sent a discouraging reply to Gleditsch, but by that time, Gleditsch had already embarked on a ship for the United States. Upon her arrival at Yale, Boltwood agreed to have Gleditsch work with him, and subsequently they became good friends. While at Yale, Gleditsch established a precise value for the half-life of radium. She also worked on the atomic mass of lead, which had been shown to differ from one mineral source to another. As meticulous as ever in her measurements, Gleditsch's results provided key evidence for Soddy's discovery of isotopes.

Returning to Norway, Gleditsch obtained poor-paying, low-status positions at the University of Oslo. In June of 1916, Curie requested Gleditsch to return to Paris to work at the radium extraction factory. Gleditsch undertook the perilous wartime crossing from Norway, first to England where Ernest Rutherford had obtained a security pass for her, and thence to France. Gleditsch worked at the factory until Christmas before returning to Norway. After the War, in 1920, Curie asked her to return to Paris to run the research centre while Curie was on a tour to Brazil. The friendship and contacts between Gleditsch and Curie continued for the remainder of Curie's life.

At the University in Oslo, Gleditch's teaching commitments mounted while she endeavored to continue research. Finally, in 1929, against considerable opposition, Gleditsch was appointed Professor of Chemistry.

In the 1930s, as the political situation deteriorated in Europe, Gleditsch offered haven to as many fleeing scientists as she could. Though Lise Meitner had fled to nearby Stockholm, Kubanek points out that, surprisingly, Gleditsch had little contact with Meitner, even though Gleditsch visited Stockholm periodically to see her long-time friend and colleague in radiochemistry, Eva Ramstedt. Throughout the Second World War, Gleditsch was active with the Norwegian resistance movement.

After formal retirement, Gleditsch continued with lecture and laboratory work, while expanding her diverse other interests. Despite having been exposed to so much radiation and suffering from periodic bouts of anemia, Gleditsch lived an active life until her death in 1968 at age 88.

This short review has focused upon Gleditsch's activities within radiochemistry. Kubanek's book has gone beyond this, giving a true sense of Gleditsch's life in the context of a woman scientist in early twentieth-century academia. In addition, there are interesting insights into the workings of the Curie laboratory. Kubanek should be congratulated for having filled a missing piece in the early history of radioactivity.

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The First Miracle Drugs: How the Sulfa Drugs Transformed Medicine, John E. Lesch, Oxford University Press, Oxford & New York, 2007, xii + 364 pp, ISBN 0-19-518775-X, $29.95

John Lesch accomplishes a great deal with this exhaustively researched and well-written narrative about a chapter in the history of science and medicine that has received surprisingly little attention. *The First Miracle Drugs* superbly explores the historical importance of sulfa drugs, persuasively showing how they sparked an expansion of pharmaceutical research and production, and "at the same time effected a significant change in the direction of medicine." (p. 7)

Developed in the 1930s, and used extensively until the mid 1940s to treat common bacterial infections (and particularly effective against streptococcal infections), sulfa drugs rather quickly were overshadowed by penicillin and other antibiotics. What Lesch reveals, however, is how sulfa drug research, application, and chemical theories were instrumental to advances in twentieth-century biomedicine.

First, sulfa drugs demonstrated the power of chemotherapeutic agents, initially developed by Paul Ehrlich during his quest for an anti-syphilitic agent in the early 1900s. Based on the proposition of chemotherapy—namely that chemical compounds introduced into the host organism could destroy disease-causing microorganisms—sulfa drugs represented a successful and dramatic step forward in one of the most important pathways in medical therapeutics. On Christmas Day 1932, the Ger-

man I.G. Farben company applied for a patent for Prontosil, unveiling a breakthrough drug that opened a "new era in the chemical treatment of bacterial infection." (p. 61) Lesch adds fresh material and analysis to the pivotal biography of Gerhard Domagk, who was awarded the Nobel prize in 1939 (although the Nazis prevented him from receiving it at that time) for the development of Prontosil, the first sulfonamide azo compound.

Second, sulfa drugs fueled expansion of pharmaceutical industries in Western Europe and the United States, and seeded growing international networks of scientists, physicians, and researchers. Lesch adroitly analyzes the complexities of pharmaceutical research and development in the context of Nazi Germany, carefully considering the activities and stances of I.G. Farben's research manager, Heinrich Horlein. After looking closely at the historical record, Lesch concludes that Horlein, who was tried and acquitted for war crimes at Nuremberg along with several high-level I.G. Farben executives, only joined the National Socialist party for "tactical accommodation rather than ideological conviction," and cites several instances of actions Horlein took to protect German science from Nazi influence (p. 109). Furthermore, Lesch traces the uptake of sulfa drugs, and the dynamics of their eventual development in France, Britain, and the United States. For example, the United States was the last to embrace sulfa drugs. It was not until 1936 that two Johns Hopkins University medical researchers attended the Second International Congress on Microbiology in London in 1936 and learned about Prontosil and the second generation Prontylin, which they then tested in experimental and clinical trials across the Atlantic.

Finally, Lesch illuminates the compressed yet intense years from the mid 1930s to the early 1940s when several types of sulfa drugs were the most effective therapies against an array of infectious diseases including pneumonia, gonorrhea, meningitis, bacillary dysentery, hemolytic streptococcal infections, and wounds and burns. Although their efficacy was uneven, and particularly weak for wound infections, sulfa drugs "carried the main burden of treatment and played an important role in prevention throughout World War II." (p. 249) Yet once penicillin entered the battlefield in January 1943, proving its effectiveness for all conditions except for bacillary dysentery, penicillin and subsequent generations of antibiotics soon eclipsed sulfa drugs. Their resounding success helped to erase awareness of the significant role of sulfa drugs in combating what until the 1930s had been humans' greatest bacterial threats.

The First Miracle Drugs is a significant achievement. Not only does it restore the oft-forgotten role of sulfa drugs, it also provides insight into the *modus operandi* of prominent pharmaceutical industries during the pivotal decades of the 1930s and 1940s. With no chip on his shoulder, Lesch evaluates the strengths and limits of key players involved in the research, development, and clinical application of sulfa drugs. Furthermore, in the book's concluding chapters, Lesch shows how attempts to explain the limits of sulfa drugs, namely the Woods-Fildes Theory, helped to generate the contemporary antimetabolite concept, which guided innovative research in medicinal chemistry (above all, for tuberculosis and leukemia) in the second half of the twentieth century.

In sum, Lesch's book is model scholarship for the history of science. He weaves together sufficient scientific mastery of chemistry with an ability to explain the significance of seemingly small details at the laboratory bench, thus demonstrating the larger significance of the story of sulfa drugs to biomedicine, scientific knowledge networks, and the politics of war and disease during the World War II era. One hopes that *The First Miracle Drugs* will receive a large readership despite the fact it is published only in cloth and at times requires some basic knowledge of chemistry.

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