

# *Activities in NSF's Division of Mathematical Sciences*

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DIVISION DIRECTOR  
DIVISION OF MATHEMATICAL SCIENCES  
JANUARY 15, 2020



# HIGHLIGHTS

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35 DAY GOVERNMENT SHUTDOWN – MANY CHALLENGES

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NSF BUDGET RISES TO \$8.3B FOR FY20 FROM \$8.1B  
IN FY19

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10 BIG IDEAS – MAJOR ACTIVITY THROUGH FY19

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NSF-SIMONS MATH BIO CENTERS OFF TO GOOD START

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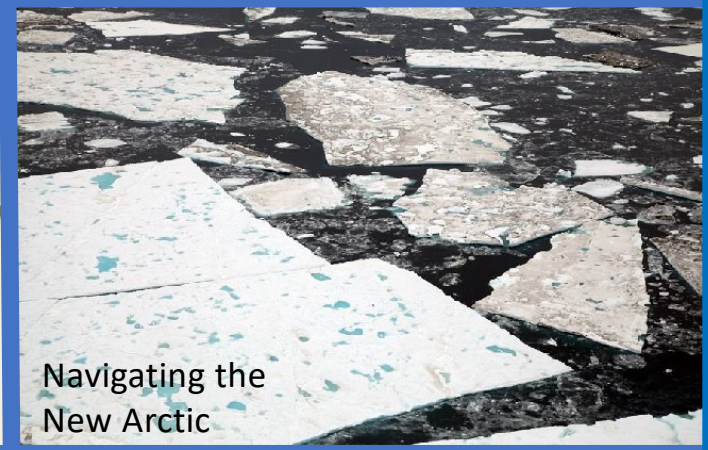
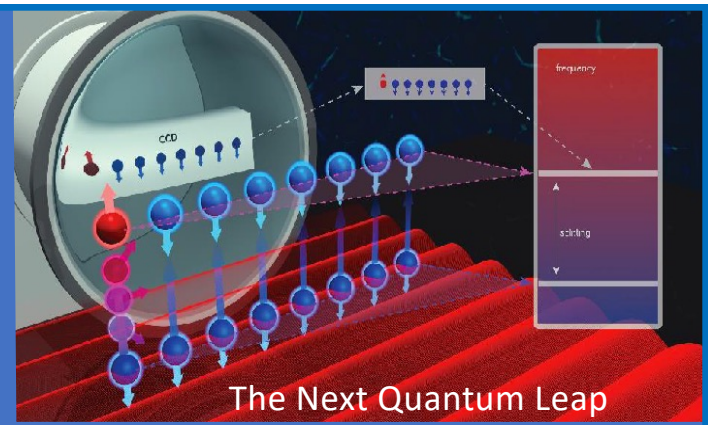
NEW PARTNERSHIPS DEVELOPED

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EMPHASIS ON GRADUATE STUDENT SUPPORT



MATHEMATICAL, STATISTICAL, COMPUTATIONAL FOUNDATIONS  
 ANALYTICS, DATA SCIENCE  
 FUNDAMENTAL RESEARCH, MACHINE LEARNING  
 RESEARCH DATA, CYBERINFRASTRUCTURE  
 MODELING, DATA MINING  
 STATISTICS, INTEROPERABILITY, HUMAN DATA INTERFACE  
 RESEARCH CASUALTY, VISUALIZATION  
 REPOSITORIES, EDUCATION WORKFORCE  
 OPEN, PUBLIC ACCESS, DISCOVERY  
 INFERENCE, SEMANTICS, EHR, PRIVACY, OPEN, REPOSITORIES, EDUCATION WORKFORCE  
 CYBERSECURITY, DOMAIN SCIENCE, CHALLENGES, SYSTEMS ARCHITECTURE, INTERNET OF THINGS  
 BIO, REPRODUCIBILITY, STATISTICS, INTEROPERABILITY, HUMAN DATA INTERFACE  
 CASE, GEO, MACHINE LEARNING, VISUALIZATION  
 CASUALTY, VISUALIZATION  
 GIS, DATA MINING  
 HUMAN DATA INTERFACE



HARNESSING THE  
DATA REVOLUTION  
FY19 FUNDING  
OPPORTUNITIES  
TOTALLED \$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

	<b>IDEAS LABS [NSF 19-543]</b>	<b>FRAMEWORKS [NSF 19-549]</b>	<b>TRIPODS [NSF 19-550]</b>	<b>DATA SCI CORPS [NSF 19-518]</b>
# 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



- DISTRIBUTED ACROSS ALL SCIENTIFIC DISCIPLINES
- AWARDS TO PIs IN 26 STATES AND PUERTO RICO
- UNIVERSITIES, COMMUNITY COLLEGES, RUI, AND HBCUS

## HDR AWARDS HAD A BROAD GEOGRAPHIC DISTRIBUTION



# 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



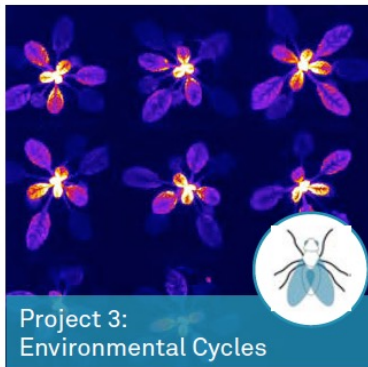
- 5 Experimental Projects
- 4 Model Organisms
- 3 Mathematical Concepts



Project 1:  
Embryonic Development



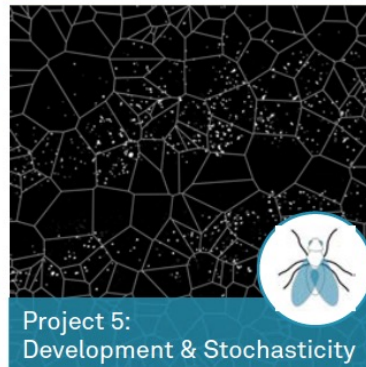
Project 2:  
Growth & Environment



Project 3:  
Environmental Cycles



Project 4:  
Pluripotency



Project 5:  
Development & Stochasticity

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/EPSCRC
  - COLLABORATIVE RESEARCH PROPOSALS MAY BE SUBMITTED TO EITHER DMS OR EPSCRC
  - **NSF 19-082** DCL: MPS/DMS-EPSCRC 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

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DMS INVESTED AN ADDITIONAL **\$10M**  
TOWARDS GRADUATE STUDENT SUPPORT  
IN FY19

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RESULTED IN AN **ADDITIONAL 350**  
GRADUATE STUDENTS FUNDED ON  
RESEARCH FELLOWSHIPS

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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

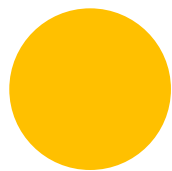
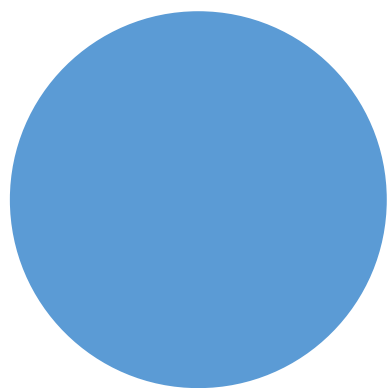


REPORT 2019



STATISTICS AT A CROSSROADS:  
WHO IS FOR THE CHALLENGE?

RAPPORTEURS: Xuming He, David Madigan, Bin Yu, Jon Wellner  
PREPARED FOR: The National Science Foundation



LOOKING AHEAD



# FUNDING OPPORTUNITIES – FY2020

- **UNDERSTANDING THE RULES OF LIFE**

- EPIGENETICS
- [http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=505582](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505582)
- MICROBIOME THEORY AND MECHANISMS
- [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=505694](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505694)

LOI DEC 20, 2019

LOI JAN 17, 2020

- **NATIONAL AI RESEARCH INSTITUTES**

- RESEARCH INSTITUTES
- PLANNING GRANTS
- [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=505686](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686)

PROPOSALS JAN 28, 2020

PROPOSALS JAN 30, 2020

- **QUANTUM LEAP**

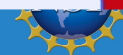
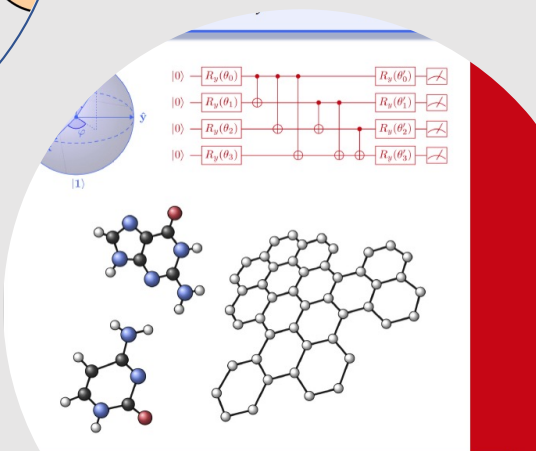
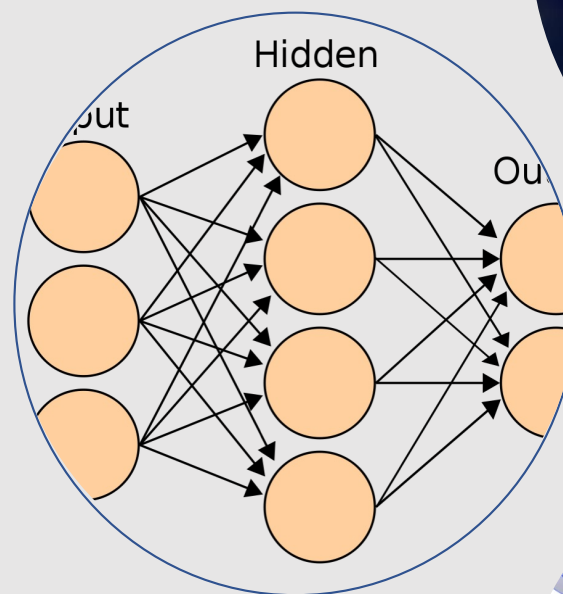
- CHALLENGE INSTITUTES
- [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=505634](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505634)

LOI AUGUST 3, 2020



# 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)

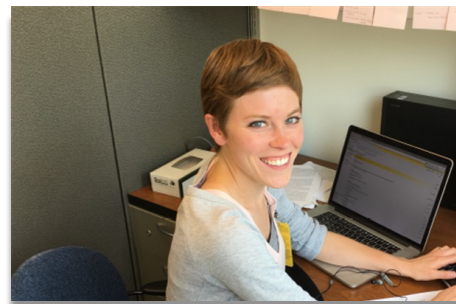
- DEADLINE OCTOBER 2020



# 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

**MANAGED BY OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION**

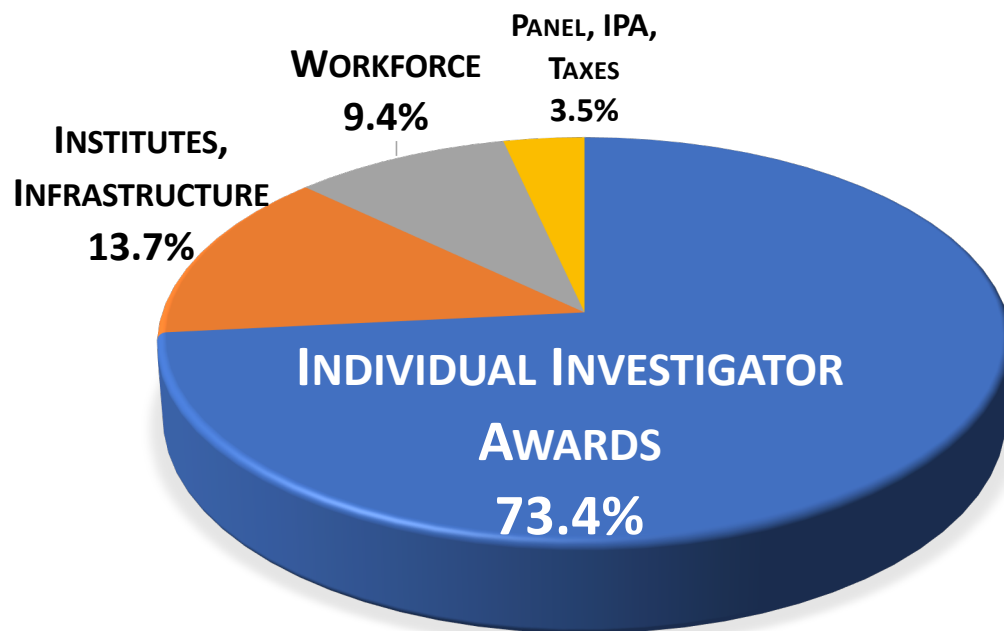


SIAM NEWS  
ARTICLE  
(12/01/2017)

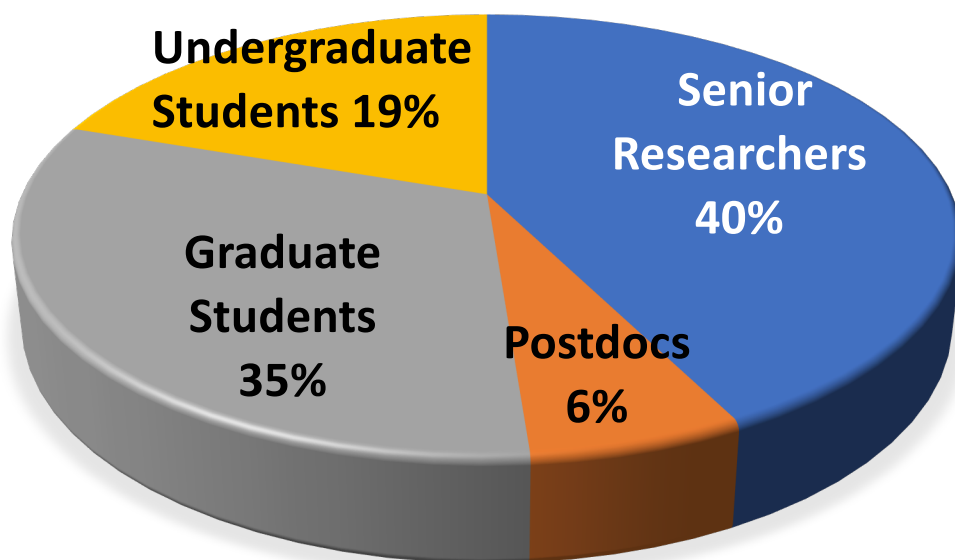


## DMS FUNDS ALLOCATION

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?

