This latter mode of proceeding characterizes the investigations of Ptolemy on the refraction of rays in their passage through media of unequal density. Ptolemy caused the rays to pass from air into water and glass, and from water into glass, under different angles of incidence, and he finally arranged the results of these physical experiments in tables. This measurement of a physical phenomenon called forth at will, of a process of nature not dependent upon a movement of the waves of light (Aristotle, assuming a movement of the medium between the eye and the object), stands wholly isolated in the period which we are now considering.* This age presents, with respect to investigation into the elements of nature, only a few chemical experiments by Dioscorides, and, as I have already elsewhere noticed, the technical art of collecting fluids by the process of distillation.† Chemistry can not be said to have begun until man learned to obtain mineral acids, and to employ them for the solution and liberation of substances, and it is on this account that the distillation of sea water, described by Alexander of Aphrodisias under Caracalla, is so worthy of notice. It designates the path by which man gradually arrived at a knowledge of the heterogeneous nature of substances, their chemical composition, and their mutual affinities.

The only names which we can bring forward in connection with the study of organic nature are the anatomist Marinus, Rufus of Ephesus, who dissected apes, and distinguished between nerves of sensation and of motion; and Galen of Pergamus, who eclipsed all others. The natural history of animals by Ælian of Præneste, and the poem on fishes by Oppianus of Cilicia, contain scattered notices, but no facts based on personal examination. It is impossible to comprehend how the enormous multitudes of elephants, rhinoceroses, hippopotamuses, elks, lions, tigers, panthers, crocodiles, and ostriches, which for upward of four centuries were slain in the Roman

whether a particular result has sprung from a phenomenon purposely called forth or accidentally observed. Where Aristotle (*De Cœlo*, iv., 4) treats of the weight of the atmosphere, which, however, Ideler appears to deny (*Meteorologia veterum Græcorum et Romanorum*, p. 23), he says distinctly, "an inflated bladder is heavier than an empty one." The experiment must have been made with condensed air, if actually tried.

* Aristot., *De Anima.*, ii., 7; Biese, *Die Philosophie des Aristot.*, bd. ii., s. 147.

† *Joannis* (*Philoponi*) *Grammatici*, in libr. *De Generat.*, and *Alexandri Aphrodis.*, in *Meteorol. Comment.* (Venet., 1527), p. 97, b. Compare my *Examen Critique*, t. ii., p. 306–312.