

Volta: Science and Culture in the Age of Enlightenment. By *Giuliano Pancaldi*. Princeton: Princeton University Press, 2003. xv + 381 pp. Illustrations, figures, bibliography, notes, index. Cloth, \$35.00. ISBN: 0-691-09685-6.

Reviewed by Larry Stewart

Historical treatments of scientific research tend to see the public merely as either an audience for its methods or as a recipient of its products. Yet much recent attention has been paid to the role of the public in the rapidly expanding world of scientific debate. Some scholars have begun to look into the story of how a republic of amateurs achieved a more participatory role in scientific research. Such studies, by Steven Shapin, Simon Schaffer, and Mary Terrall, to name but a few, explore public engagement with early modern science during the Enlightenment. Giuliano Pancaldi's study of Alessandro Volta reveals the vast international trade in scientific knowledge that, by the end of the eighteenth century, had transformed the promotion of experiment.

Pancaldi's treatment of Volta as a major figure in the revolutionary world of the late eighteenth century is an important addition to studies of a scientific public. In many ways, it marks an extension of the attempts during the last decade to view science as culture. If Volta was, as Pancaldi says, "a committed, motivated professor and public servant" (p. 7), he was also far more. He was a proponent of the ideals of enlightenment, seeking to recruit many participants into the highly charged atmosphere of late-eighteenth-century experimental philosophy. In addition to his efforts to achieve administrative and educational reforms in the Austrian domain of Lombardy, Volta cultivated international patrons, corresponding with preeminent experimentalists, such as Joseph Priestley in London. Thus, Volta served not merely as an academic or government functionary; he was also able to build a reputation, particularly in the dominant scientific capitals of London and Paris, through correspondence networks and contacts in the Royal Society, the Academie des Sciences, and especially among scientific-instrument-makers in London like Tiberius Cavallo, and with the Portuguese spy Jean Hyacinthe de Magellan, the Dutch experimentalist Martinus van Marum, and the Swiss amateur Jean Andre de Luc, to name but a few.

Volta's renown rests on his experiments in the contested and cosmopolitan world of eighteenth-century electricity. Pancaldi exploration is a rich trove of connection and reputation. Volta became a master in the world of patronage, using his newly constructed electrostatic machines as a means to influence potential backers, a campaign "in which the shared values of education, the enlightened 'pursuit of knowledge,' as well as the notion of 'public utility,' all played a role" (p. 95). Like Galileo before him, newly designed scientific instruments helped him in furthering this strategy. Volta's innovations, through which he sought to exploit the power of short-range electric forces, led him to search for useful applications, especially in medicine, and in this effort he received not only the support of Priestley but also the encouragement of François Rozier in Paris in 1776.

Significantly, utility was essential to the polemic of early modern science, and Volta took advantage of the growing power of the eighteenth-century state to enhance the authority of his technical expertise. Volta's travels throughout Europe on behalf of the Austrian Empire in northern Italy were typical of state-sponsored initiatives of the time, which were launched as a means of gathering information. The trips constituted a kind of low-grade scientific and technical espionage, an endeavor in which the French especially seemed to excel. Of course, in the rapidly shifting fortunes of eighteenth-century politics, which were nowhere more uncertain than in northern Italy, skill was needed to keep up with trends that could shape a career. When Volta developed various versions of his famous electric battery, he appealed to General Guillaume Brune, commander of Napoleonic troops in Italy, for funds that would enable him to go to Paris at the expense of the pro-French administration in Milan. His reputation was secured by experiments with "Volta's battery," an instrument "easy to replicate even by amateurs, and [which] produced surprising effects to the satisfaction of lay and expert audiences alike" (p. 236). By the time of the Napoleonic Empire, patents and utility were paramount throughout Europe, and in England medical electric machines were soon being patented. But Volta, notwithstanding the invention of his battery, opted for "other, more obvious, avenues to obtain recognition and reward," avenues that would enhance his reputation and forge links with valuable patrons (p. 249).

Volta's great strength was his ability to avoid being drawn entirely into the quicksand of electric theory. While he was certainly tempted to follow the theoretical route, instrumentation and experimentation were what attracted him. Indeed, he was repeatedly advised by Priestley and the engineer Paolo Frisi to avoid being drawn into the morass of theory. The downside of following this route was that he could be dismissed in some quarters as a mere inventor of electric apparatus. However, Volta's designs were taken seriously by many instrument-makers, and he sought out those with international reputations, especially in London. Pancaldi devotes considerable space to the international aspect of Volta's work, describing the enthusiastic response to his inventions by the Dutch and the English and the connections he established with Lombard banking families, which paved the way to introductions to Dutch instrumentalists, notably van Marum, with whom he entered into a lengthy correspondence.

Instruments played a large role, not only in Volta's career but also in the international exchange of experimental research. Instruments like the battery "slowly changed the eighteenth-century hierarchy of ascribed ranks of competence within the physicist community" (pp. 142–3). It was one thing to dismiss Volta as an inventor of electric amusements; doing so, however, would clearly overlook the fact that such inventions cut across a trend toward wide public involvement in experimentation. Popular demonstrations were only part of this development. The key was not in the popularity of the battery, but in the force of instrumental demonstration. Volta's apparatus, and his demonstrations, were particularly influential among "the mixed community of expert and amateur electricians, natural philosophers and instrument makers" (p. 252). Pancaldi's treatment of this community is the strongest part of his study of a figure who looked for the power of utility amid enlightenment. Volta's career also reversed the field, demonstrating that there was enlightenment as well in the promotion of "useful knowledge."

*Larry Stewart is professor of history at the University of Saskatchewan, Canada. Along with numerous articles, he is the author of The Rise of Public Science (1992) and, most*

*recently, with Margaret Jacob, Practical Matter: Newton's Science in the Service of Industry and Empire, 1687–1851 (2004).*