tellects in science have condescended to write text-books of their subjects, by which a great reform has been brought about in the higher scientific literature.[1] At the same time —after fifty years of experimental research and accumulation of material—it has become necessary to review the fundamental principles on which scientific reasoning rests: a more philosophical, not to say metaphysical, spirit is manifesting itself within the limits of science.[2] In the abstract, and especially the mathematical, sciences, real progress depends now mainly upon the discovery of methods of simplification, on conciseness and elegance of treatment, and on the discovery of unifying principles and generalising aspects.[3]

22. Scientific reasoning more philosophical.

[1] This remark refers mainly to England and Germany. In France, as a result of giving lectures at the École Polytechnique, the Bureau des Longitudes, the Faculté des Sciences, &c., the great mathematicians and physicists of the century have frequently worked up their researches in connected treatises. For such we are indebted to Lamé, Cauchy, Poncelet, and many others. But the two works which in England and Germany created probably the greatest reform in the teaching of the principles of natural philosophy were Thomson and Tait's 'Natural Philosophy' (first sketch, 1863, 1st ed., 1867) and Kirchhoff's 'Vorlesungen über Mechanik' (Leipzig, 1877).

[2] I refer principally to the various writings of Helmholtz, following those of Riemann, and the many hints thrown out in Gauss's published papers, and in his correspondence with Schumacher. Helmholtz has—of all purely scientific writers—paid most attention to the metaphysical foundations of geometry and dynamics, and has critically examined the earlier theories of Kant, published a century ago. It is interesting in this respect to note what Kant is reported to have said to Stägemann in 1797: "I have come with my writings a century too soon; after a hundred years people will begin to understand me rightly, and will then study my books anew and appreciate them." (See 'Tagebücher,' von Varnhagen von Ense, Leipzig, 1861, vol. i. p. 46.) Next to Helmholtz we are most indebted to Emil du Bois-Reymond and his brother Paul. See Emil's 'Reden' (Leipzig, 1886-87, 2 vols.), and the posthumous work of his brother: 'Ueber die Grundlagen der Erkenntniss in den exacten Wissenschaften' (Tübingen, 1890).

[3] An authority on this subject says: "Generality of aspects and methods, precision and elegance of exposition, have, since the time of Lagrange, become the common property of those who claim to be scientific mathematicians. This