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A Tale of Seven Scientists and a New Philosophy of Science

A Tale of Seven Scientists and a New Philosophy of Science.. Eric Scerri 262 pp. Oxford U.P., New York, 2016. Price: $29.95 (hardcover). ISBN 9780190232993.

Michael D. Gordin

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A Tale of Seven Scientists and a New Philosophy of Science. Eric Scerri. 262 pp. Oxford U.P., New York, 2016. Price: $29.95 (hardcover). ISBN 9780190232993. (Michael D. Gordin, Reviewer.)

We tend to think of science as a future-directed endeavor, but we all have stakes in its past. This is obvious regarding historians of science, like myself, but scientists do it too, and chronically. Every citation in an article is a reconstruction (accurate or not) of its past, and anecdotes and cautionary tales (accurate or not) remain staples of the everyday scientific life. Philosophers of science, too, have sought to extract lessons from the past—most famously Thomas Kuhn in his *Structure of Scientific Revolutions* (1962)—although recently an emphasis on contemporary developments has shifted philosophers, especially philosophers of physics, away from historical hunting grounds.

Eric Scerri's *A Tale of Seven Scientists and a New Philosophy of Science* insists that there is much to be gained from returning to history as a source for philosophy. This book consists of a series of concise chapters outlining the biographies and principal intellectual contributions of seven scientists engaged in the question of electron configuration in atomic theory during the first decades of the twentieth century: John Nicholson, Anton Van den Broek, Richard Abegg, Charles Bury, John D. Main Smith, Edmund Stoner, and Charles Janet. (The last is somewhat of an outlier, being principally an innovator in the structure of the periodic table, which isn't quite the same thing as electron configuration.) These are not exactly household names in the textbook-sidebar history that emphasizes Niels Bohr, Wolfgang Pauli, and H. G. Moseley, among other luminaries. Scerri picks them precisely because they are less well known. Scerri believes that people tend to attribute their achievements to Bohr and Pauli—a persistent leitmotif of the text are barbs hurled especially at Bohr (for example, pp. 29, 84, and 95) for being credited with developments that Scerri argues are primarily Nicholson's or Bury's. (It is hard to see how this is Bohr's fault.)

The repeated emphasis on priority is ironic in two senses. First, one of Scerri's main philosophical points is that science develops by incremental changes with manifold contributions by those who are forgotten by later generations, and therefore that scientists, philosophers, and historians should be substantially less obsessed with credit. Yet his mode of argument consistently manifests a redoubled emphasis on credit, albeit one that is redistributed away from Bohr and Pauli. (Scerri recognizes the tension twice, on p. 142 and in endnote 21 on p. 214.) Following the citation trail shows that every skyscraper was made out of innumerable girders.

This is related to the second irony. Scerri maintains that scientists should be generous in their acknowledgment of the many contributions that have led to their achievements, but he himself is somewhat less so. Many of the citations, especially for historical claims, are to articles or books by Scerri, themselves dependent on legions of historians unnamed here. Scerri laments that historians do not pay attention to his stratum of unacknowledged scientists, but for several decades scholars such as Buhm Soon Park, Ana Simões, Kostas Gavroglu, Michel Janssen, Theodore Arabatzis, and others have addressed the history of electron configuration. I mention them here because I agree with Scerri that more awareness of their past would be beneficial to practicing scientists, and *A Tale of Seven Scientists* does not provide a clear bibliographic guide.

At the (substantial) risk of seeming pedantic, at many places minor errors work against the force of Scerri's interesting scientific reconstructions. For those who read the book electronically, the occasional vanishing of umlauts in German names or the tendency of J. J. Thomson to become "Thompson" will make some individuals hard to locate. (The index has it right.) More problematic are casual assertions that are not fact-checked. For example, in lamenting Janet's presentation to Anglophone audiences in *The Chemical News* in 1929, Scerri asserts that the misleading piece was likely written by the editor, William Crookes (p. 165). One can certainly raise eyebrows at Crookes—alongside a stellar scientific career, he was also a devotee of séances and believed he had photographed ghosts—but of this sin he must be innocent, because when the article appeared he had already been dead for a decade. I recognize this is the kind of thing that makes historians less fun at parties, but to my mind it is the same respect for accuracy that Scerri (and all of us) rightly demands of scholarship, including science.

In the end, Scerri's historical claim about recovery of attribution is subordinate to his philosophical claim: that science develops by incremental progress, in very strong analogy to evolution by natural selection, and that an emphasis on "revolutions" is deeply misguided. It is hard to argue with the critique of revolutions: you would be hard pressed to find many historians or philosophers of science of the past two decades who deploy this language. His target here, as hinted at above, is Thomas Kuhn, whose 1962 classic remains a touchstone, though a largely superseded one. Most scholarship on Kuhn—such as that cited by Scerri in his final synthetic chapter—is critical of the revolutionary frame. More surprising to me as a reader of Kuhn is that Scerri's picture of incremental contributions to science is extraordinarily close to Kuhn's arguments about "normal science"—that is, "puzzle-solving" as the day-in, day-out work of most scientists in most periods. This is a view that ought to be congenial to Scerri's own presentation, and yet he does not mention it, nor does he engage the quite similar program of

Imre Lakatos. Scerri does situate himself in the context of writings in evolutionary epistemology, and he concedes his view is on the stronger side.

Many parts of the book remain thought-provoking, and will likely be of great interest to certain readers. As he admits more than once (p. 11, 64), his audience is not really historians, since they largely agree with his picture of science. I expect philosophers might remain unpersuaded of the evolutionary picture (that Scerri dubs in the introduction, in analogy to James Lovelock's controversial views, "SciGaia" [pp. 8 and 9], to highlight evolution independent of agency) and would prefer to see a more rigorous defense. The final readership—scientists—seems the right one, and both experts and non-specialists will find the presentation of Nicholson and Stoner's work, as well as of the other five scientists', illuminating. If this book prompts the reader to dig back into old journals and read some fascinating forgotten pioneers of science, it will have served an admirable purpose.

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True Genius. The Life and Work of Richard Garwin, The Most Influential Scientist You've Never Heard Of. Joel N. Shurkin. 308 pp. Prometheus Books, Amherst, New York, 2017. Price: $25 (hardcover). ISBN 978-1-63388-2232. (Cameron Reed, Reviewer.)

Richard Garwin is one of the last surviving members of the cadre of Manhattan Project-era physicists and their students who went on to distinguished careers as both scientists and policy analysts. The depth and breadth of Garwin's contributions to pure physics, commercial and national-security technologies, and service on government committees, boards, and panels is astonishing. As the subtitle of this biography indicates, Garwin is probably largely unknown to the public and likely even to today's generation of physicists. A sense of the magnitude of his contributions is indicated by a very partial list of the recognitions he has received: the National Medal of Science, the Presidential Medal of Freedom, election to all three United States National Academies, and being named one of ten Founders of National Reconnaissance by the National Reconnaissance Office.

A biography of Garwin is long overdue. This work was begun by writer and historian Daniel Ford in the 1990s but was taken on by Joel Shurkin when Ford was unable to complete the project. Shurkin had access to numerous interviews conducted by Ford, which he has complemented with considerable research and additional interviews of his own, including several with Garwin. Overall, Shurkin does a respectable job, but the result is marred by a choppy writing style and several minor errors.

Shurkin covers Garwin's life in essentially chronological order in 19 fast-paced chapters. Garwin's technical and mathematical talents were evident at a young age. He graduated from high school at age 16 and enrolled in the Case School of Applied Science, which is now part of Case Western Reserve University. A scholarship then took him to graduate school at the University of Chicago in 1947 where, as a student of Enrico Fermi, he graduated with his Ph.D. after only two years. Fermi considered Garwin a "real genius"; indeed, in his mastery of both experiment and theory, Garwin is reminiscent of Fermi. His career in public policy may have been inspired by Fermi, who towards the end of his life lamented what he felt to be his own relative lack of involvement in this area.

In the summer of 1950, Garwin accompanied Fermi to Los Alamos, where he became involved in the development of the "super" or hydrogen bomb in response to President Truman's call for research on such weapons. By the following summer, the Teller-Ulam radiation-implosion concept had been developed, and Teller assigned Garwin to draft a design, which he did in a still-classified six-page memo. This was not a final design but certainly played a role in the design of the "Ivy Mike" thermonuclear device that yielded a staggering 10.4 megatons when it was detonated in October 1952. Eclipsed by the debate over whether Teller or Ulam deserved credit for the bomb, Garwin's contribution to the project remained essentially unknown beyond a small group of insiders for nearly 50 years.

Garwin returned to Chicago in 1951 following his stint at Los Alamos, but the next year took a job as the Director of IBM's new computing laboratory located at Columbia University. His H-bomb work had brought him to the attention of the weapons establishment and its administrators in Washington, and his IBM contract included 1/3 release time for him to pursue government consulting. Both IBM and the nation benefitted from this arrangement.

Individual chapters of this book are each largely devoted to some technology, physical theory, or defense program in which Garwin had a hand in developing, proposing, or analyzing. His position at IBM coupled with two 4-year terms as a member of the President's Science Advisory Committee and longstanding service as a member of the JASON science advisory group brought him into contact with virtually every important defense and technological issue of the last half of the twentieth century. An incomplete list includes methods of detecting underground nuclear explosions and surprise bomber and missile attacks, advising President Kennedy on radiation released in the high-altitude *Starfish Prime* nuclear test of 1962, air traffic control systems, fast Fourier transforms, photocopiers, laser printers, touch screens, global positioning satellites, nuclear power, Permissive Action Links for nuclear weapons, electronic sensing of enemy troop movements in Vietnam, supersonic passenger aircraft, the MX missile system, the futility of anti-ballistic missile systems, briefing President Carter on the possible South African nuclear test of 1979, consulting on virtually every nuclear-arms treaty in existence, testifying against inflated claims for the Strategic Defense Initiative, and debunking claims of a second shooter in the Kennedy assassination. Some of his proposals were remarkably prescient, such as a computer-based system for exchanging medical records, off-shore floating airports to ease congestion in crowded urban coastal areas, solar-sail spacecraft, superconducting power transmission, and sea-to-air refueling of aircraft. His assessments were always backed up by hard-headed analysis of the physics involved and a deep understanding of the relevant current and likely future technologies. One JASON member was of the opinion that Garwin was "the most informed person in the United States on defense matters."

More often than not, Garwin's analysis of some issues would identify a technologically and economically superior approach only to run headlong into status-quo inertia, entrenched bureaucracies, the political power of contractors, and politicians who possessed no real technical understanding of programs upon which they were deciding. Despite numerous setbacks, Garwin never shied away from telling truth to power. He remains active, as evidenced by his 2015 effort to spearhead the preparation of a letter to President Obama praising the Iran nuclear deal that was signed by 29 distinguished scientists.

Unfortunately, the telling of Garwin's fascinating story suffers in this book. Perhaps reflective of his background as a freelance science writer and reporter, Shurkin's style is jumpy, characterized by frequent short phrases that gave me a sense of a work that was still in draft form, much in need of some editorial smoothing. An author's style is of course his or her own, but I suspect that many readers will find the narrative jarring. Some passages are garbled or come off as flippant, given the seriousness of the issues involved. For example, in a discussion of coincidence counting in Garwin's thesis work, we read that "He produced gamma-ray measurements less than a hundred-millionth of a second…" (p. 24). A discussion of the discovery of fission on page 22 summarizes that phenomenon as "…splitting the atom, and $E = mc^2$ and all that." A description of how a fission-fusion-fission bomb operates concludes with "Then the whole thing blows up" (p. 52). I came across a number of relatively minor but surprising errors that should have been corrected: Otto Hahn and Fritz Strassmann were chemists, not physicists (p. 22); Otto Frisch was in Birmingham, not London, when fission was discovered (p. 22); it is a leap to assert that Fermi's CP-1 pile showed that "it would be possible to build a city-destroying bomb" (p. 23); tritium is not "a radioactive isotope of lithium" (p. 29); the Department of Energy did not exist in 1962 (p. 92); and "National Research Laboratory" was probably intended to be "Naval Research Laboratory" (p. 192). These errors do not reflect on Garwin, but a biographical subject of his stature deserves better. Future treatments of Garwin will no doubt cite Shurkin, and misinformation propagation is bound to result.

Despite these problems, this book is required reading for anyone interested in learning about one of the key contributors to so many technologies and policies of the twentieth century. At a time when governments need sound scientific advice more than ever, Garwin is a shining example of a true patriot-citizen-scientist.

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BOOKS RECEIVED

Carbon Nanomaterials: Synthesis, Structure, Properties, and Applications. Rahesh Behari Mathur, Bhanu Pratap Singh, and Shailaja Pande. 282 pp. CRC Press, Boca Raton, FL, 2017. Price: $159.95 (hardcover) ISBN 978-1-4987-0210-2.

Size. Mark G. Kuzyk. 83 pp. Create Space Independent Publishing Platform, North Charleston, SC, 2017. Price: $6.95 (paper) ISBN 978-1548451639.

Solar Fuel Generation. Yatendra S. Chaudhary (ed.) 184 pp. CRC Press, Boca Raton, FL, 2017. Price: $169.95 (hardcover) ISBN 978-1-4987-2551-4.

Advances in Smart Cities: Smarter People, Governance, and Solutions. Apan Kumar Kar, Manmohan Prasad Gupta, P. Vigineswara Ilavarasan, and Yogesh K. Dwivedi (eds.) 229 pp. CRC Press, Boca Raton, FL, 2017. Price: $149.95 (hardcover) ISBN 9781498795708.

Foundations of Nuclear and Particle Physics. Thomas W. Donnelly, Joseph A. Formaggio, Barry R. Holstein, Richard G. Milner, and Bernd Surrow. 659 pp. Cambridge U.P., New York, 2017. Price: $84.99 (hardcover) ISBN 978-0-521-76511-4.

Macro-Econophysics: New Studies on Economic Networks and Synchronization. Hideaki Aoyama, Yoshi Fujiwara, Yuichi Ikeda, Hiroshi Iyetomi, Wataru Souma, and Hiroshi Yoshikawa. 416 pp. Cambridge U.P., New York, 2017. Price: $94.99 (hardcover) ISBN 978-1-107-19895-1.

Gravity: A Very Short Introduction. Timothy Clifton. 118 pp. Oxford U. P., New York, 2017. Price: $11.95 (paper) ISBN 978-0-19-872914-3.

Computer Simulation of Liquids. 2nd ed. Michael P. Allen and Dominic J. Tildesley. 640 pp. Oxford U.P., New York, 2017. Price: $60 (paper) ISBN 978-0-19-880320-1.

The Photomultiplier Handbook. A. G. Wright. 638 pp. Oxford U.P., New York, 2017. Price: $125 (hardcover) ISBN 978-0-19-956509-2.

Non-Relativistic Quantum Mechanics. Ravinder R. Puri. 455 pp. Cambridge U.P., New York, 2017. Price: $89.99 (hardcover) ISBN 978-1-107-16436-9.