Émigré Biographies

BY MARK WALKER*

ANJA SKAAR JACOBSEN, *Léon Rosenfeld: Physics, Philosophy, and Politics in the Twentieth Century*. Hackinsack: World Scientific, 2012. xii + 354 pp., illus., index. ISBN 978-981-4307-81-9. $87.00 (hardcover).

CHRISTOPH LAUCHT, *Elemental Germans: Klaus Fuchs, Rudolf Peierls and the Making of British Nuclear Culture 1939–1959*. London: Palgrave Macmillan, 2012. xiv + 274 pp., index. ISBN 978-0-230-35487-6. $75.00 (hardcover).

MARY JO NYE, *Michael Polanyi and His Generation: Origins of the Social Construction of Science*. Chicago: University of Chicago Press, 2011. xi + 405 pp., illus., index. ISBN 978-0-226-61063-4. $50.00 (hardcover).

SIVAN S. SCHWEBER, *Nuclear Forces: The Making of the Physicist Hans Bethe*. Cambridge, MA: Harvard University Press, 2012. viii + 579 pp., illus., index. ISBN 978-0-674-06587-1. $35.00 (hardcover).

All of these books are biographical studies of physicists or physical chemists who emigrated from Germany to other countries during the 1930s. Their careers were influenced by National Socialism, its purge of German science and the war it caused, by Stalinism and the subsequent Cold War between East and West, by the creation, use, and debate surrounding the control and proliferation of nuclear weapons, and by the scientific communities and societies of their host countries. Moreover, these scientists interacted with each other. Bethe and Peierls became close friends in Germany and England; Bethe, Fuchs, and Peierls were all at Los Alamos; Peierls and Polanyi were colleagues in Britain; and many of these scientists mingled at Niels Bohr's Copenhagen institute. Rosenfeld and Polanyi belonged on opposite sides of the political spectrum, but because of their shared personal and professional interest in the

*Department of History, Union College, Schenectady, NY 12308; walkerm@union.edu.

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history of why some scientific work is recognized and other work is not, they contributed to, and in some sense helped pioneer metascientific studies. Peierls and Rosenfeld, again with very different political perspectives, were active in postwar scientists' organizations, campaigning for the control and against the proliferation of nuclear weapons after the war. Collectively their careers shed light on the turbulent history of physical science during the twentieth century.

Sam Schweber has written a partial biography of Hans Bethe, covering his childhood to the eve of the Second World War. According to the author, this is "as much an attempt to understand the self-development of Bethe as an individual and as a physicist as it is an attempt to understand the development of theoretical physics during his lifetime." Schweber additionally provides brief surveys of the post-1941 part of Bethe's life, at both the beginning and end of this biography.

Hans Bethe was "the last of the young physicists who, from 1925 to the early 1930s, established quantum mechanics, the theory that made possible the intellectual mastery of the microscopic world" (2). Schweber describes the history of theoretical physics as being dominated by "off-scale" people, including Bethe, whose abilities are repeatedly described in this way throughout the book. He provides a deep, detailed analysis of Bethe's early life and how it subsequently influenced him as a physicist. Bethe acquired self-confidence as a young man and modesty in his later years. He had a strong attachment to his mother, whose "emotional instability and difficult personality" (274) had a powerful, and not always positive, influence on him. As a boy and young man in Germany, Bethe moved in assimilated Jewish circles, a cultural niche that disappeared when the National Socialists came to power and defined "non-Aryans" according to biology, not religion. His father, Albrecht Bethe, a scientist who was deeply committed to Darwin's theory of evolution, also had a strong influence by nurturing his son as a young scientist.

According to Schweber, Hans Bethe was successful because of his conservatism and caution when choosing research topics, tackling only problems he thought he could solve. "The first [insight] was his ability to recognize his strengths and limitations . . . His second insight into his abilities was that he came to know *when* to undertake a problem by evaluating the empirical data and theories at hand . . . The third was being able to assess realistically whether he possessed the knowledge and mathematical tools to tackle and solve the problem" (154). Bethe was ambitious and understood that his achievements would bring him scientific authority, status, recognition, and fame.

Arnold Sommerfeld in Munich, who built the most outstanding school of theoretical physics in the first third of the twentieth century, first molded Bethe as a theoretical physicist. Equally important were the social settings and atmosphere Bethe discovered in Stuttgart, Cambridge, Rome, and Manchester, as well as the professional and social friendships he made. After describing the Nazi anti-Semitic policies that forced Bethe to emigrate from Germany to pursue his career, Schweber notes that he asked Bethe what he would have done if "the Nazis had not been anti-Semitic [and thus Bethe would have remained in Germany], but had done the same terrible things?" Bethe replied that he would not have been a hero, would not have wished for a German victory, and might have done research for the war to escape military service. "In other words, I would have tried to make as few compromises as possible, but to survive" (229). Indeed the fact that his mother was Jewish made it perfectly clear that he would have had to emigrate from Germany.

When Schweber describes Bethe's 1933 move to Manchester, he emphasizes that Bethe's time there was not only extremely productive, but that through his close collaboration with experimentalists and theorists, Bethe acquired new ways of doing physics. During his stay in Manchester, Bethe's immersion in physics was total; he paid very little attention to the plight of other scholars and scientists who had to leave Germany.

In 1935, Bethe was hired by the Physics Department at Cornell University. Schweber emphasizes Bethe's privileged place among the scholars who fled Hitler by making clear that this was not aid to an émigré, but rather Cornell's desire to gain someone with Bethe's impressive scientific reputation. Just a year later, Bethe wrote to Sommerfeld: "today I would hardly return to Europe even if I would be offered the same amount of dollars as at Cornell. The characteristic trait of physics in America is team work . . . the experimentalist constantly discusses his problems with the theorist, the nuclear physicist with the spectroscopist" (312). Schweber describes how Bethe quickly built up a strong physics community at Cornell, including productive collaborations with colleagues and students.

This book and its close, detailed analysis explains very well how family, friends, and specific colleagues influenced and molded Hans Bethe as a scientist and person, and how important and successful his early scientific work was. Other topics that play an important role in the other books in this essay review—such as the scientist as science policy maker, activity in scientific organizations, and commentary on science as a profession—are certainly also relevant for Bethe, but mainly fall outside the scope of Schweber's biography.

Whereas Schweber analyzes how the context makes the scientist, Mary Jo Nye describes how physical chemist Michael Polanyi used his own experience to analyze science and thereby sheds light on the new social conception of science that emerged during the twentieth century, one of the most influential movements in the discipline of the history of science. Briefly describing work by Thomas Kuhn, Paul Forman, Barry Barnes, Steven Shapin, and others, Nye argues that this movement's "roots are to be found in the scientific culture and political events of Europe in the 1930s, when scientific intellectuals struggled to defend the universal status of scientific knowledge and to justify public support for science in an era of economic collapse, the rise of Stalinism and Fascism and increasing demands from governments for applications of science to industry and social welfare" (xv). Polanyi, who is best known for his 1958 book, *Personal Knowledge*, developed his concern with a new epistemology of science from "the experiences of his changing scientific career in Austro-Hungary, Germany, and Great Britain during the revolutionary and catastrophic decades of the early twentieth century" (302).

In his second career as a philosopher of science, Polanyi argued that there are two kinds of knowledge: "explicit, articulated, and formal knowledge on the one hand and tacit, unarticulated, and nonformalized knowledge on the other hand" (xix), and that the first cannot be achieved without the second. As Nye demonstrates, ironically what distinguishes the first generation of pioneers in the social epistemology of science, like Polanyi, from their "intellectual children," so critical of science, is the former's "deep reverence for natural science and mathematics" (xx).

Like Bethe, Fuchs, Peierls, and Rosenfeld, Polanyi was a member of the 1930s generation of central European refugees with Jewish origins who left their countries because of the politics of anticommunism and anti-Semitism. Indeed Polanyi had a double exile, first from Hungary, then from Germany. Polanyi's political experiences as a youth in Budapest, during the tumultuous swings from communism to political reaction, coupled with his émigré experiences and reflections on the experiences of his fellow refugee scientists, led him to think deeply about the structure of scientific life and the social conditions and behavioral values that made possible scientific careers and the advance of scientific knowledge.

Throughout her book, Nye elegantly describes the context for Polanyi's personal and professional development. Whereas Schweber placed most emphasis on personal influences, Nye focuses more on institutions, for example, the scientific culture of Weimar Berlin. Polanyi's thirteen years in Berlin

and his position at Fritz Haber's Kaiser Wilhelm Institute for Physical Chemistry were so productive that he could not accept the notion of leaving the city until confronted with the "brutal ugliness and moral abyss of the new German state" (83). He later transformed this experience into an idealized version of the scientific research community. Polanyi's later reflections on the world he had lost propelled him into an intellectual exposition and defense of the social and institutional preconditions that are necessary for the flourishing of modern science.

Nye makes clear that Polanyi's subsequent critical analysis of the nature of science was very clearly the result of reflections on the successes and disappointments of his own career, including both praise and criticism from luminaries like Albert Einstein and Fritz Haber. Resistance to his work—for example, to his theory of the adsorption of gases by solids—turned him to sociological explanations for the mechanism by which scientific priority and recognition are accorded within the structure of the scientific authority. Polanyi took a novel tack in explaining the relationship between theories and evidence: individual scientists often ignore good evidence when a community of opinion favors a competing theory that they assume will eventually explain originally anomalous data.

Polanyi supported a modified laissez-faire capitalist economy, and opposed Marxist interpretations of science, including J. D. Bernal's social relations of science movement and admiration of science policy in the Soviet Union. Indeed Polanyi specifically located his decision to write about the nature of science in the Lysenko Affair and the founding of the anti-Bernal Society for Freedom in Science. In 1953, Polanyi also became active in the Congress for Cultural Freedom, an anticommunist advocacy group that was secretly funded by the CIA. Indeed for radically different reasons, both Polanyi and Bernal decided to shift talk about science from the scientific method and scientific heroes to scientific communities and scientific practice—"from the logic of science to the life of science" (184).

In *Personal Knowledge*, Polanyi intended to treat science as a subset of systems of knowledge that prevail through personal persuasion, conversion, and commitment. According to Polanyi, science is a "system of apprenticeship rooted in tacit knowledge that often cannot be articulated and constitutes a tradition passed from mentor to apprentice" (245–46). As Thomas Kuhn subsequently argued, Polanyi proposed a view of the nature of science and the scientific community that were, fundamentally, politically conservative and sociologically elite.

However, like all authors, Polanyi lost control of his texts. As Nye points out, much of what Polanyi wrote about science, if taken out of context, could be used for ends antithetical to his own aims and values. The sociology of scientific knowledge "transformed Polanyi's arguments against objective scientific knowledge into a denial of realism, or Truth, in scientific explanation" (304), a position that was anathema to Polanyi. When the broad social turn in studies of science later occurred around 1970, its advocates rejected the single most fundamental assumption shared by both Bernal and Polanyi, the privileged nature of scientific knowledge and scientists' notion of truth.

Nye's deep, detailed, and subtle analysis is especially important because by showing how Polanyi's personal experiences directly led to his path-breaking sociological analysis of science, it illuminates and explicates the historical context and roots of an intellectual movement that has profoundly influenced our understanding of science.

As biographers, all of the authors in this review emphasize the importance such personal experiences can have. Christoph Laucht's double biography compares Klaus Fuchs and Rudolf Peierls, both of whom left Germany after the National Socialists took power, moved to Britain, worked on the Manhattan Project at Los Alamos during the war, and returned to Britain afterward. Klaus Fuchs became infamous for passing information on nuclear weapons to the Soviet Union. Laucht's main argument is that these two émigrés profoundly influenced the development of British nuclear culture, and their status as outsiders and German backgrounds in theoretical physics were key in this regard. This could easily be applied to Bethe in the United States as well, and is analogous to Nye's argument about the importance of Polanyi's background when he moved to Britain.

Both scientists had to emigrate to continue their careers in science. Peierls was "non-Aryan," and Fuchs was known as a communist—both of which were persecuted in the Third Reich. Once they made it to Britain, they encountered an "ambiguous atmosphere." On the one hand, they were out of reach of the National Socialists, and both aid societies and fellow émigrés offered them support; on the other hand, they struggled to find employment with a steady income, encountered difficulties in integrating into their new host country's society and academic world, and, once war began, faced severe reprisals as so-called "enemy aliens" (15).

Laucht emphasizes that émigré atomic scientists faced fundamental differences in national preferences in research and teaching styles between Continental Europe and the United Kingdom. Whereas German universities had

a stronger emphasis on theory, British schools and physics departments generally leaned more toward empirical research. Ironically, this combined with their German-speaking backgrounds prevented them from engaging in sensitive war work and pushed them into atomic weapons research, which at the time was seen as being of little value and did not require such clearance. Their personal experiences with the National Socialist state and their insider knowledge of the scientific potential available to this regime translated into a stronger motivation to pursue atomic weapons research than their British-born colleagues had.

Fuchs's and Peierls's schooling in German and Continental European centers of theoretical physics later allowed them to fill important niches in the Los Alamos laboratory. Peierls was one of the most important group leaders at Los Alamos, overseeing research into the compression of materials. Otto Frisch led the group determining the critical mass of both uranium-235 and plutonium-239 assemblies. After the war, the Los Alamos Laboratory tried to keep Klaus Fuchs (but not Peierls), which makes clear how valuable he had been. However, both moved back to the United Kingdom. Peierls returned to his professorship at Birmingham University, while Fuchs became head of the theoretical physics division at the new Atomic Energy Research Establishment at Harwell. There he was mainly concerned with the civilian applications of nuclear power, but also occasionally advised the British nuclear weapons project, until his espionage came to light.

Peierls played a leading role in the British atomic scientists' movement and its main organization, the Atomic Scientists Association (ASA). Laucht emphasizes that Peierls and many other scientists who had worked on the British and American nuclear projects during the war were now driven by a very strong personal motivation to try and make sense of their wartime work and cope with the moral responsibilities that came from creating nuclear arms and energy. In a very idealistic spirit, Peierls and the ASA became the major forum in the United Kingdom for the education of the general public about the benefits and perils of nuclear power. Their most successful effort was perhaps their "atomic train," a travelling exhibition put on with the strong support of the British government that presented its viewers with a choice between a bright atomic future or nuclear annihilation.

Peierls and the ASA asserted that they were politically "objective," but observers were not convinced. Indeed Peierls' concept of "objectivity" was complex. For example, he condemned any use of nuclear weapons as "police weapons" alongside conventional weapons in regional conflicts, but believed in

the atom bomb's potential deterrent on the global scale. The ASA members found it increasingly difficult to present one unified position. The H-bomb became the litmus test for the Association's future because, as one member put it, "the continuance of an Association depends on whether or not we have anything to say about the H-Bomb" (161). In the end, they did not.

Whereas Bethe was apolitical, Polanyi and Peierls became politically active as scientists after the Second World War, and Fuchs committed the political act of passing intelligence on to the Soviet Union, the Belgian physicist Léon Rosenfeld embraced Marxism at a young age, which had a profound influence both on his science and philosophy. Anja Skaar Jacobsen provides a scientific and philosophical biography of Rosenfeld, who is best known as a scientist for his publications with Niels Bohr on measurability in quantum electrodynamics and as spokesman for Bohr's complementarity interpretation of quantum mechanics. Like Polyani late in his career, Rosenfeld fully recognized the political and social dimensions of science, and like both Polyani and Peierls after the war, the Belgian physicist took very seriously his responsibility as a scientist to speak out and challenge misinterpretations (as he saw them) of scientific concepts. Wherever he was active—in Belgium, Holland, Britain, or Denmark—he engaged with philosophers and historians of science as well as with physicists and astrophysicists. Rosenfeld also worked actively for socialism and peace.

At the same time Rosenfeld was introduced to quantum theory, in 1926–1927 Paris, his "political and social awakening began" (16). He was attracted to the mathematical foundations of physics, but also found enlightenment in Karl Marx's *Das Kapital*: "When I opened the book and read the first chapter, it struck me that I had [here] a man of genius, just as when you open Darwin and read it, you feel there is something there which is a really superior grasp of the questions" (32). The strong connection that Jacobsen makes between political ideology and scientific career for Rosenfeld clearly also works for Fuchs and is compatible with much of Nye's analysis of Polanyi.

In his historical publications, beginning in the early 1930s, Rosenfeld was preoccupied with the question of discoverers versus their precursors in the history of science. He wanted to understand and explain why some discoveries (like his own work) are not assimilated into the scientific community right away. This was analogous to Polanyi's own efforts to explain why some scientific results were accepted and others were not. Whereas for Nye, this metascientific analysis was one of the most important aspects of Polanyi's career, Jacobsen ranks it behind Rosenfeld's science and political engagement.

Indeed Rosenfeld's metascientific publications were not as influential as Polanyi's.

Rosenfeld suggested that it is not possible to understand and appreciate the position that forerunners occupy in the evolution of scientific ideas unless one takes into account their social interaction within the scientific community. Scientific work is never the work of an isolated individual; it is, instead, always the more or less fruitful interaction between, on one hand, the personal contributions of individuals and, on the other, both the social milieu in which they move and the accepted ideological, experimental, and mathematical techniques within the scientific community. The established scientific community is never prepared to accept a new idea without resistance; a new idea will be introduced in science only as a result of a "veritable fight" (44) between the pioneer who made the discovery and the conservative scientific tradition of the scientific community he confronts. If the pioneer loses the fight, argued Rosenfeld, then he remains a forerunner.

Rosenfeld matured as an intellectual leftist, connecting science with socialism in the 1930s, a turbulent period with the rise of Fascism and Nazism and the leftist Popular Front in France. He was working in Holland when the Second World War began, and stayed there under the German occupation, including the courageous efforts he and his wife made to protect people who were threatened. Rosenfeld himself went into hiding in the spring of 1944, staying in the roof space above his bedroom, either because he was part Jewish or to avoid being deported to Germany for forced labor. After the war Rosenfeld immediately engaged with renewed energy in political issues, writing extensively in left-wing periodicals. He was particularly concerned with the social responsibility of scientists following the bombings of Hiroshima and Nagasaki in August of 1945.

Although Rosenfeld developed into Bohr's strongest supporter in physics, they were politically active on very different levels and in different ways, occupying opposite political and ideological fronts in the Cold War. In the summer of 1950, they clashed over how to handle the Russians and the international control of nuclear weapons. Although he excused the domestic politics of the Soviet Union because "the intellectual level in that socialist state was not mature enough" (221), Rosenfeld neither followed the Soviet party line in physics, nor gave up on the socialist cause, instead choosing to follow his own Marxist line. Rosenfeld was not a member of the Communist Party yet supported communist-led organizations; he exhibited knee-jerk reactions against the United States and clearly favored the Soviet Union in the context of the

Cold War. The decade 1947–1958 has been called the "age of the banishment of complementarity" in Russia (257). Following the new Soviet ideological line in science, art, and literature, Bohr and his student Werner Heisenberg were attacked for being positivistic and speculative. Rosenfeld strongly defended Bohr and his science, suggesting that his senior colleague could in fact be regarded as an unconscious Marxist because of his dialectical approach, open-mindedness, and critical spirit.

According to Jacobsen, there was general agreement among scientists that the production and use of nuclear weapons had to be supervised worldwide. Rosenfeld emerged from the war as "a full-blown socialist" (192), blamed capitalism for war and Fascism, and argued, "Society will be a socialist world federation, or it will not be at all" (198). In contrast to elite scientist-administrators like Vannevar Bush and to Bohr's solitary efforts to control nuclear weapons, but like Peierls and Polanyi, Rosenfeld worked through scientists' organizations to persuade governments and public opinion to end the nuclear weapons race, to further the role of science's peaceful applications in society and for public welfare, and to promote international relations and cooperation.

There obviously is no one right way to write a biography of an émigré physicist or physical chemist working in the twentieth century. Collectively these books enrich our understanding of a very important period in the history of science, but the commonalities in the biographies of the subjects are overshadowed by the varying historiographic approaches taken. For Schweber, the personality of Bethe and his personal contacts with friends, family, and colleagues were most important, and made him an "off-scale" figure in science. In contrast, Nye uses the professional context of Polanyi, institutions and scientific communities, to explain why he made the intellectual leap from his own research to a deeper understanding of how science works. Laucht argues that the common German background and émigré experiences of Fuchs and Peierls influenced their subsequent political activity. Finally, Jacobsen portrays Rosenfeld as an idiosyncratic figure, an outsider as an independent Marxist, but an establishment insider in his role as Bohr's advocate.

After surveying these four biographies of physical scientists, including over 1,600 pages, it is striking to see what is missing. Jacobsen does not really explain what Bohr thought of Rosenfeld's Marxism, what communist scientists (including some in the West) thought of his defense of complementarity, or whether his Western colleagues cared about his political activism. Laucht does not get much below the surface of his subjects. Nye's penetrating account

leaves the historian of science wondering how much icons of our profession like Thomas Kuhn owed to Polanyi and other predecessors. Schweber's fine book teases the reader, who now wants to learn the second, and perhaps even more interesting part of the story. Finally, these comparisons skirt the question of the émigrés who did not have such successful careers, and for whom no biographies have been written. We are still far away from a deep understanding of what the forced emigration of so many scientists from Germany in the 1930s did for physics.