The Cost of Science

Not long ago, I got a voice message on my office telephone answering system that no scientist ever wants to hear. Funding for a major US Department of Energy (DOE) project, dealing with ways to contain anionic, aqueous radionuclides in groundwater plumes, was suddenly and unexpectedly eliminated. The program was one that I considered to have important societal implications. Our group and several others at national labs were having success, making significant progress with a host of powerful new sorbants. But the reality is that the DOE is headed for budgetary reductions and restrictions, probably for several years. Ray Orbach, Director of DOE's Office of Science, warned that the budget constraints "are not going to go away in 2007 (and) it's going to be a difficult four years."

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Although it may at first seem unrelated, I had the great pleasure to serve at the request of Margaret Leinen, the leader of the Directorate for Geosciences at the National Science Foundation (NSF) in Washington, DC, on the Geosciences Advisory Board between 2000 and 2002. During those three years, I got to see what really makes NSF tick from the inside out, and I was impressed. With a current annual budget of close to $5.6 billion dollars, the NSF is entrusted with driving many critical segments of academic research in the United States. Many other countries have an equivalent agency, and I dare say in a number of cases equally as well run. With only about 5% of its budget going to administration, the NSF handles over 40,000 proposals per year. And the scientists and support staff work extremely hard (and wisely) to do just that. But that is where the good news ends. Between 2000 and 2004, the number of proposals increased by an astounding 49%, but the number of awards increased by only 5%. The overall NSF proposal funding rate has gone down by nearly a third since 2000, from 33% to 24%.

And that's not even the scary part. Recently, the NSF asked themselves this question: How much would it cost to fund *all* of the excellent proposals received, and to give these projects the money that they really deserve for new equipment and better student salaries? The answer: a foundation-wide funding increase of just over 300% would be required. That's nearly $19 billion dollars annually. Yet in this country, you don't have to look far to see that kind of funding for science, in this case, human health-related science. The National Institute of Health (NIH) has an annual budget well in excess of $25 billion dollars. Just 30 years ago, the NIH budget was not even twice that of NSF. Now it exceeds the NSF budget by more than four times. This funding has certainly been critical to the enormous success of the genomics and proteomics revolutions.

I used to know the funding director at NIH (we served on a government committee together). One day I asked her how the NIH could be so enormously successful at securing large budgetary increases year after year, decade after decade, while NSF resources had remained essentially flat (inflation adjusted) until just a few years ago. Her answer was short, simple, and in the form of another question: "Have you ever met a politician who would vote against funding for medical research?" Yet in the long run, isn't the rest of science just as important? Of course it is. But here is the catch. Most of science is a long-term investment, and long-term investments have historically been hard sells to the general public, and therefore to politicians.

Yet despite DOE budgetary woes, and equivalent concerns and negative actions in Europe and elsewhere, maybe, just maybe, there is overall longer term progress. Science drives technology, and technology drives economies. In the US, politicians, liberal *and* conservative, are more and more buying into this (i.e. our) way of thinking. For example, in the last four years, the NSF budget has increased by 43%, and the US Congress has passed a bill to double the NSF budget—a great start (if it really happens) to getting the NSF budget where it needs to be.

Science is very expensive. To continue to justify it, as we must, it is imperative that we do it well, and it is imperative that we continue to let the world know what we are doing and why it is important. Publishing *Elements* is one more way that we can achieve these ends.

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Note from the editors: We invite your comments on scientific funding, especially from countries other than the United States. Look for a new regular column in *Elements* on policy and funding.