

## NSF AT WORK

### Next Generation Power Tools



Researchers have developed a new mechanism to efficiently control hydrogen fuel cell power in a breakthrough that could make fuel cells practical for such small machines as lawnmowers and chainsaws. Many standard fuel cell designs use electronics to control power output, but such designs require complex systems to manage humidity and fuel recovery and recycling systems to achieve acceptable efficiency.

The new process controls the hydrogen feed to match the required power output, just as one controls the feed of gasoline into an internal combustion engine. NSF awardee Jay Benziger of Princeton University developed the new technique with his student Claire Woo, a recipient of an NSF Research Experiences for Undergraduates award and now a doctoral candidate at the University of California, Berkeley.

*Researchers have developed a new mechanism to efficiently control hydrogen fuel cell power, which could one day be used for lawnmowers and other small engines. The new design could open doors to small-scale fuel cells. Credit: © 2007 JupiterImages Corp.*

Woo and Benziger published their findings the February 2007 *Chemical Engineering Science*. They believe the first applications for their technology will be in smaller engines. Fuel cells are currently inefficient on such scales due to the need for fuel recycling and excess hydrogen in standard designs. The researchers' new design is closed, so 100 percent of the fuel is used and there is no need for a costly fuel recycling system.

See NSF's release, "[Hydrogen-Powered Lawnmowers?](#)," for more information.

### NSF Provides \$14 Million to Advance Research in Comparative Genomics of Economically Important Plants

Scientists will find improved ways of studying the structure, function and evolution of the genomes of economically important plants, thanks to \$14 million in new awards from NSF.

Resources to be developed include genomic sequences, genetic markers, maps and expressed sequence collections. These are much-needed tools for researchers working in areas as diverse as plant breeding and weed control.

Research projects center on economically important plants, including cotton, canola, wheat, rice and corn. The research will help improve crop production, yield possible avenues for better selective control of weeds, as well as improve our basic understanding of gene structure and function in plants.



*Botanists funded by NSF's comparative genomics in economically important plants program will conduct research on the maize genome. Credit: Cornell University.*

For more details on these new awards, see [NSF's Press Release](#).

## Safe to Touch the Water

Engineers have developed a system that eliminated 100 percent of the microbes in New Orleans flood waters left from Hurricane Katrina. The technique makes use of specialized resins, copper and hydrogen peroxide to purify tainted water.

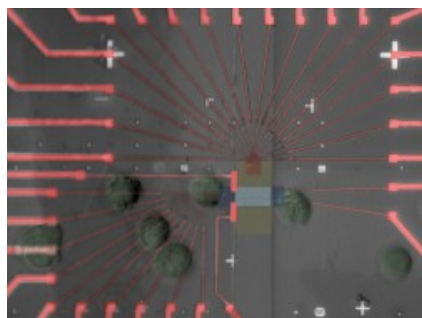
The system--safer, cheaper and simpler to use than many other methods--cleans the water, although it doesn't yet make the water drinkable. However, the method may eventually prove critical for limiting the spread of disease at disaster sites around the world.

Applying their technique to water from the Industrial and 17th Street canals in New Orleans, the NSF-supported researchers destroyed all of the bacteria in the samples within 15 minutes. In tests with laboratory water samples containing even higher bacterial concentrations, the process killed at least 99 percent of the bacteria in 90 minutes. More information on this filtration system is available in [NSF's press release](#).



*NSF-supported researchers hold the polymer that is critical to the water filtration system they are helping to develop. The system kills 100 percent of microbes in flood waters taken from Hurricane Katrina disaster sites. Credit: Dowling University.*

## Tiny Device Carries a "Ton" of Memory



*Researchers have created an ultra-dense memory device the size of a white blood cell. The bluish-grey area in the center of the picture contains the 160,000 bit memory array. The greenish circles nearby are white blood cells. Credit: J. Green, J. Nagarath and H. Ahmad, California Institute of Technology.*

Researchers have created an ultra-dense memory device the size of a white blood cell that has enough capacity to store the Declaration of Independence and still have space left over. The accomplishment represents an important step toward the creation of molecular computers that are much smaller and potentially more powerful than today's silicon-based computers.

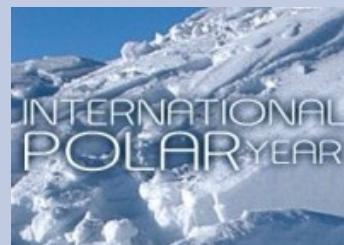
A team of chemists successfully demonstrated a large-scale, "ultra-dense" memory device that stores information using reconfigurable molecular switches. The 160-kilobit molecular memory was fabricated at a density of 100 billion bits per square centimeter -- "a density predicted for commercial memory devices in approximately 2020," according to one of the researchers.

The research was funded by NSF and the Defense Advanced Research Projects Agency. See NSF's release, "[Blood-Cell-Sized Memory Device Beats Industry Estimates for Computing Capacity](#)" for more information.

## DID YOU KNOW?

Beginning in March 2007, the United States will lead more than 60 nations in deploying thousands of researchers in a global research campaign to improve our understanding of the role of the polar regions in the global ecosystem. This initiative is called the International Polar Year (IPY) 2007-2008.

The most recent Polar Year--also known as the 1957 International Geophysical Year (IGY)--laid the foundations for U.S. leadership in polar science and the nation's role as a guarantor of the integrity of the Antarctic Treaty System, which sets Antarctica aside solely for scientific purposes. A U.S. IGY milestone in 1957 included building the first manned station at the South Pole. NSF expects to dedicate a completely rebuilt and ultra-modern U.S. research station at the South Pole during the IPY period.



*International Polar Year is a global research effort to better understand the polar regions and their climatic effect on the Earth. Over the next two years, more than 200 scientific expeditions will take place to study changes to permafrost, the melting of polar ice sheets, and marine life in the cold and dark. The IPY research will provide a baseline for understanding future environmental change. See NSF's IPY Fact Sheet for more.*

## FACES OF NSF RESEARCH

### NSF's Budget Open House

On Feb. 5, NSF hosted an open house featuring 15 NSF-supported science and engineering research and education projects. The day-long event, held in conjunction with the release of the budget request for the 2008 fiscal year, attracted hundreds of visitors of all ages.



See the [NSF Web site](#) for more information about the [Open House](#) and [Budget Request](#).

All of the photos here are courtesy of NSF staff. Please see "[At the NSF FY 2008 Budget Open House](#)" for more information and additional photos.



## NSF IN THE NEWS

[NSF Enjoys a Heartfelt Ending to a Difficult Budget Year](#) -- *Science* (02/23/07) -- Congress finally approved a fiscal 2007 \$334 million increase in the National Science Foundation's \$4.4 billion research budget, matching its request. NSF Director Arden Bement hopes to use some of the funding to begin construction on three major research facilities-- the Ocean Observatories Initiative, the Arctic Research Vessel, and the National Ecological Observatory Network.

[Test-Driving Budding Engineers at \(MS\){+2}](#) -- *Washington Post* (02/22/07) -- The new "Design Squad" PBS science-centered teen television show produced by WGBH in Boston was funded in part by the National Science Foundation.

[Wireless Sensors Extend Internet's Reach](#) -- *USA Today* (02/12/07) -- The University of California at Los Angeles Center for Embedded Networked Sensing was seeded last year with a \$40 million, 10-year National Science Foundation grant. It serves as a hub for wireless sensor networking R&D.

[Engineering Education Prepares for 2020](#) -- *EE Times* (02/01/07) -- Future engineers will need to be taught new attributes and in new ways, 2007 IEEE President Leah Jamieson said during her keynote address at the DesignCon 2007 conference on Jan. 31. She gave an overview of the new National Academy of Engineering (NAE) report on engineering in 2020, which said engineers will need to be creative, flexible, leaders, and have business skills.



*Excerpts from*  
**NSF's FY 2008 Budget  
 Request Presentation**  
*by*  
**NSF Director**  
**Arden L. Bement, Jr.**  
*on*  
**February 5, 2007**  
**NSF Headquarters**

No matter what compass you choose, path-breaking research is on the horizon from the smallest particles of matter to the cosmos, and from the dynamic interactions among humans and our institutions to the intricate complexity of life on earth. The NSF budget for FY 2008 sets an ambitious agenda for capitalizing on this potential to discover new knowledge that can boost the nation's economic vitality and improve our quality of life.

NSF's commitment to the science and engineering enterprise comes from an abiding belief that knowledge is a powerful force for progress. NSF works at the frontier of knowledge where high-risk, high-reward research can lay the foundation for revolutionary technologies and tackle complex problems that challenge society.

Quite simply, our investments in fundamental research and education aim to improve the quality of people's lives and keep the nation safe and growing. The NSF budget for 2008 reflects this vital agenda. NSF is requesting \$6.43 billion dollars. That's an increase of nearly \$409 million, or 6.8 percent above the 2007 Request. Funding at this level will keep us on the course set by the President's American Competitiveness Initiative.

Funding levels increase for every major NSF appropriations account. Investments in Research and Related Activities increase by 7.7 percent--Education and Human Resources by 4.8 percent--and MREFC by 1.8 percent. The budget includes across-the-board increases for every Directorate and Office of NSF.

Rapid progress in these areas will generate new concepts and tools with far-reaching applications, lay the foundations for next-generation tools and technologies, and develop educational strategies to engage students and prepare them for the fast-changing, global environment I believe that America can continue to be on the leading edge of ideas and research that can chart the global path for the next half century.

Staying at the forefront of discovery and innovation will require the level of investment proposed in the NSF budget. In a science and technology based world, to retreat from the frontier is to put the nation at peril.

*Dr. Bement's [complete speech](#) is available on the NSF Web site. Also see NSF's [FY 2008 Budget Request to Congress](#).*

**New Congress Wraps Up  
 2007 Budget with  
 Increases for Key R&D  
 Programs: A Clip from  
 AAAS's FY 2007  
 Appropriations Update**



Just days before the release of the President's proposed fiscal year (FY) 2008 budget, the Democratic majority in the 110th Congress filed a spending bill to finalize the FY 2007 appropriations bills left unfinished by the previous Congress. The 'joint funding resolution' provides funding for the entire fiscal year for all programs funded by the 9 unfinished FY 2007 appropriations bills covering most domestic programs, mostly at FY 2006 funding levels but with increases for selected programs.

The new spending bill contains pleasant surprises for three key physical sciences agencies, including NSF. NSF would receive the full requested increase of 7.7 percent or \$334 million for its core Research & Related Activities (R&RA) account. This funding would allow most research directorates to reverse declining funding of recent years with increases of between 6 and 8 percent. Total NSF R&D would climb 7.0 percent to \$4.5 billion within a total budget of \$5.9 billion, reversing two years of cuts in 2005 and 2006. The funding resolution leaves NSF's major research equipment and education & human resources flat at last year's levels instead of requested increases.

See [www.aaas.org/spp/rd/upd107.htm](http://www.aaas.org/spp/rd/upd107.htm) for AAAS's complete FY 2007 Appropriations Update.



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 \$5.58 billion. NSF funding reaches all 50 states through grants to roughly 1,700 universities and institutions. Each year, NSF receives about 40,000 competitive requests for funding and makes about 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.