Activities in NSF's Division of Mathematical Sciences

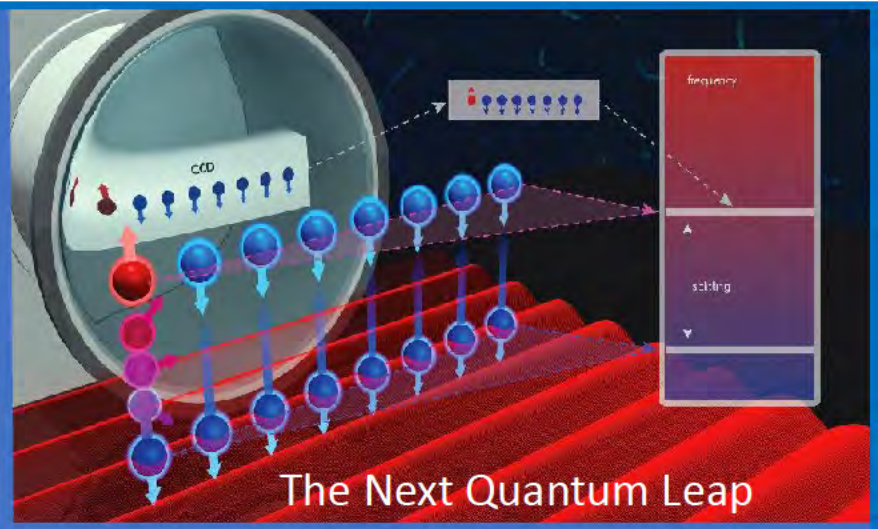
JUAN C. MEZA
DIVISION DIRECTOR
DIVISION OF MATHEMATICAL SCIENCES
JANUARY 15, 2020

Highlights

- 35 Day Government Shutdown – Many Challenges
- NSF Budget Rises to $8.3B for FY20 From $8.1B in FY19
- 10 Big Ideas – Major Activity through FY19
- NSF-Simons Math Bio Centers Off To Good Start
- New Partnerships Developed
- Emphasis on graduate student support

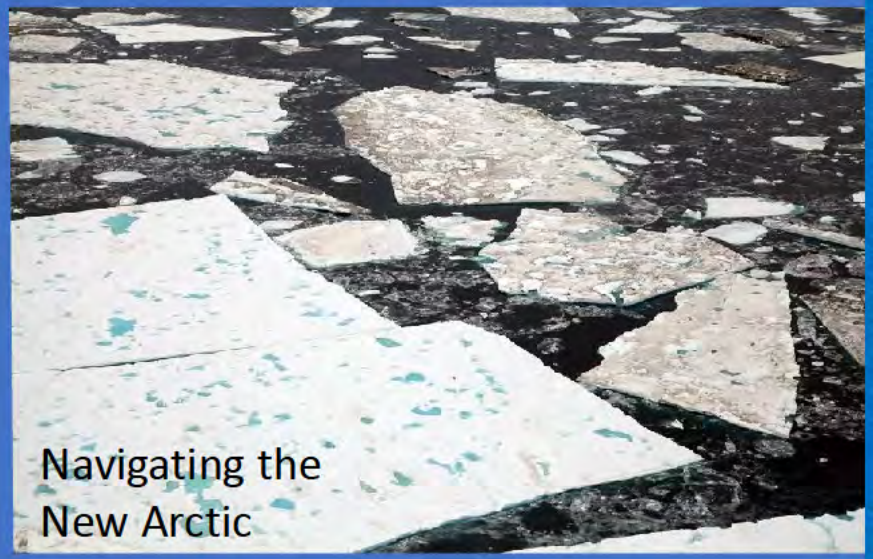
MATHEMATICAL, STATISTICAL, COMPUTATIONAL FOUNDATIONS
OPEN
REPOSITORIES
EDUCATION
WORKFORCE
DISCOVERY
PRIVACY
PUBLIC ACCESS
INFERENCE
SEMANTICS
EHR
ANALYTICS
ENG
DATA SCIENCE
HARNESSING THE DATA REVOLUTION
FUNDAMENTAL RESEARCH
CISE
GEO
CASUALITY
MACHINE LEARNING
CYBERSECURITY
DOMAIN SCIENCE CHALLENGES
SBE
BIO
RESEARCH DATA CYBERINFRASTRUCTURE
MPS
VISUALIZATION
SYSTEMS ARCHITECTURE
INTERNET OF THINGS
REPRODUCIBILITY
STATISTICS
MODELING
GIS
DATA MINING
INTEROPERABILITY

Windows on the Universe


CCD
frequency
spectrum
The Next Quantum Leap

Rules of Life

Work at the Human Technology Frontier


Navigating the New Arctic

Growing Convergent Research

MidScale Infrastructure

NSF 2026

NSF INCLUDES

Harnessing the Data Revolution FY19 Funding Opportunities Totaled $63M

Data Science Corps
(NSF 19-518)

Data-Intensive Research in Science and Engineering: Ideas Labs
(NSF 19-543)

Data-Intensive Research in Science and Engineering: Frameworks
(NSF 19-549)

Foundations: TRIPODS Round 2
(NSF 19-550)

Harnessing Data Revolution by the Numbers

- 52 Projects
- 147 Awards
- 300 Investigators

	Ideas Labs [NSF 19-543]	Frameworks [NSF 19-549]	TRIPODS [NSF 19-550]	Data Sci Corps [NSF 19-518]
# Awards	75	30	18	22
# Projects	15	13	15	9
Awards ($M)	26.3	26.5	22.2	10.3
PIs + co-PIs	79	76	81	64

HDR Awards Had a Broad Geographic Distribution

- Distributed across all scientific disciplines
- Awards to PIs in 26 States and Puerto Rico
- Universities, Community Colleges, RUI, and HBCUs

NSF-Simons Research Centers for Mathematics of Complex Biological Systems

- Five year, $40M program funded equally by NSF and Simons Foundation
- Mathematical approaches aimed at understanding complex causal relationships leading to emergent properties:
  1. Of molecular, cellular and organismal systems
  2. Resulting from the complex integration across these levels of organization at different time scales

Northwestern | NSF-SIMONS CENTER FOR QUANTITATIVE BIOLOGY

NSF-Simons Center for Multiscale Cell Fate Research
UC Irvine

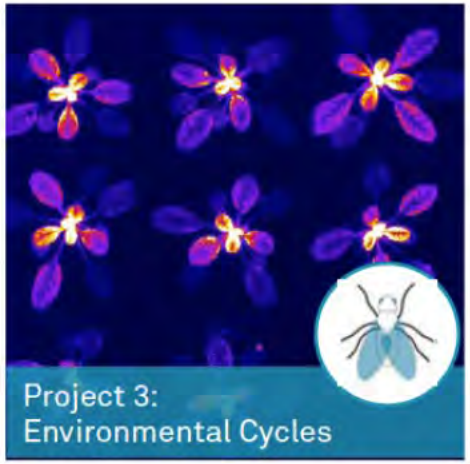
Southeast Center for Mathematics and Biology

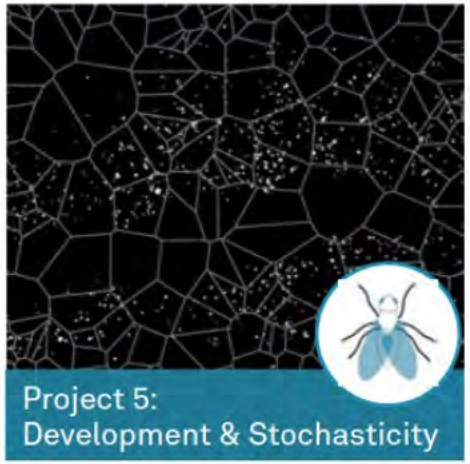
NSF SIMONS CENTER HARVARD
MATHEMATICAL & STATISTICAL ANALYSIS OF BIOLOGY

5 Experimental Projects

4 Model Organisms

3 Mathematical Concepts





NSF-Simons Center for Quantitative Biology

Northwestern University

What are the mathematical rules governing development, growth, and responses to environment?

- Dynamical Systems Theory
- Dimension Reduction
- Stochastic Processes

Two New International Partnerships – UK and Israel

- New MOU with UKRI/EPSRC
  - Collaborative Research Proposals may be submitted to either DMS or EPSRC
  - **NSF 19-082** DCL: MPS/DMS-EPSRC Lead Agency Opportunity in Mathematical Sciences
- Partnered with Israel's Binational Science Foundation
  - Collaborative Proposals should be submitted to DMS
  - **NSF 17-120** DCL: Special Guidelines for Submitting Collaborative Proposals under NSF and US-Israel BSF Collaborative Research Opportunities

Emphasis on Graduate Student Support

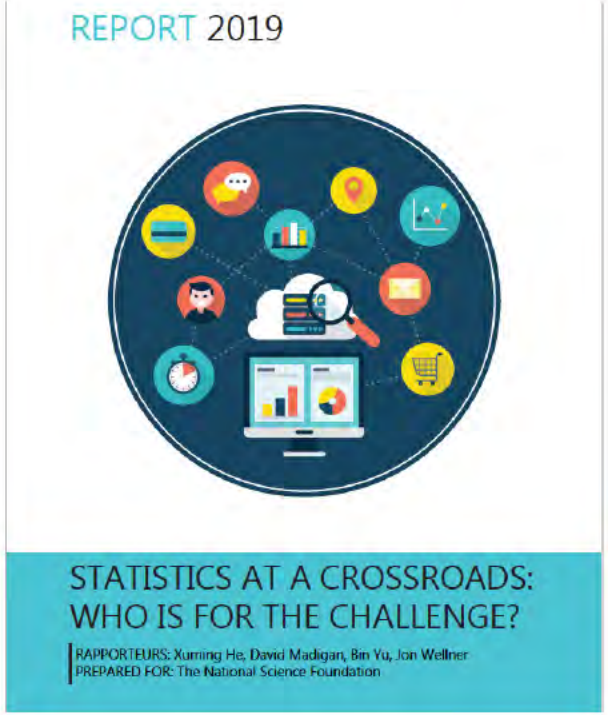
DMS invested an additional **$10M** towards graduate student support in FY19

Resulted in an **additional 350** graduate students funded on research fellowships

DMS will continue to look for other means to help support graduate students

Other DMS FY19 Activities

- Workshop Report from Statistics at a Crossroads
- Workshop Report from Rules of Life in the Context of Future Mathematical Sciences
- Workshop Report for Research Training Group Grants



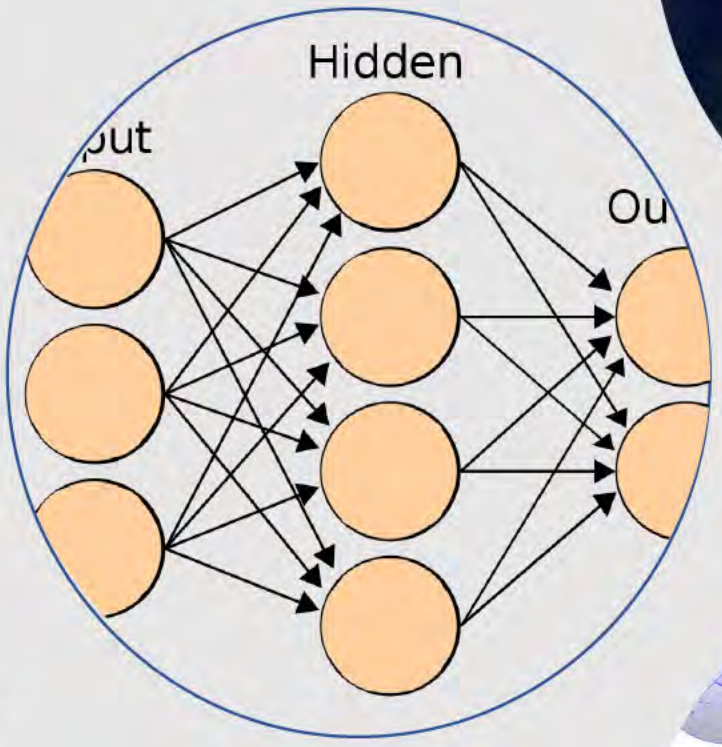
Looking Ahead

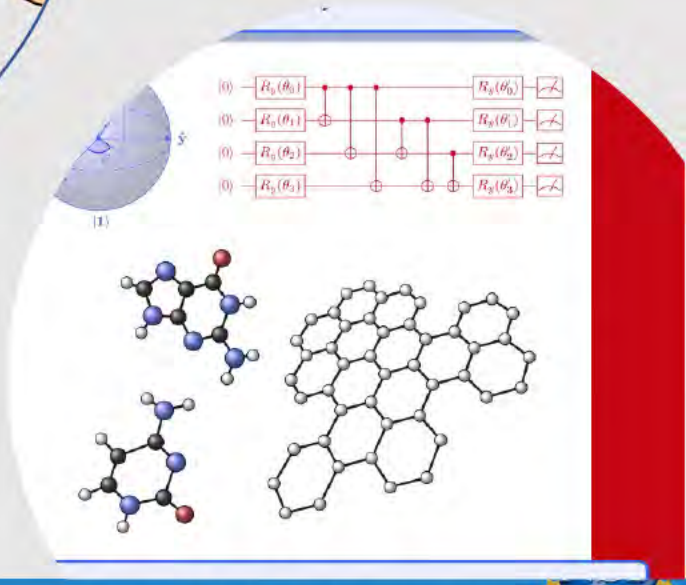
Funding Opportunities – FY2020

- **Understanding the Rules of Life**
  - Epigenetics — LOI Dec 20, 2019
  - http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505582
  - Microbiome Theory and Mechanisms — LOI Jan 17, 2020
  - https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505694
- **National AI Research Institutes**
  - Research Institutes — Proposals Jan 28, 2020
  - Planning Grants — Proposals Jan 30, 2020
  - https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686
- **Quantum Leap**
  - Challenge Institutes — LOI August 3, 2020
  - https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505634

DMS Activities of Interest

- Deep Learning
  - New MOU with Simons Foundation On Mathematical Foundations of Deep Learning
- Math Bio
  - MODULUS: Dear Colleague Letter: Models for Uncovering Rules and Unexpected Phenomena in Biological Systems, NSF 19-054
- Quantum Algorithms





Graduate Student Opportunities

NSF Mathematical Sciences Graduate Internship

- Deadline January 31, 2020

NSF Research Traineeship (NRT)

- Deadline February 6, 2020

Graduate Research Fellowship Program (GRFP)

- Deadline October 2020

Mathematical Sciences Graduate Internship

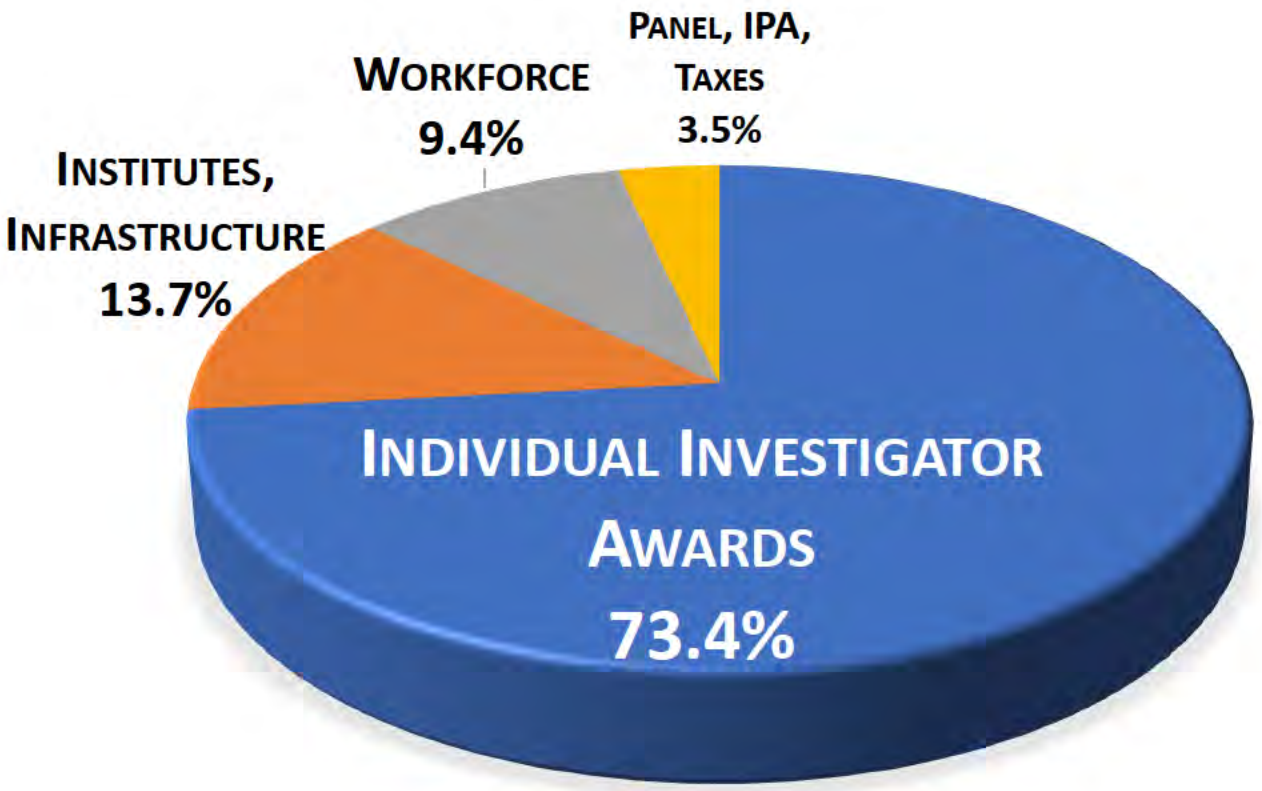
- opportunity for mathematical sciences PhD students to intern at national laboratories, industry and other approved facilities
- Aimed at students who are interested in understanding the application of advanced mathematical and statistical techniques to "real world" problems
- 40 graduate students from 38 universities worked in 10 National Labs in the Summer of 2017

SIAM News Article (12/01/2017)

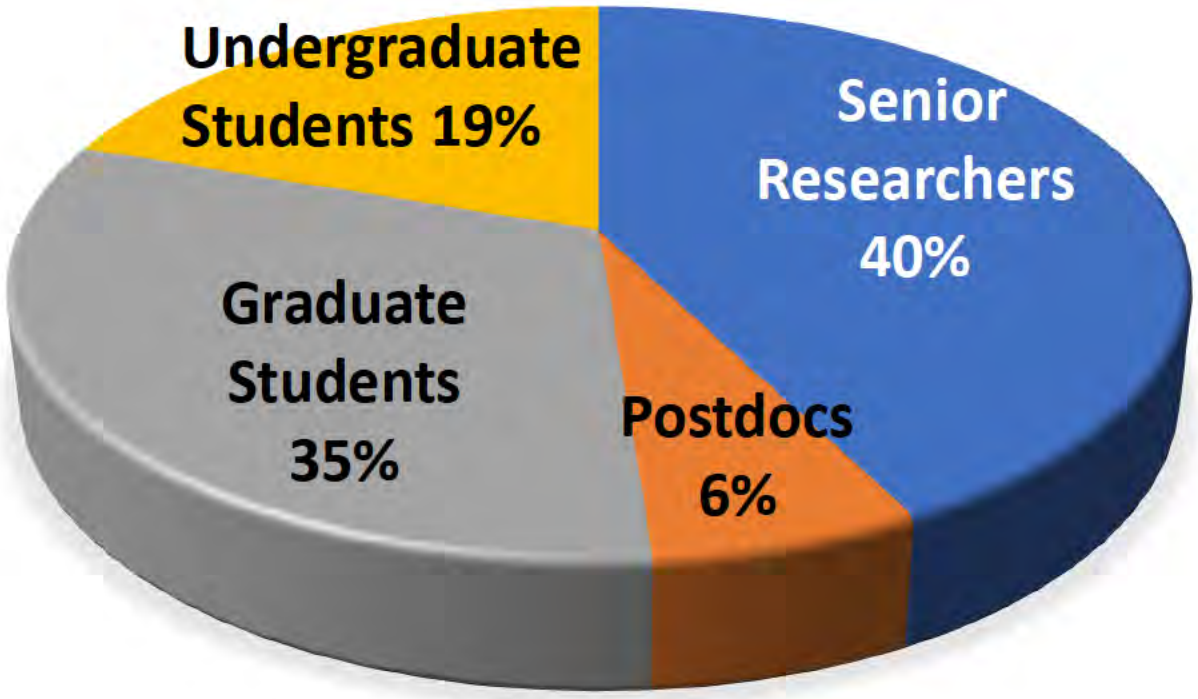
Managed by Oak Ridge Institute for Science and Education

DMS Funds Allocation

73% of Funds go to Individual PIs



DMS SUPPORTS OVER 6,500 PEOPLE



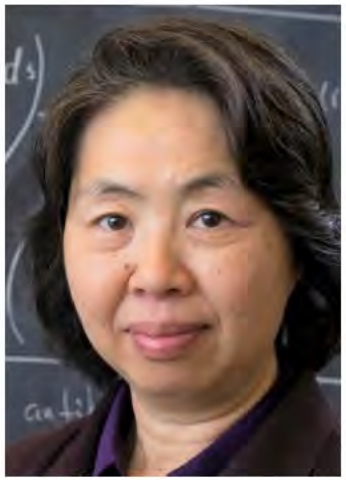
SENIOR RESEARCHERS	2618
POSTDOC ASSOCIATES	385
GRADUATE STUDENTS	2306
UNDERGRADUATE STUDENTS	1214

Data Source: FY 2019 Actuals

New DMS Program Officers 2019-2020

Annalisa Calini

Christian Rosendal



Zhilan Feng

Eun Heui Kim

Cesar Silva

Malgorzata Peszynska

Yong Zeng

Thank You!

Questions?