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BOOK REVIEW

Gisela Boeck and Alan J. Rocke, *Lothar Meyer: Modern Theories and Pathways to Periodicity*

Cham: Birkhäuser, 2022. Pp. xi + 193. ISBN 978-0-303-78341-9. £79.99 (hardcover).

Gisela Boeck and Alan J. Rocke, *Lothar Meyer: Moderne Theorien und Wege zum Periodensystem*

Berlin: Springer Spektrum, 2022. Pp. ix + 217. ISBN 978-3-662-63932-0. £79.99 (softcover).

Peter J. Ramberg

Truman State University

Until recently, the German chemist Lothar Meyer (1830–95) has eluded detailed historical analysis. Although the name is certainly recognizable to historians of chemistry, the memory of Meyer has always lived in the shadow of Mendeleev's periodic table, and the details of Meyer's own route to the periodic law, pre-dating Mendeleev by five years, have remained less well known. Alan Rocke and Gisela Boeck have now addressed this deficiency. In 2019, they independently published articles on Meyer and the origins of his version of the periodic table, and in this volume, published in both English and German versions, Boecke and Rocke have collected three major works by Meyer. The English edition now provides the first lengthy English translations of any of Meyer's works. Included is a full translation (ninety-four pages) of Meyer's most famous book, *Modern Theories of Chemistry and Their Significance for Chemical Statics* (1864), a full translation of Meyer's 1870 article in the *Annalen der Chemie*, 'The nature of the chemical elements as a function of their atomic weights', and a partial translation of the 1872 second edition of *Modern Theories of Chemistry*, including excerpts from the introduction, approximately forty pages from the portion describing the periodic system, and five pages from the conclusion. The authors have also inserted the original page numbers into the appropriate locations in the text, filled in Meyer's own abbreviated citations with complete references and added many useful explanatory footnotes.

The lengthy introduction makes use of existing obituaries of Meyer and archival material and provides both a biography of Meyer and the background to the publication of *Modern Theories*. Among nineteenth-century chemists, Meyer had an eclectic education in medicine, physiology and physics before settling in Breslau as a *Privatdozent* in chemistry in 1858. While in Breslau, he reluctantly attended the 1860 Karlsruhe conference, but shortly after reading Stanislao Cannizarro's pamphlet on the reform of atomic weights (distributed at the conference) he became intensely interested in crafting a comprehensive general account of determining a consistent set of atomic weights following

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Cannizarro's outline and the consequences of those weights for the new theories of valence and structure in organic chemistry.

The result was the first edition of *Modern Theories*, a monograph directed at his colleagues in both chemistry and physics. It was in the last section of the book that Meyer introduced the relationship between chemical properties and atomic weights that would later become the periodic law. As the authors note, Meyer was drawn to this relationship by the similarity to the regular increases in the weight in organic compounds caused by the insertion of carbon radicals of constant weight. Meyer concluded that the atoms themselves must not be simple, indivisible entities, but have an internal complexity that increased in a regular manner. Thus Meyer's route to periodicity differed significantly from Mendeleev's, who assumed the atomic weight to be the defining characteristic of each element and not reflective of an internal complexity. Meyer's 1864 table also implicitly predicted the existence of new elements in the same way that Mendeleev's more famous 1869 table would, although Meyer did not, to his later regret, draw attention to this aspect of his table as Mendeleev did. The authors also note that, with a little manipulation, Meyer's table from 1870 is closer to the modern version than Mendeleev's first tables. Meyer also gave more consideration to physical properties of the atoms, reflective of his background in physics and physical chemistry, and in the 1872 edition of *Modern Theories* produced a distinctly visual image that showed a cyclic increase and decrease of atomic volume with atomic weight. The authors' account of the origins, similarities and differences between Meyer's and Mendeleev's periodic systems is thoughtful and well grounded in an analysis of texts and surviving correspondence.

In reading *Modern Theories*, I was struck by how the discussion of periodicity takes up only a few pages near the end of the book as a natural consequence of all that has preceded it. The bulk of *Modern Theories* consists of a quasi-historical account of nineteenth-century atomism, showing the various chemical and physical lines of thought that led to a consistent set of atomic weights, which in turn led to consistent concepts of valence and structure in organic chemistry. The path leading to these concepts was fraught with contentious issues that, according to Meyer, 'now appear already to have come to a certain degree of completion and inner consensus' (p. 53). Meyer also bookends the discussion with his admiration for Claude-Louis Berthollet's chemical statics, a chemical theory founded on attractive forces between particles. Berthollet's goal had not yet been attained, Meyer noted, and although chemists and physicists had parted ways in the early nineteenth century, their goals were similar, and both would benefit from a closer interaction. *Modern Theories* is also relevant as an example of nineteenth-century philosophy of science, as Meyer discusses the differing status of theories and hypotheses in chemistry and physics, and their roles in directing investigations of nature.

The translations are excellent overall, although in places the prose reads like a literal translation that could be rephrased in more idiomatic English (which is understandable, given the length of material to be translated). There are also some translations that I might have done differently. For example, in the section on periodicity at the end of 1864 monograph, a sentence is translated as 'It can scarcely be doubted that there is a distinct law behind the numerical values of the atomic weights' (p. 134). The original German sentence uses the verb *walten*, which has the more direct meaning of 'preside' or 'rule', and the sentence would translate better by noting something like 'that a certain law presides over the numerical values of the atomic weights'. This phrasing would be consonant with Meyer's statements elsewhere about laws and theories. Nevertheless, this is a minor point. These are welcome translations to complement the existing English translations of Mendeleev's works, and together with the introduction they provide an accessible route into a more detailed picture of the origins of the periodic law and an important insight into the relationship between chemistry and physics of the nineteenth century. I recommend this book highly to historians of both chemistry and physics.

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