National Science Foundation
WHERE DISCOVERIES BEGIN

NSF CURRENT
NATIONAL SCIENCE FOUNDATION

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NSF AT WORK

Oil Spill's Biggest Threat May Be to Wetlands

Scientists at the **National Center for Earth-surface Dynamics (NCED)** agree that while the April 20 oil spill in the Gulf of Mexico has already harmed fish and wildlife, the greatest threat is to Louisiana's wetlands. These wetlands play a vital role in protecting inland areas, such as the city of New Orleans, from hurricane damage but also provide habitat for wildlife and play a key role in maintaining water quality.

As the Mississippi River enters the Gulf of Mexico, it deposits its load of sediment in a delta. Credit: NASA

Every year, more wetlands disappear from the region for reasons involving sea-level rise and disruption of coastal processes. Scientists at NCED have been working to find ways to restore the wetlands by developing ecologically sound land-building methods for the Mississippi River Delta.

Diverting sediment-rich water from the river is the traditional approach, but diversions can send water enriched with nitrates from agricultural runoff into the coastal wetlands. This increases the possibility of algal blooms and lowered oxygen concentrations in the wetland waters.

Researchers at NCED have found that two types of sediment--mineral-rich and organic-dominated--settle out of the river waters. The scientists have also found that denitrification, or removal of the harmful nitrates, can occur when a transition from deposition of mineral-rich sediment to organic matter takes place. The results hold out some hope to those looking for ways to protect and restore fragile wetlands. "Even before the April 20th disaster, these wetlands were in jeopardy," says H. Richard Lane of **NSF's Division of Earth Sciences, which funds NCED**. Read more about NCED's work **here**.

NSF is also funding a study, through its rapid response grant program, that will investigate how dispersants affect the degradation of oil by microbes in the Gulf. Read more **here**.

Molecular Robots

The word 'robot' makes most people think of solid machines that use computer circuitry to perform defined jobs, such as vacuuming a carpet or welding together automobiles. In recent years, though, scientists have worked to create extremely small robots that could also reliably perform useful tasks, but at a molecular level. This is, needless to say, not a simple endeavor, and it involves reprogramming molecules to perform in specific ways.

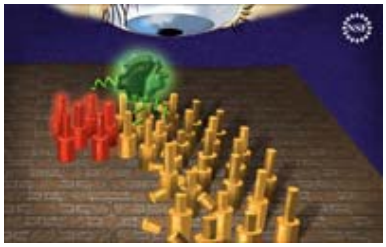


Illustration of molecular robots. Credit: Zina Deretsky, NSF

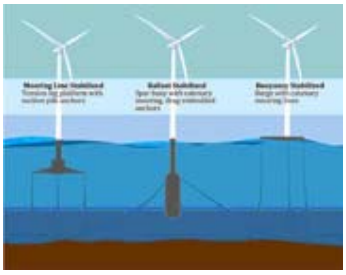
Now, **NSF-funded scientists** have created and programmed robots the size of a single molecule that can move independently across a nano-scale track. This development, outlined in the May 13 edition of the journal *Nature*, marks an important advancement in the nascent fields of molecular computing and robotics, and could someday lead to molecular robots that can fix individual cells or assemble nanotechnology products.

The **new work** has produced so-called DNA walkers, or strings of reprogrammed DNA with 'legs' that enabled them to briefly walk. In addition to being incredibly small--about 4 nanometers in diameter--the walkers also move slowly, covering 100 nanometers in times ranging from 30 minutes to a full hour by taking approximately 100 steps. This is a significant improvement over previous DNA walkers that were capable of taking only about three steps. Read more about this work **here**.

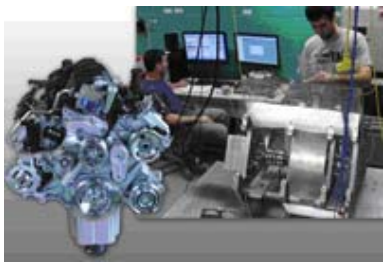
NSF-Funded Research Leads to New Energy Innovations

NSF-funded research is leading to innovations in the energy field. Developments include new ways of capturing solar energy, wind energy and improving car fuel efficiency.

The University of Maine's **AEWC** Advanced Structures and Composites Center is working on new ways to capture wind energy and has developed a physical model of a floating deepwater wind farm that will test digital models from the National Renewable Energy Laboratory (NREL). The information from these tests will significantly accelerate the development of floating offshore wind turbine platforms near U.S. population centers on the East and West coasts. The AEWC is **funded** through NSF's Partnerships for Innovation (PFI) program.



The floating turbine concept. Credit: AEWC



Right: specialized rotor test rig for evaluation of prototype absorbers. Left: V8 engine that could incorporate the absorbers, resulting in increased fuel efficiency. Credit: Brian Feeney, Michigan State University

Michigan State University has been **funded** through the Grant Opportunities for Academic Liaisons with Industry (GOALI) program for research aimed at improving car fuel efficiency through the reduction of unwanted vibrations. The research on advanced engines uses a system called a Centrifugal Pendulum Vibration Absorber (CPVA). By creating a novel way for the absorbers to move, the investigators have succeeded in creating a prototype system that works for a wide range of engines. Researchers are now working on creating a final production model of the system that could result in fuel savings of 10 percent or more.

Cool Energy, Inc. of Boulder, Colo., has created a low temperature engine that allows a rooftop solar system to create both heat and energy for a household. The engine, known as the SolarHeart® Engine, may be ready for the marketplace as early as 2011 and was developed with **funding** from NSF's Small Business Innovation Research (SBIR) program.

The SolarHeart® Engine. Credit: Cool Energy, Inc.

The SolarHeart® Engine has a control system that works with local weather systems to optimize the creation and storage of heat and electricity. The SolarHeart® also has the ability to recycle exhaust gas heat from other engines and industrial processes to create electricity. Cool Energy's technology has the potential to significantly reduce household energy bills and to prevent the release of carbon dioxide.

Did You Know?

NSF, the National Institutes of Health (NIH) and the Economic Development Administration of the U.S. Department of Commerce recently announced a new partnership that will devote $12 million in funding to encourage the commercialization of new technologies in six regions of the

country. Known as the I6 Innovation Challenge, the initiative is intended to help "move ideas from the lab into the marketplace," according to Gary Locke, U.S. Commerce Secretary.

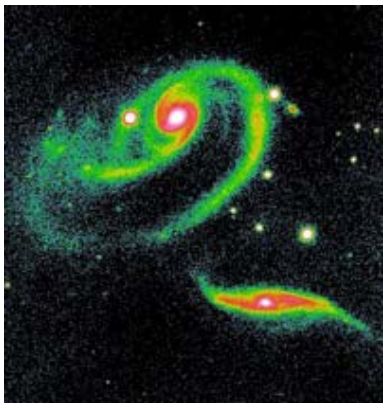
NSF already supports small business through its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. This new interagency partnership will help NSF extend its reach and encourage innovation in key technological areas. Read more **here**.

Faces of NSF Research

Citizen Scientists At Work

Some of the faces associated with NSF research might surprise you. Consider 11-year-old Jilene and 10-year-old Jonathan Penhale. One day in 2006, the pair discovered a rare nine-spotted ladybug near their home in Virginia. It was the first time a nine-spotted ladybug had been found in the eastern United States in 14 years, confirming that the species was not, as had been feared, extinct.

What could have been merely a fun day playing and exploring outside became a major scientific discovery when the two youngsters reported their findings to the **Lost Ladybug Project**, whose staff confirmed that the bug was, indeed, *Coccinella novemnotata*, the almost-extinct nine-spotted ladybug. The exciting result showed that even kids can make important scientific contributions. The Lost Ladybug project is just one of several ways ordinary citizens participate in NSF's scientific enterprise.



Interacting spiral galaxies Arp 273. Zooniverse citizen scientists are scanning data for evidence of merging galaxies. The brightness of this image has been converted to color in order to show the fainter regions more clearly. Credit: WIYN/NOAO /AURA/NSF

The **Folding at Home** project is another way for anyone to make real contributions to science. Downloadable software from the project website can be set to run during a computer's otherwise idle moments. This software will carry out computations as part of an enormous calculation of protein structure. By connecting the world's desktop computers together in a giant distributed processor, the project leaders hope to be able to determine the process by which proteins fold into incorrect shapes. Misfolded proteins are linked to a variety of diseases, including Alzheimer's, ALS, Huntington's, Parkinson's and several types of cancers.

Another opportunity for citizen scientists to participate in valuable scientific studies is the **NSF-funded Zooniverse project**, associated with the **Citizen Science Alliance** and aimed at analyzing the nighttime sky. An enormous amount of data has been obtained from scanning the heavens, and searching through all these images to find information that is useful to astronomers is a job perfectly suited to an army of citizen scientists. Current participants are scanning for solar storms, studying the merging of galaxies and looking for evidence of supernovae. To sign up, visit the **Zooniverse website**.

NSF in the News

Emergency NSF Grants for Oil Spill (*The Scientist*) NSF is ramping up to provide emergency funding for research projects to probe the biological impact of the oil spill in the Gulf of Mexico through its RAPID program.

Scientists Discover Asphalt Volcanoes (*LA Times*) Scientists have discovered a cluster of underwater asphalt volcanoes rising about 65 feet from the seafloor just off Santa Barbara, Calif. NSF is funding the exploration and study of these small volcanoes using a tiny battery-powered submarine.

Not All Buildings in Hawaii Are Tsunami-proof (*Honolulu Star Bulletin*) An NSF-funded engineering study has revealed that while medium-to-tall reinforced concrete buildings in Hawaii would likely withstand a tsunami, some shorter buildings and wooden structures might not.

Scientists Say Growing Grain for Food Is More Energy Efficient (*U.S. News & World Report*) Devoting farmland to grow crops for food rather than fuel is more energy efficient, according to NSF-funded research.

Oceans Grow More Acidic (*MSNBC*) NSF-funded scientists warn that oceans are becoming more acidic, threatening corals and shellfish. The acid is created when carbon dioxide dissolves in seawater.

The Ripple Effect

Celebrating 60 Years of Discovery

NSF is celebrating its sixtieth year, and as part of the anniversary activities, a new history page has been established. Among the features on this page are an interactive special report on "**The Future of NSF**," an **interactive historical timeline**, an archive of NSF's flagship magazine, ***Mosaic***, which was published from 1970 to 1992, and a video record of the anniversary lecture series, "**Voices from the Future**." Also included is a list of 60 important advances or discoveries that were made possible with NSF funding; this list, the "**Sensational 60**," and other historical information can be found on the **new history page**.

New Video Series Released

NSF has released a new video series, "**Green Revolution**." These five-minute videos feature scientists and engineers working to develop and improve clean energy sources, new fuels and other energy-related technologies. Each segment explores the research carried out at the forefront of discovery and innovation related to clean energy, as well as the basic science behind the work.

Learning from Haiti

Earthquake damage in downtown Jacmel, Haiti. Credit: Liesel A. Ritchie, Natural Hazards Center at the University of Colorado at Boulder

In late April, NSF hosted a live webcast with several NSF-supported scientists who deployed to Haiti to gather data and insights about the Jan. 12, 2010 earthquake. The discussion centered on rapid-response research and how NSF and other U.S. agencies use disaster research to help save lives. Watch a **video** of the webcast.

VORTEX2 to Study Tornado Formation

This tornado was the first captured by the National Severe Storms Laboratory Doppler radar and chase personnel. Credit: NOAA

Scientists from the Verification of Rotation in Tornadoes Experiment 2 (VORTEX2) project, partially funded by NSF, have been busy chasing tornadoes across the midwestern United States since late in April. They employ a fleet of instruments that literally surround tornadoes. The researchers are blogging daily about their work; follow along **here**.

Data Management Plans to Be Required

Beginning this fall, NSF will require that all proposals include a data management plan in the form of a two-page supplementary document. The research community will be informed of the specifics of the anticipated changes and the agency's expectations for the data management plans.

The changes are designed to address trends and needs in the modern era of data-driven science. "Science is becoming data-intensive and collaborative," notes Ed Seidel, acting assistant director for NSF's Mathematical and Physical Sciences directorate. "Researchers from numerous

disciplines need to work together to attack complex problems; openly sharing data will pave the way for researchers to communicate and collaborate more effectively." Read more about the new requirement **here**.

The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year 2010, its budget is $6.9 billion. NSF funds reach all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 48,000 competitive requests for funding, and makes over 11,300 new funding awards. NSF also awards over $400 million in professional and service contracts yearly. Contact ***NSF's Office of Legislative and Public Affairs*** *for more information or for permission to reuse newsletter images.*

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