

Funding for Software Engineering Research

Sol Greenspan



National Science Foundation

Directorate for
Computer & Information Science & Engineering (CISE)
Division of
Computing and Communication Foundations (CCF)



Outline

- What you should know about your science agency (NSF specifics but perhaps generalizable)
- SE-Related Funding Opportunities
 - Core SE and Interdisciplinary
- What makes a successful proposal
 - What to emphasize
 - What to avoid



Know How it Works!

Stakeholders

- US Citizens (via US Congress)
 - Give NSF appropriations from US government
 - Entrust NSF to conduct a peer review process
 - Want societal benefits for their tax dollars
 - Demands accountability for integrity of process
- Principal Investigators
 - Submit proposals
 - Serve as peer reviewers
- Program directors
 - Are your interface to NSF
 - Are federal employees or rotators (IPAs)
 - Have track records in their program areas
 - Form panels of experts to conduct review process



The Process *

- Annual solicitations with deadlines for Small, Medium, Large proposals (also some center-scale, also some emerging topics)
 - Other solicitations for emerging topics, also center-scale
 - Core and Cross-Cutting programs
 - Eligibility criteria and proposal limits
- Review process is mostly by panels, also some individual reviews
- Decisions usually within 6 months

* Varies across NSF Longstanding Core programs; rules could change



SE-Related Funding Opportunities

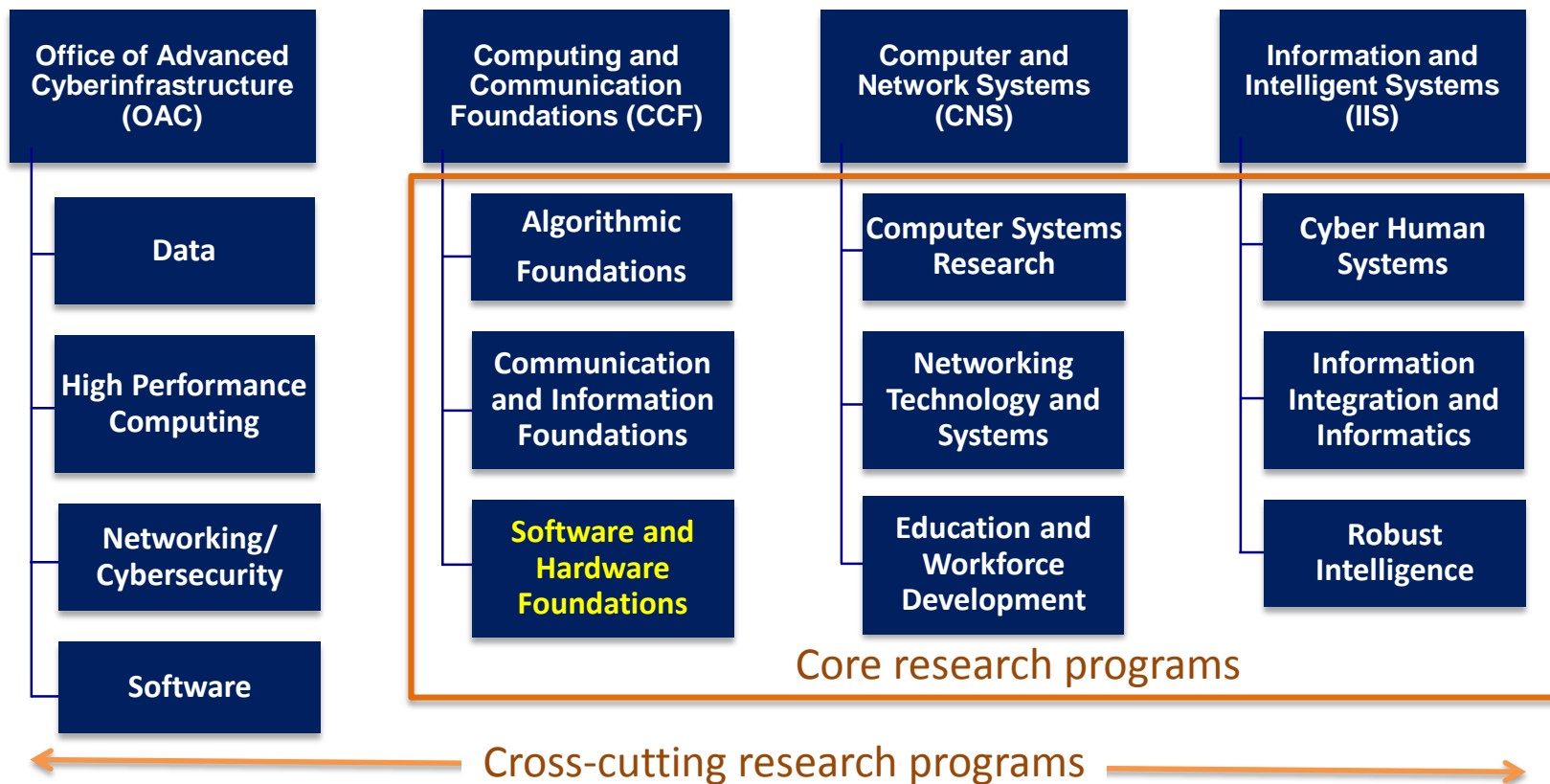
- Core programs in each Division of CISE Directorate
- Cross-Cutting programs run by CISE Directorate
- NSF-wide programs
- Programs elsewhere in NSF



CISE Research Investments

Exploring the frontiers of computing

- Strong commitment to core/fundamental research – the heart of what we do.
- Cast a broad net & let the best ideas surface.
- Engage with our community to develop new research directions.



Core SE-Related Programs in CISE

- Computing and Communication Foundations (CCF)
 - Software and Hardware Foundations (SHF)
 - Primary program for SE – FM, PL, testing/analysis, requirements, design, architecture, new paradigms, etc.
- Information and Intelligent Systems (IIS)
 - Cyber-Human Systems (CHS)
 - HCI, CSCW, other social-technical
- Computer and Network Systems (CNS)
 - Computer Systems Research (CSR)
 - Cyberphysical Systems (CPS)
- Office of Advanced Cyberinfrastructure (OAC)



Core SE-Related Programs in CISE

- Computing and Communication Foundations (CCF)
 - Software and Hardware Foundations (SHF)
 - Primary program for SE – FM, PL, testing/analysis, requirements, design, architecture, new paradigms, etc.
- Information and Intelligent Systems (IIS)
 - Cyber-Human Systems (CHS)
 - HCI, CSCW, other social-technical
- Computer and Network Systems (CNS)
 - Computer Systems Research (CSR)
 - Cyberphysical Systems (CPS)
- Office of Advanced Cyberinfrastructure (OAC)



Core SE-Related Programs in CISE

- Computing and Communication Foundations (CCF)
 - Software and Hardware Foundations (SHF)
 - Primary program for SE – FM, PL, testing/analysis, requirements, design, architecture, new paradigms, etc.
- Information and Intelligent Systems (IIS)
 - Cyber-Human Systems (CHS)
 - HCI, CSCW, other social-technical
- Computer and Network Systems (CNS)
 - Computer Systems Research (CSR)
 - Cyberphysical Systems (CPS)
- Office of Advanced Cyberinfrastructure (OAC)



Core SE-Related Programs in CISE

- Computing and Communication Foundations (CCF)
 - Software and Hardware Foundations (SHF)
 - Primary program for SE – FM, PL, testing/analysis, requirements, design, architecture, new paradigms, etc.
- Information and Intelligent Systems (IIS)
 - Cyber-Human Systems (CHS)
 - HCI, CSCW, other social-technical
- Computer and Network Systems (CNS)
 - Computer Systems Research (CSR)
 - Cyberphysical Systems (CPS)
- Office of Advanced Cyberinfrastructure (OAC)



Cross-Cutting Programs drawing on SE

- Secure and Trustworthy Cyberspace (SaTC)
(Lead is CISE/CNS; includes CISE, SBE, Math, ENG, EHR)
 - Vulnerability analysis/testing, malware defenses
 - Secure software development, designed-in security, language-based approaches
 - Intrusion detection, forensics, etc.
 - And more
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
Data and Software (Lead is CISE/ACI, involves all of NSF)
 - SE for computational science
 - Elements – software capabilities
 - Frameworks –common software infrastructure
 - CI community hubs



Cross-Cutting Programs drawing on SE

- Secure and Trustworthy Cyberspace (SaTC)
(Lead is CISE/CNS; includes CISE, SBE, Math, ENG, EHR)
 - Vulnerability analysis/testing, malware defenses
 - Secure software development, designed-in security, language-based approaches
 - Intrusion detection, forensics, etc.
 - And more
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
Data and Software (Lead is CISE/ACI, involves all of NSF)
 - SE for computational science
 - Elements – software capabilities
 - Frameworks –common software infrastructure
 - CI community hubs



Other examples of non-Core Programs

- Formal methods in the Field
 - First year of proposals are currently under review
- Scalable Parallelism in the Extreme (SPX)
 - CCF and CNS and OAC divisions
- Smart and Connected Health (SCH)
 - Run out of IIS division
 - Includes CISE, SBE, ENG directorates and several institutes of NIH



CISE Activities for Early-Career Faculty



Faculty Early Career Development (CAREER) Program

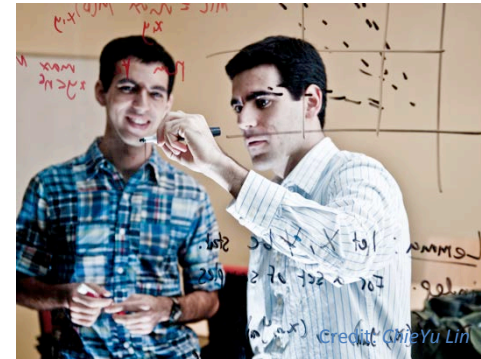
Integrating research and education efforts

One of NSF's most prestigious awards for faculty beginning their independent careers who exemplify the role of teacher-scholars.

CISE Research Initiation Initiative (CRII)

Jumpstarting research independence

Open to faculty in first years of an independent academic position to recruit and mentor undergraduate and graduate students, enabling a subsequent stream of discoveries and innovations. First awards in FY15.



Proposal Writing Workshops, Aspiring PI Meetings, and Early-career Workshops

Strengthening research and education activities through community

Introduces early-career faculty to NSF, merit review process, and peers and senior researchers in their field.



Successful Proposals

- A proposal is not a paper
 - Not “Why publish it?” rather “Why invest in it?”
- Intellectual Merit and Broader Impacts
- Science is a self-conscious, reflective activity
 - Explain the research challenges
 - Explain the scientific approach/methodology, e.g.:
 - Discovery through data collection and analysis
 - Prototype building to demonstrate a capability or improve a process
 - Theory formation, explanatory/predictive models, validation through experimentation
 - Prove a theorem and explain consequences



A Successful Proposal

- Solves an important problem
 - Why is the problem important to the field?
- Advances the field
 - How is the work situated in the field?
- Requires a high level of scientific knowledge and expertise
 - What are the research challenges and scientific methods?
- Is part of a vision
 - The vision may be long-range, but the project is only (say) three years long.
 - What are the short-term plans, and how do they contribute to the bigger picture?
- Produces long-lasting principles and artifacts
 - What is the likelihood that it will be considered important in 10 years?
- Benefits society
 - Do something you believe in. Be explicit about the benefits.



Have a Vision

- Astronomy: What/who is out there? Map the universe. Understand/predict phenomena.
- Biology: What are we made of? How does it all work? Map the gene. Study/predict ecosystem evolution.
- Physics: What is matter made of? What holds everything together?
- A.I. – how can a machine perform specific tasks better than a human? (Invoke for “perform SE tasks...”)
- Software Engineering: ???



Have a Vision

- Software Engineering:
 - We are moving toward a world where we will be programming (nearly) everything everywhere (by) everyone.
 - How can humans (individually or as a group) program a machine (or an environment) to automate everything?
 - Turn intentions into code?
 - With the least effort?
 - With the most (requirements) satisfaction?
 - While knowing what reliability guarantees are achievable and achieved
 - With SE infrastructure and services as part of the “plumbing”



SE and CS are at the center of an ongoing societal transformation



Advanced Wireless Research



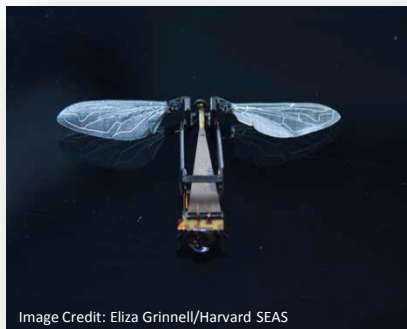
Big Data & Artificial Intelligence



Computer Science Education



Cybersecurity



Manufacturing, Robotics, & Smart Systems



Advanced Cyberinfrastructure



Smart Cities & Communities

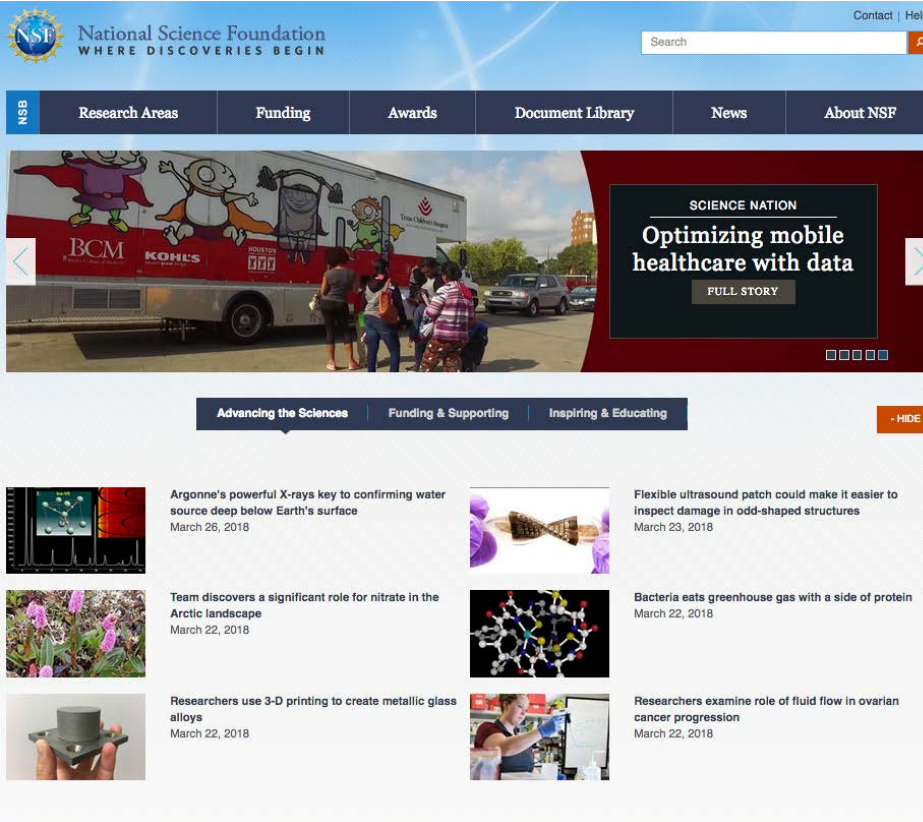


Understanding the Brain



Stay Connected

- Subscribe to get NSF updates by email at www.nsf.gov.
- Subscribe to receive special CISE announcements:
 - Send a message to: join-cise-announce@lists.nsf.gov with no text in the subject or message body.
- Visit the CISE website often: <http://www.nsf.gov/CISE>
- Talk to Program Directors: http://www.nsf.gov/staff/staff_list.jsp?org=CISE&from_org=CISE.
- Follow CISE on Twitter [@NSF_CISE](https://twitter.com/NSF_CISE).



The screenshot shows the NSF website header with the logo and tagline "WHERE DISCOVERIES BEGIN". A search bar is in the top right. Below the header is a navigation menu with "Research Areas", "Funding", "Awards", "Document Library", "News", and "About NSF". A large banner features a truck with children's drawings and a "SCIENCE NATION" article titled "Optimizing mobile healthcare with data". Below the banner are three categories: "Advancing the Sciences", "Funding & Supporting", and "Inspiring & Educating". A grid of six news items follows, each with a small image, a title, and a date. The "NSF Social Media" section includes a "FOLLOW" button, a "FOLLOW US" section with social media icons, and a tweet from "National Science Fdn @NSF" about computational neuroscience. A red arrow points from the tweet area to a yellow box that says "Get NSF Updates by Email".

NSF National Science Foundation WHERE DISCOVERIES BEGIN

Search

NSF Research Areas Funding Awards Document Library News About NSF

SCIENCE NATION
Optimizing mobile healthcare with data
FULL STORY

Advancing the Sciences Funding & Supporting Inspiring & Educating -HIDE

Argonne's powerful X-rays key to confirming water source deep below Earth's surface
March 26, 2018

Flexible ultrasound patch could make it easier to inspect damage in odd-shaped structures
March 23, 2018

Team discovers a significant role for nitrate in the Arctic landscape
March 22, 2018

Bacteria eats greenhouse gas with a side of protein
March 22, 2018

Researchers use 3-D printing to create metallic glass alloys
March 22, 2018

Researchers examine role of fluid flow in ovarian cancer progression
March 22, 2018

NSF Social Media

TWITTER FOLLOW FOLLOW US

National Science Fdn @NSF
To understand the #brain, do the math! Computational neuroscience provides a theoretical framework to study how brain works: bit.
View post on Twitter

Get NSF Updates by Email



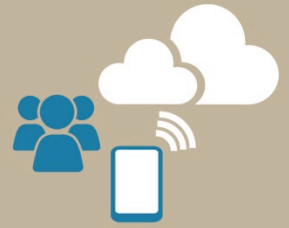
Final Words

- Learn how your agency works
- Submit your best ideas
- Know your institution's grants people and their process
- Attend a career day event
- Serve on a panel, as a reviewer
- Serve as an NSF program director (some day)
- Subscribe to `cise-announce@listserv.nsf.gov`
 - See <https://www.nsf.gov/news/announcements.jsp?org=CISE>





FOLLOW NSF



www.facebook.com/US.NSF



www.twitter.com/NSF

www.youtube.com/user/VideosatNSF



www.bit.ly/NSFflickr

www.linkedin.com/company/national-science-foundation



National Science Foundation's Mission

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



End of Slides



NSF Supports All of Science & Engineering



NATIONAL SCIENCE FOUNDATION

SKIP

OFFICE OF THE DIRECTOR
703.292.8000



France A. Córdoba
Director



Vacant
Deputy Director



Joan Ferrini-Mundy
Chief Operating Officer

NATIONAL SCIENCE BOARD (NSB)
703.292.7000



Maria T. Zuber
Chair



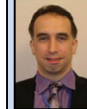
Diane L. Souvaine
Vice Chair

OFFICE OF INSPECTOR GENERAL (OIG)



Allison C. Lerner
Inspector General
703.292.7100

NATIONAL SCIENCE BOARD OFFICE



Dr. John J. Vaynsky, II
Acting Executive Officer
703.292.7000

BIO

CISE

EHR


ENG

GEO


MPS

SBE

DIRECTORATE FOR BIOLOGICAL SCIENCES (BIO)




Joanne S. Tornow
Acting Assistant Director




Margaret Caveaugh
Deputy AD
703.292.8400

DIRECTORATE FOR COMPUTER & INFORMATION SCIENCE & ENGINEERING (CISE)




James F. Kurose
Assistant Director




Eric In Ghazvini
Deputy AD
703.292.8900

DIRECTORATE FOR EDUCATION & HUMAN RESOURCES (EHR)



William (Jim) Lewis
Acting Assistant Director



Sylvia M. James
Acting Deputy AD
703.292.8600

DIRECTORATE FOR ENGINEERING (ENG)




Dawn T. Tibbitts
Assistant Director




Lihou G. Stevens
Deputy AD
703.292.8300

DIVISION OF

DIRECTORATE FOR GEOSCIENCES (GEO)




William E. Exartering
Assistant Director




Scott Borg
Acting Deputy AD
703.292.8500

DIRECTORATE FOR MATHEMATICAL & PHYSICAL SCIENCES (MPS)




Anne Kinney
Assistant Director




Deborah Lockhart
Deputy AD
703.292.8800

DIRECTORATE FOR SOCIAL, BEHAVIORAL, & ECONOMIC SCIENCES (SBE)



Fay L. Cook
Assistant Director



Katrina M. Craig-Henderson
Deputy AD
703.292.8700

OFFICE OF BUDGET, FINANCE, & AWARD MANAGEMENT (BFA)



Teresa Garacivitz
Office Head / Chief Financial Officer



Michael Siverts
Acting Deputy Office Head
703.292.8200

OFFICE OF INFORMATION & RESOURCE MANAGEMENT (OIRM)




Donna Bulera
Acting Office Head / Chief Information Officer




Moniece L. Gardner
Acting Deputy Office Head
703.292.8100

OFFICE OF DIVERSITY & INCLUSION (ODI)




Rhonda Davis
Office Head
703.292.8000

OFFICE OF THE GENERAL COUNSEL (OGC)




Lawrence Rudolph
General Counsel



Peggy Hoyle
Deputy General Counsel
703.292.8000

OFFICE OF INTEGRATIVE ACTIVITIES (OIA)



Suzanne Jackson
Office Head
703.292.8040

OFFICE OF INTERNATIONAL SCIENCE & ENGINEERING (OISE)



Rebecca S. Kaiser
Office Head



Samuel B. Howerton
Deputy Office Head
703.292.8710

OFFICE OF LEGISLATIVE & PUBLIC AFFAIRS (OLPA)



Amanda Greenhall
Office Head
703.292.8070

CHIEF INFORMATION OFFICER (CIO)



Dorothy Aronson
Chief Information Officer
703.292.4299

National Science Foundation
2415 Eisenhower Avenue
Alexandria, Virginia 22314

TEL: 703.292.5111 | FIRS: 800.877.8339 | TDD: 800.281.8749





National Science Foundation

GOLD STANDARD IN MERIT REVIEW

SKIP

Research proposals submitted to NSF are subjected to a rigorous merit review system – impartial, competitive, and transparent – ensuring that each proposal meets the highest standards of intellectual merit and broader impact on society. NSF’s merit review process is widely regarded as the gold standard of scientific review and has been emulated in numerous countries around the world.

\$7.3 billion NSF FY 2015 Budget Request

94% Funds research, education and related activities

INPUT



50,000

Proposals evaluated through competitive review process



38,000

Reviewers, including external experts and program staff



233,000

Total number of reviews, each proposal evaluated multiple times

OUTPUT



10,800

Competitive awards funded



1,922

U.S. colleges, universities, and other institutions receiving NSF funding



299,000

Estimated number of researchers, postdoctoral fellows, trainees, teachers and students NSF supports directly

IMPACT



47,800

Students supported by NSF Graduate Research Fellowships since 1952



210+

Number of Nobel Laureates supported by NSF



NSF-Supported Research

has spurred economic activity and improved the quality of life for all Americans



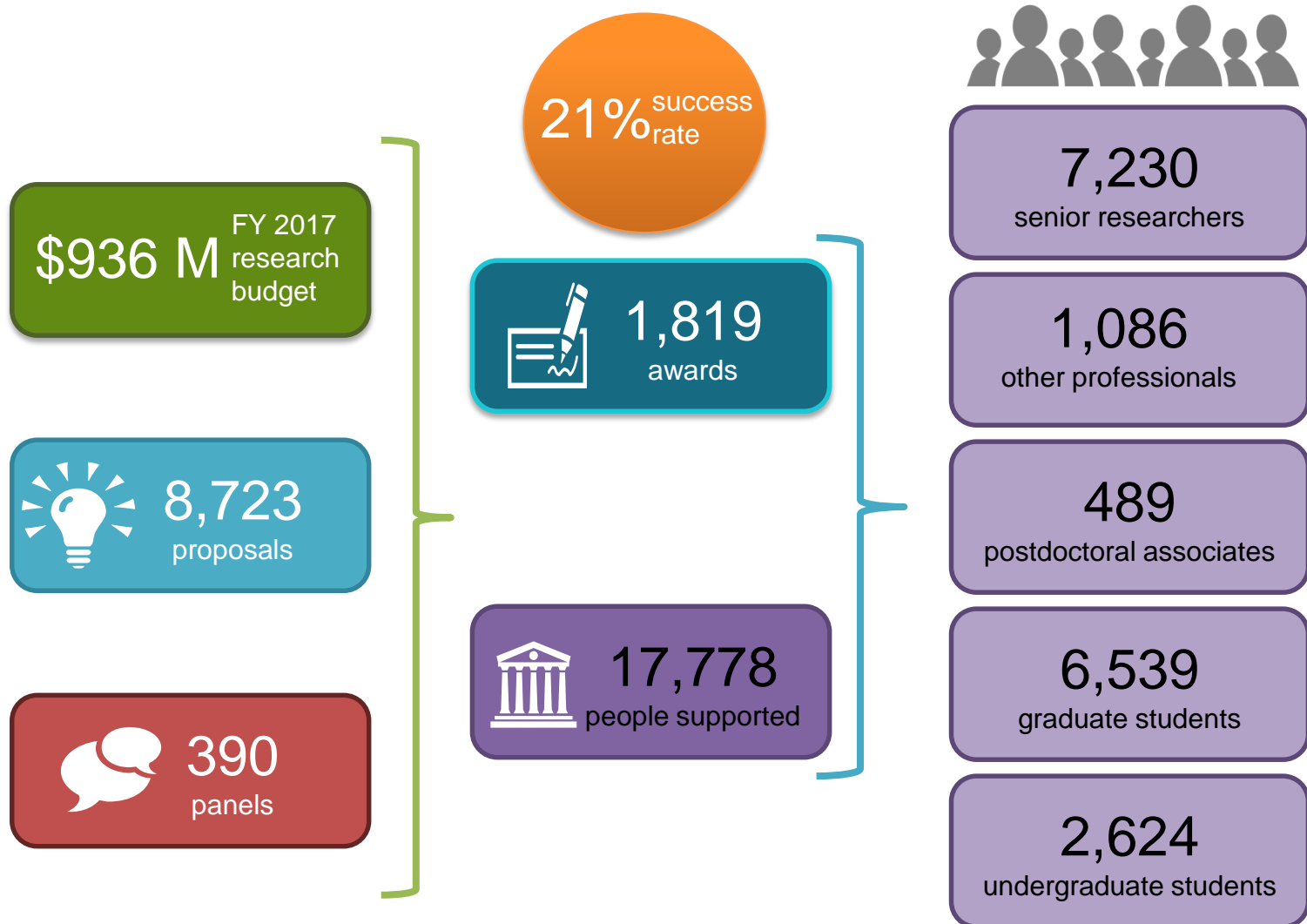
STEM Workforce Development

supports students, teachers and tools to enable the development of a diverse and highly qualified science and technology workforce

Figures other than Budget Request represent FY 2013 actuals

CISE by the Numbers: FY 2017

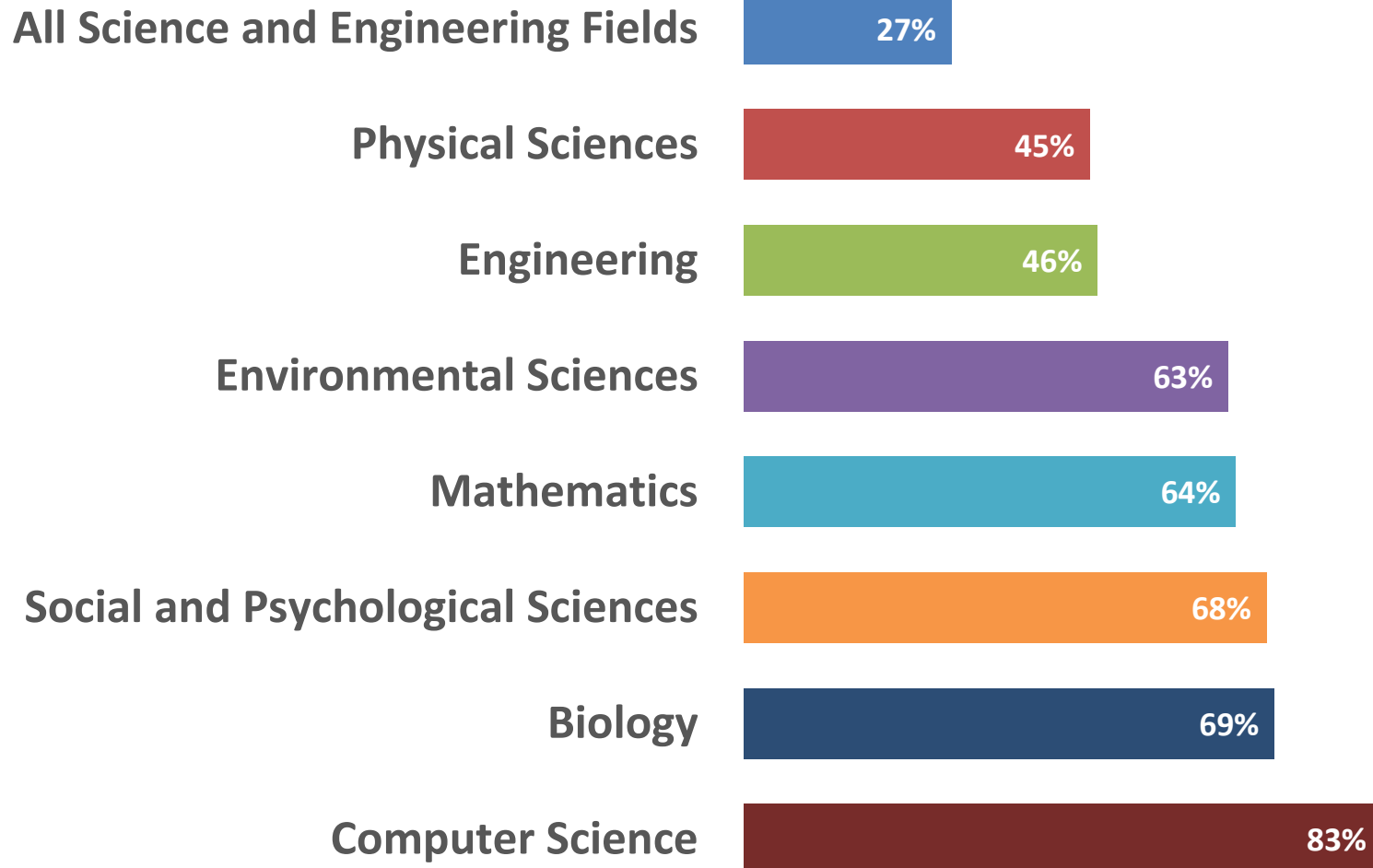
SKIP



NSF Support of Academic Basic Research

(as a percentage of total federal support)

SKIP



Cross-NSF Opportunities

SKIP

- CAREER – Early career development award
- CRII – research initiative awards to jumpstart research independence
- RUI – Research at (primarily) Undergraduate Institutions
- EAGER – groundbreaking new idea that merits immediate attention and isn't suitable for normal proposal process
- RAPID – rapid response to events
- Research Experiences for Undergraduates – REU Sites, REU Supplements
- Office of International Science and Engineering (OISE) – read their web site, CC me.

