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January/February 2009

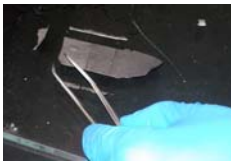
NSF AT WORK

Our Readers' Favorites in 2008

Readers' favorite news and discovery stories based on 2008 Web visitor statistics are highlighted below.

The Origins of Google

In 1994, Larry Page was a graduate student supported by an NSF grant to Stanford University for the Digital Library Initiative. Page and fellow student Sergey Brin looked at the World Wide Web as a collection of pages connected through a family tree and soon uncovered the missing links in Web page ranking.

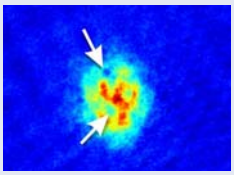


Supercapacitors: Key to a Green Energy Future?

Capacitors made of carbide-derived carbon can store an exceptionally high amount of energy by precisely matching nanopore size to the ions that pass through them. This research, conducted at Drexel University, could lead to a new class of energy storage devices.

Beyond Cold: How the World Works at Minus 459 Degrees

When atoms are cooled to 10 billionths of a degree, the weird world of quantum mechanics begins to dominate behavior. After the atoms expand for a mere 50 thousands of a second, quantum vortices begin to swirl, slowing down and eventually trapping the atoms. The result is a "quantum simulator" that can be used to study the fundamental properties of matter.



Fossil Feathers Preserve Evidence of Color

Traces of organic material found in fossil feathers are remnants of pigments that once gave birds their color. A striped feather found in 100-million-year-old rocks from Brazil provide evidence that the pigment melanin can resist decay for millions of years.

Global Warming Affects World's Largest Freshwater Lake

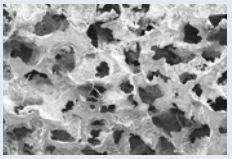
The temperature of the world's largest lake, located in Siberia, is rising. The data collected from Lake Baikal over 60 years shows that its microscopic food web is reorganizing, a striking result of global warming.

The Plastic Brain

Training can increase fluid intelligence, once thought to be fixed at birth. Fluid intelligence draws on the ability to understand relationships. New research shows that this type of intelligence can improve with memory training.

Metal Foam Has a Good Memory

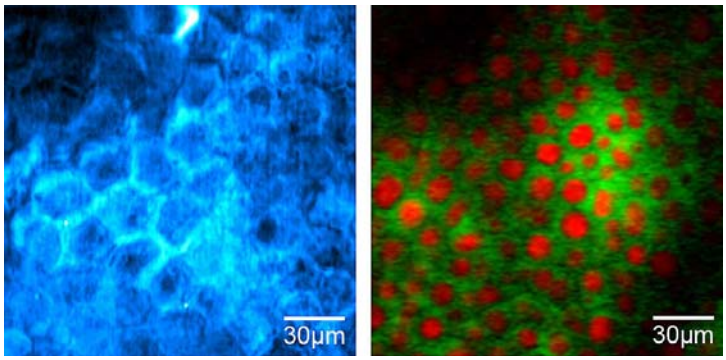
A new foam material can be deformed by a magnetic field, but returns to its original shape when the field is switched off. This new substance could have potential application where a large strain and light weight are required, such as in automobiles or even space vehicles.



Seeing for the First Time: 3D Chemical Imaging

A label-free imaging technique called stimulated Raman scattering (SRS) will likely revolutionize biomedical imaging in research and diagnostic laboratories. A team led by Sunney Xie at Harvard University reported this new technique in the December 19 issue of the journal *Science*.

Xie is enthusiastic about the ways in which SRS imaging could facilitate progress in many fields: "Applications of SRS imaging range from mapping distribution of small metabolite and drug molecules in cells and tissues to medical diagnosis of cancer. Neuroimaging is another exciting area of application." Commercialization of equipment to pursue these goals is currently under way.



3D images showing retinoic acid, a common acne drug (blue) and another substance (green) used to enhance penetration of drugs into skin. Naturally occurring skin lipids also appear (red). Credit: Chris Freudiger, Wei Min, Brian Saar, Harvard University, in collaboration with Pfizer's Jason Tsai

For more information, see the NSF press release on Next Generation Microscopy or read the Dec. 19, 2008, issue of *Science*.

The orbiTouch® Keyless Keyboard, developed by Blue Orb, Inc., eliminates finger motion from the typing process. This new technology reduces distractions that lead to cognitive confusion in children with autism, increasing their ability to use written expression.

Removing the Barriers of Autism

Keyboards can be confusing to many people, but they are especially distracting to those with autism. Using a unique type of keyboard called the orbiTouch, consisting of two computer-mouse shaped "keys," teachers with Project Blue Skies are giving children with autism the ability to communicate better with their families. The device also allows the children to connect with the world through the Internet. The orbiTouch was developed with NSF Small Business Innovation Research (SBIR) support by human factors engineer Pete McAlindon of Blue Orb in Maitland, Fla.

McAlindon conceived of the orbiTouch more than 10 years ago as a way to prevent carpal tunnel syndrome and provide computer access to people with limited use of their fingers. Now the system is helping people overcome different obstacles. Recently, the device has even been used by thousands of computer game enthusiasts through the SwitchBlade controller, which incorporates orbiTouch technology.

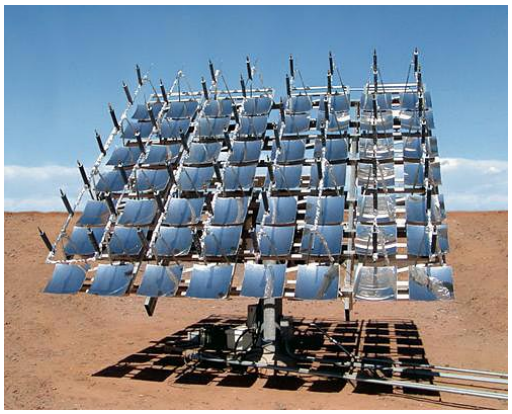
Did You Know?

Twenty young scientists who received NSF's Faculty Early Career Development Program (CAREER) awards have received additional distinction as winners of the 2007 Presidential Early Career Awards for Scientists and Engineers, or PECASE awards.

The PECASE program recognizes outstanding scientists and engineers who, early in their careers, show exceptional potential for leadership at the frontiers of knowledge. This Presidential Award is the highest honor bestowed by the U.S. government on scientists and engineers beginning their independent careers. In addition to NSF's winners, 48 scientists were nominated by other government agencies. For more, see NSF PECASE Awards.

The 2007 PECASE winners were honored on Dec. 19, 2008 in a ceremony at the White House. Credit: Teddy Yoshida

Faces of NSF Research



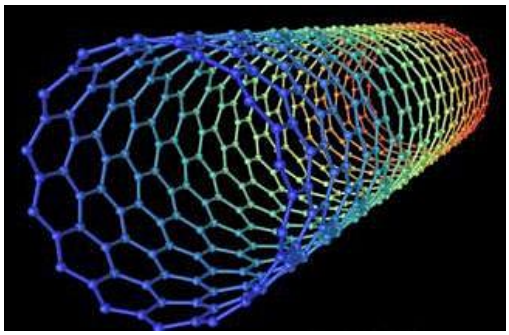
The new face of solar technology: novel carbon nanotubes could become key components of the next generation of solar panels. Credit: NREL

Nanotechnology Breakthroughs Could Make Solar Power the Bright Choice for Energy Independence

The sun's rays have always provided our planet with abundant, carbon-free energy for the right price--free. The challenge is finding cost-effective ways to transform that energy into electricity for daily use. Two recent NSF-funded breakthroughs in nanotechnology engineering have the potential to generate a next-generation leap in a variety of technologies, including solar panels.

In November, Gwo-Ching Wang at Rensselaer Polytechnic Institute debuted a measurement technique that will help scientists and companies map nanomaterials as they grow. The discovery could lead to the development of more efficient solar panels. A key step in solar energy technology is the conversion of light to electricity. By making it easier to create polycrystalline materials that grow in such a way that the transformation of light to electricity is done more efficiently Wang's discovery could revolutionize the solar technologies in common use today.

In December, Mark Hersam and Alexander Green of Northwestern University reported a new technique for efficiently producing double-walled carbon nanotubes. These tiny structures, just two carbon atoms thick, conduct electricity yet are thin enough to let sunlight in, making them promising candidates for use in solar cell technology. When double-walled carbon nanotubes are synthesized, however, the process also creates many of the single- and multi-walled varieties. Until now, there has been no easy way to separate the prized double-walled carbon nanotubes from the others. The team's technique will make it easier and cheaper to make and use these nanotubes, and the researchers are already working with private industry to market their discovery.



A single-walled carbon nanotube. A newly created double-walled tube (not pictured) shows promise in solar cell technology. Credit: Michael Strock

These big breakthroughs in tiny materials promise a bright future for solar energy, energy independence and the health of our planet. For more information, see the RPI press release and interview with Mark Hersam.

NSF in the News

Researchers Use Light Beams to Grab Molecules (*World Science*, 1/1/09) A light beam shunted through a tiny silicon channel creates a nanoscale trap that can capture DNA molecules. The trap, developed through NSF-sponsored research, explores ways to manipulate molecular-scale objects so they can be moved for analysis or used to build tiny nano-machines.

Smart Lighting Will Save Trillions of Dollars, Gigatons of CO_2 (*Environment News Service*, 12/18/08) Light-emitting diodes, or LEDs, are expected to replace the common light bulb within years, according to scientists at Rensselaer Polytechnic Institute (RPI). The findings were reported by RPI's new Smart Lighting Research Center, funded by an $18.5 million NSF grant.

U.S. Risks Standard of Living Without Boost to Research (*Computerworld*, 12/18/08) Federal funding for basic research, now at $30.4 billion to colleges and universities, has not kept up with inflation over the past two years, according to a recent NSF study. Representative Bart Gordon (D-Tenn.), chair of the U.S. House Committee on Science and Technology, which oversees federal technology research investments, warned that "the best jobs may soon be found overseas."

THE RIPPLE EFFECT

"Because the truth is that promoting science isn't just about providing resources--it's about protecting free and open inquiry. It's about ensuring that facts and evidence are never twisted or obscured by politics or ideology. It's about listening to what our scientists have to say, even when it's inconvenient--especially when it's inconvenient. Because the highest purpose of science is the search for knowledge, truth and a greater understanding of the world around us."

Barack Obama, Dec. 20, 2008

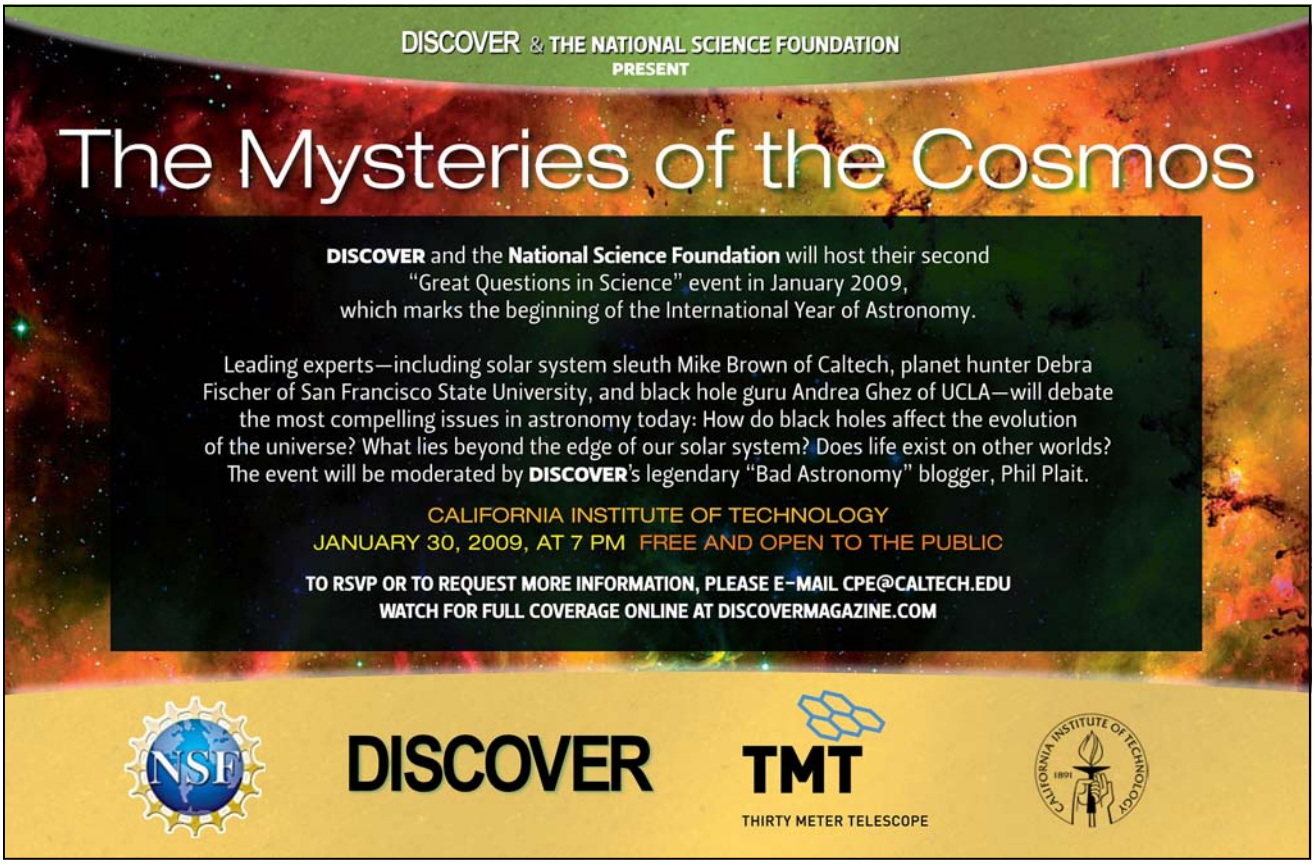


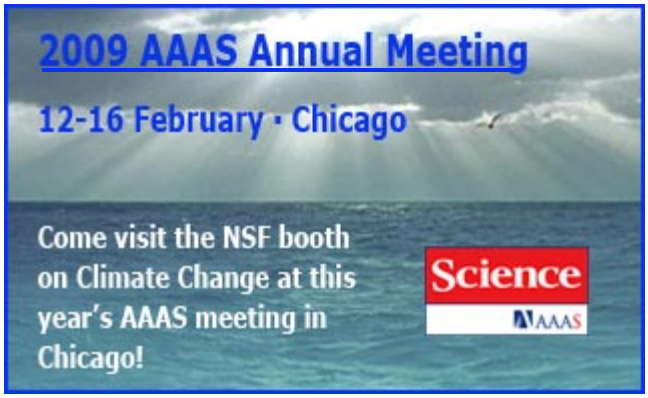
Photo by Sam Kittner/ kittner.com

Gilbert F. White Lecture in the Geographical Sciences

Climate, Oceans, and Human Health: The Saga of a Cholera-Chaser

Dr. Rita Colwell, University of Maryland

5:30 p.m. February 18, 2009
The National Academies Keck Center



The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science with an annual budget of nearly $5.92 billion. NSF funding reaches all 50 states through grants to over 1,700 universities and institutions. Each year, NSF receives about 42,000 competitive requests for funding and makes over 10,000 new funding awards. The NSF also awards over $400 million in professional and service contracts yearly. Contact NSF's Office of Legislative and Public Affairs for more information, to unsubscribe or for permission to reuse newsletter images.