



National Science Foundation
WHERE DISCOVERIES BEGIN



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Cataloging the Turtles of the World

Turtles are an ancient group of reptiles, with living species that diverged from each other well over 200 million years ago. Yet, about half of all turtle species, including the much-loved sea turtles, are in danger of extinction, according to scientists at the University of California-Los Angeles.

At the lab of biologist **Bradley Shaffer**, scientists and students are collaborating to acquire tissue samples from each turtle and tortoise species on the planet, sequence a portion of its genes, and build a phylogeny, or family tree, for the approximately 330 species living today. The tree will provide a detailed summary of the genetic distinctiveness of each species and how their characteristics diverged over time. In general, turtle species live primarily in the water and tortoise species on land.

In the past four years, the researchers have acquired tissue and used modern DNA-based tools to sequence a portion of the genes for roughly 80 percent of the living species. They have also led the sequencing of the first complete genome of a single turtle--a female *Chrysemys picta bellii*, or western painted turtle. The team plans to complete the NSF-supported family tree project in another year or so, and to make the results available for use in prioritizing turtle conservation programs. The data will also help scientists learn more about evolutionary processes such as changes in turtle shells and skulls.

Learn how sea turtles navigate during their long migration in this [NSF press release](#).



This western painted turtle was the first to have its complete genome sequenced. *Credit: Bradley Shaffer*

Technology Identifies Speech With Blazing Speed

Speech-recognition technologies translate human speech into searchable text. Engineers at Voci Technologies--a commercial startup company that stems from NSF-funded technologies developed at Carnegie Mellon University (CMU) in Pennsylvania--created the world's fastest **speech-recognition technology**. The hardware rapidly and



A telephone interviewer conducts a

affordably translates millions of hours of human voice into text, which can then be searched efficiently for applications ranging from business intelligence to homeland security.

survey. *Credit: University of Michigan*

The speed of the Voci technology allows it to extract text from large, complex data sources, such as the torrent of media being uploaded to the Web. The technology can be used to mine business intelligence from recorded interactions with call centers and to search vast streams of audio intercepts for threats to national security.

All of the speech recognizers until recently existed as software running on conventional computers. The software was profoundly limiting for tasks requiring extreme speed or accuracy.

A novel computing platform developed by CMU researchers broke these barriers by moving essential calculations into custom hardware. The resulting commercial product, available from Pittsburgh-based **Voci**, delivers a recognizer that is 10 to 100 hundred times faster than competing solutions, at an energy savings of 85 percent.

*Did you know... ? NSF features research outcomes from all states on "Science, Engineering, and Education Innovation" at **Research.gov**.*

Undergrads Unlock Fruit- and Flower-Aging Process

Students at the University of Hawaii and two community colleges collaborated to **discover** a common class of enzymes that trigger the aging of fruit and flowers important to Hawaii's economy.

The students sequenced genes and proteins and identified the enzymes, known as cysteine proteases, responsible for the aging process. The team found that low activity of the enzymes in unripe fruit and healthy colored flowers is due to an enzyme inhibitor known as cystatin. Upon division of the inhibitor, the enzymes are activated and start the aging process.

Knowing how to manipulate these enzymes could enable researchers to delay browning and softening, thereby decreasing post-harvest losses and increasing shelf life. Because the enzymes also occur in humans and play a role in degenerative diseases such as arthritis and Alzheimer's, controlling the enzymes could also lead to improved treatments for these conditions.

The students are investigating plants deeply rooted in local Hawaiian culture, such as pineapple and anthurium, or flamingo flower. According to their mentor, David Christopher, one of the goals of the project is to provide research opportunities to undergraduate university and community college students in the fields of advanced genomics and molecular biology research.

As they conduct research, the students interact with graduate students, post-doctoral scientists and professors, and use sophisticated equipment not available in small colleges.

The studies are part of a larger effort by researchers in the state to make pineapples more resistant to common pests and diseases.



Students examine plant tissue cultures used for protein sequencing. *Credit: David Christopher, University of Hawaii*



Pineapple plant. *Credit: Thinkstock*

Painting a Changing World

It's easy to miss changes in the world around us that occur over a long time span. Two new apps for iPads and iPhones are helping people observe and understand those changes.

Red Hill Studios created "**Painting With Time**" and "Painting With Time: Climate Change" to illustrate changes occurring in nature that are hard to pinpoint because of their long time scale.

The inexpensive applications include a gallery of photographs--with no alterations or manipulations--that users can select and use to apply effects that occur over time, either by "painting" on the image or using sliders. Users can change the season or time of day, move boundaries, or alter a person's age, for example.

Robert Hone, creative director of Red Hill Studios in California, said the applications and their touch-screen features have a powerful impact on people's perceptions of change.

"What's different about touch screens is that there is an almost tactile sensation," he said. "People tend to view that interaction with more meaning when they are directing the action.... When they are wiping away a glacier to reveal the condition that it is in now...it is a powerful visual punch."

The project of exploring change over different time scales began in 1993 with an NSF grant. Soon after that, Red Hill Studios and the Science Museum of Minnesota, with NSF support, developed the traveling museum exhibition "**Playing With Time**." This led to a two-hour television special, "**Exploring Time**," co-produced with Twin Cities Public Television. The "Painting With Time" app is based on those projects. The "Painting With Time: Climate Change" version focuses on the influence that climate has had on landscapes and coasts, including impacts of floods, droughts and melting glaciers.

Next, Red Hill Studios plans to add a "Now and Then" camera application that will allow individuals to build a composite of old and new images of a specific location.

"We are fascinated with the things that we know we can't see, but we know are happening," said Hone.



"Painting" the dramatic changes on the Cape Hatteras, N.C., coastline due to climate change. *Credit: Robert Hone, Red Hill Studios*



"Time slices" of the Boston Commons over several months in the spring. *Credit: Robert Hone, Red Hill Studios*

Diversity Programs Give Illusion of Corporate Fairness

Diversity training programs lead people to believe that work environments are fair, even when they see evidence of inequities in hiring, promotion or salaries, according to an **NSF-funded study**.

Workplace diversity programs are often developed by human resource departments to foster a more inclusive environment for employees--but are not usually tested for effectiveness.

A team of psychologists from the University of Washington and other universities studied whether the existence of diversity programs alone can convince others that companies value diversity and treat employees equally. The researchers used surveys to measure perceptions of companies' fairness toward minority employees.

The researchers found that a hypothetical company that had a "diversity statement" led study participants to believe the company had treated women and minorities fairly, even when provided with evidence that the actual hiring, promotion and salary practices disadvantaged these groups. The team also reported that the participants, all of whom were white, were less likely to take discrimination complaints seriously at companies that had diversity programs.



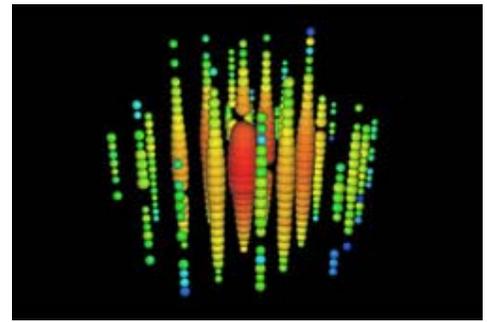
Credit: Thinkstock

South Pole Observatory Detects High-Energy Neutrinos

During their analysis of two years' worth of data from the **IceCube Neutrino Observatory**, scientists spotted two promising events. In April, the scientists **confirmed** that data from the two events indicate detection of the highest energy neutrinos ever observed--the biggest successes to date for the facility. The amount of energy detected indicates the neutrinos probably originated in outer space; however, more analysis will be required to confirm their origins.

The IceCube research platform, an array of interconnected detectors buried deep within the ice cap at the South Pole, records collisions between neutrinos and ice particles. Collisions are recorded approximately every six minutes. Most of the neutrinos exhibit energy in the range expected for neutrinos originating from Earth's atmosphere, the sun, or other nearby sectors of the Milky Way Galaxy. The energy of the two promising events was on a much **larger scale**, indicating a likely origin from far away in our galaxy or even more distant places.

Neutrinos originating from collisions in outer space provide clues to the origin and makeup of objects in the universe.



IceCube data: each sphere represents an optical sensor; the size of the sphere represents the amount of energy detected. *Credit: IceCube Collaboration*

Report Shows Baccalaureate Origins of Doctorate Recipients

Research universities play a large role in the undergraduate education of those earning science and engineering (S&E) doctorates in the United States, an NSF report has shown.

Of the top 50 U.S. institutions that had awarded bachelor's degrees to the 2002-2011 S&E doctorate recipients, all but one are research universities with very high research activity. Among the 2011 doctoral degree recipients, 29 percent had earned their bachelor's degrees from U.S. doctorate-granting institutions with very high research activity.

Public universities also play a prominent role in the baccalaureate training of U.S. S&E doctorate recipients: approximately two-thirds of the institutions on the top-50 list are public institutions.

Foreign institutions also play an increasingly large role. In 2011, 35 percent of the individuals earning S&E doctorates from U.S. institutions held bachelor's degrees earned in another country, up from 31 percent in 2002.

More information is available in this **InfoBrief** from NSF's National Center for Science and Engineering Statistics.



Credit: Thinkstock

National Science Foundation in the News

Lending STEM a Helping Hand (*Science*)--NSF teamed with Intel and GE to launch a project encouraging high-tech companies to train 1 million STEM graduates by 2020.

NCAR Scientists Study Rash of Tornadoes in High-Tech Jet (*CBS Denver*)--Colorado scientists are gathering valuable data that could improve severe weather predictions and give

people more time to prepare.

Robotic Fly Takes Flight (*USA Today*)--The first insect-sized robot promises applications such as military surveillance, search and rescue, and artificial pollinators for farmers.

Einstein's Gravity Theory Passes Toughest Test Yet (*NBC News*)--Scientists using a technique developed at the NSF-funded Green Bank Telescope reported that recently observed pulsar activity supports the theory of general relativity.



*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. Its Fiscal Year 2012 budget was \$7.0 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. Each year, NSF receives more than 50,000 competitive requests for funding, and makes about 11,000 new funding awards. Contact NSF's **Office of Legislative and Public Affairs** at 703-292-8070 for more information or for permission to reuse newsletter images. Editor: Amber Jones. Contributor: Ayesha Monga Kravetz.*



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