

Her biographical entry celebrates the work that she did, and it remains unclear how she viewed her contributions to science and the roles for women within chemistry.

Similar to Madame Marie Lavoisier, Jane Haldimand Marcet had a privileged upbringing showing interests in art and botany. Similar to Madame Lavoisier, Jane married a chemist, though not one on equal footing with Antoine Lavoisier. However, it was her husband's chemical interests that sparked Jane to begin writing introductory science texts. With twenty-three printings in the fifty years after its original 1806 publication, Jane's *Conversations on Chemistry* was an enormous success influencing countless chemistry students.

The women of the twentieth century represent the most diverse biographical entries in the book. For example, Martha Annie Whiteley, the first female professor at Royal College of Science, worked tirelessly in pursuit of her chemical research, her teaching, and expanded rights for female scientists in the first half of the twentieth century. Lina Shtern, a Russian Jew, became leader of the Institute for Physiology in the Soviet Union in the 1930s. Irén Júlia Götz-Dienes, was the first female chemistry Ph.D. in Hungary, worked with Marie Curie, and later became head of the Nitrogen Research Institute in Moscow. Kathleen Lonsdale, a pioneer in X-ray crystallography became one of the first two women elected as Fellows of the Royal Society.

The twentieth-century women have more complete biographical entries than the earlier women in the book; however, their lives, struggles, and accomplishments are naturally condensed due to the book's format. A reader

does not get to explore the horrors some of these women faced, including religious and political persecution. The notion that the difficulties women have faced are multifaceted is touched upon in *European Women in Chemistry* but not explored in any detail; for example the reasons why many female chemists at the turn of the twentieth century remained unmarried as well as the dearth of women winning prestigious awards are only given the most cursory of sentences.

While the book and its biographical entries are intended to provide a historical overview of European women in chemistry, perhaps it would have been more inspirational if it had selected a few women for longer biographical entries. For example, perhaps an exploration of the influence politics had on Lina Shtern's science and how her resulting arrest and "rehabilitation" in 1953 affected her career would have been more meaningful to a young person today. Women today face pressures and expectations that they often do not want to admit are similar to the ones faced by women of earlier generations. Questions about balancing career and family, femininity and science, political beliefs and government-funded research are only some of the ways in which women today could have benefitted from longer-form biographical entries. Despite what could have been, *European Women in Chemistry* offers an informative historical overview giving women reason to be curious about the lives and careers about many remarkable women.

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*Radioactivity: A History of a Mysterious Science*, Marjorie C. Malley, Oxford University Press, Oxford & New York, 2011, xxi + 267 pp, ISBN 978-0-19-976641-3, \$21.95.

The subtitle of Marjorie C. Malley's new book *Radioactivity* is "A History of a Mysterious Science." That is a very apt and concise indication of what this 214-page account offers. The first of the three parts that the work is divided into is the history of the new science, commencing in 1896 and continuing through the first

decade of the 1900s. To this reviewer, these roughly one hundred pages were the most fascinating part of the text, providing in a easy, flowing writing style some insight into the confusion and almost disorientation experienced by the large cast of players groping with the strange behavior of the first new elements to emerge from Marie Curie's well-known prodigious efforts as well as from others. New measurement techniques, such as spectroscopy based on physical properties, were emerging and, in retrospect, it was not surprising that chemists were mostly

reluctant to accept conclusions based on something they could not actually see.

Radioactivity was an exceptionally controversial topic at the time and deniers, some very respected scientists among them, were prevalent. Skepticism was rampant. Of course, Ernest Rutherford's contributions are spelled out but also personalized by detailing what his thought processes probably were in confronting a dizzying show of inexplicable behaviors. Among the most challenging observations to deal with was what seemed to be an endless production of vast quantities of energy without any source. Finding the source became almost an obsession. Physical science had advanced greatly in the previous few decades, but this condition probably seduced many practitioners into a sense of overconfidence. The observed random nature of radiation emissions seems to have been a major source of frustration to those trying to explain the process since it contradicted the determinism that prevailed in science at the time. Malley's book, spiced liberally with interesting sketches from personal lives of the many actors, enables the reader to imagine what it must have been like during these early developments, a vicarious experience that is simultaneously intellectual and entertaining in retrospect since histories don't usually dwell on dead ends, what can be learned from them, and precisely why they occurred. One can sense the enormous pressure investigators were under when, not only colleagues in competition, but also the public in general wanted to know what was going on with these radioactive substances that were garnering so much exposure in the media. Early hints that transmutation was occurring were suppressed largely due to the embarrassing association of the idea with the recently demolished field of alchemy. Evidence for transmutation, however, inevitably became overwhelming and the concept eventually was adopted and surprisingly quickly, although its causes awaited further developments in science. Again, it is good fun to read some of the speculations invoked to explain the origin of transmutation and to get a sense of Rutherford's exasperation with the mystery.

Part Two of *Radioactivity* is a briefer discussion on measurements and uses of radioactivity. Discussion about the early methodology of photographs, electroscopes, and scintillation devices is followed by rapid advances in not only measuring devices, but construction of more and more advanced accelerators as the physics community dominated investigations of the inner workings of the atom. Competition was tilted in favor of those

laboratories that were equipped with the most modern technology. This review can't adequately mention all the applications and developments covered in the reading.

Malley's book neatly folds in the influence, both positive and negative, of international events during these times, particularly the World Wars and the Depression. There are some surprising scenarios involving intrigue and subterfuge that, in looking backwards, should be more publicly visible. The reader will discover these. Description of the various often contradictory medical experiments shows the contrast between very promising positive effects and the harm eventually recognized in careless application of radioactivity. The rise and fall of the radium industry is presented in very understandable fashion. Part Two ends with a very brief section on the discovery of fission and its rapid deployment for military purposes. The conciseness of this section is appropriate as the topic is extremely well documented in a variety of other tomes such as Richard Rhodes's *Making of the Atomic Bomb*.

The third part of *Radioactivity* is aptly titled "Beyond the Story" and deals mostly with the humanity and philosophy of individuals, of groups, of nations, and of discoveries in general. It draws on much of the history of the earlier parts of the book but is quite thought-provoking in its emphasis, not overdone, on philosophical aspects of research and researchers, not only with respect to radioactivity itself, but to the outgrowths of that discovery including the Bohr atom and ultimately quantum theory. Marie Curie's role in encouraging large numbers of female researchers at her institute is a consequential outgrowth of her personal experiences and an obvious component of this section. Although the Curies and Rutherford are dominant characters in the history, the many other participants are given their fair share of mention.

There are six appendices at the end of the book. These include a glossary, tables of information about radioactive isotopes and their "genealogies," a cast of characters, and a timeline of relevant events and personalities.

*Radioactivity* is very easy to read in small bites or at one sitting. If this reviewer had any criticism at all, it would be that the index could have been more thorough as could the citation of reference material. I learned a lot and enjoyed the tour.

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