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Medicine in Stamps

Antoine-Laurent Lavoisier (1743 - 1794): founder of modern chemistry

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The story of Antoine-Laurent Lavoisier is one of awe, but one that was sadly and abruptly chopped short. From his revolutionary work on chemical reactions, science inherited a modern system of elemental classification, and medicine gained insight into the fundamental importance of chemistry in biological systems.

The Chemistry Revolution: Born into a wealthy family in Paris on August 23, 1743, Lavoisier started off in his father's footsteps as a lawyer but eventually succumbed to the draw of chemistry. It was then the fad in high Parisian society to attend scientific lectures, and for three years, he followed the teachings of Rouelle, a famous and popular chemist.

Lavoisier lived in the era of the French Revolution where science was still in its infancy. Water, if adequately heated, was believed to turn into earth. The circulation of blood had only recently been revealed by William Harvey, but its physiological purpose remained elusive. Robert Boyle, an English chemist, had proven 150 years earlier that animals needed air to survive and flames needed air to burn. But breathing was considered a breeze to "cool the blood," and scientists were only starting to realise that air contained important chemicals. Oxygen had yet to be discovered.

The then-dominant phlogiston theory proposed that an element termed phlogiston was contained in all combustible bodies, and this was released in the form of fire, heat or light during combustion. This erroneous theory was introduced in the 17th century by Johann Becher and Ernst Stahl, and it impeded scientific advancement for over a century. Lavoisier would eventually disprove the phlogiston theory and go on to discover the chemistry of respiration.

Lavoisier was one of the first to understand conservation of masses, although the credit has historically been given to John Dalton. His meticulous weighing of matter before and after combustion and his use of chemical equations to document every chemical change allowed him to uncover new truths. His work on water, for example, revealed that it is composed of two parts hydrogen and one part oxygen. It also led to one of his most momentous accomplishments, i.e. disproving that water mutated into earth. For one hundred days he boiled water, showing that heat did not bring about any elemental change.

This sentinel experiment paved the way for the eventual discard of the phlogiston theory. Scheele had "discovered" oxygen, which he called empyreal air and Priestly had discovered the same gas but named it dephlogisticated air. Repeating – but for unclear reasons – not acknowledging Priestley's experiments on obtaining oxygen from the red oxide of mercury, Lavoisier wrote in his paper, *Reflexions sur le Phlogistique*, that air was an integral component consumed during the process of combustion. Heat was produced from the "invisible motion of the particles" and not due to phlogiston. He also introduced some new terms e.g. hydrogen (inflammable air), oxygen and nitrogen (in the proportion of 20:80 in ambient air). In 1789, Lavoisier published his famous book *Traite Elementaire de Chimie*, now translated into English, which contained his most important discoveries.

Lavoisier's findings on combustion inevitably touched on the chemistry of respiration. He was able to piece together scattered clues that were already

known at the time. For example, blood was purplish prior to entering the lungs but turned red after it left. The change in the appearance of blood also occurred when it was aerated. Plants released oxygen, and air was vital for living things to survive. Lavoisier realised that respiration, like the burning of a flame, was linked to combustion. Food is burned to sustain life, and released as body heat. He correctly identified oxygen as an essential element that is consumed during respiration, and exhaled as carbon dioxide, which he called carbonic acid.

Other contributions to medicine followed. He wrote some seventy-three reports on medicine and public health, and his concise writing earned him positions on numerous commissions and committees. At one time, he even attempted to write, but did not finish, a drama entitled *La Nouvelle Heloise*.

The French Revolution: At an early age, Lavoisier joined the Ferme Generale (Farm General), an organisation that collected taxes and in turn paid a royalty to the king. Although he set himself apart from other members of the Ferme who dealt dishonestly with taxpayers, Lavoisier did amass substantial wealth as a result of this position. His first government appointment was the Commissioner of Powder, and the following year, he was promoted to director of the gunpowder factory. He was also part of the Committee on Agriculture where he proposed scientific methods for agricultural improvements. One of the most significant positions as a government official was serving on the Commission on Weights and Measures, which developed the metric system that is used in most countries today. He witnessed the unsanitary living conditions of the poor, and recommended humane and sanitary living conditions during his work on hospital and prison planning.

On July 14, 1789, commoners stormed the Bastille, and rose to oppose the aristocrats and the wealthy. The French Revolution had begun. Several countries, including England and Spain, declared war on France. In 1793, Louis XVI and Marie Antoinette were executed, and the Academy of Sciences was disbanded. Lavoisier was no longer regarded as a brilliant scientist, but a tax collector who appropriated funds, watered down soldiers' tobacco supply, and oppressed the commoners. As ill-luck would have it, a fellow chemist by the name of Jean Paul Marat was a member of the National Assembly that decided his fate. The unsympathetic Marat had earlier been denied election to the Academy of Sciences because of Lavoisier's recommendation. Knowing that the French government had decided there was "no use for savant," the doomed chemist accepted his fate calmly, writing on the evening before his execution these immortal words:

"I have achieved a passably long career, above all very happy . . . the emergencies in which I find myself enveloped will probably avert from me the inconveniences of old age. I shall die complete . . ."

The trial was quick and resulted in a unanimous guilty verdict. Along with other members of the Ferme Generale, Lavoisier was sent to the guillotine that very day – May 8, 1794. Fourth in line to be beheaded, he was only fifty years old.

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EDITOR'S NOTE

The Instructions to Authors have been updated. Please refer to pages 347-350 of the current issue of the journal and to the website (http://www.sma.org.sg/smj/instructions.pdf).

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