

Two threats to U.S. science

Last month, the House Appropriations Committee of the U.S. Congress began drafting its Fiscal Year 2020 funding bill. Among the promising news is the committee's support for a \$2 billion increase above Fiscal Year 2019 for the U.S. National Institutes of Health (NIH), the first step in what is likely to be a long and contentious budget process. Why, then, is the cycle of success that the U.S. scientific enterprise has enjoyed since the mid-20th century in jeopardy?

The cycle of success that catapulted the United States to a global leadership position in science and technology has long been fueled by its many research universities. These institutions create the new fundamental knowledge in science and engineering on which all else depends, and they also train the large numbers of outstanding young people required to produce the next generation of professors, technologists, and entrepreneurs. U.S. universities have attracted great young scientists and engineers from all over the world, many of whom choose to remain in the country, strengthening our institutions and enterprises. Two critical features of this system are now threatened: the support of young people and their unique potential to take risks and explore promising new ideas; and a merit-based selection of scientists and engineers to populate academia and industry, viewing everyone as equal, regardless of the nation in which they were born.

The current grant opportunities for starting a new independent research career in academia have not only become increasingly unavailable to young scientists and engineers, but are also disastrously risk-averse. At the NIH, the proportion of all grant funds awarded to scientists under the age of 36 fell from 5.6% in 1980 to 1.5% in 2017. One might ask the rhetorical question: How successful would Silicon Valley be if nearly 99% of all investments were awarded to scientists and engineers age 36 years or older, along with a strong bias toward funding only safe, nonrisky projects? Similarly,

at the U.S. Department of Energy and its National Laboratories, high-risk, high-reward research and development has been severely limited by extreme volatility in research funding and by very limited discretionary funding at the laboratory level.

Another major concern stems from a new distressing and dangerous public dialogue, encouraged by some political leaders, that unjustly disparages the many people in the United States who were born elsewhere. This strikingly un-American attitude, along with the new visa policies that it has generated, is discouraging migration to the United States of the young talent in science

and engineering from other nations instrumental to the nation's success. One of us (V.N.) moved from India to the United States in 1967, and 40 years later became the founding dean of the School of Engineering and Applied Sciences at Harvard University. Similar stories could be told tens of thousands of times. Nearly half of current doctoral students in science, technology, engineering, and mathematics (STEM) fields are from abroad, and the United States needs to make it easier, not harder, for them to stay and contribute to the cycle of success.

U.S. leadership must focus on stimulating innovation by awarding an equal number of grants to those new investigators proposing risky new research ideas and those proposing to extend the research that they did during their training period, while also funding them at a younger age. At the same time, it is imperative that the United States reconsider its visa and immigration policies, making it much easier for foreign students who receive a graduate degree in a STEM discipline from a U.S. university to receive a green card, while stipulating that each employment-based visa automatically cover a worker's spouse and children.

For success, a nation must not only appropriate funds for science and technology; it must also focus on creating an environment that keeps a cycle of success turning.

—Bruce Alberts and Venkatesh Narayanamurti



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