GUEST ESSAY

Science Keeps Changing. So Why Should We Trust It?

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As popular mistrust of expert opinion grows, we increasingly encounter the following skeptical argument about science: Historically, even well-established theories and findings have been overturned; therefore, science can't be trusted because it will eventually change again.

Robert F. Kennedy Jr., the secretary of health and human services, made a version of this argument in August when defending his decision to halt hundreds of millions of dollars in mRNA vaccine development despite the objections of vaccine scientists. He said that "science is always evolving" and the experts could not always be trusted. Likewise, when public health authorities recommended against public masking early in the Covid-19 pandemic but later argued that masking was essential, doubters concluded that the underlying science was untrustworthy.

The skeptics are right that science does not progress uniformly and steadily toward truth. Once, scientists believed in the four humors as the key to health, in phlogiston as the essence of fire and in the ether as the carrier of light. Eggs were bad for you, then fine, then maybe bad again. Even Newtonian physics, once considered unshakable, was revised by Einstein. If so many widely accepted theories have been discarded, why should we trust the ones we have now?

It's a sobering question, but also a misleading one. It implies that the only possible attitudes toward science are naïve faith and wholesale pessimism. It assumes that science is a single global entity that rises or falls all at once, when in reality, science is an array of local domains of inquiry, each with its own standards of evidence and degrees of reliability.

Fortunately, there is another attitude to adopt toward science — one you might call disciplined trust — that would serve us much better. It just happens to require some actual knowledge of science and some intellectual humility.

To understand what's wrong with the skeptical argument, it helps to look closely at the kind of reasoning it relies on. Here is an example: You heat a few samples of the element bismuth and find that they all melt at the same temperature; you conclude that all bismuth melts at this temperature. Then you heat a few wax candles and find that they all melt at a certain temperature, and again you conclude that all wax melts at that temperature.

The reasoning in these two cases is the same (it's known as induction), but only the bismuth conclusion is trustworthy. Why? Because whether this kind of reasoning is good or bad depends on the broader context. Here, the relevant background facts are that most elements (like bismuth) have just one common form, giving them a single characteristic melting point, whereas wax varies widely in composition from sample to sample, causing it to melt at different temperatures.

Let's return to the argument that interests us: You look at a bunch of past scientific theories and find that a great many of them were wrong; you conclude that our current and future scientific theories will turn out to be wrong, too. What background fact would warrant that conclusion?

One possibility is that there is something systematically defective about science. If the scientific method is flawed, you could reasonably expect science to keep generating flawed theories.

The problem is that there is no single scientific method used in all of science. Newton's deduction from observed phenomena is very different from Darwin's inference to the best explanation, which in turn differs radically from Einstein's thought experiments with light beams, trains and elevators. What people call "the scientific method" is really many distinct ways of investigating the world — different strategies for representing, experimenting and classifying.

If you want to argue that science is fundamentally unreliable, you need to look at the evidence and methods in a specific area of inquiry. Take early-stage medical research, where a large proportion of findings fail to replicate. (An analysis of highly cited studies in the field found that many of them were later contradicted by better evidence.) Here, the pessimistic argument may hold: These findings were unreliable, so the next one will be unreliable.

But notice that we're not making a sweeping claim about all of science. We're identifying a particular area of inquiry, with well-understood methodological problems — small sample sizes, publication bias, statistical overfitting — and drawing a narrow, evidence-based conclusion. Nor are we simplistically equating the failures of early-stage medical research with the "failures" of, say, Newtonian physics. (Newton's laws are accurate in many but not all contexts; one reason Einsteinian physics was considered successful was that it preserved Newton's accuracies.)

What I’m proposing is neither global pessimism nor naïve faith. It’s local skepticism, or disciplined trust, which is precisely what science needs to improve itself. The history of science is indeed a graveyard of theories, but the fact that science keeps changing is a mark of its strength. It keeps changing because the world is complex and full of wonder. That isn’t a problem; it’s the engine that drives scientific progress.

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