

A Well-Ordered Thing. Dmitrii Mendeleev and the Shadow of the Periodic Table. Michael D. Gordin, Basic Books, New York, 2004; hardcover, xx + 256 pp, \$30.

This book is by no means a classical biography, as the author himself warns in the preface: "What follows is not a traditional biography. Here is no comprehensive account of every aspect of the adult Mendeleev's life, and we encounter precious little of his childhood." The promise is kept. Overall, Gordin provides an assessment of Mendeleev that is consistent, although I am not certain that I agree with all his conclusions. Nevertheless, I am comfortable recommending the book to those with an interest in Mendeleev and Russian chemistry in the last half-century of Tsarist Russia.

Dmitrii Ivanovich Mendeleev, the subject of this book, is perhaps the most identifiable Russian chemist of the last two centuries. A major part of the familiarity of western chemists with Mendeleev is actually an acquaintance with his first major discovery: the Periodic Table of the Elements and the Periodic Law. I was fascinated to find out that I was nowhere near as familiar with Mendeleev, the man, as I thought I was; and this book has substantially altered my perspective on the man behind the science. What emerges from Gordin's narrative is a complex man living in some of the most interesting times of recent Russian history: the reigns of Alexander II, the great reformer, assassinated in 1881, and his son, Alexander III, whose reign was characterized by the roll-back of many of those same reforms.

As Gordin views it, Mendeleev's career was really two rather disparate careers, with a dividing point in time of the defeat of his nomination to the Imperial Academy of Sciences in St. Petersburg. Prior to this seminal event in Mendeleev's life, Gordin views him as predominantly the scientist, for whom organizing science was a major thrust of his efforts, while afterward, his vision became much more imperial (rather than local), and his efforts became much more involved with using the imperial bureaucracy to effect change.

The book is organized in roughly chronological order of the topics discussed, although the various chapters obviously overlap in time. The first half of the book (roughly) deals with many of the facets of Mendeleev's scientific life as a professor in St. Petersburg, as he built his reputation in the scientific community, while the second half of the book concentrates on the more bureaucratic work of the established scientist.

The first chapters of the book deal with the development of Mendeleev, the fully mature scientist. It begins with a discussion of a seminal event in chemistry, the Karlsruhe Conference of 1860, where Stanislao Cannizzarro proposed his atomic weights for the elements, based on the earlier work of Amedeo Avogadro. Mendeleev himself saw his attendance at this meeting as a watershed in his early career, and Gordin makes some interesting points about the way in which Mendeleev used his attendance at this meeting to further his own career and raise his visibility in Russia.

This is followed by a discussion of the development of the Periodic System of Elements and its evolution into the Periodic law, an excellent chapter, where Gordin gives a lucid account of this advance, and where he debunks some long-held myths about how Mendeleev developed his periodic system. He also raises some interesting questions for the reader, among which is the question of how Mendeleev himself, who (like many of his contemporaries) did not embrace the concept of atomism as a physical reality, but who adhered to the concept of "chemical atomism," viewed the periodic system of elements that he had developed as a teaching tool. The beginnings of the Periodic System as a pedagogical problem, rather than as a fundamental research problem, and the evolution of the system as a problem from the realm of teaching to that of "pure science," are most revealing.

Although known best for his development of the periodic system of elements, Mendeleev actually finished his work on this topic fairly early and by 1872 had ended his own original work in the area, although he did continue to follow the work of others as they confirmed his predictions over the next decade and a half. His next great opus was work with gases. Mendeleev's work with gases had, as its ultimate goal, finding experimental evidence for the existence of the luminiferous ether by observing the behavior of gases at low pressures. The tale told is how Mendeleev sought out funding for his *low-pressure* gas experiments—based on *high-pressure* experiments to be carried out—and how he organized his laboratory assistants to accomplish the goals of what was a "big science" program. In many ways, this chapter best illustrates Mendeleev, the man. It begins with a somewhat scathing assessment of Mendeleev himself by his contemporary, organic chemist Fedor Fedorevich (Friedrich Konrad) Beilstein, who apparently harbored a healthy skepticism of Mendeleev's periodic law.

The next two chapters were, for me, the most enjoyable of the book. They describe the two great battles of Mendeleev's professional and personal life: his work against spiritualism and his battle to be elected to the Imperial (Petersburg) Academy of Sciences. In these two chapters the life of the chemistry and broader science establishments of St. Petersburg are laid out. Gordin's well written discussions of the political undertones of these two seminal events in Mendeleev's life contain a view of the major protagonists that are sometimes at odds with the traditional views of the great Russian chemists of the nineteenth century.

Spiritualism had become a major force in Europe during the nineteenth century, counting many reputable scientists among its adherents. Indeed, Gordin's account of Butlerov's gradual alignment with the spiritualists was particularly illuminating for me. Mendeleev saw it as his job to help discredit it, believing that these reputable scientists gave it a "scientific" status that it did not deserve (much like Kolbe saw Wislicenus giving stereochemistry a status it did not merit). The debates over spiritualism as described by Gordin work to overcome the popular mythology that has grown up around this topic, but it is at the expense of the "noble" Mendeleev, who occasionally appears to be more ideologue than dispassionate seeker after truth.

The battle over Mendeleev's candidacy for election to the Imperial Academy of Sciences was a turning point in his life, but it was also a seminal event of the development of a "Russian" identity of science in Russia. Like many, I was somewhat acquainted with this story, but I did not know the details. Gordin has done an excellent job of discussing this event and its wider implications; again, not all the protagonists emerge with their reputations unsullied. Butlerov, in particular, emerges as a man who allowed his national pride to overcome his better judgment, and who was willing to sacrifice friendship for nationalistic principle.

I found the second half of the book much more difficult to read, perhaps because of a lack of social sciences in my own background. It begins with Gordin's assessment of Mendeleev's reaction to being denied election to the Academy of Sciences. There is little doubt that the losing fight over Academy membership took its toll, and in the first chapter of the second half of the book, we see the evolution of his views on scientific societies, among others, in response to his rejection. Following his rejection by the Academy, Mendeleev's emphasis shifted, becoming increasingly bureaucratic

(in the sense of organizing and standardizing the various functions of government). He used his closeness with Tsar Alexander III and his position in the Chief Bureau of Weights and Measures to make imperial Russia a laboratory for his economic theories, as he led the modernization effort, including his attempts to introduce the metric system and his introduction of tariffs to encourage domestic economic growth in the face of international competition. His views on the use of tariffs are remarkably modern; similar views are being espoused today.

This chapter is followed by an assessment of the development of Mendeleev's persona and a critical examination of the legends that surround him (e.g., his "Siberian-ness," which is compared with the romance of the "wild west" in American folk-lore), and Mendeleev's own role in developing his public image. The chapter concludes with the transformation of the image of Mendeleev, a life-long conservative and supporter of the Tsar, into a "radical" romantic and his dismissal from his post at St. Petersburg University (a similar fate awaited Markovnikov a few years later). Gordin makes the point that this transformation of Mendeleev's image was not coupled to a transformation of the man. I found Gordin's arguments about Mendeleev's probable motives to be persuasive; the image of Mendeleev as a radical liberal is inconsistent with the bureaucrat who emerges during the preceding chapters.

This dismissal from St. Petersburg University provides the introduction to the penultimate chapter, which deals with the last years of Mendeleev's life and with the collapses that led to the revolution of 1905 and his withdrawal from public life. To the end, Mendeleev is portrayed as being a staunchly loyal Tsarist, who did not believe that a republic was a viable form of government for Russia.

In the final chapter of the book, "Conclusion: The Many Mendeleevs," what emerges is a well-rounded portrait of a man who, Gordin implies, may serve as a model for both his times and his country. The Mendeleev who emerges from Gordin's treatment is not the mildly eccentric Mendeleev of popular chemistry folk-lore, but a complex individual: an ambitious man who played a central role in the development of Russian science after passage of the Great Reforms, accumulated significant influence over Russian science, and saw his own role in the Russia emerging from the Great Reforms as central to the modernization of Russian society, politics, and economics.

The narrative is extensively annotated and supported by nearly 60 pages of notes and a 40-page bibliography; the level of scholarship is impressive. However, I was disappointed with the index, which occupies a scant seven pages in three-column format, is quite sparse compared to the notes and bibliography, and which is not as useful as it should be.

The clear strength of this book is in the study of the man, Mendeleev. However, the author's insight into the chemistry underlying that man's work is not one of its strengths. There are occasional places where Gordin's

commentary is somewhat confused, betraying a less-than-commanding grasp of the underlying chemistry, especially when he addresses more modern concepts, and this will temper the enjoyment of the book by the chemist reader. From my own perspective, one of the best facets of this book is that it lays out—albeit somewhat indirectly—the effects of the Great Reforms of Alexander II and the effects of the University Statute of 1863 on the development of Russian chemistry during the second half of the nineteenth century. *David E. Lewis, Department of Chemistry, University of Wisconsin-Eau Claire, Eau Claire, WI 54702-4004.*



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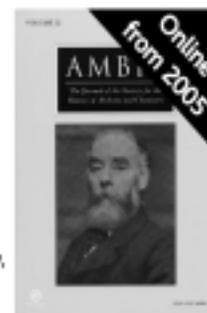
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