



# DIRECTOR'S REMARKS

*Sethuraman Panchanathan*

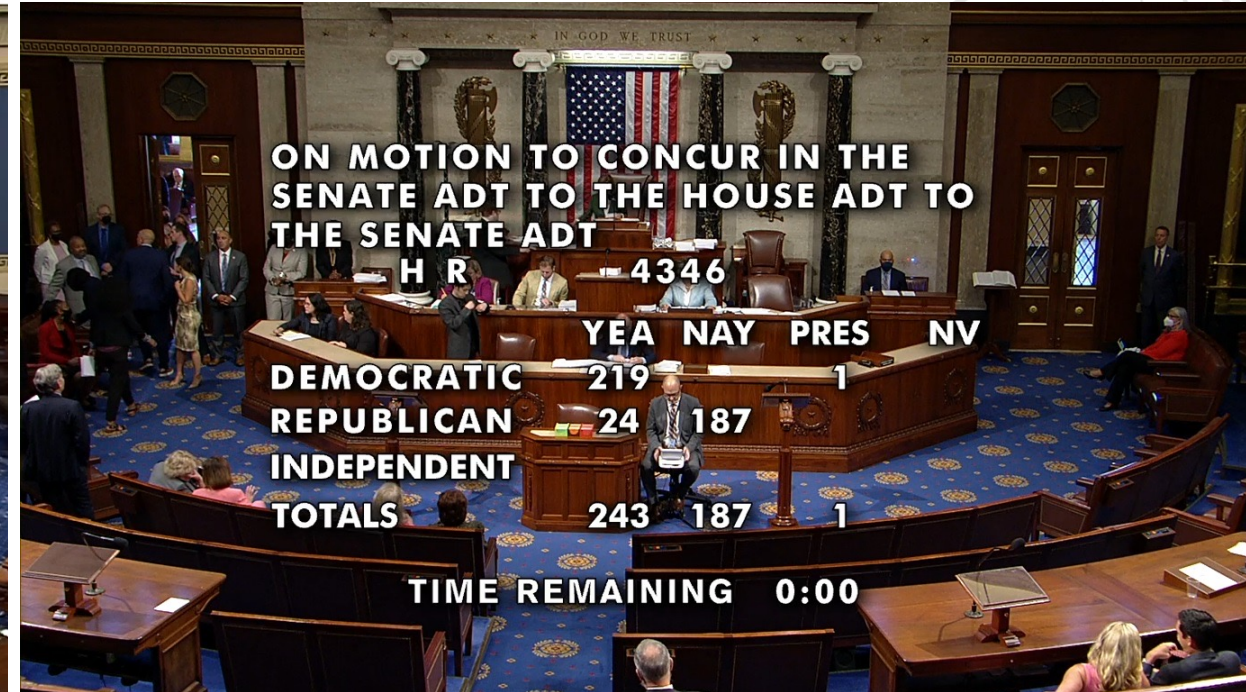
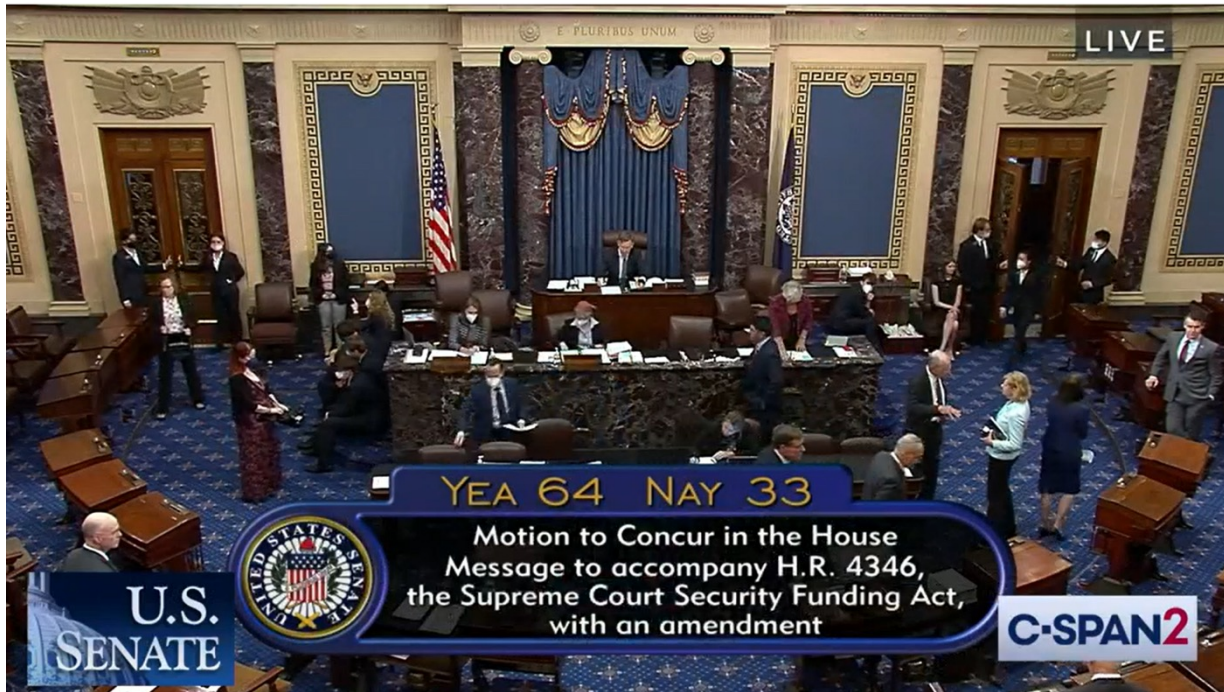
*National Science Foundation*

*National Science Board Meeting*

*August 3, 2022*



# Updates from the Hill: CHIPS and Science Bill Passes Congress



# NSF's 3 Major Priorities



STRENGTHENING  
ESTABLISHED NSF

With **investments that expand the frontiers of knowledge and technology.**



INSPIRING THE MISSING  
MILLIONS

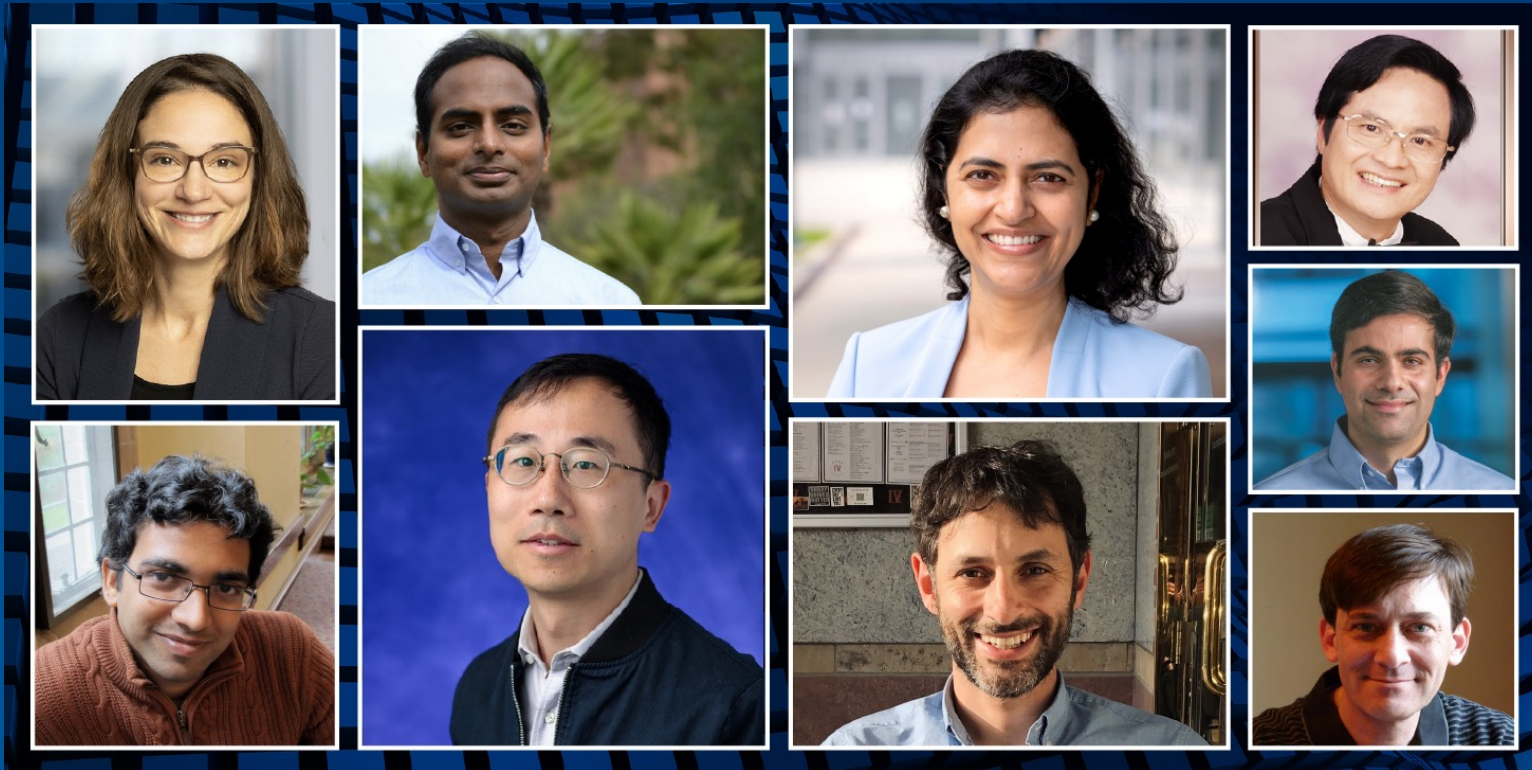
Using **interventions and capacity building** that enhance and broaden participation.



ACCELERATING TECHNOLOGY  
AND INNOVATION

Through innovative, **cross-cutting partnerships** and programs.

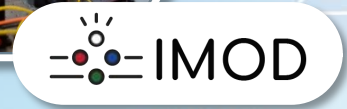




*2022 TRIPODS Awardees*



# 2022 Science and Technology Centers





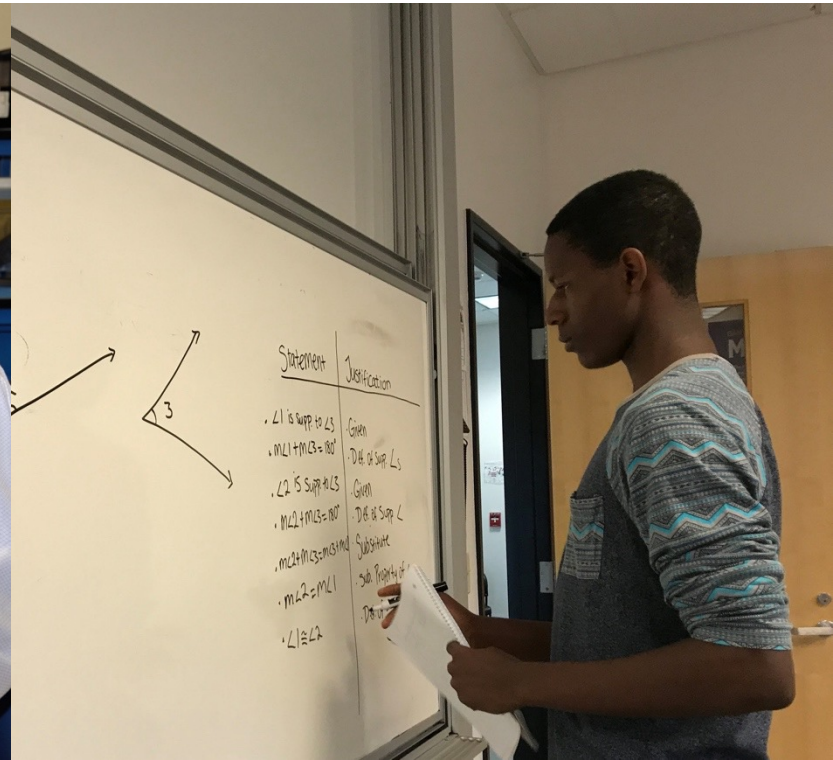
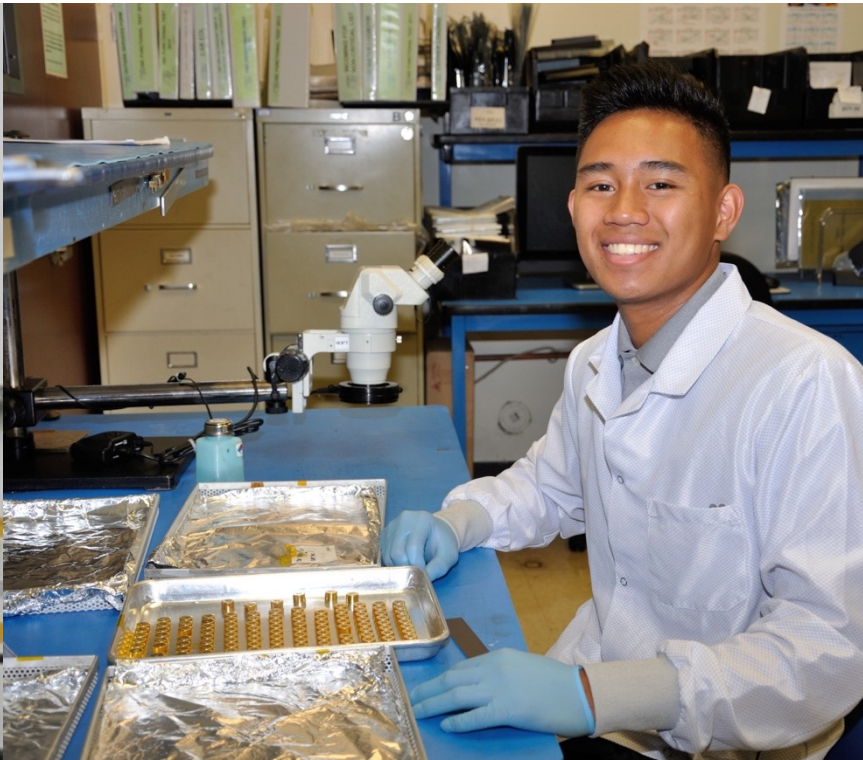
# HSI-Net Hubs

**\$29M** to support  
**research and capacity  
building** through  
collaborations and  
partnerships





# NSF INCLUDES



# \$8.6M Partnership with Foundations to Improve U.S. STEM Education

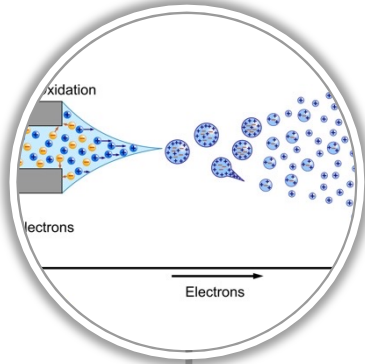
## Partners:

- Bill & Melinda Gates Foundation
- Schmidt Futures
- Walton Family Foundation

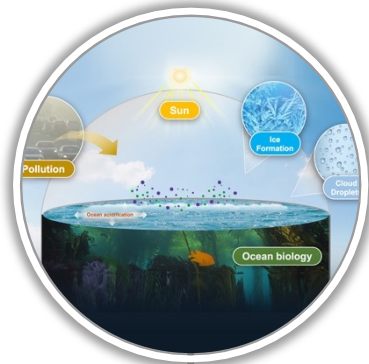


# Investment to Impact: Med Tech/Public Health

1999  
ELECTROSPRAY  
IONIZATION



2010  
AEROSOL PARTICLES IN  
MARINE ENVIRONMENT



1993  
COMPUTER VISIONING  
AND IMAGE ANALYSIS

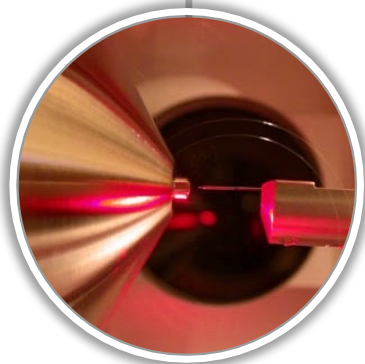


1987  
BIOLOGICALLY INSPIRED  
COMPUTER ARCHITECTURE

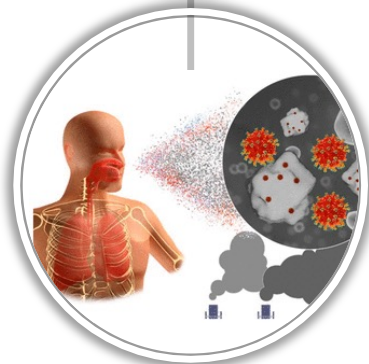


NSF  
INVESTMENTS

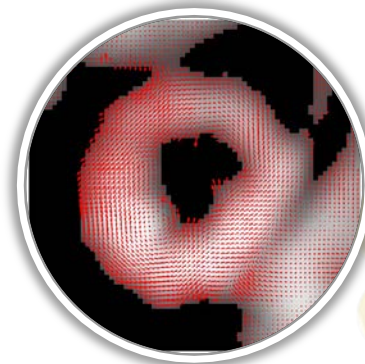
CURRENT  
IMPACTS



REVOLUTIONIZED THE  
ANALYSIS OF  
MACROMOLECULES



UNDERSTANDING OF VIRAL  
TRANSMISSION THROUGH  
AIRBORNE AEROSOLS



DECIPHERING  
RADIOLOGICAL IMAGING



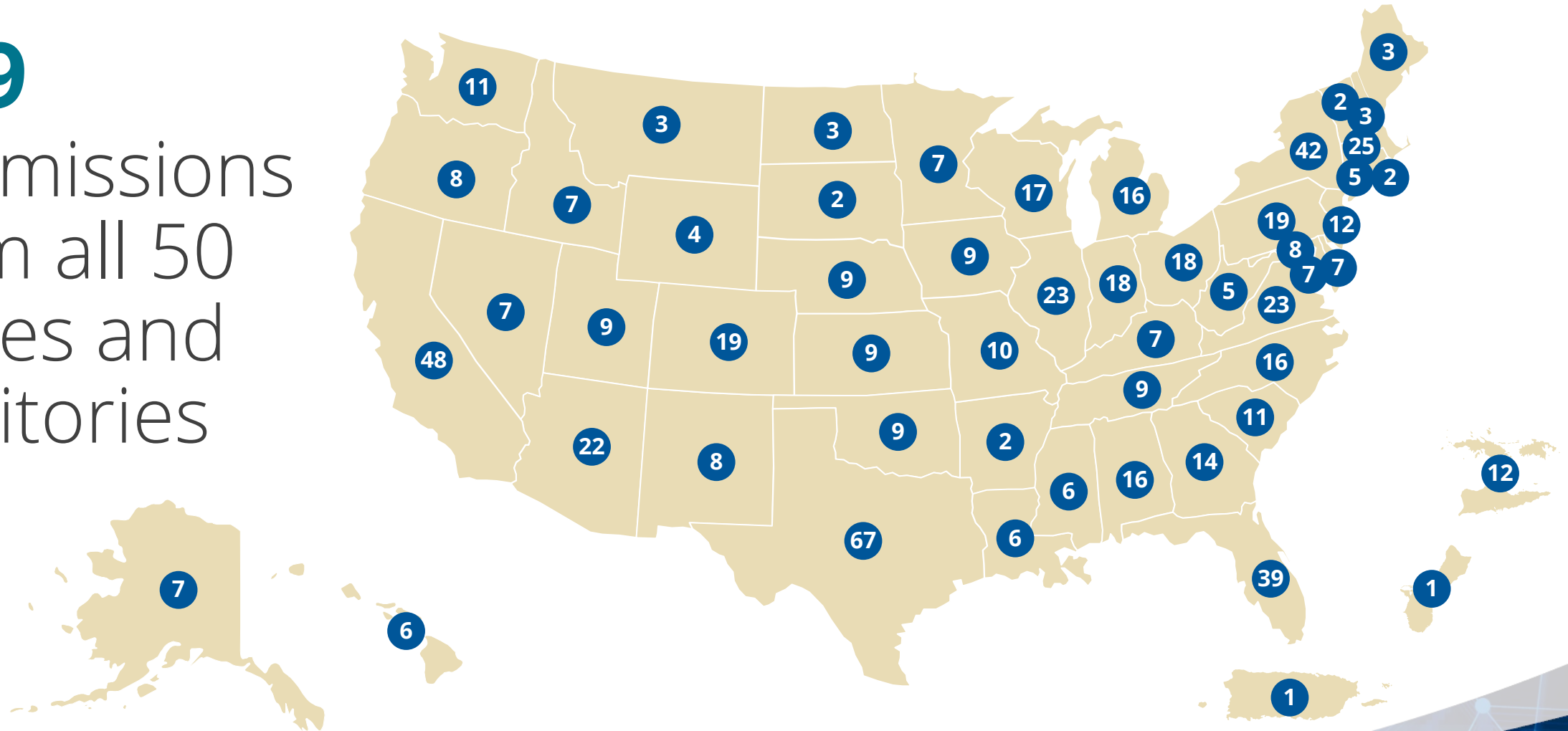
EXOSKELETONS FOR  
REHABILITATION



# Primed and Ready: NSF Engines

# 679

submissions  
from all 50  
states and  
territories



# Accelerating Intergovernmental Partnerships to Solve Major Challenges

*NSF and DOE announce partnership for **clean energy** science and engineering research*



# Accelerating Intergovernmental Partnerships to Solve Major Challenges

*NSF and NIST coordinate support for new **disaster resilience** research grants*





# Expanding the Frontiers of Discovery and Innovation



DIRECTORATE FOR  
BIOLOGICAL SCIENCES (BIO)  
**Joanne S. Tornow**



COMPUTER AND INFORMATION  
SCIENCE AND ENGINEERING (CISE)  
**Margaret Martonosi**



OFFICE OF INTERNATIONAL  
SCIENCE AND ENGINEERING (OISE)  
**Kendra Sharp**







# Cool Science: Fast Creatures and Fun Comics

*Presentation to the National Science Board (NSB)*

*Joanne Tornow, PhD*

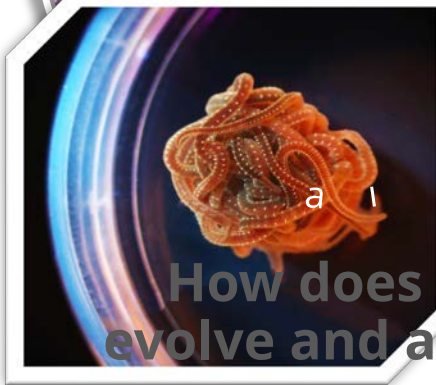
*Assistant Director for Biological Sciences*



# Big Questions in Biology



**How do genes create different visible outcomes?**



**How does life evolve and adapt?**

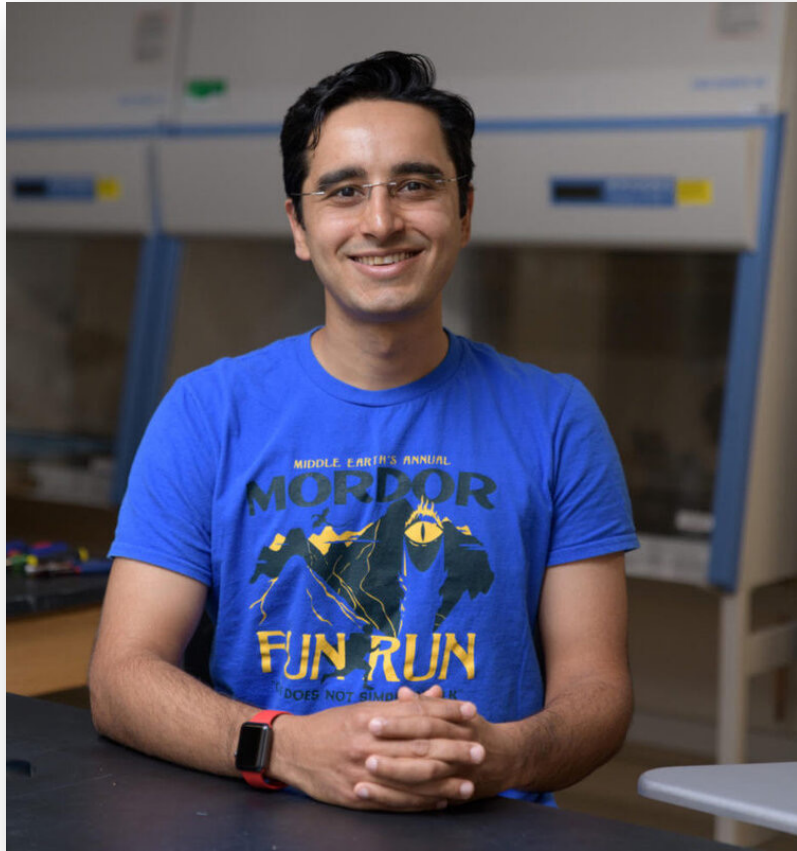


**Movement**



**How do organisms and their environments interact?**

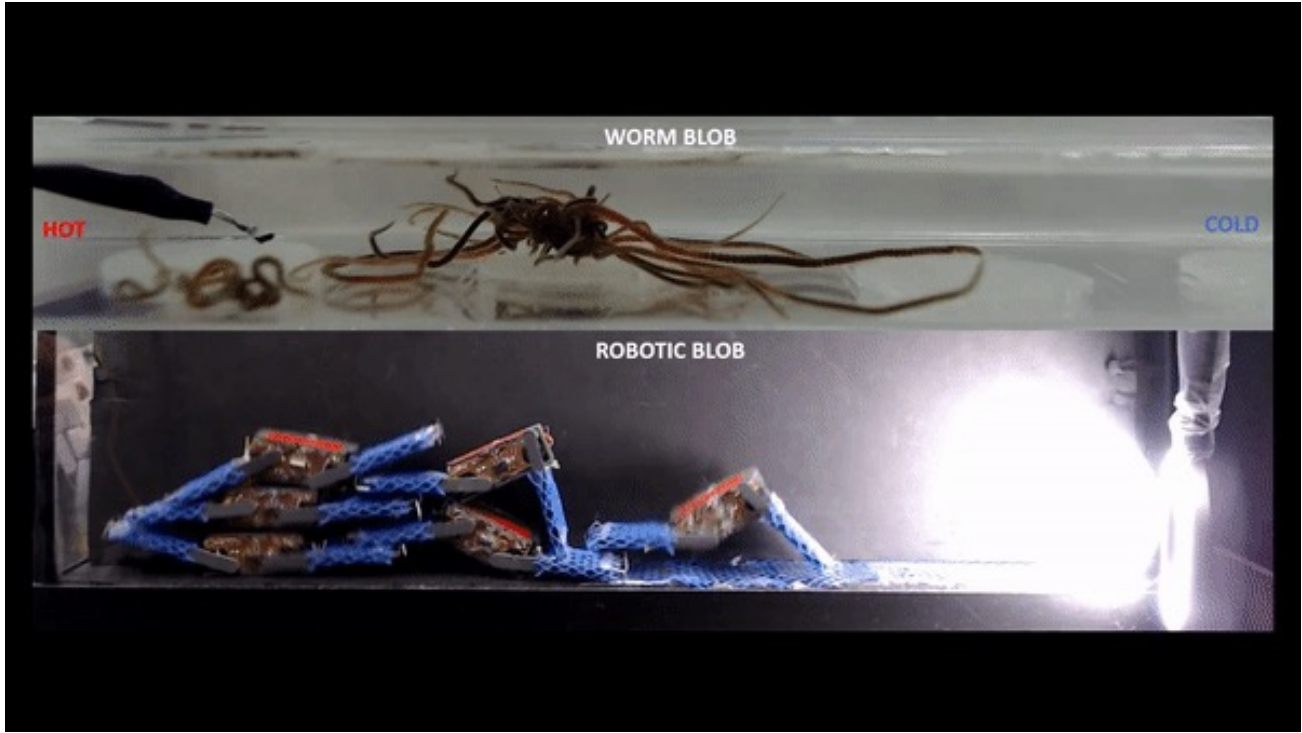
# Fast, Furious and Fantastic Beasts



# From Slingshot Spiders to Snaps



# Other Fast, Furious and Fantastic Beasts



# Fun Comics About Fast Creatures

## अत्यंत तेज़ चुटकी बजाना।

प्राचीन काल से, चुटकी बजाना लोगों द्वारा संवाद करने का तरीका होता था...

यौस युग से प्राचीन स्पेन के परमेको नृत्यों के लिए... आधुनिक सुपरहीरो फिल्मों के लिए

नहीं! आंके शिर के अंदर से बजती चाहिए।

यहाँ तक कि अन्य जीव, जैसे कि चींटी और दीमक की प्रजातियाँ, अपने मेडीकल के साथ तेज चुटकी जैसी गति पैदा कर सकती हैं।

चुटकी बजाना एक सूची भन्व्यवस्था की तरह सक्रिय प्रजाती (स्क्वा) हैं मध्य अंगुली और अंगुली को एक साथ दबाकर चुटकी बजाने का प्रक्रिया किया जाता है।

वीथ की डैमोले अंगुली से आगे किसवर्ती है जिससे चुटकी उत्पन्न होती है। इस गति का पूर्ण स्वरूप पेशेवर वैज्ञानिक मैदान की तुलना में तेज है।

### घर्षण !

लेकिन यह घर्षण के माध्यम से कैसे काम करता है?

घर्षण वह प्रतिक्रिया है जो एक वस्तु का दूसरी वस्तु पर रगड़ने पर होता है। चुटकी बजाना के लिए घर्षण की सर्वोत्तम मात्रा का पता लगाने के लिए प्रयोग किए गए।

अंगुली पर लगे रबर के डिब्बे में बहुत अधिक घर्षण पैदा किया, जिससे चुटकी के दौरान ऊर्जा का मुक्तता हुआ। एक धनु की डिब्बे में एक चुटकी के लिए पर्याप्त बल भी नहीं बनाया ... (स्पष्ट है, बर्बर)

एक पिचलाई याक दरतना बहुत विचित्र और भी अधिक बल प्रयोग पैदा करता था, जिससे संश्लेषण ऊर्जा की मात्रा कम हो जाती थी।

चाहें, मैं उस पर चुटकी बजाऊंगा।

सही चुटकी उत्पन्न के लिए लवचा के घर्षण और संश्लेषण की सही मात्रा आवश्यक है। इस तरह लवचा प्रजाती को देखने से प्राप्त खोज का उपयोग कृत्रिम अंग के बनावट और मुद्राणन यंत्रणा के घर्षण गतिविधि को बेहतर बनाने में किया जा सकता है।

मानव लवचा ने चुटकी करने के लिए सही मात्रा में घर्षण और संश्लेषण का एक गोलोलीकृत जोन का उत्पादन किया।

Shantia Lab Comic Series by Lindsey Leigh

## INTRODUCING THE SMARTICLE BLOBS (AKA: SLOBs!)

\*Smarticles Smart, Active Particle Smarticles are simple robots that act as active particles; they individually have basic functions, but can join together to do things that are even more complex.

By creating a 3D printed robot model that mimics how the worms move, scientists can figure out how the worm blob moves in a way that is easier to replicate.

Six individual robots can entangle together to form a blob.

I don't see the resemblance...

Mesh and pins to grip onto other robots

When they aren't attached, the SLOBs can wiggle and crawl around, but they aren't able to move very well.

But just like in the worm blob, the SLOBs can move more efficiently when attached (mesh and L-shaped pins are added to the robots to help them grip each other).

In experiments, a light source is used to activate the blob's movement. Like the worms, the Smart Blob moves better if the robots in the front crawl (or pull), and the robots wiggle in the back.

### 3 Rules of SLOB Locomotion:

- 1) Entangle with thy neighbor
- 2) Crawl (or pull) when in front
- 3) Be lazy or wriggle in the back

All for one!

And one for all!

Through the use of these smart blobs, scientists have learned how the worm blob works and opened up a new form of collective robotics.

Through their incredible collective decision making, these amazing balls of spaghetti prove that teamwork really makes the dream work!

## EL MARAVILLOSO ZOOLOGICO DE ORGANISMOS EXTRAORDINARIOS

# THE SLINGSHOT SPIDER

En el corazón de la Selva Amazónica...

Adéntrate y desvela el misterio de la trampa ultra rápida que elabora el arácnido conocido como "The Slingshot Spider", quien emplea ingeniosamente su telaraña para hacerse de su cena.

Todo inicia cuando la araña decide tirar de una fibra de seda con sus pedipalpos y patas delanteras, creando una redde espiral de seda enrollada como espiral y muy apretada.

Entonces la araña jala el hilo de seda fuertemente hasta que la telaraña se deforma y forma un cono estrecho y alisado. Y es precisamente cuando la araña percibe un insecto merodeando cerca...

... cuando libera de inmediato el hilo de seda que sostiene con sus patas delanteras y es catapultado junto con su tela a la trampa para capturar más insectos durante el día.

Al reboblar de regreso, la araña enrolla nuevamente el hilo de seda hasta resargar por completo su trampa y así tenerla lista para capturar más insectos durante el día.

Mercedemente, después de la jugosa recompensa a sus increíbles acrobacias aéreas...

¡Qué valiente!

Es increíble como "The Slingshot Spider" transformó el uso de su telaraña aérea en una trampa de araña ultra rápida, más valiente incluso que un guepardo. ¡Eso por esto que "The Slingshot Spider" posee el récord como la especie más rápida de los arácnidos.







# CISE Cool Science: Data Privacy Research and Researchers

*Margaret Martonosi*  
*NSF AD for CISE*





# Data Privacy and Protection



# Privacy Enhancing Technologies

**Privacy in  
Datasets and  
their Analysis**

**Foundations  
of Privacy**

**Human  
Centered  
Privacy**

**Privacy by  
Design**



# Privacy Enhancing Technologies

**Privacy in  
Datasets and  
their Analysis**

**Foundations  
of Privacy**

**Human  
Centered  
Privacy**

**Privacy by  
Design**

*NSF-funded Example:  
SugarCoat*

Seamless insertion of  
privacy protection



## Privacy by Design

*NSF-funded Example:*  
SugarCoat

Seamless insertion of  
privacy protection



# Privacy Enhancing Technologies

## Privacy in Datasets and their Analysis

*NSF-funded Example:*  
Differential Privacy

Used in US Census 2020,  
Apple, Google, etc.

## Foundations of Privacy

*NSF-funded Example:*  
Homomorphic encryption

Used in Google, Microsoft,  
Amazon, etc.

## Human Centered Privacy

*NSF-funded Example:*  
Privacy Notice and Choice  
via privacy nutrition labels

Recommended by FTC, used  
in Apple and Google, etc.

## Privacy by Design

privacy protection



# A few of the many faces of privacy research

Differential  
Privacy  
for Images



Liyue Fan  
UNC Charlotte

Privacy and  
Mitigating  
Domestic  
Violence



Nicola Dell  
Cornell Tech

Private Group  
Communication



Nick Hopper  
U. Minnesota

Usable Privacy;  
Privacy  
Nutrition Label



Lorrie Faith Cranor  
CMU

Privacy and  
Racial Bias



Apu Kapadia  
Indiana University

Privacy and  
Internet of  
Things



Kevin Kornegay  
Morgan State  
University

Privacy  
Preserving  
Machine  
Learning



Aleksandra  
Korolova  
U. Southern  
California



More needed: Privacy is crucial for individuals, enterprises, and democracy

## Why NSF?

NSF Programs support holistic and inter-disciplinary research

### **Human-centered Approach:**

Secure and Trustworthy Cyberspace and other programs strongly engage SBE and other directorates

### **Ideas to Impact:**

**NSF Transition to Practice** awards mechanisms foster impact at scale









# OISE Cool Science: International Collaborations to Confront Global Challenges

*Dr. Kendra Sharp*  
*Office of International Science and Engineering*





# Nature-based Solutions for Urban Resilience on a Changing Planet



**Nancy Grimm,**  
Arizona State University



**Timon McPhearson,**  
The New School

*International Network Increases*



*Power of Research, Speed of Learning and Scale of Impact*



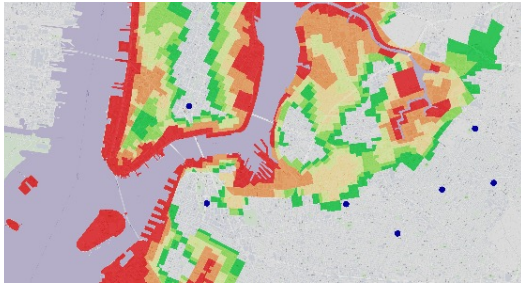
# Not Fail Safe



**Safer-to-fail!**

2015

**Urban Resilience to Extreme Weather (UREx) Sustainability Research Network**



**Understanding Rainfall Events**



**Heat Action Planning**



2015

2019

Urban Resilience to Extreme Weather (UREx) Sustainability Research Network



Understanding Rainfall Events



Heat Action Planning

Converging Social, Ecological, and Technological Infrastructure Systems (SETS) for Urban Resilience



Social - Ecological - Technological System



2015

2019

Urban Resilience to Extreme Weather (UREx) Sustainability Research Network



Understanding Rainfall Events



Heat Action Planning

Converging Social, Ecological, and Technological Infrastructure Systems (SETS) for Urban Resilience



Social - Ecological - Technological System



Nature-based Solutions for Urban Resilience in the Anthropocene (NATURA)



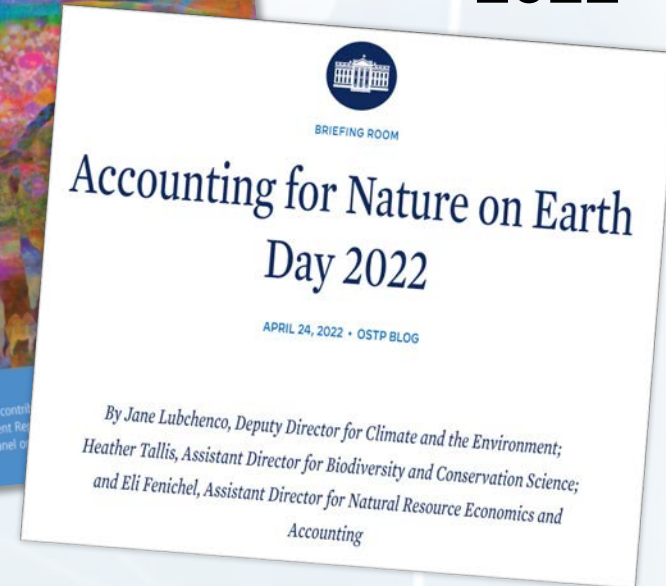
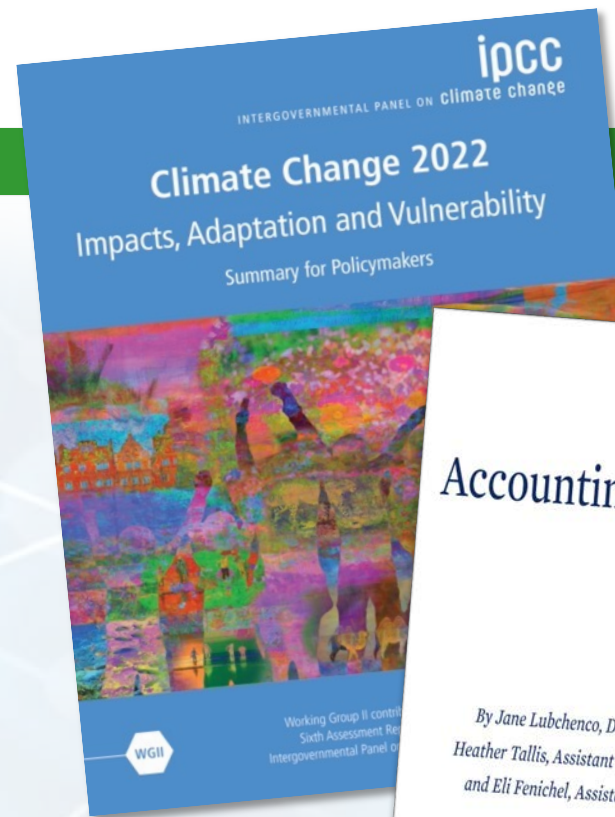
45 global networks



2015

2019

2022



# Impact: Science Informing Policy



NATURA, an international network-of-networks project, provides global leadership through:

- strategic partnerships that leverage international expertise (e.g. US – Netherlands)
- synthesis of learning from around the world to improve the **science** and **impact** of nature-based solutions for urban resilience.

*International Network Increases*



*Power of Research, Speed of Learning and Scale of Impact*







# Engagement Highlights





# DIRECTOR'S AWARDS 2022



# WELCOME NEW NSF LEADERSHIP



**Dr. Kellina Craig-Henderson**  
*Assistant Director – Directorate  
for Social, Behavioral and  
Economic Sciences*



**Janis Coughlin-Piester**  
*Chief Financial Officer*



**Teresa Grancorvitz**  
*Deputy Chief  
Operating Officer*



**Dr. James L. Moore**  
*Education and  
Human Resources*



# THANK YOU



**Joanne Tornow**  
*Assistant Director, BIO*



Partnership for Public Service recognizes...

# NSF 2<sup>ND</sup> BEST MID-SIZE AGENCY TO WORK AT IN THE FEDERAL GOVERNMENT

SCIENCE  
HAPPENS **HERE**



Partnership for Public Service recognizes...

DIRECTORATE FOR  
**EDUCATION  
AND HUMAN  
RESOURCES**

**1<sup>ST</sup> BEST AGENCY SUBCOMPONENT**  
IN THE FEDERAL GOVERNMENT

SCIENCE  
HAPPENS **HERE**



Partnership for Public Service recognizes...

DIRECTORATE FOR  
**BIOLOGICAL  
SCIENCES**

**4<sup>TH</sup> BEST AGENCY SUBCOMPONENT**  
IN THE FEDERAL GOVERNMENT

SCIENCE  
HAPPENS **HERE**





**SCIENCE**  
HAPPENS **HERE**



*Gemini North, part of Gemini  
Observatory, in Maunakea, HI*

**#NSFstories**



Share Your **Story**







