NATIONAL SCIENCE FOUNDATION CENTERS

NSF supports a variety of centers programs that contribute to the Foundation's mission and vision. Centers exploit opportunities in science, engineering, and technology in which the complexity of the research problem or the resources needed to solve the problem require the advantages of scope, scale, duration, equipment, facilities, and students. Centers are the principal means by which NSF fosters interdisciplinary research.

NSF Centers Funding

(Dollars in Millions)

	Program initiation	Number of Centers in FY 2007	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate Amount	Percent
Centers for Analysis & Synthesis	1995	2	$6.67	$13.41	$18.41	$5.00	37.3%
Centers for Chemical Innovation[1]	1998	8	3.00	7.50	20.00	12.50	166.7%
Engineering Research Centers	1985	15	47.05	52.86	53.55	0.69	1.3%
Materials Research Science & Engineering Ctrs	1994	26	55.97	54.73	62.73	8.00	14.6%
Nanoscale Science & Engineering Centers	2001	18	38.61	42.59	44.61	2.02	4.7%
Science and Technology Centers	1987	17	68.56	64.95	76.02	11.07	17.0%
Science of Learning Centers	2003	6	12.64	14.94	15.00	0.06	0.4%
Total, Centers			$232.50	$250.98	$290.32	$39.34	15.7%

Totals may not add due to rounding.

[1] Formerly titled Chemical Bonding Centers.

CENTERS DESCRIPTIONS

Centers for Analysis and Synthesis (BIO)

The Centers for Analysis and Synthesis are designed to continue development of new tools and standards for management of biological information and meta-information, support data analysis capabilities with broad utility across the biological sciences, host workshops that bring together scientists from a variety of disciplines, and begin to host and curate databases. The centers have a critical role in organizing and synthesizing biological knowledge that is useful to researchers, policy makers, government agencies, educators, and society.

The National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California at Santa Barbara promotes integrative studies of complex ecological questions and serves as a locus for the synthesis of large data sets. The National Evolutionary Synthesis Center (NESCent) is a collaborative effort by Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill to foster a greater conceptual synthesis in biological evolution by bringing together researchers and educators, extant data, and information technology resources.

The Center for Research at the Interface of the Mathematical and Biological Sciences (CIMBS) will be established in FY 2009 to stimulate research and education at the interface of the mathematical and biological sciences. The Center will play a critical role in addressing national needs, particularly in the area of modeling infectious diseases of animals and plants, and will provide knowledge that will be useful to policy makers, government agencies, and society. Although predominantly supported by BIO, MPS will also contribute to CIMBS.

Lastly, a Plant Science Cyberinfrastructure Collaborative (PSCIC) will be established in FY 2008 to create intellectual synergy among biologists, computer and information scientists, mathematicians, engineers, and others to drive discovery and enable new conceptual advances through integrative, computational approaches. In FY 2009, PSCIC will receive increased funding to use advanced computational and cyberinfrastructure capabilities and expertise to craft solutions to an evolving array of grand challenges in biology.

Centers for Chemical Innovation (formerly Chemical Bonding Centers) (MPS)
The Centers for Chemical Innovation (CCI) are designed to support research on strategic, transformative "big questions" in basic chemical research. The program is stimulating the chemical sciences community to perform work that is high-risk and of potential high scientific and societal impact, particularly through innovation. CCIs promote the integration of research and education through the extensive involvement of students and postdoctoral fellows in all phases of the work. The Centers are expected to be agile, responding to scientific opportunities as they arise, and to creatively engage the public, Grand challenges include emulating and even surpassing the efficiency of the natural process of photosynthesis to capture the sun's energy; learning how molecules combine to become living things; activating strong bonds as a means to store and use chemical energy and to lower energy costs in chemical processing; and designing self-assembling, complex structures, such as molecular computers, with emergent and useful functions not even yet known or foreseen.

The first Center awarded in FY 2007 is developing chemistry needed to transform raw materials such as plants into high value organic compounds such as fuels and chemicals for industry. Developing centers are designing nanostructured catalysts to promote the solar-powered conversion of water into hydrogen and oxygen, using new laser methods to probe elementary chemical events on ultrasmall and ultrafast scales, and designing molecular machines powered by chemical bonds.

The program is designed as a staged competition, supporting several Phase I centers ($500,000 per year for three years), which then compete for Phase II awards ($4.0 to 5.0 million per year for five to ten years). In FY 2009, the requested $12.50 million increase will launch three new Phase II Centers (for a total of five) and three new Phase I Centers (for a total of six).

Engineering Research Centers (ENG)
NSF's Engineering Research Centers (ERCs) are proven cauldrons of innovation, bridging the energy and intellectual curiosity of universities with the real-world applications of industry-focused research. These centers also are uniquely successful in educating a technology-enabled workforce with hands-on, real-world experience. These characteristics create an environment that catalyzes the development of marketable technologies to generate wealth and address engineering grand challenges, many of which intersect with the Administration's American Competitiveness Initiative. This is particularly evident in ERCs that address hydrogen as an alternative fuel, biomedical healthcare innovations, and multimedia information systems.

ERCs succeed in these areas because they provide the intellectual foundation for industry collaboration with faculty and students to resolve long-range challenges, continue the steady advances in technology, speed their transition to the marketplace, and train graduates who are effective in applying them in industry. ERCs are also devoted to the integration of research and education by creating collaborative environments for learning and research, and producing curricula and course materials for bioengineering, manufacturing, electronic packaging, and particle science and technology, among others. Also, all ERCs have active programs to stimulate interest in engineering among pre-college students and their teachers; several have sites at local museums to educate the general public about engineering and technology.

During the last few years, the ERC program, established in 1985, has seen the total number of centers supported increase from the historical level of 15 to a peak of 19. Concurrently, the number of proposals received by the Directorate for Engineering research programs has increased dramatically causing a significant drop in funding rate across the Directorate. As the next generation of ERCs come online, the number of centers will fall back to the historical level of 15. In FY 2008, five new ERCs are planned to replace graduating centers in order to maintain the total at 15. Funding in FY 2009 will increase slightly as these five new ERCs ramp up their activities, but no new awards are planned.

Materials Research Science and Engineering Centers (MPS)
Materials Research Science and Engineering Centers (MRSECs) address fundamental materials research problems of intellectual and strategic importance that are critical for American competitiveness and the development of future technologies. MRSECs also support shared experimental facilities, place strong emphasis on the integration of research and education at all levels, and provide seed support to stimulate emerging areas of materials research. They support cutting-edge materials research in areas such as electronic and photonic materials, polymers, biomimetic and biomolecular materials, magnetic and ferroelectric materials, nanoscale materials, structural materials, and organic systems and colloids. MRSECs have strong links to industry and other sectors, enabling the development of marketable technologies that depend on new classes of materials and the discovery, control, and innovative exploitation of materials phenomena. Areas of potential technological impact include computers and communications, transportation, energy storage, structural engineering, health, and medicine. MRSECs also foster research and education partnerships among academic institutions in the U.S. as well as international partnerships. A significant component of new MRSEC awards are expected to tie to Foundation-wide activities, particularly Science and Engineering Beyond Moore's Law.

There are now 26 MRSECs. Open competitions for NSF support are held triennially. The 2005 competition yielded two new centers devoted to genetically engineered materials and to interfaces in electronic and magnetic materials, respectively. Three other centers are currently phasing out with final funding in FY 2007. A new competition is planned for FY 2008, from which three new centers are expected to be supported; funding for these new centers will be ramped up in FY 2009.

Nanoscale Science and Engineering Centers (multi-directorate)
Nanotechnology, which addresses technology on the smallest of scales, is projected to be one of the largest drivers of technological innovation for at least the next decade and beyond. This potential was recognized in the National Nanotechnology Initiative and more recently in the American Competitiveness Initiative, particularly in the burgeoning area of nanomanufacturing. Research at the nanoscale through NSF-funded Nanoscale Science and Engineering Centers aims to advance the development of the ultra-small technology that will transform electronics, materials, medicine, environmental science, and many other fields. Each center has a long-term vision for research. Together they provide coherence and a long-term outlook to U.S. nanotechnology research and education; they also address the social and ethical implications of such research. Support will be provided for education and outreach programs from K-12 to the graduate level, designed to develop a highly skilled workforce, advance pre-college training, and further public understanding of nanoscale science and engineering. The centers have strong partnerships with industry, national laboratories, and international centers of excellence, which puts in place the necessary elements to bring discoveries in the laboratory to real-world, marketable innovations and technologies.

There are 18 NSECs, including the National Nanotechnology Network and Nanotechnology in Society Network. Four NSECs on nanomanufacturing have established the core of the National Nanomanufacturing Network in FY 2007. The Center for Environmental Implications of Nanotechnology, with an annual budget of $4.0 million, will be competed in FY 2008.

Science and Technology Centers: Integrative Partnerships (multi-directorate)
The Science and Technology Centers: Integrative Partnerships (STC) program advances discovery and innovation in science and engineering through the integration of cutting-edge research, excellence in education, targeted knowledge transfer, and the development of a diverse workforce while broadly advancing the goals and objectives of the American Competitiveness Initiative. The STC research portfolio reflects the disciplines of science and engineering supported by the NSF. Examples of continuing investment include cyber-security, advanced sensors and embedded networked sensing, revolutionary materials for information technology, advanced nano/microfabrication capabilities, new materials and technologies for monitoring water resources and water quality, medical devices, modeling and simulation of complex earth environments for improving their sustainability, and weather/climate prediction. STCs engage the Nation's intellectual talent and robustly draw from its full human diversity through partnerships among academia, industry, national laboratories, and government. These partnerships result in synergistic effects that enhance and ensure the timely transfer of knowledge and technology from the laboratory to appropriate industries, the application of patents derived from the work of the STCs, the launching of spin-off companies, and creation of job opportunities. Furthermore, STCs have impressive records of publications and research training of undergraduate students, graduate students, postdoctoral fellows, established researchers, and educators as well as contributions to K-12 education, industry, and other sectors.

In FY 2008, support for five centers from the Class of 2000 program will begin to phase out with full program sunset in FY 2009. A new competition is planned for FY 2009 with five to seven new STCs expected to be named.

Science of Learning Centers (multi-directorate)
The Science of Learning Centers (SLC) goals are to advance fundamental knowledge about learning, transform the way people learn and teach, secure the U.S. leadership role in innovation and technology, and prepare the Nation’s workforce for the 21st century.

The six existing SLCs will continue to harness and integrate knowledge across multiple disciplines to create a common groundwork of conceptualization, experimentation, and explanation that underlie new lines of thinking and inquiry leading to a deeper understanding of learning. The SLC portfolio represents synergistic, exciting research efforts that address different dimensions of learning, including:

- combined modeling and experimental studies to link brain function and behavior and permit innovations in technology;
- development of learning technologies to study robust learning in classrooms so that new principles can inform use and design of new technologies that enhance learning;
- the processes involved in learning visual languages and how this knowledge can improve language processing and reading in deaf, hearing-impaired, and hearing learners;
- the influence of time and timing on learning across multiple scales and multiple levels of analysis, to inform understanding of learning from the cellular level to social interactivity in classrooms;
- the interplay between learning in informal and formal environments; and

- spatial intelligence and learning, the malleability of the underlying processes and how they can be enhanced to improve learning in STEM domains.

In FY 2009, $15.0 million will provide continuing support for the second cohort of SLCs and for programmatic activities, including administration costs, workshops, Small Grants for Exploratory Research, and supplements for program infrastructure and development.

Estimates of Centers Participation in 2007

(Dollars in Millions)

	Number of Participating Institutions	Number of Partners	Total FY 2007 NSF Support	Total Leveraged Support	Number of Participants
Centers for Analysis & Synthesis	4	20	$7	$2	1,463
Centers for Chemical Innovation	60	23	$3	$5	445
Engineering Research Centers	494	455	$47	$181	4,647
Materials Research Science & Engineering Centers	200	219	$56	$45	5,190
Nanoscale Science & Engineering Centers	140	280	$39	$17	5,350
Science & Technology Centers	100	355	$69	$35	2,495
Science of Learning Centers	29	59	$13	$10	586

No. of Participating Institutions: all academic institutions participating in activities at the centers.

No. of Partners: the total number of non-academic participants, including industry, states, and other fed agencies at the centers.

Total Leveraged Support: funding for centers from sources other than NSF.

No. of Participants: the total number of people who use center facilities, not just persons directly support by NSF.

Centers Supported by NSF in FY 2007

Center	Institution	State
Centers for Analysis and Synthesis		
National Center for Ecological Analysis and Synthesis (NCEAS)	U of California-Santa Barbara	CA
National Evolutionary Synthesis Center (NESCent)	Duke, NC State U, U of N. Carolina	NC
Centers for Chemical Innovation (formerly Chemical Bonding Centers)		
Activation and Transformation of Strong Bonds (CATSB)	U of Washington	WA
Center for Molecular Cybernetics	Columbia	NY
Chemical Design of Materials	U of California-Santa Barbara	CA
Chemistry at the Space-Time Limit: Time Resolved Nonlinear Spectroscopy of Elementary Chemical Events	U of California-Irvine	CA
Darwinian Chemical Systems	Mass. General Hospital	MA
Orchestrating Proton Transport Through Supramolecular Alignment of Functionalities	U of Massachusetts-Amherst	MA
Powering the Planet: A Chemical Bonding Center for the Direct Conversion of Sunlight into Chemical Fuel	California Institute of Technology	CA
The Origins Chemical Inventory and Early Metabolism Project	Georgia Institute of Technology	GA
Engineering Research Centers		
Advanced Engineering Fibers and Films	Clemson	SC
Biomimetic Microelectronic Systems	U of Southern California	CA
Collaborative Adaptive Sensing of the Atmosphere	U of Mass-Amherst	MA
Compact and Efficient Fluid Power	U of Minnesota	MN
Computer-Integrated Surgical Systems and Technologies	Johns Hopkins	MD
Engineering of Living Tissue	Georgia Institute of Technology	GA
Environmentally Beneficial Catalysis	U of Kansas	KS
Extreme Ultraviolet Science and Technology	Colorado State	CO
Mid-IR Tech for Health and the Environment	Princeton	NJ
Power Electronic Systems	Virginia Tech	VA
Quality of Life Technology	Carnegie Mellon/U of Pittsburgh	PA
Structured Organic Composites	Rutgers	NJ
Subsurface Sensing and Imaging Systems	Northeastern	MA
Synthetic Biology	U of California-Berkeley	CA
Wireless Integrated MicroSystems	U of Michigan	MI
Materials Research Science and Engineering Centers		
Center for Complex Materials	Princeton	NJ
Center for Materials for Information Technology	U of Alabama	AL
Center for Materials Research	Cornell	NY
Center for Materials Science and Engineering	Mass Institute of Technology	MA
Center for Micro- and Nanomechanics of Materials	Brown	RI
Center for Multifunctional Nanoscale Materials Structures	Northwestern	IL
Center for Nanomagnetic Structures	U of Nebraska	NE
Center for Nanoscale Science	Pennsylvania State	PA
Center for Nanostructured Interfaces	U of Wisconsin	WI
Center for Nanostructured Materials	Columbia	NY
Center for Polymer Interfaces and Macromolecular Assemblies	Stanford, UC-Davis, IBM	CA
Center for Research on Interface Structures and Phenomena	Yale	CT
Center for Response-Driven Polymeric Films	U of Southern Mississippi	MS
Center for Science and Engineering of Materials	California Institute of Tech	CA
Center for Semiconductor Physics in Nanostructures	U of Oklahoma, U of Arkansas	OK, AR
Ferroelectric Liquid Crystals Materials Research Center	U of Colorado-Boulder	CO
Genetically Engineered Materials Science and Engineering Center	U of Washington	WA
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA

Materials Research Center	U of Chicago	IL
Materials Research Science and Engineering Center	Harvard	MA
Materials Research Science and Engineering Center	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	U of Maryland	MD
Materials Research Science and Engineering Center	U of Minnesota	MN
Materials Research Science and Engineering Center	Carnegie Mellon	PA
Materials Research Science and Engineering Center	Johns Hopkins	MD
Materials Research Science and Engineering Center on Polymers	U of Massachusetts	MA
Nanoscale Science and Engineering Centers		
Affordable Nanoengineering of Polymer Biomedical Devices	Ohio State	OH
Center for Environmental Implications of Nanotechnology	To be completed in FY 2008	tbd
Center for Integrated and Scalable Nanomanufacturing	U of California-Los Angeles	CA
Directed Assembly of Nanostructures	Rensselaer Polytechnic Institute	NY
Electronic Transport in Molecular Nanostructures	Columbia	NY
High Rate Nanomanufacturing	Northeastern, U of New Hampshire, U of Mass-Lowell	MA
Integrated Nanomechanical Systems	U of Calif-Berkeley, Cal Tech, Stanford, U of California-Merced	CA
Integrated Nanopatterning and Detection Technologies	Northwestern	IL
Molecular Function at the Nano/Bio Interface	U of Pennsylvania	PA
Nanotechnology in Society Network: Center at ASU	Arizona State U	AZ
Nanotechnology in Society Network: Center at UCSB	U of California-Berkeley	CA
Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems	U of Illinois-Champaign-Urbana	IL
Nanoscale Systems in Information Technologies	Cornell	NY
Nanoscience in Biological and Environmental Engineering	Rice	TX
National Nanomanufacturing Network: Center for Hierarchical Manufacturing	U of Massachusetts-Amherst	MA
Probing the Nanoscale	Stanford, IBM	CA
Science of Nanoscale Systems and their Device Applications	Harvard	MA
Templated Synthesis and Assembly at the Nanoscale	U of Wisconsin-Madison	WI
Science and Technology Centers		
Adaptive Optics	U of California-Santa Cruz	CA
Advanced Materials for Water Purification	U of Illinois	IL
Behavioral Neuroscience	Georgia State	GA
Biophotonics Science and Technology	U of California-Davis	CA
Center for Remote Sensing of Ice Sheets (CReSIS)	U of Kansas	KS
Coastal Margin Observation and Prediction	Oregon Health and Science U	OR
Earth Surface Dynamics	U of Minnesota	MN
Embedded Networked Sensing	U of California-Los Angeles	CA
Environmentally Responsible Solvents and Processes	U of North Carolina	NC
Integrated Space Weather Modeling	Boston U	MA
Layered Polymeric Systems	Case Western Reserve U	OH
Materials and Devices for Information Technology Research	U of Washington	WA
Microbial Oceanography: Research and Education	U of Hawaii	HI
Multi-Scale Modeling of Atmospheric Processes	Colorado State U	CO
Nanobiotechnology	Cornell	NY
Sustainability of Semi-Arid Hydrology and Riparian Areas	U of Arizona	AZ
Ubiquitous Secure Technology	U of California-Berkeley	CA
Science of Learning Centers		
A Center for Learning in Education, Science, & Technology (CELEST)	Boston U	MA
Pittsburgh Science of Learning Center - Studying Robust Learning with Learning Experiments in Real Classrooms	Carnegie Mellon	PA

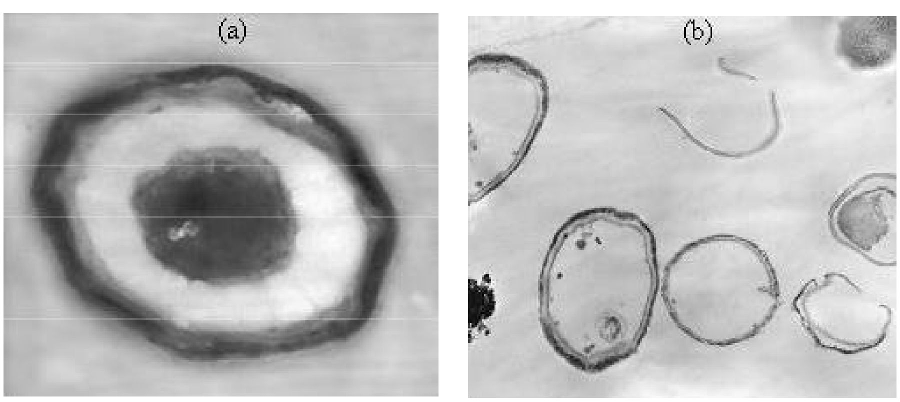
The LIFE Center - Learning in Formal and Informal Environments	U of Washington	WA
Spatial Intelligence and Learning Center (SILC)	Temple	PA
The Temporal Dynamics of Learning Center (TDL)	U of California-San Diego	CA
Visual Language and Visual Learning (VL2)	Gallaudet	DC

Recent Research Highlights

Experimental Model Systems. *Credit: Center for Behavioral Neuroscience, Atlanta, Georgia.*

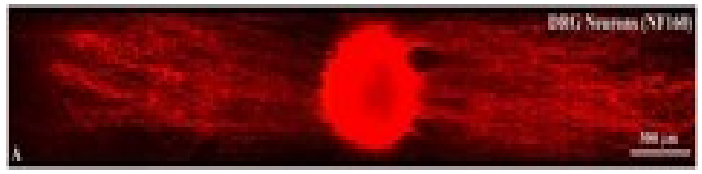
► **Where Biology Meets Business**: The NSF-funded Center for Behavioral Neuroscience in Atlanta, Georgia is making great strides at improving how undergraduates view science. It helps transfer relevant discoveries from the laboratory to the public, with programs such as its BioBusiness Seminar Series, which brings together undergraduate science and business students to learn how their two disciplines merge in companies that commercialize bioscience products. The program makes students aware of job opportunities and fosters development of applied technology and business-oriented culture in the universities while training potential management-level employees. It also educates new generations of research scientists and students in innovative, interdisciplinary ways of investigating the neural basis of social behavior. (BIO/STC).

► **Using Visible Light to Destroy Pathogens in Water**: Chemical byproducts from disinfecting water can be toxic or can cause cancer. A safer way to treat water uses light to destroy pathogens but problems with titanium dioxide catalysts have stymied this approach. Using nanomaterials, researchers at the Center of Advanced Materials for the Purification of Water with Systems, an NSF Science and Technology Center, developed effective titanium dioxide catalysts. This removes the primary obstacle to using light for water treatment and makes it possible to use visible light, rather than UV, to disinfect drinking water. (ENG/STC).



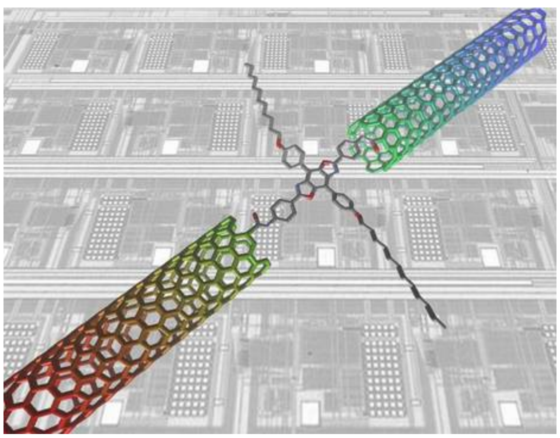
Transmission electron microscopy image of bacillus spores before (left) and after (right) photocatalytic treatment by visible light-illuminated metal doped TiON. *Credit: Mark Shannon, University of Illinois.*

► **Synthetic Scaffolds to Repair Nerves**: Today most damaged nerves are replaced with grafts from a patient's own nerves. However, appropriate grafts may not be available and infection is a risk when transplanting tissue and organs. Researchers from the Georgia Tech/Emory University Center for the Engineering of Living Tissues (an NSF-funded Engineering Research Center) have used polymeric nanofibers to develop a biocompatible material that functions as a scaffold on which new nerve tissues can grow. The method paves the way for safer, more cost effective nerve regeneration. By offering topographical cues to guide cell alignment, the polymer scaffolds matched the performance of an autograft across a long nerve gap in rodents. This research lays the foundation for off-the-shelf engineered polymeric grafts to repair damage to peripheral nerves. (ENG/ERC).



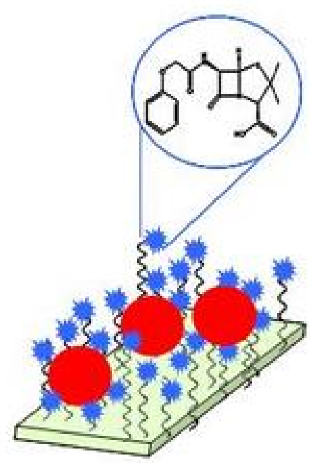
A fluorescent image of nerve cells in a chick. The red lines show regeneration along the nanoscaffolds. *Credit: GTEC.*

► **How to Solder an Individual Molecule to an Electrode**: How can we solder an individual molecule to an electrode structure? A multidisciplinary team from the Columbia University Nanocenter answered that question. They developed a new method to wire molecules directly into nanometer-scale gaps in conducting single-walled carbon nanotubes. They precisely cut a single-walled carbon nanotube using oxygen to make a carbon-oxygen-terminated electrode separated by a gap of d10 nanometers. The chemical species at the gap is a carboxylic acid. When the point contacts are exposed to another kind of molecule – one with a nitrogen – they react to form carbon-oxygen-nitrogen bridges between the molecule and the nanotube. These chemical contacts are robust and have allowed the team to test conductance in a wide-variety of molecules. This research will spur rapid progress in the drive towards molecular level electronics. (MPS/NSEC).



A nanotube electrode developed for directly measuring the conductance of single molecules. *Credit: Image created by Dr. Colin Nuckolls, graduate student Jinyao Tang, and Dr. Shalom Wind of the Columbia Nanocenter. Funding provided by NSF and the New York State Office of Science, Technology, and Academic Research.*

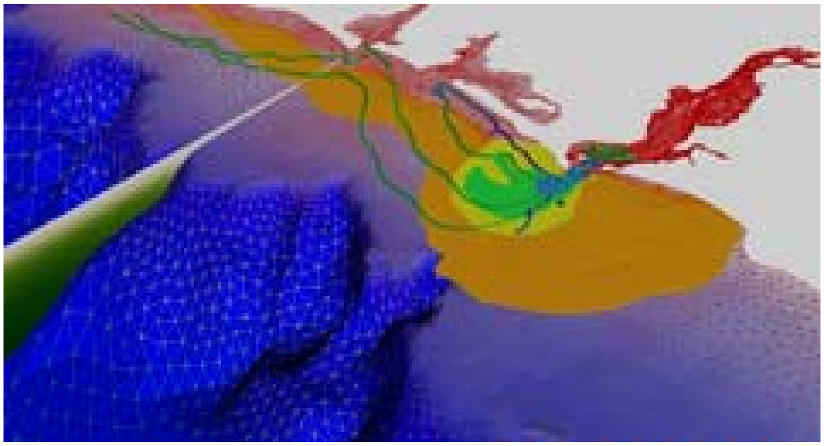
► **Penicillin-Coated Polymer for Medical Devices**: Researchers at the Materials Research Science and Engineering Center at the University of Southern Mississippi chemically attached penicillin to expanded polytetrafluoroethylene (PTFE) to produce an antibacterial surface that kills *Staphylococcus aureus,* the most common cause of staph infections. Expanded PTFE is a highly porous polymer commonly used in waterproof fabrics such as Gore-Tex. It is also extensively used in medical devices and implants. This means that antibiotics can be built into objects that are inserted into the body rather than giving patients antibiotics to ward off infections. The research team is now working on attaching an array of drugs to expanded PTFE. They are exploring blood clotting and applying other antibiotics to surfaces for control of an array of bacteria. (MPS/MRSEC)



This cartoon shows the penicillin molecule as a blue puffball attached to the surface of expanded PTFE by a spacer. Bacteria is shown as large red balls. The spacers allow the penicillin to surround the bacteria – killing it. The chemical structure of penicillin is shown in the bubble. *Credit: Marek Urban.*

► **Studying Coastal Margins Using Observation and Prediction Technologies**: Coastal margins are among the most densely populated and developed regions in the United States. At the same time they are highly complex ecosystems, sensitive to many scales of variability. Natural events and human activities place stresses upon coastal margins, rendering the development of sustainable coastal resources and ecosystems difficult and contentious, with policy decisions sometimes based on insufficient understanding of the consequences of natural and anthropogenic phenomena.

In 2006, NSF awarded a grant to support a new Science and Technology Center for Coastal Margin Observation and Prediction (CMOP). CMOP will enable researchers to focus on novel technological and scientific opportunities to solve major science questions on the impact of climate on coastal margins, the role of coastal margins on global elemental cycles, and the seaward extent of human impacts. Integral to CMOP is a river-to-ocean testbed observatory for the Pacific Northwest, consisting of modeling systems, observation networks, and information systems all aimed at fundamental advancements in science and the delivery of more reliable information to scientists, educators, resource managers, and interested citizens. This work will lead to transformative understanding of critical yet vulnerable coastal ecosystems. (GEO/STC).



The image depicts selected aspects of the dynamics of the Columbia River plume, in winter. Downwelling-favorable winds drive the plume to the North, forming a narrow coastal jet. Shown are constant salinity surfaces and pathways of three virtual drifters, all of which released from inside the estuary. Simulations were conducted with unstructured-grid 3D circulation models and are a part of the modeling system of a river-to-ocean coastal observatory for the Columbia River estuary and plume. *Credit: Paul J. Turner*.