

eye must admit very little light, though it may allow great distinctness of vision.

In measuring different parts of the eye, I was assisted by Mr. Aspdin, an ingenious watch-maker, in this town.

OBSERVATIONS *on the* KNOWLEDGE *of the*
ANCIENTS *respecting* ELECTRICITY ; *by*
WILLIAM FALCONER, M. D. F. R. S.
Communicated by Dr. PERCIVAL.

READ MAY 2, 1788.

IT is, I believe, generally allowed, that Electricity, considered as a principle, or quality, pervading all nature, was unknown to the philosophers of antiquity. It is, however, admitted, that some of its effects were observed by them, but their observations led them to believe, that it was a peculiar property of certain bodies only, and not that it was, as it now appears to be, one of the most general and active agents in the natural system. Theophrastus is, as far as I know, the first writer that has remarked the attractive power of bodies to one another, distinct from the attractions of gravity and magnetism.

netism*. He speaks in his Treatise on Stones, of
 “amber dug on the coast of Liguria, which had
 “an attractive power. He intimates, that the
 “clearest had this property in the highest de-
 “gree, and that it would attract iron.” The
 same writer ascribes similar properties to the
 lapis lyncurius, which is now believed to be
 the tourmalin, though it was formerly esteemed
 to be the same with amber. Theophrastus,
 however, clearly distinguishes them from one
 another, though he ascribes the same attractive
 properties to both. “It possesses†,” he says,
 “an attractive power like amber; and, as they
 “say, attracts not only straws, and leaves, but
 “copper also, and iron, if in small particles.”

Pliny gives a similar account. “Amber‡,”
 says he, “being rubbed with the fingers, and

* και γαρ ορυκτον περι λιγυσινην. Και τουτο αν η του ελκειν
 δυναμις ακολουθοιη μαλιστα δε επιδαλος και φανερωτατη η τον σιδηρον
 αγουσα. Theophrast. περι λιθων.

The contrary is now thought to be the case, as the
 cloudy amber is thought to be the most strongly electric
per se. See Dr. Milner on Electricity.

† Ελκει ωσπερ το ηλεκτρον. Οι δε φασιν ε μονον καρφην, και
 φυλλα, αλλα και χαλκον, και σιδηρον, εαν η λεπτος. Ibidem
 Theophrasti.

‡ Cæterum attritu digitorum acceptâ, vi caloris attra-
 hunt in se paleas & folia arida, ut magnes lapis ferrum.
 Plin. lib. XXXVII. cap. 3.

Nec folia autem aut stramenta in se rapere, sed æris aut
 ferri laminas. Ibidem Plinii.

“having thereby become warmed, attracts to
 “itself straws and dried leaves, in the same man-
 “ner as the magnet does iron.” He ascribes
 the same properties to the lapis lynceus. Soli-
 nus*, Priscian†, and, I believe, many other
 writers have noticed the same quality of that
 stone.

But the attractive power which electricity
 imparts to bodies, is not the only property of
 that fluid that was known to the ancients.
 They were acquainted with the effects of the
 electric shock; and have minutely described the
 sensations occasioned thereby, upon the human
 body. I do not however mean to insinuate, that
 they apprehended any connection to subsist between
 the attractive power just spoken of, and that
 which I am about to mention. It is now proved,
 beyond a doubt, that the benumbing power, which
 is found in the torpedo, and several other fishes, is,

* *Lapidi isti ad succinum color est pariter spiritu attra-
 hit propinquantia. Solin. cap. II.*

† *Paleas rapiunt tractu frondesque caducas. Prisc. in
 Periegesi.*

In Syria quoque foeminas verticillos inde facere & vo-
 care harpaga, quia folia & paleas vestiumque fimbreas ad se
 rapiat. Plin. XXXVII. 3.

The word by which amber was known among the Arabs
 (karabe) is said by Avicenna to be of Persian origin, and
 to signify its power of attracting straws. Salm. De homo-
 nym. hylés iatricæ.

in reality, produced by the electric stroke, which they have a power of imparting to any object they please, with which they come in contact; and is indeed the method they have both of defending themselves, and providing food. Aristotle says, that the torpedo* “causes, or “produces a torpidity upon those fishes it is “about to seize, and having by that means got “them into its mouth, feeds upon them.” He adds, “that this fish hides itself in the sand and “mud, and catches those fish that swim over it, “by benumbing them; of which,” he says, “some have been eye-witnesses. The same fish “has also the power of benumbing men.” Pliny says, “that this fish† has the power of “communicating its benumbing quality, if “touched with a spear, or a rod; and is able to “impart a torpor over the strongest muscles of “the body; and, as it were, binds and stops the “feet even of the swiftest persons.” Galen‡

* η τε νερκη νερκαν ποιουσα ων αν κρατησειν μελλη ιχθυων, τω τροπω ον εχει εν τω στοματι λαμβανουσα, τρεφεται τουτοις. κατα- κρυπτεται δε εις την αμμου και πηλον· λαμβανει τε τα επινεοντα οσα αν νερκηση επιφορομενα των ιχθυων· και τουτου αυτοπλιν γεγεννηνται τινες. — η τε νερκη φανερα εστι, και τοις ανθρωποις ποιουσα νερκαν. Arist. Hist. Anim. L. IX. 37.

† Torpedo etiam procul & e longinquo, vel si hastâ virgâve attingatur, quamvis prævalidos lacertos torpescere facit, & pedes quamlibet ad cursus veloces & alligat & retinet. Plin. XXXII. 1.

‡ Galen de locis affect.

says,

says, “ that the torpedo is endued with such a
 “ a power, that if it be touched by the fisherman
 “ with his eel spear, it instantly stupifies the
 “ hand, transmitting this power through the
 “ spear, to the hand.” Plutarch* says, “ that
 “ it affects the fishermen through the drag-net;
 “ and, that if any person pours water on a living
 “ torpedo, the sensation will be conveyed through
 “ the water to the hand.”

Oppian has gone still farther, and has discovered the organs by which this fish is enabled to produce this extraordinary effect, which he ascribes to “ two† organs of a radiated texture,
 “ which are fixed, or grow on each side of the
 “ fish.” Claudian has written a short poem on the torpedo, but he mentions no qualities of it different from those which have been recited above, save that it can convey its influence from the hook, with which it is caught, to the hand of the fisherman. From the above accounts we see, that the philosophers of antiquity had accurately observed the nature of this extraordinary influence, though they knew not to what

* Plutarch de Solert. Anim.

† Ἀλλὰ οἱ ἐν λαγόνεσσιν ἀναλκμείης δόλος ἀλκή,
 Κερκίδες ἐμπεφύασι παρὰ πλευρὴν ἐκάτερθεν
 Ἀμφιδύμοι, τῶν εἰ τις ἐπιψαύσειε πελάσσης,
 Αὐτίκα οἱ μέλεωσ' σθένος ἐσβέσεν.

Opp. lib. II. ver. 62.

general

general principle it ought to be ascribed. They noticed the sensation, and its effects on the body, the use the fish makes of this property for its defence and support, and that the fish had the power of conveying it through wood, metals, hemp or flax, and even through water; and lastly, that this extraordinary power was lodged in organs peculiar to the fish, a fact which the late accounts of the dissection of the electrical eel farther confirm. It is remarkable, that Pliny ascribes this power of the fish to a certain invisible agency, and calls it by the same name* that has been applied by later writers to denominate the electrical influence.

It is farther worthy of remark, that the electrical shock, imparted by means of the living torpedo, was used in medicine. Vossius† mentions, from some ancient authority, that an inveterate

* Quod si necesse habemus fateri, hoc exemplo, esse vim aliquam, quæ odore tantum & quadam *aurâ* sui corporis afficiat membra, quid non de remediorum omnium momenti sperandum est. Plin. XXXII. cap. i.

† It appears to be from Scribonius Largus.

Capitis dolorem quemvis veterem & intolerabilem protinus tollit & in perpetuum remediat torpedo viva nigra, imposita eo loco qui in dolore est, donec desinat dolor & obstupefeat ea pars, quod quum primum senserit, removeatur remedium, ne sensus auferatur ejus partis. Plures autem parandæ sunt ejus generis torpedines, quia nonnunquam vix ad duas, tresve respondet curatio, id est, torpor quod signum est remediationis. Scrib. Larg. cap. i.

head

head-ach was cured by the application of a living torpedo to the part where the pain was seated. The same remedy was also in use for the gout; the patient* being directed to place a living torpedo under his feet, as he stood on the sea shore, and to continue it until he found the numbness not only affect the whole of the foot, but the leg also, as far as the knee. This remedy is said to have cured Anthero, a freedman of Tiberius Cæsar.

Dioscorides† advises the same remedy for inveterate pains of the head, and for protrusions of the rectum; and Galen‡ seems to have copied him in recommending the same remedy for such complaints. The same application for the head-ach is to be found in Paulus Ægineta,|| and I believe, several other of the later writers on medicine. An ingenious and learned Gentleman suggested to me, that it was probable, that even the method of drawing down electrical fire from

* Ad utramlibet podagram, torpedinem nigram, vivam, quum accesserit dolor, subjicere pedibus oportet, instantibus in litore, non sicco, sed quod alluit mare, donec sentiat torpere pedem totum & tibiam usque ad genua. Hoc et in præsentis tollit dolorem, & in futurum remediatur: hoc, Anthero Tiberii libertus supra hæreditates remediatus est. Scribon. Larg. cap. XLI.

† Dioscorid. lib. II. Art. Torpedo. Vide edit Matthioli. 1560.

‡ Galen. Simpl. Medic. lib. XI.

|| Pauli Æginet. lib. VII. Art. Νάρκη.

the clouds was known in very early times, and particularly to Numa Pompilius, the second king of Rome; and that his successor Tullus Hostilius, perished by his unskilful management of so dangerous a process. Numa Pompilius, we know, was a Sabine, a tract comprehended in the limits of the ancient Etruria, a country from whence the Romans professedly derived most of their religious rites and ceremonies. Diodorus Siculus informs us, that the Tyrrheni or Etrusci, Numa's countrymen, were particularly knowing in every circumstance relative to thunder, as a branch of natural history, which they studied very eagerly: γραμματα τε και φυσιολογιαν εξεπονησαν επι πλειστον, και τα περι την κεραυνουσκοπιαν μαλιστα παντων ανθρωπων εξειργασαντο.

Lib. V. p. 219, edit. Rhodomanni.

Pliny speaks to the same purpose. *Extat annalium memoria sacris quibusdam . . . vel cogi fulmina vel impetrari. Vetus fama Hetruriæ est impetratum . . . evocatum & a Porſenâ ſuo rege.* Numa himself was, undoubtedly, a man of science. He rectified the calendar, and by intercalation brought the lunar and solar years to correspond. He was acquainted with the power of a concave speculum in concentrating the sun's rays, so as to inflame bodies; and it was in this way that the vestal fire was lighted. He instituted religious ceremonies, and formed a college of heralds, and was indeed their principal legislator, in

in what regarded religion and the laws of nations. Among other acts, Livy tells us, that he built an altar on the Aventine mount to* Jupiter Eli-cius, whom, it was given out, that he had a power of drawing down from heaven, to explain what was portended by prodigies, and particularly by thunder and lightnings, and to advise with him on other important occasions. Arnobius, copying Plutarch, says, that Numa not being acquainted with the means of procuring thunder, which knowledge he was desirous to acquire, applied to the goddess Egeria, who taught him the method of drawing Jupiter down from heaven. Now we know, that in the Jewish religion, the visible appearance of the Deity was in the form of a flame of fire; witness the manifestation to Moses, in two instances, and the Shechinah of the temple. The same idea prevailed in the Pagan mythology; Jupiter, when he was obliged to come to Semele† with the characte-

* Quæque prodigia fulminibus, aliove quo viso, missa fusciperentur atque curarentur: ad ea elicienda ex mentibus divinis, Jovi Elicio aram in Aventino dicavit, deumque consuluit auguriis, quæ fuscipienda essent. Livii lib. I.

Eliciunt cœlo te Jupiter, unde minores

Nunc quoque te celebrant Eliciumque vocant.

Ovid. Fastor. lib. III. 327.

† Immistaque fulgura ventis

Addidit, & tonitrus & inevitabile fulmen.

Ovid. Metamorphos. III. 300.

The few lines above are called *Insignia Jovis*.

rific

ristic signs of his presence, came in this manner; to draw down thunder then, and to draw down the Deity, were, according to this acceptation, the same thing; and this. Pliny* testifies, as he says, from good authority, had been often performed by Numa. Let us now examine the account of the death of Tullus Hostilius. Livy† says of him, “ that after examining the Com-
“ mentaries of Numa, and finding there a descrip-
“ tion of certain occult and solemn sacrifices,
“ performed to Jupiter Elicius, he set himself to
“ execute these in private; but from some impro-
“ priety in the commencement and conduct of
“ these operations, he not only failed of being
“ favoured with any intercourse with any celest-
“ tial beings, but was, through the wrath of
“ Jove, excited by his being importuned with
“ such irregular rites and ceremonials, struck
“ with lightning, and consumed, together with
“ his palace.”

* Et ante cum a Numâ sæpius hoc factitatum, in primo annalium suorum tradidit L. Piso gravis auctor. Plin. II. 53.

† Ipsum regem tradunt, volventem commentarios Numæ, quum ibi quædam occulta solennia sacrificia Jovi Elicio facta invenisset, operatum his sacris se abdidisse; sed non recte enitum aut curatum id sacrum esse; nec solum nullam ei oblatam cælestium speciem, sed irâ Jovis, sollicitati prava religione, fulmine ictum cum domo conflagrasse. Livii. lib. I. cap. 31.

Pliny's

Pliny's* account agrees herewith. He says, that Tullus Hostilius, "whilst he was imitating
"in an irregular and improper manner, the pro-
"cess of Numa, for drawing down lightning,
"was struck with a thunderbolt."

Dionysius Halicarnassensis† agrees, that he perished by fire, together with his family; but though he says, that many thought the burning of the palace was an artifice, to conceal the murder of the king and his family, yet himself inclines rather to the opinion that he died by lightning, on account of his improper conduct respecting the sacred rites. All agree that he perished in a storm, and during the performance of a private religious ceremony. Considering the intent of these rites, which were probably composed of some processes, which exhibited appearances of an electrical nature, it is, I think, at least probable, that he really lost his life by his unskilful management.

There is a remarkable passage in Lucan, relative to this subject. Arruns, a learned Etrurian, whom he had before described as skilled in the motions of lightning‡, is said, by him, to have
"collected the fires of lightning that were dis-

* Quod (scilicet fulminis evocationem) imitatum parum rite Tullum Hostilium ictum fulmine. Plin. lib. II. cap. 53.

† Dionys. Halicarn. p. 176, edit. Sylburgii.

‡ fulminis edoctus motus. Lucan.

"perished

perfed through the fky, and to have buried them* in the earth. “What is this, but the description “of the use of a conductor, to fecure buildings “from being ftruck by lightning?”

Let us now fee if any probable conjecture may be formed, concerning the means or instruments which they employed in thefe operations. We know that the Hetrufcans and Sabines, Numa’s countrymen, worfhipped† fpears, and were, indeed, the inventors of thofe weapons. It is probable that they might not worfhip, or employ one fpear only in fuch folemnities, but a number, perhaps a large cafe, or what Homer calls Δουροδηνν†, or a kind of foreft of fpears. The firft places of worfhip were in the open air, the word *templum* § originally fignifying the heaven, or fky. Befides, they were upon high places. The Law was delivered to Mofes upon mount Sinai: and high places are mentioned often || in the fcriptures as

* Arruns difperfos fulminis ignes

Colligit, & terra mæfto cum murmure condit.

Lucan. Phars. I. 606, 607.

† Sive quod hafta quiris prifcis eft dicta Sabinis,

Bellicus a telo venit in astra Deus.

Ovid Faft. II. 477.

‡ Odyff. I. 128.

§ Templum cœlum dictum eft quia ipfum primò tue-
mur. Stephan. Thesaur.

|| Levit. xxvi. 30. Numbers xxii. 41. — xxxiii. 52.

1 Kings iii. 2, 3. — xii. 31, 32. — xiii. 2, 32, 33. — xv. 14.
& fere paffim.

the seats of idolatrous worship. Now, were a forest of spears, with the points upwards, and with the handles of dry wood, or, perhaps, some of the Teribinthinate kind, which are bad conductors, and placed upon an elevated situation, they might, if placed within striking distance, exhibit a luminous appearance, and in certain seasons collect electrical fire, sufficient to make a great discharge; and, as I suppose, to destroy any person within the reach of their influence. This is not altogether matter of conjecture. Plutarch says, that balls of fire were seen to rest on the points of the soldiers' spears, and we know, that in our own times, in the Mediterranean sea, it is common for balls of fire to rest on the rigging of the ships, which appearances were formerly called by the names of Castor and Pollux; and in later times, the fires of St. Helmo, and are thought to foretel good weather. Was it from this opinion, that St. Paul's ship, mentioned in the Acts of the Apostles, had the images of Castor and Pollux on its prow. Livy* speaks of a spear, in a house, that burned more than two hours, yet without being consumed. Could this be any thing but electrical?

It should be observed, that Numa did not build a temple, but an altar, in the open air, to

* Fregellis in domo L. Atrei hasta, quam filio militi emerat, interdiu plus duas horas arsisse, ita ut nihil ejus ambureret ignis, dicebatur. Liv. XLIII. 13.

Jupiter Elicius, and that it was situated on a hill, namely, the Aventine Mount. But Tullus Hostilius, it is said, was in some retired part* of his house, and alone,

A spear, however, might become electrical in a thunder storm, in which Tullus Hostilius is said to have perished, even in a house; witness the story from Livy, mentioned above; but we may suppose, that he might be on the house top, which was a common place of worship, and there have erected his apparatus for drawing down lightning. That this was a common place for idolatrous worship, we learn from the scriptures. The book of Kings† speaks of the altars, that were on the top of the upper chamber of Ahaz. Jeremiah‡ speaks of “the
“houses, upon whose roofs they have burned
“incense unto all the host of heaven, and have
“poured out drink-offerings to the gods.” Zephaniah || mentions those “that worship the host of heaven on the house tops.” Might not

* μελλοντος δε Τυλλου θυσιαν τινα κατ’ οικον επιτελειν, αυτους μονον εβουλετο τους αναγκαιους ειδεναι, κατα τυχην της ημερας εκεινης χειμεριου σφοδρα γενομενης, κατα τε ομβρον και ζαλην και σκοτον. Dionys. Antiq. Rom. lib. III. p. 176, edit. Sylburg.

Is it not probable from hence, that these sacrifices were commenced on the approach of storms?

† Kings, book II. chap. xxiii. 12.

‡ Jerem. xix. 13. || Zephaniah i. 5.

then Tullus Hostilius, supposing him placed in an elevated situation, and upon the top of a building, and surrounded by, or in the neighbourhood of a number of spears, placed with their points upwards, receive a stroke by their means from an electrical atmosphere; or might not an electrical cloud be so attracted and discharged upon a multitude of metalline points, terminating in bad conductors, as to explode and destroy him, and burn the house: and might not Numa be instructed, how to conduct this process with greater safety, though, perhaps, not scientifically? But many a house is preserved by conductors, whose inhabitants, and even the artificers that erected them, are nearly ignorant of the rationale of the matter.

ESSAY *on some supposed* DRUIDICAL REMAINS,
near HALIFAX *in* YORKSHIRE; *by* Mr. THOMAS BARRITT.

READ OCTOBER 19, 1787.

ABOUT a mile westward of Saddleworth church, in the county of York, is a high hill, which commands an extensive prospect over the adjacent country. It is called, by the neighbouring people, POTS AND PANS. Upon the summit



Falconer, William. 1790. "Observations on the knowledge of the ancients respecting electricity." *Memoirs of the Literary and Philosophical Society of Manchester* 3, 278–292.

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