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June 2006

NSF AT WORK

NSF Director Emphasizes International Scientific Cooperation at NSF Beijing Office Opening

At the official ceremony opening NSF's new office in Beijing, NSF Director Arden L. Bement, Jr., noted that the most enduring benefit of international collaboration is its power to bring people together to pursue common goals and build a world of peace and prosperity.

"China and the United States have a long history of cooperation in scientific research," said Bement. "We look forward with great expectation to new and expanded partnerships among Chinese and U.S. researchers in the years ahead, as we explore together new frontiers of science and technology."

The NSF Beijing Office occupies a suite in the Silver Tower high rise located in Beijing's Chaoyang district and is part of the U.S. Embassy in China. It officially began operations in September 2005. The new office is NSF's third foreign office. NSF also maintains research offices in Paris and Tokyo.

See NSF's press release, "U.S. National Science Foundation Celebrates Opening of Beijing Office" for more information about the opening. The release also includes a video of the Director's address and the ribbon cutting.

A poster commemorates the official opening of the NSF Beijing Office. Credit: Nicolle Rager Fuller, NSF.

NSF to Dedicate New South Pole Station

This aerial photo from October of 2005 shows the new South Pole Station (without its final outer layers) in the upper right portion of the frame. The old station is the geodesic dome at the lower left. Credit: Scot Jackson, NSF.

For more on the NSF-managed U.S. Antarctic Program, see NSF's Special Report: "U.S. South Pole Station."

In January 2007, a century after Norwegian Roald Amundsen erected the first small tent at the South Pole, NSF will dedicate the third and newest U.S. scientific station at the Earth's southern extremity.

The new facility will replace the iconic domed facility built in 1975, and will mark two historic occasions: the International Geophysical Year's 50th anniversary (when scientists took up residence in the very first South Pole station) and the beginning of International Polar Year 2007-2008, a global scientific field campaign.

The new $153-million Amundsen-Scott South Pole Station is a technological and engineering marvel designed to support an array of scientific investigations, from astrophysics to seismology, while accommodating harsh conditions on the polar plateau.

The station will house more than 20 times as many people as stood at the Pole with Amundsen at a level of comfort, safety and connectedness to the outside world that would have been almost inconceivable to the explorers for whom the station is named.

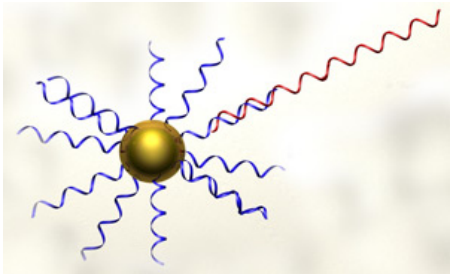
DNA "Strikes It Rich" in Rush to Fight Cancer

By attaching strands of "antisense" DNA to nanometer-scale gold particles, scientists at Northwestern University have significantly enhanced the strands' ability to suppress the production of proteins that cause cancer.

Antisense DNA, a kind of molecular mirror image of ordinary DNA, can be tailored to disrupt the production of specific protein molecules in the cell. Researchers have long believed that antisense DNA could be more effective than conventional drugs at fighting cancer and other diseases with a genetic basis, but the strands tend to break down in biological systems.

Now, the Northwestern group has shown that attaching antisense DNA strands to the surface of gold nanoparticles makes the strands both more stable and more effective in their protein-suppression role.

This research team is supported in part by NSF. Read NSF's Discovery, "Gold Nanoparticles Could Improve Antisense Cancer Drugs" for more details.



Researchers have significantly enhanced "antisense" DNA's ability to suppress the production of proteins that cause cancer by attaching it to nanometer-scale gold particles. The DNA strands (purple) then sequester RNA molecules (red) before they have the chance to result in disease-causing proteins. Credit: F. Tsuyohiko, N. Rosi, and D. Giljohann, Northwestern Univ.

Flippers for Locomotion: Better Two? Better Four?

Madeleine, an underwater robot, is helping scientists and engineers better understand the most energy-efficient way to use flippers for locomotion as well as to design more efficient underwater autonomous vehicles. Credit: John Long, Vassar College.

An underwater robot is helping scientists understand why four-flippered animals such as penguins, sea turtles and seals use only two of their limbs for propulsion, whereas their long-extinct ancestors seemed to have used all four.

When researchers put a robot named Madeleine through her paces, they found that her top cruising speed did not increase when she used four flippers instead of two -- apparently because the front flippers created turbulence that interfered with the rear flippers' ability to generate forward propulsion. Maintaining the same speed with four flippers also took significantly more energy. Results from experiments such as these aid engineers in designing underwater autonomous vehicles and help scientists understand why certain traits survived over others during the process of evolution.

Madeleine was developed through support provided by NSF's Collaborative Research at Undergraduate Institutions and the Major Research Instrumentation programs. For more information, see "Swimming Robot Tests Theories About Locomotion in Existing and Extinct Animals."

Did You Know?

Support from NSF in basic biological research was critical to the discovery of Yellowstone National Park's most famous bacterium, *Thermus aquaticus*. An enzyme derived from this microorganism powers a process called the polymerase chain reaction (PCR), which is used in thousands of laboratories to make large amounts of DNA for a variety of biotechnology applications.

As a result of this technology, an entire industry centered on creating PCR-related tools developed. The demand for PCR in biotechnology and pharmaceutical labs has resulted in a plethora of reagents and consumables from manufacturers. The ability to use DNA via PCR has also revolutionized medical diagnostics, forensics, paternity testing and other biological sciences.

PCR -- a ubiquitous technology -- now underpins the biotechnology industry. The Biotechnology Industry Organization (BIO) reported the total value of U.S. publicly traded biotech companies at $311 billion as of early April 2005. Credit: Nicole Rager Fuller, NSF.

Faces of NSF Research

Touching Base with Jim Collins

Jim Collins is one of the first to tell you that NSF support can help mold a future. An NSF undergraduate scholarship introduced him to biological research—and he never left the field. In addition to being a Virginia M. Ullman Professor of Natural History and Environment at Arizona State University, Collins now heads NSF's Directorate for Biological Sciences (BIO). He oversees the foundation's nearly $580-million annual investment in fundamental biological research and serves on the senior management team. We recently chatted with him to learn more about the "fruits of his labor." (Photo credit: Sam Kittner/kittner.com).

NSF: Has NSF influenced your career? **Collins:** Definitely, yes. I've worn many NSF hats. I had my first NSF support in the summer of 1968; it was from the program that NSF now calls Research Experiences for Undergraduates. The opportunity afforded to me by that program launched my research career in biology. Over the years, my research has also been supported by NSF grants. I've also previously served as an NSF program officer and on external advisory committees.

Now, I'm fortunate to find myself as the head of NSF's Biological Sciences Directorate. It's a privilege to play a role in NSF's senior leadership.

NSF: How would you characterize your first months as BIO's Assistant Director? **Collins:** In a word, "busy." I've enjoyed engaging in NSF activities at this new level. It's fun, exciting and challenging—all the things I hoped it would be.

NSF: Do you see any common themes throughout NSF's biological research portfolio? **Collins:** We support basic research in four principal areas: molecular and cellular biology; evolutionary biology; genetics; and ecology—as well as the connections at their interfaces, which is integrative biology. This research is broadening the theoretical and conceptual boundaries in biology.

We also recognize that many of the biological research frontiers require integration with other areas of scholarship, like the social sciences, geology, engineering, the physical sciences, and computer sciences. It's creating a synergy that will lead to amazing new research opportunities.

NSF: Do you see challenges in the near future for biological research? **Collins:** An ongoing challenge in managing NSF's research portfolio is the ability to fund all the great ideas we receive in the form of proposals. Ensuring that support for basic biological research continues to grow is vital for continued success.

"Historians will look back on this time as the 'Century of Biology.' We're poised for an unprecedented wave of innovation that will improve human health, environmental sustainability and agricultural production. Knowledge gained from basic research will fuel our progress."

Training the next generation of biological researchers and educators is also a key to maintaining our nation's preeminence in science and engineering.

NSF: You are maintaining your research lab at Arizona State; how is that going? **Collins:** It's great. I have wonderful students and post-docs that keep me directly engaged in the science. The needs of the students and the day-to-day operation of the laboratory, combined with the day-to-day interactions with terrific scientists and science administrators here at NSF, are constant reminders of a researcher's true perspective. The direct interaction with scientists and students in the field and lab keeps me connected to the basic research questions and needs of an educator-scientist, like those in the communities we serve at NSF.

NSF in the News

Supercomputers Are About to Get a Lot More Super
Knight Ridder Newspapers (06/20/06) -- The National Science Foundation has asked researchers to submit proposals for the development of the infrastructure for a petascale computing system to be ready by the close of the decade to help in such endeavors as the mapping of the three-dimensional structure of the trillions of proteins that make up a living organism and ever-changing interactions within the land, ocean, and atmosphere that control the Earth's weather and climate.

Playing 2nd Base: R2-D2
Arizona Republic (06/19/06) -- Professors from Arizona State University have built the world's first baseball-fielding robot as part of a NSF-funded effort to create machines capable of performing simple human tasks.

Engineering Careers Begin Here, NSF, Teachers Hope
Worcester Telegram & Gazette (06/13/06) -- The three-year Power UP! project sponsored by NSF and the Boston Museum of Science aims to bring Massachusetts teachers and researchers together to brainstorm how best to encourage students to participate in STEM fields.

NSF PERSPECTIVES

NSF Director Speaks Out on Energy

"Energy, the Essential Resource: Crafting its Benign Future"

Excerpts from Dr. Arden Bement's remarks at the Conference on Scientific Challenges for Energy Research, OECD Global Science Forum on May 17, 2006.

"Energy, in all its guises, presents us with a major dilemma. It has already been said that energy is a means, not an end. It brings us food, light, heat, mobility, processes and products -- in short, energy adds to our quality of life and prosperity. And yet, to add further emphasis, our energy systems and sources are not sustainable."

"As we look for solutions to our energy dilemma, it is our own future we are designing -- so we need to be good engineers and stewards of the planet. In today's climate of high-velocity change and super-heated expectations, we need to acknowledge the constraints that sustainability puts on our solutions."

"NSF has a unique role... to search out the most promising fundamental research at the frontiers of discovery. I call this 'dogging' the frontier. It is imperative to continually push the frontier forward, because it is generally beyond the frontier that new, revolutionary ideas and concepts can be found. These are the ideas and concepts that can dramatically change our lives, spawn innovative technologies, or solve major dilemmas that challenge our societies."

"Fundamental research is already propelling us down a positive path. The very conduct of science is changing in ways that make our prospects for the future brighter than they were only a decade ago."

"In every major area of energy development -- production, storage, transportation and use -- there remain fundamental challenges in basic science and engineering that we must resolve. The fact remains that fundamental breakthroughs are needed before we can realistically claim a future of sustainable energy."

"We all recognize that new ideas will come from every part of the globe. And we know that partnerships can combine the best resources of laboratories, institutes and universities to speed progress. International collaboration in frontier research can increase the momentum needed to speed us toward framing rational solutions to common problems. Our energy future may be the most pressing and demanding of all. I look forward to many fruitful collaborations."

House Appropriators Recommend Eight-Percent Increase for NSF

On Wednesday, June 14, 2006, the House Appropriations Science, Departments of State, Justice, and Commerce and Related Agencies Subcommittee marked up its FY 2007 appropriations bill and provided NSF with its full FY 2007 request of $6 billion, or $439 million (eight percent) over the FY 2006 enacted level.

The Research and Related Activities (R&RA) account is funded at the request level of $4.67 billion -- $335 million (eight percent) above the FY 2006 appropriated level. The Education and Human Resources (EHR) account is funded at $832 million, or $35 million (four percent) above the current estimate and $16 million (two percent) above the request level. The Major Research Equipment and Facilities Construction (MREFC) account is funded at $237 million, or $46 million (24 percent) above the FY 2006 estimate and $3 million (one percent) below the request.

The Salary and Expenses Account (S&E) account is funded at $269 million, $22 million (nine percent) above the current estimate and $13 million (five percent) below the request level. The National Science Board and the Office of Inspector General are funded at the request level.

The full House of Representatives is expected to consider the bill before the July 4 recess.