

**Statement for the Record  
(WRITTEN TESTIMONY)**

**Chancellor Rebecca M. Blank  
University of Wisconsin–Madison**

**Before the U.S. Senate Commerce Subcommittee on Science, Oceans, Fisheries and  
Weather**

**Hearing on: “Research and Innovation: Ensuring America’s Economic and Strategic  
Leadership”**

**October 22, 2019  
2:30 p.m.**

Chairman Gardner, Ranking Member Baldwin, and members of the Subcommittee, thank you for inviting me to discuss international competitiveness and the importance of federal investments in research. Much of our nation’s federal research funding goes to America’s leading research universities, including the University of Wisconsin–Madison, where I serve as Chancellor. UW–Madison is ranked six in the nation for overall research expenditures annually, and funding from the federal government supports about 2,000 awards at my institution each year.

My message to you today is two-fold: First, U.S. global leadership in science, technology and innovation is threatened, as other countries rapidly increase their investments in research and grow their STEM workforce.

Second, this is not inevitable; we can take steps to maintain our long-term leadership in innovation and discovery. With a strong and sustained commitment to federal investment in scientific research we can continue to be a world leader. Such investments will drive the U.S. economy forward and lead to improvements in the human condition.

Let me start with the first point: U.S. global leadership in science, technology, and innovation is threatened.

The U.S. is one of the few Organisation for Economic Co-operation and Development (OECD) countries whose public investments in research and development have declined in the past 25 years. Countries that are highly competitive with the U.S., such as South Korea and Germany, have been investing more and more public funds in R&D and have surpassed the U.S. in the share of GDP going into publicly-funded research.

Most notably, China's investment in R&D has risen rapidly and is expected to surpass the U.S. in the next few years.

That country's Made in China 2025 initiative outlines the intent to become an international leader in frontier sectors such as advanced robotics, aerospace, and biotechnology. Meanwhile, the U.S. government's investment in research and development (R&D) is roughly half what it was in the mid-1970s as a percent of GDP, according to American Association for the Advancement of Science data estimates.

In recent years, Congress has started to close the gap, but greater investment is still needed. The increases Congress has provided agencies such as the National Institutes of Health (NIH) over the last four years are helping to correct the devastating effects of sequestration and budgets that declined in inflation-adjusted dollars.

However, while NIH has seen funding increases, it is important that other key research agencies such as the National Science Foundation (NSF) see similar increases and not get left behind. We know that too many researchers are vying for limited resources, creating a hypercompetitive environment that is particularly challenging for new- and mid-career investigators. Many highly meritorious research proposal applications go unfunded. In financial year 2016, the NIH received 26,187 applications for new R01 grants. Only 17.3% were funded.

As specified in the 21<sup>st</sup> Century Cures Act, NIH continues to pursue a number of important initiatives, including the Cancer Moonshot, the All of Us program (formerly the Precision Medicine Initiative), and the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative.

These programs focus resources on specific areas of human health that are critical for further discovery-oriented research. But they build upon decades of more basic biological research that created the scientific knowledge necessary for more targeted, disease-focused efforts to succeed. To advance our knowledge and lay the groundwork for similar opportunities in the future, the U.S. must continue to invest in basic as well as translational research, and to incentivize creative investigator-initiated inquiry.

Chinese R&D investment has grown remarkably over the past two decades according to NSF data. Among all countries, China is now number two in expenditures on R&D, and accounts for 20 percent of total world R&D expenditure. Its rate of R&D investment growth greatly exceeds that of the U.S. and the E.U.

Unfortunately, the U.S. is not just failing to keep pace with other countries in terms of research dollars. According to the 2019 benchmark report from the Task Force on American Innovation (TFAI) — an alliance of leading American companies and business associations, research university associations, and scientific societies —while U.S. researchers will produce more published articles than other countries, that output is declining and China is catching up. China ranks just behind the U.S. in terms of annual research publications, particularly in fields such as computer sciences and engineering, highlighting the country's research priorities.

The report also highlights declines in the U.S.'s patent productivity in recent years, while East Asian economies such as South Korea, Taiwan, and Singapore have accelerated their patent output.

Other nations also outperform the U.S. in science and engineering education.

The TFAI report notes that the U.S. trails the E.U. and China in output of bachelor's degrees in science and engineering. China is now the world's number one producer of undergraduates with science and engineering degrees, delivering almost one quarter of first university degrees in science and engineering globally.

The U.S. also trails the E.U. in total doctoral degrees awarded in science and engineering, with China rapidly gaining. Since 2007, China has awarded more Ph.D. degrees in natural sciences

and engineering than any other country. As our share of trained Ph.D. researchers falls, so will our share of future research output.

China has been transparent about its goals in research and wants to lead the world in key areas.

Let me give you an example of where China is ramping up its research resources in an area historically dominated by the United States – weather satellites.

Last year, China launched 38 satellites, more than any other country, as it attempts to catch up with the West's satellite infrastructure. China's government has made conquering space a key strategic priority, with the nation's reported \$8 billion space budget second only to that of the U.S., according to the American non-profit Space Foundation.

At UW–Madison, we take satellite research seriously and have long had one of the top-ranked research departments in this field. Our Space Science and Engineering Center (SSEC) and our Cooperative Institute for Meteorological Satellite Studies (CIMSS), an internationally renowned satellite meteorology research center, hold the world's largest, online and publicly available geostationary weather satellite data archive. This archive provides high quality, geophysical data to researchers who study weather and to industries affected by weather, from agriculture to energy and aviation.

The University of Wisconsin–Madison has long been a strong proponent in the international sharing of satellite data, going back to the early days of Verner Suomi, who is often referred to as the father of satellite meteorology. As a result, the U.S. and Europe have partnered on numerous agreements to share weather data from our respective satellites.

The U.S., however, is not staying ahead of international competition. In the 21st century, China has become an important co-equal partner in the global satellite observing system.

For example, the Chinese recently launched the Geostationary Interferometric Infrared Sounder, the world's most modern geostationary satellite weather monitoring system.

While they developed the technologies to build and launch the instrument, they were building on widely used and published design concepts that originated at the University of Wisconsin.

Today's basic scientific research is the foundation on which future advances in technology, health, and productivity are built. Countries expanding their R&D investments will reap the benefits in future decades. The U.S., with reduced investments in science, will no longer be the future leader in innovation.

My second major point is that the relative decline in U.S. research leadership is not inevitable; we can take steps to maintain our long-term leadership in innovation and discovery.

I urge you to continue to provide meaningful and predictable annual budget increases that support basic and translational research at our nation's universities. At a minimum, if we don't want to lose ground, research funding increases should match with the rate of inflation. But funding must grow even faster if we want to catch up with our competitors.

In addition to assuring that basic and translational science is funded at America's leading research universities, we also need to improve the commercialization of federally funded research. Supporting the rapid and efficient transfer of information from academia to the private sector, as well as among researchers worldwide, is necessary if we want to achieve maximum benefit from new technological advances. This requires effective collaborations.

Federally-funded research discoveries often provide the basis for innovations commercialized by the private sector. This public-private partnership has been critical to U.S. leadership in both manufacturing and the biomedical sciences.

Let me highlight some examples in medical research. Entrepreneurs, such as those at UW–Madison, have been instrumental in helping to advance areas such as stem cell research, organ transplantation, gene therapy, computerized X-ray images of blood vessels, brain plasticity research, head injury treatment, and asthma research.

According to a recent article in the *Proceedings of the National Academy of Sciences*, all 210 new molecular entities approved by the Food and Drug Administration between 2010 and 2016

were associated with NIH-supported research. Importantly, 84 of those new drugs involved a newly discovered mechanism of action or biological target in the body.

The commercial opportunities created from NIH research fuels our economy and creates jobs. According to an updated 2019 report, NIH research funding in FY 2018 supported more than 430,000 jobs and generated nearly \$74 billion in total economic activity nationwide.

Of course, this research isn't important just because of its effect on jobs. The long-term effects of this research are crucial to advances in human health. Investments in cancer research, including projects at UW–Madison, have helped reduce the death rate from all cancers in the U.S. over the past two decades, according to the American Cancer Society. As of 2015, the cancer death rate for men and women combined had fallen 26 percent from its peak in 1991, translating to nearly 2.4 million lives saved.

In 2009, six economists published a large study entitled *An Economic Evaluation of the War on Cancer*. They look at cancer outcomes between 1988 and 2000, which allows time for the early research to show results in clinical practice. Their analysis indicates the likelihood of cancer survival (across all cancers) improved markedly between 1988 and 2000. By their analysis, 80% of the increase in survival was due to better treatment as a result of research advances. Over this time period, that adds up to 23 million additional years of life across the U.S., years that these patients can enjoy with their families.

Beyond the positive results that emerge from research findings, Federally-funded research at universities also plays a critical role in training the next generation of scientists by supporting trainees with individual fellowships and institutional grants.

To build the STEM workforce this country needs, we must continue to invest in training for highly skilled graduates in the STEM fields. These students build their skills by working with faculty on research projects.

Thank you, Senators Gardner and Peters, for co-authoring the American Innovation and Competitive Act, which was signed in 2017. This bipartisan federal research and technology

policy not only maximizes basic research opportunities, reduces administrative burdens for researchers, encourages scientific entrepreneurship, and promotes oversight of taxpayer-funded research, it also promotes diversity in STEM fields, incentivizes private-sector innovation, and boosts manufacturing.

There are three aspects of that policy that are key for the future of American scientific leadership. The Act:

- *Promotes diversity in STEM fields* by creating a working group to study how to improve inclusion of women and underrepresented individuals in STEM fields, and reaffirming the necessity of broadening participation in STEM fields through NSF programs;
- *Bolsters scientific entrepreneurship* by authorizing the successful I-Corps program to help scientists move their research from the laboratory to the marketplace; and
- *Reaffirms the importance of commercialization* by directing NSF to continue awarding translational research grants and strengthening public-private cooperation.

We also need to invest in new and mid-career researchers. I commend Congress for passing the 21st Century Cures Act, and including the Next Generation Researchers Act in the bill, as championed by Sen. Tammy Baldwin. This law is a big step in the right direction. These initiatives will expand opportunities for new scientists and promote growth, stability, and diversity of the biomedical research workforce.

Today, significant challenges loom before us: The opioid epidemic is a national public health crisis. An aging population will mean increased incidence of heart disease, diabetes, kidney disease, arthritis, and cancer. Recent weather patterns threaten coastal areas. America's infrastructure is aging.

America's research universities are working on these challenges. We know that addressing such complex problems will require us to reach across disciplines in areas such as global health,

agriculture, language, political studies, climate, and many more. At UW–Madison, we embrace collaboration as a means of accelerating discovery.

Such work goes faster when we share ideas and best practices with scientists around the world. But we also know these collaborations must be thoughtful and in our best national interests.

All of this requires a stable environment in which the R&D enterprise can thrive.

The partnership between the Federal government and research universities is long-standing in the United States and has produced an unparalleled set of discoveries and inventions that have improved lives around the globe. With the challenges in front of us, this partnership needs to be even stronger now than in the past. This means stable and predictable research funding to build labs, experiment with new ideas and complete long-term research projects. It means training the next generation of scientists by supporting trainees with individual fellowships and institutional grants. It means prioritizing science in the Federal budget.

With this type of investment, the U.S. will maintain its excellence in cutting-edge research.

Thank you.