The ABC's of NSF

Margaret Martonosi
NSF Computer and Information Science and Engineering (CISE)
(on leave from Princeton University CS Faculty)

MRM in One Slide

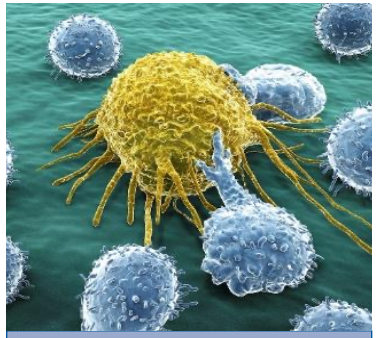
PRINCETON UNIVERSITY

NSF

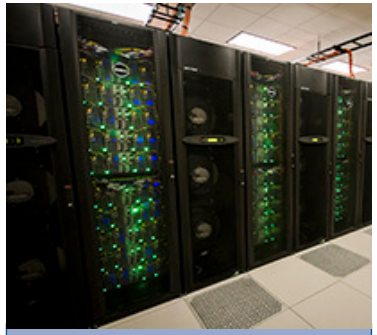
National Science Foundation's Mission

"To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."

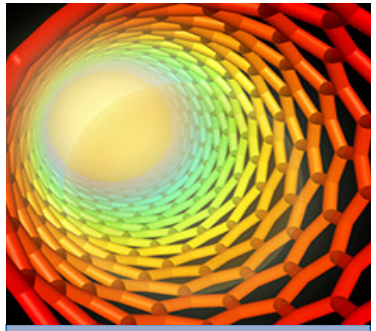
NSF Champions Research and Education across all Fields of Science and Engineering



Biological Sciences

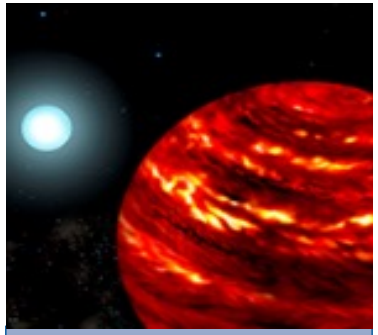


Computer & Info Science & Engineering



Engineering

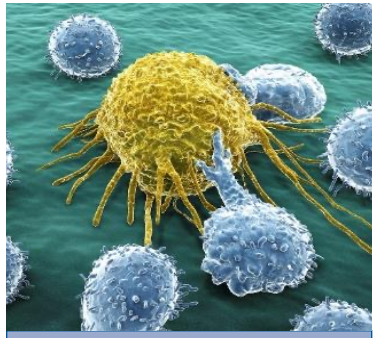
Geosciences (including Polar Programs)



Mathematical & Physical Sciences

Social, Behavioral & Economic Sciences

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



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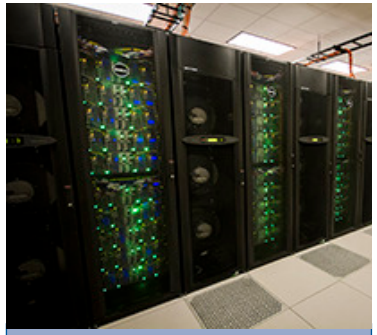

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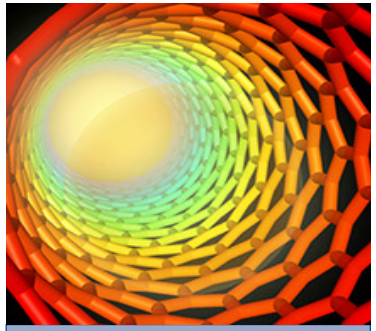

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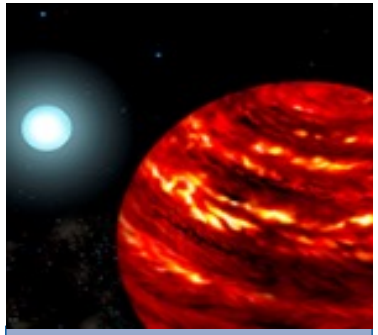


Mathematical & Physical Sciences

Social, Behavioral & Economic Sciences

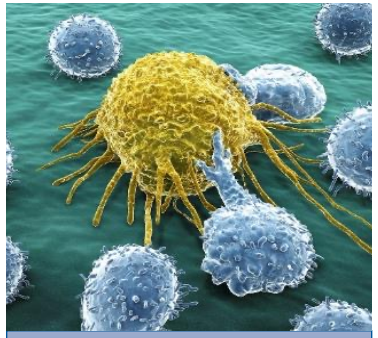
Office of Integrative Activities

Directorate for Education and Human Resources (STEM Education)

Office of International Science & Engineering

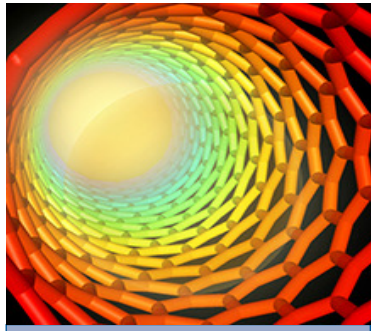
Directorate for Technology, Innovation and Partnerships

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



Biological Sciences

Computer & Info Science & Engineering



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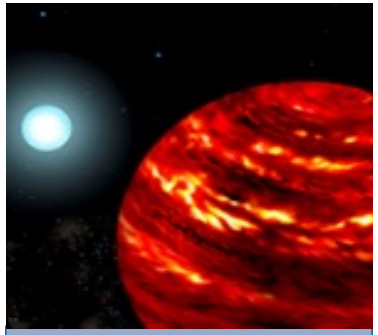
Geosciences (including Polar Programs)



Mathematical & Physical Sciences

Social, Behavioral & Economic Sciences

Office of Integrative Activities

Directorate for Education and Human Resources (STEM Education)

Office of International Science & Engineering

Directorate for Technology, Innovation and Partnerships

NSF By The Numbers

93%
Funds research, education and related activities

$8.8B
FY 2022 Enacted

43,600
Proposals evaluated

2,000
NSF-funded institutions

11,300
Number of awards NSF funds each year

318K
People NSF supported

$1.5B
STEM education

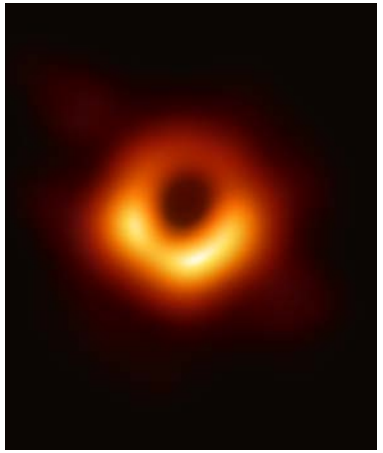
$181M*
To seed public/private partnerships

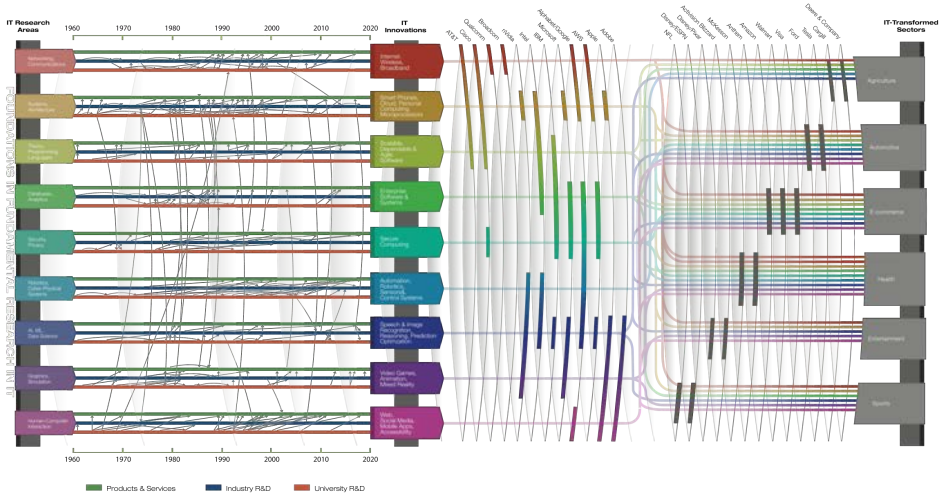
253
NSF-funded Nobel Prize winners

Data represents FY 2021 Actuals unless otherwise indicated.
**Corresponds to NSF investments initiated in FY 2021 and spanning multiple years.*


Research:
Planting trees
now,
to benefit the
next generation

Planting Trees: Foundational, Translational, Societal Impacts





Foundational

CISE-funded research has led the world in fundamental questions of how information is gathered and analyzed

44 of the 72 Turing Awardees have received NSF funding

Translational

CISE-funded research has changed how the world computes and communicates.

>$1Trillion of economic impact via the IT sector and beyond.

Societal

CISE-funded research is benefitting American communities

Changing the face of computing, and changing the world

https://www.nationalacademies.org/our-work/depicting-innovation-in-information-technology

CISE Organization and "Core" Programs

Office of Advanced Cyberinfrastructure (OAC)

- Data/Software
- Leadership and Advanced Computing
- Networking/Cybersecurity
- Learning and Workforce

Manish Parashar
Office Director

Amy Walton
Deputy Office Director

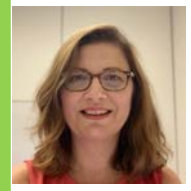
Gurdip Singh
Division Director

Behrooz Shirazi,
Acting Deputy
Division Director

Computing & Communication Foundations (CCF)

- Algorithmic Foundations
- Communications and Information Foundations
- Software and Hardware Foundations
- Foundations of Emerging Technologies

Walter Cleveland II,
Division Director



Funda Ergun,
Acting Deputy
Division Director

Henry Kautz,
Division Director

Wendy Nilsen,
Acting Deputy
Division Director

CISE Leadership

Margaret
Martonosi,
Assistant Director

Joydip Kundu,
Deputy Assistant
Director

Computer & Network Systems (CNS)

- Computer and Network Systems
- Education and Workforce Development

Information & Intelligent Systems (IIS)

- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence

Major CISE-wide and Multi-Directorate Initiatives

Office of Advanced Cyberinfrastructure (OAC)

Computing & Communication Foundations (CCF)

<u>CISE-wide Initiatives</u>

Expeditions in Computing
Broadening Participation in Computing Plans
CISE Community Research Infrastructure (CCRI)
CISE MSI Research Expansion
Principles and Practice of Scalable Systems (PPOSS)

<u>Sample Multi-Directorate Initiatives that CISE Leads</u>

National AI Research Institutes
Secure and Trustworthy Cyberspace (SaTC)
Cyber-Physical Systems (CPS)
Predictive Intelligence for Pandemic Prevention (PIPP)
Smart & Connected Communities (S&CC) /Civic Innovation Challenge (CIVIC)

Computer & Network Systems (CNS)

Information & Intelligent Systems (IIS)

NSF CISE by the numbers, FY 2021

24% success rate

$1,022M FY 2021 enacted budget

7,248 proposals

461 Panels

1,740 awards

19,321 people supported

373 institutions supported

8,164 senior researchers

1,460 other professionals

581 postdoctoral associates

6,162 graduate students

2,954 undergraduate students

NSF funds ~80% of federally-funded academic CS research in the US.

(*Source: NCSES*)

~50% of CISE budget is in the Core:
All CISE Topic Areas

Small: up to $600K, no deadlines.
Medium: $600K-1.2M, annual deadline

If you had a billion dollars a year, what research would you spend it on?
What trees would you plant?

And, how much more could we do with more?

Today…

- Technical Themes
- ”How to get there”: Programs, Infrastructure, People…
- Q&A

Technical Themes

CISE in a Post-Moore World: The Seismic Shift

Transcendence of Artificial Intelligence

Designing Beneficial Sociotechnical Systems

CISE in a Post-Moore World: Seismic Shift…

- **Challenge**: Across many different topic areas, a fundamental need to design new interface layers & design practices.
- **Opportunity**: Sweeping change across many CISE research topics.
- **Rethink** Hardware, Software, Curriculum…

- Principles and Practice of Scalable Systems (PPoSS) [NSF 22-507]
  - January deadlines (Jan 23, 2023)
  - First large awards just announced

https://www.nsf.gov/pubs/2022/nsf22507/nsf22507.htm

Technical Themes

CISE in a Post-Moore World: The Seismic Shift

Transcendence of Artificial Intelligence

Designing Beneficial Sociotechnical Systems

NSF-LED NATIONAL AI RESEARCH INSTITUTES

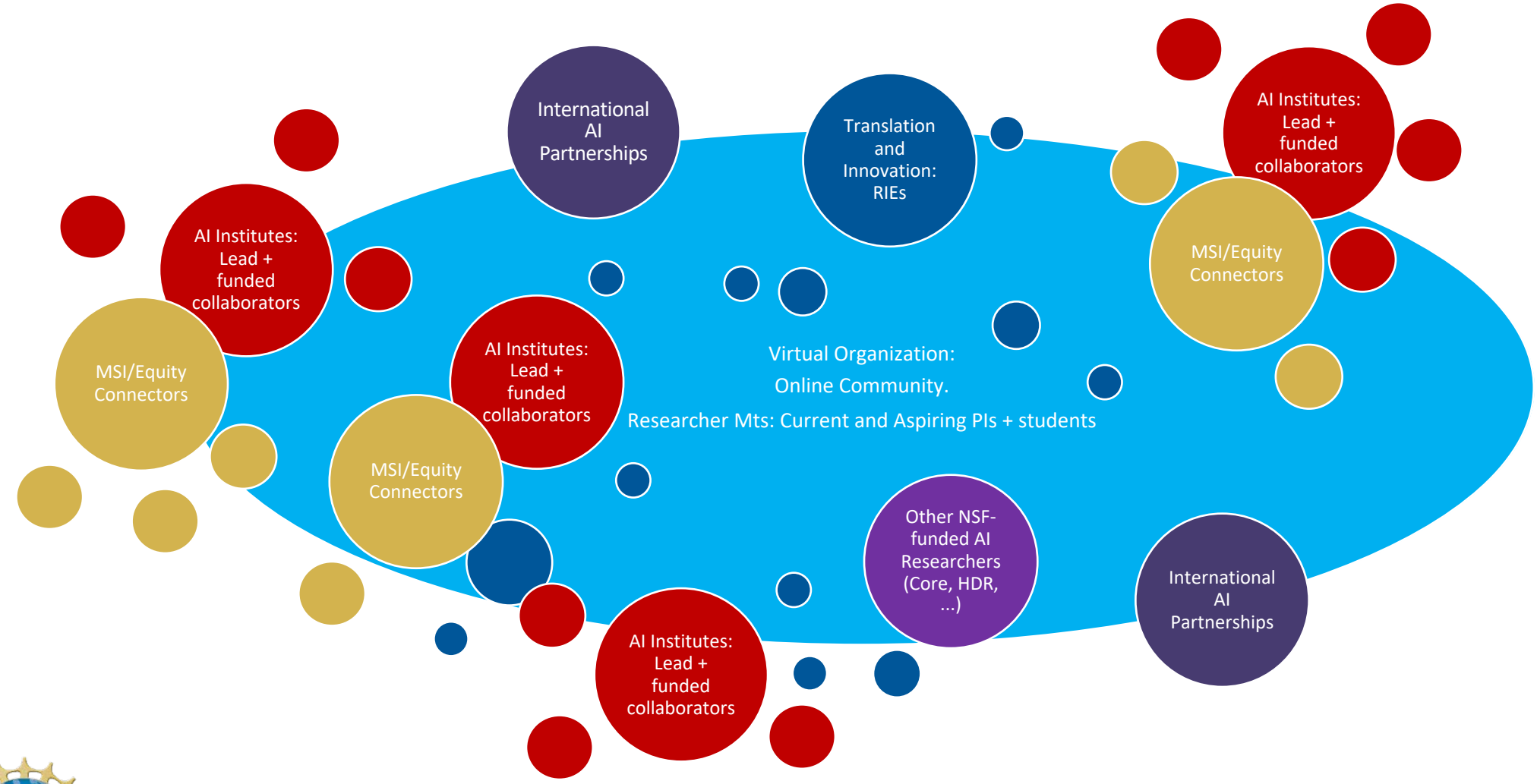
★ LEAD ORGANIZATION ■ PRINCIPAL ORGANIZATIONS ● PARTNERS/COLLABORATORS

*The U.S. National Science Foundation (NSF) announced a **$220** million investment in eleven new Artificial Intelligence (AI) Research Institutes, building on the first round of seven AI Institutes totaling **$140** million funded last year. **(The default map view below shows all awards combined).***

FY20 and FY21 Awards:
18 Institutes spanning 40 states

The map reflects the approximate location of the Institutes' lead and principal organizations (staffing and/or activity), as well as their initial funded and unfunded partners.
***Note:** Partners and collaborators related to an Institute may be represented with a single plot due to space limitations.*

Vision: National AI Research Network of Networks



Vision: National AI Research Network of Networks

NSF 22-046

Dear Colleague Letter: International Collaboration Supplements in National Artificial Intelligence Research Institutes

February 16, 2022

Dear Colleagues:

With this Dear Colleague Letter (DCL), NSF invites requests for supplemental funding from existing awardees of the National Artificial Intelligence (AI) Research Institutes program (NSF 20-503, NSF 20-604) to add a new — or strengthen an existing — international dimension to their award. International collaboration should advance efforts to achieve the goals of the institute as outlined in the existing NSF award. Supplemental funding requests should represent mutual benefit and true intellectual collaboration with international partners.

NSF 22-031

Dear Colleague Letter: Special Guidelines for Submitting Collaborative Proposals under National Science Foundation (NSF) and Natural Sciences and Engineering Research Council of Canada (NSERC) Collaborative Research Opportunities in Artificial Intelligence and Quantum Science

December 16, 2021

Dear Colleagues:

The U.S. National Science Foundation (NSF) and the Natural Sciences and Engineering Council of Canada (NSERC) have signed a Memorandum of Understanding (MOU) on Research Cooperation. The MOU provides an overarching framework to encourage collaboration between U.S. and Canadian research communities and sets out the principles for developing jointly supported activities. The MOU provides for an international collaboration arrangement whereby U.S. researchers may receive funding from NSF and Canadian academic researchers may receive funding from NSERC.

https://www.nsf.gov/pubs/2022/nsf22031/nsf22031.jsp

https://www.nsf.gov/pubs/2022/nsf22046/nsf22046.jsp

Technical Themes

CISE in a Post-Moore World: The Seismic Shift

Transcendence of Artificial Intelligence

Designing Beneficial Sociotechnical Systems

CISE's Sociotechnical Frontier

- Cyber-Physical and Cyber-Human interactions increasingly shape our society and economy, at all levels and in many forms: Health, connectivity, community, fair access to trustworthy information…
- Reshape computation to "bake in" equity, fairness, security, trust, privacy, …

Highlights

- DASS: Designing Accountable Software Systems
- CIVIC Innovation Challenge (Next deadline May 5)
- Smart Health and Biomedical Research in the Era of Artificial Intelligence (SCH)
- NASEM Study on Ethics and Governance in Computing Research and Applications

Technical Themes

CISE in a Post-Moore World: The Seismic Shift

Transcendence of Artificial Intelligence

Designing Beneficial Sociotechnical Systems

Priorities: AKA How to Get There?

- Budget and Program Portfolio
- Infrastructure
- People
- Partnerships

Platforms for Advanced Wireless Research (PAWR): Enabling At-scale Experimentation

POWDER

Salt Lake City, UT

Software defined networks and massive MIMO

COSMOS

West Harlem, NY

Millimeter wave and backhaul research

AERPAW

Raleigh, NC

Unmanned aerial vehicles and mobility

ARA

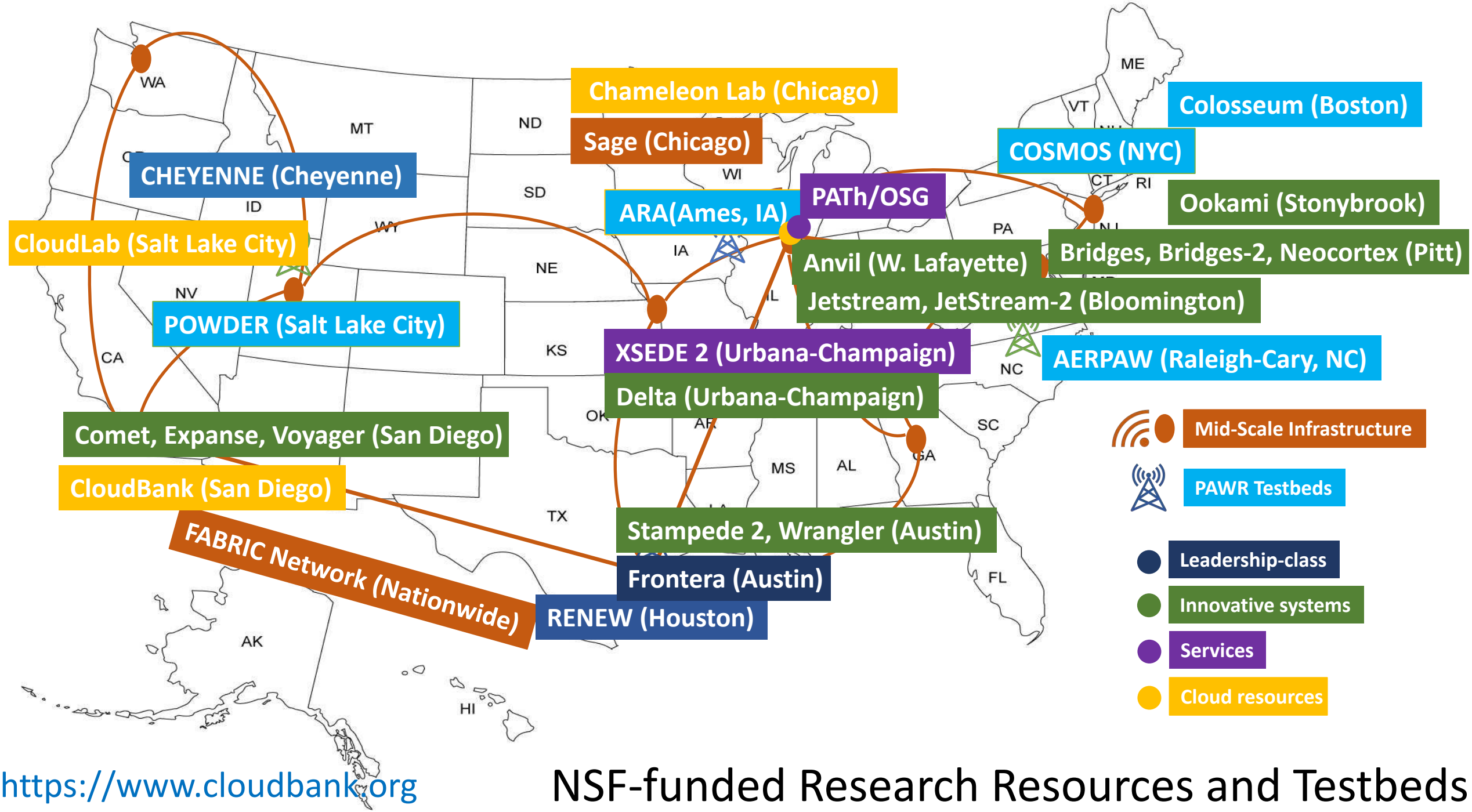
Ames, IA

Rural broadband

$100M public-private partnership with DOD, USDA NIFA, and >35 companies

Accelerating beyond-5G wireless research

https://www.advancedwireless.org



https://www.cloudbank.org

NSF-funded Research Resources and Testbeds

New NSF Program – POSE: Pathways to Enable Open-Source Ecosystems

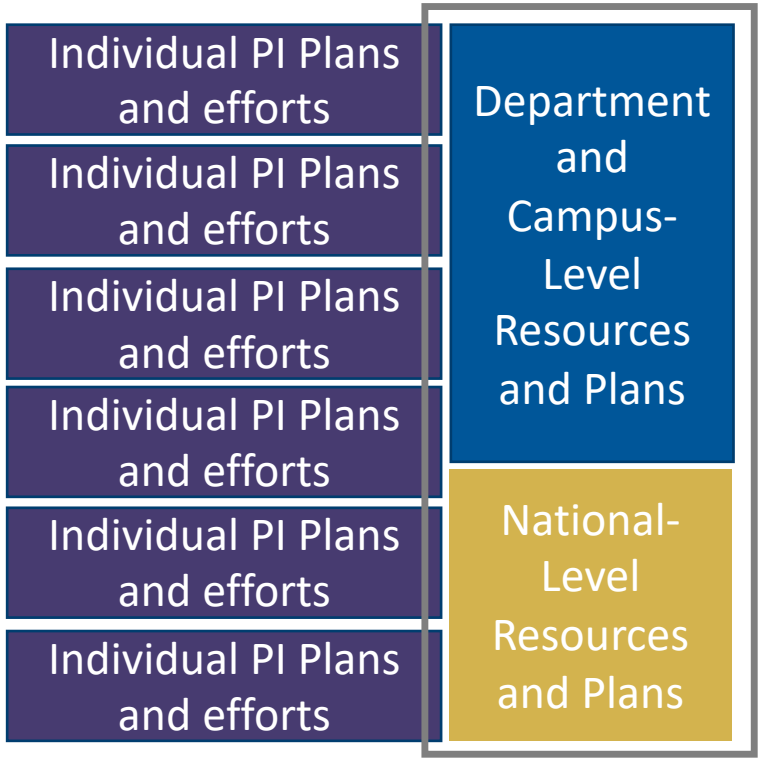
- Purpose of the program is to:
  - harness the power of open-source development for the creation of new technology solutions to problems of national and societal importance.
  - fund new open-source ecosystem (OSE) managing organizations, each responsible for the creation and maintenance of infrastructure needed for efficient and secure operation of an OSE based around a specific open-source product or class of products.
- **Full proposal deadlines: May 12 (Phase1); October 22 (Phase II)**
  - **More information:** https://beta.nsf.gov/funding/opportunities/pathways-enable-open-source-ecosystems-pose

Priorities: AKA How to Get There?

- Budget and Program Portfolio
- Infrastructure
- People
- Partnerships

BPCNet provides resources for CISE PIs

- https://bpcnet.org
- Developed and curated by CRA, NCWIT
- Best and promising practices: Evidence-based and vetted resources
  - Not just ***what*** but ***how***
  - Departmental data and teaching efforts
- Departmental and Individual BPC Plan Workshops
  - + Ongoing 1-1 Consulting Office Hours
  - Vetting, Hosting Departmental Plans in a Single Library



The Basics of an NSF Proposal

- Pay for faculty, students, equipment, travel etc.
- Principal Investigator (PI) is typically a faculty member
- Deadline or no-deadlines
- About 15 pages
- Questions -> Ask your program officer (found on webpage)
- Merit review by other researchers
- Two main review criteria: Intellectual Merit and Broader Impacts
- Ask your professor if you can help with proposal writing!

CSGrad4US Fellowship Program – Deadline: May 19

- **Goal:** Increase the number and diversity of US domestic graduate students pursuing research and innovation careers in the CISE fields: computer science, computer engineering, or information science.
- **Target:** Bachelor's degree holders returning from industry into Ph.D. programs
- Fellowship begins with 1-year mentorship program: graduate school application, process, and research success.

New DCL: https://www.nsf.gov/pubs/2022/nsf22061/nsf22061.jsp?org=NSF

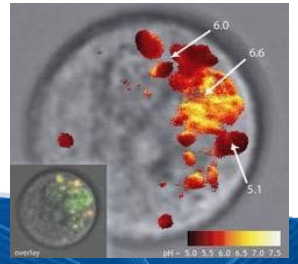

NSF

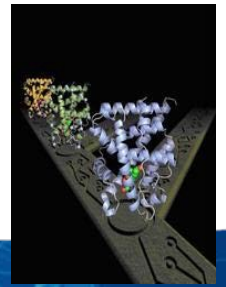
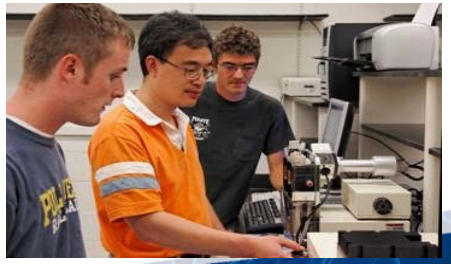
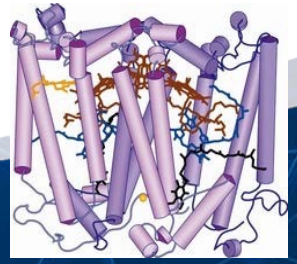
Some takeaway links

- https://www.nsf.gov
- https://www.nsf.gov/CISE
- CSGrad4US Graduate Fellowships: STUDENTS APPLY. Due May 19
  - https://www.nsf.gov/pubs/2022/nsf22061/nsf22061.jsp
- For your faculty to know about and apply:
  - CIVIC Innovation Challenge: Deadline May 5
    - https://beta.nsf.gov/funding/opportunities/civic-innovation-challenge-civic
  - US-Canada AI Collaborations
    - https://www.nsf.gov/pubs/2022/nsf22031/nsf22031.jsp
  - International Research Experiences for Students (IRES): Deadline Sept 20
    - https://beta.nsf.gov/funding/opportunities/international-research-experiences-students-ires-0

International Research Experiences for Students (IRES)

- NSF 20-598
- Offered by NSF Office of International Science & Engineering
- Faculty can apply to offer student professional development through international research and research-related activities
  - Faculty-led cohort of undergrads and/or grad students
  - Seminar-style training for graduate students
  - Deadline: September 2022

NSF Funding Opportunities in CISE Topic Areas: Slide 1 of a 2-slide Primer: The Core Programs

Core Programs:
Small (no deadlines, now $600K)
+ Medium.

Notes and Recent Changes:
CCF FET
CNS unified core programs (formerly CSR + NeTS)
IIS: HCC (new name)
OAC: Core (new)

CISE directorate

Office of Advanced Cyberinfrastructure (OAC)

- Data/Software
- Leadership and Advanced Computing
- Networking/Cybersecurity
- Learning and Workforce

Computing & Communication Foundations (CCF)

- Algorithmic Foundations
- Communications and Information Foundations
- Software and Hardware Foundations
- Foundations of Emerging Technologies

Computer & Network Systems (CNS)

- Computer and Network Systems
- Education and Workforce Development

Information & Intelligent Systems (IIS)

- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence
- Foundational Research in Robotics (joint with ENG)

NSF Funding Opportunities in CISE Topic Areas: Slide 2 of a 2-slide Primer: Beyond the Core

Other CISE Programs

- CISE-MSI Research Expansion
- Principles and Practices of Scalable Systems
- Formal Methods in the Field
- Designing Accountable Software Systems

Multi-directorate Programs led by CISE

- Secure and Trustworthy Cyberspace
- Cyber-physical Systems
- National AI Research Institutes
- Smart Health and Biomedical Research in the Era of Artificial Intelligence (SCH)
- Smart and Connected Communities
- Civic Innovation Challenge (CIVIC)
- National Robotics Initiative
- Research on Emerging Technologies for Teaching and Learning
- Collaborative Research on Computational Neuroscience

Early-Career

- CAREER
- CISE Research Infrastructure Initiation Award (CRII)

Programs Led by Other Directorates but of Interest to CISE

- Designing Materials to Revolutionize and Engineer our Future
- SemiSynBio
- Future Manufacturing
- Spectrum Innovation Initiative
- Sustainable Regional Systems
- Neural and Cognitive Systems
- ExpandQISE

Education & Workforce

- Computer Science for All
- Computing in Undergraduate Education
- BPC Alliances
- Data Science Corps

Infrastructure

- Major research Instrumentation (MRI)
- Mid-Scale Research Infrastructure – Size classes 1 ($6-20M) and 2 ($20-100M)
- CCRI – CISE Community Research Infrastructure
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
- Campus Cyberinfrastructure (CC*)

Entrepreneurship and Translation

- Pathways to Enable Open Source Ecosystems (POSE)
- Convergence Accelerator
- I-Corps, SBIR/STTR
- Industry/University Cooperative Research Centers (IUCRC)
- CISE InTrans supplements, CISE Transition-to-Practice opportunities

Join Us!

Students

- Research Experiences for Undergraduates (REU)
- CSGrad4US Fellowships
- NSF Graduate Fellowships

Faculty

- Send us your great proposals
- Proposal Writing Workshops
- Tell us your research triumphs
- Be an NSF Panel Reviewer
- Be an NSF Rotator!