straightaway the "new" physics, emphasized simple experiments, and rejected superfluous historicism, key pedagogical features that, when coupled with equally simple demonstration methods and instruments, made "System Pohl" a success in Germany and beyond.

Three essays direct our attention to the classroom setting, where questions of whom to teach, what to teach with, or how to teach science gain attention. Lissa Roberts describes three late eighteenth-century Dutch orphanages that possessed cabinets of teaching instruments "well enough equipped to rival, if not surpass, that of Leiden University"; the use of these instruments in the classroom served Dutch social ideals by teaching worthy orphans the utility of science, thus helping to elevate them to become productive members of society (p. 85). The multifaceted role of plants as classroom tools in teaching botany and biology in the United Kingdom and America from the late 1800s to the early 1900s is well explained in an essay by Dawn Sanders. Hayo Siemsen's essay explains the way modern Finnish schools use Ernst Mach's epistemology of science as an effective guide for using instruments in teaching science to youth.

Overall, these essays accomplish the editors' main goal of "raising crucial issues concerning the role of experiments and instruments in the history of teaching science, and its relation to the history of science at large" (p. 12). In foregrounding issues like how best to introduce experiments into a classroom or what instruments to buy, these essays show how science pedagogy involved much more than communicating the ideas of science—that experiments, instruments, textbooks, and classroom setting mattered. In addition, they nicely fulfill David Kaiser's appeal to "[move] pedagogy from the periphery to the center" in science studies (*Pedagogy and the Practice of Science* [MIT, 2005]). If this volume has one shortcoming, it is that these essays do not particularly interconnect, though opportunities existed in their shared attention to common themes. However, this imperfection should not distract us from the original work done here or from viewing this volume's larger mission as a worthy avenue of pursuit (which suggests a follow-up symposium).

DANA A. FREIBURGER

David Hyder. *The Determinate World: Kant and Helmholtz on the Physical Meaning of Geometry*. (Quellen und Studien der Philosophie, 69.) viii + 229 pp., bibl., index. Berlin/New York: Walter de Gruyter, 2009. $105 (cloth).

The Determinate World results from David Hyder's close study of Kant's *Metaphysical Foundations of Natural Science* (1786) and several writings by Helmholtz, including his four papers on geometry published from 1868 to 1878, read against the background of his arguments in the *Conservation of Energy* (1847) and several papers on color theory and spatial manifolds.

The primary thesis of the book is that Helmholtz's work on geometry arose not only from his studies of sensory physiology and psychology but was also deeply conditioned by his work in physics and philosophy of physics. A subsidiary thesis is that Helmholtz's initial philosophy of physics embodied a Kantian perspective on the problem of using geometry to describe the spatial properties of bodies and the operation of forces but subsequently departed from Kant, when Helmholtz paid closer attention to conditions of measurement.

After an agenda-setting introduction, the author devotes a lengthy chapter (more than one fourth of the book) to Kant's theory of geometry in relation to his treatment of Newtonian mechanics in the *Metaphysical Foundations*. He then examines Helmholtz's (allegedly) Kantian arguments in his *Conservation of Energy* and argues that these arguments appeal to the regulative notion of the comprehensibility of nature in a transcendental argument to establish central forces. Next he examines how Helmholtz was stimulated by Hermann Grassmann's theory of manifolds in representing the relations among colors and was also informed by James Clerk Maxwell's work on color. Following a chapter of summary and prospect, the author reads Helmholtz's geometry papers as exhibiting an emerging awareness of the central role of movable rigid bodies in measurements of physical spatial extents. He seeks to defend Helmholtz against the charge that he begs the question against conventionalism—the view that the choice between Euclidean and certain non-Euclidean geometries for describing the structure of bodies in space is a matter of mere convention. He holds that Helmholtz can avoid conventionalism by appeal to the principle that physical laws should be position independent, on the grounds that position-dependent laws presuppose an unknowable absolute space. The final chapter summarizes the main conclusions and situates Helmholtz's positions in relation to subsequent developments in physics and philosophy of physics.

The work proceeds as a kind of internal rational reconstruction of arguments from Kant

and Helmholtz. It offers some interesting discussion of the role of experienceability and measurement in Kant's and Helmholtz's discussions of geometry and physics. Except for the chapter on color theory, it is lightly referenced. There are few quotations from primary sources and little discussion of or reference to the extensive secondary literature. Because of this, certain important aspects of the argument depend more on circumstance and bare assertion than on close analysis and argumentation. Thus, the claim that Helmholtz was deeply Kantian in his conservation work depends largely on the comparison of some shared concerns of the two authors pertaining to the parallelogram of forces, the principle of decomposing force relations into point pairs, conservation laws, central forces, and the determinateness of spatial relations. Since the work of neither Kant nor Helmholtz is placed in the context of the ongoing history of physical theory, the matter of whether these shared concerns suffice to establish a direct connection between Helmholtz and the details of Kant's *Metaphysical Foundations* remains unassessed. Further, Hyder asserts that "there can be no doubt that Helmholtz adhered to a version of Kant's epistemology that had been naturalised at the hands of Herbart, Wundt and Lotze" (p. 162) but offers no description of this naturalized version of Kant's epistemology or of how it was mediated by the diverse group of authors named.

There are some historical lapses. For example, the author (p. 58) chastises Kant for being unaware of Newton's "Tract of October 1666," which was unpublished. Elsewhere, he describes work on color theory during the 1850s as being "instrumental in bringing the [field of psychophysics] into being" (p. 108 n 6), which is implausible because Fechner arrived at his psychophysical research program in 1850 and published it in his *Zend-Avesta* of 1851 (G. T. Fechner, "Outline of a New Principle of Mathematical Psychology [1851]," trans. Eckart Scheerer, *Psychological Research*, 1987, *49*:203–207).

More generally, the book invokes certain concepts repeatedly without explaining them or defending their application. The most important case is the notion of a "transcendental argument." Both Kant and Helmholtz are ascribed such arguments repeatedly. From context, it is apparent that Hyder takes transcendental arguments to involve presuppositions or conditions for a given fact or practice, but he offers no systematic discussion of this crucial concept.

The book will be of interest to specialists who engage geometry and space in Kant and Helmholtz.

GARY HATFIELD

Jeremiah James; Thomas Steinhauser; Dieter Hoffmann; Bretislav Friedrich. *One Hundred Years at the Intersection of Chemistry and Physics: The Fritz Haber Institute of the Max Planck Society, 1911–2011.* xii + 309 pp., illus., tables, bibl., index. Berlin: Walter de Gruyter, 2011. €56 (cloth).

Scientific institutions have played pivotal, albeit changing, roles in the development of modern science, and the complexities of these changes have stimulated studies by historians and sociologists of science from the externalist and internalist perspectives. The authors of this book commemorating the centennial of the Fritz Haber Institute (FHI) are either historians of science or scientists with a strong interest in the history of science, and their contributions exhibit a sensitivity that scientific knowledge created within this institution was the result of intellectual visions that, at times, determined what and how certain research programs were pursued. On the other hand, scientific knowledge at the FHI was sometimes determined by social, political, cultural, and economic factors: for example, the authors are insightful in detailing how political and military influences dominated the institute during the National Socialist period. Despite the celebratory provenance of this study, it is saved from merely parochial interest by the freedom granted the authors by the FHI's Board of Directors to make use of largely untapped archival resources in pursuing their scholarly goals, one of which was to investigate the failures as well as the successes of the scientists and administrators of the institute.

The authors structure their book chiefly chronologically, moving from the institute's founding in 1911 to 2011. Because other scholars have published studies on the Kaiser Wilhelm and Max Planck Societies, the authors have wisely decided to focus on the Fritz Haber Institute. The success of the initial "Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry" was largely due to the leadership of Fritz Haber, who also began what would characterize the goal of several future directors—organized research based on personal rather than disciplinary interests. For example, during World War I over half of the institute's expenditures centered on military applications, particularly gas warfare, one of Haber's specialties. After the war, however, under pressure from the victorious Allies, Haber's institute was