The Tory Interpretation of History

BY MICHAEL D. GORDIN*

HASOK CHANG. *Is Water H_2O?: Evidence, Realism and Pluralism*. Dordrecht: Springer, 2012. xxi + 316 pp., illus., index. ISBN 978-94-007-3931-4. $189.00 (hardcover).

Hasok Chang wants you to confront your fundamental assumptions about science, philosophy, and history. In *Is Water H_2O?*, he has certainly succeeded. Chang, the Hans Rausing Professor of the History and Philosophy of Science at the University of Cambridge, is a central figure in the small but dynamic movement of scholars working for an "integrated HPS," where history and philosophy of science deploy their disparate tools in the joint project of understanding the sciences. Chang is also the initiator—and, as far as I know, still the sole practitioner—of a "brand" (his word, in this new book) of the history and philosophy of science that seeks to expand scientific knowledge itself. He calls it "complementary science," which "aim[s] to give a novel function to history and philosophy of science, without denying its traditional functions" (12).

Developed by Chang in the 2004 monograph *Inventing Temperature*, and further explicated by him in a series of subsequent articles, complementary science excavates discarded scientific theories and especially forgotten scientific phenomena (such as the reflection of cold or the bizarre anomalies of electrochemistry) and seeks to replicate them using today's equipment and, if possible, contribute to the scientific enterprise by adding data and concepts that today's scientists are too occupied with other business to undertake themselves.[1] One of the primary goals of this work is pedagogical, teaching students

*Department of History, Princeton University, 136 Dickinson Hall, Princeton, NJ 08544 USA; mgordin@princeton.edu.

1. Hasok Chang, *Inventing Temperature: Measurement and Scientific Progress* (New York: Oxford University Press, 2004), chap. 6.

Historical Studies in the Natural Sciences, Vol. 44, Number 4, pps. 413–423. ISSN 1939-1811, electronic ISSN 1939-182X. © 2014 by the Regents of the University of California. All rights reserved. Please direct all requests for permission to photocopy or reproduce article content through the University of California Press's Rights and Permissions website, http://www.ucpressjournals.com/reprintinfo.asp. DOI: 10.1525/hsns.2014.44.4.413.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

how science works by actually having them *do* it.[2] Yet the underlying ambition is certainly broader: to utilize the philosopher of science's conceptual clarity and the historian's knack for uncovering puzzling arcana and illuminating abandoned cul-de-sacs in order to deepen our scientific understanding of nature. "What I did not quite see when I initially put that idea forward," he writes in *Is Water H_2O?*, "was that the project of complementary science was the expression of a thorough-going pluralism" (290).

This book is the full articulation of that vision, a sustained argument about the vital importance of pluralism in science. Chang maintains that the picture of science with which most philosophers, historians, and especially scientists are currently possessed is doggedly monist: at any given moment science entertains one correct picture, one proper theory, one paradigm. Chang believes not only that science is not practiced this way, but that it shouldn't be.[3] "The pluralism I advocate is unapologetically *normative*," he writes. "[M]y position is that if we should find a field of science which is quite monistic, then that is quite likely not healthy, and we should consider reforming it" (269). As Chang puts it, with a nod to Paul Feyerabend: "my slogan for pluralism is not 'Anything goes', but 'Many things go'" (261).[4] It is unclear how many things go in science studies for Chang; although he earlier maintained that complementary science was only one mode in which history and philosophy of science might be conducted, the implications of the arguments in this book are much more prescriptive, perhaps undermining the very pluralism of our own disciplines.

Is Water H_2O? is one of the most interesting works I have ever read in the history or philosophy of science, being insightful and infuriating, brilliant and elusive (and often quite witty). Everyone should read it. It challenges historians of science to think very deeply about their self-professed opposition to

2. Chang has extended the same approach to historical research, tasking several different groups of students over the years to explore specific topics, whereby each new group "inherits" the research notes, materials, and write-ups of the former classes, thus forming a "research community." The results of a pilot project along these lines was published as Hasok Chang and Catherine Jackson, eds., *An Element of Controversy: The Life of Chlorine in Science, Medicine, Technology and War* (London: British Society for the History of Science, 2007).

3. On the plurality of paradigms in science, see also Helen Longino, *Studying Human Behavior: How Scientists Investigate Aggression and Sexuality* (Chicago: University of Chicago Press, 2013).

4. Chang deals with the problem of demarcation—how to rule out certain theories (especially fringe theories) from flourishing alongside the dominant theory (or theories) of the science of the day—surprisingly casually (262).

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

"Whiggish" accounts of past science, and articulating a response to that challenge will occupy the latter half of this essay. The provocation to the philosophers is different. There is hardly a scientific statement more universally accepted, at all levels of education, than "water is H_2O." Chang's goal is to place enormous pressure on this claim, insisting that "it will be beneficial for people to realize that it is not crazy to subject the most fundamental truths of modern science to critical scrutiny, and to contemplate the possibility of scientific systems which deny or do without them" (xvi). If water cannot sustain his onslaught, then there is little hope for "things like DNA, quarks, black holes, parallel universes, etc." (204). Gauntlet thrown.

Although it consists of five chapters, the book is a manifestation of threes. The first triplet consists of three chapter-length historical studies. The opening episode is the richest and most provocative: Chang's retelling—based on an exhaustive survey of the secondary literature and a good amount of reinterpretation of primary sources—of the Chemical Revolution, especially the debate between Joseph Priestley and the phlogistonists versus Antoine Lavoisier and the anti-phlogistonists over whether water was an element or a compound of two substances, which the latter labeled "hydrogen" the water-maker and "oxygen" the acid-maker. At every stage, Chang dismantles unreflective conventional wisdom on these topics, and the revision proposed is total and disturbing. Chang does not believe there were good reasons—intellectual or social, in eighteenth-century terms or in ours—to abandon phlogiston in favor of Lavoisier's oxygen theory. There are several components to this argument. First, we need to take Lavoisier's theory at face value, and the simple verdict is that his three most significant innovations (his theories of acids, combustion, and caloric) are "clearly wrong," both from our viewpoint and from the viewpoint of chemists a few decades after Lavoisier's tragic execution by the Revolutionary Terror (8). Even more to the point, phlogistonists actually got a lot of things *right*, or at least potentially right, and—according to Chang—opened up the possibility of something resembling the electron and concepts of free energy. Even the classic phlogistonist conundrum of "negative weight" is no insuperable difficulty, and Chang offers a series of excellent arguments dismissing it (36), arguments I plan to crib shamelessly when I teach this episode. According to Chang, Lavoisier won not because he was correct or because phlogiston was incorrect, but because of a broader transition from thinking of chemistry in terms of principles to emphasizing the composition of substances. Chang's quarrel is not so much with Lavoisier—although a combative grumpiness creeps into his prose—but with historians, who have placed

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

a thumb on the scales when evaluating the arguments on both sides of this classic controversy:

> We really need to lose the habit of treating "phlogiston theory got *X* wrong" as the end of the story; we also need to ask whether Lavoisier's theory got *X* right, and whether it didn't get *Y* and *Z* wrong. There has been a great tendency, among philosophers and historians alike, to ignore and minimize the things that Lavoisier's theory could not explain (or got wrong by modern standards). (52)

If you sniff some Whiggism here, you are not wrong. Precisely what that odor is, and how we should react to it, is the central question this book poses for historians of science writ large.[5]

The second historical case relates an almost forgotten debate that Chang dubs "the distance problem" in the early history of what would later come to be called "electrochemistry." If, as anti-phlogistonists claim, water molecules are broken apart in electrolysis into oxygen and hydrogen, why do the gases accumulate at separate electrodes? Does a molecule split at the negative electrode and emit hydrogen, and then the oxygen atom jog over several centimeters (or even meters!) to the positive to emerge from the water? Chang emphasizes the alternative explanation due to oddball Romantic chemist Johann Wilhelm Ritter (1776–1810), who believed that in truth water *was* an element, which produced oxygen when it combined with positive electricity and hydrogen when it combined with negative electricity.[6] Although Ritter—who was fringed out of the natural philosophical community for a variety of reasons (hyperbolic Romanticism, creepy auto-experimentation, etc.)—and his explanation were dismissed, the distance problem remained unresolved until the ionization theories of Svante Arrhenius in the 1880s. The episode has been forgotten, according to Chang, because of a "closure obsession" (87) on the part of historians of science, who neglect the early years of electrochemistry precisely because so little was resolved. Rather than look for closure, we should recognize that unresolved debates are extremely common, that what was going on in the various systems that Chang articulates is "neither prescience nor a revolutionary spasm in between periods of normal science, but a long-lasting plurality in which multiple systems co-existed" (107). The same is true for Chang's third case: the history of atomism in the first half of the

5. I am sure other communities of readers will find different pivotal concerns in this book.

6. Here, Chang relies on secondary literature, and cites none of Ritter's original German-language writings.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

nineteenth century, when various systems for determining atomic weights—and thus, whether the formula of water was H_2O or HO (as John Dalton would have it)—coexisted and interacted without premature closure.

Each of these three historical cases is written in three parts: first, an accessible narrative account; then a detailed and exhaustive historical-cum-philosophical retread, dealing with all the byways and alleyways that interest the fastidious scholar; and finally a grab bag of ancillary questions that would have distracted in the second part (concerning theories of progress, objectivity, or truth, for example). But perhaps the most significant "three" throughout these chapters of the book, alongside the two more philosophical chapters that follow, are the disciplines that Chang addresses—history of science, philosophy of science, and (in a "complementary" fashion) science itself.

Each of those audiences will find the book disturbing for different reasons, but as a historian the one that struck me most forcefully is what can be understood as its "Whiggishness" in judging practitioners of past science—and, in many cases, finding them lacking. Hasok Chang thinks that the thoroughgoing anti-Whiggish stance of present-day history of science has gone too far, becoming an instinctual and deleterious overreaction that closes off reasonable inquiries. Not only *can* historians responsibly judge their historical actors, Chang contends, but in many instances we *should*.[7]

He is indisputably correct that the professional history of science as a discipline is officially and resolutely "anti-Whiggish." Of course, not everyone succeeds in the struggle against teleological, presentist, or triumphalist narratives—and these are, obviously, all somewhat different things—but there is no surer way to dismiss an article, monograph, or talk in the history of science than to expose the Whiggish elements of its analysis.[8] In some ways, a militant hostility to Whiggish narratives *defines* the history of science against other fields, and one can often spot historians of science at a talk when they query the potentially Whiggish approach of a speaker in, say, military or legal or political history.

7. This was widely regarded as the most provocative claim in his July 2013 Presidential Address to the British Society for the History of Science. One can see the entire lecture at: Hasok Chang, "Putting Science Back into the History of Science: BSHS Presidential Address," delivered at the International Congress for the History of Science, Technology, and Medicine, Manchester, England, 22 Jul 2013 (available at www.youtube.com/watch?v=ynRSXVAjA4U, accessed 14 Dec 2013).

8. On the distinction between Whiggism and triumphalism, see the pointed analysis in Hasok Chang, "We Have Never Been Whiggish (About Phlogiston)," *Centaurus* 51 (2009): 239–64.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

Chang's alternative vision is most clearly on display in his chapter about the Chemical Revolution. "My present purpose is to assess whether there were good reasons for abandoning the phlogistonist system, not only whether past scientists themselves thought so," he writes. "Therefore, I must give my own judgments in the end, though it would be silly to ignore the historical actors' judgments completely" (19). There are several reasons why Chang considers this an important function of his historical writing. Primarily, he is immensely concerned with what has been called "Kuhn loss"—the sacrifice of hard-won empirical or theoretical insights with the change in a paradigm or conceptual scheme, which can only be regained through rediscovery—and therefore he is strongly critical of the anti-phlogistonists when they promoted a new vision of chemistry but abandoned valuable explanations or even questions, like the phlogistonists' concern with why all metals resembled each other.[9] (Phlogistonists understood metals as having a surfeit of phlogiston, which accounted for their shiny appearance and ductile qualities. For Chang, with a soupçon of counterfactual reasoning, this is well on the way to our current understanding of the metals' sea of free electrons.)[10] Likewise: "Whiggishly speaking, phlogiston served as an expression of chemical potential energy, which the weight-based compositionism of the oxygenist system completely lost sight of" (46). If there has been Kuhn loss, then "complementary science" swings into action. Historians and philosophers today can explore these dead ends from past science and, in cases where contemporary science has not recovered the Kuhn losses, push the boundaries of science further.[11]

Chang's next concern stems from what comes across as a sense of disappointment with the dead. Some natural philosophers, like the converted

9. Whether "Kuhn loss" happens is a point of much philosophical debate. Chang does not address another possibility: that such loss of knowledge might be a good thing, as has been argued with respect to losing "tacit knowledge" in the construction of nuclear weapons. See Donald MacKenzie and Graham Spinardi, "Tacit Knowledge, Weapons Design, and the Uninvention of Nuclear Weapons," *American Journal of Sociology* 101 (1995): 44–99.

10. "If we were to be truly whiggish, we would recognize phlogiston as the precursor of free electrons." Chang, "We Have Never Been Whiggish" (ref. 8), 247. Chang's position, without the normative, complementary-science component, is related to the "reverse Whiggism" gambit proposed in Douglas Allchin, "Phlogiston after Oxygen," *Ambix* 39 (1992): 110–16.

11. As Chang stated in *Inventing Temperature* (ref. 1), 142: "However, there is no reason why we should not retrace, analyze, and reconsider their steps, thinking about how they could have avoided certain pitfalls, where else they might have gone, or how they might have reached the same destinations by more advisable routes. There will be fresh understanding and new discoveries reached by such considerations."

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

neo-oxygenists, simply did not live up to their own stated epistemological values. They ought to be held accountable:

> Where different values jostle with each other, the epistemologist is in uncomfortable territory. How are we to say which of the values cherished by different historical scientists were more valuable? Do we have any right to make such judgments? In my view, this is not a question of rights, as we are not going to be *doing* anything to the past actors themselves by our judgment. Rather, I think the question is about the present, and I believe that we have a *duty* to ourselves to make such judgments. . . . My honestly biased way of posing the question would be: which attitude was (and is) more rational or scientific, between adapting theories to new phenomena that we learn about, and giving dogmatic dominance to a favoured theory? (27)

Uncomfortable territory indeed. It does seem, not to put too fine a point on it, rather "Whiggish."

But what exactly is a "Whiggish interpretation," especially in the history of science? Herbert Butterfield's classic essay defining the term, *The Whig Interpretation of History* (1931), is no longer standard fare, although the text is invigorating and well worth the afternoon it takes to read it. The problem, for Butterfield, is the set of assumptions that historians unconsciously make when they write histories with one eye trained on the present. "Our assumptions do not matter if we are conscious that they are assumptions, but the most fallacious thing in the world is to organise our historical knowledge upon an assumption without realising what we are doing," he wrote, "and then to make inferences from that organization and claim that these are the voice of history. It is at this point that we tend to fall into what I have nicknamed the whig fallacy."[12] The bias tends in one direction: to picking the winners, to telling how our society is the necessary outcome of a series of victories of the just over the benighted across the course of history. "Through this system of immediate reference to the present-day, historical personages can easily and irresistibly be classed into the men who furthered progress and the men who tried to hinder it; so that a handy rule of thumb exists by which the historian can select and reject, and can make his points of emphasis," wrote Butterfield.[13] Chang himself does not fall afoul of Butterfield's condemnations. First, he is intensely aware of his own assumptions, and quite explicit about them; and second, he

12. Herbert Butterfield, *The Whig Interpretation of History* (New York: W. W. Norton, 1965 [1931]), 23–24.

13. Ibid., 11.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

does not use his judgments to present the winners more winningly—his sympathy is with the losers, the phlogistonists, even the Ritters of this world.

Yet neither Butterfield nor Chang quite adheres to current usage. For starters, Butterfield was worried about a *Whig* interpretation—that is, a point of view that happened to be touted by a political party as well as a breed of shoddy historians—not a Whig*gish* one. He deplored political histories that wrote contemporary ideology into events of the past, to the distortion of lived experience. That is not precisely what historians of science lose sleep over. As Nick Jardine observed a decade ago, vigilance against "Whiggism" did not begin to saturate the field until the early 1970s. Historians of science before then had tended to abhor "anachronism" or "presentism" rather than framing their perspective in Butterfield's words. (Butterfield did not always hew to his 1931 principles, especially when talking about science; his 1957 *The Origins of Modern Science, 1300–1800* has more than its share of Whiggism.)[14] According to Jardine, the adoption of "Whiggism" as a fighting word was linked to the post-Kuhnian separation of historians of science from practicing scientists, so that historians would cease to be regarded as simply teachers or promoters of science.[15] I expect everyone reading this has had the experience of talking to a scientist about what we do and finding anti-Whiggism the incommensurable sticking point. Anti-Whiggism seems mandatory today because we have wired it into the central core of our field *as a discipline*.

It might be tempting for those committed to a strong anti-Whiggish stance—as I am—to consider Chang to be Whiggish plain and simple, but that is not quite right. Unlike a card-carrying Whig, Chang's strongly scientistic perspective does not assume that our current theories of the world are correct and (consistent with his pluralism) he only wants there to be more options for debate and discussion. What would be the point of complementary science if there were no desire to reshape current science? (It would certainly lose some of its motivating forces as a pedagogical program.) In another article on this issue, Chang tells us that he literally wears a "Whiggish hat" when lecturing, so that students will understand that it is an assumed perspective—although seemingly one that can be doffed rather casually.[16] Chang is less

14. This point, as well as a defense of limited Whiggism in historical interpretation (not confined to the history of science), is made in William Cronon, "Two Cheers for the Whig Interpretation of History," *Perspectives on History* 50, no. 6 (2012): 5.

15. Nick Jardine, "Whigs and Stories: Herbert Butterfield and the Historiography of Science," *History of Science* 41 (2003): 125–40.

16. Chang, "We Have Never Been Whiggish" (ref. 8), 240.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

a Whig than an "anti-anti-Whig," to posit a parallel with the liberal anti-anti-Communists of the McCarthy era who deplored red-baiting and witch hunts but could hardly be accused of being "pro-Communist."

The parallel points a way through the challenge Chang poses to today's historians of science. Aside from its disastrous infringements on liberty, anti-Communism suffered from an incapacity to state what it was *for*; that, at least, was a difficulty Communism itself never had. Anti-anti-Communism had this problem in spades: it was not a coherent ideological position as much as a set of objections to a set of objections, which meant that proponents tended to emphasize issues of procedure (due process, for example). To the extent that it grew out of this negative (really, negative of a negative) phase into something closer to "civil libertarianism," anti-anti-Communism became a positive program. At present, anti-Whiggism is still mired in negativity, and we see some elements of proceduralism in nitpicky emphasis on actors' terminological categories. Anti-anti-Whiggism, à la Hasok Chang, has a positive articulation in "complementary science." In fact, it is when his retrospective judgments are most anti-anti-Whiggish—that is, most interventionist, most vehement about finding past scientists lacking—that complementary science is most potentially productive.[17]

Similarly, to preserve what many of us recognize as the methodological, narrative, and explanatory benefits of anti-Whiggism, historians of science need to elaborate the positive content of anti-Whiggism. Let's call it, for the moment, the Tory interpretation of history.[18] I do not propose to fully articulate the content of this approach, which would surely demand substantially more space and reflection, but I believe it would be helpful, in conclusion, to enumerate some of the benefits that anti-Whiggism brings us as a field aside from differentiating us from the writers of historical sidebars in science textbooks.

The most important quality of Tory history is that it is hard, even unnaturally hard. Butterfield noted something similar in 1931, observing in relation to the political/ideological history that preoccupied him, "though there have been Tory—as there have been many Catholic—partisan histories, it is still true that there is no corresponding tendency for the subject itself to lean in this direction."[19] This is not because of political ideology, but because treating the

17. Chang, *Inventing Temperature* (ref. 1), 250.

18. Just as Whiggish historians are not necessarily partisans of religious tolerance or laissez-faire economics, there is no requirement that Toryish historians skew rightward.

19. Butterfield, *Whig Interpretation of History* (ref. 12), 7.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

past on its own terms as much as possible, and not simply as a runway aimed at the present, goes against our instincts of placing ourselves and our times at the center of the world-picture. You have to *train* yourself to be anti-Whiggish, and this takes effort and some degree of cognitive dissonance. Chang asserts that the history of science has become "strong enough" as a discipline to shed the strictures of anti-Whiggism, but strength and disciplinary autonomy are not the point.[20] Tory readings are the particular gift that we give students and the general public: learning to see the world from the point of view of others, even in the seemingly unbending epistemological métier of science itself. We aren't anti-Whiggish for ourselves, but for others. Every semester I have the same experience with my students, laboriously explaining why it is important to not read the past through the present. Sometimes I can actually see the penny drop. It is one of the most valuable lessons I teach. If we abandon the Tory interpretation and the rigors it imposes, we will experience a "Kuhn loss" of our own.

And what would we gain? *Is Water H_2O?* shows the stakes very clearly. The power of Chang's argument is its relentless consistency, which traces out two paths to the future. If we as a field begin to assert judgments about the behavior of historical actors, which standard should we use? The obvious answer, implicit throughout this book is: that of present-day science. Chang laments the trouncing of phlogiston because with pluralism scientists might have discovered the electron sooner. That might be true, but it is a truth built upon our current understanding of subatomic particles, a Whiggish understanding. Chang also says nothing of what might *not* have happened while resources were being poured into phlogiston instead of into those areas that followed the anti-phlogistonist victory. Maybe entropy would have been delayed, maybe we would have never developed spectral analysis. Who knows? No one, because the only way to evaluate these counterfactuals is based on today's science, which is the very core of Whiggism. That outcome makes sense from the framework of complementary science, which is, as the name advertises, a project in *science*. We must choose: either complementary science or Tory interpretations.

In fact, we can never be Tory enough. As I noted earlier, even before historians of science began talking explicitly about anti-Whiggism, they were careful to try to read the past on its own terms. Even so, our graduate students read the works of previous generations and deplore the Whiggism of their

20. For Chang's position, see the Manchester lecture (ref. 7) as well as his "We Have Never Been Whiggish" (ref. 8), 254.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021

elders. With the passage of time, past historians *do* seem Whiggish. To their own audiences, those historians were trying to show how past science (or natural philosophy, or mathematics, or medicine) should be evaluated by its own lights. It is only with hindsight—our hindsight—that we apprehend where they fell short. Future historians of science will find the same in our own works, as I find it (to my horror) in my own earlier writing. Beyond adding to the empirical record with new documents and forgotten theories from the past, this is the closest thing to progress that I recognize in our historical practice. We get asymptotically better at recognizing Whiggism in our accounts, and remain committed to trying to extirpate it. That's a Toryism I can get behind.

ACKNOWLEDGMENTS

I would like to thank Yael Geller, Jacob Darwin Hamblin, Erika Lorraine Milam, Mary Jo Nye, and Felix Rietmann for helpful comments on an earlier version of this essay.

Downloaded from http://online.ucpress.edu/hsns/article-pdf/44/4/413/377596/hsns_2014_44_4_413.pdf by Princeton University user on 31 January 2021