omits serious examination of what that course might have been—neglects, for example, to deal in any depth with the question, If not microwave electronics, what instead? Then, too, Leslie treats the military as a faceless, autonomous entity, uninfluenced in its R&D policies by the scientists and engineers whom it was supporting. In fact, academic physicists and engineers lived in symbiotic partnership with the military, helping to shape defense agency research programs as advisers and consultants and using military support to pursue their own purposes.

In retrospect, the military's salient presence on the campuses appears chilling in many respects, not least to the idea of an open university. (A high official in the electronics program at Stanford noted, without irony, that not much was secret about the program's activities, since virtually all the faculty and a third of the students held security clearances.) However, it is not necessarily the case that a heavy emphasis on defense R&D in and of itself is crippling to American civilian competitiveness, even though Leslie is in good company these days in advancing that view. After all, at least through the 1970s military R&D seems to have spun off a good deal into the civilian sector, including jet transports, navigation systems, microelectronics, semiconductors, and computers. To understand why that spinoff worked so well then—and apparently has not in recent years—requires close examination of all that figures in the translation of innovation into commerce, including not only the modes of R&D that Leslie so ably illuminates but the patterns of public and private investment, incentives, and markets in which those modes are imbedded.

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Naturalist Administrator

Spencer Baird of the Smithsonian. E. F. RIVINIUS and E. M. YOUSSEF. Smithsonian Institution Press, Washington, DC, 1992. xii, 228 pp. + plates. $29.95.

Spencer Fullerton Baird (1823–1887) served as assistant secretary and then secretary of the Smithsonian, as head of the U.S. Fish Commission, and in numerous other central administrative capacities. These facts suggest that studying his career can tell us much about American science and its setting, yet he is one of the architects of American science who have not yet received much attention. Dean Allard began to look at Baird in a 1978 book documenting his role with the Fish Commission but did not proceed to a full biographical study. Fortunately, Rivinius and Youssef have begun that work. They have used the rich collections at the Smithsonian Archives, as well as their own familiarity with the Smithsonian and its history, to produce a valuable introduction to this important figure. They describe and analyze the man as well as his administrative work, painting Baird as human and fallible in some respects even while he seemed superhuman in others.

Portrait of Baird from a cigar box, "indicative of the popular esteem and recognition accorded him during his career." [From *Spencer Baird of the Smithsonian*; Smithsonian Institution]

Baird began his naturalist career as a socially well-placed boy in rural Carlisle, Pennsylvania. There he loved observing and collecting and also developed what Rivinius and Youssef see as his compulsive need to drive himself—perhaps sublimating other physical drives—with extremely long walks in the country. Though real (that is, paying) jobs pursuing these interests were practically nonexistent, Baird did manage to secure a teaching position at his alma mater, Carlisle's Dickinson College. There he continued his collecting. In the naturalist tradition, he also established his requisite network of correspondents with whom to exchange specimens, information, advice, and influence. In the process he became, as Rivinius and Youssef put it, a "collector of collectors."

Spencer Baird's desk—a "Wooton Patent Secretary"—at the Smithsonian Institution. "On the desk are personal Baird memorabilia from the national collections, including . . . two volumes of *A History of North American Birds* . . . and a white cloth napkin reportedly used by Napoleon I at his breakfast on the morning that he left the Island of Elba. How this last item came into Baird's hands is a mystery." [From *Spencer Baird of the Smithsonian*; Richard Strauss, Smithsonian Institution]

Turning that influence and the political clout offered by his family and that of his new wife (Mary Helen Churchill) to good effect, Baird gained perhaps the one paid position in the federal government in 1850

that would suit him: that of assistant secretary of the Smithsonian, serving under secretary Joseph Henry. This was largely a desk job, requiring Baird to carry out Henry's requests, to write literally thousands of letters each year, and to contribute publications in the Smithsonian's name based on the growing collections. The job did not require Baird to undertake the strenuous or life-threatening expeditions he evidently did not like. Nor did it require him to produce any original theoretical scientific contributions in order to secure his reputation; he could continue the cataloging and describing that he preferred. As Rivinius and Youssef argue, Baird remained self-assured in his work, but he stayed on familiar ground and avoided risky scientific ventures or new inquiries. He would often do more and more of the familiar rather than try the truly innovative.

When Louis Agassiz sought to exclude Baird from the new National Academy of Sciences in part because his work was too straightforwardly descriptive and Baconian, Baird had enough influential friends to block the move and to become a member. Baird made other enemies as well, though probably fewer than most of us would have made in similar roles. Moreover, there were problems of his wife's health, which Rivinius and Youssef have had retrodiagnosed by Allen Greenlee. Greenlee suggests that she may have had endometriosis complicated by loneliness and depression, aggravated by Baird's obsessive work and neglect of her needs. She controlled her partner emotionally in what the authors see as a warm, companionable, but not passionate marriage. Their single daughter Lucy remained devoted to her parents—and remained single.

While Baird was at his invalid wife's beck and call at home, he evidently needed to retain control elsewhere. Thus when he succeeded Henry to the secretaryship of the Smithsonian, he ran everything himself and let his assistants do little decision-making, certainly less than he had done as assistant secretary. This naturally led to conflicts with his associates and made life at the museum more stressful.

Rivinius and Youssef offer relatively little detail about Baird's scientific work, but they do not pretend to have written a comprehensive scientific biography. Rather they have given us a good first look at Baird as a person and as an important organizer of American science, particularly through his work at the Smithsonian. In introducing us to Baird, they entice historians to probe further and to ask new questions about Baird, about the Smithsonian's role in American science, and about the nature of natural history itself. This work does not replace Allard's study of Baird at the Fish Commission, nor does it undercut the need for further work on Baird. Indeed, this delightfully well-written volume whets the appetite for more.

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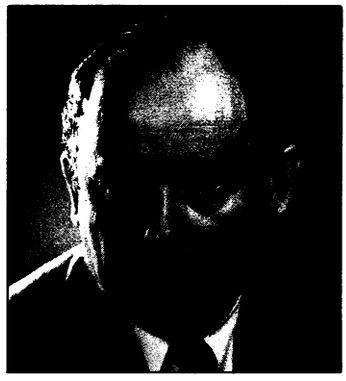
Unpopularized Genius

John von Neumann. NORMAN MACRAE. Pantheon, New York, 1992. x, 406 pp., illus. $25.

Norman Macrae, recently retired as the principal editor of *The Economist*, says he wrote this book after discovering that very little biographical material about "Johnny" von Neumann (1903–1957) was available to the general reader, even though among those scientists and mathematicians who were familiar with von Neumann's work all agreed that his genius was as great as that of any 20th-century scientist, including Einstein and a host of others about whom much has been written at all levels. Von Neumann's contributions to mathematics and to digital computing do not lend themselves easily to a lay interpretation, nor do they evoke the kinds of metaphorical allusions to society that, say, Einstein's theory of relativity does, and this may explain why his name is not a household word. (On the other hand, given the ways the popular press has distorted and sensationalized the work of more famous 20th-century scientists, perhaps von Neumann's obscurity is not such a bad thing after all.) In any case, Macrae bravely wades in not only to the Hungarian mathematician's works on computers and game theory, which do lend themselves to a lay interpretation, but also to his other, more abstract mathematical works that until now few outside the specialized fields have ever seen explained, if even noted. Macrae does not entirely succeed, but his effort is commendable. His experience as a chronicler of the science of economics—itself no easy subject to explain—serves him well here.



John von Neumann. [Photo Researchers, Inc.; Los Alamos National Laboratory]

Among the few popular books that do discuss von Neumann's life, several emphasize the fact that in the 1950s he had moved from a role as a mathematician to that of a scientific adviser to the Pentagon on matters of nuclear deterrence and warfare. Books such as Steve J. Heims's *John von Neumann and Norbert Wiener* (MIT Press, 1980) lament this falling away from the purity of his earlier life and work. In the introduction to the present book, Macrae warns the reader that he sees nothing wrong with von Neumann's shift into politics and his alliance with the more hawkish faction of the U.S. military establishment. Anticipating criticism for this unconventional apology, Macrae warns the reader beforehand and takes pains whenever he brings up this subject to argue that perhaps von Neumann's advice, repugnant as it might seem to us, may indeed have successfully prevented an all-out exchange of nuclear weapons between the United States and the Soviet Union during the past four decades. He has a point.

But while worrying about building up a case for defending von Neumann's role as a Cold Warrior, Macrae falls down elsewhere. The worst passages in the book are where he looks at von Neumann's role in bringing the stored-program, digital computer first into the consciousness of electrical engineers, mathematicians, and scientists, then into the commercial world. Drawing on the events of the early 1950s, when von Neumann was at the Institute for Advanced Study and loosely connected with an early stored-program computer there, Macrae concludes that the one-time theoretical mathematician had an excellent sense of the commercial and, what is more, that his model for bringing a technology out of the laboratory is one that the Japanese have learned to copy better than the Americans and is responsible for Japan's current technological lead in a variety of modern science-based technologies. There is nothing wrong with raising the issue of Japanese competition here, and Macrae is well qualified to discuss it. But using von Neumann's experience at the Institute for Advanced Study seems all wrong. It is true that the IAS team freely disseminated the design details of their creation as it was taking place, but the IAS computer was hardly an elegant piece of engineering. (An example: when certain tubes in the computer burned out it was necessary for a technician to cut through several wires to get at them, unplug them, and replace them with fresh ones. The wires then had to be soldered back again.) Most of the labs and universities that made copies of the IAS computer had to modify the design extensively, and even then few