

Proposal Preparation and Review and NSF Programs



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Division of Undergraduate
Education (DUE)



November 4, 2019
Indiana University –
Purdue University at Indianapolis



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Plan for the day

- Welcome & Introductions
- Overview of Programs/Questions
- NSF's Merit Review Process
- Interactive Discussion of Components of a Proposal
- Lunch
- Awardee's Panel
- Breakouts about Special NSF Programs
- Research and Evaluation
- Wrap-up & Closing Remarks



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Alert: This
presentation is
not all-inclusive



NSF Mission



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

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NSF Funds All Fields of Science and Engineering



**Biological
Sciences**



**Computer &
Information
Science &
Engineering**



**Education &
Human
Resources**



Engineering



**Integrative
Activities**



**International
Science and
Engineering**



**Social,
Behavioral &
Economic
Sciences**



**Mathematical
& Physical
Sciences**



**Geosciences
(including Polar
Programs)**



Ten Big Ideas for Future NSF Investments

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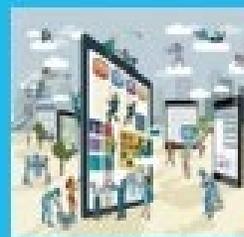
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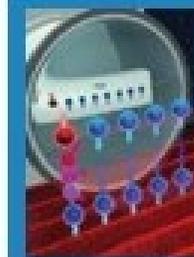
RESEARCH IDEAS



Work at the Human-Technology Frontier: Shaping the Future



Windows on the Universe: The Era of Multi-messenger Astrophysics



The Quantum Leap: Leading the Next Quantum Revolution

Harnessing Data for 21st Century Science and Engineering



Navigating the New Arctic

Understanding the Rules of Life: Predicting Phenotype



PROCESS IDEAS

Mid-scale Research Infrastructure



NSF 2026



Growing Convergent Research at NSF



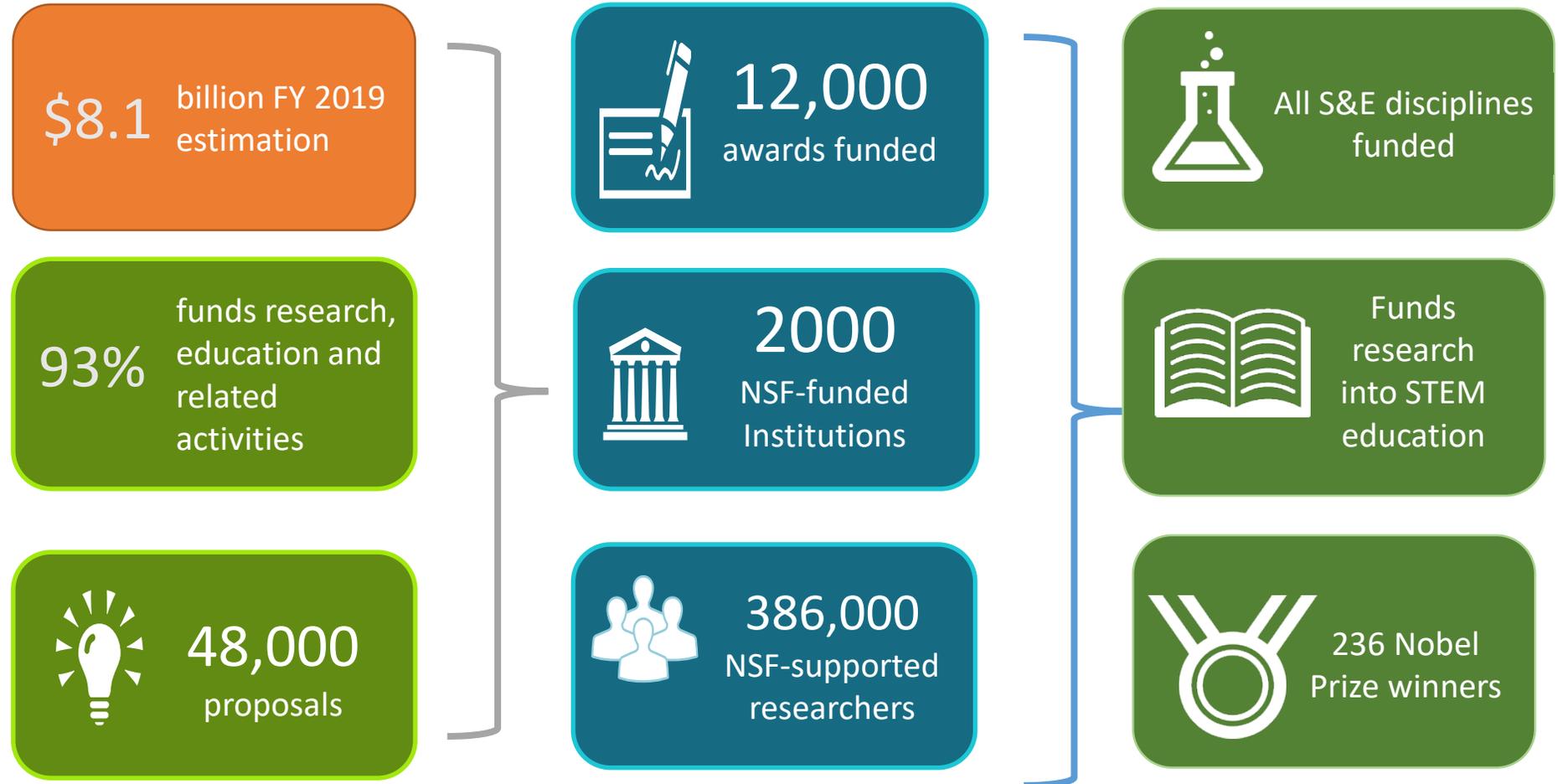
NSF INCLUDES: Enhancing STEM through Diversity and Inclusion



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NSF by the numbers



Numbers shown are based on FY 2019 activities.



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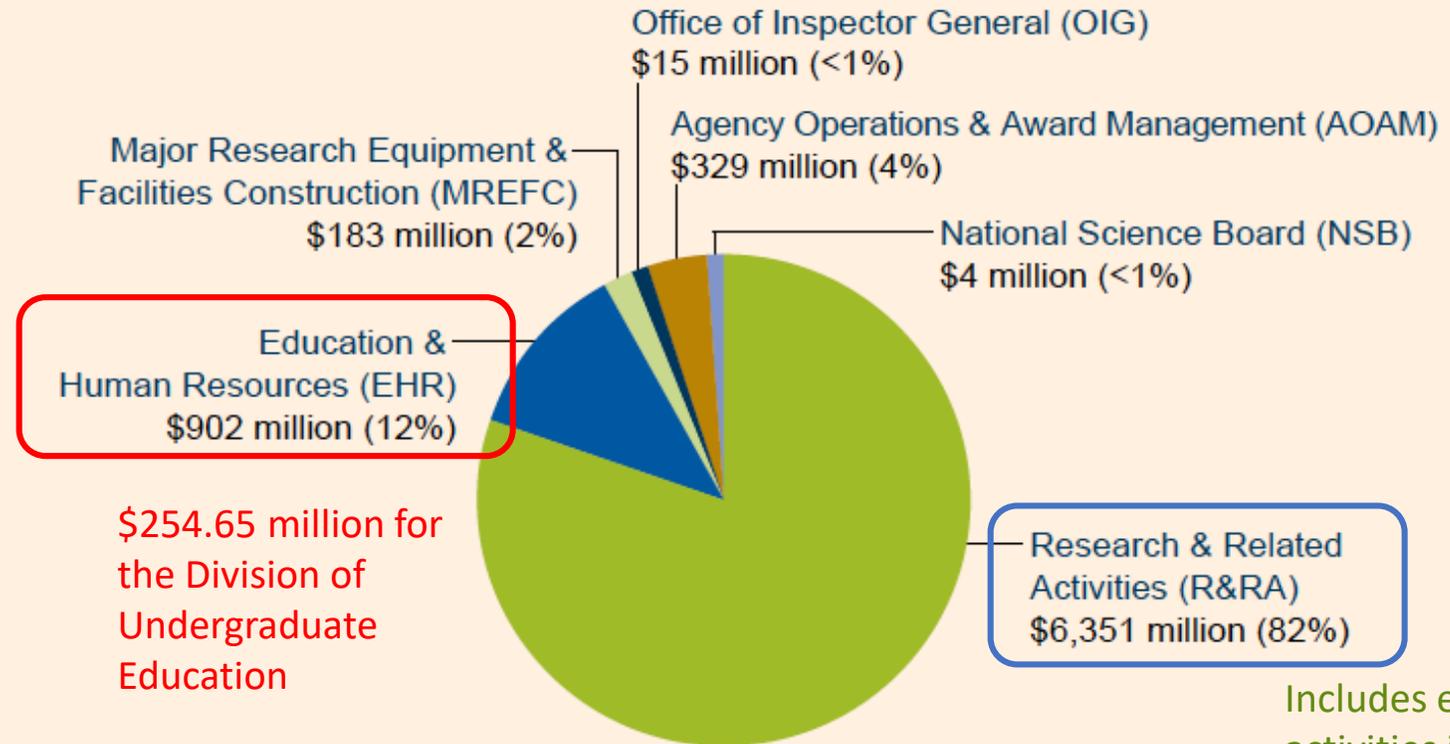
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The NSF Budget

Where It Comes From

FY 2018 Appropriations by Account—\$7,784 million



\$254.65 million for
the Division of
Undergraduate
Education

Includes education-related
activities in Biology,
Engineering, Computer
and Information Science
and Engineering

Note: R&RA includes Additional Supplemental Appropriation for Disaster Relief Requirements of \$16.3 million from P.L. 115-123.

Totals may not add due to rounding.

<https://www.nsf.gov/pubs/2019/nsf19003/nsf19003.pdf>

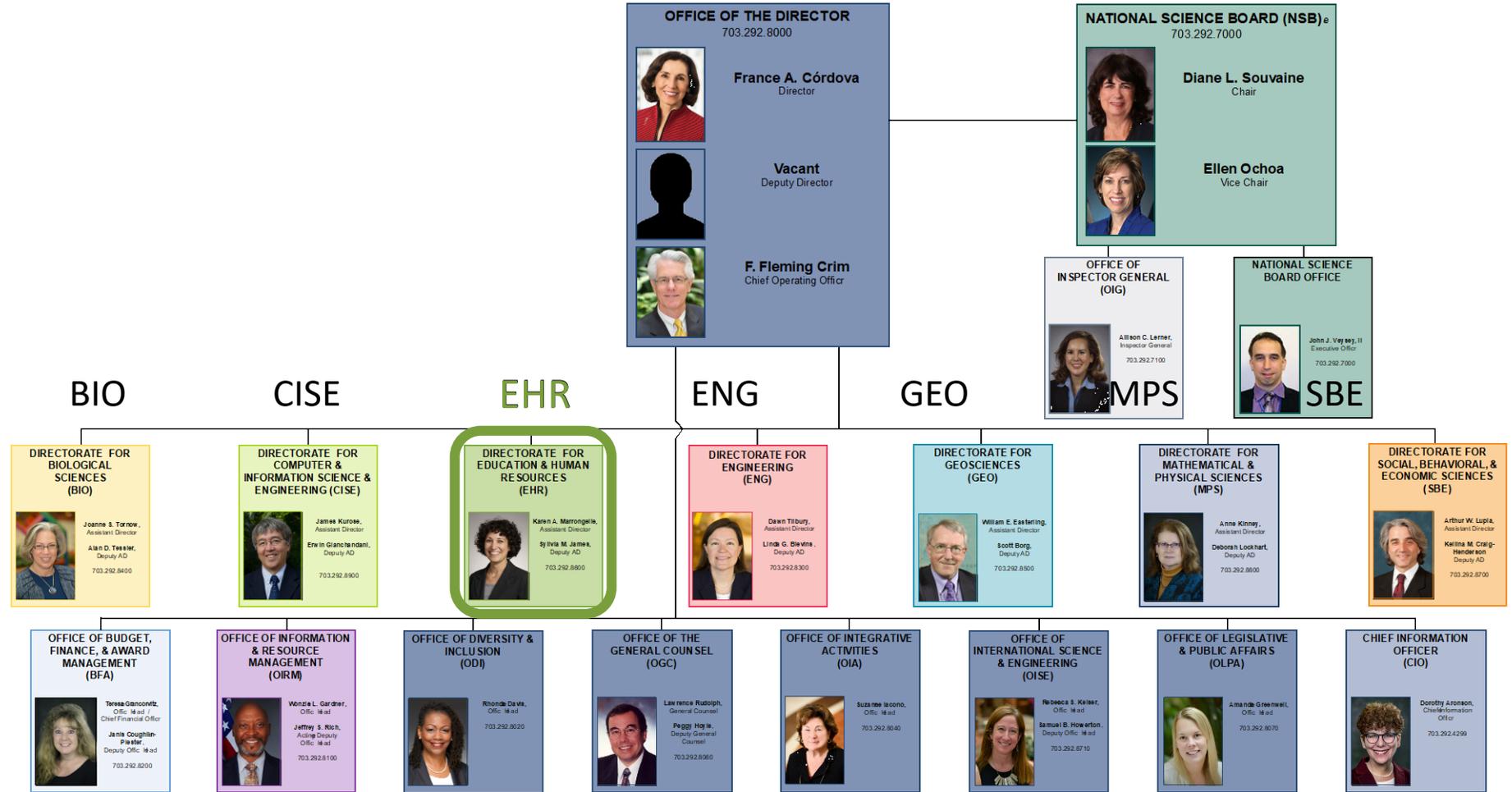
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NSF Organization



NATIONAL SCIENCE FOUNDATION



National Science Foundation
2415 Eisenhower Avenue
Alexandria, Virginia 22314
TEL: 703.292.5111 | FIRS: 800.877.8339 | TDD: 800.281.8749

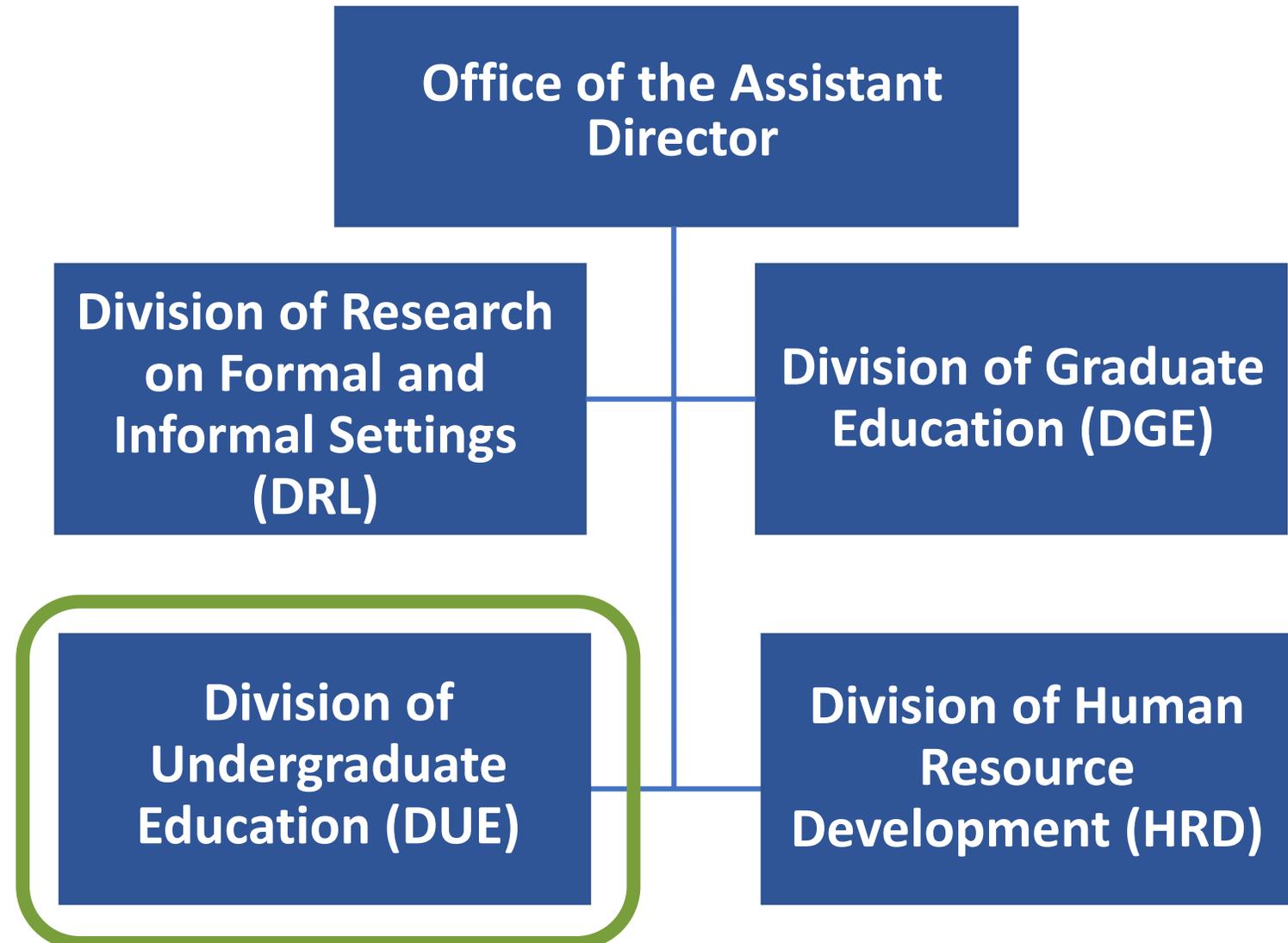


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Directorate for Education & Human Resources





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Directorate for Education and Human Resources (EHR) Goals

- ✓ Prepare the next generation of STEM professionals and attract/retain more Americans to STEM careers
- ✓ Develop a robust research community that can conduct rigorous research and evaluation to support excellence in STEM education
- ✓ Increase the technological, scientific and quantitative literacy of all Americans
- ✓ Broaden participation and close achievement gaps in all STEM fields



Funding Opportunities



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Advanced Technological Education

(ATE, NSF 18-571)

ATE focuses on the education of technicians to meet workforce demands in existing and emerging advanced technological fields.

Must respond to hiring needs for highly-skilled technical workforce in the service area of the proposing institution(s).

Must address sustainability.

Colleges that award two-year degrees and their faculty must play a leadership role on all projects.

Requires partnerships between two-year colleges and business and industry, along with secondary schools, four-year colleges and universities, and government, as appropriate.

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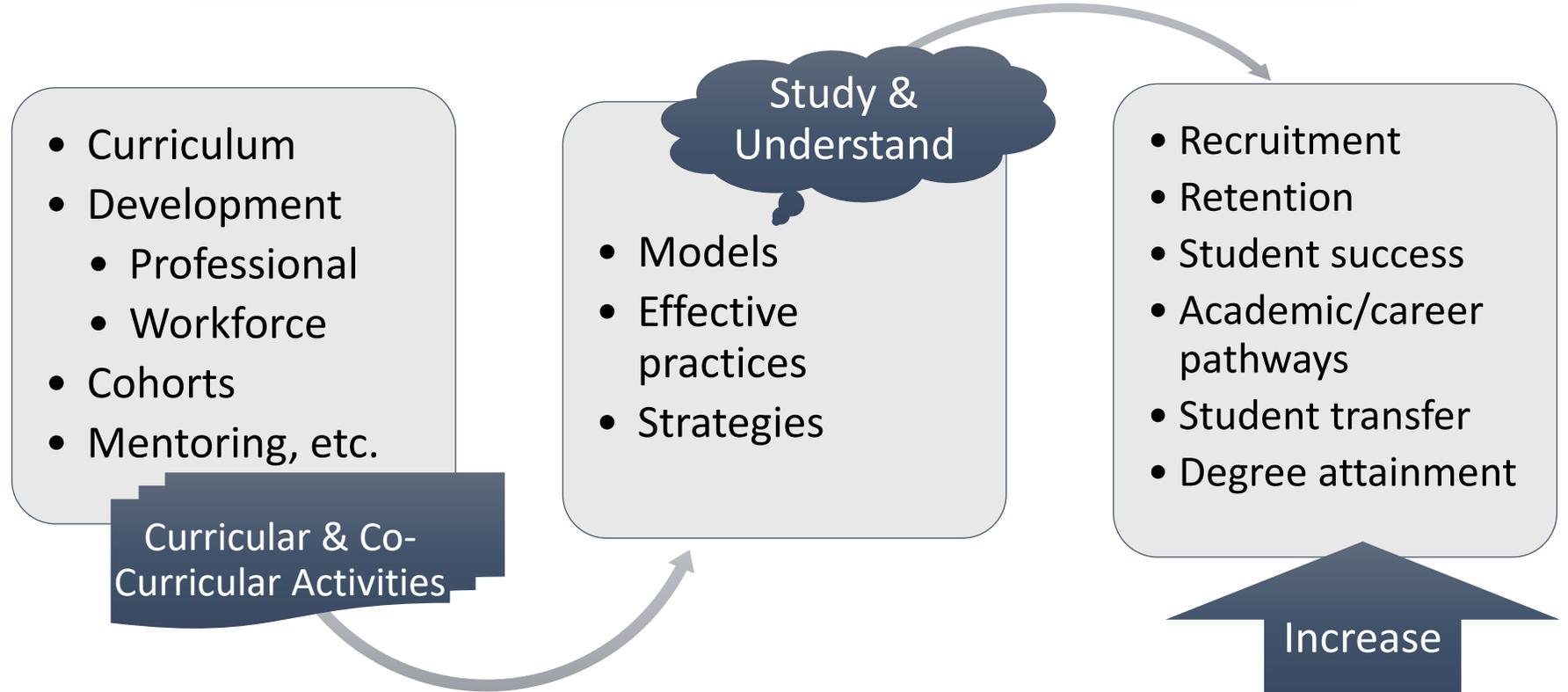
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Scholarships for Science, Technology, Engineering, and Mathematics (S-STEM)

NSF 17-527

Due: last Wednesday in March

Up to \$10,000 per year for STEM majors at
Associate, Bachelors, Masters, or PhD Level



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Improving Undergraduate STEM Education (IUSE: EHR)

NSF 17-590

Competitive proposals should **build on available evidence and theory, generate evidence, and build knowledge.**

- Improve STEM learning and learning environments
- Build professional STEM workforce for tomorrow
- Broaden participation and institutional capacity for STEM learning

Questions



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NSF Proposal Process

PHASE I

PROPOSAL
PREPARATION
AND SUBMISSION
90 DAYS

1

OPPORTUNITY
ANNOUNCED

2

PROPOSAL
SUBMITTED

3

PROPOSAL
RECEIVED

PHASE II

PROPOSAL
REVIEW AND
PROCESSING
6 MONTHS

4

REVIEWERS
SELECTED

5

PEER
REVIEW

6

PROGRAM OFFICER
RECOMMENDATION

7

DIVISION
DIRECTOR
REVIEW

PHASE III

AWARD
PROCESSING
30 DAYS

8

BUSINESS
REVIEW

9

AWARD
FINALIZED





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Merit Review Criteria

- **Intellectual Merit**
 - advance knowledge
- **Broader Impacts**
 - achieving societal goals
 - How?
 - through research itself
 - related to specific research projects
 - through complementary projects





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Merit Review Considerations

- Potential to advance knowledge
- Benefit to society
- Creative, original, transformative
- Project plan well-reasoned, well-organized, sound rationale
- Assessment mechanism
- Qualifications of leadership team
- Adequate resources

Break



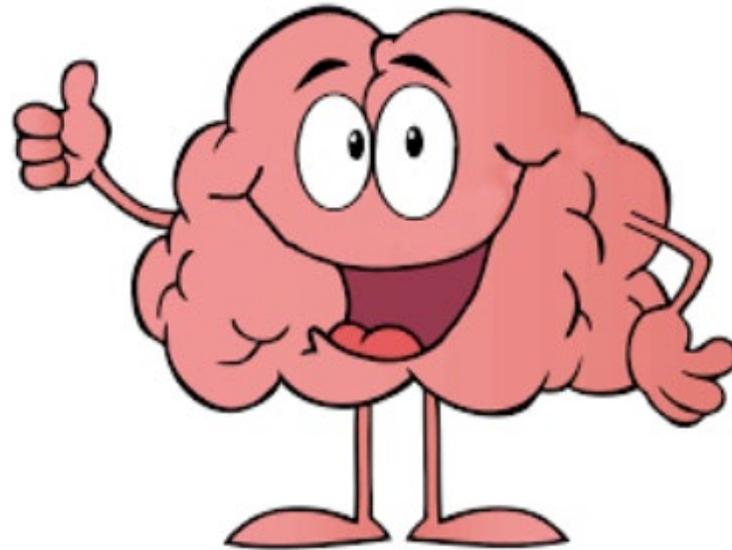
Vignettes



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Is it Intellectual Merit or Broader Impacts?



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Think, Pair, Share: NSF's TWO Merit Review Criteria

1. Intellectual Merit
 - What will we learn?
 - How will it advance knowledge?

 2. Broader Impacts
 - What will the impact be on society?
 - How will it make the nation a better place?
- Challenging in educational proposals

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MOOC Vignette

- This project is developing the use of Massively Open Online Courses (MOOCs) and associated on-line learning modes to engage large numbers of STEM future faculty and to prepare them to implement and advance evidence-based, high-impact teaching practices.



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Big Data

- The new department will focus on the analysis of "big data" - large sets of computational and observational data - that are becoming increasingly prevalent in STEM.

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Faculty Development

- Activities planned will provide in-depth faculty development through a national series of workshops, and an expansion of an ongoing national study of the effectiveness of this approach for learning about evolution and the nature of science.



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Hypothesis-Driven Experimental Science

- This project will demonstrate that engaging in hypothesis-driven experimental science is a powerful tool in educating students to become scientists.





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Development, Implementation, and Research

- In addition to development and implementation of a novel curriculum, the project will include educational research to uncover new information about undergraduate model-based-reasoning through detailed assessment of classroom learning.



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Project Impacts

- Project impacts will include reform of a key introductory course at two institutions which serve large numbers of students from underrepresented groups



Lunch Break



Breakouts to talk about special programs you are interested in



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Who will talk about the programs

Karen

- CAREER 1:45
- EHR Core Research 2:00
- Building Capacity in STEM Education Research 2:00

Steve

- Robert Noyce Scholarships 1:45
- Midscale Infrastructure 2:00

Stephanie

- Harnessing the Data Revolution: Data Science Corps 1:45
- IUSE: Computing in Undergraduate Education 1:45
- Future of Work at the Human-Technology Frontier 2:00
- National Artificial Intelligence (AI) Research Institutes 2:00

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Harnessing the Data Revolution: Data Science Corps (HDR: DSC, NSF 19-546)

- Build capacity for harnessing the data revolution
 - at the local, state, national, and international levels
 - to help unleash the power of data in the service of science and society
- Focuses specifically on enabling participation by undergraduate students in the *Data Science Corps*, by
 - supporting student stipends for participation in data science projects
 - supporting integration of real-world data science projects into classroom instruction



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Improving Undergraduate STEM Education: Computing in Undergraduate Education/Re-envisioning computing in Undergraduate Education (USE, CUE, NSF 19-546)

➤ Two key program requirements

- 1) Collaborations of 3 to 5 IHEs working together, structured and functioning (formally or informally) as a Networked Improvement Community
- 2) All proposals must include specific BPC effort



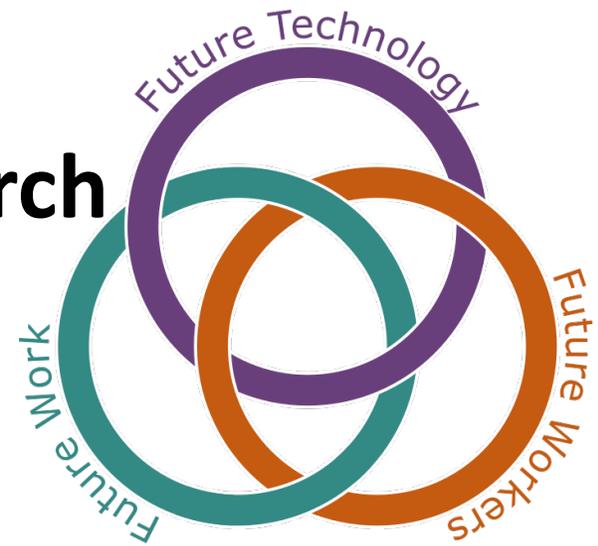
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Future of Work at the Human-Technology Frontier: Core Research

(FW-HTF, NSF 19-541)



Overarching vision

- Support convergent research within the **domain of work**
- Understand and advance the human-technology partnership
- Promote new technologies to augment human performance
- Illuminate the emerging socio-technological landscape and understand the risks and benefits of new technologies
- Foster lifelong and pervasive learning with technology

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National Artificial Intelligence (AI) Research Institutes: Accelerating Research, Transforming Society, and Growing the American Workforce (NSF 20-503)

- Accelerate the development of transformational technologies
- Ground AI research in critical application sectors that
 - Motivate foundational research advances
 - Provide opportunities for the effective fielding of AI-powered innovation
- Themes for 2020
 - Trustworthy AI
 - Foundations of Machine Learning
 - AI-Driven Innovation in Agriculture and the Food System
 - AI-Augmented Learning
 - AI for Accelerating Molecular Synthesis and Manufacturing
 - AI for Discovery in Physics
- Joint effort multiple agencies: NSF, USDA NIFA, DHS S&T, DOT FHWA, VA



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Education and Human Resources Programs

- **EHR Core Research (ECR, NSF 19-508)**

- Focuses on fundamental research (basic research or use-inspired basic research) that advances knowledge in one or more of the three Research Tracks: Research on **STEM Learning and Learning Environments**, **Research on Broadening Participation in STEM fields**, and **Research on STEM Workforce Development**

- **Associated Dear Colleague Letters**

- **NSF 19-044:** Fundamental Discipline-Based Education Research (DBER) Focused on Undergraduate and Graduate STEM Education within the EHR Core Research (ECR) Program
- **NSF 19-033:** Research to Improve STEM Teaching and Learning, and Workforce Development for Persons with Disabilities
- **NSF 19-035:** Fundamental Research on Equity, Inclusion, and Ethics in Postsecondary Academic Workplaces and the Academic Profession within the EHR Core Research Program
- **NSF 19-025:** STEM Workforce Development Using Flexible Personal Learning Environments
- **NSF 19-036:** Developing and Testing New Methodologies for STEM Learning Research, Research Syntheses, and Evaluation



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Building Capacity in STEM Education Research (BCSER)

Solicitation 19-565

- **BCSER** supports projects that build individuals' capacity to carry out high quality STEM education research that will enhance the nation's STEM education enterprise and broaden the pool of researchers that can conduct fundamental research
- Supports activities that enable early and mid-career researchers to acquire the requisite expertise and skills to conduct rigorous fundamental research in STEM education: qualitative and quantitative research methods and design,
- Specifically targeting disciplinary researchers that might want to become educational researchers in STEM

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Faculty Early Career Development (CAREER) Program

NSF 17-537

- Supports early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the missions of their organizations

Requirements:

- ✓ Hold a doctoral degree by proposal deadline
- ✓ Be untenured and employed in a **tenure-track (or tenure-track-equivalent)** assistant professor position at an eligible institution as of October 1st following deadline
- ✓ Have both research and educational responsibilities at the eligible institution
- ✓ Have not previously received a CAREER award
- ✓ Have not had more than two CAREER proposals reviewed previously





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Research & Evaluation

Research

- **Research** addresses a research question and/or hypothesis that is important to the project and the field, and is appropriate to the **size** and **scope** of the project.

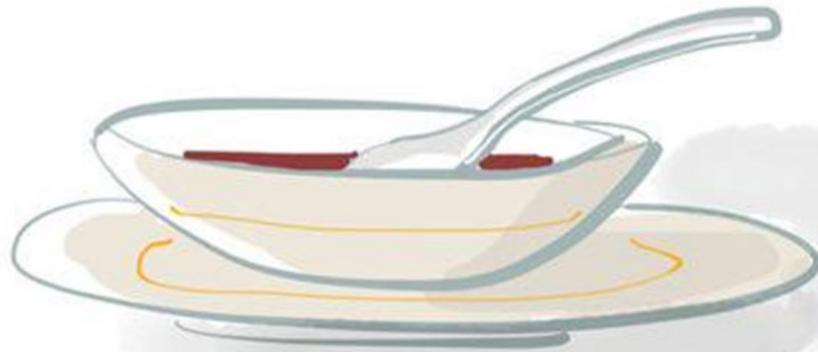
Project Evaluation: Measures to Assess Success

- The **evaluation plan** examines all aspects of the project activities to inform the project's progress towards its goals, and is appropriate to the **size** and **scope** of the project.

Successful proposals will have well aligned research questions/hypotheses, methods, analyses, project activities, and project evaluation.



Research vs. Evaluation



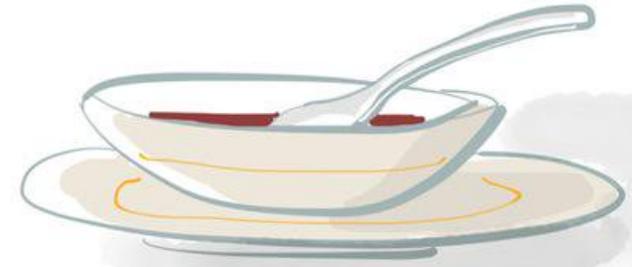
- **Research**
 - What happens to the soup's flavor when I use different ingredients?
 - How does the rate of cooling change when I use different bowls?
- **Evaluation**
 - Did I use appropriate procedures to make the soup?
 - Did I adequately consider the possible ingredients I might use?

Kinds of Evaluation

FORMATIVE SUMMATIVE



WHEN THE **CHEF**
TASTES THE SOUP



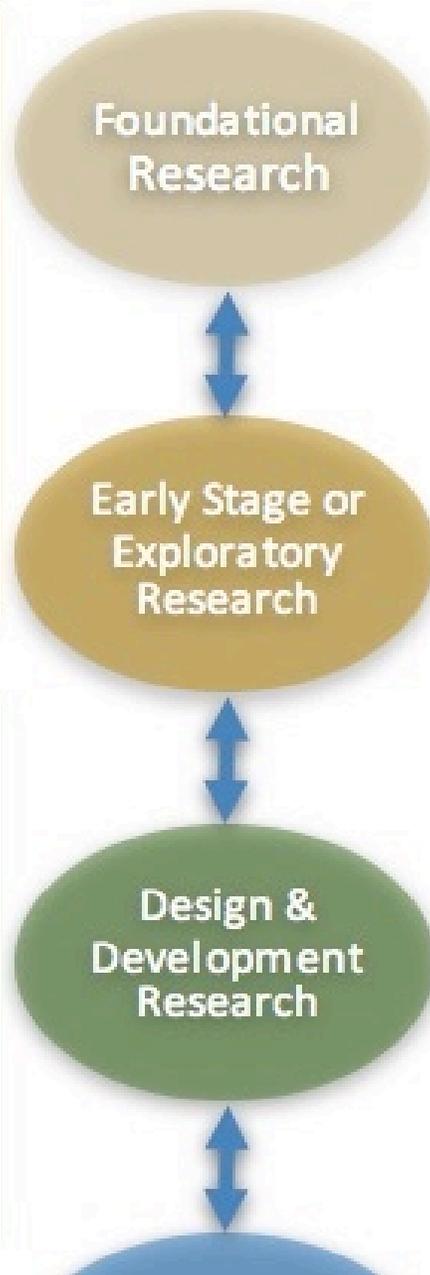
WHEN THE **GUESTS**
TASTE THE SOUP





Contribute to core knowledge:
How does learning take place?

Develop Solutions:
Will a particular intervention or strategy achieve the intended outcomes?



Pipeline View^[1]

- What is the phenomenon to be studied?
- How is the phenomenon linked to desired outcomes?
- What is a possible solution? What measures will assess the implementation of the solution? How will data be collected to determine the feasibility of implementing the solution? How will a pilot study be conducted to examine the promise of generating the intended outcome?
- Can carefully chosen participants in a formative assessment workshop complete the exercise and

[1] Stephanie E. August. 2017. NSF PROGRAM OFFICER'S VIEWS: Common guidelines for conducting education research. ACM Inroads 8, 1 (February 2017), 35-36. DOI: <https://doi.org/10.1145/3029346>

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Dev
Will
inte
act
out

Contribute to evidence of impact:
What evidence estimates the ability of a fully developed intervention or strategy to achieve its intended outcomes?



formative assessment workshop complete the exercise and demonstrate the intended outcome when the developer is there to explain the application, answer questions, and make fixes as problems arise?

- Can students complete the exercise and demonstrate the intended outcome when the developer presents it as a regular class activity in the context of a regular offering of the target course?
- Can students at multiple universities or in parallel offerings of the courses at one university taught by multiple instructors complete the exercise and demonstrate the intended outcome independently?

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Common Guidelines

- The publication, [Common Guidelines for Education Research and Development](#) (NSF 13-126), offers guidance on building the evidence base in STEM learning.
- “To establish cross-agency guidelines for improving the quality, coherence, and pace of knowledge development in science, technology, engineering and mathematics (STEM) education.”
- Research and development efforts that increase understanding of effective undergraduate STEM teaching and learning provide the foundation for building the STEM workforce of tomorrow and improving scientific literacy.



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Research, Evaluation, and Assessment

Discuss with your name– same or
different?

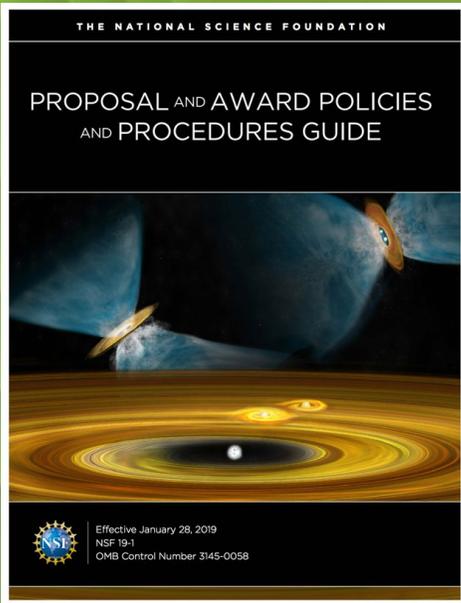
Be ready to share out an idea.

Questions?



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NSF 19-1 PAPPG

- Provides guidance for preparation of proposals
- Specifies process for deviations, such as individual program announcements
- Describes process -- and criteria -- by which proposals will be reviewed
- Describes process for withdrawals, returns & declinations
- Describes the award process and procedures for requesting continued support
- Identifies significant grant administrative highlights



2. Sections of the Proposal

The sections described below represent the body of a research proposal submitted to NSF. Failure to submit the required sections will result in the proposal not being accepted¹², or being returned without review. See Chapter IV.B for additional information.

A full research proposal must contain the following sections¹³. Note that the *NSF Grants.gov Application Guide* may use different naming conventions, and sections may appear in a different order than in FastLane, however, the content is the same:

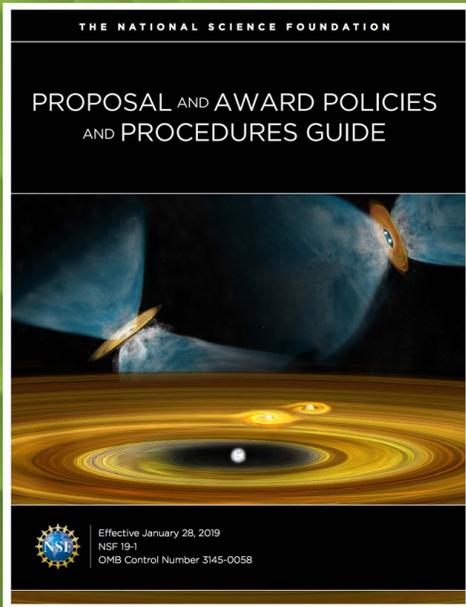
- a. Cover Sheet
- b. Project Summary
- c. Table of Contents
- d. Project Description
- e. References Cited
- f. Biographical Sketch(es)
- g. Budget and Budget Justification
- h. Current and Pending Support
- i. Facilities, Equipment and Other Resources
- j. Special Information and Supplementary Documentation
 - Data Management Plan
 - Postdoctoral Mentoring Plan (if applicable)
- k. Single Copy Documents
 - Collaborators & Other Affiliations Information

The proposal preparation instructions for RAPID, EAGER, RAISE, GOALI, Ideas Lab, FASED, conference, equipment, travel, center, research infrastructure, and fellowship proposal types may deviate from the above content requirements.

All proposals to NSF will be reviewed using the two NSB-approved merit review criteria described in greater length in Chapter III.

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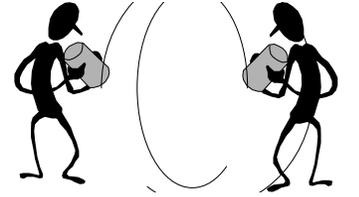


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Who should you talk to?



NSF Program Officer

- Your proposed project
- Clarifications on specific program requirements/limitations
- Current program patterns

Your Organization's Sponsored Projects Office

- University guidelines for applications
- Institutional Review Board “IRB” Approvals
 - e.g. institutional Animal Care and Use Committee (IACUC) approvals

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Funding decisions

- The merit review panel summary provides:
 - Review of the proposal and a recommendation on funding.
 - Feedback (strengths and weaknesses) to the proposers.
- NSF Program Officers make funding recommendations guided by program goals and portfolio considerations.
- NSF Division Directors either concur or reject the Program Officer's funding recommendations.

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Issuing the award

- NSF's Division of Grants and Agreements (DGA) reviews the recommendation from the program office for business, financial, and policy implications.
- NSF's grants and agreements officers make the official award as long as:
 - ✓ The institution has an adequate grants management capacity.
 - ✓ The PI/Co-PIs do not have overdue annual or final reports.
 - ✓ There are no other outstanding issues with the institution or PI



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Other Useful Resources

**FastLane
User
Support**

(7 AM to 9 PM Eastern Time • M-F)
1-800-673-6188

- NSF: www.nsf.gov
- PAPPG: https://www.nsf.gov/pubs/policydocs/pappg19_1/index.jsp
 - Proposal Preparation Instructions:
https://www.nsf.gov/pubs/policydocs/pappg19_1/pappg_2.jsp
- Guide to Programs: www.nsf.gov/funding/browse_all_funding.jsp
- Award Information: www.nsf.gov/awardsearch
- FastLane: www.fastlane.nsf.gov
- Data Management Plan: www.nsf.gov/bfa/dias/policy/dmp.jsp
- Funding Opportunities: www.nsf.gov/funding



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Receiving NSF Notifications

- Deadlines are 90 days after the announcement is posted to the NSF website
- To get notifications, go to <http://www.nsf.gov/>
 - Click on “News” in the top menu panel
 - Click on the “Get News Updates by  Email” link at the top
 - You can also sign up to get updates from Directorates



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Announcements

New INCLUDES Alliances Solicitation Released [Read More >](#)

New IUUSE: HSI Solicitation Released [Read More >](#)

DCL - EHR AD Search [Read More >](#)

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Remarkable 'electronic nose' could sniff out nerve gas and rotten foods simultaneously

FEBRUARY 22, 2018



Duplicate genes help animals resolve sexual conflict

FEBRUARY 19, 2018



Why bees soared and slime flopped as inspirations for systems engineering

FEBRUARY 19, 2018

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EHR supports excellence in U.S. STEM education at all levels, in all settings for the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians and educators and a well-informed citizenry.

[Read More](#)

Announcements

- New INCLUDES Alliances Solicitation Released [Read More >](#)
- New IUSE: HSI Solicitation Released [Read More >](#)
- DCL - EHR AD Search [Read More >](#)

[See All >](#)

News

-  Remarkable 'electronic nose' could sniff out nerve gas and rotten foods simultaneously
FEBRUARY 22, 2018
-  Duplicate genes help animals resolve sexual conflict
FEBRUARY 19, 2018
-  Why bees soared and slime flopped as inspirations for systems engineering
FEBRUARY 19, 2018

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Interested in more insight?

- An excellent way to train for writing a winning proposal is to review proposals
 - Become more familiar with proposal structure
 - Learn to look at a proposal from inside the mind of the reviewer
 - Complete the reviewer survey
 - https://www.surveymonkey.com/r/NSF_DUE_Reviewer_Info
 - Contact a cognizant PO to volunteer today
 - Send a 2-page CV





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Thank you for coming!

Karen Keene kkeene@nsf.gov

Stephanie August saugust@nsf.gov

Steve Turley rturley@nsf.gov

