The Big Read **Scientific research**

The cost of Trump’s attack on American science

Sweeping funding cuts threaten to undermine the innovation that has been a central part of US economic strength for decades

Michael Peel and **Hannah Kuchler** in London

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Rebecca Simmons has been working in science in the US for over five decades, but she has never seen the field in the turmoil it is today.

A doctor and researcher, she and her colleagues had wanted to investigate why Black women are more likely to experience complications during pregnancy including stillbirths, high blood pressure and preterm deliveries.

But then, on inauguration day, an executive order from President Donald Trump forbade any federal grants for work related to diversity, equity and inclusion (DEI).

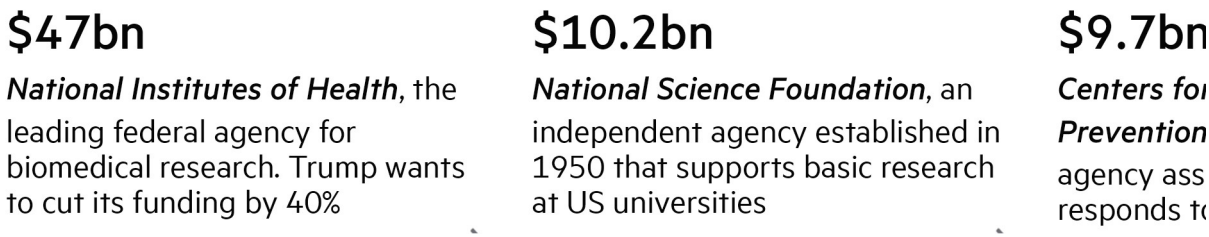
An official at the National Institutes of Health (NIH), the world's largest public source of biomedical finance, told the team that the policy change had scuppered its application, Simmons says.

"Not being able to study that has profound implications," says Simmons, a professor of neonatology at the University of Pennsylvania. "Ignoring disparities in health effects in disadvantaged populations — and ignoring research that is trying to understand why those effects happen — places those communities at very high risk of worsening health." The NIH did not respond to a request for comment.

The directive is part of a wide-ranging campaign to shrink publicly funded US science, from space exploration to materials discovery. The Trump administration has slashed finance for leading organisations and suppressed research on subjects including gender inequalities, vaccines and climate change.

The administration's actions are an amalgam of cost-cutting and ideological missions, critics say. The result is a sweeping, scattergun series of changes that are hard to track, constantly amended and, in some cases, may yet be overturned by litigation. Even in areas where measured reforms are arguably needed, scientists say the changes are too sudden and opaque to be justified.

US scientific institutions — and their budgets — potentially at risk



For critics, the cuts threaten to undermine the innovation that has powered US economic success — as well as encourage wilful ignorance about important threats facing humanity.

Since the second world war, the publicly funded science base in the US has been an engine of discovery and global economic growth. The turmoil in research is a huge risk for powerful industries such as pharmaceuticals, whose products are often built on publicly funded research.

"This dampening of scientific inquiry is profound," says Simmons. "It is going to have a huge ripple effect that's going to last at least a generation."

Even if these policies are softened or reversed, the effects are likely to be lasting. The administration's actions have shaken the decades-old assumption that the US is a solid, well-funded and intellectually open environment for research.

After a slow start, resistance is gathering. Last month, almost 2,000 researchers including dozens of Nobel Prize winners issued an open letter raising the alarm. "We see real danger in this moment," said the appeal. "We are sending this SOS to sound a clear warning: the nation's scientific enterprise is being decimated."

Jeremy Levin, a biotech chief executive who sits on the board of the US industry group Biotechnology Innovation Organization (Bio), says the cuts risk driving away talented practitioners to more attractive places overseas and, ultimately, ceding scientific leadership to China.

"As America steps back, cuts its basic research," he says, "China has the opportunity to step forward and to become the leader in the world of science and medicine."

The change of direction at the NIH exemplifies the chaos now engulfing many leading scientific institutions.

The agency has grown from its origins in a 19th-century one-room laboratory into a biomedical behemoth that gave research grants totalling $33bn in 2022. That was more than 25 times the amount given by number two awarder the Wellcome Trust, among 10 leading funders that provided data. NIH funding has aided breakthroughs from gene editing to mRNA technology. Each $1 spent by the NIH generated new economic activity of $2.56 nationwide, according to a study published last month.

Biomedical behemoth: NIH dominates research and grants

Annual grant amount by leading funding bodies* ($bn, 2022)

Hover over circles to see details of funding body and amount

FINANCIAL TIMES Source: World Health Organization • *top 10 funders to provide data

The Trump administration wants to cut the NIH's $47bn annual funding by about 40 per cent, according to media reports of preliminary plans. It has already announced moves to slash billions from the grant funding it gives to researchers each year. The proposed curbs are currently being challenged in the courts, as are terminations of some existing awards and delays in considering new applications. The NIH will pull money awarded to universities that have DEI programmes or boycott Israeli companies, it announced on Monday.

The Department of Health and Human Services, which governs the NIH, is now run by longtime vaccine sceptic Robert F Kennedy Jr. It has so far announced the firing of about 1,200 of the NIH's 20,000 staff, with others reassigned or placed on leave. Some appear to have returned to work, such as a team of neuroscientists whose dismissal was blamed on inaccurate data.

The NIH has additional political symbolism because of its association with Anthony Fauci, a top official there until 2022. Fauci was the public face of the White House Covid-19 task force, where he sometimes contradicted Trump's claims about the virus. He became a hate figure for some in the Maga movement and Elon Musk called for him to be prosecuted — one reason Joe Biden granted him a pre-emptive pardon before leaving office.

Within days of coming to power, the new Trump administration removed Fauci's security detail. Now senior NIH officials, including Fauci allies and associates, are being moved from their jobs, according to people with knowledge of the matter. Fauci's wife Christine Grady, the head of the NIH Clinical Center's bioethics department, was threatened with demotion and placed on administrative leave. The same is true of Jeanne Marrazzo, Fauci's successor as director of the National

same is true of Jeanne Marrazzo, Fauci's successor as director of the National Institute of Allergy and Infectious Diseases.

Scientists Anthony Fauci and his wife Christine Grady have both suffered the backlash from the Trump administration. Former president Joe Biden granted Fauci a pre-emptive pardon before leaving office © HUM Images/UIG/Getty Images

Ideological-driven conflicts are engulfing other health agencies. Peter Marks, who quit his role as the Food and Drug Administration's (FDA) vaccine chief last month, accused Kennedy of spreading "misinformation and lies" about vaccines. Meanwhile, projects to combat vaccine hesitancy have been cancelled. Kennedy has also hired David Geier, a long-standing vaccine critic once disciplined by the state of Maryland for practising medicine without a licence there, according to media reports. Geier, who did not respond to a request for comment, has long promoted the idea that jabs are linked to autism, a claim made by already discredited research. Kennedy himself has caused alarm by promising to find "what has caused the autism epidemic" by September.

For some critics of the administration, these purges have prompted comparison to the 1950s McCarthyist persecution of public figures accused of Communist sympathies. Then, professors who refused to testify in front of Congress were "essentially blackballed", says Mary Sue Coleman, the president emerita of the University of Michigan. Coleman says even this comparison doesn't fully capture the nature of what is happening now. "For me this feels like an almost unprecedented time," she says.

The health department and the NIH did not respond to requests for comment.

The new drive for cutbacks has shaken other scientific sectors too. Under administration proposals, Nasa's $7.6bn science budget could be almost halved.

The American Astronomical Society has called these plans "catastrophic". It argues that they would severely hit efforts to launch new telescopes, protect communication systems from space weather and bring rock samples from Mars for the first time.

Nasa says it is reviewing proposals from the presidential Office of Management and Budget. The OMB didn't respond to a request for comment.

Federal science institutions have been hit further by slashed budgets elsewhere in government. The dismantling of the US Agency for International Development (USAID) has shut down funding for areas including agriculture and programmes combating diseases such as HIV and malaria. The Department of Energy has said it is cutting grants to colleges and universities to "halt inefficient spending".

Smaller but still important organisations are also feeling the squeeze. The Atomic Spectroscopy Group of the National Institute for Standards and Technology (NIST), part of the commerce department, is reportedly scheduled to close this month. The atomic measurements made by the group are a standard international reference point and used by experts from cosmologists to makers of industrial products.

NIST says it is "premature" to comment on potential changes, since the commerce department has not released a final plan.

A geologist wears a mock-up spacesuit during a Nasa press event. Cuts to the space agency's budget could severely hit efforts to launch new telescopes and bring rock samples from Mars for the first time © Patrick T Fallon/AFP/Getty Images

"The profound impact of Donald Trump's capricious funding cuts is twofold," says Philip Plait, an independent astronomer and commentator. "One is the immediate loss of necessary funding to do any research and pay the researchers. The other is the growth of uncertainty for any new funding or support that researchers might need."

The administration's drive has also hit research into global warming, about which Trump and his allies have long been sceptical. The administration wants to end almost all climate change-related research at the National Oceanic and Atmospheric Administration, according to an internal budget proposal reported by the academic journal Science. An open letter signed by more than 2,500 scientists and other experts in February urged against cuts at the agency.

"Undermining the ability of scientists at Noaa to produce independent, world-class science will lead to devastating impacts on the United States and global climate and weather research community," the letter read.

Noaa says it does not discuss "internal personnel and management matters", nor do "speculative interviews".

This rollback of research comes in jarring contrast to the push for global scientific pre-eminence that emerged in the US out of the second world war.

Developments from advances in radar to the building of the atomic bomb showed the extraordinary — and sometimes terrifying — power of state-driven American scientific endeavour. The National Science Foundation was created in 1950 and today accounts for about a quarter of federal support to America's colleges and universities for basic research.

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The NSF's 75th anniversary in May will arrive in an atmosphere very far from jubilation. In February, it fired about 10 per cent of its staff, although some appear to have been reinstated after litigation. Last week, the NSF announced that it had begun "terminating [funding] awards that are not aligned with agency priorities". These include — but are not limited to — grants linked to

Rebecca Simmons, University of Pennsylvania

DEI and the study of misinformation and disinformation.

The changes appear to undermine long-standing NSF efforts to broaden participation by people from under-represented communities in science, technology, engineering and mathematics. The NSF should "not preference some groups at the expense of others", said Sethuraman Panchanathan, the organisation's director, who has previously spoken of how "world-class science is shaped by a wide range of perspectives".

The agency did not respond to questions from the FT about the magnitude of its cuts, projects it has cancelled or changes to its anniversary plans. Panchanathan has said his priorities have not shifted — and that the organisation continues to make "significant progress".

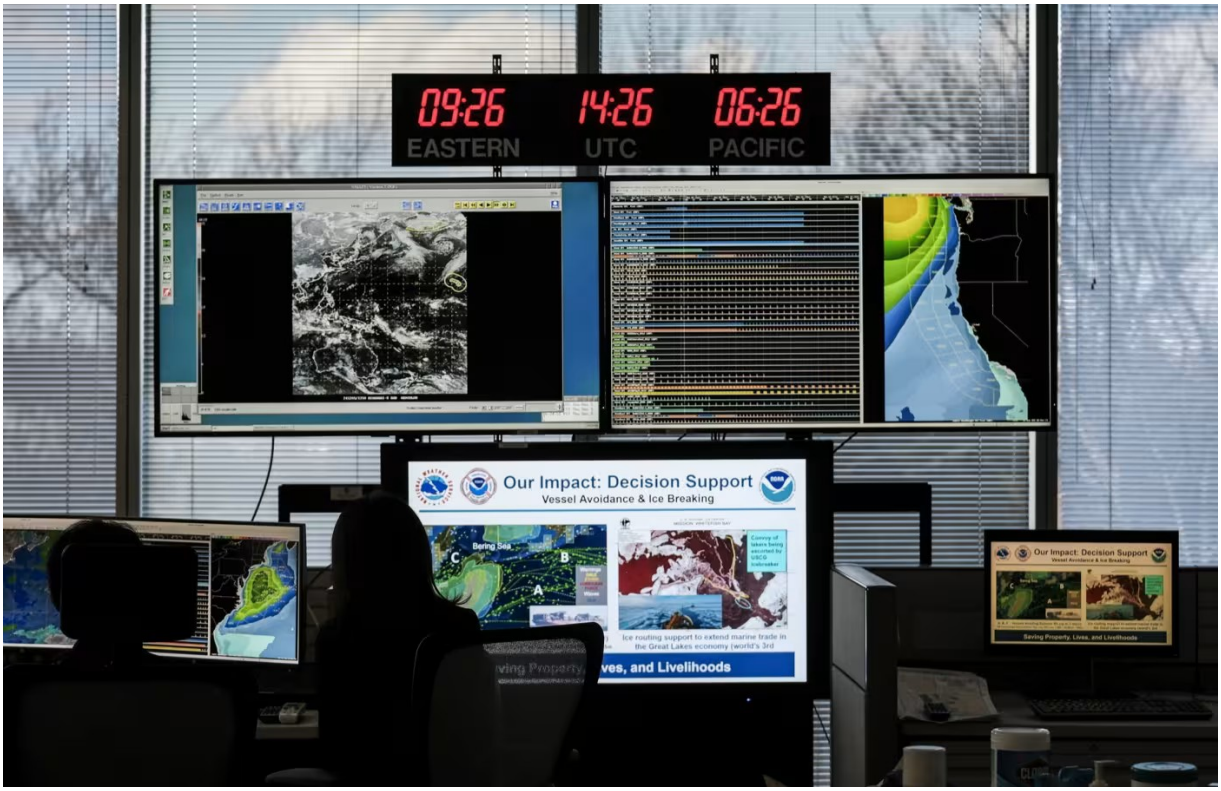
Even though Trump is just three months into his second term, the consequences of the scientific clampdown are reaching far beyond American shores.

One potential beneficiary is China. The country is already a scientific superpower in areas such as materials science and quantum communications thanks, in no small part, to state funding. Critics say this makes it geopolitically rash to curtail US research, especially when Trump is challenging China in other areas, notably trade.

Institutions in other countries are already offering themselves as a haven for rattled US-based researchers. And foreign scientists are being deterred from heading to America by stories such as entry being refused to a French researcher who had criticised the Trump administration's science policies.

"Just the idea that people are worried is of course a worry in itself," says Sven Lidin, president-elect of the Royal Swedish Academy of Sciences. "Science is, perhaps more than anything else, dependent on foreseeable and stable conditions."

Few observers think the private sector or philanthropic bodies want, or have the ability, to fill the deep gap left by cuts to state-funded research. Levin, the biotech chief executive, compares NIH grants to the country's highway system. Although they were built by the federal government, industries could not function without them, he says. "Without the highways you wouldn't have got very far in this country."



The US government wants to end almost all climate change-related research at the National Oceanic and Atmospheric Administration © Michael A McCoy/Bloomberg

Core interventions such as treatments for high blood pressure and immune system-harnessing cancer drugs likewise required decades of government research, Levin points out. “History teaches us that basic science is the foundation for all medicines,” he says, adding that the longer term effects could be “very severe”.

The impact will be felt over time by patients and their families, many suggest. Alzheimer’s sufferers are dependent on the work being done in university labs, says Daniel Diermeier, chancellor of Vanderbilt University in Tennessee. “If you reduce the funding, you’re going to have less drug discovery,” he says. “This cannot be made up by private funds. It is not possible. There is not enough money there.”

Yet pharmaceutical industry leaders have largely been silent. At a Stand Up for Science protest last month, former NIH chief Francis Collins pointed to a 2023 study conclusion that NIH funding contributed to more than 99 per cent of drugs approved between 2010 and 2019.

The University of Michigan’s Coleman says universities are a “wellspring” of scientific research for business, but she has not heard many chief executives defend them: “I wish more corporate entities would speak up.”

The pharmaceuticals industry is keeping quiet, worried about a backlash, executives say. They want to maintain a low profile as they try to tackle other threats to the sector, including tariffs and policies to lower drug prices.

Executives say they are talking privately to the administration, making the case that slashing publicly funded science will end up having a calamitous impact on America's global scientific standing.

Leading science bodies now face the same quandary confronting other sectors targeted by the Trump administration, including universities and law firms.

So much of long-term success in academia depends on early wins — grants, fellowships, key opportunities — and these are the very things being cut

Emma Courtney, a PhD candidate

They are grappling with whether to openly fight the government, or lobby discreetly and meet some or all of its demands. Many individual scientists are understandably reluctant to speak out for fear of reprisals by the administration.

It is perhaps telling that the founding architects of the Stand Up for Science movement are relatively junior researchers. One of them, Emma Courtney, a PhD candidate at New York's non-profit Cold Spring Harbor Laboratory, says younger scientists are "watching our career paths shift in real time".

"So much of long-term success in academia depends on early wins — grants, fellowships, key opportunities — and these are the very things being cut," Courtney says. "While many senior scientists have been incredibly supportive, they often face fewer incentives, and sometimes more risk, from speaking out directly."

Some researchers believe that the mood is shifting. The initial anger at the scientific upheaval is transforming into a will to mobilise — and, crucially, a search for leadership. "We haven't had that clarion call yet," says Simmons, the Pennsylvania professor. "But it's coming."

Data visualisation by Ian Bott

This article has been corrected to make clear that Vanderbilt University is in Tennessee, not Kentucky as originally stated

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