

denying that a number of words in the later development of language were purely notional, that is, intended to represent an idea, not to imitate a sound, he strongly contended, that the whole original stock of language was either direct imitations of natural sounds, or analogical representations of things visible and tangible by things audible. As proofs of this he adduced various illustrations from the Aryan and the Semitic languages. He showed specially that most motions are accompanied by certain sounds or noises, and these sounds are imitated more or less perfectly by the great family of verbs which express motion in all languages; that objects which are sharp or blunt, rough or smooth to touch, are expressed by words which have the same character to the organs of speech and to the ear; and that there is a distinct correlation between all outward sensuous impressions and the emotions thereby excited in our minds and nervous system, which necessarily causes the vocal expression of any feeling to bear a likeness to the external impression from which it proceeded. He did not consider the scientific truth of this matter to be in any way affected by the vexed question, whether man was created originally an infant or full-grown; and the disownment of the imitative principle in the formation of language by Professor Max Müller, in his recent work on the science of language, he considered as the result of a German prejudice against even the appearance of sensationalism, a fondness for the abstract in preference to the concrete in philosophy, and a delight in the mysterious.

### 3. Note on the Phlogistic Theory. By Alexander Crum Brown, M.D., &c.

When we consider that the Phlogistic Theory formed, as it were, the central point round which the facts of chemistry first crystallized into regular scientific form, and that for more than a hundred years it was recognised by all as the foundation of the science, we might reasonably suppose that it should contain at least some germ of truth.

I think I shall be able to show in the following note that not only is this the case, but that the theory itself, as stated by its founders, Beccher and Stahl, is, if not strictly true, a very close approximation to what we now recognise as truth.

According to Stahl, all combustibles contain one and the same substance in different proportions, according to the degree of their combustibility. That substance is phlogiston; and when a combustible is burnt, or a metal calcined, its phlogiston is given out. When charcoal or oil is heated with a metallic calx, the phlogiston leaves the former, and is found in combination in the metallic regulus.

Now, if we consider the facts of the case in an unprejudiced way, we must admit that a combustible loses something when it is burnt, it loses combustibility, or the capability of being burnt. In the same way, in the preparation of phosphorus, or the reduction of a metallic calx, the charcoal loses this capability, while the phosphorus or metal acquires it.

The capability of being burnt is essentially the power of emitting a certain quantity of heat, and, as we know from the researches of Rumford, Davy, and others, and from the later and more accurate determinations of Joule, that heat is a particular form of what has been called kinetic energy, we can have no difficulty in admitting that the power of emitting a certain quantity of heat is a particular form of potential energy.

If, in the statement of the phlogistic theory, we read potential energy for phlogiston, and understand that when phlogiston is separated from one body and not taken up by another, as in combustion, this potential energy is converted into kinetic energy, we have a tolerably complete account of what we now know of the matter.

Whether we choose, with Beccher and Stahl, to call phlogiston a substance or not, depends on our definition of what a substance is, If we restrict that name to ponderable matter, of course it is not a substance, but when we consider that energy is as indestructible as matter, that we can trace it through its various combinations and double decompositions, and that we are in a fair way to discover, not, indeed, its atomic weight, for it has none, but its chemical unit, it does not seem very absurd or unreasonable to class it along with the ordinary chemical elements.

It may be objected to the phlogistic theory, as thus explained, that it is not the combustible alone, but the combustible and oxygen, that have potential energy, and that it is only when the two unite that this potential energy is transformed into kinetic. This objec-

tion is equally valid against the statement, that a clock, when wound up, contains potential energy, it is not the clock, but the clock and the earth, which contain this, and it is transformed when the clock weight and the earth approach each other.

In fact, energy is not conceivable without a system of at least two bodies.

We must, of course, recollect that the phlogistic chemists were ignorant of the existence and nature of oxygen, and it is to this ignorance that we must ascribe the downfall of the theory of phlogiston. They attempted to explain, by means of this theory, facts (such as the increase of the weight of a combustible when burnt) depending on a totally different cause. They were thus led to modify the theory, and ascribe to phlogiston negative weight, and to identify it sometimes with carbon and sometimes with hydrogen gas.

It is not surprising that the theory, thus mutilated, should have been overthrown, and we have only to regret that the valuable truth embodied in it should have been lost sight of; that the antiphlogistic chemists, like other reformers, destroyed so much of what was good in the old system, and that, in consequence of this, we are only now beginning to see what was obvious to such a man as Stahl, that oxide of iron does not contain metallic iron; that no compound contains the substances from which it is produced, but that it contains them minus something. We now know what this something is, and can give it the more appropriate name of potential energy; but there can be no doubt that this is what the chemists of the seventeenth century meant when they spoke of phlogiston.

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