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*** START OF THE PROJECT GUTENBERG EBOOK AN ESSAY TO SHEW THE CAUSE OF ELECTRICITY; AND WHY SOME THINGS ARE NON-ELECTRICABLE ***

AN

ESSAY

TO SHEW THE

CAUSE

OF

ELECTRICITY;

AND

Why Some Things are Non-Electricable.

In which is also Consider'd

Its Influence in the *Blasts* on Human Bodies,
in the *Blight*s on Trees, in the *Damps* in
Mines; and as it may affect the *Sensitive*
Plant, &c.

In a LETTER

To Mr. WILLIAM WATSON, *F.R.S.*

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

Naturam expellas furcâ, tamen usque recurret.

The SECOND EDITION: With an APPENDIX.

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MDCCLXVI.

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

SIR,

Those who have the Honour of your Acquaintance, and thence know your many excellent Qualifications, must applaud my Choice in dedicating this small Piece to you; whose Name, if there be any Merit in the Performance, will, before any other, add a Lustre to it. I am, with the highest Esteem,

*Your most Obliged,
Humble Servant,*

JOHN FREKE.

The PREFACE.

When I first enter'd 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 Publick.

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 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 awaken 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 you may be acquainted 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 may be more fully understood, it may afford us Means whereby we may be better enabled to reason more intelligibly than now we can, concerning various Operations in Nature.

I am very sensible what Tribute a new Author is liable to pay to Criticks: I know it is too common to find much too large a Part of them inclin'd to look into a Book for its Faults, rather than for its Use; and are more ready to pull down, than they have Abilities to put any thing in its Place. But as I am not writing 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 chuse rather to stand their Censure, than deny the Publick 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 those who set up for Criticks will try their Hands at this Performance, and, if they can, will condemn it.

It would be a great Wonder, indeed, if this should escape the Censure of some, when the great Dr. Harvey had his implacable Adversaries to his Account of the Circulation of the Blood; and even Sir Isaac Newton met with Opponents to several of his Theorys. 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 for the clearing those Truths I would establish; and if, after all, what appears 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.

ESSAY

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 Improvement 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 relating thereto, I was in hopes, from you or some of them, an Essay would 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 of the *Apparatus* itself; not either from the glass Ball, nor the Leather, nor from the Tube, or 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 ancient and ablest Philosophers have look'd upon the Animal and Vegetable World as actuated by Fire; and that they are nourish'd by Water, and what it contains. 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 dropp'd 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 consider one Particle of the Water without a Particle of the Medicine: Just so it may be with the Fire of this lower Region, or, what I chuse rather to call it, this *Flamma Vitalis*.

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

To make this Conjecture the more easily apprehended, I will suppose, that the Nature of Fire is as similar to its Parts, and they have as great a Propensity to adhere to one another, as we find the different Arrangements in all natural Bodies have; as may be seen in Gems, in Water, and in the various *Strata* of the Earth, and the like. Do but force or invite these fiery Particles to a closer Contact than they have been supposed to be in, when uniformly dispersed through all Nature, and they are Lightning, or a Fire of 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 Reasoning be allow'd 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 rubb'd with a Piece of Leather, as they are used in electrical Experiments, I say, the Air, so rubb'd, may leave behind it that Quantity of agitated Fire which causes Electricity.

For, suppose the Ball or Tube enveloped with a Quantity of this Fire moving spirally round them, with the utmost Velocity; and 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. Every body almost 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 more clear Day; and therefore some may be liable to attribute that to the *Apparatus*, which may be better accounted for by the watry Particles in the Air; which may be liable to 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, 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 to be given 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 many 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 to 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 Person, who liv'd 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? And its subsisting together in that Hurricane shews, I think, very plainly, that if its Cohesion had not been natural, the Wind would then have scatter'd it.

Though I apprehend that the Four Elements of Fire, Water, Earth, and Air, may never have been increased or diminished, since the Great GOD of Order created them, yet I can also apprehend each of them unequally dispers'd 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 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; which, if its Properties are to invigorate all Nature, you must of course suppose its Power not to be controul'd; 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, or by the Disorders 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 insentive Thing is only so because its Fire is quenched."

It had been impossible that this wonderful *Phænomenon* of Electricity should ever have been discover'd, if there had not been such Things as are non-electricable. For, as fast as this Fire had been driven on any thing, its next Neighbour would have carried it further: But, when it was most wonderfully found out, that any thing which was suspended in 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 also is a Non-electricable), it could no more part with its Fire, than when suspended in a silk Cord, I think it will become worth Inquiry, why they are not electricable.

To prove 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, can no longer be supposed to be capable of them; and therefore must be consider'd 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 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 Plants? Which Plants, whilst they remained in the Life of Nature, had nothing but their unalter'd Juice in them. Pitch and Resin 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 acknowledg'd 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 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, 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 may be supposed, that the Flame of Fire is produced out of the Air, only; the Wax or Resin being a fatty sulphureous Matter, which, as Coals, may likewise be supposed to serve as a *Pabulum*, fitly adapted only to let this Element pass through it, for the Purposes here described.

The more of the Air that passes through 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; though, before, the same Materials were employ'd. 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 through 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 this my Conjecture 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, and that Space was left full of stagnated Air, and therefore could not admit of fresh to enter, it became impossible for Fire, or any living Creature, to subsist there.

The Cure of this Evil is performed in Mines by a Horse-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 many other Animals, just as Damps did: Now how will you account for this, if you suppose not that its 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 nigh to your Cheek and 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.

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

First, I will endeavour to shew, Why an electrify'd Body will kindle an *Alcohol*, or rectify'd Spirit of Wine, and many other compounded 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, 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, if it consisted of many Tons Weight, as soon, and 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 Suspension 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 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 being the greatest Quantity of Iron, and in the best Shape, they could get it for Suspension. And were a Person 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 them.

Now, as, by the Contrivance of Man, here is more of this Fire crouded together, than was intended by the Author of all Uniformity, seeing, 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, 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 every thing, as this seems to do.

I am to shew, first, the Cause of its kindling a Flame in certain compounded 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, as is shewn, 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 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 fiery Particles one to another: For, if all Nature be agitated by this Fire, all 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 consider'd 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 Smoak of a Candle just blown out to kindle it again, will do.

As therefore there is a trite Proverb, passing universally, that *where there is Smoak 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 supposed Fire I have been speaking of. For, now, suppose you see the Flame of a Candle circumscribed and limited in its Shape and Size, which it has 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 every Body when it is 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 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 further than in the Flame of that Candle? Yet every body, on Recollection, knows, that the Flame will heat Parts at a great 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 occasion'd by Electricity. For, till you touch this *Capsula* of lambent Flame (which is commonly to be met with near a Quarter of to Half an Inch short of 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 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 nigh the Ear, from the Electricity passing through the different shaped Pores of it.

And furthermore the Wind may seem 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.

The third Thing I proposed to shew, is, Why the electrical Power departs from one Thing to another by giving a smart Crack, and send-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 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 if you consider, that you may as effectually electrify one Quantity of Iron as another, that it may be done to many Ton Weight as easily as to a small Piece, and that, when it departs into a Person, 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, that if this Repercussion, or infinite Recoil, from so large and solid a Body, be so great, when its Power is thus sent, what may it not do in its utmost Extent?

Having now, I think, gone thro' what I propos'd to shew, and given a Reason, as far as my Conjecture reaches, for every *Phænomenon* which I have seen 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, it 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 more 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, and 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 Resin, 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 Body or Thing.—This I think seems to me to give as great a Proof of the Truth of my Conjecture as the Nature of the Thing can admit of, respecting the Sensitive Plant.

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

Now, if there was 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 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, begotten 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.

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 what 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 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 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, that 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 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 offer'd to your Consideration, is it not natural for any of this Fire, which passes as frequently through the Air in the Daytime (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 Writers about it chuse 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 chuse rather to suppose, that the Air is an Element as well as Fire, and that the Difference 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 the Air on the Top of the Tube, which was extracted or emerged out of the Quicksilver, by the Weight of the said Quicksilver, 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 met with.

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

I remember that a Person, riding in an open Chaise, in an Easterly Wind, receiv'd a Stroke upon one of his *Scapula's*, 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 happen'd; 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

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 there as to a proper *Nidus*, or whether they are brought in this Fire, which seems plainly to have burn'd the Leaves, I will not undertake to account for.

I am, &c.

The kind Reception this small Treatise has met with from the Public occasions the Printing this 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 than either, I absolutely have no Concern about them.

There are those, 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; 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 instance in 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 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, Resin, and the Tribe of Non-electricables, never had their Existence from Nature only; and 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 Dye, 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 *Phænomenon*, which might properly be 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, chusing 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 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, are bound to try all Means to gain Applause. I would endeavour to ascertain the Laws or Principle 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 Resin (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 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 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 Yesterday 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 such an unmannerly Abuse from a Country Show-man, who published some Experiments, and owns 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 Booksellers; 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 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 are more Answers to Books written to pay a Landlady, or an Alehouse-Score, than from any other Cause; especially, if they 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 Headach from his Thinking too intensely.

FINIS.

Transcriber's note:

Width of em-dashes has been regularised.

Page 8, 'unphilophical' changed to 'unphilosophical,' "how unphilosophical and unmeaning"

Page 16, 'mortuum' changed to 'Mortuum,' "as a Caput Mortuum. Of"

Page 27, 'convergeing' changed to 'converging,' "prove this converging Fire"

Page 31, 'wil' changed to 'will,' "so it will be"

Page 56, 'whetever' changed to 'whatever,' "then, whatever ceases to"

Page 57, second 'to' struck, "ceases to be in"

*** END OF THE PROJECT GUTENBERG EBOOK AN ESSAY TO SHEW THE CAUSE OF
ELECTRICITY; AND WHY SOME THINGS ARE NON-ELECTRICABLE ***

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