

subsequently led to the establishment of the laws of the sphere of action, and of the distribution of electricity. He heard the first sound, and saw the first light in artificially-produced electricity. In an experiment instituted by Newton in 1675, the first traces of the electric charge in a rubbed plate of glass were seen.* We have here only sought the earliest germs of electric knowledge, which, in its great and singularly-retarded development, has not only become one of the most important branches of meteorology, but has also thrown much light on the internal action of terrestrial forces, since magnetism has been recognized as one of the simplest forms under which electricity is manifested.

Although Wall in 1708, Stephen Gray in 1734, and Nollet conjectured the identity of friction-electricity and of lightning, it was first proved with empirical certainty in the middle of the eighteenth century by the successful efforts of the celebrated Benjamin Franklin. From this period the electric process passed from the domain of speculative physics into that of cosmical contemplation—from the recesses of the study to the freedom of nature. The doctrine of electricity, like that of optics and of magnetism, experienced long periods of extremely tardy development, until in these three sciences the labors of Franklin and Volta, of Thomas Young and Malus, of Ørsted and of Faraday, roused their cotemporaries to an admirable degree of activity. Such are the alternations of slumber and of suddenly-awakened activity that appertain to the progress of human knowledge.

But if, as we have already shown, the relations of temperature, the alternations in the pressure of the atmosphere, and the quantity of the vapor contained in it, were made the object of direct investigation by means of the invention of appropriate, although still very imperfect physical instruments, and by the acute penetration of Galileo, Torricelli, and the members of the Accademia del Cimento, all that refers to the chemical composition of the atmosphere remained, on the other hand, shrouded in obscurity. The foundations of pneumatic chemistry were, it is true, laid by Johann Baptist von Helmont and Jean Rey in the first half of the seventeenth century, and by Hooke, Mayow, Boyle, and the dogmatizing Becher in the closing part of the same century; but, however striking may have been the correct apprehension of detached and important phenomena, the insight into their connection was still wanting. The old belief in the elementary simplic-

* Brewster, *Life of Newton*, p. 307.