



The Impact Trump's Proposed 2021 NSF Budget Would Have on Mathematics

Karen Saxe

Introduction

Each year our elected lawmakers determine how much money will be allocated to the National Science Foundation (NSF), money the agency then uses to fund researchers and students. Sixty-seven percent of all federal funding for basic mathematics research done at colleges and universities comes from the NSF.

The first step in the annual process of allocating funds is for the president to unveil the administration's priorities for spending. Fiscal year 2021 (FY21) priorities for NSF spending focus on "industries of the future," including artificial intelligence, quantum information science, wireless research, advanced manufacturing, and biotechnology.

There are a few proposed cuts that are quite severe and are to NSF programs well-used by the mathematics community, including a 30% cut to the Faculty Early Career Development Program (CAREER) and an almost 20% cut to the Research Experiences for Undergraduates (REU) program.¹

Karen Saxe is associate executive director of the AMS and director of the Office of Government Relations. Her email address is kxs@ams.org.

¹All decreases and increases in this article are from FY19 levels, unless otherwise stated.

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The president's proposal would hurt students and faculty at Minority Serving Institutions. Hispanic Serving Institutions would see a dramatic 68% cut; the Historically Black Colleges and Universities (HBCU) Undergraduate Program and the HBCU Excellence in Research programs are slated to be cut by 11% and 47%, respectively; and Tribal Colleges and Universities would experience a 17% decline in investment.²

Outside of the NSF, there are other proposed cuts that would affect our community. President Trump proposes to eliminate the Public Service Loan Forgiveness program. This program aims to help those who have careers in public service. In short, it erases remaining student loans for those who enter careers in public service and who make regular payments for ten years. Math professors who work at a public state college or city college are often eligible for student loan forgiveness through this program.

If you'd like to learn more about the process, a brief description of the very complex annual appropriations process appears on the AMS Office of Government Relations website.³

²The numbers in this paragraph compare with FY20 levels.

³<https://www.ams.org/government/dc-budgetprimer>

Some Proposed Budget Details for Mathematics

President Trump's FY21 proposal for NSF funding favors the "industries of the future," and proposes significant cuts to investments in all other areas of research, STEM education, and broadening participation activities. The "Big Ideas" continue to garner support.⁴ Cybersecurity continues to be an area of interest, and numerous activities will be funded in 2021 through the Safe and Trustworthy Cyberspace (SaTC) program.⁵ Outside of the NSF, a winner in science is space exploration; specifically, the National Aeronautics and Space Administration (NASA) would receive a boost for its Moon to Mars program.⁶ Funding to NASA and NSF come from the same budget pool, so a gain for NASA must be balanced with cuts to other agencies such as the NSF.⁷

For FY21, President Trump proposes a total of \$7.7 billion for the NSF, which is a 6.5% decrease from FY20. It is estimated that the NSF will receive over 34,000 research grant proposals and that about 25% will—if the president's budget is in fact adopted—be funded (this percentage varies, quite a bit, by directorate). Of the \$7.7 billion, approximately \$1.4 billion will go to the Directorate for Mathematical and Physical Sciences and, of that, \$215 million will go to the Division of Mathematical Sciences (DMS). This represents a 9.4% DMS decrease from FY19 (final numbers for FY20 were not all known at the time of this writing). Roughly 54% of the DMS portfolio is available to support new research grants each year; the remaining 46% supports research grants made in prior years. Training the next generation of mathematical scientists and supporting the Mathematical Sciences Research Institutes remain a priority. Partnerships with other disciplines are encouraged.

The Directorate for Education and Human Resources (EHR) runs programs to build a diverse and highly skilled STEM workforce and also to increase STEM literacy more broadly. The proposal from the Trump administration for the EHR budget is \$931 million, which is a relatively small cut of 1%.⁸ The largest cuts within this are to programs that support undergraduate education; the Division of Undergraduate Education (DUE) would experience a 10.7% cut.

The Division of Graduate Education would benefit in FY21 if President Trump's budget is adopted, with an 11.3% increase. Mathematics graduate students are funded directly by EHR's Graduate Research Fellowships Program (GRFP), as well as through senior researcher's individual grants. A small number of graduate students in mathematics participate in Research Traineeship (NRT) programs. The NSF provides support for approximately 32% of the science and

engineering graduate students receiving federal funds; in mathematics and statistics, it is 60%.⁹ The number of new GRFP fellows (across all fields) is expected to drop from 1,976 in FY19 to 1,600 in FY21. The GRFP decrease would be accompanied by a large increase in funding for NRT. The traineeship program is distinguished from the GRFP by its emphasis on graduate students—at both the Masters and PhD level—working in research areas of national priority. This NRT expansion will include a special focus on traineeships in artificial intelligence and artificial intelligence engineering. The GRFP program will also increasingly align awards with administration priorities, including artificial intelligence and quantum information science.

What's Next in the Appropriations Process?

The president's budget is just a first step taken annually in determining final appropriations; the White House released this budget—"A Budget for America's Future"—on February 10.¹⁰ Next, the Senate and House each arrive at their own proposals, and then hash out their differences. This process takes place, usually, from March through September. When (and if) this is done, the president is then asked to sign their proposal into law. If this process does not come to completion by October 1, we get a government shutdown. One way to avoid a shutdown is to put in place a continuing resolution,¹¹ which can be used to provide temporary funding to continue programs and activities until final appropriations are agreed to.

Last cycle, on September 26, 2019, a continuing resolution was enacted that lasted until November 21 and, on that day, a second one was passed that lasted until final appropriations were completed on December 16. The year before, there was a series of three continuing resolutions, but there was a gap between two of them and this resulted in a (partial) government shutdown. If you recall, the 2019 Joint Mathematics Meetings took place during this gap and, as a result, NSF staff could not participate fully at our meetings, a real loss for the community.

Congress is not likely to embrace the president's budget, and final NSF appropriations have always exceeded President Trump's proposals. In advance of the release of his budget, the NSF and the president work together on specifics of how the agency would spend the amount he wants to give them. There are political games played—the NSF might go along with the president's proposal for a *smaller* budget for the GRFP (as well as for other programs Congress loves) because they strongly believe that Congress will not want to reduce the number of graduate students supported through this program and thus will give the NSF

⁴<https://blogs.ams.org/capitalcurrents/2019/03/07/mathematical-sciences-and-the-nsf-big-ideas/>

⁵https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504709&org=DMS&from=home

⁶<https://www.nasa.gov/topics/moon-to-mars>

⁷<https://fas.org/sgp/crs/misc/R45702.pdf>

⁸As compared to FY20 level.

⁹Other federal agencies support the remaining 68% and 40%. Tables 2–13 at <https://www.nsf.gov/statistics/2018/nsb20181/data/appendix?achapter561>

¹⁰<https://www.whitehouse.gov/omb/budget/>

¹¹<https://fas.org/sgp/crs/misc/R42647.pdf>

a larger total budget than the president's proposal. Indeed, Congress has rejected his previous proposals to cut the GRFP program.

By the time you are reading this, it is possible that we will know the outcome of FY21 appropriations negotiations. I am writing this in May: we are still in the midst of the COVID crisis and it is very hard to predict where we will be in the life of this pandemic when you read this column. Due to Congress's understandably diverted focus on this crisis, it seems quite unlikely that the normal appropriations negotiation calendar will be followed, and a timeline is hard to determine. The November election brings additional uncertainty. Indeed, the 2020 presidential election is going to be dramatic, and could bring big changes in federal science investments whether we have a second Trump term or a party switch in the White House. If your seatbelts are not already fastened, fasten them now!

Despite knowing how the budget process is supposed to unfold,¹² it has not done so in many years and this has resulted in us living with continuing resolution after continuing resolution, interspersed with government shutdowns. The last time Congress completed its appropriations work on time was in 1996, and there have been many years in between without a pandemic to blame for the lack of completion. There are various proposals¹³ out there for changing the process altogether. Reform is needed—we are stuck and this is hurting Americans and America.

Final Notes

This post has focused on the president's budget for the NSF. To get more details of the NSF budget, to read more about the budgets for other science agencies, and to keep up-to-date, I highly recommend the American Institute of Physics's *Federal Science Budget Tracker*.¹⁴

Let me remind you (or tell you if you missed my earlier AMS blog post about the history of the NSF¹⁵) that this year the NSF turned 70, and it is the 75th anniversary of the publication of *Science, the Endless Frontier*, in which Vannevar Bush outlined his vision for what would become the NSF. Our national investment in the NSF—the only agency with no guiding scientific mission determining its choices of projects to fund—is more important now than ever!

¹²<https://www.ams.org/government/dc-budgetprimer>

¹³<https://www.brookings.edu/blog/fixgov/2019/03/25/enough-of-our-budget-farce/>

¹⁴<https://www.aip.org/fyi/federal-science-budget-tracker>

¹⁵<https://blogs.ams.org/capitalcurrents/2019/08/14/some-light-summer-reading-a-brief-history-of-the-national-science-foundation/>

What You Can Do to Make Sure Congress Hears the Voices of Mathematicians

The AMS Office of Government Relations advocates for our mathematics community. Our website describes the work we do in Washington, DC, as well as the programs we run and opportunities to engage in AMS policy and advocacy work.¹⁶ This includes information about two of our government-related opportunities for mathematicians: the AMS CASE Fellowships for graduate students and the AMS Congressional Fellowships for those with doctorates.

In my Capital Currents blog,¹⁷ I write regularly about the NSF's budget; you can subscribe and read my posts therein to stay updated.

The AMS carefully monitors information and legislation in Congress on matters that affect the mathematics community. When there is a need for your congressional delegation to hear from you on an important issue, the AMS Office of Government Relations will request that you "Take Action" (see the link in the left-hand column of the Office of Government Relations website¹⁸). We post these calls to action when timely and appropriate and provide you an easy and very quick way to contact your senators and representative through our website. When you take action, you can elect to have your contact information saved for the next time you want to contact your congressional delegation, and you can also sign up to receive emails related to grassroots advocacy in the future. We hope we can count on your participation!

Sources

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Karen Saxe

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¹⁶<https://www.ams.org/government/government>

¹⁷<https://blogs.ams.org/capitalcurrents>

¹⁸<https://www.ams.org/government/government>