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April 2009

NSF AT WORK

Using Science to Feed the World

Sorghum. Credit: Mississippi Genome Exploration Laboratory

Pervasive droughts threaten the food supply around the world, and scientists are responding by trying to develop crop strains resistant to dry conditions. One promising piece of research focuses on sorghum, an African tropical grass that thrives in hot, dry conditions. If the basis of sorghum's drought-resistance could be determined, it might be possible to incorporate this feature into other grassy crops such as wheat and rice.

NSF-supported investigators Joachim Messing, Remy Bruggmann and a team of international collaborators recently reported, in the journal *Nature*, the complete genetic sequence of sorghum. The findings could help breeders produce better food crops in arid areas of the world. They might also lead to improved feedstocks for biofuels.

Joachim Messing, Credit: Rutgers University

The investigators chose sorghum for study because it is a food staple in much of the world, including India and many countries in Africa. You can read more about the work here.

Artist's rendering of world's biggest snake. Credit: Jason Bourque, Florida Museum of Natural History

World's Biggest Snake

Scientists have recovered fossils from a 60-million-year-old South American snake named *Titanoboa cerrejonensis* by its discoverers. Its length and weight make today's anacondas seem like garter snakes. The size of the reptile's vertebrae suggest it weighed 1,140 kilograms (2,500 pounds) and measured 13 meters (42.7 feet) nose to tail tip.

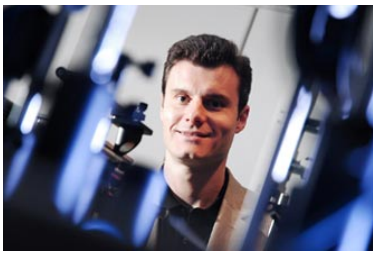
Its size is amazing, researchers say. At its greatest width, the snake would have come up to the hips of an average-height human.

Scientists classify *Titanoboa* as a boine snake, a type of non-venomous constrictor that includes anacondas and boas. Investigators determined the likely placement of *Titanoboa* fossil vertebrae by comparing the fossils' structure to the vertebrae of today's boine snakes. Snake vertebrae become larger near a snake's midsection, but they are also structured differently than vertebrae closer to a snake's head or tail. These estimates show the snake could have been even larger than its fossil remains indicate.

You can read more about this NSF-funded work here.

Detecting Pancreatic Cancer Before It's Too Late

Pancreatic cancer is deadly if ignored but screening for it is dangerous. A pancreatic biopsy can have fatal complications. With few obvious symptoms, the cancer is difficult to detect without one, however.



Vadim Backman. Credit: Northwestern University

Now, results from a recent clinical trial suggest that doctors may be able to detect the early stages of the disease without a pancreatic biopsy. Taking advantage of a phenomenon called the field effect, a hypothesis that cancer causes noticeable changes in adjacent organs, Vadim Backman and coworkers at Northwestern University have developed a less-invasive procedure. They use routine endoscopies to screen the small intestine adjacent to the pancreas.

The team reports in a recent issue of *Disease Markers* about a four-dimensional elastic light scattering fingerprinting (4D-ELF) and low-coherence enhanced backscattering spectroscopy (LEBS) technique that can distinguish cancerous from healthy tissue with 95 percent accuracy. The technique, developed with support from the NSF biophotonics program, appears to be the most successful yet developed for detecting pancreatic cancer at a curable stage and for identifying high-risk individuals.

To read more about this work, see Determining Risk for Pancreatic Cancer.

Branching Nanoscale Molecules Capture Contaminants From Water

Diallo, second from left, and research team. Credit: CalTech

As concerns about a safe and adequate supply of clean water grow, communities around the world are considering alternative water sources and filtration systems. They are searching for water filtration processes with a high capacity for binding contaminants, as well as features that enable scalability and flexibility and are configurable for a variety of purification needs.

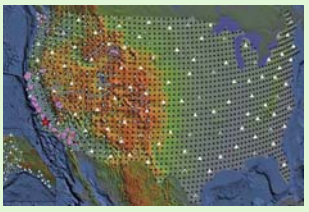
Dr. Mamadou Diallo, Director of Molecular Environmental Technology at the Caltech Materials and Process Simulation Center, recently patented a system for water filtering that uses nanoscale dendrimers. These branched molecules can bind to or react with many different types of contaminants, including metals, ions, bacteria, viruses, and synthetic and natural organic materials. The consistent shape and relatively large size of dendrimers allow membrane or solid matrix filters to capture contaminants that have become bound to the dendrimers in a process requiring little pressure or energy. Because dendrimers are expensive to produce, Diallo and his team have developed low-cost dendrimer-like macromolecules and microparticles that are suitable for existing water systems.

The NSF Directorate for Engineering supports Diallo's research on dendrimer nanotechnology. Since 2005, he has also led NSF-sponsored interdisciplinary research linking researchers from Caltech, Howard University, and the University of California at Berkeley to focus on applying dendrimer nanotechnology to water treatment. Diallo is now seeking to commercialize this technology through a company he co-founded, AquaNano Technologies LLC.

Did You Know?

One of NSF's missions is to provide a world-class research infrastructure, including equipment and facilities essential for discovery, innovation and learning. A recent NSF report lists a number of examples of equipment and facilities that NSF funding has made possible.

These components of the nation's research infrastructure are as varied as a gravity-wave observatory, multiple laboratories for materials research, a center for optical science used to improve Lasik surgery and the EarthScope facility. This continental-scale array of geophysical instruments enables study and prediction of tremor activity in North America.



Map depicting EarthScope instrument array. Credit: EarthScope

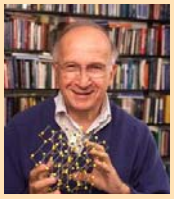
Faces of NSF Research

National Science Board Announces 2009 Award Winners

Once a year, the National Science Foundation (NSF) and the National Science Board (NSB), which oversees NSF policies, bestow honorary awards on the best and the brightest in science. This year's awardees will be honored at a black-tie dinner ceremony on May 13, 2009, at the U.S. Department of State.

It befits this International Year of Astronomy for NSF to have selected 34-year-old astronomer **David Charbonneau** for its **Alan T. Waterman Award**. This award recognizes an outstanding young (under 35) researcher in any NSF-supported field of study. *Discover* Magazine's 2007 Scientist of the Year, and currently the Thomas D. Cabot Associate Professor of Astronomy at Harvard, Charbonneau develops novel techniques for the detection and characterization of extra-solar planets, also known as exoplanets, orbiting nearby Sun-like stars.

A Bronx native who attended New York City public schools through junior high, **Mildred Dresselhaus** is one of the foremost experts in the multi-faceted field of carbon science and long-time MIT Institute Professor. She has been named the NSB 2009 **Vannevar Bush Awardee**. Dresselhaus is honored for her leadership through public service in science and engineering, her perseverance and advocacy in increasing opportunities for women in science, and for her extraordinary contributions in the field of condensed-matter physics and nanoscience.



The NSB has also selected two recipients of the 2009 NSB **Public Service Award**. This annual award recognizes both people and organizations that have increased public understanding of science and engineering. **Roald Hoffmann**, 1981 Nobel laureate in Chemistry, is recognized for his extensive, broad-reaching and diverse contributions to increasing public understanding of science and, more specifically, fostering appreciation of the relevance of chemistry to culture.

The American Chemical Society's (ACS) Project SEED (Summer Experiences for the Economically Disadvantaged) summer research program is the second recipient of this year's award, chosen for fostering interest in science as a career through work with groups of economically disadvantaged high school students.

For more information on the NSB 2009 award winners, see the NSF press releases on the Alan T. Waterman, Vannevar Bush and Public Service awardees.

NSF in the News

Horses Domesticated Earlier Than Once Thought (*The Boston Globe)* New evidence shows that the Botai people, residents of the region of Central Asia now known as Kazakhstan, domesticated horses over 5,000 years ago, about 1,000 years earlier than had been widely believed. The work was funded by Britain's Natural Environment Research Council, the British Academy and NSF.

Sleuthing Software Can Reassemble Deleted Photos (*The New York Times)* Is a deleted digital photograph gone forever? New software has now been developed that is smart enough to find and reassemble fragments of digital photos, even when the directions for locating the fragments have also been deleted. The work was funded, in part, by NSF.

Spun-sugar Fibers Spawn Sweet Technique For Nerve Repair (*Medical News Today)* Researchers at Purdue University have developed a technique using spun-sugar filaments to create a scaffold of tiny synthetic tubes that might serve as conduits to regenerate nerves severed in accidents or blood vessels damaged by disease. The work was funded by NSF and the National Institutes of

THE RIPPLE EFFECT

Upcoming Hearing

Date and Time: Thursday, April 30, 2009 10:00 a.m.
Location: 192 Dirksen Senate Office Building
Hearing: Fiscal Year 2010 Budget Hearing
Committee: Senate Committee on Appropriations; Subcommittee on Commerce, Justice, Science and Related Agencies
Witnesses: Dr. Arden L. Bement, Jr., NSF; NOAA representative

NSF and the American Recovery & Reinvestment Act of 2009

On February 17, 2009 in Denver, Colo., the President signed into law the $789 billion American Recovery and Reinvestment Act of 2009. A component of this legislation provides an extra $3 billion to NSF, nearly half its typical annual budget, for investment in scientific research.

As President Obama noted, *"this recovery act represents the biggest increase in basic research funding in the long history of America's noble endeavor to better understand our world. And just as President Kennedy sparked an explosion of innovation when he set America's sights on the moon, I hope this investment will ignite our imagination once more, spurring new discoveries and breakthroughs in science, in medicine, in energy, to make our economy stronger and our nation more secure and our planet safer for our children."*

NSF management has developed plans for allocating and overseeing these funds. The money will fund research projects but will also be used to develop infrastructure, create new scientific tools and support the training of new scientists.

NSF Booth at AAAS Meeting

NSF staff and investigators participated in the AAAS Annual Meeting Feb. 12-16, 2009, held in Chicago. The theme for NSF's presentation was "Climate Change." NSF-funded investigators from around the country presented results of their research on this topic to attendees at the meeting.

Many people agree that global climate change is one of the most urgent and pervasive challenges for science and technology in the 21st Century. New knowledge from NSF-funded research is advancing our understanding of global climate change, its impacts, and the need for informed public policy decisions.

On February 19, 2009, the first episode of NSF's video series *"To What Degree? What Science Is Telling Us About Climate Change"* premiered on the ResearchChannel. The multi-part series will air throughout the spring. Episodes will also be available on the Research Channel Web site.

Come behind the scenes with the National Science Foundation to explore the science of climate change. Meet the scientists on the cutting edge. Learn how we read Antarctica's deepest secrets, collect clouds, build computer models to contain an entire world--and try to stay one step ahead of a changing planet.

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.