

NSF AT WORK



An NSF and BEA study underscores the importance of R&D on the U.S. economy, stating that the U.S. GDP would be higher if research and development were treated as an investment. Credit: © 2007 JupiterImages Corporation.

Research and Development Bolsters U.S. Economic Growth

The Gross Domestic Product (GDP) would be nearly 3 percent higher each year between 1959 and 2004--\$284 billion higher in 2004 alone--if research and development (R&D) spending were treated as investment in the U.S. national income and product accounts.

The National Science Foundation (NSF) and the Bureau of Economic Analysis (BEA) partnered to produce these estimates as part of an ongoing activity to illustrate how spending on R&D affects U.S. GDP.

Other major findings include:

- R&D accounts for 5 percent of real GDP growth between 1959 and 2004, and 7 percent between 1995 and 2004. This ramp-up in R&D's contribution helps explain the pick-up in economic growth and productivity since 1995.
- Information, communication and technology and biotechnology-related industries account for two-thirds of the business sector's R&D contribution to GDP growth between 1995 and 2004.
- Recognizing R&D as investment boosts the level of state GDP the most in New Mexico (8.2 percent) and in Maryland (6.2 percent) between 1998 and 2002.

To learn more about the report, visit the [NSF press release](#).

Technology to the RESCUE

A well-planned and coordinated response to disasters and emergencies can minimize injuries and prevent the loss of life. In order to successfully respond to a crisis, first responders and local government officials need to process a flood of information and communications so they can make sound decisions quickly.

The Responding to Crises and Unexpected Events (RESCUE) project is working to transform how communities and first responders plan for and respond to both natural and man-made disasters by turning new technologies and cutting-edge research into practical tools for emergency planners and responders. Funded by the NSF, RESCUE's goal is to dramatically improve the ability of emergency responders to gather, process and disseminate information with each other and the general public.

RESCUE has participated in several emergency preparedness drills with local responders to analyze how effective the potential response is and to find ways RESCUE expertise can help emergency personnel. These drills and exercises have already produced useful new tools and insights that will be put into place in the event of a disaster. See the [NSF press release](#) for more.



A demonstration of the EvacPack, a high-tech tool developed by the RESCUE team. The pack allows the user to send and receive up-to-the-minute information during a disaster response, including video, audio and text-based data. Credit: University of California, Irvine.

Preparing Teachers for Success



NSF's Noyce Scholarship program gives future math and science teachers classroom experience. Here, Noyce scholar and middle-school science teacher, Enriqueta Ramirez, helps a student with an experiment. Credit: Claremont Graduate Univ., Teacher Education Internship Program.

Like doctors in training, future math and science teachers in New York University's (NYU) Teaching and Learning Residency program get real-life exposure to the demands of their profession while learning their craft from a team of experts. Recruited from among undergraduate science, technology, engineering and math (STEM) majors, the prospective teachers are placed in exemplary New York City math and science classrooms in high-needs secondary schools and also attend weekly seminars designed to introduce them to the content and pedagogy involved in teaching math and science.

The NYU program is one of 16 projects funded in 2007 through NSF's Robert Noyce Scholarship program. Successful completion of the residency makes STEM majors eligible for a \$10,000 undergraduate scholarship, plus a \$15,000 scholarship for a fifth-year program leading to teacher certification and a master's degree in science or math education.

To date, 91 awards to institutions in 32 states have been made under the Noyce Scholarships. For more on the program, see NSF's ["Cultivating Math and Science Teachers for High-need School Districts."](#)

NSF "Bytes" Into Computing Education

NSF's Directorate for Computer and Information Science and Engineering has awarded grants for its Pathways to Revitalized Undergraduate Computing Education (CPATH) program, an initiative that aims to transform undergraduate computing education on a national scale. More than 25 institutions across the country received grants totaling \$6 million.

Despite the pervasive impact of computing and the creative efforts of individuals in academic institutions, undergraduate computing education often looks much as it did several decades ago. Enrollment in computer science programs in the United States has declined in recent years. In order for the nation to maintain its competitive edge, computing classes and curricula must keep students engaged while preparing them for careers in the 21st century.

The CPATH initiative should help create better computing education at the undergraduate level. Creating successful programs that can be replicated at other colleges and universities is key to the CPATH program's goal of transforming undergraduate computing education. See ["NSF Provides Funding to Transform Computing Education"](#) for more information on the program.



Engineering students learn 3-D modeling at Michigan State University using advanced computing. New NSF grants seek to transform computing curricula and better prepare students for the workforce. Credit: H. J. Seeley, © Michigan State Univ. College of Engineering.

DID YOU KNOW?

Some 178 Nobel Laureates have been supported by the public through grants from NSF and often from other federal agencies at some point in their careers, and sometimes throughout their careers. By the time these awardees are recognized internationally, their early fundamental research has developed implications for such broad areas as the environment, business and decision making.

NSF congratulates the 2007 Nobel laureates, particularly Leonid Hurwicz, Eric Maskin and Roger Myerson, who earned the prize for their economics research. All three received NSF support for the research that earned them this year's prize. In fact, since 1969, when the Nobel Prize in economics was established, NSF has funded 38 recipients of the Nobel economics honor.

See NSF's special report, ["The Nobel Prizes: the NSF Connection"](#) for more details on NSF-supported laureates.

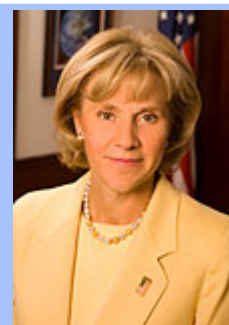
NSF's ADVANCE Program Changes the Face of Academic Science and Engineering

On October 17, Dr. Kathie L. Olsen, NSF's deputy director, testified before the House Science and Technology Committee's Research and Science Education Subcommittee about women on science and engineering academic faculties. In particular, Olsen highlighted NSF's ADVANCE program, which aims to improve the environment for female science and engineering faculty at academic institutions.

Since the program's inception in 2001, ADVANCE funding has gone to 58 institutions in 36 states. Across-the-board increases in the number of women faculty and advancement toward salary and promotional parity have been reported by ADVANCE campuses.

At the hearing, Olsen and other witnesses pointed to the success of the ADVANCE program as evidence that institutional transformation is essential to increasing the ranks of women in science and engineering academic departments across the country. During questioning from the members of the subcommittee, the panelists emphasized that reducing implicit bias in academic institutions benefits everyone, not just women. In concluding the hearing, Dr. Olsen told the subcommittee that the institutional transformation ADVANCE promotes is "not just good for science, it's good for America."

For more information on ADVANCE, please visit the [program website](#).



NSF Deputy Director
Kathie L. Olsen
Credit: Sam
Kittner/kittner.com

**Pictured below
are examples of
women and girls
doing science in
ADVANCE and
other NSF-
supported
programs.**

				
<i>BUGS (Bringing Up Girls in Science program)</i>	<i>SciTech Center Supported by ISE (Informal Science Education) program</i>	<i>Robert Noyce Scholarship program</i>	<i>SPICE (Science Partners for Inquiry- based Collaborative Education)</i>	<i>ALISON (Alaska Lake Ice and Snow Observatory Network)</i>

Please click on an image above for full caption, credit and usage information.

NSF IN THE NEWS

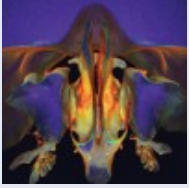
[Study Shows Road to Ph.D. Long, Difficult](#) -- *The Daily Texan* (10/5/2007) -- A study done by NSF shows the road to a doctorate is a long one, often taking seven or eight years in some fields. This might explain why only 51,000 people nationwide are expected to receive their doctoral degree this year, compared with more than 1.5 million bachelor's degrees expected to be conferred this year, according to the National Center for Education Statistics.

[Science Leader Airs Concerns: U.S. Fails to Properly Train Future Scientists](#) -- *StarLedger* (10/16/07) -- America may be holding its own as a research powerhouse, but it isn't working hard enough to train future scientists and engineers, according to the head of the federal agency responsible for basic research. "Math and science education are the foundation of the 21st century work force," said Arden Bement, director of the National Science Foundation, speaking yesterday to dozens of educators from area colleges and schools at Drew University in Madison, N.J. "Your roles as educators who inform, instruct and inspire is critical to both the region and the nation."

[Where Are the Geek Women?](#) -- *Red Herring Magazine* (10/19/07) -- Women make up 46 percent of the U.S. labor force but hold just 22 percent of tech jobs. The world of tech remains overwhelmingly male, especially in the top rungs. The gender gap is most obvious in the graduate schools that fill the ranks of technology leadership, although there are signs of progress. Between 1996 and 2005, female representation in the United States increased from 12 to 18 percent among engineering Ph.D.s, from 13 to 15 percent among physics Ph.D.s, and from 15 to 20 percent among computer science Ph.D.s, according to data from NSF.

THE POWER OF PICTURES Check out the wonder of science through this first-place winning imagery, selected from more than 200 entries! NSF and the journal *Science* have announced the winners of their fifth annual International Science and Technology Visualization Challenge. Illustrators, photographers, computer programmers and graphics specialists from 23 countries submitted visualizations that intrigued, explained and educated.

Photography (tie)



What Lies Behind Our Nose? Human anatomy it may be, but the airways that riddle the space behind our noses take on an alien aspect in this unearthly rendering created by Kai-hung Fung, a radiologist at the Pamela Youde Nethersole Eastern Hospital in Hong Kong. A computed tomography (CT) scan from a 33-year-old Chinese woman being examined for thyroid disease provided the raw data for Fung's rendering. He stacked together 182 thin CT "slices" to create a 3D image looking upward at the sinuses from underneath the head.

Credit: K. Fung, Pamela Youde Nethersole Eastern Hospital



Irish Moss. The slimy, glistening mass of seaweed washed up on a sandy beach seems light-years distant from this feathery, dendritic image of Irish moss created by Andrea Ottesen, a botanist and molecular ecologist at the University of Maryland, College Park. "If you pull [it] out of the ocean, it's folded on itself--really curled up," she says. It wasn't until after she had "pressed every one of those little ends down with sea stones" and left it to dry for 2 days that the seaweed's beautiful, simple shape was revealed.

Credit: A. Ottesen, University of Maryland

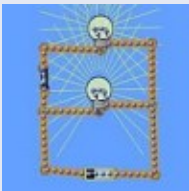
Informational Graphics



Modeling the Flight of a Bat. Most short-nosed fruit bats spend their nights flitting about in the jungles of Southeast Asia. Interested in the mammals' flight dynamics, engineer Kenneth Breuer used lasers and a motion-tracking system to record how their wings and the air around them distorted as the animals flew in a wind tunnel. Aeronautical engineer David Willis, computer scientist Mykhaylo Kostandov, and their colleagues then created a computer model of bat flight. "When viewed in slow motion," says Willis, "bat flight is beautiful and complex. The goal of this illustration is to capture that beauty while also adding scientific merit."

Credit: K. Breuer, D. Willis, M. Kostandov, D. Riskin, J. Paire, D. Laidlaw, S. Swartz, Brown University

Interactive Media (screen shots)



Physics Education Technology (PhET) Project. Nobel laureate Carl Wieman was looking for a way to explain his research into Bose-Einstein condensates--strange assemblies of supercold atoms that lose their individuality and form "superatoms"--to both physicists and schoolchildren. He began creating computer simulations, but he swiftly realized their wider potential for teaching physics of all types and initiated the [Physics Education Technology \(PhET\)](#) project at his then-home of the University of Colorado, Boulder, and began churning out simulations. The PhET Web site now lists 65 simulations available for free download.

Credit: S. McKagan, C. Wieman, K. Perkins, W. Adams, M. Dubson, N. Finkelstein, L. Koch, P. Loeblein, C. Keller, D. Harlow, N. Podolefsky, S. Reid, C. Malley, J. de Goes, R. LeMaster, M. Gratny, L. Wellmann

Non-Interactive Media (screen shots)



Nicotine: The Physiologic Mechanism of Tobacco Dependence. With every drag a smoker takes, trillions of nicotine molecules stimulate the release of pleasure-inducing dopamine. But as nicotine is eliminated, dopamine levels fall, and smokers crave another dose. Over time, the brain becomes dependent on the drug. The resulting addiction claims four million lives a year from smoking-related diseases. That is the message of this video, created by art director Donna DeSmet, animator Jason Guerrero, and their team at New York City-based Hurd Studios, a scientific visualization company specializing in "cutting-edge science with educational aspects," according to President Jane Hurd.

Credit: J. Hurd, D. DeSmet, J. Guerrero, D. Tolentino

Caption text from Ben Lester, Science 317: 1857-1863 (2007). Reprinted with permission from AAAS. Full story at <http://www.sciencemag.org/sciext/vis2007/>.



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