Who We Are and What We Do

- The mission of the National Science Foundation (NSF) is to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

- NSF's vision is of a Nation that creates and exploits new concepts in science and engineering and provides global leadership in advancing research and education.

- NSF supports research and workforce development programs that help drive future economic growth and enhance our Nation's security and global competitiveness.

- NSF seeks high-risk, potentially transformative research that will generate pioneering discoveries and advance exciting new frontiers in science.

- NSF funds advanced instrumentation and facilities, Arctic and Antarctic research and operations, and cooperative research between universities and industry, and U.S. participation in international scientific efforts.

▶ **NSF Helps Drive our Nation's Economy**

NSF by the Numbers	
$7.5 billion	FY 2017 Appropriations (does not include mandatory accounts)
2,000	Colleges, universities, and other institutions receiving NSF funding in FY 2017
49,000	Proposals evaluated in FY 2017 through a competitive merit review process
11,000	Competitive awards funded in FY 2017
203,000	Proposal reviews conducted in FY 2017
359,000	Estimated number of people NSF supported directly in FY 2017 (researchers, postdoctoral fellows, trainees, teachers, and students)
55,700	Students supported by NSF Graduate Research Fellowships since 1952

From the Director

Credit: NSF/Stephen Voss

The National Science Foundation (NSF) is pleased to present NSF's *FY 2017 Performance and Financial Highlights*, one of three accountability reports that provides key financial and performance information to our stakeholders and the American people. The past year has been exciting at NSF, a time during which we have watched our investments produce remarkable results. Notably, the NSF-supported Laser Interferometer Gravitational-Wave Observatory (LIGO), in coordination with its European Virgo partners and some 70 ground- and space-based telescopes, made the first direct detection of gravitational waves from the collision of two neutron stars. This discovery merited Science Magazine's 2017 "Breakthrough of the Year." Researchers are only beginning to understand the scope of this discovery's implications.

As the only agency with a portfolio that spans the full spectrum of research and education in science and engineering, NSF helps sustain the U.S. leadership in discovery and innovation. Our mission is to promote the progress of science; to advance the national health, prosperity and welfare; and to secure the national defense. And for nearly seven decades, NSF has invested in scientific and engineering research and education that drives the nation's economy, strengthens national security, and promotes growth and opportunity throughout the nation.

Today, outcomes from basic research across multiple scientific disciplines are transforming entire industries, from transportation and computing to manufacturing and agriculture. NSF investments enable researchers across various disciplines to investigate methods for ensuring sustainable supplies of food, energy and water, and identifying novel ways to protect the ecosystems that are essential for humankind.

NSF serves as a major player in the rapidly growing field of nanotechnology, helping transform U.S. industry through advances in manufacturing, electronics, medical instrumentation, and materials science. NSF investments in some of the world's most powerful and sophisticated telescopes allow scientists to peer into space to detect gravitational waves, survey distant galaxies, detect cosmic particles, and monitor the sun's magnetic field and solar flares.

NSF is a leader in the preparation of the future science, technology, engineering, and mathematics (STEM) workforce. Researchers and educators in STEM disciplines, along with a well-informed public, are key to future U.S. STEM leadership and excellence. NSF's investments in the development of STEM talent are vital to meeting the high-technology workforce needs of today and tomorrow.

As stewards of American taxpayer dollars, we are committed to ensuring NSF funds are used effectively so we may continue as a champion of U.S. basic research. NSF's *Annual Performance Report*, which is included in the agency's *FY 2019 Budget Request to Congress*, includes a full discussion of NSF's progress toward its annual performance goals. In FY 2017, NSF fully achieved four of nine performance goals, including both priority goals. As in past years, all NSF performance data were independently verified and validated using guidelines for completeness and reliability from the Government Accountability Office. NSF's *Annual Performance Report* contains a discussion of NSF's data validation.
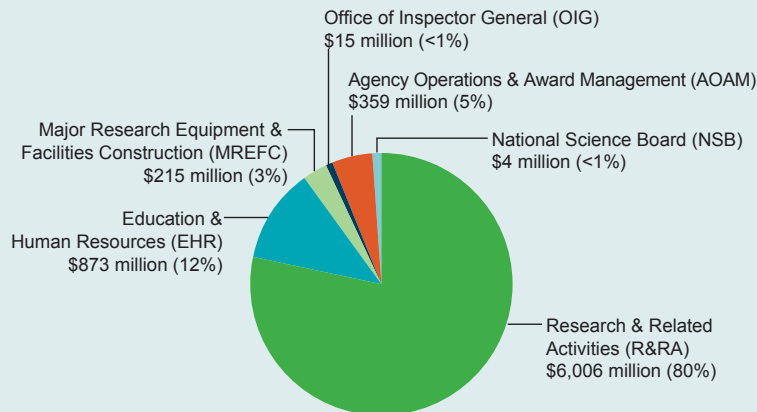
I invite you to review NSF's FY 2017 *Agency Financial Report* and our website at *www.nsf.gov* to learn more about NSF's investments in science and engineering research and education.

France A. Córdova
February 12, 2018

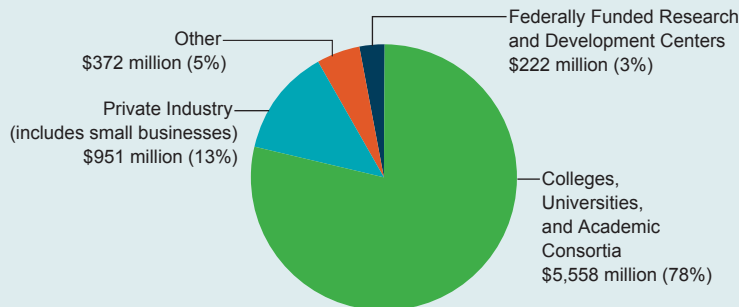# NSF by the Numbers

Where It Comes From
FY 2017 Appropriations by Account—$7,472 million

Office of Inspector General (OIG)
$15 million (<1%)

Agency Operations & Award Management (AOAM)
$359 million (5%)

Major Research Equipment &
Facilities Construction (MREFC)
$215 million (3%)

Education &
Human Resources (EHR)
$873 million (12%)

National Science Board (NSB)
$4 million (<1%)

Research & Related
Activities (R&RA)
$6,006 million (80%)

Notes: MREFC includes $6 million transferred from R&RA to fund NEON construction. AOAM includes $29 million in transfers for NSF headquarters relocation expenses. Transfers to AOAM: $22 million from R&RA, and $7 million from EHR. These transfers were authorized by P.L. 115-31, Consolidated Appropriations Act, 2017.
Totals may not add due to rounding.

Where It Goes
Institutions Funded by NSF
FY 2017 Obligations for Research and Education Programs—$7,103 million

Other
$372 million (5%)

Private Industry
(includes small businesses)
$951 million (13%)

Federally Funded Research
and Development Centers
$222 million (3%)

Colleges,
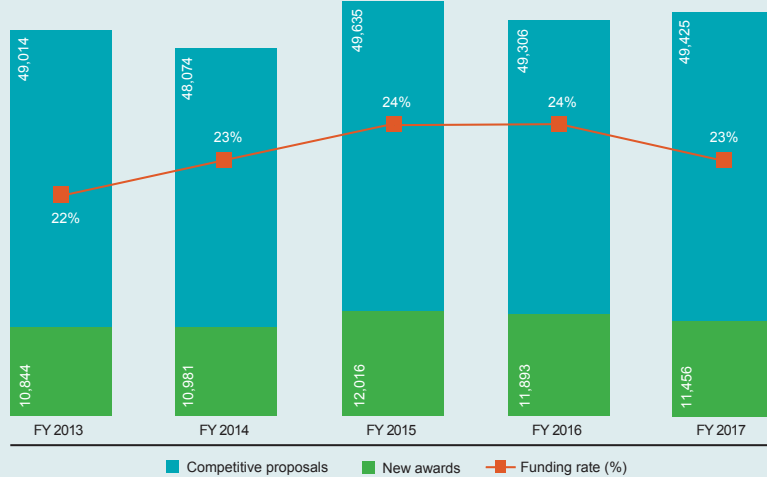Universities,
and Academic
Consortia
$5,558 million (78%)

Notes: NSF Research and Education Programs include Research & Related Activities, Education & Human Resources, and Major Research Equipment & Facilities Construction appropriations. Other institutions funded include federal, state, and local governments; nonprofit organizations; and international organizations.
Totals may not add due to rounding.

How It Gets There
NSF Award Mechanisms
FY 2017 Obligations for Research and Education Programs—$7,103 million

Contracts
$341 million (5%)

Cooperative Agreements
$1,551 million (22%)

Grants
$5,211 million (73%)
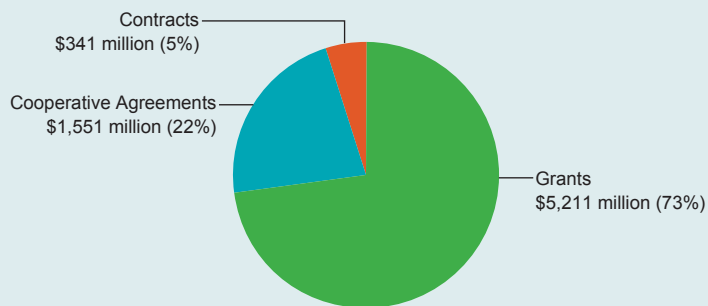
Note: NSF Research and Education Programs include Research & Related Activities, Education & Human Resources, and Major Research Equipment & Facilities Construction appropriations.
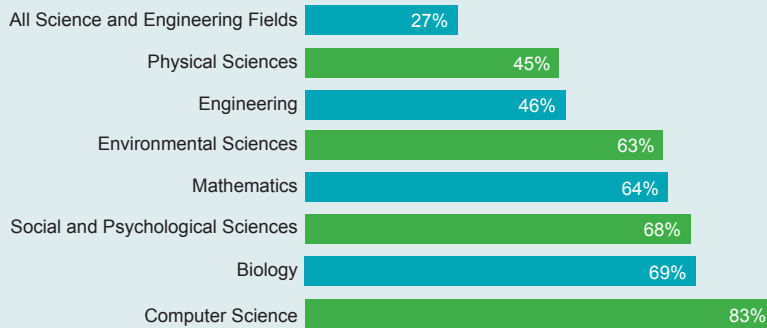
- NSF is funded primarily through six Congressional appropriations, which totaled $7,472 million in fiscal year (FY) 2017. R&RA, EHR, and MREFC fund the agency's programmatic activities and account for 95 percent of NSF's total appropriations. The AOAM appropriation provides funds to administer and manage those programmatic activities. Separate appropriations are provided to support the activities of the OIG and NSB. (Appropriations acronyms are spelled out in chart to the left.)

- Nearly 34,000 members of the science and engineering community participated in the merit review process as panelists and proposal reviewers. Awards were made to 1,798 institutions in 50 States, the District of Columbia, and 3 U.S. territories. These institutions employ America's leading scientists, engineers, and educators; and they train the leading innovators of tomorrow.

- Seventy-eight percent of support for research and education programs was to academic institutions, including colleges, universities, and academic consortia. Awards were also provided to federally funded research and development centers and private industry, including small businesses. Other recipients included federal, state, and local governments; nonprofit organizations; and international organizations. A small number of awards fund international science and engineering research, education, and partnerships, which add value to the U.S. scientific enterprise and maintain U.S. leadership in the global scientific enterprise.

- Most NSF award funding (about 95 percent) was through grants or cooperative agreements. Grants can be funded either as standard awards, in which funding for the full duration of the project is provided in a single fiscal year, or as continuing awards, in which funding for a multiyear project is provided in increments. Cooperative agreements are used when the project requires substantial agency involvement (e.g., research centers, multi-use facilities). Contracts are used to acquire products, services, and studies (e.g., program evaluations) required primarily for NSF or other government use.

How It's Spent

Number of NSF Competitive Proposals, New Awards, and Funding Rates

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Competitive proposals	49,014	48,074	49,635	49,306	49,425
New awards	10,844	10,981	12,016	11,893	11,456
Funding rate (%)	22%	23%	24%	24%	23%

■ Competitive proposals ■ New awards ■— Funding rate (%)

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

Field	Percentage
All Science and Engineering Fields	27%
Physical Sciences	45%
Engineering	46%
Environmental Sciences	63%
Mathematics	64%
Social and Psychological Sciences	68%
Biology	69%
Computer Science	83%

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 & Development, FY 2015

- Between FY 2016 and FY 2017, the number of competitive proposal actions was stable and in excess of 49,000.

- The overall funding rate in FY 2017 was 23 percent, a decrease of 1 percentage point.

- In FY 2017, an estimated 359,000 people were directly involved in NSF programs and activities, receiving salaries, stipends, or participant support. Beyond this, NSF programs indirectly impact millions of people. These programs reach kindergarten through 12th-grade students and teachers, the general public, and research through activities including workshops; informal science activities such as museums, television, videos, and journals; outreach efforts; and dissemination of improved curricula and teaching methods.

- NSF accounts for approximately 27 percent of the total Federal budget for basic research conducted at U.S. colleges and universities, and this share increases to about 60 percent when medical research supported by the National Institutes of Health is excluded. In many fields, NSF is the primary source of Federal academic support.

FY 2017 Financial Management Performance Results	Results
Financial Statement Audit* • Unmodified opinion (20th consecutive "clean" opinion) • Material weaknesses	 Yes None
Management Assurances • Effective internal control over operations, reporting, and compliance (FMFIA §2 and §4) • Compliance with Section 803(a) of FFMIA: system requirements, accounting standards, and U.S. General Ledger at transaction level	 Yes No lack of compliance noted
Digital Accountability and Transparency (DATA) Act of 2014	Compliance
Grants Oversight and New Efficiency (GONE) Act	Compliance

* NSF's FY 2017 Independent Auditors' Report is in NSF's *FY 2017 Agency Financial Report*.
FMFIA: Federal Managers Financial Integrity Act of 1982
FFMIA: Federal Financial Management Improvement Act of 1996

How We Are Doing: Performance Results

In FY 2017, NSF tracked progress toward the three strategic goals in its Strategic Plan, *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014–2018*. Nine performance goals were tracked, of which two were Agency Priority Goals (APGs). APGs monitor progress in specific areas where near-term focus on agency execution can have the most impact.

- NSF achieved both of its APGs in FY 2017. Of the nine goals in FY 2017, four achieved all targets.

- FY 2017 was the last full fiscal year under the current Strategic Plan.[1] This plan was the first to use the annual Strategic Review (SR) process. In 2017, NSF conducted a retrospective SR which assessed the previous three years of SRs and made recommendations for areas of opportunity and improvement.

NSF's *FY 2017 Annual Performance Report* provides a full description of the SR process and all of the agency's performance measures, including descriptions of the metrics, methodologies, results, and trends, along with a list of relevant external reviews.

Priority Goal	Status
Improve Graduate Student Preparedness. By September 30, 2017, NSF will fund at least three summer institutes and 75 supplements to existing awards to provide STEM doctoral students with opportunities to expand their knowledge and skills to prepare themselves for a range of careers.	✓ Across the two-year timeframe of this goal, a total of 163 supplements were funded. Two awards supporting a total of five summer institutes were funded.
Build the capacity of the Nation to solve research challenges and improve learning by investing strategically in crowdsourcing and other forms of public participation in STEM research (PPSR). By September 30, 2017, NSF will implement mechanisms to expand and deepen the engagement of the public in research.	✓ NSF increased outreach efforts around PPSR and increased the number and type of funding mechanisms available to researchers using PPSR methods.

FY 2017 Performance Goal	Result
1. Agency Priority Goal: Improve Graduate Student Preparedness.	✓
2. Agency Priority Goal: Invest Strategically in Public Participation in STEM Research.	✓
3. Ensure that key FY 2017 NSF-wide program investments are implemented and on track.	✓
4. Ensure program integrity and responsible stewardship of major research facilities and infrastructure.	✖
5. Use evidence-based reviews to guide management investments.	~
6. Inform applicants whether their proposals have been declined or recommended for funding in a timely manner.	✖
7. Foster a culture of inclusion through change management efforts resulting in change leadership and accountability.	✖
8. Enable consistent evaluation of the impact of NSF investments with a high degree of rigor and independence.	✓
9. Increase the percentage of proposal review panelists that participate virtually while maintaining the quality of the merit review process.	✖

✓ = all targets met | ~ = achieved some, but not all, targets | ✖ = achieved no targets
STEM: Science, Technology, Engineering, and Mathematics.
Performance data have been independently verified and validated. For more information, see NSF's *FY 2017 Annual Performance Report*, found in the Performance chapter of NSF's *FY 2019 Budget Request to Congress*.

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[1] The new *NSF Strategic Plan for FY 2018–2022 Building the Future: Investing in Discovery and Innovation* is at the following location: https://www.nsf.gov/about/performance/strategic_plan.jsp.

Management Challenges

For FY 2017, the NSF Office of the Inspector General (OIG) identified seven management and performance challenges facing the agency:

- Establishing accountability over large cooperative agreements and ensuring sound business practices and effective oversight.
- Managing NSF's business operations in the areas of improper payments, information technology, new government-wide data reporting requirements, and government records.
- Managing and providing oversight of the program that brings external researchers and educators (called "rotators" or "IPAs") to work temporarily at NSF.
- Moving NSF's headquarters efficiently and on time.
- Managing a world-class scientific research program in Antarctica, with a focus on cost control, infrastructure modernization efforts, and inventory management.
- Improving grant administration and ensuring grant funds are spent as intended.
- Encouraging the ethical conduct of research through providing oversight and guidance on the implementation of responsible conduct of research requirements and training.

OIG's memorandum on FY 2017 Management Challenges can be found in NSF's *FY 2016 Agency Financial Report*. Management's report on the significant activities undertaken in FY 2017 to address these challenges is included in NSF's *FY 2017 Agency Financial Report*.

For More Information

NSF Budget and Performance Website
https://www.nsf.gov/about/performance

NSF FY 2017 Agency Financial Report
*https://www.nsf.gov/publications/pub_summ.
jsp?ods_key=afr*

NSF FY 2017 Annual Performance Report
*See Performance chapter of NSF FY 2019
Budget Request to Congress
https://www.nsf.gov/about/performance*

Report to the National Science Board on NSF's Merit Review Process FY 2016
*https://www.nsf.gov/nsb/publications/2017/
nsb201726.pdf*

NSF Research and Education Discoveries
https://www.nsf.gov/discoveries

NSF FY 2017 Progress Report on OIG Management Challenges *(See Appendix 4B)*
*https://www.nsf.gov/publications/pub_summ.
jsp?ods_key=afr*

Building the Future: Investing in Discovery and Innovation, NSF Strategic Plan for FY 2018–2022
*https://www.nsf.gov/about/performance/
strategic_plan.jsp*

Investing in Science, Engineering, and Education for the Nation's Future, NSF Strategic Plan for 2014–2018
*https://www.nsf.gov/publications/pub_summ.
jsp?ods_key=nsf14043*

FY 2017 NSF Senior Management

Office of the Director (O/D)
France A. Córdova, Director
Vacant, Deputy Director
Joan Ferrini-Mundy, Chief Operating Officer

O/D Offices:

Office of Diversity & Inclusion
Rhonda Davis, Head

Office of the General Counsel
Lawrence Rudolph, General Counsel

Office of Integrative Activities
Suzanne Iacono, Head

Office of International Science & Engineering
Rebecca S. Keiser, Head

Office of Legislative & Public Affairs
Amanda Greenwell, Head

Directorate for Biological Sciences
James L. Olds, Assistant Director

Directorate for Computer & Information Science & Engineering
James F. Kurose, Assistant Director

Directorate for Education & Human Resources
William (Jim) Lewis, Assistant Director (Acting)

Directorate for Engineering
Dawn Tilbury, Assistant Director

Directorate for Geosciences
William E. Easterling, Assistant Director

Directorate for Mathematical & Physical Sciences
James S. Ulvestad, Assistant Director (Acting)

Directorate for Social, Behavioral, & Economic Sciences
Fay L. Cook, Assistant Director

Office of Budget, Finance, & Award Management
Teresa Grancorvitz, Head (Acting)

Office of Information & Resource Management
Joanne S. Tornow, Head

Other Designated Senior Officials

Affirmative Action Officer
Rhonda Davis (Office of Diversity & Inclusion)

Chief Financial Officer Performance Improvement Officer
Teresa Grancorvitz, Acting (Office of Budget, Finance, & Award Management)

Chief Human Capital Officer
Joanne S. Tornow (Office of Information & Resource Management)

Chief Information Officer
Dorothy Aaronson, Acting (Office of Information & Resource Management)

National Science Board Members in FY 2017

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Massachusetts Institute of Technology

Diane L. Souvaine, *Vice Chair*
Tufts University

John L. Anderson
Illinois Institute of Technology

Deborah L. Ball
University of Michigan

Roger N. Beachy
Washington University, St. Louis

Arthur Bienenstock
Stanford University

Vinton G. Cerf
Google Incorporated

Vicki L. Chandler
Minerva Schools at KGI

Ruth A. David
Analytic Services Incorporated

W. Kent Fuchs
University of Florida

Inez Y. Fung
University of California, Berkeley

Robert M. Groves
Georgetown University

James S. Jackson
University of Michigan

G. Peter Lepage
Cornell University

W. Carl Lineberger
University of Colorado

Stephen L. Mayo
California Institute of Technology

Victor R. McCrary
Morgan State University

Emilio F. Moran
Michigan State University

Ellen Ochoa
Lyndon B. Johnson Space Center

Sethuraman Panchanathan
Arizona State University

G.P. "Bud" Peterson
Georgia Institute of Technology

Julia M. Phillips
Sandia National Laboratories

Geraldine L. Richmond
University of Oregon

Anneila I. Sargent
California Institute of Technology

Member *ex officio*:
France A. Córdova
National Science Foundation

National Science Board Office
John J. Veysey, II,
Executive Officer (Acting)

Office of Inspector General
Allison C. Lerner, Inspector General

Research and Education Highlights

LIGO has done it again! For a fourth time, the NSF Laser Interferometer Gravitational-Wave Observatory (LIGO) in Livingston, Louisiana, and Hanford, Washington, has detected gravitational waves—ripples in space-time—from the collision of two neutron stars. The most recent detection, by both LIGO and Virgo (the European detector near Pisa, Italy), was the first observation of gravitational waves by three different detectors and marks a new era of greater insights and improved localization of cosmic events now available through globally networked gravitational-wave observatories. The three scientists who were seminal in the development of LIGO won the 2017 Nobel Prize in Physics for their work detecting gravitational waves—ripples in space-time created by the motion of massive objects in the universe. NSF initiated funding for what eventually became the LIGO project 40 years ago; and its continued commitment to LIGO's high-risk, high-reward research has launched a new field of gravitational astronomy that is transforming our understanding of the universe.
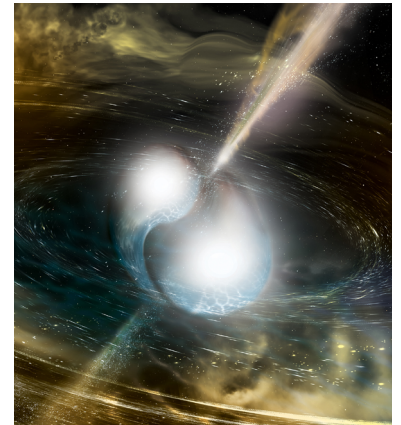

Credit: NSF/LIGO/Sonoma State University/A. Simonnet.

Low-cost mechanical device for minimally invasive surgery. Thanks to researchers and small business entrepreneurs funded by NSF, surgeons can now use a new type of mechanical instrument to perform complex, minimally invasive procedures, also known as laparoscopic surgery. This handheld instrument provides the same sorts of benefits as robot-assisted surgery, such as greater precision and functionality, but at a lower cost compared to existing robotic surgical systems. The technology even offers a higher degree of dexterity and intuitive control than traditional laparoscopic instruments, which require significant training and can be difficult and tiresome to use—leading to longer surgeries and higher costs. This innovation could result in less trauma and shorter recovery times after surgery. The simplicity and affordability of this device has great potential in underfunded medical centers in the U.S. and around the world.
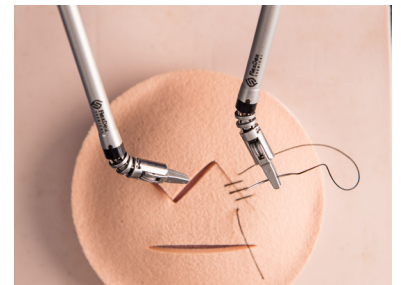
Credit: FlexDex Surgical.

First on-chip nanoscale optical quantum memory developed. With NSF funding, researchers have built the first nanoscale optical quantum memory device that could one day be used to create more reliable and secure internet communications. Quantum memory stores information in a similar fashion to the way traditional computer memory does, but on individual quantum particles—in this case, photons of light. This allows it to take advantage of the peculiar features of quantum mechanics to store data more efficiently and securely. The use of individual photons to store and transmit data has long been a goal of engineers and physicists because of photons' potential to carry information reliably and securely. Because photons lack charge and mass, they can be transmitted across a fiber optic network with minimal interactions with other particles.
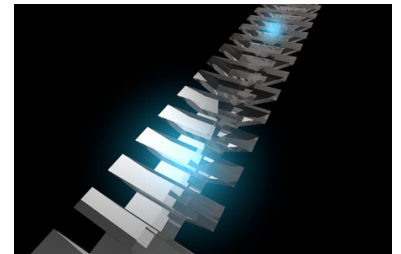

Credit: Ella Maru Studio.

Native students graduating with advanced science degrees. Northwest Indian College in Washington State offers one of the few Bachelor of Science in Native environmental science programs in the world. Supported by NSF's Tribal Colleges and Universities Program, the first student enrolled in the program graduated in 2009. Since then, 51 students have graduated from the program, with 10 more on track to graduate in 2017 and another 81 currently enrolled. Of the 2016 graduates, 6 are pursuing advanced degrees, and the first Ph.D. graduate will return to the college as a faculty member.

Credit: Marco Hatch, Western Washington University.

Scientists link recent California droughts and floods to distinctive atmospheric waves. California is one of the many places to have suffered from unforeseen weather emergencies in recent years—extreme drought in the 2013–2015 winter seasons and drenching storms causing floods and mudslides this past winter. Scientists at the National Center for Atmospheric Research have discovered a wave pattern, wavenumber-5, that emerges in the upper atmosphere and circles the globe. This pattern may sometimes make droughts or floods in local areas, such as California, more likely to occur. Increasing our understanding of the wave pattern, its formation, seasonal nature, and strength holds the promise of better understanding and predicting weather patterns in California and around the world.
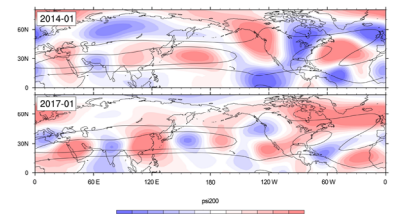
Credit: Haiyan Teng and Grant Branstator, ©UCAR.

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