The main subdivisions of the great advance in physical optics, of which we have now to give an account, are the following:—

1. The explanation of the *periodical colors* of thin plates, thick plates, fringed shadows, striated surfaces, and other phenomena of the same kind, by means of the doctrine of the *interference* of undulations.

2. The explanation of the phenomena of *double refraction* by the propagation of undulations in a medium of which the optical *elasticity* is different in different directions.

3. The conception of *polarization* as the result of the vibrations being *transverse;* and the consequent explanation of the production of polarization, and the necessary connexion between polarization and double refraction, on mechanical principles.

4. The explanation of the phenomena of *dipolarization,* by means of the interference of the *resolved parts* of the vibrations after double refraction.

The history of each of these discoveries will be given separately to a certain extent; by which means the force of proof arising from their combination will be more apparent.

Sect. 2.—Explanation of the Periodical Colors of Thin Plates and Shadows by the Undulatory Theory.

THE explanation of periodical colors by the principle of interference of vibrations, was the first step which Young made in his confirmation of the undulatory theory. In a paper on Sound and Light, dated Emmanuel College, Cambridge, 8th July, 1799, and read before the Royal Society in January following, he appears to incline strongly to the Huyghenian theory; not however offering any new facts or calculations in its favor, but pointing out the great difficulties of the Newtonian hypothesis. But in a paper read before the Royal Society, November 12, 1801, he says, " A further consideration of the colors of *thin plates* has converted that prepossession which I before entertained for the undulatory theory of light, into a very strong conviction of its truth and efficiency; a conviction which has since been most strikingly confirmed by an analysis of the colors of *striated surfaces."* He here states the general principle of interferences in the form of a proposition. (Prop. viii.) " When two undulations from different origins coincide either perfectly or very nearly in direction, their joint effect is a combination of the motions belonging to them." He explains, by the help of this proposition, the colors which were observed in Coventry's