Law II. When a compound body suffers decomposition, the force required to effect this, will be exactly equal to the force given out in the formation of that body from its elements.

Law III. If now the elements of a compound body enter into more intimate union—which presupposes the decomposition of the already formed body—the resulting force will be in the direct ratio of the strength of the affinity exercised by its elements, &c., as in law one, but minus the force which was required to decompose the pre-existing body.

Law IV. If a body be decomposed and give its elements to the formation of another body whose stability, &c., as in law one, is less than that of the body so decomposed, the force actually expended in effecting such change will be in the ratio of the strength of the affinity which existed between the elements of the preformed body, minus the strength of the affinity existing in the new compound.*

Now the force evolved in composition and required to effect decomposition may be (1) heat, as in ordinary combustion, and indeed in almost, if not in every act of chemical union, even when the main part of the force given out takes some other form. The converse of this is well seen in the case of the decomposition of the carbonate of lime by heat, and also very beautifully in the following experiment by Robertson.† A substance capable of supporting intense heat without fusing, and at the same time incapable of being acted upon by either of its elements, (such as platinum or iridium) raised to a higher point of ignition and then immersed in water will decompose some of it, and bubbles of oxygen and hydrogen will rise to the surface. The heat required to effect this decomposition is, according to the experimenter, equal to 2386°. (2) This force may be electricity as when that is evolved by a galvanic battery, or conversely, when it is made to decompose water, the alkalies, &c. (3) It may be light as when this is given off along with heat in ordinary combustion, and this is better seen in cases of slow combination such as phosphorescence, where light is much the most manifest of the forces evolved, and where heat is developed in such small quantities that for a long time it was doubted if any is liberated at all. Conversely it is well known that light has the power of decomposing several of the salts of silver, hydrocyanic acid, &c., and in contact with the green leaves of plants, carbonic acid and ammonia. So I might go on with the other forms of physical force, but to no purpose, as these examples will be sufficient to illustrate my meaning, and I am not now concerned with the correlation of the *physical* forces.

I shall now attempt to apply in some measure the laws which have been laid down to the manifestations of force presented by the two forms of life on this planet.

And first of plants.

---

* It does not, strictly speaking, devolve upon me to explain why, in the union of bodies, force is given out, and the converse. A very ingenious theory on the subject is put forth by Dr. Wood, who also gives his opinion as to why bodies unite, which is one step further back still from my subject. See Phil. Mag. Vol. III of the 4th series. Compare Grove "On the correlation of the Physical forces," pp. 175-8.

† Robertson "On the effect of heat in lessening the affinities of the elements of water." Transactions of the Royal Irish Academy, Vol. XXI, p. 2.