Division of Mathematical Sciences

What's New

Conference Board on the Mathematical Sciences
December 7, 2017

Henry Warchall
Senior Advisor
Division of Mathematical Sciences

NSF Has Moved!
2415 Eisenhower Avenue, Alexandria, Virginia 22314

Division of Mathematical Sciences FY 2018

Office of the Division Director

Tie Luo Acting Division Director	Nandini Kannan Acting Deputy Division Director	Henry Warchall Senior Advisor	Sharon Alston Program Support Manager	Onica Andrews Operations Specialist	Jennifer Connell Secretary	Catherine Paolucci AAAS Fellow

Administrative Staff

Khoren Claiborne Student Trainee	Robert Cruz Program Assistant
Antoinette Dedmon Program Technology Analyst	Carmen Franceschi Program Assistant
LaWanda Myers Program Specialist	Camelita Sellars-Wright Lead Program Assistant

Algebra & Number Theory

- J. Matthew Douglass
- Timothy Hodges
- Anatoly Libgober
- Andrew Pollington

Analysis

- Kevin Clancey
- Justin Holmer
- Yunping Jiang
- Edward Taylor

Applied Mathematics

- Marian Bocea
- Pedro Embid
- Victor Roytburd
- Michael Steuerwalt

Computational Mathematics

- Matthias Gobbert
- Leland Jameson
- Yvonne Ou

Probability, Combinatorics & Foundations

- Tomek Bartoszynski
- Stefaan De Winter

Statistics

- Nandini Kannan
- Robert Lund
- Gabor Szekely
- Yong Zeng

Topology & Geometric Analysis

- Thomas Ivey
- Joanna Kania-Bartoszynska
- Swatee Naik
- Christopher Stark

Mathematical Biology

- James Powell
- Junping Wang

FY 2018 Budget Request - DMS

R&RA in $M	FY15 Actual	FY16 Actual	FY17 Request	FY17 Current	FY18 Request
NSF	$6,042	$5,998	$6,079	$5,997	$5,362
MPS	$1,376	$1,349	$1,355	$1,356	$1,219
DMS	$235	$234	$235	$234	$210

DMS Funding Rates (Competitive Awards)

Comp. Awards	FY14	FY15	FY16	FY17
NSF	21%	22%	21%	21%
MPS	24%	25%	24%	24%
DMS	26%	26%	25%	24%

Ten Big Ideas for Future NSF Investment

https://www.nsf.gov/news/special_reports/big_ideas/index.jsp

RESEARCH IDEAS

MATHEMATICAL, STATISTICAL, COMPUTATIONAL FOUNDATIONS — EDUCATION WORKFORCE — ANALYTICS — DATA SCIENCE
HARNESSING THE DATA REVOLUTION
FUNDAMENTAL RESEARCH — MACHINE — DOMAIN SCIENCE — RESEARCH — LEARNING — DATA — CHALLENGES — CYBERINFRASTRUCTURE — MODELING — DATA — MINING — INTERNET OF THINGS

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

Navigating the New Arctic

Windows on the Universe: The Era of Multi-messenger Astrophysics
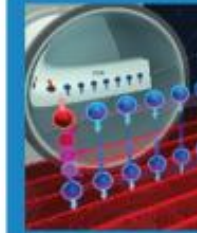
The Quantum Leap: Leading the Next Quantum Revolution

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

Ten Big Ideas for Future NSF Investment -- Research

- Harnessing Data for 21st Century Science and Engineering

- Understanding the Rules of Life: Predicting Phenotype

- The Quantum Leap: Leading the Next Quantum Revolution

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

- Navigating the New Arctic

- Work at the Human-Technology Frontier: Shaping the Future

Ten Big Ideas for Future NSF Investment -- Process

- Mid-scale Research Infrastructure (RFI: NSF 18-013)

- NSF INCLUDES: Enhancing Science and Engineering through Diversity (NSF 17-591 for INCLUDES Hubs)

- NSF 2026: The Integrative Foundational Funds

- Growing Convergent Research at NSF (DCL: NSF 17-065)

Transdisciplinary Research in Principles of Data Science (TRIPODS)

- Joint with NSF Computer Information Science & Engineering (CISE) Directorate
- Bring together the statistics, mathematics, and theoretical computer science communities to develop the theoretical foundations of data science through integrated research and training activities
- 12 Phase I awards. Each $500k per year for three years
- First PI Meeting in Oct. 2017
- Follow-on Phase II planned

NSF-Simons Research Centers for Mathematics of Complex Biological Systems

- Facilitate sustained collaborations among mathematical scientists and biologists to develop novel mathematical and statistical approaches that advance fundamental understanding of how and why emergent properties arise in molecular, cellular, and organismal systems

- Accelerate development of predictive frameworks for understanding phenotype

- Build capacity through cross-disciplinary training of the next generation of researchers

- Leverage ongoing biological research

NSF-Simons Research Centers for Mathematics of Complex Biological Systems

Division of Mathematical Sciences (DMS)

Division of Integrative Organismal Systems (IOS)

Division of Molecular and Cellular Biosciences (MCB)

Simons Foundation (SF)

Five year, $30M program to support 3 centers
equally funded by NSF and the Simons Foundation

- More than 50 proposed projects from over 80 institutions involving more than 400 researchers
- Review panel held in Nov. 2017
- Reverse site visits planned for February 2018

Mathematical Sciences Graduate Internship

Managed by Oak Ridge Institute for Science and Education

- Provide an opportunity for mathematical sciences doctoral students to participate in internships at federal national laboratories, industry, and other approved facilities

- For students who are interested in understanding application of advanced mathematical and statistical techniques to "real world" problems, regardless of whether the student plans to pursue an academic or nonacademic career

- 40 graduate students from 38 universities worked in 10 National Labs in the Summer of 2017

- SIAM News Article (12/01/2017): **The Mathematics of Seeing Clearly: Deblurring Images for National Security**

- **Next application deadline: February 1, 2018**

Joint DMS-EHR call for proposals in
Improving and Supporting the Transition to Graduate School in the Mathematical Sciences

Call for:

- Projects designed to encourage and prepare U.S. students to pursue and succeed in graduate doctoral study in the mathematical sciences generally, with a particular emphasis on broadening participation among students from underrepresented populations

- Projects that are (1) scalable to serve large numbers of students without large increases in cost and (2) sustainable, that is, have continued impact without ongoing large influxes of grant funding

DCL NSF 17-078: www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17078

Algorithms for Threat Detection (ATD)

- Collaboration with the National Geospational Intelligence Agency and with contributions from Behavioral and Cognitive Sciences (BCS) in SBE

- Support research projects to develop the next generation of mathematical and statistical algorithms for analysis of large spatio-temporal datasets with application to quantitative models of human dynamics, focusing on detecting unusual events

- 20 projects awarded

- First PI Meeting in September 2017

- Next proposals due in February 2018

Algorithms for Modern Power Systems (AMPS)

- Collaboration with Department of Energy
- Support research projects to develop the next generation of mathematical and statistical algorithms for improvement of the security, reliability, and efficiency of the modern power grid
- 10 projects awarded, PI meeting in Spring 2018
- Next competition planned for 2019

On the Horizon

- Connecting TRIPODS data science institutes with domain scientists

- Mathematical aspects of advancing fundamental understanding of quantum phenomena, materials, systems, and information processing methods

- Joint DMS and National Library of Medicine program on innovative approaches to important applications at the intersection of the biomedical and data sciences
  FY 2019 (MOU to be finalized)

- TRIPODS Phase II

- **Mathematical Sciences Research Institutes**
  Letters of intent due in December 2018
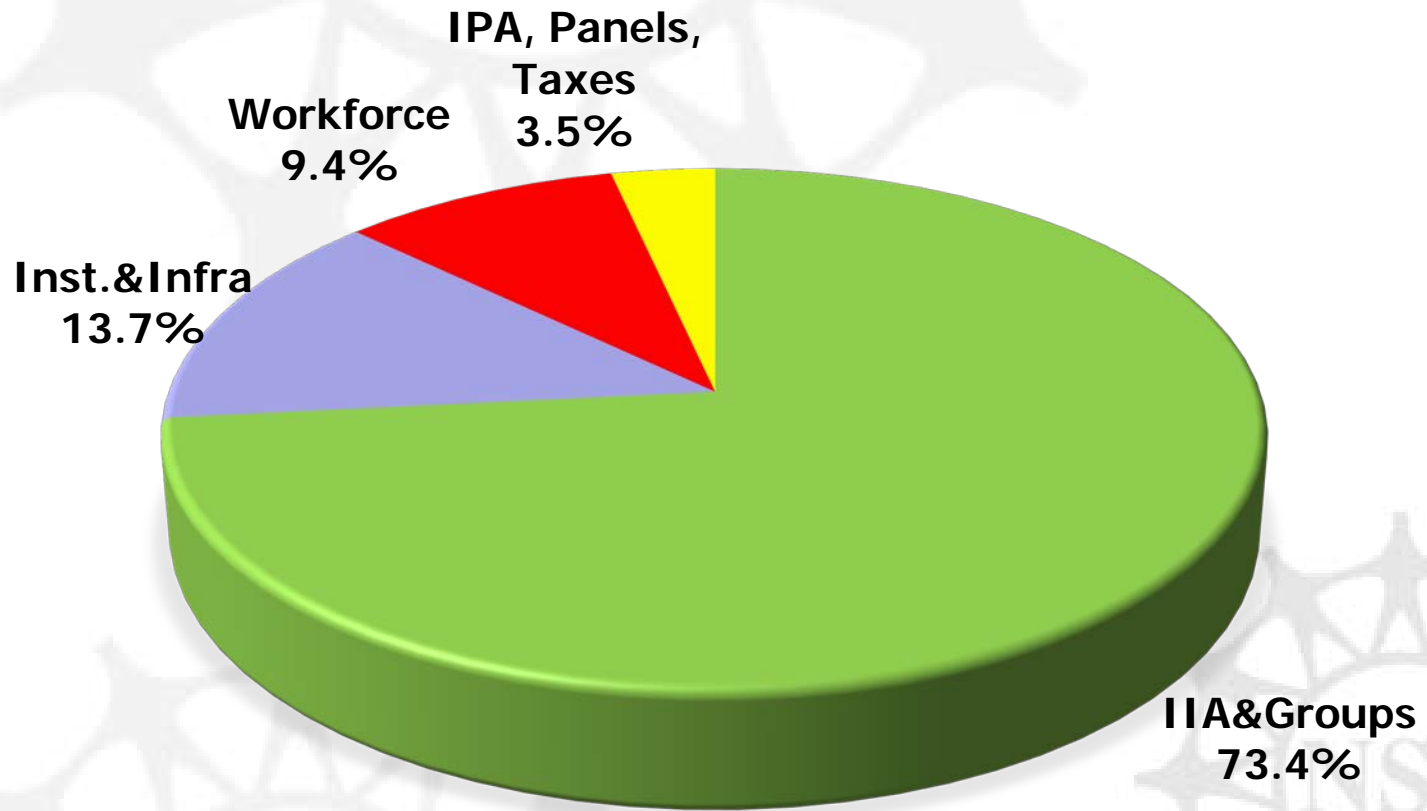 Proposals due in March 2019

Questions?

DMS FY 2016 Funds Allocation

Joint NSF/NIH Initiative on Quantitative Approaches to Biomedical Big Data (QuBBD)

- While there have been some encouraging developments related to foundational mathematical, statistical, and computational approaches for big data challenges over the past decade, there have been relatively few opportunities for collaboration on challenges related to biomedical data science

- QuBBD is designed to support research that addresses important application areas at the intersection of the biomedical and data sciences by encouraging inter- and multi-disciplinary collaborations that focus on innovative and transformative approaches to address these challenges

- 3 projects awarded by NSF and 7 by NIH