National Science Foundation
WHERE DISCOVERIES BEGIN

NSF CURRENT
NATIONAL SCIENCE FOUNDATION

November 2011

Each month, the *NSF Current* newsletter highlights research and education efforts supported by the National Science Foundation. If you would like to automatically receive notifications by e-mail or RSS when future editions of *NSF Current* are available, please use the links below:

Subscribe to *NSF Current* by e-mail | **What is RSS?** | **Print this page** | **Return to *NSF Current* Archive**

NSF AT WORK

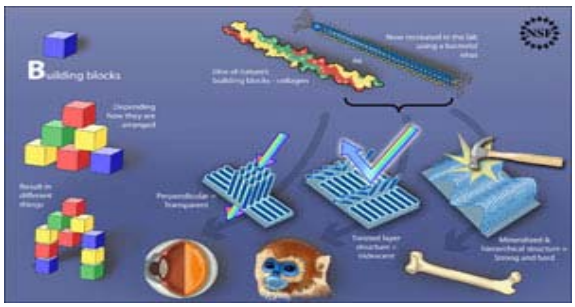
Artificial Intelligence Efficiently Finds, Retrieves Sounds From Audio Libraries

Audio engineers have developed a novel artificial intelligence-based system for classifying and indexing sound. It is a unique tool for finding audio recordings, without having to depend on imprecise or non-standardized text-based keywords. The software provides unprecedented search capability to retrieve recorded sounds--from musical riffs to gunshots. The new tool can match audio clips based on a user's audio criteria. For example, users can search for hard-rock music tracks featuring electric guitar solos, differentiating them from acoustic and jazz-guitar tracks.

The algorithms behind Imagine Research's MediaMined™ differentiate between instruments, voices and other sounds without needing text keywords. The algorithms index sound files to allow sound-similarity searching. In the left screen image above, the sound profile of *Star Wars* movie character Yoda, saying, "You must feel the force around you," is distinct from sound profiles of acoustic and electric guitars (center and right screens, respectively). Credit: Imagine Research, Inc.

Having concluded beta testing with one of the world's largest Hollywood sound studios and leading media streaming and hosting services, Imagine Research of San Francisco, Calif., is now releasing **MediaMined**™ for applications ranging from music composition to healthcare. The company developed the tool with support from the National Science Foundation's Small Business Innovation Research program (**IIP-0912981** and **IIP-1206435**). See the press release, titled "**Sound, Digested**," for more details.

Manufacturing Goes "Viral"



Using a simple, single-step process, NSF-supported engineers and scientists at the University of California-Berkeley recently developed a technique to direct benign, filamentous viruses, called M13 phages, to serve as structural building blocks for materials with a wide range of properties.

By controlling the physical environment alone, the researchers caused the viruses to self-assemble into hierarchically organized thin-film structures, with complexity that ranged from simple ridges, to wavy,

Credit: Researchers have coaxed viruses to assemble into synthetics with microstructures and properties akin to those of corneas, teeth and skin. This illustration reveals how the arrangement of molecular building blocks results in materials with unique properties, both in nature and the laboratory. Credit: Zina Deretsky, NSF

chiral strands, to truly sophisticated patterns of overlapping strings of material. These results may also shed light on the self-assembly of biological tissues in nature.

Each film presented specific properties for bending light, and several films were capable of guiding the growth of cells into structures with precise physical orientations.

Read NSF's **press release** for additional details on this new manufacturing breakthrough.

"Big," "Little," "Tall" and "Tiny": Words That Develop Spatial, Math Skills

Preschool children who hear parents use words describing the relative size and shape of objects--and who then use those words in their everyday interactions--do much better on tests of spatial skills, a University of Chicago study shows.

Learning words about size and shape improves readiness for STEM education among one- to four-year-olds. Credit: © 2011 JupiterImages Corporation

The study is the first to demonstrate that learning a wide range of words related to shape and size may improve children's later spatial skills, which are important in mathematics, science and technology.

These are skills that physicists and engineers rely on to take an abstract idea, conceptualize it and turn it into a real-world process, action or device, for example.

Researchers found that children who were exposed to more spatial terms as part of their daily activities and who learned to use these words did much better on spatial tests than children who did not hear and say as many of these terms. The research team reported that one- to four-year-olds who heard and then spoke 45 additional spatial words that described sizes and shapes experienced, on average, a 23-percent increase in their scores on a non-verbal assessment of spatial thinking.

"This study is important because it will help parents and caregivers to better recognize and to seek opportunities that enhance children's spatial learning," said Soo-Siang Lim, director for the Science of Learning Centers Program at NSF, which partially funded the study. "Study results could also help spatial learning play a more purposeful role in children's learning trajectories."

In addition to NSF's Science of Learning Centers Program award to the Spatial Intelligence and Learning Center, the research was supported by the National Institute of Child Health and Human Development. See the NSF **press release** for more information.

Did You Know?

Minority Graduate Students in S&E Double in 20 Years

Credit: © 2011 JupiterImages Corporation

The past two decades have brought increased diversity to the population of U.S. graduate students in science and engineering (S&E) fields. From 1989 to 2009, the number of American minority graduate students in S&E more than doubled, growing from approximately 37,700 to 92,700. This gain almost tripled the number of Hispanics and American Indians/Alaska Natives and more than doubled the number of blacks and Asians/Pacific Islanders in graduate S&E programs.

Despite these substantial gains for minority graduate students, 2009 data showed that blacks and Hispanics are still underrepresented among S&E graduate students as compared to the proportion of black or Hispanic adult citizens in the U.S. population. In contrast, the percentage of American Indians/Alaska Natives in the 2009 S&E graduate student population was very similar to that found in the general population, and the percentage of Asians/Pacific Islanders pursuing S&E graduate degrees was more than twice the proportion of Asians/Pacific Islanders in the general

U.S. adult population.

More information on this topic can be found in NSF's National Center for Science and Engineering Statistics **InfoBrief**.

Faces of NSF Research

President Obama Honors the Nation's Top Scientists and Innovators

President Barack Obama honors National Medal of Science and National Medal of Technology and Innovation award winners. Credit: Sandy Schaeffer for NSF

On October 21, in an award ceremony at the White House, President Barack Obama honored seven eminent researchers with the **National Medal of Science** (NMS) and five inventors with the **National Medal of Technology and Innovation** (NMTI), the highest honors bestowed by the United States government in the fields of science and engineering. President Obama stated, "I'm pleased to recognize these extraordinary scientists, engineers, and inventors for their work exploring the very frontiers of human knowledge and making our world a better place."

NSF funded research by six of the seven National Medal of Science awardees and one of the five Medal of Technology and Innovation laureates at some point in their careers. Of these, three NMS awardees and the NMTI awardee have active NSF grants. Among the NMS laureates, all but the mathematicians are active National Institutes of Health grantees, as well.

Distinctive "firsts" punctuate this prestigious group of laureates. Current awardee Jacqueline Barton and her husband, Peter B. Dervan, are the first husband-and-wife team to have received the National Medal of Science; Dervan received the award in 2007. Ralph Brinster is believed to be the first veterinarian to win the NMS. While not a "first," Richard Tapia, a former National Science Board member, is the second U.S.-born Latino to receive the NMS, and Barton is the 40th female NMS laureate in the award's more than half-century history.

This year's recipients of the National Medal of Science are **Jacqueline K. Barton**, **Ralph L. Brinster**, **Shu Chien**, **Rudolf Jaenisch**, **Peter J. Stang**, **Richard A. Tapia**, and **Srinivasa S.R. Varadhan**.

NSF-funded **Rakesh Agrawal** is among the five National Medal of Technology and Innovation laureates. The other winners are B. Jayant Baliga, C. Donald Bateman, Yvonne C. Brill and Michael F. Tomopsett.

Read more about the **award recipients** and the White House ceremony **online**.

NSF in the News

Video Games Linked to Children's Creativity (*USA Today*) Researchers at Michigan State University showed that creativity both in boys and girls was positively related to their use of video games, but not other technologies such as computers, the Internet or cell phones.

Understanding Big Cats' Roar (*New York Times*) New research funded in part by NSF shows it is the shape, not the size, of big cats' vocal cords that is responsible for the intensity of their roars.

Plants' Metabolome Mined for Biofuels (*MSNBC*) U.S. and Japanese scientists are teaming up to boost the production of renewable biofuels through research on the metabolome, those plant metabolic mechanisms responsible for generating energy, building plant structures and contributing to other life-sustaining processes.

The Ripple Effect

Crowdsourcing Research: The Success of Foldit

Foldit players use a variety of tools to interactively reshape various regions of proteins. Credit: University of Washington

Public news outlets have been buzzing about the remarkable scientific achievement of Foldit, an online computer game that cracked the structure of an AIDS-related protein. In just 10 days, Foldit players solved the structural mystery of this retrovirus enzyme that had baffled biologists for almost two decades. "It's citizen science," states Firas Khatib, a biochemist and member of Foldit's research team at the University of Washington. "The players are the heroes in this."

The Foldit team is integrating the game with Xbox Kinect technology. With this interface, players will intuitively turn and pull the on-screen protein shape using hand gestures, making the game more accessible. More players means more capacity to generate faster solutions and study other molecules. "The more collective brainpower, the better. The search space [for these problems] is too large for even a supercomputer," says Khatib.

Read more about the NSF's support for Foldit **online**.

Hispanic Engineering, Science and Technology Week: STEM Careers in Texas

Student experimenting during HESTEC science workshop. Credit: Kathy Jurado Munoz

The University of Texas-Pan American (UTPA) and the Office of Congressman Rubén Hinojosa recently organized the 10th Annual Hispanic Engineering, Science and Technology (**HESTEC**) Week (September 26 - October 1).

HESTEC engaged an estimated 50,000 students, their families and teachers, and was widely attended by community leaders. The Little Shop of Physics, funded by an **NSF award** to HESTEC, highlighted hands-on physics projects. Attendees were encouraged to consider careers in science, education, engineering or mathematics (STEM).

On behalf of NSF, Thomas Peterson, assistant director of NSF's Engineering Directorate, accepted the HESTEC Pioneer Award for support of the HESTEC STEM programs.

CREATIV Pursuits: NSF's Search for Emerging Science

This month, NSF unveiled a pilot program aimed at redefining the boundaries of scientific fields. Called CREATIV (Creative Research Awards for Transformative Interdisciplinary Ventures), it will provide significant support for exploratory and high-risk research at the interface of all NSF-supported areas of science, engineering, technology and related education. The aim is to spur potentially transformative discoveries. CREATIV is part of the INSPIRE initiative (Integrated NSF Support Promoting Interdisciplinary Research and Education). More about CREATIV is available on the **NSF website**.

*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 (FY) 2011, its budget is about $6.9 billion. NSF funds reach all 50 states through grants to nearly 2,000 universities and institutions. Each year, NSF receives over 45,000 competitive requests for funding, and makes over 11,500 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: Jennifer Boehme. Contributors: Jennifer Boehme, Neysa Call, Craig Fisher, Christine Hamel, Lee Herring, David Mason, Mayra Montrose, Steve Lonker, Cheryl Roesel, Marcelo Vinces, Fen Zhao.*

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