

VI. *Experiments of the Luminous Qualities of Amber, Diamonds, and Gum Lac, by Dr. Wall, in a Letter to Dr. Sloane, R. S. Secr.*

S I R,

HAVING lately observ'd several natural solid *Noctiluca's*, not hitherto by any, as I know, taken notice of, (I think I may be well assur'd some of the *Phaenomena* never were,) at your Request I give you the larger account of 'em: But, before I speak of my own Observations, give me leave to inform you a little concerning the Artificial *Phosphorus*, which, you know, is a Subject I'm pretty well acquainted with, having made a great number of Experiments about it, whereby I was naturally led to the following Remarks.

You may remember my telling you many Years ago of my good Friend Mr. *Boyle's* communicating to me, about the Year 1680, his way of making the *Phosphorus* with Urine, at the same time desiring me to use all my Endeavours to find out some other Subject, from whence it might be made in greater Quantity, and perhaps he might have made the like Request to many more; for, to use his own Words, he said, he really pity'd his Chymist, who was forc'd to evaporate so prodigious a Quantity of Urine, to get a very little of the *Phosphorus*. Soon after, in order to see some Experiments in Chymistry, I lodg'd for a short time at his Chymist's House, one Mr *Bilgar*, then living in *Mary-le-Bone* Street near *Piccadilly*, who indeed was equally, if not more importunate with me than Mr. *Boyle*, to try if I cou'd find out some other

other Matter, from which more might be made than from Urine, telling me there was so great a demand for it, that it wou'd be of very great advantage to him. It being then a very hot Summer, I caus'd a piece of the dry'd Matter in the Fields, where they empty the Houses of Office, to be digg'd up, in which, when broken in the Dark, a great number of small Particles of *Phosphorus* appear'd: This Matter I carry'd to Mr. *Boyle*, who view'd it with great Satisfaction, and Mr. *Bilgar*, by his Direction, fell to Work thereon, but from it cou'd make very little or no *Phosphorus*, till another Matter was added to it in Distillation, and then he cou'd therewith make large Quantities, to his great Profit; for while I was at his House, I often saw him make it, and sell it for six Guineas, and six *Louis d'Ors* an Ounce, whereby he got so much Money, that, I believe, he thought himself above his Business, and quickly left *England*; so that we lost an Honest and Ingenious Chymist, and Mr. *Boyle* a Faithful and Industrious Servant. I forbear to mention the abovesaid Matter in kindness to Mr. *Godfrey*, who succeeded Mr. *Bilgar* as Chymist to Mr. *Boyle*, and is the only Person, that I know of, who now makes it.

Now, *Sir*, my being, as you have heard, well acquainted with the Artificial *Phosphorus*, was the occasion of my making many Reflections about it, and caus'd me to consider, whether there might not be *in rerum natura* other natural ones, besides those that Mr. *Boyle* and some others have given an account of.

You well know, *Sir*, that Humane Urine and Dung do plentifully abound with an *Oleosum* and Common Salt, so that I take the Artificial *Phosphorus* to be nothing else but that Animal *Oleosum*, coagulated with the Mineral Acid of Spirit of Salt, which *Coagulum* is preserv'd and not dissolv'd in Water, but accended by Air.

These Considerations made me conjecture that *Amber*, which I take to be a Mineral *Oleofum* coagulated with a Mineral Volatile Acid, might be a Natural *Phosphorus*, so I fell to make many Experiments upon it, and at last found, that by gently rubbing a well polish'd Piece of Amber with my Hand in the dark, which was the Head of my Cane, it produc'd a Light; whereupon I got a pretty large piece of Amber, which I caus'd to be made long and taper, and drawing it gently thro' my Hand, being very dry, it afforded a considerable Light. I then us'd many Kinds of soft Animal Substances, and found none did so well as that of Wool. And now new *Phænomena* offer'd themselves; for upon drawing the piece of Amber swiftly thro' the Woollen Cloth, and squeezing it pretty hard with my Hand, a prodigious number of little Cracklings were heard, and every one of those produc'd a little flash of Light; but when the Amber was drawn gently and slightly thro' the Cloath, it produc'd a Light but no Crackling; but by holding one's Finger at a little distance from the Amber, a large Crackling is produc'd, with a great flash of Light succeeding it, and, what to me is very surprizing, upon its eruption it strikes the Finger very sensibly, wheresoever apply'd, with a push or puff like Wind. The Crackling is full as loud as that of Charcoal on Fire; nay, five or six Cracklings, or more, according to the quickness of placing the Finger, have been produc'd from one single Friction, Light always succeeding each of 'em. Now I make no question, but upon using a longer and larger piece of Amber, both the Cracklings and Light would be much greater, because I never yet found any Crackling from the Head of my Cane, altho' 'tis a pretty large one; and it seems, in some degree, to represent Thunder and Lightning; but what to me is more strange than all I have been telling you is, that tho' upon friction with Wool in the day time, the Cracklings seem to be full as many and

as large, yet by all the Tryals I have made, very little Light appears, tho' in the darkeſt Room; and the beſt time of making theſe Experiments, is when the Sun is 18 Degrees below the Horizon; and when the Sun is ſo, tho' the Moon ſhines never ſo bright, the Light is the ſame as in the darkeſt Room, which makes me chuſe to call it a *Noſtiluca*.

I will not preſume to give you my Thoughts concerning Amber, (which ſeems to be a Receptacle, and an inexhauſtible Treafure of Light;) why upon a hard friction the Light ſhould, as it were, be ſtrain'd out of ſuch a number of places? Nor why upon an eaſie friction it ſhould not give thoſe Cracklings and Light, unleſs the Finger, or ſome other Body, be held at a little diſtance from it? Nor why in a dark Room, tho' it Crackles, it ſhould give little or no Light till the Sun is near down? But I have mention'd theſe few things, amongſt many others, to ſee if I cou'd provoke you, *Sir*, to give me your Thoughts about them, not knowing any one ſo capable of doing it as your ſelf: And the Friendſhip you have always profeſs'd to me, makes me hope you'll be pleas'd to excuſe this irregular account of my Obſervations, for you have 'em in the ſame order juſt as I made 'em.

As the Artificial *Phoſphorus* led me to that of Amber, ſo Amber directed me to that of a *Diamond*, from its being Electral as well as the other, which is alſo a Natural *Phoſphorus*, or rather a *Noſtiluca*, exceeding all others, and may, without any Exception, be call'd a Mineral *Phoſphorus*, it being, as I think, the moſt pure of all *Oleoſums*, coagulated with a Mineral *Acidum*; and if in the Diſcovery of this I have not oblig'd the Learned, I'm in hopes I ſhall all thoſe who deal in *Diamonds*; for none of the many I have talk'd withal know any thing of the Matter; tho' Mr. *Boyle* has given the World an Account, at the latter end of his *Book of Colours*, of Mr. *Clayton's* *Diamond*,

Diamond, and afterwards says, that some Diamonds would, and some would not shine in the Dark: But if any one else has since then made a Discovery, that all Diamonds would give Light in the Dark, they have been very unkind to the World in not letting them know it, because I'm well assur'd that a great many People have been but too often cheated with 'em, which I hope to prevent for the future; but thus much I must take leave to say, that I never understood any such thing till I discover'd it my self, tho' now I remember, that Mr. *Boyle* several times spoke to me of Mr. *Clayton's* Diamond, lamenting that he cou'd not prevail with the Owner to part with it at any rate. I have now by me a yellow Diamond, which I have shewn to a great many Jewellers and others, and but a very few of 'em will allow it to be a Diamond; but by as many Tryals as I have made, I think my way of distinguishing Diamonds is so certain, that none need fear to affirm 'em to be so, even upon Oath.

A Diamond, by an easie slight friction in the Dark, with any soft Animal Substance, as the Finger, Woollen, Silk, &c. appears in its whole Body to be Luminous; nay, if you keep rubbing for a little while, and then expose it to the Eye, 'twill remain so for some little time: But if the Sun be 18 Degrees below the Horizon, if any one holds up a piece of Bays or Flannel stretch'd tight between both hands, at some distance from the Eye, and another rubs the Bays or Flannel with a Diamond swiftly and pretty hard on the other side of it, the Light to the Eye of him that holds it, seems much more pleasant and perfect than any other way I have yet try'd. But what to me seems more surprizing than all I have mention'd, is, that a Diamond being expos'd to the open Air in view of the Sky, gives almost the same Light of it self without rubbing, as if rubb'd in a dark Room; and if in the

open Air you put your hand or any thing else a little over it, to hinder its Communication with the Sky, it gives no Light: And I do assure you, I have try'd all or most of the other Precious Stones, but could find no such *Phenomenon* in any of them; and I must further add, that all the Experiments here related were made at the latter end of *May* and beginning of *June*, and therefore I can't pretend to account for the *Phenomena* that may attend Experiments made while the Sun is on the other side of the *Equator*.

There are some other Bodies that afford Light, and perhaps many more remain yet undiscover'd, but I'm well assur'd, that all or most of the Bodies which have an Electricity yield Light; for in my Opinion, 'tis the Light that is in 'em, which is the cause of their being Electral, yet this Electricity never shows it self without friction; if you rub any Body that has an Electricity, and apply it near to some light Bodies, as particularly very thin Slices of Cork, 'twill put them into a great Agitation, and make them seem to the Eye as hanging at the Body by a fine Hair.

I forbear speaking of Jet, which seems to me to be a black Amber, having most of the Properties of Amber, but not so perfect and pure.

I must not forget to speak of another Substance so frequently made use of by almost all sorts of People, not hitherto by any, I as know, taken notice of to be endu'd with a luminous Quality, which is also another Natural *Phosphorus*, or *Noctiluca*, and that is *Gum Lac*, and also Red Sealing-Wax, which is made with *Gum Lac* and *Cinabar*, the *Cinabar*, no way impeding, but rather promoting its Luminous Quality, for I caus'd long taper Rolls to be made up of *Lac* alone, and of pure Red Sealing-Wax, both being well polish'd: The Sealing-Wax upon friction, seems to me to emit its Crackling and Light sooner than the *Lac*, which

I impute to the *Cinabar's* constringing its parts, tho' I think *Lac per se* has the greatest Electricity, both having all or most of the Properties of Amber; and by all the Tryals I have hitherto made of *Lac* and Sealing-Wax, I find that tho' the Cracklings are as plentiful in the day time, as when the Sun is down, yet in the darkeſt Places I cou'd discover but a little appearance of Light, ſo that this deſerves the Name of a *Noctiluca* or *Phosphorus*, as well as the others already ſpoken of, it being no other than a Vegetable *Oleoſum* coagulated with an Animal Volatile *Acidum*. I don't know in the Animal Kingdom, any thing but Piſmires that affords a Volatile Acid, and in the *East-Indies* there's a large kind of em, that live on the Sap of certain Plants, affording both a Gum and a Colour, which Sap paſſing thro' the Body of thoſe Inſects or Animals, is by their Acid Spirit converted into an Animal Nature; which is the reaſon that with the Colour extracted from *Gum Lac* (which *Gum Lac* is nothing elſe but the Excrements of theſe Inſects or Animals) almoſt as good and full as laſting Colours are made as from *Cochinele*: I'm the more confirmed herein, becauſe I know of an Artificial way of converting Vegetable Colours into an Animal Nature very much like this, by which the Colours are made more pleaſant and permanent, the Method whereof I ſhall forbear mentioning at preſent, and refer it to what I may hereafter have occaſion to write in relation to Colours. After the ſame manner the remaining Gum, which is an *Oleoſum*, being digeſted and paſſing thro' the Bodies of thoſe Inſects or Animals, is by their Volatile Acid converted into a Vegetable-Animal *Phosphorus*, or *Noctiluca*; the Artificial *Phosphorus* is a Mineral-Animal *Phosphorus*, whereas I take the others to be altogether Mineral.

Perhaps, Sir, this haſty and ſhort Account of my Obſervations may by ſome be thought little better than a

Trifle, so might probably be the attraction of Iron by the Loadstone, when that was the first observable *Phænomemon* in it; which tho' small in it self, yet gave to the Curious an occasion of finding out the other Properties of that Mineral, which have been since improv'd to an Universal Benefit in the discovery of new Arts and new Worlds. And I am not without hopes but that some more elevated and happy Genius may arise, under whose Conduct these Hints may be carry'd on to an height not easie to be foreseen by Persons of short Views, whose Conceptions are confin'd within the narrow limits of what's already known, and whose Self-sufficiency sooths 'em with a *Ne plus ultra*.

Thus, *Sir*, I please my self with the remote prospect of new Scenes in Nature, which, tho' imperfect at present, may in time by some skilful Hand be finish'd and fitted for a nearer view, tho' before that time shall come, nothing may remain of me besides this Testimony of my good Will to Mankind, and particular respect for you.

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