H. Floris Cohen. *How Modern Science Came into the World. Four Civilizations, One 17th-Century Breakthrough.* Amsterdam: Amsterdam University Press, 2010. xl + 784 pp. + 53 illus. €65.00. Review by DARIN HAYTON, HAVERFORD COLLEGE.

In his most recent book, H. Floris Cohen claims to have solved the problem of the Scientific Revolution by answering three smaller questions: Why did modern science emerge in Europe? Why did it emerge in the period between Nicolaus Copernicus and Isaac Newton? And why has science continued in an unbroken sequence of growth since then? Resisting current scholarly trends that tend toward microhistories or tightly focused, empirically grounded histories, Cohen offers a big-picture that spans two millennia, four civilizations, and presents a causal explanation for the rise of modern science. This magisterial book, weighing in at more than 800 pages complete with a "Users' Guide" in the prologue, reflects Cohen's immense learning and careful thought.

Cohen's general thesis is that the potential for the scientific revolution existed in Greek antiquity but was not realized until the seventeenth century when two traditions came together with a third to produce what we call modern science. Two traditions in classical antiquity existed side by side but did not interact: Athens and Alexandria. The Athens tradition reflected the speculative natural philosophy of Plato, Aristotle, the Stoics, and the Epicureans. The Alexandrian tradition was based in mixed and pure mathematics such as mechanics, astronomy, and conic sections. The first 150 pages recount the failures of Athens, Alexandria, early medieval China, early medieval Islam, and medieval and Renaissance Europe to realize the potential scientific revolution latent in these intellectual traditions. Each cultural transplantation produced an initial flourishing of intellectual activity and innovation that was slowly replaced by a reversion to traditional authorities. Creative exploration of the new insights dwindled as scholars returned to canonical topics and arguments. Finally in sixteenth- and seventeenth-century Europe a series of cultural transformations occurred that paved the way for a proper scientific revolution. Johannes Kepler and Galileo Galilei helped establish a realist mathematics in

which mathematical analyses revealed something real about the natural world. Following closely on this realist mathematics was the revival and subsequent development of ancient atomism. René Descartes's and Isaac Beeckman's mechanical-corpuscular natural philosophies represent this second transformation. The third transformation occurred when William Harvey, William Gilbert, Jean Baptiste van Helmont, and like-minded experimentalists turned to the natural world to find new facts.

For Cohen, these three transformations were necessary but not sufficient for the Scientific Revolution. Only after the boundaries separating the various traditions had dissolved could an additional three transformations occur. Descartes, Christiaan Huygens, and Isaac Newton were largely responsible for the fourth transformation that used geometry to understand corpuscular motion. The fifth transformation combined corpuscular motion, ideas about active principles, and Baconian experimentalism. This "Baconian Brew" was largely an English phenomenon, centered in London and the work of Robert Boyle and Robert Hooke. Finally, the Newtonian synthesis ties these threads together in the last cultural transformation that produced modern science.

Cohen's narrative is wide ranging and layered. He rejects monocausal explanations for the rise of modern science, refuses to identify a single, revolutionary moment, and emphasizes the contingency in seventeenth-century science that produced the Newtonian synthesis. He does, however, recognize Newton as "a *sans pareil* genius" whose solution to "the force knot" ushered in modern science. In the latter 600 pages we encounter many of the names associated with the Scientific Revolution, and we see them making their standard contributions. In Cohen's account, the Scientific Revolution remains largely an intellectual development. References to people and places function to locate those intellectual developments in time and space more than they serve to introduce the social, political, religious, or economic contexts. This assessment is meant to characterize rather that criticize Cohen's book, which will appeal to readers looking for a rich intellectual history of the Scientific Revolution but will not satisfy readers looking for a more social history.

Although Cohen underscores the contingency that ultimately resulted in Newton's synthesis, he is not advancing a historicist argument. He does not seek to understand what scholars in the ancient world, medieval China, medieval Islam, or medieval Europe were trying to do when they investigated the natural world using the tools they had developed. Instead, he treats science as perennial project aimed at articulating a mathematical-physical theory of the natural world. Consequently, Cohen's book is structured around a genealogical narrative that identifies the key characteristics of modern science and searches back in time to find their immature antecedents. Each of his cultures—Athens, Alexandria, medieval China, medieval Islam, and medieval Europe—perhaps tried but ultimately failed to cultivate the seeds of science. It is legitimate to ask: To what extent were these different cultures interested in the same intellectual activity that ultimately developed in the seventeenth century? Can we assume that when an ancient Greek observed the stars, a Muslim scholar mapped the constellations, a Chinese scholar recorded sun spots, and a medieval European scholar witnessed a comet they were all engaged in a similar project to understand that natural world? A corollary is: To what extent were scholars in the seventeenth century merely reviving or extending the intellectual traditions they inherited? In other words, how and why did the sets of questions, the resources used to answer those questions, and the criteria by which the answers were assessed change in each period and culture?

My reservations notwithstanding, Cohen's *How Modern Science Came into the World* is an impressive work of scholarship that does not shy away from offering a big-picture, comparative narrative. It is not for the uninitiated or the feint of heart. Readers need to possess considerable knowledge to understand Cohen's argument and to appreciate how it reinforces or conflicts with other scholarship. Cohen's book can augment more narrow histories of the Scientific Revolution but should not be read in place of them.