there existed three different theories which aimed at finding a general formula or law that should embrace all known electro-dynamic phenomena. The two earlier ones were propounded independently and about the same

life. Du Bois-Reymond was a pupil of Johannes Müller. One of the merits of Müller's school was to have made the discoveries of physics useful for physiology and medicine as the school of Liebig made those of chemistry. Helmholtz was trained in the school of Müller, but he also came largely under the influence of Franz Neumann of Königsberg, the great teacher of mathematical physics, and of Gauss and Weber, the originators in Germany of the system of absolute measurements. It is known that the interest in electrical phenomena received a great impetus through Galvani's and Volta's discoveries. But as du Bois-Reymond ('Reden,' vol. ii. p. 389) tells us, the galvanic pile constructed by Volta withdrew attention from the phenomena of animal electricity to the much more powerful actions of artificial arrangements of metals and solutions. The study of animal electricity was for a time continued only by Italian professors, and beyond the seas by Alexander von Humboldt in his observations on the torpedo; and had to wait till the school of Müller, and notably du Bois-Reymond, approached the subject methodically with the methods and ideas of modern science. This was in the fifth decade of the century. Modern science in Germany had, however, studied the properties of the galvanic current exhaustively only in linear (one dimensional) and in closed circuits or conductors. The phenomena of nervous and muscular electric currents demanded the study of sudden and repeated electrical impulses, and of the behaviour of currents in two and three dimensional conductors, and in unclosed conductors or circuits. Incited by du Bois-Reymond, Helmholtz undertook to deduce from the formulæ of Ampère, Neumann, and Weber the action of electric currents in these modified conditions. It was then found that these formulæ gave indefinite results and required to be modified or amplified. After many years of thought and research Helmholtz arrived at a generalisation which comprehended all the different existing theories as special cases. He then—in addition to a masterly mathematical discussion—betook himself to devise special experiments to decide which of the three possible expressions of the general formula came nearest the truth. A perusal of the memoirs contained in the first volume of his 'Wissenschaftliche Abhandlungen' (pp. 429-820) shows how by gradual and strictly logical steps he convinced himself of the intrinsic correctness of Faraday's conception, which, in addition to the phenomena in linear conductors or wires, constantly took notice also of those of the surrounding medium or space — *i.e.*, of the electro-magnetic field. Looking back from our present position on the development of the ideas concerning electricity in motion, we can say that Continental thinkers tried to gain a correcter and more complete understanding by a mathematical, English science by a physical, extension of the then existing notions. Helmholtz in his Faraday Lecture (1881) showed how both courses, consistently pursued, lead to the same result.