



National Science Foundation  
WHERE DISCOVERIES BEGIN



December 2012

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## Graduate Research Fellowships: NSF Signature Program Marks 60 Years

What do Secretary of Energy Steven Chu, Google founder Sergey Brin, *Freakonomics* co-author Steven Levitt and ant biologist Edward O. Wilson have in common? All received funding for their graduate education through NSF's **Graduate Research Fellowship Program**.

The fellowships support outstanding students pursuing research-based graduate degrees in science, technology, engineering and mathematics disciplines--in fields as diverse as microbiology, earthquake engineering and public policy. Since 1952, NSF has selected more than 46,500 students as Graduate Research Fellows, 40 of whom earned a Nobel Prize later in their careers.

The program was one of the first federal grant opportunities offered by NSF after the agency's formation, funding 573 predoctoral and postdoctoral fellowships the first year. It remains highly competitive, offering fellowships to 2,000 students annually from a pool of about 12,000 applicants in recent years.

"This is NSF's signature program," said program director Gisele Muller-Parker. "These students have demonstrated their potential to be high-achieving scientists and engineers. Many later credit the support they got through this program as a keystone to their careers as scientists and engineers."

As part of the program's 60th anniversary celebration, current Graduate Research Fellows were challenged to create 90-second videos explaining how their NSF-funded research will shape the future. The winners of this video contest will be announced at an anniversary ceremony at NSF on December 5, featuring NSF Director Subra Suresh and Secretary of Energy Chu.



Biologist Edward O. Wilson received one of the first NSF graduate research fellowships, in 1952. *Credit: Beth Maynor Young*

## Predicting Storm Surges and Coastal Property Values

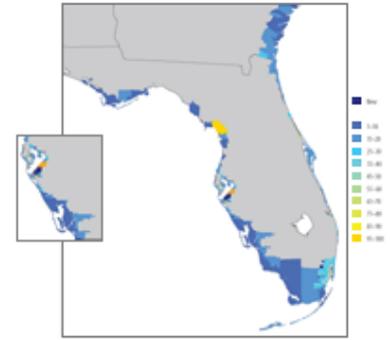
By combining diverse datasets as well as scientific and engineering models, NSF-funded researchers are working hard to quantify how future storms and other disasters may impact U.S. coastal property.

One study, by a team from Harvard University, the Massachusetts Institute of Technology, and Atmospheric and Environmental Research, Inc., projects the potential inundation from tropical storm surges at the level of zip codes. The research assumes that past patterns in coastal

sea-level change will continue over the coming decades. Learn more [here](#).

Another research group, at Florida International University, developed tools for quantifying the effects of a disaster on property values--while studying the effect of the Deep Water Horizon oil spill in the Gulf of Mexico. The team analyzed massive datasets on property sales and geographical locations to find patterns of potential significance.

Although the team's model was motivated by the oil spill, it can be applied to natural disasters. To test the model, the researchers studied the effects of Hurricanes Andrew (1992) and Wilma (2005) in Miami-Dade County, successfully identifying the geographical regions where property values declined. Learn more [here](#).



Tropical storm surge risk for Florida in 2030. *Credit: Ross Hoffman, AER*

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## Mississippi River Diversion Helped Rebuild Wetlands

The Mississippi River flood in the late spring of 2011 took lives and set records for damage to homes and crops. However, the flood also helped rebuild Louisiana wetlands, scientists report.

The U.S. Army Corps of Engineers took action to reduce the potential destruction from record levels of rainfall in the Mississippi River watershed by opening the Morganza Spillway. The controversial decision involved the deliberate flooding of 12,000 square kilometers (4,633 square miles) in rural Louisiana. The opening of the flood-control structure diverted water into the Atchafalaya River Basin and provided a large-scale experiment in how periodic natural flooding rebuilds marshes and other ecologically valuable wetlands.



Water flowing from the Morganza Spillway in May 2011. *Credit: Jennifer LaVista, US Geological Survey*

An **international team** that included several NSF-funded scientists analyzed the effect of sediment, usually held back by the levee system, that was deposited in the Mississippi Delta during the diversion. The analysis may help scientists and engineers develop ways of altering the levee system to restore some of the river's natural wetland-building capacity.

The **National Center for Earth-Surface Dynamics**, an NSF **Science and Technology Center**, was among the institutions participating in the study.

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## Profile: A Computer Scientist Who Studies Emotion

Rosalind Picard develops technologies for recognizing and responding to human emotion, or "affective" technologies. They can be applied to creating intelligent machines and to helping people who face challenges processing emotional information, including people with autism or limited vision.

**Picard**, an NSF-funded electrical engineer and computer scientist at the Massachusetts Institute of Technology Media Lab, is widely acknowledged for advancing the field of affective computing.

As she and her team members struggled to teach computers how to recognize digital bits related to emotion, she learned from the human brain and visual and auditory systems. The neurological functions associated with memory, attention and emotion especially intrigued her.

At first, Picard hesitated to move into research on emotion. As she read more about neuroscience and psychology, however, she realized that understanding emotion was critical in studying intelligent thinking, rational decision-making, perception--and almost every other area involved in artificial intelligence.



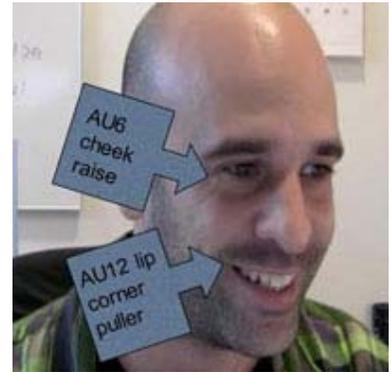
Computer Scientist Rosalind Picard. *Credit: Sunaina Rajani, NSF*

Since then, her team has developed Affdex and the Q Sensor and, with support from an NSF Small Business Innovation Research grant, founded the startup company **Affectiva** to market them.

Affdex is a technology that allows a computer with a webcam to identify and measure emotional states, such as pleasure and attention, from facial expressions. With these data, marketers can analyze consumer response to products or media. For example, Affdex graphs viewers' peak attention as they watch a commercial, allowing an advertiser to revise ads to be more effective.

The Q Sensor is a wireless, wearable biosensor that measures emotional arousal via skin conductance, a form of electrodermal activity that increases during states of anxiety, attention and excitement and reduces during states of relaxation and boredom.

Picard is thrilled to be a woman in science. She feels that women's ways of thinking and feeling contribute enormous value largely because they are different from men's perspectives. The more differences, she says, the more value to science--a field which always needs multiple perspectives to advance.



Scientists are developing technology that can analyze, for example, whether a smile represents delight or a different emotion. *Credit: Rosalind Picard, MIT*

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## Email "Vacations" Reduce Stress, Improve Concentration

Being cut off from work email significantly reduces stress and allows employees to focus better, according to a study supported by NSF and the U.S. Army.

Researchers at the University of California-Irvine, using heart rate monitors and software-tracking sensors, determined that workers who read email changed computer screens twice as often and remained in "high alert" states, with more constant heart rates.

People cut off from email for five days experienced less stress and more natural, variable heart rates. The latter also reported a greater ability to do their jobs and stay on task. Read more **here**.



*Credit: NSF*

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## Why We Need Insects--Even "Pesky" Ones

Many people would probably love to get rid of insects such as pesky mosquitoes, ants and cockroaches. But researchers have found that getting rid of insects could trigger unwelcome ecological consequences, such as the rapid loss of desired traits in plants--including their good taste and high yields.

A recent NSF-funded study, led by Anurag Agrawal of Cornell University, showed that evening primroses grown in insecticide-treated plots lost, through evolution, the defensive traits that helped protect them from plant-eating moths. What's more, the plants did so quickly--in only three or four generations.

The findings indicate that efforts to breed pest-resistant crops could pose substantial trade-offs. As Agrawal explains, the traits plants develop to defend against insects, such as the bitter taste of some fruits, are sometimes the traits that make the plants desirable. Learn more from this **press release** and **podcast**.



Evening primrose (yellow plants). *Credit: Anurag Agrawal.*

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## National Science Foundation in the News

**Science is the Key to Growth** (*New York Times*) - Former NSF Director Neal Lane cites the importance of federal investments in science to economic growth.

**High Anxiety: How Worrying About Math Hurts Your Brain** (*TIME*) - Research by Illinois

psychologists shows that anxiety about math can trigger a reaction in the brain that resembles pain.

**Spaced Out: Majority of Gen X Can't Identify Home Galaxy** (*MSNBC News*) - A survey by Michigan scientists found that only 43 percent of Generation Xers could identify a picture of a spiral galaxy.

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### They Come to Learn—But Do They Stay?

Do foreign-born nationals stay in the United States after earning a research doctorate from a U.S. institution?

U.S. universities are magnets for foreign-born nationals seeking to earn research doctorates in science, engineering or health. In 2010, nearly 40 percent of the doctorates awarded by U.S. universities in these fields went to foreign nationals. But what happens after graduation? Are foreign citizens also attracted to job opportunities in the United States?



*Credit: NSF*

After graduation, 20 percent returned to their country of origin, according to a 2008 survey. Among foreign graduates who did not return to their home country, nearly 90 percent remained in the United States. Among other factors, country of origin helped to predict the likelihood of staying in the United States. Over 90 percent of graduates from China remained in the United States after graduation, along with 88 percent of graduates from India and 84 percent of those from the former Soviet Union.

Read more in this **InfoBrief** from NSF's National Center for Science and Engineering Statistics.



*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. Its Fiscal Year 2012 budget is \$7.0 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 50,000 competitive requests for funding, and makes about 11,000 new funding awards. Contact NSF's **Office of Legislative and Public Affairs** at 703-292-8070 for more information or for permission to reuse newsletter images. Editor: Amber Jones. Contributor: Sunaina Rajani.*



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