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

Richard Dickinson, Division Director-CBET

Engineering Directorate

National Science Foundation

ENG Advisory Committee Meeting - October 2019

National Science Foundation

MISSION OF CBET DIVISION

Support fundamental engineering research that involves:

– the transformation of matter by chemical, thermal, or biological means

– the transport of mass, energy, or momentum

..in order to:

– maximize quality and length of life

– allows humans to live sustainably on earth

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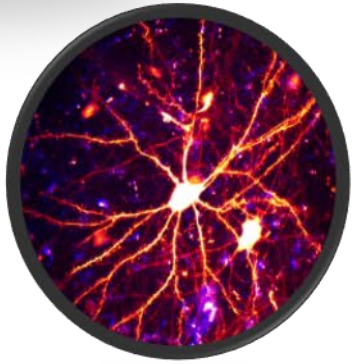
SUPPORTED COMMUNITIES

Civil/Environmental Engineering

Chemical Engineering

Mechanical Engineering



Biological/Biomedical Engineering

…and others!

Division of Chemical, Bioengineering, Environmental, and Transport Systems

Division Director
Richard Dickinson

Deputy Division Director
Timothy Patten

Chemical Process Systems

1401 Catalysis
Robert McCabe

1417 Molecular Separations
Christina Payne

1403 Process Systems, Reaction Engineering, & Molecular Thermodynamics
Triantafillos Mountziaris

7644 Electrochemical Systems
Carole Read

Chemical Process Systems Cluster
Catherine Walker

Engineering Biology & Health

1491 Cellular & Biochemical Engineering
Steven Peretti

5345 Engineering of Biomedical Systems
Aleksandr Simonian

7236 Biophotonics
Leon Esterowitz

7909 Biosensing
Chenzhong Li

5342 Disability & Rehabilitation Engineering
Aleksandr Simonian

Engineering Biology & Health Cluster
Steven Zehnder

Environmental Engineering & Sustainability

1440 Environmental Engineering
Karl Rockne

1179 Biological & Environmental Interactions of Nanoscale Materials
Nora Savage

7643 Environmental Sustainability
Bruce Hamilton

022Y INFEWS
James Jones

Environmental Engineering & Sustainability Cluster
Brandi Schottel

Transport Phenomena

1407 Combustion & Fire Systems
Harsha Chelliah

1443 Fluid Dynamics
Ronald Joslin

1415 Particulate & Multiphase Processes
William Olbricht

1406 Thermal Transport Processes
Ying Sun

Transport Phenomena Cluster
Shahab Shojaei-Zadeh

Division Experts and AAAS Science & Technology Policy Fellows

Engineering of Biomedical Systems Expert
Carol Lucas

Multiple Programs Expert
Geoffrey Prentice

AAAS S&T Policy Fellow
Thomas Baird

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CHEMICAL PROCESS SYSTEMS (CPS) CLUSTER

Seeks to improve the efficiency, resource utilization, and/or intensification of chemical processes while minimizing emissions.

- Catalysis
- Molecular Separations
- Electrochemical Systems
- Process Systems, Reaction Engineering, & Molecular Thermo

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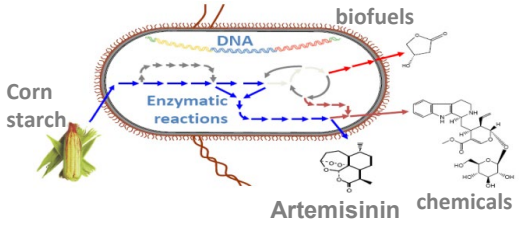
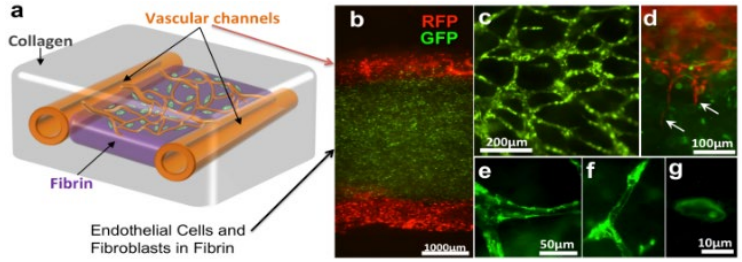
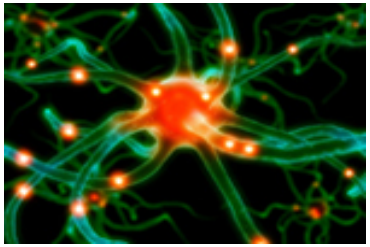
ENGINEERING BIOLOGY & HEALTH (EBH) CLUSTER

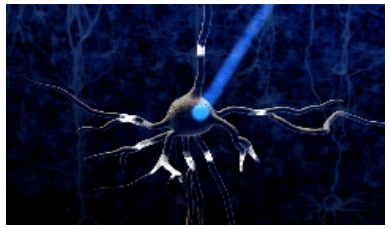
Supports engineering research to improve human health and the understanding of biological and physiological systems

- Cellular & Biochemical Engineering
- Engineering Biomedical Systems
- Disability & Rehabilitation Engineering
- Biosensing
- Biophotonics









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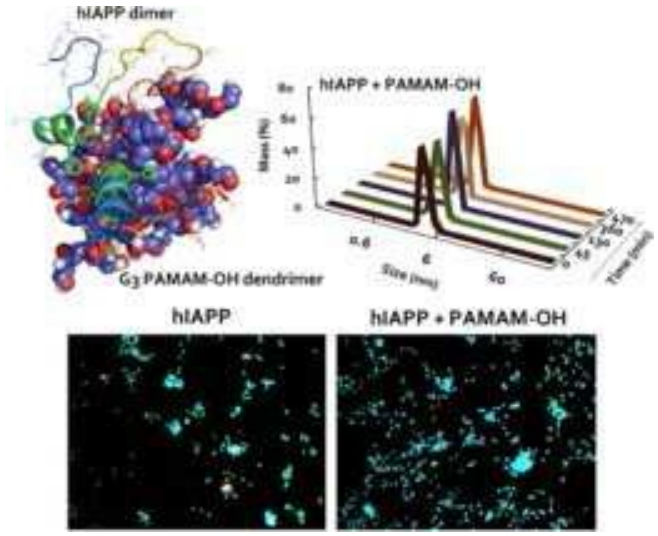
ENVIRONMENTAL ENGINEERING & SUSTAINABILITY (EES) CLUSTER

Seeks to promote and encourage transformative research in sustainable engineering and systems that support the natural environment

- Environmental Engineering
- Environmental Sustainability
- Biological & Environmental Interactions with Nanomaterials



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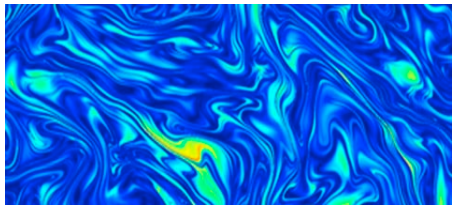
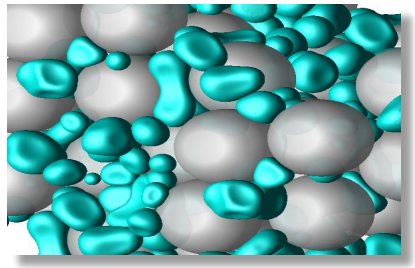
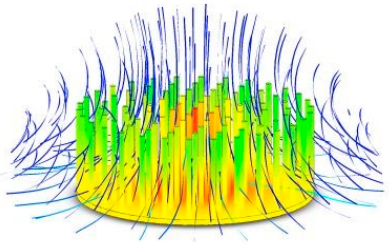
TRANSPORT PHENOMENA (TP) CLUSTER

Supports fundamental research on the transport of mass, species, momentum and energy

- Fluid Dynamics
- Particulate & Multiphase Systems
- Thermal Transport Processes
- Combustion & Fire Systems







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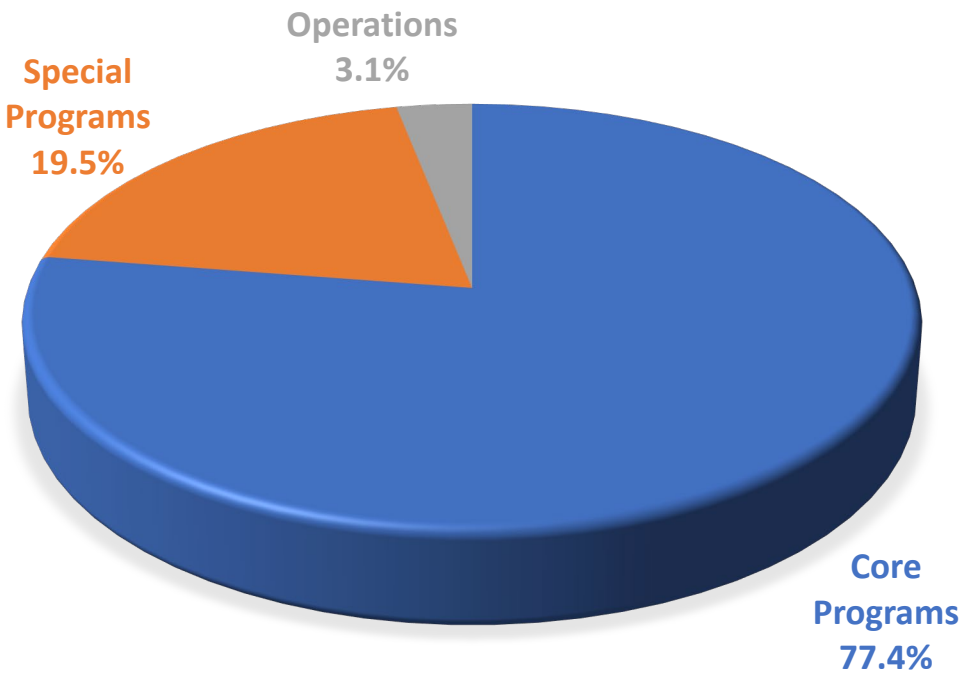
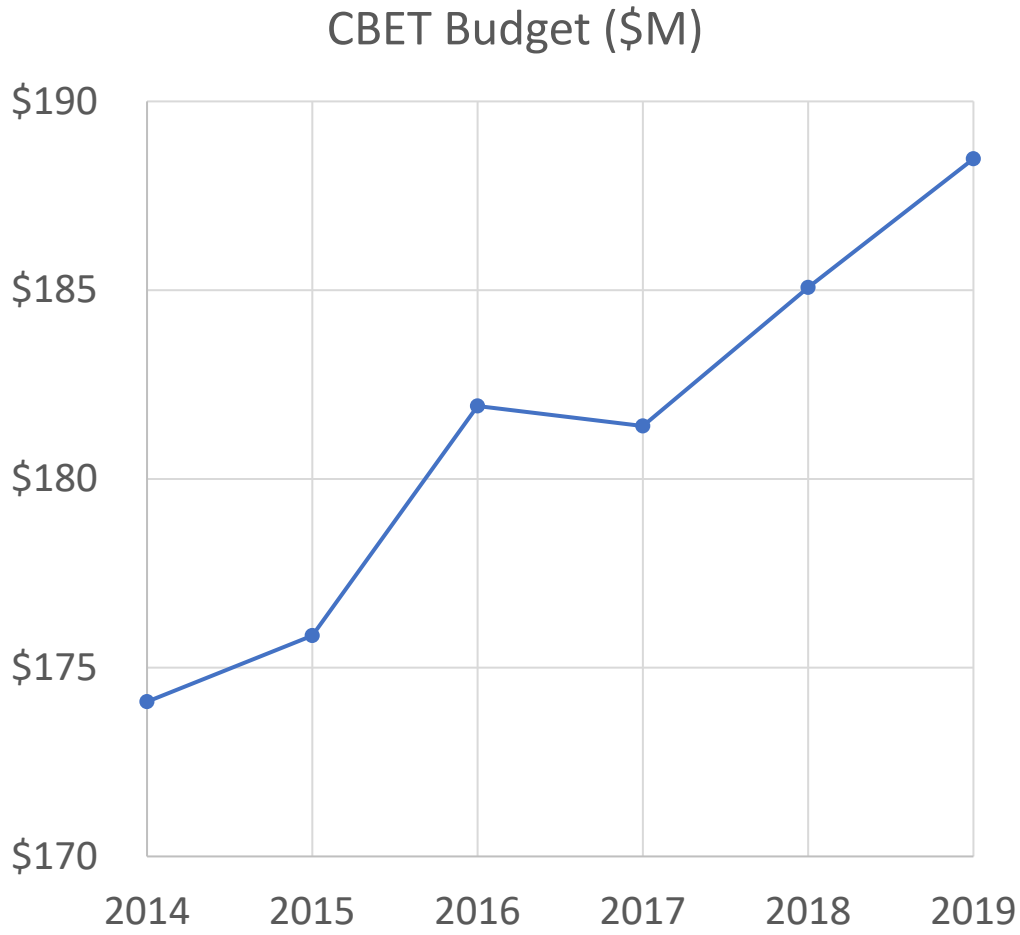
CBET BUDGET

FY2019 BUDGET ($188.5M)





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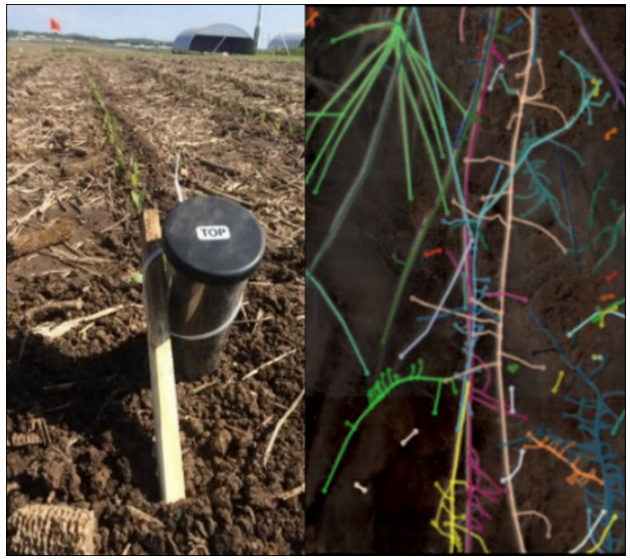
SIGNALS IN THE SOILS (SITS)

Signals in the Soils (SITS) seeks convergent research to understand dynamic near-surface processes through advances in sensor systems and dynamic models



Credit: Colby Moorberg, Kansas State University

CBET Program Directors:

Jim Jones

Brandi Schottel

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RESEARCH IN MICROGRAVITY ON THE INTERNATIONAL SPACE STATION

RESEARCH IN SPACE TO BENEFIT LIFE ON EARTH

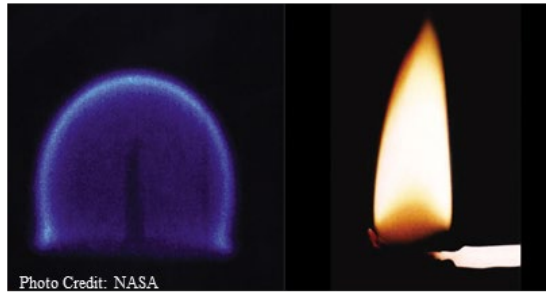
NSF/CASIS Collaboration for Tissue Engineering and Mechanobiology Research on the International Space Station (NSF 19-509)

NSF/CASIS Collaboration on Transport Phenomena Research on the International Space Station (ISS) to Benefit Life on Earth (NSF 19-525)

CBET Program Directors:

Shahab Shojaei-Zedah

Alex Simonian



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SUSTAINABLE URBAN SYSTEMS (SUS)

Sustainable Urban Systems (SUS) seeks to

- understand interactions among natural, built, and social systems in urban areas
- develop generalizable theories of urban systems;
- model and predict the future of sustainable urban systems.
- engage with communities and stakeholders in urban areas to co-produce knowledge

CBET Program Directors:

Bruce Hamilton

Brandi Schottel

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RAPID RESPONSE RESEARCH (RAPID) ON HURRICANE IMPACTS

Image Credit: UT-San Antonio

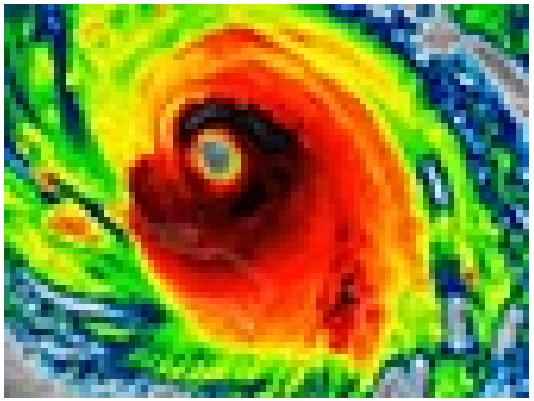


Image Credits: Jeff Fitlow

CBET supported several RAPID projects to study the environmental impacts of the 2017 and 2018 hurricanes.

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EMERGING FRONTIERS FOR RESEARCH & INNOVATION (EFRI)

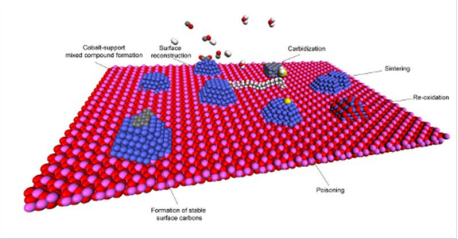
EFRI supports transformative, high-risk, high-reward multi-disciplinary research that addresses a national need or grand challenge

Selected FY2020/21 Topics:

- Engineering the Elimination of End-of-Life Plastics

Christy Payne

- Distributed Chemical Manufacturing



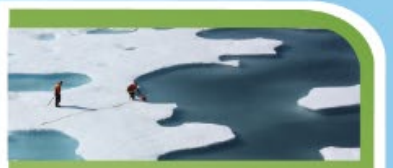
Molecular-level Science and Engineering Research

Module-level Intensification

DChEM
Autonomous Systems

Lakis Mountziaris

NSF's Ten Big Ideas



Navigating the New Arctic

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

RESEARCH IDEAS

Understanding the Rules of Life: Predicting Phenotype

The Quantum Leap: Leading the Next Quantum Revolution

Windows on the Universe: The Era of Multi-messenger Astrophysics

PROCESS IDEAS

Growing Convergent Research at NSF

NSF-INCLUDES: Enhancing Science and Engineering through Diversity

Mid-scale Research Infrastructure

NSF 2050: Seeding Innovation

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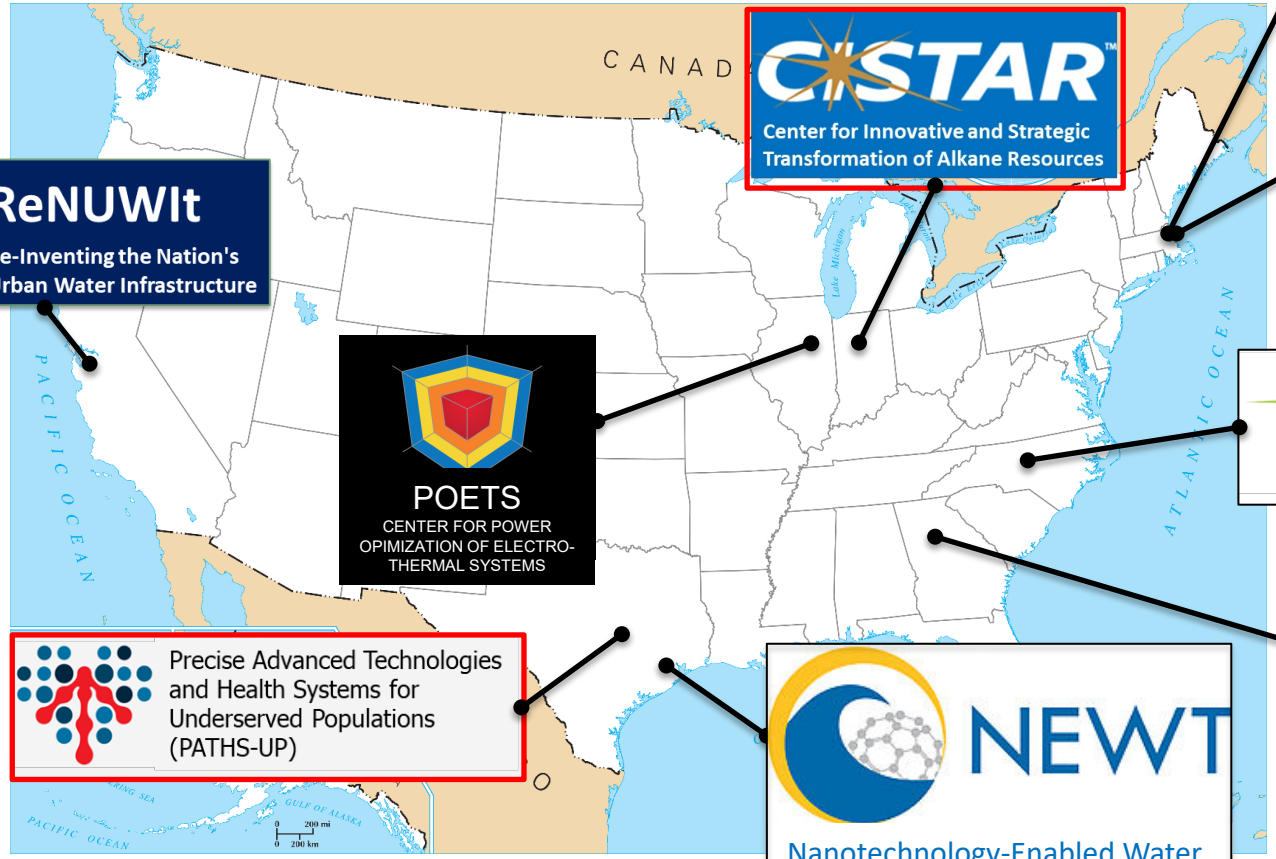
ENGINEERING RESEARCH CENTERS AND SCIENCE & TECHNOLOGY CENTER



CELL-MET
Directed Multiscale Assembly of Cellular Metamaterials with Nanoscale Precision

CISTAR
Center for Innovative and Strategic Transformation of Alkane Resources

EBICS
Emergent Behaviors of Integrated Cellular Systems

ReNUWIt
Re-Inventing the Nation's Urban Water Infrastructure

POETS
CENTER FOR POWER OPIMIZATION OF ELECTRO-THERMAL SYSTEMS

ASSIST
Advanced Self-Powered Systems of Integrated Sensors and Technologies

Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP)

NEWT
Nanotechnology-Enabled Water Treatment

CMaT
NSF Engineering Research Center for Cell Manufacturing Technologies

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CBET PARTNERSHIPS

International Partners

EPSRC
Engineering and Physical Sciences Research Council

BBSRC
bioscience for the future

BSF
United States – Israel Binational Science Foundation

Science Foundation Ireland
sfi
For what's next

Invest Northern Ireland

NERC
SCIENCE OF THE ENVIRONMENT

NSFC
National Natural Science Foundation of China

Agency Partners

FDA

USDA
NIFA

Department of Energy

NEEF
National Environmental Education Foundation

Air Force Research Laboratory

United States Environmental Protection Agency

ISS
U.S. NATIONAL LABORATORY

CASIS

Water Research Foundation

+

Water Environment & Reuse Foundation
WE&RF