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The Pedagogical Construction of Chemistry

Inventing Chemistry: Herman Boerhaave and the Reform of the Chemical Arts by John C. Powers, University of Chicago Press, 2012, viii+260 pp., Hardback, £26.00, ISBN 978-0-226-67760-6

Recent historiography has disrupted a traditional revolutionary narrative of the history of chemistry, in which singular figures such as Robert Boyle and Antoine Lavoisier traded speculation for experiment and established chemistry as an empirical science. Historians of alchemy, led by William Newman and Lawrence Principe, have taken a leading role in this revisionism, demonstrating that early modern 'chymistry' was not a charlatan's ruse but part of a coherent experimental natural philosophy. One may nonetheless ask: when, where, and how did chymistry become chemistry?

In Inventing Chemistry: Herman Boerhaave and the Reform of the Chemical Arts, John C. Powers offers a surprising answer: chymistry became chemistry by way of medical pedagogy. Boerhaave is typically considered a pioneer in the organization of medical education, not a founding father of chemistry. Drawing upon manuscript notes spanning Boerhaave's forty years in Leiden, Powers contends that these two roles went hand-in-hand: 'Boerhaave used academic methods of structuring university medical courses and the experimental methods of demonstration from physics and physiology to reshape the pedagogy of chemistry and, in doing so, reform the status, aims, and theoretical framework of the field' (4).

Powers opens by situating Boerhaave within the University of Leiden, where he studied for a decade beginning in 1684 and to which he returned as a professor in 1701. Boerhaave built his popular medical courses out of an eclectic mixture of experimentalism, empiricism, and mathematics, which he managed to portray as triply orthodox: grounded in Calvinism, the teachings of the Leiden professoriate, and ancient Hippocratic practice.

Chemistry, however, had little place in any of these traditions. The Leiden medical faculty marginalized the teaching of chemical operations and recipes--which Powers, following Owen Hannaway, calls 'didactic chemistry'--as mere artisanal practices. Boerhaave sought to codify a sound method for chemistry and integrate it into the medical curriculum. He accomplished both, Powers argues, through a pedagogical innovation. Marrying the skeptical-experimental philosophy of Boyle to a chemical taxonomy proposed by Leipzig physician Johannes Bohn, 'Boerhaave created a chemistry, tailored for the medical faculty, that was about knowing things ... in addition to making them' (91). Crucially, Boerhaave recast fundamental chemical bodies or 'principles' as 'instruments': entities that mediated chemical change. These instruments created a systematic pedagogical order for Boerhaave's treatment of the vast variety of empirical chemical phenomena, permitting Boerhaave to avoid what he considered the mistaken generalizations of Paracelsian medical chemistry.

The heart of Powers' analysis comes in his fifth chapter, which addresses the ongoing 'instruments course' that Boerhaave taught from 1718 through 1728. In this course, Boerhaave used experimental demonstrations to teach chemical facts, theories, and methods of discovery and proof. To do so, he developed natural-philosophical applications of new technology such as the Fahrenheit thermometer and a novel technique of exposition, which Powers christens the 'demonstrational form.' Boerhaave codified this method of philosophical chemistry in his popular textbook, Elementa Chemiae. While some historians searching for precursors to Lavoisier's chemical revolution have dismissed Elementa as backward-looking, Inventing Chemistry suggests Elementa articulated theoretical principles, an experimental method, and open questions that set the agenda for the new chemistry of the mid-eighteenth century. Powers concludes with a pedagogical reframing of Boerhaave's alchemical efforts. In subjecting alchemical phenomena to the methods of rigorous experiment and orderly presentation that he used in his medical and chemical teaching, Boerhaave came to reject mercurialist claims that had previously shaped his understanding of the composition of metals. Chymist became chemist.

Powers writes clearly and persuasively, effectively folding the analytical apparatus of the social history of early modern science (virtual witnessing, literary technologies, credibility) into his treatment of Boerhaave's pedagogy. Readers new to the history of alchemy and chemistry will find plenty of historical background to orient them, while specialists will find Powers' reconstructions of Boerhaave's mercury experiments of particular interest. Philosophically inclined readers may find the Popperian upshot of the concluding chapter -- that a chymist's failed experiments might cause him to reject alchemical principles but reaffirm his method -- grist for productive debate.

As its title suggests, the subject of Inventing Chemistry is Boerhaave's chemistry, not Boerhaave himself; however, readers interested in learning more about the man will find plentiful references to biographical sources. And while Powers does an admirable job reconstructing Boerhaave's pedagogical career, the pedagogical experience of Boerhaave's students remains a mystery. This may leave fans of Kathryn Olesko, Robert Kohler, Andrew Warwick, David Kaiser, Suman Seth, and other contributors to the pedagogical history of modern science wanting to know more. However, by demonstrating the fruitfulness of attending to pedagogy in the early modern period, Inventing Chemistry makes an important contribution to this genre as well as to the history of chemistry.

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