

between these two stools. Unable to compete with either the precision mapping at Greenwich or the resolving power of the privately funded observatories, university observatories throughout most of the nineteenth century had a role that was conflicted and marginal. And on the international stage, government-funded colonial observatories at—for example—Madras, Cape Town, or Sydney were often better equipped and more active than that at Cambridge, typically the most well endowed of the university observatories.

In the twentieth century, however, this institutional hierarchy began a slow process of inversion. Private observatories all but disappeared, and eventually Greenwich would be eclipsed by university-based astronomy. By 1998 the government had shuttered Greenwich's remaining research facilities so as to reallocate funds to academic astronomy departments. In order to understand how and why that shift took place, Hutchins sets out to provide a long view of the university observatories and their place within the social and professional networks of British astronomy. His explanation of the eventual success of academic astronomy (if not the original university observatories) lies largely with the emergence of the new discipline of astrophysics and the ways in which university observatories successfully adapted to the subsequent shifts in the research landscape. Crucially, when laboratory physics and observational astronomy began to merge, affordable new avenues of research were found, and astronomy professors' "clienteles"—students—began to increase in number.

Hutchins's approach is descriptive, mosaic, and detailed; he has produced a collection of interlinked institutional histories set within a broad social and material framework. The author's progressive view of the history of science is interestingly balanced by his choice of subject: a collection of institutions that were sites not of growth and progress but of stagnation, struggle, and failure. Hutchins's narrative focus is "the cause and effect between personality and institutional politics, between human strengths and weaknesses and the progress of science" (p. xviii). Much of that narrative is developed through examination of observatory directors' interactions with university administrations, on the one hand, and the Royal Astronomical Society, on the other. *British University Observatories, 1772–1939*, makes use of over a dozen archives and contains sixty-one high-quality images. Perhaps the book's greatest strength lies in its quantitative analyses. Twenty-two tables collate and summarize data on such subjects as astronomers' salaries, observatory

budgets, equipment expenditures, and numbers and types of professional astronomical positions. Hutchins has done important work here; his excavation of the labor and material economies of nineteenth-century astronomy beyond Greenwich is likely to become a key reference for those working on the physical sciences during the period.

Throughout the work, each observatory is given separate descriptive sections, with the most space given to Cambridge and Oxford. Analytically, Hutchins treats the six university observatories as a group, and in introductory and concluding sections he draws broad conclusions across the whole. The ambitious scope of the work may justify those generalizations, but some of the claims feel asserted rather than demonstrated. For example, Hutchins repeatedly maintains that a central feature setting the university observatories apart from national or private observatories was "the burden of the directors' primary duty to teach [and] a consequent tension between teaching and research" (p. 5). He says that there is "considerable evidence" to support that claim (p. 172). Yet in the section on undergraduate teaching (Sections 4.1–4.4) the evidence given for this tension amounts to two quotations from letters of grumbling observatory professors. Somewhat puzzlingly, he also later goes on to state that there was in fact little tension between teaching and research at Glasgow and Durham. In order to carry the broader claim, the dynamic between research and teaching within each of these observatories requires closer scrutiny than it receives here.

More importantly, however, Hutchins's able survey of an uncharted area helpfully opens up many new routes for further research. The work also adds considerably to scholarship on the relationship between professionalization and disciplinary change in nineteenth- and early twentieth-century physical sciences. And in extending the historiography of modern British astronomy beyond Greenwich and the Grand Amateurs, Hutchins has produced a valuable addition to the literature.

JESSICA RATCLIFF

**K. Maria D. Lane.** *Geographies of Mars: Seeing and Knowing the Red Planet.* xiii + 266 pp., illus., bibl., index. Chicago/London: University of Chicago Press, 2010. \$45 (cloth).

I must admit that I had some questions when opening Maria Lane's book. Lane is a historical geographer by training and identity. As an outsider to the history of science, would she bother

to ground herself in the secondary literature of her topic? What could a geographer tell me about the history of Martian observations during the last quarter of the nineteenth century and the first quarter of the twentieth century that historians like Michael Crowe, Steve Dick, Norriss Hetherington, William Sheehan, and David Strauss haven't? The scientific and cultural history of observations of Mars from 1877, when Giovanni Schiaparelli announced the discovery of "*canali*" on Mars, to Percival Lowell's death in 1916 is well known: the translation of what was in Italian a descriptive term with a variety of meanings as "canals," a word that implied, at a minimum, the presence of past intelligent life on Mars; the subsequent public frenzy over the possibility of that life; the establishment of the Lowell Observatory in Arizona and the rise of Lowell as a controversial figure in American astronomy; and the ultimate conclusion that the canals were just an optical illusion. Lane had published a very nice article in *Isis* ("Geographers of Mars: Cartographic Inscription and Exploration Narrative in the Late Victorian Representation of the Red Planet" [2005, 96:477–506]), but could she sustain a book?

Well, Lane has done her homework, immersing herself in the primary and secondary literature; and yes, she has definitely made a major contribution to the discussion. Although I am not fully convinced by every argument she makes, she has changed some of my views of this historical event and convinced me of the usefulness of geography (at least historical geography) for enhancing our understanding of events in the history of science. I urge historians of astronomy and of Victorian science to read *Geographies of Mars* and to consider its conclusions carefully.

Lane makes four specific arguments, leading to an overarching one. She begins by stating what a geographer would find obvious but an astronomer might overlook: "Knowledge about the canals [of Mars] was first circulated in maps—the quintessential geographical representational format" (p. 17). She emphasizes that the astronomers involved in the canal debate had ties to the world of geographers. She draws parallels between cartographical conventions for the earth and for Mars. Her argument, which I found convincing and important, is that it was Schiaparelli's map and cartographic representation, not his language, that drove the debate in the direction it did.

The next two arguments are drawn from Lane's earlier publications. The intense debate over the nature of Mars coincided with great changes in astronomy, especially in the United

States: the building of new observatories, the expansion of the astronomical community, and the selection of new research problems. Some of these new observatories were built in high altitudes. Lane contends that in the Mars debate observations from these high-altitude observatories gained a level of legitimacy superior to those from more traditional locations. At the same time, that portion of the astronomical community concerned with Mars came to be represented as explorers and adventurers. By tapping into audience preconceptions of scientific exploration, astronomers gained public support for their positions about the planet.

The concluding third of the book supports what I see as Lane's most controversial argument. She attempts to link the Martian controversy with the ongoing imperialistic and expansionistic activities of the United States and Europe during the last quarter of the nineteenth century and the early twentieth century. She compares Lowell's and Alfred Russel Wallace's interpretations of the observations of Mars. Both Lowell and Wallace, in her view, "relied heavily on geographical and political theories that were then emerging as the drivers of imperial and expansionist policy and activity" (p. 21), but from different sides of the Atlantic and with different preconceptions. Lane concludes that the debate over the canals of Mars, and therefore the question of life on the planet, occurred at a particular moment in history when the geopolitical scene was dominated by European imperialism and American expansionism. But that domination produced an intellectual and social climate that allowed for only one interpretation of Mars observation that would be acceptable to the majority of Western scientists and the general public: Mars was "an arid, dying, irrigated world peopled by unfathomably advanced beings" (p. 13).

The argument for the role of the geopolitical environment in the interpretations of observations of Mars is thought provoking and must be taken into account in subsequent treatments of the controversy. But I get very uneasy when I am told that a social and intellectual environment so restricts the options of both scientific participants and the general public that only one interpretation would have been acceptable. Lane may be right. Or it may be that the geographical approach leads one to certainties that the historical approach may not.

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**Andrew J. Lewis.** *A Democracy of Facts: Natural History in the Early Republic.* (Early Amer-