

NSF AT WORK



Maysam Ghovanloo (left) points to a small magnet attached to graduate student Xueliang Huo's tongue. Credit: Gary Meek, Georgia Tech

### Tongue-in-Cheek Technology

Researchers have developed an experimental system that may allow individuals with debilitating disabilities to control wheelchairs, computers, and other devices with ease and sophistication--through a tongue-based system.

Because the tongue is connected to the brain via cranial nerves, it usually remains mobile when other body parts lose function due to disease or accidents. This gives patients a greater range of motion and an alternative to a medical sip/puff switch control or a brain implant.

Electrical engineer Maysam Ghovanloo developed the Tongue Drive system with graduate student Xueliang Huo.

"Tongue Drive is inherently wireless and touch-free because it relies on a tiny magnetic tracer attached to the tongue with no power consumption," says Ghovanloo. "Tongue movements are fast, accurate and do not require much thinking, concentration or effort."

The new technology, funded by both NSF and the Christopher and Dana Reeve Foundation, is already showing speed and flexibility that surpass other technologies. For more information, see the [NSF press release](#).

### Research Turns Biodiesel Waste Into Profitable Chemicals

Chemical engineers at Rice University have unveiled a set of techniques for cleanly converting problematic biodiesel waste into profitable chemicals. A new fermentation process now allows certain bacteria to convert glycerin--the major waste by-product of biodiesel production--into formate, succinate and other valuable organic acids.

"The rapid increase in biodiesel production has left biodiesel producers paying to get rid of it," said lead researcher Ramon Gonzalez, Rice's William W. Akers Assistant Professor in Chemical Biomolecular Engineering. "The new metabolic pathways we have uncovered paved the way for the development of new technologies for converting this waste product into high-value chemicals."

"We want to use the technology as a platform for the 'green' production of a whole range of high-value products," Akers said.

Technologies based on this work have been licensed to Glycos Biotechnologies Inc., a Houston-based startup company that plans to open its first demonstration facility within the next 12 months. The U.S. Department of Agriculture, NSF, Rice University and Glycos Biotechnologies supported this research. See the Rice University [press release](#) for more information on this discovery.



Oil from soybeans is the usual starting material for biodiesel. Credit: Scott Bauer, ARS



Communities may soon have advance warnings of flash floods. Credit: U.S. Geological Survey

## Scientists Test System to Forecast Flash Floods along Colorado's Front Range

People living near vulnerable creeks and rivers along Colorado's Front Range may soon get advance notice of potentially deadly floods, thanks to a new forecasting system being tested this summer by the National Center for Atmospheric Research (NCAR) in Boulder, Colo. Known as the NCAR Front Range Flash Flood Prediction System, it combines detailed atmospheric conditions with information about stream flows to predict floods along specific streams and catchments.

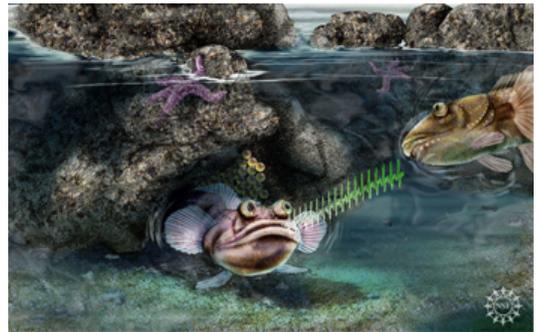
"The goal is to provide improved guidance about the likelihood of a flash flood event many minutes out to an hour or two before the waters start rising," says NCAR scientist David Gochis, one of the developers of the new forecasting system. "We want to increase the lead time of a forecast, while decreasing the uncertainty about whether a flood will occur."

Funding to create the system came from NSF, which is NCAR's sponsor, as well as the National Oceanic and Atmospheric Administration. For more on the system, see the NSF [press release](#).

## Sorry, Charlie, You and Nemo Aren't the Only Fish That Talk

From the comedic portrayal of "Mr. Limpet" by Don Knotts, to the children's Disney favorite, "Nemo," fish can talk, laugh and tell jokes--at least on television and the silver screen. But can real fish verbally communicate? Researchers say, "Yes," in a paper published in the July 18 issue of *Science*.

By mapping the developing brain cells in newly hatched midshipman fish larvae and comparing them to those of other species, Andrew Bass and his colleagues, Edwin Gilland of Howard University and Robert Baker of New York University, found that the neural network behind sound production in vertebrates can be traced back through evolutionary time to an era long before the first animals ventured onto dry land. The neural circuitry that enables human beings to verbally communicate--not to mention birds to sing, and frogs to "ribbit"--was likely laid down hundreds of millions of years ago with the hums and grunts of fish. To hear clips of chattering fish, visit the NSF [press release](#).



An artist's representation shows the midshipman fish singing to attract a mate. Credit: Nicolle Rager Fuller, NSF

### DID YOU KNOW?

The world has some 7,000 living languages, and linguists estimate they are dying off at a rate of one every two weeks. You can now hear some of these languages on the big screen.

"The Linguists," a film documentary funded in part by NSF, follows scientists David Harrison of Swarthmore College and Gregory Anderson of Living Tongues Institute on a journey to record unique languages and understand the cultural and political pressures threatening their extinction.

The film premiered at this year's Sundance Film Festival. Visit [www.thelinguists.com](http://www.thelinguists.com) to see the film's trailer.



In Bolivia, linguists David Harrison and Gregory Anderson worked to document a language once spoken by healers to the Inca emperor. Credit: Ironbound Films, Inc.

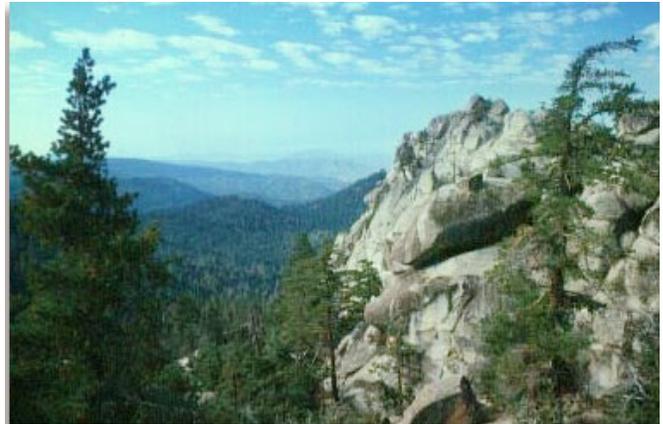
## FACES OF NSF RESEARCH

### Facing the Great Outdoors, Indoors!

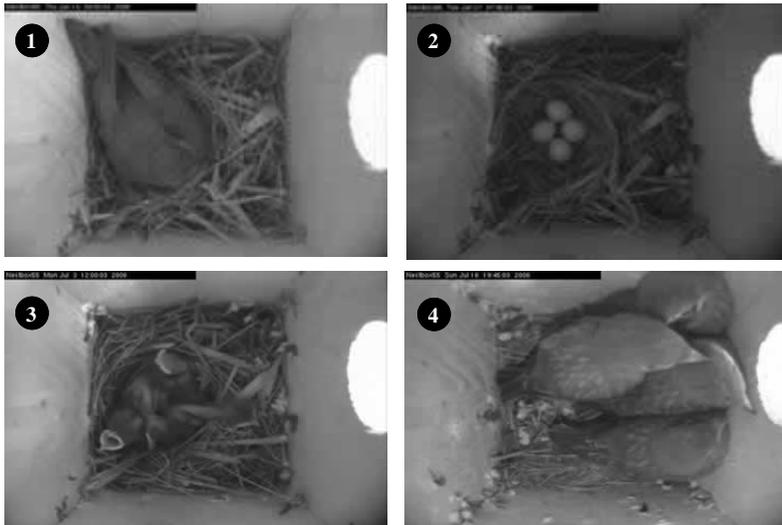
Have you ever wanted to witness the beauty of nature from the comfort of your home? NSF-supported technology is making that a real possibility.

The University of California, Los Angeles's [Center for Embedded Networked Sensing](#) (CENS) develops sophisticated wireless sensing systems and cameras that enable scientists, and the public, to observe natural ecosystems with a level of detail that was never before possible.

CENS brings engineers, computer scientists, and biologists together in the development and testing of a variety of wireless networked, durable, low-power, land- and water-based sensing systems.



Scenic overlook of the James San Jacinto Mountain Reserve in California. Credit: James San Jacinto Mountain Reserve



Western Bluebird development observed through a nestbox camera: (1) the female laying eggs; (2) a clutch of four eggs; (3) four nestlings; and (4) the nestlings at nest-fledging size. The photos were taken as part of the CENS project, "Imagers for Animal Observing Systems." Credit: CENS Sensing and James Reserve

The systems can monitor ecosystems ranging in scale from microscopic to an entire watershed, and within a gradient of landscapes from urban to wildland.

NSF provided funding for wireless embedded networked sensing systems at two sites in the University of California Natural Reserve System: the [James San Jacinto Mountains Reserve](#) and the [Quail Ridge Reserve](#).

By controlling robotic cameras, users can take a look around each site in real-time. Other features accessible to the public include vegetation cameras, audio recordings and bird nestbox cameras. See the development of bluebirds as captured by a nestbox camera on the left.

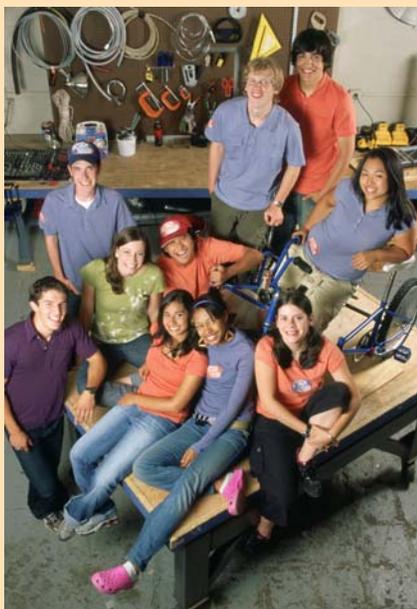
## NSF IN THE NEWS

[Clean Water More Accessible](#) (*The Daily Texan*, 07/23/2008) -- An international research team has developed a process to desalinate water that will make water cheaper and more accessible.

[Researchers Look to Mass Produce Plant Gene for Biofuel](#) (*Energy Current*, 07/21/2008) -- The oleoresin gene has been cloned from the copaiba "diesel tree." This gene is being introduced into other plants to mass produce oleoresin, which could be used to fuel automobiles.

[Researchers Rebuild Their Effort to Rebuild the Internet](#) (*The Chronicle of Higher Education*, 07/18/2008) -- The Global Environment for Network Innovations project, which hopes to develop a new and improved Internet, has included efforts from disciplines other than computer science in hopes of maximizing the Internet replacement's effectiveness and impact.

## THE RIPPLE EFFECT



The cast of "Design Squad," where highschoolers face a wide variety of engineering challenges. Credit: WGBH Boston

## Roll Out the Red Carpet: Science Media Wins Big with Daytime Emmys® and More

It has been a banner year for NSF-supported educational science media. Award-winning television programs include PBS Kids' "[Design Squad](#)," and "[FETCH!](#)," and Discovery Kids' "[PEEP and the Big Wide World](#)," all produced by WGBH Boston, and "[DragonflyTV](#)," produced by Twin Cities Public Television. These shows, which are broadcast on public television stations around the country, were honored at the 35th Annual Creative Arts & Entertainment Daytime Emmy® Awards program of 2008.

"Design Squad" won a Daytime Emmy® for Outstanding Directing in a Children's Series. Targeted to nine- to 12-year-olds, "Design Squad" inspires a new wave of future engineers as it follows eight high-school students through an array of engineering challenges. The show also won the prestigious [Peabody Award](#) for its first season.

Part game show, part reality TV and part spoof, "FETCH!" features real kids, real challenges, real science and an unreal host (an animated dog) named Ruff Ruffman. Targeting six- to ten-year olds, "FETCH!" mixes live-action with animation, and took home the Daytime Emmy® for Outstanding Original Song under the Children's and Animation category.

"DragonflyTV," now in its seventh season, was awarded two Daytime Emmy® awards for Outstanding Achievement in Single Camera Photography and for Outstanding Achievement in Single Camera Editing. "DragonflyTV," a science education program, uses the resources of television, community outreach and the Web to engage millions of children, parents and teachers in accessible, hands-on science activities.

The animated series "PEEP and the Big Wide World" follows a newly hatched chicken on his daily adventures in and around a pond, a bush and a tin can. Each episode contains two stories that highlight specific science concepts, plus two live-action shorts presenting real kids playing and experimenting with these concepts. The writers of "PEEP and the Big Wide World" won the Daytime Emmy® award for Outstanding Writing in Animation.



"PEEP and the Big Wide World" is based on the original artwork of Oscar-nominated, animator Kai Pindal and has a theme song performed by blues legend Taj Mahal. Credit: WGBH Boston

A Web-based project funded by NSF also won recognition for bringing Polar research to audiences around the world. "[Ice Stories: Dispatches from Polar Scientists](#)" offers a close look at the world of penguin biologists, glaciologists, cosmologists, geologists and marine scientists working in Antarctica and the Arctic. "Ice Stories" received two recognitions at the 12th Annual Webby Awards in New York City on June 8-10, 2008: it was nominated in the Events and Live Broadcasts category and selected as an Honoree in the Science Web site category.



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.