

Overall, a solid picture emerges of the life of a mathematical practitioner in the century between Elizabethan England and the coming of the new science inaugurated by Newton. Moore's activities challenged the views of academic mathematicians, which were hostile to the value of practical mathematics. He demonstrated through his writings and career that there was a role for a unitary mathematics combining theory with practical applications. These two strands cannot be better illustrated than in his role in the founding of the Royal Observatory, where scientific knowledge and precision instruments were to be employed with the practical aim of discovering longitude for the benefit of navigation and astronomy; it was the crowning achievement of his life.

This is a book of considerable erudition, primarily of use and interest to scholars engaged in studies of seventeenth-century science and mathematics. It is illustrated with, *inter alia*, interesting plates taken from Moore's maps and books. It is well indexed and, as one might expect in a work of such scholarship, well documented in an extensive bibliography.

JOYCE BROWN, *Department of Civil Engineering, Imperial College,  
London SW7 2BU, U.K.*

### **Institutions; Education, Libraries, Museums**

MARIE BOAS HALL, *Promoting Experimental Learning: Experiment and the Royal Society*. Cambridge: Cambridge University Press, 1991. xiv + 207 pp. £35.00; \$59.95.

Recent developments in three distinct sets of professional literature have propelled questions concerning laboratory practice, experimentation, and the history of the early Royal Society to the forefront of scholarly research on science and the practice of science. Both sociologists and philosophers of science have joined historians in pursuing the subject of experimentation in the day-to-day practice of science at the Royal Society as a kind of Rosetta Stone from which we can expect to unravel the past's most arcane secrets about science: its historical definition and the motivations of its practitioners. The results have, overall, proven impressive. The recent collective efforts of historians, sociologists, and philosophers of science have etched subtle and nuanced delineations for new visions of the importance of day-to-day practices in the laboratory.

In her *Promoting Experimental Learning*, Marie Boas Hall has clearly sought to weigh in with her contribution to the growing literature on the quotidian, the unseen, the deep-running currents of the history of science. In this thin volume Boas Hall takes on one of the most widely recognized conundrums of the history of science: How could the Royal Society, that supposedly vibrant, cutting-edge nodal point of early experimentation, fall on hard times? Indeed, how could this institution fall into patterns of cycling through decay and resurrection?

Boas Hall takes the late seventeenth and early eighteenth centuries—from the founding through Newton's Presidency—as the frame for her analysis, but actually entertains a much broader interest in the longer run of the Royal Society's history. More especially, she seeks to explain how, across the eighteenth and early nineteenth centuries, 'the character of the Royal Society's meetings altered, changing from an atmosphere of lively discussion and debate and the frequent display of experiment to one which was determinedly formal and lifeless' (p. 1). The answer she finds lies in the patterns of the Society's first three-quarters of a century.

The scope of *Promoting Experimental Learning* is certainly ambitious, perhaps too much so, especially in light of many excellent studies that have recently appeared on various aspects of experimentation and laboratory practice at the early Royal Society. Boas Hall intends to interweave a narrative chronology with a statistically based survey of experiment and related discussions at the Royal Society's meetings across its first seventy-five years. The narrative account covers what is largely familiar territory. Thus, the statistical analysis carries the greater promise; yet, this analysis takes the author into areas where she seems uncomfortable. At one and the same time she explains her statistics and graphs both as simply satisfying a scholarly fashion 'in accordance with modern historical usage' (p. 5) and as a critical methodological corrective for the fact that the elusive quality of experiment renders 'strict quantitative analysis impossible' (p. 6). Indeed, Boas Hall's refusal to take a definite position defining how she counted something as 'experimental' casts a long shadow across this entire analysis.

Admittedly, defining what can and should count as 'experiment' in seventeenth- and eighteenth-century science can prove frustrating; but then, completing this frustrating exercise is nominally the centrepiece to the analysis offered in this book, and should be taken as a primary

gauge for measuring the book's success. In that regard, *Promoting Experimental Learning* proves less than satisfactory. Boas Hall has certainly put her finger on a central characteristic of scientific practice at the early Royal Society, and she promises to give the reader 'some precise idea of what the Royal Society actually did during its first three-quarters of a century' (p. 2). Nevertheless, even in her own words the attempt at quantification is more impressionistic than analytical: 'In both the graphs and the text I have tried to distinguish roughly between *experimental* learning and *observation*, but without attempting an exact definition of experiment' (p. 5). With such waffling from the author in defining the central analytical framework, it becomes difficult to invest this analysis with the credibility it should merit.

*Promoting Experimental Learning* is a curious book, one plagued by inconsistencies that run the gamut from the almost trivial and minor to the far more substantial. At the more mundane end of this spectrum, readers will find that Chapter 6, which the 'contents' page describes as covering the extraordinary period from 1677 to 1803 actually covers the more logical 1677 to 1703. On more substantial counts, readers will find the Bibliography extremely sparse and lacking many obvious entries. Likewise, on the question of what constitutes *experimental science*, the ambiguous shifting back and forth between the appearance of quantitative analysis and blanket disclaimers proves extremely frustrating. Perhaps, there is no better way to summarize this point than to quote the author: 'Clearly any such analysis must be highly subjective, and I make no claims to precise accuracy; yet I hope that my graphs will be a useful guide and show at least relative activity if they cannot show absolute numbers' (p. 5). Given the author's purpose in explaining widely recognized organizational developments in the Royal Society's history, this self-confessed lack of analytical precision certainly calls this book's usefulness into question. At bottom, Boas Hall is actually delivering an extremely limited agenda, a chronological narrative accompanied by rough numerical approximations that show correlation between 'experimental activity' and organizational vitality in the first seventy years of the Royal Society's history. This is a finding that will neither surprise nor challenge readers who possess even a nodding acquaintance with recent scholarship on the early Royal Society.

DAVID S. LUX, *Department of History and Social Sciences,*  
*Bryant College, Smithfield, RI 02917, U.S.A.*

### Philosophical Aspects of Science

DAVID BLITZ, *Emergent Evolution: Qualitative Novelty and the Levels of Reality.* Dordrecht/Boston/London: Kluwer Academic Publishers, 1992. ix + 239 pp. Dfl150.00; £89.00; £52.00.

As Charles Darwin readily admitted, the origin of complex organs such as the eye and other examples of qualitative novelty was problematic under the theory of natural selection, but he could nevertheless imagine how such organs could arise under a gradualistic selection of favourable variations. It was more the apparently functionless, 'beautiful' structures, such as the peacock's tail, that caused him more difficulty, eventually being subsumed under the tenet of sexual selection in the *Descent of Man*. For others, however, the origin of qualitative novelties, and the related question of the origin of life from inorganic matter and of human consciousness from mental phenomena, posed greater difficulties, and they attempted to resolve such issues through the further consideration of the philosophy underlying evolution theory.

In *Emergent Evolution* (volume 19 of the philosophical series 'Episteme' under the general editorship of Mario Bunge), David Blitz focuses on the philosophical basis of the concept of emergent evolution, examining the background, origin, and debate over the view that the development of qualitative novelty is the result of a critical transition in the evolutionary process from one level of reality to another, such that a new systemic relation is produced.

The tenets of emergent evolution were initially formulated in the 1910s by the British philosopher and comparative psychologist Conwy Lloyd Morgan (1852–1936). Blitz traces in the first part of his book the historical antecedents to Lloyd Morgan's work, showing that he drew upon philosophical considerations found in the writings of Thomas Henry Huxley, Alfred Russel Wallace, Herbert Spencer, George Henry Lewes, George John Romanes, Henri Bergson, and others. In part two, Blitz concentrates on Lloyd Morgan's own writings, tracing the development of his views on evolution and epistemology from the 1880s, under the influence of Romanes's work, through the formulation and elaboration of the concept of emergent evolution