also for young practicing physicists who wonder how American physical science "came of age."

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David L. Anderson is professor of physics at Oberlin College. He served at Los Alamos during World War II, and in recent years has written on the discoveries of the electron and of nuclear fission.

Electricity in the 17th and 18th Centuries: A Study of Early Modern Physics

J. L. Heilbron
620 pp. U. California, Berkeley, Cal., 1979. $40.00

Readers of PHYSICS TODAY will find in John Heilbron's impressive work an account of the origins of their profession. He leads us with meticulous care through evidence painstakingly drawn together to show that, beginning in the 17th century, a new group was forming. He counts the numbers and then examines their theories, their societies, their universities, their salaries, the cost of their instruments, their interrelationships, their styles of expression. This is by no means light reading, especially for the non-historian, since Heilbron has the historian's instinct to make available as much of the information he has uncovered as he can. But this also means that the book abounds with intriguing sidelights and commentaries which can make browsing a rewarding experience.

For someone especially interested in electrical instrumentation, like myself, there is satisfaction in reading his view that "new apparatus played a capital role in altering ideas about electricity during the eighteenth century" (page 5). He lays special emphasis on the importance of the Leyden jar. Its "power and unexpectedness . . . the distress, even fear, it initially provoked" (page 307) assured that it would not be ignored. In the end, it revealed inconsistencies in existing theories. "It made a mockery of the confidence of the system-builders of 1745. It created a crisis" (page 316).

Other factors also played critical roles. One of these was the Jesuits. Their extensive educational system was a powerful force, which Heilbron credits with keeping knowledge of electricity alive in the seventeenth century. One of the most important aspects of this system was that members were willing to question Aristotelian doctrines that they were supposedly preserving. Furthermore, a late sixteenth century proposal to develop official textbooks died early in the seventeenth century, a fortunate circumstance since, as Heilbron notes, "Such a text, by freezing curriculum just as the new science began to develop, would seriously have handicapped Jesuit efforts to educate Catholic Europe for survival in the modern world" (page 109).

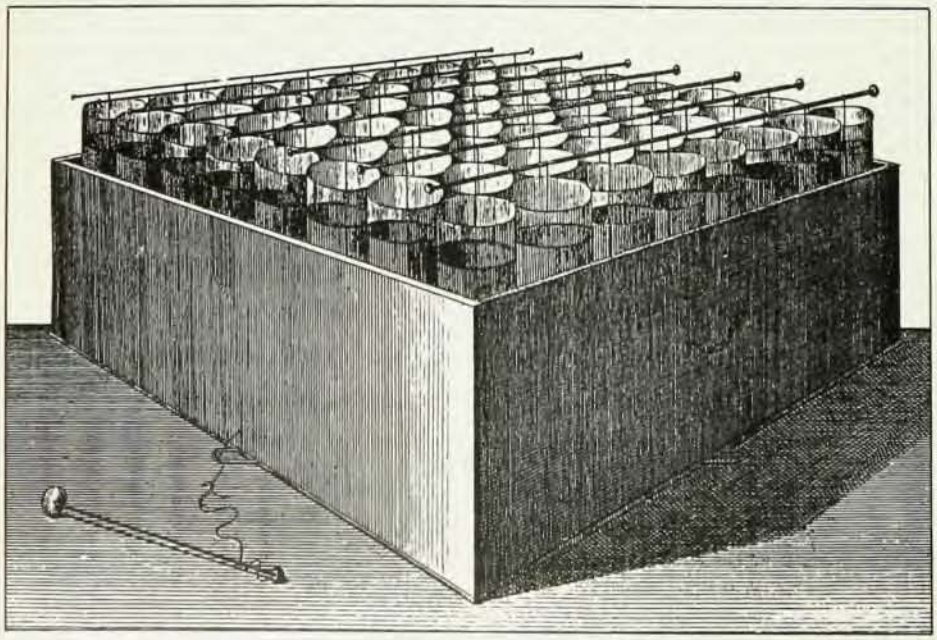
And there are insights that reveal that parts of the profession have remained unchanged over three centuries. It was often necessary for the successful professor to be a showman, yet to perform in this manner could result in getting students who only attended class to be entertained. To be serious, on the other hand, might drive away the bulk of the students, hence also their fees. This was a dilemma that not all teachers could successfully resolve.

Several times Heilbron treats the various roles of theories in terms that must seem quite familiar to practitioners today. For instance, Gilbert's decision (largely arbitrary at the beginning of the seventeenth century) to treat electricity and magnetism as entirely separate, proved to be very fortunate in terms of allowing him and his successors to define for electricity its own set of problems for which unique solutions could be sought. However, the distinction also introduced difficulties. "For example, the supposed one-sidedness of electrical attraction and two other fanciful items later introduced made it difficult for electricians of the seventeenth century to recognize mutuality in electrical interactions, and practically impossible for them to discover conduction and electrostatic repulsion" (page 176). Thus Heilbron notes, as others have, that Franklin's isolation in America served him well, since he was able to remain ignorant of recent European thinking as he pursued his experiments with a relatively fresh mind (page 330). He goes on to write that some of Franklin's explanations were much too simplistic to be valuable beyond first approximations, yet strength of their statement pressed others to examine and resolve anomalies (page 334).

Heilbron also supports the importance of personality. Thus, when Alessandro Volta traveled to Germany in 1784 he visited G. C. Lichtenberg (of Lichtenberg figures) at Göttingen, who was not particularly well-disposed toward his Italian colleague. "Volta's visit changed that. Lichtenberg could not resist his 'lusty' guest, a genius who swore and crackled over his experiments, guzzled and disputed over his dinner, electrified the ladies . . . and understood more of electricity than anyone else in Europe. After a few days . . . Lichtenberg was prepared to grant him the Newtonship of Electricity," and to promote Volta's views in his writings.

Surely this study of our past tells us something meaningful about our approach to the discipline at present.

BERNARD S. FINN
National Museum of History & Technology
Smithsonian Institution



Leyden jar battery with 64 jars connected in parallel, constructed by Joseph Priestley. From Priestley's *The History and Present State of Electricity, with Original Experiments (1767).*

Plasma Physics for Nuclear Fusion

K. Miyamoto
620 pp. MIT, Cambridge, Mass., 1979. $50.00

Kenro Miyamoto, professor at the Institute of Plasma Physics, Nagoya University, is well known in the field of stellarator research. He has attempt-