



NATIONAL SCIENCE FOUNDATION
2415 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22314

NSF 23-096

Dear Colleague Letter: Future Proofing Plants to a Changing Climate

November 2, 2023

Dear Colleagues:

Climate change is challenging the sustainability and resilience of our agri-food systems, through long-term changes to temperature and rainfall, increased threats due to extreme weather events and shifts in pests and diseases. Plants overall need to be more resilient and adapt to these threats while crops need to continue meeting the demand for safe and affordable food for a growing population on less land and with greater resource use efficiency, in order to lower the impact on the natural environment.

To address this imminent challenge, we need accelerated approaches in plant sciences translating knowledge across different plant and crop species. This necessitates new ways of working, access to diverse, complementary expertise and greater research coordination across multiple geographical locations and agri-environments to deliver a deeper understanding of the genome-phenome-environment relationship in the context of climate change. Broad community building and matching of strengths and diverse expertise in research intensive nations can accelerate solutions and leverage national research investments.

Germany, the United Kingdom (UK) and the United States (US) have world leading capability in plant and crop sciences, and together can drive greater coordination of research efforts beyond borders. This Dear Colleague Letter (DCL) highlights a new trilateral funding opportunity that will support collaborative research in the three countries with synergies expected to include:

- A novel route to inter-agency funding, supporting world-leading researcher collaborations across international teams with complementary expertise;
- Enabling multidisciplinary research approaches that build on areas of particular country strengths, for example, UK's strengths in systems biology and molecular modeling, Germany's whole organism-level understanding and US's capacity to scale up modeling

- of crops and farming systems;
- Providing strategies to close the knowledge gap between the genetic and physiological research at individual plant scale in artificial environments and the farming system level;
 - Achieving synergies across complementary national research resources that can be brought to bear in new ways, for example, national facilities, datasets, and biological resources;
 - Reducing duplication of effort and embedding common data standards to enhance collaboration within the international research community;
 - Delivery of novel tools, methods and approaches that could be disseminated and adopted more broadly across the plant and crop sciences research community; and
 - Access to wider international networks and training opportunities for early career researchers, strengthening national skill-sets and enhancing future international leadership and collaboration within and across the three countries.

RESEARCH THEMES

From Molecules and Mechanisms to Field Performance

A multi-scale understanding of model and crop plant physiology has the potential to deliver a step change in our ability to understand genotype x environment interactions and their impact on phenotype. Current bottlenecks include the lack of tools that enable integration of existing plant physiological, cellular and genomics knowledge into whole farming systems understanding.

The need to consider plants in real world contexts also extends to the influence of the plant microbiome and plant-soil interactions, where beneficial relationships play a role in plant resilience and resource use efficiency.

Integrative research is needed to understand the links between plant genetics, metabolism/physiology, and performance in complex and fluctuating environments. This requires bringing together observations from multiple scales, including molecular, cellular, physiological, organismal, and at the plant population level. Optimizing traits in the context of abiotic and biotic challenges, such as water stress or pathogenic threats, often leads to trade-offs that have implications for performance. This is particularly true when trying to link insights from laboratory studies to field performance of crops.

Research in this area should seek to develop or harness advances in modeling, machine learning and phenotyping, as well as a range of other multi-modal technologies, to deliver quantitative insights and potential strategies to optimize plant performance under different conditions, particularly in the field.

Programmable Plants

The ability to "program" plants with predictable and novel characteristics and ideotypes suited to specific environments, will provide fresh insights into complex genotype-phenotype relationships and offer innovative solutions for agricultural adaptation to climate change impacts. Biotechnological and synthetic biology approaches are needed to accelerate plant research in this direction and deliver step-changes in our ability to control plant growth, developmental and stress responses more precisely.

Areas that will benefit from further research include complex multigenic trait engineering in genomes and development of innovative techniques to control chromosome recombination for rapid and efficient implementation of pan-genome diversity or crop wild relatives to enhance complex traits, such as encoding resistance to stresses like drought, flooding, salinity, temperature, or pathogens and microbial interactions.

Furthermore, engineered approaches to reduce reliance on fertilizers and pesticides (e.g., nitrogen fixation and microbiome modulation), or enhanced carbon capture (e.g., improved sequestration in below ground tissues and photosynthetic efficiency), will strengthen plant resilience in more challenging and volatile climates and environments.

Finally, development of new tools and methods that address current bottlenecks in engineering plant systems, plant transformation, or those that harness disruptive approaches such as those in plant synthetic biology, genome editing, speed breeding, and rapid phenotyping, will accelerate the pipeline of development of rationally engineered plant traits for a changing climate.

This funding opportunity allows German, US and UK researchers to submit a single collaborative proposal that will undergo a single review process by BBSRC, on behalf of DFG, NSF and USDA-NIFA. Proposals which address research questions that sit under the 'From Molecules and Mechanisms to Field Performance' theme or the 'Programmable Plants' research theme are welcome.

The research must fall within the scope of [BBSRC](#), DFG, NSF and USDA-NIFA. Only UK, Germany and US based applicants are eligible to apply. Each joint research project must consist of three (UK, Germany, and US) national teams. Each national team must be led by one principal investigator.

Applicants should demonstrate how bringing together researchers based in the UK, Germany and the US will add value and advance research. We expect that each partner substantially contributes to the common project. This also includes taking on organizational responsibilities. The division of responsibilities should be reflected in the amount of funds requested by each partner.

SUBMISSION PROCESS

- i. Applicants will submit an Expression of Interest (EoI) to BBSRC through the UK Research and Innovation Funding Service ([Sign in - UKRI Funding Service](#)). The EoI will include an outline of the anticipated research programme, a list of project partners, and an overview of funds requested, broken down by country. Once received, BBSRC will share EoIs with DFG, NSF and USDA-NIFA via secure extranet.
- ii. The applicants' eligibility and projects' suitability to the call will be checked by BBSRC, DFG, NSF and USDA-NIFA against each country's respective eligibility requirements and the scope of the call. Applicants will be informed of the outcome and eligible applicants will be invited to submit a proposal. For proposals that are considered out of scope or are considered ineligible, BBSRC will convey the decision to the lead applicant. Full proposal budgets should not vary from those specified by the EoI by more than 10% of each funding agency's contribution, and changes to the researchers named on the EoI are not allowed without prior agreement of the agencies.
- iii. Applicants are invited to submit a full proposal should submit through the UK Research and Innovation Funding Service ([Sign in - UKRI Funding Service](#)). Proposals should include a description of the full proposed research programme and research team (CV's and track record of the applicant and partners) and should describe the total resources for the joint project. Separate budgets and budget justifications will be required for each agency. All budget items must conform to the national rules applicable to each applicant.
- iv. When preparing and submitting a proposal, applicants are expected to comply with the application process and requirements of BBSRC.
- v. All proposals are to adhere to the budget restrictions of the funding opportunity. UK applicants will adhere to BBSRC's eligibility rules and guidelines as set out in the [BBSRC grants guide](#), German applicants are to adhere to DFG's eligibility rules and US applicants are to adhere to NSF or USDA-NIFA's eligibility rules. If necessary, NSF and USDA-NIFA will provide guidance on respective funder suitability to US applicants. Applicants should contact NSF or USDA-NIFA for advice.

REVIEW PROCESS

- i. Proposals received via UKRI's Funding Service will be peer reviewed following the criteria of the lead participating agency - BBSRC. After proposal scope and applicant eligibility checks, every submitted proposal will be subject to external international peer *ad hoc* review and a PI response stage, followed by assessment at a panel meeting.
- ii. During the PI response stage, evaluation reports will be anonymously made available to the applicants who may respond briefly and only in case they wish to do so. PIs will typically have two weeks to respond in no more than one page per review. PI responses will serve as extra information for the panel meeting.
- iii. The review panel will take the following into account when evaluating and scoring proposals: 1) assessment criteria as stated in the funding opportunity guidance; 2) the

- scope and remit of the funding opportunity; 3) application documentation submitted, evaluation reports of the external international reviewers and corresponding PI responses; and 4) individual expertise and independence of each review panel member.
- iv. BBSRC will share review comments, panel scores and rank order with DFG, NSF and USDA-NIFA after the panel meeting by secure file transfer.
 - v. The outcomes of peer review and assessment panel will remain confidential until all concerned participating agencies have taken their national funding decision. BBSRC will inform lead applicants of funding outcomes, following which the non-lead agency will get in touch with their in-country applicants.
 - vi. For successful proposals, UK applicants will provide a copy of the proposal that was submitted to BBSRC to the US applicants who will then submit it via NSF's Research.gov system or through the NIFA process at Grants.gov. Links to these platforms will be provided within the call guidance document.

POST-AWARD CONDITIONS

- i. Awards will be announced publicly in accordance with BBSRC, DFG, NSF and USDA-NIFA standard procedures.
- ii. Awardees will be expected to comply with the award conditions and reporting requirements of the participating agencies from which they receive funding.
- iii. Awardees will be expected to acknowledge BBSRC, DFG, NSF or USDA-NIFA in any publications arising from the grant.
- iv. Requests for extensions will be considered by the participating agencies using standard procedures. Requests for changes to awards will be discussed with other involved funding agencies before a mutual decision is reached.
- v. BBSRC, DFG, NSF and USDA-NIFA requirements for data management apply to awardees funded by the respective agencies.
- vi. For projects involving human subjects or vertebrate animals, each countries' awardees must comply with their respective country's requirements and the requirements of the funding agency.

Applicants who are uncertain whether their proposal would be eligible should contact BBSRC for clarification:

- remit@bbsrc.ukri.org
- DFG: catherine.kistner@dfg.de
- NSF: dbipgr@nsf.gov
- NIFA: christian.tobias@usda.gov or
- john.erickson@usda.gov

Sincerely,

Susan Marqusee
Assistant Director
Directorate for Biological Sciences