LAURE JOUMEL

FEATURE

Before 'modern' chemistry: a stroll inside the French books from the Roy G. Neville Historical Chemical Library

In France, the history of chemistry is an integral part of the university science curriculum. Students learn about the historical figures in the development of chemistry and the books they wrote, which became cornerstones of science. Some of the first and most beautiful editions of these works are conserved in a wonderful library of the Chemical Heritage Foundation (CHF) in Philadelphia, Pennsylvania, USA. The collection of the Roy G. Neville Historical Chemical Library (www.chemicalheritage.org/library/lib-neville.html), which is carefully conserved and open to the public, spans the late 15th century to the early 20th century and includes many of the most important works in the history of chemical science from that period. (Neville, who founded the firm Engineering and Technical Consultants, is a passionate bibliophile.) The Neville Collection is part of the Othmer Library of Chemical History, one of the richest libraries of this specialty in the world, with roughly 40 000 titles. (Donald F. Othmer was a founding editor of the *Kirk-Othmer Encyclopedia of Chemical Technology.*)

The Neville Library offers a remarkable selection of French-language books, including some rare and precious editions that detail the origin and development of chemistry before Lavoisier's 'revolution'. The library contains editions not only of Lavoisier and his contemporaries, including Louis Bernard Guyton de Morveau, Claude Louis Berthollet, Antoine François de Fourcroy, Pierre Joseph Macquert and Nicolas Lemery, but also his predecessors who marked the transition from alchemy to early modern science. And, of course, since the 'revolution' was not confined to France, the collection also features works from the rest of continental Europe.

Laure Joumel reviewed the Roy G. Neville Collection at the Chemical Heritage Foundation (CHF), during a one-month stay in Philadelphia, Pennsylvania, USA, under a CHF-Travel Grant. Joumel is still based in Philadelphia, where she now works in the communication department of Arkema. She is also a freelance writer.

From a philosophy to a science

One of the earliest French works in the collection is *Discours admirables* (Paris, 1580), by the great potter. Bernard Palissy (c.1510–1589/90) spent decades studying chemistry and other sciences to perfect his porcelain-making techniques. Palissy criticised contemporary alchemists who sought chemical knowledge in hopes of generating wealth through transmutation rather than applying their knowledge to practical ends, writing, 'Those who want to make gold and silver, their stinginess can not be hidden; their goals are at the same level as the lustful and lazy.' (Translations in this article are my own.)

Palissy would undoubtedly have been more satisfied with the practical importance of a 1697 work by Nicolas Lémery (1645–1715), an apothecary from Rouen, Normandy. In *Pharmacopée universelle*, a book that became a reference tool for generations of chemists (CHF owns a copy of the second edition, Paris, 1725), Lémery explained, 'I have begun a task that is greatly desired by many people and that no one, as far as I know, has ever worked on: a universal pharmacopoeia, in which I collect all the descriptions of old and modern pharmacy.' Lémery also wrote *Cours de chymie* (Paris, 1675), a standard reference in the teaching of early modern chemistry that had an influence well beyond France's borders. CHF owns French, English, Italian and German versions.

At the end of the 17th century, a British critic of contemporary chemistry, Robert Boyle, argued that a more orderly approach to chemical theories and practice was required. Conserved in a brown-red box in the CHF library, its cover cracked with age, is a copy of the first edition of Boyles' *The Sceptical Chemist* (London, 1661). The preface to this book reveals the author's thoughts:

> Chymical Notion about matters philosophical are taken for granted and employed and so adopted by very eminent writers both Naturalists and Physitians. Now this I fear may prove somewhat prejudicial to the advancement of solid philosophy: For though I am a great Lover of Chymical experiments . . . for ought I can hithero discern, there are a thousand phenomena in Nature, besides a multitude of Accident relating to the humane body, will scarcely be clearly and satisfactorily made out by them that confine themselves to deduce things from Salt, Sulfur, and Mercury.

The book found a wide audience in several languages and countries; CHF's holdings include editions published in the Netherlands (1668) and Switzerland (1680).

A new step

An early attempt to provide theoretical grounding to early modern chemistry was Georg Ernst Stahl's (1660–1734) theory of phlogiston.

According to Stahl, phlogiston (derived from 'flame') is the engine of combustion. He saw fire – one of Aristotle's four elements – as a component of all matter. When matter

burnt, it lost the fire that was inside it: phlogiston. Conversely, when matter was heated, it gained some phlogiston. The principle was seductive because it provided a harmonious answer to two of chemistry's most perplexing questions, combustion and reduction.

Pierre Joseph Macquer (1718–1784) was one of the key exponents of the theory of phlogiston in France. In his *Dictionnaire de chymie* (Paris, 1766), Macquer (1718–1784) praises the key figure in the development of this theory: 'We have to recognize the magnificent and deserved titles of the famous [Georg Ernst] Stahl, brilliant, an active imagination, and animated by wisdom.' The presence in the Neville Library of French-language copies of several of Stahl's most famous books testifies to his influence on French chemists before Lavoisier.

The cornerstone of modern chemistry was built during the second half of the 18th century. Scottish chemist Joseph Black (1728–1799) isolated carbon dioxide (which he called 'fixed air'), which marked the beginning of the end of phlogiston. Henry Cavendish (British, 1731–1830) discovered the synthesis of water and understood that it comes from two different gases: 'ignitable (inflammable) air' (H_2) and 'dephlogistic air' (O_2) – indeed before Lavoisier. Joseph Priestley (1733–1804), the last great holdout against Lavoisier's 'new chemistry', was also well-read in France. In his *Experiments and Observations on Different Kinds of Air* (1775), Priestley reflected, 'All the species of Air that seem for me different from each other are fixed Air, acid Air, and alkaline Air because these and another called phlogiston, that I couldn't isolate and by now has never been proved in any shape, are all the species of Air that I know.' The Neville library holds (besides several British editions) two French editions of his *Experiments and Observations on Different Kinds of Air* (1775).

Another important precursor to Lavoisier's theories was the work of the Swede Carl Wilhem Scheele (1742–1786), who discovered the 'acid' muriatic dephlogiston (which would later be called chlorine) and the 'fire' Air (which would be called oxygen). In *Supplément au Traité de l'Air et du Feu* (Paris, 1785), Scheele begins, 'We know that we can't see our Air just as an elastic liquid because if you take off all the heterogen that belongs to it … we find that the Air is formed by two distinguished parts: one is called "vicie Air" because it is dangerous and deadly, and the other is called "pur Air" or "fire air" because it is exactly the opposite and permits breath.'

The birth of modern chemistry

Priestley's isolation of oxygen and other gases and centuries of chemical experimentation by other pneumatic chemists set the ground for Lavoisier's pathbreaking work. CHF owns dozens of early French-language editions by Lavoisier and his followers, including a 1789 edition of his glorious *Traité élémentaire de chimie* which contains illustrations engraved by Madame Lavoisier. The inspiration behind Lavoisier's magnum opus lay in his work on a new, standardised chemical nomenclature: 'As I was working on nomenclature, while I just wanted to perfect the language of chemistry, my book was changing in my hands … it became an elementary course of chemistry.'

The Neville Library holds a first edition of the book that provided the foundation of our modern chemical language. The result of eight months of collaboration between its authors – Lavoisier, Guyton de Morveau, Berthollet and Fourcroy – *Méthode de nomenclature chimique* (Paris, 1787) provides a step-by-step guide to the thinking that led to the new vocabulary: 'We adopt the expression "oxygen" … from the Greek *oxnz*, acid, and *geinoma*, generate.' The theories and vocabulary espoused by Lavoisier were quickly adopted in his native land and elsewhere.

The books in the Neville Library by Lavoisier's predecessors, contemporaries, and followers – many of them translated into several languages – show the development and dissemination of the 'new chemistry' and its nomenclature. It is from the knowledge contained in these texts that modern discoveries bloomed.

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