Testimony for the Record

Hearing: Driving Innovation Through Federal Investments

Submitted to the

Committee on Appropriations

United States Senate

by

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Chairwoman Mikulski, Ranking Member Shelby, and members of the committee: I am David Vogan, President of the American Mathematical Society (AMS) and Professor of Mathematics at the Massachusetts Institute of Technology. The AMS is a professional organization of about 30,000 mathematicians. On behalf of the AMS, I ask the Committee to consider a FY 2015 budget of at least $7.5 billion for the National Science Foundation (NSF), a little less than the (inflation-adjusted) FY 2010 budget.

What has NSF done for the country that merits level funding in a time of reducing budgets? One example is “public key cryptography,” which protects your bank account every time you use an ATM. The mathematical ideas involved begin with the German mathematician Carl Friedrich Gauss in the eighteenth century. The cryptographic applications were first made by Ron Rivest, Adi Shamir, and Leonard Adleman at MIT in the 1970s, working with support from the National Science Foundation (as well as the Office of Naval Research).

Medical CT scanners are built using mathematics done in 1917 by the Austrian mathematician Johann Radon. Nothing about Radon’s work

appeared at the time to have value for medicine. His ideas were made into a crude imaging machine in 1963 by the physicist Allan Cormack at Tufts University in Medford, supported by funding from the Atomic Energy Commission. In 1971, the English industrial engineer Godfrey Hounsfield designed the first machine that could produce the "slice" medical images with which we are all now familiar. Advances in medical imaging technology since that time have been informed constantly by mathematical work descended from what Radon did almost a hundred years ago. At MIT I have had the privilege for almost forty years of watching the work of Professor Sigurdur Helgason on those ideas; his research was supported for decades by the NSF.

There are similar stories to tell about the mathematics behind the Google search engine, commercial aircraft design, and Pixar movies; about the epidemiology of HIV and the statistics of medical research trials. I can't tell you—nobody can tell you—exactly which NSF grants today will change your children's lives, but I can say for certain that some of them will.

Let me conclude by saying a little bit about what it's been like to work at MIT for forty years, in a world supported strongly and consistently by NSF. My graduate education was funded by NSF. I was taught by scientists and mathematicians whose research was funded by NSF. The ways of thinking needed for that research informed their graduate classes and their freshman classes. "Teacher" and "researcher" weren't separate for them. Like breathing and eating, they were just two aspects of their identities, and neither one could ever be suspended. Those whose ideas never won prizes, or founded companies, still inspired students year after year. Some of those *students* won prizes, and founded companies.

Now I'm the one talking to the graduate students and the freshmen, trying to pass along some part of the love for understanding that I received from those teacher-researchers. My work is what NSF supports.

I ask that the Committee strongly consider providing an FY 2015 NSF budget of at least $7.5 billion. Thank you for considering this request.

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