apply strict experimental research, combined with actual measurements, to physical, organic, and psychical phenomena, which had so far escaped all exact treatment; and from Berlin, where in the person, and still more in the school, of Johannes Müller, the great and complex phenomenon of life in the higher organisms was analysed into various mechanical and physical processes, each connected with some well-defined organ which was more and more recognised as possessing the properties of a physical apparatus. A great deal of the work of the numerous members of this school consisted in unravelling with the microscope the structure of such organic apparatus, and studying its action by physical measurements and experiments. As examples and models of this kind of work we have Du Bois-Reymond's 'Researches in Animal Electricity' (1848), and Helmholtz's 'Physiological Optics' (1867, second edition, much enlarged, 1896), and 'Physiological Acoustics' (1862). In the course of these labours it was found that the older ideas of "Stoffwechsel," and the conception of the circulation of matter as it was taught in the school of Liebig, required to be corrected and extended. I have referred in an earlier chapter[1] to the interesting circumstances under which our modern notions of the conservation of energy first dawned independently upon Mayer and Helmholtz whilst studying the phenomena of heat in the animal organism. In the school of Liebig we meet with an occasional attempt to extend the idea of "Stoffwechsel," the exchange of material or of elementary matter in the living body of animals and

19. Johannes Müller.

[1] See *supra*, chap vii.