

**Testimony for the Record  
Submitted to the  
United States Senate Committee on Appropriations  
For Hearing on “Driving Innovation Through Federal Investments”**

**April 29, 2014**

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Chairwoman Mikulski and Vice Chairman Shelby, the American Physical Society thanks the Committee for holding today’s hearing on federal support of scientific and engineering research, and the role it plays in spurring innovation, fostering economic growth and creating jobs. We also express our appreciation for the work of the Administration’s witnesses who have been the public face of the President’s dedication to science and technology.

We will focus our testimony for the record principally on three issues: the nature of the American innovation ecosystem, the challenges that system faces from rapidly growing global competition and the threat sequestration and constrained budgets pose for our national primacy in high-technology.

The innovation ecosystem, ideally functioning, is like a fine-tuned engine. Science is the fuel, human creativity is the process that delivers the fuel and economic growth is the output.

Our exceptional institutions of higher education train the human mind, foster the creativity and allow scientists and engineers to pursue their dreams of discovery and innovation. Our extraordinary system of national laboratories and their scientific user facilities play a crucial role in enabling the nation’s academic and industrial research community to address complex problems and carry out projects requiring large-scale, very-costly equipment.

The innovation engine also requires a free-market environment that rewards entrepreneurship and protects intellectual property rights. And it requires financial capital that is at times patient and at other times highly motivational, but at all times understanding of the need for appropriate risk taking.

For more than half a century, the American ecosystem could afford to function less than ideally. World War II had left our traditional economic competitors in a desperately weakened condition, and today’s developing world had barely started to develop. The 21<sup>st</sup> century landscape is remarkably different. It is “flat,” as Thomas Friedman has characterized it, and it is highly competitive. In just the past dozen years, the U.S. share of worldwide R&D has fallen from 37 percent to 32 percent (see Figure 1). While we have continued doing business as usual, allowing our innovation engine to operate inefficiently and occasionally sputter, other nations have built theirs to 21<sup>st</sup> century standards and are on the verge of making ours look woefully obsolete.

If we were living in isolation, it would be very difficult to establish a target for R&D spending. It would largely be determined by deciding what quality of life we desired and how much we

valued longevity. The term “innovation deficit” that has recently gained some currency would have no fundamental metric. But in a highly competitive world, in which the future of the American economy is at stake, it is appropriate to benchmark our spending to the spending trajectories of other nations. “Rising Above the Gathering Storm,” the 2005 National Academies analysis of our nation’s looming technological ills, did just that. Its prescription for treatment, ramping up our spending on long-term research and making drastic improvements to STEM education, led to a tick-up in federal support of the physical sciences and engineering for a few years. But since 2011, stringent federal budgeting has caused the downward slide to resume. The brief period of sequestration and the threat of its resumption in FY 2016 have created unacceptable misfires of the engine of innovation and potential disruptions of its scientific fuel supply.

Unpredictable funding cuts, like sequestration and the subsequent government shutdown, can immediately disrupt the nation’s research enterprise and create devastating long-term impacts as well. Even the threat of a shutdown can have an adverse effect on federal agencies such as the National Science Foundation (NSF) and Department of Energy (DOE). For example, as the shutdown approached, NSF put a hold on funding all new grants, leaving scientists and their research projects in limbo. The IceCube Neutrino Observatory at the South Pole, which is funded by NSF, was on the verge of being closed as the shutdown dragged on. The Department of Energy’s 17 laboratories prepared to close their doors to more than 30,000 scientists engaged in cutting-edge research. Even four Nobel Laureates failed to escape the impact of the government shutdown: Eric Cornell, William Phillips and David Wineland, who work at the National Institute for Standards and Technology, and John Mather, who works at NASA’s Goddard Space Flight Center, were all furloughed. While the innovation ecosystem may ultimately recover from the sequestration and shutdown, continued R&D budget reductions will be disastrous for future generations of Americans.

For more than half a century, the U.S. government’s commitment to funding basic research at leading universities, paired with innovative manufacturers and businesses, consistently kept our top talent stateside and drew the brightest minds from overseas. Federally funded research at our universities and national labs provided an environment to educate and train the next generation of scientists and engineers necessary to operate our innovation engine. However, the recent trend of stagnating budgets compromises our ability to train the nation’s future science and technology workforce and limits the opportunities for promising young researchers in the U.S. to become leaders in their fields. If we continue to be outpaced in R&D expenditures by our competitors around the globe, our capacity for economic growth will quickly decline, and what was once the world’s most vibrant innovation ecosystem will turn desolate.

While sequestration was still in effect, almost 6,400 science students across the United States signed a petition urging lawmakers to end across-the-board spending cuts, stressing the long-term harm the reductions would do to their hopes and aspirations of becoming the innovators of the future. John Mergo, a physics graduate student at Cornell University and the initiator of the petition, wrote this in Capitol Hill Quarterly. “...we want to continue to attract the best and brightest scientists to the United States. [But] the transformational breakthroughs that have improved our lives won’t continue if young scientists leave the country and start their labs overseas.”

The strength of the American innovation ecosystem of tomorrow will be determined by the R&D investments the federal government makes today. To sustain our global economic leadership and our primacy in high-technology, it is essential that the federal government continue to make investments in scientific research that (1) meet or exceed annual inflation in the cost of doing research and (2) keep pace with the increasing commitment our global competitors are making to science and technology.

Again, the American Physical Society and its 50,000 members in universities, industry and national laboratories thank you for holding this hearing and for extending to us the opportunity to submit testimony.

Figure 1: Global R&D Expenditures (billions of U.S. PPP dollars), By Region

