

THE LAW OF SUBSTANCE

nomena, is unchangeable. When the locomotive rushes along the line, the potential energy of the steam is transformed into the kinetic or actual energy of the mechanical movement; when we hear its shrill whistle, as it speeds along, the sound-waves of the vibrating atmosphere are conveyed through the tympanum and the three bones of the ear into the inner labyrinth, and thence transferred by the auditory nerve to the acoustic ganglionic cells which form the centre of hearing in the temporal lobe of the gray bed of the brain. The whole marvellous panorama of life that spreads over the surface of our globe is, in the last analysis, transformed sunlight. It is well known how the remarkable progress of technical science has made it possible for us to convert the different physical forces from one form to another; heat may be changed into molar movement, or movement of mass; this in turn into light or sound, and then into electricity, and so forth. Accurate measurement of the quantity of force which is used in this metamorphosis has shown that it is "constant" or unchanged. No particle of living energy is ever extinguished; no particle is ever created anew. Friedrich Mohr, of Bonn, was very near to the discovery of this great fact in 1837, but the discovery was actually made by the able Swabian physician, Robert Mayer, of Heilbronn, in 1842. Independently of Mayer, however, the principle was reached almost at the same time by the famous physiologist, Hermann Helmholtz; five years afterwards he pointed out its general application to, and fertility in, every branch of physics. We ought to say to-day that it rules also in the entire province of physiology—that is, of "organic physics"; but on that point we meet a strenuous opposition from the vitalistic biologists and the dualist and spiritualist