

quences from Fresnel's calculations : Fresnel was invited to prove by experiment these astonishing results, and he found them actually confirmed. So far as the phenomena of diffraction—erroneously termed inflection—are concerned, this work of Fresnel established the fact "that the theory of undulations foretells the phenomena as exactly as the theory of gravitation foretells the movements of the heavenly bodies."¹ It was, however, quite different if we consider that other larger class of phenomena² which revealed the fact that rays of light

¹ See Schwerd, 'Die Beugungserscheinungen aus den Fundamentalgesetzen der Undulations-theorie analytisch entwickelt' (Mannheim, 1835), Preface, p. x.

² The history of the final establishment of the wave theory of light has been written by Whewell in the second volume of the 'History of the Inductive Sciences.' The main sources which existed at that time were the memoirs of Young and Fresnel, and the 'Life of Dr Young' by Peacock. This history has been written again with ampler materials by M. Verdet as an introduction to the edition of the complete works of Fresnel, published in 1866. It is well to read both accounts, as some points which remain obscure in the earlier are fully explained in the later. There is no doubt that Young suggested that the phenomena of "sidedness," which rays of light exhibit, lead to the conception of a lateral or transverse movement; he also hinted that in biaxial crystals the shape of the wave might be that of an almond or an amygdaloid (article "Chromatics," reprinted in Works, vol. i. pp. 317, 322), what we now call an ellipsoid; but M. Verdet is right in characterising Young's suggestions as vague, and vindicat-

ing for Fresnel the full merit of having defined transverse vibrations and of having introduced the ellipsoid of elasticity as a geometrically perfect means of finding by construction the paths of rays in biaxial crystals. The method was quite independent of the theoretical views regarding light which were contained in the same memoir, the consideration of which was referred to a commission consisting of Ampère, Arago, Fourier, and Poisson. Of these Ampère had suggested transverse vibrations as a means of explaining the phenomena of polarisation ('Œuvres de Fresnel,' vol. i. p. 394). Arago, though a great friend of Fresnel and a believer in the wave theory, never to the end of his life accepted the hypothesis of transverse vibrations (ibid., p. lv.) Poisson, a supporter of Laplace's molecular theory, retired from the commission; and Arago, who composed the Report to the Academy, confined himself to pronouncing on the experimental portion, which fully confirmed the general law of double refraction announced by the author; refraining from the expression of any opinion as to the theoretical portion, it being premature to do so (see 'Œuvres de Fresnel,' vol. ii. p. 463). In-