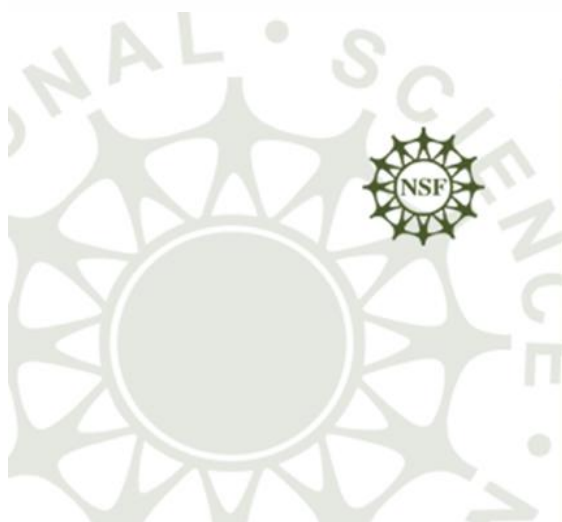


An aerial photograph of a city, likely San Francisco, with a topographic overlay in shades of green, yellow, and red. A blue river or canal winds through the city. The text "Engineering Advisory Committee Meeting" is overlaid in white.

Engineering Advisory Committee Meeting

April 24-25, 2008



**National Science Foundation
Directorate for Engineering**

**Richard O. Buckius
Assistant Director**

Engineering Advisory Committee

Agenda

- **People**
 - ◆ New ENG Staff
 - ◆ NSF Staff Changes
- **NSB Questions**
- **ENG Activities**
 - ◆ Broadening Participation
 - ◆ EFRI Update
- **FY 2008 and 2009 Outlooks**
 - ◆ Budget, Proposal and Award Trends
 - ◆ NSF and ENG Investment Areas



Advisory Committee Meeting

Meeting Agenda

- Directorate Update
- Broadening Participation Subcommittee Report and Discussion
- NAE Grand Challenges Report and Discussion
- NAE Public Understanding of Engineering Report and Discussion
- Industry-University Partnerships Subcommittee Report and Discussion
- EFRI Update
- Discussion of ENG Topics
- Discussion with the Director and Deputy Director



New Staff Introductions

Engineering

- **Civil, Mechanical and Manufacturing Innovation**
 - ◆ **Mahendra Singh, Structural Systems and Hazard Mitigation of Structures, Virginia Tech**
 - ◆ **Shaochen Chen, Nano Manufacturing, University of Texas at Austin**
 - ◆ **Demitris Kouris, Nano and Bio Mechanics, University of Wyoming**
 - ◆ **Lawrence Bank, Infrastructure Materials and Structural Mechanics, University of Wisconsin**
 - ◆ **Cerry Klein, Manufacturing Enterprise Systems and Service Enterprise Engineering, University of Missouri, Columbia**
 - ◆ **Sheila Fleet, Program Assistant**
 - ◆ **Jorn Larsen-Basse, Expert**



New Staff Introductions

Engineering

- **Chemical, Bioengineering, Environmental, and Transport Systems**
 - ◆ **Clark Liu, Environmental Engineering, University of Hawaii**
 - ◆ **Paul Bishop, Environmental Sustainability, University of Cincinnati**
- **Engineering Education and Centers**
 - ◆ **Sally Wood, Engineering Education, University of Santa Clara**
 - ◆ **Avis Taylor-Ikeji, Division Secretary**



New Staff Introductions

Engineering

- **Electrical, Communications and Cyber Systems**
 - ◆ **Eric Johnson, Electronics, Photonics and Device Technologies, University of North Carolina at Charlotte**
 - ◆ **Pradeep Fulay, Electronics, Photonics and Device Technologies, University of Pittsburgh**
- **Office of the Assistant Director**
 - ◆ **Mary Konjevoda, Secretary to the Deputy Assistant Director**



New Staff Introductions

NSF

- **Directorate for Geosciences**
 - ◆ **New Assistant Director on July 1, 2008**
 - ◆ **Timothy Killeen, currently Director of the NCAR and President of the American Geophysical Union**
- **Office of Cyberinfrastructure**
 - ◆ **Dan Atkins, term ends June 2008**
 - ◆ **Search ongoing**
- **Directorate for Engineering**
 - ◆ **Richard Buckius, term ends September 2008**
 - ◆ **Search ongoing**



NSB Questions

Discussion on Friday

- **NSB seeks input from NSF's Advisory Committees in the preparation of two reports to Congress as requested in the America COMPETES Act.**
- **Specific material are in section 10 of this binder. The items relate to:**
 - ◆ **cost sharing, and**
 - ◆ **limits on proposal submissions from institutions.**
- **The Industry-University Partnerships subcommittee will provide some background (see section 8 of this binder).**
- **IPAMM discussed institutional limitations on submissions at the last ENG Advisory Committee meeting.**



NSB Questions

Discussion on Friday

→ Limits on proposal submissions by institution

- ♦ What **impact** do limits on proposal submissions by institution have on **institutional commitment to proposals** that they submit for NSF consideration?
- ♦ What **impact** does the practice of limiting proposal submission have on **institutional workload**?
- ♦ What are **effective practices** that you are aware of that institutions could use **to select among proposals** when limited to a certain number of proposals for an NSF solicitation?
- ♦ What are possible **alternative approaches** to addressing NSF and institution workload concerns, given the practical constraints on the NSF review process?
- ♦ What are the positive and negative **impacts** of limits on proposal submissions by institution on **NSF's ability to support** the most meritorious science, engineering and education?



NSB Questions

Discussion on Friday

→ Cost Sharing

- ♦ For what types of NSF programs might **mandatory cost sharing be appropriate**, and can such cost sharing be applied effectively in a differential manner for different types of NSF programs?
- ♦ From the grantee perspective, do you believe **voluntary cost sharing is necessary for being competitive** in certain NSF programs?
- ♦ Does cost sharing **inhibit** or prohibit **certain institutions, groups or individuals from participating** and/or being competitive in NSF funding opportunities?
- ♦ What are the nature and magnitude of **challenges**, both for agencies and grantee institutions, in **tracking and reporting both mandatory and voluntary cost sharing**, particularly in-kind contributions?



An aerial photograph of a city, likely San Francisco, with a topographic overlay. The overlay uses a color gradient from green to red to represent elevation. A blue line representing a river or waterway winds through the city. The text "ENG Activities" is overlaid in white on the left side of the image.

ENG Activities



ENG Broadening Participation

Current ENG Activities

- **Broadening Participation Research Initiation Grants in Engineering (BRIGE)**
 - ◆ **Up to \$175K over two years**
 - ◆ **Less than 3 years in faculty position, and less than \$50K federal funding**
 - ◆ **Announced in September 2007 with a deadline of February 8, 2008**
 - ◆ **127 proposals received across 4 ENG divisions**
 - **Strong community response considering first year and limited ability to advertise**
 - **Panels in April and May**
 - **Generally positive feedback from community; panelists, senior faculty, deans, etc.**



ENG Broadening Participation

Current ENG Activities

- **Bridges to Engineering Research 2020: Building National Partnerships Conference**
 - ◆ **Held at North Carolina A&T State University.**
 - ◆ **Many academic leaders from HBCUs and research extensive universities, ~ 200 participants.**
 - ◆ **Young and mid-career faculty technical presentations with strong industry and NSF ENG presence.**
 - ◆ **Report being prepared on outcomes and actionable next steps.**



ENG Broadening Participation

Current ENG Activities

- **Graduate Research Supplements (GRS)**
 - ◆ Provides stipend for an additional new Ph.D. student from an underrepresented group on an existing grant to broaden participation.
 - ◆ Renewable up to 3 years on an annual basis.
 - ◆ May 12th deadline for FY08.
- **Proposal-writing workshops for faculty from underrepresented groups - CMMI, Chicago, April 2008**



EFRI Update

Activities in FY 2007 and 2008

- EFRI 2007 - **12 active awards**
 - ◆ **Autonomously Reconfigurable Engineered Systems Enabled by Cyberinfrastructure (ARES)**
 - ◆ **Cellular and Biomolecular Engineering (CBE)**

- EFRI 2008 – **52 invited full proposals; due April 30th**
 - ◆ **Cognitive Optimization and Prediction: From Neural Systems to Neurotechnology (COPN)**
 - ◆ **Resilient and Sustainable Infrastructures (RESIN)**



EFRI Update

Activities in FY 2009

→ EFRI 2009 Topics

- ◆ Hydrocarbons from Biomass (HyBi)

Key Idea: Hydrocarbon biofuels such as green gasoline are an attractive alternative to ethanol; their production in a network of rural biorefineries can be accompanied by the distributed generation of electricity.

- ◆ BioSensing & BioActuation: Interface of Living and Engineering Systems (BioSA)

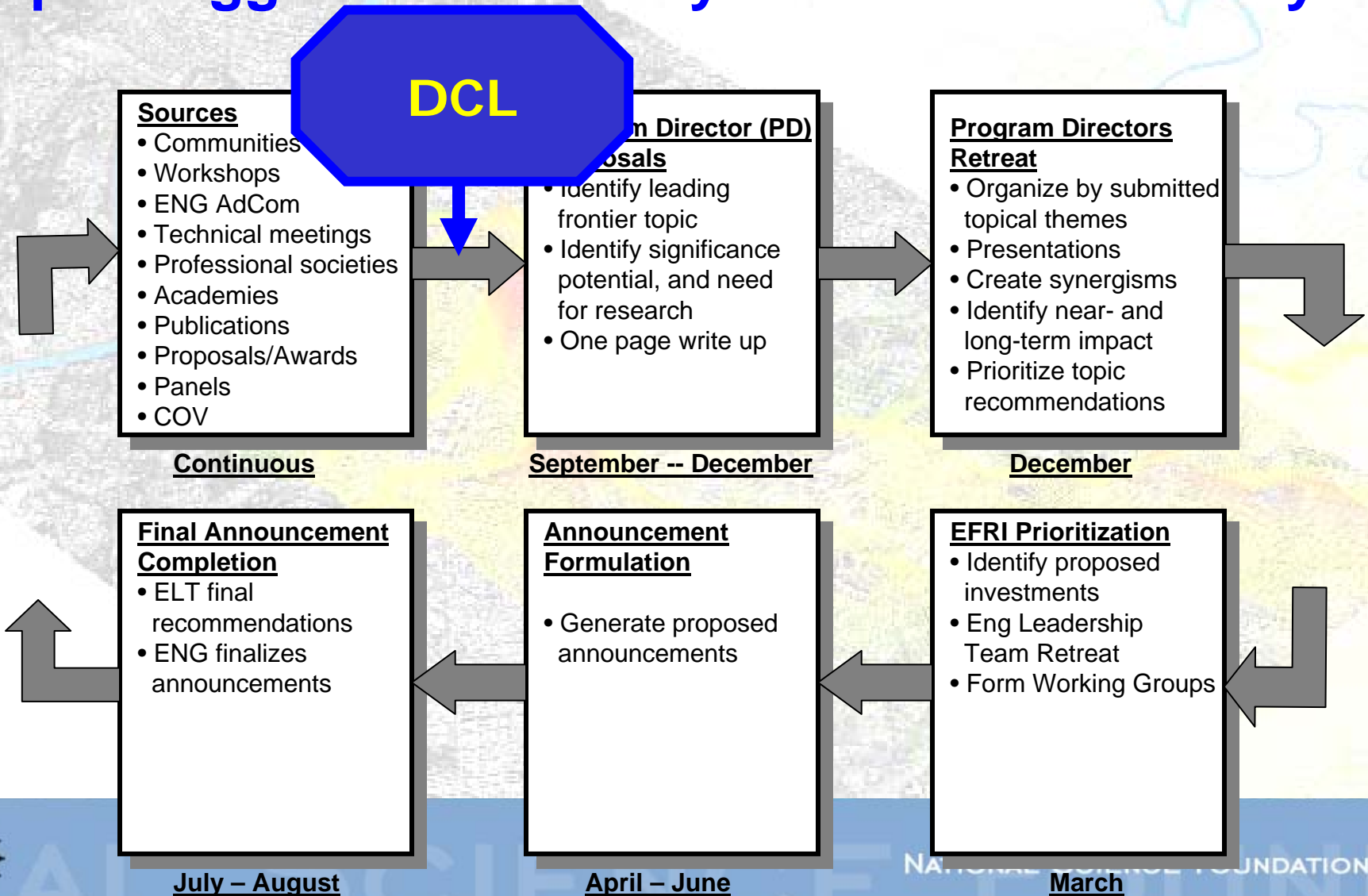
Key idea: Develop and employ bio-derived and bio-inspired technologies to engineer a new generation of devices and systems for sensing and detection, monitoring, actuation and control of stimuli and the environment.



EFRI Update

Activities for FY 2010

Topic Suggestions Directly from the Community



EFRI Update

Activities in FY 2010

Dear Colleague Letter (DCL)

→ Goals

- ◆ Engender wider community involvement and input into the EFRI process by suggesting possible EFRI topics.
- ◆ Provide a mechanism for submission of well-defined ideas.

→ Who may submit

- ◆ Individuals and groups may submit suggestions for topic areas.
- ◆ Format and guidelines will be provided.
- ◆ Submissions will be confidential.
- ◆ No direct feedback provided to submitters.



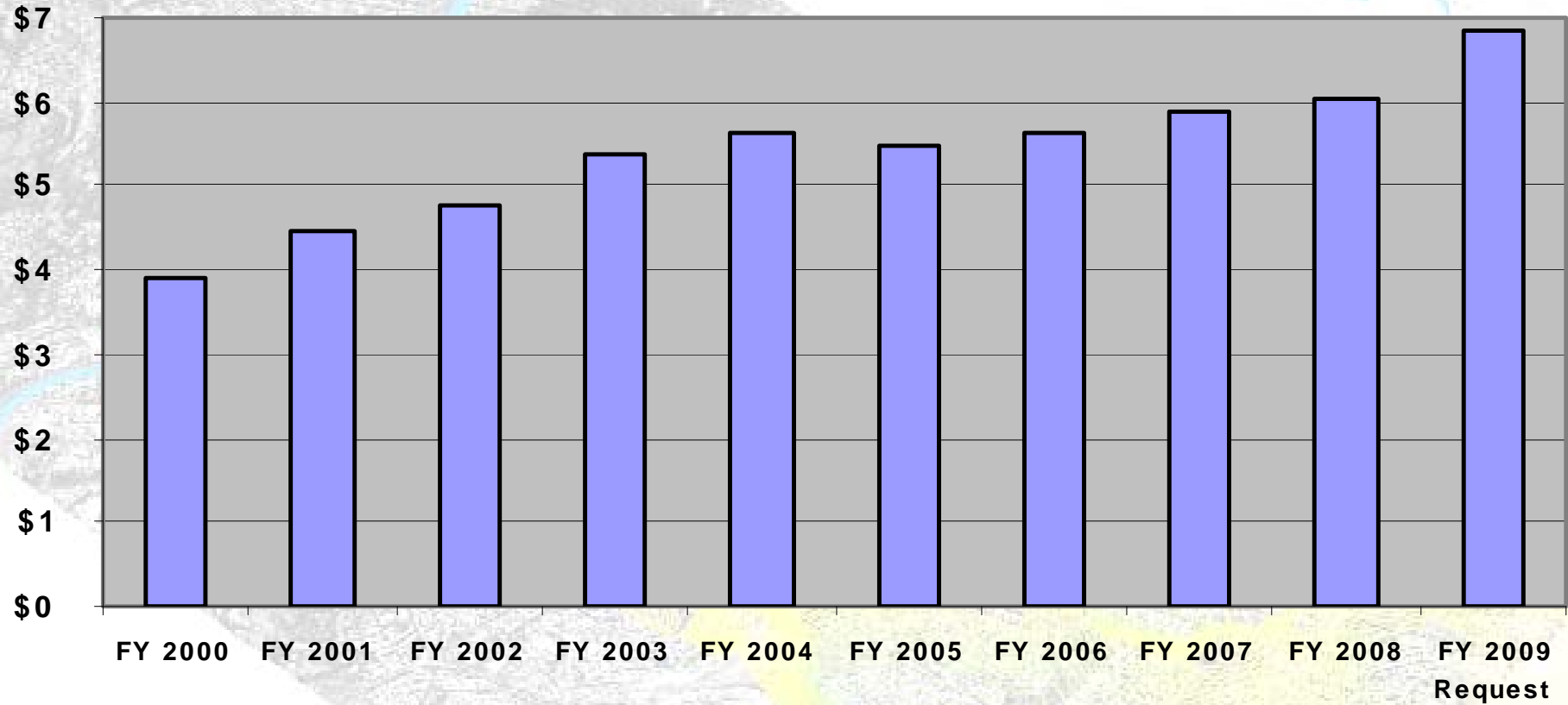


FY 2008 and 2009 Budget Overview



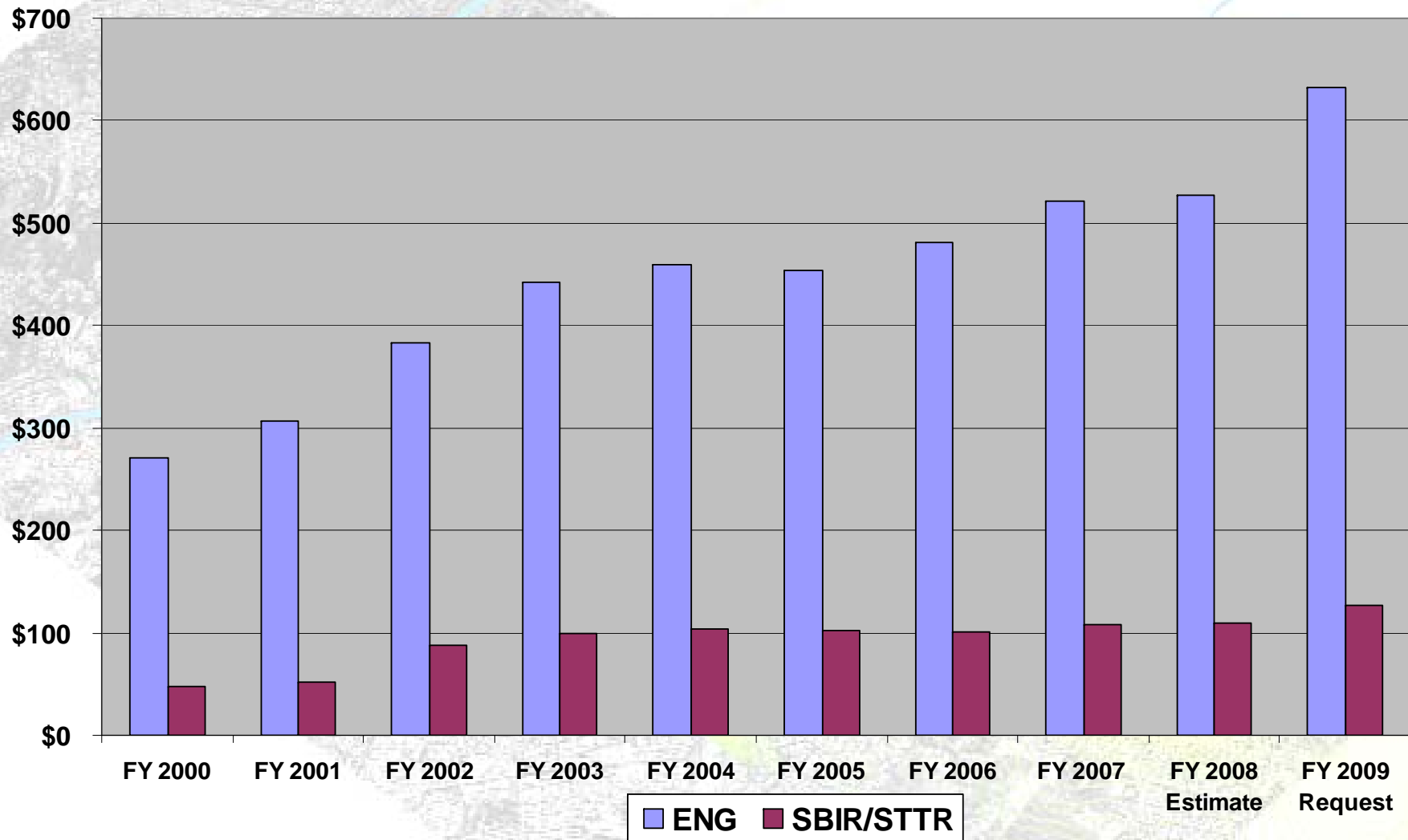
NSF Budget History

Dollars in Billions



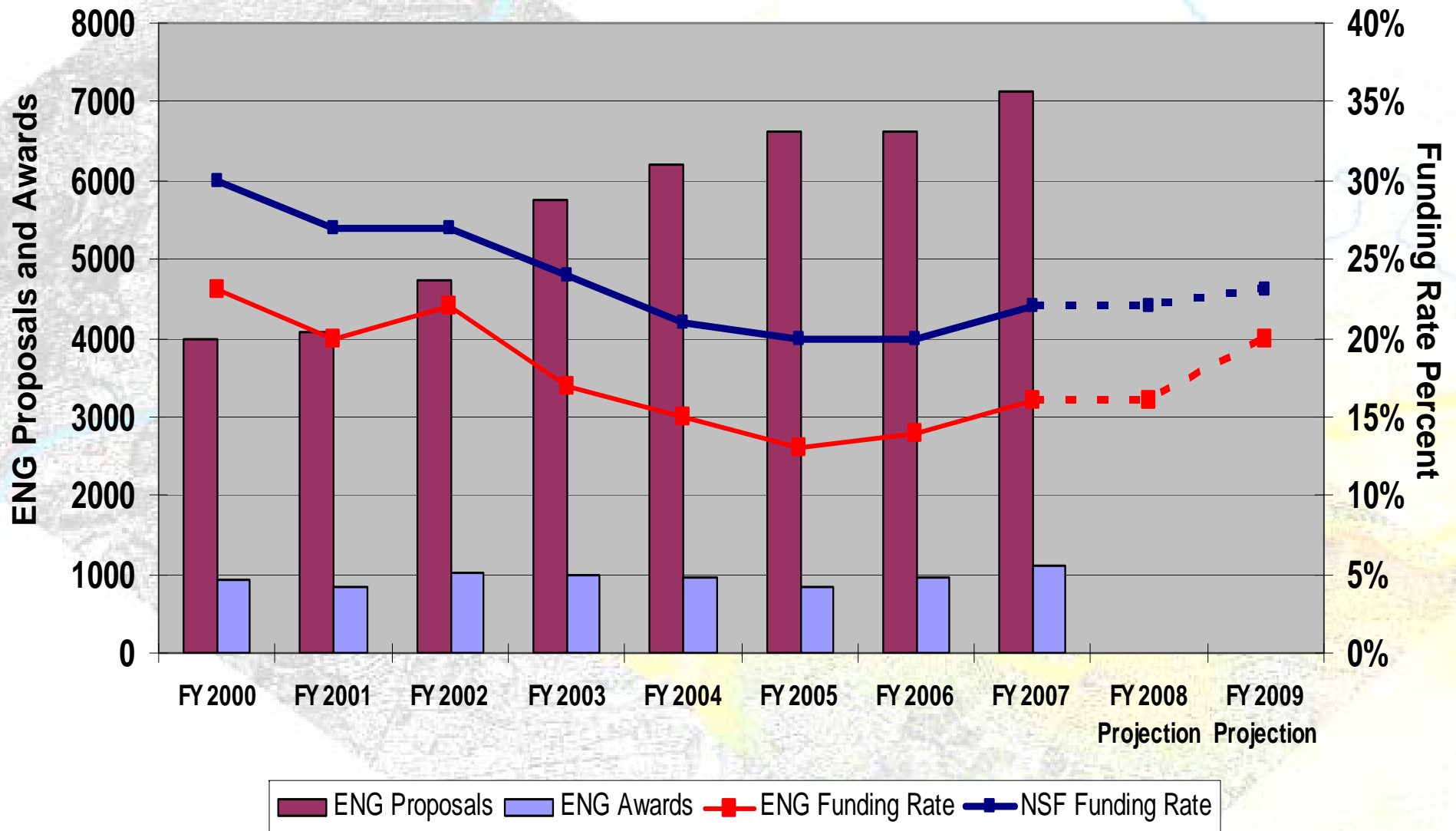
ENG and SBIR/STTR Budget History

Dollars in Millions



ENG and NSF Funding Rates

Research Grants



NSF Budget by Research Directorate

Dollars in Millions

Directorate	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	FY 2009 Request			
				Change over FY 2007 Actual		Change over FY 2008 Estimate	
				Amt	%	Amt	%
BIO	\$608.54	\$612.02	\$675.06	\$66.52	10.9	\$63.04	10.3%
CISE	526.68	534.53	638.76	112.08	21.3	104.23	19.5
ENG (<i>less SBIR/STTR</i>)	521.33	527.50	632.33	111.00	21.3	104.83	19.9
SBIR/STTR	108.67	109.37	127.00	18.33	16.9	17.63	16.1
GEO	745.85	752.66	848.67	102.82	13.8	96.01	12.8
MPS	1,150.73	1,167.31	1,402.67	251.94	21.9	235.36	20.2
SBE	214.54	215.13	233.48	18.94	8.8	18.35	8.5
OCI	182.42	185.33	220.08	37.66	20.6	34.75	18.8
OISE	40.36	41.34	47.44	7.08	17.6	6.10	14.8
OPP	438.43	442.54	490.97	52.54	12.0	48.43	10.9
IA	219.45	232.27	276.00	56.55	25.8	43.73	18.8
U.S. Arctic Research Commission	1.45	1.47	1.53	0.08	5.5	0.06	4.1
Research & Related Activities	\$4,758.44	\$4,821.47	\$5,593.99	\$835.55	17.6%	\$772.52	16.0%



NSF Investment Areas

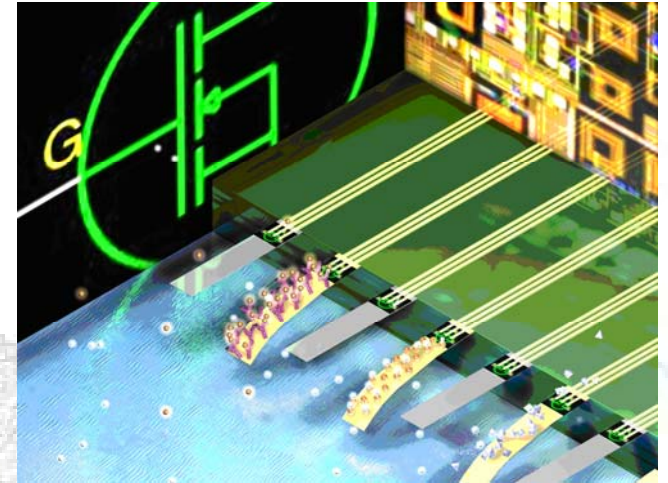
NSF Investment Totals

	FY 2007 Actual (millions)	FY 2008 Estimate (millions)	FY 2009 Request (millions)	Change over FY 2008	
				Amount (millions)	%
Adaptive Systems Technology (AST)	N/A	N/A	\$15.00	\$15.00	N/A
Climate Change Science Program	\$206.63	\$205.25	220.60	15.35	7.48%
Cyber-enabled Discovery and Innovation (CDI)	N/A	47.90	100.00	52.10	8.76
Cyberinfrastructure	617.44	644.09	682.05	37.96	5.89
Dynamics of Water Processes in the Environment (WATER)	N/A	N/A	10.00	10.00	N/A
Science & Engineering Beyond Moore's Law (SEBML)	N/A	N/A	20.00	20.00	N/A
National Nanotechnology Initiative	388.69	388.69	396.79	8.10	2.08
Networking and Information Technology R&D	908.45	931.48	1,090.25	158.77	17.04



National Nanotechnology Initiative (NNI)

- The NNI at NSF encompasses the systematic understanding, organization, manipulation, and **control of matter at the atomic and molecular levels.**
- **Novel materials, devices, and systems** open up new directions with potentially profound implications for **society.**
- **Controlling and manipulating matter at this scale promises revolutionary advances** in individualized pharmaceuticals, new drug delivery systems, more resilient materials and fabrics, catalysts for industry, and computer chips that perform an order-of-magnitude faster.

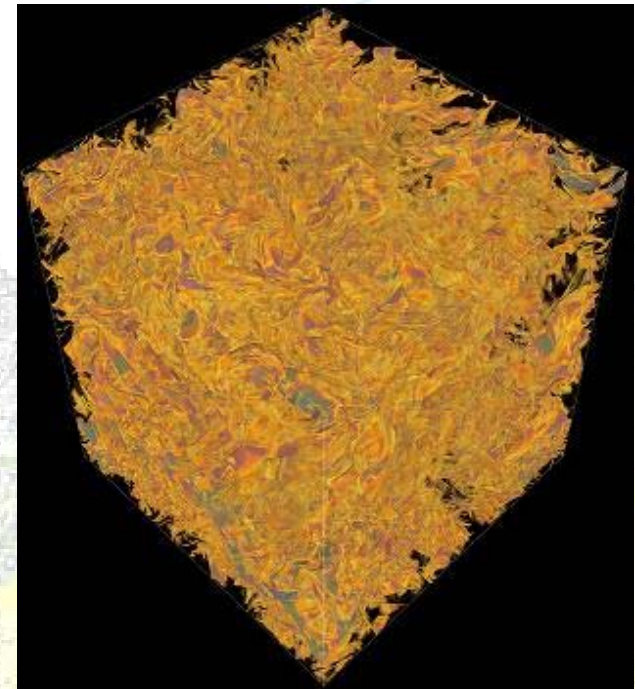


A chip hosting multiple sensing pairs of microcantilevers embedded with transistors could, in real-time, detect the presence of several different biomolecules in parallel. *David and Tark, Northwestern University.*



Cyber-Enabled Discovery & Innovation (CDI)

- Employ advances in computational **concepts, methods, models, algorithms, and tools** (computational thinking) for revolutionary science and for generating and applying new knowledge.
- CDI seeks ambitious, transformative, multidisciplinary research proposals within or across the following three thematic areas:
 - From **Data to Knowledge**
 - **Understanding Complexity** in Natural, Built, and Social Systems
 - Building **Virtual Organization**

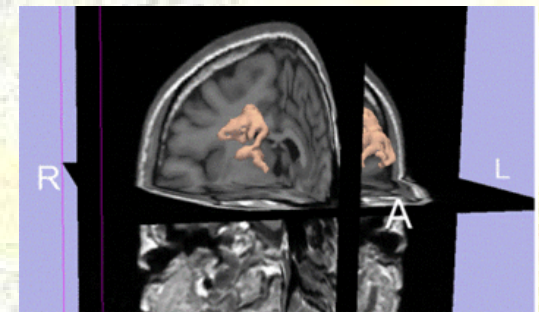
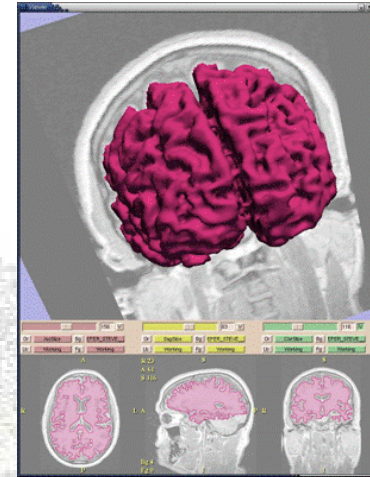


Rendering of the scalar dissipation rate for a weakly diffused passive contaminant in a three-dimensional turbulent flow . *Yeung, 0553867*



Adaptive Systems Technology (AST)

- Generate creative pathways and natural interfaces between human and physical systems.
- Apply transformational **neuroscience discoveries** to development of **engineered systems**.
- Develop engineered systems at the **human-machine interface**, **adaptive control systems**, **hybrid computer architectures**, **improved electronic PDAs**, and learning tools that are **personalized and computer-based**.

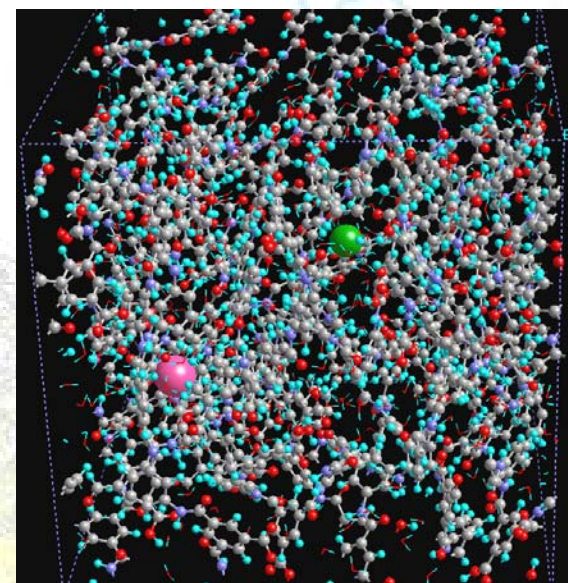


Integrating techniques from control theory, signal processing, statistical shape analysis and computer vision to use medical imaging for “seeing” schizophrenia and other diseases.
Tannenbaum, 0137412



Dynamics of Water Processes in the Environment (WATER)

- Support science and engineering to enhance our understanding and to provide a basis for decision-making about **water resources**.
- Research and model water systems for **risk assessment** and for decreased environmental impact.
- Enhance our ability to **model complex water systems** using advanced observation networks, cyberinfrastructure, and integrated large databases.

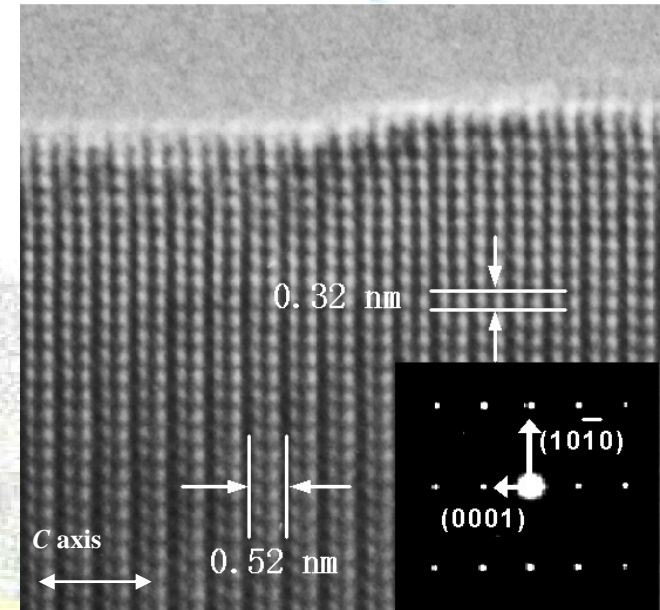


Advanced water purification and desalinization begins with a detailed understanding of how ions in water interact with purification membranes. This dynamic computer simulation shows sodium (pink) and chlorine (green) ions inside a polyamide membrane. *Shannon, 0120978.*



Science and Engineering Beyond Moore's Law (SEBML)

- Computer processing power is currently **limited** with silicon technology, and demand for new capabilities is increasing.
- Fundamental research exploiting **quantum states and interactions**, new **connection architectures**, and new **algorithms** will lead to significant advances in computational ability.
- Areas include frontier research in **new materials; new control principles**, massive parallelism and designed asynchronicity and indeterminacy; and **new algorithms**.



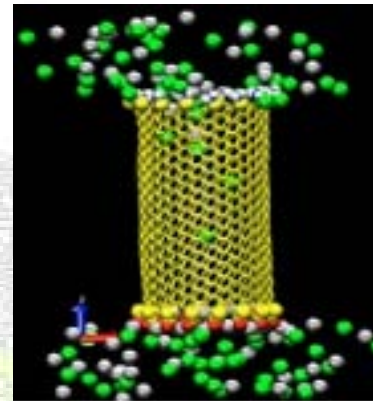
Electron and spin transport in quasi-1D systems composed of ZnO nanowires have potential to enhance electronics, optoelectronics, and magnetoelectronics devices. High resolution TEM shows single crystalline structure with lattice spacing 0.52 nm. *Lu, 0306735.*



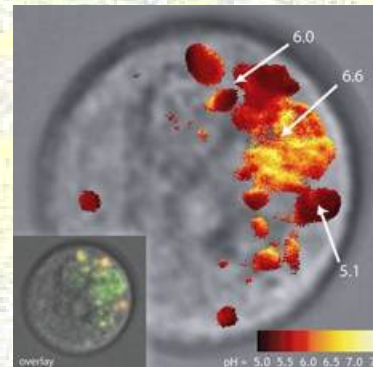
Science and Technology Centers (STC)

FY 2009

- A new competition is planned for FY 2009.
- A solicitation is planned to be posted in May or June of 2008.
- Five to seven new STCs awards are anticipated.
- STCs tackle frontier problems of national and global importance by developing innovative partnerships among disciplines and with business and industry.



Water molecules through carbon nanotubes for absorption and separation systems. Center for Advanced Materials for Water Purification, UIUC



Imaging data showing pH measurements of rat nerve mast cells using 70 nm silica nanoparticle sensors. Nanobiotechnology Center, Cornell



Advisory Committee Meetings

Upcoming Dates

- 
- **Fall 2008** **October 14 – 15, 2008**
 - **Spring 2009** **April 22 – 23, 2009**
 - **Fall 2009** **October 14 – 15, 2009**



Advisory Committee Meeting

Agenda

Day 1 - Thursday, April 24, 2008 - Room 1235

- 12:00 p.m. Registration and Light Refreshments**
- 1:00 Welcome, Intro, Agenda and Approval of Minutes, Arun Majumdar**
- 1:15 Directorate Update, Richard Buckius**
- 2:00 Broadening Participation Subcommittee, Margaret Murnane**
- 2:45 Discussion on Broadening Participation**
- 3:30 BREAK**
- 3:45 NAE Grand Challenges, Randy Atkins NAE**
- 4:15 NAE Public Understanding of Engineering ,Greg Pearson, NAE**
- 4:45 Prepare for Discussion with Director and Deputy Director**
- 5:15 Wrap Up**
- 6:00 Dinner at Caribbean Breeze**



Advisory Committee Meeting

Meeting

Day 2 - Friday, April 25, 2008 - Room 1235

- 8:00 a.m. Light Continental Breakfast/Refreshments
- 8:30 Review of Today's Agenda, Arun Majumdar
- 8:45 Industry University Partnerships Subcommittee,
Cherri Pancake
- 9:30 EFRI Update, Sohi Rastegar
- 10:00 Discussion of ENG Topics, Arun Majumdar
- 10:30 BREAK
- 10:45 Prepare for Discussion with Director and Deputy Director
- 11:00 Discussion with Arden Bement and Kathie Olsen
- 11:40 Presentations and Wrap-Up
- 12:00 p.m. Adjourn



Thank You

