Notes
on
Dewey's Lectures
on
Physics
Chem: Pharmacy

— 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 recently made. The new views they disclose respecting many of the operations of nature, and they will effect in the theory of Chem. 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 opposed the doctrine of Berthollet that Ch. affinity was affected by the masses or quantities of the substances employed, a large quantity overpowering a weaker affinity. The experiments which have been brought forward to support this doctrine were not correct; when sulphate of Baryte had been decomposed by potash, it had been by double affinity, the Carbonic acid uniting with the Baryte; when pure potash was used, no decomposition took place. This is a most important discovery, as it removes Ch. science 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. affinity was 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. 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 poles, and its attracting and repelling poles. The ~~[illegible]~~ a Crystal from Ceylon, which had become Electric, the opposite poles of the Crystal possessing opposite states of Elect.y. Chys. in the effect of Ch. affi. when the Ch. in broken in pieces each piece has the same Ch. force and the opposite points of the contact

Crystals have also their opposite states of Electricity and their polar axes. Here may be heard the connection between the operations of these mysterious powers. The subject Mr D. observed was still obscure, 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 Mr D. explained the operation and effects of heat in its combinations with Solid, Fluid and Gaseous bodies. He described the various instruments that had been invented to measure its intensity, and said that Mr James Watt had discovered that the Pyrometer of Wedgwood, composed 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 shorter time to the action of a more intense temperature. Mr D observed that the opinion generally given in the works of Chemistry, that combustion was always accompanied with a change of bulk and capacity, was incorrect. The combustion of charcoal with oxygen gas or common water, 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 lungs, which would be
the subject of a future lecture.
The most interesting fact of the lec-
ture was that which treated of the
effect of heat upon known animals
other and warm blooded animals
are 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 bear that lives on the ice
and of the whole family is nearly
at a temperature of 90°
Dr Crawford had attempted to prove
that respiration was the cause of ani-
mal 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 sanguinea
or their respiration and circulation.
Dr D. wished, particularly, to direct the
attention of Philosophers to the effects
of life on Chemical material substances
It appeared even to have the
power of modifying and changing

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

Lecture 4th — 9th Feb.y 1811

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

Dr. B. begin with stating that heat is communicated by contact, and also by radiation; he repeated a variety of Mr. Leslie's experiments on the different degrees of heat which are radiated from different coloured bodies. Black surfaces absorb, and emit radiant heat more rapidly than any other. Charcoal heated to the same degree as a polished metal, and placed at a certain distance from a thermometer, raises the 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 or China, particularly if a black color. Heat is not transmitted through glass like light; from this and other circumstances, Mr. Leslie had concluded that heat consists in certain aerial pulsations like sound. Dr. D observed that a variety of experiments did not support this ~~opinion~~ conclusion; for heat is in some instances transmitted through glass, and also radiated more powerfully in Vacuo than in the air. Heat, from the galvanic combustion of charcoal immediately affects a thermometer placed in the form of a lens. A platina wire in Vacuo ignited to a white heat by a powerful Voltaic Battery, and a thermometer placed at a certain distance from it, rose more than when in the air, in the ratio of 6 to 18 ie 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 also by that of Mr Leslie, the quantity of heat in the Earth must be constantly accumulating from the constant heat of the sun, & fixed stars, and as Herschel had formerly supposed, the accumulation would go on until a general conflagration took place; this Dr. 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 existence of invisible rays from the sun producing heat, discovered by Dr. Herschel, had been doubted, but was since fully proved; and also another distinct species of solar rays, which produced powerful Chemical effects. Mr Dr. 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 implied the polarity of light, particularly those attending the double refraction in the

Iceland Chrystal. D. D produced one of these Chrystals, and explained 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 exposition 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 properties 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 attracting and repelling poles, and that it was on the same principle as those of Electrical and Magnetical ~~forces~~ 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 doctrine of Specific heat had been admitted into the new system of Chemistry, without sufficient examination, because it gave an easy explanation of many facts; there are 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 less degree of friction 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 thereby platina in the same situation, gives out intense light and heat. From these facts, this light and heat proved to be the effect of motion. It appeared to Dr. Davy that the particles of matter excited by electricity & action were separated from each other by their polar repulsions, and moving in straight lines through space, gave the rays 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 — ~~Oct. 4th~~ 16th Feb. 1811

On Electricity and its application to Chemistry: On the combustion of the Voltaic battery and its operation, explained by a combination of 2000 plates.

Dr. Davy 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 melting of platina in Vacuo, which for the first time this experiment

has been shewn. Intense light and heat are produced accompanied with very vivid sparks. These sparks in the opinion of Dr D. were occasioned by the disengagement of an elastic fluid, probably Hydrogen, or the metal converted into vapour, emitted sparks in combining. Dr D repeated what he had stated in a former lecture, that earthy metals and (other) inflam^ble subst^ces contain Hydrogen, as a constituent part. He had disengaged Hydrogen from Lime, and from some of the metals, it was therefore highly probable that these were compound substances.

In the action of the Voltaic machine on platina in vacuo the wires were placed more than an inch asunder, when a continued current of light and heat flowed between the points of the opposite wires. By the action of the same instrument, with points immersed in water, a rapid decomposition of the water took place, and brilliant sparks were exhibited under its 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. Here Dr D. said he thought by an experiment which he was anxious to make, on the effect of this powerful battery on Oxygenated acid; he stated that it was probable it would be decomposed. The Oxygenated Acid was then placed in the Torricellian Vacuum; after some little time Gas was seen disengaged which Dr 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 engraving. Dr. D ~~[illegible]~~ proved that the different 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 Vol: machine in Vacuo, as much light and heat was produced, as when it was burned in the at: air ~~oxygen gas~~: but in Vacuo the iron undergoes no change except that of fusion.

Dr D stated some of his opinions respecting the Elect: of glass and ~~and~~ other substances. When a glass tube

was
is excited, the opposite ends had opposite ~~opposite~~ attracting and repelling electrical poles, and between these two extreme poles, there may be observed a numerous series of attracting and repelling poles alternately from one end of the tube to the other (Not true, the tube has the Elect^n from one end to the other).

When an insulated metallic conductor is placed near an excited cylinder, the end nearest 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 numerous series of poles alter: 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 particles of all bodies had some degree of polarity. The Doctor however distinctly stated that he attached little importance to his speculations when unsupported by experiments; that he did not claim any deference to them from others.

The operation 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 as vain as the former endeavours to explain sensation and thought on chemical and mechanical principles. The immortal spirit was itself a Governor controlling the agency of material Electricity. To seek for its cause among these Elec.; was seeking the living a-

among the bombs.

Lect. 6th — 23 Feb. 1811

Dr D's lecture was a combination of the subject of Galvanism. A variety of Galvanic trough was exhibited to shew the form and intensity of different combinations of plates. Dr D adverted to the report of the French Institute, which asserted 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 moistened cloths. By this imperfect

construction a considerable
part of the charge was lost.
A Galvanic trough composed of
two pairs of metal each plate
11½ inches long, and 4½ in breadth
ignited an iron wire two
inches in length. 20 pairs of
the same size ignited
eight inches of the same wire
and 30 pairs 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.
had to make its escape, by
the diversion of the Electricity
on down the sides of the
Galvanic trough.

In describing the conducting
power of different metals, Dr.
D. mentioned a curious
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
several inches of
platina wire. A wire of Zinc
of the same size and length, remained unaltered by the same
action and was not even merely
ignited by a larger 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 surface 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 plates with large surfaces were used, and a greater quantity of electricity ~~was~~ accumulated, the body was only capable of discharging a definite portion of it, each time the shock was received.

Dr. D exhibited the combustion of gold, copper and other metals, and showed, by a curious Exp.t that metals ignited more speedily and intensely in vacuo than in the open air. An iron wire was placed in a glass vessel over an air pump, and connected with the two extremities of the Galv. machine. The communication was made and the ignition was nearly perceptible. The air was then exhausted when the ignition was very vivid, on admitting the air the light became redder. Dr. D also stated that platina and other metals also fired more speedily in vacuo than in the open air, and as he observed in a former lecture, they also radiated more heat in vacuo.

A considerable part of the present lecture was occupied with the history and progress of Electr.y and Galvanic discoveries. The Ancients had no claim to any knowledge of Experimental Electr.y but our countryman 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

experimental Philosophy, should mention their first Exp.ts of Galvani, not with applause but with censure. Dr. D. noticed the illustrious character who had enriched the science of Elect.y with important discoveries. Amongst them he particularly distinguished Dr. 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.

Dr. 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 purposes, amongst them the most eminent were the pretentious Doctors; they were made of iron and brass. Of all the metals which could have been chosen, these possessed the least power of producing Elect.y from mechanical 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 Dr. D. most warmly opposed. He asserted that it was a duty to pursue and detect the truth, and he would rather be persecuted and die a martyr to its sacred cause, than bribe the slave of error, and be the parasite of false opinions. He concluded with a very elegant address on the connection which subsisted between the progress of science and political freedom. The ages

of Genius most distinguished
for heroism and freedom, were
there in which Genius was culti-
vated with the greatest success.
The mind has power to energy
by the shining voice of public
freedom and popular applause.
The patronage of a tyrant might
for a short time give a sickly
encouragement to science but it
could only stroke root and
flourish with vigour, when men
enjoyed the fruits of free discussion
and in possession of their
civil and religious rights