

The Ripple Effects of Shrinking U.S. Science

Severe cuts in research funding will cause a complex cascade of effects across the United States and around the world.

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Today, it is not hyperbolic to think that America's global advantage in science is coming to an end, the product of a bevy of aggressive attacks from the federal government on its own agencies and other public and private institutions. These attacks will likely thin the American scientific workforce across many subfields in coming years. And they've already caused one scientific journal to pause submissions of new studies. This motivates a thought experiment around how a shrunken scientific enterprise in the United States will look.

The challenge of this exercise is that American science is defined by many intertwined actors and incentives, and so the negative effects of less funding can't be compared to a linear cascade of dominoes falling. Rather, the reality looks much more like a variation on [Jenga](#), whereby perturbations in one part of the structure can send ripple effects through everything all at once. Whatever model we prefer, one thing is clear: A [shrunken American science](#) will have negative effects across many corners of the scientific world, from the way we publish to the sorts of science that we conduct.

We'll start with the most basic elements that start a cascade effect throughout the system: the lack of money available for American laboratories and research programs. The most upbeat take on this overall disaster scenario is one in which the U.S. begins to focus more on computational and theoretical training, which is cheaper than the large-scale experimental empires that live in America's powerful research institutions. A scenario like this one could lead to a generation of U.S. scientists still equipped to ask questions in today's complexified data landscape, where AI now underlies all of our scientific expeditions.

But no amount of positivity can mask the overall harm that comes from shrinking funding. The proximal impacts have already played out: [Several institutions](#) have cut down their graduate admissions classes. If this trend continues, fewer people will have access to master's and doctoral degrees in the sciences.

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One cynical take is that institutions were already training too many students. In some graduate programs, large classes are the product of copious funding and the need for student workers to churn out data to support the quest for even more funding, rather than the result of a system that intentionally matches class size to specific needs. But even so, an immediate disruption in the pipeline will cause problems in the form of fewer teaching assistants to aid in the education of undergraduates and a smaller pool of postdoctoral associates — the underappreciated engine of scientific progress in laboratories around the world. This will create smaller laboratories, capable of producing fewer discoveries. This, in turn, creates downstream effects that may shape the very sorts of questions that scientists choose to pursue.

Does funding availability influence the nature of the science that we practice? A surplus of resources facilitates the ability to do things that one would not in a scarcity. Smaller research programs cannot take on risky projects, as they must be careful about where every dollar goes. In this scenario, science becomes more — even more — risk averse. Given the prevalence of research practices that, in some opinions, are shoddy and produce results that cannot be [replicated](#), one could say that we should have been more careful about our research questions all along.

The problem with this logic is that “risk averse” should not be mistaken for “careful.” Rather, risk-averse science is more likely to adopt a herd mentality, in that labs pivot to whatever the most popular thing is because it harbors the greatest odds of being funded. This can lead to more imprecision, as we all rush to capture whatever little glory we can. The negative consequences of this are obvious: less high-risk research, more follow-the-leader practice, [less disruption](#). Scientists may love the intrepid process of discovery, but they love feeding their families much more.

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One response might be that high-risk research can and should pivot to the private sector. Yes, there are signs of the private sector's large role in bringing significant discoveries to our smartphones, desktops, and bedsides. Half of the 2024 Nobel Prize in Chemistry was given to [Demis Hassabis](#) and [John Jumper](#) of Google DeepMind, which developed AlphaFold, an AI-based algorithm that has revolutionized the study of protein folding. The field, which can inform the design of drugs based on the three-dimensional structure of proteins, has seemingly infinite implications for biology and medicine.

But many of the most provocative industry advancements have an academic origin. And this is especially true with regards to where scientists are trained. Hassabis received a doctorate from the University College of London in cognitive neuroscience, and Jumper from the University of Chicago in theoretical chemistry. With less funding, we'll have fewer opportunities to train the next generation of visionary leaders.

What else happens when the American scientific workforce shrinks? There will be direct effects to two industries tied to academic research: the laboratory supplies industry and scientific publishing. In the former case, smaller laboratories mean fewer confocal microscopes, nanopore sequencing machines, and other expensive equipment sold. Even more, there will be fewer incentives to develop new DNA and RNA sequencing technologies, as there will be fewer customers. In this sense, the shrinkage in federal funding has the ironic effect of damaging private industries tied to big science.

With regards to the science publishing industry, a workforce stretched for time and resources may bottleneck aspects of the peer-review pipeline: Fewer scientists equals a smaller pool of both submitting authors and available reviewers. Reviewing papers with great care was already a practice that was, at best, [weakly incentivized](#). We can expect the shrinking and disruption of science to negatively affect the aspects of the science that run on goodwill and tradition, and few aspects qualify like peer review.

A decline in quality products will dramatically affect the science publishing business model. When an industry undergoes a crash (and what is happening today in science may qualify), the most vulnerable entities are those that are independent, without the safety net of a large corporate structure. In the case of scientific publications, we can expect the glamour journals — Science, Nature, Cell, the Proceedings of the National Academy of Sciences, etc. — to survive. But what about the smaller, not-for-profit scientific societies? They not only publish journals with foundational papers in their fields but also host conferences where trainees can immerse themselves in greater scientific communities. These gatherings serve as hubs for interaction and mentorship, critical parts to training the scientists of today and tomorrow. But because publishing is a major source of revenue for these societies, they may have to scale back their journals and overall operations, or dissolve entirely.

In addition to affecting scientific research and the publication industry, the cascade effects of a shrinking workforce will cause larger cultural changes for society. A smaller scientific infrastructure will train fewer scientists. There will be fewer new curricula to teach students about a rapidly

changing world inside and outside of the laboratory. There will be fewer creative educational programs aimed at those who have been denied access to higher education (for example, those who are first-generation students, disabled, or formerly incarcerated). In sum, we will have a country with fewer people raised in the culture of science.

In the legal profession, it is well known that many law school graduates may not [practice](#) law but end up working in a number of sectors where legal knowledge is beneficial: not-for-profit organizations, advocacy groups, and think tanks. Similarly, graduate and post-graduate education in science has given us business leaders, secondary school [educators](#), and award-winning science journalists. A smaller science will shrink the scientific footprint on American intellectual life across sectors. Fewer people familiar with the scientific method, fewer people who have ever conducted an experiment, fewer people who know how to interpret or generate a data visualization.

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In essence, the status of scientists as the personification of “smart” will diminish, and science will become even more foreign to the everyday American. Yes, our reliance on credentials as a marker of expertise has long been a problem. But without a large population of people formally trained in the sciences, society might be more susceptible to the peddlers of disinformation.

What I’ve outlined constitutes only a sample of the many manifestations of a smaller American science. The good news is that the potential solutions to this conundrum can be just as diverse as the problems that underlie it. But before we use our imaginations towards a set of solutions, the current moment requires us to deal with the uncomfortable truth that the American scientific machine of yesterday is no longer.

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