

# EHR

DIRECTORATE FOR  
EDUCATION & HUMAN RESOURCES



# **NSF Dear Colleague Letter 21-033: Advancing Quantum Education and Workforce Development**

Webinar #3  
August 27, 2021

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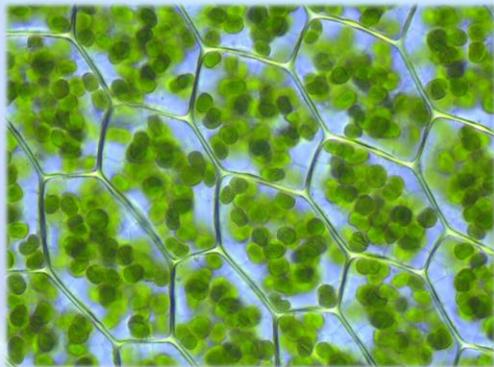
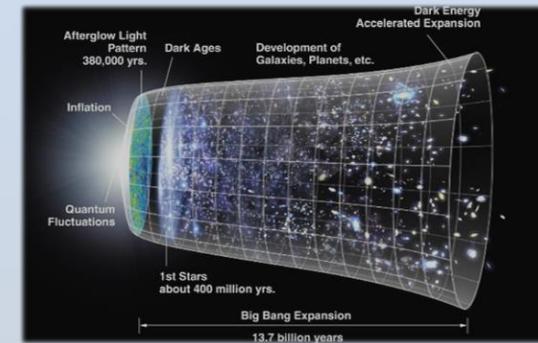
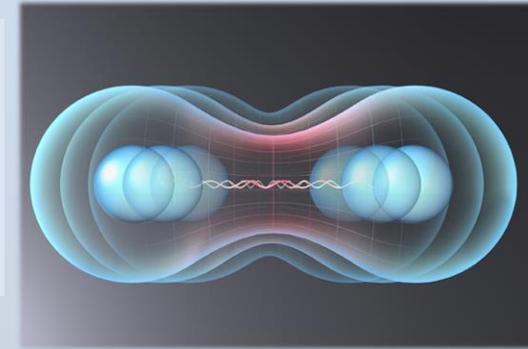


# Outline

- **NSF Approach to QISE** (by Dr. Tomasz Durakiewicz)
- **Advancing Informal STEM Learning (AISL)** (by Dr. Julie Johnson)
- **CyberCorps Scholarship for Service (SFS) and Secure and Trustworthy Cyberspace Program (SaTC-EDU)** (by Dr. Victor Piotrowski)
- **Graduate Research Fellowship Program (GRFP)** (by Dr. Christopher Hill)
- **Innovations in Graduate Education (IGE)** (by Dr. Daniel Denecke)
- **Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES)** (by Dr. Tori Smith)
- **Research on Emerging Technologies for Teaching and Learning (RETTL)**  
(by Dr. Amy Baylor)
- **Q & A**

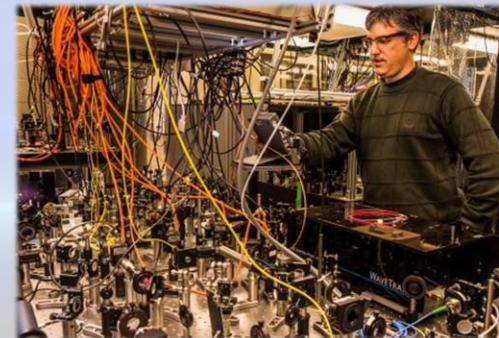
# Quantum Leap : Asking Ambitious Questions

Q1: Are there fundamental limits to how far we can push the **entanglement and coherence** frontiers for quantum states? Are there limits in time, distance, or scale?



Q2: What can we learn from quantum phenomena in **naturally-occurring and engineered quantum systems**, including emergent behavior, complexity, quantum-classical boundaries, and their theoretical foundations?

Q3: How do we galvanize the science and engineering **community** to enable quantum devices, systems, and technologies that **surpass classical** capabilities?

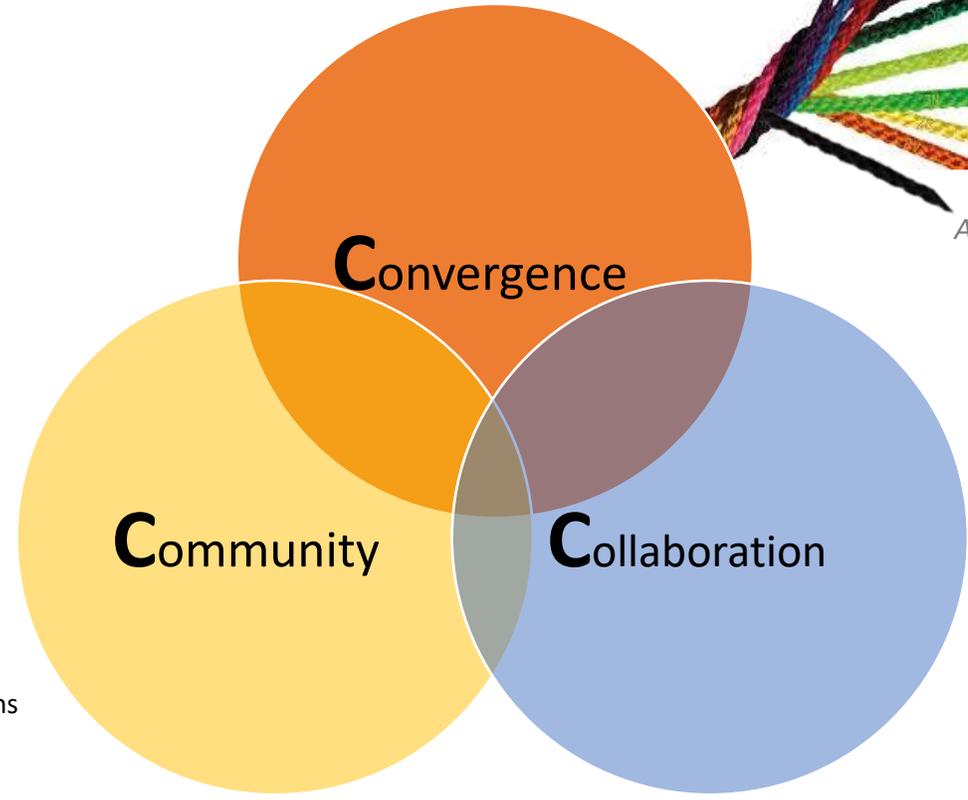


# Our Approach

Physics  
Chemistry  
Astronomy  
Mathematics  
Materials

Electrical, Communications and Cyber Systems  
Industrial Innovation & Partnerships  
Education and Workforce  
Information and Intelligent Systems  
Computing and Communication Foundations  
Computer and Networked Systems  
Advanced Cyberinfrastructure

## The 3 C's

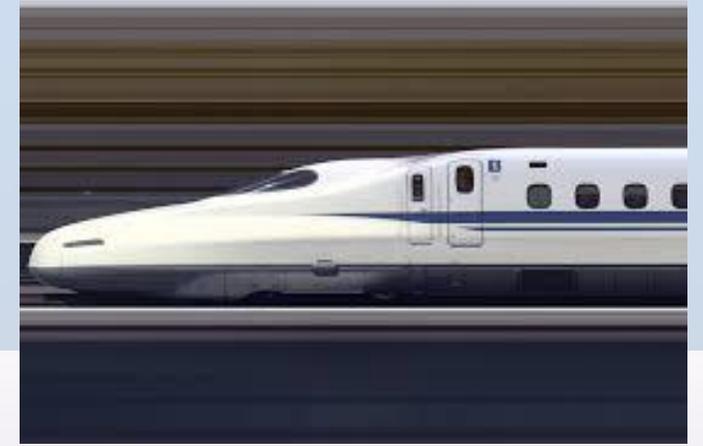


$$\left| \text{Quantum Workforce} \right\rangle = c_1 \left| \begin{array}{c} \text{Materials} \\ \text{Researchers \&} \\ \text{Chemists} \end{array} \right\rangle + c_2 \left| \begin{array}{c} \text{Engineers} \end{array} \right\rangle + c_3 \left| \begin{array}{c} \text{Physicists} \end{array} \right\rangle + c_4 \left| \begin{array}{c} \text{Mathematicians} \\ \text{\& Computer} \\ \text{Scientists} \end{array} \right\rangle$$





# All-of-Government Approach: WORKFORCE, EDUCATION AND BROADENING PARTICIPATION



## Creating a quantum-smart workforce for tomorrow

**Building Quantum Intuition:** Quantum intuition is the ability to intuitively differentiate between quantum and classical worlds at the very basic level. **LOWERING THE BARRIERS**

**Industry - academia partnerships:** recognize required skills and nature of the content specific training that is needed for a diverse workforce. **EFFICIENCY**

**Enhancing curricula in all levels of education:** early and continued engagement in STEM fields, particularly for underrepresented groups in STEM such as underrepresented minorities and women, is a key factor in retaining and mitigating attrition as students advance to higher grade levels. **INCLUSION AS OPPORTUNITY**

**Interdisciplinary programs:** mathematical algorithms need to be devised, circuit implementations need to be designed, device function needs to be well understood, devices need to be implemented in functional materials, the local environment needs to be controlled, and structural materials are needed to hold everything together. **CONVERGENCE**

**Estimating and tracking future workforce needs:** continuing assessment of specific requirements for workforce is vital, especially in a rapidly evolving landscape of workforce needs. **ASSESSMENT**

**Government Programs to enhance QIS-ready workforce:** supportive of workforce generation goals, with focused efforts undertaken in collaborative mode **LEVERAGE**

### Funding Opportunities for K-12 Education

- [Computer Science for All \(CSforAll: Research and RPPs\)](#) **\$20M**
- [Discovery Research PreK-12 \(DRK-12\)](#) **\$64M**
- [Innovative Technology Experiences for Students and Teachers \(ITEST\)](#) **\$30M**
- [Robert Noyce Teacher Scholarship Program \(NOYCE\)](#) **\$58M**

### Funding Opportunities for Undergraduate Programs

- [Advanced Technological Education Program \(ATE\)](#) **\$66M**
- [Hispanic Serving Institutions Program \(HSI\)](#) **\$11M**
- [Historically Black Colleges and Universities - Undergraduate Program \(HBCU-UP\)](#) **\$55M**
- [Improving Undergraduate STEM Education Program \(IUSE\)](#) **\$63M**
- [Scholarships in STEM Program \(S-STEM\)](#) **\$95M**
- [The Louis Stokes Alliances for Minority Participation \(LSAMP\)](#) **\$10M**
- [The Centers of Research Excellence in Science and Technology \(CREST\)](#) **\$20M**
- [Tribal Colleges and Universities Program \(TCUP\)](#) **\$12M**

### Funding Opportunities for Graduate Programs

- [Alliances for Graduate Education and the Professoriate \(AGEP\) program](#) **\$8M**
- [Innovations in Graduate Education \(IGE\) Program](#) **\$4M**
- [NSF Research Traineeship \(NRT\) Program](#) **\$55M**

### Funding Opportunities for All Educational Levels

- [Advancing Informal STEM Learning \(AISL\)](#) **\$39M**
- [EHR Core Research \(ECR\)](#) **\$35M**
- [NSF INCLUDES](#) **\$20M**
- [Research on Emerging Technologies for Teaching and Learning \(RETTL\)](#) **\$19M**
- [Secure and Trustworthy Cyberspace \(SaTC\)](#) **\$69M**

Dear Colleague Letter: Advancing Quantum Education and Workforce Development, NSF 21-033





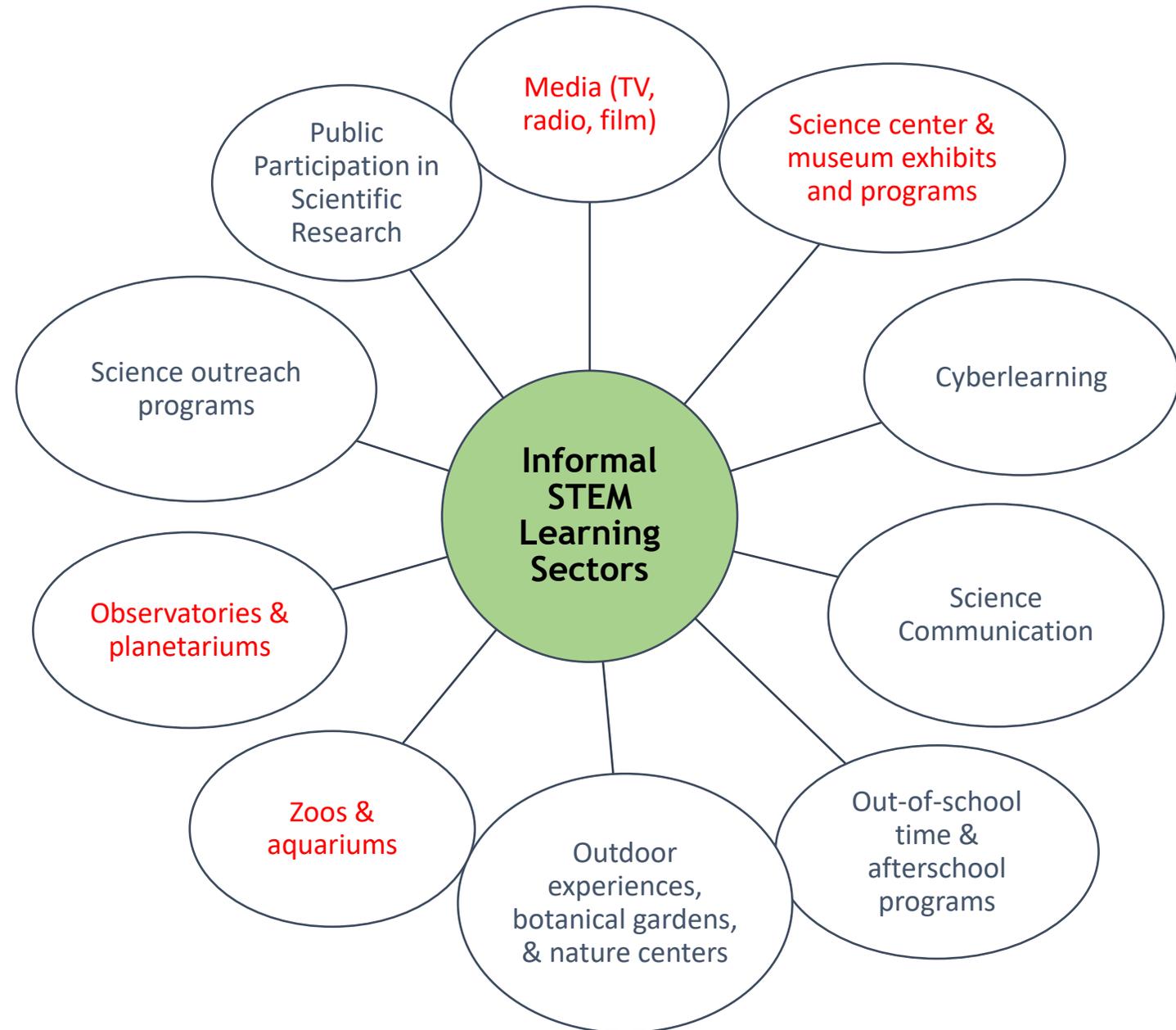
# The Advancing Informal STEM Learning (AISL) Program

Julie I. Johnson, Ph.D.

Program Officer, Division of Research on Learning

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## The Landscape for Informal STEM Learning

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The AISL program seeks to advance *new approaches to and evidence-based* understanding of the design and development of STEM learning opportunities for the public in informal environments; provide *multiple pathways for broadening access to and engagement in* STEM learning experiences; advance *innovative research on and assessment* of STEM learning in informal environments; and *engage the public of all ages* in learning STEM in informal environments.

**Current Solicitation: NSF 21-599**

**Submission deadline: January 18, 2022**

**All proposals must be submitted using**

**[Research.gov](https://www.nsf.gov) or [Grants.gov](https://www.nsf.gov)**

[https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504793](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504793)

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## AISL Program

- ❖ **Advancing** – Innovative projects that advance the field through building knowledge via innovative approaches and research.
- ❖ **Informal** – Learning that is lifelong, life wide, & life deep. Learning that occurs outside formal schooling systems.
- ❖ **STEM** – Not just focused on science; includes all disciplines funded across NSF.
- ❖ **Learning** – Learning outcomes typically include: interest, engagement, motivation, behavior, identity, persistence, understanding, awareness, knowledge, use of STEM content and practices, and 21st century skills.



# AISL Program - Options

## Project Types

Pilot/Feasibility Studies

Research in Service to Practice

Innovations in Development

Broad Implementation

Literature Reviews, Syntheses, or Meta-analyses

Conference

## Funding Levels

Up to \$300,000

\$300,000 - \$2M

\$500,000 - \$3M

\$1M - \$3M

Up to \$250,000

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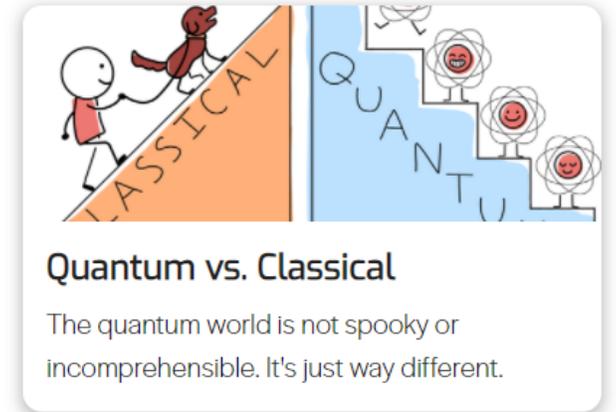
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## Examples from the AISL Program

### ➤ 1713387, **The Quantum Atlas: A Visual Guide to an Unseen World**

Project goals: (1) to make 21<sup>st</sup> century quantum science comprehensible and engaging to non-expert adult learners and (2) to increase our knowledge about the public's perception and understanding of quantum physics. <https://quantumatlas.umd.edu/>

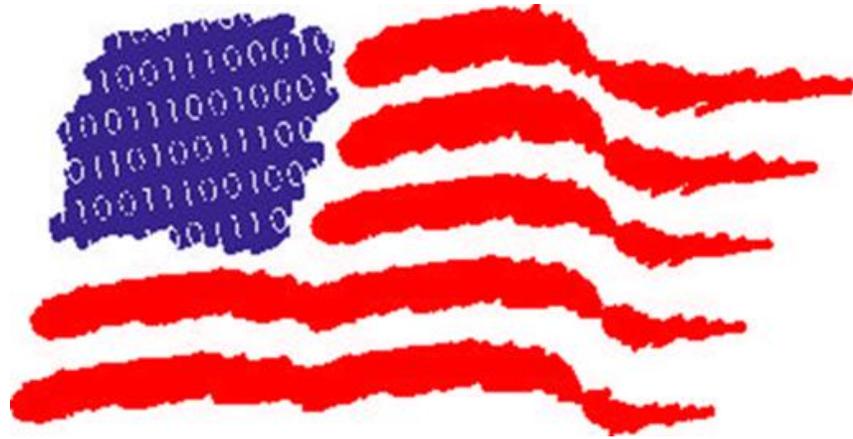


### ➤ 2115780/5843, **Building Quantum Information Science Intuition through Digital Games**

Project goal: to create a suite of accessible, engaging digital games for middle schoolers, and study their effectiveness in cultivating intuition around quantum information science.



# NSF Programs in Cybersecurity Education and Workforce Development



CyberCorps®  
Scholarship For Service (SFS)



Dr. Victor Piotrowski, Lead Program Director  
National Science Foundation



# Secure and Trustworthy Cyberspace (SaTC)

*NSF 21-500 – No deadline, submit anytime*

- Welcomes proposals that address cybersecurity and privacy and draw on expertise in one or more of these areas: computing, communication and information sciences; engineering; education; mathematics; statistics; and social, behavioral, and economic sciences.
- Proposals must be submitted to one of the following designations:
- **CORE:** This designation is the main focus of the SaTC research program, spanning the interests of NSF's Directorates for Computer and Information Science and Engineering (CISE), Engineering (ENG), Mathematical and Physical Sciences (MPS), and Social, Behavioral and Economic Sciences (SBE).
- **EDU: The Education (EDU) designation will be used to label proposals focusing entirely on cybersecurity education.**
- **TTP:** The Transition to Practice (TTP) designation will be used to label proposals that are focused exclusively on transitioning existing research results to practice.



## NSF Secure and Trustworthy Cyberspace (SaTC) -- Education Designation

*NSF 21-500 (No Deadline)*

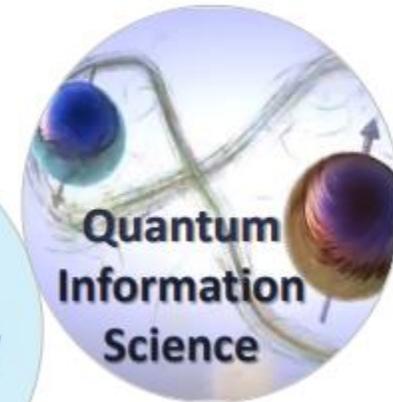
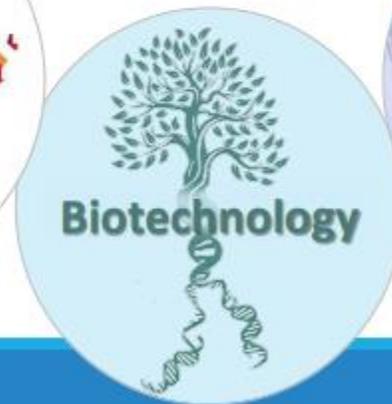
- Increase the capacity of US education enterprise to produce professionals in cybersecurity including:
  - Evaluate effectiveness of curricula, competition, games, and other outreach activities
  - Integrate research experiences into cybersecurity degree programs.
  - Develop effective evidence-based curricular and co-curricular activities at K-12, undergraduate and graduate levels
- More than 100 **active** awards with a total budget of \$31M



# SaTC-EDU and Industries of the Future

- Develop educational approaches to foster industry-relevant skills for cybersecurity jobs of the future.
- **FY2021:** Building educational capacity and curricular recommendations for AI in Cybersecurity and Cybersecurity and Privacy of AI.

“The Industries of the Future are cross-cutting, convergent, and interdependent fields of research that collectively offer enormous economic potential and are critical to the Nation’s long-term economic and national security.” *NSF Director France Córdova*





# Cybersecurity Education in the Age of AI

- [NSF Dear Colleague Letter \(DCL\) NSF 20-072](#) jointly published by Education (EHR) and Computing (CISE) Directorates
  - the interplay between AI, machine learning, and cybersecurity
  - partnerships between AI researchers, cybersecurity researchers, and education researchers in order to inspire novel education and outreach efforts
  - workforce with integrated AI and cybersecurity competencies
  - informed public that understands the privacy, confidentiality, ethics, safety, and security implications of AI.
  - 34 EAGER projects funded by EHR and CISE from 2020-2021





# CyberCorps<sup>®</sup>: Scholarship for Service (SFS) Program

*NSF 21-580 – Deadline: July 15, 2022*



- Aligns with U.S. strategy to develop a superior cybersecurity workforce.
- Grant awards to institutions of higher education to provide scholarships to undergraduate and graduate students pursuing cybersecurity.
- After graduation, scholarship recipients are required to work for a federal, state, local, or tribal government organization in a cybersecurity-related position for a period equal to the length of their scholarship.
- More than 150 **active** awards with a total budget of \$281M



# CyberCorps<sup>®</sup>: Scholarship for Service (SFS) Program

## SUPPORT

- Funding: full tuition plus stipends \$25K/\$34K and professional development \$6K per year, up to 3 years
- Obligation: Summer internship and post-graduation service requirement (work in a government agency for a period equal to the scholarship length)

## IMPACT

- 4,040 SFS scholarship recipients (since 2001)
- Placed in 357 government organizations
- B.S. (35%), M.S. (62%), Ph.D. (3%)
- Female (25%), data collection since 2013
- Placement rate 95%



# Graduate Research Fellowship Program (GRFP)

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Education and Human Resources (EHR)  
Division of Graduate Education (DGE)

## Presenters

Narcrisha Norman, Ph.D., Program Director  
Christopher L. Hill, Ph.D., Program Director



[www.nsf.gov/grfp](http://www.nsf.gov/grfp)  
[info@nsfgrfp.org](mailto:info@nsfgrfp.org)  
[www.nsfgrfp.org](http://www.nsfgrfp.org)

# ABOUT NSF GRFP

SINCE 1952



**40+ FELLOWS**  
HAVE GONE ON TO BECOME  
NOBEL LAUREATES

FELLOW FROM/IN EVERY STATE

**450+ FELLOWS**  
HAVE BECOME MEMBERS OF THE  
NATIONAL ACADEMY OF SCIENCES



## Submit Early

### OPEN TO:

GRADUATE STUDENTS WHO  
ARE OR WILL BE PURSUING  
RESEARCH-BASED MASTER'S  
AND DOCTORAL DEGREES  
In Eligible Fields of Study

[nsfgrfp.org](https://www.nsfgrfp.org)

DECISION  
TREE

FORMAT  
COMPLIANCE  
CHECK

## ELIGIBLE MAJOR FIELDS OF STUDY



CHEMISTRY



COMPUTER AND  
INFORMATION  
SCIENCES &  
ENGINEERING



ENGINEERING



GEOSCIENCES



LIFE  
SCIENCES



MATERIALS  
RESEARCH



MATHEMATICAL  
SCIENCES



PHYSICS &  
ASTRONOMY



PSYCHOLOGY



SOCIAL  
SCIENCES



STEM EDUCATION & LEARNING RESEARCH

MAJOR FIELDS HAVE SUB-FIELDS

# GRFP

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Personal profile, education, and work experience

## Application Components

Graduate research plan (2 pages)

Personal, relevant background and future goals statement (3 pages)

Transcripts

Two to three letters of reference



# NSF GRFP APPLICATION PROCESS

## IMPORTANT DATES

All applications are due at 5:00 p.m. local time, as determined by the applicant's mailing address.



### Application Deadlines - October and dependent on the applicants Major Field of Study

- Monday October 18, 2021 – Life Science
- Tuesday October 19, 2021 - Computer and information Science and Engineering | Material Research | Psychology | Social Sciences | STEM Education and Learning
- Wednesday October 21, 2021 – Engineering
- Thursday October 22, 2021 – Chemistry | Geosciences | Mathematical Sciences | Physics and Astronomy

### ALL APPLICATIONS MUST INCLUDE:



- TRANSCRIPTS**  
Transcripts are **REQUIRED** for all degree-granting programs listed.



- STATEMENTS**  
GRFP applicants are required to provide two statements: a Personal Statement and Graduate Research Plan Statement

- REFERENCE LETTERS**  
Two letters are required. Three letters are recommended.





## Reference Writers

Requirements

Reference Writer Tutorial

FAQs

Tips

## Reference Writers

Reference letters are a key component of a strong application package. The most effective reference letters provide detailed and specific information about how an applicant meets the NSF Merit Review Criteria of Intellectual Merit and Broader Impacts.

The reference letter should include comments on the applicant's potential for contributing to a globally-engaged United States science and engineering workforce, statements about the applicant's academic potential and prior research experiences, statements about the applicant's proposed research, and any other information to enable reviewers to evaluate the application according to the NSF Merit Review Criteria.

Once the applicant completes the appropriate section of their GRFP application, reference writers will receive an email detailing the requirements for the letter and the process of submission. All reference letters must be submitted online via the GRFP Module and received by the deadline for the current competition.

**Can say things about the applicant they may not necessarily say about themselves**

[https://www.nsfgrfp.org/reference\\_writers](https://www.nsfgrfp.org/reference_writers)



## Reviewers

Why Serve

Who Can Serve

Review Process

Timeline

Registration

FAQs

## Reviewers

NSF welcomes scientists and engineers to evaluate the current competition's applications each year during the annual GRFP review process. Serving as a GRFP Reviewer is an excellent opportunity to apply your research and career expertise to help identify future science and engineering leaders, and to gain valuable perspective to share with faculty and students at your institution. GRFP recognizes and supports outstanding graduate students pursuing research-based masters and doctoral degrees in science or engineering at accredited US institutions. See the [GRF Program Solicitation](#) for more details on GRFP. NSF seeks GRFP panels composed of researchers and educators from a wide range of institutions, geographic locations, and disciplinary and interdisciplinary backgrounds.

<https://www.nsfgrfp.org/reviewers>



# Graduate Research Fellowship Program (GRFP)

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Division of Graduate Education

[www.nsf.gov/grfp](http://www.nsf.gov/grfp)

[info@nsfgrfp.org](mailto:info@nsfgrfp.org)

[www.nsfgrfp.org](http://www.nsfgrfp.org)



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# NSF Innovations in Graduate Education (IGE) Program

## Program Solicitation, [NSF 20-595](#)

- IGE Project Awards:
  - 6 to 10 awards anticipated in FY 2022 expected to be up to three (3) years in duration with a total budget between \$300,000 and \$500,000.
- Proposals due: **March 25, 2022**  
March 25, Annually Thereafter

IGE Program Directors

Daniel Denecke  
[ddenecke@nsf.gov](mailto:ddenecke@nsf.gov)

Vinod Lohani  
[vlohani@nsf.gov](mailto:vlohani@nsf.gov)

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# NSF Innovations in Graduate Education (IGE) Program

## Program Goals

- Pilot, test and validate innovative approaches to graduate education
- Generate knowledge required to customize, implement and encourage broader adoption of these approaches

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# Strategic Framework for NSF Investments in Graduate Education

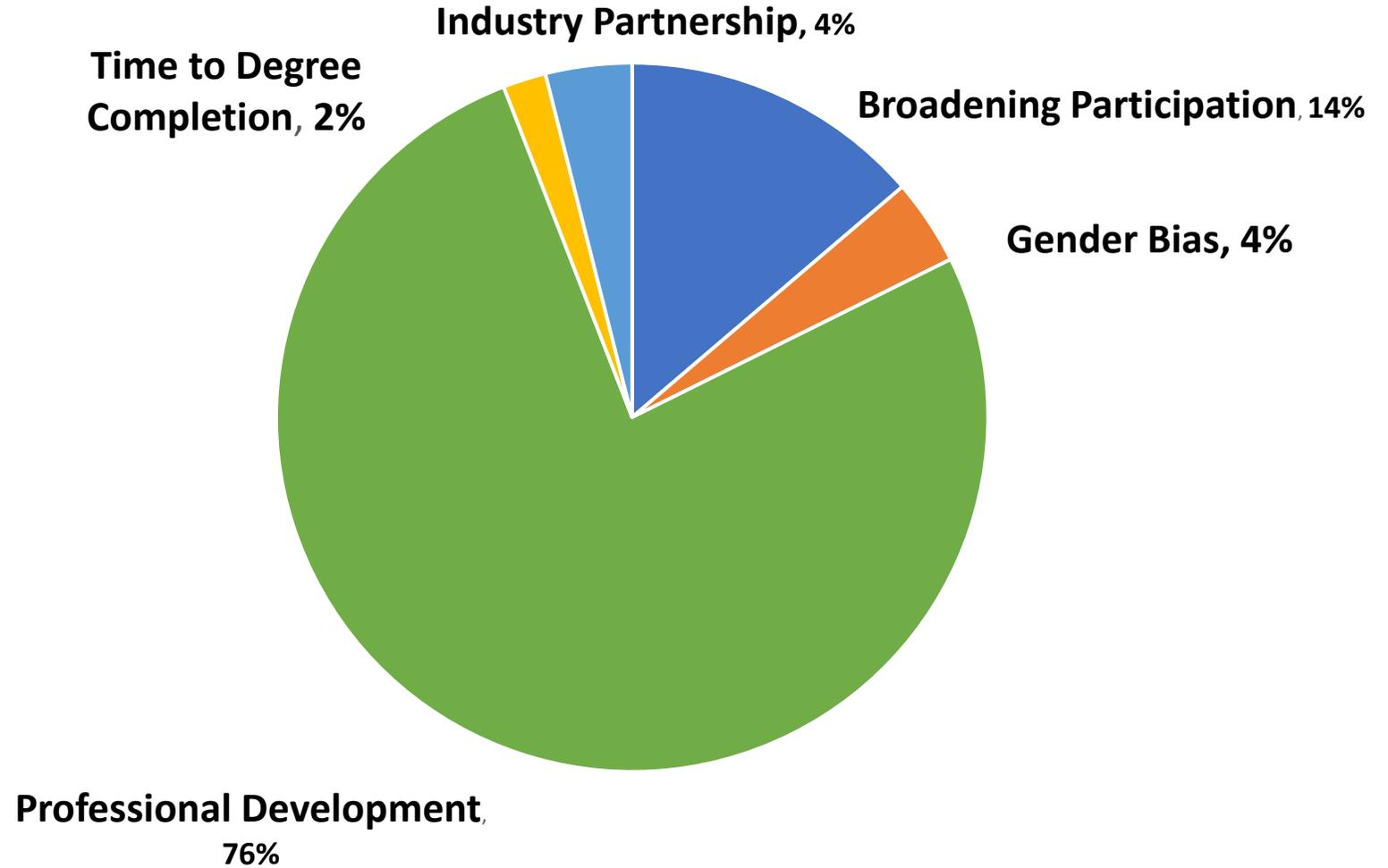
- Advance Science and Engineering (S&E) Research
- Broaden Participation to Promote Excellence in Research and Build the Next Generation STEM Workforce
- Build Effective Models of Graduate Education and Workforce Development

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## IGE Projects Research Topics



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IGE Program Directors

Daniel Denecke  
[ddenecke@nsf.gov](mailto:ddenecke@nsf.gov)

Vinod Lohani  
[vlohani@nsf.gov](mailto:vlohani@nsf.gov)

## **Example Project: University of Connecticut, “Encouraging the Participation of Neurodiverse Students in STEM Graduate Programs to Radically Enhance the Creativity of the Professional Workforce”**

Will generate knowledge about effective approaches to support participation of neurodiverse students in graduate education through:

- A Strength Profile Reporting instrument in which neurodiverse graduate students identify their strengths and challenges.
- A peer connection system and public Reddit platform
- Writing support for students
- Workshops with industry leaders

### **Research:**

- Data from an integrated research plan and evaluation will generate knowledge for scale-up and inform future enhancements of STEM graduate education.
- Research on the efficacy of evidence-based interventions inspired by the framework of positive psychology will inform development of an inclusive graduate education environment.

# NSF INCLUDES

*Inclusion Across the Nation of Communities of Learners of  
Underrepresented Discoverers  
in Engineering and Science*



Dr. Tori Rhoulac Smith  
Program Director  
Division of Human Resource Development



NSF INCLUDES  
Five Design  
Elements of  
Collaborative  
Infrastructure



*Engage the community in a shared vision*



*Provide a platform for collaborative action*



*Allow for evidence-based decision making*



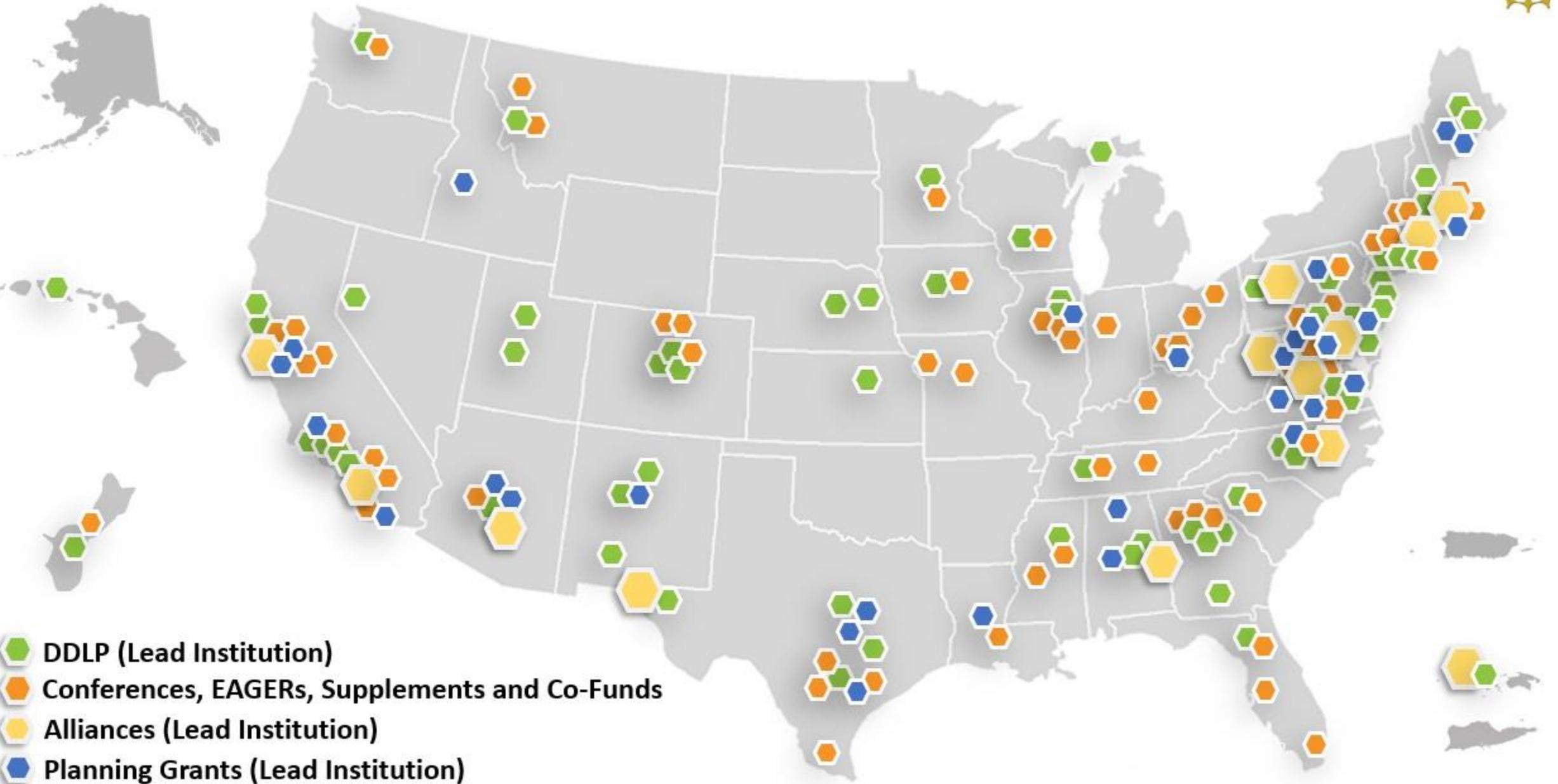
*Build capacity for leadership and communication*



*Generate more partnerships, more connections, greater impact*



# NSF INCLUDES National Network



-  DDLP (Lead Institution)
-  Conferences, EAGERs, Supplements and Co-Funds
-  Alliances (Lead Institution)
-  Planning Grants (Lead Institution)



# Welcome to the NSF INCLUDES Alliances



Diverse STEM faculty;  
Inclusive STEM teaching



Hispanic representation  
in computing



STEM success for  
rural, first-generation  
college students



Graduate students  
in the physical  
sciences



Accelerated math  
for community  
college students



Engagement in coastal  
geoscience in Island  
communities



STEM education for the  
incarcerated and  
formerly incarcerated



Equity in college  
admissions

AIICE

Identity-inclusive  
strategies in  
computing

ALRISE

Latinx representation  
in STEM; institutional  
intentionality;  
experiential learning

ENGINEERING  
PLUS

Underrepresented  
students in  
engineering

NATIVE FEWS

Indigenous participation  
in STEM; Food-Energy-  
Water Systems

TAPDINTO-STEM

Students with  
disabilities



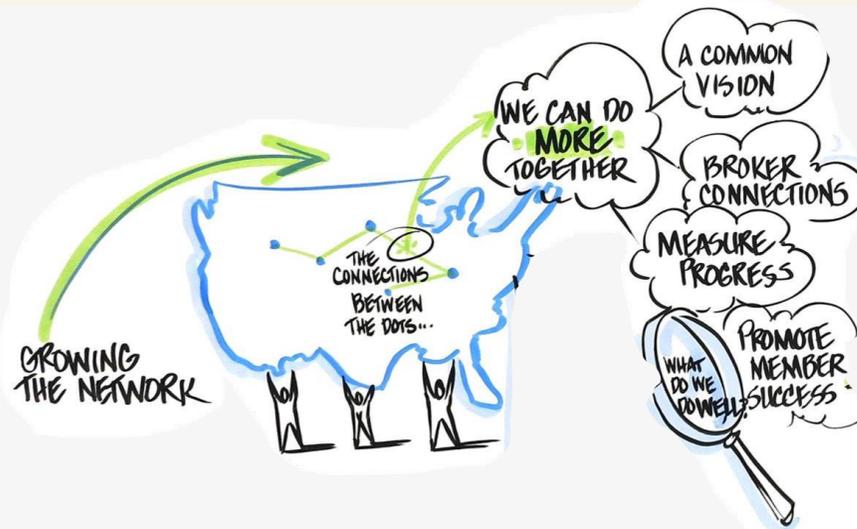
# NSF INCLUDES Coordination Hub

**Communication  
and Network  
Visibility**



The NSF INCLUDES Coordination Hub **leads, supports, and amplifies** the NSF INCLUDES National Network, which aims to accelerate progress towards diversifying the U.S. STEM workforce.

**Network Expansion  
and Diversification**

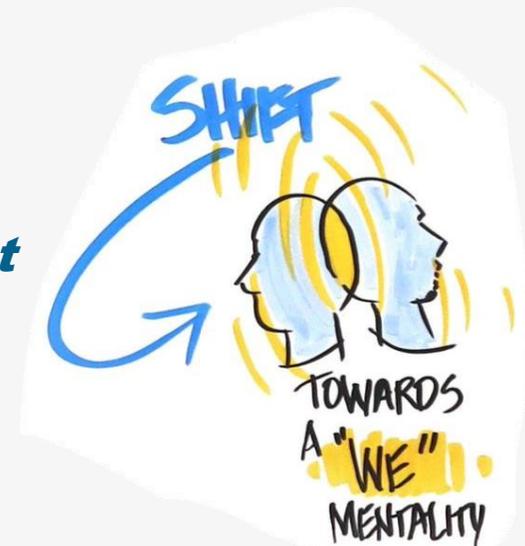


**Network Engagement  
and Capacity Building**

**Shared Measurement  
and Strategic Learning**



**Knowledge  
Development  
and Sharing**



[www.INCLUDESNetwork.org](http://www.INCLUDESNetwork.org)

# ALLIANCES

Solicitation NSF 20-569

Up to \$10 million  
Up to 5 years

*Employing a **collaborative infrastructure** approach to address a critical **broadening participation** challenge in **STEM at scale**.*

## Letter of Intent Deadlines

October 5, 2020

October 4, 2021

## Full Proposal Deadlines

January 26, 2021

January 25, 2022

**Letters of Intent and Full Proposals are due by 5 p.m. submitter's local time.** A letter of intent is **required** for all proposal submissions and must be submitted via FastLane by the due dates listed on the solicitation.





# THANK YOU

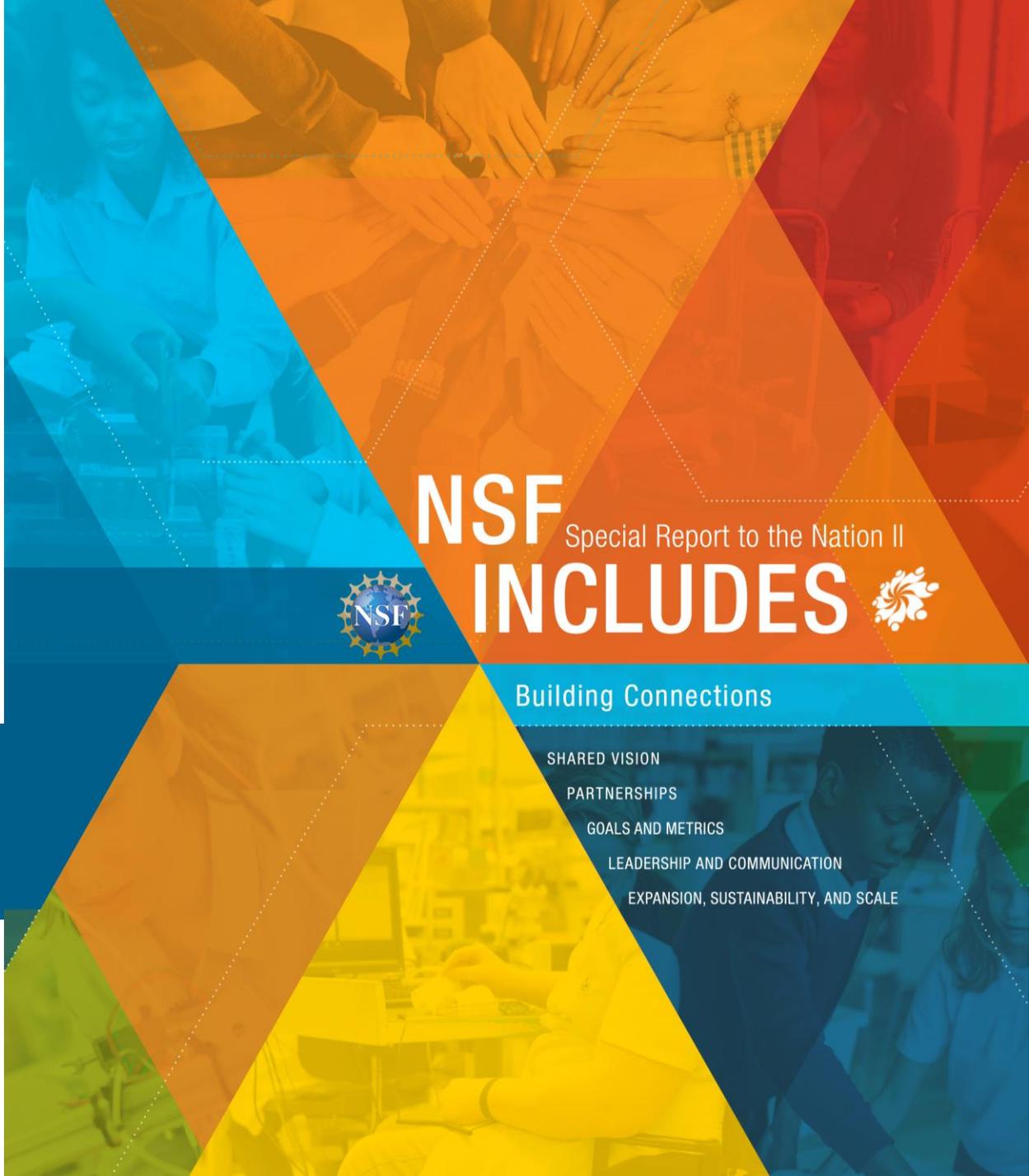
For more information...

[www.INCLUDESNetwork.org](http://www.INCLUDESNetwork.org)

NSF INCLUDES Alliances Solicitation  
Webpage

NSF INCLUDES Special Report  
to the Nation II

[NSFINCLUDES@nsf.gov](mailto:NSFINCLUDES@nsf.gov)



**NSF** Special Report to the Nation II  
**INCLUDES** 

Building Connections

- SHARED VISION
- PARTNERSHIPS
- GOALS AND METRICS
- LEADERSHIP AND COMMUNICATION
- EXPANSION, SUSTAINABILITY, AND SCALE





# NSF 20-612 Research on Emerging Technologies for Teaching and Learning (RETTL)

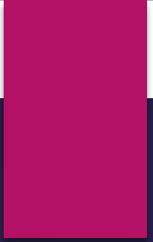
Amy Baylor, EHR Lead

# Overall Scope of RETTL

- ▶ \*The program **funds research in advanced learning technologies** in any content area with any participants and in any context
  - ▶ RETTL maintains the same spirit of the former Cyberlearning program
  - ▶ Includes a focus on Teaching
- ▶ \*A key requirement is that projects should be exploratory, experimental; those that are risky and potentially transformative are highly encouraged
- ▶ Projects should be highly interdisciplinary with team expertise in learning and computer science/engineering
  - ▶ RETTL is a cross-directorate program (EHR, CISE, SBE, ENG)
- ▶ Projects that advance broadening participation are encouraged

# Projects must have research innovations in **both** teaching/learning and technology

- ▶ Projects should have clear research objectives that integrate teaching/learning and technology.
- ▶ **RETL is unique to other NSF programs regarding the requirement for research advances in both areas.**
- ▶ **Teaching and/or learning innovation**
  - ▶ For teaching, this includes new teaching processes and approaches (e.g., andragogy and pedagogy), as integrated with the proposed technology in an educational setting,
  - ▶ For learning, this includes new learning processes, principles, and theories (e.g., cognitive, behavioral, affective, socio-cultural, social, epistemological, problem-based, project-based, developmental, and other perspectives) relevant for how the proposed technology will be situated in a learning setting, to include home, school, or workplace.
- ▶ **Technology innovation**
  - ▶ This includes new and emerging technologies within the teaching and learning context (e.g., AI-driven technologies; virtual, immersive, embodied, interactive, or augmented environments; multimodal modeling/sensing of cognitive or affective states; language and speech processing; learning analytics and dashboards; and robotics).
  - ▶ The technology innovation should advance fields involving computer science, information science, and/or engineering.



See NSF RETTL Program  
Page for FAQs

[https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504984](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504984)

# Questions and Discussion