CURRENT
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NSF AT WORK

Laser Blasts Viruses in Blood

An NSF-funded father-son research team has discovered a new use for lasers--zapping viruses out of blood. The technique, which holds promise for disinfecting blood for transfusions, uses a low-power laser beam with pulses lasting a tiny fraction of a second.

Johns Hopkins University student Shaw-Wei David Tsen says it was during a stroll in the park with his father Kong-Thon Tsen, a laser expert at Arizona State University, that the concept was born. Building on the idea that vibration wrecks a virus' outer shell, the scientists found that their low energy laser selectively destroys viruses without destroying nearby normal mammalian cells. By using a low energy laser, this technique has the advantage over UV irradiation and radioisotopes, which can leave a trail of mutated or damaged blood components. The researchers aimed their infrared laser with pulses lasting 100 femtoseconds (a femtosecond is a billionth of a millionth of a second) into glass tubes containing saline-diluted viruses. The amount of infectious virus within each cube plummeted 100- to 1000-fold after the laser treatment.

For more information on this father and son work occurring from separate laboratory benches across the country, see the Johns Hopkins' press release.

A father-son team found a way to use lasers to zap infectious viruses out of blood. The researchers speculate that laser radiation destroys drug-resistant and sensitive viruses alike, which may lead to a simple method of ridding blood of pathogens such as HIV and hepatitis C. Source: Johns Hopkins Medical Institutions

This transmission electron microscope image (with digital illustration of radio "waves"), shows a single carbon nanotube protruding from an electrode. This working radio picked up Derek and the Dominos' "Layla" and the Beach Boys' "Good Vibrations." Credit: Zettl Research Group, University of California at Berkeley and the Lawrence Berkeley National Laboratory

World's Smallest Radio Gives Good Vibrations

Harnessing the unique electrical and mechanical properties of carbon nanotubes, a team of researchers has crafted a working radio from a single nanotube that is 10,000 times thinner than the width of a single human hair. Fixed to an electrode mounted near a counter electrode, the tube successfully performed the four critical roles of a radio--antenna, tunable filter, amplifier and demodulator--to tune in a radio signal generated in the room and play it back through an attached speaker.

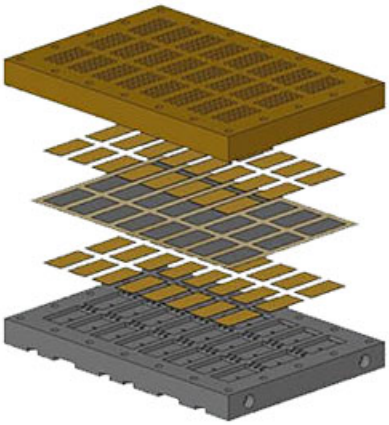
Tunable across a bandwidth widely used for commercial radio, the tiny device could have applications far beyond novelty, from a single receiver in a living cell to a vast array embedded in an airplane wing.

The new device was developed at NSF's Center of Integrated Nanomechanical Systems by a research team led by Alex Zettl of the University of California at Berkeley and the Lawrence Berkeley National Laboratory.

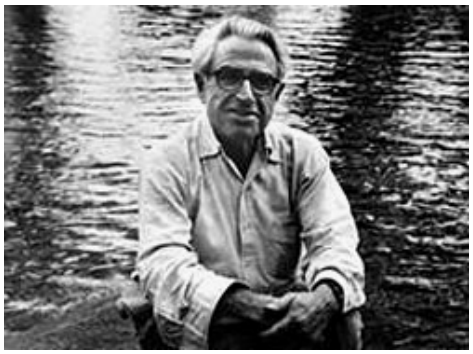
For more on the tiny tuner, see NSF's press release.

From Discovery to Success: Polymer Membrane Powers Future Technologies

Giner, Inc. of Newton, Mass., and its subsidiary, Giner Electrochemical Systems, LLC (GES), recipient of four NSF Small Business Innovation Research awards since 1999, were recently awarded a patent on a process to modify specialized polymer membranes to create compact membrane electrode structures for segmented fuel cells with higher voltages than single cells. The improvements may also enable applications in electrolyzers (which convert water into hydrogen and oxygen gas), the detection and treatment of waterborne toxins, miniature sensors, industrial electro-synthesis and other technologies that employ polymer membranes. A second patent is pending on the material itself. NSF has also provided grants to Giner for lightweight bipolar plates for fuel cells and a continuous monitor for total sulfur in natural gas.



A diagram of an array of Giner's modified polymer membrane fuel cells. Credit: Robert MacDonald, Giner, Inc.



Visit NSF's special report tribute to William T. Golden

In Honor of William T. Golden

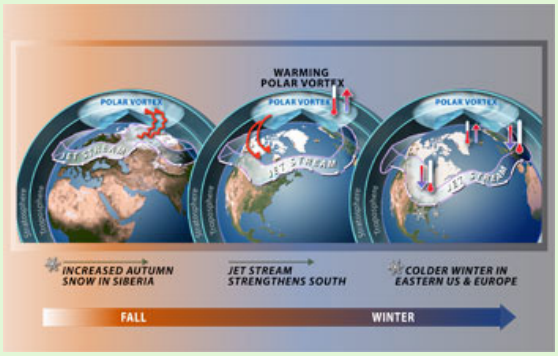
Although he never worked as a scientist and didn't receive his master's degree in biology until age 70, William T. Golden, who died on October 7, 2007, a few weeks short of his 98th birthday, was one of the most influential figures in post-World War II American science.

As a government advisor, trustee for museums and scientific organizations, and philanthropist, he helped shape the infrastructure for American science during the second half of the 20th century.

One of Golden's legacies is the National Science Board's *Science and Engineering Indicators* report, suggested by him to the Board in 1951 and implemented in 1972, which is still recognized as one of the most important publications produced by the Board. In 1991, the National Science Board presented Golden with a special award recognizing his contributions to American science.

Golden summed up his philosophy in his acceptance speech to the Board: "Homage, then, to science. Science is assuredly the Endless Frontier, and our country is indeed the land of opportunity. Let us all do all that we can to keep it that way and to make it better."

Did You Know?



Scientists have found an accurate way to predict how cold winter will be in much of the eastern United States and northern Europe by measuring the amount of snow that falls in Siberia during October. More snow in Siberia in the fall is linked to a powerful weather system called a Siberian High, resulting in a colder winter in other parts of the Northern Hemisphere.

Using a model based on this principle called sCast, atmospheric scientists from AER, Inc., a Lexington, Mass., company, analyzed the Siberian snowfall and the resulting winters from 1972 to the present. Their research, sponsored by NSF, found that the model is a particularly accurate predictor of winter conditions in the eastern United States and northern Europe. See NSF's news release "Scientists Verify Predictive Model for Winter Weather" for more details on the project.

Faces of NSF Research

A honeybee with a deadly parasitic Varroa mite on its back. The mites may be one of the pathogens involved in CCD. Credit: Scott Bauer, USDA

In the Face of Collapse: How Genomics Can Help Solve the Mysteries of Colony Collapse Disorder

Bees across the country have been leaving their hives, never to return. Colony Collapse Disorder (CCD), an epidemic characterized by the abrupt disappearance of worker bees from colonies of the Western honeybee, has had a damaging effect on agriculture across the country. Farmers rely on bees to pollinate over 130 different types of crops in the United States. Bee pollination adds $15 billion in crop value annually, according to the Department of Agriculture.

Though there may be more than one root cause, the lynchpin for understanding this disorder may lie in genomics. By studying gene expression in bees from hives with and without CCD, scientists can see if genes controlling immune response systems have been activated. An immune response of bees within hives experiencing CCD indicates that the cause may be a pathogen rather than poor nutrition, stress or pesticide use, all hypothesized triggers for CCD. Gene expression may also be used to determine abnormal social behavioral patterns in afflicted colonies.

Honeybees suffer from many diseases and parasites. These materials are used to take samples from hives. Credit: ARS/ USDA Jay D. Evans

BeeSpace, an ongoing NSF-sponsored project at the University of Illinois at Urbana-Champaign, has made significant progress in developing informatics and techniques for linking genomics, systematics and behavior. Through this continued research and an effort to link genetic heredity, environmental conditions and social behavior, researchers are helping to tackle the mystery of colony collapse disorder.

Credit: Morguefile

Bee with pollen ball hovers over dandelion. Credit: USDA

Credit: © Ken Lorenzen, University of California, Davis

NSF in the News

NSF in *U.S. News and World Report* -- NSF now provides news, images and multimedia material about NSF-funded research to the new *U.S. News and World Report* Science section.

Project Seeks to Track Terror Web Posts (*USA Today* 11/11/2007) -- Researchers at the University of Arizona are developing a tool that aims to scour Web sites, forums and chat rooms to find the Internet's most prolific and influential jihadists and learn how they reel in adherents. The bulk of a $1.3 million NSF grant to Professor Hsinchun Chen's group will focus on the people who manufacture improvised explosives and what they talk about--such as American troop movements and terrorist tactics.

NSF Facility Provides Window on a Disaster (*KNBC, San Diego, CA* 10/30/2007) -- Cameras installed in remote locations for the University of San Diego's NSF-funded High Performance Wireless Research and Education Network were intended to provide researchers with a view of the environment surrounding their remote research equipment, but the cameras found an unexpected but vital new role in late October when fire crews throughout San Diego County used images of spreading wildfires to help them determine where to send their firefighters.

Broadcast History at the South Pole

Ann Curry of NBC News Credit: elisfanclub (wikipedia)

NBC News correspondent Ann Curry made history in November with a live satellite phone report from the South Pole. The "Ends of the Earth" broadcast was part of NBC's "Green Week" of environmentally themed programming. From the South Pole, Curry spoke to her Today Show colleagues Matt Lauer, Meredith Vieira and Al Roker live on a satellite phone, and received a standing ovation from the Today Show studio.

This historic event was not without incident. Severe weather conditions at McMurdo almost prevented the Today Show crew in their effort to reach the South Pole. After eight days of trying, Ann Curry and her crew were finally able to report live by satellite from the absolute end of the earth.

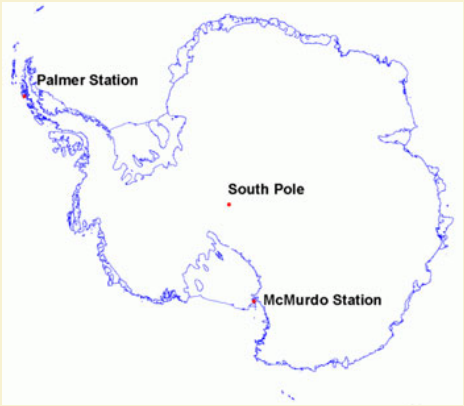
NSF provided the NBC crew access to LC-130 military aircraft, helicopters and tractor vehicles so that they could bring their viewers first-hand accounts of how scientists are researching climate change in Antarctica. Curry toured the new U.S. South Pole Station, which is still under construction.

Ann Curry, center, poses for a photo with researchers at the "Penguin Ranch" in Antarctica during her historic visit to the South Pole. Credit: Peter West, NSF

During one of her live broadcasts, Curry extended thanks to the National Science Foundation Mike Sherman, Peter West, Tom Wagner and Dena Headlee for their efforts in making the broadcast possible.

"We've all gained a lot from doing this project," she told the Today Show crew. "We've seen some fantastic scientists. We've really seen their grit in their efforts to find the truth about these issues facing our planet."

For more about NSF's Antarctic activities, including the facilities and research at the McMurdo and Amudsen-Scott Stations, visit the NSF's Office of Polar Programs Web site.



Map showing location of NSF research stations in Antarctica. Credit: USAP

Aerial view of the new elevated building at Amundsen-Scott South Pole Station. The silver cylindrical structure on the left houses a staircase. The two main sections of the building contain the dining facility, science labs and office space. The four wings contain dorm rooms, laundry facilities and a gymnasium. A dedication ceremony for the new building will be held January 12, 2008. Credit: Robert Schwarz, NSF

Emperor penguins at the Penguin Ranch, near McMurdo Station. Credit: Henry Kaiserk, NSF