The man from Penzance – Sir Humphry Davy (1778–1829)

Davy saw science to be the ultimate truth. He loved the utility and permanence of it and the feeling of progression. He was a bold chemist and an inventor, but he thought like a writer. Ledetta Asfa-Wossen takes a look at his life.

2
The number of weeks Davy took to devise the mining safety lamp at the Royal Institution

1815
The year Davy presented his paper on the mining safety lamp

92
The number of lives claimed at Felling Colliery, Gateshead, Tyne and Wear, in 1812

Davy was out to beat the clock. It was as though he knew he would stop dead at 50. As a young boy, he needed no encouragement. Inquisitive and resourceful, he leapt about with fishing tackle in one pocket and mineral specimens in the other. The eldest of five children and with his father dying at 16, he grew up fast. He taught himself theology, philosophy, poetics, several sciences and seven languages, including Hebrew and Italian. Within a year, he had become a surgeon's and apothecary's apprentice.

A few years later, he came into contact with a man called Davies Giddy (later known as Davies Gilbert). Gilbert was intrigued by Davy's behaviour and approach to scientific study. Davy had read Lavoisier's *Traité Élémentaire de Chemie* and wanted to repeat his experiments. Gilbert loaned him the use of his library and supported his experimental work. These years were the making of Davy. He cemented himself as a scientist and independent thinker on scientific issues of the time, such as the nature of heat, light and electricity, and began to criticise the doctrines of this chemistry heavyweight.

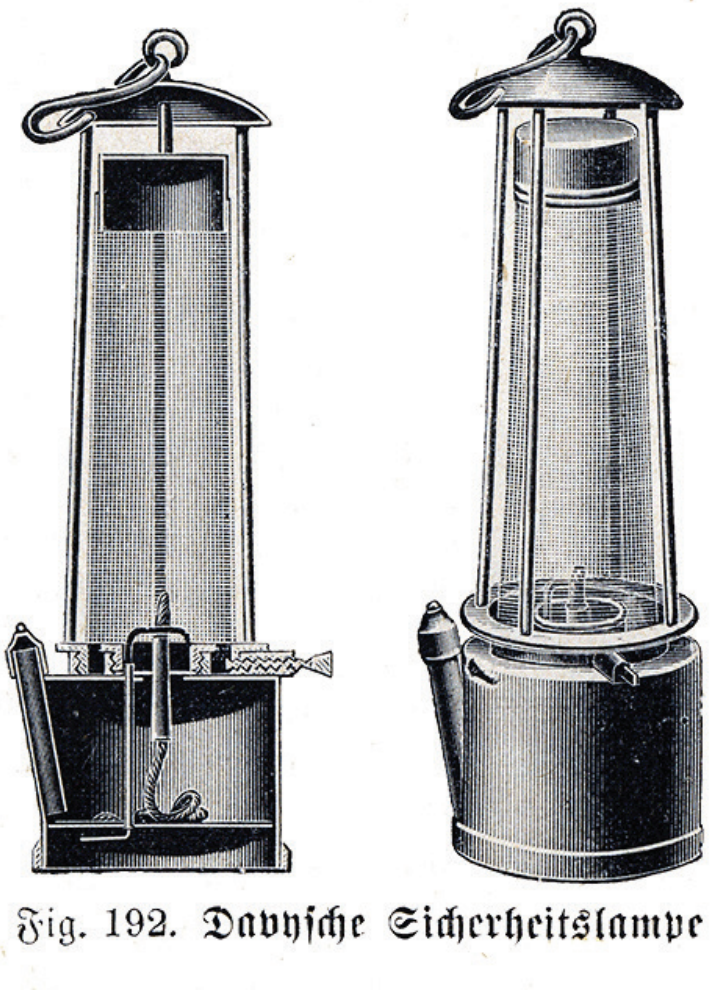
Before the age of 20, Davy was made Chemical Superintendent at Dr Thomas Beddoes's Pneumatic Institution in Bristol, UK. Here, he started to investigate the chemical and philosophical uses of gases at full strength.

A breath of nitrous oxide

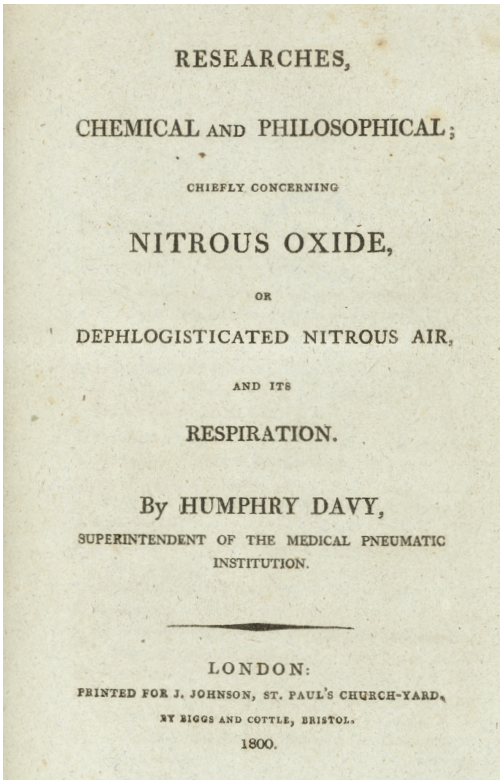
In 1799, nitrous oxide was a party accessory. You inhaled, grunted like a hog and laughed wildly into the night. Beddoes once described it as being 'bathed all over in a bucket of good humour'. However, Davy was convinced of its wider benefit and became determined to prove its anaesthetic properties. He was also sceptical of claims made by Samuel Latham Mitchell that nitrous oxide led to disease and death. Davy's open experiments into nitrous oxide became popular viewing. Like a magician, he would request the assistance of Samuel Taylor Coleridge and Robert Southey to present the effects of nitrogen oxide.

His eccentric experiments in anaesthesiology blighted his eyesight and he nearly killed himself through his inhalation of carbon monoxide and hydrogen – but he'd proved his point. Davy published his book *Researches, Chemical and Philosophical* in 1800, recommending that nitrous oxide could be used as an anaesthetic in minor surgical operations. By his death, nitrous oxide was used extensively, especially in the USA, by dentists. Within a five-year period, 45,000 people were treated using nitrous oxide between New York and Massachusetts. This was not Davy's first publication but it was the one that launched his career and led him to London.

Below:
Early illustrations of the Davy lamp for use in coal mines.



Right:
Extract: 'The moment after I began to respire 20 quarts of unmingled nitrous oxide a thrilling, extending from the chest to the extremities, was almost immediately produced. I felt a sense of tangible extension highly pleasurable in every limb.'



RESEARCHES,

CHEMICAL AND PHILOSOPHICAL;

CHIEFLY CONCERNING

NITROUS OXIDE,

OR

DEPHLOGISTICATED NITROUS AIR,

AND ITS

RESPIRATION.

By HUMPHRY DAVY,

SUPERINTENDENT OF THE MEDICAL PNEUMATIC INSTITUTION.

LONDON:

PRINTED FOR J. JOHNSON, ST. PAUL'S CHURCH-YARD,

BY BIGGS AND COTTLE, BRISTOL.

1800.

Image courtesy of the Wellcome Library, London

The London years

In 2014, Sir John Meurig Thomas' Royal Society of Chemistry lecture on Sir Humphry Davy gave some interesting insights into Davy's defining years. His work was becoming widely recognised and Count Rumford, founder of the Royal Institution, wanted to house this rising talent. 'Count Rumford of the Holy Roman Empire was an enigmatic, picaresque, egocentric American. He was a man of great abilities and he could pick winners,' said Thomas. By 1801, Davy was holding lectures as a professor at the Royal Institution. Thomas said, 'He combined felicity of poetic and literary expression with brilliant scientific work. His pellucid presentations were the talk of the town. Aristocrats, socialites and the literati would flock in droves to hear him speak. The congestion of carriages on Albemarle Street led it to be the first one-way street in London.' Coleridge once said he attended Davy's lectures simply 'to renew his metaphors'.

Davy was the first man to invent the carbon arc lamp. 'He built a massive bank of batteries that generated 2,000V. In those days, it was the equivalent of the Large Hadron Collider,' exclaimed Thomas.

He was a pioneer in the field of electrolysis, too. Davy had heard about Italian physicist Alessandro Volta's claim that the mere contact of two dissimilar metals generates continuous electricity. 'Immediately, Davy realised that the battery pile that Volta had discovered was not really operated by the contact of

Image courtesy of Lordem Ipsum

Right:
A satirical cartoon showing a Royal Institution lecture on pneumatics with Davy and Count Rumford.

copper and zinc with a bit of brine in between – but a chemical reaction. By the age of 20, he had published five papers on this subject,' added Thomas.

Davy later proposed that electrolysis offered the most likely means of decomposing all substances to their elements. During this time, he discovered sodium, potassium, magnesium, calcium, strontium and barium. He also demolished a theory advocated by Lavoisier that all acids contained oxygen. Davy demonstrated that hydrochloric acid did not contain oxygen and that the presence of hydrogen was the distinctive characteristic of an acid.

Davy even wrote the first comprehensive text on the application of chemistry to agriculture. Between 1803 and 1813, he compiled a published text that listed more than 97 appendices describing the fundamentals of agricultural chemistry. He also invented cathodic protection, which is still principally used for marine vessels.

Although Britain and France were at war, Davy was awarded a Napoleon Prize from the Institute of France for his achievements in electrochemistry. He became a man about Europe, drawing support from many institutions across the continent, and was given a small portable laboratory where he performed experiments into chlorine and iodine, and demonstrated that diamond was a form of carbon.

Davy and the lamp

Despite Davy's enduring work in electrochemistry, anaesthesiology and agriculture, his mining safety lamp is probably his most celebrated work. Lack of ventilation and open-flame illumination caused frequent mine explosions in the early 19th Century. Davy's introduction of the mining safety lamp in 1815 allowed the flame to be enclosed in a double layer of wire gauze, preventing ignition of flammable gases. 'The miner's safety lamp was ingenious,' said Thomas. 'Not only could coal miners take a naked flame into a colliery and the underground passages of a coal mine, it also changed its colour and shape depending on whether methane was present.' It took Davy only two weeks to devise, after hearing about the tragic incident in Felling Colliery, Gateshead, Tyne and Wear, in 1812.

Davy became president of the Royal Society in 1820. He began to conduct investigations into magnetic phenomena caused by electricity and continued to hold many lectures, including a Bakerian Lecture on the relation of electrical and chemical changes, revealing his last thoughts on electrochemistry.

In 1827, due to his declining health, Davy was forced to resign his presidency and hand it over to Davies Gilbert – a man who had witnessed his journey to greatness from boyhood. In this dark hour, Davy returned to writing. He produced a book on fly-fishing, *Salmonia*, in 1828, and a series of dialogues entitled *Consolations in Travel, or the Last Days of a Philosopher*, in 1830. After settling in Rome, frustrated and sick, he described himself as a 'ruin amongst ruins'. He died in Geneva shortly after his 50th birthday.

In a letter to his Lady Davy, he wrote, 'I believe the works in which I am engaged may be useful and give pleasure, and it is only upon this ground that I am anxious about their preservation. I cannot help having a little of a feeling expressed by Wordsworth, that the fame they produce the author is an omen that they are not useless.' Holy Headland, was he right.

Davy was a chemist and a poet. Through his invention of the mining safety lamp, he enabled the safe extraction of coal, increasing Britain's industrial capacity and decreasing deaths in the mines. But incredibly, he showed us that science and literature do not have to be thought of as two cultures, but that they can influence each other in mutually beneficial ways. He was also a wonderful letter writer, he wrote about a huge number of topics from travel to poetry to politics and religion.

Professor Sharon Ruston,
Department of English and Creative Writing, Lancaster University

Davy's collection of letters can be viewed at www.davy-letters.org.uk

Did you know?

In 1810, Davy discovered clathrate hydrates – a molecule buried inside a cage. At present, methane clathrates are the largest source of carbon. According to Thomas, there is more carbon in methane clathrates in the ocean beds of the Earth than in all the world's oilfields.

What does Sir Humphry Davy mean to you?
Tweet us at **@materialsworld** or email us, **materials.world@iom3.org**

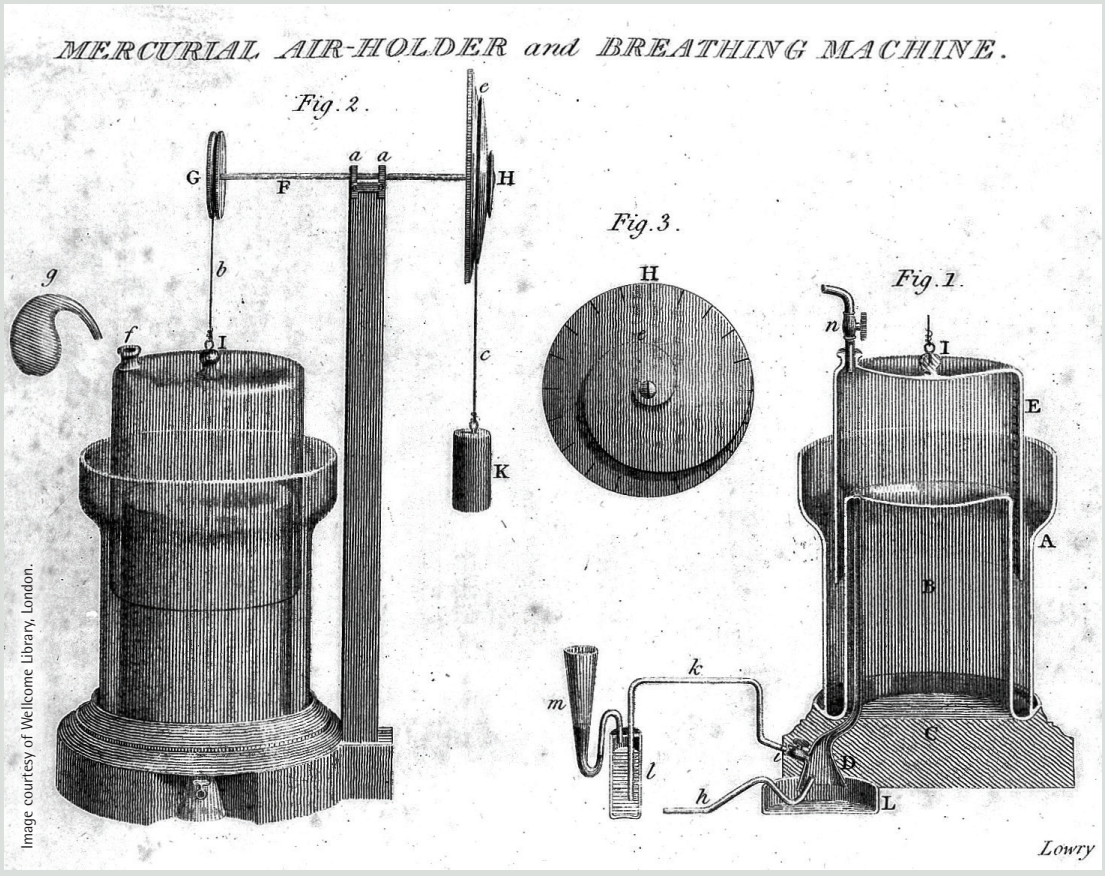


Image courtesy of Wellcome Library, London.

Left:
Mercurial air holder and breathing machine.