

## A World on Fire: A Heretic, an Aristocrat, and the Race to Discover Oxygen **FREE**

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# The breathless quest for the gas supporting combustion

## A World on Fire A Heretic, an Aristocrat, and the Race to Discover Oxygen

Joe Jackson

Viking, New York, 2005. \$27.95  
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Reviewed by John W. Severinghaus

In *A World on Fire: A Heretic, an Aristocrat, and the Race to Discover Oxygen*, author and investigative reporter Joe Jackson traces Joseph Priestley's and Antoine Lavoisier's parallel careers, fragments of their discoveries, their impacts on their societies, and their fates in the face of rejection by their countrymen. In plain language suitable for both the general public and the scientific community, Jackson's richly detailed biographies provide an intimate view of his subjects' roles and struggles in both science and politics during the Age of Enlightenment in England and France.

The book centers on the crucial clue transferred from Priestley to Lavoisier in 1774 of how to generate the strange new air that made a candle burn furiously. Priestley was the leading pneumatic chemist in England, inventor of carbonated beverages, author of a text about electricity, and widely published critic of the established church. The young prodigy Lavoisier became a tax collector of the *Ferme générale* and an elected member of the Royal Academy of Sciences in Paris at age 25. Jackson writes, "With the characteristic arrogance that amused friends and infuriated enemies, Lavoisier wanted nothing more than to lay the foundations of a new science, with its basis in combustion. He personally would dump twenty-three centuries of accepted wisdom, he believed."

**John W. Severinghaus** is a professor emeritus of anesthesia at the University of California, San Francisco. He has studied the effects of high altitude on the respiratory system and brain and developed noninvasive monitoring of oxygen in patients. He lectures widely, especially on Carl Wilhelm Scheele's long-neglected role in the discovery of oxygen.

Unpolitic statements made over the years came back to haunt Priestley and Lavoisier; both seemed incapable of realizing how unwise their actions were. Priestley's Unitarian rejection of Christian orthodoxy and his furious free-thinking support of the American and French revolutions cost him his laboratory, church, and home, and resulted in dozens of his friends losing their homes, during the Birmingham "Church and King" riots of 1791. Lavoisier's wealth from his work as a tax collector, his hated tax wall around Paris, and his arrogance, especially toward lesser scientists (for instance, Jean-Paul Marat), cost him his head in 1794. "Naively placing his faith in reason, he could never see why, for those who glorify power, reason is hated and feared," writes Jackson of Lavoisier.

The Swedish apothecary and chemist Carl Wilhelm Scheele wrote Lavoisier on 30 September 1774, describing how, in 1772, he had made oxygen, which he called "fire air." Lavoisier never acknowledged Scheele's letter or his discovery. The letter should have been received within days of the mid-October dinner given by Lavoisier at which Priestley reported to a group of scientists his 1 August 1774 discovery that heating mercury calx (HgO) with a burning glass released gas that supported fire. Lavoisier had failed to discover oxygen two years earlier because he heated mercury calx with charcoal, which consumed the released O<sub>2</sub>. After three years of repeating Priestley's and Scheele's experiments, he named the gas "principe oxygene," and eventually overturned the phlogiston theory, developed in the 17th century by Georg Stahl, that incorrectly explained combustion. Lavoisier never credited Priestley or Scheele.

Although not discussed by Jackson, the story of Scheele's letter is of current interest to science historians. Hidden for 217 years by Madame Lavoisier's family, it was deposited in the Royal Academy of Sciences in 1991 by the comte de

Chabrol, a descendant of Christian Paulze d'Ivoy, who was the brother of Lavoisier's wife Marie Anne. Historian Edouard Grimaux claimed he saw the letter and published the text in 1890. Yet no other historian from that time reported having seen it. The letter had disappeared, raising doubt. When it became public in the early 1990s, Scheele's

famous letter spawned *Oxygen: A Play in Two Acts* (Wiley-VCH, 2001) by chemists Carl Djerassi and Nobel laureate Roald Hoffmann. Their play premiered in 2001 during the American Chemical Society meeting in San Diego, California. They plausibly speculate that Madame Lavoisier hid the letter from her husband to give him the credit for the discovery

of oxygen. Or had Lavoisier read and used the letter but not acknowledged it? Perhaps good reason to withhold it—for 217 years.

Four errors caught my attention: The oxygen in the Biosphere Project in Arizona, which ended in 1993, was consumed by soil organisms, mostly bacteria, not by soil iron (page 8), and the missing CO<sub>2</sub> was absorbed by the new concrete floor, according to a 1994 article in *Earth in Space* (volume 6, page 12). Scheele's prolonged sickness and death was more consistent with his tasting arsenic (Scheele's green cake frosting) than the toxic gases hydrogen fluoride or hydrogen cyanide (page 115). Also, the anesthetic laughing gas is nitrous oxide, not nitric oxide (page 126).

*A World on Fire* is an engaging read. Jackson writes "Yet given the murder and exile of its crafters, the Enlightenment still realized its goals. . . . From the ashes of the *philosophes* rose the thing they dreamed: the establishment of parliamentary institutions, the Declaration of the Rights of Man. . . . But all new faiths need martyrs, and Priestley and Lavoisier were ready-made." And Jackson gives the last word to Madame Lavoisier, who told a guest, "You have to have lived under the vacuum pump to appreciate the luxury of breathing."

