NSF and Support of Research by Architects

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NSF

Lawrence Bank

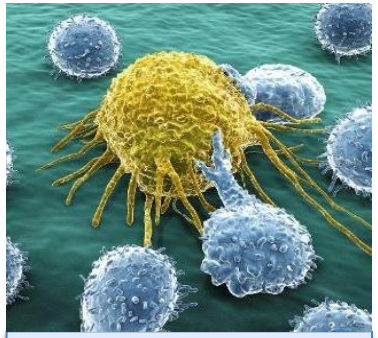
CCNY

May 28, 2019

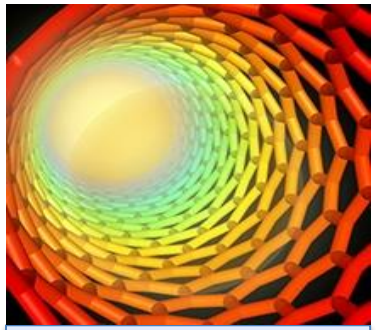
Outline

- What NSF is
- Some types of research proposals accepted by NSF
- The SEED Solicitation
- NSF's new activity on Sustainable Urban Systems (SUS) research

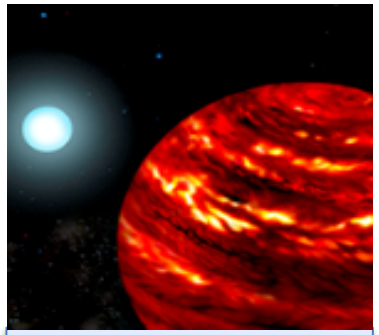
NSF Champions Research and Education across all Fields of Science and Engineering



Biological Sciences



Engineering



Mathematical & Physical Sciences

Computer & Information Science & Engineering

Geosciences (including Polar Programs)

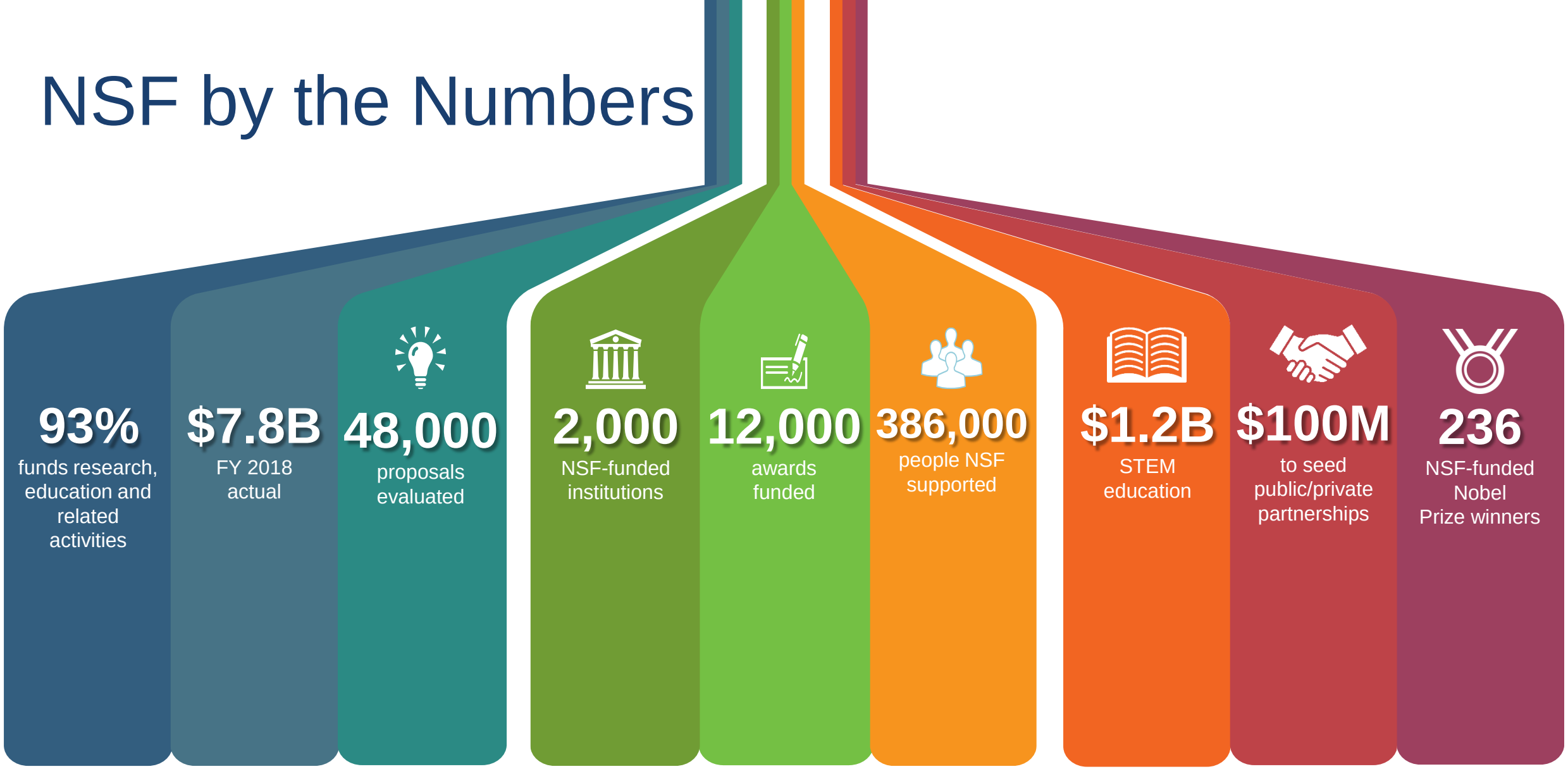
Integrative Activities

Education & Human Resources

Social, Behavioral & Economic Sciences

International Science & Engineering

NSF by the Numbers



Numbers shown are estimates based on FY 2018 activities.

Some Types of Research Proposals Accepted by NSF

- Workshops
- “Unsolicited” (no deadlines.! Ad hoc reviews)
- CAREER
- Solicited (deadlines. Panel reviews)

Workshop Grant Example #1 (Architecture)

1916623 (Joon-Ho Choi at USC)

“National Workshop on Architectural Faculty in Environmental Sustainability Research (WAFES)”

$50K from the Environmental Sustainability program

Workshop Grant Example #2 (Building Science/Architecture)

1814621 (Jin Wen at Drexel University)

"International Workshop on Connecting Woman Faculty in Sustainable Building Research (WISB)"

$60K (includes supplement)

from the Environmental Sustainability Program

- **Dalian, China: July 5-6, 2018**
- **Syracuse, NY: September 25, 2018**
- **Total of 47 women researchers, including 17 architects**

“Unsolicited” Proposals: Grant Example #1 (Architect PI)

1707068 (Joon-Ho Choi at USC)

“Human-Building Integration:

Bio-Sensing Adaptive Environmental Control for Human Health and Sustainability”

$300K (3 year duration) from

the Environmental Sustainability Program

“Unsolicited” Proposals: Grant Example #2 (Architect PI)

1804218 (Alexandra Rampel at University of Oregon Eugene)

“GOALI: Climate-Responsive Design and Control Strategies for Affordable Multi-Family Residences”

Company Partner: Mithun, Inc (a leading national sustainable design firm)

$376K from the Environmental Sustainability Program

“Unsolicited” Proposals: Grant Example #3 (Architect PI)

1605843 (Olyssa Starry at Portland State University)

“Evaluating the Influence of Ecoroof Surfaces on Indoor Air Quality”

$315K (includes REUs) from the Environmental Sustainability Program

“Unsolicited” Proposals: Grant Example #4 (Team with Architects)

1701694 (Lawrence Bank at CCNY)
1701413 (Russell Gentry at Georgia Tech)

“Collaborative US-Ireland: Re-use and Recycling of Decommissioned Composite Material Wind Turbine Blades”

$321K (includes REUs) from
the Environmental Sustainability Program
~800K from Science Foundation Ireland and NI Invests

Re-Wind

NEWS PRODUCTS PEOPLE

DRIVING INNOVATION IN THE

RE-USE OF DECOMMISSIONED WIND TURBINE BLADES

CUNY

Prof. Larry Bank
Lead Principal Investigator
(Composite Structures - Engineering)

Franco Arias
(Research Assistant)

GT

Assoc. Prof. Russell Gentry
Principal Investigator
(Design Lead - Architecture)

Asst. Prof. Tristan Al-Haddad
(Architecture)

Benjamin Tasistro-Hart
(UG Research Assistant - Architecture)

Mehmet Bermek
(PhD Research Assistant - Architecture)

Ammar Alshannaq
(PhD Research Assistant - Engineering)

UCC

Dr. Paul Leahy
Principal Investigator
(Wind Energy Lead - Engineering)

Dr. Gerard Mullally
(Sociology)

Dr. Niall Dunphy
(Political Science)

Angie Nagle
(PhD Student - Engineering)

Fergal Gough
(PhD Student - Sociology)

Heloisa Lemmertz
(PhD Student - Business)

QUB

Prof. Jian-Fei Chen
Principal Investigator
(Composite Mechanics Lead - Enginering)

Prof. Ruth Morrow
(Architecture)

Dr. Jennifer McKinley
(GIS Lead - Geography)

Conor Graham
(Research Staff - Geography)

Emma Delaney
(PhD Student - Geography)

Dr. Raj Suhail
(Post Doc - Engineering)

CAREER Grant: Example #1 (Architect PI)

1740449 (Simi Hoque at Drexel University)

“CAREER: Development of an Integrated Analytical Framework for Urban Sustainability”

$509K (5 year duration) from the Environmental Sustainability Program

CAREER Grant: Example #2 (Architect PI)

1351701 (Burcin Bercerik-Gerber at USC)

“CAREER: A Human-Building Interaction Framework for Responsive and Adaptive Built Environments”

$411K (5 year duration) from the Civil Infrastructure Systems Program (CIS in CMII)

Example Solicitation: “SEED”

NSF 09-606

“Science in Engineering and Environmental Design (SEED): Engineering Sustainable Buildings”

10 awards, each $2 million in size,

with 4 year duration,

all with architects co-PIs on the awards (required)

Review of EFRI-SEED Competition

- 205 Preproposals in 7 distinct panels.
  - Design, Materials 1,Materials 2, Modeling and Sensing, Controls, Decision Sciences. Social, Behavioral and Economic Sciences.
- 52 Full proposals in one panel.
  - About half of the panelists new.
- 10 Awards ~ $20M.

EFRI-SEED: Risk Conscious Design and Retrofit of Buildings for Low Energy 1038248; Principal Investigator: **Godfried Augenbroe**; Co-Principal **Investigator:John Peponis, Ali Malkawi**, Christiaan Paredis, C. F. Jeff Wu; Organization:Georgia Tech Research Corporation;Award Amount:$2,010,113.00

EFRI-SEED: Creating Opportunities for Adaptation Based on PULSE (Population in Urban Landscape for Sustainable Built Environment) 1038264; Principal Investigator:Jelena Srebric; Co-Principal Investigator:John Spengler, **Christoph Reinhart**; Organization:Pennsylvania State Univ University Park;Award Amount:$2,000,000.00

EFRI SEED : Toward Zero-energy Buildings Based on Electrochromic Windows(ECW) and Energy-harvesting ECW 1038165; Principal Investigator:Minoru Taya; Co-Principal Investigator:Joyce Cooper, **Christopher Meek**, Yasuo Kuga, Christine Luscombe; Organization:University of Washington;Award Amount:$2,365,000.00

EFRI-SEED: Energy Minimization via Multi-Scaler Architectures From Cell Contractility to Sensing Materials to Adaptive Building Skins 1038215; Principal Investigator:Shu Yang; Co-Principal Investigator:Jan Van der Spiegel, Nader Engheta, Peter Jones**, Jenny Sabin**, Kaori Ihida-Stansbury; Organization:University of Pennsylvania;Award Amount:$2,100,000.00

EFRI-SEED: Occupant Oriented Heating and Cooling 1038271; Principal Investigator:Cameron (Kamin) Whitehouse; Co-Principal Investigator: **Anselmo Canfora**, John Stankovic, Hossein Haj-Hariri, Stephanie Guerlain; Organization:University of Virginia Main Campus;Award Amount:$1,999,642.00

EFRI-SEED: Living Wall Materials and Systems for Automatic Building Thermo-Regulation 1038305; Principal Investigator:Zhiqiang Zhai; Co-Principal Investigator:Kurt Maute, Yifu Ding, Fred Andreas, Hang (Jerry) Qi; Organization:University of Colorado at Boulder;Award Amount:$2,362,304.00

EFRI-SEED: BUILD - Barriers, Understanding, Integration - Life Cycle Development 1038139; Principal Investigator:Melissa Bilec; Co-Principal Investigator:Stephen Lee, Amy Landis, Laura Schaefer, Alex Jones, **Khee Poh Lam**; Organization:University of Pittsburgh;Award Amount:$2,078,459.00

EFRI-SEED: Design for Autonomous Net-Zero Water Buildings 1038257; Principal Investigator:James Englehardt; Co-Principal Investigator:Kamal Premaratne, Miroslav Kubat, **Kenneth Broad**, Elizabeth Plater-Zyberk; Organization:University of Miami;Award Amount:$2,162,375.00

EFRI-SEED Framework for Advanced Sustainable Building Design. Smart Micro-grid Enabled Buildings Interacting with Utility-Side-of-the-Meter Electricity Markets 1038230; Principal Investigator:Michael Caramanis; Co-Principal Investigator:John Baillieul, **Leslie Norford, John Fernandez**; Organization:Trustees of Boston University;Award Amount:$1,986,606.00

EFRI-SEED: Solar Optics-based Active Pasteurization (SOAP) for Greywater Reuse and Integrated Thermal (GRIT) Building Control 1038279; Principal Investigator: Maria Paz Gutierrez; Co-Principal Investigator:Slawomir Hermanowicz, Luke Lee; Organization:University of California-Berkeley;Award Amount:$2,000,000.00;

Follow-up Workshop at end of grant

EFRI-SEED 2015 Workshop and MRS Symposium Travel: Innovating Next Generation Building Materials that Adapt and Respond to Users and the Environment 1451659; Principal Investigator:**Maria Paz Gutierrez**; Co-Principal Investigator:**Jenny Sabin**, J. Ardie Butch Dillen; Organization:Materials Research Society;Award Amount:$33,420.00;

2015 MRS Spring Meeting & Exhibit

April 6-10, 2015 | San Francisco

Meeting Chairs: Artur Braun, Hongyou Fan, Ken Haenen, Lia Stanciu, Jeremy A. Theil

Back to Symposium Sessions

Symposium NN : Adaptive Architecture and Programmable Matter---Next-Generation Building Skins and Systems from Nano to Macro

EFRI-SEED Workshop - Questions for Discussions

1. How has EFRI SEED transformed your research structure and its reach?
2. Have new research methods emerged from the unique interdisciplinary structure?
3. Which infrastructural advantages did EFRI provide that would have been unfeasible for your research with other typical funding sources in architecture?
4. Describe the infrastructural and pedagogical hurdles that you encountered as part of the development of your EFRI SEED research.
5. How did EFRI SEED foment for new research systems within the context of a Professional Masters or Bachelors degree in Architecture?
6. How did you integrate graduate and undergraduate architecture students in your EFRI research?
7. Conversely, how has the structure (studio hours, etc.) facilitated or created obstacles for carrying your EFRI SEED research? What were the fundamental differences when compared to PhD research assistants?

EFRI-SEED Workshop - Questions for Discussions

8. How do you anticipate emerging programs (e.g. growing MSc in Architecture departments) built upon robust interdisciplinary frameworks to integrate research models as proposed by EFRI SEED?
9. Which budget aspects have you changed (e.g. allocation for more funding for equipment)?
10. Which mechanisms/types/themes for new funding do you anticipate would be truly transformative for the active long--term participation of architects at NSF?
11. What were the dissemination (Publications, Exhibitions, etc) advantages and hurdles met through your research stages at EFRI? Did these provide advantages or not with regards to the research itself?
12. Which specific aspects of your EFRI SEED research were transformative? How do you foresee sustaining this impact in the long term?
13. What research branches stemmed from EFRI SEED, that otherwise would have been unfeasible?
14. Do you have additional / new EFRI funding?

New Potential NSF Funding Opportunity on the Horizon

Sustainable Urban Systems (SUS)

Sustainable Urban Systems (SUS)

Challenge: 80% of the US population lives on ~3% of the space in *concentrated urban cities* that are highly dependent on *surrounding rural areas* = Urban Systems.

- **Prediction:** Unable to accurately frame and model urban sociotechnical futures and how to improve them
- **Coordination:** Limited understanding on how different actors can effectively coordinate to build and maintain Sustainable Urban Systems.
- **Workforce**: Lack of tools and scope to work with multi-scale complexity.

Sustainable Urban Systems (SUS) Science

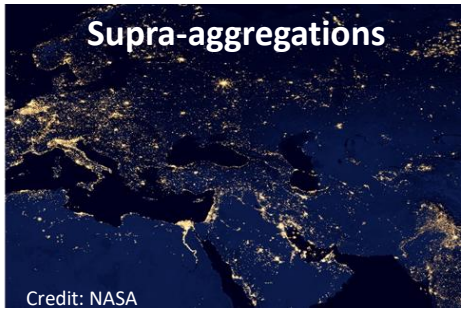
3 Major Perspectives:

- Single urban area, multiple communities, supra-aggregation

Potential Research Topics

- Role of SUS in protecting human health.
- Connections between technosphere and ecosphere of urban systems.
- Effects of sea level rise on national coastal urban systems
- Impact of urban systems on evolution of humans, organisms and microbiome
- Knowledge co-production among researchers, communities, industry groups, practitioner groups and governments

3 Major Perspectives

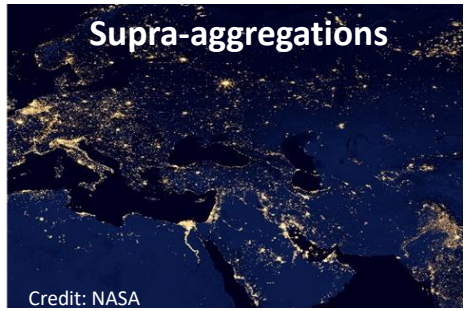


Sustainable Urban Systems (SUS) Science

Transformative Outcomes

- New understanding of interactions among natural-human & engineered systems with urban areas.
- Understanding sustainability outcomes across scale.
- Understanding and improving urban system health
- New Theories of Change -Technology & Design; Multi-level actors & governance
- Integrated systems: Sensors, Communications, & SMART systems
- Understand how humans are impacted by their changing environment
- Models for future Sustainable Urban Systems

3 Major Perspectives



SUS workshops in Summer 2019

27 NSF-funded SUS workshops are scheduled to occur across the country this summer

Three of the workshops have Principal Investigators who are architects

Check the website and see if there is a SUS workshop on a topic of interest to you, and consider contacting the PI if you are interested in attending:

https://www.nsf.gov/ere/ereweb/urbansystems/awards.jsp

Example SUS Workshop (Architect PI)

1929916 (James Wasley at U. Wisconsin – Milwaukee)

"Linking Sustainable Urban Water Systems in the Great Lakes Basin"

July 25-27, 2019 in Milwaukee, Wisconsin

The conferees will include researchers in freshwater sciences, engineering, public policy, the humanities, urban planning, urban design, architecture and landscape architecture

Example SUS Workshop (Architect PI)

1929465 (James Wescoat at MIT)

“Conference on Equitable Resilience (ER): A Necessary and Under-investigated Aspect of Sustainable Urban Systems (SUS); Cambridge, Massachusetts; Summer 2019”

The workshops bring together scholars from urban design, urban planning, and building technology, along with urban environmental scientists. It has four panels: 1) Urban ecology, society, and resilient design; 2) Equitable access to urban information, technology, and resources 3) Equitable processes of urban relocation; and 4) Convergence between equitable resilience and sustainable urban systems.

Example SUS Workshop (Architect PI)

1929601 (Ulrike Passe at Iowa State University)

"Conference: Developing a Convergence Sustainable Urban Systems (SUS) Agenda for Redesigning the Urban-Rural Interface along the Mississippi River Watershed"

August 12-13, 2019 in Ames, Iowa

This workshop will … support development of a research network that will bring architecture, arts, data science, ecology, engineering, and socio-ecological systems professionals into a dialogue with a variety of community stakeholders and industry professionals.

Potentially on the Horizon for SUS at NSF

- Draw on output from SUS workshops to formulate a solicitation for SUS Research Network proposals
- Model the SUS Research Networks on the existing NSF-funded Sustainability Research Networks (SRNs)
- Each SRN is funded for $12 million with a duration of 5 years

NSF'S 10 BIG IDEAS

NSF 2026

Investing in bold foundational research questions that are large in scope, innovative in character, originate outside of any particular directorate, and require a long-term commitment. This Big Idea is framed around the year 2026 in order to tie into the Nation's 250th anniversary ("sestercentennial").

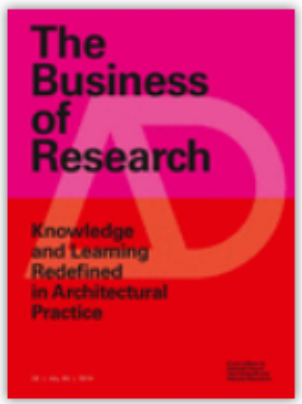
NSF 2026 will allow for systemic community input into long-term program development, and capture the imagination of critical stakeholders about what might be. NSF 2026 intends to transcend established scientific structures and standard operating procedures. It will ensure continuous exploration at the frontiers and risk-taking in areas that might not fit inside the "box" of any particular program. Such programs could cross boundaries in innovative ways, fill recognized gaps or take advantage of new opportunities.

Community input will be collected via the NSF 2026 Idea Machine, a prize competition scheduled to launch in the summer of 2018.

Post-Digital Transdisciplinarity
Marjan Colletti

Architectural Design
Volume86, Issue5
Special Issue: Digital Property: Open-Source Architecture
September/October 2016 Pages 74-81

Architectural Design



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Pages: 1-136

In Conclusion - Personal Reflections

- Engineering only became a separate Directorate at the NSF in 1981. NSF was founded in 1950.
- Architecture faculty need to determine how to engage intellectually as architects in NSF research.
- Until you lead and write a research proposal for >300k as the PI you will not understand what NSF research is really about.
- Be change agents in your universities if you believe architecture should be in the NSF. It will not happen through architects in practice.