

# MathBioSys Webinar

## NSF-Simons Research Centers for Mathematics of Complex Biological Systems

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# INTRODUCTIONS & WELCOME

## NSF and Simons Foundation Senior Managers:

- **Theresa Good**, Acting DD, Division of Molecular and Cellular Biosciences, BIO/NSF
- **Tie Luo**, Deputy DD, Division of Mathematical Sciences, MPS/NSF
- **Andrew Millis**, Associate Director for Physics, SF
- **Michael Vogelius**, DD, Division of Mathematical Sciences, MPS/NSF

# INTRODUCTIONS & WELCOME

## MathBioSys Working Group Program Directors:

- **Mary Ann Horn**, Division of Mathematical Sciences, MPS/NSF
- **Arcady Mushegian**, Division of Molecular and Cellular Biosciences, BIO/NSF
- **Elizabeth Roy**, Simons Foundation, Division of Mathematics and Physical Sciences, and representing the Division of Life Sciences
- **Junping Wang**, Division of Mathematical Sciences, MPS/NSF
- **William Zamer**, Division of Integrative Organismal Systems, BIO/NSF

# PRESENTATION OUTLINE

- Goals of **MathBioSys**
- Rationale
- Characteristics of Competitive Proposals
- Proposal Submission and Merit Review
- Q&A; Common Inquiries

# WHAT IS MATHBIOSYS?

- **MathBioSys**: NSF-Simons Research Centers for Mathematics of Complex Biological Systems (solicitation [NSF 17-560](#))
- A **collaboration** of three divisions across two **NSF** Directorates and the **Simons Foundation** (SF)
- Cross-disciplinary activity: **Mathematics** and **Biology**
- Collaboration of two funders to **leverage resources**
- NSF-SF joint support for up to **three new centers**

# GOALS OF MATHBIOSYS

## The Centers will focus on

- Enabling innovative, **collaborative research** at the intersection of mathematics and molecular, cellular, and organismal biology to understand emergent properties of complex biological systems
- Establishing **new connections** between these two disciplines
- Interdisciplinary education and workforce training; **building capacity**

# THE RATIONALE...

## ➤ **Community Input**

- ✓ Genomes-to-Phenomes wiki
- ✓ Workshop report on Genomes-to-Phenomes
- ✓ Listening sessions at professional societies

## ➤ **Relevance to internal discussions at NSF**

- ✓ Understanding the Rules of Life

# THE RATIONALE...

## A Compelling Challenge

- **A Predictive, Causal Understanding of how and why Emergent Properties arise in Living Systems from Non-Linear Interactions of Components across Spatial and Temporal Scales**



# THE RATIONALE...

## Context

- To accelerate progress, **more** attention is needed on **mathematical approaches** to understand causal relationships leading to emergent properties of molecular, cellular, and organismal systems
  - Develop **novel mathematical** approaches to improve our understanding of mechanisms underlying **emergent properties**
  - Employ non-trivial use of existing mathematical approaches at this interface
  - Build capacity in relevant collaborations
  - Develop new mathematical approaches to understand emergent properties using large volumes of biological data

# THE MATHBIOSYS CENTERS WILL...

- **Facilitate sustained collaborations** between mathematical scientists and biologists to
  - ✓ Develop a **predictive, causal framework** for understanding emergent properties in molecular, cellular, and organismal systems
  - ✓ Develop **new** foundational mathematical, statistical, and computational **concepts, theories, and tools for improved understanding of emergent properties.**
  - ✓ Employ existing mathematical, statistical, and computational approaches in **significantly new ways** to advance understanding of emergent properties
  - ✓ **Build capacity** in this particular cross-disciplinary interface during the award period

# CHARACTERISTICS OF COMPETITIVE PROPOSALS

- Explicitly aimed at developing causal, predictive frameworks for **understanding emergent properties** in molecular, cellular and organismal systems
- Cohesive set of **goals + convincing plan** that scientific progress will be achieved in the 5-year award period
- Development of **mathematics** that is **informed, validated and verified** by experimental data; reciprocally, **experiments** are **informed by, and designed** to test mathematical concepts; expected progress during the award period

# CHARACTERISTICS OF COMPETITIVE PROPOSALS

- Convincing description of activities to facilitate sustained, productive **cross-disciplinary collaborations** to achieve the goals
- Description of **disciplinary balance**
- Convincing plans for significant effort in **capacity building**
  - Cross-disciplinary training of the next generation of scientists at this interface
  - Convening activities to broaden the reach and impact of the center's science
- **Value added** of a center project is clear, compared to a set of loosely connected projects

# PROPOSAL DEVELOPMENT

## ➤ Letter of Intent:

➤ **August 10, 2017 Due Date**

## ➤ Full Proposal:

➤ **September 29, 2017 Deadline**

➤ Please read the full MathBioSys solicitation, [NSF 17-560](#)

# LETTER OF INTENT: 08/10/2017

- **Required**, but not externally reviewed
- **Names of Senior Personnel:** up to 5 including PI
- **Project Title:**
- **Participating Organizations:** up to 5 including lead organization
- **Synopsis:** research foci, approaches, other center activities
- **Training Summary:** plans for cross-disciplinary training of students and postdocs
- **Submission by AOR via FastLane** required

# FULL PROPOSAL: 09/29/2017

## ➤ **Project Description—Specific to MathBioSys**

- Consider how progress to achieving goals will be demonstrated in first 2 years
  - A Site Visit will be scheduled in year 3
- Consider metrics to be used in evaluating center performance
  - Description of the metrics must be included in the Management Plan, a required Supplementary Document
  - Develop the Project Description to be consistent with the Management Plan

# FULL PROPOSAL: 09/29/2017

## ➤ **Supplementary Documents**

### ➤ **Simons Foundation Budget**—50% of total request

- Follow SF guidance at: <http://www.simonsfoundation.org>
- Indirect Cost Rate is different

### ➤ **Other Senior Personnel and Center Leadership** (5 pages max.)

- Roles of Other Senior Personnel in center activities
- Key Leadership, their roles and qualifications



# FULL PROPOSAL: 09/29/2017

## ➤ **Supplementary Documents**

### ➤ **Management Plan (5 pages max.)**

- Describe key leadership positions, reporting lines, leadership communication mechanisms
- Mechanisms of communicating with the community
- Accountability and oversight mechanisms
- Metrics to evaluate performance of the center
- Characteristics of external advisory committee (optional)

# FULL PROPOSAL: 09/29/2017

## ➤ **Supplementary Documents**

### ➤ **Institutional Capabilities (2 pages max.)**

- Describe how resources and capabilities of lead and participating institutions will facilitate center's activities
  - Organizational leadership, technical expertise, support and maintenance; presently available space, infrastructure, and technologies for cross-disciplinary collaborations

# MERIT REVIEW

- **Panel review and/or ad hoc (external) review**
- **Site visit or reverse site visit**
- **Intellectual Merit and Broader Impacts**

# MERIT REVIEW

## ➤ 6 Solicitation-specific review criteria:

- Quality of **mission** and **goals**, and likely effectiveness in meeting them
- Potential and commitment of **center leadership** and key personnel to effectively lead and manage the center
- Proposed **structure and management** of the center: quality and effectiveness of the Management Plan, and its likely effectiveness in fostering new teams to build cross-disciplinary capacity in relevant areas to MathBioSys

# MERIT REVIEW

## ➤ 6 Solicitation-specific review criteria:

- Potential for the **Institutional Capabilities** to contribute to successful cross-disciplinary center in areas relevant to MathBioSys
- Quality, likely effectiveness and accountability of **outreach activities** and dissemination strategies
- Extent to which the center will take advantage of co-located, ongoing biological research relevant to MathBioSys to foster development of **cross-disciplinary collaborations**

# Q&A SESSION

- **Questions from the webinar attendees (Operator Assisted)**
- **May also ask questions using WebEx CHAT (Non-Operator Assisted)**
- **Questions from Emails**

# COMMON INQUIRIES

- Are there limits on the number of proposals that may be submitted per PI or Co-PI?
  - Yes. An individual may appear as PI, Co-PI or other senior personnel on no more than two proposals submitted in response to this solicitation. Other senior personnel include leads on sub-awards, and named postdoctoral research associates. There is no limitation on paid consultants.

# COMMON INQUIRIES

- May the center involve multiple institutions or research collaborations across institutions?
  - Yes. We expect this to be variable across proposals. You have to be realistic, however, in explaining how mathematical scientists and biologists will be engaging in new collaborations, how leadership and oversight will work across two or more locations, how you would meet substantial expectations of young scientists' training, etc. The conventional collaboration formats, e.g., Skype seminars once a week, or an annual workshop, are likely not to be sufficient for the level of integration that is expected in this program.
  - We strongly prefer a single proposal from a lead institution with sub-contracts to non-lead institutions



# COMMON INQUIRIES

- May foreign institutions and/or foreign collaborators be involved in a center proposal?
  - Foreign collaborators may be included in planned activities at a proposed center. However, it may be **unrealistic to include a foreign institution as a formal organizational partner** because the same challenges associated with including multiple institutions will be greater with a foreign institution (e.g., engaging in new collaborations, how leadership and oversight will work across separate locations, how substantial expectations of young scientists' training will be met, etc.). And, proposals including a foreign institution will need to include a description for why the foreign institution's facilities, infrastructure, etc., are needed, and/or why the specific expertise of a foreign collaborator is required to accomplish the goals of the proposed center as opposed to facilities, infrastructure, etc., of a US institution or the expertise or skills of a US collaborator.

# COMMON INQUIRIES

- What is the balance expected between mathematical scientists and biologists on MathBioSys proposals?
  - The Working Group recognizes that the most productive collaborations across these two disciplines will be developed over sustained periods, and will involve **biologists challenging mathematical scientists, and mathematical scientists challenging biologists** to be able to advance the science at this interface. PIs should develop goals for the proposed center activity consistent with the MathBioSys Program goals, and describe balanced collaborative teams of biologists and mathematical scientists to achieve those goals through these kinds of sustained and productive collaborations.

# COMMON INQUIRIES

- How do goals & activities of MathBioSys centers compare to those of institutes or research centers?
  - MathBioSys centers will include a **strong research focus** on understanding emergent properties through mathematical approaches as described in NSF 17-560
  - They must also include a significant focus on **capacity building**, albeit **at a smaller scope** (owing to a smaller annual budget) compared to other centers or institutes with significant training and convening activities

**Thank you for attending the  
MathBioSys Webinar**

**We look forward to receiving  
proposals from you!**