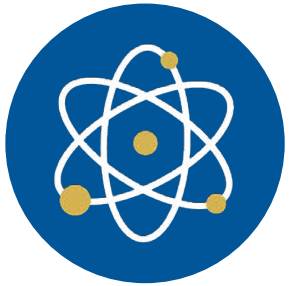
DIRECTOR'S REMARKS

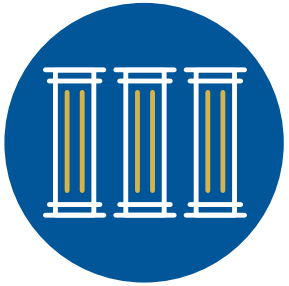
Sethuraman Panchanathan
National Science Foundation

National Science Board Meeting

December 8, 2021



NSB Vision 2030



NSF Vision

Administration Pillars

Research benefits	Advancing research	Pandemic response
STEM talent	Accessibility and inclusivity	Economic recovery
Geography of innovation	Global leadership	Racial equity
Global S&E community	Translation, Innovation, Partnerships (TIP)	Climate change

Updates From the Hill

NSF Reauthorization Bills

- Senate passed **United States Innovation and Competition Act (USICA)** on June 8th by a vote of **68-32**.
- House passed the **NSF for the Future Act** on June 28th by a vote of **345-67**.
- On November 17th Majority Leader Schumer and Speaker Pelosi announced a **formal conference process** with the goal of having a final bill passed **as soon as possible**.

Reconciliation Update

- House passed **Build Back Better Act** on November 19th.
- Includes **$3.5B for NSF**, including funding for: TIP; core research, infrastructure and capacity building at HBCUs and MSIs.
- Senate expected to take up the bill **this month**.

FY22

- **Continuing Resolution Extended** until February 18th
- Senate proposal: **$9.5B**
- House proposal: **$9.6B**

3 Major Priorities of NSF

STRENGTHENING ESTABLISHED NSF

INSPIRING MISSING MILLIONS

SUCCESS OF TECHNOLOGY, INNOVATION AND PARTNERSHIPS

2021 Nobel Prize Winners

PHYSIOLOGY OR MEDICINE

DAVID JULIUS
University of California, San Francisco

ARDEM PATAPOUTIAN
Scripps Research of the Howard Hughes Medical Institute

Discoveries of receptors for temperature and touch

ECONOMIC SCIENCES IN MEMORY OF ALFRED NOBEL

DAVID CARD
University of California, Berkeley

Empirical contributions to labor economics

JOSHUA D. ANGRIST
Massachusetts Institute of Technology

GUIDO W. IMBENS
Stanford University

Methodological contributions to the analysis of causal relationships

PHYSICS

SYUKURO MANABE
Princeton University

KLAUS HASSELMANN
Max Planck Institute for Meteorology, Hamburg

Physical modelling of Earth's climate, quantifying variability and reliably predicting global warming

GIORGIO PARISI
Sapienza University of Rome

Discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales

Investment to Impact: Applied Economics

	1980s: GAME THEORY & MARKET ECONOMICS	2000s: BEHAVIORAL ECONOMICS	2000s: ECONOMICS OF EDUCATION	2000s: ENVIRONMENT, SOCIETY, AND ECONOMICS RESEARCH
NSF INVESTMENTS				
CURRENT IMPACTS				
	2012 NOBEL PRIZE FOR MARKET DESIGN	INCREASED RETIREMENT SAVINGS	BROADENING PARTICIPATION IN COLLEGE ENROLLMENT	I-CORPS: MAMMOTH TRADING ONLINE WATER MARKET

STEM Pathways

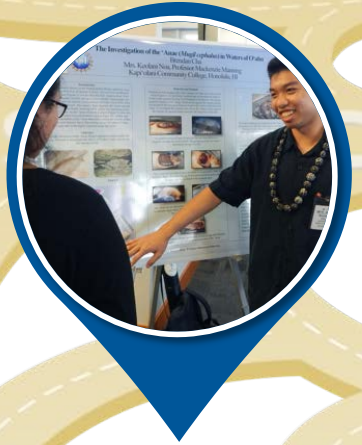
NSF Programs **Open Doors** in STEM

ITEST

HSI Program

BPC Pilot

BPE



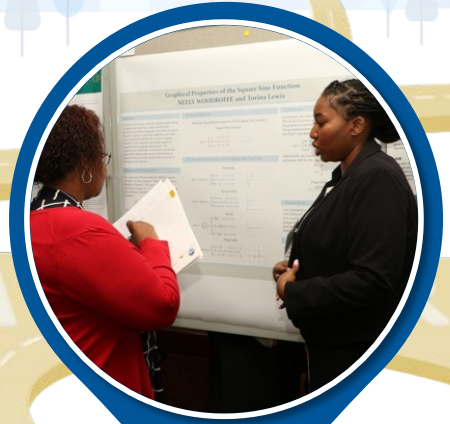
TCUP

HBCU-UP

RAHSS

NSF Programs **Retain** People in STEM

S-STEM



LSAMP

LEAPS-MSP

CIRCLES ALLIANCE

GOLD-EN

NSF Programs **Advance** Careers in STEM

CAREER

ADVANCE

HBCU-EIR

EPSCoR

SBE Build and Broaden

2020

2020s

GENE EDITING FOR RESILIENT & HIGH YIELD CROPS

2008

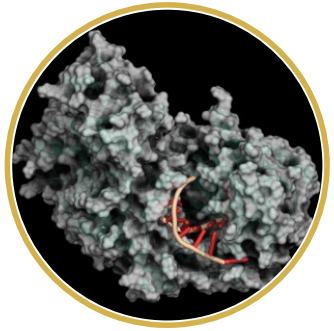
CYVERSE

CYVERSE RESEARCH PLATFORM ESTABLISHED

2010s

CRISPR & GENE EDITING BIOTECHNOLOGY

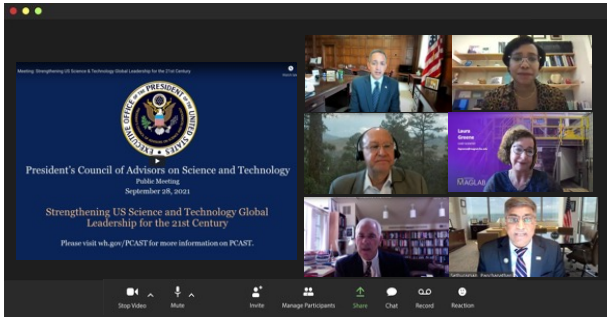
1990s-2000s



DISCOVERY OF RNAi AND GENE EXPRESSION MECHANISMS

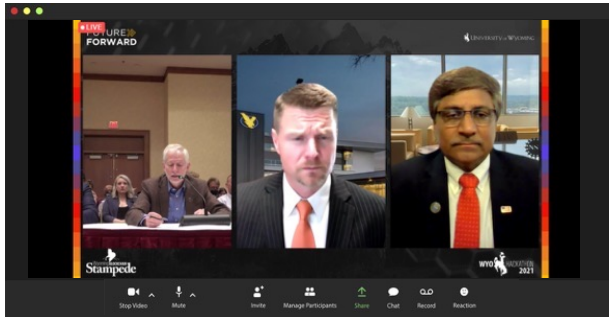
1990

Engagement Highlights

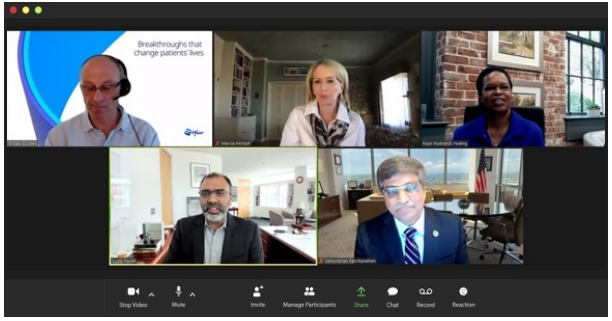


President's Council of Advisors on Science And Technology

Second Nature: Federal Research Priorities For Equitable Climate Solutions



Wyoming Blockchain Stampede: WyoHackathon



National Health Research Forum

National Academy of Inventors Annual Meeting

Naval Academy Science and Engineering Conference

Member Visits

OKLAHOMA

OSU MIXED REALITY LAB

Member Visits

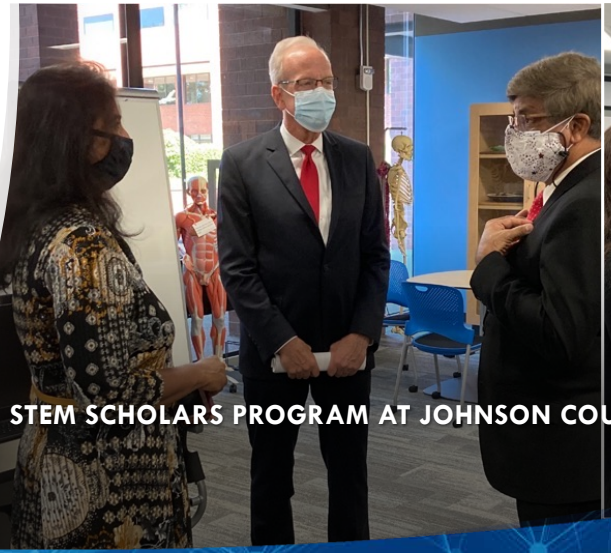
OKLAHOMA

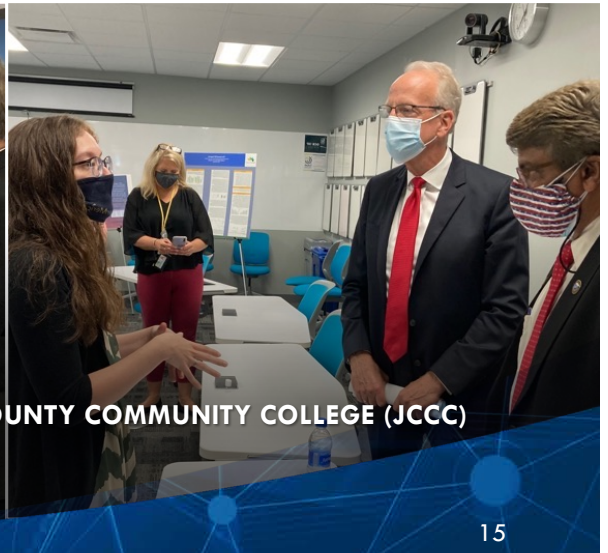
OSU EXCELSIOR LAB

Member Visits

KANSAS

BLUE VALLEY CENTER FOR ADVANCED PROFESSIONAL STUDIES (CAPS)





STEM SCHOLARS PROGRAM AT JOHNSON COUNTY COMMUNITY COLLEGE (JCCC)

Member Visits

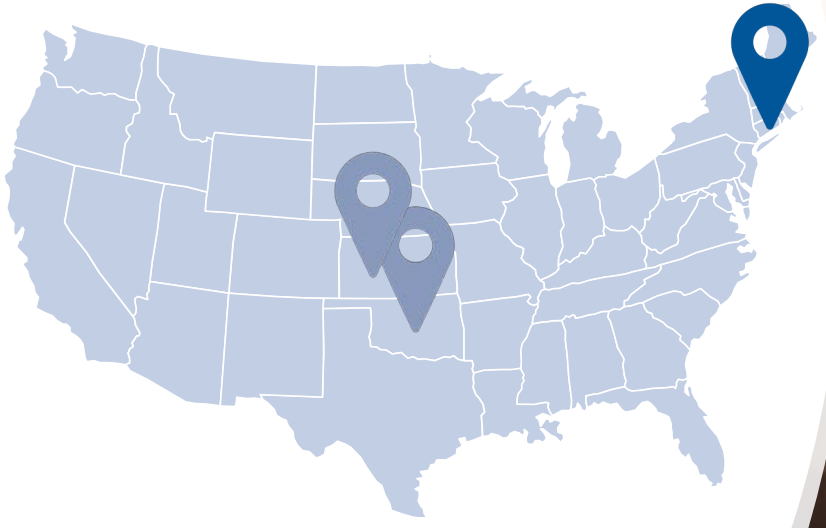
KANSAS

KU'S CENTER FOR SUSTAINABLE ENGINEERING

LUNCHEON WITH NSF SUPPORTED FACULTY

Member Visits

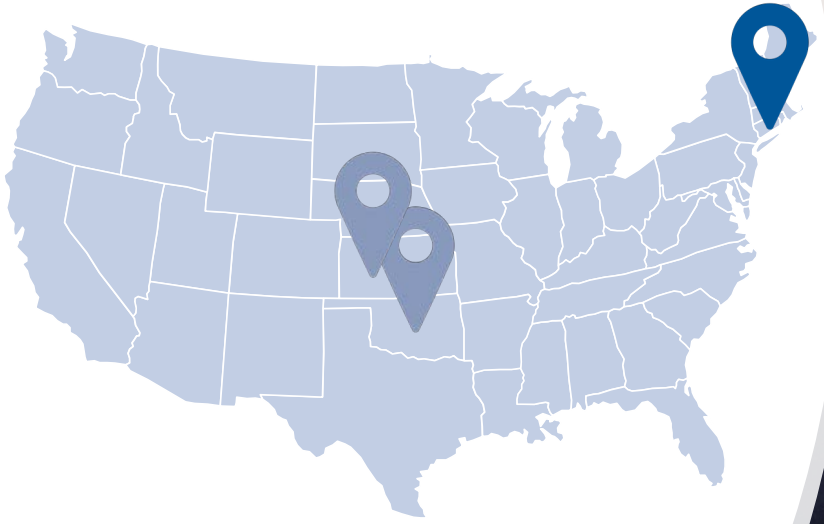
CONNECTICUT



YALE PANEL DISCUSSION ON IDEAS AND INNOVATIONS

Member Visits

CONNECTICUT



YALE PANEL DISCUSSION ON IDEAS AND INNOVATIONS

Member Visits

OHIO

Member Visits

OHIO

OSU'S ENERGY ADVANCEMENT AND INNOVATION CENTER (EAIC) GROUNDBREAKING

Expanding the Frontiers of Discovery and Innovation

Alexandra Isern, GEO

Margaret Martonosi, CISE

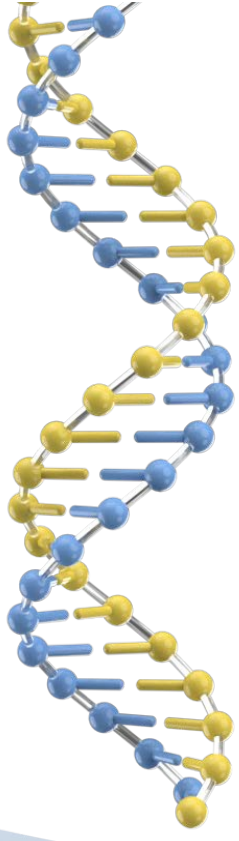
Arthur Lupia, SBE

Discovering the “Breathing” Southern Ocean

Alexandra Isern, Assistant Director

Directorate for Geosciences

An Incredible Discovery Path



1990s

- Ocean heat distribution research **improves prediction**
- Cost-effective robotic floats **improve measurements**

2000s

- Advanced understanding of dissolved carbon distribution

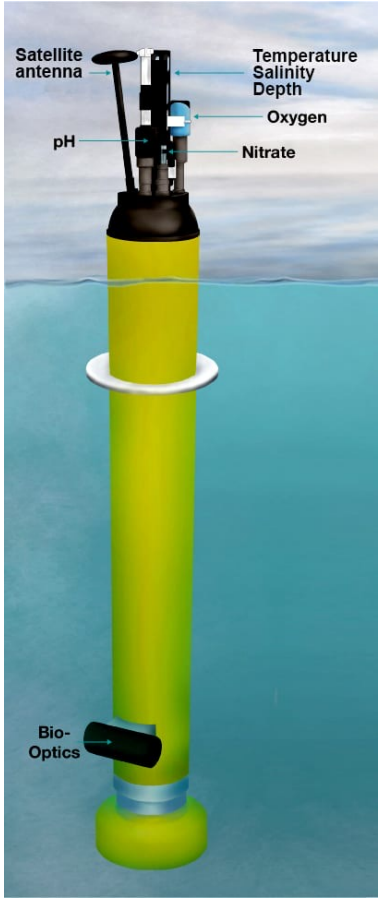
2010s

- **New biogeochemical sensors for the Southern Ocean**
- The need for a global array emerges

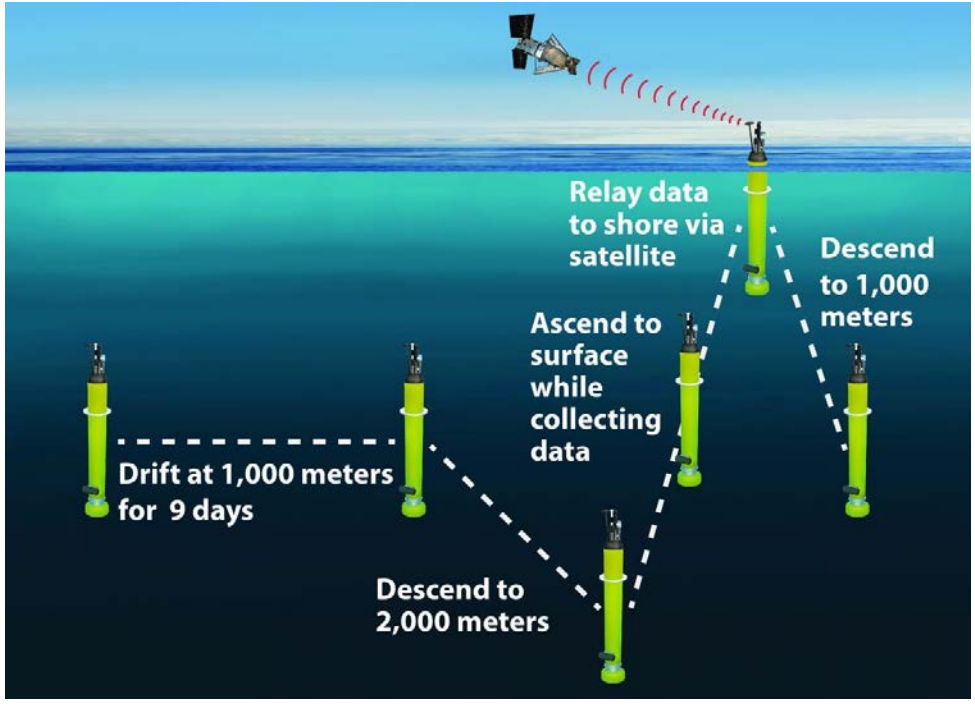
2020s

- **International support for global array**
- **Key industry partnerships**

New Technologies Yield Stunning Innovations



New Technologies Yield Stunning Innovations



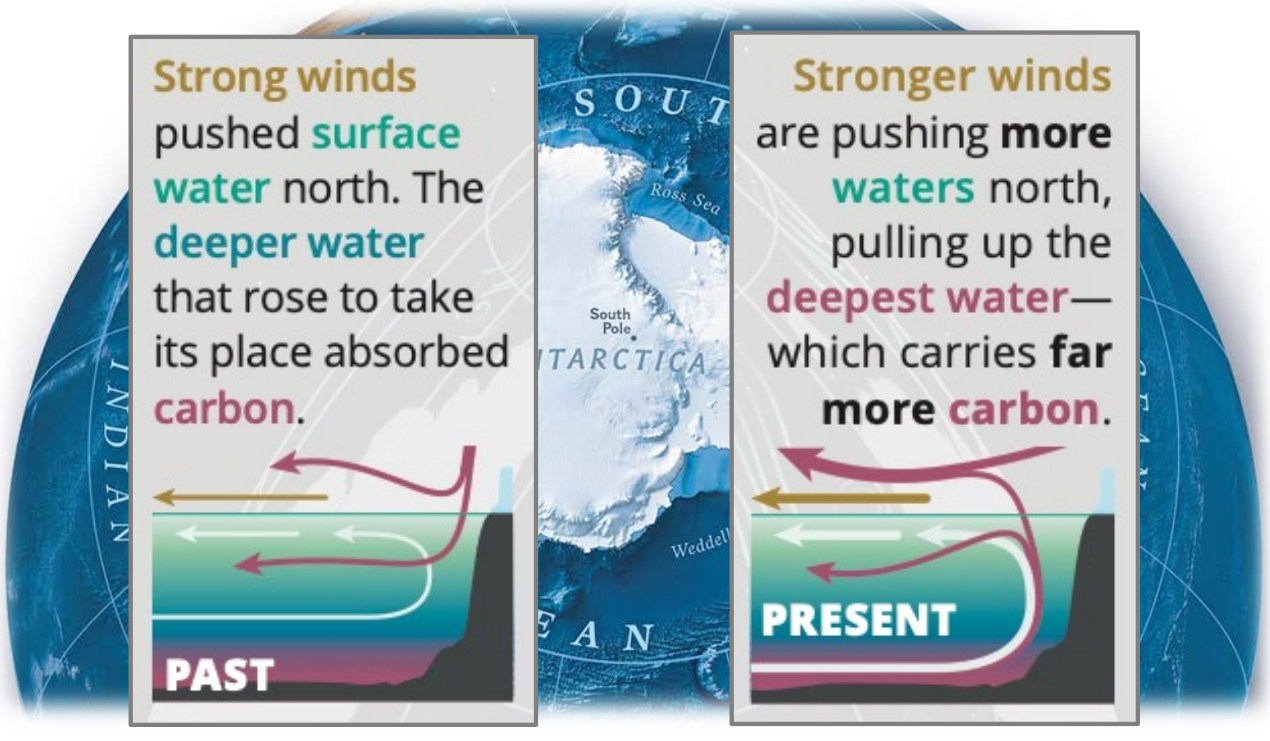
Cost of two ship days = Five years of float operations

The new floats are now *the dominant source* of high-quality data

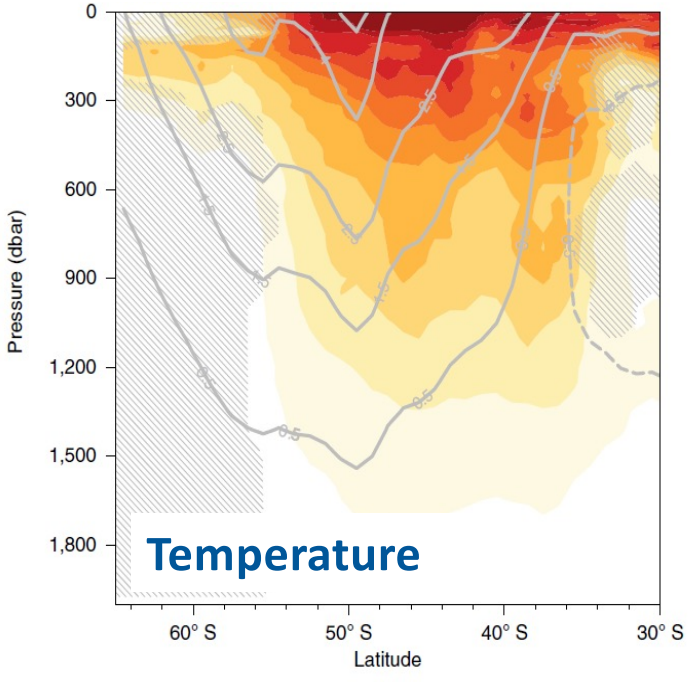
Property	Number of Profiles to >900 m	
	Ships South of 30S 2010-2017*	SOCCOM Floats 2014-2021
Oxygen	1,764	18,592
Nitrate	1,651	15,185
pH	1,054	8,505

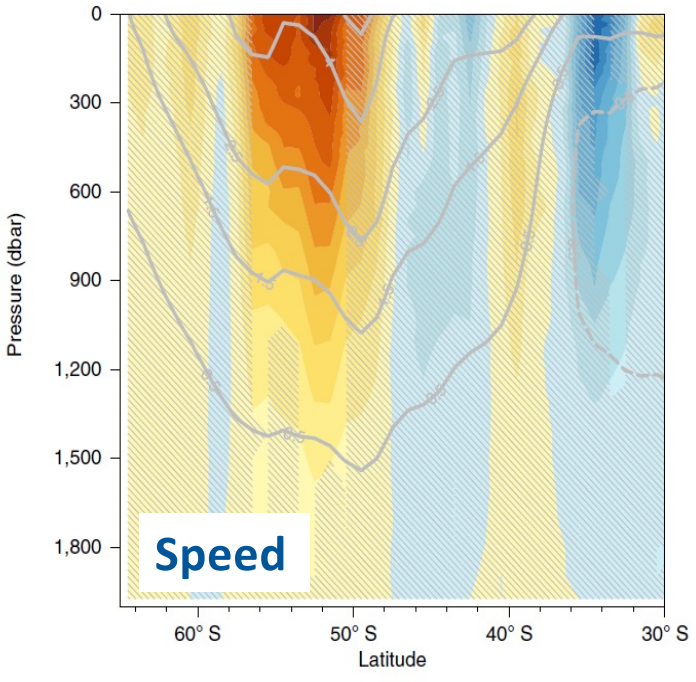
* Source: U.S. National Oceanographic Data Center

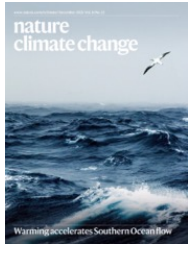
The Innovations Produce Important Findings…



Parts of the Southern Ocean are warmer and FASTER







Ocean warming and accelerating Southern Ocean zonal flow

Jia-Rui Shi, Lynne D. Talley, Shang-Ping Xie, Qihua Peng & Wei Liu

Nature Climate Change (2021) | Cite this article

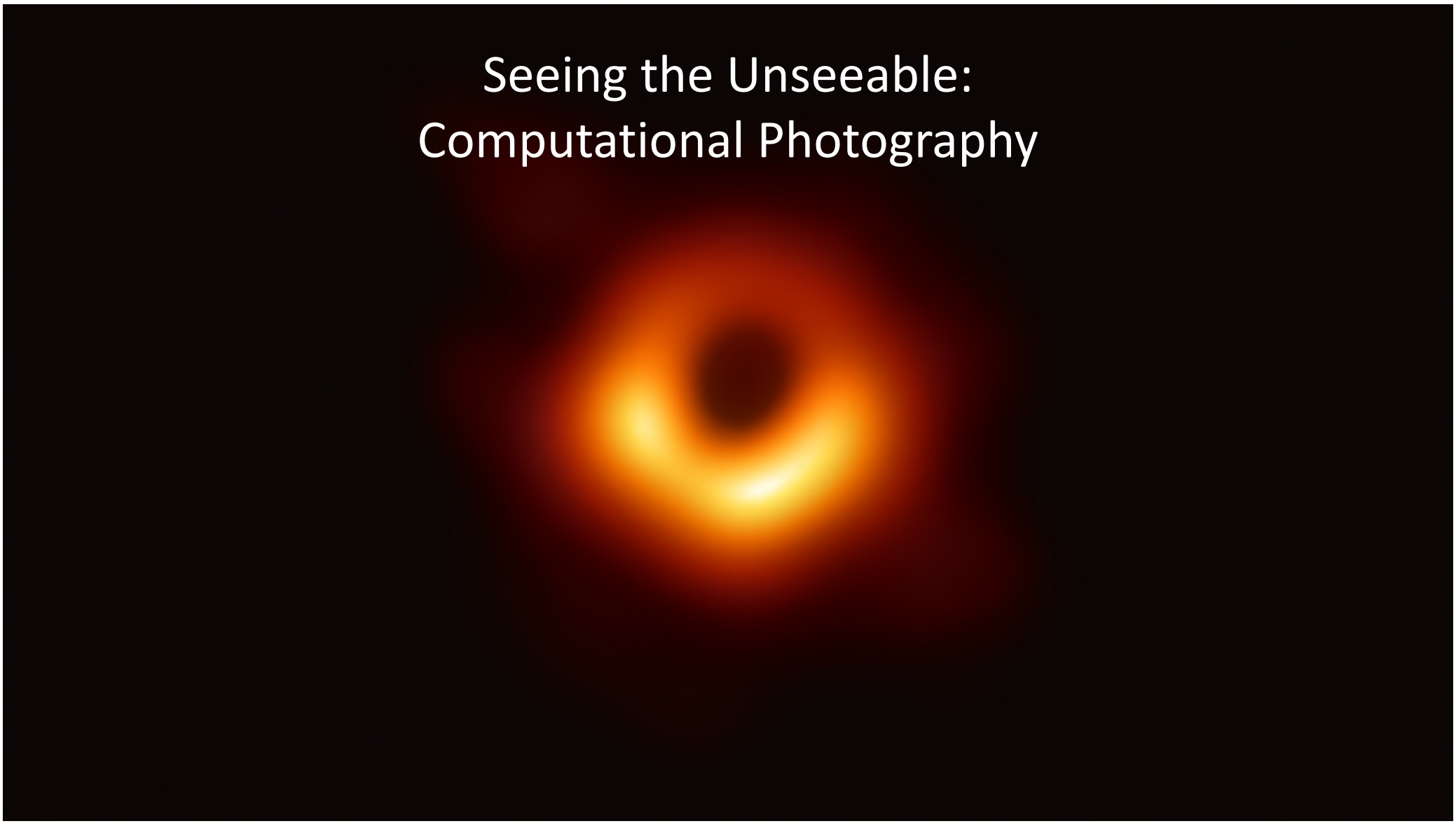

Thank you!

Seeing the Unseeable: Computational Photography and Digital Imaging

Margaret Martonosi

NSF Assistant Director
Computer and Information Science and Engineering (CISE)

Seeing the Unseeable:
Computational Photography

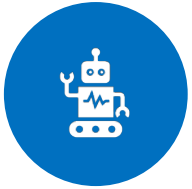


Elements of Computational Photography

SENSING AND DATA CAPTURE

COMPUTER GRAPHICS, RENDERING, VISION

EFFICIENT, TRACTABLE ANALYSIS ALGORITHMS



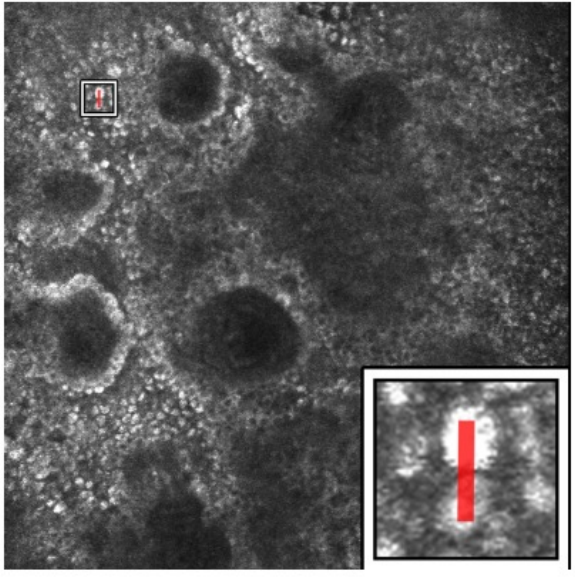
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SOCIOTECHNICAL ELEMENTS: PRIVACY, FAIRNESS

NSF Career Award: Computational Optics and Photonics for Deep Imaging of Live Tissue

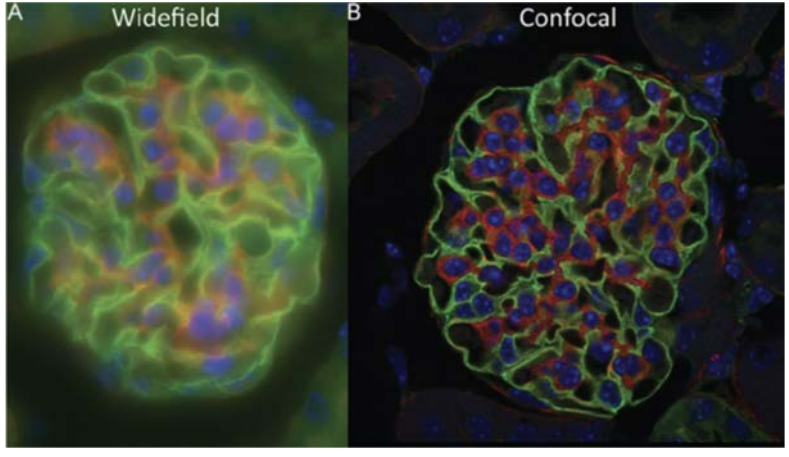
Prof. Heidy Sierra
University of Puerto Rico, Mayaguez

Use Optical Models, Compressive Sensing and Machine Learning techniques to improve image resolution and reduce rendering times



Skin stack image captured with Reflectance Confocal Microscopy (RCM), showing a layer of basal cells.

Tractable Computational Optics for Medical Imaging: Seeing below the Skin



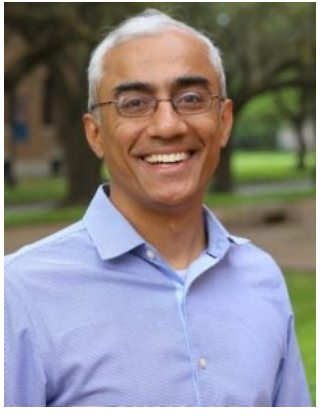
Blurred image of cells due to out of plane scattered light.

Confocal imaging eliminates out-of-plane light, resulting in better resolution.

Computational Photo Scatterography

$10M Expedition in Computing Award

https://www.seebelowtheskin.org

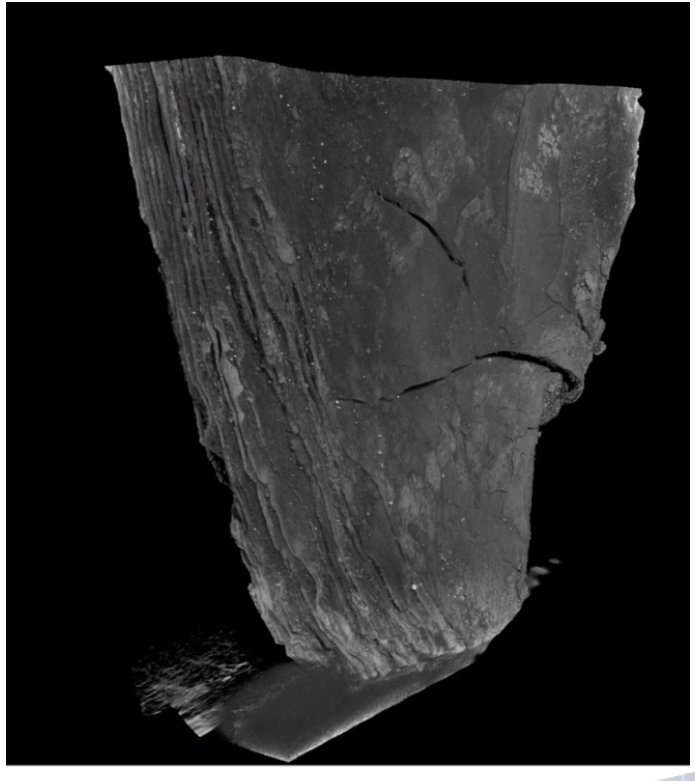


PI: Ashutosh Sabharwal, Rice Univ.

Co-PI: Latanya Sweeney, Harvard

Computational Imaging and Heritage Science: How to read an ancient scroll without unrolling it?

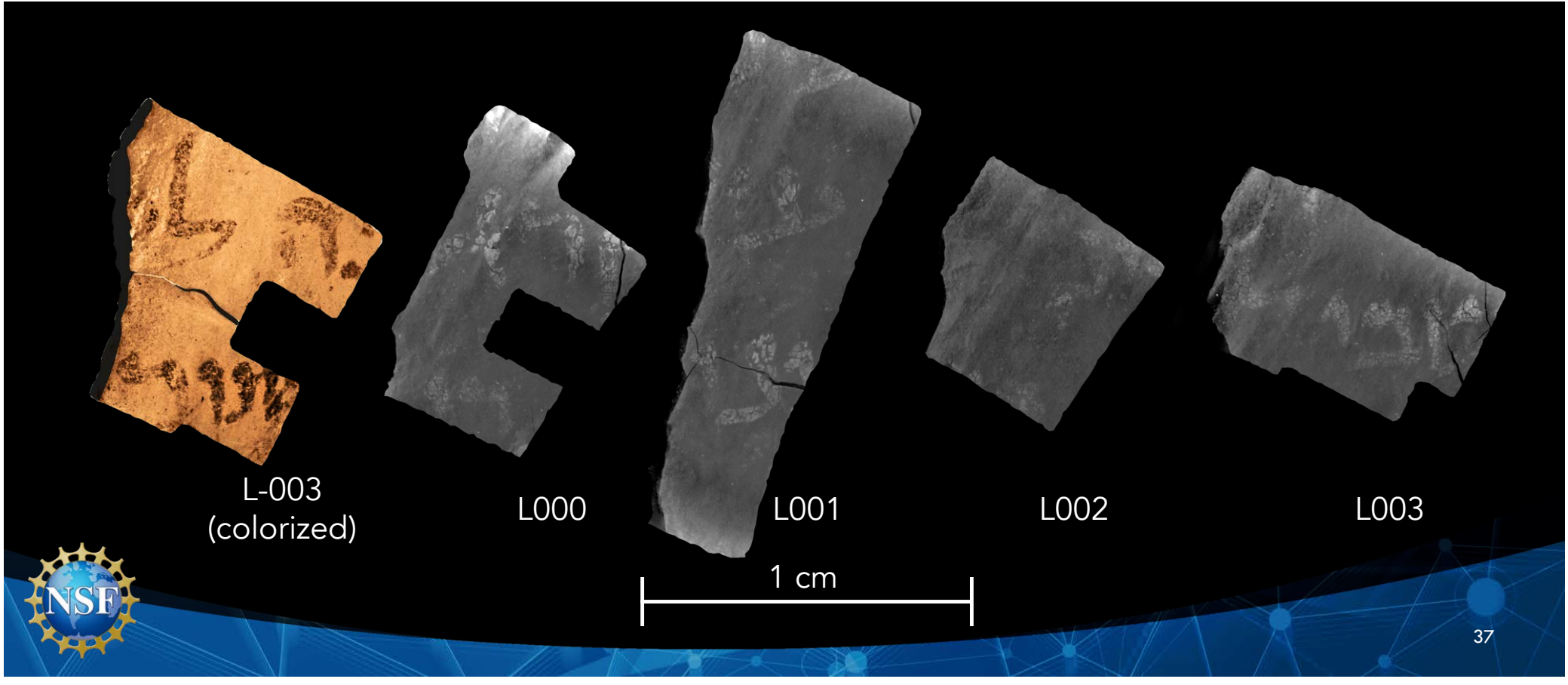
- Carbonized scrolls from archeological sites
- Locate and map 2D surfaces from a 3D object

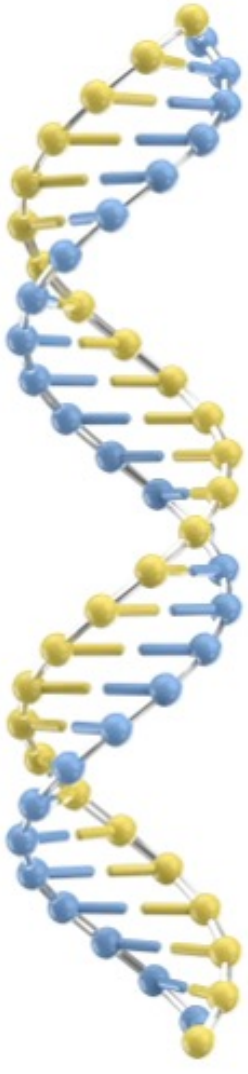


PI: Prof. Brent Seales

University of Kentucky

Computational Imaging and Heritage Science: How to read an ancient scroll without unrolling it?

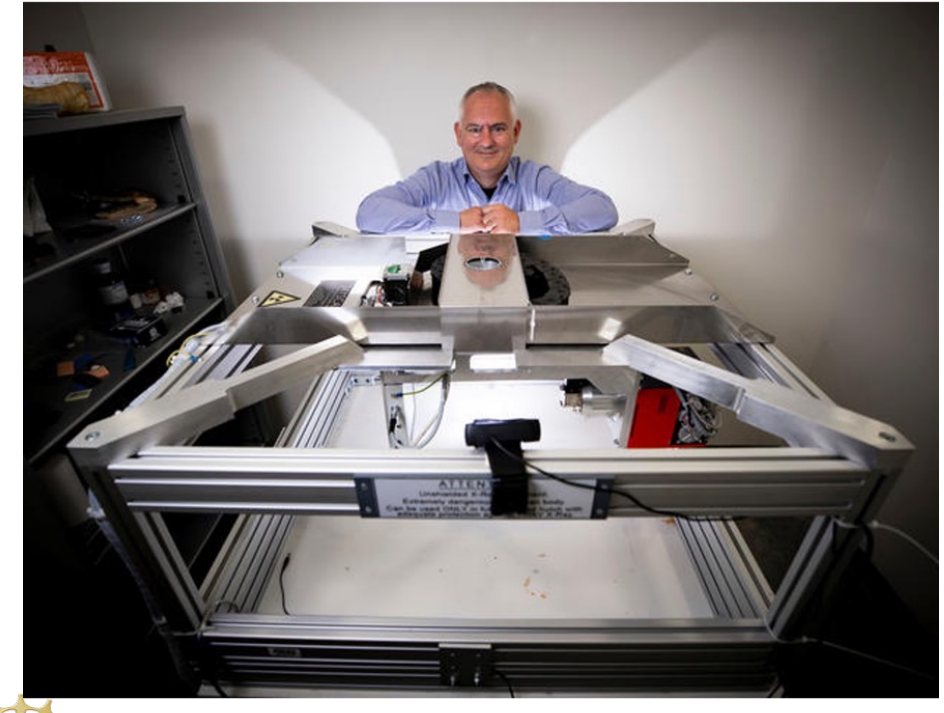




CURIOSITY-DRIVEN, DISCOVERY-BASED EXPLORATIONS

USE-INSPIRED, SOLUTIONS-FOCUSED INNOVATIONS

New Beginnings: NSF MSR-1 Infrastructure Support for Heritage Science at University of Kentucky



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SEARCH

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Awards

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- Recent Awards
- Presidential and Honorary Awards
- About Awards
- How to Manage Your Award
- Grant General Conditions
- Cooperative Agreement Conditions
- Special Conditions
- Federal Demonstration Partnership
- Policy Office Website

Award Abstract # 2131940
Mid-scale RI-1 (M1:IP): EduceLab: Infrastructure for Next-Generation Heritage Science

NSF Org:	IIS Div Of Information & Intelligent Systems
Awardee:	UNIVERSITY OF KENTUCKY
Initial Amendment Date:	September 20, 2021
Latest Amendment Date:	September 20, 2021
Award Number:	2131940
Award Instrument:	Continuing Grant
Program Manager:	Sylvia Spengler sspengle@nsf.gov (703)292-7347 IIS Div Of Information & Intelligent Systems CSE Direct For Computer & Info Scie & Enginr
Start Date:	October 1, 2021
End Date:	September 30, 2026 (Estimated)
Total Intended Award Amount:	$14,000,001.00

New Beginnings: Bouman 2021 NSF CAREER Awardee

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- Cooperative Agreement Conditions
- Special Conditions
- Federal Demonstration Partnership
- Policy Office Website

Award Abstract # 2048237
CAREER: Co-Optimized Sensing and Reconstruction for Next-Generation Computational Cameras

NSF Org:	CCF Division of Computing and Communication Foundations
Awardee:	CALIFORNIA INSTITUTE OF TECHNOLOGY
Initial Amendment Date:	January 8, 2021
Latest Amendment Date:	May 20, 2021
Award Number:	2048237
Award Instrument:	Continuing Grant
Program Manager:	Scott Acton sacton@nsf.gov (703)292-2124 CCF Division of Computing and Communication Foundations CSE Direct For Computer & Info Scie & Enginr
Start Date:	April 1, 2021
End Date:	March 31, 2026 (Estimated)
Total Intended Award Amount:	$560,000.00
Total Awarded Amount to Date:	$219,318.00
Funds Obligated to Date:	FY 2021 = $219,318.00


NSF

How Can We Improve Quality of Life?

Arthur Lupia, Assistant Director
Social, Behavioral and Economic Sciences Directorate


SBE
CISE
ENG
GEO
MPS
BIO
EHR
NSF


Social
Behavioral
& Economic
Sciences

S - BE THE SOLUTION

BE THE SOLUTION

Empowering People From Bengal to Boston

A Large-Scale Experiment

- Researchers sent a video-text to 25M randomly selected cell phones in regions of West Bengal.
- In the video, Nobelist Abhijit Banerjee explains how to reduce COVID spread.
- Videos corresponded to **doubling health symptom reporting**.

(Abhijit Banerjee, Marcella Alsan, Emily Breza, et al 2020. *National Bureau of Economic Research*)

Partnership
(Harvard, MIT, Mass General, & more)

- Randomized clinical trial of 18,223 US adults.

- Key Variations:
  - Treatment. **Varying race and gender** of doctor in COVID-19 health video.
  - Control: Placebo video on generic health topic.

Findings

- Doctor videos
  - increased knowledge,
  - and self-protective behaviors.

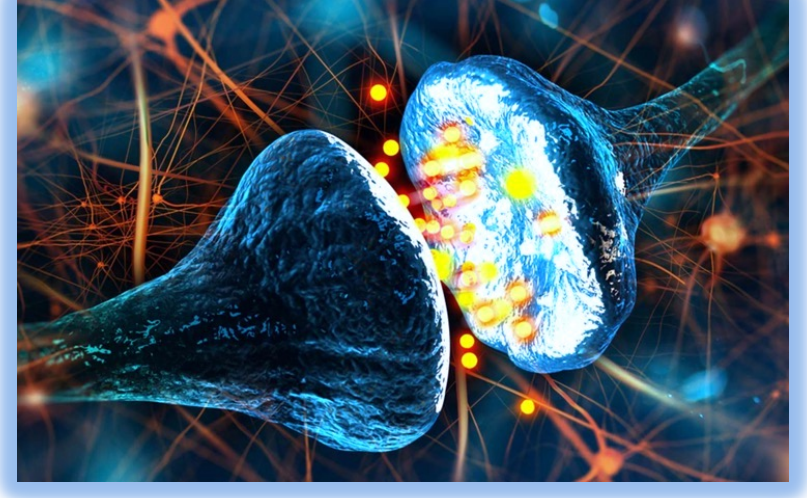
- **Doctor credibility outweighed the other factors**
  - **and improved outcomes.**

(Torres, Ogbu-Nwobodo, Alsan, et al 2021. *J. Am. Medical Assoc. Netw Open*)

Brain Power Opens New Doors


Harness
Control cable
Terminal device
Socket
Wrist

The Advance



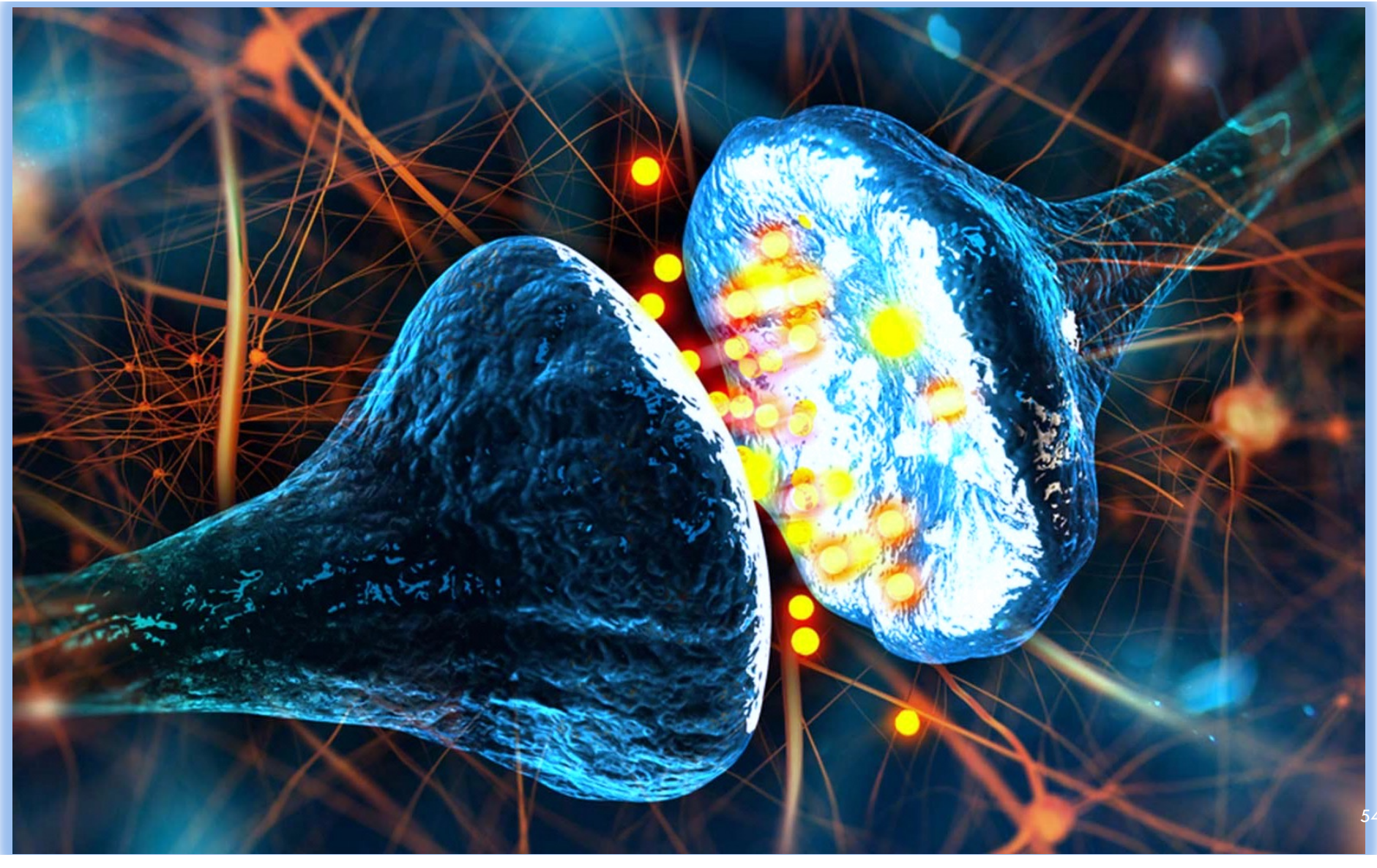


Image credit: Macrin Szczepanski/University of Michigan

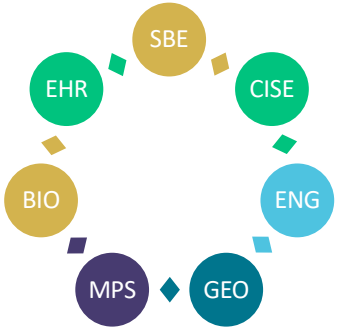
Key Finding

(Cynthia A. Chestek et al. 2021, *Neuron*)

- "Real-time machine learning that can drive an index finger on a prosthesis separately from the middle, ring, or small finger."
  - Chestek, PI.

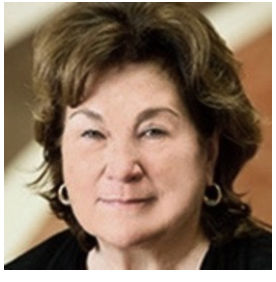
- We are now closer to
  - **real-time control** over advanced prostheses
  - or even their own hands.

Translation, Innovation, and Partnerships



Be the Solution

Thank You, Skip and Suzi!



2021 Was a Great Year, Despite the Challenges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