PITCHING YOUR PROJECT

A WORKSHOP ON WRITING

AN EFFECTIVE RESEARCH PROPOSAL

September 12, 2023
September 18, 2023

Judith A. Swan, Ph.D.
Associate Director for Writing in Science and Engineering (WSE)
Princeton Writing Program

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Note for Scholars in the Humanities and Social Sciences:

This workshop is on strategies for developing an effective proposal. Don’t be put off by the references to scientific organizations – almost everything we’ll do in this workshop applies to any kind of proposal. Because science and engineering give billions of dollars away annually in response to proposals, they offer lots of examples that we can use to get at the underlying principles behind effective proposals. You’ll need to figure out how these examples mimic or parallel your situations – but I’m confident you’ll be able to do that. After all, scientists have been doing the reverse for decades – taking principles of communication taught with humanities examples and then figuring out how to apply them to science!

NSF Graduate Research Fellowship Program
https://www.research.gov/grfp/Login.do
NSF GRFP Competition Results

- Award Offers and Honorable Mentions List

Applicant Deadlines
Applications Must Be Received by 5:00 p.m. Local Time of applicant's mailing address

Application Deadline(s) (received by 5 p.m. local time of applicant’s mailing address):

- **October 16, 2023**
  - Life Sciences

- **October 17, 2023**
  - Computer and Information Science and Engineering
  - Materials Research
  - Psychology
  - Social Sciences
  - STEM Education and Learning

- **October 19, 2023**
  - Engineering

- **October 20, 2023**
  - Chemistry
  - Geosciences
  - Mathematical Sciences
  - Physics and Astronomy

IMPORTANT INFORMATION AND REVISION NOTES

1. This solicitation covers the Fiscal Year (FY) 2024 competition.
SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

NSF Graduate Research Fellowship Program (GRFP)

Synopsis of Program:

The purpose of the NSF Graduate Research Fellowship Program (GRFP) is to help ensure the quality, vitality, and diversity of the scientific and engineering workforce of the United States. The program recognizes and supports outstanding graduate students who are pursuing full-time research-based master's and doctoral degrees in science, technology, engineering, and mathematics (STEM) or in STEM education. The GRFP provides three years of support over a five-year fellowship period for the graduate education of individuals who have demonstrated their potential for significant research achievements in STEM or STEM education. NSF actively encourages submission of applications from the full spectrum of diverse talent in STEM.

NSF GRFP was established to recruit and support individuals who demonstrate the potential to make significant contributions in STEM. Thus, NSF especially encourages applications from undergraduate seniors and Bachelor's degree-holders interested in pursuing research-based graduate study in STEM. First- and second-year graduate students in eligible STEM fields and degree programs are also encouraged to apply.

Cognizant Program Officer(s):
Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Contact: GRF Operations Center, telephone: (866) 673-4737, email: info@nsfgrfp.org

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.070 --- Computer and Information Science and Engineering
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- STEM Education
- 47.079 --- Office of International Science and Engineering
- 47.083 --- Office of Integrative Activities (OIA)
- 47.084 --- NSF Technology, Innovation and Partnerships

Award Information

Anticipated Type of Award:

Fellowship

Estimated Number of Awards: 2,500

NSF will support at least 2,500 new Graduate Research Fellowships per fiscal year under this program solicitation pending availability of funds.

Anticipated Funding Amount: $159,000

Per award (Fellowship), pending the availability of funds.

Each Fellowship provides three years of support over a five-year fellowship period. For each of the three years of support, NSF provides a $37,000 stipend and $16,000 cost of education allowance to the graduate degree-granting institution of higher education for each Fellow who uses the support in a fellowship year. The Fellowship is portable and can be transferred to a different institution of higher education if a Fellow chooses to transfer to another institution after completion of the first Fellowship year. While the Fellowship is offered to the individual, the Fellowship funds are awarded to the institution of higher education at which a Fellow is enrolled and the institution is responsible for disbursement of the stipend to the Fellow.

Eligibility Information

Organization Limit:
Fellowship applications must be submitted by the prospective Fellow. Applicants must use the GRFP application module in Research.gov (https://www.research.gov/grfp/Login.do) to submit the application. Confirmation of acceptance in a graduate degree program in STEM or STEM education is required at the time of Fellowship acceptance, no later than the deadline indicated in the fellowship offer letter, of the year the Fellowship is accepted. Prospective Fellows must enroll in a non-profit university, college, or institution of higher education accredited in, and having a campus located in, the United States, its territories or possessions, or the Commonwealth of Puerto Rico that offers advanced degrees in STEM and STEM education no later than fall of the year the Fellowship is accepted. All Fellows from the date of Fellowship Start through Completion or Termination of the Fellowship must be enrolled in a graduate degree-granting institution of higher education accredited in, and having a campus located in, the United States its territories or possessions, or the Commonwealth of Puerto Rico.

Applicant Eligibility:

See the Detailed Eligibility Requirements in Section IV for full information. Eligibility is based on the applicant's status at the application deadline.

Applicants must self-certify that they are eligible to receive the Fellowship. To be eligible, an applicant must meet all of the following eligibility criteria at the application deadline:

- Be a U.S. citizen, national, or permanent resident
- Intend to enroll or be enrolled full-time in a research-based Master's or doctoral degree program in an eligible Field of Study in STEM or STEM education (See Appendix and Section IV.3 for eligible Fields of Study)
- Have completed no more than one academic year (according to institution's academic calendar) while enrolled in a graduate degree program
- Never previously accepted a Graduate Research Fellowship
- Declined any previously offered Graduate Research Fellowship by the acceptance deadline
- Never previously applied to GRFP while enrolled in a graduate degree program
- Never earned a doctoral or terminal degree in any field
- Individuals holding joint Bachelor's-Master's degrees who did not progress directly to a doctoral program the semester following award of the joint degree must apply as returning graduate students (see below)
- Individuals with prior graduate enrollment who have: (i) completed more than one academic year in any graduate degree-granting program, (ii) earned a previous master's degree of any kind (including Bachelor's-Master's degree), or (iii) earned a professional degree must meet the following requirements:
  - not enrolled in a graduate degree program at application deadline
  - two or more consecutive years past graduate degree enrollment or completion at the application deadline
- Not be a current NSF employee
Number of Times an Individual May Apply

- Undergraduate seniors and Bachelor's degree holders who have never enrolled in a graduate degree program have no restrictions on the number of times they can apply before enrolling in a degree-granting graduate program.
- Currently enrolled graduate students who have completed no more than one academic year (according to institution's academic calendar) while enrolled in a graduate degree program can apply only once. Non-degree coursework does not count toward the one academic year limit.
- Individuals applying while enrolled in a joint Bachelor's-Master's degree program are considered graduate students who: i) must have completed three (3) years in the joint program, and; ii) are limited to one application to GRFP; they will not be eligible to apply again as doctoral students. For GRFP, joint Bachelor's-Master's degrees are defined as degrees concurrently pursued and awarded.
- Individuals holding joint Bachelor's-Master's degrees, currently enrolled as first-year doctoral students, who (i) have not previously applied as graduate students and (ii) enrolled in the doctoral program the semester following award of the joint degree, may only apply in the first year of the doctoral program.
- Applications withdrawn by November 15 of the application year do not count toward the one-time graduate application limit. Applications withdrawn after November 15 count toward this one-time limit.
- Applications not reviewed by NSF do not count toward the one-time graduate application limit.

Limit on Number of Applications per Applicant: 1

An eligible applicant may submit only one application per annual competition.
Important URLs for NSF Graduate Research Fellowships

Home page for NSF
http://www.nsf.gov

Home page of the Graduate Research Fellowship Program [GRFP].
http://www.nsfgrfp.org/

The 2023 guide to applying for a Graduate Research Fellowship.

The 2023 Program as pdf

Some thoughts from a reviewer on how well graduate fellowships work, or (don’t work) to identify outstanding future scientists.

Updated Grant Proposal Guide

Peer Review Revealed – NIH videos of Study Section and Grant Process
https://public.csr.nih.gov/

Proposed Changes to NIH Peer Review

Criteria defined
https://grants.nih.gov/grants/peer/critiques/rpg.htm
GUIDE FOR ASSIGNED REVIEWERS' PRELIMINARY COMMENTS ON RESEARCH GRANT APPLICATIONS
(R01)

Please use the following guidelines when preparing written comments on research grant applications assigned to you for review. The goals of NIH-supported research are to advance our understanding of biological systems, improve the control of disease, and enhance health. In your written review, you should comment on the following aspects of the application in order to judge the likelihood that the proposed research will have a substantial impact on the pursuit of these goals. NOTE: Your written reviews should not bear personal identifiers because unaltered comments will be sent to the investigator.

DESCRIPTION: The NIH now scans the abstract on page 2 of an application for use in the Description section of the summary statement. However, as a reviewer you must be prepared to present a summary of the goals of the application to the Study Section so that all members can follow the critiques and discussion. Thus, any description you write (in prose or in bullet form) is for your use in making this presentation.

CRITIQUE: Include as little descriptive information in this section as possible. Please address, in five individual sections, each criterion listed below. In addition: for competing continuation (renewal) applications, include an evaluation of progress over the past project period; for amended applications, address progress, changes, and responses to the critiques in the summary statement from the previous review, indicating whether the application is improved, the same as, or worse than the previous submission. Comments on progress and response to the previous review should be provided in a separate paragraph and/or under the appropriate criteria.

1. **Significance** Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge be advanced? What will be the effect of these studies on the concepts or methods that drive this field?

2. **Approach** Are the conceptual framework, design (including composition of study population), methods, and analyses adequately developed, well-integrated, and appropriate to the aims of the project? Does the applicant acknowledge potential problem areas and consider alternative tactics?

3. **Innovation** Does the project employ novel concepts, approaches or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?

4. **Investigator** Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and other researchers (if any)? PLEASE DO NOT INCLUDE descriptive biographical information unless important to the evaluation of merit.

5. **Environment** Does the scientific environment in which the work will be done contribute to the probability of success? Do the proposed experiments take
advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support? PLEASE DO NOT INCLUDE description of available facilities or equipment unless important to the evaluation of merit.

OVERALL EVALUATION: In one paragraph, briefly summarize the most important points of the Critique, addressing the strengths and weaknesses of the application in terms of the five review criteria. Recommend a score reflecting the overall impact of the project on the field, weighing the review criteria, as you feel appropriate for each application. An application does not need to be strong in all categories to be judged likely to have a major scientific impact and, thus, deserve a high merit rating. For example, an investigator may propose to carry out important work that by its nature is not innovative, but is essential to move a field forward.

PROTECTION OF HUMAN SUBJECTS FROM RESEARCH RISKS: Evaluate the application with reference to the following criteria: risk to subjects, adequacy of protection against risks, potential benefit to the subjects and to others, importance of the knowledge to be gained. (If the applicant fails to address all of these elements, notify the SRA immediately to determine if the application should be withdrawn.) If all of the criteria are adequately addressed, and there are no concerns. Write "Acceptable Risks and/or Adequate Protections." A brief explanation is advisable. If one or more criteria are inadequately addressed, write, "Unacceptable Risks and/or Inadequate Protections" and document the actual or potential issues that create the human subjects concern. If the application indicates that the proposed human subjects research is exempt from coverage by the regulations, determine if adequate justification is provided. If the claimed exemption is not justified, indicate "Unacceptable" and explain why you reached this conclusion. Also, if a clinical trial is proposed, evaluate the Data and Safety Monitoring Plan. (If the plan is absent, notify the SRA immediately to determine if the application should withdrawn.) Indicate if the plan is "Acceptable" or "Unacceptable", and, if unacceptable, explain why it is unacceptable.

GENDER, MINORITY AND CHILDREN SUBJECTS: Public Law 103-43 requires that women and minorities must be included in all NIH-supported clinical research projects involving human subjects unless a clear and compelling rationale establishes that inclusion is inappropriate with respect to the health of the subjects or the purpose of the research. NIH requires that children (individuals under the age of 21) of all ages be involved in all human subjects research supported by the NIH unless there are scientific or ethical reasons for excluding them. Each project involving human subjects must be assigned a code using the categories "1" to "5" below. Category 5 for minority representation in the project means that only foreign subjects are in the study population (no U.S. subjects). If the study uses both then use codes 1 thru 4. Examine whether the minority and gender characteristics of the sample are scientifically acceptable, consistent with the aims of the project, and comply with NIH policy. For each category, determine if the proposed subject recruitment targets are "A" (acceptable) or "U" (unacceptable). If you rate the sample as "U", consider this feature a weakness in the research design and reflect it in the overall score. Explain the reasons for the recommended codes; this is particularly critical for any item coded "U".
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<th>Minority (M)</th>
<th>Children (C)</th>
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<td>Minority &amp; non-minority</td>
<td>Children &amp; adults</td>
</tr>
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<td>2</td>
<td>Only Women</td>
<td>Only minority</td>
<td>Only children</td>
</tr>
<tr>
<td>3</td>
<td>Only Men</td>
<td>Only non-minority</td>
<td>No children included</td>
</tr>
<tr>
<td>4</td>
<td>Gender Unknown</td>
<td>Minority representation unknown</td>
<td>Representation of children unknown</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Only Foreign Subjects</td>
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**NOTE:** To the degree that acceptability or unacceptability affects the investigator's approach to the proposed research, such comments should appear under "Approach" in the five major review criteria above, and should be factored into the score as appropriate.

**ANIMAL WELFARE:** Express any comments or concerns about the appropriateness of the responses to the five required points, especially whether the procedures will be limited to those that are unavoidable in the conduct of scientifically sound research.

**BIOHAZARDS:** Note any materials or procedures that are potentially hazardous to research personnel and indicate whether the protection proposed will be adequate.

**BUDGET:** Evaluate the direct costs only. Do not focus on detail. Determine whether the total budget is appropriate for the project proposed. Provide a rationale for suggested modification in amount or duration of support.

**OTHER CONSIDERATIONS** (for Administrative Notes in the Summary Statement): These comments are useful to NIH but should not influence your overall score.

**FOREIGN:** If the applicant organization is foreign, comment on any special talents, resources, populations, or environmental conditions that are not readily available in the United States or that provide augmentation of existing U.S. resources. In addition, indicate whether similar research is being performed in the U.S. and whether there is a need for such additional research. These aspects do not apply to applications from U.S. organizations for projects containing a significant foreign component.
National Science Foundation Graduate Research Fellowship Program

Review Criteria

Applications will be reviewed by panels of disciplinary and interdisciplinary scientists, mathematicians, and engineers and other professional experts in graduate education. Applications will be assigned to panels based on the applicant's chosen field(s) of study and the discipline(s) represented. Thus, applicants are advised to select the fields of study in the FastLane applicant module that are most closely aligned to the proposed graduate program of study and research plan. Applications to interdisciplinary fields of study are reviewed by interdisciplinary panelists based on the disciplines indicated by the applicant and review of the application by the GRFP staff.

Each application, therefore, will be reviewed independently on the basis of merit using all available information in the completed application. In considering applications, reviewers will be instructed to address the two Merit Review Criteria as approved by the National Science Board – Intellectual Merit and Broader Impacts (Grant and Proposal Guide, NSF 10-1). Applicants, therefore, must address each criterion in their written statements to provide reviewers with the information necessary to respond fully to both.

1. Intellectual Merit
   a. How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
   b. How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.)
   c. To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts?
   d. How well conceived and organized is the proposed activity?
   e. Is there sufficient access to resources?

1. Broader Impacts * – Activities and projects that:
   a. How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
   b. How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
   c. To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?
   d. Will the results be disseminated broadly to enhance scientific and technological understanding?
   e. What may be the benefits of the proposed activity to society?

*See this NSF document for representative Broader Impacts activities

For each criterion, panelists evaluate and comment on the applicant’s strengths and areas for improvement on the rating sheet, assign an "excellent", "very good", "good", "fair" or "poor" rating for each criterion, and determine an overall point value.

Intellectual Merit

Panelists will consider factors including: the strength of the academic record, the proposed plan of research and whether it is potentially transformative, the description of previous research experience, references, and the appropriateness of the choice of institution relative to the proposed plan for graduate education and research.

Broader Impacts

The broader impacts criterion includes contributions that infuse learning with the excitement of discovery, and assure that the findings...
and methods of research are communicated in a broad context and to a large audience.

A strong application will encourage diversity, broaden opportunities, and enable the participation of all citizens—women and men, underrepresented minorities, and persons with disabilities—in science and research.

In addition to reaching a broad audience, a strong application must demonstrate how it will enhance scientific and technical understanding, while benefiting society.

Applicants may provide characteristics of their background, including personal, professional, and educational experiences, to indicate their potential to fulfill the broader impacts criterion.

A document with a more in-depth look at Broader Impacts, published by NSF, is [here](http://www.nsfgrfp.org/how_to_apply/review_criteria).
Dear Colleague:

Proposals received by the National Science Foundation are evaluated based on two merit review criteria: intellectual merit and broader impacts. Through its merit review process, NSF ensures that proposals submitted are reviewed in a fair, competitive, transparent, and in-depth manner.

Proposals submitted by Principal Investigators (PIs) are reviewed based on the first criterion, intellectual merit, with the expectation that the research be high quality, innovative and advance the frontiers of science. NSF asks reviewers to consider the following in evaluating intellectual merit.

- Potential of the Research to Advance Knowledge and Understanding
- Originality, Creativity and the Potentially Transformative Nature of the Proposal
- Qualifications of Researchers
- Organization and Conceptual Foundation of the Proposed Activities
- Access to Resources Needed

The broader impacts criterion identifies the important outcomes and consequences of NSF-supported research. Research supported by the Division of Materials Research (DMR) is particularly well suited to demonstrate these impacts in ways visible to scientists and engineers as well as the general public. This message is meant to clarify what is meant by broader impacts and how it is applied by Program Directors in making their final decisions.

The NSF Grant Proposal Guide (Chapter III, Section A) poses five questions that identify the general areas in which broader impacts (Merit Review Broader Impacts Criterion: Representative Activities) typically occur. Some examples that illustrate contributions in each of the five areas are given below. Proposals need not address all of these areas, and PIs are advised to focus on those areas in which they are well prepared to make meaningful contributions.

**Advance discovery and understanding while promoting teaching, training, and learning** with innovative connections of research and education. Activities that go beyond the norm in conjunction with training of graduate students, mentoring postdoctoral researchers and junior faculty are highly encouraged. PIs are expected to go beyond their normal teaching duties and faculty commitments, and create opportunities that engage, excite, recruit and retain students at all levels by connecting research in materials to the many facets of education. They should seek opportunities to involve undergraduate and high school students in research experiences, participate in the professional development of K-12 teachers for whom research activities can often contribute to updating the K-12 curriculum and take the form of new classroom instructional materials and experiments.

**Broadening participation of underrepresented groups** by involving members of underrepresented groups (women, African Americans, American Indians including Native Alaskans, Hispanics, Native Pacific Islanders, and persons with disabilities) in research and education activities at all levels. DMR is very interested in increasing the pool of future talented educators and promising researchers. Efforts are needed to broaden participation at all levels from students through faculty members. Mentoring and outreach to junior faculty, women, and minorities used as avenues for increasing professional opportunities for groups that are underrepresented in science and engineering are highly encouraged. Establishing collaborations with students and faculty from institutions and organizations serving women, minorities, and people with disabilities in the materials, chemical, and physical sciences is crucial for increasing the pool of qualified material scientists. Initiating or participating in the development of a diversity strategic plan within the proposer's academic department is another approach to achieving this goal. DMR has provided a website to assist PIs in their endeavors to create a welcoming, nurturing, effective learning and creative atmosphere for all scientists: Broadening Participation for Greater Diversity.

**Enhance infrastructure for research and education** by linking with scientists and programs to bring added value and enhance impacts of research activities. The forms this may take are numerous, such as establishing research collaborations with industry, national laboratories, and international institutions; developing new instrumentation, software, computation or data analysis methodologies that have wide range of applicability and use; providing samples of novel materials to other groups; sharing advanced laboratory or computational methods, instrumentation and software; building national and international research and education networks. Advances in networking and cyber infrastructure give researchers novel ways and new opportunities for collaboration, for conducting research and education, and sharing their work.
Broaden dissemination to enhance scientific and technological understanding by organizing materials research and education workshops and symposia; forging links to other scientific disciplines; writing scholarly articles that go beyond routine publication of research results for specialists or that are addressed specifically to non-specialist audiences; sharing of data that might not otherwise be easily accessible; working with science centers on new materials research and education exhibits; assisting journalists with their stories on technical topics; and developing new art forms for communicating materials research to wider audiences; creating materials research related websites enhanced by engaging animations and movies to educate non-scientists and the public at large.

Provide benefits to society by communicating to the public the excitement, benefits, and long term impacts of materials research and enhance public appreciation of the relevance of advanced materials research to the future and society. Emphasis should be wherever and whenever appropriate on technological advances that will profit our economy, benefit our health and increase our national security. Benefits may be specific, such as creating the scientific basis for start-up companies that employ new materials research technologies or generally enhancing the knowledge base for future devices. Fundamental materials research is often ripe for technology transfer, and researchers can participate in establishing strong partnerships with industry and developing easy mechanisms for transforming fundamental research findings into useful and practical applications.

Because materials research yields so many results of direct and obvious importance to other disciplines and society, the materials community is in a strong position to demonstrate as much creativity and originality in the broader impacts as it does in the intellectual merit of its NSF proposals. In making final decisions with respect to awards NSF program directors give careful consideration to the extent that proposals address the NSF goals of Integration of Research and Education and Integration of Diversity into NSF Programs, Projects, and Activities. PIs are encouraged to recognize these NSF objectives as they prepare proposals for consideration by DMR.

Both intellectual merit and broader impacts must be addressed in clear and explicit fashion in the Project Summary of every proposal, and the Project Description must expand upon the details of both criteria. PI capability (including track record when applicable), a realistic plan for implementation, as well as identifiable results enter into the assessment by the reviewers and NSF program officers. We wish also to mention that a distinction needs to be made between broader impacts specific to a given proposal and synergistic activities which are carried out whether or not the proposal gets funded.

In light of NSF’s commitment to the broader impacts criterion, the proposer(s) should carefully consider ways to incorporate rigorous, meaningful and innovative broader impacts activities (e.g., broadening participation) that integrate with the research being proposed. It is expected that project activities related to broader impacts will be of the same caliber as those addressing the intellectual merit criterion. Contributions to broader impacts should be based on good scholarship, and be designed to achieve clearly stated goals and metrics, while possessing the appropriate expertise and resources available for implementation.

I hope that this information provides helpful guidance, clarifies what is meant by the “broader impacts” criterion and how it is applied by program directors in making their final decisions. For further information regarding broader impacts, see the NSF July 2007 document: Merit Review Broader Impacts Criterion: Representative Activities. Feel free to contact DMR program directors, if you would like to discuss the broader impacts associated with your project.

Sincerely,

Dr. Zakya H. Kafafi
Director, Division of Materials Research
National Science Foundation
WELCOME TO THE BROADER IMPACTS SHOWCASE

On behalf of the chemists serving on the NSF Mathematical and Physical Sciences Advisory Committee (MPSAC) and the Division of Chemistry, it is a pleasure to welcome you to the Broader Impacts Showcase. The Showcase is the result of a request from our community for additional education regarding the broader impacts criterion used to evaluate NSF proposals, particularly as it applies to Division-supported research. We are grateful to the dozens of principal investigators (PIs) participating in this Showcase for their willingness to share with the community the broader impacts associated with their projects. We hope that the message that emerges for PIs and reviewers from this Showcase is that the broader impacts criterion is a large umbrella, affording a wide range of opportunities to enhance the impact of Division-supported projects.

Thank you for attending. Please feel free to consult with NSF staff (www.nsf.gov/chem) and MPSAC chemists if you have questions regarding the broader impacts of your projects.

Sincerely,

Luis Echegoyen, Organizer, Broader Impacts Showcase, on behalf of the MPSAC chemists
(Shenda Baker, Mostafa El-Sayed, Jean Futrell, Carl Lineberger, David Oxtoby)
luis@clemson.edu

Arthur B. Ellis, Director, Division of Chemistry, NSF aellis@nsf.gov

BROADER IMPACTS CRITERION: WHAT ARE THE BROADER IMPACTS OF THE PROPOSED ACTIVITY?

- How well does the activity advance discovery and understanding while promoting teaching, training and learning?
- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?

ADVANCE DISCOVERY AND UNDERSTANDING WHILE PROMOTING TEACHING, TRAINING AND LEARNING

- training and mentoring students
- presenting seminars, organizing workshops and symposia
- updating the curriculum by writing texts and developing new classroom instructional materials and laboratory experiments
- sharing laboratory methods, instrumentation, software for data analysis, and samples of compounds
- devising and sharing safer laboratory procedures and more economical research practices

BROADEN PARTICIPATION OF UNDERREPRESENTED GROUPS

- including students from underrepresented groups as participants in the proposed research and education activities
- establishing research and education collaborations with faculty who are members of underrepresented groups or are from minority-serving institutions, community colleges, undergraduate institutions and colleges for women

ENHANCE INFRASTRUCTURE FOR RESEARCH AND EDUCATION

- mentoring early-career scientists and engineers
- consulting with industrial and government colleagues
- establishing collaborations with scientists from around the world
- maintaining, operating and modernizing shared instrumentation and facilities
- developing the computing infrastructure that will allow cyber-enabled chemistry

**BROAD DISSEMINATION TO ENHANCE SCIENTIFIC AND TECHNOCLOGICAL UNDERSTANDING**

- writing scholarly review articles and articles describing research to non-specialist audiences
- creating websites enhanced by engaging animations and movies
- working with science centers on new exhibits
- assisting journalists with their stories on technical topics
- developing new art forms for communicating science to wider audiences

**BENEFITS TO SOCIETY**

- designing new routes to commodity and fine chemicals
- preparing new compounds of industrial, medical, and environmental significance
- identifying more effective ways to use energy resources
- developing new devices and methodologies for national security
- forming start-up companies for disseminating new technologies

**LIST OF POSTER AUTHORS**

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<th>PI First Name</th>
<th>Institution</th>
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</table>
Proposals as Arguments

**Significance**

Applications

Context for the research

Highlighting of novelty

Question or Problem

Orienting to the unknown by describing the known

**Feasibility**

Resources – Environment and Researcher

Methodology

Expected Results

Expected unexpected results, and how to resolve them

Alternative approaches – I have a PLAN!

What needs to be done is **MY PROJECT**

MY PROJECT will succeed and will solve the problem

**MY PROJECT = SPECIFIC AIMS**
## Orienting and Motivating: Structuring the introductory material

<table>
<thead>
<tr>
<th>I: Naïve list of elements</th>
<th>II: Functions/Purposes</th>
<th>III: Functional Elements</th>
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<td>Motivating Problem</td>
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<td>The project statement</td>
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<td>Specific Aims of this proposal</td>
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Resources for Proposal Writers at Princeton University

Other offices on campus:

Office of Research  https://orpa.princeton.edu/finding-funding
Fellowship Advising  http://www.princeton.edu/oip/fellowships/

Library Resources for Data Management:

DMPTool  https://libguides.princeton.edu/rdm

Princeton Writing Program:

Writing Center  http://writing.princeton.edu/center
Writing in Science and Engineering  http://writing.princeton.edu/wse
Proposal Flashmobs  follow the Writing Center on Twitter @PrincetonWrites
Check the Writing Program Webpage