



National Science Foundation  
WHERE DISCOVERIES BEGIN



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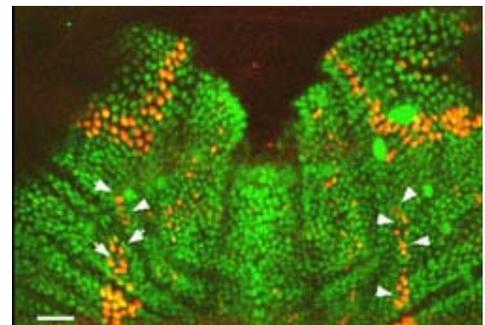
## NSF AT WORK

### Fruit Fly Neurons Help Inform Wireless Sensor Distribution Improvements

Research by Ziv Bar-Joseph, associate professor of machine learning and computational biology at Carnegie Mellon University, and his collaborator, Noga Alon, mathematician and computer scientist at Tel Aviv University and the Institute for Advanced Study in Princeton, N.J., suggests that a simple organism, the fruit fly, can teach valuable lessons to computer scientists. The researchers' work suggests that the fruit fly's pattern of tiny, hair-like sensory bristles could provide a model for deploying wireless network sensors more efficiently. Efficient deployment of wireless sensors--such as those used for environmental monitoring or for controlling groups of small robots--is crucial to effective information gathering, and can be complicated when sensors are dispersed far and wide over lakes or waterways.

The fruit fly sensory bristle develops from a nerve cell, called a sensory organ precursor (SOP), which connects to adjoining nerve cells, but does not connect with other SOPs. This patterned distribution is unlike current methods of managing the distributed computer networks. A probabilistic (repeated "roll of dice") method is currently used to distribute sensors, and this requires that all of the processors have prior knowledge of how they are connected in the network. Bar-Joseph and Alon created a computer algorithm based on the fly's approach and proved that it provided an efficient and more robust system.

This research was supported in part by grants from the National Institutes of Health and NSF (award #0448453).

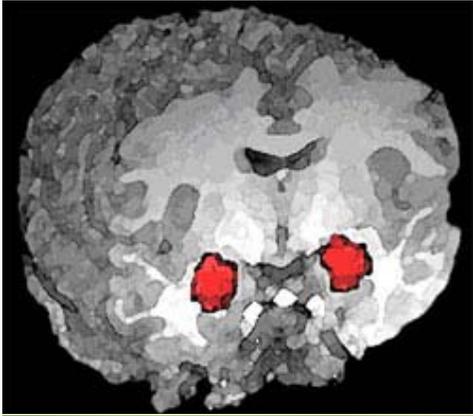


Fruit fly pupae nerve cells that self-select to become sensory organ precursors (SOPs) are identified by arrows in this confocal microscope image. Credit: Ziv Bar-Joseph, Carnegie Mellon University

### Researchers Selectively Control Anxiety Pathways in the Brain

A research team led by Karl Deisseroth, associate professor of psychiatry and behavioral sciences and bioengineering at Stanford University, used light to activate mouse neurons and precisely identify neural circuits that increase or decrease anxiety-related behaviors. Pinpointing the origin of anxiety brings psychiatric professionals closer to understanding anxiety disorders, the most common class of psychiatric disease.

This new work uses a tool called optogenetics--developed by Deisseroth and recently named Method of the Year by Nature Methods--to specifically tease out which pathways contribute to



anxiety.

Optogenetics combines genetics and optical science to selectively manipulate the way a neuron fires. **Groundwork for the optogenetics technique** was funded by NSF. Read more about this work **online**.

A new study supports the role of a brain region called the amygdala in processing anxiety. In this 3-D magnetic resonance imaging (MRI) rendering of a human brain, functional MRI activation of the amygdala is highlighted in red. Credit: NIMH Clinical Brain Disorders Branch

## New Illinois Startup Technology Extracts Clean Energy From Toxic Waste

Energy independence contributes to national security and presents unique opportunities to rebuild the nation's competitive edge in science- and technology-based industries. **Innovative Energy Solution (IES)** is an Illinois-based clean-tech startup contributing to energy independence. Building on cutting-edge fundamental research funded by NSF and the Department of Energy, IES focuses on extraction of clean energy from wastes and traditional sources.

With a **Small Business Innovative Research (SBIR)** grant from NSF, IES recently developed the Super Adiabatic Autothermal Reforming "SuperATR" process to extract clean and carbon-free hydrogen from hydrogen sulfide. Hydrogen is coveted for use in fuel and is fairly expensive when obtained from natural gas. Hydrogen sulfide is a highly regulated toxic waste and proper disposal of this waste costs the petroleum sector \$5 billion a year. Therefore, the petroleum industry continues to look for efficient ways to obtain hydrogen from hydrogen sulfide. A number of major oil companies, foreign and domestic, have shown strong interest in the SuperATR process.

The IES management team is composed of scientists who are working to develop the intellectual property portfolio as well as the technology. While IES is adding to its management team for its commercialization efforts, the company is led in the interim by Jacques P. Bingue, IES's chief executive officer. A combat-decorated veteran of the U.S. Marine Corps, Bingue spent the last 10 years researching the fundamentals of the SuperATR process.

He recently completed an NSF-led SBIR awardees course focused on new tools to successfully take technology to the marketplace. By using these tools in conjunction with his academic research training, Bingue hopes to serve as a role model and help others become successful at starting technology-based small businesses.



Jacques P. Bingue, chief executive officer of IES, (left), and Jean Pierre-Victor, chief financial officer of IES, attend a NSF-led course for SBIR awardees. Credit: Innovative Energy Solution

## NSF and Researchers Respond to Earthquake and Tsunami Crises



In response to the February 2011 earthquake in New Zealand and the March 2011 earthquake, tsunami and nuclear reactor crisis in Japan, NSF has issued a **Dear Colleague Letter** to support research and education related to these disasters. NSF uses the Rapid Response Research (RAPID) mechanism to support activities having a severe urgency with regard to availability of, or access to, data, facilities or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events.

The work funded by RAPID awards is expected to build upon ongoing NSF-funded research being applied to disaster response. For example, teams from the NSF-supported **Center for Robot-Assisted Search and**

**Rescue** (CRASAR) at Texas A&M University worked with the Japanese-based International Rescue Systems Institute to inspect port areas and to search for bodies trapped in flotsam or under submerged rubble. Read updates about CRASAR work online on the researchers' **blog**.

Satellite image of Japan taken in 2003. Credit: Wikimedia Commons

## DID YOU KNOW?

The National Science Board released **STEM Education Data and Trends**, a web-based statistical tool for the science, technology, engineering and math (STEM) education communities. The new tool provides easy access to data for parents, students, guidance counselors, teachers and other stakeholders in pre-college and undergraduate STEM education. Using data from the latest volume of Science and Engineering Indicators, the tool focuses on the STEM education stakeholder communities and allows the user to explore and analyze answers to questions such as "How much are states spending on their schools?" and "What is the science and engineering job market outlook for graduates in the U.S.?" Like other *Indicators* web tools, this one includes access to the full **Indicators report** online.

## FACES OF NSF RESEARCH

### Casey Dunn to Receive NSF Waterman Award

The **Alan T. Waterman Award** recognizes a young researcher under the age of 35 in any field of science or engineering supported by NSF. This year's Waterman awardee is Brown University biologist Casey Dunn. Dunn conducts genomic analyses that help define relationships between groups of animals, and investigates the origins of biological complexity through work with deep-sea creatures called siphonophores. His research is providing clues about how complex multicellular organisms, including humans, were formed.

One of his studies featured in the April 10, 2008, issue of *Nature* mapped the evolutionary history of animals to indicate that the **Earth's first animal**--a mysterious creature whose characteristics can only be inferred from fossils and studies of living animals--was probably significantly more complex than previously believed.

As NSF's 2011 Waterman awardee, Dunn will receive \$500,000 over three years, with which he may pursue the research of his choice, animal evolution. Dunn will collect siphonophores, the longest animals in the world that live at great depths in open oceans, and use new genomic tools to learn which genes are responsible for similarities and differences among these multi-celled organisms. "I'm really excited because, with this award, I can go after some animals that I would not have been able to get otherwise," said Dunn. "We have already run the first analyses and were just starting to look for funding," Dunn continued. "The timing could not have been better. We're ready to start these projects."

NSF funding in another area could enhance Dunn's research. **Brown University received over \$1 million** through NSF's Research Infrastructure Improvement Inter-Campus and Intra-Campus Cyber Connectivity (RII C2) program. RII C2 is part of the Experimental Program to Stimulate Competitive Research (EPSCoR), a program that supports states that have less extensive scientific infrastructures and have historically received fewer federal research dollars. Brown University is using this RII C2 funding to enhance access to a high-performance computing and bioinformatics facility that supports life science research, and to provide high-speed connections from Brown University campus sites to the University of Rhode Island and collaborators at the state's nine primarily undergraduate institutions.

The Waterman Award will be presented to Dunn at a dinner ceremony held in Washington, D.C., on May 10. Dunn will also deliver a lecture at NSF on May 9. Read more **about Dunn, his lab**, and his and others' research on **jellyfish**.



Biologist Casey Dunn is NSF's 2011 Waterman Award recipient. Credit: Gonzalo Giribet

**The Planet's Natural Air Filters** (*Time*) A new study by NSF and the U.S. Department of Energy reveals just how powerful U.S. forests can be in ameliorating the polluting effects of fossil fuels.

**Japan Crisis Showcases Social Media's Muscle** (*USA Today*) Leysia Palen's work explores the impact of social media during mass emergencies. Palen, of the University of Colorado, Boulder, is the director of Project EPIC, a NSF-supported program begun two years ago to analyze how social media are used, and by whom, in global crises.

**Firms Pushing Commercial Technologies to Lure Defense Business** (*National Defense Magazine*) A video display wall, originally funded by NSF as an academic research project, is being marketed to military defense companies. Hiperwall, an Irvine, Calif.-based firm., has commercialized this high-tech visualization product now in use by: police stations in Seoul, South Korea; an unmanned air vehicle control center in Africa; a Brussels airport; and a law enforcement center in Sacramento, Calif.

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### President Obama Highlights Success of TechBoston



President Obama at TechBoston.  
Credit: Joan Ferrini-Mundy, NSF

On March 8, President Obama visited TechBoston Academy in Dorchester, Mass.--a NSF-supported, technology-driven, 6th-12th grade pilot school within the Boston Public School System--to promote the importance of education in today's society and to highlight TechBoston as a model school for student success.

The president toured classrooms, spoke with students and teachers, and gave a speech to the student body and faculty. Melinda Gates of the Bill and Melinda Gates Foundation and U.S. Secretary of Education Arne Duncan joined the president during his visit. Joan Ferrini-Mundy, assistant director for NSF's Education and Human Resources

director, was also at the event. NSF support has promoted teacher development and student learning at the school.

The school draws many students from low-income backgrounds, and the students at TechBoston have shown great improvement in their academic performance. Observers credit a school environment that encourages student success.

The performance levels at TechBoston all exceed state and local averages. Ninety-four percent of TechBoston graduates attend two- or four-year colleges and universities, and 85 percent of TechBoston students are the first in their families to attend college. The daily attendance rate at TechBoston is 94 percent.

In his speech at TechBoston, President Obama observed, "What's happening here is working. We know what works. What's required, then, to get results from any school is no longer a mystery. And that means there can't be any more excuses--from anybody."

### NSF Participates in i6 Green Challenge

NSF will participate in the U.S. Commerce Department's Economic Development Administration (EDA) and its Office of Innovation and Entrepreneurship's \$12 million i6 Green Challenge. This challenge focuses on the nexus between economic development and environmental quality and rewards innovative, ground-breaking ideas that enable technology commercialization, new venture formation, job creation, and economic growth. i6 Green follows last year's inaugural i6 Challenge to accelerate high-growth entrepreneurship in the United States. More information on the challenge can be found on the EDA [website](#).



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## NSF Named in *TIME* Magazine's Best Twitter Feed List

NSF uses a variety of social media tools to share news about research, funding opportunities and more. The **NSF Twitter feed** was recently named in *TIME* magazine's **140 Best Twitter Feeds** list. See all of NSF's social media activities on the NSF social media **website**.

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*The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year 2010, its budget is \$6.9 billion. NSF funds reach all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 48,000 competitive requests for funding, and makes over 11,300 new funding awards. NSF also awards over \$400 million in professional and service contracts yearly. Contact **NSF's Office of Legislative and Public Affairs** for more information or for permission to reuse newsletter images. Editor: Nicole J. Garbarini. Contributors: Ellen Ferrante, Malathi Srivatsan, Dana Wilson, Lisa Joy Zgorski.*

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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749