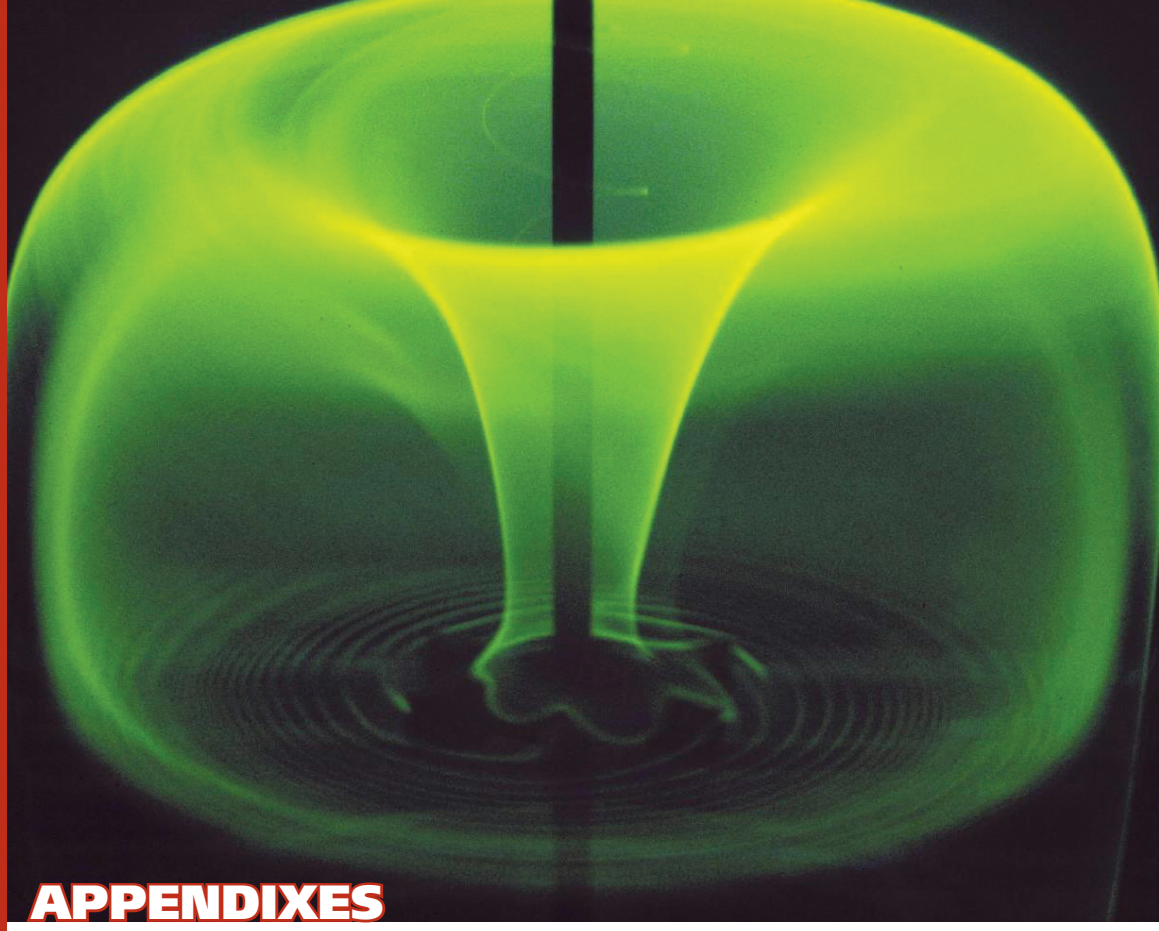


Right: In FY 2006, NSF awarded $75.3 million for five new Engineering Research Centers (ERCs) that will develop cross-disciplinary programs to advance technologies to address major societal problems and provide the basis for new industries. Scientists and engineers from a variety of disciplines collaborate on broad-based high-risk engineering research, developing fundamental knowledge and test beds for emerging technologies. The ERCs also provide rich educational and research environments for preparing new generations of engineering leaders. The five centers will pursue breakthroughs in synthetic biology, fluid power, air monitoring, drug manufacturing, and technologies for older adults and people with disabilities. In the image at the right, a fluorescent dye injected into a tank of stirred liquid creates a pattern that resembles a green apple. The demonstration, conducted by Rutgers researchers from the NSF Engineering Research Center for Structured Organic Composites, shows how liquids mix in a typical pharmaceutical manufacturing operation. This research will help enhance drug quality while reducing the cost of developing and manufacturing new drugs.

For more information:

http://nsf.gov/news/news_summ.jsp?cntn_id=107939&org=NSF&from=news

APPENDIXES

Appendix 1:
DESCRIPTION OF NSF DIRECTORATES AND MANAGEMENT OFFICES

The **Directorate for Biological Sciences (BIO)** provides support for research to advance understanding of the underlying principles and mechanisms governing life. Research ranges from the study of the structure and dynamics of biological molecules, such as proteins and nucleic acids, through cells, organs, and organisms, to studies of populations and ecosystems. It encompasses all processes that are internal to the organism as well as those that are external, and includes temporal frameworks ranging from measurements in real-time through individual life spans, to the full scope of evolutionary time. BIO plays a major role in support of research resources for the biological sciences including multi-user instrumentation, living stock centers, systematics collections, biological field stations, and computerized databases, including sequence databases for plants and microorganisms. As part of the National Plant Genome Initiative (NPGI), BIO plays a major role through support for research infrastructure to enable a broad community and for research to understand the structure, organization, and function of plant genomes. For more information, go to *www.nsf.gov/dir/index.jsp?org=BIO*.

The **Directorate for Computer and Information Science and Engineering (CISE)** supports research in all areas of computer and information science and engineering, helps develop and maintain cutting-edge national computing and information infrastructure for research and education, and contributes to the education and training of the next generation of computer scientists and engineers. CISE supports projects designed to establish the scientific foundations of computing and communication devices and to explore their usage. For example, CISE funds advances in computing and communication theory, algorithms for computer and computational sciences, architecture and design of computers and software, and revolutionary computing paradigms based on emerging scientific ideas. At the systems level, CISE supports projects to better understand the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems. CISE programs also support advances in our understanding of the effective integration and co-evolution of social and computing systems; the capabilities of human beings and computing machines to create, discover, and reason with knowledge; the application of information technology to science and engineering problems; and the potential of computational systems to perform tasks autonomously, robustly, and flexibly. For more information, go to *www.nsf.gov/dir/index.jsp?org=CISE*.

For more information:

Office of the Director
www.nsf.gov/od/index.jsp

National Science Board
www.nsf.gov/nsb/

The **Directorate for Education and Human Resources (EHR)** supports activities that promote excellence in U.S. science, technology, engineering, and mathematics (STEM) education at all levels and in all settings, both formal and informal. The goal of these activities is to develop a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators, as well as a well-informed citizenry with access to the ideas and tools of science and engineering. EHR supports education research and infrastructure development in all science and engineering disciplines. Support is provided for individuals to pursue advanced study, for institutions to build their capacity to provide excellent STEM education, and for collaborations to strengthen STEM education at all levels by fostering alliances and partnerships among colleges, universities, school districts, and other institutions in the public and private sectors. For more information, go to *www.nsf.gov/dir/index.jsp?org=EHR*.

The **Directorate for Engineering (ENG)** supports research and education activities that provide a foundation for our nation's global leadership in technology and innovation. This leadership is the key to our continued economic growth and national security. ENG investments include such emerging technologies as sensors and sensor systems, molecular electronics, photonics, cyberinfrastructure, metabolic engineering, bioengineering, manufacturing innovation, and nanotechnology. Fundamental engineering research has a profound impact on areas such as protecting the environment, improving human health, enabling science to better understand the natural world, and enhancing our standard of living. For more information, go to *www.nsf.gov/dir/index.jsp?org=ENG*.

The **Directorate for Geosciences (GEO)** supports research in the atmospheric, earth, and ocean sciences. Basic research in the geosciences advances our scientific knowledge of the Earth and advances our ability to predict natural phenomena of economic and human significance, such as climate change, weather, earthquakes, fish-stock fluctuations, and disruptive events in the solar-terrestrial environment. GEO also supports the operation of national user facilities. For more information, go to *www.nsf.gov/dir/index.jsp?org=GEO*.

The **Directorate for Mathematical and Physical Sciences (MPS)** supports research and education in astronomical sciences, chemistry, materials research, mathematical sciences, and physics. Major equipment and instrumentation such as telescopes and particle accelerators are provided to support the needs of individual investigators. MPS also supports state-of-the-art facilities that enable research at the cutting edge of science and research opportunities in totally new directions. For more information, go to *www.nsf.gov/dir/index.jsp?org=MPS*.

The **Directorate for Social, Behavioral, and Economic Sciences (SBE)** supports research and education to build fundamental scientific knowledge about human cognition, language, social behavior, and culture and on economic, legal, political, and social systems, organizations, and institutions. To improve understanding of the science and engineering enterprise, SBE also supports science resources studies that are the nation's primary source of data on the science and engineering enterprise. For more information, go to *www.nsf.gov/dir/index.jsp?org=SBE*.

The **Office of Cyberinfrastructure (OCI)** coordinates and supports the acquisition, development, and provision of state-of-the-art cyberinfrastructure resources, tools, and services essential to the conduct of 21st century science and engineering research and education. OCI supports cyberinfrastructure, such as supercomputers, high-capacity mass-storage systems, system software suites and programming environments, scalable interactive visualization tools, productivity software libraries and tools, large-scale data repositories and digitized scientific data management systems, networks of various reach and granularity, and an array of software tools and services that hide the complexities and heterogeneity of contemporary cyberinfrastructure while providing broad access and enhanced usability. OCI supports the preparation and training of current and future generations of researchers and educators to use cyberinfrastructure to further their research and education goals, while also supporting the scientific and engineering professionals who create and maintain these IT-based resources and systems and who provide essential customer services to the national science and engineering user community. For more information, go to *www.nsf.gov/dir/index.jsp?org=OCI*.

The **Office of International Science and Engineering (OISE)** serves as the focal point, both within and outside NSF, for international science and engineering activities. OISE promotes the development of an integrated, Foundation-wide international strategy and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF interests. OISE also supports programs that provide international research experiences to students and young investigators, preparing them for full participation in the global research enterprise. In addition, OISE manages cooperative relationships with partner countries around the world and with international scientific organizations on behalf of NSF. For more information, go to *www.nsf.gov/div/index.jsp?org=OISE*.

FUTURE SCIENTISTS

Researcher Alan Smith and his team at California State University, San Bernardino have completed an ambitious project to recruit and retain underrepresented ethnic groups in the earth sciences from 6th grade to post-college. In an initial survey asking minority students why they were not majoring in geology, the top reasons were lack of exposure to the geosciences and lack of knowledge about geoscience careers.

Armed with these results, the team conducted 169 outreach sessions over a three-year period that involved more than 12,000 contact hours with 5,700 students. Most students were middle- or high-school students, and three quarters were from underrepresented groups in the geosciences (52 percent were Hispanic, 13 percent African American, 5 percent Native American, and 4 percent Pacific Islander).

Group activities included hikes to the San Andreas fault and hands-on exercises related to plate tectonics and earthquakes. Hands-on activities were modified to enhance students' familiarity with the scientific method. Students began by making observations from and asking questions about maps of the Earth. One of the observations they often noted was that the coastlines of Africa and South America look like they would fit together. They also noticed the mid-ocean ridges and trenches on the sea floor. A computer animation of world seismicity was shown so that students could make observations about where earthquakes occur.

Another activity was a biannual Global Positioning System (GPS) campaign. This campaign allowed students to work with scientists and use state-of-the-art GPS receivers to precisely determine the location of benchmarks on both sides of the San Andreas and San Jacinto faults. From these measurements, the students determined the bending of the tectonic plates that will eventually lead to slip along these faults as major earthquakes. Students worked with scientists to interpret the GPS data in terms of how fast the faults were slipping. Results were presented at meetings of the American Geophysical Union and the Southern California Earthquake Center. The data were also shared with the Southern California Earthquake Data Center ***(www.scecdc.scec.org)*** for use by other scientists around the country and around the world.

The **Office of Polar Programs (OPP)**, which includes the U.S. Polar Research Programs and U.S. Antarctic Logistical Support Activities, supports multidisciplinary research in the Arctic and Antarctic regions. These geographic frontiers—premier natural laboratories—are the areas predicted to be the first affected by global change. They are vital to understanding past, present, and future responses of Earth systems to natural and man-made changes. OPP support provides unique research opportunities ranging from studies of Earth's ice and oceans to research in atmospheric sciences and astronomy. For more information, go to *www.nsf.gov/dir/index.jsp?org=OPP*.

The **Office of Budget, Finance, and Award Management (BFA)** is headed by the Chief Financial Officer, who has responsibility for budget, financial management, grants administration and procurement operations, and related policy. Budget responsibilities include the development of the Foundation's annual budget, long-range planning, and budget operations and control. BFA's financial, grants, and other administrative management systems ensure that the Foundation's resources are well managed and that efficient, streamlined business and management practices are in place. NSF has been acknowledged as a leader in the federal research administration community, especially in its pursuit of a paperless environment that provides more timely and efficient awards administration. For more information, go to *www.nsf.gov/bfa/*.

The **Office of Information and Resource Management (OIRM)** provides human capital management, information technology solutions, continuous learning opportunities, and general administrative services to the NSF community of scientists, engineers, and educators. OIRM also provides logistical support functions for NSF staff as well as the general public. It is responsible for recruiting, staffing, and other human resource service requirements for all NSF staff and visiting personnel. OIRM is responsible for the management of NSF's physical infrastructure and conference facilities, the administration of its sophisticated technology infrastructure, and the dissemination of information about NSF programs to the external community through the agency's website. It is also responsible for delivery of the hardware, software, and support systems necessary to manage the Foundation's grant-making process and to maintain advanced financial and accounting systems. For more information, go to *www.nsf.gov/oirm/*.

Appendix 2:
EXECUTIVE STAFF AND OFFICERS

NSF Executive Staff

Office of the Director
Arden L. Bement, Jr., Director

Office of the Deputy Director
Kathie L. Olsen, Deputy Director

National Science Board
Steven C. Beering, Chair
Kathryn D. Sullivan, Vice Chair

Directorate for Biological Sciences
James Collins, Assistant Director

Directorate for Computer and Information Science and Engineering
Peter A. Freeman, Assistant Director

Directorate for Education and Human Resources
Wanda Ward, Assistant Director (Acting)

Directorate for Engineering
Richard Buckius, Assistant Director

Directorate for Geosciences
Margaret S. Leinen, Assistant Director

Directorate for Mathematical and Physical Sciences
Tony F. Chan, Assistant Director

Directorate for Social, Behavioral, and Economic Sciences
David W. Lightfoot, Assistant Director

Office of Cyberinfrastructure
Daniel E. Atkins, Director

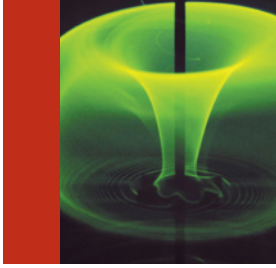
Office of International Science and Education
Thomas Weber, Director

Office of Polar Programs
Karl A. Erb, Director

Office of Equal Opportunity Programs
Ronald D. Branch, Director

Office of the General Counsel
Lawrence Rudolph, General Counsel

Office of Inspector General
Christine C. Boesz, Inspector General



Office of Integrative Activities
Nathaniel G. Pitts, Director

Office of Legislative and Public Affairs
Jeff Nesbit, Director

Office of Budget, Finance, and Award Management
Thomas N. Cooley, Director

Office of Information and Resource Management
Anthony A. Arnolie, Director

Officers

Chief Financial Officer
Thomas N. Cooley (Office of Budget, Finance, and Award Management)

Chief Information Officer/Chief Privacy Officer
George O. Strawn (Office of Information and Resource Management)

Chief Human Capital Officer
Anthony A. Arnolie (Office of Information and Resource Management)

NSF Affirmative Action Officer
Consuelo Roberts (Office of Equal Opportunity Programs)

Appendix 3: NATIONAL SCIENCE BOARD MEMBERS DURING FY 2006

Steven C. Beering (Chair)[1]
President Emeritus
Purdue University

Kathryn D. Sullivan (Vice Chair)
Science Advisor
Center of Science and Industry (COSI)

Mark R. Abbott[2]
Dean and Professor
College of Oceanic and Atmospheric Sciences
Oregon State University

Dan E. Arvizu
Director
National Renewable Energy Laboratory

Barry C. Barish
Linde Professor of Physics
California Institute of Technology

Camilla P. Benbow
Patricia and Rodes Hart Dean of Education and Human Development
Peabody College of Education and Human Development
Vanderbilt University

Ray M. Bowen
Former President
Texas A&M University

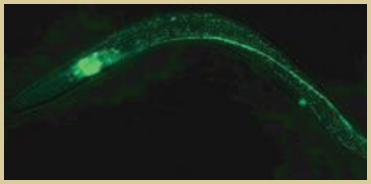
John T. Bruer[2]
President
James S. McDonnell Foundation
St. Louis, MO

G. Wayne Clough
President
Georgia Institute of Technology

Kelvin K. Droegemeier
Regent's Professor and Roger and Sherry Teigen Presidential Professor
Weathernews Chair of Applied Meteorology
Director, Center for Analysis and Prediction of Storms
Director, Sasaki Institute
University of Oklahoma

[1] Board member as of May 2006.
[2] Board member as of July 31, 2006.

UNDERSTANDING NEURONS



There are hundreds of millions of neurons in the mammalian nervous system, more than the number of stars in the Milky Way. So neuroscientists often use less dauntingly complex organisms for their research—among them the roundworm *Caenorhabditis elegans,* which has just 302 neurons. Despite the many differences between roundworms and mammals, the neurons of these organisms share many properties. Among these is the presence of a nucleus, with common genes and a common genetic code.

Now, Guy Caldwell, Associate Professor in the Department of Biological Sciences at the University of Alabama and an NSF CAREER awardee, has discovered a family of genes in *C. elegans,* above, that controls the position of the nucleus within the cell. Moreover, he has found that when these genes are turned on, the nucleus shifts position and impairs the neuron's ability to communicate with other neurons.

This discovery is not only of fundamental interest to cell biologists, but has potential implications for understanding human neurological diseases. One of the earliest responses of neurons to injury or disease is movement of the nucleus to the edge of the cell. Understanding how and why such movements occur may suggest ways to prevent or reduce the devastating behavioral consequences of damage to the nervous system.

For more information:

http://www.bama.ua.edu/~gcaldwel/