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How Modern Science Came into the World: Four Civilizations, One Seventeenth-Century Breakthrough by H. Floris Cohen

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are rich in their range of potential case studies and lend themselves easily to interdisciplinary study, but they can be difficult to organize in terms of a cohesive theoretical approach. One approach, which the editors of *Meat, Medicine, and Human Health in the Twentieth Century* have rightly taken, is to organize by commodity or food object. This approach is a common trend among food studies scholars, as seen, for example, in the recent *Edible* series (2010), a collection compiled by food historians for mapping the global histories of specific commodities and products such as cheese, chocolate, or pies, to name but a few.

The goal of this volume, which is based on a workshop held at the National Institutes of Health in 2006, is to look at the diversity of public health messages and meanings pertaining to the healthiness of meat, the diversity of actors involved in debates about meat (including a broad cast of characters from industry and government, as well as consumers, experts from the medical sciences, farmers, meat processors, butchers and retailers, vegetarians, animal rights activists, and other critics of the meat industry), and, finally, the role of science as an arbiter of “objective” information about the healthfulness or risk of a meat product.

The “meat” of this book is organized into three broad areas: therapeutics, culture and politics, and, finally, regulation. The assorted essays showcase the rise of Charles Richet’s Zomine (raw meat) therapy in France and, in the United States, the advent of curious liver, heart, kidney, and offal recipes (like liver ice cream) designed to treat pernicious anemia. These therapies created a demand and often subsequent development of industry to meet the need for different sources of meat. For example, Naomi Pfeffer’s discussion of the use of abattoir bio-trash for endocrinology research—meat gleaned from the “disassembly line” of meatpacking plants—is a fascinating example of how a therapeutic need sparked the growth of an industry and even inspired the system of assembly used to produce Ford model cars. The voices of laborers from the Chicago meatpacking industry are showcased in Donald Stull and Michael Broadway’s interesting look at “worker health” and injuries along this treacherous disassembly line, which adds some continuity between the therapeutics and the culture and politics sections of the book.

Cancer and its link to meat consumption (or the consumption of additives found in meat, like diethylstilbestrol [DES]) is another important theme. David Cantor strongly emphasizes the confused messages about meat and cancer in the

United States, whereas Jean-Paul Gaudillière uses his case study of the Food and Drug Administration and the use of DES as a growth promoter in beef as a way to showcase his proposed theoretical scheme that there exist different “ways of regulating.”

Although the book promises to showcase developments in North America and Europe, the focus is largely on the United States and actors from its government and industry bodies, such as the Food and Drug Administration, the American Society for the Control of Cancer, and, of course, the Chicago meatpackers. In light of this, Ulrike Thoms’s essay on vegetarianism in the Third Reich and Keir Waddington’s look at bovine tuberculosis and bovine spongiform encephalopathy in Britain are welcome contrasts, showing how (as the editors admit) the picture is much more complex in Europe; these essays underline the fact that one of the few overarching conclusions that can be drawn from a collection covering such a large geographic scope is that there exist many “conflicting messages” about meat, medicine, and human health.

The foray into zoonotic diseases by Waddington emphasizes the challenge of trying to focus strictly on human health when considering meat. Although the focus of the volume is on confused public health messages about meat in relation to human health, a large part of this confusion historically (at least in terms of food safety and infectious diseases) lies precisely in the perplexities over what can affect animals and not humans and vice versa. Waddington’s piece addresses this confusion and considers how these diseases shape debates and “invisible” risks. Moreover, a discussion on animal health and welfare is difficult to separate from human health, particularly when considering some of the political and ideological discussions and debates (e.g., regarding vegetarianism) covered in the other essays. Finally, there are close links historically, both structurally and institutionally, with agricultural and food ministries in some of the countries and international organizations, and perhaps a consideration of how human and animal health became separated (or remain overlapping) in the context of meat consumption would be helpful to explain the trajectory of these confusing public health messages.

BRIGIT RAMSINGH

H. Floris Cohen. *How Modern Science Came into the World: Four Civilizations, One Seventeenth-*

Century Breakthrough. xl + 784 pp., tables, illus., bibl., index. Amsterdam: Amsterdam University Press, 2010. €65 (cloth).

Floris Cohen's *How Modern Science Came into the World* is a long, detailed, impressively erudite, and extremely ambitious book, and the last is its most intriguing feature. There were many good reasons—philosophical, methodological, historiographic—for the turn of historians of science to the local and the particular, but now that the lessons have been learned, these twenty-five-year-old reasons sometimes seem like scholastic excuses for avoiding intellectual risk. It takes only a quick observation of the self-imposed sterility of some neighboring disciplines to realize that the cultural livelihood of the historiography of science demands a direct engagement with the question we pose to our incoming undergraduates—and which Cohen boldly puts forward with his title. In his previous monograph, *The Scientific Revolution: A Historiographical Inquiry* (Chicago, 1994), Cohen dealt admirably with heroic earlier attempts to answer this question—from Whewell through Koyré to Kuhn and their contemporaries—but the task he assumes is rather different from theirs: it is no longer enough to present a “thesis,” exciting and well enough supported to be studied and critiqued by peers and students—and not only because of the wealth of details that have been gathered since they made these initial forays. Cohen's challenge is to formulate such a large-scale hypothesis without suppressing the hard-earned insights that led a generation of scholars to avoid hypotheses like that altogether: that “science” is an obscure term that carries more commendatory resonance than explanatory value; that the practices and beliefs it does designate are human cultural phenomena, determined by their past rather than striving toward their destined future; that the values and criteria we ascribe to these practices—universality, rigor, independence—are “topics” to be inquired about rather than achievements to marvel at. Despite a conscientious and knowledgeable effort to do just that, Cohen meets this challenge only in part.

Cohen weaves a story of two traditions. The first comprises the four great philosophical schools of classical Greece—those of Plato, Aristotle, atomism, and the Stoa—and a fifth school, skepticism, that evolved from the failure of any of these to attain significant argumentative advantage over the others. The other tradition consists of the mathematical studies of nature that developed slightly later within the Hellenistic realm: Euclid's geometry, Archimedes' statics, Hipparchus's and Ptolemy's astronomy. Cohen terms the former “Athens”

and the latter “Alexandria,” after their place of origin and cultural locus, and he stresses the deep gap and “near-absent interaction” (p. 18) between them, in spite of some superficial similarities: Plato's mathematical epistemology had little to do with the mathematical techniques of the Alexandrian astronomers, and Democritus's wonder about fitting together the surfaces of a cut cone contributed little to Eudoxus's method of exhaustion. In this analysis lie some of Cohen's most insightful observations, but the problems of forcing the particulars into the grand narrative are already evident: for example, Galen, who does not seem to fall comfortably into either camp, is mentioned only in passing, as if his presence for later generations did not rival Aristotle's; and Ptolemy's astrology, geography, and optics become “rare efforts at unification” (p. 25), as if they did not shape the mathematical “middle sciences” for a millennium.

The Scientific Revolution of the seventeenth century, Cohen contends, is the result of the successful merging of the two traditions. This took some transformations that prompt him to coin the terms “Alexandria Plus” for the physicalized, realist version of the mathematical sciences exemplified by Kepler and Galileo and “Athens Plus” for the mechanistic-atomistic version of an all-encompassing system produced by Descartes. It also required the rise of a new, peculiarly European, “fact-finding experimentalism” whose origins lie in exploration, mining, and commerce. As it was ruder and more interventionist, and “oriented toward control and domination” (p. 138), Cohen terms this intellectual trend “Coercive Empiricism.” Together these produced the type of mathematical-empirical “nature knowledge” that we recognize as modern science.

All this is convincing. The idea that the heroes of early modern science were Kepler and Galileo, Descartes and Huygens, Hooke and Newton; that their achievements owed much to the rediscovery and innovative interpretation of the Greek sources; that this was made possible by the breaking of barriers between scholars and artisans, mathematicians and natural philosophers; that this social-cultural realignment had to do with commerce and discovery; that it was a unique phenomenon, dependent on the values and resources of a particular time and place—these are not altogether new ideas, but Cohen manages to synthesize them interestingly and along the way adds many insights about the changing role of instruments, about the need for and means of legitimization, and about the way in which his two old and one new traditions transformed themselves and each other. But his

main ambition—and, to my mind, the associated pitfall—lies elsewhere.

What Cohen attempts to account for is not simply the unique circumstances that brought about the Scientific Revolution, but why “an event sufficiently like the Scientific Revolution [that would] produce broadly the same outcome” (p. 70) did not happen in other cultures that seem to him to have been likely candidates: Han and then Sung China, Muslim culture in its Andalusian glory, Europe in the High Middle Ages.

Cohen is well aware that he is treading on dangerous ground—“yes, dear reader, we know,” he stresses (p. 45), and he reiterates the complexity of the historical process and “the room for uncertainty” (p. 71) his own narrative leaves. “What-if history,” he argues in particular, “need not be a frivolous pastime,” and he continues: “derivation by Huygens of universal gravitation from Galileo and Kepler’s laws of motion” is a possibility that “realistically might have happened”—and thus we need an explanation for why it did not (pp. 70–71).

Yet Cohen misidentifies the traps he is laying for himself. Frivolity is not what is at stake in asking why Huygens failed; the problem is the implied assumption that universal gravitation is somehow encapsulated in “Galileo and Kepler’s laws of motion,” so that, freed of obstacles and “limitations” (a term Cohen uses frequently), it could be “derived.” To object to his version of “what-if,” Cohen maintains, demands “a strictly deterministic point of view” (pp. 70–71), but it is in fact exactly the opposite: adopting it requires the assumption that there is something inevitable in the way our knowledge of the world is shaped, that its development was predetermined—if not by the world then by the ideas on which it is based.

This assumption flies in the face of the main insight sketched above: that science is a human achievement, produced by people who look at their past for resources to solve problems of their present, and that ideas have no more power than what humans put into or take from them. Indeed, Cohen is unmoved by this insight. For him, “realist-mathematical science rested as a hidden potentiality in the Alexandrian corpus; so did kinematic corpuscularianism in the Athenian corpus; so did fact-finding experimentalism in Europe’s coercive-empiricist mode of nature-knowledge” (p. 272).

Its metaphysical awkwardness aside, the assumption that modern science lay *in potentia* within Greek thought, waiting for the proper conditions to unfurl, simply does not make for good historiography. The reduction of the com-

plex—and extremely contingent—way in which the concept of universal gravitation was formed in the late seventeenth century to a “derivation” from Kepler and Galileo is one particular example of its futility. A more general example is Cohen’s analyses of other cultures’ failure to produce or maintain a “realist-mathematical science.”

Admittedly not himself a scholar of Chinese history or language, Cohen bases his claims about “China’s worldview” (p. 138) over the millennia on the work of scholars who are as committed as he is to the self-explanatory understanding of “science” teleologically emerging on its own “potentiality” and similarly given to sweeping comparisons with other forms of “nature knowledge.” The outcome is generalizations about “worldviews” and “civilizations” that are, by their very nature, false. To say, for example, that the Confucian corpus “was not . . . to be questioned at the level of its fundamentals until the encounter with European science” (p. 33) is as accurate as to say the same about Christianity: it is not only wrong regarding Confucianism (see, e.g., Benjamin Elman’s *On Their Own Terms: Science in China, 1550–1900* [Harvard, 2005]) but reflects a misunderstanding of the way intellectual traditions relate to their sacred texts, the way practitioners reaffirm, develop, and subvert them while avowing their absolute truth. It is hard to imagine a fine historian like Cohen falling into such a trap if not for the urgency to support a “thesis.”

Freed of the thesis and of references to “Islamic civilization” and “Asian cultural fabric” (p. 733), *How Modern Science Came into the World* is a solid synthesis of many of the historiographical strands Cohen presented in *The Scientific Revolution* and a good and useful book for teaching and reference. The way beyond microhistories, if such is needed, will require another approach.

OFER GAL

Barbara Hahn. *Making Tobacco Bright: Creating an American Commodity, 1617–1937.* (Johns Hopkins Studies in the History of Technology.) x + 236 pp., illus., tables, app., index. Baltimore: Johns Hopkins University Press, 2011. \$60 (cloth).

Barbara Hahn’s main argument in *Making Tobacco Bright* is that human choice constructed not only successive technological and commercial systems of tobacco production and marketing, from the colonial period to the present, but also the tobacco types themselves, defined in