J. J. Thomson and Ernest Rutherford (right) at the Cavendish Lab in 1934. (Courtesy AIP Emilio Segrè Visual Archives Bainbridge Collection)

• *Improved vacua.* Improved vacua were achieved in the 1850s, when Johann Geissler (1815–1879) began developing the tubes now named after him. Soon he was able to reach and maintain pressures of 0.1 mm of mercury. Refined versions of this tube were crucial to the discoveries of Roentgen and Thomson.

• *Ionization chambers.* Early versions of the parallel-plate ionization chamber were developed in Cambridge during the 1890s. They were used by Rutherford and the Curies in the earliest quantitative measurements of radioactivity.

• *Concave spectral gratings.* Concave spectral gratings were developed starting in the 1880s by Henry Rowland (1848–1901) at the Johns Hopkins University. Their resolving power made Zeeman's discovery possible.

• *Cloud chambers.* Work on the development of a cloud chamber was begun in Cambridge in 1895 by Charles T. R. Wilson (1869–1959). This instrument enabled Thomson to measure the electron's charge.

THE DISCOVERY

ALL RESEARCH THAT LED to the discovery of the electron deals with studies of cathode rays, a subject that had already engaged Faraday, who in 1838 made this prophetic remark on its future: "The results connected with the different conditions of positive and negative discharge will have a far greater influence on the philosophy of electrical science than we at present imagine."[13]

J. J. Thomson discovered the electron. Numerous are the books and articles in which one finds it said that he did so in 1897. I cannot quite agree. It is true that in that year Thomson made a good determination of e/m for cathode rays, an indispensable step toward the identification of the electron, but he was not the only one to do so. It is also true that in 1897 Thomson correctly conjectured that the large value for e/m he had measured indicated the existence