



Directorate Update

Engineering Advisory Committee

Thomas W. Peterson

Assistant Director for Engineering

April 13, 2011





ENG Update

- AdCom business
- New ENG staff
- Strategic planning
- Broadening participation
- Budget and trends
- Collaborative investments





AdCom Business





Future Meeting Dates

- October 26–27, 2011
- April ?, 2012





Spring Meeting Agenda

- Directorate Update
- ENG Role in NSF Initiatives
 - SEES – *Rita Teutonico and Ilesanmi Adesida*
 - CIF21 – *Alan Blatecky*
- EFRI Update and COV Report
- EEC Update



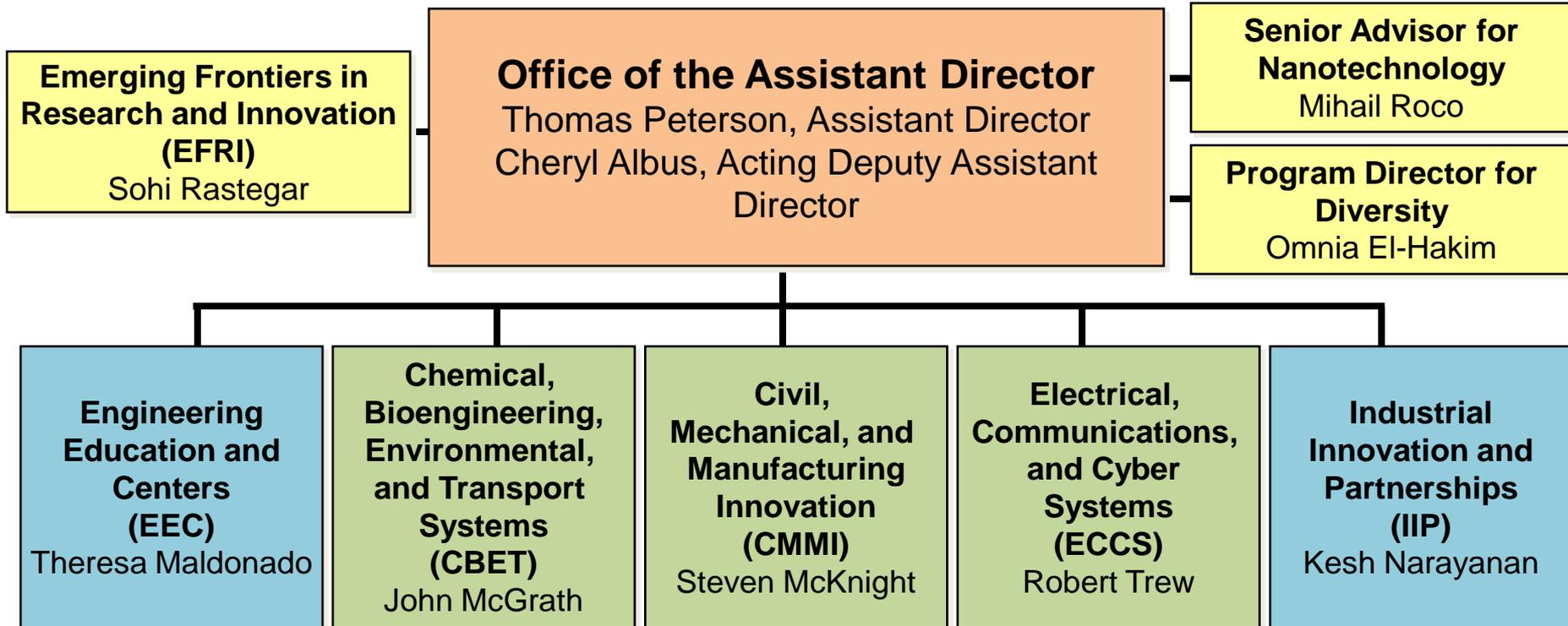


New ENG Staff





Directorate for Engineering (ENG)





CBET

- **Helena Fountain**, Program Assistant
- **Barbara Karn**, Program Director for Environmental Health and Safety of Nanotechnology (EPA)





CMMI

- **Y. Grace Hsuan**, Program Director for Structural Materials and Mechanics (Drexel)





ECSS

- **Sherryll Morton, STEP Program Assistant**





IIP

- **Prakash Balan, SBIR/STTR Program Director**
(Nittany Biodiesel LLC, State College, Pa.)





Open Recruitments

- CBET Program Directors
 - Energy for Sustainability
 - Environmental Engineering
- CMMI Program Directors
 - Hazard Mitigation and Structural Engineering
 - Mechanics of Materials
- ECCS Program Directors
 - Communications, Circuits, and Sensing Systems (2 positions)
 - Electronics, Photonics, and Magnetic Device Technology
- OAD
 - Evaluation and Assessment
 - Deputy Assistant Director





ENG Strategic Planning





Strategic Planning 2010

- On behalf of the Foundation
- On behalf of the Engineering Directorate
 - 2005
 - 2010





2009-10: Five Working Groups

- Strategic Thinking Group
- Awards and Solicitations
- Assessment and Evaluation
- Public Understanding of Engineering
- Engineering Education and Workforce
- Organization - Considered by STWG





AdCom Feedback on ENG Plan

- ELT retreat focused substantially on AdCom's recommendation memo of March 6, 2011
- In process of implementing some specific recommendations





Some Examples

- Proposal Management
 - Conducting a ‘single window’ experiment in CBET
- Potentially Transformative Research
 - New approaches to community involvement in EFRI
- Assessment and Evaluation
 - Established a position at OAD level to lead and coordinate this effort directorate-wide





NSB Policy Recommendations

- Task Force on Merit Review
 - Report with policy recommendations at the May 2011 meeting
- Task Force on Unsolicited Mid-Scale Research
 - Report with policy recommendations in Summer 2011





Current Merit Review Criteria

- Two review criteria:
 - What is the intellectual merit of the proposed activity?
 - What are the broader impacts of the proposed activity?
- Established in 1997 by the National Science Board





What is the Intellectual Merit of the Proposed Activity?

- How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
- How well qualified is the proposer (individual or team) to conduct the project?
- To what extent does the proposed activity suggest and explore creative, original, and potentially transformative concepts?
- How well conceived and organized is the proposed activity?
- Is there sufficient access to resources?





What are the Broader Impacts of the Proposed Activity?

- How well does the activity advance discovery and understanding while promoting teaching, training and learning?
- How well does the activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?





America COMPETES Reauthorization Act of 2010

- Section 526. Broader Impacts Review Criterion
 - Instructs NSF to have a Broader Impacts review criterion to address several national goals
 - Further instructs NSF to develop and implement a policy for this criterion that incorporates assessment/evaluation of Broader Impacts activities, and describes the role of the institution in supporting the PI's efforts related to Broader Impacts





NSB Task Force on Merit Review

- Established Spring 2010, charged with “examining the two Merit Review Criteria and their effectiveness in achieving the goals for NSF support for science and engineering research and education”
- Focusing on:
 - How criteria are being interpreted and used by PIs, reviewers, and NSF staff
 - Strengths and weaknesses of criteria
 - Impact of criteria on how PIs develop projects
 - Role of the institution





Sources of data for Task Force

- Input from stakeholders
 - Interviews (NSF senior leadership, a sample set of institution representatives)
 - Surveys (NSF Program Officers and Division leadership, Members of NSF Advisory Committees, NSF PIs and reviewers)
 - Open web site for comments
- Analysis of Committees of Visitors reports
- Topic modeling analysis of Broader Impacts in submitted proposals





Current Status

- The Task Force is currently analyzing the various inputs, and is developing a set of principles for guide the description and implementation of the merit review criteria
- It is anticipated that draft recommendations will be presented at the May meeting of the NSB
- NSF will develop policy related to the Broader Impacts Review Criterion by late June, as required by the America COMPETES Reauthorization Act





Broadening Participation





BRIGE Program

- Planning second grantee conference for August 2011
- Receiving significant co-funding support from the EPSCoR Office
- FY 2011
 - 126 proposals
 - Planning 30 awards (24% success rate)
- FY 2010
 - 116 proposals
 - 31 awards (27% success rate)
- FY 2009 (includes ARRA)
 - 135 proposals
 - 38 awards (31% success rate)
- FY 2008
 - 130 proposals
 - 28 awards (25% success rate)





Graduate Research Diversity Supplements

- To broaden the participation of underrepresented students in engineering Ph.D. programs through supplements to current research grants funded by ENG divisions
- FY 2011: 65 supplements planned
 - Diversity office plans to co-fund 35
- FY 2010: 61 supplements
 - Diversity office co-funded 35





NSF Family Friendly Policies

- NSF Working Group charged with creating a coherent set of family-friendly policies and program opportunities that take into account the career–family life course, to help assure an excellent U.S. STEM workforce.
 - Examining internal policies to ensure that NSF leads by example
 - Examining program opportunities, focusing initially on CAREER and postdoctoral programs, and later on GRF, ADVANCE, and other programs





Continued focus on Partnerships

- i6 Green Challenge with Dept of Commerce
- Energy ERCs with Dept of Energy
- SunShot F-PACE with Dept of Energy
- Modeling and Simulation with WH, Commerce, Council on Competitiveness, Industry





Collaboration with Commerce

i6 Green Challenge

- Led by Economic Development Administration (EDA) of Commerce in partnerships with NSF, EPA, DOE, USDA, USPTO and NIST.
- To encourage collaboration in employing “Proof of Concept Center” characteristics to accelerate economic development
- 6 Regional winners to be announced in September 2011
- NSF SBIR/STTR grantees are eligible to apply for a supplement to their existing Phase II/IIB grants to support the work of the team’s winning project.





SunShot F-PACE

- DOE-NSF Collaboration
- **Foundational Program to Advance Cell Efficiency (F-PACE)**
- \$39 million for research and development in solar device physics and PV technology
- Secretary Chu's "SunShot" Initiative pursues the goal of reducing PV system costs by to $\$1/W_{DC}$ for utility-scale systems.





Modeling and Simulation

- Led by WH Manufacturing Czar Ron Bloom
- Will launch the National Digital Engineering and Manufacturing Consortium (NDEMC), a national public-private initiative that will focus on educating and training small to medium-sized businesses on computational modeling and simulation technology.
- Purdue's nanohub technology will be one platform for the M&S efforts.





ENG Budget and Trends





ENG Budget (\$M)

	FY 2010 Omnibus Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request	Change over FY 2010 Enacted	
				Amt	%
CBET	\$157.08	\$156.82	\$194.03	\$37.21	23.7%
CMMI	189.40	188.00	226.10	38.10	20.3
ECCS	93.97	94.00	131.00	37.00	39.4
EEC	125.86	124.11	132.40	8.29	6.7
IIP	180.63	152.00	191.57	39.57	26.0
<i>SBIR/STTR</i>	<i>156.84</i>	<i>125.77</i>	<i>146.88</i>	<i>21.11</i>	<i>16.8</i>
EFRI	28.99	29.00	33.20	4.20	14.5
ENG TOTAL	\$775.92	\$743.93	\$908.30	\$164.37	22.1%





How NSF Budgets have Fared**

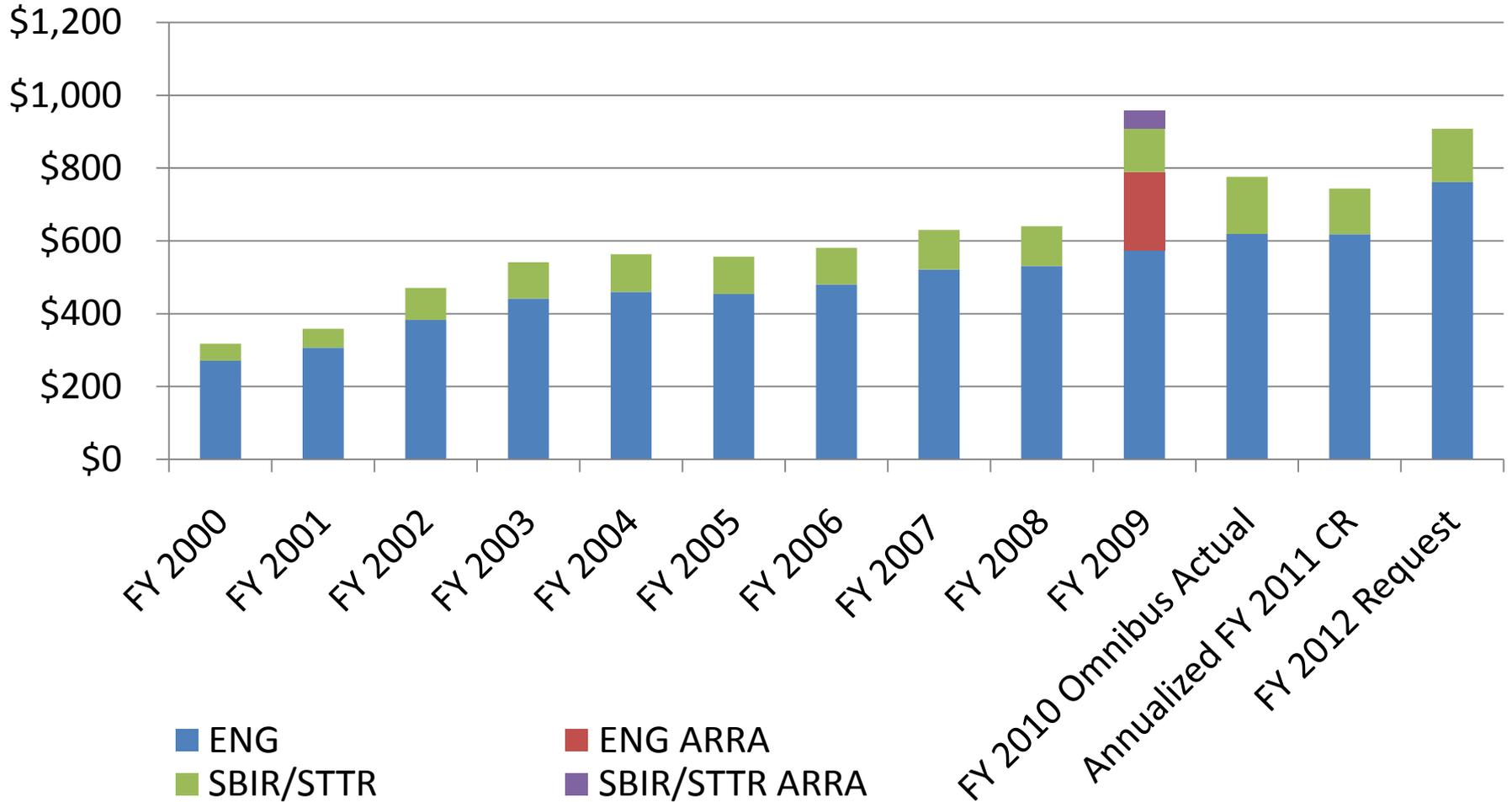
	FY09	FY10	FY11	FY12
NSF Proposed	6,854	7,045	7,424	7,767
NSF Approved	6,490	6,927		
NSF Actual	6,468	6,972		
ENG Proposed	759	764	826	908
ENG Approved	694	744		
ENG Actual	665	776		

**Millions



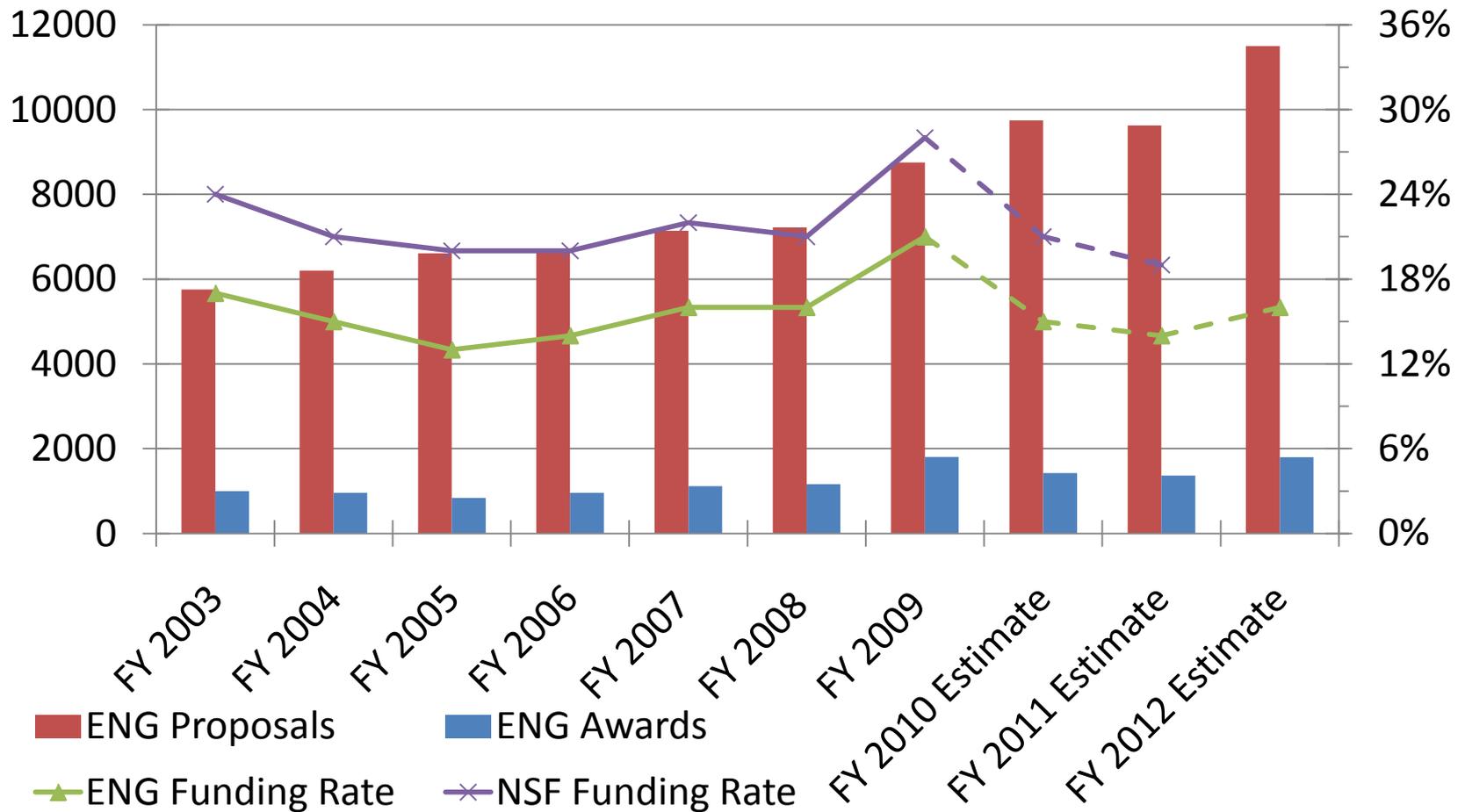


ENG and SBIR/STTR Budgets (\$M)





ENG and NSF Research Grant Proposals and Awards





ENG Interdisciplinary Investments





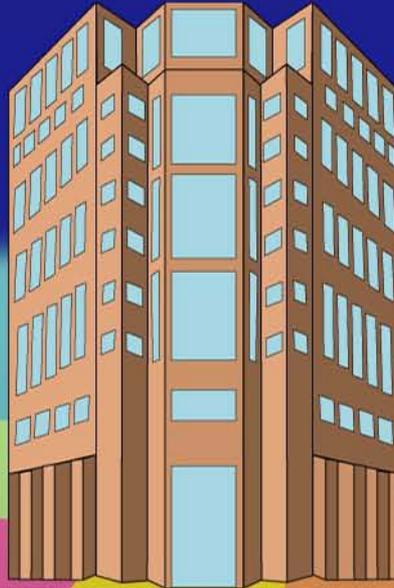
OneNSF



catalyze human capital development



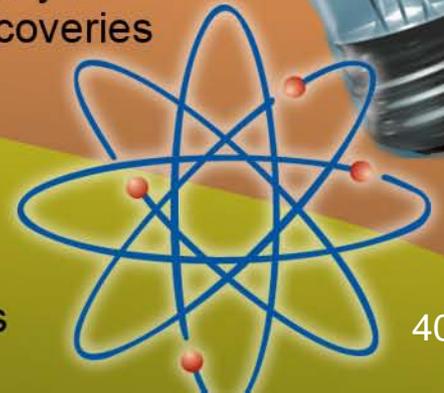
improve
organizational
efficiency



create
networks and
infrastructure
for the nation



spark greater innovation
and opportunity for
scientific discoveries



support
fundamental
research in
all disciplines



address
multidisciplinary
challenges of
national/global significance



Engineering Areas of Emphasis

- NSF Grand Challenges
 - Science, Engineering, and Education for Sustainability (SEES) and Clean Energy
 - Cyber Infrastructure for the 21st Century (CIF21)
- National Priorities
 - Innovation Ecosystem
 - Advanced Manufacturing
 - Enhancing Access to the Radio Spectrum (EARS)
 - National Nanotechnology Initiative (NNI)
 - National Robotics Initiative (NRI)





Science, Engineering, and Education for Sustainability (SEES) and Clean Energy

- ENG will invest in research and education for technologies that mitigate against, and adapt to, environmental change that threatens sustainability.
 - Sustainable Energy Pathways
- ENG will support smart grid technologies, solar energy technologies, biofuels and bioenergy, wind energy generation, and renewable energy storage.
 - BioMaPS

\$162 M/
\$173 M



Solar array. *Credit: NREL*

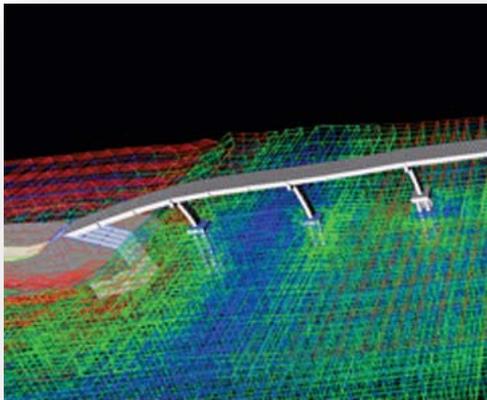




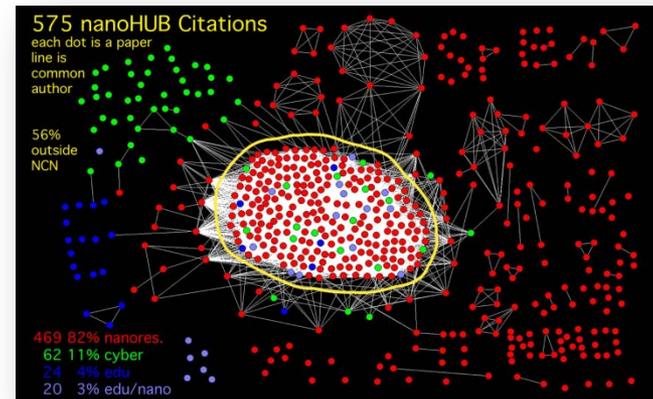
Cyber Infrastructure for the 21st Century (CIF21)

\$9 M

- The ENG investment will focus on
 - Data-enabled science
 - New computational infrastructure
 - Access/connections to cyberinfrastructure facilities



Pacific Earthquake Research Center, UC Berkeley



NanoHUB Citation Map in the Scientific Literature, Purdue University





The Innovation Ecosystem

- ENG invests in innovation research through support for
 - Research centers
 - Engineers of the future
 - Partnerships

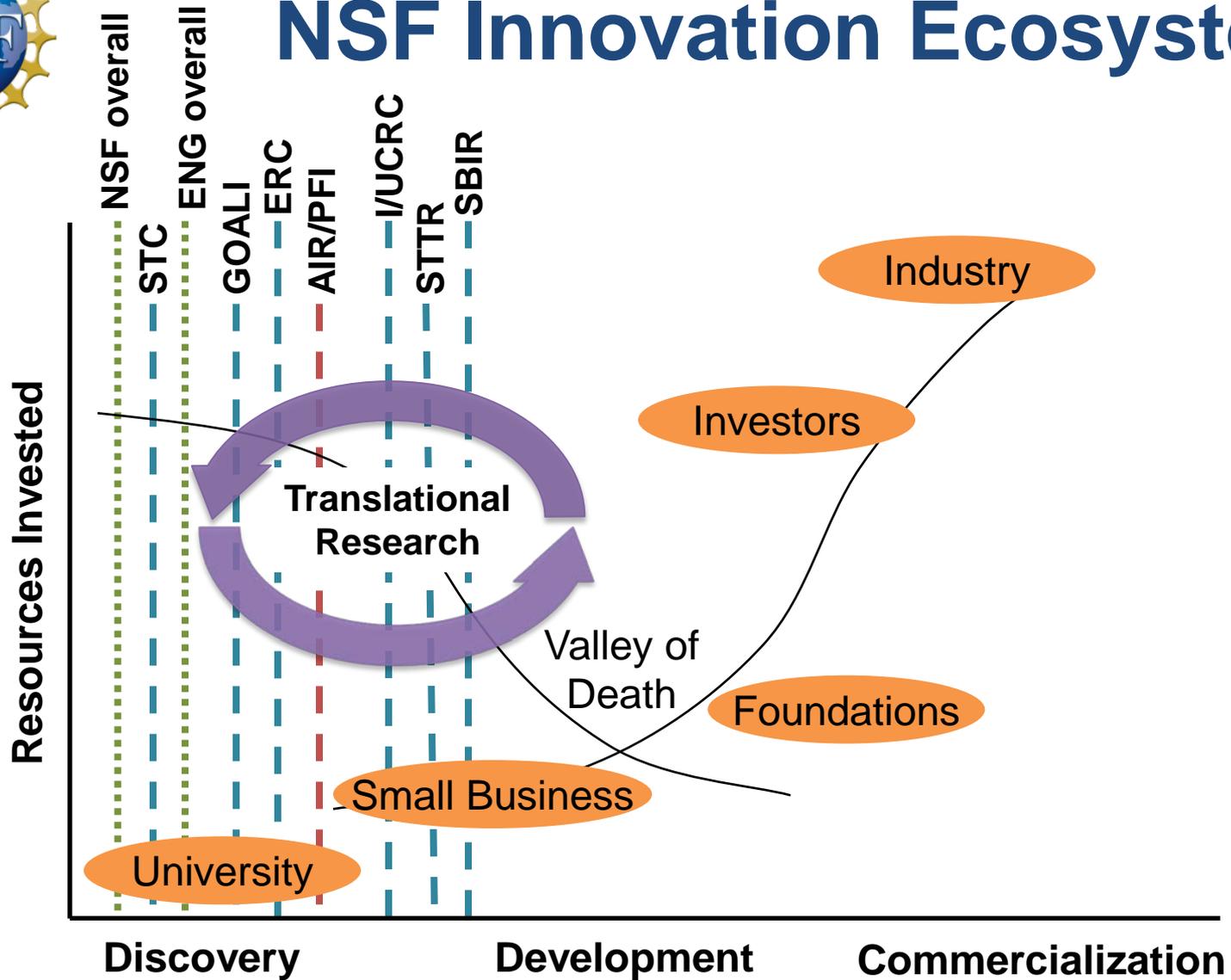


Student researchers sample contaminated sediment. *Credit: Karl Rockne, Univ. of Illinois at Chicago*





NSF Innovation Ecosystem





Research Centers

**\$81 M for
ERCs**

- Engineering Research Centers (ERCs)
 - The first class of nano ERCs will transition the nano-devices created at graduating Nanoscale Science and Engineering Centers (NSECs) to the systems level and commercialization
- Science and Technology Centers (STCs)
 - CBET will support the Center on Emergent Behaviors of Integrated Cellular Systems
 - ECCS will support the Center for Energy Efficient Electronics Science

**\$10 M for
STCs**





Engineers of the Future

- The directorate emphasizes support for
 - CAREER awards
 - Activities that promote the entry and retention of veterans and other non-traditional students in engineering programs

**\$53 M for
CAREER**



REU student Brittney Perry at work.
Credit: Biomimetic MicroElectronic Systems ERC, USC



Spc. Timothy Roy, 44th Expeditionary Signal Battalion, performs maintenance on computer servers and routers at Camp Echo, Iraq, in 2008.
Credit: Spc. Evan D. Marcy; Courtesy of U.S. Army





Accelerating Innovation Research (AIR)

\$20 M

- AIR creates partnerships for innovation involving universities and institutions to increase the economic and social impacts of basic research through
 - Engaging faculty and students across all disciplines in innovation and entrepreneurship
 - Increasing the impacts of promising university discoveries through commercialization, industry alliances, and start-up formation
 - Developing regional communities





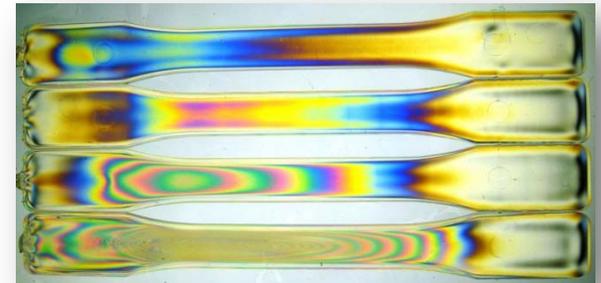
Advanced Manufacturing

\$65 M

- ENG will invest in transformative manufacturing technologies, including
 - Multi-scale modeling for simulation-based design and manufacturing across the supply chain
 - Nanomanufacturing
 - Innovative materials and manufacturing processes
 - Energy manufacturing
 - Complex engineering systems design and manufacturing
 - Science and Engineering Beyond Moore's Law (SEBML)
 - BioMaPS

A novel, dynamic injection molding process controls molecular orientation.

Credit: John P. Coulter, Lehigh Univ.

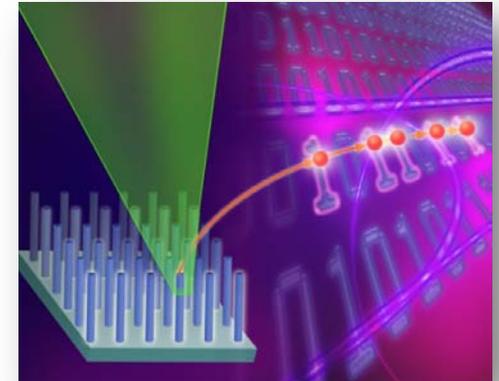




Science and Engineering Beyond Moore's Law (SEBML)

- ENG will support investigations into:
 - Devices, systems and architecture
 - Multi-scale modeling and simulation research
 - Quantum information science and engineering
 - Design of efficient and sustainable manufacturing equipment, processes, and facilities

\$29 M



A diamond nanowire matrix with defects called nitrogen vacancies. When stimulated with green light, these defects emit one red photon at a time.
Credit: Zina Deretsky, NSF





Wireless Innovation: Advancing wireless capabilities via research and testbeds

- Funded by spectrum auction revenues
 - \$1B over 5 years for NSF
- Components
 - Basic wireless research
 - Wireless testbeds
- Obama's promise to the nation
 - High-speed wireless coverage to 98% of Americans in 5 years

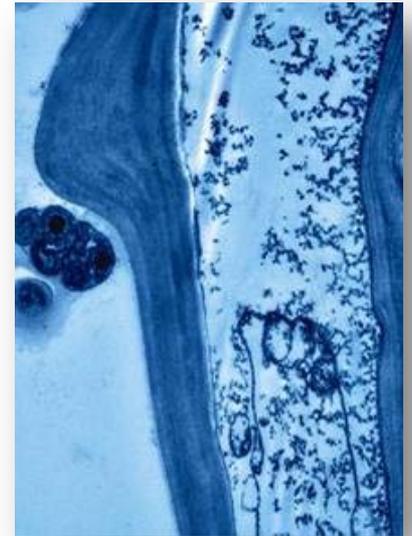




National Nanotechnology Initiative

\$174 M

- The directorate will continue support for
 - nanomaterials and nanodevices
 - nanosystems
 - nanomanufacturing
 - environment, health, and safety
- ENG will direct additional funds towards three Signature Initiatives
 - Nanoelectronics for 2020 and Beyond
 - Sustainable Nanomanufacturing
 - Nanotechnology for Solar Energy Collection and Conversion



Uptake of C70 nanoparticles and their aggregation within a rice plant leaf cell.

Credit: JoAn Hudson, Sijie Lin, and Pu Chun Ke, Clemson University





National Robotics Initiative

\$13 M

- ENG will support
 - Assistive mechanisms for those with physical disabilities and/or cognitive impairments
 - Systems integration that enables ubiquitous, advanced robotics to be realized
 - Next-generation robotics for manufacturing, healthcare and rehabilitation, surveillance and security, education and training, and transportation

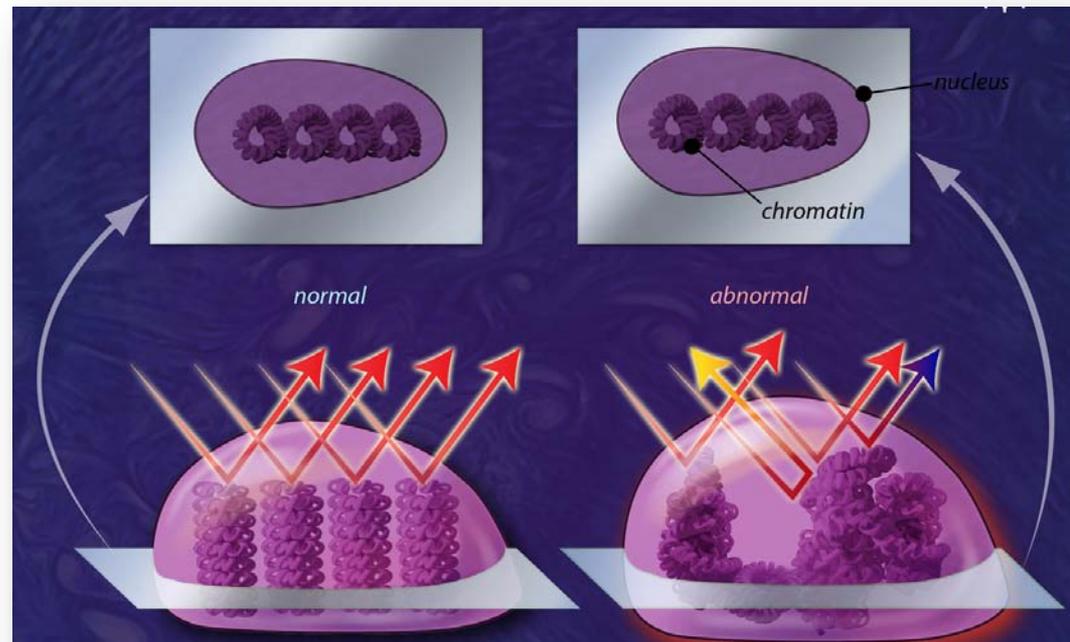




Potentially Transformative Research

- Emerging Frontiers of Research and Innovation
- Interdisciplinary research
- Disciplinary research

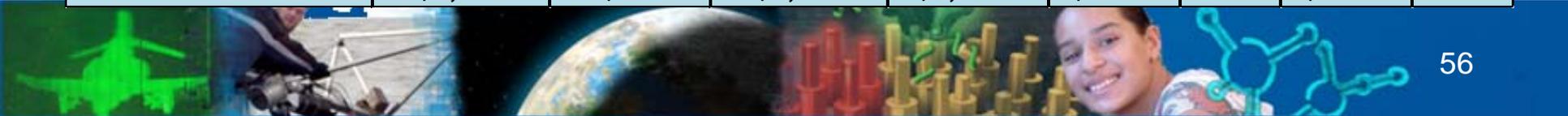
Nanoscale disturbances in cheek cells indicate the presence of lung cancer. A new technique called partial wave spectroscopic microscopy (PWS) zeroes in on nano-level disturbances. The development of PWS has been led by Vadim Backman of Northwestern University. *Credit: Zina Deretsky, NSF.*





NSF R&RA Budget (\$M)

Directorate	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request	FY 2012 Request over:			
					FY 2010 Omnibus Actual		FY 2010 Enacted	
					Amt	%	Amt	%
BIO	\$714.77	\$0.35	\$714.54	\$794.49	\$79.72	11.2	\$79.95	11.2
CISE	618.71	-	618.83	728.83	110.12	17.8	110.00	17.8
ENG <i>(less SBIR/STTR)</i>	619.09	-	618.16	761.79	142.7	23.1	143.63	23.2
SBIR/STTR	156.84	-	125.77	146.88	-9.96	-6.3	21.11	16.8
GEO	891.87	0.40	889.64	979.58	87.71	9.8	89.94	10.1
MPS	1367.95	15.70	1,351.84	1,433.14	65.19	4.8	81.30	6.0
SBE	255.31	0.25	255.25	301.3	45.99	18.0	46.05	18.0
OCI	214.72	-	214.28	236.16	21.44	10.0	21.88	10.2
OISE	47.84	0.10	47.83	58.12	10.28	21.5	10.29	21.5
OPP	451.77	2.23	451.16	477.45	25.68	5.7	26.29	5.8
IA	274.89	420.15	275.04	336.25	61.36	22.3	61.21	22.3
U.S. Arctic Research Commission	1.58	-	1.58	1.60	0.02	1.3	0.02	1.3
Research & Related Activities	\$5,615.33	\$439.17	\$5,563.92	\$6,255.59	\$640.26	11.4	\$691.67	12.4





Questions

