

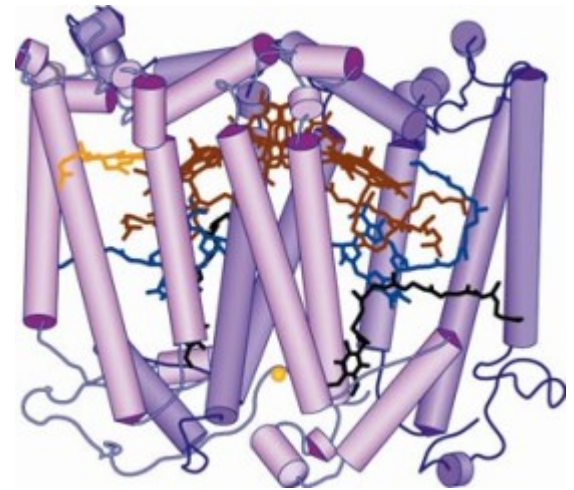
NSF AT WORK

Photosynthesis Events Happen in a Millionth of a Millionth of a Second

During the remarkable cascade of events in photosynthesis, plants approach the pinnacle of stinginess by scavenging nearly every photon of available light energy to produce food. Yet after many years of careful research into the exact mechanisms, some key questions remain about this fundamental biological process that supports almost all life on Earth.

An NSF-supported research team has come up with a new insight into the mechanism of photosynthesis. The discovery involves the orchestrated movement of proteins on the timescale of a millionth of a millionth of a second.

This research -- focused on understanding the basic principles of photosynthesis -- could be valuable in the design of organic solar cells. The efficiency of energy conversion by photosynthesis is much higher than traditional solar devices. Traditional solar cells use semiconductor devices (silicon chemistry) to convert solar energy into electricity, whereas organic solar cells are based on biological systems that use the same chemistry as living organisms to harvest the energy of sunlight to drive photosynthesis.



Biologists have discovered that a split-second, highly orchestrated process drives photosynthesis. Credit: ASU.

For more on this pioneering research, see [NSF's press release](#), "Scientists Offer New View of Photosynthesis."

Alzheimer's, Parkinson's, Type 2 Diabetes Similar at Molecular Level



A montage of micro-crystals is used to determine the microscopic structures of Alzheimer's and other diseases associated with amyloid fibrils. Credit: UCLA.

Alzheimer's disease, Parkinson's disease, type 2 diabetes, the human version of mad cow disease, and other degenerative diseases may be more closely related at the molecular level than scientists previously realized. An NSF-supported research team used X-ray analysis and a sophisticated computer algorithm to study the "clumping" proteins known to be associated with these diseases.

In particular, the scientists studied the harmful rope-like structures known as amyloid fibrils -- linked protein molecules that form in the brains of patients with these diseases. The fibrils contain a stack of water-tight "molecular zippers." The scientists found that when the computer said a protein would form an amyloid fibril, it almost always did. The researchers reported that with each disease, a different protein transformed into an amyloid fibril; but, all of the diseases were similar at the molecular level.

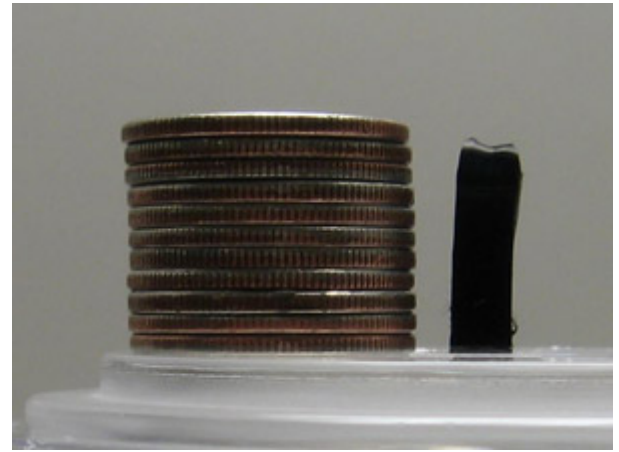
The research, while still preliminary, could help scientists develop tools for diagnosing these diseases and, potentially, for treating them through "structure-based drug design." One team member is now experimenting with various compounds to break up the fibrils. For more on the molecular zipper universal to amyloid fibrils, see [NSF's press release](#).

The Longest Carbon Nanotubes You've Ever Seen

Using techniques that could revolutionize manufacturing for certain materials, NSF-supported researchers have grown carbon nanotubes that are the longest in the world. While still slightly less than 2 centimeters long, each nanotube is 900,000 times longer than its diameter.

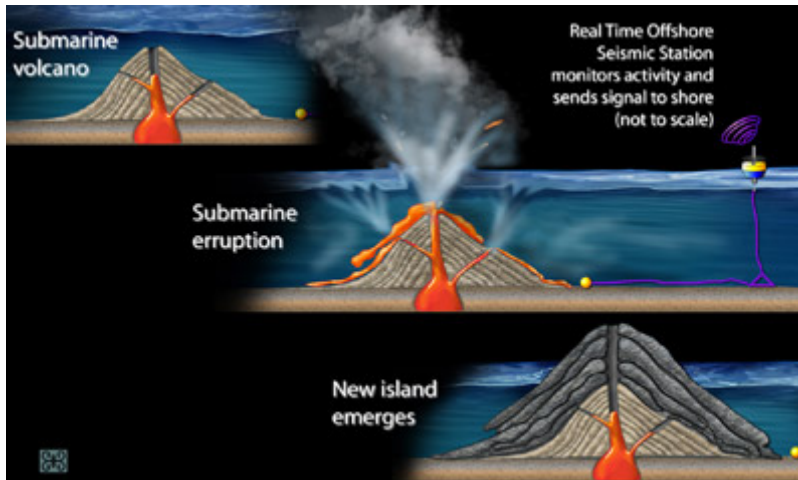
The fibers -- which have the potential to be longer, stronger and better conductors of electricity than copper and many other materials -- could ultimately find use in smart fabrics, sensors and a host of other applications. The carbon nanotubes are extremely long compared to predecessors -- the longest is 3 millimeters beyond the prior world record. More important for manufacturing, the research team grew a 12-millimeter-thick, uniform carpet of aligned carbon nanotubes on a roughly 10-centimeter silicon substrate, opening the door for scaling-up the process.

To grow the aligned bundles of tiny tubes, the researchers combined advantages of chemical vapor deposition, a technique for creating thin coatings that is especially common in the semiconductor industry, with a novel substrate and catalyst onto which the carbon attaches. For more on the tiny tubes, see [NSF's press release](#), "The Longest Carbon Nanotubes You've Ever Seen."



Researchers at the University of Cincinnati have grown the world's longest carbon nanotube arrays, long enough to be seen by the naked eye. Credit: V. Shanov, M. Schulz, University of Cincinnati.

Real-time Voice of a Volcano



Underwater volcanoes can eventually form islands. The process can take hundreds of thousands of years and thousands of eruptions. As each lava flow covers the one before it, enough layers build up to finally emerge from the sea. Researchers are studying just such a volcano called Kick 'em Jenny. They have deployed a Real Time Offshore Seismic Station (RTOSS) to take measurements closer to the action than ever before. Credit: Zina Deretsky, National Science Foundation.

Kick'em Jenny is its name, and for oceanographers working in the southeastern Caribbean Sea, this undersea volcano has been a handful. Now, a team of marine scientists funded by NSF may have figured out how to tame it. This month, the researchers will begin using radio telemetry to monitor the rumblings of Kick'em Jenny from a real-time seismic monitoring device installed on the volcano.

Scientists expect the new technology will improve the ability of natural hazards managers to protect residents from volcanic eruptions and tsunamis. Located just off the north coast of the island nation of Grenada, Kick 'em Jenny is a "natural laboratory"--a submarine volcano that will eventually emerge from beneath the sea to form a new volcanic island. It is the only "live" submarine volcano in the West Indies, and has erupted at least 12 times since 1939. The last major eruption occurred in 2001.

Part of a project to develop new technology for earthquake monitoring in coastal areas, the seismic station, called a Real Time Offshore Seismic Station (RTOSS), uses an ocean-bottom seismometer deployed directly on the volcano. RTOSS allows seismic data to be transmitted by high-frequency radio to a land-based observatory in a nearby village. The data will reach the shore within milliseconds of being collected.

For more on this new use of radio telemetry, see NSF's ["Real-Time Seismic Monitor Installed on Growing Underwater Volcano."](#)

DID YOU KNOW?

Extremophiles are organisms capable of living in conditions that would kill other life-forms, including intense cold, heat, pressure, dehydration, acidity, and other chemical and physical extremes. They evolved to thrive in hostile environments, including bone-dry deserts, boiling acid, horrendous heat and incredible cold. Research on these strange organisms is redefining the limits of life on Earth and, perhaps, on other worlds.

A few animals, such as frogs that freeze solid in the winter, can qualify. But in large part, the world's endurance champs are microbes: bacteria and archaea. Read more about their survival mechanisms in [NSF's Special Report "X-treme Microbes."](#)



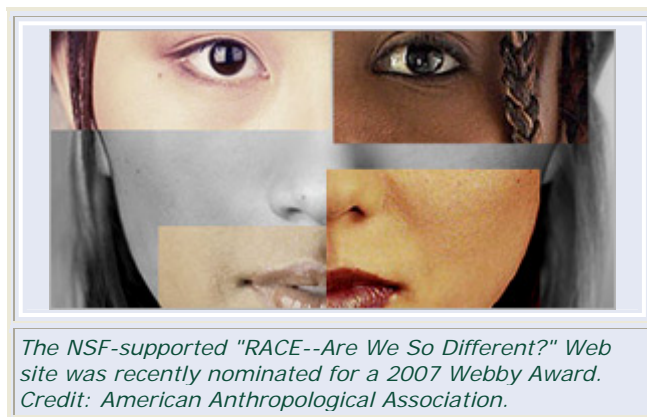
FACES OF NSF RESEARCH

RACE--Are We So Different?

Throughout history, the differences in how people look have been a source of strength, community and personal identity. But these same differences have also been a source of discrimination and oppression at times. The RACE project explores issues of race through the lenses of history, science and lived experience. The findings of contemporary science are challenging the foundations of race, leading us to question if the time has come to rethink our ideas about race and differences among people.

The project's comprehensive, engaging and educational Web site features a variety of voices and perspectives, and includes articles and guides for teachers and parents. The site also includes an interactive timeline covering 400 years of events in government, science and society, other interactive features, test-your-knowledge quizzes and a blog for visitors wanting to continue discussions.

Beyond the Web site, there is also a traveling exhibition that originated at St. Paul's Science Museum of Minnesota. Upcoming locations and dates are noted on the [Web site](#). The RACE exhibit offers interactive exhibit components, historical artifacts, iconic objects, compelling photographs, multimedia presentations and attractive graphic displays to provide visitors an eye-opening look at its important subject matter. RACE is a project of the American Anthropological Association and was made possible by support from NSF and the Ford Foundation. Visit the [RACE--Are We So Different? Web site](#).



The NSF-supported "RACE--Are We So Different?" Web site was recently nominated for a 2007 Webby Award. Credit: American Anthropological Association.

NSF IN THE NEWS

[Homegrown Scientists and Engineers](#) -- *Washington Post* (05/11/07) -- According to the NSF, a third of all science and engineering Ph.D.s awarded in the United States go to foreigners. Rather than arguing that the H-1B visa quota should be raised to help keep the United States competitive, policy makers, including the National Science Board, have placed a priority on increasing the number of native-born scientists and engineers.

[Increasing Focus on K-12 Sciences Can Keep U.S. in Nobel Race](#) -- *Journal and Courier* (05/10/07) -- A 2002 survey by the National Science Foundation found that half the U.S. public did not know electrons are smaller than atoms or that dinosaurs and humans never co-existed. Study after study indicates that while this nation remains home to many of the best and brightest scientific minds, the gap is widening between our top scientists and those at our elementary and secondary education levels.

[Engineers Getting a Makeover](#) -- *MSNBC* (05/07/07) -- The NSF funded testing of a variety of slogans for the National Academy of Engineering to market the profession to young kids. As a result of their efforts, engineering's image will be getting a marketing makeover in the months ahead.

NSF NUTS & BOLTS



ALAN T. WATERMAN AWARD
CALL FOR 2008 NOMINATIONS

The annual Waterman award recognizes an outstanding young scientist or engineer supported by NSF. Candidates may not be more than 35 years old, or seven years beyond receiving a doctorate and must stand out for their individual achievements. In addition to a medal, the awardee receives a grant of \$500,000 over a 3-year period for scientific research or advanced study in their field. For more on the nomination process, visit [NSF's site](#).



NSF congratulates Peidong Yang, a chemist at the University of California, Berkeley, as the 2007 Alan T. Waterman award winner.

Yang is a nanotechnology researcher who has pioneered research into nanowires, strings of atoms that show promise for a range of high-technology devices, from tiny lasers and computer circuits to inexpensive solar panels and biological sensors.

NSF's Bill Watch



H.R. 2272	<i>To invest in innovation through research and development, and to improve the competitiveness of the United States.</i>
Sponsor	Rep Bart Gordon (introduced 5/10/2007)
Latest Action	5/10/2007: Referred to House Committee on Science and Technology.

The bill authorizes the appropriation of about \$21 billion over the 2008-2010 period for ongoing operations of NSF. ([more information](#))

Cafe Scientifique... "A Place to Eat, Drink and Talk About Science"

NSF sponsors this monthly event, featuring speakers whose expertise spans the sciences. Here's a peek at upcoming plans:

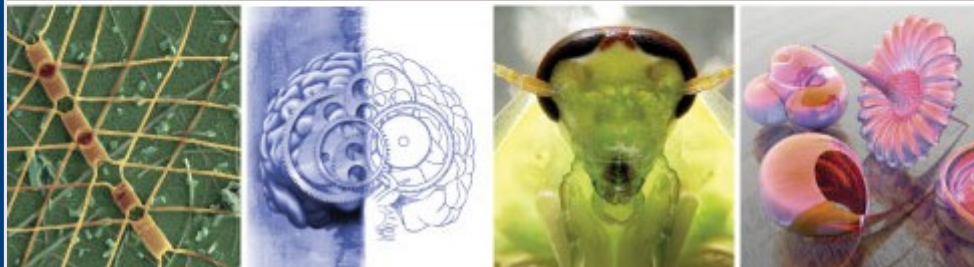
June 12:	Human Origins Expert Rick Potts (Smithsonian Institution), "The Emergence of Humans: What Makes Us Different?"
July 10:	Computer Scientist George Strawn and Author Nancy Forbes, "Computing's Conundrum: Whither the Future?"

([more information...](#))

INTERNATIONAL SCIENCE & ENGINEERING VISUALIZATION CHALLENGE COMPETITION DEADLINE APPROACHING

ENTRY DEADLINE: MAY 31, 2007

SCIENCE AND ENGINEERING'S MOST POWERFUL STATEMENTS
ARE NOT MADE FROM WORDS ALONE



Science & Engineering Visualization Challenge

The competition recognizes scientists, engineers, visualization specialists and artists for producing or commissioning innovative work in visual communication.

Submit your entries right away! No submissions postmarked later than May 31, 2007 will be accepted.

See [NSF's site](#) for more information.



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 nearly \$5.91 billion. NSF funding reaches all 50 states through grants to roughly 1,700 universities and institutions. Each year, NSF receives about 40,000 competitive requests for funding and makes about 10,000 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.