



U.S. RESEARCH SPENDING

Sequester Takes Uneven Bite From Agency Budgets

For nearly a year now, U.S. research leaders have been issuing dire warnings about layoffs and shuttered labs in the wake of the 5% budget cut, known as the sequester, that hit most federal research agencies in 2013. But as the U.S. fiscal year enters its final week, hard data on how the sequester is affecting the country's scientific enterprise remain scarce.

Several university deans and government laboratory directors report that its bite so far has been less severe than the bark, and the sequester's impact also varies by agency. Last week, Francis Collins, the director of the National Institutes of Health (NIH), announced that NIH would make 650 fewer new competitive awards in 2013, a 7% drop. In contrast, a spokeswoman for the National Science Foundation (NSF) says that, "based on an initial review, we're not seeing any noteworthy changes in the year-to-date numbers."

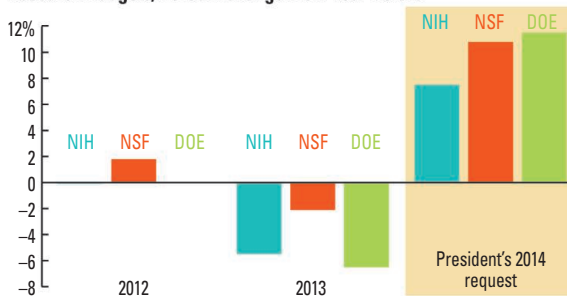
The sequester is a mandatory cut triggered by a 10-year budget agreement struck in 2011 that went bad. And agency officials are already deeply worried about the consequences of a continued squeeze on research budgets. "While NSF was able to largely mitigate the impact of sequestration [this year] ... we remain deeply concerned ... should constrained funding levels continue into [2014] and beyond," NSF acting Director Cora Marrett told *Science*. In July, Collins warned biomedical researchers at a rally hosted by

Johns Hopkins University that sequestration is "putting an entire generation of U.S. scientists and our nation at risk."

Here's a look at how three key agencies have handled this year's sequester, which went into effect in March, and its effect to date on the researchers they fund.

NIH: To trim its spending by 5.5%, to \$29.15 billion, NIH took aim at new grants.

Research Budgets, Percent Change From Year Before



The tally. This year, NSF has weathered the sequester better than DOE and NIH. But the cuts have left all agencies far below their 2014 budget requests. One consequence is fewer NIH grants (*right*).

Collins expects that only about 15% of proposals reviewed this year will receive funding, down from 18% in 2012. It is a historic low for the agency, which has seen rates tumble from a peak of 37% in 2001.

Ongoing grants are also being trimmed, by an average of 4.7%. And some NIH insti-

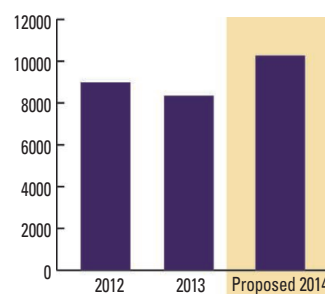
Worried. Scientists rally against the sequester in Washington, D.C., earlier this year.

tutes made deeper cuts in centers, contracts, and other large programs to help shore up investigator-initiated grants. Some clinical trials for AIDS and influenza vaccines were slashed 20%, says Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, which may mean enrolling fewer patients. The base award for the iconic Framingham Heart Study, for example, was reduced by 40%, or \$10 million. Even with the money from that and other cuts, however, the National Heart, Lung, and Blood Institute decided for the first time to offer short-term bridge funding to applicants who need buoying while they await word from NIH on a revised proposal.

Some universities and academic medical centers are reporting a drop in first-year graduate enrollment—13% in the biomedical sciences at Duke, says Chancellor of Health Affairs Victor Dzau, and 11% across all graduate programs at Vanderbilt University, says Graduate School Dean Dennis Hall. Collins stands by his prediction from last spring that 20,000 people on NIH-funded projects would lose their jobs due to the sequester, although NIH has no such unemployment data. "If nothing changes, ultimately that's going to have to be what happens," he says.

On the other hand, the University of Washington in Seattle hasn't trimmed the size of its entering graduate class, says Mary Lidstrom, vice provost for research, and faculty requests for bridge funding actually

New NIH Grants



dropped this summer. Likewise, the dire predictions of 350 staffers being pink-slipped and 50 labs shuttered at the University of Pittsburgh haven't materialized because federal funding exceeded projections and the university used bridge funding to keep many labs afloat, explains Jeremy Berg, associate

senior vice chancellor for science strategy and planning in the health sciences.

NSF: The science foundation enjoys several advantages over NIH that allowed it to cushion the impact of this year's sequester on the research community.

The biggest was that Congress increased NSF's 2013 budget by roughly 3% before the sequester kicked in. "We had a better starting point," says one NSF official. That bump-up meant a net budget reduction of only 2.1% from 2012, to \$6.88 billion (see graphic, p. 1437).

The second advantage stems from the fact that roughly two-thirds of NSF grantees get their entire 3-year award up front in what's called a standard grant. In contrast, only the first year of NIH's typical 4-year award goes out the door to principal investigators, who get the rest of what's called a continuing grant in yearly increments that may fluctuate.

Why does that matter? When faced with a sudden budget crunch, NSF can hold success rates steady by making slightly fewer standard grants and handing out more continuing

"[Sequestration is] putting an entire generation of U.S. scientists and our nation at risk."

—FRANCIS COLLINS,
NIH

grants. It's a short-term solution, to be sure, but it helped NSF keep the overall number of new awards this year close to 2012 levels. (NSF officials say they're still tallying up the final numbers.)

NSF sheltered favorite areas like its graduate research fellowships, advanced manufacturing, and cybersecurity research, as well as an interdisciplinary research initiative launched by its former director, Subra Suresh, who left in March to become president of Carnegie Mellon University. Large construction projects also escaped the ax this year, as NSF followed a White House budget directive that, as one NSF official put it, says, "Don't do something now to save money if it's going to make things worse next year."

In contrast, some disciplines have suffered disproportionate cuts. The budgets of NSF's physics and mathematics divisions shrank by 9.6% and 7.8%, respectively, its environmental biology program has dropped by 6.3%, and both atmospheric and earth sciences were trimmed by 5.3%.

DOE: The Department of Energy's (DOE's) Office of Science, the single biggest funder

of the physical sciences in the United States, managed to weather its 5% sequester, to \$4.63 billion, by eating its seed corn.

Many of the office's 10 national labs, which run large scientific user facilities such as x-ray sources and particle accelerators, had already cut staff in anticipation of a lean year and were able to avoid layoffs and furloughs this year. DOE officials also funded current operations with money from construction projects that were ending. That money normally would have gone for the next construction project.

That change in tactics will make it harder to find sufficient money to launch the next project, however. "Anything that gets started is going to be a dead lift from zero [construction funding], and that's a tough challenge even in the best of times," says Thom Mason, director of the Oak Ridge National Laboratory in Tennessee. Without the cushion of construction money to soften the blow, he adds, future cuts will require DOE to shut down facilities. "The next time it will be a disaster," warns Chi-Chang Kao, director of SLAC National Accelerator Laboratory in Menlo Park, California.

—ADRIAN CHO, JOCELYN KAISER,
AND JEFFREY MERVIS

CLIMATE POLICY

U.S. Carbon Plan Relies on Uncertain Capture Technology

Talk about unfortunate timing. On one side of the Atlantic Ocean last week, U.S. Environmental Protection Agency (EPA) chief Gina McCarthy was unveiling a landmark proposal to require new coal-fired power plants built in the United States to capture and store at least some of the carbon dioxide they emit. Meanwhile, in Norway, government officials announced that they were scrapping a long-anticipated \$1 billion effort to test carbon capture and storage (CCS) technology on a massive scale at an oil refinery.

The so-called Mongstad project was just the kind of CCS demonstration project that specialists say will be critical to making the technology practical, allowing coal-fired power to satisfy

the proposed U.S. regulations. Its cancellation, after the project went 50% over budget, was part of a discouraging pattern. Over the past decade, "a lot of programs were put in place" to develop CCS, says chemical engineer Howard Herzog of the Massachusetts

Institute of Technology in Cambridge. But "the bad news is they hit a wall." Herzog has documented more than 25 other major CCS projects around the world that have been canceled or put on hold in recent years.

Such setbacks pose a major challenge to President Barack Obama's plans to use CCS to help reduce carbon pollution and curb global warming. If last week's proposal is ultimately adopted, for instance, it would require U.S. utilities building new coal-powered plants to cap carbon emissions at 500 kilograms per megawatt hour—roughly half what an average coal plant emits. CCS could enable a plant to comply, and EPA officials say there are a variety



Fired up. Proposal would require coal-burning power plants to capture some carbon emissions.