

constitutive element of modern medical practices and entities (including drug therapies), and at the centre of which standards and standardization have been situated.

In sum, by engaging with concepts such as *Wertbestimmung* and providing a rich body of empirical evidence on the role of standards in the development of biological therapies, Christoph Gradmann, Jonathan Simon and their co-contributors throw significant new light on the origins of biomedicine in the late nineteenth and early twentieth centuries.

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DAVID C. CASSIDY, *A Short History of Physics in the American Century*. Cambridge, MA and London: Harvard University Press, 2011. Pp. 211. ISBN 978-0-674-04936-9. £22.95 (hardback). doi:10.1017/S0007087412000945

David Cassidy's new survey of twentieth-century physics is indeed short: about 170 pages of text. It aims for a brief introductory synthesis for students and the general public, so much of it will be familiar to scholars. It is primarily a history of American physics, though with occasional nods to developments abroad, such as for quantum mechanics. It has chapters on the *fin de siècle* emergence of American physics; growth in the First World War and the 1920s; the Depression; the Second World War, radar and the bomb; two chapters on postwar physics; Sputnik and the 1960s; and a long concluding chapter on the last four decades. A useful appendix provides data on numbers, demographics and funding of American physicists.

Cassidy's book will serve well as a synthesis for undergraduate courses in history of physics. It nicely complements recent short surveys of nineteenth-century physics, including Bruce J. Hunt's *Pursuing Power and Light* (2010) and Iwan Rhys Morus's *When Physics was King* (2005), both of which tell a mostly European story. Mary Jo Nye's *Before Big Science* (1996) covers the period from 1800 to 1940 and includes chemistry. Cassidy starts his story at the turn of the twentieth century and focuses on physics in the US. He provides a short alternative to more detailed surveys of twentieth-century physics, such as Helge Kragh's *Quantum Generations* (1999) and, on the American context, Daniel J. Kevles's *The Physicists* (1995). One regrets, though, the assumption – certainly grounded in teaching experience – that today's undergraduate can only tackle two hundred pages of text in a term.

Cassidy gives due attention both to ideas and to institutions. For the former, he generally provides clear explanations of physical concepts and theories; the book's brevity, however, at times limits discussion, and topics such as band spectra, isotopes, quantum field theory and quarks may mystify non-physics majors. For institutions, Cassidy pays particular and welcome attention to industry, where many – by the end of the century, most – American physicists worked. He shows how the rise of physics helped underpin the American century, through physicists' familiar role in nuclear weapons and other military technologies, and through their perhaps less recognized contributions to commerce; Cassidy nicely traces developments such as integrated circuits, lasers and supercomputers to their roots in physics research.

Cassidy addresses familiar issues for American physics, including the rise of collaborative Big Science, and especially the twin tensions between pure and applied science, and between political autonomy and the desire to serve national interests and tap federal funds. He shows how the American political system and society had subsumed physics by the 1970s, evident in the disappearance of powerful scientist-administrators. The book implicitly reveals this development: the early chapters include short biographical sketches of exemplary figures: Jewett, Hale, Millikan, Lawrence, Oppenheimer, Karl Compton, Melba Phillips, Vannevar Bush. These capsule biographies disappear from the postwar chapters. Cassidy documents persistent sexism, ethnic and racial discrimination and anti-Semitism in the physics profession. He also touches on historiographical debates, especially Paul Forman's thesis on military influence on postwar science

and Forman's later argument about modernity, postmodernity and transcendent values among physicists and their historians.

Although Cassidy describes American physics in a celebratory mood at the end of the twentieth century, his survey suggests a more ambivalent rise-and-fall narrative, which jibes with frequent expressions of a discipline in crisis in recent forums such as *Physics Today*. Some of this declinism stemmed from funding cuts, highlighted by the cancellation of the Superconducting Super Collider; some from loss of control, not only in the political arena, but also in industrial labs, which increasingly subordinated research to product development and marketing (or outsourced it altogether). Cassidy also chronicles the diffusion of the physics discipline, through fields such as chemical, medical, computational, plasma and condensed-matter physics, and more explicit interdisciplines such as astrophysics, geophysics and biophysics. These fields often have their own specialized societies and journals, and *Physical Review*, which by 1993 was publishing seventy thousand pages of research a year, has splintered into five separate sections.

Finally, Cassidy notes that internationalization and globalization, evident in the predominance of foreign graduate students in American physics programmes, have diluted the notion of a national physics community. He concludes that a similar history focused on physics in a single nation will be impossible a century from now. That assumes that a coherent discipline of physics, a historical construct of the last few centuries, is itself still around to chronicle.

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ANDREW BROWN, *Keeper of the Nuclear Conscience: The Life and Work of Joseph Rotblat*. Oxford: Oxford University Press, 2012. Pp. xvii + 347. ISBN 978-0-19-958658-5. £18.99 (hardback). doi:10.1017/S0007087412000957

Andrew Brown wrote the first biography of Sir James Chadwick (1891–1974), Nobel laureate and discoverer of the neutron. Research for this led him to interview Professor Sir Joseph Rotblat, whose biography he is well placed to write. It is based largely on material appearing in Rotblat's Churchill College Archive, some four tonnes of papers having been removed from his house after his death in 2005.

Rotblat was born in Warsaw in 1908, in what was a prosperous household, but suffered severe poverty after the failure of the family business at the start of the First World War. He started work as a domestic electrician with a growing ambition to become a physicist. Without formal education he won a place in the physics department of the Free University of Poland, gaining an MA in 1932, and then a doctorate in physics at the University of Warsaw in 1938. During his time in Warsaw he made major discoveries, including inelastic neutron scattering and Cobalt-60, subsequently used worldwide in radiotherapy. With the discovery of nuclear fission, he repeated the experiments and showed that in the fission process more neutrons were emitted than absorbed; he was probably ahead of Joliet-Curie, who won the Nobel Prize for this discovery.

In early 1939 Rotblat envisaged that a large number of fissions could occur, and if they did so in a short enough period of time, then considerable amounts of energy could be released. The idea of an atomic bomb occurred to him around February 1939. In the same year he was invited to study under James Chadwick, then at Liverpool University, who was building a cyclotron to study fundamental nuclear reactions. After the outbreak of war Chadwick instructed Rotblat to investigate the properties of uranium, to determine the absorption cross-section for fast neutrons and the energy spectrum of fission neutrons. Following work by Otto Frisch and Rudolf Peierls, it became clear that it was only a matter of time before a bomb could be made.

In 1944 Rotblat joined Chadwick's group working on the Manhattan Project, but walked out in under a year. His ambivalence towards the project was compounded when, at a dinner hosted by Chadwick, General Groves announced to the room that the whole purpose of the bomb was to