
Review

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draw comparisons to contemporary state surveys, particularly those of New York (a state whose survey rivaled Pennsylvania's in terms of size and geological importance) and Virginia (where Henry's brother, William Barton Rogers, was also struggling with Appalachian structure as well as a difficult legislature). Historians of American science will be frustrated further by the fact that Gerstner does not pursue in much detail Rogers's opposition to Alexander Dallas Bache's elitist plans for the American Association for the Advancement of Science, a professional organization Rogers helped to create.

Historians of geology will appreciate Gerstner's lucid explanations of many of the major theoretical debates of the first half of the nineteenth century. Gerstner, unfortunately, limits her discussion of these issues to Rogers's own involvement in them. A broader perspective would better situate Rogers's ideas and, more important, give some sense of his contributions to the development of geology. Rogers embraced both catastrophism and organic evolution. He preferred structural delineations to paleontological evidence, and he rejected the practice of relying solely on fossils in correlating formations. While these positions put Rogers at odds with mainstream American and British thought, as Gerstner rightly points out, some of Rogers's ideas were influential. His theories of folding and flexures and his emphasis on structure were adopted by American geologists such as J. Peter Lesley. Similarly, Rogers and the English geologist Adam Sedgwick had much in common, a subject that deserved further discussion, especially given James Secord's fine analysis of the Cambrian-Silurian dispute.

According to Gerstner, Rogers's theoretical work was largely dismissed by American and British geologists. Rogers seems not to have argued forcefully for his theories, and whenever they were rejected, which occurred with distressing regularity at scientific meetings, he became understandably depressed. Even Rogers's greatest accomplishment, the final report of the Pennsylvania survey, was apparently ignored. This conclusion gives the reader an odd sense of disappointment, since a great deal of the book is devoted to the survey. We are left wondering what, in the end, was the significance of Rogers's work?

PAUL LUCIER

R. Steven Turner. *In the Eye's Mind: Vision and the Helmholtz-Hering Controversy.* xiv + 338 pp., frontis., illus., figs., tables, bibl., index.

Princeton, N.J.: Princeton University Press, 1994. \$49.50, £37.50.

In the 1860s a scientific controversy arose between Hermann Helmholtz and Ewald Hering, important experimentalists and theoreticians whose work dominated the study of vision into the early decades of the twentieth century. The controversy concerned two central areas of visual theory, color vision and spatial perception. Several things were in dispute: the role of innate versus acquired factors in spatial vision, the theory of stereopsis and double vision, the proper understanding of the color primaries in relation to the physiology and psychology of color vision, and the comparative roles of purely physiological and psychological factors in both color and spatial perception.

R. Steven Turner provides an excellent study of this controversy in its own right and as an exemplar of the role controversy plays in scientific change. On the basis of his analysis of the Helmholtz-Hering controversy, with its background and continuation, from the 1850s to about 1920, he holds that controversy is constitutive of scientific change, actively shaping the development of scientific theories through a process of "negotiation." After filling in background (Ch. 2), Turner provides a clear and detailed account of the positions taken by Helmholtz and Hering themselves (Chs. 3–7), followed by an equally clear, though of necessity less detailed, recounting of the wider controversy in German sensory physiology and psychology (Chs. 8–11). These chapters reveal Turner's masterful grasp of the scientific literature on spatial and color vision in the latter half of the nineteenth century and beyond; they are nicely illustrated with more than two dozen line drawings. There follow analytical discussions of the implications of this case for Thomas Kuhn's "incommensurability" notion and for the development of disciplinary structure (Chs. 12–13). In a concluding chapter, Turner constructs several possible twentieth-century endings to the story.

Beyond the intrinsic interest of the Helmholtz-Hering exchanges themselves, the book deserves attention for its methodology. To track the course of the controversy, Turner uses a table that divides the literature in "physiological optics" from 1840 to 1894 into nearly one hundred categories and displays each five-years' worth of production within each category as a percentage of the whole. A second table gathers the literature into six "problem-complexes," tracked over the same period. The tables are useful and suggestive, but their reliability is conditioned by the fact that they are derived from Arthur König's

bibliography in Helmholtz's *Handbuch der physiologischen Optik* (2nd ed.; Voss, 1896), a bibliography constructed by a Helmholtz partisan and one that did not claim to be exhaustive in all categories. In analyzing the controversy itself, Turner uses effectively the "core set" approach associated with Harry Collins and Martin Rudwick, arguing convincingly that, in the German context, the controversy was carried out between two sharply polarized schools, with a smaller group of nonaligned participants. He evaluates the success of each school on social and institutional criteria, applying Gerald Geison's version of J. B. Morrell's list of such criteria. Hering's school was organized around the theoretical and philosophical stances that Hering promoted and depended heavily on his charismatic leadership. Helmholtz's partisans were more loosely related to him and to his theoretical positions, and they stood in the relation of discipleship less frequently than did Hering's advocates.

In his discussion of Kuhn's concept of incommensurability, Turner rightly observes that it arose from studies of scientific change. In the present case, he finds that despite sharp contrasts in research priorities, the lack of commonly accepted criteria for theory assessment, and divergent technical terminologies, the competing schools were able to communicate, to elicit concessions from one another, and to mount "effective appeals to nature" (p. 234). "Incommensurability" ultimately was limited to terminology. More generally, Turner argues that the controversy over spatial vision was formed through a "negotiation" in which Helmholtz used the contrast between nativism and empiricism to unify his theoretical stance and Hering subsequently emphasized it to distinguish his program from Helmholtz's. Turner rightly emphasizes the role of rhetoric and discourse control in scientific success, though he goes considerably beyond what his study supports in accepting Pierre Bourdieu's notion of "symbolic capital" and contending that a failure to monopolize terminology leads to marginalization and destruction; the Helmholtz school came to dominate the terminology (theirs survives today), but Hering's positions maintained currency and are now presented as part of textbook theory, and perhaps even as subsuming Helmholtz's color theory as a subsidiary explanatory factor. In his analysis of disciplinary structure, Turner shows that "physiological optics" and "vision studies," then as now, drew upon at least the disciplines of physics, physiology, ophthalmology, and experimental psychology; this discussion would have gained considerably in depth had the origin and

scope of the quoted labels been examined for themselves.

The book is handsomely produced, with an extensive bibliography and a useful index. The excellent study it presents should capture several audiences, including historians of German science, historians and philosophers of physiology, psychology, and the theory of the senses, today's visual scientists, and those drawn to the book's application of the analytical framework of science studies to a fascinating case history.

GARY HATFIELD

Jacques Gasser. *Aux origines du cerveau moderne: Localisations, langage et mémoire dans l'oeuvre de Charcot.* (Penser la Médecine.) 335 pp., illus., bibl., index. Paris: Fayard, 1995. (Paper.)

Jean-Martin Charcot occupies an iconic position as the "father" of French neurology. He also possesses such other immediate claims to fame as the fact that he was one of the young Freud's preceptors. He is notable for the histrionic and spectacular nature of his pedagogy. As a result, Charcot's contribution to various departments of medical thought and practice is the subject of much, possibly *too* much, attention.

Jacques Gasser concentrates upon a number of interrelated aspects of Charcot's work. He points out how from the outset of his career cerebral localization was central to Charcot's concerns. Like many of his colleagues, Charcot attempted to derive physiological insights into the distribution of particular functions upon the cerebral cortex from the cases of nervous disease presenting in his clinic. He therefore cherished the purest, most "typical" exemplars of a given pathology because of the exceptional heuristic value they possessed. In particular, those suffering from aphasic disorders were deemed to offer crucial insights into how linguistic capacities were represented in the brain.

Gasser describes the elaborate psychological theory of language and its defects that underlay these attempts at localization. For Charcot language was constituted by the action of various repositories or depots of the memory of the acoustic, visual, and motor aspects of words in determinate parts of the cerebral cortex. Aphasia ensued when one or more of these centers was damaged; such disorders were therefore understood as a form of partial amnesia.

This leads Gasser into a discussion of Charcot's rather more attenuated treatment of memory ailments in general. Most of this section is