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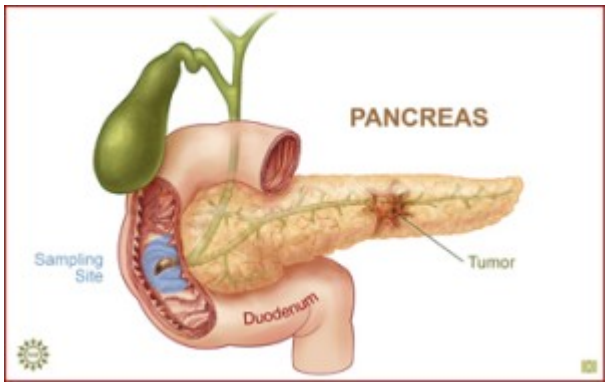
NSF AT WORK



Pancreatic cancer, unseen at its earliest stages by any other method, can be detected by examining tissue from inside the small intestine. Credit: Zina Deretsky, NSF.

A video of this novel technique is also available.

Shining Light on Pancreatic Cancer

Using novel light-scattering techniques, researchers have found the first evidence that early stage pancreatic cancer causes subtle changes in part of the small intestine. The easily monitored marker may ultimately allow early detection for a disease having few obvious symptoms, the primary reason pancreatic cancer killed more than 33,000 Americans last year.

The new detection techniques, developed with support from the National Science Foundation (NSF) and the National Institutes of Health (NIH), produce an optic fingerprint from the altered tissue and then enhance the data for a clearer diagnosis. Researchers scanned tissue samples from 19 people already diagnosed with pancreatic cancer and 32 without the disease. They properly distinguished patients with cancer at an accuracy approaching 100 percent. The clearest results came from patients in the earliest stages of the disease.

Pancreatic cancer is so deadly, in part, because early detection is so difficult. The pancreas can become dangerously inflamed if examined directly, so routine inspections for at-risk patients are usually not an option. By studying tissue extracted from an area adjacent to the pancreas, the researchers were able to screen all 51 patients with little risk of inflammation or other complications.

The results build upon prior studies with colon cancer and support the "field effect" hypothesis that suggests initial cancer stages, even pre-cancerous lesions, can cause minute, potentially detectable changes throughout an entire organ. If similar results are found in other organs, the effect could have broad impact in the timely treatment of breast and lung cancer. For more on this new diagnostic tool, see NSF's press release.

Graduate Education and Research Via IGERT

What do a portable imaging device, a material for cardiac stents and a process for creating strong and flexible plastics have in common? All are inventions that have been developed by trainees in NSF's Integrative Graduate Education and Research Traineeship Program (IGERT).

IGERT, an NSF-wide program that educates Ph.D.-level U.S. scientists and engineers who will pursue careers in research and education, brings together interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional and personal skills.

Since its inception in 1998, NSF has granted a total of 196 IGERT awards. The awards enable universities to offer stipend support and tuition allowances to graduate students to engage in research and educational training in critical interdisciplinary areas of science and engineering.

Read NSF's "Young Inventors' Research Transforms the Marketplace" for more on the benefits of IGERT awards.

Brian Schulkin, an IGERT trainee at Rensselaer Polytechnic Institute, won the first-ever Lemelson-Rensselaer $30,000 student prize for inventing an ultralight, handheld terahertz spectrometer. The device has applications in medical, aerospace, security and other fields. Credit: Rensselaer/Kris Qua.

NSF to Fund the Next "Leadership-class" Supercomputer

Petascale systems make arithmetic calculations at a sizzling 1,000-trillion operations per second. An NSF-supported petascale computer is expected to come online in 2011. Credit: © 2007 JupiterImages Corporation.

The National Science Board recently approved a resolution authorizing NSF to fund the acquisition and deployment of the world's most powerful "leadership-class" supercomputer. This "petascale" system is expected to make arithmetic calculations at a sustained rate in excess of a sizzling 1,000-trillion operations per second (a "petaflop" per second) to help investigators solve some of the world's most challenging science and engineering research problems. The University of Illinois at Urbana-Champaign will receive $208 million over 4.5 years to make available a petascale computer, "Blue Waters," which is 500 times more powerful than today's typical supercomputers.

A second resolution authorized funding for a system expected to bridge the gap between current high-performance computers and even more advanced petascale systems under development.

The award will fund an extremely powerful supercomputer at the University of Tennessee at Knoxville Joint Institute for Computational Science. The $65 million, 5-year project will include partners at Oak Ridge National Laboratory, the Texas Advanced Computing Center, and the National Center for Atmospheric Research. The group will provide the research community with a system with a peak performance of just under one petaflop. See NSF's "National Science Board Approves Funds for Petascale Computing Systems" for more information on the powerful machines.

Asia's R&D Investment Outpaces the United States

Heavy investments in science and technology during the 1990s by some Asian nations are paying notable economic dividends in high-tech areas important to the United States, according to a recently released report by NSF's Division of Science Resources Statistics.

The report, entitled "Asia's Rising Science and Technology Strength," states that Asia's research and development (R&D) activity may have surpassed the European Union in 2002, and by 2003, was nearly 10 percent greater. In 2003, Asia's R&D investment may have been as much as 80 percent of that of the United States, largely reflecting Chinese growth. While precise comparisons are technically problematical, there is little doubt about China's rapid advancement into the group of leading R&D nations.

Estimates show U.S.-based multinational corporations nearly doubled investment in overseas R&D activities since the mid-1990s, up from $11.9 billion in 1994 to $21.2 billion in 2002. Credit: Zina Deretsky, NSF.

Did You Know?

Most schools participating in NSF MSP programs show improvement in math and science. Shown here, students from a rural Georgia high school, participate in calculator/ computer-based labs in their chemistry class. Credit: University System of Georgia.

According to latest results*, more than 300 schools participating in the second year of the NSF's Math and Science Partnership (MSP) program found that a significantly higher proportion of students scored at the "proficient" level or higher on state math and science assessments in the 2004-2005 school year than they had in the previous year. Progress by elementary math students was particularly noteworthy, with student proficiency rising by more than 15 percentage points from one school year to the next.

The MSP program was established in 2002 to integrate the work of higher education with K-12 and to strengthen and reform mathematics and science education. The program currently supports 52 partnerships around the country that unite some 150 institutions of higher education with more than 550 school districts, including more than 3,300 schools in 30 states and Puerto Rico. More than 70 businesses, many state departments of education, science museums and community organizations are also partners.

* *While an earlier study tracked schools that began work in the first year of the NSF MSP program, the most recent study followed more than 300 schools participating in partnerships that began to be funded during the program's second year.*

Faces of NSF Research

On Friday, July 27th, NSF Director Arden L. Bement, Jr. and Deputy Director Kathie L. Olsen presented achievement awards to the 2005 and 2006 National Science and Technology Medalists for their exceptional contributions to science. These 'faces' of national achievement are pictured below with brief highlights of their accomplishments.

The 2005 National Medal of Science Laureates

Awardees, from left to right:

- **Jan D. Achenbach** for his contributions to engineering research and education in wave propagation and nondestructive evaluation.
- **Ralph A. Alpher** for his unprecedented work in nucleosynthesis and for his findings in space radiation and the Big Bang theory.
- **Gordon H. Bower** for his unparalleled contributions to cognitive and mathematical psychology.
- **Bradley Efron** for his important contributions to both theoretical and applied statistics.
- **Anthony S. Fauci** for his work on the human immune system and his extensive work on HIV.
- **Tobin J. Marks** for his pioneering research in areas of homogeneous and heterogeneous catalysis and solid-state chemistry.
- **Lonnie G. Thompson** for his research in paleoclimatology and his collection of climate archives.
- **Torsten N. Wiesel** for his key insights into the operation of the visual system and its connecting neural components in the brain.

The 2006 National Medal of Science Laureates

Awardees, from left to right:

- **Hyman Bass** for his fundamental contributions to pure mathematics.
- **Marvin H. Caruthers** for his developments in methods for the chemical synthesis of DNA.
- **Rita R. Colwell**, former NSF Director, for her in-depth study of the ecology, physiology and evolution of marine microbes.
- **Peter B. Dervan** for his contributions in chemistry and biology and for his influence in education and industrial innovation.
- **Nina V. Fedoroff** for her pioneering research in plant molecular biology.
- **Daniel Kleppner** for his pioneering scientific studies of the interaction of atoms and light.
- **Robert S. Langer** for his revolutionary discoveries in the areas of polymeric controlled release systems and tissue engineering.
- **Lubert Stryer**, author of a world-renowned biochemistry textbook, for elucidating how the eye's retina processes light.

Visit the NSF Web site for more information on the Medal of Science.

NSF in the News

NSF Readies Plan to Improve STEM Education -- *SpaceRef.com (08/11/07)* -- The National Science Board yesterday unanimously adopted a motion to release for public comment a draft action plan to address critical 21st century needs in the nation's STEM (science, technology, engineering, and mathematics) education system. Two overarching actions stressed in the plan are increasing coordination of STEM education and increasing the supply of qualified K-12 STEM teachers.

Panel: Nanotechnology Could Bring U.S. Billions as World Competes -- *Nanotechnology Now (08/07/07)* -- A molecule measured in the billionths of a meter could mean billions of dollars in sales for U.S. companies, though the rest of the world chases closely behind, academics and experts say.

A Math Makeover -- *Newsweek (08/06/07)* -- "We've gotten girls to take math. We've gotten girls to use math," says Patricia Campbell, who evaluates math and science programs for the National Science Foundation. "But we haven't gotten them to love it."

President Signs COMPETES Act

On August 9, 2007, the President signed the America COMPETES Act into law. The law aims to equip teachers, educate students, invest in research, and stimulate the American economy. The bill, which will help secure the United States' ability to compete in the global marketplace, was based upon many of the recommendations of the National Academies' 2005 report, "Rising Above the Gathering Storm." Chairman Bart Gordon (D-TN), former Rep. Sherwood Boehlert (R-NY), Sen. Lamar Alexander (R-TN) and Sen. Jeff Bingaman (D-NM) requested that report, which found that the U.S. stood to lose its competitive edge over other nations unless action was taken.

The law supports basic research by setting budgets at the National Institute of Standards and Technology, the DOE Office of Science, and NSF on a path to doubling within the near term. The total NSF budget is authorized at $6.6 billion in FY 2008, $7.326 billion in FY 2009, and $8.132 billion in FY 2010. These funding levels keep the agency on a path to double its budget in approximately seven years.

Moreover, the COMPETES Act authorizes $33.6 billion over fiscal years 2008-2010 for science, technology, engineering and math (STEM) education programs across the federal government. The measure authorizes multiple grant programs to help educate current and future teachers in the areas of science and math education. The law also invests in basic research and supports young researchers by expanding early career grant programs.

Particularly, strong increases are provided in FY 2008 for K-12 STEM education programs at NSF. These programs, including the Noyce Teacher Scholarship and the Math and Science Partnerships programs, will help to prepare thousands of new STEM teachers and provide current teachers with content and pedagogical expertise in their area of teaching.

Math and Science Partnerships: A middle school student describes a mathematical image at the Summer Institute for Middle School Math Teachers in Broward County, Fla. Credit: Richard F. Voss, Heinz-Otto Peitgen.

Danvers Johnston, an IGERT program fellow in the laboratory at the Nano/Bio Interface Center at the University of Pennsylvania, creates nanotubes by reacting methane and hydrogen gas with nanometer-diameter iron catalyst particles. Credit: The Nano/Bio Interface Center at the University of Pennsylvania.

The law will also help create thousands of new STEM college graduates, including two-year college graduates, through increased support for NSF's STEM talent expansion (STEP) and Advanced Technological Education (ATE) programs. For those STEM graduates who continue on the path toward graduate studies and academic careers, the law provides support for young, innovative researchers by expanding the Graduate Research Fellowship (GRF), Integrative Graduate Education and Research Traineeship (IGERT), and Faculty Early Career Development (CAREER) programs.

Visit NSF's Education and Human Resources Web site for more information about these programs.

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 $5.92 billion. NSF funding reaches all 50 states through grants to over 1,700 universities and institutions. Each year, NSF receives about 42,000 competitive requests for funding and makes over 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.