

A treatise on the nature and property of fire. In three essays. I. Shewing the cause of vitality, and muscular motion.... II. On electricity. III. Shewing the mechanical cause of magnetism; and why the compass varies in the manner it does / by John Freke.

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T R E A T I S E

O N T H E

N A T U R E and P R O P E R T Y

O F

F I R E.

In T H R E E E S S A Y S.

- I. Shewing the Cause of VITALITY, and MUSCULAR MOTION; with many other *Phænomena*.
- II. On ELECTRICITY.
- III. Shewing the Mechanical Cause of MAGNETISM; and why the Compass varies in the Manner it does.

By JOHN FREKE, Surgeon to *St. Bartholomew's Hospital, London*, and F. R. S.

— *In magnis & voluisse sat est.* PROP. T.

L O N D O N:

Printed for W. INNYS, and J. RICHARDSON, in
Pater-noster Row.

M.DCC.LII.

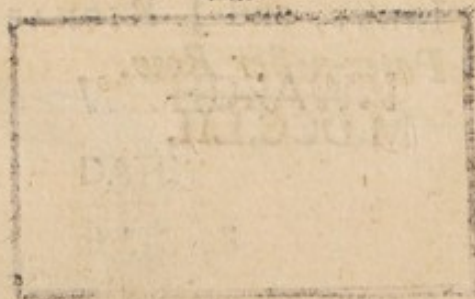


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T H E
P R E F A C E.

HAVING received a Letter in Favour of my Treatise of Electricity, I think fit to publish it, as well to gratify my Reader from its Elegancy, as to inform his Judgment. The Letter is as follows :

July 1. 1751.

BEhold, Sir, one of those Returns for your Favours, which, I fancy, will soon make you grow sick of conferring them. Here is one more Assessment upon your Patience and Time, produced to you by your kind Present of your Treatise upon Electricity ; upon which, without entering here upon all the Merits of it, I shall mention the, to me, capital one ; which is, that whilst the Experimentalists were amusing themselves, and the World, with the marvellous Feats,
A 2 *Tricks,*

‘ *Tricks, and Juglership of the electrical*
‘ *Machines in the Infancy of the Disco-*
‘ *very, You alone transferred your At-*
‘ *tention from the Effects to the Cause, and*
‘ *gave the Clew of that most important*
‘ *Discovery, only imagined by the An-*
‘ *tients, but now sufficiently proved, that*
‘ *this Fire is a Fluid universally dispersed,*
‘ *in salutary Proportion; which is not*
‘ *inherent to the electrical Apparatus, but*
‘ *collected by the Enchirefis of it out of*
‘ *that ambient Element, so as to exhibit*
‘ *those various Operations of it, which*
‘ *amazed so much at first, especially in*
‘ *the Property of its Velocity; which is*
‘ *strictly that of our Ideas, congenial with,*
‘ *and perhaps generated by, the same*
‘ *Element. But, my God! what an Open-*
‘ *ing has this Discovery given, if duly*
‘ *improved; if once regularly pursued*
‘ *from its first Principles, and reduced*
‘ *into a regular System! Probably, in*
‘ *such Case, Experimentalists would have*
‘ *no longer Reason to complain of the Bi-*
‘ *zarrerie or Caprices of Electricity.*

‘ *The Statics of the elementary Fire*
‘ *might doubtless, by a Progression of De-*
‘ *ductions from certain Axioms, be ascer-*
‘ *tained, so as to account for all its seeming*
‘ *Irregularities, as well as produce far*
‘ *nobler and more essential Discoveries*
‘ *than have hitherto employed those Gen-*
‘ *tlemen, who are scanning the Effects*
‘ *before having sufficiently deepened into*
‘ *and simplified that Cause, which, with-*
‘ *out a Compliment, you appear to me to*
‘ *have first pointed out. They must go*
‘ *back to the Element of this Fire, before*
‘ *they must hope to go usefully forwards*
‘ *with their Discoveries in it. This I*
‘ *can safely aver, that neither Boerhaave*
‘ *nor Stahl, nor indeed any Author I ever*
‘ *read, could afford me the least Satis-*
‘ *faction, especially about the Principles*
‘ *of Vitality (a Point I mention only as*
‘ *the most interesting Example of the uni-*
‘ *versal Necessity of Fire to all Nature),*
‘ *before your Notion of it let in at once*
‘ *upon my Understanding a Flood of Light.*
‘ *I never was indeed the Dupe of that*
‘ *philo-*

‘ philosophical Gibberish of nervous Fluid,
‘ Æther, &c. which, proving nothing to
‘ the Senses, established nothing : Whereas
‘ the Existence of this elementary Fire,
‘ realized to our Senses, accounts, almost
‘ palpably to me, for almost all the Ope-
‘ rations of Nature. This appears pro-
‘ bable from a Research into its Pro-
‘ perties ; as, for Example, its extreme
‘ Subtilty, Velocity, and Expansiveness ;
‘ all which may be experimentally ascer-
‘ tained, and subordinated to certain
‘ Laws : So that, should this System not
‘ be a Dream, the component Parts of
‘ the World will be simplified and re-
‘ duced into the Two primary Elements
‘ of Matter the Body, and Fire the Soul,
‘ of the World, or that vivifying Spirit,
‘ the Necessity of which to Nature was
‘ perceived only in Glimpses by the great
‘ Sir Isaac Newton, who sought for
‘ it in a nitrous Salt ; surely with less
‘ Probability than in Fire, the Nature
‘ of which he appears grievously to have
‘ mistaken.

‘ The

The Fluidity of some Bodies, Water, for Instance, seems to receive this Property from the elementary Fire; and, when adventitious Heat is superadded to that Medium of it in the State of Water, it rarefies, and, expanding into a Steam, receives the Impression of Aspiration from that superior Element, as other Materials which ascend by the same Rule in Smoke, not by their being, as is commonly imagined, specifically lighter than the Air, but involved and carried away by the Action of the Fire, which loses that Power over those Particles of Matter, as soon as resorbed into the Ocean of that Element from which it had been collected, and forced into a State of Ignition. Deplete any given Container, for Example, the Pneumatic Engine, to a certain Degree of its Contents of this Fluid; it is not all the Weight of the incumbent Atmosphere that will crush it to Pieces; but the Extraction of the intermediate equable expansive Prop, leaving to the outward Impulsion of Matter

‘ *Matter its full Energy ; by which the*
‘ *Collapsion takes place, and the Materials*
‘ *rush into Contact for want of this se-*
‘ *parating Principle. What is Suction*
‘ *too, but Attraction?*

‘ *In the animal Oeconomy, I conceive*
‘ *the Inspiration and Expiration of this*
‘ *all-sustaining Element to be the Action*
‘ *and Re-action of the pneumatic Organs*
‘ *of the Body upon it, in order to its Di-*
‘ *spersion in due Proportions, according to*
‘ *the Demands of the several Vessels ap-*
‘ *pointed to receive, entertain, and carry on,*
‘ *the whole Process of the vital Chemistry.*

‘ *However, I believe you have found it*
‘ *difficult, in general, to prevail with Peo-*
‘ *ple to dissociate Two Ideas so used to go*
‘ *together as Fire and Burning ; tho’ the*
‘ *last is a preternatural violent State of*
‘ *the first. I remember too, on this Oc-*
‘ *casion, a Maxim of Stahl’s, which I*
‘ *never took to be either quite a general*
‘ *or quite a bad one : In rebus quantum-*
‘ *cunque dubiis quicquid maximus de-*
‘ *fendit numerus, error est.*

‘ *I am, Sir, &c.*’

ON THE
NATURE and PROPERTY
OF
FIRE.

NO other Subject, which the Mind of Man can be employed about, will possibly afford so great Satisfaction as the Contemplation on the Operations of Nature.

The most considerable of the Antients have, in all Ages, thought the Time they have employed on these
B Researches

Researches most nobly spent; and the Psalmist, one of the first Writers of all in Dignity, hath declared, “ That the Works of the Lord are
“ great; fought out by all them who
“ take Pleasure therein.”

The wonderful Mechanism of our own Bodies therefore cannot but, in the Comparison with any produced from Art, raise our Admiration on the infinite Wisdom and Power of its Contriver; but if we contemplate and seek after the principal and first Cause of Activity and Motion, it will, I doubt not, be found that the Element of Fire can only be subtile and active enough, not only to create Motion, but to produce Life throughout all Nature, as well in Animals, as Vegetables and Minerals.

In

PROPERTY of FIRE. 3

In considering these important Truths, a firm Resolution should be taken by the Speculatist, not to fear what may be said against him for meddling with a Subject so little understood; though the Importance of it cannot but pay the Inquirer very amply, provided he takes Pleasure therein.

The Generality of the World neither know nor think of more, concerning the Element of Fire, than what they see of it, that it burns Materials, and, by dressing their Food, gives some Advantages; but that it is the sole Mover of all Nature, they have no Conception: So that you may perceive, it will be more easy to inform the youngest Minds of these important Truths, who, as yet, have no Prejudices about them, than to make

such as are prejudiced believe, that Fire is the kind and only Mover throughout all Nature; and that, throughout the World, Death can be no more, than that any thing has lost its natural Fire.

But, without giving full Proof of what I shall offer, I do not expect a due Regard to be paid to this Doctrine; though it may be first proper to shew the many and various Opinions of some of the greatest Philosophers who have written concerning the Element of Fire.

Doctor *Boerhaave*, as well as our great Sir *Isaac Newton*, has said many things to this Purpose: I have likewise consulted the most worthy and learned Bishop of *Cloyne*, who, in
3 his

his *Siris*, has employed great Study and Learning upon this Subject.

I have chosen this Method to shew how far the before-mentioned great Authors have proceeded in my Doctrine ; as well to vouch for what I shall offer, as to point out wherein they failed in establishing any complete System of the Nature and Property of Fire.

To begin then with the Sentiments of the great and learned Dr. *Boerhaave*, who, in Page 220 of his Book on *Chemistry*, says, “ That Fire, in
 “ Effect, appears to be the general
 “ Instrument of all the Motion in
 “ the Universe ; and that, if there
 “ was no Fire, all things would be-
 “ come fixed and immoveable ; as
 “ may be proved as well from Water

“ becoming solid when frozen, as
“ from many other Proofs to the
“ same Purpose:” And, Page 225.
he says, “ That Fire is two-fold, the
“ one pure elementary, which alone
“ we call Fire; the other vulgar,
“ which is raised and kindled from
“ the former; and that the Flame
“ of a Piece of Wood is not of the
“ same Nature with the elementary;”
although, he owns, “ it will give that
“ Fire to certain solid Bodies.”

Here I must stop, and acknowledge
his great Merit in having observed
so much as he has done, merely by
the Strength of Genius, which he has
universally proved in his Works: But
as I can shew by this he had no com-
plete System, so I shall be able to
evince, as I go on, that he wanted
Proofs of many Things he advances,
in

in not being acquainted with the Operations of Electricity ; for from thence I shall be able to prove, that there is but one kind of Fire in all Nature ; and, consequently, overthrow the Doctor's Hypothesis of Two kinds of Fire.

Again, Page 226. he says, “ That
“ Fire exists in all Places, and in all
“ Bodies ;” in which I agree with him : But how he came to think so, without having proved it by Electricity, is wonderful to me ; for herein he contradicts himself.

And Dr. *Boerhaave* says, that Sir *Isaac Newton* supposes, “ That Fire
“ is no more than the minute Cor-
“ puscles of some fixed Body, which
“ by a violent Agitation is sent off
“ into that State :” And he more-

over says, “ That some object
“ that Sir *Isaac*’s Conjectures are not
“ all true concerning Fire ; and the
“ Doctor avers that, with the Free-
“ dom that becomes a Philosopher,
“ there is no Body known, which,
“ being placed in a temperate Air,
“ has more Fire than any other.”

This I believe to be true, and hope to prove it : But, before I enter upon this Proof, I shall likewise beg Leave to quote some Passages from the very great and learned Bishop of *Cloyne* ; as well to justify my Hypothesis, in some respects, as in others to shew, that I shall demonstrably prove, that Fire is the sole Life-giver and Mover in and through all Nature.

I now proceed to give the Bishop’s Sentiments in his own Words :—
He says, “ The

“ The *Calidum innatum*, the vital
 “ Flame, or animal Spirit in Man,
 “ is supposed the Cause of all Motion
 “ in the several Parts of his Body,
 “ whether voluntary or natural;
 “ that it is the Instrument, by means
 “ whereof the Mind exerts and ma-
 “ nifests herself in the Motions of
 “ the Body. In the same Sense,
 “ may not Fire be said to have the
 “ same Force to operate and agitate
 “ the whole System of the World,
 “ which is held together and in-
 “ formed by one presiding Mind,
 “ and animated throughout by one
 “ and the same fiery Substance; as
 “ an Instrument, and mechanical
 “ Agent, not as a primary real Ef-
 “ ficient?” And again he proceeds,
 and says, “ This pure Spirit, or
 “ invisible Fire, is ever ready to
 “ exert and shew itself in its Effects,
 “ cherish-

“ cherishing, heating, fermenting,
 “ dissolving, shining, and operating
 “ in various Manners where a Sub-
 “ ject offers, to employ or deter-
 “ mine its Force. It is present in all
 “ Parts of the Earth and Firmament,
 “ though perhaps latent and unob-
 “ served, till some Accident pro-
 “ duceth it into Act, and renders it
 “ visible in its Effect.”

To justify himself in these and
 many other sublime Conjectures con-
 cerning Fire, he quotes Sir *Isaac*
Newton in the following Words.

“ Animal Motion and Sensation
 “ are accounted for by the vibrating
 “ Motion of the æthereal Medium,
 “ propagated through the solid Ca-
 “ pillaments of the Nerves. In a
 “ Word, all the *Phænomena* and Pro-
 “ perties

“ perties of Bodies, that were before
 “ attributed to Attraction, upon lat-
 “ ter Thoughts, seem ascribed to
 “ Æther, together with the various
 “ Attractions themselves.” So much
 for Conjecture without any Proofs.

And now I'll begin to shew what
 I have before proposed, by what I
 esteem undeniable Proofs: To which
 End,

I shall first suppose, that this
 World is a Machine; and that all
 the Creatures of it are kept alive,
 and in a regular and an invariable
 Order, not liable to contradict its
 great Contriver's Laws; so that, of
 course, some regular Cause of
 these Effects must be invariably or-
 dained,

This

This great Cause of Motion and Life through all Nature, I am now going to prove, proceeds from an elementary Fire.

But the first Proposition I am to make is, that the whole World is a regular Machine; which, I apprehend, will cost me no Trouble to shew, because it will be readily granted; when any one can observe from the annual and diurnal Motions of the Earth, the regular Eclipses of the Moon, and many others of the heavenly Constellations, that its Course must be regularly contrived: Therefore I will spend no more time about it; but, from the few plain Things just said, suppose no reasonable Man can doubt it.

Now

Now, as this great Machine will require some constant, active, and very powerful Principle, which is constituted by God Almighty, to keep these heavenly Bodies in their several Performances, and at the same time give Life and Increase to the several Inhabitants of the Earth ;

I'll undertake to prove, that the Sun will, of Necessity, perform it, as it will be found sufficient for that Purpose : For as the Heart of every Animal is the Engine, which, during its Life, circulates the whole Mass of Blood, so I will shew, that the Sun is the *Cor Mundi*, whose Office it is to dispense its Fire to every thing that stands in need of it.

Now comes the Question, How will you prove this ? I readily answer,

swer, From my Eyesight, and all my other Senses.

I can plainly shew, that the Sun is not only a constant Remitter of Fire to this Earth, but the Fountain and only Source of all the Fire in the Universe.

Here another Question may arise: How can this be proved?

I answer, That as the Rays of Light proceeding from the Sun, by collecting them either with a concave or convex Burning-glass, produces the strongest Fire on the Earth; so one of these Consequences must follow: Either the strongest Power of any thing in the Universe may derive its Source and Efficacy from the weaker, which every thing in
Nature

Nature shews to be false; or else, if you grant it me, that the Power given by the Sun is stronger than any that can be produced by the Operations of Man, the thing I contend for is proved.

To obviate any Cavil which may be raised about it, I shall proceed to ask such Questions as, I think, a doubting Reader would be glad to have asked: And therefore I desire to know, How it will be proved, that the Heat from the Sun is more intense than from any other Materials?

In order to answer this Question, I beg Leave again to quote another Observation from Dr. *Boerhaave*; which will prove of greater Force than if it proceeded from my own or any Person's Observation, who
pretends

pretends to establish any new Doctrine by it.

The Doctor, in Page 231. of his Treatise before quoted, says,
“ That Fire is every-where equally
“ dispersed; and that the greatest
“ Effect that any Fire can perform,
“ is, in a Moment’s time, to turn a
“ Flint into Glass; which Effect
“ (says he) is peculiar to Mr. *Vil-*
“ *lette’s* Mirrour.”

And as a further Proof of what I before advanced, that the Sun must be the Source or Giver of Fire, Dr. *Boerhaave* in the same Page advances,
“ That a Lime-stone, which would
“ endure the utmost Efforts of the
“ hottest Furnace for many Months,
“ being exposed to the Mirrour, instantly passes with a little Hiss into
“ Glass.”

I have

I have said before, that Fire is an Element not capable of any Alteration, Increase, or Diminution; and here I think proper to demand a Proof for this Assertion.

In Answer I assert, that Fire is of its own Species, and nothing partakes of its Nature; as may be seen by its keeping its Appearances and Conditions in the same Circumstances at all times; as for instance, where it once burns, it always will; where it refreshes Nature, it always will be found to do so. So is it incapable of Decay or Diminution. Moreover I will prove, that it cannot be capable of any Increase or Addition, without violating Reason, and approving of Nonsense, in order to support the contrary: For what is Nonsense, but conversing in such Words as can

C

have

have no Meaning belonging to them? As for Instance, to say that Fire can be annihilated or become nothing; if you consider the Import of these Words, they convey to you no Idea about it; for is it not as absurd to say, that any thing can be caused to become nothing, as that any thing can be made out of nothing?

Now both these can have no Place in common Understanding or Reason; which brings to my Mind one of the finest Sayings I ever heard; which is as follows:

Words are used by wise Men only as Counters; by young ones, as current Coin.

This may help to evince, why a verbose and flowery kind of Stile is admired;

admired ; and counted, by Men of Letters, preferable to a short and plain Manner of Writing.

But to proceed. As it appears to me, that if any Increase be allowed to be made to Fire ; then it follows, that this World, as it now exists, was not created intire, nor can ever be perfect ; because, from the aforefaid Argument, it must appear, that the Creator must be ever creating new Fire, to repair the Loss of the present Consumption ; or all the Fire, as an Element, which could in future time be wanted, was at first ordained. But I will content myself with what I have said, although I could proceed to give more Reasons against this absurd Notion of the Wasting of Fire. I fear, under the mistaken Notion of not giving to

God all due Praise, and by seeming to shorten his Arm of Power, we presume too much ; when, at the same time, we forget, that one of his greatest Bounties, worthy our Praise and Adoration, was, his granting and giving to Man not only the Power of willing, but of cogitating and judging of, what is right ; that, from his Revelation first, and after from our own Reason, we might perceive and adore the Excellencies of his various Contrivances.

This being premised ; from thence I shall beg Leave to shew, we can observe throughout all Nature, that a continued Motion and Agitation are necessary to every Being in the Universe, in order to refresh it, and repair its Decay ; as by giving Respiration to all Animals they receive

receive fresh Air, which plainly leaves its Fire behind to be conveyed over the whole Body, in order to give it the Warmth and Comfort it enjoys; for nothing in Nature can have any Warmth but what proceeds from Fire only: The Action of the Lungs is not sufficient to keep the whole Frame in constant Motion, but the Heart is also ordained to mill up and drive about the Blood throughout the whole Microcosm; which Blood, though it be ever passing through the Heart, as the Engine, yet the Heart has no more of the Nature of Blood in it than any other Part of the Body, which receives its common Nourishment from the Blood; nor has the Heart any more Power to generate or create Blood, than any other Part of the Body.

In like manner I look upon the Sun to be the *Cor Mundi*, or the Engine whose Office it is to be ever remitting to every thing in Nature this reviving, penetrating, and all-chearing Fluid Fire; and as I hope I have shewn, that the Quantity of Fire which God created under these Words, *Let there be Light, and there was Light*, was all that ever was to be, so it absolutely follows, in my Thought, that if all Light, which I will prove to be Fire, proceeds from the Sun, the Sun can be no other than a Machine, or Engine, which receives and circulates all that Element which subsists in the World: For if the Sun caused or made this Fire, then it created it; which is impious and silly to affirm: And thus I think it plainly appears, that the Sun is no more than a Contrivance,

trivance, or a grand Machine, appointed by God to give and receive it; as all others of his Creatures here on Earth, in a less Proportion, are ordained to perform.

Now as I have just affirmed, that all Light is absolutely Fire in its Nature; so the Reason to be given, why you cannot at all times manifest it as Fire is, because when any other Property in Nature, such as Moisture, blends itself with it, and hinders its Renitency, or Union of its live Parts together; as when the Light is admitted through a Cloud or Fog; then the Rays of Light have not all their Energy, and will not, by compelling them into a closer Contact even with *Villette's* Mirrour, shew all their Force.

This leads me to confider, Why the Light proceeding from the Sun does not melt Snow on the Tops of the higheft Mountains, when it fhall caufe a fultry Heat at the Foot of the fame Mountain at the fame time.

In order to prove this, I have already fhewn, that *Villette's* Mirrour produces from the Sun-beams the ftrongeft Heat imaginable: This being allowed, and at the fame time it being as well known, that thofe fame Rays of Light, which caufed this Heat, by the Mirrour, had they been permitted to pafs quietly by one another, had afforded no kind of Heat but only Light, as the eternal Snow on the Top of the higheft Mountains testifies: And further, to prove that all Light is Fire, nay, that

that it is every thing that has Energy, or gives any Life in Nature, do but consider those Things by which we can know its Variation, and this Mystery will unfold itself presently.

If this Light is veiled from the Mirrour by a Cloud or Mist, so as not to exert its Fire, then its Use will be found to perform another Operation in Nature, full as serviceable to Man, and beneficial to all Creatures; I mean to afford the Comfort of Light to them all, and in a soft, easy, and quiet Condition, which if not so granted to all his Creatures, God would become not their Preserver, but Destroyer. From hence, that is, from the various Uses of Fire in the Course of this World, we may perceive it at one time un-

controul-

controulable in its Power, dividing and tearing divers things into Pieces ; at another, relieving and comforting them. So that it plainly appears, that its Operations are infinite: When, for Instance, the Warmth of it is applied to the hatching an Egg, nothing but the Fowl it was to produce can proceed from it ; so when any Seed is laid in the Earth, when Rain descends, the Fire being a necessary Ingredient to Water, and which pervades every vegetable thing in all Nature ; when the Seed is become softened by its Continuance for some time in the Earth, the Fire, before hinted at, being ever passing, carries its Water with it ; which leaving such Properties behind it as the different Strainers of the Plant were adapted to receive, it thence grows and increases, till it comes to the
Perfec-

Perfection of one of its kind; and so on to all things in Nature.

This kind of reasoning will serve to shew that its various Properties and Uses arise not from any accidental Property in this Element, but from the Circumstances of Time, Place, and the many and various Accidents that it is appointed to meet with, in its passing through the whole Course of Nature.

How and why it manifests itself in the Appearance of Fire at certain times, and performs its various Operations, when at others it is ever at work invisibly, I have fully shewn in my Treatise upon Electricity; and I choose, rather than at present to take up too much of my Reader's Time, to refer him to it; which,

for that and other Reasons, I have caused to be annexed in the same Words in which it was first written, as well for the sake of shewing the Sufficiency and Plainness wherewith it was calculated to instruct others, as to shew how from the Operations of Electricity I am the first who has shewn an universal Fire throughout all Nature; and that the Excrements of Nature are such things only as by the Contrivance of Man become a *tertium quid*; and such as cannot be enlarged, are the only means by which the Course of this general Fire can be stopped.

To be sure, a civil Respect should be paid to all such as have bestowed much of their Time and Money for the Use of the Public; though at the same time to please themselves, and
their

their Friends, by shewing how many different and various States it can be found in: But is it not a great Disgrace to the Learned to employ this great Secret of Nature, which it pleased God to discover in our Days, to the low Purposes of Dancing of Puppets; of beatifying themselves; and with such mean Tricks to go on in contenting themselves rather with the Shew of it, than seek into the Cause of its amazing Greatness?— But as I am now sure I have absolutely and completely shewn the whole Nature of this Phænomenon; which, at first, I only offered with as much Diffidence as I ought; I am become so bold as to assert it from many undeniable Proofs: And as nobody has dared to contradict any of my Conjectures about it, so I dare say they never will. And I observe
many

many such as still delight in shewing the Apparatus of Electricity to others; although, either out of their not being willing, or able, to part with their former idle Conjectures, of some things being Electrics *per se*, others being *non* Electrics, they are fonder of making it as unintelligible as they can, rather than reducing it to plain Reason; because they perhaps think, that if it be too plainly made appear, it would cease to raise the Astonishment it is wont to do on uninformed Minds: Yet I cannot but observe with some inward Satisfaction, that they now own, from what I at first shewed, that it proceeded from an elementary Fire, or from the general Observations of the major Part of such as have observed at all for themselves, that it will kindle many things, and that it may even be made to light Gun-powder;

powder; these Rubbers-on in electrical Matters begin to adopt divers Notions which they would not at first grant to be true: But their first Notion, of Nothing being the Cause of producing Something; which, though it was the first time such a thing was ever heard of, they seem fond of retaining by their saying, Who knows what Experiments may not demonstrate? To which I answer, That so long as any Man, who pretends to be helping another on his Journey, is laying at the same time all Embarrassments in his Way, so these pretended Demonstrators, who keep to the Use of the first unintelligible Terms, had much better leave off this idle Admiration of their Non-intelligencies, and suffer Mankind to find the Cause of Electricity out by themselves. Now, after all, as there are somethings
which

which I can offer, more than at first when I published my Essay on Electricity, to demonstrate, that the same Fire, which is apparent to the Sight, is the real and only Cause of Life in all Animals, I shall shew it very fully from an Instance, which, I own, if it be not convincing to my Reader, is sufficient for me; because, when I am once convinced, I always rest satisfied, provided my Conviction arises from as much Proof as is necessary.

As I am now to shew, that the same Fire, which is universal in Nature, is demonstrably the same which gives Life to all Creatures on this Earth: Suppose any Creature: And as a Cat is supposed to be endued with as strong a Proportion of Life as any other Animal; suppose a Cat was
placed

placed with a lighted Candle, or any other Portion of Fire, in a certain Space of common Air, and you will find that the Life of the Candle, and that of the Cat, equally depended on the Existence of the Fire in the Air universally dispersed.

This Experiment may be tried, by putting the Candle, or some Fire, with the Animal, into a cold Oven, the Door of which may be shut up and luted so close, that no more Air can be admitted than was there at first; and if a Glass was fixed with some Putty into it, the Observer may perceive, that each subsisted, by the Fire before-mentioned, appertaining to the Air in the Oven, which before was in common with that in the Room to which the Oven belonged.

D

Now

Now if it be found, that, as soon as the Candle or Fire is extinct, the Cat that Instant dies, what Man, let him be ever so much prejudiced, can deny, that they were subsisted by the same Element? And it is a known Fact, that if, instead of the Animal, you add another Candle, they will remain lighted just as long, and no longer, as when the Candle and Cat were there together.

As it may be here objected to me, from what I have before said, that Fire passes through all Things in Nature with the greatest Freedom; so, may it not be asked, Why the Door (which, being made of Wood, is a Creation of Nature) will not admit the Fire to pass through it? I answer, It will be necessary to consider

consider how far it may be allowed to remain essentially in Nature.

To consider any thing as being in Nature, is, in my Sense, as being capable of Expansion or Growth; to which Purpose it may not be amiss to quote a very significant Adage; which is this, *Quicquid recipitur, recipitur ad modum recipientis*: And this will lead me to consider, Why Fire enters any Vegetable, so as to cause it to extend and grow? Now Fire is no other than the Pusher-on: If therefore there was no *Punctum saliens*, or Treddle in an Egg, no Animal could be produced from thence; it follows through all Nature, that the different Organization of Parts causes the different Productions. And here one cannot observe but with an

Adoration, the great Kindness God has bestowed in giving his Creatures Understandings, so as to have Fore-cast and Knowledge enough to support and preserve their Lives: The Ant is an amazing Instance of this; for it is well known, that they yearly lay up a large Granary of Wheat, &c. and as every Grain has a kind of *Punctum saliens*, or *Nucleus*, as all Vegetables must have which can grow, these Creatures never fail to bite off this Part, and thereby prevent its Growth.

If any one will set an Elder Stick in the Ground at either End, so that there be a Knot or Bud in it, which is as a *Punctum saliens*, it will increase; but without one of them, if you set the intermediate Part, it will
never

never grow. Now from these Instances we may perceive, that unless these Parts are so organized, nothing in Nature can be altered from its present State.

I know that the Prejudices of many Men are unconquerable ; and therefore with those who have never heard of this Fact, it will be as difficult to make it credited as if it was not true : But as it stands with me a full Proof ; I shall rest contented till I see what can be said against it.

It may here be proper to ask, How this Fire, supported by floating in all the Air through the Universe, not only passes through all Life, but manifests itself in the culinary Way likewise ?

To which I answer, That it is a Fact, and every body sees it to be true; and if I had only rested it on that, or occult Causes, or had said it proceeds from the Will of God, it had been sufficient; for when we shall have scrutinized into the many and curious Causes of Nature, as far as human Reason can carry us, there will still be found a first Cause too high for us to look into: But, as I am using my Reason about it, I think it will be expected, that I go as far as I can, to shew its Nature and Cohesion,

Now the Cohesion of Fire is the same with that of all Things in Nature: For Instance, it is the same with that of Water. I have chosen Water to shew it by, rather than Salts, or any other of the *Strata* of
the

the Earth ; though all Things in Nature have this Effect, that the major or larger Particular must govern and absorb the minor. If this was not so, all Things would fall into that Chaos, from whence they were taken : But I have chosen Water to illustrate this by, as being what may be more easily observed than any other Material.

I will suppose Two Drops of Water lying near each other on a Woolen Cloth ; to prove how tenacious Water is, you may see them each taking the Shape of a Globe, hugging themselves as close as though they had no Tendency to any thing in Nature but their own Class, and you will find this verified ; for if, by chance, they come to the least Contact, the smallest Drop is absorbed

into the biggest with as great a Rapidity as Light passes from the Sun.

Now this, if rightly considered, will give a Probability for the Cohesion of similar Parts throughout all Nature. And if it be asked, Why similar Parts should have a greater Tendency to connect together than others? I ask if any Figure connects together better than an Hexagon in forming an Honeycomb? I only instance in this one to shew, that where-ever God has performed any Work through the Creation, it is most complete and perfect; so that it cannot become fit for any other Purpose than what at first it was designed for. Observe the Flowers, or the Animal Creation, they are ever bound to keep their pristine State; for though sometimes Mules in them are
3 produced,

produced, yet no Contrariety of Species can ever be established, from the Mules being unable to propagate their Kind further: Which shews, that when God had said all was good, it was likewise to stand fast for ever just as he had made it.

It is just the same with the Salts, and all other things, which universally float in the common Air, as Fire does: They both shew the Propensity before spoken of, to adhere to such Parts of the same Kind as they shall meet: For Instance, you may observe, that if Nitre once affects a Picture, a Wall, or the like, the Air deposits its Salts of that Kind where it is invited by the first similar Parts, and not from the vulgar mistaken Notion, that such a thing produces another thing; which would be no less

less than making one Thing a Creator of another.

Now the Consequence of what I have said, produces thus much, That if the smaller Parts of Water, or Salts, are ever liable to be absorbed by the larger, because of their natural Connexion, what Doubt can be made, why Fire, which is found to be the most penetrating, and the most similar to itself, of any of the Elements, Why, I say, does not Fire shew from the foregoing Reason given for the Union of all Water, and the like, that it must have this Adherency likewise, that is shewn to be in Water?

And now, if Fire has this Property, and if it be universally dispersed through the Air, then it follows,

lows, that the Cause why Fire appears at one Time and Place to burn in larger Quantities than at another, can only proceed from the Stage it is on, or the Quantity of combustible Materials, which will retain it till it be consumed. There is but one Kind of Fire: The Fire of a Candle is of the same Kind as that which burns a House; in the Candle it is in Proportion to the Snuff; in the House likewise, by the proportionable Quantity of Combustibles; but both are kept burning by the same Cause, as the larger Quantity of Water absorbs the lesser.

Just so it is with Fire: The connected Quantity of it subsisting in a House, or Candle, gets the better of that in Connexion with it; which I have shewn, and will further prove,
is

is ever, and in all Places, floating in the Air.

A Question hence will arise, if what has already been said, be not sufficient, What will be sufficient to prove it?

I answer, To give a further Proof, it will be necessary to shew the Nature of this Element Fire, by considering its Subtlety and Penetration, which are found to be so powerful in their Operations, as to penetrate into many Materials, even to comminute and separate their Parts, by what is called burning to Ashes; and metallic Substances of the hardest Kinds, though some of them cannot be destroyed by it, yet none of them are proof against this Penetration of Fire; for the closest Iron

is ever liable to its Penetration to such a Degree, as to occupy so much Space betwixt every Particle of the Ore, as to disjoin them, and thereby cause them to melt; which is no more than shewing, that the Fire is crouded in such Quantities between each cohering Particle of the Iron, as to cause it to be governed by it, and to flow with the Fire.

I have here shewed wherein the Cause of melting of any Ore consists, in order to prove, that Fire ever subsists in the Air. I will relate a Fact which is uncontestable, and has of late been often shewn to many People; and is as follows:

Take a round Lump of Iron as big as your Fist, heat it in a Smith's Forge, to the Degree which is called

a welding Heat; then take it out of the Fire; and with a Pair of Bellows blow cold Air on the before-heated Iron; and the Consequence will be, that the Iron will melt as effectually, as if it had been acted upon by the most fervent Fire.

Now if the Cause before given for melting any Metal be the true one, then it will follow, that though the Lump of Iron, when taken out of the Forge, has not Fire enough in it to separate the Cohesion of its Parts; yet it plainly from hence appears, that the Air abounds, at all times, with so much Fire, as, when blown into this Lump of Iron, to leave so much more Fire behind, as, being joined with the larger Quantity of Fire which it received from the Forge, becomes powerful enough to melt it.

Whoever

Whoever is pleased to contradict this known Fact, let him first shew why, from any other Cause, a Fire is blown up in a Coal-grate; and if he cannot, then I hope what I have said, will be treated as a Probability at least.

I know how hard it is for any one to get rid of early Conceptions, though they be ever so absurd; and therefore I cannot but pity all who I think take hold of Nothing, to prove Something by it; I mean those who advanced the Jargon of Electrics *per se*, and *non* Electrics; Electrics *per se* being, in their Apprehension, such Things as had electric Matter in them; and *non* Electrics, such as had none: From hence they pretended, that the one was capable of receiving

ceiving it, and the other so replete with it, as to be incapable of receiving more.

I have the Pleasure to find, however, that the Notions I have advanced to prove Electricity from, are quite intelligible to some, who never could find the least Degree of Reason in the continuing to use those Terms of Electrics, and *non* Electrics; when, at the same time, they have taken and allowed such Notions from my System, as quite destroy the Being of Electrics, and *non* Electrics: For if Fire be allowed to be universal, why should any one talk of what is found of it in an exhausted Receiver? There can be none, to be sure, after it is proved, that the Action of all Fire proceeds from its Supply from, and Connexion with, such of it,
as

as now appears to float in the Air of the whole Universe: So that if you extract all the Air out of the Air-pump, and thereby keep it void of its Contents, why should we look to find any Fire there? But if the Glass, and as all Glass will, whether plain or otherwise, reflects external Light, what extraordinary Conclusion can be drawn from thence?

As much depends on my asserting, that the Air is replete with Fire, if I can prove, that at all Times, and in all Places, on the highest Mountains, and in the lowest Vallies, in Garrets and Cellars of all Houses, so much Fire can be collected as will fire Gun-powder, which I aver is true: I will leave the World to judge, if there be need of any

E

greater

greater Proof of its residing in the Air.

Now, since what I have advanced, is not, I think, depending on Conjectures, but subsists from absolute Proofs, either from electrical Experiments, or from such others as will admit of no Contradiction; I doubt not but I shall live to see as compleat a System of Fire-statics established, as there is at present of Water.

Even we can at this Time, in many Ways retain Fire, and keep it a Prisoner for as great a Number of Years as we choose, and this in what kind of Condition we please, and at any time let it loose again into the Air, the vast Source from whence it was collected: And this may be performed merely by the Artifice of
Man,

Man, either in a solid or fluid Form. To prove this, the making of Steel is caused by no more than impacting a great Quantity of Fire into Bars of Iron, as you do into a Stone to make Lime; and if you pass the Filings of Steel through a Candle, the Fire will emerge from it with the greatest Violence imaginable: And every one knows, that a common rectified Spirit will burn away into Dryness; but if you'll rectify it to the highest Degree, so as to become what the Chemists call Alcohol, and throw a Quantity of it up into the Air, the universal Fire will take hold of it, and disperse it into that Element from whence it was taken. Here I hope that my System of a larger Drop of Water absorbing the lesser may be reconsidered; which, if it be, will fully evince the Cause, why

not a Drop of the Alcohol, when thrown up into the Air will again descend : But to treat this Subject as it deserves, with the greatest Respect, and not as it is at present, when it is only made a Pastime of, I look on the Power of Fire, as I formerly said, to pervade every thing in Nature with as much Freedom as if those things were not in its Way, how therefore can it do otherwise than influence all the Properties and Operations of every different thing, so as to produce the various Effects from them which we behold?

But it will be asked, What Proof can be given of this? I answer, None but ocular Demonstration can be sufficient to prove any thing so universally disbelieved : But when it is once made known, it will open
to

to the Understanding of the meanest Capacity, and shew that which has hitherto been thought impossible; I mean the Power and Cause of Vitality.

Now to shew the Cause of Vitality to your Eye-sight; that is, why the Lungs must of Necessity, whether you are sleeping or waking, when you intend it not, be acting; which is, as I may say, be desiring and reaching after the Reception of the common Air:

I say, to shew a natural Cause for this, it will be necessary to consider the Cause of the great Alteration, which we can observe in the other Parts of Nature by the Power of Fire.

It

It has been shewn in my Treatise of Electricity, that if you convey electrical Fire on a Bar of Iron, so as to retain more of it there than things in common are possessed of, this electrical Fire will shew a Propensity to such things as have less of it, with as much Freedom as there is a Greediness shewn by every thing to attract it from them. Now that this is the Case, as soon as a Feather, or a Piece of Leaf gold, which may be floating in the Air, shall happen to come near an electrified Bar of Iron, it will dart to it with great Vehemence; and when it has received as much Fire as the Bar has to give, it will return with great Activity to deliver its Fire to any thing in Nature that has less of it than itself: So that, if the electrified and non-electrified Materials stand within two or
three

three Inches of each other, the Feather or Leaf-gold will fetch and carry this Power with so great Celery, as to be in a very quick Agitation; but if they are brought a little nearer, the Gold will become suspended in the Air, without touching either, by giving it as freely to that which wants this Fire, as it receives from that which gives it.

You may hence perceive, that all things in Nature are created with a great Attraction of this Fire in the Air, wherever it can attain it: So that if any Part of the animal Body has less of it, in Proportion, than there is in the Air, it must, according to the common Laws of Nature, be endued with it, whether the Animal will or not: But when we come to examine the Use and Contrivance

of the Organs of Respiration, we may soon be satisfied with a wonderful Proof, that all Animals are, in Fact, a Fire-engine: For, as soon as the Lungs have received an Inspiration from the common Air, that Fire, which is ever found in all Air, will be instantly dispersed through the Pulmonary Vessels into the Blood; and as that Blood is ever nourishing and refreshing some Parts with some of it, and imparting its Fire through the Nerves, from the various Motions of the Whole, instead of a nonsensical nervous Fluid, which never has, nor can be demonstrated (the Nerves not being pervious), the Consequence must follow, that the Lungs hereby becoming deprived of their usual Quantity, and desirous of that which every Stone, and Log of Wood desires and receives through the Universe

verse with the utmost Greediness; Why, I say, may not the Lungs become as active to reach and expand themselves for more, as often as the Lungs are robbed of it; as the Leaf-gold is shewn to be the Receiver of Fire from any thing which abounds, and gives it to any thing that has less of it.

This will lead me to ask a Question, which has hitherto never been solved: It is this; Whence proceeds that Heat, which is ever the concomitant of Life in all Creatures? Allow me but my Conjecture, and a Power sufficient for muscular Motion is established; which is capable of pervading the Solidity of the Nerves with as rapid Motion, and surely with as great Probability, as electrical Fire passes an Iron-wire,
to

to any given Length, as swift as Light.

I love that a Proof for every thing I pretend to offer may be established; and therefore, whatever can easily answer to my Proposition, and be found to agree to none else, may be allowed a sufficient Proof for this, or any unsettled Point in Nature.

From hence I conclude, as all Men know, that the Air which has once been breathed through the Lungs is no more fit for Respiration; as is found by attempting to use it after having breathed it under the Bed-cloaths; and, if you grant what I am contending for, I think I have fully proved, that the Air, which is received into the Lungs, as often as it is so, leaves its Fire in the Blood.

Now,

Now, if any Creature has this Fire given to the Blood, as I think it can be proved it has, I may suppose, that in the Fabric of the Animal there will, as long as Life shall last, be a Quantity of this Fire reserved in Store, as in a Garison, to answer all the Demands, whenever the Intelligencers shall call for the Use of it. Indeed, on certain Occasions it will not answer the Call so quick, after any violent Discharge of it, as before ; for when the body has been too much agitated by any Passion, or violent Motion, it appears to have lost so much of that Spirit with which it was actuated, as to become languid, like a sensitive Plant after it has been touched with any other thing ; so that from thence it requires some time to repair it again,

How

How the Mind operates on these Materials will, I believe, be ever inscrutable : And, considering what Use the Arrogance of Man has made of the little he knows, whatever can teach the mightiest of them to subdue their Ambition of knowing more than was ever intended for them to know, will have a very good Effect.

However, what I have attempted to shew has not been from any Hypothesis, but from known Facts : Whom these may square with, or whom contradict, concerns me not to know : They are produced as my Thoughts only, which should never have troubled the World, but for what I intend shall follow ; *viz.* a Treatise to prove the Cause of the Power of Magnetism, and of the different Variations of the Needle from
the

the Pole. And as I hope to prove this likewise is caused by Fire, I have, as you may perceive, laid in Materials (as all Builders should, who intend to raise any Structure of Note) to prove it from.

I am not so vain, as to think it worth my while to become an Author, any more than a Man of Sense to become a Builder, but for the same Reason; which is, because he who imagines a House agreeable to his Mind, will realize it often at the Expence of his Fortune.

Now, as those who know least use most Words, to conceal their Ignorance, and as they pretend to decry all Kinds of Novelty; in order to weaken what they may advance
against

against such a Doctrine as I am about to establish, I would ask any of them, if they do not know many Things of late, which formerly they knew not? And likewise, if they do not observe the *Vestigia* of many Arts which are quite lost?

From these Considerations, he who attempts a Subject of new Inquiry, should resolve not to fear what may be said against him, seeing that not above One in a Thousand, in his whole Life, forms an intire System of mechanical Operations, from his own Judgment, worth the Notice of a Man of Sense; when, on the contrary, the 999 aforesaid, who have borrowed all they have produced as their own, aim by it to shew themselves of Consequence, and to expose those they differ from.

Now,

Now, I ask, Of which Number a Man would choose to be ranked, whether of the Many or the Few?

There is another Sort of Men, who, in some Things, are very understanding, yet, in others, are so prepossessed as to hearken to no reason but their own: These, not being convinced of the Power of collecting Fire from the Air, ask, Why, if a Bar of Iron be heated in the common Fire, it will not electrify any thing, the Fire of Electricity being the same as the Culinary? To which, I say, I have, in divers Places, proved that the Operations of Electricity are shewn to our real Senses, and not by Tricks on the Imagination. For Instance: Do we not see Fire residing fullenly in a Flint for Ages? And may we not perceive

perceive the Fire of Electricity, and that of the Flint, both made to light Gunpowder ?

Now, if we consider the Sullenness of the Fire in the Flint, and the Vivacity of that of Electricity, and both of one Kind, by lighting Gunpowder ; then the Difference must arise from the different Conditions they were in before they were caused to light Gunpowder.

Suppose a heated Bar of Iron, and a cold one, were both to be electrified, why should the Fire lodged in the heated Bar cause any different Operation ? Because the Fire which heated the Bar, as it entered it by slow Degrees, from its Density, cannot part with it but by slow Degrees ; and therefore, tho' it

it cannot be considered in so fullen a State as in a Flint, yet it approximates to it ; and, from the Fire not being able to fly off so quick as electrical Fire can, it will, for all I can see, act just the same on the heated as on the cold Bar of Iron.

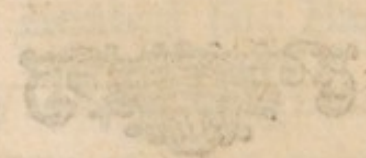
I will proceed no further in this Treatise ; but, as I said before, subjoin my other on Electricity ; that, when this and that may have been duely weighed an considered, the Reader may find, that Fire is the Instrument or Cause, under God, not only of Magnetism, but of all the Phænomena in the Universe.



it cannot be considered in its full
a State as in a State, yet it is not
makes to it; and, from the fact of
being able to fly off so quick as
electrical fire can, it will, for all I
can see, not put the flame on the
heated as on the cold Bar of Iron.

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Treatise; but as I said before, I sub-
join my other on Electricity; that
when this and that may have been
duely weighed and considered, the
Reader may find, that Fire is the
Instrument of Cause, under God,

not only of Magnetism, but of all
the Phenomena in the Universe.



A N
E S S A Y
TO SHEW THE
C A U S E
O F
E L E C T R I C I T Y ;
A N D

Why Some Things are Non-Electricable.

In which is also Consider'd

Its Influence in the *Blasts* on Human Bodies,
in the *Blights* on Trees, in the *Damps* in
Mines ; and as it as it may affect the *Sensi-*
tive Plant, &c.

In a L E T T E R

TO Mr. WILLIAM WATSON, F. R. S.

By JOHN FREKE, Surgeon to *St. Bartho-*
lomew's Hospital, *London*, and F. R. S.

Naturam expellas furca, tamen usque recurret.

THE THIRD EDITION: With an APPENDIX.

L O N D O N:

Printed for W. INNYS, in *Pater-noster Row*.

MDCCLII.

AN ESSAY
TO SHew THE
CAUSES
OF
ELECTRICITY;

AND
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In which is also Consider'd
his Influence in the Human Bodies
in the Effects on Trees, on the Clouds, on
Animals; and as it may affect the Sea,
and Plants, &c.

By
JOHN WATSON, F.R.S.

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LONDON:
Printed by J. WATSON, at the Sign of the
Three Kings, in Pall-mall.

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Printed for J. WATSON, in Pall-mall.
MDCCLXXII.

TO
MARTIN FOLKES, Esq;
PRESIDENT
OF THE
ROYAL SOCIETY.

S I R,

THOSE who have
the Honour of your
Acquaintance, and thence
know your many excellent
Qualifications, must ap-
plaud my Choice in dedi-
cating

[lxx]

cating this small Piece to
you; whose Name, if there
be any Merit in the Per-
formance, will, before any
other, add a Lustre to it.
I am, with the highest
Esteem,

Your most obliged,

Humble Servant,

JOHN FREKE.

THE
P R E F A C E.

WHEN I first entered on this Subject of Electricity, I intended only to put some Thoughts in Writing concerning it, that I might the more easily convey them to the Understandings of such as I hoped would be more likely than I should be to go farther with it. And as nobody, either here or abroad, had published any thing touching the Cause from which it was produc'd, I chose to shew the Beginning I had made to some Friends, whose

Opinion concerning Natural Knowledge I had a great Reliance on. I told them, I thought my Difficulty would be to convey what I had to propound on this new Subject to them with the necessary Clearness, as my Intention was to observe the utmost Brevity in it.

After I had read it to them, they assured me, that what I had written was perfectly intelligible; and that it gave them many new Ideas respecting this Phænomenon; and were very earnest with me to print it, for the sake of the Public.

*I was not, however, inclined to comply with their Requests, till I had shewn it to a Person who is most justly distinguish'd
for*

for his great Candor, and superlative Understanding in all natural Knowledge; and he likewise having express'd his Wishes to see it in Print, I could not but look on his Desire as a Command.

If what I have here undertaken to shew should enlighten the Minds of any of my Readers, or if it should so far excite the Attention of others as to make them give better Reasons for the Operation of this Power of Electricity than I have done, I shall not account the Time ill spent which I have employ'd on this interesting Subject; a Subject which can with more Nobleness and Dignity employ the Mind of Man, than any I can think of relating to the sublunary Part of this World: For by it we may be acquainted

LXXIV P R E F A C E.

quainted with the immediate Officer of God Almighty, which he seems to send to all Things living. Nay, this Power, according to my Conception, seems to be the Cause, under HIM, both of Life and Death. And when it is more fully understood, it will afford us Means whereby we may be better enabled to reason more intelligibly than we now can, concerning various Operations in Nature.

*I am very sensible what Tribute a new Author is liable to pay to Critics: I know it is too common to find the greater Part of them inclin'd to look into a Book for its Faults, rather than for its Use; and to be more ready to pull down, than they have Abilities to put any thing in its Place. But as I am not writing
this*

this for any Gain to myself, but the Pleasure of informing, if I can, the Minds of such as may be informed by it, I choose rather to stand their Censure, than deny the Public what may possibly be the Beginning of much Good.

It is very probable, that those who pretend to know every thing, will be so good as to say, if they like what I have advanc'd, that it squares exactly with what they thought before concerning it: And that such as set up for Critics will try their Hands at this Performance, and, if they can, will condemn it.

It would be a great Wonder, indeed, if it should escape the Censure of some, when the great Dr. Harvey had his
implacable

lxxiv P R E F A C E.

implacable Adversaries to his Account of the Circulation of the Blood; and when even Sir Isaac Newton met with Opponents to several of his Theories. What I have said opposes no one's Scheme, that I know of; it offers no Sentiments which can hurt any Man.

I have advanc'd only Conjectures towards clearing those Truths I would establish; and if, after all, what seems reasonable to me should not appear so to others, I cannot help it: For it is impossible for all Men to see the same Thing in one and the same Light, even though they were Men of the best Erudition. I would hope, that what I have undertaken to shew, is what all sensible Men would be glad to have shewn.

A N

A N
E S S A Y

TO SHEW

From what CAUSES Electricity
is produced, &c.

Kind Sir,

WHEN I reflect on the great
Ingenuity you have shewn,
in your *Apparatus* for the Improve-
ment of the Knowledge of Electricity,
and how industrious and kind you
have been in communicating the
many Experiments you have made to
your Friends and Acquaintance re-
lating thereto, I was in hopes, from
you or some of them, an Essay would
be

be made ere this, not only to go farther with these Experiments, but to give some tolerable Conjecture from whence this Fire, and astonishing Effect, is produced.

I was going to give you my Thoughts concerning it, when I last saw you at *Child's* Coffee-house; but, on Reflection, I chose rather to do it in Writing: For, in all Novelty, till the Relater is quite understood, Words are forgotten easily; but Things of this sort in Writing may again and again be consider'd.

To begin then: In order to shew whence this electrical Fire and Force is produc'd, I will first endeavour to prove, that it arises not from any Part of the *Apparatus* itself; not either from the glass Ball, nor the Leather,
nor

nor from the Tube, or the Hand that rubs it: Because nothing we know of can send out of it a Quantity of Matter, but there must be less of that Matter remaining, after it has been so discharged; whereas it cannot be shewn, but that the Ball of Glass, after ever so many Times using, remains as fit for the same Use as at first.

Having, from Probability, I think, shewn, that the Fire and Force, here treated of, come not from the *Apparatus*, it is natural for me to suppose they are produced from the Air they are mov'd in. And I believe this Notion will not appear trifling, when we consider, that the most antient and ablest Philosophers have look'd upon the Animal and Vegetable World as actuated by Fire; and that they are nourished by Water, and what it contains.

tains. If this be allow'd, then the Air, which is esteem'd the *Pabulum Vitæ*, from its rubefying the Blood of all Animals in Respiration, seems to be universally impregnated with this Fire. And tho' there is not enough of it so dispersed as to hurt the Animals in Respiration, yet I can suppose it as universally dispersed, as I can a small Quantity of any Liquor dropt in Water, which, when so dispersed, is of no Harm to a Patient, though a few Drops of it by themselves would have been certain Death. And yet, if you farther consider it so dispersed, you cannot conceive one Particle of the Water without a Particle of the Medicine: Just so it may be with the Fire of this lower Region, or, as I choose rather to call it, this *Flamma vitalis*.

I pro-

I proceed now to consider, how this Fire, so dispersed, may be collected; and, in making electrical Experiments, endowed with a Force equal to, and of the same Nature with, Lightning.

To make this the more easily apprehended, I will suppose, that the Nature of Fire is to be as similar in its Parts, and that these have as great a Propensity to adhere to one another, as we find the different Parts in all natural Bodies have; as may be seen in Gems, Water, the various *Strata* of the Earth, and the like. If these fiery Particles be forced into a closer Contact than they have been supposed to be in, when uniformly dispersed through all Nature, they become Lightning, or a Fire of

G more

more or less Force, as more or less Parts of that Fire are got together.

To illustrate this, wax a small Thread, or slide a Rope swiftly thro' your Fingers, and you are liable to burn them: Which probably arises from their grinding in, betwixt your Fingers and the Rope, so many more Particles of Fire than naturally come together when left to float in the Air.

If this be allowed to be just (which it must be, till it is overturn'd by stronger) Reasoning, then it follows, that the Air, which is violently ground or rubb'd betwixt your Hand and a glass Tube, or betwixt a glass Ball whirl'd briskly, and a Piece of Leather, as they are used in electrical Experiments; I say, the

the Air, so rubb'd, may leave behind it that Quantity of agitated Fire that causes Electricity.

For, suppose the Ball or Tube enveloped with a Quantity of this Fire moving spirally round it, with the utmost Velocity; it can no more depart from its Company than you find Sparks of Fire, which fly from Steel on a Knife-grinder's Wheel, are liable to do. Almost every body can remember to have seen them adhere to the Wheel, and frequently pursue each other quite round it.

Those who try these Experiments, find, that in moist Weather this Power is less attainable than in a clearer Day; and therefore some may be apt to attribute that to the *Apparatus*, which may be better accounted

for by the watry Particles in the Air; which may hinder the lambent Flame, by me supposed to be universally scatter'd, from uniting, by the Friction before-mention'd.

As I have mention'd Friction, I cannot help observing how unphilosophical and unmeaning it is, for any one to advance, that Fire is caused by Friction; when I think he may as well say, that Water is caused by Pumping.

We know, that a Cart or Coach-Wheel, for Want of Grease, by Friction will be set on Fire; and Fire-Canes, rubbed together smartly, will take Fire; but neither of these, I believe, nor any thing else, will beget or generate the Element of Fire. They must either collect it out of the Air, or else it must be lodged within them,

them, as we find it to be in Steel in an eminent Degree: For, if you drop the Filings of Steel through the Flame of a Candle, it sends out the most fierce Fire of any thing in Nature.

The Reason why a greater Quantity of Fire is produced from Steel-filings, than from any other Thing, I take to be owing to a larger Share of that Element, which is impacted in it from its being made out of Iron long impregnated with Fire.

Many other Bodies have actual Fire impacted in them, as Flints, and other hard Stones and Metals; but whenever you produce Fire from Steel-filings, you find that Steel melted: So when Fire is produced from Stones, and the like, each Spark is Part of that Stone burnt to a *Calx*.

Now, as I am endeavouring to shew you the natural Cohesion of Fire, and the Propensity there is in it to extend itself, I shall offer to your Consideration a very familiar Instance to prove it; which is that of the Snuff of a Candle just blown out. You cannot but have observ'd at how great a Distance from the Snuff the Flame will descend down the Smoke, and light it.

I shall further take the Liberty to observe to you another Proof of this; which, I think, will not only shew a Propensity in Fire to cohere, but will greatly strengthen my Conjecture, that this Fire, produced in Electricity, is extracted from that I have supposed to be universally dispersed.

A Per-

A Person, who lived in the Town of *Warham* in *Dorsetshire*, in the Year 1703. informed me, that in the Night of the great Hurricane and high Wind, in the strongest Part of the Tempest, he saw from his Window, on the neighbouring Hills, great Bodies of Fire, swiftly passing over them on the Ground.---Now whence arose that Fire, if it came not from the Air impelling it into those Flakes? Its subsisting together in that Hurricane shews, I think, very plainly, that if its Cohesion had not been natural, the Wind would then have scattered it.

Though I apprehend that the Four Elements, Fire, Water, Earth, and Air, may never have been increased or diminished, since the Great God created them; yet I can also apprehend

hend each of them unequally dispersed in the Universe by various Causes and Events : And when this happens, those which were intended, when in their due Order, to make every thing happy and easy, in their disordered State will create nothing but Confusion.

For Instance : The chief Use of Water seems intended, when descending in warm and gentle Showers, or flowing in kind and easy Streams, to cheer and nourish all Kinds of Vegetation, as well in Trees and Plants, as in Herbs and Flowers : But suppose, by the Contrivance of Man, or by the Accidents of Nature, a large Quantity of it lodged on the Tops of high Hills, if it breaks its Bank, it will never stop till it finds a natural Resting-place ; and in its Torrent it
will

will **overwhelm** and destroy those Trees and **Plants**, with the Herbs and Flowers, it **was** intended to nourish.

The like may be said of the Fire, which I have been supposing uniformly dispersed over the Creation ; so that, if its Properties are to invigorate all Nature, you must of Course suppose its Power not to be controuled ; but that it passes through all the Animal, Mineral, and Vegetable Creation, whilst they stand in need of Life, or any Increase.

But, as I have been conjecturing what different Purposes Water in its disorder'd State may produce, so the same Consideration may be had concerning Fire in its disorder'd State : When too much of it is brought together, either by the Contrivance of
Man,

Man, or by Irregularities in the other Elements; is it not reasonable to suppose, that it will, according to its natural Appointment, get about its Business, and break as soon as it can from its Confinement?

A very learned and eminent Author, who is now living, says, “ That
“ all Life, whether it be vegetable,
“ sensitive, or animal, is only a
“ kindled Fire of Life in such a Variety of States: And every dead
“ insensitive thing is only so because
“ its Fire is quenched.”

It had been impossible that this wonderful *Phænomenon* of Electricity should ever have been discovered, if there had not been such Things as are non-electricable: For, as fast as this Fire had been driven on any thing,

thing, its next Neighbour would have carried it farther : But, when it was most wonderfully found, that any thing which was suspended on a silk Cord (that being a Non-electricable) was obliged to retain the Fire, which by electrical Force was driven on it ; and when, moreover, it appeared, that any Person or Thing, being placed on a Cake of Bees-wax (which is also a Non-electricable), could no more part with its Fire, than when suspended in a silk Cord ; I think it will become worthy of Inquiry, why they are not electricable.

To explain this, I would reflect upon the Passage before-quoted : For from thence I think it must follow, that if Fire be the Cause of the Life and Increase in any thing, then, whatever ceases to be in a State of Life or
Increase,

Increase, can no longer be supposed to be capable of them; and therefore must be considered as a *Caput Mortuum*. Of this Sort are Bees-wax and Silk, both being non-electricable.

To pursue this kind of Reasoning concerning them: They are, in Truth, the Excrements only from those Beings which once had Life in them; the Wax being the excrementitious Matter from Bees, which; when made, was to be capable of no further Increase or Addition to its Nature: For, as its primitive Use was only intended to make Combs or Cells to preserve the Honey through the different Changes of the Season, so if this Wax had been liable to Alterations from this Fire (as all Things which are endued with it are), then the Cells would not have remained
so

so intire as the wonderful Architects left them.

As concerning the Silk, I look on it as an excrementitious Matter also; designed by GOD Almighty (who makes nothing in vain) to become a *Capsula* or Coffin to preserve the Insect in it safely, for such a Season as was intended it should remain there.

All resinous Bodies are likewise non-electricable; which I think will tend rather to prove my Conjecture to be true than false: For, are there such Things as Pitch or Resin in *Nature*? Are they not made out of the Juice of Trees or Plants? Which, whilst they remained in the Life of Nature, had nothing but their unaltered Juice in them. Pitch and Resin
became

became so by Art; and therefore no Time or Chance can give an Increase to their Quantity: From whence they may be supposed not to be in the Course of Nature.

I am aware what Objection this is liable to: For, though it must be acknowledged that these Things are non-electricable, it may be asked, If they are not the most inflammable Things that can be imagined, and, consequently, susceptible of Fire; because Candles are made out of Wax, and Torches out of Pitch and Resin? To which I answer, That here it may be necessary to inquire, what occasions this Flame, which is produced either from the Candle or Torch? Can this Flame subsist one Moment without the Passage of Air through it? I answer, No. Well then, as this

Treatise

Treatise is not intended merely to state Facts, but to account for the Nature of them, by the best Conjectures I can make, pray why does Air keep this Flame subsisting? If you will suppose, with me, that the Cause of all Heat, and the Appearance of all Fire in the World, is collected out of this universal Element of Fire; which, as I said before, perhaps, will never increase nor diminish; it being dispersed where it is most invited; if therefore, I say, you will suppose with me, that this Air, which is full of a lambent Flame, when it has been invited by the Property supposed to be in it, that the biggest Body congregates the less; from these Considerations, I think, it is not improbable, that the Flame of Fire is produced out of the Air only; the Wax or Resin being a fatty sulphureous

reous Matter, which, like Coals, may likewise serve as a *Pabulum*, adapted only to let this Element pass through it, for the Purposes here mentioned.

The more of the Air that passes thro' them, the quicker they burn; as when the Snuff of a Candle is taken off, which hindered the Quantity to pass thro' it, it increases the Flame; tho', before, the same Materials were employed. The same may be said of clearing the Ashes from, and stirring the Fire; which impeded the Quantity of Air from leaving its Fire behind, in its Passage thro' the Coals.

If the Wax had any Inherency of Fire in its Nature, Why, if you turn a lighted Candle downwards, does the Wax extinguish the Flame? If
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this be difficultly conceiv'd, pray let me farther ask, Why does a Candle, which is lighted, and let down into a Mine where there is a Damp, go out? In a large Mine there is Space enough surely for a Candle to burn in, if there had been enough of that *Pabulum Vitæ* left in the stagnated Air, which occupy'd that large Cavern.

Now, if you will suppose, with me, that this Air had been robb'd of its Fire, by its supporting and keeping alive such Things under-ground as its Business is to do every-where, that Space was left full of stagnated Air; and therefore not admitting fresh to enter, it became impossible for Fire, or any living Creature, to subsist therein.

The Cure of this Evil is performed in Mines by a Horfe-Mill, which works large Bellows, that drive fresh Air down a Shaft made for that Purpose.

I remember Dr. *Halley* told me, that he once try'd the Experiment of making a factitious Damp; which he did, by exhausting the Air out of the Receiver of an Air-pump, and then luting to a Stop-cock a Gun-barrel; the other End of which he put into a Charcoal-Fire, and with the Air, which pass'd thro' the Fire, he fill'd the Receiver again: He told me, that it instantly kill'd a Mouse he put into it, and other Animals, just as Damps did: Now how will you account for this, if you suppose not, that its natural Fire was extinguish'd, and carried from it another Way?

Having thus far, I hope, prepared your Mind to understand what I apprehend the Element of Fire is, and what its Office seems to be, I will shew, if I can,

First, Why, in Electricity, Fire proceeds from an electrical Body, so as to light into a Flame many different Compositions.

Secondly, Why a Tube of Glass, when rubbed so as to be made electrical, will not only attract to it, but repel from it alternately, any light Body, as Leaf-Gold, Feathers, and the like: And also, why it will seem to send from it a Quantity of Wind, with a singing small Noise, if you hold it near your Ear.

Thirdly, Why, when any unelectrify'd Body touches any thing electrify'd, the Electricity breaks off with a smart Crack, and a Spark of Fire.

H 2 Fourthly,

Fourthly, Why any Number of Men, who are joined together by holding a metallic Body betwixt them, if one of them touch a Piece of Iron electrify'd, shall feel a violent Concussion, in proportion to the Largeness of the Body electrify'd.

And, first, I will endeavour to shew, Why an electrify'd Body will kindle an *Alcohol*, or rectify'd Spirit of Wine, and other purify'd Liquors into a Flame.

After having attempted to prove to you, that the Cause of Electricity arises from the universal Fire scatter'd through all Nature, by its being rubb'd together in its Passage betwixt a glass Ball and a Piece of Leather, &c. I hope I shall make it appear, that it passes from thence to the Body electrify'd,

trify'd, in a converging and diverging State; just as a *Lens* converges and diverges the Rays of Light which pass through it: And that all Bodies electrify'd are shut up in a *Capsula* or Covering of this electric Matter, or lambent Flame, which not only passes over it about half an Inch thick, but pervades also every Part and Particle of Matter which constitutes that Body; which it may as easily do, even if it consisted of many Tons Weight, and as soon, from the same Necessity, as it would do to one of an Inch Diameter: And that the electrify'd Body is intirely seal'd up at each Extremity.

To shew this Fire in a converging State, you may observe, when a Gun-barrel, or any long Bar of Iron, is to be electrify'd, and it is in a State of Sus-

H 3 pension



pension on silk Cords, which are non-electricable, you may perceive the Fire issue from a Piece of iron Wire coming from the glass Ball, in a lambent Flame, which draws to a Point, and then diverges, and drives itself on, till the Gun-barrel, or Bar, is electrify'd.

Its being a Gun-barrel can be no other Reason for its Preference in that Shape than in another ; but I believe the Occasion of its being used here is, because an account of the greatest Effect which has been shewn from Electricity, was sent from abroad ; and that was caused by suspending a great Gun in a non-electricable silk Cord. The Gun seems to have been made use of here as containing the greatest Quantity of Iron, and that in the best Shape, they could devise for Suspension. And were a Person
so

so suspended, if he held in his Hand a naked Sword, you might see such a lambent Flame passing from it, in a converging and diverging State, as before describ'd.

I would further prove this converging Fire, from a late Experiment I have heard of, which is as follows: If you suspend an iron Ball by a large Piece of Wire, which descends from a Bar of Iron electrify'd, and then hold under it, in a Saucer, some small round Bubbles of Glass, near enough to be in Contact with the electrical *Vortex*, the glass Balls will follow each other round in the Saucer; and each of these Balls, if the Experiment be made in the dark, will appear to have a Spot of blue Flame at each End of it.

Now, as, by the Contrivance of Man, here is more of this Fire crouded together, than was intended by the Author of all Uniformity, both by its natural Cohesion, and the infinite Celerity it is spirally driven on with, it is no Wonder, in this confined State, if that, which, as Water unconfin'd, would be gentle and beneficent, should, with all the Power that belongs to it, break out at the first Door which is opened for its Passage from this tortur'd State.

It is no Wonder, therefore, that all undisorder'd Nature should be equally electrify'd: For how is it possible to have it otherwise? since, if a Person stands on the Ground, and touches but the *Capsula* before he touches the Body, the electric Fire starts through him into the Ground, as swift as Lightning,

ning, and thence into the universal lambent Flame, from whence it was taken.

Lightning from hence may in some measure be accounted for: Though I cannot so exactly tell what collects it together, as I can in this factitious Lightning here treated of; yet I can suppose, that the Cause of Lightning is produc'd from a great Quantity of this Fire before spoken of; which being driven together, and included in a limited State, or Covering of some Kind, when discharged from this Covering, it goes off in an Explosion, which is Thunder. The Lightning I need not describe, being intirely the same with Electricity; for it will kill without a Wound, and pass through evry thing, as this seems to do.

I am

I am to shew, first, the Cause of its kindling a Flame in certain refined Liquors; which, if what I have supposed be true, that it is by the means spoken of that this Fire is collected, and driven on, as I have said, it is plain to be seen, that at the Finger's End of a Person electrify'd, or at the End of a Sword, held as before described, being in a dark Room, a Flame issues from them: It is no Wonder then, that an inflammable Spirit should take Fire from it.

The second Thing I proposed to shew is, Why a Tube of Glass, rubb'd smartly in the Hand, so as to become electrical, repels Leaf-Gold, Feathers, and other small Bodies; and when they touch any less electrify'd Body, they shall return back again

again to the Tube, and so *vice versa*. Now, if what I have been saying be true, how can this *Phænomenon* be otherwise? For, if that Piece of Leaf-Gold, &c. be electrify'd by the Touch of the Tube, then it has as full Power given to it as the electrify'd Body had to give to it: And when the Gold, &c. touches any other Body, it imparts to it so much of its electrical Property as it had in itself: And then it may be consider'd in the same State it was in when first electrify'd: And so it will be repeatedly attracted to it, and be repell'd *toties quoties*.

But it may be asked, What causes these attractive and repulsive Faculties? I answer, The Attraction of fire Particles one to another: For, if all Nature be agitated by this Fire, all Things

Things have it in the common Proportion, as it was intended they should stand in Nature. And therefore, as I have endeavoured to shew, that Electricity is occasioned by crouding on any thing more of this Fire and Force than naturally belonged to it; and as the Flame of a Candle must of Necessity send out of it, at its Point, an Overplus (without which there could be no Succession or free Motion in its Flame); so, for the same Reason, the Redundancy of what is crouded on may be considered as spending itself at each Extremity, that it may thereby reach itself out to any thing, and invite it to it; as I have shewn the Flame descending down the Smoke of a Candle just blown out to kindle it again, will do.

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As therefore there is a trite Proverb, passing universally, that *where there is Smoke, there must be some Fire*, I will endeavour to prove, That no Heat, either from Animals, or from any other Cause, can be produced but from this Fire I have been speaking of. For, suppose you see the Flame of a Candle circumscribed and limited in its Shape and Size, which it is according to its Snuff; this Thought may serve to illustrate what I mean by the *Capsula*, which I have supposed passing over the Surface of all Bodies when they are electrify'd, and seems to be a lambent Flame, being more or less thick, as from the *Apparatus* more or less Fire has been collected and rubbed together on it, either from the Friction of a glass Tube, or the Globe: Now, as what I am about to shew, is, why
this

this attractive Faculty is found in this Experiment, I would offer to your Consideration, Whether, when common People see the Flame of a Candle circumscrib'd, they think of any Fire which may proceed farther than in the Flame of that Candle? Yet every body, on Recollection, knows, that the Flame will heat Parts at a Distance to such a Degree, as, at length, to kindle them into a Fire. And tho', till you touch the Flame, your Finger is not immediately burn'd, yet there are shewn to be Emanations of Fire at a Distance from its burning Quality. So here I beg Leave to consider the same Property in this Fire occasioned by Electricity. For till you touch this *Capsula* of lambent Flame (which is commonly to be met with from near a Quarter of, to Half, an Inch short of the

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the Body to be electrify'd), no Effect is perceiv'd, because you have not enter'd into the *Vortex* of this Whirlpool of Fire: Yet you may suppose, that it sends out an Emanation of its Fire beyond it, as other Flames do; which, when it has first, by its Heat (which I take to be Part of it), prepared small Things to be electrify'd, then they are more easily lick'd into the whole Power, and so become electrify'd. The Reason therefore, why the Gold, and other light Materials (which I have supposed to have some of this Fire in them), are attracted, is, the Invitation they receive from the curling *Effluvia* to a closer Contact: And when it has received as much as the former can give it, its Invitation ceases, till it has parted with what it had

had to its Neighbour ; and then it is again invited as before.

I come now to consider the Violence of this Fire ; which, passing thro' the Pores of the glass Tube, may, as the Sound of Organ-Pipes, which proceeds only from their differently modifying the Air, cause the various hissing Noises you hear when the Tube is held to the Ear, from the Electricity passing through the different shaped Pores of it.

And furthermore the Wind seems to arise from the distant Parts of the electrical Force playing at some Space from the Tube ; which thereby agitate and fan the ambient Air, so as to make it feel like Wind.

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The Third Thing I proposed to shew, is, Why the electrical Power departs from one Thing to another by giving a smart Crack, and sends out a Spark, which will set on fire many very inflammable Liquors.

Now (as I have, I hope, demonstrated), when this Fire of Electricity is issuing out at a Point into an inflammable Spirit, it can be no Wonder, that the Spirit, which is known to be full of Fire, should unite its Fire to that of Electricity.

As to the Crack it gives when this Fire passes away : As all Sounds are occasioned only by the Air's being put into a different Modification, it is here natural to suppose, that as the Cracking of a Whip is caused by the smart Stroke at the Point of it on
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the Air, so, in this Case, the Air seems to be agitated in the same manner, by breaking the Continuity of it, whereby the like Sound is perceiv'd.

The next Thing I propose to account for, is, Why a Company of unelectrify'd Persons, who are joined together by their holding each a Piece of iron Wire betwixt them, tho' they are ever so many, do all receive a violent Blow or Concussion on their Bodies, when one of them touches a Piece of electrify'd Iron.——I think this Experiment may be carried so far, that, as it has been found already sufficient to kill Birds, and hurt many Persons very grievously, it may have Force enough given to it to kill a Man, as effectually as the Darting of Lightning can do.

For

For if you confider, that you may as effectually electrify one Quantity of Iron as another ; that it may be done to many Ton Weight as eafily as to a fmall Piece ; and that, when it departs into a Perfon, all the Power given to it, not only on its Surface, but intimately thro' every Pore and Particle of it, darts like Lightning from the Point only it was touch'd in ; then further think, if this Repercuffion, or vaft Recoil, from fo large and folid a Body, be fo great, when its Power is thus fent, what may it not do in its utmoft Extent ?

Having now, I think, gone thro' what I propos'd to fhew, and given a Reason, as far as my Conjecture reaches, for every *Phænomenon* which I have feen or heard of in Electricity,

I think it may not be improper to endeavour to proceed a little farther with it, and consider its Power as it stands in Nature. For, since the Antients have ever supposed some uniform compulsive Power, which they called the *Anima Mundi*, and which by these electrical Experiments seems to be Fire, I will endeavour to shew, that, in the Dispersion of it in common Nature, you may observe, that some Plants abound with it, from the great Vigour they discover, compar'd with others in their own Tribe.—Some are so, as being of a more verdant Nature than others are. Now, from this Consideration, I will venture to give a Reason for that which has hitherto puzzled every body that has thought about it; which is, Why the Sensitive Plant shrinks; and, from a turgid and vivid Appearance,

pearance, immediately becomes languid, and hangs its Leaves, on the Touch of any other Body or Thing.

Now, from this my Conjecture on Electricity, if you will suppose with me, that as all Things, which stand in the common Nature of this lower World, have this Fire equally dispersed, and have more or less of it only as they are in this or that Place, where more or less of it is offer'd to be received by them, or as they are in their own Natures capable of receiving more of it than others are (as I think has been shewn by the electrical Experiments before-mention'd); and then likewise suppose the Nature of the Sensitive Plant is to have more of this Fire in it than there is in any other Plant or Thing; then it must, by the Nature of it, when

any of them touches it, impart a great deal of its Fire into that Thing by which it is touched; because that had less of it than was in the Sensitive Plant. Therefore, till the Sensitive Plant has had Time to recover its Vigour, by receiving from the Air more of this Fire, its Leaves and Branches hang in a languid State, from the great Loss of its Spirit and Fire.

To illustrate this, if you set any small Tree in a Pot upon a Cake of Refin, and then electrify the Tree, even tho' it were a Willow, it would grow extremely turgid, so as to erect its Leaves, to the great Wonder of the Beholder; and the Moment you touch even but one of its Leaves, the whole Tree becomes as languid as the Sensitive Plant would be, if touched by
any

any Body or Thing. --- This I think seems to me to give as great a Proof of the Truth of my Conjecture of the Sensitive Plant, as the Nature of the Thing can admit of.

As I am upon the Subject of Vegetation, it may not be improper to offer somewhat concerning the Direction of the *Farina facundans*, which is found in Plants and Flowers, to the *Matrix* of that, or of a neighbouring Plant or Flower.

If there were not some very attracting Influence to guide it, it would but seldom happen, I think, that they could come together by Chance.---If therefore you suppose, that both the *Matrix* and the *Farina* abound with more of this Fire than is in any other Part of the Plant or

I 4 Flower,

Flower, this great Wonder is at an End: For, by the natural Attraction there might be in each, from the Fire supposed to be in them, they would fly together, and be closely connected, as they are constantly found to be in their proper Season.

I have mention'd, that the *Farina* of one Plant may impregnate the *Matrix* of another as well as its own; because I have observed formerly, at Mr. *Fairchild's*, a Gardener at *Hoxton*, a Mule-Flower, produced betwixt a Pink and a Sweet-William.

Having consider'd how this electrical Power may be supposed to affect Vegetation in its common Growth, I shall reflect a little further concerning it, as it may affect animal Life.

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We may observe universally, that Youth abounds with infinitely more Spirits than Age doth, as well in the Human Species as in the Brute Creation; as it is clearly seen in Children, compar'd to Adults; as also in Lambs, in Colts, in Kittens, and almost all other Young, they being much more vigorous than their Dams are generally seen to be. Now the Reflection I would make on this, is, That if Life in them, and in all Nature, be owing to the same Fire as causes Electricity, then, from thence may proceed the Danger of lodging old People with young Children; who, by long Experience, have been found to draw from young Children their natural Strength; the old People having in them a less Proportion of this Fire than young ones seem to have.

Being

Being about to shew the Evil as well as the Good arising from this supposed Fire, I will, in the next place, endeavour to demonstrate, the Cause of Blasts in Mankind; and also, to give some Reason for the Blights on Trees, which I think may be occasioned by this Fire before spoken of.

Having given some Account of the Fire which was seen in the high Wind, to corroborate that Truth, I think it proper to inform you, that I have been told, by very good Authority, that, in tempestuous Weather at Sea, great Flakes of Fire are frequently seen passing not only in the Air, but on the Water also: And having myself seen the Sea-Water, in the Night-time, appear to have a great Quantity of Fire issuing out of it, when

when the Surface thereof was disturbed by the Feathering of Oars, or by the Vessel or Boat passing swiftly through it, I asked a Sailor, At what Time that Appearance happened most frequently? He told me, It most generally happen'd after tempestuous Weather; or, as his Term was, dirty Weather at Sea.

I think this will sufficiently shew the Existence of this Fire in the Air; and, if any Regard be had to what I think its Power and Use is in the World, it will intrude itself, and force its Way, into any thing where less of it is, and so join itself to it by being in a greater Quantity; as has been shewn by many electrical Experiments.

You

You may suppose a Person sitting, as it is too frequently found they are, near a Door, or in a Window, when they are in a warm Temperature, and in Perspiration : If you believe, that there can be any Probability in the Conjecture I have offered to your Consideration, is it not natural for this Fire which passes as frequently through the Air in the Day-time (though unobserved) as when it is seen in the Night ; I say, Why is it not natural for it to force its Entrance into any Person or Thing? especially as it comes then with the Assistance of the Stream of Air the Person sits in, and with which it is driven.

In order to make this Mischief the more to be regarded, I will endeavour to shew the natural State of the Air itself.

Many

Many Writers about it choose to divide it into two Sorts: The first is the pure *Æther*, which is supposed to be moving above our Atmosphere: The second is the common Air, which is supposed to be within our Atmosphere. I confess, the Feats attributed to the mighty Weight of our Atmosphere, in causing Siphons and Pumps, &c. to operate, I never could understand; but if I were to account for their Operations, as well as that of a Barometer, by the Elasticity of the Air, I think I could more easily and more naturally shew it.

Notwithstanding what has been advanced concerning the *Æther*, which is believed to inhabit above our Atmosphere, I choose rather to suppose, that the Air is an Element as well as Fire; and that the Differ-

ence in it is only betwixt heavy and foul Air, and clean and light Air. That which comes on the highest Mountains is clean, and free from our Fogs and Putrefactions, and, consequently, more elastic.

As a Proof of this, I would recommend the following Experiment: Fill a Bladder with this clean Air; then press it with a Weight just sufficient to make it give way; and you will find, that, by reason of its Elasticity, it will yield much further, than if it were fill'd with the other Air, which is impregnated with foggy and aqueous Particles.

Now, if, as in a Barometer, the Quicksilver is suspended by that Air on the Top of the Tube, which was extracted or emerged out of the Quicksilver,

Quicksilver, by its Weight, and as that Air in the Barometer cannot but have a Communication with the ambient Air, the Air within the Barometer must thence be affected, by its becoming less elastic also.

But this is not so much to my present Purpose, as to consider the Air loaded, not only with Vapours, but with poisonous *Effluvia* from the Steams of various Minerals, as well as with the Salts of dead Insects and Animals, which, in the Season of Autumn, may probably occasion so many Agues, and putrid Fevers, as are then but too frequent.

Now, if you further consider the Air as loaded with any or all of these Vapours and *Effluvia*, and demanding Entrance with the Authority

rity of Fire, its Companion, is it any Wonder, that the Rheumatism, and many other bad Effects, which frequently happen, in unguarded Seasons, to Mankind, may be owing to this Cause ?

I remember that a Person, riding in an open Chaise, in an Easterly Wind, receiv'd a Stroke upon one of the *Scapulæ* with as great Pain, and with the same kind of Sensation, as if he had been stuck with a Dagger. Upon which he instantly said to his Friend in the Chaise, He expected a violent Rheumatism from it. Which accordingly happened ; for he was not able to quit his Bed for Three Weeks after.---I think this cannot be better accounted for, than to suppose it proceeded from a pointed Body of
this

this kind of Fire, and the *Effluvia* which accompanied it.

If you will be pleased to reflect on the Air in this last described State, you need not expect, I think, to have much said concerning the Blights on Trees. It is true, somewhat may be consider'd with regard to the Insects frequently found on the blighted Leaves: But whether, when by the Blight the Leaves have been curl'd up, the Insects come thither as to a proper *Nidus*, or whether they are brought in this Fire, which seems plainly to have burn'd their Leaves, I will not undertake to account.

I am, &c.

K APPEN-

APPENDIX.

THE kind Reception this small Treatise has met with from the Public occasioned the Printing the Second Edition of it.

It is, I confess, some Satisfaction to me, that my publishing it is not without Part of the Effect I hoped for; having been told by many, who have read it, that it gave them very new and satisfactory Ideas.

As to those who have read it, and say nothing of it, either from their Want of Apprehension, or their Fear of being obliged to alter their Sentiments concerning it, or from a worse Cause

Cause than either, I absolutely have no Concern about them.

There are some, I confess, who merit with me the highest Esteem, who, having read it, object to some Things, as fearing I have not conceiv'd them rightly; but this they have done with the Temper of Gentlemen. These I think deserve to be set right; which I will therefore attempt to do in the following Manner:

The First Objection they make is, That I have called Silk, Wax, &c. which do not ordinarily convey the electrical Power to other Bodies, non-electricable, or non-electrical; when other Writers have long since agreed to call them Electrics *per se*.

The Second Objection is, That what I have advanced, to prove that the Power of Electricity proceeds not from the *Apparatus*, but from the Air, seems to be overthrown ; because, since I wrote my Book, there has been a new Experiment made, by placing the whole *Apparatus* on Wax, and also the Persons concerned in the Experiment ; and by that means the Power is intercepted.

The Third Objection is, That so large a Quantity of Iron, as I have supposed to be electrify'd, will not give greater Force, when touch'd by a Person unelectrify'd, than a smaller one will.

In Answer to the First Objection ; I cannot think, that the Term Electric *per se* is suited to any Material whatever ;

whatever ; unless some one was found out which would attract to it, of its own accord, any other Material ; as we find a Loadstone will do, when placed near any thing in its Reach : but, if you lay even Amber unrubb'd in Contact with Straws, or any other Things, they will not be attracted to it. So that Friction, it is plain, collects this Power to the Amber.

The Term Electric *per se* seems to me to be used by these Gentlemen for the same Purposes as the old Term of *Occult Quality* was.

As the Word Electricity arises from Amber, I need not insist on any other Material : Nor need I give again my Reasons, why certain Things are non-electricable ; but for clearing One Point, in which I am not rightly

apprehended : I have said, That if Fire be the Cause of Life and Increase in any thing which stands in a State of Nature, then, whatever ceases to to be in a State of Life or Increase, must have its Fire withdrawn, and it becomes a *Caput Mortuum*.—I have been told, This is not true; for a dead Animal will be electrify'd.

This I complain of, as not having been understood concerning it. This Animal, though kill'd, had once its animal Increase from Fire. Boards, when dry, have Fire in them; because the Fire, which invigorated the Tree they were saw'd out of, must naturally remain in them: The like may be said of a dead Animal: But Wax, Pitch, Refin, and the Tribe of Non-electricables, never had their Existence from Nature only; and there-

therefore they are quite of a different Tribe. For what I say is, That whatever had once Fire in it, is capable of being electrify'd. Those called Electrics *per se*, having no Fire in them, when, by Friction, Fire is collected on their Surfaces, it is either driven from thence into the Air, or into some Electricable, and so it joins with that Fire which naturally belongs to it.

Sealing-wax is compounded of Non-electricables, and, if you rub it, will attract Things to it, as Amber will: And I believe all other Things, which will not imbibe the Fire into them, when by Friction it is collected on their Surfaces, will dispose of it thence to their next Neighbour. Resin and Pitch, from their Tenacity, may difficultly be made to do it; and

yet have the Nature in them I am supposing them to have.

There may be such artful Tricks play'd with this Power, as, to an undiscerning Eye, may make it seem to be changed ; for Instance, If you wet a silk Cord (Water being electricable), it passes on the Water through the Cord, by the Cord's only retaining the Water. Some Sorts of Dyes, with which Silk is dyed, if it be of a vegetable Nature, will convey this Power through the Silk, by the Contiguity of the Dye-Stuff : So that you see there may be no End of Experiments.

I think it is a great Pity that the Word *Electricity* should ever have been given to so wonderful a *Phæ-nomenon*, which might properly be consider'd

consider'd as the First Principle in Nature. Perhaps the Word *Vivacity* might not have been an improper one; but it is now too late to think of changing a Name it has so long obtain'd.

As I am going to answer the Second Objection, I own I have not employ'd myself in making Experiments in Electricity, choosin rather, if I could, to account for those which have been found out by others, than to spend much Time in making them myself: Though I pay great Respect to those, who, for the Improvement of Knowledge, have been employ'd in them. As to those who get Money by shewing these Experiments, I do not pay so high a Regard to their Performances; because all, who shew any Arts to new Customers, for Profit,

Profit, are bound to try every Means to gain Applause. I would endeavour to ascertain the Laws or Principles by which they are perform'd; which when done, a Thousand Tricks like Legerdemain may be performed by it, by him whose Time is little worth.

In the Second Objection it is said, I am mistaken, when I advance, that the *Apparatus* is not the Cause of Electricity, but that it is produced by the Air. To shew this, I am told, That if a Person is placed, and also the *Apparatus*, on Wax or Refin (which are non-electricable), no Fire or Force is produced from them: But if the Person employ'd in doing it touches the Wainscot or the Floor with a Walking-Stick, or the like, the Electricity flows as freely as if he stood on the Floor. From whence
some

some conjecture this Power comes from the Earth only ; than which I think nothing can be more absurd : For, if you fetch it out of the Wainscot, or the Boards of the Floor, it must first be in them, and the Air could only be the Carrier of it to them. So that here the main Things, which I at first only conjectur'd, I think are fully proved ; which are, That Electricity was not generated by the *Apparatus*, but only collected by it out of the Air.

As to the Third Objection to a larger Quantity of electrify'd Iron not giving greater Force than a smaller, it should be observ'd, that in this Essay I have only conjectured what most probably is true : And as I profess not to have been engaged in making electrical Experiments, I
must

must rely on those only who have made them : But, surely, if there may be too much Iron employ'd to be so affected, as I have imagined, there may also be too little ; and therefore Time may yet shew, that such a Quantity of this Power may be so collected as to kill a Man ; since but lately I was informed, that a Person, who lives in the *Strand*, is now recovering from a Palsy, in which he lost his Speech, and other Intellects; which Mischief he received from this Force of Electricity.

I hope what I have written on this Subject will not call on me, from the thinking Part of Mankind, any undue Reflection : I have nevertheless met with a very unmannerly Abuse from a Country Show-man, who published some Experiments, and owns
he

he added the Preface to it, in order to write what I am sure no Gentleman would have written :---If this Person be poor, and did it for Gain, I heartily pity him. He owns he was much affrighted, when he heard of my publishing this Piece, because of the hard Fate, he says, of his Bookfellers ; but, before he had read Two Pages, he likewise owns he recovered his Spirits, when he found I pretended to think for myself, and did not let Sir *Isaac Newton* think for me, after he had been so long dead. I am well satisfy'd, had that Great Man been living, and had seen these electrical Experiments, he would not have bow'd very low to this great Philosopher, for thus supporting his Character. His doing this would be as ridiculous as to see a Pygmy attempt to carry a Giant. I believe there

there are more Answers to Books written to pay a Landlady, or an Alehouse-Score, than from any other Cause ; especially if their Authors think they answer one whose Character will call it into the World.---

I know nothing of my Adversary's Finances ; but how rich soever he may have made himself by his Show, he seems to have the Blessing of never being liable to the Head-ach from his Thinking too intensely.

A T R E A-

A
TREATISE ON FIRE;
SHEWING THE
MECHANICAL CAUSE
OF
MAGNETISM;
AND

Why the COMPASS varies in the
Manner it does.

The THIRD PART.

By JOHN FREKE, Surgeon to *St. Bartho-
lomew's Hospital, London*, and F.R.S.

L O N D O N:

Printed for W. INNYS, and J. RICHARDSON,
in *Pater-noster Row*.

MDCCCLII.

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MDCCLII.

ON THE
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MAGNETISM.

I AM now come to the Third Part of my Treatise on Fire, in which I propose to shew it to be the Origin and Power of Magnetism.

As Magnetism is of so interesting a Nature to the Benefit of Mankind, it is greatly to be wondered, that no satisfactory Account has yet been written of it: I hope therefore to shew, that it proceeds from Fire, as the only intelligible Cause. Though
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I apprehend it will meet with a more cold Reception, than if I attempted to prove it from the unintelligible Jargon of *Æther*, or by the Property of Air in an exhausted Receiver, &c. But as I am satisfied, that the Mind should never be embarrassed by any unintelligible thing, in order to make things not understood intelligible; I have determined, in what I have written, or shall write, to speak of nothing, but as it stands unalter'd in Nature.

When I speak of Fire residing absolutely in the Air, I have considered it as universally dispersed: But if I should suppose an *Æther*, how would it puzzle the Reader's Mind? Where can it be considered subsisting, apart from what some call the grosser Air? But as I hope I have in the foregoing Treatises sufficiently established

established an universal Fire, proceeding from the Sun, and shewn, that its Power and Force, in some States, are superior to any Power or Force in the World ; I will proceed further to shew of this Fire, as it, without begging a Question, is ever flowing to us from the Sun ; and as its Quantity can never decay ; what Course it takes to return to the Sun ; for, from what is said, thither it must return.

Now as no River can possibly send back its Water to the Fountain-head, by the Way it flows from it ; so neither can the Fire, which is ever flowing from the Sun, pass back the same Way so easily as by another Course. Moreover, if the Fire of the Sun did not circulate round the Earth, what would become of its In-

habitants on those Parts not enlightened by it, as, at some times, all, especially in the Night-Season, are liable to be ?

If therefore the Sun is ever circulating its Fire round the Earth, its Influence may be from the South to the North ; for although the apparent rising of the Sun is in the East, and it declines or sets Westward, yet it is known, and felt by all, that its intensest Heat is ever sent to our Hemisphere from the Southward ; and therefore, from what I before premised, that as every River, and all the Powers in Nature, must proceed from the Fountain-head ; so I think it natural to suppose, that if the strongest Influence from the Sun flows from the South in its Progress it must terminate in the North,

per-

performing its various Operations in Nature, as it passes over the Face of the Earth ; and this the Power of Magnetism will help to evince : For all Bars of Iron which stand upright, and are in a Direction towards the North, if they keep this Situation for any Length of Time, become magnetical by partaking of a Stream of magnetic Force ; which proves it must be ever flowing in that Direction.

Now as I have shewn, with some Probability I hope, that this must be the Course of the Sun's Influence ; and as I am persuaded no one will be able to shew any Power in Nature directing its Course to this Point powerful enough for the before-mentioned Purpose ; I shall proceed to strengthen my Conjectures by such

Means as naturally present themselves to me.

My Intent of writing the First Part of this Treatise on Fire being chiefly to guide the Mind to this Subject of Magnetism, I hope I need only refer the Reader to it, to solve such Doubts as my present Reasoning may raise : And therefore,

I shall now give further Proofs of the Nature of Magnetism, by shewing, how by the Art of Man the Power of it may be increased to the uttermost Strength it is capable of. We may plainly perceive, that the Bars before-mentioned become magnetical from their standing in such a Position : But by this means, as the Power is never so given to them, with any great Strength, it will be proper to
shew

shew the mechanical Cause, by which you may increase it.

I have before observed, that this Power proceeds from a Stream of Magnetism passing one Way only through the Bar of Iron : But as Fire has been formerly shewn pervading and passing through all Things, in Nature, at all Points; and particularly as it is capable of sending its Force with the greatest Freedom, as easily through Iron, as any other Material; if these Bars, which stood erect had often been changed in their Posture, no Magnetism had happened to them: Which will be proved, when I shall shew the Method of increasing the magnetic Force by Art, in the making an artificial Magnet; which is as follows :

Take a common Pair of Tongs, and a Poker; for, by the erect Posture they generally stand in, they all become magnetical; and from their magnetical Power you may make an artificial Magnet, as strong or stronger than the natural Magnet, of the same Size, is generally found to be.

I have said, that Iron standing in such a Direction becomes magnetical; which proves, that the Magnetism it has gained was from some Power passing more freely that Way than any other, or than it would have acquired in any other Position: But as this must be allowed to be true, I will proceed to shew, that to make this Power stronger than the Tongs and Poker can attain to, of their own Accord, a greater Currency of this
Mag-

Magnetism must be let in by some other Means: And thereby, to make an artificial Magnet as strong as possible, without any Use of a real one; take Three soft Plates of Iron, that they may the readier receive the Influence here spoken of; let each of them be about Three Inches long, half an Inch wide, and about the Eighth of an Inch thick; let a Hole be drilled through the Three, at one End, so that, on Occasion, they may be fastened together with an iron Pin.

In order to give them the greatest Strength of magnetic Power, take out the Pin, separate them, and lay them by one another, on a Table; then take the first of these Plates, and, holding a Poker directed towards the North, place it on the Poker,
and

and with the Tongs, both of which are become, in a small Degree, magnetical, stroke the Plate for a considerable Time, in a Direction toward the North; so will the Poker and Tongs give to the Plate such a Degree of Magnetism as they themselves had; then serve the second so as the first was, and then the Third; after this pin them together: And as it is found from Experience, that soft Iron, though it receives this Power quicker than if it was harder; yet as it is more liable to lose it so too, it is found proper to have Three Plates somewhat larger, and pinn'd as the former, but made out of good Steel, and well hardened; lay them also separate on a Table; and with the former Three being pinn'd together, stroke each of the Steel Plates, and lay them one by the other;

other ; then stroke each with one another, for some Minutes ; so will they obtain more Power to attract a Piece of Steel withal, than any Loadstone of their Size can.

From hence is it not easy to see, that the mechanical Cause of it is no more than, as by the Currency of the magnetic Power, which is ever flowing to the North, it must have entered the Iron in that Direction, and thereby given to it the Power now spoken of ? From what has been said, Fire, I think, can only answer this Purpose.

I will now endeavour to prove, that the Fire of the Sun passes this Way in its natural Course, to its original Fountain ; for, suppose that this Fire did not, but was under no Direction,
the

the Consequence must be, from what in my first Treatise I have shewn, that all Creatures, and every thing in Nature, must be destroyed for want of Fire; for either this must be so, or Fire is not absolutely necessary to preserve Life, as I have elsewhere fully proved it is. But to carry this farther, since we see all the Works of Nature moved by the easiest Means, not at all liable to be frustrated; and we ourselves can have no better Contrivances to create Motion, than by those we are able to be acquainted with: For Instance, Were we to suspend a Ball, and to give it a rotatory Motion, we must suspend it on each Side by Two Pivots or Points; and they must be made of such Materials as we can be acquainted with. And suppose a Machine for a perpetual Motion were to be made,

made, if we make it of Steel, which is one of the hardest Metals we know of, and it could be called then a perpetual Motion ; we know it would be ever decaying.

This farther leads me to imagine, that the Passage of the Fire, round the Earth, from and to the Sun, by its embracing, and appertaining to, all Things on the Earth, may be the Means of circumgyrating and carrying the Earth itself round ; and not only so, but it may also be possibly suspended, and turned round, as in a Fluid, with as great Facility, as it can lie at Rest in it ; and who knows, but that the whole heavenly Bodies may be so directed in their various Courses, by the Power of this supposed *Cor Mundi* ? It may here be said, that we can have no real Proof
for

for this, more than Conjecture. I answer, What more than Conjecture is there for any thing in Nature ? For we can only suppose, from the Facts we are sure of, what Probabilities may arise from them : And to apply this to what is said of the Sun's circumgyrating the Earth ; I say it can be proved, that its Operations in various Instances are powerful enough for these Purposes : And though from the Inclination and Declination of the Pole of the Earth, we account for the Cause of Summer and Winter ; yet, in respect to the Power that the Sun may have over this Earth, those Variations may have no Effect to prevent the Force of it. But, to recollect what I have said, I hope I have shewn in my former Chapters, that the Fire of the Sun is powerful and
active

active enough to perform every thing therein mentioned ; and that the various Formations of all Things create the Difference this Fire acts with : As for Instance, what I before-mentioned, that if an Elder-stick was set either End of it in the Ground, it will grow, provided there were any Knots or Buds in it, these Buds being organized Parts, or, in other Words, Parts adapted, from their peculiar Formation, to receive this elementary Fire, with the utmost Freedom, nay, rather to invite than reject it. Though that Part of the Elder-stick, which is betwixt the Knots, can never be made to grow, by ever so much Culture ; but will rot in the Ground, because the Aptness, in the Admitter of this Fire, is wanting ; and it may therefore, once for all, be ascertained, that the

various Operations from Fire depend only on the Mode of the receiving it.

From hence it will appear, that a Bar of Steel is as full of Fire as a Flint is ; but the Fire which it abounds with pervades it from Art, at all Points, and only keeps its fullen Station, as in a Flint, till some Accident produces it : But as we find the Nature of this Fire is ever to be active and busy, where it is in a Condition for it to be so, let us consider the different State in a magnetical Bar of Steel, and in one of the same Size in which it had enter'd at all Points in the magnetical Bar, as in the Knot, or *Punctum saliens*, of the Elder, it is invited, causing it to be made free for its Passage thro' it, to the next earnest Receiver ; for I have plainly shewn in a former
Part

Part of this Book, that every thing in Nature will not only receive, but calls for it, as the suspended Leaf-Gold, heretofore mentioned, plainly shews.

Now when a Bar of Steel is become as penetrable by Art for this Fire to flow through as freely as you may blow through a Cane, or as you see Water flow, at a Mill-Tail, if any Iron comes near, it will shew its Readiness to drink it in, as greedily as every thing in Nature is disposed to do on other Occasions; and from thence we may account for the Cohesion of the Giver to the Receiver.

That which will accelerate this Power in its Passage through a Magnet, may be shewn from its passing through an iron Wire, from one thing

M to

to another, which it does as quick as Lightning. The Cause of it in the Wire, is owing to there being a Succession of Parts, which could not be impregnated, but from their giving it to one another. So that we perceive all things in Nature will receive it, if possible : Therefore where a Passage is made, even by Art, through a Bar of Steel, if the Fire thereby enters the quicker, and meets with no Obstruction, it is conveyed, as in the Wire, by the Parts which are prepared, to give it successively this magnetic Power, which spends itself through as fast and freely as it enters the Bar of Steel, so prepared : For Instance, if a Bar of Steel has a magnetic Power, by which it admits this Fire to pass through it, just as one can blow through a Cane ; which Comparison may be made, though

though a Steel Magnet does not appear to the Eye-sight to have more Pores for this Fire to pass through: Yet as the Effect shews, that it admits it as free as a Cane does the Air; if this Fire enters into a Passage which is become pervious, as we conceive a Magnet to be, it must of Necessity fly through it, from one Particle driving it on to another, as I have observed it to pass through a Wire; and when it is thus set a-going, all the rest follows without any Difficulty; for the Operation of Magnetism is found to pass as quick as Light. Now it may be properly inquired how the natural Magnet also acquires this Power: To which I answer, it is caused just as the former; and that this Power is only found in Iron, or iron Ore, in which I apprehend it to reside, from its Apt-

ness to receive in the first Place, and from its Density and Fitness to retain it ; but from laying it in a bad Posture, it may soon lose it again ; but the Cause of a natural Magnet becoming so of its own accord is the Question.

Now to shew this, it should be remembred, that all Minerals, as well as Vegetables, are ever penetrated, and circulated through, by this Fire ; and therefore the Cause why a Magnet becomes so, is from mere Accident, that is, from this Fire having accidentally stray'd so long in one Direction Northward, through some Bed of iron Ore, till some of it becomes endued with this Degree of magnetic Power ; for in a large Magnet it is found frequently, that a little Portion of it, here and
there,

there, will be found perfectly strong, and their next neighbouring Parts will partake of none of it.

Now, from what I have said, I verily think, that every thing that is called electrical, may be, in some Degree, accounted magnetical ; but Electricity being employed on such Subjects as cannot invite of themselves, it must be (after they have parted with it, from the Softness of their Parts) again reagitated before they can attain it ; but the Steel, whose Parts are very dense, after it has been prepared to receive it, and thence become organized, it may continue to imbibe it, if it be not unorganized by hanging it in a false Direction, or by drawing another Magnet contrariwise over it ; for by these means the Power of the Magnet may be

M 3 destroyed ;

destroyed ; or, if it be burnt in the Fire, it will destroy its Power, by altering its Direction ; which I apprehend to be no weak Proof of its proceeding from Fire.

Let us now reconsider the different Effects Fire will produce, from the different Conditions it is to be found in.

In which I shall consider the State of electrical Fire, as collected on a Bar of Steel, out of the Air ; which you may perceive, when passing off the Extremity of the Bar, to appear in a faint blue Flame, and causing a phosphorous or nauseous Smell, I suppose, from the various Particles the Air abounds with, as well as Fire, when they are passing off in Conjunction. Now although this
Fire

Fire will burst away with such Violence as it does, when discharged from this confined State ; yet it is plain, that this Fire is so much embarrassed by the Variety of Matter, which ever abounds in the Air, as to be much weakened thereby ; whereas when we consider how purely Magnetism is extracted, without any Alloy, from the general Mass, we find it pervading Glass as free as Light will ; and though we give no determined Cause for either, we can be sure of the Facts. This Power of Magnetism being of the most subtle Nature imaginable, and so very active, as to do what no other can have any Resemblance of ; it will be proper to consider wherein it excels all Things besides.

Now every thing, be it ever so fluid, can be detained by Glafs, except Magnetism ; but if you place the Filings of Steel on a Piece of Glafs, and move a Magnet under it, they will not only be drawn to and fro as the Magnet is moved ; but its Influence will pass through the Glafs, so as to cause them to adhere together, as if no Glafs was between them, and the Magnet : Moreover, it will likewise pervade an exhausted Receiver.

Those who may be disinclined to my Cause given for this Power, perhaps will take this Opportunity of turning my Artillery against me, if I do not obviate what may be said on this Head : I presume therefore to mention what has before been said in this Treatise, that Fire much embarrassed

barras'd differs greatly from itself when it is not so : And as, in the Operation of Electricity, there plainly appears a much greater Force than can be at any time gained from so much common Fire as appears at that time in it ; from thence it follows, I think, that the violent Force of Electricity is caused by something more than Fire, although they then are concomitant. And this brings to my Mind what that great Chemist *Van Helmont* says ; that through all Nature there is a *Gas*, or, what others term it, a *Spiritus Reċtor*. This in Man he calls the *Gas vitale* ; in Ale, whilst it is working, *Gas Cerevisiæ* ; in Sulphurs, *Gas Sulphuris*, *Gas Salium* ; in Air, *Gas ventosum* ; so that then *Spiritus Reċtor*, and *Anima Mundi*, are of the same Signification with an operating Spirit ;

Spirit ; which I suppose is ever proceeding from the Sun.

Now as Magnetism is of so much more Subtlety than any thing else, why may it not be considered as a Species of the electrical Fire, but so much more refined by the organized Steel, admitting no more to pass through it than is sufficient for this Purpose ; and yet its Source may be considered as proceeding from the Sun ?

So that from hence it follows, that many Degrees of Power may proceed from the Sun, as the *Cor Mundi*.

Having, I hope, clearly explained the mechanical Cause of Magnetism, by such Laws as I find in Nature ; and as hitherto I never saw any
Account

Account of this Phænomenon, that was at all intelligible; and as most would be glad to have a right Conception of it; it may not be amiss to recite the Plan by which I have proceeded in this Book, before I shall attempt to shew the Cause of the Variations of the Magnet; so that it may appear to the Reader at one View; and be thereby fixed on his Mind: But let him try if any thing he can think on may better account for this Phænomenon; by which the Merit of this will thereby be established; for every thing which has hitherto been offered, to shew the Cause of a magnetic Power, can in no respect be understood by me.

In my First Chapter I endeavour to shew the Progress of Fire from and to the Sun, and to account for
its

its Power ; and, denying the Annihilation of it, to shew likewise, that it gives Life and Motion to all Things in Nature. In my Second Book or Chapter I shew its Power in various Experiments from Electricity. In my Third Book or Chapter on Magnetism I propose to shew, that by the Fire passing from and to the Sun it so pervades Iron aptly placed, as to make it attractive, and produce the various Operations of Magnetism.

There have been, as I before observed, many Attempts to account for the Powers of Attraction in the Magnet ; but none that I know, of the different Variations of the Needle on the Mariner's Compass : And therefore, if what I contend for be granted me, I shall hope to demonstrate the Cause, not only of the Attraction,

tion, but the different Variations of it, just as they always happen ; and, as no one has at all accounted for these, there will thence arise a natural Proof of the Laws they are supposed to proceed from reciprocally.

In order to my shewing the Cause of the different Variations of the Needle on the Mariner's Compass, it may be proper more fully to consider the Sun's Rays passing over the Earth, from the Southward ; and to try, if from the Appearances of the *Aurora Borealis*, &c. we may not gain some Strength to our Conjecture ; and therefore I say, among many other Reasons, Why may not the fiery Coruscations of the *Aurora Borealis*, which are ever observed to arise just where the Needle points, prove, that as all Light proceeds from the Fire of the Sun,

Sun, those Appearances may be accounted for from the *Crepuscula* of crouded Fire in its Passage that Way? And this leads me to inquire further, if Fire must ever (by all we know of it) be allowed to be where there is Light, Whence the Light now spoken of arises, if it proceeds not from the Course this Fire is here supposed to be in?

But not to puzzle or dwell too long on this Subject, I can at present absolutely demonstrate, that the Sun's Rays are ever dispersed towards the North.

And, if so, I can from thence likewise see a natural Reason, which will account for the Variations of the Needle ; for, from the Cause that impregnates a Magnet, it must of consequence

consequence make it delight to dwell in that State it was created in.

But as I desire to make every thing as plain as may be ; so I find the most familiar and simple Instances which can be thought on, most proper to be used for that Purpose.

Now as I build my Hope of being understood, by considering the Needle pointing directly to the very North, and not Northwards, or near to the North ; and as I have, I believe, shewn, that the Course of the Sun's Influence, in its Passage to the North, is the sole Cause of Magnetism ; it will be necessary to shew, that as the Sun sends over this Hemisphere its Power of Fire, which takes Possession of all Things in its Passage ; and as the Earth is of a globular Figure ; it will

2 plainly,

plainly, I think, appear from thence (as it may from a convex Lens), that as Fire is impelled or driven on in its Course over this Hemisphere; and as it ever penetrates all that it can; so it never can depart from this Face of the Earth, till it comes to the Extremity of it, which is the North Point exactly, as being just opposite to the South Sun: And when we also consider this Fire meeting there, from each Side of the Surface of this Earth, can it be doubted, but that it must meet as the Rays of Light do, after they have passed through a convex Lens crossing one another, and, by that means, cause it to converge on the North Side of the Globe, in its Passage back to the Sun? And thus the Circulation of these mighty Powers proceeding from the Sun, may be considered returning back to
it

it again ; and by one and the same Operation, of refreshing, and giving Motion, to all Things in its Passage ; and it thence, of Course, may attract, circumgyrate, or move round the Earth also in the constant Course, as it is observed to be directed.

I am the less afraid of what I am advancing, more particularly when I consider, that I am only offering it as a Conjecture, against nothing that I ever found, advanced by any of our Philosophers, to produce a natural Cause for Motion through the Universe.

These Conjectures may be denied a Place in the Breast of perhaps a captious or ignorant Inquirer ; but let him keep that to himself, till he first shews a more probable one to

N account

account for this Phænomenon ; and, if he does, I will not only sing his Praise, but alleviate my own Failings, by considering, that a more perfect Fabric has been erected from it.

And, after all, as I can still suppose, that there may be a Possibility remaining of the Truth of these Conjectures, I will venture on, and endeavour to shew that which I before promised ; which is, why the Needle, ever, in all Places of this Hemisphere, points exactly to the North.

For Instance, if you are nigh to either of the Tropics, or under the meridian Line, the Point of the Needle will be exactly to the North ; so that the Variations arising from
thence

thence will not proceed from that Place pointed to, but that pointed from.

I have in the foregoing Parts endeavoured to shew the State of this magnetical Power, passing from the Sun, and dispersed over this whole Globe; and if I have not been clearly understood, I will endeavour to demonstrate what I mean, by comparing the Power now spoken of to a round Lake of Water, into which a Supply of Water is supposed to be sent at the North Point only, and at the Opposite exactly there is the only Exit for the Redundancy of this Water to pass out of it. Now, suppose this Lake divided into three Parts, just as the Two Tropics, and the meridian Line, do the Globe; and if you place a Weathercock or

Fane, which the Water will as easily turn as the Wind could, just as the Water passes, from its Entrance in, and to its going out of the Lake, the Weathercock must be veered about by it : If therefore it stands in the Middle of the Lake, as the meridian Line is placed on the Globe, it will point just with the Current as the Water comes in and goes out of the Lake : But if it be placed so far on either Side as the Tropics are, it must point exactly to the going out of the Water, as it passes round from its Entrance to it ; and therefore as the Water must be in a current State, passing round the Lake as well as forwards, to its going out of it, the Fane will thence be directed to point exactly to the Exit of the Water, whither all of it must be equally tending : And if we compare this
with

with the Operation of the Sun over the Face of the Globe, it may, I hope, help to demonstrate it.

Now although I may have thought justly on this Subject, yet, as it is acknowledged to be very abstruse, and the Method of proving it entirely new, I have chosen the familiar Example of a Lake of Water, to shew the Condition of this magnetical Fluid by ; since, as it is supposed to proceed from the Sun in its Passage to the North, and also considered as the principal Agent, under God, which actuates, and drives all Matter into Motion on the Earth ; and as the Face of the Globe is spherical ; so this Power must be retained in the Form of a round Figure, by its

N 3 having

having to do with all things on the Face of the Earth.

Now the Lake of Water before-mentioned is what we can more easily observe by our Eye-sight, than from any invisible Matter, such as the Air. I hope therefore I may stand excused for applying Water to explain this Phænomenon ; for, after all, to be plain and intelligible, in a doubtful Case, may have as much Merit in it, as being ever so florid in a thing which is commonly understood.

And now give me Leave to observe, as formerly I did ; where-ever a proper Conjecture for a thing is shewn, and nothing to contradict it, and where no other has been offered to account for it, I may rest satisfied with what I have said, unless I find myself

myself refuted by some one in Answer to it.

I am sensible how difficult it is to produce a new Cause for any Phænomenon, seeing that but few agree in common Things: This obliges me to explain, as well as I can, where I may not be understood ; which leads me, for the last Time, to re-consider the Nature of the Cause of the magnetic Power : And, without begging a Question, it manifests itself to proceed in a Direction to the North, and able to pervade Iron. Now, if we compare the Power of Electricity with the Operations of Magnetism, Electricity is sufficient to pass through an iron Wire, as freely as Magnetism ; and, after it, through ever so many People, who shall hold each other by the Hand, with so great Force

and Activity, as would give a sufficient Power to produce Magnetism in Steel, were the Parts of it become so modified, as to attract it of its own Accord : Suppose this to be the Fact in Magnetism, and the *Gordian* Knot is untied.

Now, although the Powers of Electricity were sufficient to become magnetical ; yet the Moment they operated, they would fly off into the ambient Element ; whereas the Magnet is a continued Circulator of this Power through it ; so that every thing being ready to drink it in as it is discharged, the Wonder ceases why the Connexion is so strong between that and Iron ; for it is as practicable to connect many small Magnets together by the magnetical Power passing through them, as to
string

string so many Beads with a common Thread suited for that Purpose.

I doubt not but what I have said is very nigh the Truth ; but how to help on our Ideas, concerning the Organization of all such Parts in Nature, as are fit to give or receive any Power, is the Question,

To this End it may be proper to consider the violent Agitation of Acids and Alkalines ; which could not act as they do, if their Parts were not properly formed. I never knew any tolerable mechanical Cause assigned for their so acting, but from one of them abounding with the *Spiculæ* of Salts, like so many Swords ; and the other with such Parts as are fit to receive the former, in Resemblance to Scabbards, into which they are supposed

posed to enter with the greatest Agitation. Now, if their Parts were not organized so differently, such Effects could not be produced ; and though this cannot demonstrate the Form of the Power of the Magnet, yet it may help one to inquire, why, if any Parts of Matter, so shaped as those here spoken of, produce such Effects ; why, I say, may it be looked on as impossible for other Parts of Matter to become so differently modified as to produce the different Effects we can perceive in the Power of a Magnet ?

I can do no more than make myself understood ; and after all, if I have not, and many should declare, they cannot draw the Conclusion I do from what I have said, I must rest satisfied ; especially if I should

find One in a Thousand, that says he can. Now, after all, this, as well as all other doubtful Matters, must be determined at the Bar of our so highly esteemed Reason: Wherefore it may not be improper to examine Reason itself in the First Place, lest it may be made use of to false Purposes.

I will suppose a Case wherein Reason alone can be the Umpire, respecting the Form of Two Figures, the one a Globe, or round Ball; the other, that of a perfect Cube. Now when any one would instruct another in the Mathematics, and has the Examples with him of these real Forms, how easily may the one demonstrate, that the Lines which can form a Globe must of Necessity be circular; and that such as form a
Cube

Cube must be strait ! And when the Globe and Cube are present, if you shew how all the Lines serve to form each of them, the Pupil will, from his Reason, be obliged to consent to these Demonstrations ; and afterwards, when he shall meet another who has learned to acquiesce in the same Problem, they will demonstrate, from what they afterwards call their Reason, that each are what they were first shewn to be.

Now suppose this Tutor was to describe, only by Word of Mouth, the Two Figures aforesaid, to a Man who had never seen either of their Forms ; let him use the Words curved, circular, and strait Lines, as far as he could, and I believe, he would be very unable, without an uncommon Share of Reason, both in himself,
and

and his Pupil, to demonstrate them so, that for the future they would not doubt about the Infallibility of their Reason concerning them; but rather be content to say, they are what I believe answers to the Rule I was taught by to think the one to be a Globe, the other a Cube. To apply this to our present Purpose, I verily think, that it is undoubtedly found, that all Steel which is magnetical, becomes so by altering its Parts, and forming them the apter to receive the magnetic Influence; and then, when a small Portion of it is suspended on a Point, it must of course turn as freely as a Feather would by the Air, or as a Weathercock in the Current of a Lake of Water; but with this Difference: In the Case of the Two latter, they are liable to move by outward Powers only;

only; when, in the Case of the magnetic Steel, it is supposed to be impelled by a Power, not only passing through it, but invited by the Organization of its Parts; and this is shewn to be the most subtle and powerful of any to be produced in Nature.

As I have before endeavoured in this Treatise to shew the Subtilty of its being able to pass through Glafs, where nothing else that I know of in Nature can; and lest this Fact should stagger any in believing, that Magnetism and Electricity cannot proceed from the same Cause, though they have a sufficient Force to act the same Part; yet the one being invited to it by Art, the other proceeding from Nature; this I say may raise a Doubt. I think I have sufficiently shewn,

shewn, that many Parts may become so organized as to invite a Power equally strong with Magnetism : But a Question may follow, Why does not Magnetism produce a blue Flame, and sulphurous Smell, as well as Electricity, if it be of the same Genus or Tribe ? To which I answer, That this Question may be asked of any thing else that has the Operations of Nature in it, as well as concerning Electricity : For does not what I would advance fully prove, that there is but one lively operating Power through all Nature, pushing on the Growth of Animals, Vegetables, and Minerals, as well, and clearly to the Understanding, as it does on Electricity ? The Answer to this Proposition is, Suppose some certain Powers are appointed by God to coerce and drive all things into
the

the various States, and Growth, and Existence, they were severally to partake of : Now, although, with the Antients, we may suppose but one coercive Power, which they called the *Anima Mundi* ; would it thence follow, that because it might circulate Poison through some Plants, therefore it could not impel the Frangency of a Rose through its proper Strainers ? Now the Difference of these, and all things in Nature, is only in the different Organization of its Parts. The Antients, I say, called this Power the *Anima Mundi*. *Van Helmont* coined the Word *Gas* to express it by. Let me be indulged, as well as they have been, in coining a Word, which, for my present Purpose may answer better ; and yet not diminish the Powers they have assigned to it : My Term should be,
either

either the *Magisterium*, or *Spiritus Solis*; by which I would consider this Power, exerting every-where, in all Nature; but its Strength or Weakness can only appear, when blended with more or less of the Matter it is to draw along with it, in their different Operations.

And here it is worth our Consideration, why Magnetism can even pervade Glass, when Electricity cannot. I am shewing, that Magnetism is separated or secreted from every thing by Organization; and so it takes nothing in Nature, but what I term the *Spiritus Solis* purely, not clogged with any other Matter, no more than that Fire, which is contained in a Flint. Now, seeing that it is a Fact, that the Power of a Magnet will move the Filings of

O Steel,

Steel, which are placed on a Piece of Glas over it, and which will continue to act so for ever, it must be here observed, I am begging no Question, but am relating a Fact every one can try, as I have done ; when they will, by this Experiment, perceive a continued Blast passing through the Magnet, with an apparent Swiftnefs, as Water passes a Water-Engine : Now when this can be tried, and proved by any common Person to be true ; and the same Person shall, when he pleases, unorganize this Magnet, by drawing another contrariwise over it ; and then it will shew no more of this Power, than if it never had it ; I say, if the same Person shall, at his Pleasure, again reinstate it, to perform the same Operation, what Man can doubt whether I am right concerning this Phenomenon ?

So much being established towards an easy Understanding of this Mystery, if what I promised be not contradicted, which I think it is impossible to be, that the Currency of Magnetism is the Cause of the Effects thus produced ; then it must follow, that the different Variations of the Needle must arise from the Currency of that Power in which it floats.

And now having, to my thinking, established a reasonable mechanical Cause for Magnetism, I will proceed to shew the Difference betwixt it and Electricity. Electricity is a Power collected by Art out of the common Air ; in which are supposed to be floating all such kinds of Matter, which were intended to become the Agents in common Nature ; and they, being collected by Art,
and

and constringed together, form the Power of Electricity ; which Power differs from that of Magnetism, in having many Properties collected with it, beside the *Spiritus Solis* ; and, upon discharging them from their Confinement, they exhibit a Fire, and sulphurous Smell : But it must be remembred, that all of these, and every thing in Nature, must ever be accompanied with what I call *Spiritus Solis*. I find, should I proceed farther on this Subject, if I have not said enough to convince my Reader, I may be liable to use the same Arguments too often, and be guilty of Tautology, to which neither my Time nor Inclination leads me.

F I N I S.





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