



U.S. NATIONAL SCIENCE FOUNDATION  
2415 EISENHOWER AVENUE  
ALEXANDRIA, VIRGINIA 22314

NSF 24-040

## Dear Colleague Letter: Funding Opportunities for Engineering Research in Biotechnology

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December 22, 2023

Dear Colleague:

With this Dear Colleague Letter, the U.S. National Science Foundation (NSF) Directorate for Engineering (ENG) encourages the submission of research and education proposals related to **Biotechnology as an Emerging Industry**.

The U.S. is a world leader in biotechnology, a field that comprises the data, tools, research infrastructure, workforce capacity, and innovations that enable the discovery, utilization, and reprogramming of living organisms, their constituent components, and their biologically related processes. Advances supported by NSF and the Engineering Directorate include genome sequencing, editing, and synthesis; synthetic and engineered biology; imaging and biosensing; and tissue engineering and biomanufacturing. These capabilities also provide solutions to societal challenges, such as climate change and infectious disease, and provide the foundational and use-inspired research that will lead to the creation of goods and services that contribute to agriculture, health, security, manufacturing, energy, and environmental needs of the nation.

NSF supports research and education activities that address national needs and support the CHIPS and Science Act of 2022, White House strategies (including [Executive Order 14081, Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe and Secure American Bioeconomy](#)) and other policy directives to enable biotechnology discoveries and innovations.

### ENGINEERING DIRECTORATE INTERESTS

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The Directorate for Engineering encourages the submission of all types of research and education proposals related to biotechnology, including proposals in the following areas:

**Synthetic biology and related biotechnology:** Biotechnology for the engineering (through

design and construction) of live biological systems and related components, such as functional enzymes, genetic circuits, therapeutic cells, and pharmaceuticals; novel synthetic biology approaches for the development of cell-free and cell-based biosensors.

**Environmental biotechnology:** Biotechnology applied to the study of natural and engineered systems associated with pollution prevention, environmental restoration, clean water and wastewater, renewable energy or biomass production, and using biological processes to meet environmental goals; sustainability through reduction of water, energy and resource needs and yield enhancement for biomanufacturing processes.

**Novel biorecognition elements:** Design of transducing systems to enable adaptable and/or reconfigurable operating parameters in response to environmental changes or application needs at levels of device, system, or data analysis; sensing technologies that can enable monitoring and surveillance of the environment and/or individuals for novel infectious agents.

**Biological separations:** Downstream processing of biotechnology-derived chemicals, therapeutic proteins, and biologics for increased throughput and purity.

**Biomanufacturing using cells:** Understanding mechanisms of cell differentiation to enhance biomanufacturing, leading to novel products, biomaterials, and significant improvements in personalized medicine, environmental control and monitoring, and adaptive sensing.

**Tissue biomanufacturing:** Understanding mechanisms and design rules for manufacturing three-dimensional tissues, organs, and organoids; development of validated and reproducible models (in vitro or in silico) of healthy and pathological tissues and organ systems.

**Mechano-biotechnologies:** Mechanics-related research advancing biotechnology including mechanomics; sub-cellular, cell, cellular matrix and tissue physiology; pathophysiology; development, differentiation, proliferation, regeneration, or repair that are related to mechanical stimuli from applied forces or changes in mechanical properties of cells or tissue microenvironment.

**Biological heat and mass transport:** Understanding intra- and extra-cellular heat and mass transport; freeze resistance mechanisms; thermotherapy and thermoregulation; organ conservation (freezing and thawing); and mass transport in biomedical and health systems.

**Biophotonic technologies:** Research at the frontiers of photonics principles and engineering that will enable new technologies for biology, manufacturing, medical diagnostics, and therapies.

**Biofluids:** Understanding the motion of biofluids in biological and physiological systems to improve predictions of the behavior of cells, drug delivery vehicles, and other devices (for example, biobots).

**Scalable design, planning and control of biomanufacturing systems and supply chains:** Development of scalable data-driven and model-driven approaches to the planning, design and control of large-scale, resilient and effective biomanufacturing systems and supply chains, including optimization of feedstock, facility location, processes, and operations for bioproduction.

**Bioelectronic and biomagnetic sensing systems:** Innovations in design, fabrication, and characterization of biomolecules integrated in devices and circuits for sensing and neurostimulation applications in biology and medicine, platforms for cell-based sensors, and interfaces between the nervous systems and electronics; fundamental advances in synthetic biology integrated with semiconductor technology for information processing, interconnects, storage, communication, and sensing; hybrid semiconductor-biological systems, cell-semiconductor interfaces, biological pathways, and other approaches for fabrication and integration of devices with biological systems.

## PROGRAMS AND CONTACTS

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The Engineering Directorate encourages the submission of biotechnology-related proposals to the ENG core programs listed below, and to other relevant programs. To determine which program best fits a project idea, Principal Investigators are encouraged to read the program descriptions and reach out to program contacts with questions.

- **Advanced Manufacturing:** [AdvancedManufacturing@nsf.gov](mailto:AdvancedManufacturing@nsf.gov)
- **Biophotonics:** Adam Wax, [awax@nsf.gov](mailto:awax@nsf.gov)
- **Biomechanics and Mechanobiology:** [bmmb@nsf.gov](mailto:bmmb@nsf.gov)
- **Biosensing:** Aleksandr Simonian, [asimonia@nsf.gov](mailto:asimonia@nsf.gov)
- **Cellular and Biochemical Engineering:** Steve Peretti, [speretti@nsf.gov](mailto:speretti@nsf.gov)
- **Communications, Circuits, and Sensing-Systems:** Jenshan Lin, [jenlin@nsf.gov](mailto:jenlin@nsf.gov); Rosa (Ale) Lukaszew, [rlukasz@nsf.gov](mailto:rlukasz@nsf.gov)
- **Disability and Rehabilitation Engineering:** Steven M. Zehnder, [zehnder@nsf.gov](mailto:zehnder@nsf.gov)
- **Engineering of Biomedical Systems:** Stephanie George, [stgeorge@nsf.gov](mailto:stgeorge@nsf.gov)
- **Environmental Engineering:** Mamadou Diallo, [mdiallo@nsf.gov](mailto:mdiallo@nsf.gov); Karl Rockne, [krockne@nsf.gov](mailto:krockne@nsf.gov)
- **Environmental Sustainability:** Bruce Hamilton, [bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)
- **Fluid Dynamics:** Ron Joslin, [rjoslin@nsf.gov](mailto:rjoslin@nsf.gov)
- **Interfacial Engineering:** Christy Payne, [cpayne@nsf.gov](mailto:cpayne@nsf.gov)
- **Operations Engineering:** Georgia-Ann Klutke, [gaklutke@nsf.gov](mailto:gaklutke@nsf.gov); Reha Uzsoy, [ruzsoy@nsf.gov](mailto:ruzsoy@nsf.gov)
- **Particulate and Multiphase Processes:** Shahab Shojaei-Zadeh, [sshojaei@nsf.gov](mailto:sshojaei@nsf.gov)

The Engineering Directorate also encourages proposals for research centers, which tackle grand challenges and spur industrial innovation, and for workforce development, which

provides experiential learning opportunities and opens new career paths.

- **Engineering Research Centers (ERC)**: [nsferc@nsf.gov](mailto:nsferc@nsf.gov)
- **Industry–University Cooperative Research Centers (IUCRC)**: Prakash Balan, [pbalan@nsf.gov](mailto:pbalan@nsf.gov)
- **Non-Academic Research Internships for Graduate Students (INTERN)**: Prakash Balan, [pbalan@nsf.gov](mailto:pbalan@nsf.gov)
- **Research Experiences for Teachers (RET)**: Amelia Greer, [agreer@nsf.gov](mailto:agreer@nsf.gov)
- **Research Experiences for Undergraduates (REU)**: [reu.eng@nsf.gov](mailto:reu.eng@nsf.gov) (REU for ERCs: [reu.eng.erc@nsf.gov](mailto:reu.eng.erc@nsf.gov))

## SUBMISSION GUIDANCE

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Proposals submitted in response to this DCL should focus on scientific research and education relevant to biotechnology. Proposal titles should begin with “**ENG-BIOTECH:**” followed by any other relevant prefixes and the project name.

For consideration during fiscal year 2024, proposals to programs without deadlines should be submitted by April 30, 2024; proposals submitted later will be considered for fiscal year 2025.

NSF welcomes proposals that broaden geographic and demographic participation to engage the full spectrum of diverse talent in STEM. Proposals from minority-serving institutions, emerging research institutions, primarily undergraduate institutions, two-year colleges, and institutions in EPSCoR-eligible jurisdictions, along with collaborations between these institutions and those in non-EPSCoR jurisdictions, are encouraged.

This DCL does not constitute a new competition or program. Proposals submitted in response to this DCL should be prepared and submitted in accordance with guidelines in the [NSF Proposal & Award Policies & Procedures Guide \(PAPPG\)](#) and instructions found in relevant program descriptions.

Sincerely,

Susan Margulies  
Assistant Director, Engineering