introducing thermo-dynamics into chemistry, after W. Gibbs had shown how to look at chemical energy as a sum of many forms of energy, and after Helmholtz had more clearly defined the useful conception of free or available energy as the measure of chemical reaction—

49. Ostwald's 'Allgemeine Chemie.'

that Prof. Ostwald at length ventured after the lapse of eighty years to unite in a comprehensive doctrine the scattered fragments of our existing knowledge regarding chemical affinity. This he did as a restorer of the forgotten labours and fame of Berthollet.[1] By the

kinetic definition of temperature. The two principal founders of thermo-dynamics, Clausius and Lord Kelvin, did not resort to kinetic conceptions when establishing the two laws which deal with the conservation and transformation of energy: Rankine, however, connected the subject with his theory of molecular vortices; and Clausius, who was one of the founders of the kinetic theory of gases, very early attempted to interpret the laws of the transference of heat by the help of that theory. So likewise did Maxwell, Helmholtz, Boltzmann, and many others. Mr Bryan, in a very valuable report on the "Researches relating to the Connection of the Second Law with Dynamical Principles," has given a critical summary of these various attempts (see Brit. Assoc. Reports, 1891, p. 85). The three peculiar forms of motion referred to in our last chapter — periodic, rotational, and rapid translational (disorderly) motion—have been used to suggest manifold means of translating thermo-dynamical processes into kinetic models, explaining, as Mr Bryan says, "the second law, about which we know something, by means of molecules about which we know much less" (p. 121). It does not seem that much more has been gained than a general presumption that a mechanical illustration is possible. To the statistical ideas elaborated mainly by Maxwell and Boltzmann I shall revert when treating generally of the statistical view of nature.

[1] Prof. Ostwald has himself, in the Inaugural Lecture which he delivered on the occasion of his accession to the chair of physical chemistry at Leipzig, 23rd November 1887, given a very lucid statement of the principles involved. He goes back to the two theories of chemical action represented at the beginning of the century by Bergmann on the one side and Berthollet on the other. In place of the conflict of chemical forces, in which the stronger obtains a complete victory (complete reactions)—the view of Bergmann—Berthollet introduces the "manifold play of forces acting to and fro, the result being that every one gets its due. The more powerful substance gets more, the weaker less. Only in cases where one of the possible compounds in consequence of its properties entirely leaves