National Science Foundation
WHERE DISCOVERIES BEGIN

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Ice Sheets Are Warming and Melting Faster

The edge of the Greenland ice sheet near Kangerlussuaq. *Credit: Peter West, NSF*

The planet's two largest ice sheets, in Greenland and Antarctica, have been losing ice at an accelerated rate during the past decade. This finding was recently confirmed by a comprehensive study of two decades of satellite measurements. The loss may have contributed several millimeters to the rise in global sea levels, according to the study.

An **international team** of 47 scientists compared data from radar and laser readings as well as measurements of the minute gravitational changes around the ice sheets. The researchers concluded that the mile-thick ice sheets that cover Greenland experienced the greatest loss, followed by ice sheets in West Antarctica and on the mainland Antarctic Peninsula. Only the East Antarctic ice sheet gained mass during the same period.

Since 1992, the melting is estimated to have contributed an average of 0.59 millimeters (0.023 inches) per year to sea-level rise. Overall sea levels have risen by about 3.3 millimeters (0.13 inches) per year during that time; most of the increase is due to thermal expansion of warming ocean waters.

Scientists are seeking reasons for the accelerated rate of ice loss, which was not predicted by most computational climate models. Glaciologist Ian Joughin of the University of Washington **points out** that increased ice discharge to the ocean can speed up the loss even further, in an accelerating cycle, as currents carry calved icebergs away to melt elsewhere and warm water flows farther up beneath the edges of floating ice sheets. Joughin is among the NSF-supported U.S. scientists participating in the international research.

In a related finding, a **separate team** of polar scientists reported that the western part of the massive West Antarctic Ice Sheet is experiencing nearly twice as much warming as scientists previously thought. The temperature at Byrd Station, an unmanned outpost in the center of the ice sheet, recorded an increase of 2.4 degrees Celsius (36 degrees Fahrenheit) in average annual temperature since 1958. That was three times greater than the average temperature rise around the globe.

Graduate Research Fellows Gain New Overseas Opportunities

Graduate Research Fellow Adam Booth in Norway. *Credit: Adam Booth, Caltech*

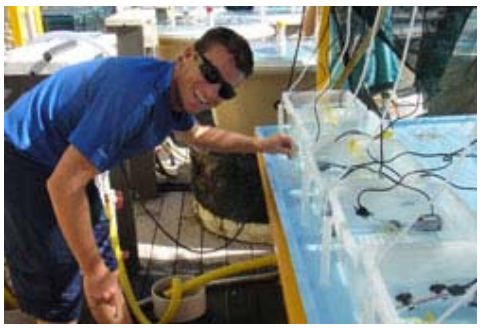
NSF Director Subra Suresh announced in December 2012 a program that will expand international research opportunities for NSF Graduate Research Fellows. The **Graduate Research Opportunities Worldwide** (GROW) program supports NSF's broader commitment to provide multiple pathways for U.S. science and engineering students and professionals to engage in international collaboration.

GROW was launched at a 60th anniversary celebration for NSF's Graduate Research Fellowship Program and includes initial agreements with science organizations in nine countries. Suresh said the collaborations "will prepare NSF Graduate Research Fellows to engage successfully in the global research enterprise by connecting them to leading scientists and research infrastructure around the world."

GROW builds on an existing effort NSF co-sponsors with Denmark, Finland, Norway and Sweden. In addition to those countries, the new endeavor will include co-funding by agencies in Japan, South Korea, Singapore, Switzerland and France.

Graduate Research Fellows selected to participate in GROW will be hosted by a science agency in a partner country for a period of three to 12 months. While overseas, they will receive a living allowance from the host country and pursue research in a host institution. They will also be eligible to receive an international travel allowance from NSF.

Profile: Decoding the Physics of the Ocean's Tiniest Critters



Roman Stocker conducting experiments on Australia's Great Barrier Reef. *Credit: Roman Stocker, MIT*

In his work at the interface of fluid mechanics and microbial ecology, Roman Stocker tries to duplicate life in the ocean in a test tube. He uses tools that measure the flow and behavior of fluids to study the lives of phytoplankton. They are the abundant marine microorganisms that produce a large portion of the earth's oxygen through photosynthesis.

Stocker and his environmental engineering colleagues at the Massachusetts Institute of Technology analyze the interactions between the organisms, their environment and their food sources. These studies of the tiny critters sometimes lead to improved understanding of global-scale environmental processes.

A **2009 study** showed that the coupling of phytoplankton swimming patterns with ocean currents leads to the formation of densely packed layers of the creatures, which could be precursors of toxic algal blooms. **Another study** from Stocker's research group found that marine microorganisms are strongly attracted to sulfur compounds, the chemicals that give the sea its characteristic smell. This behavior, the team believes, could alter the chemical properties of the ocean and potentially influence global climate by affecting cloud formation.

Recently, Stocker and his colleagues **showed** that ocean turbulence, including small whirls and eddies, affects the ability of marine bacteria to recycle organic material back into the food web that sustains all marine species.

At times, Stocker's work has attracted unexpected attention. A year ago, he and three engineering colleagues figured out how cats drink—leading to news coverage ranging from the front page of *The New York Times* to *"The Tonight Show With Jay Leno."*

*Learn more at **ScienceLives**, a feature of LiveScience.com produced in partnership with NSF.*

Doctorate Recipients Face a Tougher Job Market after Graduation

A researcher prepares samples for mass spectrometry research. *Credit: Argonne National Laboratory*

Individuals with a doctorate in science and engineering (S&E) tend to have much lower unemployment rates than those with an S&E bachelor's degree or the general population. However, this group of individuals is not immune to economic trends, and job prospects for new doctorate recipients have become somewhat bleaker recently.

In every broad S&E field, the proportion of new graduates who reported having definite plans for work or postdoc study at the time they completed their doctorate dropped in 2010 and 2011. This proportion reached or approached the lowest levels seen over the past 10 years. Within these fields, life sciences had the lowest proportion of definite commitments (63 percent in 2011, down 10 percentage points over the past 10 years). Physical sciences had the highest level of commitment (69 percent, down 3 percentage points over the past 10 years).

This downward trend was even more prevalent in every broad non-S&E field, however. In 2011, the proportion of doctorate recipients in the humanities with definite commitments reached its lowest point since 1997 (57 percent). The proportions of doctorate recipients in education and other non-S&E fields with definite commitments were lower than they have been at any point in the past two decades (68 and 71 percent, respectively).

Learn more in ***Doctorate Recipients From U.S. Universities: 2011***, a report from NSF's National Center for Science and Engineering Statistics.

Researchers Answer Tough Flu Questions

Health care worker administering the flu vaccine. *Credit: Doug Jordan*

Flu epidemics like the 2009 outbreak of the H1N1 virus raise critical questions for public health officials. Using TeraGrid supercomputers, researchers modeling such outbreaks can help policymakers locally, nationally and internationally evaluate strategies for both prevention and real-time response.

Epidemiological modeling--using computational tools to mimic how infectious diseases spread through populations--can help answer questions such as how limited amounts of vaccine should be distributed, whether schools should be closed and for how long, and which communities should get new medications first.

With NSF support, **researchers** used the Texas Advanced Computing Center's Lonestar system to model the 2009 H1N1 transmission within and among U.S. cities. The model showed the optimal choices for distributing the available antiviral medication, including regularly releasing stocks to cities in proportion to their populations. The findings indicate that antivirals can save lives and reduce transmission even in the absence of a vaccine.

Another research team, modeling the same flu outbreak using the Pople system at the Pittsburgh Supercomputing Center, found that schools may need to be closed eight weeks or longer to have a significant impact on reducing infection rates.
The Lonestar and Pople systems are part of the NSF-funded **TeraGrid** facility, an advanced cyberinfrastructure that integrates high-performance computers, data resources and experimental facilities around the world. The TeraGrid provides researchers with more than 750 teraflops of computing capability and access to more than 100 discipline-specific databases.

Did you know ... ? NSF publishes highlights of many research outcomes at "Science, Engineering and Education Innovation" on ***Research.gov****.*

Dinosaurs May be Older than Thought--by 10 Million Years

An artist's conception of *Nyasasaurus parringtoni*. *Credit: Mark Witton*

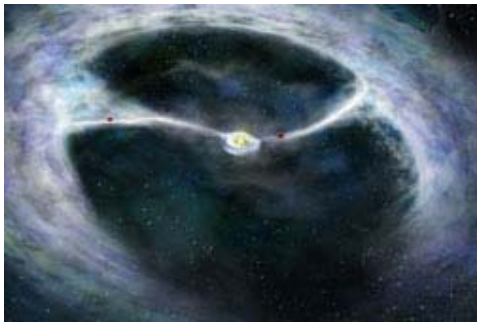
Scientists analyzing fossilized bones found decades ago in Tanzania may have identified the oldest known dinosaur.

Working with an upper arm bone and six vertebrae collected in the 1930s, an **NSF-supported team** led by biologist Sterling Nesbitt at the University of Washington determined that the animal stood upright, measured 2-3 meters (7-10 feet) long, and may have weighed between 45 and 135 pounds.

The newly named *Nyasasaurus parringtoni* lived in the Middle Triassic period, 10-15 million years earlier than dinosaurs were previously thought to have existed, according to fossil records. At that time, the world's continents were joined in the landmass called Pangaea.

In the fossilized bones, the team found characteristics found in previously identified early dinosaurs and their close relatives, such as disorganized bone tissues in the upper arm bone, indicating rapid growth.

Growing Pains: ALMA Observes Formation of a Star and Its Planets



An artist's conception of gas streamers crossing the gap. *Credit: Bill Saxton, NRAO/AUI/NSF*

Astronomers using the new Atacama Large Millimeter/submillimeter Array (ALMA) glimpsed a **stage of star formation** in which planets forming around a young star are helping the star continue to grow, resolving a longstanding mystery. In the emerging system, about 450 light-years from Earth, a complex gravitational dance was confirmed by observations using the NSF-supported instrument that is nearing completion on the high, dry plains of Chile's Atacama Desert.

As a young star gathers material from surrounding clouds of gas and dust, the material forms a flat, spinning disk around the star. Planets begin as small clumps within that disk, and, through their gravitational pull, add to their own mass. As the fledgling planets pull in more material, however, they leave gaps in the disk. Such gaps have been observed in the dust disks surrounding a number of still-forming solar systems, raising the question of how material gets through the gap in order to increase the mass of the star.

The international research team using ALMA found that the gap actually contains a thin region of residual gas, and that streamers of dense material cross the gap, probably tugged inward by the gravitational pull of the young planets. The scientists concluded that much of the material overshoots the planets and continues toward the inner disk, where the material can eventually add to the mass of the star. The process was predicted earlier by computer simulations. Before ALMA, however, the dense gas obscured the region from direct observation.

Winners of 10th Visualization Challenge Announced

Some of science and engineering's most powerful statements are not made by words alone. Illustrations can help explain, explore and encourage interest in systems and phenomena ranging from cell composition to chemical catalysts to computational modeling. For 10 years, NSF and the journal *Science* have co-sponsored the annual **International Science & Engineering Visualization Challenge** to recognize superb examples of the visual communication of science for educational and journalistic purposes. Winners were recently announced in five categories: Photography, Illustration, Posters and Graphics, Games and Apps, and Video. The winning entries are featured in the February 1 issue of *Science* and on the Challenge website.

These fantastical structures are the microscopic crystals that make up a sea urchin's tooth. *Credit: Pupa U. P. A. Gilbert and Christopher E. Killian; University of Wisconsin, Madison*

America's Scientist Idol to Be Named at AAAS Meeting!

Credit: NSF

NSF will highlight several of its investments and sponsor the selection of an outstanding science communicator--America's Scientist Idol--at the **annual meeting** of the American Association for the Advancement of Science in Boston, Massachusetts, February 15-18, 2013. In keeping with the meeting theme of "The Beauty and Benefits of Science," NSF's exhibits (at booth 801 in the exhibit hall) will feature the beauty of bat wings as well as the benefits of climate research and a new back brace developed with funding from NSF's Innovation Corps program. NSF-hosted workshops will include the scientist idol competition, an NSF town hall, an exploration of graduate education opportunities and more. A special gallery will display winners of the International Science and Engineering Visualization competition.

National Science Foundation in the News

Race Is On to Find Life Under Antarctic Ice *(National Geographic)*--NSF-supported drilling is studying the web of lakes, streams and rivers beneath the ice.

Telescope-toting balloon launches from Antarctica *(MSNBC)*--A giant helium balloon carried instruments that measured submillimeter light from star nurseries in the Milky Way.

Googled or Dished? *(US News & World Report)*--Google began as a public investment in science; its founders got early funding from NSF.

Apps Lead the Way to the Next Innovation Hypercycle *(Forbes)*--NSF uses the app model for NanoHub.org in order to advance research and development in nanoscale electronics.

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 was $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.*

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