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BOOK REVIEW

A lively, if sprawling, history of the atomic era

Craig Nelson: The age of radiance: The epic rise and dramatic fall of the atomic era. New York: Scribner, 2014, 438pp, US $29.99 HB

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Craig Nelson, the author of this unflaggingly engrossing book, comes from an impressive background in publishing, having been vice president and executive editor of Harper and Row, Hyperion, and Random House. In this respect, he reminds me of the better known Walter Isaacson, who was managing editor of Time magazine before turning his attention to writing biographies of Einstein, Steve Jobs, and Ben Franklin, and, most recently, a collective biography of the pioneers of the digital revolution. Although I reach this conclusion on the basis of having read only one book by each, I would say that Isaacson's oeuvre is more scholarly, Nelson's more journalistic. A review in the New York Times of Nelson's bestseller *Rocket Men* informs would-be readers that while the book "lacks the shapeliness and authority of some earlier lunar histories,…it ends up making an engaging contribution." Comparing *The Age of Radiance* to the many similar histories of radioactivity and the making of the bomb that I have read (several of which I have reviewed over the past decade for *Metascience*, along with biographies of some of the scientists profiled in Nelson's book), I could say much the same thing. The canvas Nelson paints is sprawling, and, in covering so much ground, the author occasionally, if only briefly, appears to lose focus. His breezy style may also undermine his authoritativeness for some readers. As a biographer of Marie Curie, I was initially taken aback at the end of Chapter 1 by Nelson's calling her "one hell of a broad." But I soon became accustomed to his *modus operandi*, and I not only enjoyed reading the book but also learned many interesting facts from it (albeit some more important than others).

Although Nelson divides the book into four parts, the first two comprise a slightly longer (and to me more interesting) section, taking us from the discovery of X-rays to the development of the atomic bomb and the detonations of Little Man and Fat Boy over Japan. The slightly shorter but more rambling Parts Three and Four focus

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on the Cold War arms race and the various nuclear power accidents from Three Mile Island to Chernobyl to Fukushima Daiichi. Nelson is somewhat more preachy in this half of the book, drumming in the assertions that nuclear weapons are ineffective as weapons of war, that the true victims of the arms race were the citizens on both sides of the Iron Curtain, that nuclear accidents have proven no more and perhaps less disastrous than other kinds of industrial mishaps, and that the public in its willful ignorance has developed a fear of all things nuclear by creating its own myths about the science of radioactivity. Interestingly, Nelson's seventeen-page bibliography does not include Spencer Weart's 1988 *Nuclear Fear* or its slimmed-down 2012 version, *The Rise of Nuclear Fear*, which explore that final point with sharper focus and more authority. (As someone who has watched too many episodes of *24*, involving Jack Bauer's heroic foiling of terrorists with "dirty" bombs, I was interested toward the end of the book to learn that Nelson dismisses them as "a myth and an absurdity," because of the difficulty that would be involved in obtaining enough fissile material and, even if this hurdle could be overcome, in keeping it from chain-reacting on its own before it could be directed to the intended target. Since this is a "nuclear fear" that sometimes grips me, I hope Nelson is right.)

My favorite part of the book is the portraits of the various scientists involved in the rise of the atomic era. To his credit, Nelson—no misogynist he—gives center stage not only to Marie Curie but also to Lise Meitner. Less fully informed about the details of Meitner's life than of Curie's, I was riveted by Nelson's depiction of the extent of the professional misogyny that impeded Meitner through life and continued to undermine her reputation after her death in 1968. During her three-decade collaboration with Otto Hahn in Berlin, Meitner had to walk to a nearby restaurant whenever she needed to use a ladies' room. Whenever colleagues from the Kaiser Wilhelm Institute encountered Hahn and Meitner together, they greeted him and ignored her. As the first female professor in German history, Meitner must have been distressed to discover an academic review's confusing the subject of her lecture on cosmic physics with "cosmetic physics." When Hahn received the 1944 Nobel Prize for chemistry for discovering fission, "the rewriting of Lise Meitner out of scientific history began in earnest." Never from the platform given to him as a laureate did Hahn go out his way to publicize "that his momentous discovery was made through correspondence" with Meitner, nor did he object to Meitner's being referred to as his assistant. In his memoirs, he referred to her only as "a bitter, disappointed woman." Even today, Munich's Deutsches Museum labels its display of Meitner's equipment and instruments as "Worktable of Otto Hahn," updated in 1983 by a small card that identifies her as Hahn's assistant. Complementing my horror at the undercutting of Meitner because of her gender is my sadness at learning that Meitner, about whose love life nothing is known, dismissed in her eighties as too late the professions of love made by physicist James Franck, with whom she had played music early in their careers.

Nelson also mentions other female scientists along the way, including Ida Noddack, Eva von Bahr-Bergius, Leona Woods, Melba Phillips, and Joan Hinton, though he might have described their contributions more fully. From the second half of the book, I learned that using women "calculators" to implement scientific

discovery was not purely a phenomenon of the Harvard Observatory in the early twentieth century. The Cold War work on the H-bomb at Los Alamos similarly relied on the effort of young women. When Feynman's group found that IBM punch-card units lacked powerful enough hardware to carry out the complicated calculations on the "phenomena arising from the intersection of fission and fusion," these women used Marchant mechanical calculators "to fill in successive boxes on a spreadsheet, where various differential equations had been reduced to first-order differential equations, so there was only adding, subtracting, and multiplying, as one crawled one's way across the spreadsheet." I also learned that John von Neumann's wife, Klari, wrote the binary code for von Neumann's expansion of Alan Turing's concept of a machine using binary code for content as well as programming. Who could fail to be charmed by the acronym for the resulting machine: MANIAC (the Mathematical Analyzer, Numerical Integrator And Computer)? Or to learn that student skits at Christmas parties at the University of Chicago's Institute for Nuclear Studies often involved an electronic computer named ENRIAC, which was able, like Fermi himself, "to provide instantly order-of-magnitude estimates"?

A topic about which I thought I knew quite a lot—Einstein's famous 1939 letter to President Franklin D. Roosevelt—turns out in Nelson's coverage (though seemingly drawn from Isaacson's biography) to be more complex than I had remembered. I knew that Leo Szilard was the impetus for the letter but had forgotten that Einstein's first draft was addressed not to FDR but to the queen of Belgium, along with a second letter to the State Department asking for a ruling about communication between resident aliens and a foreign power. Shortly after these letters were drafted in July, Alexander Sachs, a Lehman Brothers vice president and economic consultant to FDR, told Szilard that Einstein should send his concerns about the Nazi pursuit of atomic weaponry directly to the president; Sachs offered to deliver the letter himself. Szilard and Einstein thus worked on a second letter in August, which Sachs delivered in October, but not before Szilard and Einstein, in their innocence, briefly thought of approaching Charles Lindbergh to ask him to inform FDR about their fear that Hitler's scientists would use their understanding of fission to produce a weapon of mass destruction. Only upon learning of Lindbergh's high regard for the Nazi regime and of his isolationist stance regarding involvement in the war to come, did Szilard and Einstein accept Sachs's offer to act as postman. FDR's response to Einstein, dated a week after Sachs's visit to the Oval Office, informed him that a US presidential advisory committee "regarding the element of uranium" would be set up. The committee's first meeting was held shortly thereafter, but getting government funding for experiments was another matter. Szilard was anxious to carry out work on graphite as a possible moderator for a fission reaction, but the $6,000 he requested did not show up until Einstein sent a second letter to FDR. This letter followed the early 1940 visit to the US of Dutch physicist Peter Debye, who reported that German scientists were at work on uranium bombs in a facility code-named Virus House. The matter of the letter does not end there, either. Following the war, Einstein regretted having unwittingly initiated the American nuclear bomb program, even though he insisted that he "really only acted as a mailbox" for Szilard. Nelson quotes Einstein as saying,

"Had I known that the Germans would not succeed in producing an atomic bomb, I would not have lifted a finger."

The Age of Radiance is chock-full of all sorts of informative tidbits that grab the reader's interest, even if they are not all deeply consequential. In the chapter introducing the subject of Soviet spying on America's atomic research, for example, we learn that while the Russians had been informed about Fermi's first nuclear reactor, their translation for the reactor's location—a squash court underneath the eaves of the Stagg Field football stadium at the University of Chicago—was "pumpkin patch." In the same chapter, we also learn that Italian physicist Orso Mario Corbino, who in 1927, as dean of physics at the University of Rome, recruited 26-year-old Fermi with lifetime tenure, was also the author of *Accomplishments of Modern Engineering*, the very book that inspired the career of Igor Vasilievich Kurchatov, who became the Soviet counterpart of J. Robert Oppenheimer, guiding the development of the Soviets' first atomic bomb, first practical thermonuclear bomb, and first nuclear reactor. Earlier we learn that Teflon, which lines frying pans in home kitchens, was originally developed as a sealant for Harold Urey's process of separating out U-235 by centrifuging uranium hexafluoride.

Admirer of the book though I am, I have a few small bones to pick with Nelson. The book's scope is so broad that inclusion of a chronology, listing important dates in the professional lives of the scientists he profiles and of major events he describes, would have proved valuable. Nelson fails to follow up on some assertions he makes early in the book, as, for example, in Chapter 2, that "Nearly every one of [the] great leaps forward" that ushered in the atomic era "was made…by an academic nonentity." In any case, isn't it true that most researchers earn their academic stripes only after their discoveries are verified and publicized? His chapter titles are occasionally too narrow, as in the case of Chapter Four, "The Mysteries of Budapest," which somehow introduces not only the so-called Budapest Quartet of Szilard, Wigner, Teller, and von Neumann but also the Viennese Meitner. I also take issue with the second part of the subtitle Nelson has bestowed on the book as a whole. It is hard to accept that this is really a history of the "Dramatic Fall of the Atomic Era." The book's first chapter, after all, asserts that "radiation has become so ubiquitous in contemporary life that it is nearly invisible, at once everywhere and unnoticed." And the book's final paragraphs present us with an upbeat challenge: "it is humankind's responsibility to use the two-faced miracle discovered by Curie, Meitner, Fermi, Szilard, Teller, and Ulam correctly, not to turn away from it in fear, superstition, and ignorance. It is time to enter a post-Atomic Age, an era when the fearful products of nuclear science are minimized, and its beneficence maximized. It is time to learn to live with blessed curses."

In Nelson's coverage of the scientists with whose lives I am most familiar, I found a number of small errors. For example, Marie Curie's thesis advisor was Gabriel Lippmann, not Henri Becquerel. In 1995, she became not the first woman to be buried in the Panthéon but the first to be buried there on the merit of her own achievements; in 1907, Sophie Berthelot, wife of chemist Pierre-Eugène-Marcellin Berthelot, became the first woman to be buried there. Marie Curie and her daughter Irène Joliot-Curie did not die from the same disease; Marie died of aplastic anemia, which is not a cancer, while Irène died of leukemia, which is. Bohr's seaside villa

was not called Tisvalde; it was located in the village of Tisvilde, on the north coast of the island Zealand. The link between Heisenberg and Himmler did not originate in a friendship between their mothers but between their grandfathers; Heisenberg's maternal grandfather Wecklein and Himmler's paternal grandfather belonged to the same hiking club. Nelson also calls contemporary writer Amir Acazel, with whom I am acquainted, a physicist, when he is actually a mathematician. While I have no doubt that other readers may find similar small errors, they in no way diminish my admiration for *The Age of Radiance*. I recommend it to readers of *Metascience* without reservation.