

## NSF AT WORK



### Student Proficiency Projected to Fall Short

The 2002 No Child Left Behind (NCLB) Act requires every state to test students annually in reading and math, and requires the number of students scoring at the level of "proficient" or higher to rise each year until all students reach proficiency in 2014. Towards that end, each state developed its own assessment tests and identified a rate of adequate yearly progress (AYP) towards full proficiency by 2014.

Rich Cardullo from the University of California, Riverside led a study that projected California's ability to meet the 2014 goal. With funding from NSF through the [Math and Science Partnership](#) program, the research team analyzed state assessment data from more than 4,900 elementary schools in school years 2002-2003 through 2006-2007, then made projections of future proficiency scores using three different mathematical models.

An analysis of California elementary school achievement data shows projected improvements in student performance will fall short of legislated benchmarks. Credit: © 2008 JupiterImages

Even using the most optimistic model, the analysis found that nearly 100 percent of California elementary schools failed to meet AYP by 2014. In fact, average proficiency in English Language Arts fell short of AYP by the year 2011, and math proficiency fell short by 2012. Cardullo and his colleagues were led to do this work after a long history of working with schools. He notes that, "what is happening in California is possibly a good indicator of what is occurring in other states." For more on the study, see the [NSF press release](#).

### Software Company Makes Math More Accessible to Students with Disabilities

Researchers at the University of Kentucky are studying the use of MathPlayer, a software program developed by [Design Science](#) with an NSF [Small Business Innovation Research](#) grant, to help eighth-grade math students with print disabilities. The [Supported Math Accessibility Reading Tool \(SMART\) project](#) studies the use of a combination of technologies to provide students with disabilities unprecedented accessibility to math content at higher grade levels. The combined technologies allow complex math equations to be spoken and highlighted.



Students at Clark County Middle School in Winchester, Ky., use software that allows complex math equations to be spoken and highlighted. Credit: Preston Lewis, University of Kentucky, and Jennifer Bell, Clark County Schools

Results from the first year pilot have already demonstrated gains in math performance when participating students are compared to a control group. Although the SMART study is focused on students with print disabilities, the use of the combined software technologies may have broad implications for increased learning outcomes for all students.



The bubbles visible in this piece of Antarctic ice core sample contain carbon dioxide and other gases that were trapped thousands of years ago. Credit: Oregon State University

## Antarctic Ice Bubbles Yield New Climate Insights

With support from NSF, Oregon State University geoscientists Jinho Ahn and Edward Brook analyzed 390 ice core samples taken from Antarctic ice at Byrd Station. The samples offered snapshots of the Earth's atmosphere and climate between 20,000 and 90,000 years ago.

Ahn and Brook compared the carbon dioxide levels from the ice samples with temperature records from Greenland and Antarctica and with ocean sediments in Chile and the Iberian Peninsula. Data from the sediments provided the scientists with an understanding of the behavior of certain ocean currents at the time the gases were trapped. The researchers discovered that elevations in carbon dioxide levels were related to subsequent increases in the Earth's temperature as well as reduced circulation of ocean

currents in the North Atlantic. The data point to future scenarios in which global warming could cause changes in ocean currents which in turn cause more carbon dioxide to enter the atmosphere, adding more greenhouse gas to an already warming climate. For more on this research, see the [NSF press release](#).

## Beetles Get by With a Little Help From Their Friends

Humans living in communities often rely on friends to help get what they need and, according to researchers in the lab of Cameron Currie at the University of Wisconsin-Madison, many microbes, plants and animals benefit from 'friendly' associations, too.

The NSF-funded study describes the complex relationship between a beetle and the microbes it relies on to survive and thrive. The research reveals that adult beetles have a specialized compartment in their bodies to store two other organisms: a slow-growing beneficial fungus that serves as a food source and a bacterium that produces a unique, newly discovered antibiotic.

Before laying eggs in tree bark, adult female beetles spread the slow-growing, beneficial fungus and bacteria around the area where they will deposit the eggs. Interestingly, the antibiotic from the bacteria prevents growth of the fast-growing competitor fungus but does not harm the slow-growing beneficial fungus, which continues to grow and provide a rich source of nutrition for the developing beetle larvae. In-depth studies of the interactions between beetles and the beneficial microbes could lead to advances in antibiotics for humans. For more information, see the [NSF press release](#).



Adult southern pine beetle in flight. According to the USDA Forest Service, the southern pine beetle is one of pine's most destructive insect enemies in the Southern United States, Mexico, and Central America. Credit: Erich Vallery, USDA Forest Service Southern Research Station, Pineville, LA

## DID YOU KNOW?

A single female Brazilian free-tailed bat consumes about 8.1 grams of insects a night. Throughout the world, bats provide such "services" as seed dispersal and plant pollination, but the value of their contribution to pest control in agriculture is just beginning to be appreciated.

Scientists at Boston University have developed an avoided-cost approach to place economic value on the pest control services provided by Brazilian free-tailed bats in south-central Texas. Using NEXRAD Doppler radar, historic records, and agricultural data, scientists have calculated the pest control value of bats at \$741,000 for Texas' Winter Garden Region alone. For more, see the [BU researchers' Web site](#).



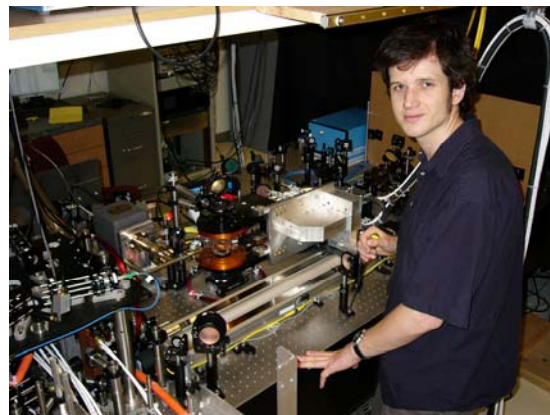
Frio Cave bat emergence. Credit: © Thomas Kunz, Boston University

## FACES OF NSF RESEARCH

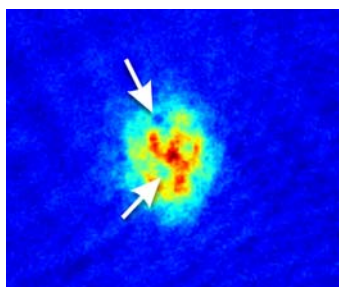
### Low Temperature Physics is "Cool" Science!

Graduate student David McKay is part of a research team at the University of Illinois, Urbana-Champaign that studies the interactions gaseous atoms at extremely cold temperatures, near 'absolute zero' or -459.67 degrees F. At just 10 billionths of a degree above absolute zero, atoms move extremely slowly. With atoms slowed down to merely tenths of an inch per second, McKay and coworkers are able to observe the quantum behavior of these atoms.

While quantum mechanics may seem like an exotic field of research, it forms the basis for many of the electronic technologies we use every day, including computer chips. However, the quantum behavior of some materials is poorly understood, including that of materials called 'high-temperature superconductors.' High-temperature superconductors conduct electricity with little resistance at higher-than-expected temperatures, and physicists want to better understand why. Superconductors, already used in MRI machines at hospitals, could likely have other beneficial applications such as high-speed rail transportation and the efficient transport of electricity from power plants, if physicists understood their behavior in greater detail.



David McKay, graduate student in Brian DeMarco's lab at the University of Illinois. Credit: Brian DeMarco, University of Illinois



Quantum vortices form when super-cooled atoms are allowed to expand. The vortices are indicated with arrows in this image. Credit: Brian DeMarco, University of Illinois

Because these materials are too complex for virtual simulation using even today's most advanced supercomputers, physicists create real-world "quantum simulators" to study the low temperature quantum behavior of atoms, which exhibit similar quantum behavior to electrons in a superconductor but are easier to observe and manipulate.

According to McKay, "Being a graduate student on a project like this entails many responsibilities. First, we had to build our simulator, which is one of the most complex experiments that can be done in a lab about the size of a large bedroom. The equipment is spread over two steel tables that weigh 1,000 pounds each, and are floated by air pistons to reduce vibrations. The experiment uses more than 10 different lasers and hundreds of mirrors and lenses. We have shelves of electronic components and several computers to run the whole thing. Fortunately, we only had to set everything up once."

To read more about David McKay and his research, see the [NSF Discovery article](#), or visit the [LiveScience.com story](#).

## NSF IN THE NEWS

[R&D Spending at Colleges Creates Plenty of Jobs, Report Says](#) (*Chronicle of Higher Education*, 10/07/08) Federal, state, and local governments, industry and institutions devoted more than \$47-billion to research in FY 2006, including \$32 billion spent at public colleges and universities.

[National Science Foundation, EPA join forces for study of nanotechnology](#) (*The Herald-Sun*, 10/2/08) NSF and EPA announced the opening of two new research centers--one led by UCLA and one led by Duke University--dedicated to understanding the environmental impacts of nanotechnology.

[Fired Up: Intel Chairman Barrett Says America Is Throwing its Future "Down the Drain"](#) (*Business Week*, 9/22/08) At a *Business Week* roundtable, Barrett said that Washington failed to fully appropriate the America COMPETES Act funding for basic science and engineering research and education, which was the equivalent of choosing not to compete in the global economy.

## THE RIPPLE EFFECT



### Got Green? The News on Biofuels

First-generation biofuels have been hampered by a range of factors, from incompatibility and lower energy yields to concerns about their potential impacts on food prices. A new, second-generation biofuel known as cellulosic gasoline, or "green gasoline," is positioned to bridge those gaps and eventually provide gasoline, diesel, jet fuel and other chemicals that are identical to petroleum counterparts yet are derived from non-food plants and agricultural waste.

NSF, in partnership with three professional engineering societies (ASME, AIChE and IIIE-USA), the U.S. National Arboretum, and the United States Botanic Garden hosted a Capitol Hill Luncheon on September 24, 2008, highlighting the progress and processes of biofuel production. Senator John Kerry, a keynote speaker at the event, reinforced the nation's pressing need to invest in alternative sustainable sources of energy. He commended NSF for its track record in fundamental research.

"NSF and other federal funding agencies are advocating the new paradigm of next generation hydrocarbon biofuels," said John Regalbuto, director of the Catalysis and Biocatalysis Program at NSF and chair of an interagency working group on biomass conversion. "Even when solar and wind, in addition to clean coal and nuclear, become highly developed, and cars become electric or plug-in hybrid, we will still need high energy-density gasoline, diesel and jet fuel for planes, trains, trucks, and boats."

At the Hill event, chemical engineers [Randy Cortright](#) of Virent Energy Systems and [George Huber](#) from University of Massachusetts Amherst explained the science behind green-gasoline technology at the briefing. Cortright explained how his company now successfully turns sugar into gasoline. Huber talked about how he has developed one of the most efficient methods for turning wood chips--or any other plant waste, such as corn husks or even waste paper--into critical gasoline components.

See NSF's press release, [From Sugar to Gasoline](#), for more on these projects and NSF's Fact Sheet [What is Green Gasoline?](#) for more information on this cutting-edge technology.



Collected straight off the catalytic system, green gasoline rests atop water. Using similar processes to the petroleum industry, two separate research groups produce "green gasoline" from sugar and carbohydrates. Credit: Virent Energy Systems, Inc. Contact Virent for image permissions and use.



### One World, One Sky: Big Bird's Adventure

*Sesame Street's* Big Bird leads American and Chinese children in an adventure exploring the night sky through an engaging planetarium show that premiered in Beijing Sept. 26, 2008, and premieres in Chicago, Ill., on Oct. 15. With major funding from NSF, "[One World, One Sky: Big Bird's Adventure](#)" brings the wonder of astronomy to young children.



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 about \$6.06 billion. NSF funding reaches all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 45,000 competitive requests for funding and makes over 11,500 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.