NSF Programs that Support STEM Education

Karen Crosby & Gül Kremer
Program Officers
NSF Division of Undergraduate Education (DUE)
Education and Human Resources Directorate (EHR)

HBCU-UP/CREST PI Meeting
February 19th-20th
NSF at a Glance

$7.2 billion
FY 2014 Appropriations

24 percent
NSF’s share of total federal support for basic research conducted at academic institutions

10,800
Competitive awards funded by NSF

22 percent
Funding rate of proposals submitted to NSF

50,000
Proposals evaluated through competitive merit review

233,000
Number of proposal reviews

36,500
Number of experts who participate in the merit review process

1,922
Colleges, universities and other institutions in all U.S. states and territories that receive NSF funding

299,000
Number of people NSF supports directly (researchers, postdoctoral fellows, trainees, teachers and students)

200 plus
Number of Nobel Laureates supported by NSF

90 percent
Proportion of NSF funding allocated through grants and cooperative agreements

$169,107
Average annual size of NSF research grant

2.9 years
Average duration of NSF research grant

Figures represent FY 2013 actuals except where noted.
Organization of EHR

DIRECTORATE FOR EDUCATION & HUMAN RESOURCES (EHR)

Joan Ferrini-Mundy, Assistant Director
Jeremelina L. Tupas, Acting Deputy AD
703.292.8600

DIVISION OF GRADUATE EDUCATION (DGE)
James Lightbourne, Division Director
703.292.8630

DIVISION OF HUMAN RESOURCE DEVELOPMENT (HRD)
Sylvia James, Division Director
703.292.8640

DIVISION OF RESEARCH ON LEARNING IN FORMAL & INFORMAL SETTINGS (DRL)
Sarah McDonald, Acting Division Director
703.292.8620

DIVISION OF UNDERGRADUATE EDUCATION (DUE)
Susan Singer, Division Director
703.292.8670
DUE’s Mission:

To promote excellence in undergraduate science, technology, engineering, and mathematics (STEM) education for all students.

Potentially Transformative Education R&D
STEM Education Programs

• DUE programs in undergraduate STEM education:
  – Improving Undergraduate STEM Education (IUSE:EHR)
  – Advanced Technological Education (ATE)
  – Scholarships in Science, Technology, Engineering, and Mathematics Education (S-STEM)

• EHR-wide: Innovation Corps for Learning (I-Corps L)

• EHR-wide: EHR Core Research (ECR)

• Cross-Directororate:
  – Faculty Early Career Development (CAREER) Programs
  – Nanotechnology Undergraduate Education (NUE) in Engineering
  – Revolutionizing Engineering Departments (IUSE/PFE:RED)
Improving Undergraduate STEM Education (IUSE: EHR) Program Goals

• **Improve STEM Learning & Learning Environments:** Improve the knowledge base for defining, identifying, and innovating effective undergraduate STEM education teaching and learning

• **Broaden Participation & Institutional Capacity for STEM Learning:** Increase the number and diversity of undergraduate students

• **Build the Professional STEM Workforce for Tomorrow:** Improve the preparation of undergraduate students

• *Proposals should describe projects that build on available evidence and theory, and that will generate evidence and build knowledge.*
IUSE: EHR Program

Two Program Tracks

Engaged Student Learning

- Exploration (smaller scope)
  - Up to $250k, 2 yrs
  - Oct. 22, 2014

- Design and Development (larger scope)
  - Level I: Up to $600k, 3 yrs
  - Level II: $601k to $2M, 5 yrs
  - Jan. 13, 2015

Institutional and Community Transformation

- Exploration (smaller scope)
  - Up to $250k, 2 yrs
  - Oct. 24, 2014

- Design and Development (larger scope)
  - Up to $3M, 5 yrs
  - Jan. 13, 2015

Focuses on design, development, implementation of and research on STEM learning models, approaches, and tools

Focus on approaches to increase the propagation of highly effective methods of STEM teaching and learning
Advanced Technological Education (ATE) Program

• ATE was launched by NSF in 1993 in response to the Scientific and Advanced-Technology Act (SATA) of 1992.
• Focus: education of science and engineering technicians for high-technology fields that drive the nation’s economy.
• ATE Projects, ATE Centers & Targeted Research on Technician Education.
• Grades 7-12, two-year and four-year institutions (pathways).
• Community and technical colleges must be in leadership roles.
• Education / Industry partnerships are a hallmark of ATE.
• Proposal deadline: October 8, 2015; October 6, 2016
NSF Scholarships in STEM (S-STEM) Program

• Supports institutional scholarship programs for full-time, academically-talented STEM students with financial need

• Strong proposals develop programs for cohorts of students that address local needs, and effectively mentor and support students to enable them to enter the STEM workforce or graduate school

• Uses FAFSA Federal Student Aid to determine need

• Funded entirely from H1-B Visa fees

• Up to $10,000/student/year

• Proposal Deadline: August 12, 2014
Innovation Corps for Learning (I-Corps L)

- **Problem**: Educational innovations not reaching potential users. Increase sustainable scaling of outcomes of NSF research.
- Program to promote adoption of innovations in STEM education resulting from prior NSF support.
- $50K award combined with intensive workshops and highly engaged mentors.
- Participate as a 3-person team in a 7-week program
- Lean and agile philosophy: Customer discovery
- 24 teams to be supported.
- 1 page application!
- **Proposal Deadline**: September 30, 2014
EHR Core Research (ECR) Program [EHR-wide]

• Supports foundational research in the four core areas of STEM Learning, Learning Environments, Workforce Development, and Broadening Participation

• Foundational questions or issues have the potential to build or refine research foundations in one or more of the four core areas

• Obama Administration’s fiscal year 2015 budget request to Congress proposes consolidating the ECR program and the Research on Education and Learning (REAL) program

• *Next target date: February 3, 2015* (NSF 13-555)
Faculty Early Career Development (CAREER) Program [NSF-wide]

• Supports junior faculty early in their independent research careers who exemplify the role of teacher-scholar

• EHR CAREER research may focus on research to understand chemistry learning and education

• Five-year integrated research and education plan, with minimum total budget request of $400,000

• DUE programs that accept CAREER proposals include:
  ▪ Improving Undergraduate STEM Education (IUSE)
  ▪ EHR Core Research (ECR)
Nanotechnology Undergraduate Education (NUE) in Engineering

• Aims at introducing nanoscale science, engineering, and technology through a variety of interdisciplinary approaches into undergraduate engineering education

• Dissemination via www.nanohub.org
  ▪ Educational content, assessment instruments, and learning results
  ▪ Host project web page

• Next *anticipated* proposal deadline: May 2015
IUSE/Professional Formation of Engineers: Revolutionizing Engineering Departments (RED)

- **Key Challenges Addressed:**
  - Bridging innovations in introductory- and capstone-level engineering and computer science education across the entire undergraduate experience, including extracurricular professional activities and student transitions in and out of the program.
  - Faculty development, faculty reward systems, and academic cultures that encourage engagement of faculty and students of diverse backgrounds in the full undergraduate-level PFE process.

- **Team Members:**
  - PI – Department Chair/Head (or Equivalent)
  - Engineering/Computer Science Education Research Expert
  - Social Science Expert

- **Letter of Intent Due Date:** October 28, 2014; **Full Proposal Due Date:** November 26, 2014
Proposal Development Resources
Project Evaluation

• Surveying STEM Faculty and Students
• Interviewing STEM Faculty and Students
• Observing STEM Teaching
• Teaching Portfolios
• Selecting and Combining Measurement Approaches
• Using Results to Improve STEM Teaching and Learning
NSF/IES guidelines “intended to improve the quality, coherence, and pace of knowledge development in STEM education”
Common Guidelines for Education R&D

- The *Common Guidelines* describe the roles of different types of R & D projects in generating evidence about strategies and interventions for enhancing student learning.
- For each type of R&D, the *Common Guidelines* describe:
  - Purpose
  - Empirical and theoretical justifications
  - Types of project outcomes
  - Quality of evidence
Common Guidelines for Education R&D

Types of Education R&D Projects:

1. Foundational
   - Contribute to core knowledge
2. Early stage/exploratory
3. Design and development
4. Efficacy studies
5. Effectiveness studies
6. Scale-up studies
   - Impact studies of fully-developed approaches
Proposal Writing Tips
"The world is round, you expect a federal grant for that?!

10-12

Frank & Earnest
Organization of a Proposal

• Goals and expected outcomes
• Rationale
  – Introduction
  – Background (prior work, theoretical basis)
  – Justification (importance, impact, need)
• Project Plans
  – Implementation plan
  – Evaluation plan
  – Management plan
  – Dissemination plan
  – Sustainability plan (beyond grant period)
• Note: There may other approaches stipulated by program solicitation
Common Strengths

- Commitment to undergraduate education
- Innovative idea
- Highly qualified PIs in technical areas
- Identifies significant issues
- Likely to have a large impact
- Builds on literature; utilizes knowledge of how we learn
- Detailed development plans
- Outreach to diverse students
- Clear evaluation plan
- Develop portable products, clear dissemination plan
- Implements active learning
- Writing style and structure well done
"I think you should be more explicit here in step two."
Common Weaknesses

• Proposed activities are not described in sufficient detail with clear plans
• Not transformative or low impact
• Not meeting program criteria (read Solicitation)
• Lacks clearly defined outcomes
• Lacks or inadequate evaluation
• Lacks or inadequate dissemination plan
• Does not build on prior work, not analyzing literature
• Not sustainable/failure to develop institutional support
• Does not have good potential for involving URM or women
• Specific to institution, not transferable
• Proposed collaboration with other organizations is not detailed or believable
• Budget allocation concerns
Little Things Can Make A Difference

- Follow the guidelines in the *Program Announcement* and *Grant Proposal Guide (GPG)*
- Separate statements on the *BROADER IMPACTS* and *INTELLECTUAL MERIT* in the Summary
- Discuss results from *prior NSF support*
- Observe the *page limitations*
- Avoid abbreviations
- Use a spell checker before submitting
- Define acronyms in the first use
- Check your references
DO YOU HAVE AN IDEA FOR YOUR GRANT YET?

NO, I'M WAITING FOR INSPIRATION.

YOU CAN'T JUST TURN ON CREATIVITY LIKE A FAUCET. YOU HAVE TO BE IN THE RIGHT MOOD.

WHAT MOOD IS THAT?

LAST-MINUTE PANIC.
Receiving NSF Notifications

• Deadlines are 90 days after the announcement is posted to the NSF website

• To get a notifications, go to www.nsf.gov
  – Click on News” in the top menu panel
  – Click on the “Get NSF Updates by mail” link at the top
  – You can also sign up to get updates from Directorates
Two new reports have recently been issued:

The first is a report of a workshop on Advancing Technology-Enhanced Education.

The second is the report of a meeting on Describing and Measuring Undergraduate STEM Practices.

If you are interested in reviewing proposals for DUE please fill out this form.
Thank you!

DUE Engineering Program Officers

Karen Crosby: kcrosby@nsf.gov  
IUSE:EHR, S-STEM, ATE

Gul Kremer: gkremer@nsf.gov  
IUSE:EHR, ATE, ECR, CAREER

John Krupczak: jkrupcza@nsf.gov  
IUSE:EHR, S-STEM, I-Corps L

Ece Yaprak: eyaprak@nsf.gov  
IUSE:EHR, S-STEM, ATE

Yvette Weatherton: yweather@nsf.gov  
IUSE:EHR, S-STEM, ATE, NUE, IUSE/PFE:RED