To Explain the World

The Discovery of Modern Science

Steven Weinberg

Harper, 2015. $28.99 (432 pp.). ISBN 978-0-0623-4665-0

In the Light of Science

Our Ancient Quest for Knowledge and the Measure of Modern Physics

Demetris Nicolaides

Prometheus Books, 2014. $19.00 (266 pp.). ISBN 978-1-6159-2225-3

Victor Frankenstein, the curious but callow protagonist of Mary Shelley's gothic masterpiece, meets two professors of natural philosophy during his fateful stay at the University of Ingolstadt. Professors Krempe and Waldman render opposing judgments on the likes of Paracelsus and Cornelius Agrippa, the premodern alchemists who had sparked Frankenstein's interest in science. Krempe scolds the youngster: "You have burdened your memory with exploded systems and useless names." Waldman, however, praises the alchemists' enthusiasm and reassures Victor: "The labours of men of genius, however erroneously directed, scarcely ever fail in ultimately turning to the solid advantage of mankind."

That contrast, though crude, captures the difference between the histories presented in the two books under review. In *To Explain the World: The Discovery of Modern Science*, physics Nobel laureate Steven Weinberg contends that the ancients were fundamentally misdirected. He presents the scientific revolution as the collective accomplishments of Nicholas Copernicus, Galileo Galilee, Johannes Kepler, Isaac Newton, and other luminaries, and argues that it was a sharp discontinuity, which launched a sequence of

scientific discovery that continues to this day. By contrast, physics professor Demetris Nicolaides with *In the Light of Science: Our Ancient Quest for Knowledge and the Measure of Modern Physics*, identifies the pre-Socratics as the first scientific thinkers. He finds manifold similarities between ancient philosophy and modern physics, both of which he sees as timeless expressions of the human condition.

These books begin from a common question: How should we view premodern efforts to understand nature from the standpoint of modern science? Historians of science—who prefer to judge historical eras by historical standards—would call this "whiggish." Whiggishness consists in imposing current values on the past. It is usually a pejorative designation, but Weinberg embraces the charge with the same zeal he shows in reclaiming "reductionism" from those who would use it as a slur. Nicolaides, although he does not mount an explicit defense of whiggishness, is also convinced that current scientific knowledge can enrich our interpretations of the past.

In advocating for and deploying a principled whiggishness, Weinberg and Nicolaides are in line with philosophers of science such as Hasok Chang, who, in his book, *Is Water H_2O?: Evidence, Realism, and Pluralism* (Springer, 2012), suggests that dogmatic anti-whiggishness might shut off fruitful lines of inquiry. Historians of science, such as myself, persist in objecting to the approach, but if we grant license on the point, an interesting question emerges: How, from the same starting point, do Weinberg and Nicolaides reach such different conclusions?

The first half of *To Explain the World* synopsizes ancient Greek physics and astronomy before pivoting to the Middle Ages, showing how Greek thought was preserved and extended in the Islamic world and Western Christendom. Weinberg's goal of distinguishing modern science from its pre-modern counterpart is evident early. He

puzzles over the fact that Aristotle never used observations of ships appearing mast-first over the horizon to argue for Earth's sphericity. He finds irony in Ptolemy's failure to use his investigations of reflection and refraction to magnify astronomical bodies. Historians will cry anachronism. Observations made at sea have long been distrusted, and with good reason. The ancient understanding of a super-lunar realm governed by heavenly rather than terrestrial order would have made optical magnification of stars and planets unthinkable. That anachronism is Weinberg's very point: The ancients, he claims, did not know how to interrogate nature in the systematic way necessary to wring reliable scientific knowledge from it.

Such know-how would not appear until the scientific revolution, the focus of the book's second half. Wherever one stands on Weinberg's claims about the distinctness of modern science, his summary of the intellectual trajectory early modern physics and astronomy followed is a bravura performance. Writing with grace and verve, Weinberg explains complex conceptual nuances with admirable clarity. Reconstructions of key discoveries made between Copernicus and Newton ground his account of what distinguishes the modern scientific attitude from prescientific philosophizing. Weinberg presents these figures as archetypes of scientific virtue, who, by seeking naturalistic explanations, insisting on an impersonal disposition towards their work, and developing standards of mathematical rigor, built a self-correcting, thoroughly modern science.

Whereas Weinberg differentiates modern from ancient science, Nicolaides emphasizes their commonalities. *In the Light of Science* also cleaves roughly in two. The first half gives a sweeping history of the conditions that first allowed human civilizations to flourish. Nicolaides presents the drive to understand nature as a basic human biological and cultural impulse—the same impulse that gave rise to mythology and religion—and

settled, agricultural civilization as the precondition necessary for it to thrive. That section is deeply speculative. Some of the speculations are compelling, such as those about the role of the Greek language in promoting systematic thought. Others, such as those about the evolutionary advantages of scientific habits, are somewhat less so. Nicolaides nevertheless turns a welcome sensitivity to complexity towards the question of why the Greeks were the first to develop a robust program of natural inquiry.

The book's second half draws a series of comparisons between the core intellectual traditions of pre-Socratic philosophy and foundational issues in modern physics. Nicolaides finds echoes of the modern quest for a theory of everything in Thales's notion of sameness as a universal principle; he sees Empedocles's conception of force as prefiguring the standard model of particle physics. Those comparisons are often strained and superficial, but they do offer a competent and accessible reconstruction of the views of noteworthy Greek philosophers and an introduction to the current frontiers of physical inquiry. Even if direct connections between ancient and modern science fall flat, Nicolaides succeeds in communicating his admonition to consider today's scientific progress within the broader sweep of human history.

Reading Weinberg and Nicolaides side-by-side makes it clear that a whiggish approach does not imply a consensus narrative. Whiggishness involves reading the past through the lens of current values—but whose values? For Weinberg, the independence of science from other human affairs is its most necessary and powerful attribute. Nicolaides sees science as but one incarnation—albeit the most successful—of the impulse that drives all essentially human activities. *To Explain the World* and *In the Light of Science* diverge in their historical interpretations because their authors advocate different perspectives on the values science does and should embody. In that sense,

these two books are as much philosophical as historical, and as much about the present as the past.

Joseph D. Martin
Michigan State University
East Lansing

Joseph D. Martin is a historian of science in the History, Philosophy, and Sociology of Science unit of Lyman Briggs College at Michigan State University.