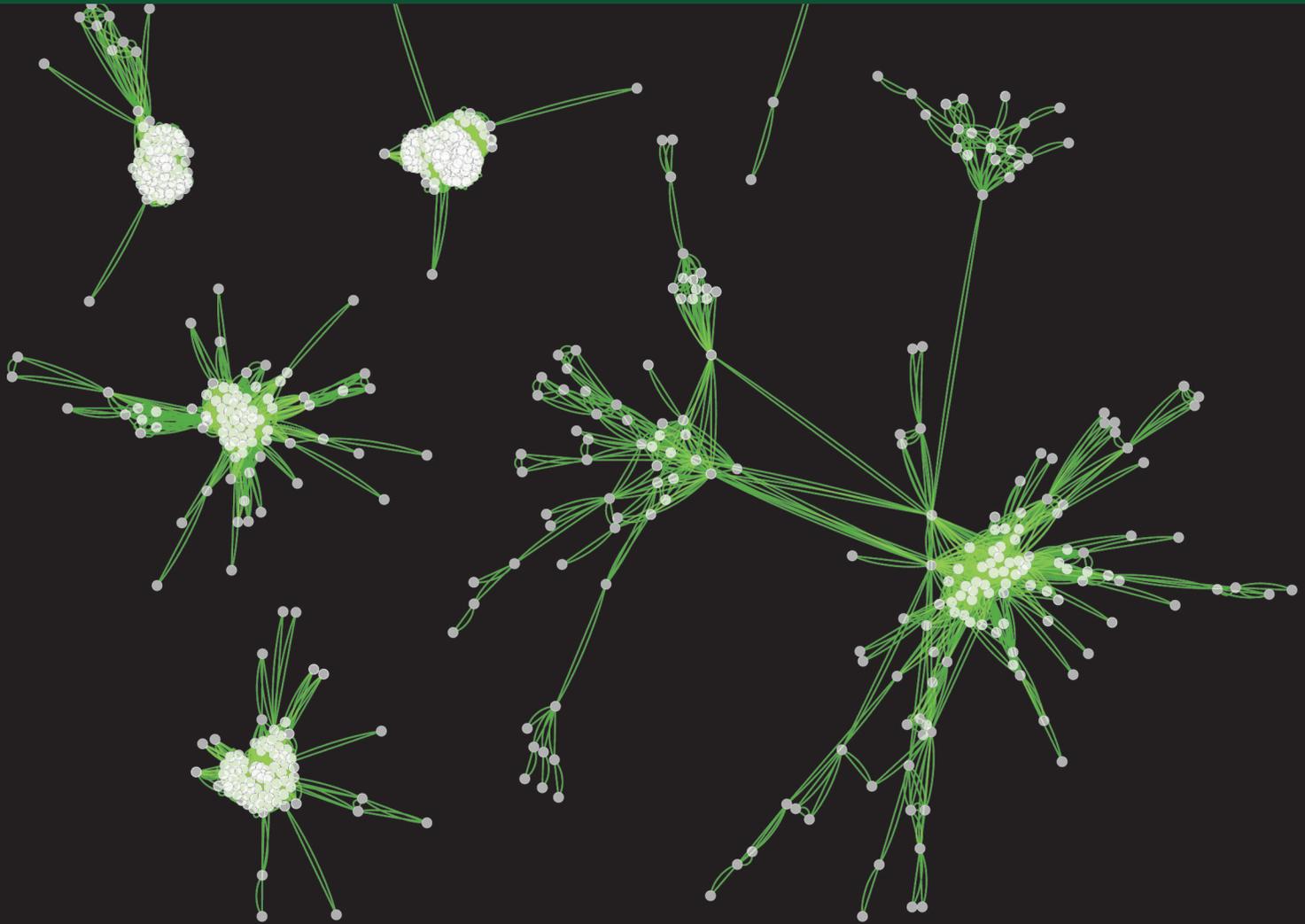


INNOVATING FOR THE NATION'S FUTURE



Office of International and
Integrative Activities



National Science Foundation

Forging the Frontiers of Discovery

Knowledge is not bound by institutional walls, state lines, national borders or traditional divides between disciplines. Likewise, the pursuit of knowledge is driven by collaboration across boundaries. As the United States' premier fundamental science agency, the National Science Foundation (NSF) recognizes the cross-cutting nature of science. Interdisciplinary and international partnerships not only advance the frontier of science and drive innovation, they ensure that the nation remains a preeminent leader in the global science, technology, engineering and mathematics (STEM) enterprise.

As science and engineering (S&E) expertise and infrastructure advance across the globe, the NSF Office of International and Integrative Activities (IIA) plays a pivotal role in promoting and sustaining U.S. leadership within the global scientific enterprise.

Building Capacity for Global Leadership

Through its diverse interdisciplinary and international research and education programs, IIA investments enhance scientific discovery, strengthen research infrastructure, support a diverse and technically trained workforce, and expand U.S. researchers' access to world-class facilities, expertise and data—both at home and abroad.

For example, the Major Research Instrumentation (MRI) program has invested in more than 4,000 state-of-the-art instrumentation projects in every U.S. state. The Experimental Program to Stimulate Competitive Research (EPSCoR) has supported more than 5,000 researchers since its inception and provides physical, human and cyberinfrastructure aimed at improving research competitiveness. The East Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI) program has supported more than 2,500 next-generation scientists and engineers to conduct research overseas and to lay the groundwork for future professional collaborations. Additionally, IIA highlights the extraordinary contributions of individual scientists and engineers through prestigious national and presidential honorary awards.

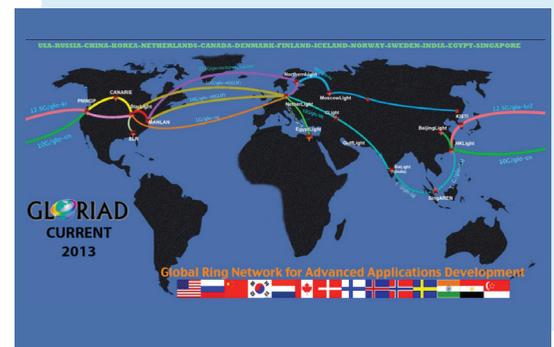
IIA's unique blend of programs and initiatives enhances the national capacity for research and education excellence. By emphasizing cooperation, innovation and broad participation, IIA strengthens the nation as a knowledge-based society.



The new Science and Technology Center for Brains, Minds & Machines works to understand intelligence and how it emerges from brain circuitry technology.



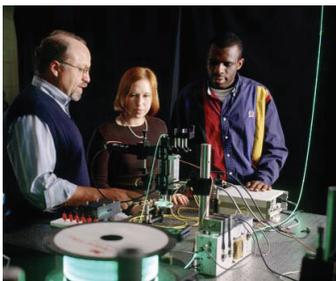
An EPSCoR-funded graduate student works with nanomaterials to improve sensor technology.



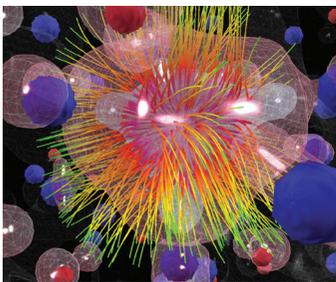
The Global Ring Network for Advanced Applications Development transmits entire libraries of information in seconds, allowing researchers worldwide to collaborate efficiently.

Fostering Cross-Boundary Transformations

IIA works across disciplinary and geographic boundaries to lead and coordinate strategic programs and opportunities that advance research excellence and innovation; develop human and infrastructure capacity critical to the U.S. S&E enterprise; and promote global engagement of scientists and engineers at all career stages. IIA consists of the three following complimentary sections.



Experimental Program to Stimulate Competitive Research (EPSCoR) strengthens research and education in S&E throughout the U.S. by providing programs and opportunities that stimulate sustainable improvements in research and development capacity and competitiveness. It advances S&E capabilities in EPSCoR jurisdictions for intellectual capacity development (including groups underrepresented in STEM), innovation and overall knowledge-based prosperity.



Integrative Activities (IA) incubates NSF-wide initiatives that capitalize on new interdisciplinary S&E concepts and generates research-based discoveries for societal benefit. IA supports building the nation's scientific infrastructure and intellectual capacity. IA also manages prestigious honorary awards, such as the President's National Medal of Science and the Alan T. Waterman award, and the congressionally mandated Committee on Equal Opportunities in Science and Engineering.



International Science and Engineering (ISE), as the focal point for international collaboration across NSF, catalyzes S&E activities throughout the world. ISE builds effective partnerships throughout the global S&E research and education community, and supports U.S. researchers engaged in international collaborations in priority research areas.

Catalyzing Real-world Results

IIA enhances the nation's S&E enterprise by investing in fundamental research, the current and next generation of scientists and engineers, and infrastructure that underpins discovery and innovation. The examples here, a few of many, epitomize the tangible work IIA supports—research and education efforts that continue to enhance lives and strengthen national prosperity.



Bomb-proofing Airports

Funded by an MRI grant, researchers developed an ultra-short pulse laser that underpins BioPhotonics Solutions, a company that sells technology to laser manufacturers. In airport screenings, one of the company's newest lasers detects combustible materials, such as powdered ammonium nitrate, in amounts 1/1000th smaller than a grain of sugar.



Fostering the Next Generation

Transforming the frontiers of S&E requires a trained, motivated and diverse workforce—one drawn from all segments of the nation's population. To promote the development of the next generation of talented scientists and engineers and to broaden participation in the U.S. STEM workforce, IIA supports students from underrepresented groups through hands-on STEM research and educational experiences. One such initiative is the IIA-coordinated NSF Summer Scholars Internship Program. Since 2000, approximately 340 students from groups underrepresented in STEM have participated in the Summer Scholars program.

“Touchy-feely” Technology Transfer

No-pressure keyboards ubiquitous in Apple Inc. products were originally developed by a University of Delaware researcher with EPSCoR support. To help people with hand disabilities, he imagined a keyboard that required a softer touch. His innovation led to the startup company, FingerWorks, which created some of the world's first tablet computers with multi-touch technology. Apple acquired FingerWorks, and the rest is history. Apple sold more than 55 million iPhones in the final quarter of 2013 equipped with a touch keyboard.



Global Partnerships for Extreme Weather

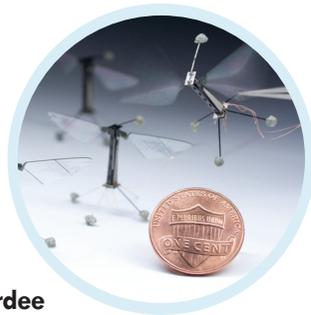
In the first decade of the 21st century, 17 Atlantic Ocean tropical cyclones each caused at least \$1 billion in property damage. Hence, graduate students supported by IIA set out to study weather systems such as cyclones, which originate in the West African region and then head westward to U.S. and Caribbean waters. New knowledge about the effects of such extreme weather systems enables U.S. policymakers and local planning officials to create policies to help mitigate the impact of these storms, in turn, reducing shoreline communities' vulnerability and economic loss.



Saving Statues

Bronze statues deteriorate from exposures to pollutants, extreme temperatures and precipitation. When left unprotected or improperly treated, they degenerate, resulting in major restoration costs for governments, museums and historical societies. BronzeShield™, a newly licensed polymer developed with EPSCoR support, allows the original patina of bronze to remain while protecting it from ultraviolet radiation, salt, moisture and vandalism. The product lasts 10 times longer than traditional wax treatments.

Credits: (left top to bottom) Marcos Dantus, Department of Chemistry, Michigan State University (MSU); Kurt Stepnitz, MSU; National Science Foundation (NSF); Gregory Jenkins, Howard University; others Thinkstock



All the Buzz for an Honorary Awardee

Taking inspiration from nature and using knowledge of the biomechanics of flying insects, Robert Wood, a 2012 Alan T. Waterman Award winner, used specialized materials and innovative fabrication techniques to assemble a swarm of insect-like flying robots. His “robobees” are all the buzz for artificial pollination, security surveillance and environmental monitoring in addition to their usefulness in furthering studies in micromechanics, microelectronics and nano-fabrication.



Robotics Serving Humanity

In 2012, 19 percent of the U.S. population were age 60 or over. This percentage is projected to increase to 27 by 2050. Hence, service robots, which constitute a projected multi-billion-dollar world market, will contribute directly to the quality of life of the nation’s older adults. These handy helpers will prolong independent living and decrease the burden on caregivers. Jaemi, a humanoid robot, embodies efforts by U.S. and Korean research collaborators to advance humanoid development. This international team seeks to enable robots to interact in real-time, socialize with humans and handle objects.



Implantable Devices

Almost 26 million Americans, or 8.3 percent of the U.S. population, suffer from diabetes. Three-dimensional printing offers mass-manufactured, implantable blood glucose sensors. Original prototypes made from standard filament were toxic when implanted inside the human body. Researchers found a novel way to replace such toxic substances with naturally occurring riboflavin, or vitamin B2, thereby making the devices safe for implant. IIA-supported biological engineering students received international training in this field at one of Europe’s leading science institutes.

Improving Efficiency in Solar Cells

EPSCoR-supported Ph.D. students at the University of Arkansas, Fayetteville have developed methods to make solar panels more efficient while reducing production costs. Their startup company, Picasolar, recently won the Massachusetts Institute of Technology Clean Energy Prize for its patent-pending technology. Improving silicon solar cell efficiency by as much as 15 percent, this technology has the potential to save solar panel manufacturers as much as \$120 million annually.



Extending the Shelf Life of Food and Medicine

The Center for Layered Polymeric Systems created new and improved plastic wraps to enhance them as gas barriers and protectors. The ultra-thin wraps, comprised of 256 alternating polymer layers, are not only thinner and stronger than standard wraps, they dramatically reduce gas permeability by a factor of two to three. These wraps increase the shelf life of foods, electronics and medicines.

More Ways

IIA Impacts People's Lives

IIA extends the reach of S&E by encouraging, identifying and funding the best ideas, most promising people and state-of-the-art infrastructure. Here are a few examples of more ways IIA research directly impacts society.

Accelerating data sharing across the globe

Analyzing how light can restore heart function

Building more energy-efficient IT systems and software

Cleaning up toxic chemicals

Creating better batteries with nanotechnology

Designing water purification technologies

Forecasting sea-level change

Identifying solutions for hydro-sustainability

Improving biomedical imaging

Mapping evolving ecosystems

Miniaturizing sensors for health monitoring

Offering inquiry-based, hands-on science learning

Predicting volcanic behavior

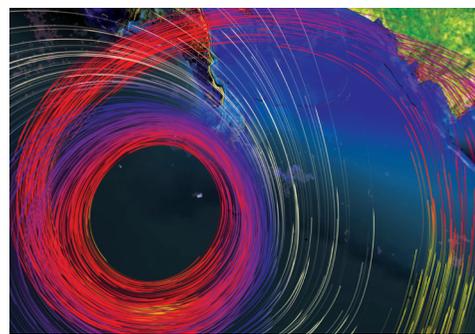
Preventing wildfires

Promoting international research experiences for students

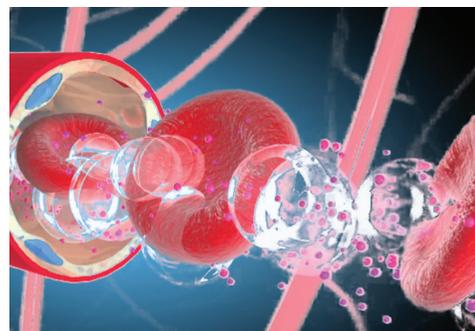
Providing access to powerful scientific equipment

Supporting underrepresented minorities in STEM

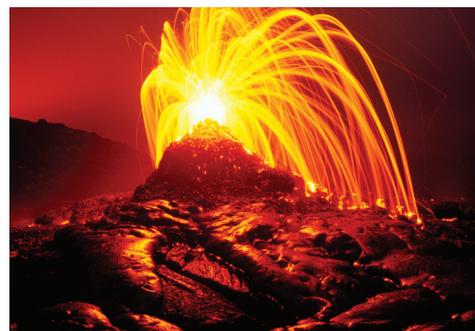
Terminating tumors



Several coastal states (Ala., La. and Miss.) supported by EPSCoR are collaborating to build an integrated coastal hazards research infrastructure capable of simulating dynamic Earth surface processes such as hurricanes.



A new treatment enables medication to slip past the brain's protective barrier and strike down malignant tumors directly.



U.S. researchers in Guatemala use mini-earthquake activity to predict active volcanoes capable of large, damaging eruptions.

Innovation

Through Team Science

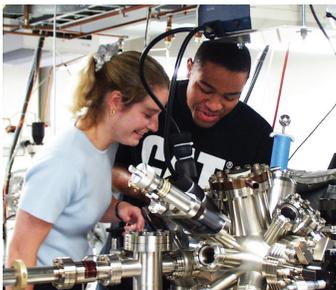
Today, the generation of knowledge takes place in a dynamic, complex and competitive international environment. IIA invests in multi-researcher, multi-institutional efforts and administers programs that integrate diverse disciplinary knowledge and leverage resources and talent.



IIA-funded **Science and Technology Centers (STCs)** conduct world-class research on national issues of importance. The Center for Embedded Networked Sensing has developed state-of-the-art wireless sensing systems and applied them to critical scientific and societal pursuits such as detecting environmental contaminants, monitoring major storms and measuring earthquake aftershocks. Institutions participating in the 14 active STCs are located across the nation in 29 states, the District of Columbia and Puerto Rico.



Through activities such as the **Career-Life Balance Initiative (CLB)** and the **Gender Summit 3 - North America**, IIA fosters policies and program opportunities that attract, retain and promote women in STEM professions. CLB works to harmonize family friendly policies across federal agencies and provide NSF-wide training on implicit career-life balance bias. In FY 2014, an international panel, including participants from the U.S., Canada, Europe and Mexico, was held in Washington, D.C., at the Gender Summit 3 – North America to exchange ideas and lessons learned about CLB policies and practices.



EPSCoR Research Infrastructure Improvement (RII) Track-1 investments support sustainable improvements throughout the U.S. in research areas that offer the best potential to improve future R&D capacity and competitiveness. Currently, 25 states, two territories and one commonwealth are eligible to compete for RII funding. In FY 2013, RII Track-1 awards supported 1,535 faculty members who produced 679 publications and were awarded 12 patents; the group also has 55 patents pending.



Partnerships for International Research and Education (PIRE), an NSF-wide program, supports international activities across all NSF-supported disciplines. PIRE supports projects that would not be possible without international collaboration. PIRE investments have built networks involving U.S. researchers from 35 states and 53 collaborating partner countries.



NSF 14-806



March 2014

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