EMERGING MATHEMATICS IN BIOLOGY (EMB) WEBINAR

November 25, 2024, 1pm-2pm EST

Submit questions using the Q&A icon in Zoom 

- **Program page:** **https://new.nsf.gov/funding/opportunities/emb-emerging-mathematics-biology**
- **Webinar page:** https://new.nsf.gov/events/emerging-mathematics-biology-webinar/2024-11-25
- **Submission deadline:** March 3, 2025.
- **Program Officers:**

Zhilan Feng, Program Director, MPS/DMS (zfeng@nsf.gov)

Julie B. Kellner, Program Director, BIO/IOS (jkellner@nsf.gov)

David J. Klinke, Program Director, BIO/MCB (dklinke@nsf.gov)

Jeremy Wojdak, Program Director, BIO/DEB (jwojdak@nsf.gov)

Jennifer W. Weller, Program Director, BIO/DBI (jweller@nsf.gov)

SYNOPSIS OF PROGRAM
NSF 25-509

The **eMB** program supports truly integrative research projects in mathematical biology that address challenging and significant biological questions through novel applications of traditional, but nontrivial, mathematical tools and methods or the development of new mathematical theories particularly from foundational mathematics, including the mathematical foundation of Artificial Intelligence/Deep Learning/Machine Learning (AI/DL/ML) enabling explainable AI or mechanistic insight. The program emphasizes the uses of mathematical methodologies to advance our understanding of complex, dynamic, and heterogenous biological systems at all scales (molecular, cellular, organismal, population, ecosystems, evolutionary, etc.).

POSSIBILITIES FOR RESEARCH TOPICS

Examples of research challenges include but not limited to:

- Mathematical foundations of AI/DL/ML theory and methods in biomathematics enabling explainable AI or mechanistic insight leading to predictive outcomes.
- Advancing methods that deal with limited, noisy, or heterogenous data, or that help scale or validate models.
- Incorporation of probabilistic modeling to deterministic modeling frameworks in biology
- Applications of foundational mathematics in genomics and other -omics applications
- Modeling of organismal development, physiology, morphology, biomechanics, behavior, and neuroscience
- Modeling dynamical interactions between organisms (e.g., self/non-self recognition, host-symbiont, plant-animal, predator-prey, disease dynamics, and behavioral interactions)
- Modeling interactions between organisms and their environment, anywhere from the organismal scale to the ecosystem or continental scale
- Modeling the feedbacks between ecological and evolutionary processes
- Development of mathematical frameworks to understand phylogenetic relationships
- Development of tools or infrastructure for automatically extracting, analyzing, and/or annotating large biological datasets
- Applications of mathematics in biotechnology
- Modeling climate impacts on the organism and on biodiversity
- Mechanistic models of respiratory infection transmission, as described in the NSF-CDC Dear DCL on Mathematical Modeling of Policy Options for Evolving Public Health Challenges (MPOPHC).

EMB PROPOSAL REQUIREMENTS

- Proposals may be submitted for up to three years duration
- All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via Research.gov
- There are no restrictions or limits on number of proposals per PI or co-PI. However, a proposal that is a duplicate of, or substantially similar to, another proposal or a pending proposal at NSF will be returned without review.
- All proposals should include metrics to assess the success of proposed **research**

ADDITIONAL SOLICITATION-SPECIFIC REVIEW CRITERIA

For eMB proposals, reviewers will also be asked to evaluate to what extent:

1. the proposal include balanced participation from both the mathematical sciences and the biological sciences (the proposal must include PI/Co-PIs with expertise in mathematical sciences and biological sciences, or a single PI needs to demonstrate expertise in both mathematical and biological sciences);
2. the proposed activities (a) use innovative mathematical methodologies or mechanistic modeling approaches to generate biological insights or (b) represent novel application of traditional but nontrivial mathematical methodologies to generate new biological insights;
3. the mechanistic or quantitative understanding of the biological problem will be advanced by the application of the proposed mathematical or mathematical modeling approaches.

COMMON INQUIRIES

- In what key ways does the eMB program differ from the core NSF Mathematical Biology program?
  - Development of new mathematics in biology. Close collaborations between math and bio scientists. More focused research topics in mathematical and biological applications, particularly topics that are of key interests to BIO programs due to the participation of Biological Science Directorate in this solicitation.
- What does new mathematics mean?
  - Mathematical theories, methodologies, or modeling approaches that have not been used before in biology but can help advance biological understanding and represent significant mathematical challenges (from any fields supported by DMS programs).
- Do new statistical modeling or new machine learning methods count as “new mathematical methodology”?
  - Yes, with a significant component on foundational mathematics.

COMMON INQUIRIES

- Is it necessary to have an interdisciplinary team?
  - The proposal must include PI/Co-PIs with expertise in mathematical sciences and biological sciences, or a single PI needs to demonstrate expertise in both mathematical and biological sciences
  - Reviewers will be asked to evaluate the strength of interdisciplinary expertise from both the mathematical and biological sciences.
- Are there any restrictions on what organisms can be studied?
  - Any organisms suitable for BIO programs are also suitable for eMB.
- What is the nature of the biological problems to be addressed by this call? On the spectrum that ranges from high-level theory down to specific application, where are they supposed to lie?
  - All problems are considered but there are focused topics (see slide 3).

COMMON INQUIRIES

- Does the proposal have to have experimentalists or real data?
  - They are not required, but a strong link between mathematical results and biological applications (including the applicability of modeling tools to real biological systems) is important.
- What sort of supporting data is expected for these proposals?
  - Supporting data is not required. However, proposals must include compelling illustrations for the mathematical novelty and how the math results can improve biological understanding, and specific metrics to assess the success of the proposed research must be included.
- Are proposals that are heavy on theory and limited in data integration welcome?
  - Yes, with a clear demonstration that the mathematical theory is applicable to real biological systems.

COMMON INQUIRIES

- Does the 12-month moratorium (which is required for the core MB program) apply to eMB?
  - No. Submission to eMB is independent of that requirement for core MB proposals. A resubmitted proposal must undergo a substantial revision.
- Are there limits on the number of proposals that may be submitted per PI or Co-PI?
  - No. There are no restrictions or limits.
- Is there a limit to the size of the eMB awards?
  - No. There are no restrictions or limits. But the budget should be consistent with the proposed research and, as described in the solicitation, the Anticipated Funding Amount is $2,000,000 to $6,000,000 and the Estimated Number of Awards is 10 to 15. Browse projects funded by this program

COMMON INQUIRIES

- Can one apply to this program as well as the usual NSF Math Bio program with an open deadline?
  - Yes. There are no restrictions.
  - However, each proposal must be significantly different from other proposals including those pending at NSF in order to be considered for review. A proposal that is a duplicate of, or substantially similar to, a pending proposal at NSF will be returned without review.

EMERGING MATHEMATICS IN BIOLOGY
NSF 24-513

Thank you!

Questions?

EMERGING MATHEMATICS IN BIOLOGY
NSF 25-509

Thank you for attending the eMB Webinar

We look forward to receiving proposals from you!