



NATIONAL SCIENCE FOUNDATION
2415 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22314

NSF 21-034

Dear Colleague Letter: IMAGiNE FG: Functional Genomics

December 23, 2020

Dear Colleagues:

An unsolved grand challenge in biology is determining the functional integration of genomic and environmental variation in producing organismal structures, functions, performance, and fitness. While the speed, precision, and depth of genomic and phenotypic data have grown exponentially over the last three decades, we still do not understand the functions of all the genes in any organism or how genes interact within genetic and environmental contexts to produce an organism's phenotype. Technical advancements have led to the ability to sequence genomes and their products from single cells, tools to manipulate genes with precision, infrastructure to analyze these sequences, and the ability to rapidly and precisely measure multiple phenotypes across time and space. However, we still lack the ability to precisely manipulate complex trait expression and regulation, nor can we predict complex organismal phenotypes from their genetic underpinnings. Advancements in this critical area will have large and long-lasting effects on food security, control and detection of infectious diseases, and all aspects of the bioeconomy, both in the United States and internationally.

In response to this challenge, The Division of Integrative Organismal Systems (IOS) has developed a thematic research focus entitled **Integrating Mechanisms of Adaptation with Genes in Networks and across Environments (IMAGiNE)**. A Dear Colleague Letter (DCL), [NSF 20-044 IMAGiNE: 2020: Organisms in a Dynamic Environment](#) - was issued that is still current and actively encouraging submission of proposals addressing how organism-environment interactions determine the emergence of complex traits. This DCL (**IMAGiNE FG: Functional Genomics**) complements and extends the IMAGiNE theme. Here, the focus is to encourage research on the organismal mechanisms, analytical frameworks, and biological theories that advance our understanding of the connection between an organism's genome and its phenotype, i.e., functional genomics.

In an effort to develop strategies to move the field of functional genomics forward the National Academies of Sciences, Engineering, and Medicine (NASEM) in Washington, DC recently held a workshop entitled "Next Steps for Functional Genomics." ^[1] The goals of the workshop

were to determine the current state of research in functional genomics and to identify the factors limiting advancements in this field. This **IMAGINE FG: Functional Genomics DCL** acts on the proceedings of the NASEM workshop by encouraging the submission of proposals that include the dual criteria of research that (1) is relevant to any of the programs in the IOS Core Programs solicitation [NSF 21-506](#), the Plant Biotic Interactions (PBI) solicitation [NSF 20-576](#), or the Plant Genome Research Program (PGRP) solicitation [NSF 21-507](#) and (2) addresses obstacles to moving the field of functional genomics forward as identified in the NASEM workshop report.

IOS particularly encourages the following types of proposals in response to this DCL:

- **Research Coordination Network (RCN) proposals** to build collaborative networks of scientists in diverse disciplines to coordinate and expand research in functional genomics. Highest priority will be given to RCNs that bring together researchers in organismal biology fields typically supported in IOS with researchers having expertise in computational modeling, mathematics, artificial intelligence (AI), complex data analysis, and '-omic' technologies.
- **Conference proposals** that bring together teams of scientists bridging experimental, computational, and -omic expertise to discuss approaches to overcoming research bottlenecks to advances in functional genomics. Conferences should not focus on the current state of research in the field but rather future directions and research priorities that will advance our understanding of the connection between the information contained in an organism's genome and its phenotype.
- **Research proposals** relevant to one of the IOS research programs that advance our understanding of functional genomics and predicting phenotypes. Specific areas of interest include, but are not limited to studies that: focus on genes with unknown functions, especially those that can be applied across diverse study systems and organisms; address ways in which extensive non-coding regions of a genome contribute to organismal function; unravel how functions ascribed to genes vary depending upon environmental context; investigate regulatory mechanisms and variation for multi-genic quantitative traits; and increase the annotation and validation of results from high-throughput screening. Development of new approaches is encouraged. However, proposals focused solely on tool and/or method development are not appropriate for this DCL. This DCL is therefore complementary to and expands upon the Enabling Discovery through Genomics ([EDGE](#)) program in IOS by encouraging proposal submissions advancing research in functional genomics to programs across the Division.

Proposals should be submitted to the IOS program most-closely related to the topic of interest - as determined by the primary questions being asked and the hypotheses being tested. Proposal titles should be prefaced by any solicitation or [NSF Proposal & Award](#)

Policies & Procedures Guide (PAPPG) specific requirements, followed by "IMAGiNE FG:" for ease of identification. Proposals for RCNs should be prepared and submitted consistent with the guidelines in the RCN solicitation ([NSF 17-594](#)) with the proposal title prefaced with "RCN: IMAGiNE FG:". Research proposals should be submitted to the IOS core programs solicitation [NSF 21-506](#), the PBI solicitation [NSF 20-576](#), or the PGRP solicitation [NSF 21-507](#). Conference proposals should be prepared and submitted in accordance with the guidance contained in [PAPPG Chapter II.E.7](#).

Researchers are strongly encouraged to consult with IOS Program Directors as they are developing their proposals.

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[1] National Academies of Sciences, Engineering, and Medicine 2020. Next Steps for Functional Genomics: Proceedings of a Workshop. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25780>.