



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

NSF 24-120

Dear Colleague Letter: Advancing Plant Transformation

August 28, 2024

Dear Colleagues:

Plant genetic transformation, a process of introducing DNA, RNA, and proteins into plant cell/tissue and the regeneration of transformed materials, is of vital importance for both basic and applied research. In basic research, the generation of knock-out mutants, targeted mutagenesis, or over-expressing lines by plant transformation is a key approach for the functional characterization of genes. In applied research, genetic transformation enables genome editing and transgenesis that allows precise and knowledge-based gene modifications for plant breeding.

Except for *Arabidopsis thaliana* and a few other species from the Brassicaceae family, which can be transformed using non-tissue culture-based technique, most plant species require complex transformation and regeneration protocols with extensive in vitro culture procedures. These protocols are time-consuming, expensive, and often technically demanding. For many plant species, regeneration is highly genotype-dependent and transformation rates can be prohibitively low. This recalcitrance is a major bottleneck for fundamental research and crop improvement.

There is an urgent need for increased plant transformation capacity in the USA. Reliable, genotype-independent, and highly efficient plant transformation protocols are essential for the research community to effectively make full use of recent advances in genomics, bioinformatics, and gene editing technologies. Recent developments in morphogenic and growth regulator gene-assisted transformation protocols are promising. However, these protocols have only been established for a few plant species.

With this Dear Colleague Letter (DCL), existing programs in the U.S. National Science Foundation's (NSF) Directorate for Biological Sciences (BIO) and the United States Department of Agriculture's National Institute of Food and Agriculture (NIFA) Agriculture and Food Research Initiative (AFRI) highlight their interest in receiving proposals during fiscal years 2025 and 2026 that advance the field of plant transformation, including proposals

supporting basic research and protocol/tool development, and proposals of applications that emphasize potential outcomes with benefits to society. The programs listed in this DCL welcome proposals for exploring novel transformation technology and substantially improving current transformation methodologies. Long-term studies, including inter-disciplinary or multi-disciplinary collaborative research, centered on understanding the fundamental aspects of cell totipotency, cell communication/interaction under different environmental conditions as it relates to regeneration or transformation, cellular mechanisms in receiving and managing exogenous genetic components, mechanisms governing the interactions between plants and microbial change-agents, and plant transformation research of under-investigated species that is instructive to the fundamental understanding of plant regeneration as well as species evolution and crop domestication are also of interest.

PROPOSAL PREPARATION AND SUBMISSION

Proposal titles should be prefaced with "PlantTransform:" and submitted to the NSF/BIO or NIFA program most closely related to the proposed research.

Proposals with relevance to NSF-supported research may be submitted to one of the following NSF programs or clusters that are most aligned with the proposed research:

NSF Division of Integrative Organismal Systems (IOS)

- [Plant Genome Research Program \(PGRP\)](#)
- [Plant Biotic Interactions \(PBI\) Program](#)

NSF Division of Molecular and Cellular Biosciences (MCB)

- [Genetic Mechanisms \(GM\) Cluster](#)

Proposals submitted to the GM cluster must focus mainly on mechanistic questions about cell totipotency at the molecular and cellular scale.

Proposals with relevance to U.S. agriculture may be submitted to the following NIFA Program Area Priorities that are most aligned with the proposed research:

- Foundational Knowledge of Plant Products (AFRI A1103);
- Physiology of Agricultural Plants (AFRI A1152);
- Plant Breeding for Agricultural Production (AFRI A1141); or
- Emergency Citrus Disease Research and Extension Program ([ECDRE](#)).

The AFRI program's descriptions, deadlines, and points of contact are published in the current [AFRI Foundational and Applied Science Program Request for Applications](#).

This DCL is not intended to announce a special competition or a new program, but simply to

highlight NSF/BIO's and USDA/NIFA's interest in an area of research funded through existing programs.

POINTS OF CONTACT

Investigators interested in submitting a proposal are strongly encouraged to contact one of the Program Directors listed below for further information:

- Diane Okamuro and Gerald Schoenknecht, BIO/IOS/PGRP, dbipgr@nsf.gov
- Courtney Jahn, BIO/IOS/PBI, cjahn@nsf.gov
- Stephen DiFazio, BIO/MCB/GM, sdifazio@nsf.gov
- Christian Tobias, NIFA/A1141, christian.tobias@usda.gov
- John Erickson, NIFA/A1152, john.erickson@usda.gov
- Vance Owens, NIFA/A1103, vance.owens@usda.gov
- Erika Kistner-Thomas, NIFA/ECDRE, erica.kistnerthomas@usda.gov

Sincerely,

Susan Marqusee, Assistant Director
Directorate for Biological Sciences

Venu Kalavacharla, Deputy Director
Institute for Food Production and Sustainability