Weinberg, Leonard Susskind, Sean Carroll, Lisa Randall, and other multiverse proponents, or asserts his own opinions. His referring to opponents of the multiverse with the pejorative "deniers" links them with deniers of evolution, climate change, or worse. A less partisan presentation would have improved the book's balance. Finding multiverse opponents is not exactly difficult; an informative, if heated, debate recently took place between multiverse proponents and opponents in reaction to the article by Anna Ijjas, Paul Steinhardt, and Abraham Loeb in the February 2017 issue of *Scientific American*. Healthy debate is a welcome feature of the multiverse landscape.

Other books on the multiverse include Brian Greene's *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos* (2011) and Max Tegmark's *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality* (2014). Those texts largely eschew the history of the multiverse and cover the pertinent, if esoteric, physics more thoroughly.

The Number of the Heavens shines when Siegfried adopts a journalistic neutrality about the arguments for and against the multiverse. His wry wit is evident throughout, but nowhere more so than when relating past episodes of confusing and even contradictory interpretations of metaphysical ideas.

At the outset, Siegfried stresses that "there is no greater story in science than the human quest to comprehend the cosmos." Our understanding of the universe is rapidly expanding. But physicists still debate the definition of the words we use to describe the cosmos's capaciousness. Even the term multiverse constantly evolves. At least with *The Number of the Heavens*, we finally know where it began.

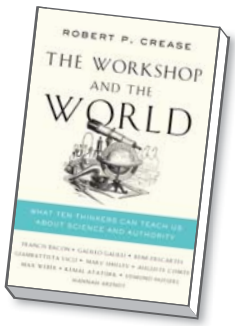
Brian Keating
University of California, San Diego
La Jolla

ISTOCKPHOTO.COM/TRIFONOV_EVGENIY

Why do people mistrust science?

The Workshop and the World
What Ten Thinkers Can Teach Us About Science and Authority

Robert P. Crease
W. W. Norton, 2019. $26.95



The Workshop and the World: What Ten Thinkers Can Teach Us About Science and Authority attempts to uncover the origins of science skepticism and contribute to the highly politicized US debates about climate change. Robert Crease addresses the problem of science and authority through 10 historical characters—thinkers, as he calls them—Francis Bacon, Galileo Galilei, René Descartes, Giambattista Vico, Mary Shelley, Auguste Comte, Max Weber, Kemal Atatürk, Edmund Husserl, and Hannah Arendt. That mix is a clever choice, especially because some of those chosen are not the usual suspects in Anglo-American histories of science. The diversity helps broaden the scope and complexities of Crease's discussion, and that alone may be an interesting reason to read the book.

Each chapter of *The Workshop and the World* covers moments when the authority of "this thing we call science," to paraphrase Alan Chalmers, was under threat. And therein lies the strength and weakness of Crease's book. The strength is acknowledging that science has often had to both earn its authority and negotiate with those in authority. The weakness is thinking of science as a necessary, well-defined category with a natural authority that should be recognized at all times and in all places.

Much of Crease's argument rests on the label "science denier," which I think needs a less politically biased clarification. Crease says, "Ensuring the authority of science requires carefully considering the social and historical context" in which a particular scientific community evolves. Here in Europe, where the word "science" is not quite so politicized, I may be missing important US-local points of the discussion. But targeting so-called science deniers as a uniform, antiscientific group seems excessively simple. Moreover, by comparing them to ISIS terrorists, for example, I am not sure the author does what he claims when he writes, "To confront

science denial we have to understand what stories are unfolding in his [the denier's] head and where they come from."

As a historian of science, I welcome attempts to understand the present through history. One should, however, be careful with the use of universal categories that might easily be challenged, such as the word science (yes, singular) as we find it in the book. Crease's narrative seems to unravel as follows: Bacon invented how to institutionalize modern science, and people such as Galileo and Descartes had to fight against those who opposed an otherwise obvious need for such methods and institutions. After that, some thinkers—including Vico, Shelley, Husserl, and Arendt—helped shape the social authority of science with their valid criticisms of it.

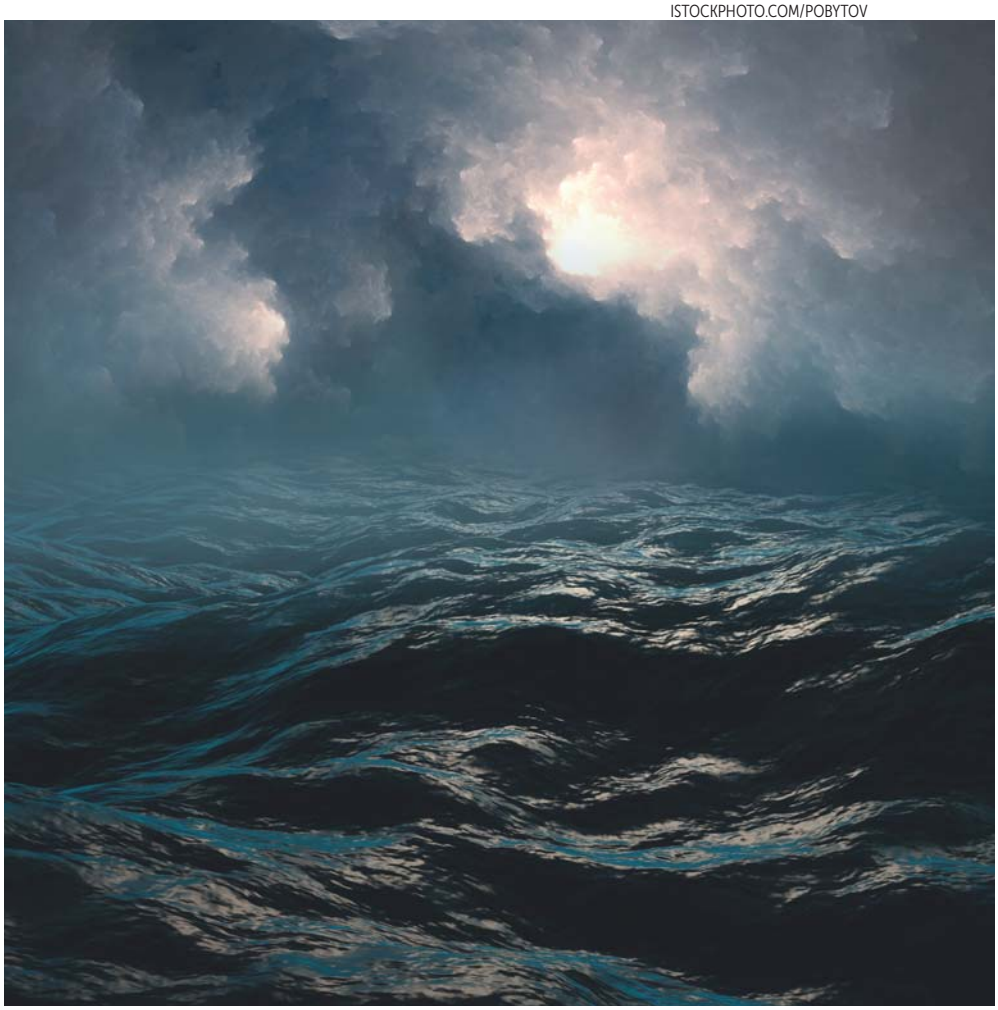
Meanwhile, members of the Inquisition, dictators, contemporary Trump supporters, and others have stubbornly or irrationally attacked the authority of science. I believe that the Manichean story is far too simple. I wonder, for example, if Crease would regard President Dwight Eisenhower's 1961 farewell address warning about the dangers of technocracy as antiscience.

Crease proposes as solutions a list of short-term and long-term policies, the most surprising being to demand that any person wanting to participate in the public sphere take a pledge for science. That sounds to me like a totalitarian attempt to expel criticism. Who would write and police that pledge? And how far could it go without becoming ideological rather than scientifically neutral? A diverse group of philosophers of science would probably never agree on a common text for the pledge. Perhaps we should leave the work of granting scientific citizenship to Comte and his positivist church in chapter 6 of Crease's text or to a new Atatürk in chapter 8.

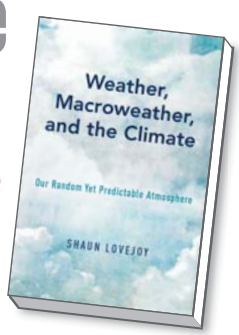
Some long-term strategies that Crease suggests, including the emphasis on science education and nuanced historical accounts of how we got here, may indeed be helpful. And if done honestly, those strategies will prevent science from being used as a simplistic ideological catchword, which, at the end of the day, is what science deniers—and some self-appointed science promoters—do.

Jaume Navarro
University of the Basque Country
Bilbao, Spain

ISTOCKPHOTO.COM/POBYTOV



An introduction to our chaotic atmosphere and climate



Weather, Macroweather, and the Climate

Our Random Yet Predictable Atmosphere

Shaun Lovejoy
Oxford U. Press, 2019. $34.95

The geophysical community recognizes that the observational data they collect are incredibly complex. As temporal and spatial scales get larger, the fluctuations in the atmospheric and other Earth fields systematically increase or decrease. Such behavior occurs not only in climate dynamics but in seemingly unrelated fields such as geomorphology. A closer look reveals that complex signals are governed by statistical relationships that connect billions of structures over a wide range of time and length scales. The resulting quantifiable scaling laws capture the power law growth or decay of fluctuations. Lewis Fry Richardson first proposed the idea in the Richardson ⅓ law of turbulent diffusion.

The ubiquitous nature of scaling laws is masterfully analyzed in *Weather, Macroweather, and the Climate: Our Random Yet Predictable Atmosphere* by Shaun Lovejoy. Recipient of the 2019 Lewis Fry Richardson Medal, Lovejoy has devoted his career to understanding scaling laws empirically and theoretically. In his book, he shows readers from all back-