How to Apply for an NSF Graduate Fellowship

August 28, 2019
Prof. Christy Till
Summary of the Fellowship

Synopsis of Program:

The purpose of the NSF Graduate Research Fellowship Program (GRFP) is to help ensure the 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 for the graduate education of individuals who have demonstrated their potential for significant research achievements in STEM or STEM education. NSF especially encourages women, members of underrepresented minority groups, persons with disabilities, veterans, and undergraduate seniors to apply.

The Graduate Research Fellowship Program (GRFP) awards Fellowships for graduate study leading to research-based master's and doctoral degrees in STEM or in STEM education. **GRFP supports individuals proposing a comprehensive plan for graduate education that takes individual interests and competencies into consideration. The plan describes the academic achievements, attributes, and experiences that illustrate the applicant's demonstrated potential for significant research achievements.** The applicant must provide a detailed profile of their relevant education, research experience, and plans for graduate education that demonstrates this potential.

**Estimated Number of Awards: 1,600**

The NSF expects to award 1,600 Graduate Research Fellowships per fiscal year under this program solicitation pending availability of funds.

**Anticipated Funding Amount: $138,000**

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

Each Fellowship consists of three years of support during a five-year fellowship period. Currently, NSF provides a stipend of $34,000 to the Fellow and a cost-of-education allowance of $12,000 to the graduate degree-granting institution for each Fellow who uses the fellowship support in a fellowship year.
Eligibility to Apply

Applicant Eligibility:

See the information provided below in Detailed Eligibility Requirements.

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 by the application deadline:

- Be a U.S. citizen, national, or permanent resident
- Intend to enroll or be enrolled full-time in a research-based graduate 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 never previously accepted a GRFP award
- If previously offered a GRFP award, have declined by the deadline
- Have never previously applied to GRFP while enrolled in a graduate degree program
- Have never earned a doctoral or terminal degree in any field
- Have never earned a master's, professional, or bachelor's-master's degree in any field, unless (i) returning to graduate study after an interruption of two (2) or more consecutive years immediately preceding the deadline, and; (ii) are not enrolled in a graduate degree program at the application deadline
- Not be a current NSF employee

Number of Times Individuals May Apply

- Undergraduate seniors and bachelor's degree holders may apply before enrolling in a degree-granting graduate program.
- Graduate students enrolled in a degree-granting graduate program are limited to only one application to the GRFP, submitted in the first year or at the beginning of the second year of their degree program.
- Individuals pursuing a master's degree simultaneously with the bachelor's degree (joint bachelor's-master's degree) must have completed three (3) years in the joint program and are limited to one application to GRFP; they will not be eligible to apply again as a doctoral degree student. Individuals in this category who applied in the FY2019 competition (Fall 2018 deadline) are eligible to apply as first-year doctoral students only in the FY2020 competition (Fall 2019 deadline).
- 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 (returned without review) do not count toward the one-time graduate application limit.
- There is a limited opportunity for returning graduate students to apply for a graduate research fellowship. Individuals who have (i) completed more than one academic year in a degree-granting program, (ii) earned a previous master's degree of any kind (including bachelor's-master's degree), or (iii) earned a non-doctoral professional degree are eligible only if:
  - they have had a continuous interruption in graduate study of at least two consecutive years immediately prior to the application deadline; and
  - are not enrolled in a degree-granting graduate program at the application deadline.
Deadlines

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

October 21, 2019
  Life Sciences, Geosciences

October 22, 2019
  Computer and Information Science and Engineering, Engineering, Materials Research

October 24, 2019
  Psychology, Social Sciences, STEM Education and Learning

October 25, 2019
  Chemistry, Mathematical Sciences, Physics and Astronomy
What does the application consist of?

• **Research Proposal (2 pages)**
  • Addressing Intellectual Merit & Broader Impacts
• Personal, Relevant Background & Future Goals Statement (3 pages)
• College Transcripts

• Three reference letters:
  • PhD Advisor
  • Undergraduate research advisor
  • Undergraduate Professor
  • Collaborator
Guidelines

- standard 8.5" x 11" page size
- 12-point, Times New Roman font
- 10-point font may be used for references, footnotes, figure captions and text within figures
- 1" margins on all sides
- Single-spaced (approximately 5 lines per inch) or greater line spacing. Do not use line spacing options such as "exactly 12 point," that are less than single spaced.

The maximum length of the Personal, Relevant Background and Future Goals Statement is three (3) pages. The maximum length of the Graduate Research Plan Statement is two (2) pages. These page limits include all references, citations, charts, figures, images, and lists of publications and presentations. Applicants must certify that the two statements (Personal, Relevant Background and Future Goals Statement, and Graduate Research Plan Statement) in the application are their own original work. As explained in the NSF Proposal and Award Policies and Procedures Guide (PAPPG): "NSF expects strict adherence to the rules of proper scholarship and attribution. The responsibility for proper scholarship and attribution rests with the authors of a proposal; all parts of the proposal should be prepared with equal care for this concern. Authors other than the PI (or any co-PI) should be named and acknowledged. Serious failure to adhere to such standards can result in findings of research misconduct. NSF policies and rules on research misconduct are discussed in the PAPPG, as well as 45 CFR Part 689."

Both statements must address NSF’s review criteria of Intellectual Merit and Broader Impacts (described in detail in Section VI). In each statement, applicants should address Intellectual Merit and Broader Impacts under separate headings to provide reviewers with the information necessary to evaluate the application with respect to both Criteria.
Instructions for Your Proposal

GRADUATE RESEARCH PLAN STATEMENT

Present an original research topic. Describe the research idea, your general approach, as well as any unique resources that may be needed for accomplishing the research goal (i.e., access to national facilities or collections, collaborations, overseas work, etc.) You may choose to include important literature citations. Address the potential of the research to advance knowledge and understanding within science as well as the potential for broader impacts on society. The research discussed must be in a field listed in the Solicitation (Section X, Fields of Study).

Proposed Research Title
The title should be brief, informative, scientifically or technically valid, intelligible to a scientifically or technically literate reader, and suitable for use in the public press. It should describe in succinct terms your proposed research, reflecting the contents of your proposal. Use key words, and do not use abbreviations and chemical formulas (in 255 characters or less). This title will be used for searching research topics using the key words you supply. Do not use curly brackets, {}, in your Proposed Research Title or Key Words.

12 pt. font (10 pt. minimum for references only), Times New Roman, single spaced, 2 pages, 1” margins required.
Suggested Proposal Structure

“LARGE GENERAL TOPIC OF WIDE INTEREST
(Global Warming, Immigration, Cancer, Etc.)

Brief Ref. to Literature I
Brief Ref. to Literature II

“HOWEVER, scholars in these fields have not yet adequately addressed XXXX...”

GAP IN KNOWLEDGE
1. Urgency: This gap is bad!!!
2. HERO Narrative: I will fill this gap!!!

YOUR RESEARCH QUESTION
“I am applying to XXX to support my research on XXX”

SPECIFICS OF YOUR PROJECT
(background info, location, history, context, limitations, etc.)

LITERATURE REVIEW (Multi-page, thorough, accurate, relevant)

METHODOLOGY (Discipline specific)

TIMELINE (Month by month plan)

BUDGET (Realistic and legitimate expenses)

STRONG CONCLUSION!!!
(“I expect this research to contribute to debates on xxxxxxx”)

May be reproduced with credit: Karen Kelsky, Ph.D., McNair Scholars Program, University of Oregon
Grab reader with big problem, and statistics

think of a funnel structure from BIGGEST problem your work relates to....

....to the much more specific research problem you will solve
Examples

Graduate Research Plan Statement

**Intellectual Merit:** The transfer of energy from rainfall impacting the surface is responsible for contributing to changes in landforms across the Earth. Specifically, the rainfall kinetic energy (KE) that is directly related to the drop size distribution (DSD) is recognized to play a significant role in erosion processes. The KE of rainfall is also responsible for widespread damage to infrastructure and loss of human life during flood events, in particular debris flows and mudslides. Societal hazards related to flooding are expected to grow as urban areas continue to expand and storm systems respond to global climate change. As one of the fastest growing urban regions, the Phoenix metropolitan area had a reported $16.3 million in damages associated with summer storms in September 2014 alone\(^1\). My previous industry experience has provided first-hand experience in assessment of the damages caused and the implementation of solutions related to extreme storm events. The cost of rebuilding infrastructure and reducing future flood-
Examples

Karalee Brugman

Introduction: I propose to model the cumulative thermal effects of the Late Heavy Bombardment (LHB) on Mercury’s mantle to explain the unexpected presence of komatiites on Mercury, and to use the results to produce a comprehensive model for transferring heat into the mantles of silicate planets through impacts.

One of the greatest mysteries in the geologic history of our planet is what conditions were responsible for the emplacement of komatiites—rare, magnesium-rich rocks found in only a few locations on Earth. Komatiites formed mostly during the Archean, when a time of increased heat production allowed Earth’s mantle to reach temperatures in excess of 1500°C. Because the mantle has long since cooled by ~200°C, all the specimens on Earth are very old and highly modified. Consequently, the mechanics of komatiite generation—and the related interior dynamics of early Earth—are poorly understood.
Examples

Subduction-related volcanism constitutes ~25% of the total magma erupted on Earth annually (1). A wide variety of processes contribute to the production of arc magmas including: the transfer of elements from the subducting slab to the mantle, mantle melting and the interaction of mantle melts with continental crust. However, there is no cogent model to explain the formation of arc magmas (see reviews of debate in 2, 3, 4). It is still unclear whether the primary mechanism of melt generation at subduction zones is: 1) the addition of an H\textsubscript{2}O-rich component released from the subducted slab and associated sediments to the mantle wedge, 2) melting of the slab and/or sediments, or 3) a combination of both. Understanding the production of arc magmas is also a crucial step in answering broader geologic questions such as how the continental crust formed or how crust is recycled in the mantle.

INTRODUCTION
Each year, 50-70 volcanoes erupt and endanger the local population, as well as disrupt air traffic and damage property and infrastructure (Cashman and Sparks, 2013; USGS Circular 1309). Today, volcano monitoring provides a wealth of information about magma storage and movement beneath active volcanoes (e.g., Acocella, 2014). However, we still lack a sufficient context to interpret this data such that we can categorically predict when the movement of magma will lead to an eruption (Sparks, 2003). The deposits from past eruptions, in particular their crystal cargoes, provide information regarding
Radiometric dating has long been considered essential to understanding geologic processes. In recent years, a wide variety of radioactive decay schemes in minerals have been employed to constrain ages of crystallization, recrystallization and metamorphism. Zircon (U/Pb) and $^{40}\text{Ar}^{39}\text{Ar}$ geochronology, for example, are widely used and can generate accurate and precise ages, but they are not applicable to all rock types and typically cannot be used to determine ages of intermediate to high temperature metamorphism particularly if there are multiple domains.

Monazite, Ce[LiREE, Th]PO$_4$ is rapidly becoming a valuable accessory mineral for geochronology for several
Examples

Emma Grace Blackwell

Arizona State University, School of Earth and Space Exploration, Tempe, AZ, USA

The impacts of recently intensified hurricanes, rising sea levels, and subsiding coastlines are increasing inundation and flooding along the southeastern coast of the United States. Globally, sea level rise (SLR) has expanded from 1.7 mm/yr during the late twentieth century to 3.2 mm/yr in the past two decades due to a variety of factors [1]. The strongest contributors to this increase are the thermal expansion of oceans, glacial melt, and groundwater extraction with annual SLR contributions of 1.1 mm, 0.8 mm, and 0.6 mm, respectively [1]. Further, the contribution of glacial melt is expected to continue as ice sheet melt accelerates [2]. While it is important to
Challenge Statement
“To learn X, I propose to Y”

Why is this problem need to be solved? and say that you can solve it.

“HOLDER, scholars in these fields have not yet adequately addressed XXXX…”

GAP IN KNOWLEDGE
1. Urgency: This gap is bad!!!
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YOUR RESEARCH QUESTION
“I am applying to XXX to support my research on XXX”

SPECIFICS OF YOUR PROJECT (background info, location, history, context, limitations, etc.)

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STRONG CONCLUSION!!! (“I expect this research to contribute to debates on xxxxxxx”)

May be reproduced with credit: Karen Kelsky, Ph.D., McNair Scholars Program, University of Oregon
This study aims to ameliorate the gap in the current understanding of the variability of land subsidence in North Carolina and its effects on regional SLR to determine how groundwater extraction and sediment compaction combine to affect relative sea level rise, coastal topography, and flooding patterns. When variations in land subsidence and regional SLR are not considered, inundation risk projections based on the Representative Concentration Pathways models of sea level rise may be inaccurate, leaving coastal communities at greater risk than they may realize.

To remedy this, I will combine estimates of SLR until the year 2100 (Representative Concentration Pathways 2.6, 4.5, 6.0, and 8.5) with inferred land subsidence rates to determine relative SLR along the east coast of North Carolina. This relative SLR rate and storm surge data will be combined to create better flooding risk map under various SLR and storm surge scenarios.
Recently, there has been a substantial effort to work towards analyzing the amounts of heavy elements present in the CGM (Peeples 2015). However, the observed properties of many ionized species remain unexplained by current ionization models, with the most puzzling species being five times ionized oxygen, O_{VI}, (Werk et al. 2016). **Thus it is my proposed plan of research to use supercomputer simulations to investigate these ionized states of heavy elements and help understand how the observed CGM species may arise.**
However, there is significant disagreement between the theoretical solutions and empirical observations, including the unresolved discrepancy between mean and spatiotemporally variable DSDs. Later studies have confirmed that additional effort is needed for gathering direct measurement of the DSD from many storm types throughout their lifetimes with differing intensities, durations, altitudes, wind updrafts, and geographical regions to understand the relation between the observed erosion values and calculated rainfall KE\textsuperscript{5,9,10}.

In this proposed effort, I will coordinate the collection of rainfall DSD, sediment yield, and meteorological data from three sites in a climatic region subjected to a bimodal precipitation regime. The three sites have been selected based on the well-known variations in annual rainfall and the percentage received during the more intense summer season. Two rural sites in the
Figures!

*Figures really are worth a 1000 words!!!!*

- Need to be able to be fairly small but still legible.

- Reviewers read A LOT of these, so helps makes it easy to digest and memorable.

- Suggestions include:
  - A cartoon that explains the basic ideas
  - A key dataset that explains the problem or method (without a lot of background knowledge required!)

- Don’t include a figure just for a sake of including a figure
Intellectual Merit vs. Broader Impacts (used to review all NSF proposals)

1. What is the potential for the proposed activity to:
   a. advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. benefit society or advance desired societal outcomes (Broader Impacts)?
Other words of wisdom

• Avoid vague verbs like “I want to understand…”, always better to use active and descriptive verbs like, “minimize, quantify, delimit, determine…etc.”

• Use a mix of short and long sentences, and make sure each sentence is rich with meaning. Delete vague, and repetitive sentences.

• Limit jargon! Explain any terms you do use.
Who will review these?

- Scientists, mostly professors at US universities and national research facilities.

- People far outside your field!!! A chemist might review a geology proposal etc.

- Limit jargon! Explain any terms you do use.
Where to find info.

I’ll post this presentation & examples (with permission from students) on my webpage: www.christytill.com

NSF Website:


8 tips for crafting and NSF GRFP: https://www.profellow.com/tips/8-tips-for-crafting-a-winning-nsf-grfp-application/

Tips and TONS of examples of other winning fellowships: https://www.alexhunterlang.com/nsf-fellowship


Penn State Tips on Writing A Personal Statement: https://www.e-education.psu.edu/writingpersonalstatementsonline/p5_p3.html
Where to find info.

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Recent NSF Grad Fellowships Recipients & Current SESE graduate students who have offered to help you:

Ed Buie (Astrophysics)
Kara Brugman (Geology)
Eric Escoto (Hydrology)
Wren Ramming (Geomorphology)