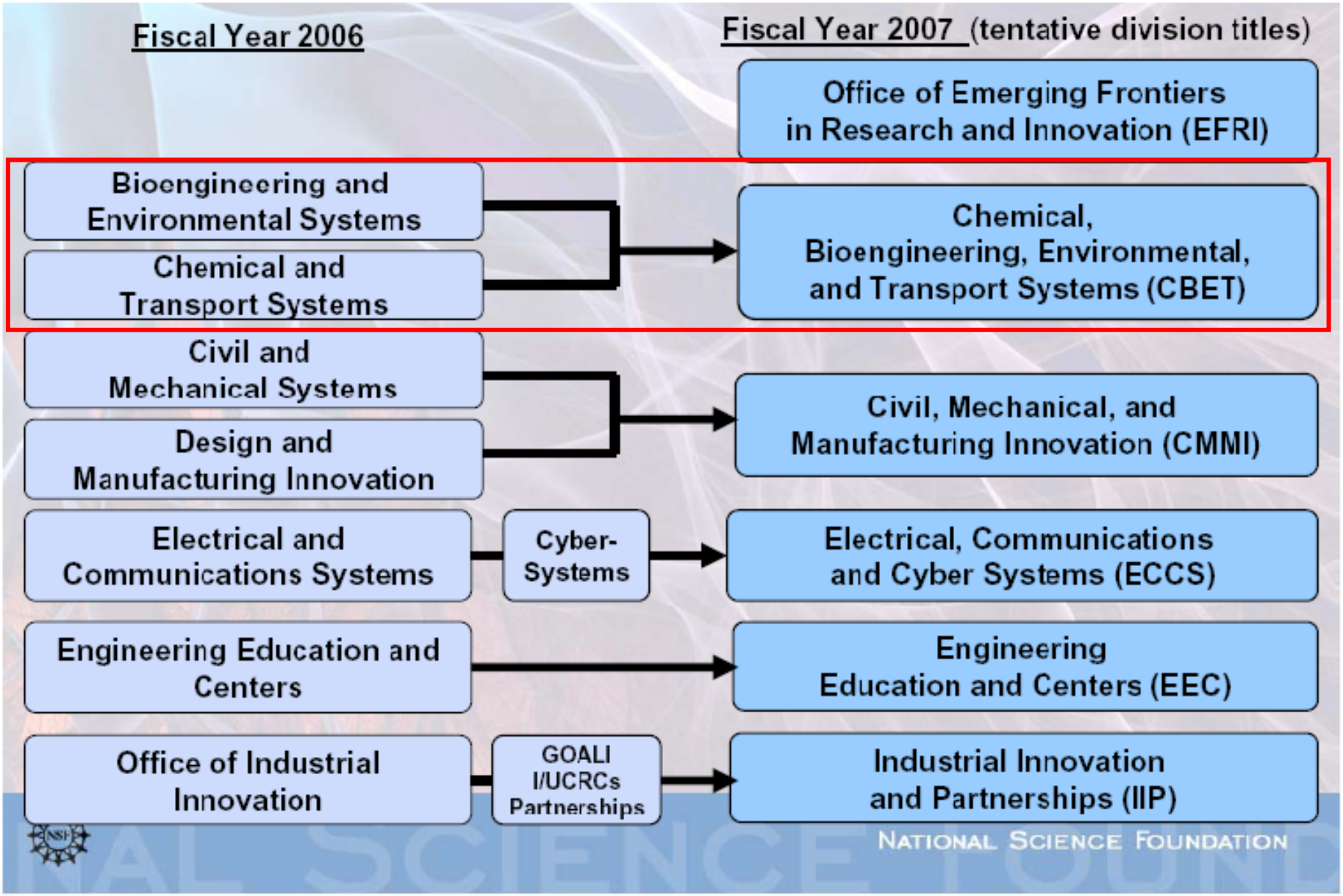
Division of Chemical, Bioengineering, Environmental & Transport Systems (CBET)

Overview (2006-2008)

John McGrath
Division Director
jmcgrath@nsf.gov

ENG Advisory Committee Meeting
October 21, 2009

Merging Divisions and Priorities



National Science Foundation | Directorate for Engineering

Chemical, Bioengineering, Environmental, and Transport Systems Division (CBET)

Deputy Division Director
Bob Wellek

Division Director
John McGrath

Senior Advisor
Marshall Lih

Chemical, Biochemical, and Biotechnology Systems

- 1401 - Catalysis and Biocatalysis — George Antos
- 1417 - Chemical and Biological Separations — Rose Wesson
- 1403 - Process and Reaction Engineering — Maria Burka

Bioengineering and Engineering Healthcare

- 5345 - Biomedical Engineering — Semahat Demir
- 7236 - Biophotonics, Advanced Imaging, and Sensing for Human Health — Leon Esterowitz
- * 7909 – Biosensing — Alex Simonian
- 1491 - Biotechnology, Biochemical, and Biomass Engineering — Fred Heineken
- 5342 - Research to Aid Persons with Disabilities — Ted Conway

Environmental Engineering and Sustainability

- * 7644 - Energy for Sustainability — Greg Rorrer
- 1440 – Environmental Engineering — Paul Bishop
- 1179 - Environmental Implications of Emerging Technologies — Cindy Ekstein
- * 7643 - Environmental Sustainability — Bruce Hamilton
- Assessment & Impact of Research Funding Investments — Peter Wu – AAAS Fellow

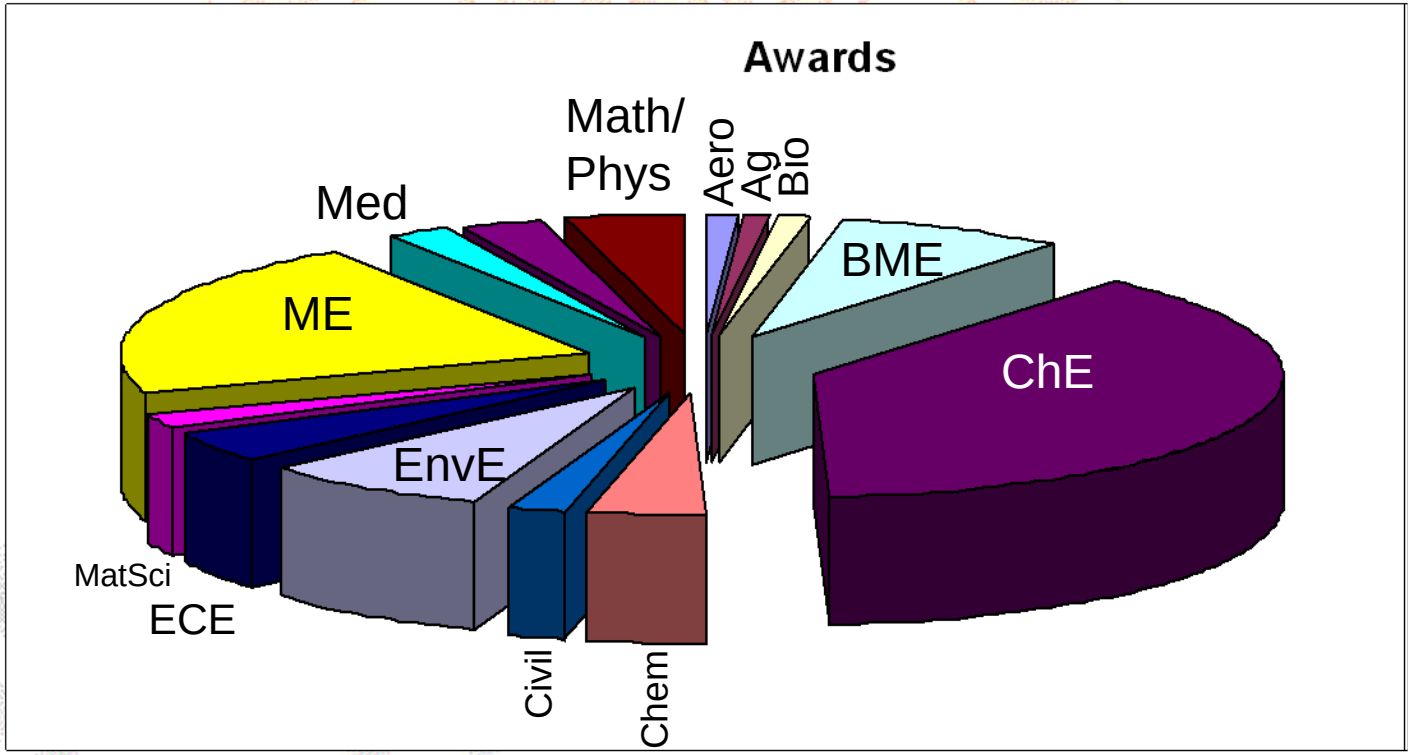
Transport and Thermal Fluids

- 1407 - Combustion, Fire, & Plasma Systems — Arvind Atreya
- 1443 - Fluid Dynamics — Henning Winter
- 1414 – Interfacial Processes and Thermodynamics — Bob Wellek
- 1415 - Particulate and Multiphase Processes — Marc Ingber
- 1406 – Thermal Transport Processes — Ted Bergman

NOTE: Program Titles are arranged alphabetically within each cluster.

Expansion & Focus

CBET Serves a Diverse Community



- Dominated by ChE & ME
- Significant BME & Environmental
- Chemistry (MPS), Math/Physics (MPS), EE Eng

NSF Vision: Advancing discovery, innovation, and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering.

Mission: To promote the progress of science, to advance the national health, prosperity, and welfare; to secure the national defense (NSF Act of 1950)

Strategic Goals

- **Discovery** — *Advancing frontiers of knowledge*
- **Learning** — *S&E workforce and scientific literacy*
- **Research Infrastructure** — *Advanced instrumentation and facilities*
- **Stewardship** — *Supporting excellence in S&E research and education*

Cross-Cutting Objectives

- To inspire and Transform
- To Grow and Develop

Investment Priorities (by Strategic Goal)

DIVISION PLAN

DIVISION OF CHEMICAL, BIOENGINEERING, ENVIRONMENTAL, AND TRANSPORT SYSTEMS (CBET)

DIRECTORATE FOR ENGINEERING

NATIONAL SCIENCE FOUNDATION

NSF 08-008

DECEMBER 2007

Discovery Goals

Strategic Objective 1:
Fund more unsolicited awards

Goal:
- Dedicate at least 50% of CBET budget to this in core programs by 2010

Status:
- FY06 to FY09: 75-80% of CBET Budget to "Non-Targeted", Unsolicited Awards

Outlook:
- Emphasize Unsolicited Awards
- Sharpen Program Foci

NSF and ENG Level Activities

- ADVANCE
- Cyber-enabled Discovery and Innovation (CDI)
- National Nanotechnology Infrastructure Network (NNIN)
- Petascale Applications (PetaApps)
- Interdisciplinary Research (IDR)
- WATERS

- Building Engineered Complex Systems (BECS)

Emerging Frontiers in Research and Innovation (EFRI) Initiatives

FY07

Auto-Reconfigurable Engineered Systems (Burka, Hamilton)
Cellular & Biomolecular Engineering (Heineken, Wellek)

FY08

Cognitive Optimization & Prediction (Demir, Heineken)
Resilient and Sustainable Infrastructures (Hamilton, Schultz)

FY09

Hydrocarbon from Biomass (Regalbuto, Burka, Hamilton, Schultz)
BioSensing and Bioactuation (Esterowitz)

FY10

Renewable Energy Storage (RESTOR) (Esterowitz, Bergman, Wesson)
Science in Energy & Environmental Design (SEED) (Hamilton)

Discovery Goals

Strategic Objective 2:

-Emphasize four thematic research areas

- Energy, Water and Sustainability (EWS)
- Integration of Life Sciences with Engineering (LSE)
- Nano-scale Science and Engineering (NSE)
- Systems and Multi-Scale Modeling Engineering (SME)

Goal:

Maintain NSE and Increase activity in EWS, LSE and SME by 20%

Status: Achieved

Outlook: Continued relative emphasis on these foci

- Energy, Environment, Water and Sustainability (EEWS)

Learning Goals

Strategic Objective 3:
Support new faculty

Goal:
- Support CAREER awards: Success rates > 15% by 2010 and More Uniformity Across Programs

Status:
- Achieved >15% for FY06 through FY09; Non-uniform

Outlook:
- Seek >15% success rate- challenge of proposal number
- Seek more uniformity across programs

Comment:
- 40% to 45% Proposals from New PIs (FY06-09)

Infrastructure Goals

Strategic Objective 5:

Encourage interdisciplinary, group projects

- Goal is 15% of annual budget
- Status: Exceeded (~40%)
- Outlook: Continued emphasis

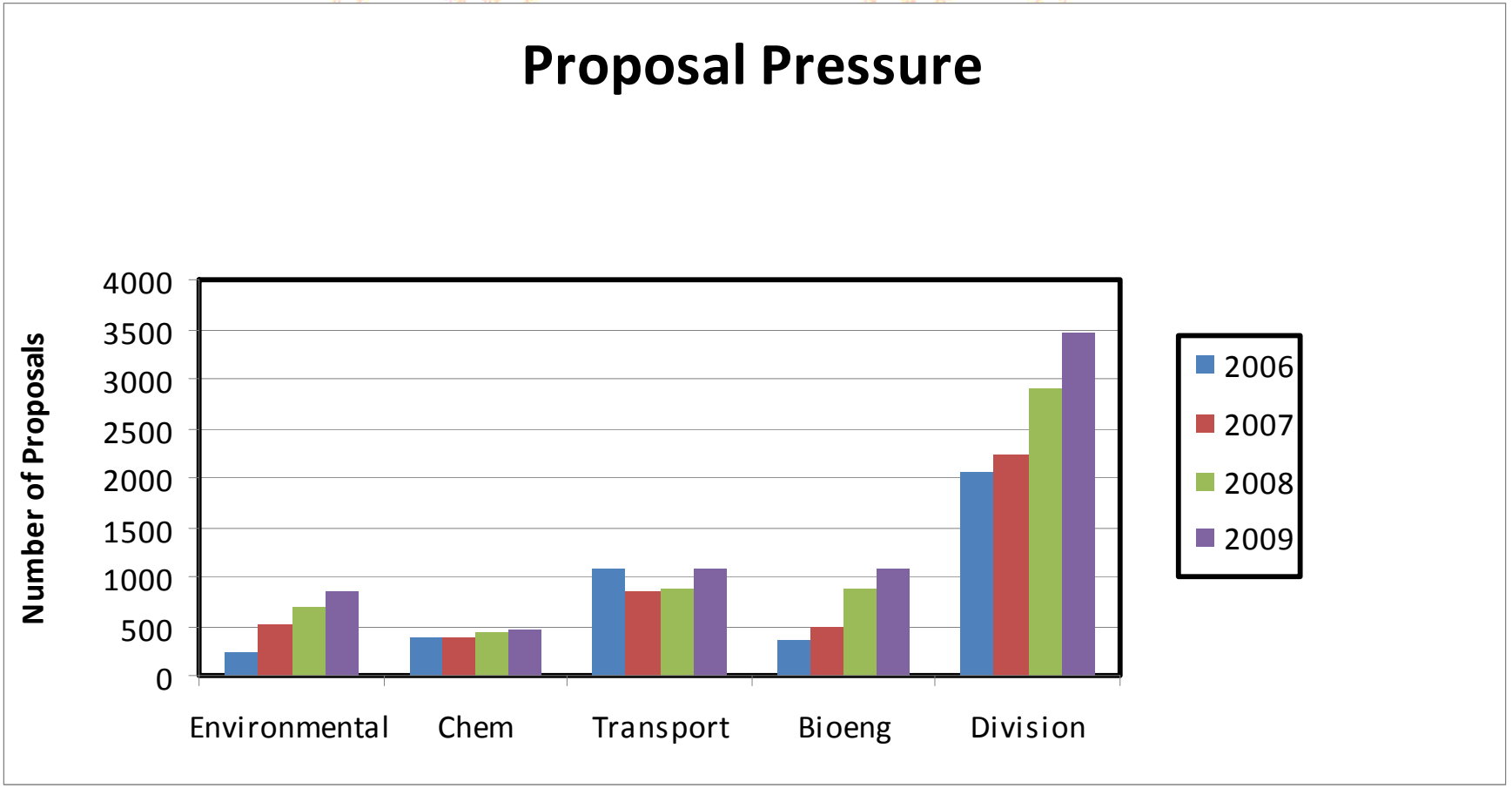
Strategic Objective 6:

Apply cyber-infrastructure to CBET fields

- Goal: Not defined quantitatively
- Status:
  - $4.125M Division funds in CDI (FY09)
  - Additional Program funds
- Outlook: Continued investment in CDI

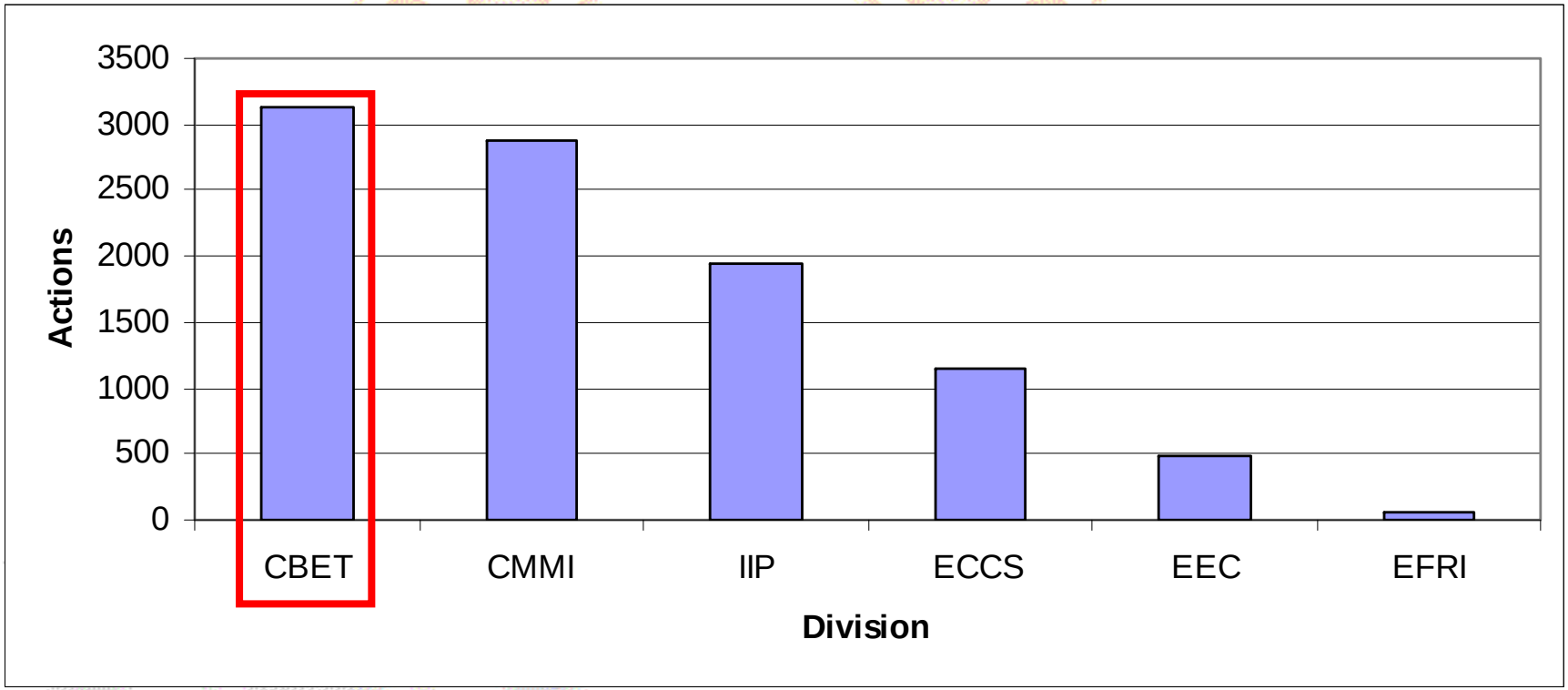
"Hot" Areas Produced Increased Workload:

Environmental/Energy & Bioengineering



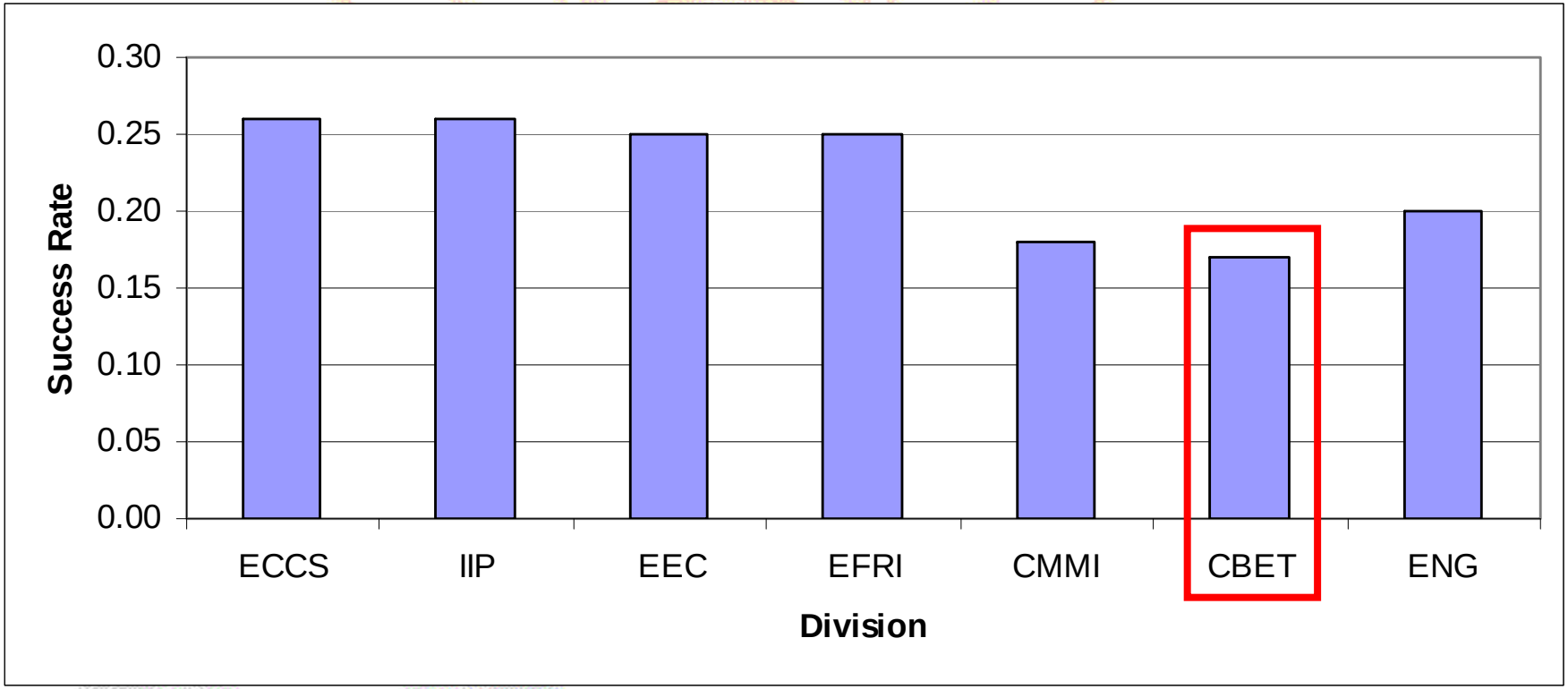
Largest Number of Actions In ENG:

Proposal Pressure & Workload Issues



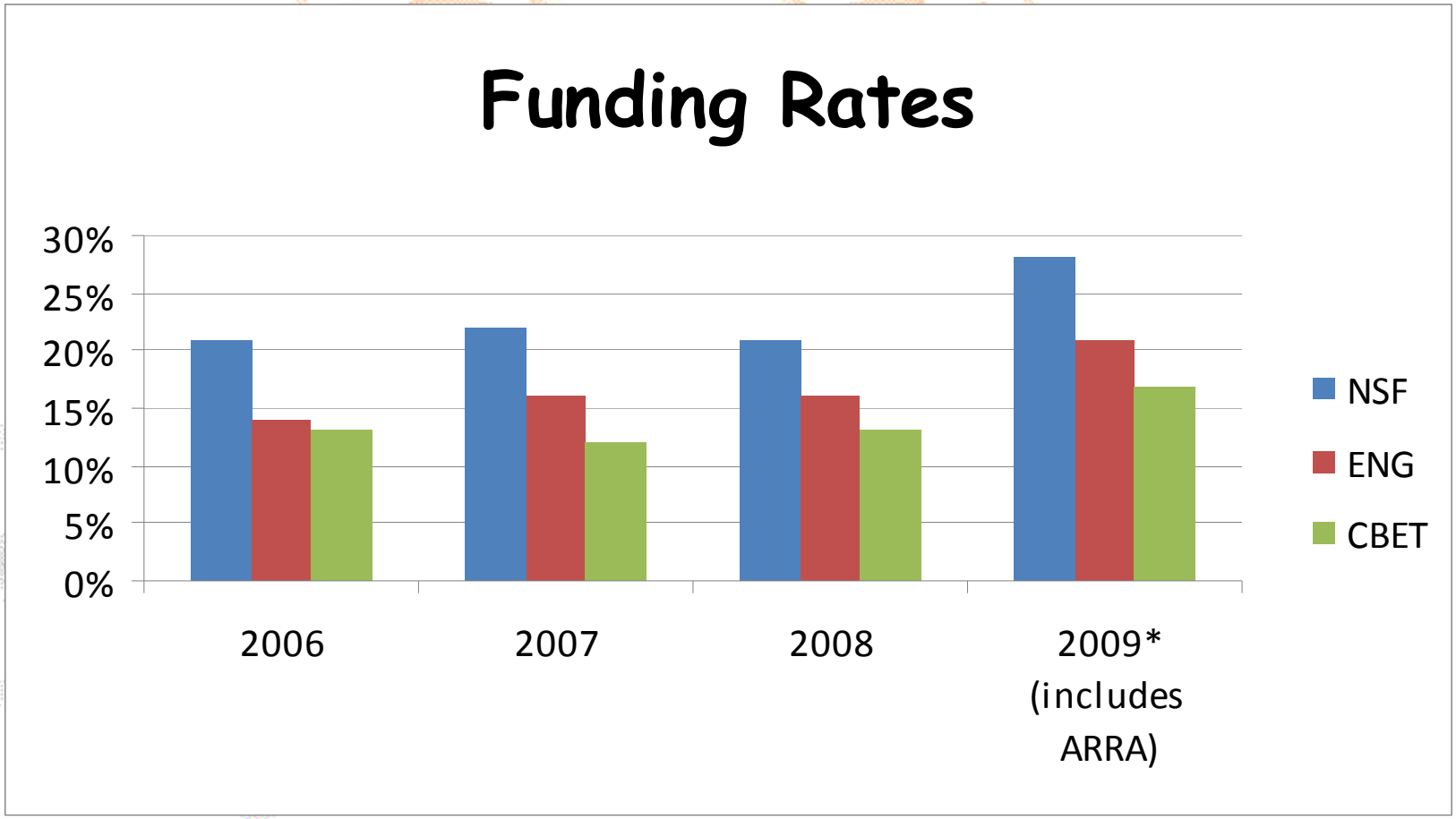
FY08 All Award Categories (EIS)

Lowest Success Rate In ENG

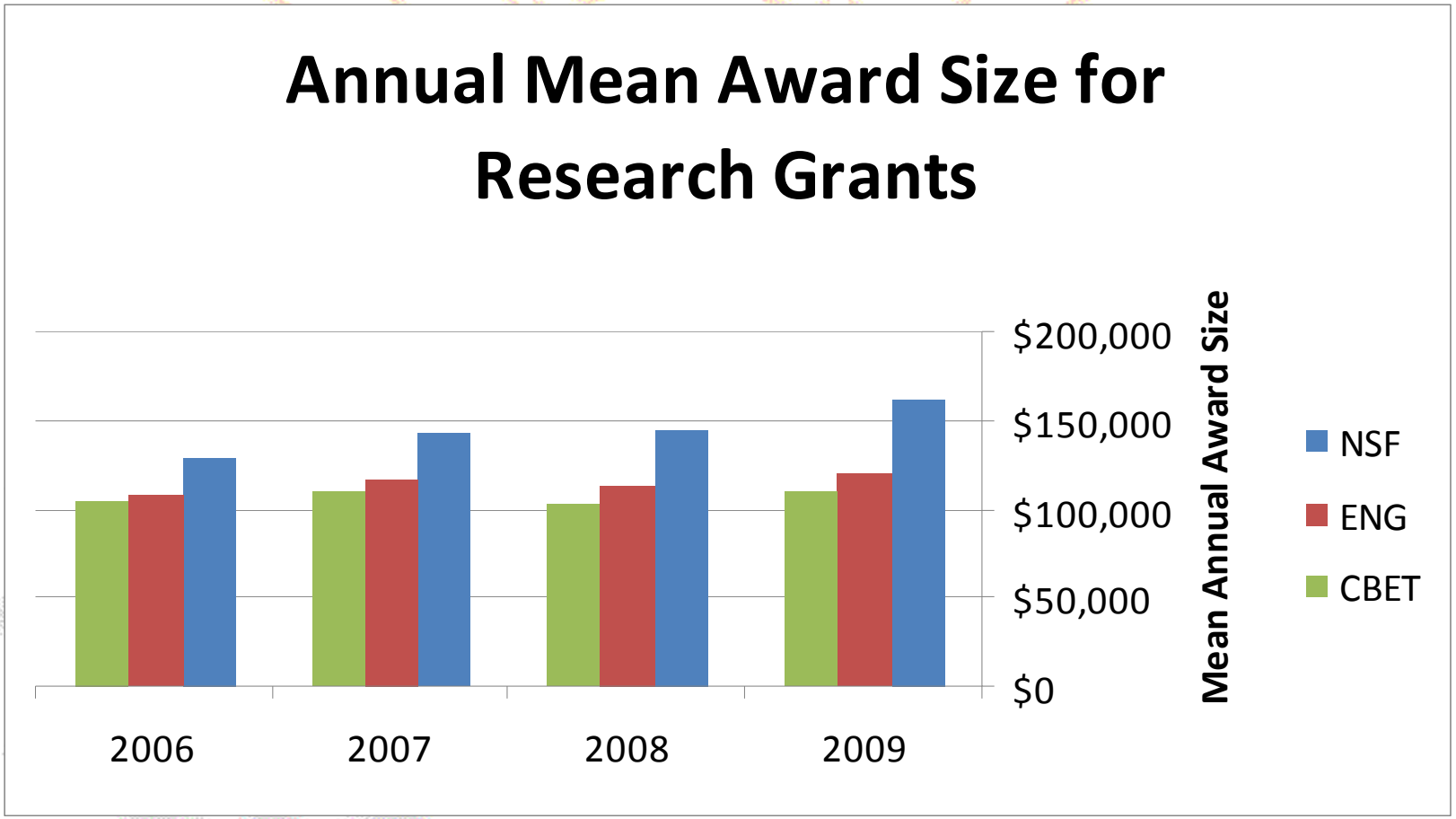


FY08 All Award Categories (EIS)

Funding Rate Comparison for Research Awards

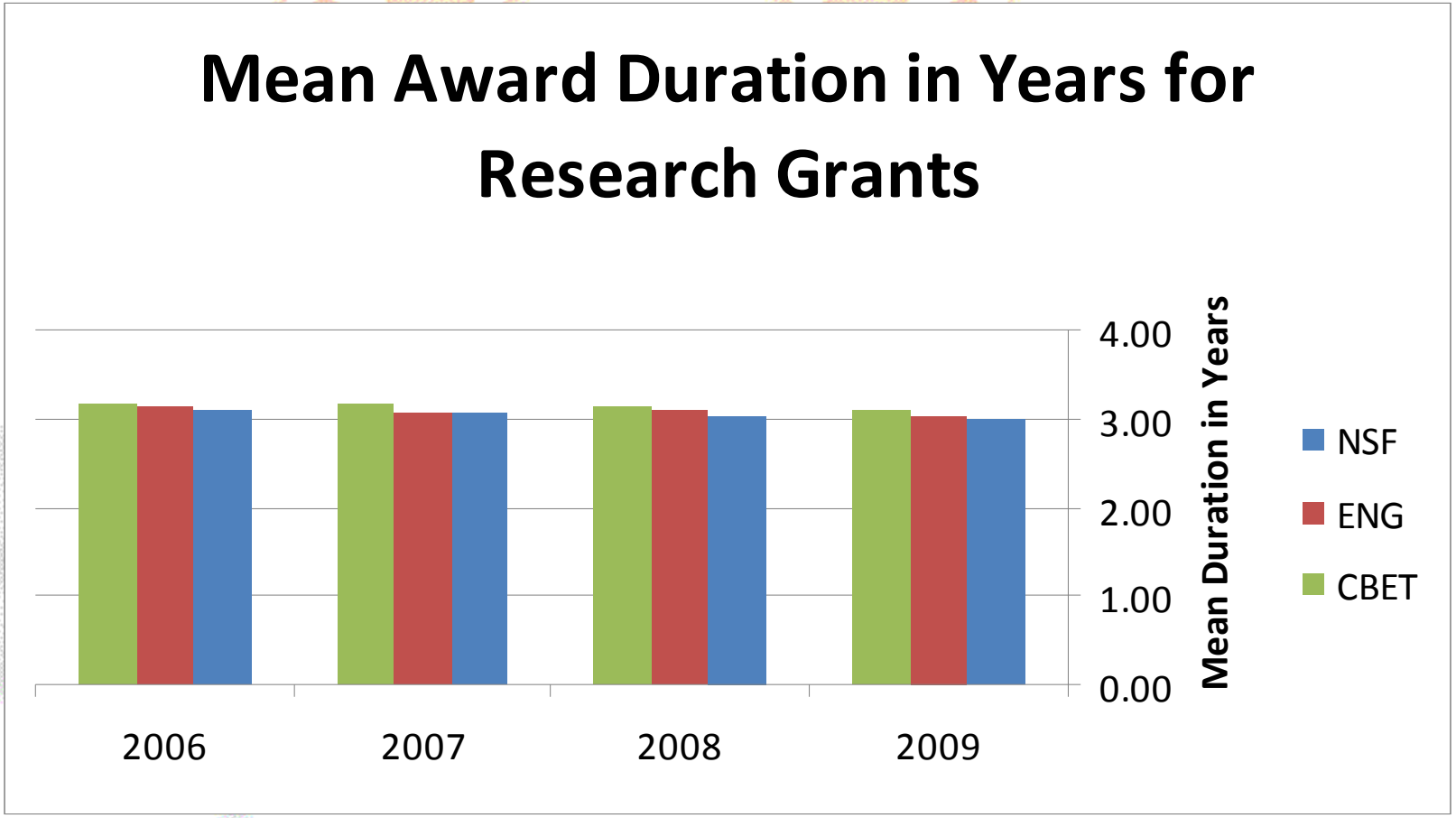


Comparison of Annual Award Size



Average Award Duration

-Little Change-



Program Strategies:

Opportunities and Directions

- New Tool *(Program Strategies)*
- In Process of Integrating These Into Division Plan
- Share with PI Community and Reviewers

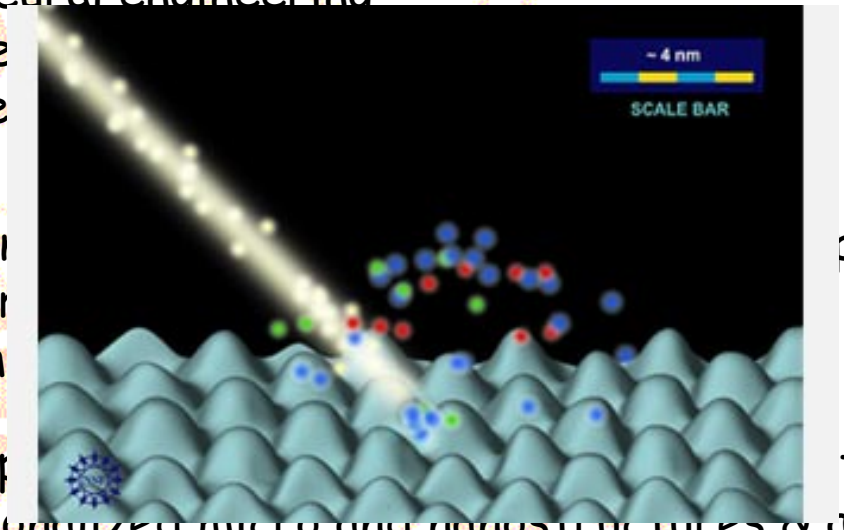
--Now, let's take a look at the CBET Clusters and Programs

Chemical, Biochemical, and Biotechnology Systems

- **1401 - Catalysis and Biocatalysis**
  George Antos
- **1417 - Chemical and Biological Separations**
  Rose Wesson
- **1403 - Process and Reaction Engineering**
  Maria Burka

- Clea
- Pho
- Str
- Nov
- Com
- Wat
- Ren
- Clim
- Rea
- Con
- Des
- Rea

- Neural engineering
- Ge
- Ce
- Mi
- Ea
- Im



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- Novel p tegies based on functionalized micro and nanostructures & advanced materials
- Food safety, health acre, water quality,

Bioengineering and Engineering Healthcare

- **5345 - Biomedical Engineering** — Semahat Demir
- **7236 - Biophotonics, Advanced Imaging, and Sensing for Human Health** — Leon Esterowitz
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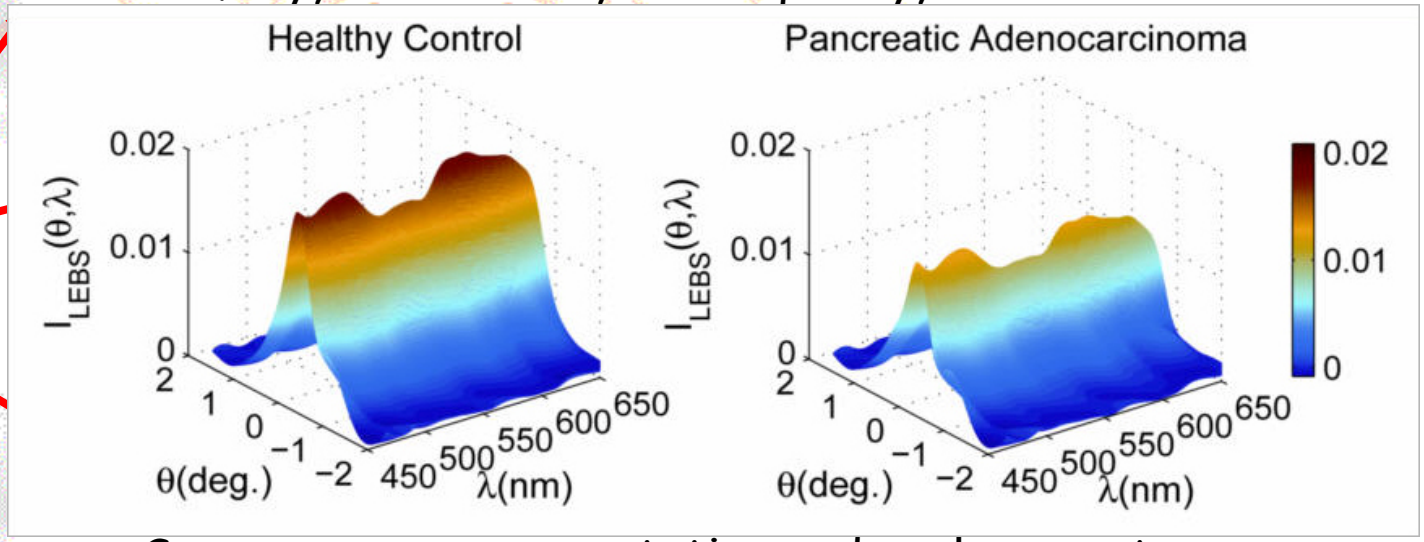

- Sensory organ augmentation and replacement
- Internal systems monitoring and drug delivery

Environmental Engineering and Sustainability

- **7644 - Energy for Sustainability** — Greg Rorrer
- **1440 – Environmental Engineering** — Paul Bishop
- **1179 - Environmental Implications of Emerging Technologies** — Cindy Ekstein
- **7643 - Environmental Sustainability** — Bruce Hamilton

PI Amy Pruden sampling water at a stream site where she is studying changes in microbial community during passive in-situ treatment. Her research is evaluating antibiotic resistance genes as emerging contaminants.

CAREER: Antibiotic Resistance Genes (ARG) as Emerging Pollutants in Our Water: Pathways, Mitigation, and Treatment

Amy J. Pruden - Virginia Polytechnic Institute and State University CBET-050547342/ 0852942

- Transport and Thermal Fluids
  - 1407 - Combustion, Fire, & Plasma Systems — Arvind Atreya
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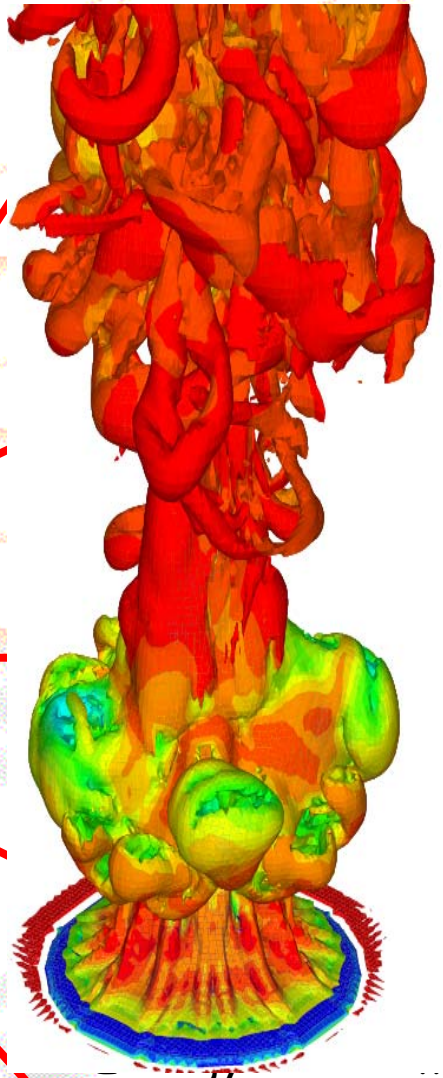

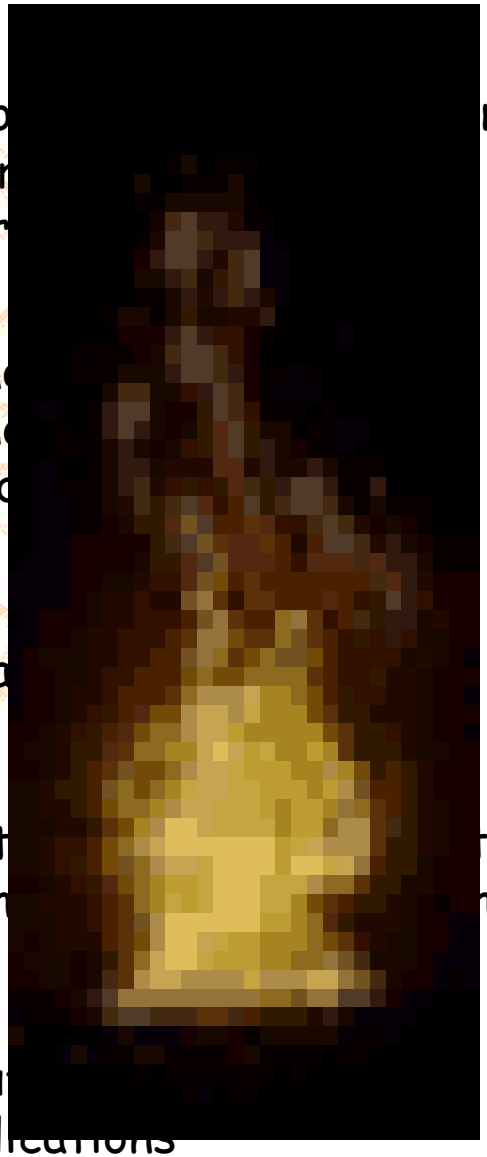

- Health and biological applications
- IT, Security

Desjardin, Univ at Buffalo

CBET: Well-Aligned with National Priorities

External Priorities

CBET Foci	Obama Priorities	NAE Grand Challenges	NSF-Wide Investments	ENG Theme
Healthcare	X	X		X
Climate/Environment	X	X	X	X
Energy	X	X		X
Nanotechnology	X		X	X
Information Technology	X	X	X	

Examples:
Current/Emerging Activities

- "Green Gasoline"
- Sustainable Water
- DOE/CBET Partnership Being Discussed
- Bio-Economy

Strategic & Tactical Considerations
-Summary-

- **Address National Needs:** Retain current research foci; Bio-Economy
- **Assure Adequate PI Support:** Increase award size
- **Improve Success Rate:** Larger budget, Partnerships, Reduce number of proposals ("Tighten" foci of programs, limit windows, phase out programs, etc)
- **Improve Quality of Life for Staff**
  - More staff to reduce workload, achieve work load equality

Strategic & Tactical Considerations
-Summary-

- **Improve Review Process:** Continuity of reviewers, define and enforce Broader Impacts criteria, Novelty, "tele-panels"
- **Broaden Participation:** Proactive action to produce more proposal submissions from minorities & disabled persons
- **Assess Impact of Investments:** AAAS Fellow
- **Improve Strategic Planning:** Explicit integration of program strategies, Share strategies with PIs and reviewers, Targeted workshops