

*American Historical Review*, vol. 109, No. 5, December 2004, pp. 1669-1670.

GIULIANO PANCALDI. *Volta: Science and Culture in the Age of Enlightenment*. Princeton: Princeton University Press. 2003. Pp. xv, 381. \$35.00.

Alessandro Volta (1745-1827) played a critical role in the events that historians of science sometimes call the second scientific revolution. His invention of the electrical battery in 1800 was the single most important contribution to transforming the science of electricity at the beginning of the nineteenth century. By making available for the first time a steady current, the battery also gave rise to the electrical technologies that have since transformed the world. Yet, Volta and his invention emerged from the scientific world of the European Enlightenment, a world of genteel virtuosi, run by aristocratic patronage, which was to recede as rapidly as the *ancien régime* after the revolutionary turmoil that ushered in the new age. The scale of the transformation has often cast the sciences of the eighteenth century into a shadow, from which historians have only recently begun to rescue them.

Giuliano Pancaldi's engaging book contributes substantially to a reappraisal of the sciences of the Enlightenment, as well as providing a wealth of information about Volta's life and accomplishments. Grounded in exhaustive archival research, the book depicts the emergence of the battery against the background of Volta's career and style of scientific practice. Pancaldi begins in biographical mode, tracing Volta's background among the lesser nobility of Como and his ambition to escape the limitations of provincial life by joining the international republic of letters. Like other Lombard intellectuals, Volta saw opportunities in the patronage of the reformist Austrian administration of the province. In the early 1770s, he secured a position as superintendent of public education in Como, moving within a few years to the chair in physics at the University of Pavia. Readers are given a good sense of Volta's tricky negotiations of the slippery trails down which patronage flowed in enlightened Italy. He encountered some setbacks, as when Giambattista Beccaria, a professor in Turin and the leading Italian scholar on electricity of the previous generation, scorned his speculative theories and suggested he "keep silent forever" on the subject (p. 90). The obstacles Volta faced were fairly typical of an age when established social networks still channeled much of the support for intellectual endeavor provided by governments and universities. Pancaldi draws out the common features of his situation by providing a prosopographical survey of seventy-four Italian scholars of the sciences in the period. Unfortunately, he overlooks the few women who were active in the field, although some recent studies have shown what they were able to achieve despite the restrictions under which they labored.

The key to Volta's success, in Pancaldi's interpretation, was his facility for inventing new electrical machines. The battery was the third such device to gain him international renown, following earlier acclaim for the "electrophorus" (1775) and the "*condensatore*" (1780). Pancaldi supplies detailed analyses of how these devices worked, both as physical artifacts understood in terms of the theoretical vocabulary of the time, and as tokens used as currency in the scientific community. Volta's first two inventions gained him respectable standing in an international community that prized curiosity and public display. They enabled him to establish

connections with natural philosophers in France, Britain, and Germany, as well as elsewhere in Italy. But, neither the conceptualization nor the social uses of these two devices broke with the prevailing patterns of enlightened science. Volta sought to understand them through the non-mathematical, discursive style of reasoning commonly applied to physical phenomena in the previous decades. The battery, in contrast, marked a breakthrough to a new world of physical power with unforeseen social implications, as Napoleon Bonaparte-whose fascination with the apparatus was nurtured by Volta-seemed to understand.

Pancaldi explains that the battery emerged from Volta's attempt to reproduce with inorganic materials the workings of the electric fish, an object of interest to many experimenters as a source of animal electricity. The new invention was announced in a communication by its discoverer to the Royal Society of London in the spring of 1800, and was rapidly replicated in half a dozen places before the end of the year. In Britain, experimenters used silver half-crown coins as plates, placed between zinc discs and pieces of cardboard soaked in water. Pancaldi uses the incident as a case study of the replication of experimental phenomena, a topic much discussed among sociologists of scientific knowledge in recent years. He reads the evidence as suggesting a conclusion midway between the positions he ascribes to "realists" and "constructivists." On the one hand, the physical form of the battery made rapid replication possible, independent of the local cultures in which this was done-a point to the realists. On the other hand, however, constructivists would be right to point out that interpretations of its mode of action continued to vary markedly among local groups of experimenters. The fact that batteries were easy to make did not mean that it was easy to secure agreement about how they worked.

Pancaldi deserves credit for drawing out the implications of his research for these contested issues; he shows how good historical scholarship can contribute to philosophical debate. His example should inspire further research and reflection on the history of experimental science in this period. The book raises certain questions that it does not answer. One wonders, for example, whether anything interesting happened in Volta's life after 1800. But, overall, it is an impressive accomplishment that significantly advances the historiography of the sciences in enlightened Europe.

JAN GOLINSKI

*University of New Hampshire*