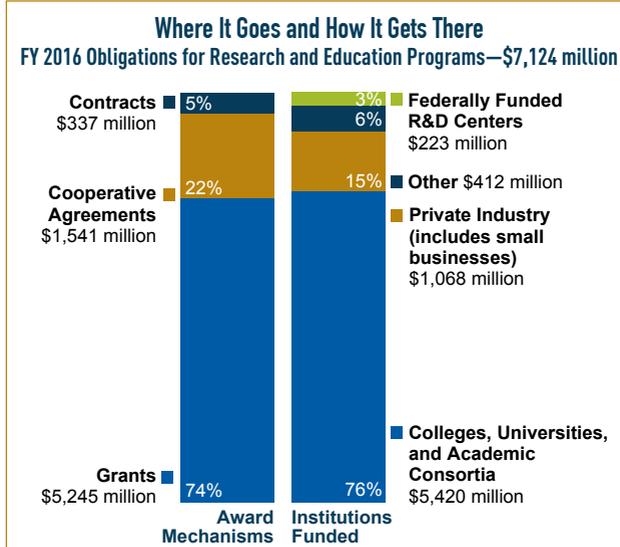
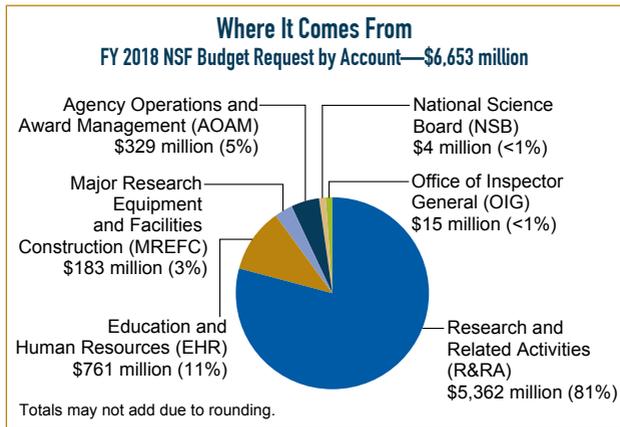


## FOLLOWING THE MONEY



This chart shows the distribution of NSF's obligations by institution type and funding mechanism. While the data shown are based on FY 2016, the relative shares should provide a good indication of the FY 2018 distribution.

Notes: NSF Research and Education Programs include R&RA, EHR, and MREFC appropriations. Other institutions funded include federal, state, and local governments; nonprofit organizations; and international organizations. Totals may not add due to rounding.

R&D = Research & Development.

**About the cover:** Science has revolutionized the way we live our lives. As the only federal agency specifically mandated to support fundamental research across all fields of science, technology, engineering, and mathematics, NSF has supported discoveries and innovations that have transformed the way we live, sparked and expanded the limits of our curiosity, opened the world to entirely new occupations and industries, and enriched our quality of life. NSF plays a vital role in keeping the United States at the forefront of discovery and innovation.

**Cover image credit:** Illustration by Nicolle Rager Fuller, NSF. Modified by HR Communications, Ltd.

## RESEARCH AND EDUCATION HIGHLIGHTS

### Predicting Potential Zika Outbreaks in U.S. Cities



Credit: James Gathany, CDC

A study led by the NSF-funded National Center for Atmospheric Research (NCAR) provided data to the scientific and public health communities suggesting which areas in the United States were at highest risk for Zika outbreaks during the summer 2016. After examining multiple factors such as summer weather conditions, travel patterns, socio-economic status, and mosquito biology, the researchers concluded that cities in southern Florida and impoverished areas in southern Texas could be hotspots for local virus transmission. Anticipating the timing and location of outbreaks, public health officials could prepare a response plan, potentially reducing an outbreak's impact. This work lays a foundation for forecasting, handling, and possibly preventing future outbreaks of Zika and other serious diseases.

### A Glimpse of the Milky Way 13 Billion Years Ago



Credit: ALMA

The NSF-funded Atacama Large Millimeter/submillimeter Array (ALMA), a powerful radio telescope, has given astronomers their first look at how galaxies like the Milky Way formed about one billion years after the birth of the universe. During this period, galaxies were generating lots of new stars on their way to peak star formation two billion years later. ALMA allowed the astronomers to detect the bright spectral lines of carbon atoms inside the galaxies. This acted as a tracer to outline the galaxy's structure in the distant universe. Previously, astronomers used the light from quasars to illuminate the location of nascent galaxies, but that light is so bright that its glare obscures the rest of the galaxy. The discovery provides evidence that the galaxies are embedded in an extended halo of hydrogen gas.

### Making Artificial Joints Stronger



Credit: Jeff Fitlow/Rice University

Generally, titanium is the material of choice for artificial knees and hips. It's nontoxic, strong, and wears well. However, NSF-funded researchers at Rice University have discovered that adding gold to the metal can make it nearly four times harder than most steels. The new alloy is more compatible with the human body than titanium alone and outperforms it in wear and tear tests. Easy to synthesize, the new material may help reduce the 200,000 surgeries performed each year in the United States to replace failed hip and knee implants. This would be an important advance since knee replacements are expected to increase 673 percent and hip replacements by 174 percent by 2030.

### For More Information

NSF FY 2018 Budget Request to Congress  
[www.nsf.gov/about/budget](http://www.nsf.gov/about/budget)

Research and Education Results Supported by NSF  
[www.nsf.gov/discoveries](http://www.nsf.gov/discoveries)

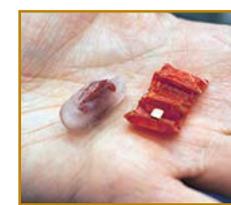
NSF Budget and Performance  
[www.nsf.gov/about/performance](http://www.nsf.gov/about/performance)

NSF Strategic Plan for 2014–2018  
[www.nsf.gov](http://www.nsf.gov)

Driving Federal Performance  
[www.performance.gov](http://www.performance.gov)

## RESEARCH AND EDUCATION HIGHLIGHTS

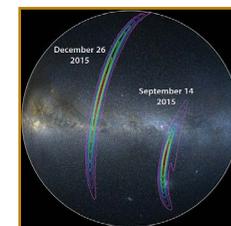
### Foldable Robots for the Clinic



Credit: Melanie Gonick, MIT

NSF-funded researchers at the Massachusetts Institute of Technology developed a tiny foldable robot the size of a small pill. This gives doctors an alternative to surgery to retrieve the some 3,500 button batteries that are swallowed annually in the United States. If left in the body, ingested batteries can burn the digestive tract. Once swallowed, the robot unfolds and moves toward its target via external magnetic field. Then it will dislodge the battery from the stomach lining, allowing both the battery and robot to be naturally passed from the digestive system. Besides foreign object retrieval, the devices can patch wounds and deliver medicine. After completing its mission, the robot passes through the body or dissolves. The researchers plan to redesign the robot, adding sensors so that it can control itself rather than relying on external manipulation.

### Wave Hunting with LIGO



Credit: Axel Meltinger/LIGO

In December 2015, almost 3 months after the initial confirmation of the existence of gravitational waves in the universe, the NSF-funded Laser Interferometer Gravitational-Wave Observatory (LIGO) captured a second set of waves from another black hole merger 1.4 billion light years away. For the first time, researchers confirmed that one of the black holes was spinning, indicating that the spinning black hole experienced some dynamic process before the merger. Data from this observation allowed researchers to verify the validity of Einstein's theory of relativity, with more precision. NSF was the initial funder of the LIGO project 40 years ago, and its continued commitment to LIGO's research now enables an entirely new way to observe the universe.

### Computer Science Moves Away from the Desk



Credit: Pete Zinke, NYU

Computers are now an indispensable tool in the classroom, but for young students the experience can be isolating. To move away from the traditional monitor, keyboard, and mouse, a group of NSF-funded researchers, led by researchers at New York University, use a LEGO robot named Quinn to teach basic geometry concepts to middle school students. Quinn is the centerpiece of the Robo-Tangible Activities for Geometry (rTAG) system that encourages physical interactions with a robot. Using an iPod Touch, students "help" Quinn learn how to solve geometry problems as they guide the robot around a large, white floor mat.



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# National Science Foundation FY 2018 BUDGET REQUEST TO CONGRESS



**MISSION:** To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

—From the National Science Foundation (NSF) Act of 1950 (P.L. 81–507)

**VISION:** A Nation that creates and exploits new concepts in science and engineering and provides global leadership in research and education.

—From Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014–2018

# Investing in Science, Engineering, and Education for the Nation's Future

## ABOUT NSF

- Established by Congress in 1950 as an independent federal agency to promote American science and engineering (S&E).
- The only federal agency that funds basic non-biomedical research and education across all fields of S&E and at all levels of education.
- Funds advanced instrumentation and facilities, Arctic and Antarctic research and operations, cooperative research between universities and industry, and U.S. participation in international scientific efforts.
- Ninety-three percent of appropriated funds directly support research and STEM education, 76 percent of it at our Nation's colleges and universities.
- Has supported 223 Nobel Laureates since its inception.

NSF by the Numbers	
<b>\$6.7 billion</b>	FY 2018 Budget Request
<b>\$7.5 billion</b>	FY 2016 Enacted Budget
<b>1,883</b>	Colleges, universities, and other institutions receiving NSF funding in FY 2016
<b>49,300</b>	Proposals evaluated in FY 2016 through a competitive merit review process
<b>11,900</b>	Competitive awards funded in FY 2016
<b>225,000</b>	Proposal reviews conducted in FY 2016
<b>362,000</b>	Estimated number of people NSF supported directly in FY 2016 (researchers, postdoctoral fellows, trainees, teachers, and students)
<b>53,800</b>	Students supported by NSF Graduate Research Fellowships since 1952

## FY 2018 BUDGET REQUEST

NSF Budget by Appropriation (dollars in millions)					
Account	FY 2016 Actual	FY 2017 Enacted	FY 2018 Request	Change Over FY 2017 Enacted	
				Amount	Percent
Research and Related Activities	\$5,998	\$6,034	\$5,362	-\$672	-11%
Education and Human Resources	\$884	\$880	\$761	-\$119	-14%
Major Research Equipment and Facilities Construction	\$242	\$209	\$183	-\$26	-13%
Agency Operations and Award Management	\$351	\$330	\$329	-\$1	*
National Science Board	\$4	\$4	\$4	-	-
Office of Inspector General	\$15	\$15	\$15	*	-1%
<b>TOTAL, NSF</b>	<b>\$7,494</b>	<b>\$7,472</b>	<b>\$6,653</b>	<b>-\$819</b>	<b>-11%</b>

Note: Totals may not add due to rounding. \* indicates <\$500,000 or <0.5%.

## FY 2018 BUDGET HIGHLIGHTS

- NSF's \$6.7 billion in funding in FY 2018 will support approximately 8,000 new research grants.
- Funds construction of three major research equipment and facilities projects (Daniel K. Inouye Solar Telescope, Large Synoptic Survey Telescope, and Regional Class Research Vessels): (\$183 million).
- Invests in the acquisition and deployment of a new high-performance computing system that will serve as a national resource for advancing the frontiers of science and engineering: (\$60 million).
- Provides for Polar Facilities and Logistics, investments that are essential to maintaining a strong and consistent U.S. presence in the Antarctic and the Arctic: (\$285 million).
- Supports underlying investments in basic research and education in areas of national priority, such as cybersecurity and advanced manufacturing: (\$145 million and \$173 million, respectively).
- Seeds investments that advance the NSF "Big Ideas"—areas at the frontiers of science and engineering that are poised for potentially transformative discoveries and advances.

## RESEARCH TO RESULTS

NSF is vital because it invests in basic research and the people who make the discoveries that transform our future. These investments—

- Spur short- and long-term innovation and robust job creation.
- Have led to technologies that have added billions of dollars to the U.S. economy through businesses and technologies like QUALCOMM, Google, the iPhone, and 3-D printing.
- Support our military and lead to discoveries that keep our troops safe, such as better bullet-proof vests; more accurate GPS; more functional, durable, and reliable prosthetics; and tools to counter violent extremism, detect explosives, and predict conflict.
- Give the United States the competitive edge to remain a global leader.

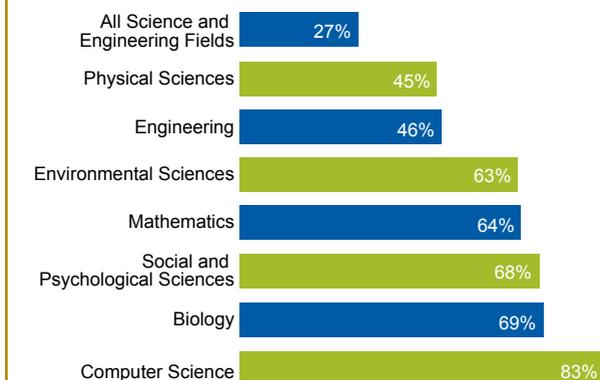
NSF Research Grant Awards and Funding Rate		
	FY 2016	FY 2018
Research Grant Awards	8,800	8,000
Funding Rate	21%	19%

## BIG IDEAS

NSF continues to pursue its "Big Ideas"—a set of 10 bold, long-term research ideas that identify new frontiers for basic research and underscore where greater investments are needed. The Big Ideas also serve as invitations to others to help expand, develop, and turn them into reality.

- Harnessing the Data Revolution
- Work at the Human-Technology Frontier: Shaping the Future
- Windows on the Universe: The Era of Multi-messenger Astrophysics
- The Quantum Leap: Leading the Next Quantum Revolution
- Understanding the Rules of Life: Predicting Phenotype
- Navigating the New Arctic
- Mid-scale Research Infrastructure
- NSF 2026: Seeding Innovation
- NSF INCLUDES: Enhancing Science and Engineering through Diversity
- Growing Convergent Research at NSF

### NSF Support of Academic Basic Research in Selected Fields (as a percentage of total federal support)



Notes: Biology includes Biological Sciences and Environmental Biology. Biology and Psychological Sciences exclude National Institutes of Health funding from the total amount of federal support.

Source: NSF/National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FY 2015.