

the second half of the century, the influence of French thought on German science has been less marked, partly owing to the independent course which the latter, since the age of Johannes Müller, has struck out for herself in the biological sciences, partly through the more intimate intercourse which has set in between English and German thought. The three great scientific ideas which the second half of the century has been establishing—the law of the conservation of energy, Darwin's theory of descent, and Faraday's novel conception of electrical phenomena—have been elaborated mainly by the co-operation of English and German research, though it must be admitted that at least one of these developments dates back to the beginnings laid by French science,<sup>1</sup> whilst the views of Faraday are subversive of some of the fundamental notions to which the works of the great French mathematicians had given very general currency. Before we can enter more fully on a review of these more modern ideas, I must, however, give a picture of the state of scientific thought in England during the first half of the century. This will be our subject in the last portion of the present section.

<sup>1</sup> Darwin's theory of descent has its forerunners in Lamarck and St-Hilaire, whose merits in this respect are supposed to have been overlooked owing to the overwhelming authority of Cuvier. See Huxley, "Origin of Species" in 'Lay Sermons,' 1891, p. 252; "Evolution in Biology" in 'Science and Culture,' 1888, pp. 296, 313. But whilst it is true that Lamarck and St-Hilaire entertained doubts as to the fixity of species, the explanation of the particular manner in which the change of species takes

place is entirely due to Darwin, and without this further step speculations as to the origin of species would have remained for a long time in the vague. Lamarck's speculations were of no real use to Darwin, and had besides been anticipated by Erasmus Darwin. On the other hand, the researches of Sadi Carnot were of great value in the hands of Joule, Thomson, and Helmholtz, who may be regarded as the founders of the doctrine of the conservation of energy.