

NSF AT WORK



A 'Corny' Discovery: Getting Down to the Genome

History is rife with examples of corn's usefulness to society from its original domestication over 6,000 years ago by the Indians of modern Central America to Columbus' diary entry of 1492 noting its 'very good taste.' Besides being a Thanksgiving dinner staple, corn is used for biofuel and feedstock. More than 80 million acres of land in the United States is devoted to growing corn, accounting for more than 90 percent of the total value of feed grain.

The importance of sequencing the corn genome cannot be underrated. Through a joint National Science Foundation (NSF) and United States Department of Agriculture grant, a consortium of researchers led by the [Genome Sequencing Center](#) at Washington University are close to mapping the entire corn genome. This is an immense task; at 2.5 billion base pairs covering 10 chromosomes, the corn genome size is comparable in size to the human genome.

Once completed, the project will allow scientists to understand the functional genetic components of the plant, undoubtedly leading to crops with increased yields, and improved drought and pest resistance. For more details, see NSF's "[All Eyes and Ears on the Corn Genome.](#)"

Corn dominates American agriculture. In 2007, U.S. farmers produced a record 3.1 billion bushels of corn, an increase of nearly 25 percent over the previous year according to the USDA. The production value of the 2007 crop was estimated at \$3.3 billion. Credit: Jupiter Images

Investors See 'Green' Firms as Less Risky

New NSF-supported research from the University of Oklahoma suggests that when companies go green, they can acquire funds less expensively than similar companies that do not. The finding is one of several from a study that shows improved green performance benefits corporations in ways previously not considered by economic analysts.

The ability to obtain financing at lower costs frees a company's other assets for further investment and future growth. Until now, evidence of this positive connection between a company's green practices and investments by financial markets has not been well documented. Instead, researchers historically saw "green" practices as a negative or a cost to companies and argued they should be minimized whenever possible. A recent study, however, took a different view, opting to focus primarily on how investors perceive firms committed to green practices.



A company's decision to go green can result in more willingness by financial markets to invest in them, thereby helping improve their bottom line. Credit: Morguefile

To learn more about why companies choose to go green, see NSF's Discovery "[Financial Markets Grow Green Companies.](#)"



View of Hurricane Ike in the Gulf of Mexico. Credit: NASA

The Link Between Hurricanes and Climate Change

Following the devastation caused by Hurricanes Gustav and Ike, the scientific community is striving to provide practical climate change information to coastal communities, offshore drilling operations and other groups of interest. Currently, the National Center for Atmospheric Research (NCAR) in Boulder, Colo., an NSF-sponsored center, is examining the influence of global warming on recent hurricanes and potential future impacts. NCAR utilizes computer simulations to recreate the behavior of a single hurricane and map its impact.

Greg Holland, leader of the NCAR project, said, "It is clear from the effects of recent hurricane activity that we urgently need to learn more about how hurricane intensity and behavior may respond to warming climate." To learn more about NCAR's research efforts, see the NSF's "[Future Risk of Hurricanes: The Role of Climate Change.](#)"

Using Your Computer to Grow More Nutritious Rice for a Hungry World

Earlier this year, consumers around the world noticed higher food prices as the cost of most grains escalated. In many parts of the developing world, rice, a crucial staple for billions of people, became too expensive or not available at all, triggering large-scale hunger and food riots that destabilized entire countries and regions.

In May of this year, a group of computational biologists at the University of Washington began tapping the collective power of more than 1 million desk-top computers to better understand the protein structures of rice plants. Building on research funded by the NSF, the [Nutritious Rice for the World project](#) is already yielding results that are being used by plant biologists around the world. The goal of this combined effort is to grow hardier and more productive strains of rice that are also more nutritious.

Ultimately, the combined power of these computers should allow the researchers to map out the 30,000 to 60,000 rice protein structures, leading to higher yields and more nutritious grain. See [NSF's Discovery](#) for more information on this scientific rice race.



Basmati rice before harvest. Billions of people around the world depend on rice as a major part of their diet. Computational biologists are using a distributed computing network of more than 1 million computers to better understand rice's protein structures. Credit: International Rice Research Institute

DID YOU KNOW?

NSF's [Directorate for Biological Sciences](#) (BIO) funds 67 percent of basic biological research occurring at U.S. universities and colleges. More specifically, NSF's BIO Directorate supports 62 percent of all environmental biology at U.S. academic institutions.

Studies on recent jellyfish blooms offer an example of timely non-medical, NSF-supported biological science research. In recent years, massive blooms of stinging jellyfish have overrun some of the world's most important fisheries and tourist destinations--even transforming large swaths of water into veritable 'jellytatoriums.' The result: injuries (sometimes serious) to water enthusiasts and even occasional deaths. To read more about jellyfish blooms, see NSF's Special Report: "[Jellyfish Gone Wild!](#)"



Credit: Flickr

FACES OF NSF RESEARCH

Staying Competitive: NSF Provides Fellowships to Early-Career U.S. Chemists

Four early-career U.S. chemists were recently awarded the first American Competitiveness in Chemistry Fellowships. The awards showcase U.S. economic competitiveness within the global marketplace and serve to enrich research programs of beginning chemists.

The two-year, \$200,000 fellowships, funded by NSF, require the chemists to establish research partners from industry, national laboratories or centers funded by [NSF's Division of Chemistry](#). Awardees must also develop and implement plans that broaden participation within the chemical sciences.

The inaugural fellows each has a unique set of research objectives.

Takiya Ahmed of the University of Washington is working to convert low-value byproducts from biodiesel manufacturing into more valuable chemical products.

Diane Hinkens of South Dakota State University will increase the efficiency of converting sunlight to energy. She talks about her research and her life as a scientist in a "Science Lives" article, which can be seen at LiveScience.com.



Diane Hinkens is currently a postdoctoral research associate in the Department of Electrical Engineering at South Dakota State University. Credit: Diane Hinkens.



Hinkens is working on organic solar cells, which aim to overcome limitations of silicon-based solar cells. Here she is in a clean room, where the environment is specialized for the fabrication of solar cells. Credit: Qiquan Qiao

Andrea Munro of the University of Arizona is developing new low-cost solar cell devices.

Jonathan Raff of the University of California-Irvine will improve our understanding of how chemical reactions on surfaces affect atmospheric processes, including corrosion, catalysis and the degradation of electronics.

"The fellowship program was established by the NSF Division of Chemistry in response to the president's 2006 American Competitiveness Initiative and Congress' 2007 passage of the America COMPETES Act," said Luis Echegoyen, director of NSF's Division of Chemistry. "It is an excellent vehicle for broadening participation in chemistry." At the time of the award, a fellow must hold a doctorate in the chemical sciences and must be a U.S. citizen or permanent resident.

NSF IN THE NEWS

[Robots and Sensors to Help Elderly Stay Independent](#) (*Dallas Morning News*, 10/14/08) Like smart pets that never require feeding, robots will scoot from room-to-room to wake seniors in the morning, remind them to take their medication and send for help if someone falls. With support from NSF, Dr. Fillia Makedon and colleagues are designing technologies that will allow tomorrow's seniors to remain independent longer than previous generations.

[Data Mining for Terrorists Is Futile](#) (*PC World*, 10/13/08) The kind of pattern-seeking data mining and behavioral surveillance technologies that are being used by several federal agencies to identify potential terrorists are far too unreliable to be of any real value, according to a report issued by the National Research Council (NRC). The continued use of such tools also poses potential privacy problems for individuals, the NRC said in its 376-page report, which was prepared at the request of the U.S. Department of Homeland Security and NSF.

THE RIPPLE EFFECT

Counting Votes “ACCURATE”-ly

A team of computer scientists and other academic researchers from across the country are working to help bring the latest research, insights and innovations from the lab to the voting booth. Created in 2005 with a \$7.5 million award from NSF, the Center for Correct, Usable, Reliable, Auditable and Transparent Elections ([ACCURATE](#)), is funded by NSF's CyberTrust program, an initiative seeking to make the nation's IT systems reliable, even in the face of cyber attacks.

The researchers are examining voting technologies from a scientific perspective and are using a holistic approach to understand how the computers, touch screens and other technologies are interrelated in elections.

The team has created several new tools using existing theories and approaches commonly used in computer science to test voting technologies and systems, which state and local elections officials can use to test their election plans and find possible vulnerabilities. In 2007, the ACCURATE team produced many new research results in all of their core research areas, including system level issues, the role of cryptography, design for verification, relating policy to technology, and usability and accessibility. For more information on ACCURATE, see the [NSF press release](#) and [ACCURATE's 2007 Annual Report](#).



Counting ballots is not the only challenge local elections officials face. Voting systems are vulnerable to attacks from many different sources. ACCURATE's AttackDog project helps the people who run elections analyze their entire voting systems in the same way computer security experts defend their networks against hackers. Credit: Jupiter Images

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“We are excited to have both NSF and NASA award information in Research.gov,” said Kathie L. Olsen, NSF deputy director. “Now anyone can easily find how federal research dollars are spent, giving the general public, the scientific community and Congress a better window into the results achieved with federally-funded research.”



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