Chemical analysis

Language reform played an integral role in the development of a discipline.

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Science is often viewed as an esoteric knowledge associated with powerful and obscure practices. This is especially true of chemistry. Chemical names and formulas, though of obscure meaning to most people, refer to tangible and edible products which can poison people or relieve their pains. Who dared to create an artificial vocabulary to replace the words used in everyday life?

The easy answer is: Antoine Lavoisier did, in 1787. At the birth of modern chemistry, according to this widely held view, the founder had to wash away a plethora of names derived from alchemy to create a logical system of nomenclature. Without being absolutely wrong, this cliché distorts history.

Lavoisier did not set out to reform the language by himself. This project was initiated by the lawyer and chemist Louis-Bernard Guyton de Morveau, who established a set of basic principles. Nomenclature should reveal “the nature of things”, he said. Simple substances should have simple names evoking their most characteristic property. Compound names should express the composition of chemical compounds. Greek etymologies should be used in preference to Latin.

Furthermore, the initiative to reform the language of chemistry preceded the chemical revolution. Eighteenth-century chemists, using new and improved analytical procedures that allowed them to distinguish between substances, repeatedly complained either that one name referred to various substances or that various local names were used for one single substance. Moreover, names were needed for newly identified substances such as cobalt and vanadium, named after figures from northern European mythology.

But the increasing number of substances was not the only driving force behind the construction of a new language. Chemists were also following the example of natural scientists, who had introduced a systematic nomenclature into botany. They were further inspired by the Enlightenment philosophers' quest for a rational and universal language.

Guyton started his attempt to reform the language in 1782 and submitted his project to the Paris Academy of Sciences in January 1787. There he encountered a fierce debate over the existence of ‘phlogiston’, a principle that explained combustion and reduction in the opposite way to Lavoisier. Most chemists at the time believed in phlogiston, but Guyton was converted to Lavoisier's theories and revised his work with the help of Lavoisier,

Claude Berthollet and Antoine Fourcroy. Four months later it was published with no mention of phlogiston but with new words such as ‘oxygen’ — from Greek words meaning ‘acidifying principle’ — stemming from Lavoisier's controversial belief that all acids contained oxygen.

Lavoisier, a disciple of the philosophy of language developed by Etienne Bonnot de Condillac, argued that the new language mirrored nature and that it was a sure and definitive method because it followed “natural logic”. Surprisingly, despite numerous objections raised by contemporary chemists, the new language was adopted all over Europe during the next two decades. But adoption of the French nomenclature did not always mean conversion to Lavoisier's chemistry and philosophical commitments. The reform fulfilled a long-felt need among the chemical community and it came at the right moment as the teaching of chemistry was itself developing.

The reform of language was an integral part of the formation of the autonomous discipline of chemistry. It also contributed to the subordination of pharmacy to chemistry and, more broadly, to the redefinition of chemical arts as applied chemistry. The new language, forged by academic chemists, separated many users of chemical substances from their own traditions. Pharmacists, dyers, glass-makers and manufacturers were not really happy with the substitution of compositional terms for the terms they had used expressing colours, odours or medical properties. The new language ignored the chemists' senses, banished all reference to geographical origins or the discoverers of the substances, and imposed an analytical quantitative logic.

This logic proved to be a good method of naming over time. But the principles of the system were never strictly applied in the nineteenth century. Oxygen should have been renamed when Humphry Davy established that many acids do not contain it. But custom prevailed over the imperative of systematization. Colours and odours were restored after the discovery of chlorine and iodine, named from the Greek for ‘yellowish-green’ and ‘violet’, and bromine — from the Greek for ‘stink’. In the realm of organic chemistry, the medical properties still provided names such as morphine, named after Morpheus, god of dreams. Geographical origins resurfaced with benzene, named after *Styrax benzoin*, a

Oxygen: inspired a new nomenclature.

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tree native to Sumatra and Java. Nationalism also infiltrated chemical nomenclature with scandium, germanium and polonium. In brief, it seems that the systematization imposed by four chemists, who acted as legislators in the name of rationality, remained an ideal often contradicted by practice.

This tension between the ideal of a systematic language based on general principles and the constraints of daily use remains a major characteristic of twentieth-century chemical nomenclature. Reforming the language is no longer a revolutionary enterprise conducted by four ambitious chemists in four months. It is the task of a permanent commission called the International Union of Pure and Applied Chemistry (IUPAC). New rules are formulated from time to time, as part of everyday science. But so great is the difficulty of keeping up with systematic names for complex compounds that reformers have renounced any ambition of submitting the molecular world to systematization. The ideal of a rational language, a mirror of nature, gave way to the imperative of standardization. Time will tell us whether this more modest attitude will improve the public understanding of chemistry. ■

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