Notes
on
Prof. Lecture
on
Hist.
Chem. Phenomena

— Observer —

Dr. Davy's Lectures at the Royal Institution commenced on the 19th Dec. 1810.

Few events in the history of Science have caused more curiosity and expectation than the discoveries he has lately made. The new views they disclose respecting many of the operations of nature, and they will effect in the theory of Chemistry fully justify the interest they have raised.

Mr. D. congratulated the members of the Institution on the improvements which had taken place in the arrangements of the Society, by which in future, it would be enabled to promote, more effectually, the cause of Science. He informed

Lecture 2 – 26 Jan.y 1811

In this Lecture Dr. Davy oppos.d the doctrine of Berthollet that Ch.l affinity was affected by the mass or quantities of the substances employed, a large quantity overpowering a weaker affinity. The experiments which have been brought forward to support this doctrine are not exact; when sulphat of Baryles had been decomposed by Potash, it had been by double affinity, the Carbonic Acid uniting with the Baryles; when pure Potash was used, no decomposition took place. This is a most important discovery, as it seems Ch.l affinity from the confusion and uncertainty which would attend its operations, were the opinions of Berthollet established. Dr. D. stated that it would be proved by experiment that bodies always combine together in definite proportions, and that Ch.l affinity has a certain invariable force.

In the course of the lecture he exhibited a newly discovered gas called Fluoboracic, which has a more powerful attraction for the moisture of the atmosphere than any substance hitherto known, and affords the means of ascertaining the quantity it may at any time contain.

Magnetism, Elect.y and Chem.l affinity have a connection with each other. Elec.y will communicate Magnetism to steel. When a magnet is broken into number of pieces, each piece has its proper poles, and its attracting and repelling poles. The Tourmaline a Crystal from Ceylon, when heated becomes Electric, the opposite poles of the Crystal presenting opposite states of Elect.y. Chem.l affinity is the effect of Ch. affinity when the Ch. in bodies in given each piece has the same Ch. power and the opposite powers of the centre

Chrystals have also their opposite states of Electricity and their polar axes. How may be found the connexion between these oppositions of these mysterious powers. The subject Dr D. observed was full obscurity, but when the first streak of light was discerned on the distant horizon it was reasonable to hail it as the harbinger of more perfect day.

Lecture 3 – 2 Feb. 1811

In this Lecture Dr D. explained the operations and effects of heat in its combinations with Water, Steam and Gaseous bodies. He described the various instruments that had been invented to measure its intensity, and said that Mr James Watt had invented that the Pyrometer of Wedgwood, consisting of pieces of clay, could not be depended on, for when the clay was exposed a long time to a moderate heat, it contracted as much as when submitted for a short time to the action of a more intense temperature. Dr D observed that the opinion generally given in the works of Chemistry, that combustion was always accompanied with a change of Vol. and Capacity, was incorrect. The combustion of Charcoal with Oxygen Gas or common air, is attended

with intense heat and light, yet the volume or quantity of air remains the same as before.
He was also of opinion that the explanation of this fact must be sought in the connection between heat and the [illegible], which would be the subject of a future Lecture.
The most interesting part of the lecture was that which treated of the effect of heat upon Animal life. When arterial blood or its serum was found capable of existing in air heated to more than 212° or more than the heat of boiling water, but a very remarkable circumstance attending it was the state of the blood, which had been raised little more than two degrees, by the exposure of the body to this burning Atmosphere
The Negro of the Torrid zone, the Greenlander of the Arctic circle, and the inhabitant of milder regions possess the same degree of animal heat. The blood of the whole being that lives on the ice and of the whole family is nearly at a temperature of 98°
Dr Crawford had attempted to prove that respiration was the cause of animal heat. Dr D. was inclined to believe that animal heat was the effect of all the different changes and operations that were going on in organized living bodies. It had lately been shewn before the Royal Society, that the nerves of some animals might be entirely destroyed, and respiration be still continued, but unattended by animal heat; from whence it would appear that the Nervous System was more necessary to its production than the sanguineous or then respiratory and circulating.
Dr D. wished, particularly, to direct the attention of Philosophers to the effects of life on Gaseous material substances
It appeared even to have the power of modifying and changing

The effects of one of the most powerful elements, that of heat. In vain had it been attempted to explain the causes of life by changes produced dependent on Chemical or mechanical principles. Life and motion were not the effects of these changes, they were themselves causes producing them from a higher principle which is mind.

Lecture 4th — 9th Feb.y 1811

On the radiation of heat, its connection with light, and the dependence of their effects on the property of light analogous to polarity, and on the connection of heat and light with Electricity.

Dr. D. begun with stating that heat is communicated by contact, and also by radiation; he repeated a variety of Mr. Leslies experiments on the different degrees of heat when radiated from different coloured bodies. Black surfaces absorb, and emit radiant heat more rapidly than any others. Charcoal heated to the same degree as a polished metal, and placed at a certain distance from a Thermometer, raises its temperature much more rapidly than the polished metal placed at the same distance, as was proved by an experiment of Count Rumford on this principle he explained

the reason why polished metallic
vessels preserved the heat of tea longer
than those of common Earthen ware
of China, particularly if black colour.
Heat is not transmitted through glass
like light; from this and other circumstances, M. Leslie had concluded
that heat consists in certain aerial
Pulsations like sound. D. D observed
that a variety of experiments did not
support this conclusion; for
heat is in some instances transmitted
through glass, and also radiated more
powerfully in Vacuo than in Air.
Heat, from the Galvanic combustion
of Charcoal immediately affects a Thermometer in the form of a Cone. Pulsations
were in Vain applied to a White heat
by a powerful Voltaic Battery, and a
Thermometer stood at a certain distance
from it, sooner than when in the sun,
in the ratio of 6 to 15 or in ⅓ the
time. These facts could not be explained by the theory of Aerial
pulsations.

By the commonly received opinion
on this subject, and this by that of M.
Leslie, the quantity of heat in the Earth
must be constantly accumulating,
from the constant heat of the sun, by
insulation, and as Parabolas had formerly supposed, the accumulation
would go on until a general conflagration took place; this D. D. observed
was contrary to experience, and implied
an imperfection in the System, and
all theories which supposed a defect in
the works of Providence ought justly
to be suspected.

The reactions of invisible rays from
the sun producing heat, discovered by
D. Herschel, had been doubted, but was
since fully proved; and also another
distinct species of solar rays, which
produced powerful Chemical effects. Mr
D. D. gave an elegant translation of
a passage in Lucretius in which the
Poet imagines what has been since
proved, that besides light & other rays
of various kinds, and producing various
effects, are constantly emitted from the
sun.

Various circumstances employed by
Priestley & Englefield particularly those
attending the double separation in the

Iceland Chrystal. D. D produces one of these Chrystals, and explains the progress of a ray of light through it. The double refraction, he observed, always took place on the plane in a line with the axis of the Chrystal. On a subject so new, and in some degree intricate, it was impossible, without diagrams, to give more than a very faint outline; every friend to science will wait with ardent expectation for a full explanation of D. D.'s views of this interesting part of Nat.l Philosophy. With a certain angle of incidence, there is only one refraction. By passing the light through two Chrystals at a certain angle of incidence, four refractions take place. When the Chrystal was broken in pieces each piece had the same Rhomboidal form, and possessed the same powers of double refraction as the larger Chrystal. The frotundity of Chrystals had been stated in the former lecture. D. D was inclined to believe that each particle of light has also its proper axis, and attractive and repelling poles, and that it was on the same principle as those of Electrical and Magnetical attractions and repulsions, that the refractions and reflections of light were to be explained.

D. D. combated the theory that light consists of certain undulations of an Ethereal fluid. He was also inclined to believe that light and heat were not specific substances. The decision of Sprengel that had been admitted into the new system of Chemistry, without sufficient examination, because it gave an easy explanation of many facts; those also others, however with which it was in direct discordance. The heat excited by hammering a nail had been explained in the same manner as squeezing water out of a sponge, and the nail could not be restored to its former state, but by heating in the fire; yet if a high degree of heat be employed the iron may be kept constantly hot. Count Rumford had even made water boil by the friction of two pieces of iron

A platina wire may be kept constantly at a white heat in vacuo, by the action of the Voltaic battery; and charcoal placed in the same situation, gives out intense light and heat. From whence does this light and heat proceed? It appeared to be Dr D's opinion that the particles of matter excited by electrization were separated from each other by their polar repulsions, and moving in straight lines through free space, were the cause of light and heat. He conceived that these particles had different motions on their polar axes, which might cause the different rays of light. The particles of fluids he supposed had a ~~motion~~ constant rotatory motion round their polar axes, and those of solids were in a state of rest.

Lect. 5th — 16th Feb ~~9th March~~ 1811

On Electricity and its application to Chemistry; On the construction of the Voltaic battery and its operation exemplified by a combination of 2 simple zinc plates.

Dr D began by explaining the form and construction of the Voltaic battery, and exhibited the effects of a series of 2000 plates in full action, which is the most powerful machine of the kind that has yet been made. One constructed in France, by order of Bonaparte is made of plates and pieces of moistened cloth, and is inferior in power to this in which the plates are put into troughs. Gold, silver, platina and iron were instantly fused by it. He exhibited the swelling of platina in vacuo, which is the first time this experiment

has been shewn. Intense light and heat was produced accompanied with very vivid sparks. These sparks in the opinion of Mr D. were occasioned by the disengagement of an elastic fluid, probably Hydrogen, or the metal converted into vapour, emitted sparks in condensing. Mr D repeated what he had stated in a former lecture, that certain metals and (other) inflam[mable] substances contain Hydrogen, as a constituent part. He had disengaged Hydrogen from Carbon, and from some of the metals, it was therefore highly probable that there were compound substances.

In the action of the Voltaic machine on platina in which the wires were placed more than an inch asunder, when a continued current of electricity and heat flowed between the points of the opposite wires. By the action of the same instrument, with points connected in water a rapid decomposition of the water took place, and brilliant sparks were exhibited under the surface. The same experiment was repeated in the spirit of wine and other fluids; different coloured lights were produced, and in all these cases, the fluids were decomposed. Mr D. said he [illegible] by an experiment which he was answered to make on the effect of this powerful battery on oxygenated muriatic acid; he stated that it was probable it would be decomposed. The oxygenated muriatic acid was then placed in the Torricellian Vacuum; after some little time Gas was disengaged which Mr D. observed probably came both from the metal and the acid, intermixing the

compound nature of these substances. This experiment he said he should repeat with the intention of bringing the ongoing. D. B [illegible] that the opposite effects of Electrical attraction and repulsion, and the charging of the Leyden phial might be produced by the Voltaic battery, the same as by the common Electrical machine. When iron was acted on by the Voltaic action in Vacuo, as much light and heat was produced, as when it was burned in Oxygen gas: but in Vacuo the iron undergoes no change except that of fusion.

D. B stated some of his opinions respecting the Elect. of glass and other substances. When a glass tube was excited, the opposite ends had opposite attracting and repelling Electrical poles, and between these two natural poles, there may be observed a succession series of attracting and repelling poles alternately from one end of the tube to the other (not true, the tube has the Elect. from one end to the other).

When an insulated Metallic conductor is drawn near an excited Cylinder, the end next the Cylinder is negative, the remote end is positive and the middle exhibits no signs of Electricity. The conductor has only two poles, one attracting the other repelling. In this respect the Elect. of the Metallic conductor, when insulated, differs from that of glass, which has a succession of poles alternately with each other

F. D offered a variety of conjectures respecting Magnetism, Electricity and Light; he observed that future discoveries would probably prove that the principles of all bodies had some degree of polarity. He doubted however distinctly state that he attached little importance to his speculations when unsupported by experiments; that he should be alarmed any opinions he then form others

The operations of Natural Electricity in the production of Thunder Storms and water spouts was next adverted to. Earthquakes. he observed might in some instances be occasioned by the Electrical effects of metallic bodies in the bowels of the earth on the principle of the Galvanic pile. It was proved that the shock of the torpedo and Gymnotus Electricus is an electrical shock, arising from some peculiar organs which produce it in a manner similar to the Galvanic discharge.

After the discovery of animal Electricity an attempt was made by it to explain the powers of life. this had proved in vain as the former endeavours to explain similar and Thought on Chemical and Mechanical principles The immortal Spirit was likely a Governor controuling the agencies of Material Electricity to work for its ends among these Elements, was nothing the living en-

among the bombs.

Lect. 6th — 23 Feb. 1811

Dr D's lecture was a continuation of Galvanism. A variety of Galvanic troughs was exhibited to show the force and intensity of different combinations of plates. Dr D adverted to the report of the French Institute, which stated that the number of pairs of plates to produce a double effect must be increased eight times. Dr D said that he had made a variety of experiments, during the present week, to ascertain the fact, and he had found that the statement of those philosophers was not correct, which he attributed to their making use of plates composed of plates and iron wires and cloths. By this imperfect

construction a considerable part of the charge was lost. A Galvanic trough composed of two pieces of metal each plate 11½ Inches long, and 4½ in breadth ignited an iron wire two inches in length. 20 pieces of the same size ignited eight inches of the same wire and 30 pieces ignited 12 Inches. The effect decreasing in a certain ratio with the number of plates made use of, but not in any degree corresponding with the ratio of decrease stated by the French. Dr. D. attributes this decreasing ratio of effect to the tendency which an accumulated quantity of Elect.ty had to make its escape, by the Circuit of the Atmosphere down the sides of the Galvanic trough the

Conductors

In denoting the conducting powers of different metals, Dr. D. mentioned a remarkable fact; Platina which is the most difficult of all metals to fuse in the furnace, is by the action of the Galvanic trough, fused more readily than Zinc, one of the most fusible of metals. With a series of twenty plates Dr. D. exhibited the fusion of eight inches of platina wire. A wire of Zinc of the same size and length remained unaltered by the same action and was not even nearly ignited by a longer series of plates. The effect of the Galvanic shock on the human Body corresponds, on the number not on the size of the plates; but to fuse metals the size of the plates must be increased. Dr. D accounts for this effect, by stating

that the human body being an imperfect conductor, could only receive a certain quantity of the charge at a time; and if [illegible] very extensive was used, and a greater quantity of Electricity accumulated, the body was only capable of discharging a determinate portion of it, each time the shock was received.

Dr. P. exhibited the combustion of Gold, Copper and other Metals, and shewed, by a curious Expt. that metals ignited more speedily and intensely in Vacuo than in the open air. An iron wire was fixed in a glass Vessel over an Air pump, and connected with the two extremities of the Galv. Apparatus. The communication was made and the ignition was nearly imperceptible. The air was then exhausted when the ignition was very vivid, no sensible thing the air the light became reduced. Dr. P. also stated that platina and other metals are fused more speedily in Vacuo than in the open air, and as he observed in a former lecture, they also radiate more heat in Vacuo

A considerable part of the present Lecture was occupied with the history and progress of Elect. and Galvanic discoveries. The ancients had no claim to any knowledge of Experimental Elect. Our own Country man Gilbert appears from his treatise de Magnete, to have been the first who made any experiments on this subject.

It is not a little remarkable that Lord Bacon, the father of

the inductive philosophy, should

Experimental Philosophy, should mention their first Exp.t of Gilbert, not with applause but with censure. D.r D. noticed the illustrious characters who had enriched the Science of Elect.y with important discoveries. Amongst them he particularly distinguished D.r Franklin, whose clear and penetrating mind, the observer, first introduced accurate reasoning on the subject; he was also the grand discoverer of the identity of lightning with the Electric fluid. He recommended his Style as a proper model of philosophical composition.

D.r D. in the course of the Lecture, took notice of the various impositions which had been practised by pretended applications of Elect.y to the medical art, amongst them the most eminent were the pretended Cures; they were made of iron and brass: of all the metals then proposed the least power of producing Elect.y from mutual action by contact. Their only real effect was that of drawing money from the pockets of the credulous.

It had been said "that if People wish to be deceived, it was folly to attempt to undeceive them". This doctrine D.r D. most warmly opposed. He asserted that it was a duty to pursue and discover the truth, and he would rather be persecuted and die a Martyr to the cause, than Libel the Name of man, and be the parasite of false opinions. He concluded with a very eloquent address on the connection which subsisted between the progress of science and political freedom. The ages

of Green most dist inguished
for heroism and freedom, were
those in which Learning was culti-
vated with the greatest success.
The mind can never be enjoy
by the chearing views of public
freedom and prosperity oppressive.
The patronage of a Tyrant might
for a short time give a sickly
encouragement to learning but it
could only strike root and
flourish with Vigour, when men
enjoyed the fruits of their industry
and were in possession of their
civil and religious rights