

ROBERT BOYLE, THE FATHER OF CHEMISTRY

By

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Robert Boyle (1627-1691), 'The Father of Chemistry', was the most influential scientist ever born in Ireland. His influence on chemistry has been likened to that of Copernicus (1473-1543) on cosmology, who proposed that the sun and not the earth lies at the centre of the solar system. Apart from chemistry Boyle made many other contributions to science.

Robert Boyle was born in Lismore, Co. Waterford, the youngest son of Richard Boyle, First Earl of Cork, and his second wife Katherine Fenton. Richard accumulated a great fortune in Ireland and enjoyed a high social standing. Robert displayed a quiet scholarly disposition and was his father's favourite son.

After early education at home, Robert was sent for a while to Eton College in England. Then at the age of 11 he was sent, with a tutor, on a grand tour of Europe which lasted for 6 years. Apart from conventional studies on the tour, Robert was also exposed to some vulgar ways of the world. For example, he attracted the amorous attentions of a couple of Friars, but he staunchly resisted the 'preposterous courtship' of those 'gowned sodomites'.

During his tour of Europe, the young Boyle experienced an awesome thunderstorm which had the effect of a religious conversion experience. Boyle thought he was going to die and felt very ill-prepared to meet his Maker. Surviving the storm, he resolved to keep his spiritual side well serviced so that he would not be caught unawares again.

Boyle returned to Dorset in England in 1644 and embarked on a writing career, largely of pious and moralistic material in the beginning. In 1649 he set up a scientific laboratory, and he began to write accounts of his scientific work, promulgating the use of experiment and the scientific method.

In 1655 Boyle moved to Oxford where he joined a group of natural philosophers that foreshadowed the Royal Society, founded in 1660. Robert Hooke (1635-1703) entered Boyle's employ at this time and helped him in his experiments. They built the air-pump used to create vacuums and with which Boyle carried out many trials to elucidate the nature and importance of air.

Boyle demonstrated the necessity of air for combustion, for animal breathing, and for the transmission of sound. Prior to moving from Oxford to London in 1688, he published much influential work, including *New Experiments Physio-Mechanical, Touching the Spring of the Air and its Effects* (1660) and *The Sceptical Chymist* (1661). In *The Spring of The*



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Air he described the inverse relationship between the volume of a gas and its pressure – now known as Boyle's Law.

Medieval science was dominated by the ideas of Aristotle (384-322 BC). Aristotle proposed that matter was composed of 4 elements – earth, air, fire, and water - which in varying proportions constituted all things. Paracelsus (1493-1531), an adept in alchemy, proposed that various combinations of three controlling elements (mercury, sulphur, salt) accounted for the various properties of matter.

Modern chemistry developed out of medieval alchemy. Alchemy was a pseudoscientific practice that sought a method (by varying the proportions of the 3 controlling elements) of changing base metals into gold, an elixir to prolong life indefinitely, a panacea to cure all ills, and a solvent capable of dissolving anything. Alchemy was still practiced in Boyle's time and he himself studied the art. He was quite prepared to believe that 'cosmical qualities' transcended pure mechanical laws in the universe. However, he sharply differentiated his scientific experimentation and theorising from his alchemical work.

Francis Bacon (1561-1626) laid down guidelines for the pursuit of inductive science by controlled experiment but Boyle, the experimenter par excellence [italics], worked out this idea in full and must be credited for properly introducing the modern experimental method into science and for teasing chemistry away from its alchemical origins.

Boyle was very religious. His major preoccupation was the relationship between God's power, the created realm and man's perception of it, and he was very hostile to views of nature that he saw as detracting from an appreciation of God's power in his creation. His principal target in this respect was the Aristotelian worldview so prevalent in his day. Boyle used his experiments to demonstrate that mechanical explanations of the world are better than the traditional qualitative explanations associated with the ideas of Aristotle.

In his book *The Sceptical Chymist*, Boyle attacked Aristotle's and Paracelsus's theories. He proposed that elements are basically composed of 'corpuscles' of various sorts and sizes capable of organising themselves into groups and that each group constitutes a chemical substance. He clearly distinguished between mixtures and compounds and showed that a compound can have very different properties from those of its constituents. This prefigured the atomic theory of matter. Boyle declared that the proper object of chemistry was analysis of composition and, indeed, he coined the term analysis itself. He was also the first chemist to collect a sample of gas.

Robert Boyle was friendly with Isaac Newton (1642-1727). Newton worked intensively on alchemical investigations, but he kept this work secret. Newton had something of a paranoid personality and was secretive about most of his activities. He tried unsuccessfully to infect Boyle with this paranoia. Boyle, the wealthy aristocrat, had an easy self confidence lacking in the self-made Newton.

In his will Boyle endowed a series of Boyle Lectures, which still continue, 'for proving the Christian Religion against notorious Infidels'. He rarely dedicated any of his many books to others. Interestingly, his last work, *Free Discourse Against Swearing*, published posthumously, was dedicated to his brother, the Second Earl of Cork.

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