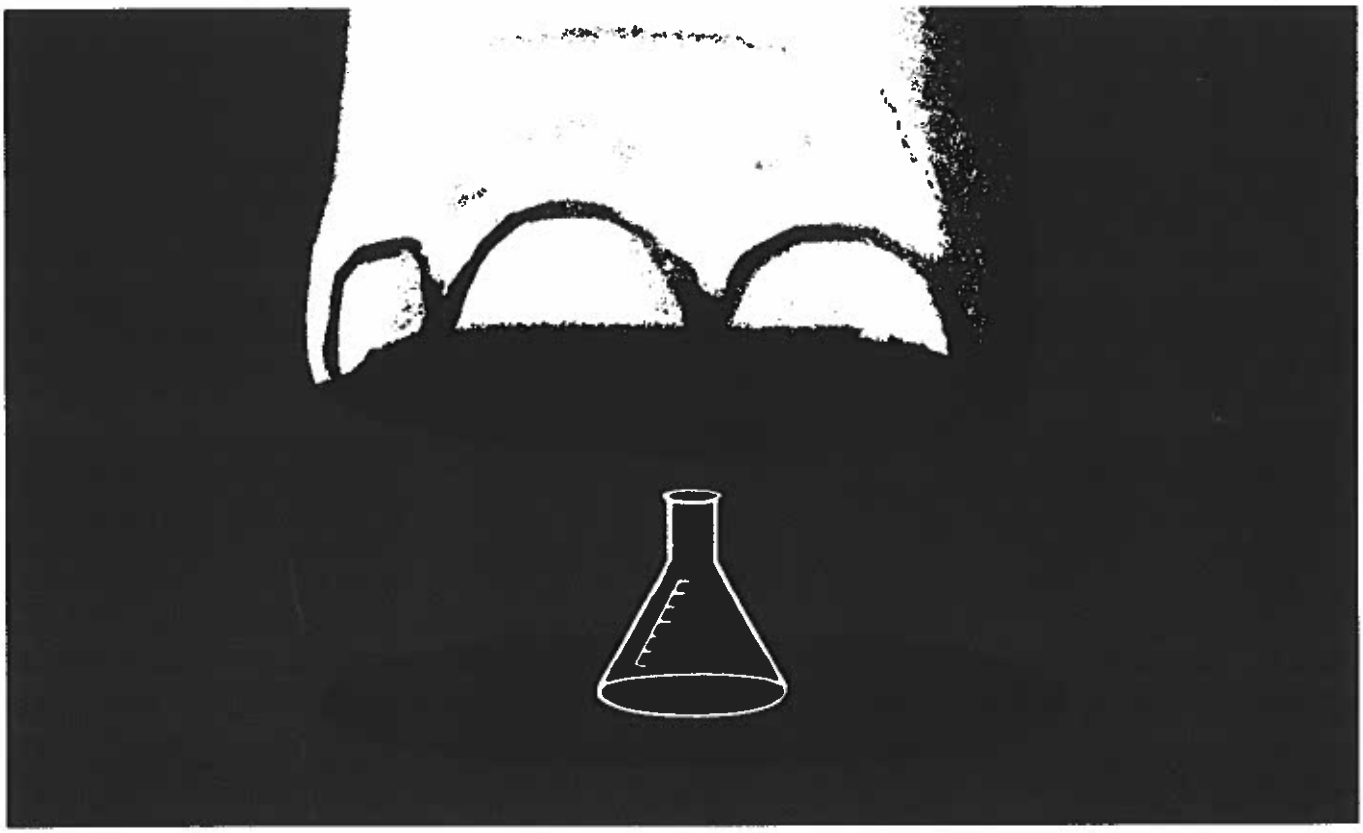
Science & technology



American science (1)

Looming disaster

BOSTON AND LOS ANGELES

The Trump administration is waging an assault on American science. This special section examines the scale of the cuts as well as the risks of a brain drain

SCIENTISTS IN AMERICA are used to being the best. The country is home to the world's foremost universities, hosts the lion's share of scientific Nobel laureates and has long been among the top producers of influential research papers. Generous funding helps keep the system running. Counting both taxpayer and industrial dollars, America spends more on research than any other country. The federal government doles out around $120bn a year, $50bn or so of which goes towards tens of thousands of grants and contracts for higher-education institutions, with the rest going to public research bodies.

Now, however, many of America's top scientific minds are troubled. In the space of a few months the Trump administration has upended well-established ways of funding and conducting research. Actions with the stated goal of cutting costs and stamping out diversity, equity and inclusion (DEI) initiatives are taking a toll on scientific endeavour. And such actions are broadening. On May 15th it emerged that the administration had cancelled grants made to Harvard University for research on everything from Arctic geochemistry to quantum physics, following a similar move against Columbia. The consequences of these cuts for America's scientific prowess could be profound.

Under the current system, which was established soon after the second world war, researchers apply to receive federal funding from grant-making agencies, namely the National Institutes of Health (NIH) and the National Science Foundation (NSF) as well as the Departments of Defence (DoD) and Energy (DoE). Once a proposal has been assessed by a panel of peers and approved by the agency, the agreed money is paid out for a set period.

This setup is facing tremendous upheaval. Since Mr Trump's return to the White House, somewhere in the region of $8bn has been cancelled or withdrawn from scientists or their institutions, equivalent to nearly 16% of the yearly federal grant budget for higher education. A further $12.2bn was rescinded but has since been reinstated by courts. The NIH and the NSF have cancelled more than 3,000 already-approved grants, according to Grant Watch, a tracking website run by academics (see chart 1 on next page); an unknown number have been scrapped by the DoE, the DoD and others. Most cancellations have hit research that Mr Trump and his team do not like, including work that appears associated with DEI and research on climate change, misinformation, covid-19 and vaccines. Other terminations have targeted work conducted at elite universities.

Much more is under threat. The president hopes to slash the NIH budget by 38%, or almost $18bn; cut the NSF budget by $4.7bn, more than 50%; and scrap nearly half of NASA's Science Mission Directorate. All told, the proposed cuts to federal research agencies come to nearly $40bn. Many have already gone under the knife. In March the Department for Health and Hu- ▸▸

→ ALSO IN THIS SECTION

68 How non-scientists could suffer

69 America risks a scientific brain drain

man Services (HHS), which includes the NIH, announced it would scrap 20,000 jobs, or 25% of its workforce. According to news reports, about 1,300 jobs, or more than 10%, have been lost at the National Oceanic and Atmospheric Administration (NOAA), which carries out environmental and climate research. Staff cuts were reportedly also due to start at the NSF, but have been temporarily blocked by courts. To save more money, the NIH, the NSF, the DoE and the DoD have launched restrictive caps on so-called indirect grant costs, which help fund facilities and administration at universities. (These limits have also been partly blocked by courts.)

The administration says it has a plan. Mr Trump entered office on a mission to cut government waste, a problem from which the scientific establishment is not immune. On May 19th Michael Kratsios, his scientific adviser, stood up in front of the National Academies of Sciences and defended the administration's vision. It wants to improve science by making it better and more efficient, he said—to "get more bang for America's research bucks". To do so, funding must better match the nation's priorities, and researchers should be freed from groupthink, empowered to challenge each other more freely without fear of convention and dogma.

Shaking things up

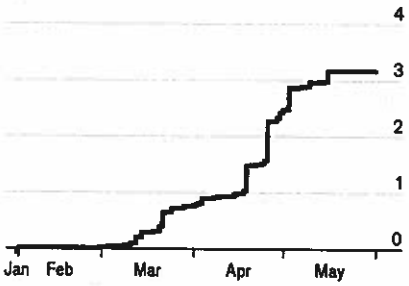
He is right that science has a number of stubborn problems that can hardly be solved by a business-as-usual approach. Scientific papers are less disruptive and innovative than they used to be, and more money has not always translated into speedier progress. In the pharmaceutical sciences, new drug approvals have plateaued in recent years despite ever larger budgets. Researchers also spend much too long writing grant proposals and completing similar administrative tasks, which keeps them away from their laboratories.

Some of Mr Trump's proposals are, in fact, overdue. Many NASA watchers, for example, would agree with his plan to find commercial alternatives for the Space Launch System, a giant rocket being built to take people to the Moon and beyond but which is years behind schedule and billions of dollars over budget.

It would be hard, if not impossible, to improve the science funding system without some disruption. The problem, however, is that the administration's cuts are broader and deeper than they first appear, and its methods more chaotic. Take the focus on DEI, which the administration bemoans as a dangerous left-wing ideology. The agencies are targeting it because of an executive order banning them from supporting such work. But DEI is notoriously ill-defined. Programmes that are being cancelled are not just inclusive education

Untimely ends 1

United States, number of NIH and NSF grants terminated*, 2025, '000



*Includes 76 NIH grants that may have been reinstated
Source: Grant Watch

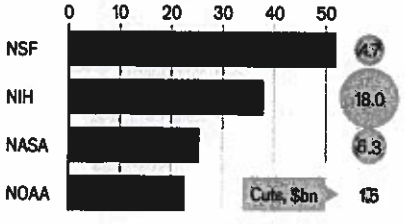
schemes, but also projects that focus on the health of at-risk groups.

Though it is mostly unclear why specific projects have been cancelled, Grant Watch keeps track of words that could have landed researchers in trouble. "Latinx", for example, is a term for Hispanic people flagged as a telltale sign of DEI by Ted Cruz, a Republican senator. The NIH has cancelled a project on anal-cancer risk factors, the abstract of which uses the word Latinx. Another cancelled project concerns oral and throat cancer, for which gay men are at higher risk. Its abstract uses the phrase "sexual minority". There are many such examples.

Other cuts may do more damage. Some NIH-funded research on vaccines has been cancelled, as have $11bn-worth of special funds from the Centres for Disease Control and Prevention (CDC) for pandemic-related research. In March Ralph Baric, an epidemiologist at the University of North Carolina at Chapel Hill who helped test the Moderna mRNA vaccine for covid-19, had several vaccine grants terminated. One project aimed to develop broad-spectrum vaccines for the same family of viruses that SARS-CoV-2 comes from; scientists fear other strains might cross from animals to humans. Both the CDC and NIH justified such cuts by saying that the covid-19 pandemic is over. But this is short-sighted, argues Dr Baric, given the number of worrying viruses. "We're in for multiple pandemics" in the future, he says. "I guess we'll have to buy the drugs from the Chinese."

Slash and burn 2

United States, proposed cuts to 2026 budget, as % of 2024 budget



Sources: The White House; government reports

Even for scientists who have not been affected by cuts, other changes have made conducting research more challenging. For example, the NIH and NSF have both delayed funding new grants. Jeremy Berg, a biophysicist at the University of Pittsburgh who is tracking the delay in grant approvals, wrote in his May report that the NIH has released about $2.9bn less funding since the start of the year, relative to 2023 and 2024. According to media reports, the NSF has stopped approving grants entirely until further notice.

At the NIH itself, the largest biomedical research centre in the country, lab supplies have become more difficult to procure. Department credit cards have been cut back and the administrative staff who would normally place orders and pay invoices have been fired. Scientists report shortages of reagents, lab animals and basic equipment like gloves. All these factors are destabilising for researchers—labs need a steady, predictable flow of cash and other resources to continue functioning.

If next year's cuts to federal agencies are approved, more pain could be coming (see chart 2). The NSF's budget cuts, for instance, will hit climate and clean energy research. And, according to leaked documents, the research arm of NOAA would most probably cease to exist entirely. That would almost certainly mean defunding the Geophysical Fluid Dynamics Laboratory at Princeton University, "one of the best labs in the world for modelling the atmosphere", says Adam Sobel, a professor at Columbia University's Lamont-Doherty Earth Observatory. NASA's Earth-observation satellites would likewise take a beating, potentially damaging the agency's ability to keep track of wildfires, sea-level rises, surface-temperature trends and the health of Earth's poles. Those effects would be felt by ordinary people both in America and abroad (see next story).

And as Mr Trump increasingly wields grant terminations as bludgeons against institutions he dislikes, even projects that his own administration might otherwise have found worthy of support are being cancelled. Take his feud with Columbia. His administration has accused the institution of inaction against antisemitism on campus after Hamas's attack on October 7th 2023 and Israel's subsequent war in Gaza. On March 10th the NIH announced on X that it had terminated more than 400 grants to Columbia on orders from the administration, as a bargaining chip to get the university to take action. Some $400m of funding has been withheld, despite Columbia having laid out what it is doing to deal with the administration's concerns. Those grants include fundamental research on Alzheimer's disease, schizophre-

nia and HIV—topics that a spokesperson confirmed to *The Economist* represent priority areas for the NIH.

Columbia is not alone. The administration is withholding $2.7bn from Harvard University, which has responded with a lawsuit. Within hours of Harvard refusing the administration's demands, scientists at some of the university's world-leading labs received stop-work orders. The administration has since said that Harvard will be awarded no more federal grants. Letters from the NIH, the NSF, the DoD and the DoE sent to Harvard around May 12th seem to cancel existing grants as well.

While it is too soon to say exactly how many grants are involved, 188 newly terminated NSF grants from Harvard appeared in the Grant Watch database on May 15th, touching all scientific disciplines. A leaked internal communication from Harvard Medical School, the highest-ranked in the country, says that nearly all its federal grants have been cancelled. Cornell University says it too has received 75 stop-work orders for DoD-sponsored research on new materials, superconductors, robotics and satellites. The administration has also frozen over $1.7bn destined for Brown, Northwestern and Princeton universities and the University of Pennsylvania.

As these efforts intensify, scientists are hoping that Congress and the courts will step in to limit the damage. Swingeing as the budget plan is, the administration's proposals are routinely modified by Congress. During Mr Trump's first term, similar proposals to squeeze scientific agencies were dismissed by Congress and he might meet opposition again.

Susan Collins, the Republican chairwoman of the Senate appropriations committee, which is responsible for modifying the president's budget, has expressed concern that Mr Trump's cuts will hurt America's competitiveness in biotech and yield ground to China. Katie Britt, a Trump loyalist and senator for Alabama, has spoken to Robert F. Kennedy junior, the health secretary, about the the need for research to continue. (The University of Alabama at Birmingham is among the top recipients of NIH money.) When on May 14th Mr Kennedy appeared before lawmakers to defend the restructuring of the HHS, Bill Cassidy, the Republican chairman of the Senate health committee, asked him to reassure Americans that the reforms "will make their lives easier, not harder".

Courts will have their say as well. On May 5th 13 universities sued the administration over the NSF's new indirect-cost cap, and the American Association of University Professors has likewise sued Mr Trump over his treatment of Harvard and Columbia. Harvard's suit is ongoing. Dr Baric is one researcher who has had his grant terminations reversed in this manner. His state of North Carolina, alongside 22 other states and the District of Columbia, sued the HHS over the revoked CDC funding for vaccine research. On May 16th the court ruled that the federal government had overstepped and not followed due process, and ordered the HHS to reinstate the funding.

Reversing more cuts will take time, however. And the uncertainty and chaos in the short term could have lasting effects. A country where approved grants can be terminated before work is finished and appealing against decisions is difficult becomes a less attractive place to do science. Some researchers may consider moving abroad (see final story). American science has long seen itself as the world's best; today it faces its gravest moment ever. ■

American science (2)

Chilling effects

ATLANTA AND LOS ANGELES

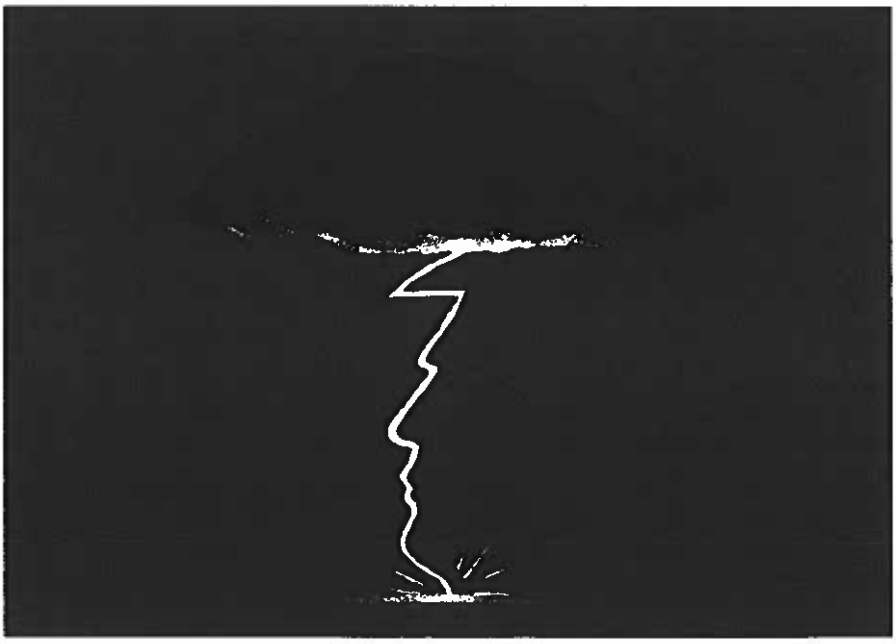
Cuts to science funding will hurt ordinary Americans

FROM LAW firms to universities, Donald Trump's administration has taken aim at elites. But the consequences of cuts to research spending and reductions in the federal workforce carried out since Mr Trump returned to the White House will trickle down quickly.

Federally funded science agencies provide all sorts of services, many of which save lives and generate economic value. The National Oceanic and Atmospheric Administration (NOAA), for example, provides weather forecasts that farmers rely on to determine when to plant, irrigate and harvest and that authorities use to prepare for disasters. The Centres for Disease Control and Prevention (CDC), in its role as America's public-health agency, collects data essential to the effective treatment of diseases and funds clinics that treat them. Research on pollution at the Environmental Protection Agency (EPA), meanwhile, is critical for refining regulations that protect Americans from contaminants. The cuts to these agencies and others are likely to hurt ordinary Americans.

DOGE, Mr Trump's cost-cutting special force, has already implemented personnel cuts at NOAA. A leaked memo suggests that Congress will soon slash its research budget and eliminate more positions (see other stories). This will further disrupt operations. In normal circumstances the agency's National Weather Service (NWS) offices launch weather balloons twice a day. These balloons carry instruments that record atmospheric pressure, temperature and humidity data, all of which inform predictions of where storms develop, how they move and how strong they may be.

One current NWS employee, who requested anonymity for fear of retaliation, says that his office has lost four of 13 forecasters since the Trump administration took office. He and his remaining colleagues are now sending balloons up only in the evening, in effect halving the resolution of their data. Other offices have delayed or suspended launches. The Mountain West region, which includes Idaho and Montana, is hardest hit. "That's where the storm systems that produce severe weather really get going in the spring months," says Chris Vagasky, a meteorologist at the University of Wisconsin-Madi-



son. The NWS office in Jackson, Kentucky is no longer able to staff overnight shifts. When tornadoes ripped through the state last week, killing at least 19 people, the agency was hard-pressed to find cover. Workers stayed overtime and neighbouring offices sent support staff.

Cuts to data collection are being exacerbated by cuts to the groups responsible for warning people about dangerous conditions. Kayla Besong worked at the Pacific Tsunami Warning Centre in Hawaii. Her team wore pagers, like doctors in hospital, which alerted them to earthquake activity. Using data about the location, size and magnitude of a given earthquake, she says, they would have to calculate the likelihood of a tsunami being generated and decide whether the public needed to be warned. Two people were on watch at all times, which made for lengthy work rotas for a small team. Dr Besong was fired in February when probationary employees across the federal bureaucracy were sacked by DOGE. She warns about the toll that long shifts can take on her already thinly stretched colleagues. Burnout was "a huge concern" even before the cuts, she says. Overworked employees may make mistakes which, when it comes to severe weather, could prove deadly.

At the CDC, fewer employees make it harder to prevent the outbreak of disease. The Medical Monitoring Project, for example, was created in 2005 to collect and analyse data on people with HIV. Until recently state and local health departments across the country used its data—on everything from comorbidities and behaviour that causes transmission to barriers to receiving medical care—to direct their services. On April 1st all but one of the 17-person team that ran it was fired, abruptly ending the 20-year-long project. "The only source of nationally representative information on people with HIV is now gone," says a CDC physician. As much as 45% of the broader HIV-prevention team was also fired. All HIV research at the agency has since been paused and many grants for basic medical care were terminated.

HIV work is in the cross-hairs in part because of its focus on racial and sexual minorities, who contract the virus at especially high rates. Such focus is seen by the Trump administration as evidence of "woke" ideology getting in the way of hard science. Empowerment Resource Centre, an HIV clinic in downtown Atlanta, Georgia, is one of many feeling the blow. Its $400,000 CDC grant for serving gay and transgender patients is in limbo—the funds for May have still not come through. This week the entire HIV department in Fulton County (in which Atlanta sits), its only other funder, was sacked. Jacqueline Brown, the non-profit's boss, says she is having to make painful decisions about which kinds of services to cut and how to reduce the number of clients the clinic serves. "We will try to continue as long as we can, but inevitably we'll have to suspend programmes; there is just no money left," she says. Leandro Mena, a professor of medicine at Emory University, in Georgia, reckons that such cuts mean HIV rates will rise in the next two or three years.

Across the board

Other agencies are also under pressure. In early May Lee Zeldin, the Trump-appointed administrator of the EPA, announced a restructuring that will see staffing at the agency return to Reagan-era levels—equivalent to a 25% reduction—and its dedicated research unit dissolved. The unit, known as the Office of Research and Development, collates independent evidence on pollution, which in turn informs the EPA's guidelines and regulations. Since the agency's creation in 1970, these regulations have led to an almost 80% decrease in common air pollutants, saving hundreds of thousands of Americans from early death each year. In Mr Trump's proposed budget, the EPA also stands to lose almost 55% of its funding, achieved by scrapping "skewed, overly-precautionary modelling" that informs regulations as well as "woke climate research".

The government may eventually come to understand that warning people of deadly storms and easing access to medical care helps many beyond the elites. But for now, at least, there are few signs of any such policy reversals. ■

American science (3)

Your loss is our loss

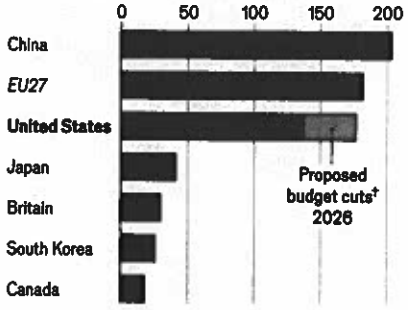
America is in danger of experiencing an academic brain drain

MATTHIAS DOEPKE was impressed when he moved to America as a graduate student in the 1990s. Academic pay was better than in his native Germany and university departments were slick and organised. But what he appreciated most was the attitude. "You come to the US and you have this feeling that you are totally welcome and you're totally part of the local community," he says. In 2012 he became a professor of economics at Northwestern University in Illinois, and in 2014 became a naturalised citizen.

But in April Dr Doepke resigned from Northwestern; he is now a professor at the London School of Economics. He is clear about why he and his family left: the election of Donald Trump as president. "Once the election happened," he says, "it was clear we weren't going to stay." Mr Trump's government is taking a chainsaw to American science, pulling grants, revoking researcher visas, and planning enormous cuts to the country's biggest funders of research (see chart 1). Academics talk of a "war on science". Few have followed Dr Doepke's example and moved overseas just yet. But plenty of data suggest they soon might. An exodus from the world's scientific superpower beckons.

Scientific powerhouses 1

Research spending at government institutions and universities, 2023 or latest, $bn at PPP*



*Purchasing-power parity †Selected cuts from CDC, DOE, EPA, NASA, NIH, NIST, NOAA, NSF and USGS
Sources: OECD; The White House; *The Economist*

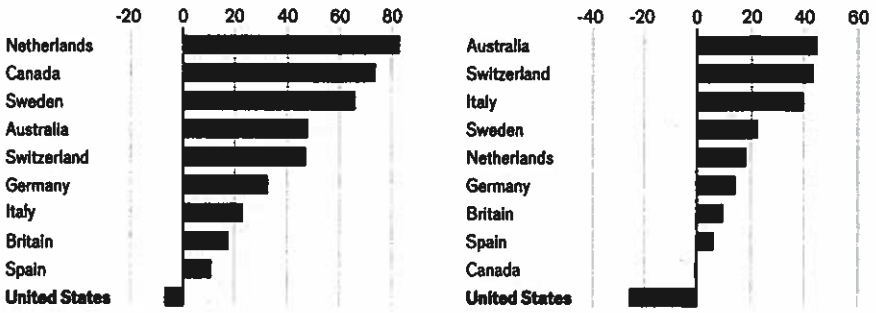
Springer Nature publishes *Nature*, the world's most prestigious scientific journal. It also runs a much-used jobs board for academics. In the first three months of the year applications by researchers based in America for jobs in other countries were up by 32% compared with the same period in 2024. In March *Nature* itself conducted a poll of more than 1,200 researchers at American institutions, of whom 75% said they were thinking of leaving (though disgruntled academics were probably more likely to respond to the poll than satisfied ones). And just as American researchers eye the exit, foreigners are becoming more reluctant to move in. Springer Nature's data suggests applications by non-American candidates for American research jobs have fallen by around 25% compared with the same period last year.

Attitudes are souring at the bottom of the academic totem pole as well. Searches for American PhDs on FindAPhD, a website that does exactly what its name sug-

gests, were down by 40% year on year in April. Interest from students in Europe has fallen by half. Data from another website, Studyportals, show less interest in domestic PhDs among Americans, and a rise in interest in international studentships compared with 2024 (see chart 2).

Keep the doctors away 2

Webpage views per PhD programme, by programme country, April 2025, % change on a year earlier



Sources: Studyportals; *The Economist*

Greener pastures

Why is America losing its allure? The most straightforward reason is money, or the looming lack of it. Mr Trump's administration has cancelled thousands of research grants since January, when he took office. Grant Watch, a website, calculates that at least $2.5bn-worth have been rescinded so far, leaving researchers without salaries and unable to pay expenses. Much more could be coming. The White House's budget for 2026 aims to slash science spending. The National Institutes of Health (NIH), the world's biggest funder of biomedical research, faces a nearly 40% cut. The National Science Foundation (NSF), another big federal funder, may lose 52%.

Such cuts must be approved by Congress. But if the budget is enacted, *The Economist* calculates that more than 80,000 researchers could lose their jobs. American funding for academic science would fall significantly behind that of either China or the European Union, after adjusting for costs.

Funding is not the only issue. Many scientists, especially those who are citizens of other countries, are beginning to feel intimidated. In the first four months of 2025 at least 1,800 international students or recent grads had their visas revoked without explanation, only to have them restored again in April. Senior scientists report difficulty obtaining visas for incoming researchers, and have advised junior colleagues from overseas not to travel home, lest they be detained on their return.

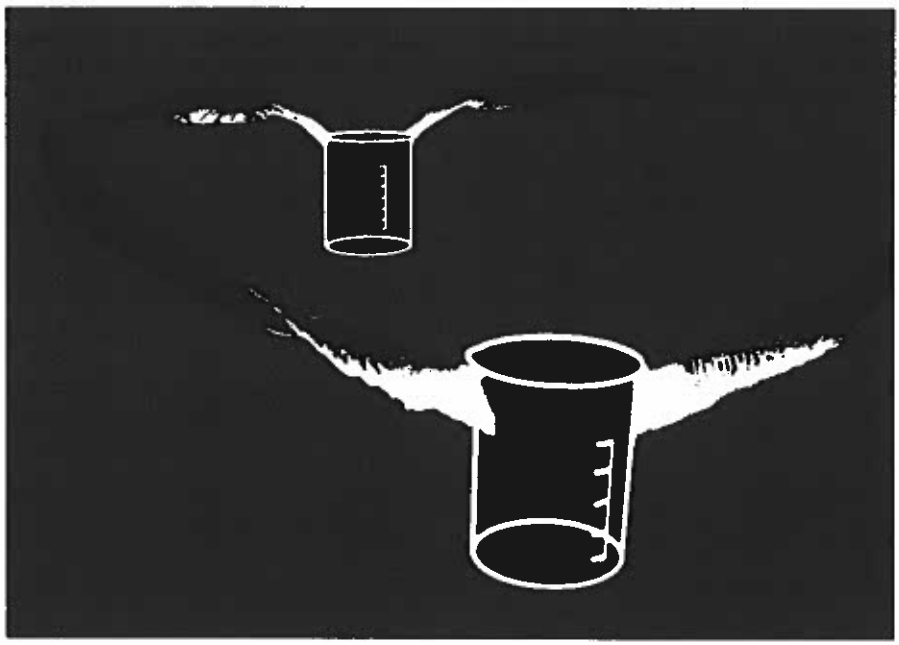
Others allege that the government is meddling with their research. Kevin Hall, a researcher at the NIH, quit in April after two such incidents. First, he says the NIH asked him to edit a section of a paper that mentioned "health equity". ("Equity" is an unpopular word among Mr Trump's supporters.) Later Dr Hall published a study showing that ultra-processed foods did not activate the same addiction pathways in the brain as drugs do—contradicting the views of administration officials. Dr Hall alleges the NIH edited his responses to a journalist, without his approval, to downplay his findings. (The NIH told *The Economist* that it does not respond to false allegations by former employees.)

Some other countries spy in all this an opportunity to beef up their own scientific capabilities. Several Canadian universities, including the Toronto's University Health Network and Laval University in Quebec, have announced funding worth tens of millions of dollars explicitly aimed at diverting researchers from America. On May 5th Ursula von der Leyen, the president of the European Commission, gave a speech in Paris urging scientists to "choose Europe", highlighting a wodge of new money and the bloc's social safety-net. The University of Helsinki has been targeting Americans with adverts on social media, promising them "freedom to think".

China is likely to be another beneficiary. According to the *South China Morning Post*, the country is redoubling its efforts to lure Chinese-born scientists from America by offering big salaries. Between 2019 and 2022 the share of non-native artificial-intelligence (AI) researchers who left America for China after their PhD doubled, from 4% to 8%. Springer Nature's data suggest that in the first quarter of this year applications for jobs in China from scientists based in America were up by 20% compared with the same period last year.

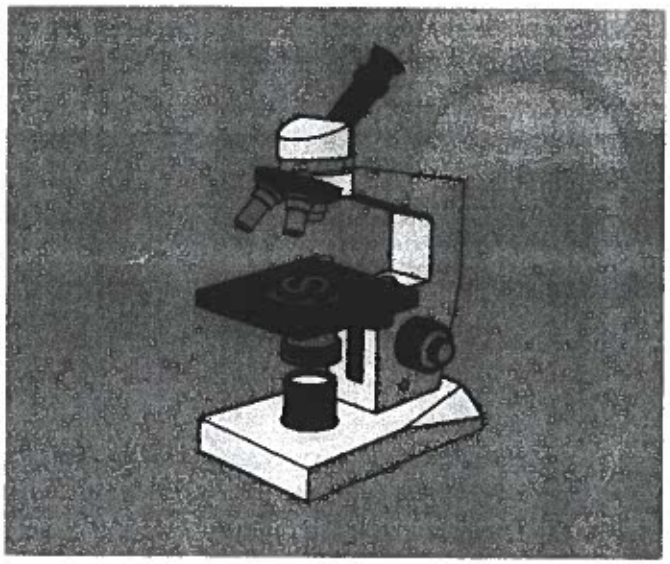
That matters, for much of America's scientific pre-eminence has been built by researchers who were not born there. Since 1901, researchers based in America have won 55% of academic Nobel prizes, and more than a third of these scientists were foreign-born. Immigrant inventors produce an outsize share of patents, too. The Paulson Institute, a think-tank, reckons that in 2022 almost two-thirds of top-tier AI researchers working in America hailed from overseas. Losing even some of those would be a blow to American innovation.

Other countries might gain, but the disruption would harm science as a whole. At around $40bn, Mr Trump's planned funding cuts are too big for other countries to make up by themselves. (The extra funding promised by Mrs von der Leyen, for instance, is worth only €500m, or $566m, over three years.) Many researchers will probably leave science altogether. Everyone would lose—even if America lost most. ■



FREE EXCHANGE
The science subsidy

America's boffins raise living standards for everyone else



ONE OF THE best things about living in Europe is America. Faced with a moribund domestic stockmarket, European investors can redirect their savings into the S&P 500. Residents enjoy the protection of America's security umbrella without having to foot the bill. At times of crisis the continent's central banks rely on swap lines from the Federal Reserve. All the while they enjoy better food, nicer cities and superior cultural offerings.

But America, under President Donald Trump, now threatens to withdraw many of these implicit subsidies. His administration's attacks on science, involving deep cuts to the budgets of institutions, may damage the biggest subsidy of all (see Science & technology section). America is a research powerhouse. It has the best universities. It accounts for 4% of the world's population, yet produces a third of high-impact scientific papers. It also accounts for a third of global research-and-development spending.

Americans benefit most of all from their country's scientific prowess. The average American medical scientist earns $100,000 a year, for instance—some 60% more than the average American worker. But as any economist knows, knowledge is a public good, meaning science has large "spillover" benefits. In 2004 William Nordhaus of Yale University argued that companies only capture 2.2% of the total returns from their innovations. Patents expire and even before that competitors copy ideas. Innovation therefore drags up everyone's living standards, as lots of companies become more productive and ordinary people benefit from better goods and services. America's average incomes are fantastically high.

Economists have devoted less attention to the question of international spillovers. Nevertheless, America almost certainly runs a surplus in science with the rest of the world, providing much more to foreigners than it receives in return. In recent years, too, the size of this subsidy has almost certainly grown. Three mechanisms stick out—all of which are now under threat.

First, people. American scientific institutions are a melting pot. There are twice as many foreign students today as in the early 2000s. Many outsiders, having graduated, return home, taking ideas with them. We estimate that around 15% of the people who have graduated from MIT, a top American science school, live abroad. On that basis, the raw material of future scientific progress has already spilled out from America to elsewhere.

Second, new ideas. When a scientist publishes a paper online, almost anyone in the world can read it. Traditionally research was a domestic affair. One bibliometric study found that in 1996 only about 40% of citations of American scientific publications were from foreign researchers. More recently the globalisation of scientific knowledge has intensified. By 2019 foreign scientists accounted for about 60% of America's citations. Scientists in the rest of the world thus stand on the shoulders of American giants.

American consumers also subsidise R&D. This is most well-known in the case of pharmaceuticals. Prescription drugs are more expensive domestically than abroad. American consumers, in effect, pay for the research that creates them. And this pattern is apparent elsewhere, too. National-accounts data suggest that, on average, American corporations earn returns on domestic capital that are more than 50% higher than abroad. So while Americans may fund corporate R&D, the world shares the benefit.

The third factor is new technologies. Every other country has long drawn from the well of American innovations. This was how Europe rebuilt itself following the second world war. French steel executives visited American steelworks in order to copy workflow designs. Britain's car bosses turned to American executives in an attempt to improve plant efficiency. Economists struggle to measure the ways in which American tech spills abroad today. In some cases the American government explicitly provides it to the world for free, as in the case of GPS. During the covid-19 pandemic America gave away vaccines to poor countries. Many American artificial-intelligence companies release "open source" models. Even when American firms try to protect their intellectual property, foreign competitors find workarounds. Many other smartphone companies have copied Apple's aesthetic, for instance.

According to Nancy Stokey of the University of Chicago, one quantitative measure of technological spillovers involves looking at capital goods, in which new tech is often embodied. From the early 1990s to 2024 America exported nearly $5trn-worth of high-tech capital goods, more than any other country, spreading the American way to every corner of the Earth. Another proxy is outward foreign direct investment. This is when an American buys a controlling stake in a foreign business or builds a new industrial facility abroad—and often introduces new tech as part of the bargain. Americans' direct investments abroad are worth some $10trn, which is far more than any other country.

Nutty professor

If Mr Trump follows through with his proposed cuts, and America's scientific system stumbles, can another country pick up the mantle? Many American scientists say they want to leave the country; a few already have. China, which on some measures of scientific prowess already surpasses America, may hope to capitalise. Yet few foreigners want to do their PhD in China. A closed political system slows down the diffusion of innovations across international borders. So does the language barrier.

Even if China changed, however, decades of research on economic clusters shows that they are rarely replicated. Just as you could not uproot Hollywood and move it elsewhere, scientists leaving Berkeley and Boston will not carry on as before when they arrive in Beijing or, indeed, London. If America's scientific system sneezes, the rest of the world will catch a cold. ■