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Scientific Biography: History of Science by Another Means?

By Mary Jo Nye*

ABSTRACT

Biography is one of the most popular categories of books—and indeed the most popular category among nonfiction books, according to one British poll. Thus, biography offers historians of science an opportunity to reach a potentially broad audience. This essay examines approaches typical of different genres of scientific biography, including historians' motivations in their choices of biographical subject and their decisions about strategies for reconstruction of the biographical life. While historians of science often use biography as a vehicle to analyze scientific processes and scientific culture, the most compelling scientific biographies are ones that portray the ambitions, passions, disappointments, and moral choices that characterize a scientist's life.

JAMES ATLAS, a biographer and the editor of the Penguin Lives Series, writes in the *New York Times Book Review* of a rainy afternoon leisurely spent in a London bookshop, where he was “stunned by the sheer profusion of ‘lives,’ as the British call biographies.” Biographies of Churchill lined an entire back wall, surrounded by shelves of biographies of people unknown or unfamiliar to Atlas. Clearly, biography maintains a great appeal. Indeed, a 1994 poll on reading habits in Britain revealed biography to be the most popular category of nonfiction book and a genre considerably ahead of contemporary fiction (preferred by 19 percent of readers, compared to 14 percent for contemporary fiction).¹ Yet, one wonders how many of those books in Atlas's London were scientific biographies. It is tempting, too, to wonder how many of the bookstore's scientific biographies were written by professional historians of science.

To be sure, historians of science embraced biography and entered its practice on a large scale in the 1960s with the huge editorial project of the *Dictionary of Scientific Biography*,

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¹ James Atlas, “My Subject, Myself,” *New York Times Book Review*, 9 Oct. 2005, pp. 24–25; and Michael Shortland and Richard Yeo, eds., *Telling Lives in Science: Essays on Scientific Biography* (Cambridge: Cambridge Univ. Press, 1996), p. 1 (1994 poll data).

now under way in a third phase with the *New DSB*, edited by Noretta Koertge. The first of the eighteen volumes of the *DSB* appeared in 1970 under the editorship of Charles Gillispie, followed by supplementary volumes edited by Frederic L. Holmes.² From its inception, some historians voiced misgivings about the enterprise and expressed objections to perpetuating a tradition of writing the history of science as the biographies of great men and great ideas. Social historians and sociologists challenged historians to write about the ordinary scientists, technicians, and instrument makers who do most of the work of science and to focus on disciplinary settings. Feminist scholars pointed to the absence of women scientists in older big-history narratives and called attention to historical prejudices that excluded women from the company of male heroes.³

Some scientists also counseled a different approach to the history of science. Among them was the physical chemist-turned-philosopher of science Michael Polanyi. Writing in 1962, he advised historians to pay attention to ordinary workers in the scientific community, modestly saying that, while

the example of great scientists [like Einstein] is the light which guides all workers in science, . . . we must guard against being blinded by it. There has been too much talk about the flash of discovery and this has tended to obscure the fact that discoveries, however great, can only give effect to some intrinsic potentiality of the intellectual situation in which scientists find themselves. It is easier to see this for the kind of work that I have done than it is for major discoveries.⁴

GENRES

To a striking degree, scientific biographies written by professional historians of science since the 1970s show the influence of discussions provoked by the *DSB* project and other events of the 1960s. Of course, biographies of superhero celebrities such as Galileo, Newton, Darwin, Einstein, and Marie Curie continue to appear and fulfill the demands of an apparently insatiable readership. Some of these biographies meet the highest standards of the genre of “lives” or “life and times,” as remarked by Atlas. Janet Browne writes of her subject Charles Darwin that “his story is the story of the era.” This same Charles Darwin, in the biography written by James Moore and Adrian Desmond, provided—in Moore’s words—a focus for a biographical genre of historical writing that “may yet prove the most effective way of informing the widest audience about the politics of scientific practice and the cultural formation of natural knowledge.” In this mode, in *Energy and Empire: A Biographical Study of Lord Kelvin*, Crosbie Smith and Norton Wise used the biographical device in order to demonstrate how Kelvin’s science emerged from his culture and how Kelvin drew on the conceptual and material resources of his industrial milieu to arrive at

² Charles Coulston Gillispie, ed., *Dictionary of Scientific Biography*, 16 vols., including Suppl. 1 (New York: Charles Scribner, 1970–1980); Frederic L. Holmes, ed., *Dictionary of Scientific Biography*, Suppl. 2 (New York: Charles Scribner, 1990); and Noretta Koertge, ed., *New Dictionary of Scientific Biography* (New York: Charles Scribner, forthcoming).

³ Steven Shapin and Arnold Thackray, “Prosopography as a Research Tool in History of Science: The British Scientific Community, 1700–1900,” *History of Science*, 1974, 12:1–28; Lewis Pyenson, “‘Who the Guys Were’: Prosopography in the History of Science,” *ibid.*, 1977, 15:155–188; Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (New York: Harper, 1980); and Evelyn Fox Keller, *Reflections on Gender and Science* (New Haven, Conn.: Yale Univ. Press, 1985).

⁴ Michael Polanyi, “My Time with X-Rays and Crystals,” in *Knowing and Being*, ed. Marjorie Grene (London: Routledge & Kegan Paul, 1969), pp. 97–104, on p. 97, rpt. from *Fifty Years of X-ray Diffraction*, ed. P. P. Ewald (Utrecht: Oosthoek, 1962), pp. 629–636.

physical theories.⁵ This is not simply a biography of a great man and his great ideas, but an inquiry into the cultural resources of scientific theory and the social construction of scientific knowledge.

Yet, we may ask, are the most popular scientific biographies, as a rule, books about the scientist or books about the science? We might take the case of one of the most recent subjects of biographical interest, Fritz Haber. An article in the *New York Times* in late 2005 notes the debut of Daniel Charles's biography *Master Mind: The Rise and Fall of Fritz Haber, the Nobel Laureate Who Launched the Age of Chemical Warfare; Einstein's Gift*, a play about Haber and Einstein written by Vern Thiessen; the short German film *Haber*, by Daniel Ragussis; and the opera *Zyklon*, by the jazz musician Peter King. "I learned nothing about science working on the project," said Thiessen, "but I learned a tremendous amount about *scientists*." His aim, he added, was to enable the audience to "understand the passion behind the work."⁶

Thiessen's comment might have pleased Polanyi, who argued in essays and in his book *Personal Knowledge* that historians must not only portray the reason and logic of a scientist's work but also the passion that undergirds scientists' commitment and quest for scientific knowledge. This passion or obsession is often readily apparent in the very genius of the heroic and "off-scale" scientist, whose creativity, as S. S. Schweber puts it, "astounds" and overwhelms the reader, instilling "joy of soul." The scientist's devotion also can be portrayed in the activities of the everyday workers practicing Thomas Kuhn's normal science. However, the technical science that is the object of the passion, or ambition, of the scientist remains a problem for a writer of scientific biography. Precisely how much should be explained to the reader of the expert manipulation and reasoning that is the essence of a scientist's everyday scientific work? No historian has demonstrated the workings of scientific creativity better than F. L. Holmes, but his dense narrative of Hans Krebs's investigative pathways was intended only for a narrowly trained audience, not for a broader public. Thomas Hankins remarked on the problem in an essay of 1979: how does the biographer integrate the technical science and the professional and personal life into a coherent picture and a readable text?⁷

⁵ Janet Browne, *Charles Darwin: A Biography*, Vol. 1: *Voyaging* (New York: Knopf, 1995), p. xiii; James Moore, "Metabiographical Reflections on Charles Darwin," in *Telling Lives in Science*, ed. Shortland and Yeo (cit. n. 1), pp. 268–281, on p. 281; and Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge Univ. Press, 1989), p. xx. Of course, historians of Darwin's work and historians of the social sciences have often made these kinds of arguments, but it is rarer in the history of the physical sciences.

⁶ Vern Thiessen is quoted in Ken Gordon, "From a Scientist's Life, Art's Cautionary Tales," *New York Times*, 12 Oct. 2005, p. B4. In addition to Daniel Charles, *Master Mind: The Rise and Fall of Fritz Haber, the Nobel Laureate Who Launched the Age of Chemical Warfare* (New York: HarperCollins, 2005), two excellent biographies of Haber are Dietrich Stoltzenberg, *Fritz Haber: Chemist, Nobel Laureate, German, Jew: A Biography*, abridged and translated from the German (Philadelphia: Chemical Heritage Foundation, 2005), and Margit Szöllösi-Janze, *Fritz Haber 1868 bis 1934* (Munich: Beck, 1998).

⁷ Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London: Routledge & Kegan Paul; Chicago: Univ. Chicago Press, 1958), pp. 135, 173 (see, more generally, the chapter "Intellectual Passions," pp. 132–202); Polanyi, "Passion and Controversy in Science," *Bulletin of the Atomic Scientists*, 1957, 13:114–119; S. S. Schweber, "Writing the Biography of a Living Scientist: Hans Bethe," in *The Pauling Symposium: A Discourse on the Art of Biography*, ed. Ramesh Krishnamurthy et al. (Corvallis: Oregon State Univ. Libraries, 1996), pp. 159–196, on p. 159; Schweber, *QED and the Men Who Made It: Dyson, Feynman, Schwinger, and Tomonaga* (Princeton, N.J.: Princeton Univ. Press, 1994), p. xv; Frederic Lawrence Holmes, *Hans Krebs*, Vol. 1: *The Formation of a Scientific Life, 1900–1933* (Oxford: Oxford Univ. Press, 1991), Vol. 2: *Architect of Intermediary Metabolism, 1933–1937* (Oxford: Oxford Univ. Press, 1993); and Thomas L. Hankins, "In Defence of Biography: The Use of Biography in the History of Science," *Hist. Sci.*, 1979, 17:1–16, on pp. 8–9.

The technical science need not be a principal focus or necessary component of the biography. James Hershberg concentrates on scientists, atomic weapons, and science policy, not Conant as a chemist, in *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age*. In their biography of Robert Oppenheimer, Kai Bird and Martin Sherwin similarly provide a rich history of twentieth-century America and the troubling drama of Oppenheimer's rise and fall. In *J. Robert Oppenheimer and the American Century*, David Cassidy also describes Oppenheimer's role in the development of theoretical physics in considerable detail, much as he did for Heisenberg in an earlier biography. Biographies abound, like Cassidy's, that include varying degrees of technical scientific history in their treatments of multivalent individuals whose lives, like Conant's and Oppenheimer's, incorporated the roles of scientist, political activist, and administrator. For the recent modern period, portrayals of Werner Heisenberg, Niels Bohr, Paul Langevin, Frédéric Joliot, Dorothy Hodgkin, and Linus Pauling come to mind.⁸ These biographies examine scientific work and institutions, social history, and politics with considerable, but hardly exclusive, attention to the technical science.

What else do scientific biographies do? In my recent biography of Patrick Blackett, I found myself asking how this gifted experimental physicist in Rutherford's Cavendish Laboratory came to make choices about how he would live his life: what scientific problems he would study, how he would organize his laboratory, what administrative responsibilities he would take on, what political issues he would address publicly, how he would serve his country during World War II, and how much open controversy he was willing to endure in science and in politics. His scientific biography came to be one that asked questions about the nature of leadership in a scientific community and the moral courage of a scientific life. As Thomas Söderqvist phrases it in his reflections on biography, an aim of biography is a study of life as an achievement or a deed, of how one lives and crafts a life.⁹

Many scientific biographies pose and answer questions that are essentially about moral conduct and public virtue: how to behave, how to make the right choices in and outside the laboratory. These scientific biographies aim to provide lessons to their readers. John Heilbron's portrayal of the dilemmas faced by Max Planck is such a book, as is S. S. Schweber's treatment of the parallel lives and choices of Hans Bethe and Robert Oppenheimer. David Cassidy wrote of his study of Heisenberg that one of the aims is "to learn from his successes and failures and to appreciate how and why they occurred." Ethical questions are at the core of Thiessen's play and Charles's book about Haber: the story is one of a man "who wants to do good and fails miserably."¹⁰

⁸ James G. Hershberg, *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age* (New York: Knopf, 1993); Kai Bird and Martin J. Sherwin, *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer* (New York: Knopf, 2005); David Cassidy, *J. Robert Oppenheimer and the American Century* (New York: Pi, 2004); Cassidy, *Uncertainty: The Life and Science of Werner Heisenberg* (New York: Freeman, 1991); Abraham Pais, *Niels Bohr's Times, in Physics, Philosophy, and Polity* (Oxford: Oxford Univ. Press, 1991); Bernadette Bensaude-Vincent, *Langevin: Science et vigilance* (Paris: Belin, 1987); Michel Pinault, *Frédéric Joliot-Curie* (Paris: Odile Jacob, 2000); Georgina Ferry, *Dorothy Hodgkin: A Life* (London: Granta, 1998); and Thomas Hager, *Force of Nature: The Life of Linus Pauling* (New York: Simon & Schuster, 1995).

⁹ Thomas Söderqvist, "What's the Use of Writing Lives of Recent Scientists?" in *The Historiography of Recent Science, Medicine, and Technology: Writing Recent Science*, ed. Ronald E. Doel and Söderqvist (London: Routledge, forthcoming); and Söderqvist, *Science as Autobiography: The Troubled Life of Niels Jerne*, trans. David Mel Paul (New Haven, Conn.: Yale Univ. Press, 2003), pp. xxiii–xxvi.

¹⁰ John L. Heilbron, *The Dilemmas of an Upright Man: Max Planck as Spokesman for German Science* (Berkeley: Univ. California Press, 1986), p. x ("His struggle . . . [has] . . . the elements of heroic tragedy. His

From a moral perspective, some biographies aim to redress a wrong perpetrated against their subject. Many biographies of women scientists come to mind, such as Susan Quinn on Marie Curie, Anne Sayre on Rosalind Franklin, and Ruth Sime on the “distortion of reality and suppression of memory” in German accounts of Lise Meitner’s scientific work during the Nazi period and afterward.¹¹ On the other hand, redressing a wrong can take the form of vengeance against the biographical subject. The great scientist Georges Cuvier provides an exemplar of this kind of moral lesson in his *éloge* for Jean Baptiste Lamarck, published in 1835: “Others [namely, Lamarck] . . . have been less severe in scrutinizing the evidence . . . and . . . have laboriously constructed vast edifices on imaginary foundations. . . . It is . . . our duty . . . to indicate, as far as we can, the cause, or, if it may be so expressed, the genealogy of his deviations.”¹² More contemporary examples of retributive biography include the chemist Jean Jacques’s book on Marcelin Berthelot, whom Jacques views as a scourge upon the French chemistry community at the end of the nineteenth century, and the sociologist Steve Fuller’s diatribes against Thomas Kuhn, whom Fuller thinks turned the history of science profession toward the wrong political direction.¹³

INTERACTIVE SUBJECTIVITY

As Cassidy notes, “Every biography . . . brings together three lives: the subject’s, the author’s and the reader’s.” The author must make a decision on how to reorder and reconstruct the subject’s life. In my biography of Blackett, I decided on thematic chapters that appear in a fundamentally chronological order. Blackett’s experimental work in the areas of nuclear physics, the earth’s magnetism, operational research, and continental drift are treated largely separately from his naval career, political activities, and roles in education, administration, and science policy. Söderqvist made a different decision in his study of Niels Jerne, as did William T. Scott and coauthor Martin Moleski in their biography of Michael Polanyi. As Moleski explains in his introduction, “Michael Polanyi embodied in himself the full scope of the Western liberal tradition. He moved freely from the world of medicine and science to the domain of art and literature. In a single day, he might return from the laboratory to care for his family, then turn his thoughts to poetry, art, literature, philosophy, politics or prayer.”¹⁴ Any given chapter in Scott and Moleski’s chronologically organized biography may include all of these elements from Polanyi’s everyday life; this

life is a lesson”); S. S. Schweber, *In the Shadow of the Bomb: Oppenheimer, Bethe, and the Moral Responsibility of the Scientist* (Princeton, N.J.: Princeton Univ. Press, 2000); Cassidy, *Uncertainty* (cit. n. 8), p. xi; and Thiessen, quoted in Gordon, “From a Scientist’s Life” (cit. n. 6), p. B4.

¹¹ Susan Quinn, *Marie Curie: A Life* (New York: Simon & Schuster, 1995); Anne Sayre, *Rosalind Franklin and DNA* (New York: Norton, 1975); and Ruth Sime, *Lise Meitner: A Life in Physics* (Berkeley: Univ. California Press, 1996), p. x.

¹² Georges Cuvier, “Elegy of Lamarck” [probably trans. by Robert Jameson], *Edinburgh New Philosophical Journal*, Jan. 1836, 20:1–22; see http://www.victorianweb.org/science/science_texts/cuvier/cuvier_on_lamarck.htm (accessed 31 Aug. 2005).

¹³ Jean Jacques, *Berthelot 1827–1907: Un autopsie d’un mythe* (Paris: Belin, 1987). Steve Fuller, *Thomas Kuhn: A Philosophical History for Our Times* (Chicago: Univ. Chicago Press, 2000), pp. xvi, 383: “I hope to help put an end to certain trends traceable to *Structure*”; “Kuhn was not sufficiently attentive to the obligations that were incurred by the privileges he enjoyed as a recruit to the American intellectual aristocracy.” Fuller, *Kuhn vs. Popper: The Struggle for the Soul of Science* (New York: Columbia Univ. Press, 2004), p. viii: “The more I have tried to make sense of Kuhn’s words and deeds, the more I have come to regard him as an intellectual coward.” See also, in this genre, Micheline Charpentier-Morize, *Jean Perrin 1870–1942: Savant et homme politique* (Paris: Belin, 1997).

¹⁴ Cassidy, *Uncertainty* (cit. n. 8), p. x; and William Taussig Scott and Martin X. Moleski, S.J., *Michael Polanyi: Scientist and Philosopher* (Oxford: Oxford Univ. Press, 2005), p. ix.

is also true of some of Söderqvist's chapters on Jerne, except for a period in Jerne's life when very little seemed to divert him from his researches.

A goal effected by strictly chronological organization may be the writing of biography as *Bildungsroman*, a narrative of self-development. In his biography of Karl Pearson, Ted Porter achieves this aim even though employing a thematic, rather than strictly chronological, organization. As Porter writes in this Focus section, Pearson himself insisted on his own coherence as a person, so that the biographer is obliged to seek the unique self within the diverse themes of his life. In a review of biographical studies of Benjamin Franklin, Adam Gopnik suggests that there were two very different Ben Franklins, one a capitalist operator at the edge of an empire and the other an Enlightenment savant. Franklin's electrical experiments become the narrative key to unify the life.¹⁵ In reflecting on his studies of Alfred Wegener, Mott Greene notes that there are various devices that the biographer can use to bring coherence to the biography, if not to the life. For example, the biographer may characterize the subject as a nonconformist or an outsider in order to find a deeper thread than simple chronology of events for the structure of the biography. Turning points, discovery dreams, or eureka moments also can be used to give drama to a narrative that otherwise would be fragmented (or dull).¹⁶

The biographer's choice of the means for effecting the biographical interpretation reflects his or her own beliefs about chance, fate, character, or cunning in the lives we all live. Richard S. Westfall arrived at the insight that the Puritan ethic that informed his own life furnished the set of categories that he used to construct his picture of Newton. Even while the real Newton receded from Westfall the longer he studied him, "in writing his biography I have nevertheless composed my own autobiography . . . a portrait of my ideal self, of the self I would like to be."¹⁷ For Westfall, biography is a reflection of the author as well as of the subject.

Some biographical subjects have led what Söderqvist calls a "biographical" life, saving absolutely everything—not only both sides of correspondence, diaries, and laboratory notebooks, but even theater stubs and utility bills.¹⁸ Such a wealth of personal as well as professional records (which do not exist for Blackett) make a historically accurate *Bildungsroman* possible. Historians writing biographies of contemporary scientists, unlike Westfall in writing about Newton, can engage the subject in conversations, as well as make use of oral histories obtained from friends and colleagues, all providing lively anecdotes and memories to be sorted out for veracity. Historical detachment is all the more difficult when the subject is still living, but real detachment seems impossible to imagine in any event—for why, then, would the historian begin a biographical project at all?

¹⁵ Theodore M. Porter, *Karl Pearson: The Scientific Life in a Statistical Age* (Princeton, N.J.: Princeton Univ. Press, 2004); and Adam Gopnik, "American Electric: Did Franklin Fly That Kite?" *New Yorker*, 30 June 2003, pp. 96–100, on p. 97. See also Justin Kaplan, "The 'Real Life,'" in *Studies in Biography*, ed. Daniel Aaron (Cambridge, Mass.: Harvard Univ. Press, 1978), pp. 1–8; and James Clifford, "'Hanging Up Looking Glasses at Odd Corners': Ethnobiographical Prospects," *ibid.*, pp. 41–56.

¹⁶ Mott Greene, "Writing Scientific Biography without the 'Biographical Imperative,'" colloquium on scientific biography, History of Science Friday Lunch Bunch, Oregon State Univ., 11 Feb. 2005.

¹⁷ Richard S. Westfall, "Newton and His Biographer," in *Introspections in Biography: The Biographer's Quest for Self Awareness*, ed. Samuel H. Baron and Carl Pletsch (Hillside, N.J.: Analytic, 1985), pp. 175–190, on pp. 175–176, 188.

¹⁸ Söderqvist, *Science as Autobiography* (cit. n. 9), p. xviii. Linus Pauling led this kind of biographical life, as can be seen in the documents and artifacts in the Ava Helen and Linus Pauling Papers, Special Collections, Valley Library, Oregon State University, online at <http://osulibrary.oregonstate.edu/specialcollections/coll/pauling/index.html>.

Thomas Hager, who spent much time with Pauling before Pauling's death in 1994 and published his biography in 1995, wrote that he began the project as a Pauling enthusiast and remains one but came to realize that "below the surface charm . . . was a fiercely competitive and emotionally constricted man." Söderqvist, who spent a great deal of time with Jerne in the south of France, eventually admitted to himself that he did not like the man. It was only after Jerne's death that Söderqvist found the greater detachment that enabled him to finish the biography. Thomas Powers suggests that Sherwin may have put aside his intended biography of Oppenheimer, finally published in 2005 with Bird, because Sherwin had come to loathe the man who was his biographical subject.¹⁹

I chose to write about Blackett because of my great admiration—hardly an objective view—for the originality and breadth of his scientific work, for his principled socialist politics, and for his courageous stands against wartime civilian bombing and against post-war development of nuclear weapons. I came to see that Blackett's experimental and theoretical scientific work took courage, too, carrying with it, as does all scientific work, the risk of mistakes, failure, and humiliation. Blackett himself addressed the quandary in a playful poem mimicking the famous lines of Rudyard Kipling's poem "If":

If you can organize your lab
nor lose the power to think
and deal with academic chores
nor drive yourself to drink.
If you can make a test of all your findings
and risk it on one test of yes or no
and lose, then
you'll stay a prof my son.

More seriously, the geneticist and statistician Ronald A. Fisher wrote a colleague that he wondered how many scientific discoveries have been left unmade for a lack of moral courage.²⁰

Polanyi, who was one of Blackett's colleagues and friends, wrote that the most penetrating and moving representations of the "young scientist's struggles" come from novelists, such as Sinclair Lewis, C. P. Snow, and Neville Shute. Polanyi wanted accounts from historians, philosophers, and scientists that would render the scientist's life, including the darkest moments, with feeling and imagination: "We want to know . . . about the kind of research team which 'is a death-trap for young scientist[s] and a slough of despond for the older ones.'" June Goodfield's pseudonymous Anna Brito, an immunologist whose real research life is brilliantly described in *An Imagined World*, writes to Goodfield of the scientist's struggles and passions: "When you do an experiment that proves your point. That is the orgasmic moment. It is an exciting and most *intimate* moment. You can get that moment from a graph, or from numbers in a machine, or you can see it under a microscope. So that is why, whenever you ask me about science, it is always images of enthusiasm, innocence, freshness, and love that come into my mind."²¹

¹⁹ Hager, *Force of Nature* (cit. n. 8), p. 14; Söderqvist, *Science as Autobiography*, p. xxi; and Thomas Powers, "An American Tragedy," *New York Review of Books*, 22 Sept. 2005, 52:73–79, on p. 76.

²⁰ Blackett's handwritten manuscript, undated, Blackett Family Papers (privately held), courtesy of Giovanna Blackett Bloor; and Ronald A. Fisher, quoted in Edward Irving, "Continental Drift, Organic Evolution, and Moral Courage," *Eos*, 2000, 81:546.

²¹ Michael Polanyi, rev. of Paul Freedman, *The Principles of Scientific Research* (London: Macdonald, 1949), *Manchester Guardian*, 3 Aug. 1949; and "Anna Brito," quoted in June Goodfield, *An Imagined World: A Story of Scientific Discovery* (New York: Penguin, 1982), p. 230.

Polanyi wanted to see passion, not only reason, in the depiction of the scientist's life. Yet, of course, the historian is considerably more constrained than Polanyi's novelist or June Goodfield, writing as a philosopher-anthropologist, in the freedom to portray the everyday routines, cycles of discouragement, and joys of discovery of the scientific life. Among historians of science, Russell McCormmach's *Night Thoughts of a Classical Physicist* remains an unusual exemplar of a genre intermediary between history and fiction in depicting a life in physics—and one that might have pleased Polanyi. McCormmach used diverse archival materials and personnel files from a large number of German physicists who were active in the decades before 1918 to construct the fictional Professor Jakob. Jakob was one of Polanyi's ordinary scientists, schooled in classical physics and unwilling and unable to participate in the revolution of the early twentieth century. Yet, however close his portrayal to real scientists and however much he tells us about the development of theoretical physics from Ohm to Einstein, Professor Jakob is a fictional character, not an authentic subject of scientific biography.²²

AUDIENCES

We often ask each other who we are seeking for our audiences. In 1986, the year in which his book on Max Planck first appeared, John Heilbron gave the plenary lecture at the annual History of Science Society meeting, addressing the subject he called "applied history of science" and calling attention to the audiences for historians of science in general education, science education, and science policy. When Ken Alder accepted the 2003 Watson Davis and Helen Miles Davis Prize, awarded for books in the history of science directed to a wide public, he repeated Heilbron's plea for attention to our audiences, both specialized and general. Similarly, in an earlier Focus section in *Isis*, Steven Shapin worried about the hyperprofessionalism of many academic historians of science who fail to connect their own interests to those of a larger readership.²³

As a genre of historical writing and analysis, scientific biography is an effective means for engaging readers in the struggles, successes, and failures of scientists crafting their own lives as they explore and construct knowledge of the natural world. Scientific biographies that are rich in science and that are engaging as lives can reach large audiences well beyond Shapin's hyperprofessionals, and they have done so. Among biographies written by historians of science, Ruth Sime's *Lise Meitner: A Life in Physics* and David Cassidy's *Uncertainty: The Life and Science of Werner Heisenberg* are examples of books that interpret both the biographical subject's technical science and the broader scientific life while reaching large audiences, with sales well over ten thousand copies apiece. Our challenge is to write such accounts that make their way onto the bookshelves of the aficionados of biography, as well as of the readers of history and science. Such books succeed in the historical aim of interpreting the changing character of scientific practice, as well as the specific character of individual scientists.

²² Russell McCormmach, *Night Thoughts of a Classical Physicist* (Cambridge, Mass.: Harvard Univ. Press, 1986). See also Christa Jungnickel and McCormmach, *Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein*, 2 vols. (Chicago: Univ. Chicago Press, 1986).

²³ John Heilbron, "Applied History of Science," *Isis*, 1987, 78:552–563 (the published version of his HSS lecture); and Steven Shapin, "Hyperprofessionalism and the Crisis of Readership in the History of Science," *ibid.*, 2005, 96:238–243.