Topic Page: Black, Joseph, 1728-1799

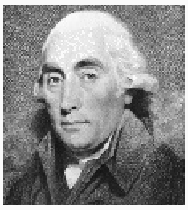

Image from: **Joseph Black** in *The Cambridge Dictionary of Scientists*

Summary Article: **Black, Joseph**
From *Encyclopedia of Life Sciences*

(1728-1799) French-born Scottish chemist noted for his work on carbon dioxide and the nature of heat.

Joseph Black was a close friend of the geologist James Hutton and the economist Adam Smith with whom he shared a central role in the Scottish Enlightenment. Born in France the son of an Ulsterman and his Scottish wife, he was educated in Belfast but went to Glasgow University at the age of 16. He completed his arts course in 1748 and began to study medicine not through a determination to be a physician, but through the desire to study natural philosophy under a new lecturer in chemistry - William Cullen (1710-1790) who was one of the first teachers in Britain to base his teaching on principles of chemistry rather than on *materia medica.*

After four years in Glasgow, Black moved to Edinburgh to complete his studies, choosing the subject of causticity and the character of the alkaline magnesia alba (magnesium carbonate) - commonly used for acidic indigestion as the topic for his MD dissertation. He engaged in painstaking and meticulous experimental research, which he extended to quicklime and potash and presented to the Philosophical Society of Edinburgh in an essay entitled ‘Experiments on magnesia alba, quicklime and other alcaline substances’ in 1755.

Black attempted to show that ‘fixed air’ (carbon dioxide) was lost when magnesia was heated, but given the practical difficulties of collecting the ‘fixed air’, he used a series of chemical reactions to prove his arguments. In the process he not only promoted reactivity as a reliable indicator of chemical change and a principal chemical methodology, he also noted that quicklime only absorbed one sort of air ‘fixed air’ - but did not absorb the rest of the air, thereby indicating that there were at least two sorts of air. This information was critical to later chemical research.

Black was appointed to William Cullen's position in Glasgow in 1755 and changed the direction of his researches to explore the nature of heat - then regarded by most chemists of the period as a substance. Black was extremely reluctant to hypothesize and he deplored most forms of speculation and theorizing entirely. It was this reluctance, consistent with contemporary Enlightenment philosophy and his insistence on the facts, that helped him develop important scientific insights into the way substances - notably water - absorb heat. Black was interested in the phenomenon of melting and in the way that some salts dissolved in water cause temperature changes by either increasing or decreasing the temperature of water. He considered the question of why ice does not melt immediately when the temperature rises above freezing and how it was possible to measure changes using a mercury thermometer when no change of state occurred. His researches led him to develop the idea of latent heat, that is the extra heat required to melt the ice, and thereby calculate the latent heat of ice.

Black began to work on the related issue of the heat of vaporization from 1762 and was able to calculate the latent heat of steam and to show that the conversion of steam to water and vice versa was probably equal and opposite. His work in this area brought science and technology in partnership as he had to work in close collaboration with the pioneer of steam power, James Watt, who was instrument maker to the University of Glasgow. Black developed his research to discover the specific heat of different substances - the fact that different substances took up heat at different rates - and developed an understanding of the absorption of heat as a chemical process and a function of chemical composition rather than bulk or density.

Black took up the Edinburgh chemistry chair in 1766 but did little active research. He had to devote most of his efforts to teaching and to his small private medical practice. He became an influential adviser to industry, for instance suggesting that caustic potash (potassium hydroxide) could act as a bleach for linen.

Black's work on latent heat provided the foundation for Lavoisier's caloric theory of heat and Black himself embraced Lavoisier's chemistry from the 1790 s when many, particularly in English universities and research institutions, preferred Joseph Priestley's phlogiston theories. He was elected a foreign member of the French Academy of Sciences in 1789. Black died suddenly in 1799.

Further Reading

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