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Peter Vickers. *Identifying Future-Proof Science*. Oxford University Press 2023. 288 pp. \$81.00 USD (Hardcover 9780192862730).

What is future-proof science that Peter Vickers is mindful of it? ‘Science has hit upon the truth,’ when it comes to a future-proof idea, ‘and all that remains is for scientists to build upon and develop the correct idea they already have. No feasible scientific developments could bring them to reject the idea’ (1). Future-proof science consequently consists of established—indeed, bracketing hyperbolic skepticism, certain—scientific facts. Vickers offers a list of what he regards as good examples, with each example a pair of a general area of science in which there are established facts and a singular claim within it, e.g., ‘Plate tectonics, including the history of past land-masses such as Laurasia and Gondwana’ and ‘Between 120 and 160 million years ago, South America split from Africa’ (17). The project of the bulk of the book is to examine, and ultimately, to recommend, criteria for identifying future-proof science. In doing so, as the preface explains, it proceeds from the philosophy of science to the sociology of science.

Faced with the idea of future-proof science, a natural reaction is to wonder how it comports with forms of scientific antirealism, including those of Bas van Fraassen, Kyle Stanford, and Larry Laudan, which emphasize various reasons to be wary of overreaching on behalf of science. In his wide-ranging and somewhat difficult chapter 2, Vickers in effect responds that the issues are orthogonal: realist or antirealist, philosophers, like scientists, have to evaluate these claims on the basis of the quality and quantity of the evidence (which, in the limit, confers future-proof status). In the contemporary scientific world, he acknowledges, it is difficult, even for scientists, directly to consider even a fraction of the evidence relevant to a given scientific claim. Thus, Vickers writes, foreshadowing the eventual sociological turn of his discussion, ‘The only option is to indirectly access the overall evidence by assessing the judgment of the relevant scientific community’ (50, emphasis in original).

Before taking that turn, however, Vickers devotes a pair of chapters to adroitly using episodes from the history of science—J. F. Meckel’s successful prediction of gill slits based on a mistaken theory of embryonic development in chapter 3 and the discovery of the ‘fishapod’ *Tiktaalik* considered as a novel predictive success of evolution in chapter 4—to dismiss philosophical attempts to provide criteria for future-proof science. He concludes that the Meckel episode provides no reason to think that evidence and truth are not correlated, partly because ‘[r]ecapitulation theory was never a serious candidate for future-proof science’ (74), and that the



discovery of *Tiktaalik* was neither predictively nor explanatorily significant as regards the future-proof status of evolution. Toward the end of chapter 4, Vickers segues again into a discussion of scientific consensus, here with regard to evolution. (Disclosure: here he briefly discusses the National Center for Science Education's Project Steve, which I administer.)

Considering his discussion of scientific consensus, Vickers offers a two-prong sociological criterion for identifying future-proof science: '(1) At least 95 per cent of relevant scientists are willing to state the claim unambiguously and without caveats or hedging. If prompted they would be willing to call it an "established scientific fact". (2) The relevant scientific community must incorporate a substantial diversity of perspectives' (111). Subsequent chapters evaluate the criterion against case studies. Thus, in chapter 5, Vickers illuminatingly examines the apparent counterexample of continental permanency, concluding that neither prong was fulfilled as a matter of historical fact, while continental drift, as noted above, is among his examples of future-proof science. In chapter 6, he considers whether it is necessary to revise the two-prong criterion to accommodate fundamental physics on account of its frequent revolutions and its interpretative controversies, concluding that it is not.

In chapter 7, Vickers addresses the asteroid impact theory of Mesozoic dinosaur extinction, concluding that although it is trending toward future-proof status, it is not there yet. Chapter 8 considers various issues related to the COVID-19 pandemic: Vickers properly separates policy questions from scientific questions, noting that the scientific consensus that the virus SARS-CoV-2 is the cause of COVID-19 emerged rapidly. Chapter 9, finally, is devoted to rehearsing the criterion for future-proof science and the arguments in its favor, offering practical guidance for applying it, reviewing the possible objections and his replies to them, and considering implications for education and philosophy. With regard to applying the criterion, it is noteworthy that, together with *Future-Proof Science*, Vickers launched the Institute for Ascertaining Scientific Consensus, which aims to survey the world's scientists repeatedly, partly in order to ascertain whether a scientific consensus obtains on various topics of interest.

Three observations. First, Vickers relies on the judgment of scientists as registered in terms such as 'true' and 'fact'—but these are not used uniformly by scientists. For example, the vertebrate paleontologist Kevin Padian and the population geneticist Jerry Coyne are equally keen defenders of evolution, but when Padian reviewed Coyne's popular exposition *Why Evolution is True* (2009), he fretted at length about the adjective in the title: 'Is it most effective to tell them [people from a conservative religious background] that evolution is "true," implying that other

explanations are “false”?’ Examples could be multiplied. Vickers addresses a related worry—that if his views come to be widely accepted, scientists might alter their usage of such terms—by quipping, ‘That is why we must hide this book from the scientists’ (227). But that solution will not avoid the variance in scientists’ usage of these key terms, which may in part reflect philosophical divergences.

Second, the handling of diversity is not entirely satisfying. Considering 19th-century classical physics as a possible counterexample to his criterion, Vickers replies that the community of classical physicists was not substantially diverse because ‘99 per cent (give or take) of the relevant scientists were male,’ adding, ‘This may seem like a “cheap” way to wriggle out of possible counterexamples’ (154). Indeed. There is at least a lacuna in his reply, since diversity is supposed to be of perspectives: Vickers would need to argue that the predominance of male scientists implies that the community lacked a substantial diversity of perspectives—a notion that he never defines. Since his criterion specifies a sufficient, not a necessary, condition for future-proof status, there is no barrier to his setting the bar as high as he likes without offering a principled justification: he only needs to establish that every claim that meets the criterion is future-proof. But the higher he sets the bar, the less interesting the criterion is.

Third, in chapter 9’s discussion of consensus in philosophy, Vickers observes that ‘strong consensuses in philosophy are vanishingly rare (for positive claims at least)’ (239), adding that rejection of the view that knowledge is justified true belief might be a negative claim on which there is philosophical consensus. Oddly, he doesn’t mention the two PhilPapers surveys of Anglophone philosophers conducted in 2009 and 2020, which suggest (though with room for quibbling about whether the sampled philosophers are substantially diverse and about how to classify the responses) the existence of a philosophical consensus that adult humans are conscious but no such consensus that knowledge is not justified true belief. In the same discussion, Vickers also floats the argument that without a consensus of relevant experts that his views are right, he should not believe them. If he is not joking, then he is misapplying his own criterion, which only states a sufficient, not a necessary, condition for accepting a claim.

These minor concerns notwithstanding, *Identifying Future-Proof Science* poses interesting and novel questions and consistently pursues them thoroughly and illuminatingly. Particularly impressive is Vickers’s use of episodes from the history of science, which are focused on making a philosophical point clearly yet still present the facts accurately, in depth, and with insight; these discussions alone would warrant a recommendation. Also impressive is the clever way in which

Vickers structures his arguments: readers will constantly discover that just as soon as a criticism or question occurs to them, it will be addressed shortly thereafter in the book. In addition, Vickers is cautious and modest in his claims where appropriate, acknowledging areas of uncertainty, vagueness, and incompleteness. If *Identifying Future-Proof Science* inspires philosophers, historians of science, and sociologists of science to develop, revise, and extend Vickers's pioneering work, it will be no more than it deserves.

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