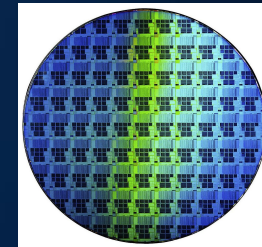**MICROELECTRONICS EDUCATION FUNDING OPPORTUNITIES (NSF 23-115)**

Webinar #2
August 8, 2023

Outline

- **Introduction to the DCL (NSF 23-115)** (by Dr. Abiodun Ilumoka)

- **Advancing Informal STEM Learning (AISL)** (by Lynn Tran)

- **Computer Science for All (CSforAll: Research and RPPs)** (by Dr. Fengfeng Ke)

- **Improving Undergraduate STEM Education: Hispanic Serving Institutions (HSI) Program**

  (by Mr. Michael Davis)

- **NSF Research Traineeship (NRT) Program (**by Dr. Vinod Lohani**)**

- **Innovations in Graduate Education (IGE) Program (**by Dr. Vinod Lohani**)**

- **Historically Black Colleges and Universities - Undergraduate Program (HBCU-UP)**

   (by Dr. Carleitta Paige-Anderson)

- **The Louis Stokes Alliances for Minority Participation (LSAMP)** (by Dr. Martha James)

- **Q & A**

Goal: Excite, motivate and prepare students for participation in the Microelectronics industry of the future in response to the CHIPS and Science Act of 2022 (CHIPS Act)

- US- based leaders in chip-manufacturing technology plan to ramp up domestic production of microchips
- Benefits include:

✔ reduce supply chain delays and risks for consumables;
✔ promote advanced manufacturing;
✔ improve the microchip manufacturing industrial base;
✔ galvanize chip design research;
✔ create and fill new jobs
✔ provide enduring economic and national security benefits

- But

✔ **Who will design and build the 5nm microchips of the future ?**
✔ **What are the educational needs at the undergraduate level?**
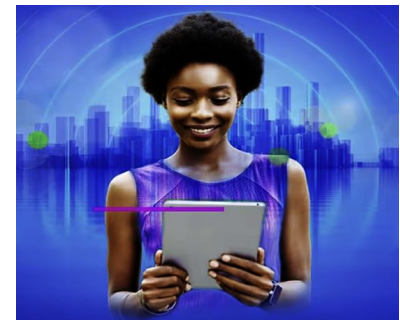
Deloitte Insights

Leveraging Existing NSF EDU Programs to Promote Microelectronics Education

1. Advanced Technological Education Program (ATE)
2. Advancing Informal STEM Learning (AISL)
3. Computer Science for All (CSforAll: Research and RPPs)
4. Discovery Research PreK-12 (DRK-12)
5. Improving Undergraduate STEM Education: Hispanic Serving Institutions (HSI) Program
6. Improving Undergraduate STEM Education Program (IUSE)
7. Innovative Technology Experiences for Students and Teachers (ITEST)
8. NSF's Eddie Bernice Johnson INCLUDES Initiative
9. NSF Research Traineeship (NRT) Program
10. Robert Noyce Teacher Scholarship Program (NOYCE)
11. EDU Core Research (ECR)
12. Historically Black Colleges and Universities - Undergraduate Program (HBCU-UP)
13. Innovations in Graduate Education (IGE) Program
14. Scholarships in STEM Program (S-STEM)
15. The Louis Stokes Alliances for Minority Participation (LSAMP)

**All Academic Levels
Pre-College, Undergraduate,
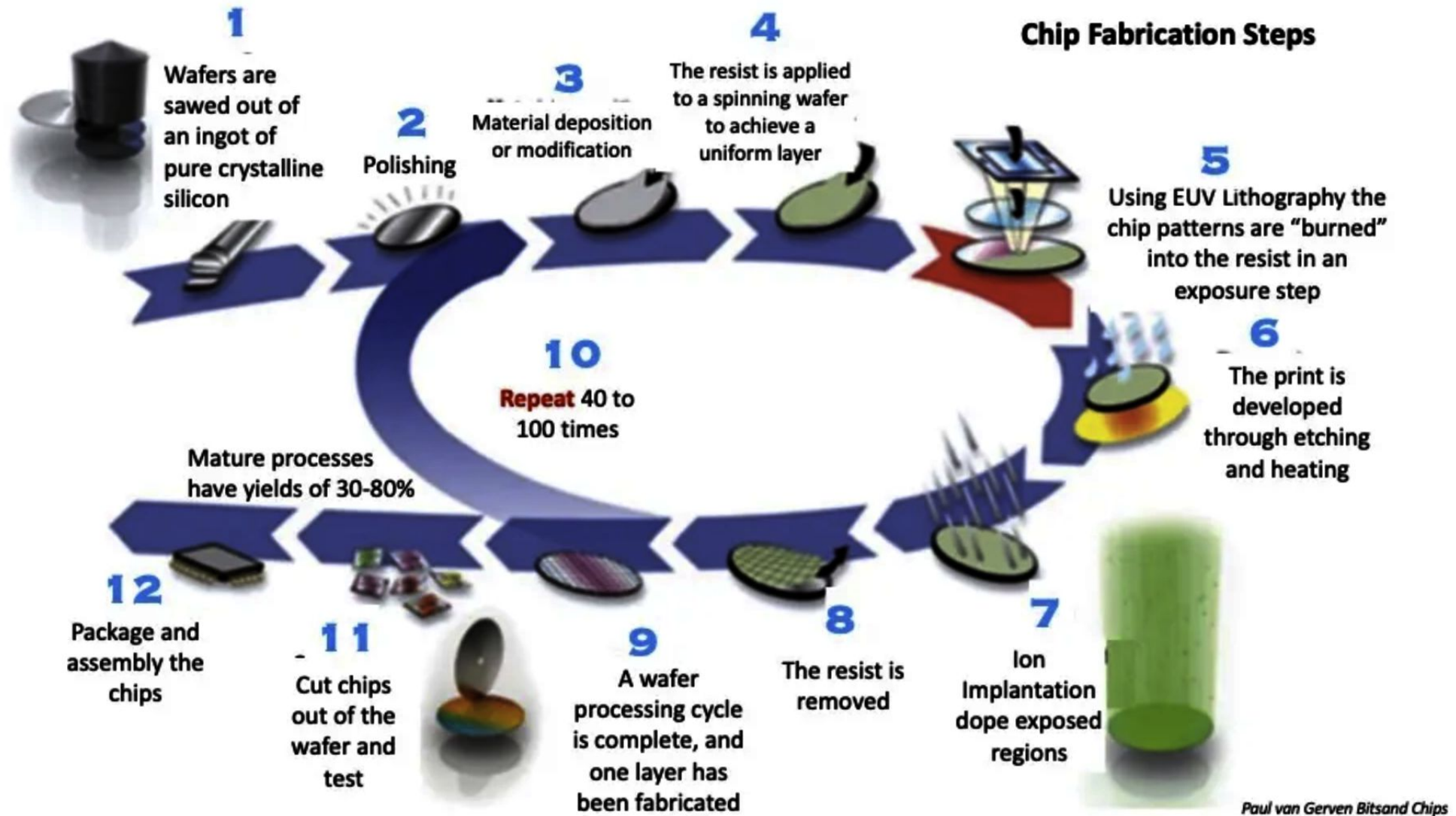Graduate
Formal, Informal**

NSF DCL
23-115

Microelectronics
Education
Funding
$$$$

Microelectronics Education – Challenges & Opportunities

- Human hair is approx 100,000nm wide (there are 25 million nanometers per inch)

- Feature sizes on today's chips less than 100nm, shrinking to 10nm-50nm

- AI-powered tools for chip design speed up design process exponentially

- You cannot see what you are making – design of 100 billion electronic devices on one square inch of chip area requires sophisticated software simulation tools and a fertile imagination!

- Microelectronics education requires ability to design, fabricate & test actual devices to verify performance

- Chip fabrication expensive – requires specialized clean rooms, equipment for photo-lithography, e-beam litho, chemical and materials processing and packaging

- Fabrication yields are appallingly low (<20%), multiple steps, many variables…

- Chip performance susceptible to 2nd order effects: RF noise, crosstalk, delay, heat, mechanical defects, etc.

- Chip performance characterization requires expensive specialized test & measurement equipment

Chip Fabrication Steps – Complex Process

Chip Fabrication Steps

1 Wafers are sawed out of an ingot of pure crystalline silicon

2 Polishing

3 Material deposition or modification

4 The resist is applied to a spinning wafer to achieve a uniform layer

5 Using EUV Lithography the chip patterns are "burned" into the resist in an exposure step

6 The print is developed through etching and heating

7 Ion Implantation dope exposed regions

8 The resist is removed

9 A wafer processing cycle is complete, and one layer has been fabricated

10 Repeat 40 to 100 times

Mature processes have yields of 30-80%

11 Cut chips out of the wafer and test

12 Package and assembly the chips

Paul van Gerven Bitsand Chips

DRL

Division of Research on Learning in Formal & Informal Settings (DRL)

INVESTS in the improvement of STEM learning for people of all ages by promoting innovative research, development, and evaluation of learning and teaching across all STEM disciplines in formal and informal learning settings.
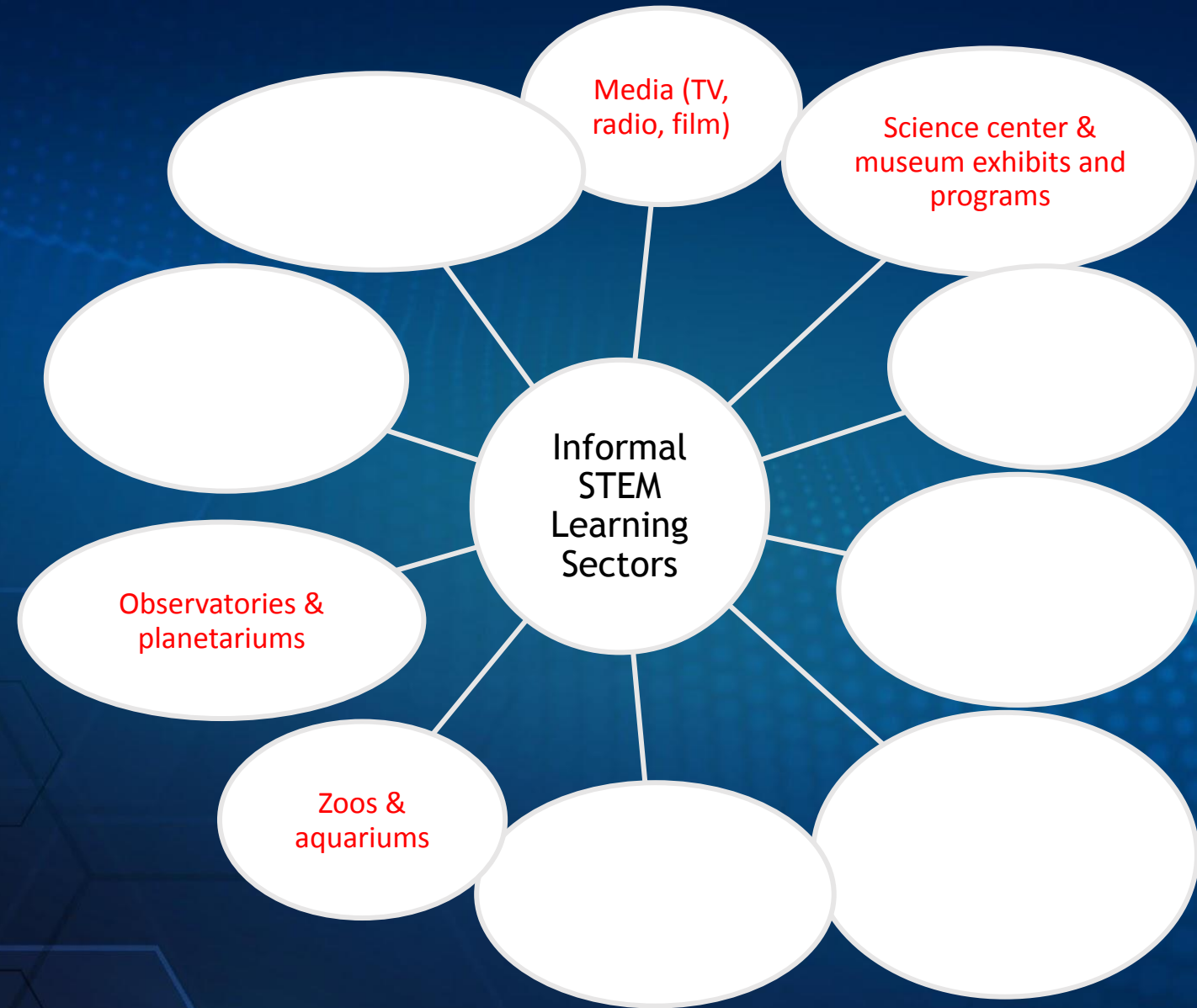
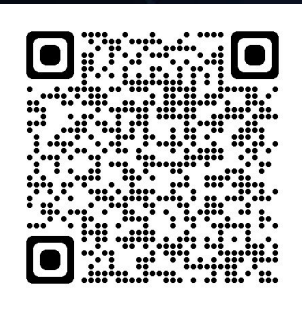Lynn Tran, PhD
Program Director

Advancing Informal STEM Learning

Advancing Informal Stem Learning (AISL)

Supports research on the design, development and impact of STEM learning opportunities and experiences for the public in informal educational environments

Current solicitation: 22-626
Deadline: January 10, 2024
Annually, second Wednesday in January

drlaisl@nsf.gov

Informal STEM Learning Sectors

- Media (TV, radio, film)
- Science center & museum exhibits and programs
- Observatories & planetariums
- Zoos & aquariums

National Science Foundation
Directorate for STEM Education (EDU)

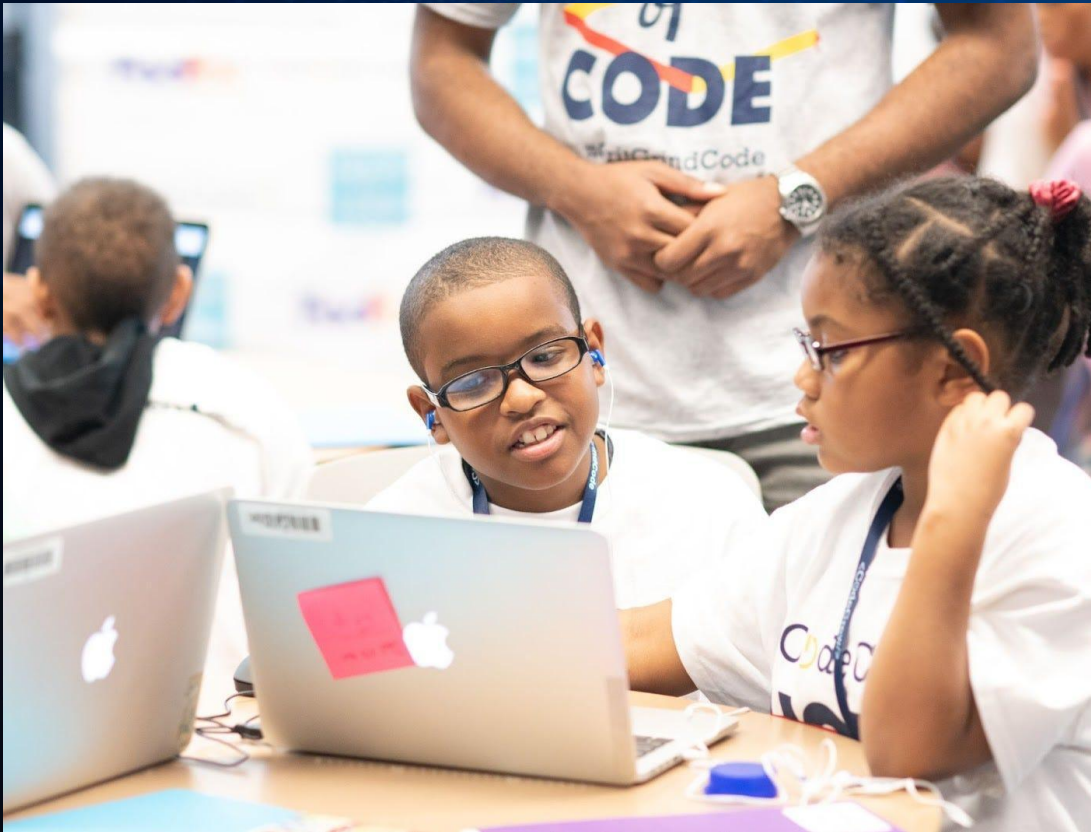Preparing a diverse STEM workforce and a well-informed citizenry

Program Goals & Project Types

1. **Learning STEM in Informal Experiences and Environments**
2. **Advancing the Knowledge Base of Informal STEM Learning**
3. **Equity, Belonging, and Broadening Participation**
4. **Intentionally Community/Practitioner Driven**
5. **Professional Capacity Building & Informal STEM Infrastructure**
6. **Support Learners' Participation in and Understanding of STEM practices**

1. Synthesis
2. Conferences
3. Partnership Development & Planning
4. Integrating Research & Practice
5. Research in support of wide-reaching public engagement in STEM

National Science Foundation
Directorate for STEM Education (EDU)

Preparing a diverse STEM workforce and a well-informed citizenry

Computer Science for All (CSforAll)

Solicitation 20-539
Deadline:
Second Wednesday in February

HTTPS://BETA.NSF.GOV/FUNDING/OPPORTUNITIES/COMPUTER-SCIENCE-ALL-CSFORALL-RESEARCH-RPPS

National Science Foundation
Directorate for STEM Education (EDU)

Preparing a diverse STEM workforce and a well-informed citizenry

Computer Science for All (CSforAll)

- Goal: To provide all U.S. students with the opportunity to participate in computer science (CS) and computational thinking (CT) education in their schools *at the preK-12 levels*

- Scope: *Introductory computer science* (Note: Topics that are typically taught in courses that require prerequisite coursework in computer science are not intended to be in focus for the CS for All program)

- Project strands: 1) Research-Practice Partnerships; 2) Research on Learning and Instruction
    - **High school teachers**: preparation, professional development (PD) and ongoing support that CS teachers need to teach rigorous CS courses,
    - **K-8 teachers**: the instructional materials and preparation they need to integrate CS/CT into their teaching,
    - **Schools and districts**: the resources needed to define and evaluate multi-grade pathways in CS and CT, and
    - **Research** about the learning and teaching of introductory computer science.

- Broadening participation in computer science

CSforAll: Examples of Funded Projects

- Researching Pre-College Factors that Lead to Persistence in Computer Science

- Supporting participation of underrepresented youth in computing using tangible computational craft kits

- Designing Professional Development to Foster Mastery and Interest for Integrating Computer Science into Mathematics Classes

- Collaborative Research: An Equity-Focused Approach to Integrating Physical Activity and CS Education for K-8 Learners

- Culturally Relevant Robotics: A Family and Teacher Partnership for Computational Thinking in Early Childhood

Minority Serving Institutions

AANAPISI
Asian American and Native American Pacific Islander Serving Institutions

ANNH
Alaskan Native and Native Hawaiian Serving Institution

HSI
Hispanic Serving Institution

PBI
Predominantly Black Institution

HBCU
Historically Black Colleges and Universities

TCCU
Tribally Controlled Colleges and Universities

Improving Undergraduate STEM Education: HSI Program

The goals of the HSI Program are to:

1. Enhance the quality of undergraduate STEM education, and

2. Increase the recruitment, retention, and graduation rates of students pursuing associates or baccalaureate degrees in STEM fields at HSIs.

HSI Program Tracks

Tracks	Track 1: Planning or Pilot Projects (PPP)	Track 2: Implementation and Evaluation Projects (IEP)	Track 3: Institutional Transformation Projects (ITP)
Timeframe	Up to 3 Year Long Projects	3 to 5 Year Long Projects	5 Year Long Projects
Funding Amounts	• $200,000 – single institution • $300,000 – collaborative • $100,000 – incentive to include one or more community college as a lead or partnering institution	• $500,000 – single institution • $800,000 – collaborative • $200,000 – incentive to include one or more community college as a lead or partnering institution	• Up to $3,000,000
Upcoming Deadlines	• September 30, 2022 • February 8, 2023 • August 30, 2023	• September 30, 2022 • February 8, 2023 • August 30, 2023	• September 30, 2022 • August 30, 2023

Conference proposals that serve/support HSIs may be submitted by institutions of higher education, including non-HSIs, and non-profit organizations.

NSF Research Traineeship (NRT) and Innovations in Graduate Education (IGE) Programs

Vinod K Lohani, PhD

Program Director

Division of Graduate Education

Directorate for STEM Education (EDU)

National Science Foundation

Training & Research spans all NSF Directorates

Computer & Information Science & Engineering

Geosciences

Engineering

NSF Research Traineeship Program

Biological Sciences

Mathematical & Physical Sciences

Technology, Innovation & Partnerships

Social, Behavioral & Economic Sciences

STEM Education

Key Elements of a Successful NRT Program

Institutional Transformation & Inclusive Workforce Development

Training
Interdisciplinary/Convergent

Professional Development
Teamwork, Communication, Ethics, Leadership, Internships, Entrepreneurship, etc.

Research
Interdisciplinary/Convergent

FY 2024 Deadline = September 6, 2023

Two tracks:
Track 1: $3M over 5 years (for both R1 and non-R1 institutions)

Track 2: $2M over 5 years (for non-R1 institutions)

Contact: nrt@nsf.gov

Innovations in Graduate Education (IGE)

IGE is dedicated to:

(a) piloting, testing, and validating innovative approaches to graduate education, and

(b) generating the knowledge required for the customization and implementation of the most successful, transformative approaches.

**FY 2024 Deadline = March 25, 2024 (IGE Proposals)**
Max. award size: $500k over 3 years

Contact: ige@nsf.gov

Historically Black Colleges and Universities - Undergraduate Program (HBCU-UP)

Goal: To enhance the quality of undergraduate STEM education and research at HBCUs in order to broaden participation in the nation's STEM workforce and STEM graduate programs.

Accredited HBCUs in the U.S.

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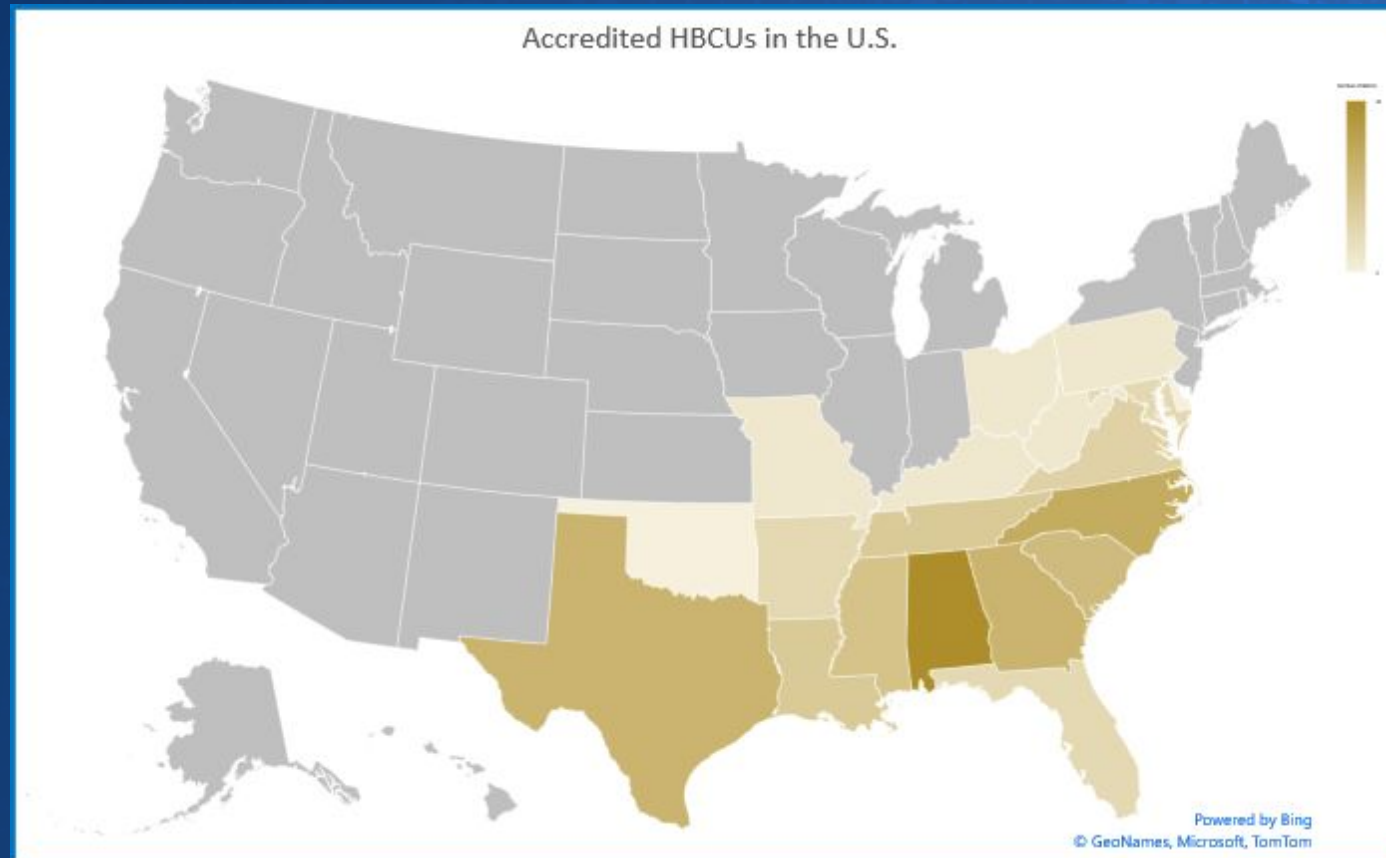
Historically Black Colleges and Universities Undergraduate (HBCU-UP)

HBCU-UP supports the development, implementation, and study of evidence-based, innovative models and approaches to prepare HBCU undergraduates for the STEM workforce.

Project Type	Award Amount	Duration	Submission Deadlines
Research Initiation Awards (RIA)	$450,000	3 years	LOI-7/25/23; Full-10/3/2023
Research on Broadening Participation in STEM (BPR)	$350,000	3 years	LOI-9/12/23; Full-11/9/2023
Targeted Infusion Projects (TIP)	$400,000	3 years	LOI-9/12/23; Full-11/9/2023
Implementation Projects (IMP)	$1.25-3M	4-5 years	IMP – LOI-9/12/23; Full-11/9/2023
Broadening Participation Research Centers (BPRC)	$9 M	5 years	Prelim-3/26/24; Full-11/26/2024

Questions: Email: HBCU_UP@nsf.gov

LOUIS STOKES ALLIANCES FOR MINORITY PARTICIPATION (LSAMP)

Solicitation 20-590 (Under Revision)

LOUIS STOKES ALLIANCES FOR MINORITY PARTICIPATION (LSAMP)

LSAMP

- Supports alliances among institutions of higher education to design and implement high impact practices to increase the competitiveness and number of degrees to underrepresented groups in STEM.

- Prepares LSAMP populations for entry into STEM graduate programs and/or STEM careers. LSAMP populations:
  - Blacks/African-Americans, Hispanic/Latino Americans, American Indians, Alaska Natives, Native Hawaiians and Pacific Islanders.

Funding Opportunities:

- Bridge to the Baccalaureate
- (B2B)
- STEM Pathways Implementation-Only (SPIO)

Budgets and Project Durations:

- B2B: $1.5M for 3 years
- SPIO: $3.5M for 5 years

Questions: Email: LSAMP_National@nsf.gov

Next Deadline: B2B and SPIO – Third Friday in November 2023

Questions and Discussion