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July 2006

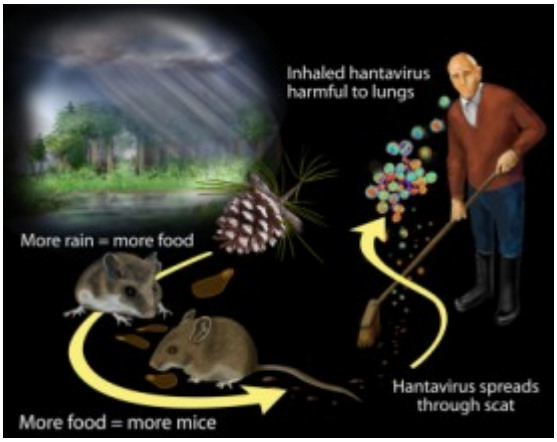
Scientists Use Satellite Images to Forecast Hantavirus Outbreaks

The Four Corners region of the United States -- where Arizona, New Mexico, Colorado and Utah meet -- will be at greater risk for hantavirus outbreak this year than in 2005, say scientists at Johns Hopkins University, the University of New Mexico, and other institutions.

The study is among the first to forecast the location and extent of an infectious disease outbreak. The forecast, based on research funded by the joint NSF-NIH Ecology of Infectious Disease Program, is based on an analysis of satellite imagery.

To forecast the disease risk, the scientists examined 2005 satellite images of areas of the Four Corners region where vegetative growth, soil moisture and other ecological conditions favored mice and hantavirus spread. They then calculated the level of risk for the region in 2006.

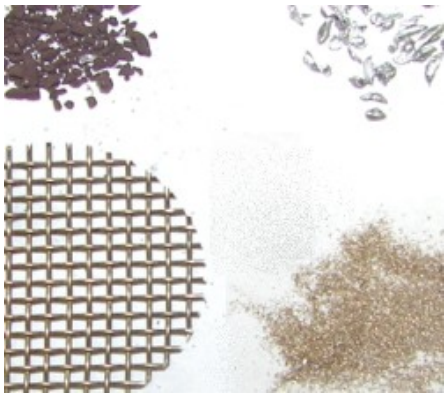
The researchers verified the accuracy of their forecast model by comparing their forecasts with actual hantavirus outbreaks going back to 1993. Their forecasts accurately predicted the actual disease outbreaks for 1994, 1998 and 1999.



Hantavirus pulmonary syndrome -- a rare but deadly respiratory disease -- is caused by exposure to a variety of hantaviruses. Contact with rodents and their waste puts humans at risk for exposure to hantavirus. In 2005, the Four Corners region recorded four cases of hantavirus. Now, researchers forecast the risk of hantavirus outbreaks by studying satellite images. Credit: Zina Deretsky, NSF.

Read NSF's press release, "Increased Risk of Hantavirus Forecast for U.S. Southwest" for more details on this NSF, NIH and CDC co-supported project.

NSF-Funded Researchers Solve Lead-Poisoning Mystery



Virginia Tech researchers examined different types of leaded particles that can attach to screens or sampling containers, rendering them undetectable during water tests. Their data demonstrated actual lead content in water up to five times higher than amounts determined by standard testing procedures. Credit: Christopher Strock, Civil Engineer, Virginia Tech.

Researchers funded by NSF have found evidence that particles of lead solder used in plumbing may have sickened two children in Greenville, N.C. The researchers collaborated with local health department officials who were initially perplexed because a thorough search could not identify the usual poisoning sources, such as leaded paint chips or leaded dust in the buildings the children frequented.

The Virginia Tech team demonstrated actual water-lead contents that were five times higher than amounts determined by standard water tests.

The team found that larger leaded particles can get trapped in faucet aerator screens or cling to sampling containers, precluding them from making it to the actual water analysis. Yet these lead fragments still pose a hazard, particularly if they become dislodged.

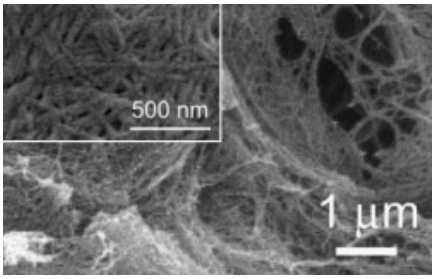
Read NSF's press release, "The Ones That Get Away" for more details.

Novel Nanogels Hold Enormous Promise

Researchers have created organic gel nanomaterials that could be used to encapsulate pharmaceutical, food, and cosmetic products and to build 3-D biological scaffolds for tissue engineering.

Scientists combined olive oil, six liquid solvents, and an enzyme to chemically activate a sugar that changed the liquids to organic gels. The novel compound self-assembles into 3-D fibers measuring approximately 50 nanometers in diameter. As the fibers entangle, they entrap some 10,000 molecules.

Funding for the research was provided by NSF through the Center for Directed Assembly of Nanostructures, a Nanoscale Science and Engineering Center at Rensselaer Polytechnic Institute. For more, see NSF's "Researchers Create New Organic Gel Nanomaterials."



Biocompatible nanogels could be used for tissue engineering, artificial membranes and drug delivery. These scanning electron microscope images show nanogel fibers. Credit: Jonathan Dordick, Rensselaer Polytechnic Institute.

Hype for HIAPER's First Complete Mission

HIAPER, the nation's most advanced research aircraft, just completed its first experiment. A modified Gulfstream V jet, the aircraft can fly at higher altitudes for extended periods and can carry 5,600 pounds of sensing equipment, making it the premier plane for scientific discovery. Credit: NSF.

The nation's most advanced research aircraft, called HIAPER –- short for High-Performance Instrumented Airborne Platform for Environmental Research -- recently completed its first scientific mission.

The experiment, known as terrain-induced rotor experiment, or T-REX, consisted of a series of nine-hour flights over a one–month period. An international team of 60 researchers gathered data about treacherous whirlwind turbulence called atmospheric rotors and the waves of air associated with them. Very little is known about how rotors develop and the dangers they pose to commercial aircraft.

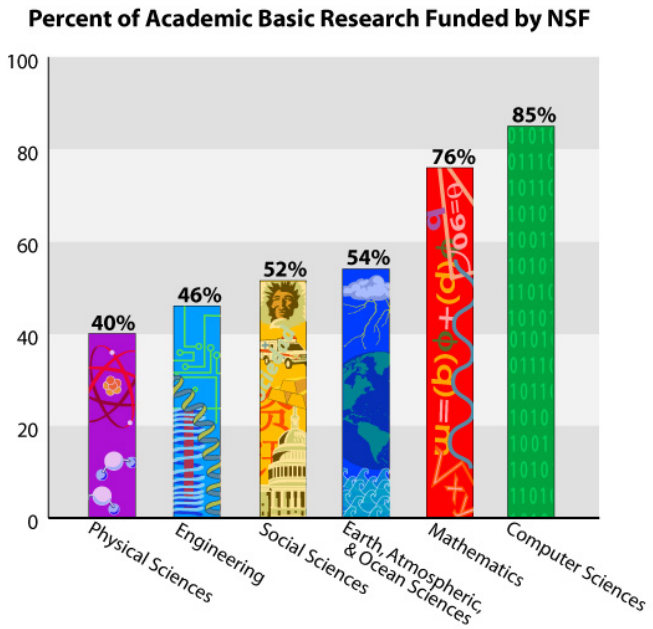
Even though project flights lasted only a month, researchers are already making discoveries that may help protect commercial aircraft flying over mountainous terrain. For more, see NSF's "Nation's Most Advanced Research Aircraft Completes First Science Mission."

Did You Know?

Each year, NSF supports about 13 percent of all federally financed R&D occurring in our nation's universities.

With this investment, **NSF supports the majority of basic academic research in six fields: computer sciences; earth, atmosphere, and ocean sciences; engineering; mathematics; physical sciences and social sciences.**

These disciplines are considered pivotal to maintaining our nation's preeminence in science and engineering. See Chapter Five of Science & Engineering Indicators 2006 for more on NSF's role in academic research and development.



Faces of NSF Research

Going to School with Samuel Wheeler

Meet Sam Wheeler from Southeast Raleigh High School and one of our nation's most outstanding math and science teachers -- with a medal from President Bush to prove it. Wheeler is a 2005 recipient of the "Presidential Awards for Excellence in Math and Science Teaching." During his 11 years in the classroom, Wheeler has learned to have fun with the courses and the kids. "There are lots of exciting things that science teachers can do. I have found that if the kids see an excited teacher, they get excited too!" We recently talked with Sam and were as inspired as his students.

NSF: What is your most successful tool to inspire students to study science? **Wheeler:** I craft my science courses in such a way that the students themselves become the investigator and principal learner, and I become a guide or facilitator. If they are allowed to explore the material from their own interests with the proper springboard, then it is easier to inspire them.

NSF: What do you consider the biggest challenge in getting students excited about science? **Wheeler:** It's getting students to overcome their fear of math and science. This fear usually stems from the fact that science requires a committed thought process rather than the usual "immediate-gratification" experience that many students expect. Teaching science involves teaching students how to approach and solve problems and with that, how to overcome the roadblocks and hurdles associated with all problems. Once students learn how to slow down and think through a problem, science becomes more exciting and rewarding to them.

NSF: Describe a student's "aha" moment, when something you were teaching in class "clicked." **Wheeler:** I'm reminded of one instance, in particular. We were working on a projectile-motion lab, and one student had already run through the experiment several times unsuccessfully. The student was struggling with the concept of 2-D motion. I went over to help de-bug his setup. The student soon remarked, "You know, from watching the other groups, if your table is higher, the marble goes further." That was one of the key points I wanted them to get from the lab, but I purposefully left it out of their lab handout. I thought to myself -- and probably said aloud -- "he finally understands!" It was a great moment for me as a teacher!

NSF: What feedback do you get from your students concerning science, and how important do they consider it to everyday life? **Wheeler:** I incorporate current events on science in general, and physics in particular, into my curriculum. Each week I have students present their current event to the class, and I give the class a chance to ask the presenter questions. Usually I add my own commentary to the discussion as well. I have found that many students want to give feedback on how science and math affect their lives. Soon after, they realize more and more that their everyday life is impacted by the subject they study.

"Our society cannot exist as it is today if the future populations don't re-supply the engineering, research and teaching roles that have kept America strong and independent."

NSF in the News

3-D Imaging Goes Ballistic
Wired News (07/20/06) -- New ballistics-imaging technology developed by Intelligent Automation of Rockville, Md., allows forensic experts for the first time to capture a fired bullet's distinctive markings in 3-D. The technology was developed with help of NSF funding.

Camp Helps Girls Apply Math, Science to Life
St. Petersburg Times (FL) (07/16/06) -- The University of South Florida Oceanography Camp for Girls encourages entering high school freshmen to apply their math and science knowledge as partners in a simulated commercial fishing company. The camp was launched a decade ago with seed funding from NSF.

National Study Investigates Air Turbulence
ABC7 Chicago (07/14/06) -- The new $81.5-million NSF Gulfstream Five study aims to gain enough insight into clear air turbulence to make it predictable so as to boost commercial flight safety.

"From Commitment to Engagement: How Industry Can Cultivate Competitiveness"

Read excerpts from Dr. Arden L. Bement's address at the Digital Dialogue Forum June 28, 2006

Maintaining U.S. competitiveness is one of the greatest challenges facing industry, academe and government. The President's announcement of the American Competitiveness Initiative, better known as the ACI, brought this challenge to the national stage.

Although NSF primarily supports fundamental research, we also have direct partnerships with the private sector. NSF's research center programs, such as our Industry/University Cooperative Research Centers, invite private sector partners to engage in or sponsor cutting-edge research that often leads to technological innovations.

NSF's Small Business Innovation Research and Small Business Technology Transfer programs support the largest source of new jobs in the country – emerging small businesses. Our small business programs support a host of high-impact emerging technologies, including nanotechnology and information technology.

The importance of engaging local schools cannot be overstated. Last week, the *Christian Science Monitor* cited a study showing a 40 percent drop-out rate among high-school students in the nation's 10 largest public school districts. At that rate, the study found that less than half of black and Hispanic male students will earn a diploma. The *Monitor* describes the dropout rate as a "societal crisis," which is an understatement.

The United States cannot afford this loss of intellectual resources. These high-school students are literally our future, and they live, discouraged, in our neighborhoods. Aristotle said, "Well begun is half done." Commitment is the first, well-begun, half; active engagement completes the task.

Senate Appropriators Recommend Seven Percent Increase for NSF

On July 13, 2006, the U.S. Senate Committee on Appropriations approved the FY 2007 Commerce, Justice, Science Appropriations bill for fiscal year 2007 and provided NSF with $5.99 billion. The appropriation is $28.3 million below NSF's FY 2007 budget request and $410.5 million over the FY 2006 enacted level.

The Research and Related Activities account is funded at $4.65 billion -- $19.5 million below the request and $314.9 million above the current estimate. The FY 2007 request levels of $101.2 and $50.7, respectively, are provided for the Plant Genome Research program and National Radio Astronomy Observatory.

The Education and Human Resources account is funded at $835.8 million, or $19.5 million above the request level and $39.1 million above the current estimate. The increase above the request level will plus up the Experimental Program to Stimulate Competitive Research, the Historically Black Colleges and Universities—Undergraduate program, the Louis Stokes Alliances for Minority Participation program, and the Science, Technology, Engineering and Mathematics Talent Expansion program.

The Major Research Equipment and Facilities Construction account is funded at $237.3 million, or $46.4 million above the FY 2006 estimate and $3 million below the request. Five continuing projects and three new starts are funded at the request level.

The Salary and Expenses account is funded at $256.5 million, $9.7 million above the FY 2006 enacted level and $25.3 million below the budget request. The National Science Board and the Office of Inspector General are funded at the request levels of $3.9 and $11.9, respectively.

The U.S. House of Representatives passed its version of the FY 2007 Science, State, Justice, Commerce, and Related Agencies Appropriations bill on June 29, 2006. The House version of the bill provides NSF with its full FY 2007 request of $6 billion, or $439 million over the FY 2006 enacted level versus the $411 million over the FY 2006 enacted level provided by the Senate Appropriations Committee, resulting in a $28-million difference. The full Senate is expected to consider the bill after the fall recess.