

Essays of the strange subtilty, determinate nature, great efficacy of effluviums : to which are annext new experiments to make fire and flame ponderable : together with A discovery of the perviousness...

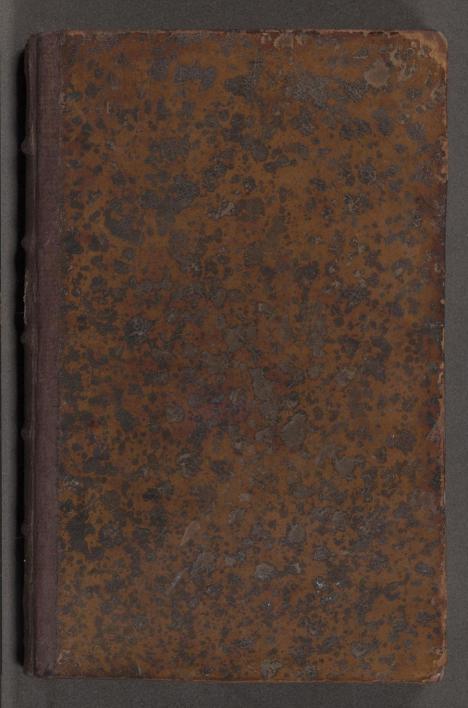
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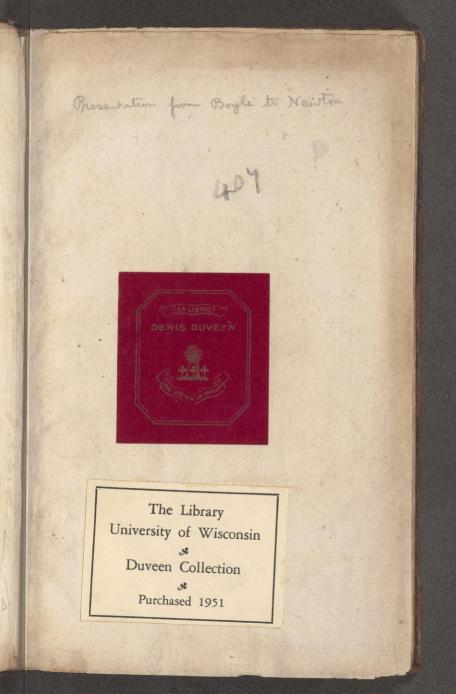
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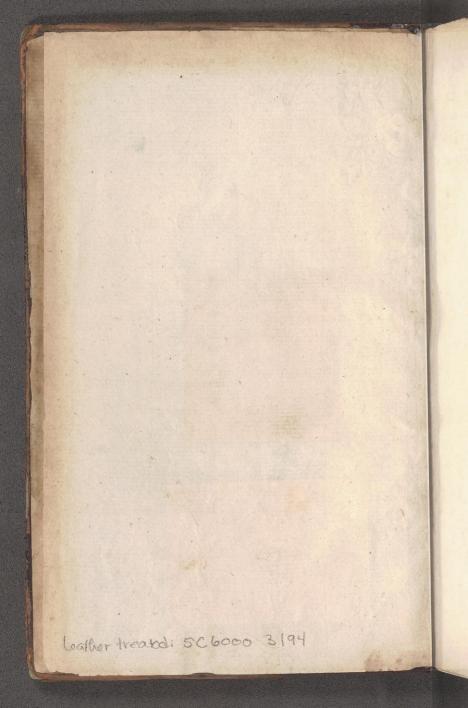
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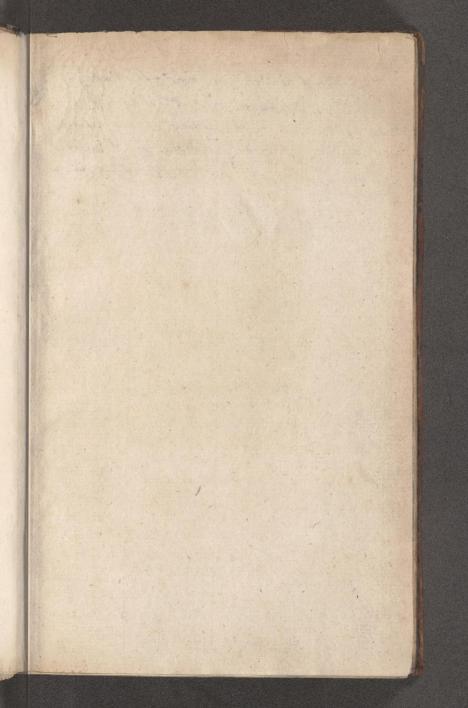
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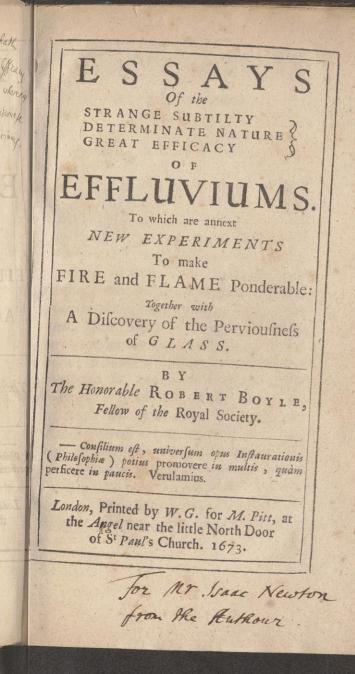
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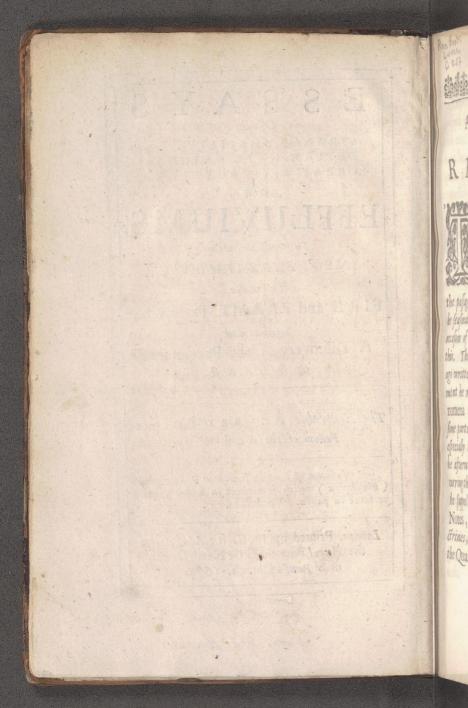






The Book binder by mistale hath E bound ye Iscourge of ye great foracy of Efluriums in the wrong place, whereas STRA it should chamediately formous ye descourge of ye Dekracinat Nature of Effluiring, GREA EFF. Fa theter in particular Lundan, F the Ap





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An Advertisement to the READER



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Pour IS hop'd, the Reader will not think it strange, not to meet with in the following Papers a more close and uniform contexture of the passages that make them up, if he be feasionably inform'd of the rise and occasion of penning them, which was this. The Author having many years ago written an Essay about an Experiment he made of Nitre, by whofe Phanomena he endeavour'd to exemplifie some parts of the Corpuscular Philosophy, especially the Production of Qualities; he afterwards threw together divers occurring thoughts and experiments, which he suppos'd might be imployed by way of Notes, to prove or illustrate those Do-Etrines, and especially those that concern'd the Qualities of Bodies; and among these obser-

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observing those that are call'd Occult. to be Subjects uncultivated enough, (at least in the way that seem'd to him proper,) he propos'd to handle them more largely than most of the rest; and in order to that Design he judg'd it almost necessary, to premise some Considerations and experimental Collections about the Nature and power of Effluviums, about the Pores of Bodies and Figures of Corpuscles, and about the efficacy of such Local-motions as are wont either to be judged very faint, or to be pass'd by unheeded. For he had often look'd upon these three Doctrines, of Estuvia, of Pores and Figures, and of Unheeded Motions, as the three principal Keys to the Philosophy of Occult Qualities. But having hereupon made (uch Collections, as upon review appear'd too large to paß for Notes on so short a \* And fome that Text, he was induc'd to were publish'd An. draw them \* into the 1669. under the Title of The Atmoform (they now appear Spheres of confistent in) of Effays, but he Bodies. would not put himself to chat concern

the trouble of doing it, with care to keep them

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them from retaining much of their first want of exact Method and Connexion. Nor was the Author folicitous to finifb them up, in regard that his other Studies and occasions made him perceive, that in what he had defign'd about Occult Qualities, he had cut himself out more work than probably he should during many years have opportunity to set upon in earnest, and complete. And in this Condition these Papers lay for divers years, ( as is well known to several that faw them, or even transcrib'd some of them,) and might have continued to do fo, if the Author had not been induc'd to let them come abroad, partly by confidering, that though the Subjects, ( however he handled them) were as well important cas curious, yet he did not find himsfelf prevented by others in what he had to publish about them; and partly by the References he had made to them in some other Papers, that he had promifed his Friends, wherein several things here deliver'd are vouched, and others suppos'd. And because the Notes concerning the Porofity of greater Bodies and the Figura-

### An Advertisement

Figurations of minute Particles, together with the Paper about unregarded Motions, having been long laid aside among and the other neglected papers, were some of h minute them milling, and others so mis-us d, and and that they could not eafily be made ready was the st to accompany those that now come abroad; the Author, that he might keep this Book from having its dimensions too difproportionate, was content to add to the thickneß of it, by subjoyning one of those little Tracts, that lay by him, concerning Flame, because of the Affinity betwist the preceding Doctrine about Effluviums in general, and Experiments. that shew in particular the Subtilty and the Efficacy of those of Eire and Flame. And though, to that Tract it felf, there belong another, design' d to examine, whether the matter of what we call the Sun-beams, may be brought to be ponderable ; yet a supposing this, hitherto cold and wet Summer, to be like to be as unfriendly to the Tryals to be made with Burningglasses as of late years some other summers have prov'd, he was eafily prevail'd with , not to make those Experiments

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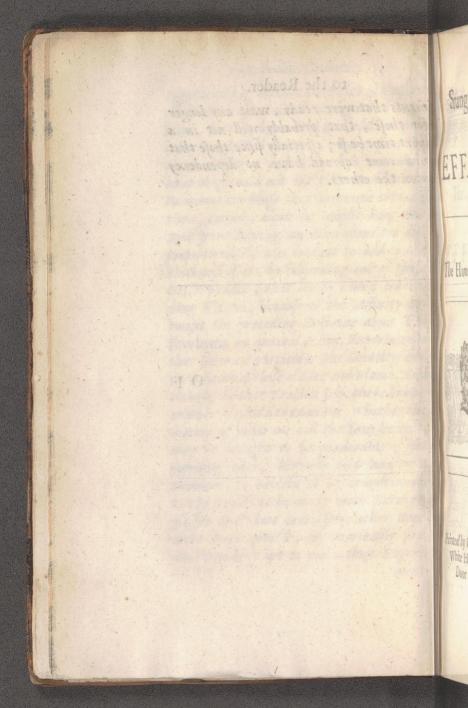
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here belong thether the m-beams, ible ; yet and wet unfriendly Burningther someally prefe Esperiments

uded the ments that were ready, wait any longer all amm for those, that probably will not in a set time of thort time be so; especially since those that is much, enous come abroad have no dependency madeus upon the others.

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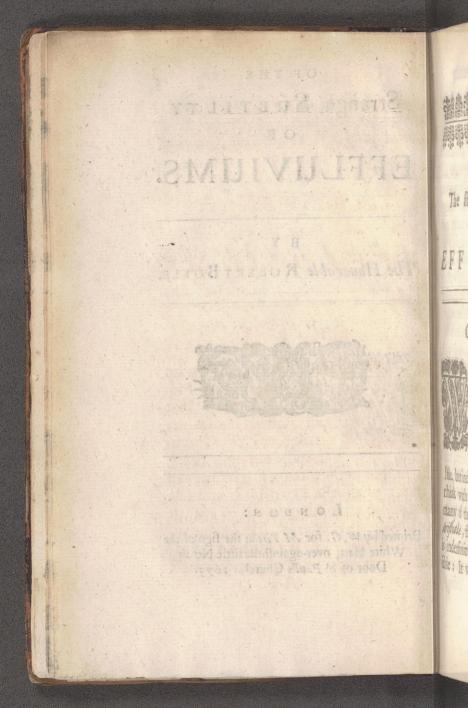
# OF THE Strange SUBTILTY OF EFFLUVIUMS.

BY The Honorable ROBERT BOYLE.



#### LONDON:

Printed by W. G. for M. Pitt at the fign of the White Hart, over-against the little No th Door of S<sup>t</sup> Paul's Churchs 16736



# OFCONON The Arange Subtilty OF EFFLUVIUMS.

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# CHAP. L.



Hether we fuppole with the Antient and Modern Atomists, that all fenfible Bodies are made up of Corpufeles, not only infen-

fible, but indivifible; or whether we think with the Cartesians, and (as (many of that Party teach us) with Aristotle, that Matter, like Quantity, is indefinitely, if not infinitely divilible : It will be confonant enough A 2

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to either Doctrine, that the Effluvia of Bodies may confift of Particles extremely small. For if we embrace the Opinion of Aristotle or Des-Cartes, there is no ftop to be put to the fubdivision of Matter, into Fragments, ftill leffer and leffer. And though the Epicurean Hypothesis admit not of fuch an interminate division of Matter, but will have it ftop at certain folid Corpufcles, which for their not being further divisible are called Atoms ("ATOMOL;) yet the Affertors of these do justly think themselves injured, when they are charged with taking the Motes or fmall Duft, that fly up and down in the Sun-Beams, for their Atoms; fince, according to these Philosophers, one of those little grains of Duft, that is visible only when it plays in the Sun-Beams, may be composed of a multitude of Atoms, and exceed many thousands of them in Bulk, This the Learned Gaffendus in his Notes on Diogenes Laertius makes probable by the inftance of a finall Mite, which, though fcarce diffinctly E A.

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diffinctly differnable by the naked Eye, unlefs when 'risin motion, does yet in a good Microfcope appear to be a compleat Animal, furnished with all necessary Parts; which I can eafily allow, having often in Cheefe-Mites very diffinctly feen the Hair growing upon their Legs. And to the former Inftance I might add, what I have elfewhere told you of a fort of Animals far leffer than Cheefe-Mites themfelves, namely those that may be often-times seen in Vinegar. But what has been already faid may fuffice for my prefent purpose, which is only to shew, that the wonderful minuteness I shall hereafter afcribe to Effluvia, is not inconfiftent with the most received Theories of Naturalists. For otherwise in this Effay the Proofs I mean to employ, must be taken, not à Priori, but à Posteriori. And the Experiments and Observations I shall employ on this occasion will be chiefly thole, that are referrible to one of the following Heads. aldstroids

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- I. The strange Extensibility of some Bodies whilst their Parts yet remain tangible.
- II. The multitude of Visible Corpuscies, that may be afforded by a small portion of Matter.
  - III. The smallness of the Pores at which the Effluvia of some Bodies will get in.
  - IV. The small decrement of Bulk or weight, that a Body may fuffer by parting with great store of Effluvia.
  - V. The great quantity of Space that may be fill'd, as to sense, by a small quantity of Matter when rarified or differs'd. want or odirote role illeine winte che molt

But though to these distinct Heads I shall design distinct Chapters, yet you must not expect

This Effay was defigned 10 be but a part upon his Effay about Salt-peter.

to find the Instanof the Author's Notes CES folicitoufly marshall'd, but set down in the order they

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occurr'd to me; fuch a liberty being

of EFFLUVIUMS. 7 allowable in a Paper, where I pretend not to write Treatifes, but Notes

### CHAP. II.

A Mong many things that are groß enough to be the Objects of our Touch, and to be managed with our Hands, there are fome that may help us to conceive a wonderful minuteness in the small Parts they confift of.

I do not remember what Cardan, and fince him another Writer have deliver'd about the Thinnefs and Slendernefs to which Gold may be brought. And therefore without positively affenting to, or abfolutely rejecting what may have been faid about it by others, I shall only borrow on this occasion,

what I have mention'd on another Improbable Truths. upon my own Observation; namely, A 4 That

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That Silver, whofe Ductility and Tra-Stility are very much inferiour to those of Gold, was, by my procuring, drawn out to fo flender a Wire, that, when we meafur'd it, which was fomewhat troublefom to do, with a long and accurate meafure, we found, that eight Yards of it did not vet fully counterpoife one Grain: So that we might add a Grain more without making the Scale, wherein 'twas put, manifeftly preponderate, notwithstanding the Tenderness of the Ballance. Whence we concluded, that a fingle Grain of this Wire amounted to 27 Foot, that is, 324 Inches. And fince Experience informs us, that half an English Inch can by Diagonal Lines be divided into 100 parts great enough to be eafily diffinguish'd, even for Mechanical uses, it follows, that a Grain of this wiredrawn Silver may be divided into 64800 parts, and yet each of these will be a true metalline, though but flender and fhort, Cylinder, which we may very well conceive to confift yet

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vet of a multitude of minuter parts. For though I could procure no Gilt Wire near fo flender as our newly mention'd Silver-wire ; yet I tryed that fome which I had by me was fmall enough to make one Grain of it fourteen foot long : At which rate an Qunce did amount to a full Mile, confifting of 1000 Geometrical Paces, (of 5 foot a-piece,) and 720 foot over and above. And if now it be permitted to fuppose the Wire to have been, as in probability it might have been, further drawn out to the fame flenderness with the above-mention'd Silver-wire, the Inftance will still be far more confiderable; for in this cafe, each of those little Cylinders, of which 64800 go to the making of one Grain, will have a superficial Area, which, except at the Basis, will be cover'd with a Case of Gold; which is not only feparable from it by a mental Operation, but perhaps also by a Chymical one. For I remember, that from very flender gilt Wire, though I could get none

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none fo flender as this of meer Silver. I did more than once, for Curiofities lake, fo get out the Silver, that the golden Films, whilft they were in a Liquor that plumpt them up, feem'd to be folid wires of Gold: But when the Liquor was withdrawn, they appear'd, (as indeed they were) to be oblong and extremely thin and double Membranes of that Metal, which, with an Instrument that had been delicate enough, might have been ripp'd open, and difplayed, and been made capable of further Divisions and Subdivisions. To this I shall add, that each of the little filver Cylinders I lately spake of, multinot only have its little Area, but its Solidity; and get I faw no reason to doubt, but that it might be very possible, if the Artificer had been fo skilful and willing as I wish'd, to have drawn the lame quantity of Metal to a much greater length, fince even an Animal fubftance is capable of being brought to a flendernels much furpaffing that of our Wire, fuppoling the Truth of

FI

ersun, of an Observation of very credible Curofine Perfons, critical enough in making , hat the Experiments, which, for a Confirmawill tion and an Improvement of our premil + fent Argument, I shall now subjoyn. Burnen An Ingenious Gentlewoman of my they a Acquaintance, Wife to a Learned m) the Phylician, taking much pleasure to and dout I keep Silk-worms, had once the Curio-, which, I fity to draw out one of the Oval Cainternal fes, (which the Silk-worm spins, not, are han as 'tis commonly thought, out of its and been Belly, but out of the Mouth, whence Willow I have taken pleasure to draw it out with my Fingers,) into all the Silkenwere wire it was made up of, which, to notonly the great wonder as well of her Hussolidity, I band, as her felf, who both inform'd be, but me of it, appeared to be by measure eithe a great deal above 300 Yards, and we weigh'd but two Grains and a withe | half: fo that each Cylindrically shap'd much Grain of Silk may well be reckon'd Animal to be at least 120 Yards long.

Another way, I remember, I allo min employed to help men by the extenfibility of Gold the better to conceive the

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We took fix beaten Leaves of Gold, which we meafured one by one with a Ruler purpolely made for nice Experiments, and found them to have a greater equality in Dimensions, and to be nearer true Squares, than could be well expected : The fide of the Square was in each of them exactly enough three Inches and  $\frac{1}{2}$ , (or  $\frac{1}{4}$ ,) which number being reduc'd to a Decimal Fraction, viz. 3125, and multiplied by it felf; affords 1,1625 for the Area, or superficial Content of each square Leaf : And this multiplied by 6, the number of the Leaves, amounts to 63 137 10 fquare Inches, for the Area of the fix Leaves. These being carefully weigh'd in a pair of tender Scales, amounted all of them to one Grain and a quarter : And fo one Grain of this foliated Gold was extended to fomewhat above fifty Inches; which differ'd but about a fifth part from an Experiment of the. like nature, that I remember I made many

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many years ago in a pair of exact Scales; and fo finall a difference may very well be imputed to that of the pains and diligence of the Gold-Beaters, who do not always work with equal firength and skill, nor upon equally fine and ductile Gold.

Now if we recal to mind what I was lately faying of the actual divisibility of an Inch into an hundred fenfible parts, and fuppofe an Inch fo divided to be applied to each fide of a square Inch of the Leaf-Gold newly mention'd, 'tis manifest that by fubtle parallel Lines, drawn between all the oppofite Points, a Grain of Gold must be divisible into five hundred thousand little Squares, very minute indeed, but yet difcernible by a fufficiently sharp-fighted Eye. And if we suppose an Inch to be divided into two hundred parts, as I lately told you it was in a Ruler I employ, then, according to the newly recited way, the number of the Squares, into which a fingle Grain is capable of being divided, will amount to no lefs than two Millions. There

## 14 Df the strange Subtilty

There is yet another way that I took to fhew, that the extensibility, and confequently the divisibleness of Gold is probably far more wonderful, than by the lately mention'd Tryal it appears. NE

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For this purpole I went to a great Refiner, whom I used to deal with for purify'd Gold and Silver', and inquir'd of him, how many Grains of Leaf-Gold he was wont to allow to an Ounce of Silver, when it was to be drawn into gilt Wire as slender as an Hair ? To this he answer'd me, that eight Grains was the proportion he allowed to an Ounce when the Wire was to be well gilt; but if it were to be more flightly gilt, fix Grains would ferve the turn. And to the fame purpole I was anfwer'd by a skilful Wire-drawer. And I remember, that defiring the Refiner to thew me an Ingot of Silver, as he did at first gild it; he shew'd me a good fair Cylindrical Bar, whereon the Leaf-Gold, that overlaid the furface, did not appear to be by odds

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35 w that rodds to thick as fine Venetian Paper ; milbiling and yet comparing this with gilt Manels of Wire, which I also defired to see, with the Wire appeared to be the better gilt of the two; poffibly becaufe the Gold in passing through the various Holes, was by the fides of them not only extended but polished, which er, and made it look more vividly than the unpolish'd Leaves that gilded the Ingot,

So that, if we suppose an Ounce of the gilt Wire formerly mention'd to have been gilt with fix Grains of Leaf-Gold, it will appear by an eafie calculation, that at this rate one Ounce of Gold, employ'd on gilding Wire of that flenderness, would reach between ninety and an hundred Miles. But if now we further suppose, as we lately did, that the flender Silverwire, mention'd at the beginning of this Chapter, were gilt; though we should allow it to have ( because of its exceeding flendernefs,) not, (as the former) 6 Grains, but 8 Grains of Leaf-Gold to an Ounce of Siver,

### 16 Df the Arange Subtility

it must be acknowledged, that an hollow Cylinder or theath of Gold weighing but eight Grains, may be fo ftretch'd, that 'twill reach to no less than 60 times as much (in weight) of Silver-wire as it covers : FI faid 60 times, for fo often is 8 contain'd in 480, the number of Grains in an Ounce;] and confequently ( a Grain of that Wire having been found to be 27 foot long,) the Ounce of Gold would reach to feven hundred feventy feven thousand fix hundred foot. that is, an hundred fifty five Miles and above a half. And if we yet further fuppofe this fuperficial or hollow Cylinder of Gold to be flit all along, and cut into as flender lifts or thongs as may be, we must not deny that Gold may be made to reach to a ftupendious length. But we need not this last supposition to make what preceded it an amazing thing: which yet though it be indeed Stupendious and seem Incredible, ought not at all to be judg'd Impossible; being no more than what upon the Suppo-

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A Fter what has been faid of the A minutenels of tangible Objects, 'twill be proper to fubjoyn fome inftances of the finallness of fuch as yet continue visible. But in regard these Corpufcles are fingly too little to have any common measure apply'd to any of them, we must make an estimate of their minuteness by the number of those into which a finall portion or fragment of matter may be actually divided, the multitude of these being afforded by so inconfiderable a Quantity of matter, fufficiently declaring, that each of them, in particular, must be marvelously little.

Among the inftances, where the fmallnefs of Bodies may be deduc'd from what is immediately the Object of Sight, it may not be unfit to take B notice

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notice of the evaporation of Water. which though it be granted to confift of grofs particles in comparison of the spirituous and odoriferous ones of divers other Liquors, as of pure Spirit of Wine, Effential Oyls of Spices, &c. yet to flew that a small Quantity of it may be dispers'd into a multitude of manifestly visible Corpufcles, I thought upon, and more than once try'd, the rarefaction of it into Vapors by help of an Æolipile, wherein, when I made the Experiment the last time, I took the pains to register the Event as folclumme, of their minuteness by Swol

We put an Ounce of common Water into an *Æelipile*, and having put it upon a Chafing-difh of coals, we obferv'd the time when the freams of Vapors began to be manifeft. This ftream was for a good while impetuous enough, as appear'd by the noife it made, which would be much increased, if we applied to it at a convenient diffance a kindled brand, in which it would blow up the

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the fire very vehemently. The ftream continued about a quarter of an hour (fixteen minutes or better, ) but afterwards the Wind had paufes and gufts for two or three minutes before it quite ceased. And by reason of the thape of the Eolipile , (which being fram'd chiefly for other purposes, was not fo convenient for this) a great portion of the Vapors condens'd in the upper part of it, and fell down in drops; fo that fuppofing that they also had come out in the form of Wind, and the blaft had not been intermitted toward the latter end, I guess'd it might have continued uninterruptedly 18 or 20 minutes. Note, That applying a measure to the Smoak, that came out very vifible in a form almost conical, where it feem'd to have an Inch or more in Diameter, 'twas diftant from the hole of the *Æolipile* about twenty Inches ; and five or fix Inches beyoud that, though it were foread for much, as to have four or five Inches in Diameter, yet the not uniform B 2 but

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### 20 Df the Grange Subtilty

but still-cohering Clouds (which was the form wherein the Vapors appear'd) were manifest and confpicuous. Tuble 1

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After the rarefaction of Water when 'tis turn'd into Vapors, we may confider that of Fewel when 'tis turn'd into Flame; to which purpofe I might here propole feveral Tryals as well of our own as others, about the prodigious Expansion of some Inflammable Bodies upon their being actually turn'd into Flame. But in this place to mention all thefe, would perhaps too much intrench upon another Paper; and therefore I shall here propose to your confideration but one inftance, and that very eafie to be tryed; of which I find this account among my Adverfaria.

Having oftentimes burnt Spirit of Wine, and alfo Oyl in Glafs-lamps, that for certain ules were fo made, that the furface of the Liquor was ftill circular, 'twas obvious to obferve, how little the Liquor would fub-

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Tubfide by the waft that was made of it, in about half a quarter of an hour. And yet if we confider, that the naked Eye after fome Exercife, may, as I have often tryed, difern the motions of a Pendulum that fwings fast enough to divide a lingle minute of an hour into 240 parts, and confequently half a quarter of an hour into 1800 parts; if we also confider into how many parts of the time imployed by a Pendulum, the Vibrations, flow enough to be difcernible by the Eye, may be mentally fubdivided; and if we further confider, that without intermission, the Oyl is preved upon by an actual Flame, and the particles of it do continually furnish a confiderable stream of fhining matter, that with a strange celerity is always flying away; we may very well conceive, that those parts of Flame into which the Oyl is turned, are flupendioully minute, fince, though the wasting of the Oyl is in its progress too flow to be perceived by the Eye, yet 'tis B 3 unwhole

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undoubted that there is a continual decrement of the depth of the Oyl, the Phylical furfaces whereof are continually and fucceffively attenuated and turn'd into flame; and the flrange fubtilty of the Corpufcles of flame would be much the ftronglier argued, if we should suppose, that instead of common Oyl the flame were nourish'd by a fewel fo much more compact and durable, as is that inflammable substance made of a Metalline Body, of whole laftingness I have elfewhere made In some Papers particular mention, afabout Flame. ter having taught the

way of preparing it.

Having in a pair of tender Scales carefully weigh'd out half a Grain of good Gunpowder, we laid it on a piece of Tile, and whelm'd over it a veffel of glafs (elfewhere defcrib'd, and often mention'd) with a Brafsplate to cover the upper orifice of it. Then having fir'd the Gunpowder, we obferv'd that the fimoak of it did opacate, and as to fenfe fo fill the whole

### of EFFLUVIUMS.

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whole cavity of the Glafs, though its Basis were eight inches, its perpendicular height babove twenty inches, and its figure far more capacious than if it were conical; and this finoak, not containing it felf within the veffel, iffued out at two or three little intervals, that were purpofely left between the orifice of the veffel and the plate that lay upon it. This cover we then remov'd , that we might observe how long the fmoak would continue to alcend which we found it would do for a bout half a quarter of an hour, and during near half that time, (wize the three first binnutes ) the continually afcending finoal feen'd to be, at its going out, of the fame Diameter with the orifice at which it isfu'd and it would afcend fometimes a foot, fometimes half a yard o fometimes two foot or more into the Air, before it would difperfe and vanish into it.on Now if we confider, that the car vity of this round Onifice was two inches in Diameter, how many myriads B4 meathres

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riads of visible Corpufcles may we eafily conceive throng'd out at fo large an out-let in the time abovemention'd, fince they were continually thrufting one another forwards ? And into fo many visible Particles of imoak must we admit, that the half Grain of Powder was thatter'd, befide those multitudes, which, having been turn'd into actual flame, may probably be fuppos'd to have fuffer'd a comminution, that made them become invisible. And though I shall not attempt fo hopeless a work, as to compute the number of these small Particles, yet to make an effimate whereby it would appear to be exceeding great, I thought fit to confider, how great the Proportion was between the fpaces, that to the Eye appear'd all full of fmoak, and the dimensions of the Powder that was refolv'd into that fmoak. Caufing then the Glass to be fill'd with common Water, we found it to contain above two and twenty Pints of that liquor, and caufing one of those TIACS. B 4. measures

OF EFFLUVIUMS. 25 measures to be weigh'd, it was found d out at io + to weigh fo near a pound ( of fixteen e time aboveounces,) that the computation of the whole Water amounted to at leaft 160000 grains , and confequently wilible Par-320000 half grains. To which if we add, that this Gunpowder would r was het readily fink to the bottom of Water, as being (by reafon of the Saltpeter dual fame, and Brimftone, that make up at leaft a where i fix parts of feven of it ) in specie headatade vier than it, and in likelyhood twice as heavy, (for it is not easie to dehapelels a termine it exactly,) we may probably amber of guess the space to which the finoak make an reach'd to exceed sooooo times that, appear to which contain'd the unfir'd Powder ; within and this, though the fmoak, being oportion confinid in the veffel, was thereby to the kept from diffusing it felf for far as the and by its ftreaming sout it feem'd likely der that that it would have done old sile to Cauling of To thefe Inftances from Inanimate thom Bodies I shall fubjoyn one more taken from Animals. Whereas then bothat men have with Reason wonder'd, d their chian fo finall a Body as a Cheefe-mite, malures anorr

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which by the naked Eye is oftentimes not to be taken notice of, unless it move, (if even then it be fo,) should by the Microfcope appear to be an Animal furnish'd with all necessary parts; whereas this, I fay, has given just occasion to conclude, that the Corpufcles that make up the parts of fo fmall an Animal, must themfelves be extremely fmall; I think the Argument may be much improved by the following Confideration. Those that have had the Curiosity to open from time to time Eggs that are fat upon by a hatching Hen cannot but have observed, how small a proportion in reference to the bulk of the whole Egg the Chick bears, when that, which the Excellent Harvey calls Punctum faliens, discloses the motion of the Heart, and the colour of the Blood ; and that even about the feventh or eighth day the whole Chick now visibly form'd, bears no great proportion to the whole Egg, which is to fupply it with Aliment, not only for its nourifhment,

OF EFFLUVIUMS. 27 d Eye is the ment, but speedy growth for many anticof un days after. In finow , aller a nod w

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rankely that To apply this now to the matter manufer in hand, having feveral times ob-Ily, have Cheefe-mites themfelves are generathe, that ted of Eggs, if we conceive, that in the part these Eggs, as in ordinary ones, the a, mit des Animal at its first formation bears ind, I the but a finall proportion to the bulk of to minimper the whole Egg, the remaining part g Conlidental being to fuffice for the food and the Curiofity growth of the Embryo probably for Egst a pretty while; fince, if an Ingemy Her an nious perfon, that I defired to watch d, how im them, did not mis-inform me, they menthebut used to be about ten or twelve days Chickles in hatching; this whole Egg it felf Excellent will be allowed to be but little in dicher reference to the Mite it came from, and the colou how extremely and unimaginably mevenabol minute may we happofe those parts a the win to be , that make up the Alimental mid, ha Liquors, and even the Spirits, that the the paffing through the Nerves or Anainfinition logous parts, lerve to move the Limbs and Senfories of but, as it were, men the

## 28 Df the Arange Subtilty

the Model of fuch an Animal, as; atua when it refts, would not (perhaps) it felf to the naked Eye be fo much as visible; and in which we may insder prefume the nobler fort of ftabler parts to be of an amazing flender- with nefs, if we confider, that, though in ade man other hairy Animals, the Optick or pla fome other of the larger Nerves do, I know not how many times, in thickness and circuit furpass a hair aver of the fame Animal; yet in a Cheefe- judged Mite, though none of the largest of unbr those Creatures, we have divers times manifeftly feen , as is before space intimated, fingle Hairs that grow what n nids od or Livas alpica upon the Legs.

Another way there is, that I imployed to give men caufe to think, that the invifible *Effluvia* of Bodies that wander through the Air may be ftrangely minute; and this was, by fhewing how fmall a fragment of matter may be refolved into particles minute enough to affociate themfelves in fuch numbers with a Fluid fo much more denfe than Air, as Water

### OF EFFLUVIUMS.

29

Animal as Water is, as to impart a determinate ut (perhaps) Colour to the whole liquor. What which me I did with Cocheneel in profecution white may of this defign, my Experiments about In a hile Colours may inform you; but I shall azing lander now relate the fuccefs of an attempt at, though in made another way, for which per-10 Opink of haps fome of your friends the Chya Nerves de mifts will thank me; though I was times, in not folicitous to carry on the Experihundry hair ment very far with Gold, not because etinole I judged that lefs divifible into a he land on number of colour'd particles, but have direct because I found, as I expected, that wis lefter the paleness of the native colour of the Gold may make it in the end lefs confpicuous, though, if I had then that had by me a Menstruum, as I someto think times had, that would diffolve Gold of Bodie blood-red, perhaps the experiment edir man with Gold would have furpais'd that, tis was which 'tis now time I should begin fragment of to relate, as foon as I have hinted in to you by the way, that, for varie-contribution fake, I made a tryal with Copthe first as be accused of having omitted to Water 115 employ

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Water, Wh employ a Metal whofe Body Chymists suppose to be much opened by rale that Calcination. And though the event - nes oftenti were notable even in Comparison of whiels, t that of the experiment made with Cocheneel, yet my conjectures inclin'd me much to preferr the way defcrib'd in the following Account.

We carefully weigh'd out in a pair HGlais, that of tender Scales one grain of Copper to the to the not-calcin'd, but barely fil'd; and because, as we made choice of this Metal for its yielding in most Menstruums a Blew, which is a deep and confpicuous colour ; we alfo chofe to make a folution, not in Aqua fortis or Aqua regis, but the Spirit of Sal Armoniack ( as that is an urinous Spirit,) having found by former tryals, that this Menstruum would give a far deeper folution than either of the others. This lovely Liquor, of which we us'd a good proportion, that all the Copper might be throughly diffolved, we put into a tall cylindrical Glafs of about four inches in Diameter, and by degrees pour'd to it of diftill'd Water,

## OF EFFLUVIUMS.

Subtily.

of Body Ch. Water, which is more proper in this auch opened cafe than common Water, which hugh the even has oftentimes an inconvenient Sal-a Comparison tifhnefs, 'till we had almost fill'd the ent make wird Glass, and faw the colour grow somenature inter what pale, without being too dilute ewaydeland to be manifest; and then we warily pour'd this liquor into a conical doutin apl Glass, that it might be the more rand Coppa: easie to fill the veffel feveral times to the fame height. This conical Glass the diffe we filled to a certain mark four times in melton, confecutively, weighing it, and the isadeepan liquor too, as often in a pair of excelweath that lent Scales purposely made for Statiin Aqua fur cal experiments, and which, though interstat ftrong enough to weigh fome pounds inous spine in each Scale, would, when not too mak, in much loaden, turn with about one esfardeen grain. These feveral weights of the the other Glass, together with the contained hich weus liquor, we added together, and then the Carefully weighing the empty Glafs differ again, we deducted four times its ndrical Cate weight from the above-mentioned Dimeter fumm, and thereby found the weight in the liquor alone, to be that, which Water 19900 reduc'd

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reduc'd to grains amounted to 28534; fo that a grain of Copper, which is not full half to heavy *in fpecie* as fine Gold, communicated a Tincture to 28534 times its weight. Copp

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But now if you pleafe to take notice, that the fcope of my Experiment was to fhew, into what a number of parts one grain of Copper might be divided, you will allow me to confider, as I did, that this multitude of parts must be estimated by the Proportion, not fo much in weight as in bulk, of the tinging Metal to the tinged Liquor, and confequently, fince that divers Hydrostatical tryals have inform'd me, that the weight of Copper to the weight of Water of the fame bulk is proxime as 9 to 1, a grain-weight of Copper is in bignefs but the ninth part of as much Water as weighs a grain; and fo the formerly mention'd number of the grains of Water must be multiplied by 9, to give us the Proportion between the tinging and tinged Bodies, that is, that a fingle grain of Copper

## of EFFLUVIUMS.

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10 2414 Copper gave a blewnels to above when s 256806 parts of limpid Water, each the as he of them as big as it? Which, though the to it may feem flupendlous, and fearce credible; yet I thought fit to profeone of cute the Experiment formewhat far-"Even ther, by pouring all the liquor out training of the tall cylindrical Glafs into Copput another clean veffel, whence filling allow the conical Glafs twice, and emptying the this it as often into the fame cylindrical chunted Glafs; the third time I fill'd the comuch a nical Glass with colourless diffill'd tinging Water, and pouring that also into and the cylindrical Glass, we found the Hedro mixt liquor to have yet a manifest, me that though but a pale, blewnefs. And, eweight a laftly, throwing away what was in s maximi the cylindrical Glafs, we poured into Copper lit, out of the fame conical Glafs, equal and as parts of diffill'd colourles Water, in and 1 and of the tincted Liquor we had formber of merly fet apart in the clean Veffel; and found, that, though the colour oppring were very faint and dilute, yet an Be attentive Eye could eafily difcern it gand to be blewish; and fo it was judg'd Copper Copper by

## Of the Arange Subtilty

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by an intelligent Stranger that was brought in to look upon it, and was defir'd to difcover of what colour he thought it to be. Whereby it appears, that one grain of Copper was able to impart a colour to above double the quantity of Water above mentioned.

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This Experiment I have allow'd my felf to be the longer and more particular in relating, both because I know not, that any fuch has been hitherto either made or attempted. and becaufe it will probably gratific your Chymifts , that love to have the Tinctures of Metals believ'd very diffusive ; and because, if Circumftances were not added, it would feem to you as well incredible, as perhaps it does feem stupendious, that a portion of matter should be able to impart a conspicuous colour to above 256806 times its bulk of Water, and a manifest tincture to above 385200, (for fo it did, when the proportion of the ting'd part to the whole mixture, made of it and the unting'd part,

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is true . I son induced on believe, by CHAP. IV. of the unveloping experiment I had

TT were easie for me (Pyroph.) to give you feveral Instances, to thew, that the Effluvia of Liquors may get in at the Pores of Bodies that are reputed of a close Texture, but I shall at prefent forbear to mention fuch Examples, not only doords along perhaps to because they belong to A Difeourse of tapph nanother place \*, where Pores of Bodies 10 11 take notice of them, Corpufeles.

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would not feem fo remarkable, nor asiant be fo confiderable to our prefent purportion pose, as a few taken from Bodies that whole mare not Fluid.

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of good credit, that feveral Perfons, (for the Experiment does not hold in all) by barely holding for fome time dryed Cantharides in their hands, have been put to much pain at the neck of the Bladder, and have had fome other parts ministring to the secretion of Urine fenfibly injured. That this is true, I am induced to believe, by what I have elfewhere related to you of the unwelcome experiment I had of the effect of Cantharides applied but outwardly to my neck, and that unknown to me, upon the Urinary Paffages; and that these Operations are due to material Effluxes, which, to get into the Mass of Blood, must pals through the pores of the skin, you will not, I prefume, put me to prove.

Scaliger Exercit. 186. relates, that in Gascony, his Countrey, there are Spiders of that virulency, that, if a man treads upon them to crush them, their poyson will pass through the very soles of his Shooes. Which story, notwithstanding the Reputation of

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37 of the Author, I should perhaps have left unmention'd, because of a much Aranger about Spiders, which he relates in the fame Section, but that I met with one that is analogous in the diligent Pifo's late Hiftory of Brafile; where, having spoken of another venemous Fish of that Country, and the Antidotes he had fuccefsfully ufed to cure the hurts it inflicts, he proceeds to that Fish the Natives call Amoreatim, of one kind whereof, call'd by the Portugals Peize Sola, his words are these; Que mira sane efficasia non solum manum vel levissimo attactu, sed & pedem, licet optime calceatum, Piscatoris incaute pisciculum conterentis, Paralysi & Stupore afficit, instar Torpedinis Europae, sed minus durabili. Lib. 5. cap. 14.

What I shall ere long have occafion to tell you of the power of the Torpedo, and fome other Animals, to affect the Hand and Arm of him that ftrikes them, feems applicable to the matter under confideration : For, though their affecting the striker at menodi C 3 a di-

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a diftance, may very well be afcrib'd to the flupefactive or other venemous Exhalations that expire (and perhaps are as it were darted) from the Animal irritated by the flroke, and are breath'd in together with the air they infect, yet their benumming, or otherwife affecting the Arm that flruck them, rather than any other part, feems to argue, that the poyfonous fleams get in at the pores of the skin of the Limb, and fo flupifie, or otherwife injure, the nervous and mufculous parts of it.

Other Examples belonging to this Section may be referr'd hither from divers other places in these Papers about Occult Qualities, and therefore I shall only add here that most remarkable Proof, That fome Emanations, even of folid Bodies, may be fubtil enough to get through the pores, even of the closest Bodies; which is afforded us by the Effluvia of the Loadstone, which are by Magnetical Writers faid to penetrate without refistance all kind of Bodies. And though

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39 though I have not tryed this in all forts, yet having tryed it in Metals themselves, I am apt to think, the general Rule admits of very few Exceptions, especially, if that can be fully made out , which is affirm'd about the perviousnels of Glass to the Effluxions of the Loadstone. For, not only Glafs is generally reputed to be as close a Body as any is, but (which weighs more with me) I have by Tryals purpofely made, had occafion to admire the clofenefs of very thin pieces of Glass. But the reason why I just now express'd my felf with an 16, was, because I was not entirely fatisfied with the Proof wont to be acquiefc'd in, of the pervioufnefs of Glafs; namely, that in Dials and Sea-Compasses that are cover'd with plates of Glafs, the Needle may be readily moved to and fro by a Loadstone held over it. For these Plates being commonly but fasten'd on with Wax, or at best with Cement, a Sceptick may pretend, that the magnetical Effluvia Magne país C 4

### Df the ftrange Subtilty

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pais not through the Glais, but through that much more pervious matter, that is imployed to fecure the Commiffures, only from the accefs of the Air. To put then the matter past doubt, I caused some Needles to be Hermetically feal'd up in Glafspipes, which being laid upon the furface of water (whereon by reafon of the bignels of the Cavities they would lightly float,) the included Needles did not only readily feel the virtue of an externally applied Loadfrone, (though but a weak one) but complied with it fo well, that I could eafily, by the help of the Needle, lead, without touching it, the whole Pipe, this was thut up in, to what part of the furface of the water I pleafed. And I alfo found, that by applying a better Loadstone to the upper part of a fealed Pipe, and a Needle in it, I could make the Needle leap up from the lower part as near to the Loadstone as the interpofed Glafs would give it leave. But I thought it would be more conliderable, to manifest that the Magnepals

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# OF EFFLUVIUMS.

41 Magnetical Effluvia, even of fuch a dull Body, as the Globe of the Earth, du leurethe, would alfo penetrate Glass. And tom traces though this feem difficult to be tryed, the tranter because no ordinary Loadstone, nor Medicing any Iron touch'd by it, was to be " in Gue imployed to work on the included ad upon the Iron; yet I thought fit to attempt it an by realout after this manner : I took a cylinand they drical piece of Iron of about the bigthe included nefs of ones little finger, and between half a foot and a foot long, (for I had applediant formerly observed, that the quantity altone) but of unexcited Iron furthers its Operathe loud tion upon excited Needles, ) and ha-Vedle, led, wing Hermetically feal'd it up in a whole Pipe, Glais-pipe but very little longer than what part it; I supposed, that if I held it in a hald And perpendicular pofture, the Magnetiingabetter cal Effluvia of the Earth, penetrating tofaleid the Glass, would make the lower ould make sextreme of the Iron answerable to the the lower North Pole ; and therefore having tone as the applied this to the point of the Neeveit lena dle in a Dial, or Sea-Compaís, that demore look'd toward the North, (for Aufit the thors mean not all the fame thing by Magne- MAHO the

Subtilty e Glass, but 1 more pervious

### Of the strange Subtilty 42

the Northern Pole of a Needle or Loadstone,) I prefum'd it would ; according to the Laws Magnetical (elfewhere mention'd) drive it away which accordingly it did. And having for farther tryal inverted the included Iron, (fo that the end which was formerly the lowermoft, was now the uppermoft) and held it in a perpendicular pofture just under the fame point of the Needle, that extreme of the Iron-rod, which before had driven away this point, being by this inversion become (in a manner) a South-Pole, did (according to the fame Laws ) attract it: By which fudden change of Poles, meerly upon the change of fituation, it also appear'd, that the Iron ow'd its Virtue only to the Magnetilm of the Earth, not that of another Loadftone, which would not have been thus eafily alterable. And this Experiment I the more particularly relate, because this is not the only place, where I have occasion to make ufe of it, and out ils ton mon and CHAP.

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tome of them Learned men, have con- With (b thather A Nother proof of the great Sub-tilty of Effluviums, may be tathe loweken from the small Decrement of uppermolite weight or bulk that a Body may fufmargaturater by parting with great store of with Nee fuch Emanations, ave no beyond

the hund. That Bodies, which infus'd in Limany inquors impregnate them with new ion become Qualities fuitable to those of the imle, did (ac mers'd Bodies, do fo by imparting to amadin them fomewhat of their own Sube of Pols offance, will, I prefume, be readily of finance granted by those that conceive not, Iron owe how one Body should communicate to main manother a folitary and naked Quality, the load unaccompanied by any thing Corpohave been real to fupport and convey it. But I his En would not have you think, Pyrophilus, man that the only matter of fact I have to mocountenance this notion, is that Exformate periment, which has convinc'd divers Chymifts and Phyficians, otherwife CHAP ..... not

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not friends to the Corpufcular Philofophy, that Medicines may operate without any confumption of themfelves. For, though divers of these, fome of them Learned men, have confidently written, that Glaß of Antimony and Croc is Metallorum, being either of them infus'd in a great proportion of Wine, will make it vomitive; and ALT CIT if that liquor be poured off, and new be poured on, every new portion of fuch liquor will be impregnated with the fame virtue, and this though the liquor be chang'd a thousand times, and yet the Antimonial Glaß or Crocus a min will continue the fame as well in a line weight as virtue; and though thence weight fome of them, especially Chymists, argue, that fome Metals without imparting any thing fubstantial, but only, as a mu Helmont speaks of some of his Ar-2 能切了 cana, by irradiation: Tet, I confes, I have fome doubts, whether the main Experiment have been competently tryed, and shall not fully acquiesce when w in what has been faid, till fome skil- I wurn ful Experimenter deliver it upon his auto own not

## OF EFFLUVIUMS.

45 pullar Mo. own Tryal, and acquaint us too, with is may opened what Instruments and what Circumfind then fpection he made it. For , befides drend thee, that the Ingeniousest Physicians I men, hwon. have queftion'd about it, acknow-Cliffer Animony ledg'd the Taft, and fometimes the bing either Colour of the Wine to be alter'd by poportion of the infus'd Mineral, I could not acomitive, and quiefce in the affirmation of an ordiof andnew nary Chymift or Apothecary, or even Phylician, if he flould barely avery ongrad with that he had weigh'd an Antimonial is dough in Medicine before 'twas put to infule, and after the infusion ended, and obslife cum ferv'd no decrement of weight. For eas well in I have had too much experience (as thugh theme I elfewhere mention ) of the difficul-Chrinkan ty of making exact Statical tryals indutingate not to know, that fuch Scales, as are hundry wont to be imployed by Chymilts of he dr. and Apothecaries in weighing Drugs, loufes are by no means fit to make tryals whether the with the nicety which that I am computer fpeaking of requires I It being eafle. wanthe even with the better fort of fuch untaccurate Scales , especially if they be not fulpended from fome fixt thing, own -scients but

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but held with the hand, to miltake half a grain or a grain; and perhaps a greater quantity, and at least more than by divers of the Experiments of this Effay appears neceffary to be fpent upon the impregnating of a confiderable proportion of Liquor with Corporeal Effluxions. Befides, that if, when the beaten Crocus or Glaß be taken out of the Wine to be weigh'd again, the Experimenter be not cautious enough to make allowance for the Liquor that will adhere to the Medicament, 'tis plain that he may take notice of no decrement of weight, though there may be really Effluviums of the Mineral amounting to feveral grains, imbib'd by the Liquor. And though he be aware of this, and dry the powder, yet 'tis not so easie, even for a skilful man, to be fure that none of the more vifcous particles of the Liquor stick to the Mineral, and being sensible upon the Ballance, though not to the Eye or Hand, repair the recess of those emetick Corpufcles that diffus'd themSublin OF EFFLUVIUMS. 47 to mill themselves into the Menstruum. And undpendent the fense of these difficulties put me the upon the attempting to make fo nocomments ble an Experiment with excellent adding the Scales, and the care that it deferves: mained But after a long tryal, an unlucky of fine accident frustrated at last my endea-Bene vours. But though, till competent m Crush Relators give us an account of this Winewh matter upon their own tryal and unner repeat the Infusion very much oftener, make than, for ought I find, any man has will be yet done, I must not acquiesce in all minthat what is faid of the Impregnation of exement of Wine or other Liquors by Autimonial the tell Glass and Crocus Metallorum; yet that amounting after divers repeated Infufions the by the Mineral fubftance should not be denhe aware fibly diminish'd in bulk or witter e retin may well fuffice to make this Inwhich han hance though not the only or chief mot withat may be brought for our puror lick pole, yet a pertinent one to it. b For fible up that there is a powerful Emetick Quaother lity imparted to the Liquory is maad infeft by experience; and that the Mineral does not impart this virtue them- - STO 35

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as twere by irradiation, but by fubstantial effluxion, feems to me very probable; not only because I conceive not, how this can be done otherwife, but because, as 'tis noted above, the Wine does oftentimes change colour by being kept a competent time upon the Mineral, as if it drew thence a Tincture; and even when it is not discolour'd, I think it unfafe to conclude, that the Menstruum has not wrought upon it. For I have kept good Spirit of Vinegar for a confiderable time upon finely powder'd Glass of Antimony made per se, without finding the Spirit to be at all ting'd, though 'tis known, that Antimonial Glais is foluble in Spirit of Vinegar, as mine afterwards appear'd to be, by a longer digeftion in the fame Liquor. But there may be a great number of minute particles diffolved in the Menstruum before they be numerous enough to change the Colour of it. And with this agrees very well what is observ'd, That though too great a quantity of the pre-

### OF FFFLUVIUMS.

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prepar'd Antimony be put into the liquor, yet it will not be thereby made too ftrongly Emetick. For the Wine, being a Menstruum, will, like other Menstruums, be impregnated but to a certain measure, without diffolving the overplus of the matter that is put into it. And Mars, which is a harder and heavier body than Glafs, of Antimony, is it felf in part foluble in good Rhenish or other white Wine, (and that in no long time,) and fometimes even in Water. 1000

I do not therefore reject the Emerick Infusion, as unfit to have a place in this Chapter, but till the experiment have been a little more accurately made, I think it inferiour, as sappeard to our purpose, to some of the Inon in the frances to be met with in the next Chapter, and perhaps also to that ties all mention'd by Helmont, and tryed by more than one of my Acquaintance, mage in concerning the Virtue of killing Worms, that Mercury imparts to That the water or wine wherein it has the been long enough infus'd, or elfe for a while

#### Of the strange Subtility 50

a while decocted. Though Quickfilver given in fubstance is commended as an effectual Medicine against

\* As Quercetanus, Burggravius. raus, Cafalpinus, &c.

Worms, not only by Libavius, Zabata, many profeft \* Spagyrifts, but by divers \*\* As Vidius, Pa- \*\* Methodifts of good Note. And though, andre

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fome other things, Chymical and Philosophical, keep me from being of their opinion, who think that in this cafe the Mercury impregnates the liquor as it were by Irradiation, rather than in a Corporeal manner, yet the Eye does not perceive, that even limpid water takes any thing from clean and well purg'd Mercury, which we know that divers corrofive liquors themfelves will not work upon.odt 'ni daiw.aar

To this Instance I must add one that is yet freer from exceptions, which is, that having for Curiofity fake suspended in a pair of exact Scales, that would turn with a very fmall part of a grain, a piece of Amber-greece bigger than a Walnut, and

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SI and weighing betwixt an hundred and fix-fcore grains, I could not in three days and a half that I had opportunity to make the tryal, difcover, even upon that Billance, any decrement of weight in the Amber-greece; though fo rich a perfume, lying in the open Air, was like in that time to have parted with good flore of odoriferous Steams. MAnd a while after fulpending a Lump of Alla fatida five days and a half , I found it not to have fuftain'd any difcernible lofs of weight, though, in fpite of the unfavourable cold weather, it had about it a neighbouring Atmosphere replenished with foetid exhalations. And when twelve or fourteen hours after, perhaps upon fome change of weather, I came to look upon it, though I found that in that time the Equilibrium was formewhat alter'd, yet the whole Lump had not loft half a quarter of a grain; which inducid me to think , that there may perhaps be Steams difeernet of nible even by our Noftrils, that are than far more fubril than the odorous they'r bus D 2 exha-

## 52 Df the ftrange Subtilty

exhalations of Spices themfelves. For, having in very good Scales fulfpended in the Month of March an ounce of Nutmegs, it loft in about fix days five grains and a half. And an ounce of Cloves in the fame time loft feven grains and five eigths. ther

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You will perhaps wonder, why I do not preferr to the Instances I make mention of in this Chapter, that which may be afforded by the Loadftone, that is acknowledg'd continually to emit multitudes of Magnetical Steams without decrement of weight. But though I have not thought fit to pass this wholly under filence; yet I forbear to lay fo much ftress on it, not only because my Ballances have not yet fatisfied me about the Effluvia of Loadstones, ( for I take them not all to be equally diffusive of their Particles; ) but becaufe I foresee it may be doubted, whether Loadstones, like odorous Bodies, do furnish afresh of their own, all the Corpufcles that from time to time issue from them ? Or, whether they

## OF EFFLUYIUMS.

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they be not continually repaired, partly by the return of the Magnetical Particles to one Pole that fallied out of the other, and partly by the continued paffage of Magnetical matter (fupplied by the Earth or other Mundane Bodies) it make the Pores or Channels of the Loadstone their constant Thorow-fares.

I doubt not but it will make it more probable, that a small Quantity of matter being scatter'd into invisible Effluvia may be exceedingly rarified and expanded, if it can be made appear, that this little portion of matter shall, for a confiderable time, emit multitudes of visible parts, and that in fo close an order among themfelves, as to feem in their Aggregate but one intire liquor, endow'd with a ftream-like motion, and a distinct superficies, wherein no interruption is to be feen, even by an Eye plac'd near it. To devise this Experiment, I was induc'd, by confidering, that hitherto all the (total) diffolutions that have been made of Merals D 3 Pig-

### Df the Grange Subtilty

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Pigments, have been in liquors naturally cold, and confifting probably of much lefs fubrile, and certainly of much lefs agitated parts, than that fluid aggregate of Anining matter that we call Flame ; whereas I argued, that if one could totally diffolve a Body compos'd of parts fo minute as those of a Metal into actual Flame, and husband its Flame fo, as that it should not immoderatly waffe, I thould thereby diffolve the Metal in a far more subtil Menstruum than our common water, or Aqua fortis, or Aqua Regis, or any other known Menstruum I have yet imployed. And confequently the attenuation and expansion of the Metal in this truly Igneous Menstruum would much furpals not only what happens in ordinary Metalline folutions, but poffibly allo what I have noted in the third Chapter of this Estay; about the ftrange diffusion of Copper diffolv'd in Spirit of Urine and Water. In profecution of this defign, I fo prepar'd one fingle grain of that Metal,

### OF EFFLUKIUMS.

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Metal, by a way that I elfewhere teach, that it was diffolv'd in about a spoonful of an appropriated Menstruum. And then having caus'd a finall Glass-lamp to be purposely blown to contain this liquor, and fitted it with a focket and wieck, we lighted the Lamp, which, without confuming the wieck, burnt with a flame large enough and very hot, and feem'd to be all the while of a greenish blew, as if it were a but finer and fhining folution of Copper. And yet this one grain of prepar'd Metal ting'd the flame that was from moment to moment produc'd, during no lefs than half an hour and fix minutes. And now if we confider, that in this flame there was an uninterrupted Succeffion of multitudes of colour'd Particles newly extricated, and flying off in every of those many parts wherein a minute of time may either actually or mentally be divided; and, if we confider Flame as a light and very agitated body, paffing with a stream upwards through the Air, and 4 the s

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and if we also confider the quantity of liquor that would (as I shall by and by tell you) run through a Pipe of a much leffer diameter than that Flame, within the compass of the forementioned time : What a quantity of the ffreaming fluid we call Flame, if it could have been preferv'd and collected into one Body, may we suppose would appear to have issued out of one grain of Copper in the space of thirty-fix minutes; and what a multitude of metalline Corpuscles: may we suppose to have been supplied for the tinging of that Flame during. fo long a time? fince a Cylindrical ftream of water falling but through a very fhort Pipe of glass, constantly fupplied with liquors, did pals at fuch a rate, that, though the aqueous Cylinder feem'd more flender by half, (or perhaps by two thirds or better) than the Flame, yet we effimated, bythe help of a Minute-watch and a good pair of Scales, that, if I had had conveniencies to let it run long enough, the water efflux'd in thirty. fix a that is a

## OF EFFLUVIUMS. ST. quanty fix minutes ( the time of the Flames -I halfy duration) would have amounted to

lubtility

above nine gallons, or , (reckoning that a pint of water to contain a pound of middle fixteen ounces) feventy-two pounds. Att a quan-uid we call mpreferva 7, may we VI.

are illud THE laft fort of Instances I shall propose to shew the strange aut Subtility of Effurita, is of fuch, as Corpulds difcover the great quantity of space alipphed that may by a finall quantity of matnediring, ter, when rarified or dispers'd, be induct either fill'd as to fense, or, at least; through made (as they fpeak) the fphear of its onlanty activity. and all a le one and chery

To manifest this Truth , and therefaquenus by as well confirm the foregoing this Chapter, as make out what is defign'd theter) in this; I shall endeavour to shew, and help your imagination to conceive, that how great a space may be impregnamid ted with the Effluxions of a Body, ming offentimes without any fentible, and oftener without any confiderable defx Distri crement

### 58 Df the firange Subtilty

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crement in bulk or weight of the nads," Body that affords them. And in order to this, though I shall not pretend hand to determine precifely how little the apart fubstances, Lam to instance in, would bire lat wafte upon the Ballance, becaufe you make w will very eafily fee they are not that une way to be examin'd ; yet I prefume, a with you will as eafily grant, that the a dram decrement of weight would be but unit inconfiderable, fince of fuch light i had fubstances the loss even of bulk is to; chigh which laft claufe I shall now attempt i with to make good, by fetting down fome in min Observations; partly borrow'd from the the writings of approv'd Phyficians, summ and partly that my friends and I have runted made about the durable Evaporation of fuch fmall particles of the Efflu- antixions of Animals, as are actually not com to be difcern'd by the Eye to have any atting of those things flicking to them, which are fo very long in flying fuc- o stan ceffively away. and angle that well fram

Tis wont to be fomewhat furprishing zing to men of Letters, when they first go a hawking with good Spaniels,

#### OF EFFLUVIUM S.

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milt of the niels, to observe, with how great And may fagacity those dogs will take notice auprenal of, and diftinguilh by the fcent, the have lately been. But I have much because you more wonder'd at the quick scent of an excellent Setting-dog, who by his alprent, way of ranging the fields, and his , that the other motions, especially of his Head, ad be but would not only intimate to us the in hight kinds of game, whole fcent he chanc'd this to light on, but would discover to is where Partridges had been (though down without flaying in that oud fun place) feveral hours before, and affift Phylicans, us to guess how long they had been and have gone before we came and intered but

Errormin I have had ftrange answers given me in *Ireland*, by those who make main a gain if not an intire livelihood by have any killing of Wolves in that Countrey, to them, (where they are paid to much for fingthe every head they bring in ) about the fagacity of that peculiar race of dogs they imploy in hunting them ; but that has not truffing much to those Relators, and Sna I shall add, that a very sober and niels, las discreet

#### Df the strange Subtilty 60

discreet Gentleman of my acquaintance, who has often occasion to and it imploy Blood-hounds, affures me, that if a man have but pass'd over a field, the fcent will lye (as they fpeak) I met fo as to be perceptible enough to a good dog of that fort for feveral hours after. And an ingenious Hunter affures me, that he has observ'd, that the fcent of a flying and heated Deer will fometimes continue upon the ground from one day to the next following. -1949-9-5

And now we may confider thefe three things ; Firft, That the fubstance left upon the grass or ground by the transient tread of a Partridge, Hare, or other animal, that does but pass along his way, does probably communicate to the grafs or ground but some of those Effluxions, that transpire out of his feet, which being small enough to escape the difcernment of the Eye, may probably not amount to one grain in weight, or perhaps not to the tenth part of it. Next, That the parts of fluid Bodies, dilereet

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### OF EFFLUVIUMS.

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as fuch, are perpetually in motion, and to are the invitible particles that fwim in them ; as may appear by the diffolution of Salt or Sugar in water, and the wandering of a the Air stand of the Air stand of the Air stand of the Air stand of the when the Eye perceives them anous Hun not. And thirdly, That though the as oblerval, Atmosphere of one of these small parcels of the exhaling matter we are ipeaking of, may oftentimes be exemittent Body, as may be guess'd by the diffance, at which some Setters, the fub for Blood-hounds; will find the scent or ground of a Partridge, of Deer's yet in plat Patting ces exposid to the free air or wind, a dishit 'tis very likely that these steams are probly affiduoufly carried away from their ground Fountain, to maintain the fore-mention'd Atmosphere for fix, eight, or which we more hours, that is, as long as the up thede fcent has been observ'd to lye, there will be requisite a continual recruit And that fo very small a portion of Bodies matter as that which we were fayas enis ing

#### Of the Arange Subtilty 62

the ga ing the fomes of these steams may be judg'd to be, being fenfibly to impregnate an Atmosphere incomparably greater than it felf, and supply it with almost continual recruits, we cannot but think, that the steams it parts with, must be of an extreme and fcarce conceivable minutenels.

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And we may further confider, that the fubstances, which emit these fteams, being fuch as newly belong'd to Animals, and were, for the most part, transpir'd through the pores of their feet, must be in likelihood a far more evaporable and diffipable kind of Bodies than Minerals or aduft Vegetables, fuch as Gunpowder is made of; to that if the grains of - CICISO 1 Gunpowder emit Effluviums capable of being by fome Animals perceiv'd at a diffance by their fmell, one may probably fuppole, that the fmall grains of this powder may hold learn, out very many times longer to fup-We Ve ply an Atmosphere with odorable their bo Iteams, than the Corpuscles left on Didicies' the Stil

#### OF EFFLUVIUMS.

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make the ground by transient Animals. by nin. Now though it be generally aincome gree'd on, that very few Birds have any thing near fo quick a fense of minute fimelling as Setting-dogs or Blood-, the hounds, yet that the odour of Gunit bein powder, especially when affisted by evale in the steams of the Caput mortuum of Powder formerly fir'd in the fame confider. Gun, may by Fowls be finelt at a mittel notable diftance, particularly when the wind blew from me towards them, I often perfwaded my felf I re most observ'd, especially as to Crows, when I went a flooting; and was confirm'd in that opinion, both by about the common Tradition, and by fomounder's ber and ingenious perfons much exgrand ercis'd in the killing of Wild-fowl, and of fome fourfooted Beafts.

mis per. I had forgotten to take notice of in one Obfervation of the experienc'd that Fulius Palmarius : Whence we may myhid dearn, that Beafts may leave upon the Vegetables, that have touch'd their bodies for any time, fuch Corside pufcles, as, though unheeded by the maxely other

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#### 64 Of the strange Subtilty

other Animals, may, when eaten by them, produce in them fuch difeafes as the infected Animals had. 1 Heatty For this Author writes in his ufeful atterw Tract de morbis Contagiosis, that he observ'd Horses, Beeves, Sheep and other Animals, to run mad upon the cating of fome of the ftraw on which fome mad Swine had layn.

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And now to refume and profecute : # our former discourse, you may take site 0 notice, that the Effluvia, mention'd stand to have been finelt by Animals, are, with though invisible, yet big enough to a Physical Reputer of the second sec be the objects of fense; fo that 'cis a term not improbable, that, among the int Reams that no fense can immediately perceive, there should be fome a line far more fubtil than these, and confequently capable of furnishing an a data Atmosphere much longer , without I che quite exhaufting the effluviating 1 the matter that afforded them. 07 79

\* Forestus, an useful Author, recites an Example of Pe-\* Lib. 6. 06stilential contagion long ferv. 220 preferv'd in a Cobweb. Alexan-199110

## OF EFFLUVIUMS. 65

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Alexander Benedictus writes also, that at Venice a Flock-bed did for many years harbour a peftiferous malignity to that degree, that when afterwards it came to be beaten, it Shand prefently infected the by-ftanders with the Plague.

And the Learned \* Sennertus himfelf relates, that in the \* tib. 4. de

year 1542. there did in Teb. cap. 3. a may take the City of Uratislavia

mond (vulgarly Breflam,) where he aftermals, m, wards practifed Phyfick, dye of the enough 10 Plague, in lefs than fix Months, lit-6 the is the lefs than fix thousand men, and mong the that from that time the Pestilential meture Contagion was kept folded up in a be here linnen cloth about fourteen years, and at the end of that time being ing al difplay'd in another City, it began a Plague there, which infected alfo the neighbouring Towns and other places.

\* Trincavella makes mention of a yet lastinger Conta-\* Libr. 3. gion, ( which occasion'd con. 17. the death of ten thousand E

perfons)

#### 66 Df the strange Subtilty

perfons) that lay lurking in certain Ropes, with which at *fustinopolis* those that dy'd of the Plague had been let down into their Graves. time

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But, though none of these Relations should to some Criticks appear fcarce credible, it may be objected, that all these things, wherein this Contagion refided, were kept clofe fhut up, or at least were not exposid to the Air. Wherefore having only intimated, that the exception, which I think is not irrational, would, though never fo true, but leffen the wonder of these strange Relations, without rendering them unfit for our prefent purpofe, I shall add, that though 'tis the opinion of divers Learned Phyficians, that the matter harboring Contagion cannot last above Twenty or a few more days, if the Body it adheres to be expos'd to the free air and the wind, and though I am not forward to deny, that their judgement may hold in ordinary cafes; yet I must not deny neither, that a Contagion may fometimes

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times happen to be much more tenacious and obstinate : Of which I shall give but that one, almost recent instance, observ'd by

the Learned \* Dimmer- \* Lib. 4. de brook in his own Apothe-

cary, who having but remov'd with his foot, from one fide to the other of a little Arbour (in his Garden) fome ftraw, that had layn under the Pallet, on which near eight Months before a Bed had layn, wherein a Servant of the Apothecaries, that recover'd , had been fick of the Plague ; the infectious steams prefently invaded the lower part of his leg, and produc'd a pungent pain and blifter, which turn'd to a peftilential Carbuncle, that could scarce be cur'd in a Fortnight after, though during that time the Patient were neither feaverish, nor, as to the reft of his Body, ill at ease. This memorable inftance, together with fome others of the like kind, that our Author observed in the fame City (of Nimmegen) obtain'd, not to fay, E 2 ex-

#### 68 Of the Grange Subtilty

extorted, even from him, this Confeffion; which I add, becaufe it contains fome confiderable, and not yet mentioned Circumstances of the recited cafe: Hoe exemplo Medicorum Doctrina de Contagio in fomite latente fatis confirmatur. Mirum tamen est, boc Contagium tanto tempore in prædicto stramine potuisfe fublistere, utpote quod tota hyeme ventis & pluvis, (he adds in another place) nivibus & frigori, expositum fuisfet. leveral

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And now I will that up this Chapter with an inftance, that fome will think, perhaps, no lefs ftrange than any of the reft, which is, that though they that are skilful in the perfuming of Gloves, are wont to imbue them with but an inconfiderable quantity of odoriferous matter, yet I have by me a pair of Spanish Gloves, which I had by the favour of your fair and virtuous Sifter (F.) that were fo skilfully perfum'd, that partly by her, partly by those, that prefented them her as a Rarity, and partly by me, who have kept them feveral

## OF EFFLUVIUMS. 69

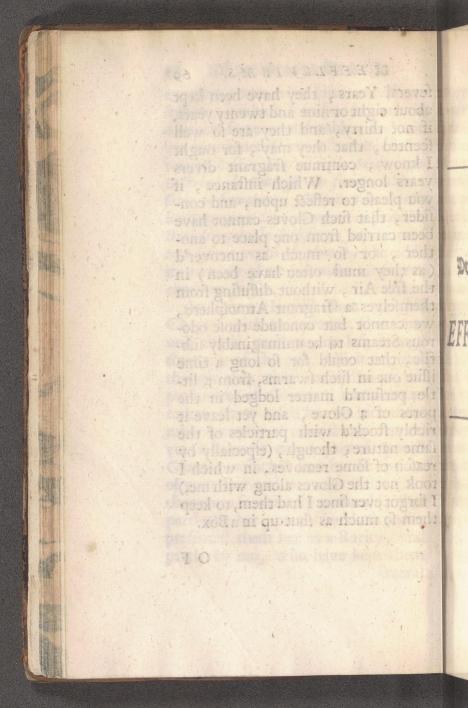
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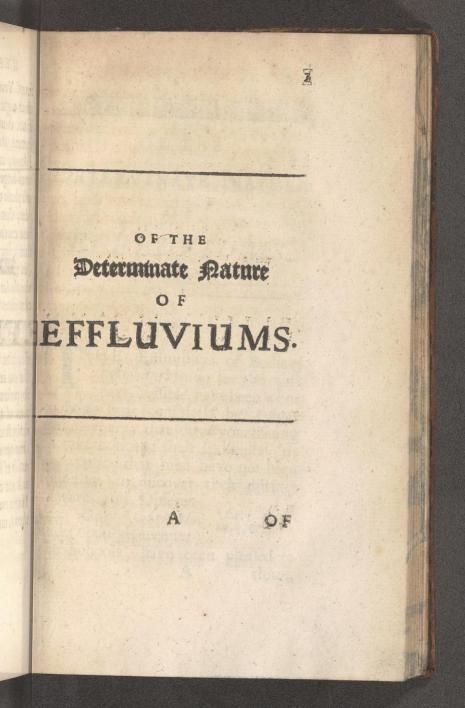
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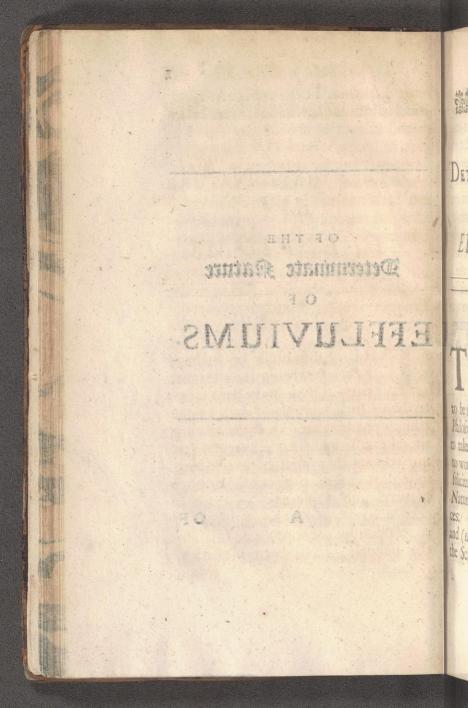
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this in feveral Years, they have been kept becaule it about eight or nine and twenty years, and m if not thirty, and they are fo well ans of the scented, that they may, for ought I know, continue fragrant divers mitelante years longer. Which instance, if tames its you please to reflect upon, and conin public fider, that fuch Gloves cannot have where and been carried from one place to anothe adds ther, or fo much as uncover'd offinit, (as they must often have been) in the free Air, without diffuling from mit themselves a fragrant Atmosphere, thatione we cannot but conclude those odos frange rous Steams to be unimaginably fubhis, but tile, that could for fo long a time hlinde listue out in fuch swarms, from a lite wonth itle perfum'd matter lodged in the inconfide pores of a Glove, and yet leave it s matter, irichly ftock'd with particles of the such fame nature; though, (efpecially by entour reason of some removes, in which I her (A) took not the Gloves along with me,) id, in I forgot ever fince I had them, to keep the them fo much as thut up in a Box.

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THE Effluviums of Bodies, Pyrophilas, being for the moft part invisible, have been wont to be so little confider'd by vulgar Philosophers, that scarce vouchsating to take notice of their Existence, 'tis no wonder that men have not been folicitous to discover their distinct Natures and Differences. Only \* Aristotle, \*Lib. 1 Materia and (upon his account) the Schools, have been pleased to A think,

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think, that the two grand parts of our Globe do fometimes emit two kinds of Exhalations or Steams; the *Earthy* part affording those that are hot and dry, which they name *Fumes*, and very often, simply, *Exhalations*; and the *Aqueous* part, others that are (not as many of his Disciples mistake him to have taught, Cold and Moist,

\* Cap. 3. "Es pa's which they usually oris, uper and Sepure. \* Cap. 3. "Es pa's which they usually call Vapours, to diferiminate them from the

Fumes(or Exhalations,) though otherwife, in common acceptation, those Appellations are very frequently confounded.

But, though the Ariftotelians have thus perfunctorily handled this Subject, it would not become Corpufcularian Philosophers, who attribute so much as they do to the Infensible Particles of Matter, to acquiesce in so flight and jejune an account of the Emanations of Bodies. And fince we have already shewn, that besides the greater and more simple Masses of

### Pature of Effluviums.

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of Terrestrial and Aqueous matter newly mention'd, there are very many mixt Bodies, that emit Effluviums, which make, as it were, little Atmofpheres about divers of them, it will be congruous to our Doctrine and Defign, to add in this place, That befides the flight and obvious differences, taken notice of by Aristotle, the Steams of Bodies may be almost as various as the Bodies themfelves that emit them; and that therefore we ought not to look upon them barely under the general and confused notion of Smoak or Vapours, but may probably conceive them to have their diffinct and determinate Natures, oftentimes (though not always) fuitable to that of the Bodies from whence they proceed.

And indeed the newly mentioned Division of the schools gives us fo flight an account of the Emanations of Bodies, that, methinks, it looks like fuch another, as if one should divide Animals into those that are Horned, and those that have Two Feet : For

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For, belides that the Diffinction is taken from a Difference that is not the confiderablest, there are divers Animals (as many four-footed Beafts and Fishes) that are not comprised in it, and each member of the Divifion comprehends I know not how many diffinct forts of Animals, whole differences from one another are many times more confiderable, than those that constitute the two supreme Genus's, the one having Bulls and Goats, and Rhinoceros's, and Deer, and Elks, and certain Sea-Monfters whofe Horns I have feen; and the other Genus comprising also a greater Variety, namely, a great part of Four-footed Beafts, and, belides Men, all the Birds (for ought we know) whether of Land or Water. And as it would give us but a very flender Information of the Nature of an Elk or an Unicorn, to know that 'tis an Horned Beaft; or of the Nature of a Man, an Eagle, or a Nightingale, to be told, that 'tis an Horn-leß Beaft : so it will but very little instruct a man 111

## Pature of Effluviums.

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in the Nature of the Steams of Quickfilver or of Opium, to be told, that they are Vapours Hot ( or rather Cold) and Moift, or of the Steams of Amber or Cantharides, or Cinnamon, or Tobacco, to be told, that they are Hot and Dry. For , befides that there may be Effluviums, which, even by their Elementary Qualities, are not of either of these two supreme Genus's, ( for they may be Cold and Dry, or Cold and Moift,) these Qualities are often far from being the Nobleft, and confequently those that deferve to be most confider'd in the Effluviums of this, or that, Body; as we shall by and by have occasion to manifest, lated grains will be fo too, and the

Water, the filtrated folution was let to evaporatallin an H D n-mouthed whats, and being then left to theor in

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A Nd here it may not be improper to mention an Experiment, that, I remember, I divers years fince A 4 em-

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employed to illustrate the Subject of our present Discourse. which

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I confider'd then, that Fluid Bodies may be of very unequal denfity and gravity, as is evident in Quickfilver, Water and pure Spirit of Wine, which, notwithstanding their great difference in specifick gravity, may yet agree in the conditions requifite to Fluid Bodies. Therefore prefuming, that by what I could make appear visible in one, what happens analogically in the other, may be ocularly illustrated, I took fome Ounces of Roch-allom, and as much of fine Salt-peter. I took some Ounces of each, because, if the quantity of the ingredients be too fmall, the concoagulated grains will be fo too, and the fuccels will not be fo confpicuous. Thefe being diffolved together in fair Water, the filtrated folution was fet to evaporate in an open-mouthed Glass, and being then left to shoot in a cool place, there were fastned to the lides and other parts of the Glass feveral fmall Cryftals, fome Octoedrical, which

#### Pature of Effluviums.

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Subject which is the figure proper to Rochallom, and others of the Prifmatical Ind In Thape of pure Salt-peter; befides fome a during other Saline concretions, whole being diffinctly of neither of thefe two Sound Thapes, argued them to be concoagulations of both the Salts. And this gran, we did by using fuch a degree of Cethous re lerity in Evaporating the liquor, as Therefore was proper for fuch an effect. For, which is to be athanas employ'd when one would recover avbecan the Salts more diffinctly and manine Ounces feftly, the matter may ( as I found if ine by tryal) be fo ordered, that the aluafter minous Salt may, for the most part, of the in she first coagulated by it felf, and then anong from the remaining liquor curioufly min thap'd Cryftals of Nitre may be cobicuous, pioufly obtained.

Tryals like this we alfo made with other Salts, and particularly with Sea-Salt, and with Allom and Vitriol; the *Phanomena* of which you may meet with in their due places. For the recited Experiment may, I hope, alone ferve to affift the imagination

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to conceive, how the Particles of Bo-the dies may fwim to and fro in a Fluid, with (which the Air is,) and though they dealer be little enough to be invisible, mays in the many of them retain their diffinct hun and determinate natures, and their determinate aptnels to cohere upon occasion; and others may, by their various occurfions and coalitions, unite into leffern atta Corpufcles or greater Bodies differing from the more fimple Particles, that the composed them, and yet not of indeterminate though compounded Figures.

# CHAP. III. oh mes

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THese things being premis'd, we may now proceed to the particular Infrances of the Determinate Nature of Effluviums; and thele we may not inconveniently reduce to the three following Heads, to each of which we shall affign a diffinct Chapter; the first of these I shall briefly

## Pature of Effluviums. ĨĨ micles of the briefly treat of in this third Chapter, and treat somewhat more largely of In the first place then, That the

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ther dind Effluviums of many Bodies retain , autor a determinate Nature oftentimes in calion; and an invisible smallness, and oftener in nous nout fuch a fize as makes them little enough ento lefer to fly or fwim in the Air; may apsolutions pear by this, that these Effluvia being that by Condenfation or otherwife reuninot of the ted, they appear to be of the fame unded H nature with the Body that emitted them. Thus in moiff weather, the Vapours of Water, that wander invifibly through the Air, meeting with Marble-Walls or Pavements, or other Bodies, by their Coldness and other Qualifications, fit to condense mid me and retain them, appear again in the he path form of Drops of Water; and the terminate same Vapours' return to the visible them form of Water, when they fall out ne one of the Air in Dews, or Rains.

aut d Quickfilver it felf, if it be made that to alcend in diffillation with a conit wenient degree of Fire, will almost all

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#### 12 Df the Peterminate

be found again in the Receiver in the form of running Mercury. Which ftrange and piercing Fluid, is in fome cafes to disposed to be strip'd of its Difguifes, and re-appear in its own form, that divers Artificers, and especially Gilders, have found, to their coft, that the fumes of it need not be, as in Distillation, included in close Veffels to return to their priftine nature, Mercury having been feveral times found in the Heads and other parts of fuch People, who have in tract of time been killed by it, and fometimes made to difcever it felf during the Lives of those that dealt fo much in it; of which I elsewhere give fome Inftances. Wherefore I shall only observe at present, that 'tis a common Practice, both among Gilders, and fome Chymifts, that, when they have occasion to make an Amalgam, or force away the Mercury from one by the fire, they keep Gold in their Mouthes, which by the Mercurial fumes, that wander through the Air, will now and them, by

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## Pature of Effluviums.

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eceiver inthe by that time 'tis taken out of their Mouths, be turned white almost, as if it had been filver'd over.

A mais of purified Brimitone being fublimed, the alcending fumes will condense into what the Chymifts call *Flores Sulphuris*, which is true Sulphur of the fame nature with that, for-merly exposed to fublimation; and in close ver imerly exposed to fublimation; and manue, may readily by melting be reduced into fuch another mass.

And to give you another like Ex-ample of dry Bodies; I tryed, that by fubliming good Camphire in clofe veffels, it would all, as to fenfe, be raifed into the upper veffel, or part of the Subliming-glafs in the form of dry Camphire as it was before. Nay though a Body be not by Na-

ture, but Art compounded of fuch differing Bodies as a Metal and anoh, that, ther Mineral, and two or three Salts; w make yet, if upon Purification of the mixture from its groffer parts, the remaining and finer parts be minute enough and fitly shap'd, the whole liquor will afcend, and yet in the Receiver

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Receiver altogether recover its pristine form of a transparent Fluid, composed of differing Saline and Mineral parts. This is evident in the Distillation of what Chymists call Butter, or Oyl of Antimony, very well rectified. For, this Liquor will pass into the Receiver diaphanous and fluid, though, befides the Particles of the Sublimate, (which is it felf a factitious compounded Body) it abounds with Antimonial Corpufcles. carried over and kept invisible by the corroding Salts; whatever Angelus sala, and those Chymists that follow him, have affirm'd to the contrary; as might be eafily here proved, if this were a fit place to do it in.

I found by inquiring of an Ingenious perfon, that had an intereft in a Tin-Mine, that I was not deceived in gueffing, that Tin it felf, though a Metal whofe Ore is of a very difficult fusion, and which I have by it felf kept long upon the Cupel without finding it to fly away, would yet retain its Metalline nature in the form of

#### Pature of Effluviums.

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wer in price of fumes or flowers, For this expe-Ent Ind rienc'd Gentleman answer'd me, that meanly divers times they would take great the flore of a whitish Sublimate from the all upper part of the Furnaces or Chimwhere they brought their Ore a wants to fusion, or wrought further upon it; allous and that this Sublimate, though pere Panels haps elevated to the height of an orhis the dinary Man, would, when melted Budy) it down, afford at once many Pounds Cumples, of very good Tin. On which occathe the fion I shall add, that I have my felf Mulu more than once railed this Metal in hathlow the form of white Corpufcles by the help of an Additament, that did scarce roved if weigh half fo much as it.

# CHAP. IV.

THe fecond way; by which we may difcover the Determinate Nature of Effluviums, is, by the difference that may fometimes be obferv'd in their Senfible Qualities. For, thefe

#### 16 Df the Determinate

these Effluviums that are endow'd with them, proceed from the same fort of Bodies, and yet those afforded by one kind of Bodies being in many cafes manifestly differing from those that fly off from another, this evident disparity in their Exhalations argues their retaining diffinct natures, according to those of the respective Bodies whence they proceed.

I will not now ftay to examine, whether in the Steams, that are made vifibly to afcend from the Terreftrial Globe by those grand Agents and ufual raifers of them, the Sun, and the agitation of the Air, the Eye can manifeftly diftinguish the diversity of colours : But in some productions of Art fuch different colours may be difcovered in the Exhalations, even without the application of any external heat to raile them. For, when Spirit of Nitre, for example, has been well rectified, I have often observ'd, that even in the cold the fumes would play in the unfill'd part of the ftop'd Vials it was kept in, and appear in

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re chow'd it of a reddifh colour, and, if those the fame veffels were open'd, the fame fumes ofe afforded w would copioully afcend into the Air, in the form of a reddish or orangeing in many l tawny Smoak. Spirit or Oyl of Salt ton those this evident alfo, if it be very well dephlegm'd, ions anus though it will fearce in the cold vitures, at fibly afcend in the empty part of a Vial, whilft it is kept well ftop'd; yet, if the free Air be allow'd access comine, to it, it will, in cafe it be fufficiently attained, fly up in the form of a Tendinal w whitish fume. But this is inconfidegents and rable in comparison of what happens Sun, and in a volatile Tincture of Sulphur, I eFreen have elfewhere taught you to make with Quick-lime. For, not only upon a flight occasion the vacant part of much the Vial will be fill'd with white fumes, though the Glafs be well ftop'd; much but upon the opening the Vial thefe or when fumes will copioully pals out at the hashed neck, and afcend into the Air in the der form of a Smoak, more white than perhaps you ever faw any. And both this and that of the Spirit of Salt-peter main do by their operation, as well as fmell, B disclose it son

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disclose what they are; the latter being of a Nitrous nature; (as is confels'd) and the former, of a Sulphureous: In fo much that having for curiofities fake in a fitly shap'd Glass caught a competent quantity of the afcending white fumes, I found them to have conven'd into Bodies transparent and Geometrically figur'd, wherein 'twas easie to discover by their fenfible qualities, that there were ftore of Sulphureous particles mixt with the Saline ones. That the liquors of Vegetables, distill'd in Balneo or in Water, are not wont to retain any thing of the colour of the Bodies that afforded them, is a thing eafie to be observ'd in Distillations made without Retorts or the violence of the Fire. But it may be worth while to make tryal, whether the Effential Oyl of Wormwood afcend colour'd like the Plant, whence 'tis first drawn over with Water in the Limbec, or rectified in Balneo. For, I forgot to take notice of it, when upon some particularities, I observ'd in that Plant, my

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my curiofity led me to find, that not only in the first distillation in a Copper Limbec, tinn'd on the infide, the Oyl came over green, but by a rectification purpofely made in a Glafsvessel, the purified liquor was not depriv'd of that colour.

The mention of these Essential Oyls, as Chymists call those that are drawn in Limbecs, leads me to tell you, that, though these liquors be but Effluria of the Vegetables they are distill'd from, condens'd again in the Receiver into liquors; yet, as fubtile as they are, many of them retain the genuine tafte of the Bodies, whence the heat elevated them; as you will eafily find, if you will taft a few drops of the Effential Oyl of Cinamon, for example, or of Wormwood diffolv'd by the intervention of Sugar or Spirit of Wine in a convenient quantity of Water, Wine, or Beer. For, by this means you have the natural tafte of this Spice or Herb. And Wormwood man o is a Plant, whole Effluvia do fo retain Plan, the nature of the Body that parts with B 2 them

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them, that I must not forbear to alledge here an Observation of mine, that may fhew you, that 'tis poffible, though not ufual, that even without the help of the Fire the expirations of a Body may communicate its taft. For, among other things, that I had occasion to observe about some quantity of Wormwood laid up together, I remember, I took notice, and made others do the like, that coming into a room, where 'twas kept, not only the organs of fmelling were powerfully wrought upon by the Corpufcles that fwarm'd in the Air, but also the Mouth was fenfibly affected with a bitter taft. Perhaps you will fcarce think it worth while, that after this instance I should add, that I found the expirations of Amber, kept a while in pure Spirit of Wine, tast upon the tongue like Amber it felf, when I chew'd it between my teeth. But I choose to mention this instance, becaufe it will connect those lately mention'd with another fort, very pertinent to our prefent purpole. For, the imeria

Pature of Effluviums. 2 I the expirations that I have obtain'd from Amber, both with pure Spirit of Wine, and a more piercing Menstruum, did manifeltly retain in both those liquors a peculiar finell, with which I found it to affect the Noftrils, when, for tryals fake, I excited the Electrical faculty of Amber by rubbing. And as for Odours, 'tis plain, that the Effential Oyls of Chymifts, well drawn, do many of them retain the peculiar and genuine fent of the Spices or Herbs that afforded them. And that these Odours do really confift of, or refide in certain invisible Corpuscles that fly off from the visible Bodies, that are faid to be endow'd with fuch Smells, I have elfewhere prov'd at large; and it may fufficiently appear from their flicking to divers of the Bodies they meet with, and their lafting adhesion to them. moolib

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Other Examples may be given of the fetled difference of Effluviums directly perceivable by Humane Organs of Senfe, as dull as they are ; B 3 which

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which laft expression I add, because I fcarce doubt, but that, if our Senfories were fufficiently fubtile and tender, they might immediately perceive in the fize, shape, motion, and perhaps colour too of fome now invifible Effluviums, as diftinguishable differences, as our naked Eyes in their prefent conftitution fee, between the differing forts of Birds, by their appearances, and their manner of flying in the Air, as Hawks, and Partridges, and Sparrows, and Swallows. To make this probable I will not urge, that in fine white Sand, whofe grains by the unaffifted Eye are not wont to be diffinguished by any sensible Quality', I have often observ'd in an excellent Microfcope, à notable difparity as to bulk, figure, and fometimes as to colour : And that in fmall Cheefe-mites, which the naked Eye can very scarcely discern, so far is it from difcovering any difference between them, one may (as was noted in the last esfay) plainly see, besides an obvious difference in point of bignels, many

#### Pature of Effluviums.

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many particular parts, on whofe accounts the ftructure of those moving points may difference them from each other. And I have sometimes seen a very evident disparity even in point of shape between the very Eggs of these living Atoms, (as a Poet would perhaps stile them.) But these kinds of proofs (as I was saying) I shall forbear to infiss on, that I may proceed to countenance my conjecture by the effects of the Effluviums, that are properly so call'd, upon Animals.

And first, though the Touch be reckon'd one of the most dull of the five Senses, and be reputed to be far less quick in Men than in divers other Animals; yet the gross Organs of that, may, in Men themselves, even by accident, be fo difpos'd, as to be fusceptible of impressions from Effluvia: Of this in another Paper I give fome Infrances. And I know not whether divers of the Prefages of Weather to be observ'd in some Animals, and the Aches and other pains, that, in many crazy and wounded B4 364 men,

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men, are wont to fore-run great changes of Weather, do not often (for I do not fay alwayes) proceed (at least in part) from invisible and yet incongruous Effluxions, which, either from the fubterraneal parts, or from fome Bodies above ground, do copioufly impregnate the Air. And on this occasion it will not be impertinent to mention here what an experienc'd Physician being (if I much mifremember not) the Learned Dimmerbrook, relates concerning himfelf, who having been infected with the Plague by a Patient that lay very ill of it, though by Gods bleffing, which he particularly acknowledges, upon a flight but feafonable Remedy, he was very quickly cured, and that without the breaking of any Tumor; yet it left fuch a change in fome parts of his Body, that he fubjoyns this memorable passage; Ab illo periculo ad contagiofos mibi appropinguanti in emunctoriis successit dolor, vix fallax Pe-His indicium. Das sodo A els bas alera

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## Pature of Effluviums.

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oun gam of the like nature you meet with in another of my Papers \*. proceed And I shall now add, \* About Cofmical Suspitions. that I know an ingenim, with, ous Gentlewoman (Wife to a famous Phylician) who was of a very curious ground, to and delicate complexion, that has feve-An And ral times affur'd me, that the can very t beimper readily difcover, whether a perfon, that comes to visit her in Winter, alluch scame from fome place where there is candidm. any confiderable quantity of Snow; ig huld, and this she does, ( as she tells me ) not with the by feeling any unufual cold (for if the av ter il ground be frozen but not cover'd ing which with Snow, the Effect fucceeds not, ) des, un but from some peculiar impression, ement, he which the thinks, the receives by the and the organs of Smelling. I might add, "Tumor, that I know alfo ( as I may have for-(mepans merly told you) a very ingenious orns this Phylician, who falling into an odd kind of Feaver, had his fenfe of Hearing thereby made fo very nice and tender, that he very plainly heard foft whilpers, that were made at a confiderable distance off, and which were of star I not

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#### 26 Df the Determinate

not in the leaft perceiv'd by the healthy by-ftanders, nor would have my been by him before his fickness. his were Which (fickness) I mention as the more thing, that gave his organs of Hear- theth, ing this preternatural quickness, be- mitim cause when the Feaver had quite left him, he was able to hear but at the much rate of other men. And I might tell alus you too, that I know a Gentleman want of eminent parts and note, who, du- until ring a diftemper he had in his Eyes, porport had his organs of Sight brought to mend be fo tender, that both his friends a him and himfelf alfo have affur'd me, that mil when he wak'd in the Night he could welv for a while plainly fee and diftinguish kining Colours, as well as other objects, di- man feernable by the Eye, as was more with than once try'd, by pinning Ribbands or the like Bodies of feveral colours, ettenothe to the infide of his Curtains in the man dark. For if he were awaken'd in tom the Night, he would be able to tell hant in his bed-fellow, where those Bodies has were plac'd, and what colour each of color them was of an Ho entrance derab to make I have 100

# Pature of Effluviums.

I have mention'd these Instances would have only to shew you, that if our Sensowhich ries were more delicate and quick, the they would be fufficiently affected by addar Objects, that, as they are generally chats, by conftituted, make no impreffions at authall upon them. For otherwife I know, but a the the Species (as they call them) both might of Sounds and Colours, are not held Antienan by many of the Moderns, (from whom , the differt not, ) to be fo much a history a corporeal Effluxions, trajected through much of the medium, as peculiar kinds of Lomindical Motion convey'd by it. Thereme interfore I shall now confirm the conjethrough Eure I would countenance by the difing crimination made by the organs of other Animals of fuch Effluvia as to us men are not only invilible but in-Ribbands fenfible. And therefore partly to mours frengthen what I deliver'd, and sin the partly to confirm what I am now difcourfing of, it will not be impertiment to fubjoyn two or three Rela-And tions, that I had from perfons of very machan good credit, whom I thought likely to make me no unfatisfactory returns Thave .

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to my Queftions about things they were very well vers'd in.

A perfon of Quality, to whom I am near allied, related to me, that to make a tryal, whether a young Bloodhound was well instructed, (or as the Huntsmen callit, made ) he caus'd one of his Servants, who had not kill'd, or fo much as touch'd any of his Deer, to walk to a Countreytown, four Mile off, and then to a Market-town three Miles diftant from thence; which done, this Nobleman did, a competent while after, put the Blood-hound upon the fcent of the man, and caus'd him to be follow'd by a Servant or two, the Master himfelf thinking it also fit to go after them to fee the event; which was, that the Dog, without ever feeing the Man he was to pursue, follow'd him by the fcent to the above-mentioned places, notwithstanding the multitude of Market-people that went along in the fame way, and of Travellers that had occasion to cross it. And when the Blood-hound came to the chief 01

#### Pature of Effluviums.

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chief Market-town, he país'd through the ftreets, without taking notice of any of the people there, and left not till he had gone to the Houfe, where the Man, he fought, refted himfelf, and found him in an upper Room to the wonder of those that follow'd him. The particulars of this Narrative the Nobleman's Wife, a person of great veracity, that happen'd to be with him when the tryal was made, confirm'd to me.

Enquiring of a fludious perfon, that was Keeper of a Red-dear-park and vers'd in making Blood-hounds, in how long time, after a Man or Deer had pass'd by a graffy place, one of those Dogs would be able to follow him by the fcent ? He told me, that it would be fix or feven Hours: Whereupon an ingenious Gentleman, that chanc'd to be prefent, and liv'd near that Park, affur'd us both, that he had old Dogs of fo good a fcent, that if a Buck had the day before pass'd in a Wood, they will, when they come where the fcent lies, though

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though at fuch a diftance of time dam after, prefently find the fcent and house run directly to that part of the Wood bond where the Buck is. He also told me, with that though an old Blood-hound will pering not fo eafily fix on the fcent of a fingle may Deer, that prefently hides himself in april a whole herd ; yet if the Deer be and h chas'd a little till he be heated, the inter Dog will go nigh to fingle him out, though the whole herd allo be chas'd. The above-nam'd Gentleman alfo affirm'd, that he could eafily diftinguish | thous whether his Hounds were in chafe whether of a Hare or a Fox by their way of and running, and their holding up their atta Nofe higher than ordinary when they purfue a Fox; whole fcent is more three ftrong. These Relations will not be them judg'd incredible by him that reflects whit on some of the Inftances that have circumf already (in the foregoing Effay) been given of the strange subtilty of Efa confi fluvia: To which I shall now add, that I remember, that to try whether it tage is I could in some measure make Art t Rrvail' imitate Nature, I prepared a Body t our Exp of

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# Rature of Effluviums.

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dim of a vegetable fubstance, which, feen with though it were actually cold, and the Word both to the Eye and Touch dry, did told m, for a while emit fuch determinate and piercing, though invisible, Exhaladaingle tions, that having for Tryals fake intin applied to it a clear Metalline Plate Deer be (and that of none of the very fofteft ated, the kind neither) for about one Minute of hin out an Hour, I found, that, though there uchasid, had been no immediate contact bem that tween them, I having purfpofely interpoled a piece of Paper to hinder it; in the yet there was imprinted on the furway of face of the Plate a confpicuous stain when of that peculiar colour, that the Bowhen they dy, with whose Steams I had imbued the vegetable substance, was fitted il note to give a Plate of that mix'd Metal. treffets And though it be true, that in fome the circumstances, the lately mention'd Inftances about Blood-hounds have a confiderable advantage of this I have now recited; yet that advantervail'd, by fome circumstances of But our Experiment. For, not to repeat, that

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that the emittent Body was firm and cold, the Effect produced by the Effluvium that guided the Settingdog, was wrought upon the Senfory of a living and warm Animal; and fuch an one, whole organs of Smelling are of an extraordinary tender Constitution above those of Men and other Animals, and probably the Impression was but transient; whereas in our cafe the invisible Steams of the vegetable substance wrought upon a Body which was of fo ftrong and inorganical a Texture as a (compounded) Metal, though it were fenc'd by being lapt up in Paper, notwithstanding which these Steams invaded it in fuch numbers, and fo notably, as to make their Operation on it manifest to the Eye, and confiderably permanent too; fince coming to look upon the Plate after the third day, I found the induced Colour yet conspicuous, and not like fuddenly to vanifi nono lour a set

Hitherto in this Chapter I have argued from the conftant and fetled diffe-

#### Pature of Effluviums.

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32 difference of the sensible Qualities of Effluviums, that they do not always lofe their diffinct natures, when they feem to have loft themfelves by vanishing into Air. But before I difmils this Subject, I must confider an Objection, which I know may be made against the Opinion we have been countenancing. For it may be alledg'd, that there may be many cafes, wherein the Effluviums of Bodies are, in their passage through the Air, sensibly alter'd, or do affect the Organs of fense otherwise than each kind of them apart would do: Nor is this difficulty altogether irrational. For it feems confonant enough to Experience, that fome fuch cafes should be admitted, and therefore in the foregoing Discourse I have, where I thought it neceffary, forborn to exprefs my felf in fuch general and abfolute terms, as otherwife I might have done. But, as for fuch cafes as I have inlifted upon, and many more, I shall now represent, that the objected alterations need not hinder, but that Efflu

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Effluviums at their first parting fromthe Bodies, whence they take wing (if I may fo fpeak,) may retain as much of the nature of those Bodies, as we have afcribed to them; fince the fubfequent change may very probably be deduc'd from the combinations or coalitions of divers Steams affociating themfelves in the Air. and acting upon the Senfory, either altogether and conjointly, or at least to near it, that the Senfe cannot perceive their Operations as diffinct. This I shall elucidate, but not pretend to prove, by what happens in Sounds and Tafts. For if, by way of instance, in a Mufical instrument, two ftrings tun'd to an eigth, be touch'd together, they will firike the Ear with a found, that will be judg'd one, as well as pleafing, though each of the trembling ftrings make a diffinct noife, and the one vibrates as fast again as the other. And if, into Oyl of Tartar per Deliquium, you drop a due proportion of Spirit of Nitre, and exhale the fuperfluous moifture, the'

#### Mature of Effluviums.

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the Acid and Alcalizate Corpufcles, that were fo finall as to fwim invifibly in those liquors, will convene into Nitrous Concretions, whole taft will be compounded of, but very differing from, both the tafts of the Acid and Tartareous Particles; which Particles may yet, for the most part, by a skilful Diffillation, be divore'd again. And fo, if to a ftrong folution of Pot-ashes or Salt of Tartar you put as much in weight of Sal Armoniack, as there is of either of those fixt Salts contain'd in the liquor; you may, befides a fubril Urinous Spirit that will eafily come over in the distillation, obtain a dry Caput mortuum, which is almost totally a compounded Salt, differing enough from either of the ingredients, especially the Alcalizate, as well in Taft as in fome other Qualities: This Salt (free'd from its faces) being that Diuretick Salt, I feveral years ago gave quantities of, to fome Chymifts and Phylicians, from the most of whom I received great thanks, accompanied with Cz

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with the (more acceptable) accounts of the very happy fuccels they had employed it with, though ufually but in a fmall Dofe, as from fix, eight or ten Grains to a Scruple. But this being mentioned only upon the by, I shall proceed to tell you, that, fince I intimated to you already, that I would mention Examples of Sounds and Tasts only to illustrate what I had been delivering; I shall now add fome Inftances by way of Proof, of the Coalition and refulting change of Steams in the Air. 'Tis eafily obfervable in fome Nofe-gays, where the differing Flowers happen to be conveniently mix'd, that in the fmell afforded by it, at a due diftance, the Odours of the particular Flowers are not perceiv'd, but the Organ is affected by their joynt-action, which makes on it a confuled but delightful impreffion. And fo, when in a Ball of Pomander, or a perfum'd Skin, Musk, and Amber, and Civet, and other fweets are skilfully mix'd, the coalition of the distinct Effluvia of the ingre-

#### Rature of Effluviums.

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37 ingredients, that affociate themfelves in their passage through the Air, produce in the Senfory one grateful perfume, refulting from all those Odours. But if you take Spirit of fermented Urine and Spirit of Wine, both of them Phelgmatick, and mix them together, they will incorporate like Wine and Water, or any other fuch liquors, without affording any dry concretions. But if you expose them in a convenient Veffel but to the mild heat of a Bath or Lamp, the afcending Particles will affociate themselves, and adhere to the upper part of the Glass in the form of a white but tender Sublimate, confifting both of Urinous and Vinous Spirits, affociated into a mixture, which differs from either of the liquors, not only in Confiftence, Taft and Smell, but in fome confiderable Operations performable by this odd mixture; which, this is not the place, to take further notice of. And if Spirit of Salt and Spirit of Nitre be, by Diftillation, elevated in the form of Fumes, C 3 10 WYSW!

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fo order'd as to convene into one liquor in the Receiver, this liquor will readily diffolve crude Gold, though neither the Spirit of Nitre alone, nor that of Salt would do fo. AVERY DE

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And that you may have an ocular proof of the Poffibility of the diffinctnels and fublequent Commixture of Steams in the Air; I shall now add an Experiment, which I long fince devis'd for that purpose, and which I foon after shew'd to many curious perfons, most of whom appear'd somewhat surpriz'd at it. The Experiment was; that I took two fmall Vials, the one fill'd with Spirit of Salt, but not very ftrong, the other with Spirit of fermented Urine or of Sal Armoniack very well rectified : These Vials being plac'd at fome diftance, and not being ftop'd, each liquor afforded its own fmell, at a pretty diffance, by the Steams it emitted into the Air, but yet these Steams were invisible. But when these Vials, (which should be of the fame fize ) came to be approach'd very

#### Pature of Effluviums.

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very near to each other, though not fo, as to touch ; as when the two liquors are put together in the form of liquors, they will notably act upon one another; fo their respective Ef-Huviums meeting in the Air, would, anfwerably to the littleness of their bulk, do the like, and, by their mutual occurfions, become manifeftly visible, and appear moving in the Air like a little portion of Smoak or of a Mift, which would quickly ceafe, if either of the Vials were remov'd half a Foot or a Foot from the other. And I remember, that, to add to the oddness of the Phanomenon, I sometimes made a drop of the Spirit of Salt hang at the bottom of a little flick of Glass or some other convenient Body, and held this drop thus fuspended in the Orifice of a Vial that had Spirit of Sal Armoniack in it, and was furnish'd with a somewhat long neck; for by this means it happen'd, as I expected, that the alcending Urinous Particles, though invifible before, invading plentifully the Acid C4

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Acid ones of the drop, produced a notable Smoak, which, if the drop were held a little above the neck of the Glafs, would most commonly fly upwards to the height of a Foot or half a Yard : But if the drop were held fomewhat deep within the Cavity of the neck, a good part of the produced Smoak would oftentimes fall into the Cavity of the Vial, which was left in great part empty, fometimes in the form of drops, but ufually in the form of a flender and fomewhat winding ftream of a white colour, that feem'd to flow down just like a Liquor from the depending drop, till it had reach'd the Spirit of Sal Armoniack; upon whole lurface it would fpread it felf like a Mift. But this only upon the by. As for the main Experiment it felf, it may be, as I have found, fuccefsfully try'd with other Liquors than thefe; but tis not neceffary in this place to give an account of fuch Tryals; though perhaps, if I had leifure, it might be worth while to confider, whether thele - # (-

Plature of Effluviums. 4I these Coalitions of differing forts of Steams in the Air, and the Changes refulting thence of their particular precedent Quantities, may not affift us to inveftigate the caufes of divers fudden Clouds and Mifts, and fome other Meteorological Phanomena, and alfo of divers changes that happen in the Air in reference to the coming in and ceafing of feveral either Epidemical or contagious Difeases, and particularly the Plague, that feem to depend upon fome occult temperature and alterations of the Air, which may be copioufly impregnated by the differing fubterraneal ( not to add here, Sidereal) Effluviums, that not unfrequently afcend into it ( or otherwife invade it,) with Peftiferous or other Morbifick Corpufcles, and i my fometimes with others of a contrary Nature, and fometimes too perhaps, he hat neither the one fort of Steams, which to give may be fuppos'd to have imbued the thigh Air, is in it felf deleterious; nor the the other fulutary, but becomes fo upon their cafual coalition in the Air. You will

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will perhaps think this Conjecture of Fother C the refultancy of pestilential Steams, 1 later the less improbable, if I here add that bable on odd Observation, which was frefince, 2 quently made in the formerly menrience . tioned Plague at Nimmegen by a Phythe wa fician fo Judicious as \* Traft. de Pefte, \* Dimmerbrook, whole lib. 2. cap. 3. words are thefe; Illud

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notatu dignum sepissime observavimus, nempe in illis ædibus in quibus nulla adbuc pestis erat, si linteamina sordida aqua & fapone nostrate (ut in Belgio moris est) illic lavarentur, eo ipso die, vel interdum postridie, duos tres-ve simul peste correptos fuisse, ipsique egri testabantur fætorem aque japonatæ illis primam & maximam alterationem intulisse. Hos ipsum quoque in meo ipsius hospitio infelix experientia docuit, in quo post lota linteamina statim gravem alterationem perceperunt plerique domestici, & proxime sequenti notte tres peste correpta, ac brevi post mortua fuere. I omit the Inftances he further fets down to confirm this odd Phenomenon , of which, though perhaps fomer other

## Bature of Effluviums.

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other

or other Caufe may be devifed, yet that Stans, I lately affign'd feems at least a probable one, if not the most probable; fince, as 'tis manifeft by daily experience, as its manual occasion'd by rience, that the finell occasion'd by the washing of foul Linnen with the Soap commonly used in the Nether-, while lands, produces not the Plague ; fo hele, Im by our Learned Author's Oblervation by our Learned Author's Concrete and it appears, either that there were not yet any Pertilential Effluxions in the Air of those places, which on the occasions of those washings became infected, or at leaft that by the addi-tion of the fetid Effluxia of the foapy Water, those Morbifick Particles, that were difpers'd through the Air before, had not the power to introduce a malignant conftitution into the Air, Air, and to act as truly Peftilential, magazin till they were enabled to do fo by being affociated with the ill-scented Effluvia of the Soap.

Whether alfo Salutary, and, if I may to call them, Alexipharmacal Corpufcles may not be produc'd in the Air by Coalition, might be very well

### DE the Determinate

well worth our Enquiry : Especially if we had a competent Historical Account of the yearly ceasing of the Plague at Grand Cayro. For, as I have elsewhere noted out of the Learned Prosper Alpinus, who practis'd Physick there; and as I have also been inform'd by some of my Acquaintance who visited that vast City, that almost in the midst of Summer as

\* The Plague which here miferably rageth upon the first of the Flood doth instantly ceafe; in fo much as when five Hundred dye at Cayro the day before, which is nothing rate, (for the found keep conspany with the fick, holding Death fatal, and, so avoid them, Irreligion,) not one doth dye the day following; fays Mr. Sandys in his Travels, Lib, 2.

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foon as the River begins to rife\*, the Plague has its malignity fuddenly check'd, even as to thofe that are already infected, and foon after ceafes; fo if other Circumftances contradict not, one might guels, trates

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that this ftrange *Phenomenon* may be chiefly occafion'd by fome Nitrous or other Corpufcles that accompany the overflowing *Nile*, and by affociating themfelves with what *Hippo*crates

# Pature of Effluviums.

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Effects crates fomewhere calls rooreeds Somppolas, difable them to produce their wonted pernicious Effects. To which Hyroore than one Traveller into by more than one Traveller into the by more than one travel

ing Emanation diffus d thorow the Air. \* Mr. Sandys in the Book abovecited.

flowing of *Nilus*, that it proceedeth from a natural Caufe, this one, though ftrange, yet true Experiment will fuffice. Take of the Earth of *Egypt* adjoining to the River, and preferve it carefully, that it neither come to be wet nor wafted, weigh it daily, and you fhall find it neither more nor lefs heavy until the feventeenth of *June*, at which day it beginneth to grow more ponderous, and augmenteth

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menteth with the augmentation of the River, whereby they have an infallible knowledge of the ftate of the Deluge, proceeding without doubt from the Humidity of the Air, which having a recourfe through all paffible places, and mixing therewith increafeth the fame, as it increafeth in moifture.

That these Sanative Steams perform their Effects meerly becaufe And they are moift, I prefume Naturalifts will fcarce pretend ; but that they have may be of fuch a nature as by their the Coalition with the Morbifick Corpufcles to increase their Bulk and alter their Figure, or precipitate them out of the Air, or clog their Agility, or pervert their Motions, and in a word deftroy all or fome at leaft of those Mechanical Affections which made those Corpuscles Peftilential : That, I fay, these Antidotal Vapours (if I may to call them) may have and thefe Effects upon thofe that formerly were Morbifick, and that fo there may refult from the Affociation of twoi

# Mature of Effluviums.

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harm of har an two forts of Particles, whereof one was of a highly noxious nature, a harmlefs mixture, might here be made probable by feveral things; but that there is about the Coalitions of the Effluvia of Spirit of Salt and of Urine (Liquors known to be highly contrary to each other) is not already forgotten by you.

because And the Experiment with which Namility I am to conclude this Effay will perthat hey haps make you think it poffible, that s by their the Peftiferous Steams that have alher Cor ready pass'd out of the Air, and in-Bulk and vaded, but not too much vitiated, the Bodies of Men, may have their main lignity much debilitated by the fu-min pervening of these Antidotal Partit left cles. For in that Experiment you with will find, that the Steams emitted hienna into the Air from the Liquor there Wants defcribed, though that were actually my his cold, were able to reach, and manifinery feftly to Operate, (and that probably the by way of Pracipitation, ) upon Cornum of pufcles that were fenced from them two.

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by the Interpolition of other Bodies, not more porous than those of living Men. Whether the fume of Sulphur, which by many is extoll'd to prevent the Infection of the Air, do by its acid or other Particles difarm, if I may fo fpeak, the Peftilential ones, I have not new time to inquire : No more than whether in Ireland. and fome few other Countries, that breed or brook no poyfonous Animals, that hostility may proceed, at least in great part, from the peculiar Nature of the Soyl, which both from its fuperficial and deeper parts, constantly supplies the Air with Corpuscles destructive to venemous Animals. And fome other Particulars, that may be pertinently enough confider'd here, you may find treated on in other Papers. And therefore at prefent I shall only intimate in a word, that having purpofely made a vifible and lafting Stain on a folid Body barely by cold Effurvia, I did by the invisible and cold Steams of another Body make in two or three Minutes a visible

Pature of Effluviums. 40 visible change in the colour of that Stain.coup A , such flom and a of . but

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And as for the other part of the Conjecture, (viz.) That Meteors. may fometimes be produc'd by the Occurfions of Subterraneal Effinitia; fome of them of one determinate Nature, and fome of another, I think I could, to countenance it, give you divers Instances of the plentiful Impregnation of the Air at fome times, and in fome places, with Steams of very differing Natures, and fuch as are not fo likely to be attracted by the Heat of the Sun, as to be fent up from the Subterraneal Regions, and fometimes from Minerals themfelves. But for Instances of this kind, I shall, for brevities fake, refer you to another Paper\*,

where I have pur- \* An Effay of Subposely treated of this tions. Subject, and particu- and port

terraneal Exhala-

larly shewn, That though usually the Effluxions that come from under ground are ill-scented, yet they are not alwayes fo; and alfo that Sulphureous

#### Of the Determinate

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phureous Exhalations even from cold, and, for the moft part, Aqueous Liquors may retain their determinate nature in the Air, and act accordingly upon folid Bodies themfelves, to whole Conftitution those Effuria chance to be proportionate.

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But one memorable Story not mention'd in that Difcourfe is too much to our prefent purpofe to be here omitted, efpecially having met with it in fo approved an Author as the experienc'd Agricola, who having mention'd out of antient Hiftorians the Raining of White and Red liquors, which they took (erroneoufly I doubt not) for Milk and "Agrie de Nat. eorem due effluant e Terra, "Wit autem majorem fidem babeamus An-

nalium monumentis facit res illa decantata, que Patrum memorià (in another place he specifies the Year of our Lord) in Suevia assidit; Aen enimille stillavit guttas, que lineas vestes cracibus rubris quasi fanguineis imbuebant. Which I the rather mention, because it does not

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not only prove what I alledge it for ; but may keep, what is lately and very credibly reported to have happen'd in divers places of the Kingdom'of Naples foon after the Fiery Eruption of Vefuvius, from being judg'd a Phanomenon either altogether fabulous, (as doubtless many have thought it,) or a Prodigie without all example, as is prefum'd even by those that think it not miraculous. And to this I add, that 'twill be the lefs improbable, that the more agile Corpufcles of Subterraneal Salts, Sulphurs and Bitumens, may be rais'd into the Air, and keep diffinct natures there, if fo fixt a Body as common Earth it felf can be brought to fwim in the Air. And yet of this the worthy Writer newly quoted gives us, befides what Annals relate, this Teftimony upon

his own knowledge: \* Certè hic Kempnicii undecimum abhinc annum mense Septembri

mum abhinc annum mense Septembri effluxerunt imbres, sic cum terra lutea D zi com-

#### Of the Determinate

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And to fhew you that in fome cafes the Particles even of Vegetable Bodies may not fo foon perifh in the Air as they vanish there, but may retain distinct natures at a greater diftance, than one would think, from the Bodies that copioufly emit them; I shall add, that having defir'd an ingenious Gentleman, that went on a confiderable Employment to the East-Indies, to make some Observations for me in his Voyage; he lent me among other things this Remarque : That having fayl'd along the Coaft of Ceylon, (famous for Cinnamon-trees and well-fcented Gums.) though they Coasted it almost a whole day, the Wind, that then chanc'd to blow from the fhoar, brought them a manifestly odoriferous Air from the Island, though they kept off many miles (perhaps twenty or twentyfive) from the floar. Nor flould this be thought incredible, becaufe the diffusion seems to disproportionate to that

#### Pature of Effluviums. 53 that of other Bodies diffolved by Fluids; as, for inftance, though Salt be an active Body and refoluble into abundance of minute Particles, yet one part of Salt will learce be taftable in an hundred parts of Water. For fenfibly to affect fo grofs an Organ as that of our Taft, there is usually required in fapid Particles a bignets far exceeding that which is necessary to the making Bodies fit Objects for the fenfe of Smelling, and, which is here mainly to be confidered, there is a great difference between the power a Body has to impregnate fo thin and fine a Fluid as Air, whole parts are to rare and lax, and that which it has to impregnate Liquors, fuch as Water or Wine, whole parts are fo conflipated as to make it not only visible and tangible, but ponderous. On which occafion I remember that having had a Curiofity to try how far a fapid Body could be diluted without ceafing to be fo, I found by Tryal, that one drop of good Chymical, and, as Artifts call it, Effential D 3 Oyl

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Oyl of Cinnamon being duly mix'd by the help of Sugar with Wine, retain'd the determinate taft of Cinnamon, though it were diffus'd into near a quart of Wine. So that making a moderate effimate, I concluded, that upon the common supposition, according to which a drop is reckon'd for a Grain, one part of Ovl had given the specifick Taft of the Spice, it was drawn from, to near fourteen thoufand parts of Wine. By comparing which Experiment with what I noted about the proportion of Salt requifite to make Water talt of it, you will eafily perceive ; that there may be a very great difference in point of diffusiveness between the little Particles that make Bodies fapid : Which may ferve to confirm both fome part of the first Chapter of the foregoing Esfay of the Subtilty of Effluvia, and what I was lately faying to fhew it possible, that Antimonial Glass might impart flore of Steams to the Emetick Wine, without appearing upon common Scales to have loft of its 11- 288. 3 Chin weight ;

#### Mature of Effluviums.

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weight; fince we fee, that one Drop of fo light a Body as Ovl may communicate not infensible Effluvia, but taftable Corpufcles to near a Quart of Liquor. But this is not all for which I mention our Experiment: for I must now add, that besides the almost innumerable Sapid parts of a fpicy Drop communicated to the Wine, it thence diffused a vaft number of odorous Particles into the Air. which both I, and others perceived to be imbued with the diffinct fcent of Cinnamon, and which perhaps the Liquor would have been found able to have Aromatized for I know not how long a time, if I had had leifure to profecute the Obfervation. beenels or lituperaction, for example,

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Subtiliv of Effloriums,

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Effuria \* of the Fifth

THE third and laft way I shall mention of shewing the Determinate Nature of Effluviums, is to D 4 be

tion'd by the Ingenious Pilo, mani-

### Of the Determinate

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be taken from the Confideration of their Effects upon other Bodies than the Organs of our Senfes; (for of their Operations upon these we have already spoken in the foregoing Chapter.) For the Effects, that certain Bodies produce on others by their Effluviums, being constant and determinate, and oftentimes very different from those, which other Agents by their Emissions work upon the fame and other subjects, the diffinct nature of the Corpuscies emitted may be thence sufficiently gather'd.

We may from the foregoing Tract of the Subtility of Efflueia, borrow fome Infrances very pertinent to this place. For the temporary benumbednels or flupefaction, for example,

\* See the Effay of the Subtility of Effluviums, Chap. 4. produc'd in the Fiftherman's Foot by the Effluvia \* of the Fifth (Amoreatim) menthrough

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tion'd by the Ingenious Pife, manifefts, that those ftupifying Emanations retain'd a peculiar and venemous nature during their whole passage through

#### Pature of Effuviums.

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through the Shoe, Stocking and Skin, interpos'd betwixt the Fifh and the find nervous part of the Foot benumb'd the by it. And though there are very few other Bodies in the World, that are minute enough to pais through by that the pores of Glass, "tis apparent, by tand the Experiment there recited of the very di oblong Iron Hermetically feal'd up there in a Glass-pipe, that the Magnetical Effluvia of the Earth may retain their edint peculiar and wonderful nature in a inductive fimallness that qualifies them to pass freely through the pores of Glais it In Explications the root and juyo fish an In

but that I may neither repeat what you have already met with in the foregoing Tract, nor anticipate what I have to fay in the next; I will employ in this Chapter fome Intyphe flances that may be fpar'd from both.

the That divers Bodies of a Venemous nen nature may exercise fome fuch Opemi a rations upon others by their Effluyiums transmitted through the Air, mous as they are wont to do in their groß fubftance, is a Truth, whereof though baisgor I have

## 58 Df the Determinate

I have not met with many, yet I have met with fome Examples among Phynervous part of the Foot besensibil

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The Learned \* Sennertus observes \* Lib. 5. parte 7. as a known thing, cup. 1. Apothecaries have even th been caft into profound Sleeps, when man in diffilling Opiat and Hyphotick Liquors they have received in at their Plan Nottrils the Vapours exhaling from man those Bodies. Intrabriow bors milliosa lame

Tis recorded by the \* Writers i shalo to estabout Poylons', y that at the \* In Explicatione the root and juyce of po me Herbarum Eiblicarum, cap. 2. Mandragora caftsthofe, ni fiv terr ythat take it winto a me deep Siper not unlike a Lethargy And hat h though the Apples of the fame Plant rated bel thought to be much lefs malignantis yet Levinds Lemnins relates that it happen'd to him more than a when once, that having laid fome Man- hare drake Apples in his Study , he was wing by their Steams made fo fleepy; that un Cla he could hardly recover himfelf; but tod the Apples being taken away he while I have regain'd

# Pature of Effluviams.

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httlm regain'd alacrity, and threw off all anding Pho drow finefs.

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Among all Poyfons there is fcarce Diators and whole Phanomena are in my opiminimi nion more ftrange than those that Appender proceed from a mad Dog; and yet canes has even this Poyfon, which feems to enny, what require Corpufcles of fo odd and demund terminate a nature, is recorded by at the Phyficians to have been conveyed by Exhalations. Aretaus writes (as a Learned modern quotes him,) Quod \* With a rabido cane, qui in faciem, dum spirino, the tus adducitur, tantummodo inspiraverit, diverse & nullo modo momorderit, in rabiem and homo agatur. And as there are relations, among Phyficians, of Animals, my And that have become Rabioli by having eaten of the parts or excrements of er rabid Animals; fo \* Libro 3. Acutor.

\* Calius Aurelianus, \* Libro 3. Acutor. Morbor. who writes, that fome

have been made to run mad, not by being bitten, but wounded only with the Claws of a mad Dog, tells us alfo of a man, that fell into a Hydrophobia (which is wont to be a high regaine degree

#### Dt the Determinate 60

degree of the Rabies, and by fome of the antienter Writers was employ'd to fignifie that Difease ) without being bitten by a mad Dog, but infected solo odore ex rabido cane attracto. By which Odours in this and other Narratives of Poylons I understand not a bare Scholastick species, but a fwarm of Effluvia, which most commonly are all or at least fome of them odorous. And though it may justly feem strange to many, that the Venom of a mad Dog should be communicated otherwile than by biting, which is fuppos'd to be the only way he can infect by, it may appear lefs improbable, because Mattheus de Gradibus names a perfon, who, he fays, prov'd infected after many days, by only having put his Hand into the Mouth of a mad Dog, who did not bite him. And the formerly mentioned Matthiolus relates, that he faw two, that were made rabid without any wound by the flabber of a mad Dog, with which they had the miffortune to be befmear'd. degree

\* Sen=

#### Pature of Effluviums.

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\* Sennertus himself affirms of a Painter of his acquainance, \* Sennert. Libr. 6.

when he had opart. 6. cap. 2.

he had long kept included *Realgar*, a noxious Mineral, fometimes ufed by Painters and not unknown to Chymifts, and had unfortunately fnuff'd in the Steams of it, he was feis'd with a giddinefs in his Head and fainting fits, his whole Face alfo fwelling, though by taking of Antidotes he efcap'd the danger.

a gradiners in his Head and fainting fits, his whole Face allo fwelling, though by taking of Antidotes he efcap'd the danger. Divers other Examples we have met with in the writings of Phyficians, which I forbear to add to thefe, becaufe, I confefs, I very much doubt the Truth of them, though the deliverers of fome of them be men of Note. But the probability of moft of the things already cited out of credible Authors may be ftrengthned by what I fhall now fubjoyn, as a further proof of the diffinct Nature of Effluvia; of which it will be a very confiderable Proof, if Medicines, which are of a milder and

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Inrega more familiar nature and operation alledgid than Poyfons, shall yet be able in fome cafes to retain, in their invilible Particles fwimming in the Air, the fame, (though not fo great) power of Purthe Air ging, which is known to belong to them when their groß Body is taken the Bo in at the Mouth. Of this I have elfewhere, on another occafion, given 1 fome Examples. To which I fhall now add, that I know a Doctor of Phyfick, that is ufually Purg'd by the rate b Odours or Exhalations of a certain Electuary, whofe Cathartick Operaof the Pa tion, when it is taken in fubstance, is wont to be but languid. And another Doctor of my acquaintance, latter caufing good frore of the root of Mind black Hellebore to be long pounded . The in a mortar, most of those, that were the in the room, and effectially the party that pounded it, were thereby purg'd, and fome of them ftrongly enough. Into the And the Learned Sennertus fomewhere affirms, that fome will be state purg'd by the very Odour of Colocyn- 10 the this. And 'tis not to be pass'd by unre-

### Pature of Effluviums.

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unregarded, that in the cafes I have the minimum alledg'd, Exhalations, that are enmildepart dow'd with Occult Qualities, (for those of Cathartick Medicines are ourd fur reckon'd among fuch) afcend into the Air without being forc'd from the Bodies they belong'd to by an I have de External heat.

And if I would in this place alinit I had ledge Examples of the Operations of about of fuch Effluvia, as do not pass into the angle the Air, but yet operate only by the confactor tact of the External parts of the Botact Open dy, I could give Instances, not only librare, of the *Purgative*, but the *Emetick* Qua-And and lities of fome Medicines exerted without their being taken in at the Mouth, or injected with Instruments.

There are alfo other forts of Examples than those hitherto mentioned, that argue a Determinate Nature in the Effluxions of fome Bodies emitted into the Air. Approv'd Writers tell us, that the Shadow of a Walnut-tree with the Leaves on it is very hurtful to the Head; and fome Inftances they give us of great mischief it has fome-

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fometimes done. And though the Shadow, as fuch, is not likely to be guilty of fuch bad Effects; yet the Effluvia of the neighbouring Plant may be noxious enough to the Head. For I, that was not at all prepofiels'd with an opinion that it was fo, and therefore without fcruple reforted to the Shade of Walnut trees in a hot Countrey, was by experience forc'd to think it might give others the Head-ach, fince it did to me, who, thanks be to God, both was, and am still very little subject to that diftemper. And this brings into my mind an Observation that I have met with among fome ingenious Travellers into the west-Indies, who observe in general, and of late a Countrey-man of our own affirms it in particular, of the poylonous Manchinello-tree, that Birds will not only forbear to eat of the Fruit of venemous Plants, but, as to fome of them, will not fo much as light on the Trees: Which I therefore mention, becaufe proba-5 FEATS bly Nature instructs them to avoid fuch -omoi

#### Pature of Effluviums,

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o avoid fuch fuch Trees by fome noxious Smell, or other Emanation, that offends the approaching Birds. And I remember, that fome of our Navigators give it for a Rule to those that happen to land in unknown Islands or Coasts, that they may venture to eat of those parts of Fruits which they can perceive, the Birds, like kind Tasters, to have been pecking at before.

Nicolaus Florentinus (cited by Sennertus) tells us of a certain Lombard, that having in a House, that he nam'd, at Florence, burn'd a great black Spider at the flame of a Candle; so unwarily, that he drew in the Steams of it at his Nostrils, presently began to be much diforder'd and fell into a fainting fit, and for the whole night had his Heart much disaffected, his Pulse being so weak, that one could scarce perceive he had any; though afterwards he was cured by Treacle, Diamosc, and the powder of Zedoary mixt together.

And I remember, that being some years ago in *Ireland*, I gather'd a E certain

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certain Plant (peculiar to fome parts of that Countrey) which the Natives call Maccu-buy, because of strange Traditions that go about it; the chief of which I found by tryal not to be true: But yet being fatisfied, that its Operations were odd and violent enough, I was willing to gratifie the chief Phylician of the Countrey, who was defirous I should propose to him fome wayes of correcting it; and whilft I was speaking of one that required the pounding of it, he told me on that occasion, that intending to make an extract of it with Vinegar, he caus'd his man to beat it well in a Mortar, which the man foon repented he had begun to do : And the Doctor himself, though at a pretty distance off, was fo wrought upon by the Corpufcles that iffued out into the Air, that his Head, and particularly his Face, fwell'd to an enormous and disfiguring bulk, and continued tumid for no inconfiderable time And I remember, that being That

I have not leifure to fubjoyn many more

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more Inftances to shew the Determinate Nature of Effluviums, small enough to wander through the Air; nor perhaps will it be neceffary, if you pleafe but to confider these two things. The first, that many odoriferous Bodies, as Amber, Musk, Civet, &. as they will, by the adhelion of their whole substance, perfume Skins, Linnen, &c. fo they will in time perfume some Bodies disposed to admit their action, though kept at a diftance from them. And the other is, that in Pestilential Feavers and divers other Contagious fickneffes, as the Plague, Small-pox, or Meafels, the fame determinate Disease is communicable to found perfons, not only by the immediate contact of the infected party; but without it, by the Contagious Steams that exhale from his Body into the Air. And having faid this and defir'd you to reflect upon it, I shall conclude this Chapter with an Experiment, that poffibly will not a little confirm a great part of it.

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Confidering then with my felf, how I might best devise a way of fhewing to the very Eye, That Ef-Auvia elevated without the help of Heat, and wandering in the Air, may both retain their own Nature, and upon determinate Bodies produce Effects, that a Vulgar Philosopher would afcribe to Occult Qualities: I remember'd, that I had found by tryals (made to other purposes) that Volatile and Sulphureous Salts would fo work upon fome Acid ones fublim'd with Mercury, as to produce an odd diversity of Colours, but chiefly an Inky one; on which account I judg'd it likely that my aim would by answer'd by the following Experiment.

I took an Ounce, or better, of

\* The Liquor here mention'd is, for the main, the fame with that deferib'd by the Author in his Book of Colours, Experiment the fuch a Volatile Tincture of Sulphur, as I have elfewhere \* taught you to make of Quick-lime, Sulphur and Sal Armo-

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capable of containing at least twice as much; then taking a Paper whereon fomething had been written with invisible Ink, I laid it down fix Inches off of the Vial, which, being unftop'd, began, upon the access of the Fire, to emit white Fumes into it, and by thefe, what was written upon the Paper, notwithstanding its distance from the Liquor, quickly became very legible, though not quite fo fuddenly, as if a Paper, written with the fame clear Liquor, were held at the like diftance directly over the orifice of the Vial. And having caus'd feveral pieces of clean Paper to be written on, with a new Pen dip'd in the clear Solution of Sublimate made in Water, 'twas pleafant to fee, how divers of the Letters of feveral of these Papers, being plac'd within some convenient distance of the Vial, would be made plainly legible, and fome of them more, fome lefs blackish, according to their distances from the smoaking Liquor, and other Circumstances. But 'twas E 3 more

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more furprizing to fee, that when I held or laid some of these Papers, though with the written fide upwards, just upon or over the orifice of the Vial, though the contained Liquor did not by fome Inches reach fo high, yet the latent Letters would become not only legible but confpicuous in about a quarter of a Minute of an Hour ( measur'd by a good Watch fit for the purpole, as more than one tryal affur'd me.) And as it may be observ'd, that in some Circumfrances the fmoaking Liquor and the Solution of Sublimate will make an odd Precipitate almost of a filverish colour, so in one or two of our Tryals we found a like colour produc'd, by the Steams of that Liquor, in fome of the colourless Ink. Nor is it fo neceffary to employ a vifibly fmoaking Liquor for the denigrating of invilible Ink at a diftance. For I have, to that purpose, with good fuccess, though not equal to that I have recited, employ'd a couple of Liquors, wherein there was neither Sulphur, nor

#### Pature of Effluviums.

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nor Sal Armoniack, nor Sublimate. What other Tryals I made with our Volatile Tincture of Sulphur, 'tis not neceffary here to relate; only one Experiment, which you will poffibly think odd enough, I shall not omit; because it will not only confirm the precedent Tryals, but also much of the foregoing Essay, by shewing the great Subtilty and penetrating power of Essive that seem rather to issue out very faintly, than to be darted out with any briskness.

Caufing then fomething to be written with diffolv'd Sublimate upon a piece of Paper, we folded the Paper with the written fide inwards, and then inclos'd this in the midft of fix theets of Paper, laid one upon another, not plac'd one within another, and folded up in the form of an ordinary Letter or packet to be feal'd, that, the edges of the enclosing Paper being inferted one within the other, the Fumes might not get into this written Paper but by penetrating through the Leaves themfelves : This done, E4 which

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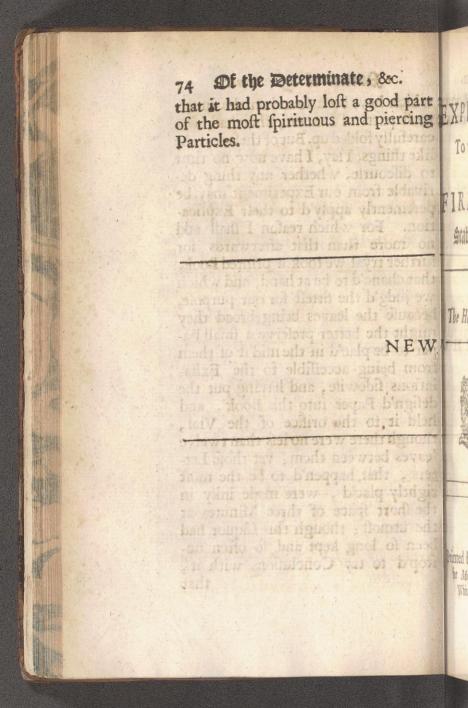
done, that fide of the Packet, on which there was no commissure, and on which, were it to be fent away, the Superfeription should bed written, was laid upon the orifice of the Vial, which (as was before intimated) was fome Inches higher than the furface of the Liquor, and left there about ten Minutes; after which taking off the folded Papers, and opening them, we found, that the Steams had pervaded all the Leaves, in which the written Paper had been enclos'd. For, though the Leaves did not appear ftain'd or alter'd', yet the formerly latent Characters appear'd conspicuous. I I have not time to discourse, whether and how far this Experiment may affift us to explain fome odd Effects of Thunder, or of that strange Phanomenon, (glanc'd at in the foregoing Chapter,) which is faid to have happen'd lately in the Kingdom of Maples after the great Eruption of Vefavine, which is faid to have been follow'd by the appearing of the Croffes formerly mention'd, fome of which

## Pature of Effluviums. 73

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which

which have been found on the innerand on most parts of Linnen, that had been any, the carefully folded up. But of these and the like things, I fay, I have now no time to discourse, whether any thing derivable from our Experiment may be the lunder pertinently apply'd to their Explicaere about tion. For which reason I shall add aking of no more than that afterwards for them, further tryal we took a printed Book, that chanc'd to be at hand, and which we judg'd the fittelt for our purpole, his because the leaves being broad they might the better preferve a small Paiment per to be plac'd in the mid'ft of them from being acceffible to the Exhalight, lations fidewife, and having put the here defign'd Paper into this Book, and held it to the orifice of the Vial, of the though there were no lefs than twelve tinthe leaves between them; yet those Letinto ters, that happen'd to be the most ingim rightly plac'd, were made inky in mind the fhort space of three Minutes at the utmost; though this Liquor had the been to long kept and to often unmed ftop'd to try Conclusions with it, that



NEW EXPERIMENTS, To make the PARTS OF FIRE and FLAME Stable & Ponderable.

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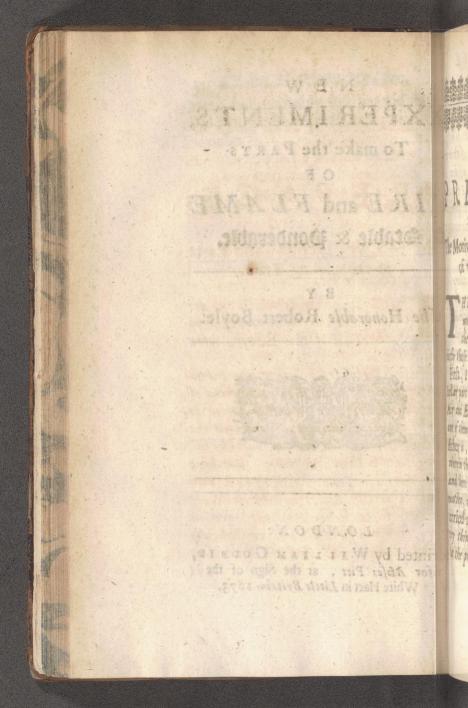
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B Y The Honorable Robert Boyle.



#### LONDON:

Printed by WILLIAM GODBID, for Moses Pitt, at the Sign of the White Hart in Little Britain. 1673.



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HO.ATTRICT.

## A PREFACE;

The Motive, Defign, and Parts of the enfuing Tract.

HE Inducements which put me upon the Attempt, express'd in the Title of this Effay, were shiefly these:

First, I consider'd, that the Interstellar part of the Universe, consisting of Air and Æther, or Fluids analogous to one of them, is diaphanous; and that the Æther is, as it were, a wast Ocean, wherein the Luminous globes, that here and there like Fishes swim by their own motion, or like Bodies in Whirlpools are carried about by the Ambient, are but very thinly dispers'd, and consequently that the proportion, that the Fixt Stars and

and Planetary Bodies bear to the diaphanous part of the World, is exceeding fmall and fearce confiderable, though we should admit the Sun and Fixt Stars to be Opacous Bodies upon the account of their terminating our fight: Which diffident Expression I employ, because I have elsewhere shewn by two or three Experiments, purposely devised, that a Body may appear opacous to our Eyes, and yet allow free passing to the beams of Light.

I further confider'd, that there being fo raft a diffreportion between the diaphanous part of the world and the Globes, about which 'tis every way diffused, and with which it is sometimes in great portions mingled, as in the water, which together with the Earth makes up the Globe we inhabit; and the nature of Diaphanons Bodies being fuch, that, when the Sum or any other Luminous Body illustrates them, that which we call Light does so penetrate and mix it self per minima with them, that there is no fensible part of the transparent Body uninlightned; I thought it worth the enquiry, whether a thing, jo vaftly diffused as

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as Light is were some thing Corporeal or not? And whether, in case it be, it may be subjected to some other of our Senses besides our Sight, whereby we may examine, whether it hath any affinity with other Corporeal beings, that we are acquainted with here below?

I did not all this while forget, that the Peripateticks make Light a meer et Aling Quality, and that Cartefius ingeniously endeavours to explicate it by a modification of Motion in an Ætherial matter: But I remember'd too, that the Atomists of old, and of late the Learned Gaffendus, and many other Philosophers affert In gitt My Light to be Corporeal; and that fome Years fince, though I declined to pass my Judgement about the Question, yet I had emution if Die ploy'd Arguments, that appear'd plausible enough to shew, That 'two as not abfurd to suppose, that the Sun, which is the Fixt Star most known to us, might be a Fiery # Body. And therefore doubting, whether the Corporeity of Light would be in hafte ut but all Determined by meer Ratiocinations, I thought it very well worth the endeawhen vouring to try whether I could do any thing

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thing towards clearing the dispute of it by Experiments; especially being perfivaded, that, though such an attempt fould be ineffectual, it would but leave the controversie in its former state, without prejudicing either of the contending Hypotheles; and yet, if it (bould prove successful, the consequences of it would be very great and useful to= wards the explicating of divers Phanomena in divers parts of Natural Philo-Sophy, as in Chymistry, Botanicks, and (if there be any fuch) the allowable part of Aftrologie. (Nor perhaps would it be impossible by the help of flight Theorical alterations, to reconcile the Experiments, I design'd, to either of the abovemention'a Hypotheses, and fo, as to the Explication of Light, to one another.)

To compass then, what I aim'd at, I thought, 'twas fit in the first place to try, what I could do by the Union of the Sun-beams, they being on all hands confess'd to be Portions (as I may so speak) of true and Celestial Light: And then, I thought fit to try, what could be obtain'd from Flame; not only because that

that is acknowledg'd to be a Luminary, but because I hoped, the difficulties, I fore fair in the other Tryals, might be in some measure avoided in those made with Flame; and if both forts of them should succeed, the later and former would serve to confirm each other. According to the Method I proposed of handling these two Subjects, I should begin with some account of what I attempted to perform in the Sun-beams. But the truth is, that when I chanc'd to fall upon the Enquiry that occasion'd this Paper, besides that the time of the Year it felf was not over-favourable, the weather proved so extraordinary dark and unseasonable that it was wonder'd at; fo that, though I was furnish'd with good Burning-glasses, and did several times begin to make tryals upon divers Bodies, as Lead, Quickfilver; Antimony, &c. yet the frequent interposition of Clouds and Mists did so disfavour my Attempts, that, however they were not all alike defeated, yet I could not profecute the greatest part of them to my own fatisfaction. And therefore being unwilling to build on them as yet 3. I Ball

CE. dispute of it being pirall attempt d but leave mar Hate, of the somyet , if it : unfequences s t useful to. 2 rs Phanoural Philo- 2 nicks, and m omable part el bs would it i ht Theorie Experis s the abover is , as to the re nother.) aima at, a ft place to ion of the sa namas coni (i lbeat) a And then , a ild be obbranle

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I shall referve an account of them for another opportunity; and now proceed to the mention of that fort of Experiments which depending less on Casualties, 'twas more in my power to bring to an Isfue.

I know I might have faved both you and my felf some time and pains by omitting feveral of these Tryals, and by a more compendious way of delivering the reft. But I rather chose the course I have taken; partly because the Novelty and Improbabilities of the Truth I deliver feems to require, that it be made out by a good number of Tryals; partly because I thought it might not be altogether useless to you and your Friends, to fee upon what Inducements the feveral steps were made in this Inquiry; partly because I was willing to contribute fomething towards the History that non perhaps will be thought fit to be made of the Increment or Decrement that particular Bodies may receive by being expofed to the Fire ; and partly ( in fine ) because the Incongruity of the Dostrine here afferted to the Opinions of the Schools, and the general Prepoffessions of

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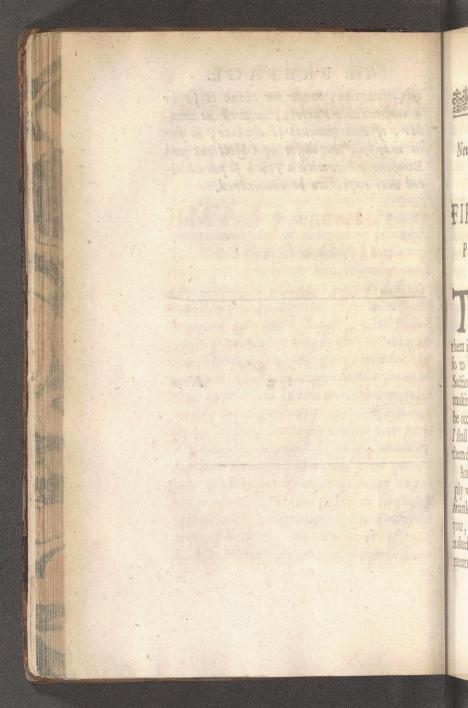
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y; partly bate fimenow permade of int particing expe-( in fine) e Doltime us of the male finas of of Mankind, made me think it fit by a confiderable Variety, as well as number, of Experiments to obviate, as far as may be, the differing Objections and Evalions wherewith a Truth fo paradoxical may expect to be encountred;

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## New EXPERIMENTS, To make FIRE and FLAME PONDERABLE.

Y

Hough there be among the following Tryals a Diverfity that invites me, as to rank them into four or five differing forts, fo to affign them as many diffinct Sections; yet for the conveniency of making the References, there will be occasion to make betwixt them, I shall wave the Distinction, and fet them down in one continued Series.

And becaufe I am willing to comply with my haft, as well as to deal frankly and without Ceremony with you, I shall venture to subjoyn the naked Transcripts of my Experiments, as I had in an artless manner F 3 let

#### Experiments, to make

fet them down with many others for my own remembrance among my Adversaria, without fo much as retrenching fome Circumstances that relate lefs to my present Argument, than to fome other purposes.

I shall then begin with the mention of a couple of Experiments, which though they might conveniently enough be referr'd to another Paper; yet I shall here set them down, because it seems very proper to endeavour to shew in the first place, that Flame it-felf may be as 'twere incorporated with close and folid Bodies so as to increase their bulk and weight.

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#### EXPERIMENT I. and though the Copper-

Piece of Copper-plate not near A fo thick as a Half-crown, and weighing two Drachmes and twenty-five Grains, was fo plac'd with its broad part Horizontal, in a Crucible, whofe bottom had a little hole in it, for Fumes to get out at, that it could not be removed from its Polition, nor be eafly made to drop down or lofe its Level to the Horizon, though the Crucible were turned upfide down : Then about an Ounce and half of common Sulphur being put into a taller and broader Crucible, that, wherein the Copper fluck, was inverted into the orifice of it, that the Sulphur being kindled, the flame, but not the melted Brimftone in fubftance, might reach the Plate, and have fome vent beyond it at the above-mentioned hole. This

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#### Experiments, to make

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This Brimstone burn'd about two Hours, in which time it feem'd all to have been refolved into Flame, no flowers of Sulphur appearing to have fublimed into the infide of the upper Crucible; and though the Copperplate were at a confiderable diffance from the ignited Sulphur, yet the Flame feem'd to have really penetrated it, and to have made it visibly swell or grow thicker; which appear'd to be done by a real acceffion of fubftance: fince, after we had wip'd off fome little adhering fordes, and with them divers particles of Copper that fluck clofe to them, the Plate was found to weigh near two and thirty Grains more than at first, and confequently. to have increased its former weight by above a fifth part.]

#### EXPER. II.

[Having, by refining one Ounce of fterling Silver with Salt-peter, according to our way reduc'd it to feven Drachms or fomewhat lefs;

FIRE and FLAME Ponderable. 5 we took a piece of the thus purified femidal Silver, that weighed one Drachm wanting two Grains, and having orwhere I der'd it as the Copper-plate had been in the former Experiment, after the Copperflame of above one Ounce and a diane quarter of Sulphur, (that Quantity it chancing to be fuitable to the Capaenerated city of the Crucible ) had for about livellor an Hour and a half beat upon it, the Silver-plate feem'd to the Eye fomewhat fwell'd, and the lower furface of ine of it, that was next the flame, was brought to a great fmoothness, which the weight being increas'd to one shund Drachm five Grains and three quar-Grams ters; which increase of weight falequenty ling fo fhort of that which was gain'd neight by the Copper, I leave it to you to confider, whether the difference may be attributed to the closeness and compactness of the Silver, argued by its being heavier in specie than Copour oper; or to the greater congruity of the pores of Copper to be wrought in on by the fiery Menstruum; or to les come other caufe. ] If

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If you should here ask me, by what Rational inducements I could be led to entertain fo extravagant an expectation, as that fuch a light and fubtile Body as Flame should be able to give an augmentation of weight to fuch ponderous Bodies as Minerals and Metals; I shall now, to avoid making anticipations here, or needless repetitions hereafter, return you only this Anfwer : That the expectation you wonder at may justly be entertained upon the fame or fuch like inducements, as you may eafily discover in another Paper, entitled Corollarium Paradoxum. For, suppofing upon the grounds there laid, that Flame may act upon fome Bodies as a Menstruum, it seems no way incredible, that, as almost all other Menstruums, fo Flame should have fome of its own Particles united with those of the Bodies expos'd to its action : And the generality of those Particles being, (as 'tis shewn in the Paradox about the Fewel of Flames,) either Saline, or of fome fuch

## FIRE and FLAME Ponderable. 7

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fuch piercing and Terreftrial nature, wild be a 'tis no wonder, that being wedg'd into the Pores, or being brought to adhere very falt to the little Parts of the Bodies expos'd to their action, the acceffion of fo many little Bodies, that want not gravity, fhould, becaufe of their multitude, be confiderable upon a Ballance, whereon one or two, or but few of these Corpuscies would have no visible Effect.

I could here, if it were expedient, the or his impention fome odd foruples about the myally preceding Experiments, and fome alfo t, entitled of the fublequent; but, left you should, with fome other of my Friends, upthe kid, braid me with being too jealous and fine & Sceptical, I will not trouble you iems to with them; but proceed to the next fort of Tryals, wherein, though the manter were not always manifeftly beaten on by a spining Flame ; yet emode it was wrought on by that, which would be called Flame by those who "then take not that word ftrictly, but in a Brd of latitude, and which this Igneous fubfilm fance may more properly be ftiled, fich SERVE than

#### Erperiments, to make 8

than it can be call'd common Fire. this being visibly harbour'd in burning Coals or other groß materials, from which our Metals were fenc'd. And I have elsewhere shewn by experiment, that Visibility is not in all cafes neceffary to Actual Flame, particularly when the Eye receives a predominant impression from another Light. Flodt to wet and to w

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#### EXPER. III.

TNto a Crucible, whole fides had L been purpofely taken down to make it very shallow, was put one Ounce of Copper-plates; and this being put into our Cupelling-furnace, and kept there two Hours, and then being taken out we weighed the Copper (which had not been melted) having first blown off all the ashes, and we found it to weigh one Ounce and thirty Grains. EXPER.

#### FIRE and FLAME Ponderable. 9

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#### EXPER. IV.

[ Supposing that Copper, being were fenc'd, www.reduc'd to filings, and thereby gaining Im all more of Superficies in proportion to Mine, maits bulk, would be more exposid to recents the Action of the Fire, than when from no tis in places as it was formerly; we took one Ounce of that Metal in filings, and putting them upon a very shallow Crucible, and under a Muffler, we kept them there about three Hours, (whilft other things that required fo long a time were Cupelling; ) and afterwards taking them off, we found them of a very dark colour, not melted but caked together in one Lump, and increas'd in weight (the ashes and dust being blown off) no lefs than about fortynine Grains. Part of which increment, above that obtained by the Copperplates in the former Experiment, may not improbably be due to the longer time that in this Experiment the fil'd Copper was kept in the Fire. ] EXPER.

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[ Being willing to fee, whether calcin'd Harts-born, that I did not find eafie to be wrought on by corrolive Menstruums, would retain any thing of the Flame or Fire to which it fhould be expos'd ; we weigh'd out one Ounce of Imall Lumps of Hartshorn, that had been burnt till they appear'd white, and having put them Farmer into a Crucible, and kept them in n the en a Cupelling-furnace for two Hours, whilft fome Metals were driving off to have there by the violence of the Fire, we but, for found, that when they were taken the Bal out, they had loft fix or feven Grains though of their former weight ; perhaps either because, notwithstanding the external whitenels of the Lumps, the internal Parts of fome of them might not be fo exquilitely calcin'd, but retain fome Oleaginous or other Volatile Substance; or, because, having omitted to ignite them well before they were weigh'd, they may have fince

## FIRE and FLAME Ponderable, 11

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fince their first Calcination imbib'd fome moift Particles of the Air. Which conjecture feem'd the likelier, whith because, having kept them a while distind in the Scales they were weigh'd in, monine they did within two or three Hours mythin make it fomewhat preponderate. On which occasion I shall add, that, at the fame time, with the Harts-horn Hans we put in one Ounce of well-heated Brick, and kept that likewife in the guitten Furnace for above two Hours ; at the end of which weighing it whilft Han, it continued hot, we did not find it ming of to have either fentibly got or loft; me but, some time after, it seem'd upon the Ballance to have imbib'd fome, month though but very little, moisture from the Cupel, whereby tome rik and why the Cupel was loft in the Furnice, sham

#### and yet il Vit R B ER the VI. 1 by bas Litharge, weighd feven Grains more winn

[Upon a good Cupel we put one Ounce of English Tin of the better fort, and having plac'd it in the Furdon mace under a Muffler, though it pretently melted, yet it did not forlake fince soy

its place, but remain'd upon the concave furface of the Cupel, till at the end of about two Hours it appear'd to have been well calcin'd; and then being taken out and weighed by it felf, the Ounce of Metal was found to have gained no lefs than a Drachm.]

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[An Ounce of Lead was put upon the Cupel, made of calcin'd Hartshorn, and placed under the Muffler after that the Cupel was first made hot and then weighed. This Lead did not enter into the Cupel, but was turn'd into a pretty kind of Litharge on the top of it, and broke the Cupel, whereby fome part of the Cupel was lost in the Furnace, and yet the reft, together with the Litharge, weigh'd feven Grains more than the Ounce of Lead and the heated Cupel did when they were put in.]

But becaufel, though this tryal fhew'd that fome weight was gain'd either by the Metal or Cupel, or both; yet FIRE and FLAME [Bonderable, 13 yet it did not by this appear, what either of them acquir'd; it feem'd, fit to fubjoyn a further tryal.

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# EX.P ER.gvIII.

We took a Cupel about two Ounces in weight, made of about ten parts of Bone-alhes, and one of Charcoal-ashes, made up together with Ale. This was by it felf put in a Cupelling-furnace, under a Muffler and the Laborant, well vers'd in weighing, was order'd to take it out when 'twas throughly and highly heated, and to weigh it whilft 'twas in that condition (I being then prefent:) This being done, 'twas forthwith plac'd again under the Muffler, where some Metalline Bodies were Cupelling, and kept there for about two Hours; at the end of which time 'twas taken out red-hot , and prefently put into the fame Ballance, as before, which was already faftned to a Gibbet; where having caus'd the adhering ashes to be blown off, G I found.

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I found, that whereas, when 'twas first taken from under the Muffler, we had but two Ounces and two Grains, now the fame weight being put into the opposite Scale, it had gain'd very near one and twenty Grains. And here note, that 'twas not without fome caufe, that I was careful to have the Cupel weighed red-hot. For I had a fufpition, that, notwithstanding the dryness of the Bone, it might receive fome little alteration of weight by imbibing fome little Particles wandering in the Air; which fuspition the event justified. For leaving the Cupel counterpois'd to cool in the Ballance, in a fhort time it began fenfibly to preponderate; and fuffering it to continue there nine or ten hours, till we had occasion to ufe the Ballance, I found it at the end of that time to be about three Grains heavier than before. ]

This was not the only tryal we made about the augmenting the weight of Cupels, but this being the faireft, and exempt from those mif-

mischances, from which the other were not altogether free; I shall content my felf to have fet down this: In the mention of which I thought fit to take notice of the increase of the weight of the Cupel after it had layn in the Scales, and alfo that we weighed it at first whilst it was throughly hot, because those Circumstances, as not being suspected, may easily be left unthought on, even by skilful Experimenters; and yet the weighing of the Cupel, when it had been well neal'd, and the not weighing it foon . enough after'tis taken from the Fire, may keep those, that shall reiterate this Experiment, from making it cautioully and accurately enough. For if the former Circumstance be omitted, that which the Cupel may feem to have lost of its substance, was nothing but the adventitious moisture of the Air; and if the later Circumstance be neglected, the weight, it may feem to have gain'd from the Fire, was indeed due to the waterish Particles of the Air. I could G 2 wift

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wifh alfo, that tryal were made, whether the fuccefs would be the fame in Cupels made in differing forts of Bone-afhes, and other materials, wont to be employed for that purpofe. For That I had not opportunity to do.

### EXPER. IX.

Iron being a Metal, that experience had inform'd me will more eafily be wrought on by Fluids that have Particles of a Saline nature in them, than is commonly believed; 'twas not unreafonable to expect, that Flame would have a greater Operation on it, (efpecially if it were before-hand reduc'd to fmall Parts) than on any of the Bodies hitherto defcrib'd. Which fuppofition will be confirm'd by the fhort enfuing Note.

[Four Drachms of filings of Steel being kept two Hours on a Cupel under a Muffler, acquir'd one Drachm fix Grains and a quarter increase of weight.]

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# EXPER. X.

[ A piece of Silver, refin'd in our own Laboratory, being put upon a Cupel under a Muffler, and kept there for an hour and half, whilft other things were refining, was taken out and weigh'd again, and, whereas before it weighed three Drachms, thirty-two Grains and a quarter, it now weighed in the fame Scales three Drachms, thirty-four Grains and a half, or but little lefs.]

Finding this Memorial among divers others about the Weight of Bodies, expos'd to the Fire, I thought it not amifs to annex it in this place; though finding it to be but fingle, I would not have it to be rely'd on till further tryal have been made to difcover, whether it was more than a cafual and anomalous Experiment; and if the Silver had not been refin'd, I fhould have fufpected, that the Copper, that was blended with it, as 'tis ufually blended with common  $G_3$  Silver,

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#### (Postcript.)

Since the foregoing Experiment was first fet down, meeting with an opportunity to reiterate the tryal once more, we did it with half an Ounce of filings of Silver, well refin'd with Lead in our own Laboratory, and kept it about three hours upon the Cupel; after the end of which time taking it out, we found it to be of a lefs pleafant colour than it was of before, and melted (though not fo perfectly) into a Lump, which weigh'd four Drachms and fix Grains; and yet, the fuccels being fo odd, and, if it prove constant, of fuch moment, I could wish the tryal were further repeated in differing quantities of the Metal.

#### EXPER. XI.

[We took a Drachm of filings of Zink or Spelter, and having put it upon

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upon a Cupel under a Muffler, we kept it there in a Cupelling-fire about three Hours, (having occafion to continue the Cupellation fo long for other tryals,) then taking it off the Cupel, we found it to be caked into a brittle and dark-colour'd Lump, which look'd as if the filings had been calcin'd. This being weigh'd in the fame Scales gain'd full fix Grains, and fo a tenth part of its firft weight.]

#### EXPER. XIL

Among our various tryals upon common Metals, we thought fit to make one or two upon a Metal brought us from the *East-Indies*, and there call'd *Tutenâg*, which name being unknown to our *European* Chymists, I have elsewhere endeavoured to give fome account of the Metal it felf; whence I shall borrow the enfuing Note, as directly belonging to our present purpose.

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nag being put upon a Cupel, and kept under the Muffler for about two hours, the filings were not melted into a Lump of Metal, but look'd as if Cerus and Minium being pouder'd had been mingled together; fome of the parts appearing diffinctly white, and others red : The Calx being put into the Ballance appear'd to have gained twentyeight Grains and a quarter. Another time the Experiment being reiterated with the like Circumstances, we found, that two Drachms of the filed Tutenâg gained the like increase of weight, abating less than one Grain.] So that this Indian Metal feems to have gain'd more in the fire, in proportion to its weight, than any we have hitherto made tryal of.

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[ Being defirous to confirm by a clear Experiment, what I elfewhere deliver contrary to the vulgar Opinion of those that believe, that in all Cupellations almost all the Lead that

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that is employ'd about them, does, together with the bafer Metals that are to be purg'd off from the Silver or Gold, fly away in Smoak, as indeed in fome fort of Cupellations a good proportion may be blown off that way: We took two Ounces of good Lead and one Drachm of filings of Copper, and having caus'd a Cupel to be ignited, and nimbly taken out of the Furnace, and weighed, whilft 'twas very hot, 'twas prefently put back, together with the two Metals laid on it, into the Cupelling-furnace, where having been kept for about two hours, it was taken out again, and 'twas found, ac-

cording to what (as I \* Effay the fixth elfewhere \* note) ufes of ibe uleful. of Nat. Philof. to happen in fuch Cir-

cumffances, to have nothing on the furface of it worth weighing diffinctly in the Scales, in which the Cupel erher with what was funk into it amounted to four Ounces three Drachms and eleven Grains, which wanted but nine Grains of the whole weight of 53631103 the

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the Cupel and the two Metals, when they were all three together committed to the Fire.] So that, though we make a liberal allowance for the increment of weight that may with any probability be fuppofed to have been attained by the Cupel and what was put upon it, yet it will eafily be granted, that very much the greater part of the Metals was not driven officiated in Fumes, but enter'd into the Subftance of the Cupel.

# Tryals of the Third fort.

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A Fter having shewn that either fluxions of the Fire will be, what Chymists would call, Corporified with Metals and Minerals exposed maked to its action; I thought it would be a defirable thing to difcover, whether this Flame or igneous Fluid were subtile enough to exercise any such Operation upon the Light Bodies shelter'd from its immediate contact

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eas, when contact by being included in close Vessels; but it being very difficult to expose Bodies in Glasses to fuch while in vehement Fires without breaking or melting the Glafs, and thereby lofing the bure the Experiment; I thought fit, first e and when to employ Crucibles carefully luted together, that nothing might visibly thegretical get in or out, and of that attempt driven of I find among my Notes the follow-ing Account.

#### EXPER. XIV.

fint. FWe took an Ounce of Steel freshly filed from a Lump of that Metal, the end that the filings might not be rufty, and having included them betwixt be, two Crucibles, as formerly, kept Arportian them for two hours in a ftrong Fire, s explea and fuffer'd them to continue there till the Fire went out; the Crucibles being unluted, the filings appear'd a guine hard caked together, and had acquir'd nextle a dark colour fomewhat between black and blew, and were increas'd entate five Grains in weight.]

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The foregoing Experiment being the first I mention of this kind, 'twill not be amils to confirm it by annexing the following Memorial.

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TAn Ounce of filings of Steel being put between the Crucibles luted together, after they had been kept the about an hour and half in the fire, were taken out, and being weigh'd, were found to have gained fix Grains. ]

#### ing Account. EXPER. XV. EXPER XI

Two Ounces of Copper-plate were put into a new Crucible, over which a leffer was whelmed, and the commiffures were closed with. lute, that nothing might fall in. After the fame manner two Ounces of Tin were included betwixt Crucibles, and alfo two Ounces of Lead; thefe being put into the Cupellingfurnace were kept in a ftrong Fire about an hour and a half; while fomething elfe was trying there. And then being taken out, the event was, that the Copper-plates, though they ftuck The

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fluck together, were not quite melted, and feem'd fome of them to have acquir'd fcales like Copper put into a naked Fire, and the two Ounces had gain'd eight Grains in weight. The Lead had broke through the bottom the defign'd Observation. The Tin acquir'd fix Grains in weight, and in Grains was in part brought to a pure white *Calx*, but much more of it was melted into a Lump of a fine yellow colour, almost like Gold, but deeper.] The in Experim. XXI. to which I theredold " fore referr you. wold , bleegong-ovode

M. B. Becaufe Lead in Cupella-Ounces tion enters the Cupel, we were wil-Ing to try, if we could fo far hinder it from doing fo, as to make fome Curdent eftimate what change of Weight the Operation of the Fire would make in it : And therefore being able alto make a near guels, how much a quantity of Tin may gain by being calcined on a Cupel, and remem-

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remembring alfo from fome of my took on former tryals the indisposition which Tin gives Lead to Cupellation, we them be mixed a Drachm of Tin with two o whelm'd Ounces of Lead, and exposing the Int. W mixture (in a Cupel) to the Fire r ners of under a Muffler, we first brought it froma to fusion, and then it feem'd at the man top dry and fwell'd and discolour'd; firme notwithstanding which, having continued the Operation a good while, Main because of other things that were to studen be done with the fame Fire, we were above not lucky enough to bring the Ex- latter periment to an iffue worth the relating here, in reference to the fcope ther with above-propos'd, though in relation more to another the fuccels was welcome 1 weight enough.]

#### EXPER. XVI.

[ Supposing that if Copper were have n beaten into thinner plates than those Lutes. we lately us'd, and kept longer in the fire, this would have a more confiderable Operation upon them, we took

med my took one Ounce of very thinly hammund mer'd pieces of Copper, and putting them betwixt two Crucibles ( one when whelm'd over another ) as in Expewith the rim. XV. with fome lute at the corn the mers of the juncture, to keep the fire houghts from coming immediately at the Memida the tal, we kept them in the Cupellingicolouid furnace about three hours, and then wing con disjoyning the Veffels, we found the Metal covered with a dark and brittle m meto fubstance, like that deferib'd in the e, we were above recited Experiment. Which att Is fubstance, when scal'd off, disclos'd a the relation of the relation o the forme ther with these burnt scales, amounted in relignent to one and twenty Grains above the s releases weight that was first put in. ]

If, when these things were doing, I had been furnished with a very good Lute, which is no such easie thing to procure, as Chymists, that have not frequently employed vulgar Lutes, are wont to think; I would have made a tryal of the ensuing Experiment for a good while in the maked Fire, notwithstanding that divers

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divers Metalline Minerals will scarce be brought to fusion in Glaffes, lefpecially without fuch a Fire, whofe violence makes them break the Veffels. For I thought, that by making a fit choice of the Metals to be employed, I could prevent that inconvenience : But wanting the Accommodations I defir'd, and yet prefuming, that in a Sand-furnace I might by degrees administer heat enough to melt fo fulible a Metal as fine Tin. and keep it in fusion ; I refolved to make fome tryals, first upon that, and then upon another Metal. For though I was not fure of being then able to profecute the Experiment far enough; yet I hoped, I might at least fee fome Effects of my first tryal, which would enable me to guess, what I was to expect from a complete one. I boop

# EXPER. XVII.

[We took then a piece of fine Block-Tin, and in a pair of good Scales weighed out carefully half a Pound

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Pound of it; this we put into a choice Glafs-retort, and kept it for two days or thereabouts in a Sandfurnace, which gave heat enough to keep the Metal in fusion without cracking the Glafs. Then taking out the mixture, we carefully weigh'd it in the fame Scales, and found the fuperficies a little alter'd (as if it were difpos'd to calcination) and the weight to be increafed about two Grains or fomewhat better. ]

#### EXPER. XVIII.

[ The other Experiment, I tryed in Glaffes, was with Mercury, hoping, that, if I could make a Precipitate per fe in a Hermetically feal'd Glafs, I fhould by comparing the weight of the Precipitate, and the Quickfilver that afforded it, have a clear Experiment to my purpofe; and I fhould have no bad one, if I could but make it fucceed with a Glafs, though not feal'd, yet well ftop'd; inftead of those Infernal-glaffes (as H they

they call them ) which are commonly us'd and wont to be left open (though fome flightly ftop them with a little Paper or Cotton :) But though, partly that I might a little diverlifie the Experiment, and make it the more likely to fucceed in one or other of the Glasses, I divided the Mercury and distributed it amongst feveral of them, and but a little to each, the fuccefs did not answer expectation, the Hermetically feal'd Glaffes being unluckily broken; and the Precipitation in the others proceeding fo flowly, that I was by a remove oblig'd to leave the tryal imperfect; only I was encouraged, (in cafe of a future opportunity) to renew it another time, by finding that most of the Glasses, though tall, and ftop'd with fit Corks, afforded fome very fair Precipitate, but not enough to answer my Delign. In morning x I

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# Tryals of the Fourth fort.

Oft of the Experiments hither-IVI to recited, having been made as it were upon the by with others, whole exigencies 'twas fit these should comply with ; very few of the expos'd Bodies were kept in the Cupelling-fire above two hours or thereabouts. Upon which account I thought fit to try, how much fome Bodies, that had been already expos'd to the Fire, would gain in weight by being again exposid to it; especially confidering, that most calcinable Bodies, (for I affirm it not of all) which yield rather calces than ashes by being without additament reduc'd in the Fire to fine powder, feem'd to be by that Operation open'd, or (as a Chymift would fpeak) unlock'd, and therefore probably capable of being further wrought upon and increas'd in weight by fuch a Menstruum as I fuppos'd Flame and igneous Ex-H 2 halations

halations to be. And about this Conjecture I shall subjoyn the enfuing Tryals.

#### EXPER. XIX.

[ One Ounce of Calx of Tin, that had been made per se for an Experiment in our own Laboratory, being put in a new Cupel and kept under the Muffler for about two hours, was taken out het and put into the Scales, where the powder appear'd to have gain'd in weight one Drachm and thirty-five Grains by the operation of the Fire, which made it alfo look much whiter than it did before, as appeared by comparing it with fome of the Calx that had not been. exposed to the fecond Fire: No part of the Puttie was, as we could perceive, melted by the vehemence of the Fire', much lefs reduc'd into Metal. ]o alderer videdorg profereda

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[Out of a parcel of filings of Steel, that had been before exposid to the fire, and had its weight thereby increasid fome Grains, not Scruples; we took an Ounce, and having exposid it at the fame time with the *Calx* of Tin, and, for the fame time, kept it in the Fire, we took it out at the two hours end, and found the weight to be increasid two Drachms and two and twenty Grains. The filings were very hard bakid together, and, the Lump being broken, looked almost like Iron.]

# EXPER. XXI. Thous

The following Experiment, though it may feem in one regard but a Continuation of the  $XV^{ib}$ ; yet it has in this fomething peculiar from all the foregoing, that not only it affords an inftance of the increase of Weight obtain'd by a Metal at the fecond H 3 time

time of its being exposed to the fire, but fhews alfo, that fuch an increment may be had, though this fecond ignition be made in *clofe* Veffels. othe

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[Some of the Copper mention'd in *Experim*. XV. being accidentally loft, one Ounce and four Drachms of what remain'd was included betwixt two Crucibles and expos'd to a ftrong fire for two hours, and fuffer'd to continue there till the fire went out: When it was taken out, it appear'd to have gain'd ten Grains in weight, and to have upon the fuperficial parts of the Plates (as we obferv'd) divers dark colour'd flakes, fome of which fluck to the Metal, but more, upon handling it, fell off.]

And here I shall conclude One of the Two Parts of our defigned Treatife: For, though I remember, that these were not all the Tryals that were made and set down upon the Subject hitherto treated of; yet these are the chief, that having escaped the mischances, which befel some others,

others, I can meet with among my promiscuous Memorials; whose number, when I drew them together. I could fcarce increase, having by all thefe and other Tryals of differing kinds wafted my Cupels and commodious Glaffes, where I could not well repair my lofs. Whether I should have been able by Reduction, specifick Gravity, or any other of the ways, which I had in my thoughts, to make any discovery of the Nature of the Substance that made the Increment of Weight in our Ignited Bodies; the want as well of leifure, as of accommodations requilite to go through with fo difficult a task, keeps me from pretending to know. But these three things, I hope, I may have gained by what has been deliver'd. The First, That we shall henceforth fee caule to proceed more warily in the Experiments we make with Metals in the Fire, especially by Cupellation. The next, That it will justifie and perhaps procure an easier assent to some passages in my other H4

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#### 36 Experiments, to make, &c.

other Writings, that have Relation to the Substance, what-ever it be, that we are speaking of. And the third, (which is the principal,) That it will probably excite you, and your inquisitive Friends, to exercise their fagacious Curiofity, in discovering what kind of Substance that is, which, though hitherto overfeen by Philosophers themselves, and, being a Fluid, far more fubtile than visible Liquors, and able to pierce into the Compact and Solid Bodies of Metals, can yet add fomething to them, that has no defpicable Weight upon the Ballance, and is able for a confiderable time to continue fixt in the Fire, I company proton and agest But thes three things I hape, I may

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Xperiments to difcover the Increase in Weight of Bodies, though inclos'd in Glaffes, being those that I confidered as likeliest to answer what I defign'd in the hitherto profecuted Attempt, and finding the feventeenth Experiment as well as the next (try'd upon Mercury) to be very flow, and its performance not to be very great, I began to call to mind, what, many years ago, Experience had shewn me poffible to be perform'd, as to the managing Glafs-veffels, even without coating them, in a naked Fire, pro-

Metal b provided a wary perfon were conand the ftantly employ'd to watch them. ) france t And supposing hereupon, that, in no - Coals, longer time than a Laborant might, without being tir'd, hold out to atthe orit with a tend a Glass, a Metal expos'd in it to a naked fire might afford us a much i mo more profperous tryal than that lately a when referr'd to, I afterwards refolv'd, Could when I should be able to procure And fome Glaffes conveniently shap'd, to ridde profecute my Defign; in pursuance in the of which though I had not any Fur- bing naces fitted for my purpose, I dire- im, cted a Laborant to make the followv Metalli ing Tryals. antwer what I defice

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TWe took eight Ounces ( Troy weight) of Block-Tin, which being cut into bits was put into a good round Vial with a long neck, and then warily held over quick Coals without touching them till it was melted; after which it was kept almost continually shaken, to promote the Calcination, near an hour, the Metal

Additional Experiments. 39 "Ite on Metal being all the while in fusion, the then and the Glafs kept at fome ditime france from the throughly kindled Coals. The most part of this time month the orifice of the Vial was cover'd which a Cap of Paper (which fomemanual times fell off by moving the Glafs) thatlately to keep the Air and Steams of the realist, Coals from getting into the neck. procure And at the end of this time, he that held the Glass being tir'd, and having puture his Hand almost fcorch'd, the Vial multi being remov'd from the fire was bro-Ide ken, that we might take out the follow I Metalline Lump, which had a little darkish Calx here and there upon the upper furface, but much more beneath, where it had been contiguous s / Imp to the bottom of the Glass; then putbing ting all this carefully freed from little fragments of broken Glass into the fame Ballance with the felf-fame counterpoise I had us'd before, I found, according to my Expectation, an increase of weight, which amounted to eighteen Grains, that the Tin had acquir'd by this Operation. ]

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## EXPER. II.

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This done we feparated the Calx for fear of lofing it, and having melted the Metal in a Crucible, that by pouring it out it might be reduc'd to thin Plates capable of being cut in pieces, and put into fuch another Vial as the laft; we weigh'd it again together with the lately referv'd Calx, but found, that, notwithftanding all our care, we had loft three Grains of the eighteen we had gain'd. This done we put the Metal into another Vial. But in regard. the neck was shorter than that of the former, and could not like it be long held in ones Hand; and becaufe alfo I was willing to fee what Interest the shaking of melted Tin has in the quickness of the Calcination, the Glafs, which had a ftopple of Paper put to it to keep out Smoak and Air. was held at fome diftance from the Coals, only whilft the Tin was melting; and then was warily laid upon

Additional Experiments. 41 upon them and kept there for two hours, at the end of which 'twas again taken off, and the Metal weigh'd with the fame Counterpoife and Ballance as formerly; and then it appear'd to amount to eight Ounces twenty-four Grains, and to have much more separable Calx than at the first time. Nor did I much wonder, that the weight should be increas'd in this last Operation but nine Grains in two hours, and in the former twice to many in half the time; fince, during the two hours, the Glass was kept in one posture, whereas in the first Operation, it was almost perpetually shaken all the while 'twas kept in fusion. And 'tis observ'd, that the agitation of melted Minerals will much promote the Effect of the Fire upon them, and conduce to their Calcination.]

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#### EXPER. III.

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yet to convince even thole that are fo, I undertook, in fpite of the difficulties of the Attempt, to make the Experiment in Glaffes Hermetically feal'd, to prevent all fufpition of any acceffion of Weight accruing to the Metal from any Smoak or Saline Particles getting in at the mouth of the Veffel. And in profecution of this defign I thought upon a way of fo Hermetically fealing a Retort, that it might be expos'd to a naked fire without being either crackt or burft; an Account of which Tryal was thus fet down.

[ Eight Ounces of good Tin carefully weigh'd out was Hermetically feal'd up in a new fmall Retort with a long neck, by which 'twas held in ones Hand, and warily approach'd to a kindled Charcoal-fire, near which the Metal was kept in fufion, being alfo ever now and then fhaken for almost half an hour, in which time it feem'd to have acquir'd on the furface fuch a dark colour as argued a beginning of Calcination, and it both

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both emitted Fumes that play'd up and down, and also afforded two or three drops of Liquor in the neck of the Retort. The Laborant being not able to hold the Glafs any longer, 'twas laid on quick Coals, where the Metal continued above a quarter of an hour longer in fusion; but before the time was come that I intended to fuffer it to cool in order to the removing it, it fuddenly broke in a great multitude of pieces, and with a noife like the Report of a Gun; but (thanks be to God) it did no harm neither to me nor others that were very near it. In the neck we found fome drops of a yellowish Liquor, which a Virtuoso that tafted it affirm'd to be of an odious but peculiar Sapor; and as for the Smell, I found it to be very flinking, and not unlike that of the diftill'd Oyl of Fish.]

But, though our first Attempt of this kind had thus miscarried, we were not thereby discourag'd, but in profecution of the same design made the ensuing Tryal.

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#### EXPER. IV.

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The Tin which had been before ( in the first or some such Experiment) partly calcin'd in a Glafs, being melted again in a Crucible, that it might be reduc'd to pieces small enough to be put into another Glass, was put again into the Scales, and the furplulage being laid alide, that there might remain just eight Ounces; these were put into a Bolt-head of white Glass with a neck of about twenty Inches long, which being Hermetically feal'd ( after the Glafs had been a while kept over the fire; left that should break by the rarefaction of the Air,) the Metal was kept in fusion for an hour and a quarter, as (being hinder'd by a Company of ftrangers from being there my felf) the Laborant affirm'd. Being unwilling to venture the Glass any longer, it was taken from the fire; and when 'twas grown cold, the feal'd end was broken off; but before I would

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I would have the bottom cut out, I observ'd, that the upper surface of the Metal was very darkly colour'd, and not at all fmooth, but much and very odly afperated; and the lower part had between the bottom and the lower part of the Lump a pretty deal of loofe dark-colour'd Calx, though the neighbouring furface and fome places of the Lump it felf look'd by Candle-light (it being then Night) of a golden Colour. The Lump and Calx together were weigh'd in the fame Scales carefully, and we found the weight to have increas'd twentythree Grains and better, though all the Calx, we could eafily separate, being weigh'd by it felf amounted not to four Scruples or eighty Grains.]

For Confirmation of this Experiment I shall subjoyn another, wherein but a quarter of so much Metal was employed with such success as the annexed Memorial declares.

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#### EXPER. V.

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Two Ounces of filings of Tin were carefully weigh'd and put into a little Retort, whose neck was afterwards drawn flenderly out into a very finall Apex ; then the Glafs was plac'd on kindled Coals, which drove out fumes at the small orifice of the neck for a pretty while. Afterwards the Glass; being seal'd up at the Apex, was kept in the fire above two hours; and then being taken off was broken at the fame Apex; whereupon I heard the outward Fire rush in, because when the Retort was feal'd the Air within it was highly rarified. Then the body of the Glass being broken, the Tin was taken out, confifting of a Lump, about which there appear'd fome gray Calx and fome very fmall globuls, which feem'd to have been The filings melted into that form. whole weigh'd two Ounces twelve Grains, the later part of which weight appear'd to have been gain'd by the Operation of the Fire on the Metal.

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Metal. In the neck of the Retort, where it was joyn'd to the body, there appear'd a yellowifh and clammy fubftance thinly fpread, which finelt almost like the foetid Oyl of Tartar.]

# forv'd, that he upper part of the Glass

To vary the foregoing Experiments by making Tryals on a Mineral that is held to be of a very Metalline nature, but is not a true Metal, nor will be brought to fusion by fo moderate a Heat as will fuffice to melt Tin, and yet has parts les fixt than Tin, as being far more eafily fublimable, we thought fit to make the following Experiment.

We took an Ounce of filings of Zinke carefully weigh'd, and having as carefully put them into a round Bolt-glafs, we caus'd the neck to be drawn out very flender, and then order'd the Laborant to keep it upon quick Coals for the appointed time. Afterwards returning home, I call'd for the Glafs, which he faid he had I 2 kept

# 48 Additional Experiments.

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kept four hours upon the Coals : anfwering me allo, that there did for a great part of the time Smoak appear to alcend from the Zink and get out at the unftopt Apex. And in effect I obferv'd, that the upper part of the Glafs was lin'd with Flores or Sublimate of a darkish gray. The Glass being dextroufly cut afunder, we took out not only the filings of Zinke, fome of which were melted into little globuls , but the Flores too , and vet weighing all thefe in the fame Scales. we had us'd before, we found five Grains and fomewhat better wanting of an Ounce. Which we the lefs wonder'd at, because of the continuance of the lately mention'd Exhalations' emitted by the filed Mineral.] Sinke carefully weighd, and having

#### as carefully or. Sng ng X H a round Bolt-glafs, we caus d the neck to be

For more ample confirmation of the truth difcover'd by what I have been reciting about Tin, I thought fit to try the like Experiment upon another Metal, which though of fome-

Additional Experiments. 49 fomewhat more difficult fusion than Tin, I had reason to think might, if employed in a moderate quantity, and warily managed, be kept melted in Glass without breaking it. And accordingly having carefully weigh'd out four Ounces of good Lead out before-hand into pieces little enough for the orifice of the Glass, I cauled them to be put into a fmall Retort with a long neck, wherein was afterwards left but an orifice not much bigger than a pins head : Then leaving directions with the Laborant what, to do, becaufe I was my felf call'd abroad, at my return he brought me together with the Glass, this Account : That he had kept it over and upon the Coals two hours, or better, and then supposing the danger of breaking the Glais was over, he had fealed it, up at the little Orifice newly mention'd, and kept it on the Coals two hours longer. Before the Glafs (which I found to be well feal'd), was broken, I perceived the pieces of Lead to have. been melted into a Lump a whole furface EXPER. 1 3

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#### 50 Additional Experiments.

furface was dark and rugged, and part of the Metal to have been turn'd into a dark-colour'd Powder or *Calx*: All this being taken out of the Retort, was weigh'd in the fame Ballance, whereon the Lead appear'd to have gain'd by the Operation fomewhat above thirteen Grains.

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To fhew that Metals are not the only Bodies that are capable of receiving an increase of Weight from the Fire, I thought fit to make upon Coral a tryal, whereof my Memorial gives me this Account.

Little bits of good red Coral being Hermetically feal'd up in a thin bubble of Glafs, after two Drachms of them had been weigh'd out in a pair of nice Scales, were warily kept at feveral times over and upon kindled Coals, and at length being taken out for good and all, were found of a very dark Colour, and to have gain'd in weight three Grains and about a half.] EXPER.

#### Additional Experiments. 51

#### EXPER. IX.

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One Experiment there is, which, though it might. have come in more properly at another place, is not to be omitted in this, becaufe it may invite us to confider, whether in the foregoing Experiments, excepting those made on Lead and Tin in feal'd Veffels, there may not be more of the Fire adherent to or incorporated with the Body expos'd to it, than one would conclude barely from the recited Increments of their Weight. For having taken very ftrong fresh Quick-lime provided on purpole for choice Experiments, and expos'd it, before the Air had time to flake it, upon the Cupel, to a ftrong fire where it was kept for two hours; I found that it had increas'd in weight even somewhat beyond my expectation : For being feafonably put into the Ballance, the Lumps that weigh'd, when expos'd, but two Drachms, amounted to two Drachms 14

## Additional Experiments,

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Drachms and twenty-nine Grains: which makes this Experiment a pregnant one to our purpole. For by this it appears, that notwithstanding a Body may for many hours, or even for fome days, be expos'd to a very violent Fire, yet it may be still capable of admitting and retaining fresh Corpuscles; fo that, though well made Lime be ufually observ'd to be much lighter than the Stones whereof 'tis made ; yet this lightness does not necessarily prove, that, because a burnt Lime-stone has loft much of its matter by the Fire, it has therefore acquir'd no matter. from the Fire; but only inferrs, that it has loft far more than it has got. And this may give ground to fuspect, that in most of the foregoing tryals the acceffion of the fiery Particles was greater (though in fome more, in others lefs fo,) than the Ballance discover'd; fince, for ought we know, divers of the lefs fixt Particles of the expos'd Body might be driven away by the vehemence of the Heat; and con-

Additional Experiments. 53 Grans, confequently the Igneous Corpufcles at a pro- that failined themfelves to the re-For by 1 maining matter might be numerous i enough, not only to bring the accelin fion of Weight that was found by the Scales, but to make amends for my be all the fugitive Particles, that had and to been expell'd by the violence of the b that, Fire. And fince fo fixt a Body as und Quick-lime is capable of being wrought upon by the Igneous Effu-Rt via, io as that they come to be as ment twere incorporated with it, it may me perchance be worth confidering, whe-Fire, ther in other calcin'd or incinerated Matter Bodies the remaining Calces or Afhes s, htt may not retain more than the bare mut Impression ( unless that be stretch'd whether to mean fome participation of a fubtrais stance,) of the Fire. Whether these miles Particles that adhere to or are mingled with the ftony ones of the Lime may have any thing to do in the Heat and tumult that is produc'd upon the flaking of Lime, this is not a fit place to examine. And though by this Experiment and those made in

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# 54 Additional Experiments.

in feal'd Retorts, which fhew that what is afforded by Fire may in a Corporeal way invade, adhere and add Weight to even fixt and ponderous Bodies, there is a large Field open'd for the Speculative to apply this Difcovery to divers *Phanomena* of Nature and Chymiftry; *yet* I fhall leave this Subject unmedled with in this place.

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FLAME: With fome Reflexions on it by way of COROLLARY.

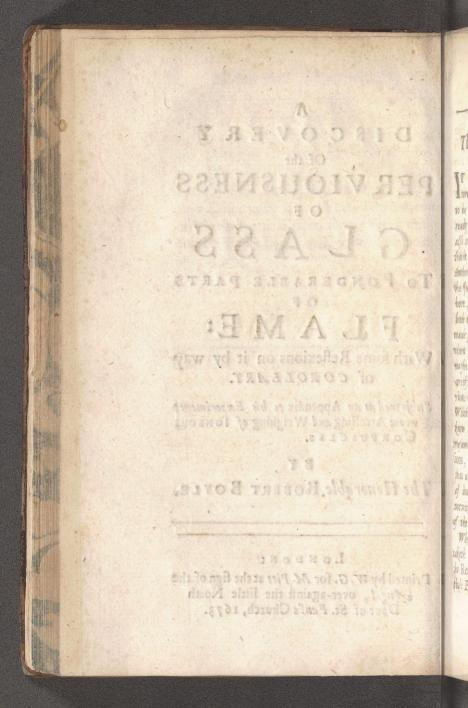
Subjoyned as an Appendix to his Experiments about Arrefting and Weighing of IGNEOUS CORPUSCLES.

#### BY

The Honorable ROBERT BOYLE.

#### LONDON:

Printed by W. G. for M. Pitt at the lign of the Angel, over-against the little North Door of St. Paul's Church, 1673.



# The Printer to the Reader.

TT bath been thought, it might be the In-I tereft of the Reader , especially Foreiners, to be advertised, That these Estays are already Translating into Latin, and beginning also to be Printed in that Language; which that it may duly be done, both as to this and the Anthor's other Writings, to be published for the future, the greater care will be taken here, because it bath been several times found both at home and ellewhere, that the Versions made of them abroad, and not in the place, where in case of any difficulty the Author may be confulted with by the Latin Interpreters, are often very defective, and not feldom injurious to the (enfe he bath deliver'd them in. Which being confider'd by those that defire to know the genuine sense of the Author, 'tis prefumed, they will rather choose those Verlions, which are made by perfons that have that advantage of confulting him in any cafe of doubt, than such as shall mis-inform them; notwithstanding the pretence of a cheaper rate of the Book.

Which being thus advertised, the Printer taketh this opportunity of farther acquainting the Reader from the Latin Interpreter, that these Essays, to his knowledge, were ready and

## The Printer to the Reader:

and in the Prefs several Months before Dr. Thomas Bartholin's A&ta Philosophica & Medica appear'd in English, in which there are two or three passages that may seem of affinity with some to be met with in the latter part of the Papers about Experiments of Arresting the parts of Flame, and of making them Ponderable.

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The Reader is also defired to take notice, That in what the Author has written about the Perviousness of Glass, he was content to suppose with Chymists and Physicians, that Glass Vessels contribute nothing of their matter to the Bodies that are prepared in them. And though he knew, as appears by the 61, and 62 Pages, it might possibly be alleaged, that the Weight gain'd by the included Metal was lost by the Glass; yet he declin'd inlarging on a surmise, all whose possible Cases could not in few words be well examin'd, and would probably be thought too Sceptical, and therefore Impertiment or Tedious to be discussid.

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# The Perviousnels of GLASS EX BITR. I.

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HAT I might obviate fome needless foruples that may be entertain'd by fulpitious Wits upon this Circumstance of our Additional Experiments, That the Glassemploy'd about them were not exposed to the Action of mere Flame, but were held upon Charcoals, ( which to fome may feem to contain but a Groffer kind of Fire : ) And that also I might, by diversifying the way of tryal, render fuch Experiments both more fit to afford Corollaries, and more ferviceable to my other purpofes, I attempted to make it fucceed with a Body fo thin and difingaged from

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from groß matter as mere Flame is allowed to be, knowing, that by going cautioully with it to work, one might handle a Retort without breaking it, in fpite of a violent agitation of kindled matter.

#### EXPER. I.

Possder able Parts of Supposing then that good common Sulphur by reafon of its great Inflammability and the vehemency and penetrancy of its Flame, would be a very fit fuel for my purpole, I provided a small double Veffel fo contrived, that the one should contain as many Coals as was necessary to keep the Sulphur melted, and that the other, which was much smaller, and shap'd like a Pan, should contain the Brimstone requisite for our Tryal; and (laftly,) that these two should be with a convenient Lute fo joyned to one another, that all being clos'd at the top, fave the orifice of the little Pan, (the fire and smoak of the Coals having their vent another, way,)

# Perbiousnels of GLASS, &c. 59

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way, ) no fire should come at the Retort to be employed, but the flame of the burning Brimstone. Then two ounces of filings of Tin being heedfully weigh'd out, and put into a Glass-Retort provided for fuch Tryals, and made fit to be eafily feal'd up at the neck, when the time should be convenient, the Sulphur (which ought to be of the purer fort) was kindled, and the Glass by degrees exposed to it; where it continued, as the Laborant inform'd me, ( the fmell of Brimftone, peculiarly offenfive to me, forbidding me to be prefent,) near two hours before the Metal melted ; after which he kept the Retort near an hour and half more with the Metal melted in it. Then bringing it me to look upon, I perceived a pretty deal of darkish Calx at the bottom, and partly too upon the furface of the far greater part of the Metal, which now lay in one Lump. The part of the Retort that had been feal'd being broken off, we first took out the Calx, and then the

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the Lump, and putting them into the Scales, they had been formerly weigh'd in, found them to have made a very manifest acquist of weight, which, if both the Laborant and I be not mistaken, (for the paper, which (hould inform us, is now miffing) amounted to four grains and a half, gained by the recited Operation. Afterwards, we being grown more expert in making luch Tryals, the experiment was repeated with the fame quantity of filings of the fame Metal : At the end of the Operation, (which in all lasted somewhat above three hours) having broken off the feal'd neck of the Retort, we found, that a good proportion of darkcolour'd Calx had been produc'd. This being weighed with the uncalcin'd part of the Metal, the two ounces we first put in appear'd to have acquir'd no lefs than eleven grains and a half ( and fomewhat better.)

Such Superftructures, both for number and weight, may poffibly in

Berbidumels of GLASS, &c. 61 in time be built on this and the like Experiments, that I shall venture to obviate even fuch a fcruple as is like to be judg'd too Sceptical. But I remember, that, confidering upon occafion of fome of the Experiments formerly recited, that though it were very improbable, yet it did not appear impossible, that the increment of Weight, acquir'd by Bodies expos'd in Glass-vessels to the Fire, might proceed, not from the Corpufcles of Fire, but from the Particles of the Glass it felf, loosened by the power, of fo intense a Heat, and forcibly driven into the inclos'd Body ; I was content to take a couple of Glasses, whereof one was fliap'd into a little Retort, and having weigh'd them, and then having kept them for a confiderable time upon kindled Coals, and then weigh'd them again, I could gather little of certainty from the Experiment, (the Retort at one time feeming to have acquir'd above half a grain in the fire,) fave that there was no likelihood at all, that fo K

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fo confiderable an increase of weight, as we divers times obtain'd in close vessels, should proceed from the Glass it felf, and not from the Fire. Per

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#### EXPER. II.

Because it seems evident enough, that, whatever Chymifts tell us of their Hypoftatical Sulphur, common Brimftone is a body Heterogeneous enough, having in it fome parts of an oyly or inflammable nature, and others acid, and very near of kin to the Spirits of Vitriol; I thought fit. to vary our Experiment, by making it with a liquor that is generally reputed to be as Homogeneous as Chymifts themfelves are wont to render any, I mean with a Spirit of Wine, or fome fuch liquor as will totally flame away without affording Soot, or leaving any drop of Phlegm behind it. In profecution of this defign, we carefully weighed out an ounce of filings of Block-Tin, and put them into a Glafs-Retort, fit for the

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the purpole, whole neck was afterwards drawn out to a great flendernefs; and we also provided a conveniently shap'd metalline Lamp, such as that the flame of this ardent Spirit might commodioufly burn in it, and yet not melt nor crack it; which Lamp, though furnished with a Cotton wick, afforded no Soot, because as long as it was supplied with liquor enough, it remained unburnt. These things being in readinefs, the Retort was warily ap-proach'd to the flame, and the Metal was thereby in a short time melted. After which the Glass being kept expos'd to the fame flame for near two hours in all, the feal'd apex of the Retort was broken off, and there appear'd to have been produc'd a not inconfiderable Quantity of Calx, that lay loofe about the remaining part of the Tin, which, upon its growing cold, was harden'd into a Lump. This, and the Calx, being taken out of the Retort with care, that no little fragment of Glais fibuld K z

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fhould at all impose upon us, was weigh'd in the fame Scales as formerly, and found to have gain'd four grains and a half, befides the Duft that fluck in the infide of the Retort, of which we reckon'd enough to make about half a grain more; fo that of fo fine and pure a flame as of this totally ardent Spirit, enough to amount to five grains was arrested, and in good measure fixt by its operation on the Tin it had wrought upon.

#### EXPER. III.

For confirmation of the former tryal, wherein we had imployed the *spiritus ardens* of Sugar, we made the like experiment with highly Reclified Spirit of Wine, only fubftituting an ounce of Lead inftead of one of Tin. The event, in fhort, was this; that after the Metal had been for two hours or better kept in the flame, the feal'd neck of the Retort being broken off, the external Air **Derbiouinels of** GLASS, &c. 65 Air rush'd in with a noife, (which shew'd the Vessel to have been very tight,) and we found pretty flore of the Lead, for 'twas above seven scruples, turn'd into a grayish Calx', which together with the rest of the Metal being weigh'd again, there was very near, if not full, fix grains of increase of weight acquir'd by the Operation.

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I. N. B. The Lump of Lead, that remain'd after the newly recited Operation, being feparated from the Calx, was weighed and cut in pieces, that it might be put into a fresh Retort, wherein it was again exposid to the flame of Spirit of Wine, that I might fatisfie my felf, whether probably the whole Body of the Lead might not, by repeated Operations, or (perhaps by one continued long enough ) be reduc'd to Calx. And though, after the Retort (whole neck had been drawn out) had been kept in the flame for about two hours, it was, by the negligence of a Footboy, unluckily broken, and fome of the K 3

#### 66 A Discovery of the

the Calx loft; yet we made a fhift to fave about five grains of it, (whofe colour was yellowifh;) which was enough to make it likely, that, if we had had conveniency to purfue the Operation to the utmoft, the whole Metal might have been calcin'd by the action of the flaming Spirit. 130

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2. N.B. And left you should be induc'd by fome Chymical conceits to imagine, that the particles that once belong'd to flame, did make more than a Coalition with those of the Lead, and by a perfect Union were Really transmuted into the Metal whole weight they increas'd; I shall add, that (according to a Method elfewhere deliver'd) I examin'd the feven scruples of Calx, mention'd to have been made in the third Experiment, by weighing them in Air and Water, and thereby found, as I expected, that though the abfolute Gravity of the Metal had been increasid by the particles of Flame that fluck fast to it, yet this Aggre-May is here build and a s gate

perbiouinels of GLASS, &c. 67 gate of Lead and extinguish'd Flame had loft much of its *fpecifick* Gravity. For, whereas Lead is wont to be to Water of the same bulk, as about *ele*ven and a *half* to one, this subtil Calx of Lead was to Water of the same bulk little, if at all, more than as *nine* to one.

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These are not the only Experiments I made of the Operation of meer Flame upon Bodies inclos'd in Glaffes; but thefe, I fuppole, are fufficient to allow me to comply with my prefent hafte, and yet make good the Title prefixt to this Paper. For, whence can this increase of absolute weight ( for I speak not of specifick Gravity,) observ'd by us in the Metals expos'd to the mere flame, be deduc'd, but from some ponderable parts of that Flame? And how could those parts invade those of the Metal inclos'd in a Glass, otherwife than by paffing through the pores of that Glafs ? But, because I judge it unphilosophical, either to be more careful that what one writes should appear strange, than be true; K 4

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or to be forward to advance the repute of Strangenefs, to the prejudice of the Intereft of Truth, though it be perhaps but a remote one, or a collateral one; I fhall deal fo impartially, as to fubjoyn on this occasion two or three fhort Intimations, that may prove *botb* feasionable for Caution, in reference to the Poroulinefs of Glafs, *and* give a hint or two in relation to other Things.

I do not then by the foregoing Experiments pretend to make out the Porofity of Glafs any farther, than is expreft in the *Title* of this Paper; namely, in reference to fome of the Ponderable parts of Flame. For otherwife I am not at all of their mind, that think Glafs is eafily penetrable, *either*, as many do, by Chymical Liquors, or, as fome, by Quickfilver; or, as others, at leaft by our Air : Thofe opinions not agreeing with the Experiments I made purpofely to examine them, as you may find in another Paper.

Again, if we compare the Increase we

Perviousnels of GLASS, &cc. 69 we observe to be made in the Weight of the Bodies that we expose to the naked Fire, and those of the same or the like kinds that we included in Glaffes, or fo much as in Crucibles; it may be worth confidering, Whether this difference in acquir'd weight may not give caule to fulpect, that the Corpufcles, whereof Fire and Flame confifts, are not all of the fame fize, and equally agitated, but that the interpos'd Veffel keeps out the groffer Particles like a kind of Strainer, though it gives paffage to the minuteft and most active :

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ocreate we I offer it also to Confideration, Whether this perviousness of Glass, even to the minute particles that pervade it, and their adhesion to the Metal they work on, does necessfarily imply Pores constantly great enough to transmit such Corpuscies? or, Whether it may not be faid, that Glass is generally of a closer Texture, than when in our Experiments the pores are open'd by the vehement Heat of the flame that beats upon it, and

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and in that state may let pass Corpuscles too big to permeate Glass in its ordinary state; and that this penetration is much affifted by the vehement agitation of the Igneous parts, which by the rapidness of their motion both force themselves a paffage through the narrow pores of the Glais, and pierce deep enough into those of the included Body to flick fast there; (as hail-shot thrown with ones hand against a board, will pals off from it, but being that out of a Gun will pierce it , and lodge themfelves in it?) And I know a Menfruum that does not work upon a certain Metal whilft the liquor is cold, or but faintly heated, and yet by intending the Heat would be made to turn it into a powder or Calx, (for it does not properly diffolve it.) Perhaps it may not be amils to add on this occafion, that though Glass be generally acknowledged to have far smaller pores, than any other matter wont to be implyed to make veffels, that are to be expos'd tò

Perbiousnels of GLASS, &c. 71 to the fire; yet till I be farther fatisfy'd, I shall forbear both to determine, whether the rectitude, that fome Philosophers suppose in the pores of Glass, as 'tis a transparent body, or rather in their ranks or rows, may facilitate the Perviousness we above observ'd in Glass, and to conclude from the foregoing Experiments, that ponderable parts of Flame will be able as well to pass through the pores of Metalline veffels as those of Glass. For though, with a filver veffel, made merely of plate without Soder, I made two or three Tryals (of which you may command an account) in order to the refolving of these doubts; yet by an accident, which, though it were not a furprizing one, was unlucky enough to defeat my endeavours, I was kept, for want of fit Accommodations, from bringing my intended tryals to an iffue.

And now having endeavour'd by the foregoing Advertisements to prevent the having unfafe Consequences drawn

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drawn from our Experiments; it remains that I briefly point at three or four *Corollaries* that may more warily be deduc'd from them. To which, if I get time, I may fubjoyn a hint or two about further Inquiries.

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# COROLLARY I.

Confirming this PARADOX, That Flame may act as a Menstruum, and make Coalitions with the Bodies it works on.

THE Experiments, we have made and recited of the permeating of Flame (as to fome of its parts) through Glafs-veffels, and of its working on included Metals, may much confirm the Paradox I have elfewhere propos'd, That Flame may be a *Menstruum*, and work on fome Bodies at the rate of being fo; I mean not only by making a notable Comminution and Diffipation of the parts, but

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but by a Coalition of its own particles with those of the fretted Body, and thereby permanently adding Subfrance and Weight to them. Nor is it repugnant to Flames, being a Menstruum, that in our experiment the Lead and Tin, expos'd to it, were but reduc'd to powder, and not diffolv'd in the form of a Liquor, and kept in that state. For, besides that the interpos'd Glass hinder'd the Igneous particles from getting through in plenty enough; I confider, that 'tis not necessary, that all Menstruums should be fuch Solvents, as the objection fuppofes. For whether it be (as I have fometimes fulpected,) that Menstruums, that we think simple, may be compounded of very differing parts, whereof one may precipitate what is diffolved by the other; or for fome other Caufe, I have not now time to discuss. Certain it is, that fome Menstruums corrode Metals and other Bodies without keeping diffolved all, or perhaps any confiderable part; as may be seen, if you put Tin 10

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in a certain quantity of Aqua fortis, which will in a very fhort time reduce it almost totally to a very white fubstance, which, when dry, is a kind of *Calx*. And fo by a due proportion of Oyl of Vitriol, abstracted from Quickfilver by a strong fire, we have divers times reduc'd the main body of the Mercury into a white powder, whereof but an inconfiderable part would be diffoluble in water. And fuch a white *Calx* I have had by the action of another fretting Liquor on a Body not Metalline.

And having thus clear'd our Paradox of the oppos'd Difficulty, my hafte would immediately carry me on to the next Corollary, were it not, that there is one *Phanomenon* belonging to this place that deferves to be taken notice of. For, *whether* it be, as feems probable, from the vehement agitation of the permeating particles of Flame, that violently tear afunder the Metalline Corpufcles, or from the nature of the Igneous *Menstruum*, (which being as 'twere percolated through

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through Glass it felf, must be strangely minute,) 'tis worth observing, how fmall a proportion, in point of weight, of the additional adhering Body may ferve to corrode a Metal, in comparifon of the Quantity of vulgar Menstrumms that is requisite for that purpose. For, whereas we are oblig'd to imploy, to the making the folution of crude Lead, feveral times its weight of Spirit of Vinegar, and (though not fo many times ) even of Aqua fortis, 'twas observ'd in our Experiment, that, though the Lead was increas'd but fix grains in weight, yet above fix score of it were fretted into powder, fo that the Correfive Body appear'd to be but about the twentieth part of the corroded.

#### COROLL. II.

Proposing a FARADOX about Calcination and Calces.

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of Glass to Flame, may be this; That there is caufe to question the Truth of what is generally taken for granted about Calcination, and particularly of the notion, that not only others, but Chymifts themfelves, have entertain'd about the Calces of Metals and Minerals. For, whereas'tis commonly fuppos'd, that in Calcination the greater part of the Body is driven away, and only the Earth, to which Chymifts add the Fixt Salt, remains behind; and whereas even Mechanical Philosophers, (for two or three of Them have taken notice of Calcination,) are of opinion, that much is driven away by the violence of the fire, and the remaining parts by being depriv'd of their more radical and fixt moisture are turn'd into dry and brittle particles : Whereas these Notions, I say, are entertain'd about Calcination, it feems, that they are not well fram'd, and do not univerfally hold; fince, at least they are not applicable to the Metals, our Experiments were made on. For, it does not appear by

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by our Tryals, that any proportion, worth regarding, of moift and fugitive parts was expell'd in the Calcination. but it does appear very plainly, that by this Operation the Metals gain'd more weight than they loft; To that the main body of the Metal remain'd intire, and was far from being, either as a Peripatetick would think, Elementary Earth, or a compound of Earth and Fixt Salt, as Chymifts commonly suppose the Calss of Lead to be. From which very erroneous Hypethesis they are wont to inferr the fweet Vitriol of Lead, which they call Saccharum Saturni, to be but the fweet Salt of it extracted only by the Spirit of Vinegar, which does indeed plentifully enough concurr to compose it. Whence I conclude, that the Calx of a Metal even made (as they fpeak) per se, that is, by fire without additament, may be, at least in some cafes, not the Caput mortuum, or Terra damnata, but a Magistery of it. ? For, in the fense of the most intelligible of the Chymical Writers, that is I. pro-

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properly a Magistery wherein the Principles are not feparated, but the bulk of the Body being preferved, it acquires a new and convenient form by the addition of the Menstruum or Solvent imployed about the preparation. And, not here to borrow any Argument from my Notes about particular Qualities, you may guels, how true it is, that the greatest part of the Body, or all the radical moifture is expell'd in Calcination, which therefore turns the Metal into an arid unfulible powder; by this, That I have feveral times from Calx of Lead reduc'd corporal Lead. And I remember, that having taken what I guess'd to be but about a third or fourth part of the Calx of Lead, produc'd by the third Experiment ; I found by a tryal purpofely devis'd, that without any Flux-powder or any additament, but meerly by the application of the Flame of highly Rectified Spirit of Wine, there could in a short time be obtain'd a considerable proportion of malleable Lead; whereof -019

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whereof the part I had the Curiofity to examine, was true malleable Lead; fo little was the arid powder, whence this was reduc'd, depriv'd by the foregoing Calcination of the fuppo'sd radical moifture requifite to a Metal. The Confideration of what may be drawn from this Reduction in reference to the Doctrine of Qualities belongs not to this place.

## COROLL. III.

One use, among the reft, we may make, by way of Corollary, of the foregoing Discovery, which is in reference to a Controversie warmly agitated among the Corpufcular Philofophers themfelves. For, fome of them, that follow the Episurean or Atomical Hypothesis, think, that when Bodies are exposid in close veffels to the fire, though the Igneous Corpufcles do not ftay with the Bodies they invade, yet they really get through the Pores of the interpos'd Veffels, and permeate the included L 2 Bodies

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Bodies in their passage upwards; whereas others, especially favourers of the Cartesian Doctrine, will not allow the Atomists Igneous Corpufcles, which they take to be but vehemently agitated particles of Terrestrial matter, to penetrate such minute pores as those of Glass; but do suppole the operation of the fire to be perform'd by the vehement agitation made of the small parts of the Glass, and by them propagated to the included Bodies, whole particles by this violent Commotion are notably alter'd, and receive new Textures, or other modifications.

But our Experiments inform us, that, though neither of the two Opinions feems fit to be defpifed, yet neither feems to have hit the very mark; though the *Epicurean Hypothefis* comprize fomewhat more of the Truth than the other. For, though it be not improbable, that the brisk agitation communicated by the fmall parts of the Glass to those of the Body contain'd in it, may contribute much

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to the effect of the fire; and though, by the fmall increment of weight, we found in our expos'd Metal, tis very likely, that far the greater part of the Flame was excluded by the close Texture of the Glass; yet on the other fide'tis plain, that Igneous particles were trajected through the Glafs, which agrees with the Epicureans; and they, on the other fide, miftook, in thinking that they did but pass through, and divide and agitate the included Bodies; to which nevertheless our Experiments shew, that enough of them, to be manifeftly ponderable, did permanently adhere.

Whether these Igneous Corpufcles do stick after the like manner to the parts of meat, dreft by the help of the fire, and especially roast-meat, which is more immediately exposed to the action of the fire, may be a question, which I shall now leave undifcussed, because I think it difficult to be determined, though otherwise it feems worthy to be confidered, in regard it may concern mens Health, L 3 to

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to know, whether the Coction of meat be made by the fire, only as 'tis a very hot body, or whether it permanently communicates any thing of its fubftance to the meat expos'd to it: In which (laft) cafe it may be fulpected, that not only the degree and manner of application of a fire, but the nature of its fuel may be fit to be confider'd.

# COROLL. IV.

The Experiments above recited give us this further Information, That Bodies very fpirituous, fugitive, and minute, may, by being affociated with congruous particles, though of quite another nature, fo change their former Qualities, as to be arrefted, by a folid and ponderous Body, to that degree, as not to be driven away from it by a fire intenfe enough to melt and calcine Metals.

For, the foregoing Tryals (taking \* Exp. III. N.B. 2. in what I \* lately deliver'd of the lellen'd fpecifiek Gravity of calcin'd Lead) feems

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feems plainly enough to discover, that even the agitated parts of flame, minute enough to pass through the pores of Glass it felf, were as 'twere entangled among the metalline particles of Tin and Lead, and thereby brought to be fixt enough to endure the Heat that kept those Metals in fusion, and little by little reduc'd them into calces: Which is a Phanomenon that one would not eafily look for, especially confidering how fimple a Texture that of Lead or Tin may be fuppos'd to be in comparison of the more elaborate structures of very many other Bodies. And this Phanomenon, which shews us, what light and fugitive particles of matter may permanently concurr to the Compolition of Bodies ponderous and fixt enough, may perchance afford useful hints to the Speculative; especially if this ftrict Combination of spirituous and fugitive fubftance with fuch, as being groß or unwieldy, are less fit than organiz'd matter to entangle or detain them, be applied, (as it LA may

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may be with advantage) to those aggregates of spirituous Corpuscles, and organical Parts, that make up the Bodies of Plants and Animals. And this hint may suggest a main Inference to be drawn from the Operations of the Sun-beams on appropriated subjects, supposing it to prove like that of shame on Tin and Lead.

And now having difpatch'd our COROLLARIES, we might here inquire, Whether all the particles of Fire and Flame, that are fubtile and agitated enough to penetrate Glafs. and fasten themselves to included Bodies, be reduc'd by Ignition to the fame nature, or elfe retain fomewhat of their proper Qualities ? Which Inquiry I have fome caufe not to think fo undeterminable, as at first blush it may appear. For, one of the ways, that may be propos'd for this Examen, is already intimated at the close of the third Experiment, which shews, that we may compare the fpecifick Gravity of the Calces of the fame

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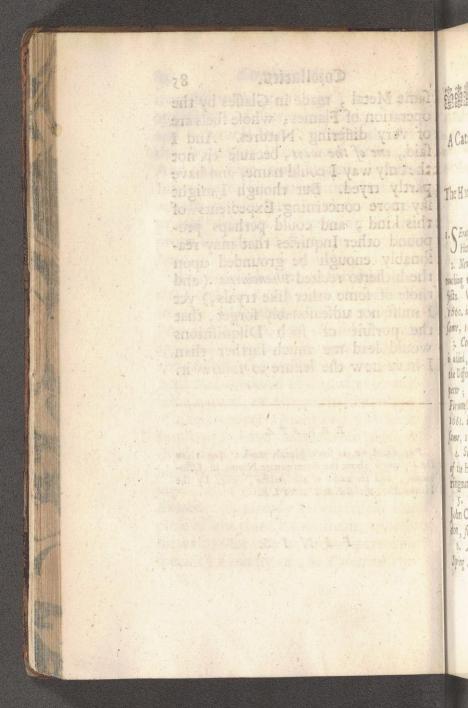
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fame Metal, made in Glaffes by the operation of Flames; whole fuels are of very differing Natures. And I faid, one of the ways, because 'tis not the only way I could name, and have partly tryed. But though I might lay more concerning Expedients of this kind, and could perhaps propound other Inquiries that may reafonably enough be grounded upon the hitherto recited Phanomena (and those of some other like tryals,) yet I must not unfeasonably forget, that the pursuit of such Disquisitions would lead me much farther than I have now the leifure to follow it.

#### ERRATA.

Pag. 44. 1. 19. r. fome Metals work ; pag. 1: in the Discourse about the Determinate Nature of Effluviums, add the name of the Author, viz. By the Honorable ROBERT BOTLE.

FINIS.



# 

A Cathlogue at the

# A Catalogue of the Writings

#### Publisht by

#### The Honorable ROBERT BOYLE.

1. S Eraphick Love. London, for Henry Herringman, 1660. in 3°.

2. New Experiments Phylice-Mechanical, touching the Spring of the Air, and its Effects. Oxford, for Thomas Robinson, 1560. in 8°. In Latin : Oxford; for the fame, 1661. in 8°.

3. Certain Physiological Essays; to which is added, The Physico-Chymical Essay about the Differing parts, and Redintegration of Saltpeter; as also, the History of Fluidity and Firmmess. London, for Henry Herringman, 1661. in 4°. In Latin; London, by the same, 1661. in 4°.

4. Some Confiderations touching the Style of the H. Scriptures. London, for H. Herringman, 1661. in 2°.

5. The Sceptical Chymift. London, for John Crook, 1661. in 8°. In Latin; London, for the same, in 5°. 1662.

6. A Defence of the Doctrine touching the Spring and Weight of the Air, against the Ob-

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Objections of Franciscus Linus, London, for Tho. Robinson, 1662. in 4°.

7. An Examen of Mr. Hobbes his Dialologus Physicus de Natura Aeris : with and Appendix touching Mr. Hobbes his Doctrine of Fluidity and Firmnes. London, for Tho. Robinson, 1662. in 4°.

8. Usefulness of Experimental Philosephy. Oxford, for Rich. Davies, 1663. in 4°.

9. Experimental History of Colours. London, for H. Herringman, 1664. in S<sup>o</sup>. In Latin : London, for the fame, 1665. in 12°.

10. Hiftory of Cold. To which is added, an Examen of Antiperistasis, and of Mr. Hobbes his Doctrine of Cold. London, for John Crook, 1665. in 8°.

11. Hydroftatical Paradoxes. Oxford, for Rich. Davies, 1666. in 8°. In Latin; Oxford, for the fame, 1669. in 12°.

12. Origine of Forms and Qualities. Oxford, for Rich. Davies, 1667. in 8°. In Latin; Oxford, for the fame, 1669. in 12°.

13. Free Considerations about Subordinate Forms. Oxford, for Rich. Davies, 1667. in 8°. In Latin; Oxford, 1669.

14. Continuation of New Experiments Physico-Mechanical touching the Spring and Weight of the Air, and the Atmosphere of Confistent

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fistent Bodies. Oxford, for Rich. Davies, 1669. in 4°.

15. Of the Absolute Rest of Solid Bodies. London, for H. Herringman, 1669. in 4°: In Latin; London, for the same, 1672. in 12°.

16. Several Tracts; viz. An Introduction to the History of Particular Qualities: Of Cosmical Qualities and Suspitions: Of the Temperature of the Subterraneal and Submarine Regions: Of the bottom of the Sea. Oxford, for Rich. Davies, 1671. in 8°. In Latin; London, for the Same, 1672. in 12°.

17. Small Tracts; viz. Of a Difcovery of the admirable Rarefaction of the Air, even without Heat: New Observations about the Duration of the Spring of the Air: New Experiments touching the Condensation of the Air by meer Cold, and its Compression without Mechanical Engins: The admirably Differing Extension of the same Quantity of Air rarified and compressed. London, for H. Herringman, 1670. in 4°. In Latin; London, for the same, 1670. in 12°.

18. Of the Usefulness of Natural Philosophy, Tom. 2. Oxford, for Rich. Davies, 1671. in 4°.

19. An Essay about the Origine and Virtue of Gems. London, for Moses Pitt, 1672. in 8°. In Latin; London, for the same, 1673. in 12°. 20. Se-

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20. Several Tracts, containing New Experiments touching the Relation betwixt Flame and Air, and about Explosions: An Hydroftatical Discourse answering some Objections of Dr. Henry More: An Hydroftatical Letter, dilucidating an Experiment about a way of weighing Water in Water: New Experiments of the Positive or Relative Levity of Bodies under Water: Of the Air's Spring on Bodies under Water: About the differing Pressure of Heavy Solids and Fluids. London, for Rich. Davies, 1672. in 2°.

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21. Ellays, of the ftrange Subtilty, the great Efficacy, and the Determinate Nature of Effluviums. To which are annext, New Experiments to make Fire and Flame Ponderable; together with a Difcovery of the Perviousness of Glass. London, for Moses Pitt, 1673. in 8°.

22. A Dialogue concerning the Politive or Privative nature of Cold; by a Member of the R. Society: And a Discourse about the Saltness of the Sea; and another of a Statical Hygroscope; together with some Phanomena of the force of the Air's Moisture. To which is adaed a Paradox about the Natural and Praternatural State of Bodies, effecially the Air. London, for Rich. Davies, 1673. in 8°.

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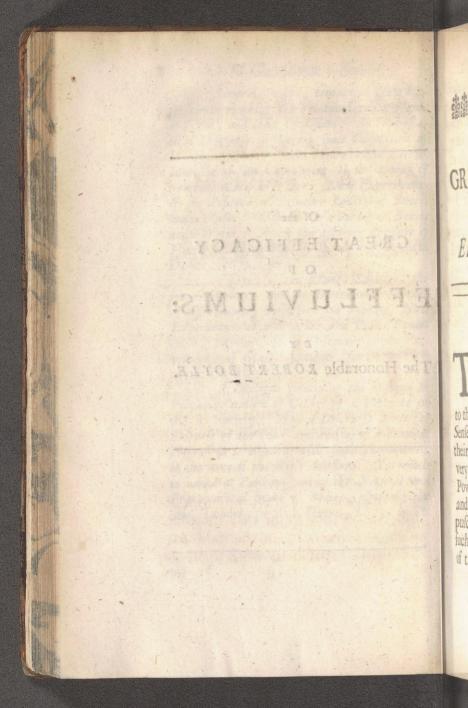
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# OF THE GREAT EFFICACY OF

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# CHAP. I.

They that are wont in the Effimates they make of Natural Things, to truft too much to the negative informations of their Senfes, without fufficiently confulting their Reafon, have commonly but a very little and flight opinion of the Power and Efficacy of Effiviums; and imagine that fuch minute Corpuscles (if they grant that there are fuch,) as are not, for the most part of them, capable to work upon the B

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tendereft and quickeft of Senfes, the Sight, cannot have any confiderable Operation upon other Bodies. But I take this to be an error, which, as it very little becomes Philofophers, fo it has done no little prejudice to Philofophy it felf, and perhaps to Phyfick too. And therefore though the nature of my defign at prefent did not require it, yet the importance of the fubject would *invite* me to fhew, That this is as ill-gounded as prejudicial a Suppofition.

And indeed if we Confider the fubject attentively, we may obferve, That though it be true, that, cateris paribus, the greatness of Bodies doth, in most cases, contribute to that of their Operation upon others, yet Matter or Body being in its own precise nature an unactive or moveless Subject, one part of the Mass acts upon another but upon the account of its Local Motion, whose Operations are facilitated and otherwise diversified by the Shape, Size, Situation and Texture both of the Agent and of the Patient.

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Patient. And therefore if Corpufcles, though very minute, be numerous enough, and have a competent degree of motion, even these small Particles, especially if fitly shap'd, when they chance to meet with a Body, which the congruity of its texture disposes to admit them at its Pores, and receive their either friendly or hostile imprefsions, may perform such things in the patient, as visible and much groffer Bodies, but less conveniently shap'd and mov'd, would be utterly unable (on the fame Body) to effect.

And that you may with the lefs difficulty allow me to fay, that the Effluviums of Bodies, as minute as the y are, may perform Confiderable things, give me leave to obferve to you, that there are at least fix ways, by which the Effluviums of a Body may notably operate upon another; namely, 1. By the great number of emitted Corpufcles. 2. By their penetrating and pervading nature. 3. By their celerity, and other Modifications of their Motion. 4. By the congruity and incon-B 2 gruity

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gruity of their Bulk and Shape to the Pores of the Bodies they are to act upon. 5. By the motions of one part upon another, that they excite or occafion in the Body they work upon according to its Structure. And 61y, By the Fitnefs and Power they have to make themfelves be assisted, in their Working, by the more Catholick Agents of the Universe. And though it may perhaps be fufficiently proved, that there are feveral cafes wherein a Body that emits Particles, may act notably upon another Body by this or that fingle way of those I have been naming; yet ufually the great matters are performed by the affociation of two, three or more of them, concurring to produce the fame Effect. Upon which fcore when I shall in the following Paper referr an Inftance or a Phenomenon to any one of the forementioned Heads, I defire to be underftood as looking upon that but as the Head, to which it chiefly relates, without excluding the reft.

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# CHAP. II.

Aking those things for granted, that have, I hope, been fufficiently proved in the former Tract about the fubtlety of Effluviums, I suppose it will readily be allowed, That the Emanations of a Body may be extremely minute; whence it may be rightly inferr'd, that a small portion of matter may emit great multitudes of them.

Now that the great number of Agents may in many cases compensate their littlenefs, especially where they Act or Relift per modum unius, (as they fpeak,) men would perhaps the more ealily grant, if they took notice to this purpole of fome familiar Instances.

We see that not only lesser Landfloods that overflow the neighbouring Fields, but those terrible Inundations that fometimes drown whole Countreys, are made by Bodies fingly fo fo fmall and inconfiderable as Drops of

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of Rain when they continue to fall in those multitudes we call Showers. Aqua

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So the aggregates of fuch minute Bodies as grains of Sand being heaped together in fufficient Numbers, make Banks wherewith greateft Ships are fometimes fplit, nay and ferve in most places for Bounds to the Sea it felf.

And though a fingle Corn of Gunpowder, or two or three together, are not of Force to do much mifchief, yet two or three Barrels of those Corns taking Fire all together are able to blow up Ships and Houses, and perform prodigious things.

But inftead of multiplying fuch Inftances, afforded by Bodies of fmall indeed but yet vifible Bulk, I fhall (as foon as I have intimated, that the above-mentioned drops of Rain themfelves confift of convening Multitudes of Vapors most commonly Invisible in their Afcent,) endeavour to make out what was proposed, by two or three Instances drawn from the Operations of Invisible particles. And first, we fee, that though Aqueous

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Aqueous Vapours be look'd upon as the faintest and least active Effluviums that we know of, yet when multitudes of them are in Rainy weather difperfed thorow the Air, and are thereby qualified to work on the Bodies exposed to it, their Operations are very confiderable, not only in the diffolution of Salts, as Sea-Salt, Salt of Tartar, &c. and in the putrefactive changes they produce in many Bodies, but in the intumescence they caufe in Oak and other folid Woods; as appears by the difficulty we often find in and before Rainy weather, to fhut and open Doors, Boxes, and other Wooden pieces of work, that were before fit enough for the Cavities they had been adjusted to.

I might here urge, that though the ftrings of Viols and other Mufical Inftruments are fometimes ftrong enough to fuftain confiderable weights, yet if they be left forewed to their full tenfion, (as it frequently happens) they are oftentimes by the fupervening of moift weather made to break, not B 4 with-

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without impetuofity and noife. But it may fute better with my prefent aim, if I mention on this occasion, (what I elfewhere more fully take notice of:) Being defirous to try what a multitude even of Aqueous Steams may do, I caufed a Rope that was long, but not thick, and was in part fuftained by a Pully, to have a Weight of Lead fo fastned to the end of it, as not to touch the ground, and after the Weight had leifure allowed it to ftretch the Cord as far as it could, I observed that in the moist weather the waterish particles, that did invifibly abound in the Air, did fo much work upon and shorten the Rope, as to make it lift up the hanging Weight, which was, if I mis-remember not, about an hundred Pounds.

The invisible Steams, issuing out of the Walls of a newly plaster'd or whited Room, are not sensibly prejudicial to those that do but transiently wist it, or make but a very short stay in it, though there be a Charcoal-fire in the Chimney; but we have many instances

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val-fire many inftances of perfons, that by lying for a night in fuch Rooms, have been the next morning or fooner found dead in their Beds, being fuffocated by the multitude of the noxious Vapours emitted during all that time.

And here I think it proper to obferve, That it may much affift us to take notice of the multitude of Effluvia, and make us expect great matters from them, to confider, that they are not emitted from the Body that affords them all at once, as Hail-shot out of a Gun, but iffue from it as the Vaporous Winds do out of an Æolipil well heated, or Waters out of a Springhead in continued Streams, wherein fresh parts still fucceed one another; fo that though as many Effluxions of a Body as can be fent out at one time were numerous enough to Act but upon its Superficial parts, yet the Emanation of the next minute may get in a little farther, and each finalleft portion of time supplying fresh Recruits, and perhaps urging on the Steams already entred, the Particles may

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may at length get into a multitude of the pores of the invaded Body, and penetrate it to the very innermost parts. the for

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# CHAP. III.

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T Come now to fhew in the fecond place, That the fubtile and penetrating nature of Effluviums, may in many cafes cooperate with their multitude in producing notable effects; and that there are Effluviums of a very piercing nature, though we shall not now enquire upon what account they are fo, we may evince by feveral Examples. For not only the invilible Steams of good Aqua Fortis and Spirit of Nitre do ufually in a fhort time, and in the cold, fo penetrate the corks wherewith the Glaffes that contained them were ftop'd, as to reduce them into a yellow pap; but also the emanations of Mercury have been fometimes found in the

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the form of coagulated, or even of running Mercury in the heads or very bones of those Gilders, or Venereal Patients, that have too long or too unadvifedly been exposed to the fumes of it, though they never took Quickfilver in its groß fubstance. Chymists too often find in their Laboratories, that the steams of Sulphur, Antimony, Arfnick, and divers other Minerals, are able to make those stagger, or perhaps strike them down, that without a competent wariness unlute the Veffels wherein they had been diftilled or fublimed; of which I have known divers fad Examples. And of the Penetrancy even of animal Steams we may eafily be perfwaded, if we confider, how foon in many Plagues the contagious, though invisible, Exhalations are able to reach the Heart, or infect other internal parts; though in divers of these cases the Blood helps to convey the infection, yet still the Morbifick particles must get into the body before they can infect the mais of Blood. And in those stupefactions that are

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are caused at a distance by the Torpedo, the parts mainly affected feem to be the Nervous ones of the Hand and Arm, which are of the most retired and best fenced parts of those members. And there is a Spirit of Sal Armoniack, that I make to fmell to, whofe invifible Steams, unexcited by heat, are of fo piercing a nature, that not only they will powerfully affect the Eyes and Nostrils, and Throats, and sometimes the Stomachs too (yet without proving Vomitive, ) of the Patients they invade, but also when a great cold has fo clog'd the organs of fmelling, that neither fweet nor ftinking odours would at all affect them, these piercing Steams have not only in a few minutes both made themfelves a way, and which is more, fo open'd the paffages, that foon after the Patient has been able to fmell other things alfo. And by the fame penetrating Spirit, a perfon of Quality was, fome time fince, restored to a power of smelling, which he had loft for divers Years, (if he ever had it equally with other men.) I could eafily

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eafily fubjoyn Examples of this kind, but they belong to other places. And here I shall only add, that the steams of Water it self assisted by warmth, are capable of diffolving the Texture of even hard and folid bodies, that are not suspected to be Saline; as appears by the Philosophical calcination (as Chymifts call it) wherein folid pieces of Harts-horn are brought to be eafily friable into pouder, by being hung over waters, whil'At their steams rife in distillation and without the help of Furnaces. The Exhalations, that ufually fwim every night in the air, and almost every night fall to the ground in the form of Dews (which makes them be judged Aqueous,) are in many places of the Torrid Zone of lo penetrating a nature, that, as Eye-witneffes have informed me, they would in a very short time make Knives ruft in their sheaths, and Swords in their scabbards, nay and Watches in their cafes, if they did not constantly carry them in their pockets. And I have known even in England. divers

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divers hard bodies, into which the Vapours fwimming in the air have infinuated themfelves, fo far as to make them friable throughout. But of the penetration of Effluviums, I have given, in feveral places, fo many infrances, that 'tis not neceffary to add any here. And therefore to fhew, that, as I intimated at the beginning of this Chapter, the Penetrancy and the multitude of Effluviums may much affift each other, I shall now fubjoyn; That we must not for the most part look upon Effluviums as fwarms of Corpufcles, that only beat against the outsides of the Bodies they invade, but as Corpufcles, which by reason of their great and frequently recruited numbers, and by the Extreme smallness of their Parts, infinuate themselves in multitudes into the minute pores of the bodies they invade, and often penetrate to the innermost of them; fo that, though each fingle Corpufcle, and its diftinct action, be inconfiderable, in respect of the multitude of parts that compose the

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the body to be wrought on; yet a vast multitude of these little Agents working together upon a correlpondent number of the small parts of the body they pervade, they may well be able to have powerful effects upon the Body, that those parts constitute : as, in the cafe mentioned in the former Chapter, the Rope would not probably have been enabled to raife fo great a weight, though a vehement Wind had blown against it, to make it lofe its perpendicular straightness, but a vaft multitude of Watery Particles, getting by degrees into the pores of the Rope, might, like an innumerable company of little wedges, fo widen the pores as to make the thrids or splinters of Hemp, the Rope was made up of, fwell, and that fo forcibly, that the depending weight could not hinder the flortning of the Rope, and therefore must of necessity be rais'd thereby. And I have more than once known folid and even heavy Mineral Bodies, burft in pieces by the moisture of the Air, though We

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# CHAP. IV.

Hat the Celerity of the motion of very minute Bodies, especially conjoyned to their multitudes, may perform very notable things, may be argued from the wonderful effects of fired Gunpowder, Aurum fulminans, of Flames that invisibly touch the Bodies they work on, and alfo Whirlwinds, and those streams of invisible Exhalations and other aerial Particles we call Winds. But because instances of this fort fuit not fo well with the main fcope of this Tract, I shall not infift on them, but fubjoyn fome others, which, though less notable in themselves, will be more congruous to my prefent Defign. That the Corpufcles whereof Odours confift, fwim to and fro in the Air, as in a fluid Vehicle, will by

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to the Wind, the Current of the Air drives the Steams forcibly upon the Senfory, which otherwife it does not.

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That there is a briskness of motion requifite, and more than ordinarily conducive to Electrical attractions, may be argued from the necessity that we ufually find by rubbing Amber, Jett, and other Electrical bodies, to make them emit those Steams, by which 'tis highly probable their action is performed: And though I have elfewhere shewn, that this precedent rubbing is not alwayes neceffary to excite all Electrical bodies; yet in those that I made to attract without it, it would operate much more vigoroufly after attrition; which I conconceive makes a reciprocal motion amongst the more stable parts, and does thereby as 'twere discharge and fhoct out the attracting Corpufcles; whole real emiffion, though it may be probably argued from what has been already faid, feems more ftrongly proveable by an Obfervation that I made

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I made many years ago, and which I have been lately inform'd to have been long fince made by the very Learned Fabri, The Observation was this; That if, when we took a vigoroufly excited Electrick, we did at a certain nick of time (which circumstances may much vary, but was usually almost as foon as the body was well rubbed) place it at a just distance from a suspended Hair or other light body, or perhaps from fome light powder; the Hair, &c. would not be attracted to the Electrick, but driven away from it, as it feem'd, by the briskly moving fteams that iffue out of the Amber or other light body.

This Argument I could confirm by another Phænomenon or two of affinity with this, if I should not borrow too much of what I have elsewhere noted about the History of *Electricity*.

I know a certain fubstance, which though made by distillation, does in the cold emit but a very mild and inoffensive smell, but when the vessel

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that holds it is heated, though no feparation of conflituent Principles appear to be thereby made, (the Body being in all ufual tryals homogeneous,) the Effluviums will be fo altered, that I remember a Virtuofo, that, to fatisfie his curiofity, would needs be finelling to it, when'twas heated, complain'd to me, that he thought the Steams would have killed him, and that the Effluviums of Spirit of *Sal* Armoniack it felf were nothing near fo ftrong and piercing as those.

And even among folid Bodies, I know fome, which, though abounding much in a fubftance wherein fome rank fmells principally refide, yet (if they were not chafed) were fcarce at all fenfibly odorous; but upon the rubbing of them a little one againft the other, the attrition making them, as it were, dart out their Emiffions, would in a minute or two make them ftink egregioufly.

And as the Celerity of motion may thus give a vigor to the Emanations of Bodies, fo there may be other

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other modifications of motion, that may contribute to the fame thing, and are not to be wholly neglected in this place. For as we fee, that greater Bodies do operate differingly according to fuch and fuch modifications ; as there is a great difference between the effects of a Dart or Javelin, fo thrown as that its point be alwayes forwards, and the fame weapon if it be fo thrown, that during its progressive motion the extremes turn about the Center of gravity or fome inward parts, as it happens when Boyes throw flicks to beat down fruit from the tops of trees; fo there is little doubt to be made, but that in Corpuscles themselves 'tis not all one, as to their effects, whether they move with or without rotation, and whether in fuch or fuch a line, and whether with or without undulation, trembling or fuch a kind of confecution; and in fhort, whether the motion have or have not this or that particular modification; which how much it may diversifie the Effects of C 3

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of the Bodies moved, may appear by the Motion, that the Aerial particles are put into by Mufical Inftruments. For, though the effects of harmony, difcord and peculiar founds be lometimes very great, not only in Human bodies, but, as we shall shew in the following Tract, in Organical ones too; the whole efficacy of Mulick and of Sounds that are not extraordinarily loud and different, feems, as far as itis afcribable to Sonorous bodies, to depend upon the. different manners of motion whereinto that Air is put, that makes the immediate impression on our organs of hearing , and , share ad on aduch

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I Should now proceed to fhew, how the *Celerity* and other modes, that diversifie the motion of Effluviums, may be affisted to make them operative by their determinate fizes and figures, and

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and the congruity or incongruity which they may have upon that fcore with the Pores of the groffer Bodies they are to work on : But I think it not fit to entrench upon the \* of the Pores fubject of another \* Tract, of Bodies. and where the relation be- Figures of Cor. tween the figures of Cor- pulcles.

pufcles and the Pores of groffer bodies is amply enough treated of. And therefore I shall only in this place take notice of those effects of Lightning, which feem referable, partly to the Celerity and manner of Appulse, and partly to the diffinct fizes and shapes of the Corpuscles that compose the destructive matter, and to the peculiar relation between the particles of that matter and the ftructure of the bodies they invade. I know that many ftrange things that are delivered about the Effects of what the Latins call Fulmen (which our English word Lightning does not adæquately render) are but fabulous; but there are but too many that are not fo; fome of which I have been C 4

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# 24 Of the Great Efficacy

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an Eye-witness of, within less than a quarter of an hour after that the things happened. And though it be very difficult to explicate particularly many of these true Phenomena, yet it feems warrantable enough to argue from them, that there may be Agents fo qualified, and fo fwiftly moved, that notwithstanding their being fo exceedingly minute, as they must be, to make up a flame, which is a fluid Body, they must in an imperceptible time pervade folid Bodies, and traverfing fome of them without yiolating their Texture, burn, break, melt, and produce other very great changes in other Bodies that are fitted to be wrought on by them. And of this I must not forget to mention this remarkable inftance; That a perfon Curious enough to collect many rarities, bringing me one day into the Study where he kept the choiceft of them, I faw there among other things a fine pair of Drinking-glaffes that were somewhat slender, but extraordinarily tall; they feem'd to have been

of EFFLUVIUMS. 25 been defigned to refemble one another, and made for fome drinking entertainment. But before I faw them, that refemblance was much leffen'd by the Lightning, that fell between them in fo ftrange a manner, that, without breaking either of them, that I could perceive, it alter'd a little the figure of one of them, near the lower part of the Cavity; but the other was fo bent near the fame place as to make it stand quite awry, and give it a pofture, that I beheld not without fome amazement. And I cannot yet but look upon it as a very ftrange thing, and no lefs confiderable to our prefent purpose, that Nature should in the free Air make of Exhalations, and that fuch as probably when they afcended were invifible, fuch an aggregate of Corpufcles, as should without breaking fuch frail Bodies as Glasses, be able in its paffage thorow them, that is, in the twinkling of an Eye, to melt them; which to do is wont even in our Reverberatory Furnaces to coft the

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And this calls into my memory, that upon a time, hearing not far off from me fuch a clap of Thunder as made me judge and fay, that questionlefs fome of the neighbouring places were thunder-ftrook, I fent prefently to make inquiry; which having juftified my conjecture, I forthwith re-paired to the house, where the milchief was done, by fomething, which those, that pretended to have seen it coming thither, affirm'd to be like a flame moved very obliquely. To omit the hurt, that feemed to have been done by a Wind that accompanied it, or was perhaps produced by it, to divers perfons and cattel; that which makes me here mention it, was, that observing narrowly what had happen'd in an upper room, where it first fell, I faw, that it had in more than one place melted the Lead in its paffage, (though that poffibly outlasted not the twinkling of an Eye,) without breaking to pieces

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pieces the glass-cafements, or burning (that I took notice of) either the Bed or Hangings or any other combuffible houshold-stuff; though near the window it had thrown down a good quantity of the folid substance of the Wall, through which it feem'd to have made its passage in or out. And that, which made me the lefs fcruple to mention this accident, is, that having curioully pry'd into the Effects of the Fulmen, not only in that little upper room, but in other parts of the Houle, beneath whofe lowermost parts it feem'd to have ended its extravagant course, I could not but conclude, That if fo be it were the fame Fulmen, it must have more than once gone in and out of the House, and that the line of its motion was neither ftraight, nor yet reducible to any curve or mixed line, that I had met with among Mathematicians ; but that, as I then told fome of my Friends, it moved to and fro in an extravagant manner, not unlike the irregular and wrigling motion of thofe

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those fired Squibs that Boys are wont to make by ramming Gunpowder into Quills. But about Thunder more perhaps elfewhere. I shall here only add, That whereas'tis a known Tradition, which my own Observations heedfully made feem now and then to confirm, that vehement Thunder, if Beer be not very ftrong, will ufually (for I do not fay alwayes) fowre it in a day or two; if this degeneration be not one of the confequences of the great and peculiar kinds of the concuffions of the Air that happens in lowd Thunder (in which cafe the Phenomenon will belong to the next Discourse,) the effect may probably be imputed to fome fubtile Exhalations diffuled thorow the Air, which, penetrating the pores of the Wooden veffels, whole contexture is not very close, imbue the liquor with a kind of acetous Ferment; which conjecture I should think much confirmed by a tryal, it suggested to me, if I had made it often enough to rely upon it. For confidering that the pores 310(1)

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pores of Glass are straight enough to be impervious (for ought I have vet observed) to the Steams or spirituous parts of Sulphur as well as to other odorous Exhalations, I thought it worth trying, whether there be any fulphureous Steams or other Corpuscles diffused thorow the Air in time of Thunder, that would not be too grofs to get in at fuch minute pores as those of Glass. And accordingly having Hermetically fealed up both Beer and Ale apart, I kept them in Summer time till there happen'd a great Thunder, a day or two, after which the Beer which we drank, that was good before, being generally complained of as fowred by the Thunder, I fuffer'd my liquors to continue at least a day or two longer, that the fowring Steams, if any luch there were, might have time enough to operate upon them, and then breaking the Glaffes, I found not that the liquors had been fowred, though we had purposely forborn to fill the Glasfes, to facilitate the degeneration of the

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the liquors. Perhaps it will be pardonable on this occasion to mention a practice, which is usual in fome places where I have been, and particularly employ'd by a great Lady, that is a great house-keeper, and is very curious and expert in divers Physical Observations; for, talking with her about the remedies of the Sowring of Beer and other drinks by Thunder, which is fometimes no finall prejudice to her, the affirm'd to me, that she ufually found the practice, I was mentioning, fucceed: And that before the then last great Thunder, of which I had observed the Effects upon Beer, the preferved hers by putting, at a convenient distance, under the Barrels, Chaffingdifhes of Coals, when the perceiv'd that the Thunder was like to begin, which practice, if it conftantly fucceed, may put one a confidering, whether the Fire do not by rarifying the Air and difcuffing the fulphureous or other Steams, by altering them, or by uniting with them the Exhalations of

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of the Coals, or by fome fuch kind of way, render ineffectual thefe fowring Corpufcles, which perhaps require a determinate bulk and fhape, befides their being crowded very many of them together, to have their full Operation on Barrell'd Liquors. But thefe things are but meer Conjectures, and therefore I proceed.

### CHAP. VI.

THE fifth way whereby Effluviums may perform notable things, is the Motion of one part upon another, that they may excite or occafion in the Body they work on according to its ftructure.

I shall in the following Tra& have occasion to fay fomething of the Motions into which the Internal parts of Inanimate Bodies may put one another; but the Examples now produced are defigned to manifest the Efficacy, that Effluviums may, on the newly

### 32 Of the Great Efficacy

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newly mentioned accounts, have on Organical and living Bodies. To which Inftances it would yet be proper to premife, That even Inanimate and Solid Bodies may be of fuch a ftructure as to be very much alterable by the appropriated Effluviums of other Bodies, as may be inftanc'd in the power, that I have known fome vigorous Loadstones to have, of taking away in a trice the attractive virtue of an excited Needle, or giving a verticity directly contrary to the former without fo much as touching it.

And we may pertinently take notice of the attractive virtue of the Loadstone, as that, which may afford us an eminent Example of the great power of a multitude of invisible Effluviums, even from Bodies that are not great, upon Bodies that are Inorganical or liveles: For taking it for granted, what both the *Epicureans*, *Cartessans*, and almost all other Corpuscularian Philosophers agree in, that Magnetism is performed by corporeal Emissions, we may confider, that

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that these passing unresistedly thorow the pores of all folid Bodies, and even Glass it felf, which neither the fubtilest Odours nor Electrical Exhalations are observ'd to do, seem to be almost incredibly minute, and much finaller than any other Effluviums, though themselves too fmall to be visible; and yet these so incomparably little Magnetical Effluxions proceeding from vigorous Loadstones, will be able to take up confiderable quantities of fo ponderous a Body as Iron; in fo much that I have feen a Loadstone not very great, that would keep fuspended a weight of Iron, that I could hardly lift up to it with one Arm; and I have feen a little one, with which I could take up above eighty times its weight. And these Effluvia do not only for a moment fasten the Iron to the Stone. but keep the Metal sufpended as long as one pleases.

This being premised, I come now to observe, That the chief effects of Effluvia belonging to the fifth Head are

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are wrought upon Animals, which by virtue of their curious and elaborate structure, have their parts fo connected and otherwife contrived, that the motions or changes that are produced in one, may have by the confent of Parts a manifest operation upon others, although perhaps very distant from it, and so fram'd as to declare their being affected by actions that feem to have no affinity at all with the Agents that work upon the part first affected.

\* The Vlefalmels of Expelofophy.

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I have shewn at large in another \* Treatile, that a Humane Body ought not to be rimental Phi- look'd upon meerly as an aggregate of Bones, Fleih,

and other confiftent parts, but as a most curious and a living Engin, fome of whofe parts, though fo nicely fram'd as to be very eafily affected by external Agents, are yet capable of having great Operations upon the other parts of the Body, they help to compose. Wherefore without now repeating what is there already deliver'd,

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liver'd, I shall proceed to deliver fuch Effects as are wrought on Human Bodies by these Effluviums without any immediate contact of the Bodies that emit them.

And first, not to mention Light, because its being or not being a Corporeal thing is much disputed even among the Moderns; 'tis plain, that our organs of Smelling are fensibly affected by such minute Particles of matter as the finest odours confiss of. Nor do they alwayes affect us precisely as odours, fince we see, that many persons, both men and women, are by Smells, either sweet or stinking, put into troubles of Headaches.

If it were not almost ordinary, it would be more than almost incredible, that the smell of a pleasing Perfume should presently produce in a Human Body, that immediately before was well and strong, such faintnesses, swoons, loss of sensible respiration, intumescence of the *Abdomen*, seeming Epilepsies, and really convulsive motions of the Limbs, and D 2 I know

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I know not how many other frightful Symptoms, that by the unskilful are often taken for the effects of Witchcraft, and would impose upon Phyficians themfelves, if their own or their Predeceffors Experience did not furnish them with Examples of the like Phanomena produc'd by Natural means. Those Symptoms manifest, what the confent of Parts may do in a Humane Body; fince even Morbifick Odours, if I may fo call them, by immediately affecting the organs of Smelling, affect fo many other parts of the genus Nervosum, as oftentimes to produce Convulfive motions, even in the extreme parts of the Hands and Feet.

Nor is the efficacy of Effluviums confined to produce Hyfterical fits, fince thefe invifible Particles may be able (and fometimes as fuddenly as Perfumes are wont to excite them) to appeafe them, as I have very frequently, though not with neverfailing fuccefs, tryed, by holding a Spirit, I ufually make of Sal Armomiack,

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miack, under the Nostrils of Hysterical perfons. My remedy did not only often recover, in a trice, those whose Fits were but ordinary, but did more than once, somewhat to the wonder of the By-standers, relieve, within a Minute or two, perfons of differing Ages and Constitutions, that were fuddenly fallen down by Fits, that the By-standers judg'd Epileptical, (but I, Hysterical.)

I attribute the good and evil Operations of the fore-mentioned Steams, rather in general to the confent of the parts that make up the genus Nervolum, than to any hidden Sympathy or Antipathy betwixt them and the Womb, not only for other realons, not proper to be infifted on here, but because I have known Odours have notable Effects even upon Men. I know a very eminent person, a Traveller, and a man of a Itrong constitution, but confiderably Sanguine, who is put into violent Head-aches by the Smell of Musk. And I remember, that one day being with D.3

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with him and a great many other men of note about a Publick Affair. a man that had a parcel of Musk about him, having an occasion to make an application to us, this perfon was fo difordered by the fmell, which to most of us was delightful, that in fpight of his Civility he was reduc'd to make us an Apology, and fend the perfumed man out of the room, notwithstanding whose recess this perfon complained to me, a good while after, of a violent pain in his Head, which I perceived had fomewhat unfitted him for the Transaction of the Affair whereof he was to be the chief manager. I know another perfon, whofe happy Mule hath juftly made him many Admirers, that is fubject to the Head-ach upon fo mild a fmell as that of Damask-Rofes, and fometimes even of Red-Rofes, in fo much that walking one day with him in a Garden, whofe Alleys were very large, fo that he might eafily keep himfelf at a diftance from the Bushes, which bore many of them Red-Roles ; he

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he abruptly broke off the difcourfe we were engag'd in, to complain of the harm the Perfume did his Head, and defired me to pass into a Walk, that had no Roses growing near it.

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If it were not for the Sex of this perfon, I could relate an Inftance that would be much more confiderable of the Operation of Roles. For I know a difcreet Lady to whom their finell is not unpleasing, (for she answer'd me that 'twas not fo at all,) but fo hurtful, that it prefently makes her fick, and would make her fwoon if not feafonably prevented : And the told me that being once at a Court in which the was a Maid of Honour, though the her-felf did not know whence it came, the found her felf extremely ill on a fudden, and ready to fink down for faintness, but being then in discourse with a person, whose High Quality the payd her profound relpect to, her Civility, that kept her trom complaining or withdrawing, might have been dangerous if not fatal to her, had not the Princess who D 4 tat

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who was speaking with her, and who knew her Antipathy to Rofes, taken notice that her Face grew ftrangely pale, and was covered with a cold fweat. For thereby prefently gueffing what might be the caule, which the fick Lady her felf did not, fhe asked aloud whether fome body had not brought Rofes ( which were then in feafon) into the Bed-chamber. which queftion occafioned a fpeedy withdrawing of a Lady, that flood at a diftance off, and had about her Roles, which were not feen by the Patient, who was by this means preferved from falling into a fwoon, though not from being for a while though the very much difcomposed.

But this you may tell me was the cafe of a *woman*, who complain'd her malady affected her Heart, not her Head. Wherefore returning to what I was speaking of before I mention'd Her, I shall proceed to tell you, that as Odours may thus give Men the Headach, so I have often found the smell of rectified Spirit of *Sal Armoniack* 

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to free Men as well as Women from the Fits of that diffemper; and that fometimes in fo few Minutes, that the perfons reliev'd could fcarcely imagine, they could fo quickly be fo.

To which I shall not add the Tryals that I have fuccessfully made upon my felf, because being, thanks be to God, very feldom troubled with that distemper, the occasions I have had of making them have not been many. And though I have not *alwayes* found fo flight a Remedy to work the defired Cure, yet that it does it often, even in Men, is sufficient to shew the Efficacy of Sanative Effluviums.

Now, to manifeft, that Steams do not Operate only upon Hyfterical Women, or perfons fubject to the Head-ach, I will add fome Inftances of the Effects they may produce upon other perfons, and parts.

'Tis but too well known an Obfervation, that Women with Child have been often made to mifcarry by the ftink of an ill-extinguisht Candle, though

# Of the Great Efficacy

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though perhaps the finoak afcending from the Snuff were diffipated into the invifible Corpufcles, a good while before it arriv'd at the Nostrils of the unhappy Woman; and what violent and straining motions Abortions are frequently accompanied with, is fufficiently known already. perfe

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I think I have elfewhere mentioned, that a Gentleman of my acquaintance, a proper and lufty man, will be put into the fits of Vomiting by the fmell of Coffee, boyl'd in Water; I shall therefore rather mention, that I know a Phylician, who having been, for a long time when he was young, frequently compelled to take Electuarium lenitivum, one of the gentleft and leaft, unpleafant Laxatives of the Shops, conceived fuch a diflike of it, that still, as himself has complained to me, if he fmell to it, as he fometimes happens to do in Apothecaries Shops, it will work (now and then for feveral times) upwards and downwards with him. I know another very ingenious perfon though

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perfon of the fame faculty, that has been a Traveller by Sea and Land, who has complain'd to me, that the fmell of the Greafe of the Wheels of a Hackney-coach, though it do but pafs by him, is wont to make him fick and ready to Vomit.

Every body knows, that Smoak is apt to make mens Eyes water, and excite in the organs of Refpiration that troublefom and vehement commotion we call Coughing. But we need not have recourie at all to vifible Fumes, for the production of the like Effects, fince we have often obferved them, and repeated Sneezings to boot, to proceed from the invifible Steams of Spirit of *Sal Armoniack*, when Vials containing that liquor, though they were perhaps but very finall, were approached too haftily, or perhaps too near to the Noftrils.

And because in most of the foregoing Instances, the chief Effects leem to be wrought, by the consent of parts, on the genus Nervosum and the action of one of them upon the other,

# 44 Of the Great Efficacy

other, and thereby upon feveral other parts of the Body, I will fubjoyn a remarkable inftance of the Operation of a mild and grateful Odour upon the Humors themfelves, and that in a Man.

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A famous Apothecary, who is a very tall and big man, feveral times told me, that though he was once a great lover of Rofes, yet having had occasion to employ great quantities of them at a time, he was to altered by their Steams, that now, if he come among the Rofe-bushes, the fmell does much difcompose him. And the odour of Rofes, (I mean Incarnate-Rofes, which we commonly call Damask-Rofes, though they be not the true ones, ) makes fuch a colliquation of Humors in his Head, that it fets him a coughing, and makes him run at the Nofe, and gives him a fore throat; and by an affluence of Humors makes his Eyes fore, in fo much that during the feason of Rofes, when quantities of them are brought into his House, he is oblig'd for other,

of EFFLUVIUMS. 45 for the most part to absent himself from home.

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## CHAP. VII.

NE may fhew on this occasion, that as there might be confiderable things performed by Effluviums, as they make one part of a living Engine work upon another by virtue of its structure, so the action of fuch invisible Agents may in divers cafes be much promoted by the fabrick and laws of the Universe it felf, upon this account, that, by the Operation of Effluvia upon particular Bodies, they may dispose and qualifie those Bodies to be wrought upon, which before they were not fit to be, by Light, Magnetisms, the Atmofphere, Gravity or fome other of the more Catholick Agents of Nature, as the World is now constituted. But not to injure another Tract, I shall conclude this, when I shall have taken notice,

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notice, that in the Inftances hitherto produced, there has been a visible Local diftance between the Body that emits Steams, and that on which they work. But if I thought it neceffary, it were not difficult to fnew, that one might well enough referr to the title of this Tract divers Effects of Bodies that are applied immediately to ours; fuch as are Blood-ftones, Cornelions, Nephritick-ftones, Lapis Malacenfis , and fome Amulets , and other folid fubftances applied by Phyficians outwardly to our Bodies. For in thefe applications the groß Body touches but the Skin, and the great Effects, which I elfewhere relate my felf to have fometimes ( though not often, much lefs alwayes) obferved to have followed upon this External contact or near application, may reafonably be derived from the fubtle Emanations, that pass thorow the Pores of the Skin to the inward parts of the Body: As is evident in those, who by holding Cantharides in their Hands, or having them apply'd to

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to fome remote External part, have grievous pains produc'd in their Urinary parts, as it has happen'd to Me as well as to many others. And to the infinuation of these minute Corpufcles, that get in at the Pores of the Skin, feems to be due the Efficacy of fome Medicines, that purge, vomit, refolve the Humors, or otherwife notably alter the Body being but externally applied; of which I could here give feveral Instances, but that they belong more properly to another place, and are not neceffary in this, where it may fuffice to name the notorious Power, that Mercurial Oyntments or Fumes, either together or apart, have of producing Copious Salivations, to shew in general, that both the Steams and the Emanations of outwardly applied Medicinal Bodies may have some great Effects on Human ones,

