

FARADAY, Michael (1791-1867)

Michael Faraday is best known for a brilliant series of experiments on the nature of ELECTRICITY which resulted in the invention of the DYNAMO and the formation of his laws of ELECTROLYSIS (the breakdown of solutions by electricity).

Faraday was born in Newington Butts, Surrey, on 22 November 1791, and was the son of a blacksmith. He became interested in science when he attended some lectures given in 1812 by Sir Humphrey DAVY. After serving an apprenticeship in bookbinding, he sent his lecture notes to Davy, along with a request for a job. In 1813 he began work as Davy's assistant at the Royal Institution; later that year he accompanied Davy on a European tour, which was good experience for the modestly educated young scientist. Persistent conflict with Lady Davy, however, made the journey an ordeal.

After his return to the Royal Institution, Faraday had to work hard, since he was the main source of income for the Institution, which was then having financial difficulties. During this period Faraday worked on glass and steel, performed many chemical analyses and investigated the chlorides of carbon for Davy. His work resulted in the discovery of benzene in 1825.

Davy had by then left the Institution, but Faraday had been

Below: the original ring used by Michael Faraday in his experiment of 1831 to demonstrate the phenomenon of electromagnetic induction. Two coils of wire were wound on the same ring of iron and a voltage applied across one coil, inducing a voltage across the other.

Right: Michael Faraday lecturing at the Royal Institution before the Prince Consort (1855). His experiments and lectures covered many subjects including the chemistry of carbon and properties of gases.

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much influenced by him and performed many experiments for him. When Faraday discovered, in 1823, that gases could be liquefied by pressure, Davy took the credit. Later the two were in conflict when Davy opposed the election of Faraday as a fellow of the Royal Society; it seemed that Davy was jealous of the younger man.

In 1821, the year he married, Faraday was asked by a scientific journal to write an article about the new electrical phenomena. There were many isolated discoveries at that time which defied explanation. For example, OERSTED had noticed that a wire carrying current affects a compass needle. Faraday realized that a magnet would push a wire to one side, and devised an experiment to demonstrate it. He suspended a wire carrying current over a magnet, and found that it moved in circles around the magnet. This experiment made him famous throughout Europe, but led to some false charges of plagiarism.

By 1831 the Royal Institution was in better financial condition, and Faraday was able to concentrate on research. In that year he performed his famous ring experiment demonstrating electromagnetic INDUCTION. It followed from his idea of what caused the wire to move in a magnetic field, and he had been trying to demonstrate the effect since 1821. When a current flowing through a coil of wire on one side of an iron ring was switched on or off, it induced a current in a coil on the other side. He reasoned that a 'magnetic wave' was produced by the first coil and passed through the second, causing an electric current to flow. A way of sustaining the wave was to rotate the conductor (a copper disc) in a magnetic field; in doing so, Faraday had constructed the first dynamo.

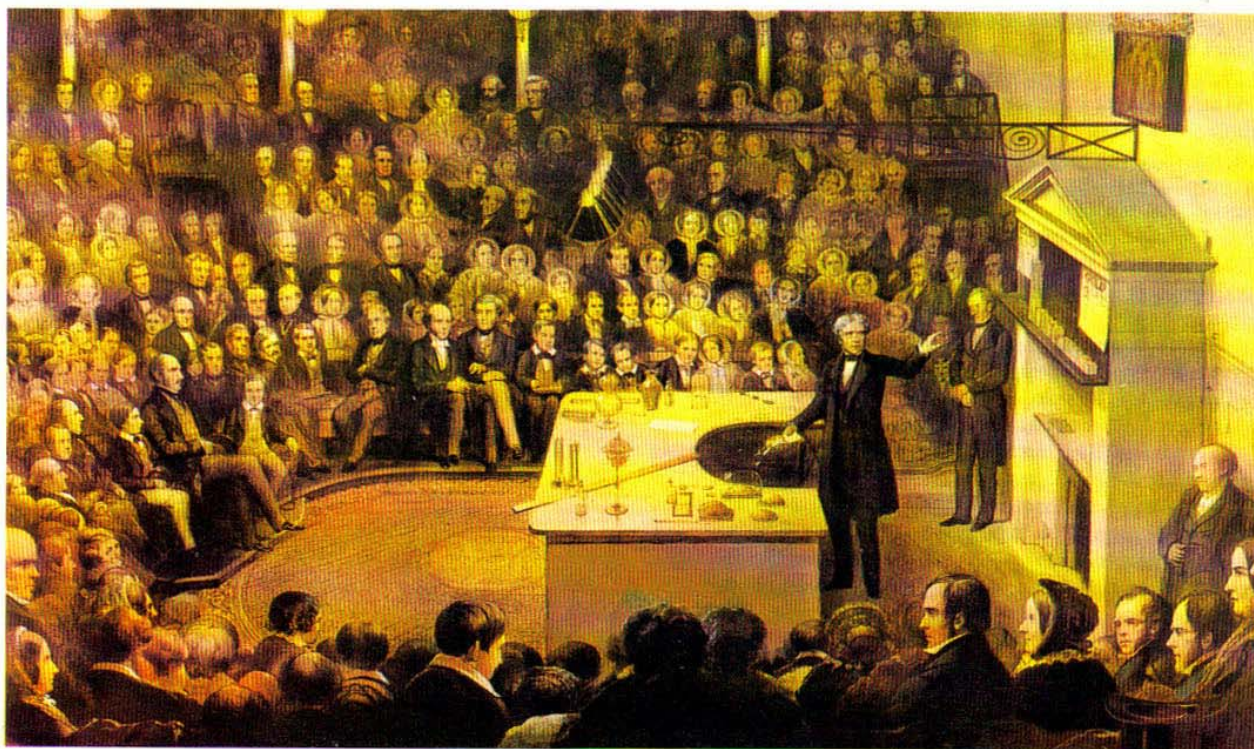
In the next few years, by passing currents through solutions, Faraday showed that all kinds of electricity, however generated, were the same. In this way he developed his laws of electrolysis, which relate the amount of decomposition in a solution to the amount of current passed through it.

In 1839 Faraday suffered a mental breakdown; his convalescence, in England and abroad, took four years. His breakdown left him with a poor memory, which grew worse with time. He returned to his work, this time investigating the effect of a magnetic field on non-metallic substances. These are weakly attracted or repelled, and Faraday introduced the names *paramagnetic* and *diamagnetic* for them. His scientific work began to suffer at the expense of his dabbling in other, less demanding activities. In 1853 Faraday investigated 'table-turning', in which supernatural forces were supposed to be at work. Two years later he wrote a letter to *The Times* about water pollution in the Thames.

Tragically, in the late 1850s he began to find lecturing more difficult. Lecturing was a love of Faraday's; he had carefully observed Davy as a young man and took much care with his own lectures. Ironically, it was during this period that he delivered his most famous lectures, including *The Chemical History of the Candle*.

In 1861 Faraday, then 70, retired from the Royal Institution and moved to a house in Hampton Court that Queen Victoria had offered him. By now his condition was so bad that he required permanent assistance. On 25 August 1867, he died, and was given a private funeral at Highgate Cemetery.

Faraday was able to blend theory and experiment in his researches to an extent few men have been able to match. He had little money to spend on apparatus and knew no mathematics. Many of his discoveries were not put to use until decades after his death. Perhaps his most important accomplishment was his research into electromagnetics, which was to be the seed of one of the major achievements of nineteenth century science: the development of FIELD theory by James MAXWELL.



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