The National Science Foundation Graduate Research Fellowship

Workshop

September 13, 2013
141 Loomis Lab

The Graduate College
Fellowship Opportunities Database

Welcome to the Fellowship Opportunities database, maintained by the Office of External Fellowships in the Graduate College. This database contains over 800 graduate student funding opportunities. To search, select the relevant category below and browse the listings. Though it requires an investment of time, this is the best way to locate all the fellowships appropriate for you.

If you want information only on one particular award, enter the name in the box below and click "Search Fellowships."

For tips on searching the database as well as information on our grantwriting workshops and proposal advising services, watch the short video at the lower right.

Browse fellowships by category:

- Campus
- Dissertation Support
- External
- Humanities/Social Science
- International Students
- Postdoctoral
- Research or Study Abroad
- Science/Engineering
- Underrepresented Groups
- Women
- All Fellowships

https://www.grad.illinois.edu/fellowship/
Resources

• *GRFP Essay Insights* (online)

• Departmental Review Committees

• One–on–One Proposal Review: Office of External Fellowships

• Sample Proposals

• *GRFP Resource Persons* (online)
Packets

- Rack Card
- Helpful Resources
- NSF–GRF Program Solicitation
- Articles by NSF–GRF Winners
- Program
- Dr. Hahn’s PowerPoint Presentation
- Tips for Reference Writers
Agenda

William Hahn 2:45–3:30
Elizabeth Hsiao–Wecksler 3:30–3:50
Glaucio Paulino 3:50–4:10
Q&A 4:10–4:30
William J. Hahn

Georgetown University
The National Science Foundation

Federal agency created in 1950 to “to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense”

~$6.9 billion annual budget for research and education in Science, Technology, Engineering and Math (STEM) disciplines - all fields but clinical biomedical (NIH)

(Note that Education was only directorate to go up in FY2013 with GRFP the fastest growing program.)

NSF annually awards about 10,000 research grants, 2,700 new graduate fellowships (student as awardee), 1,500 graduate trainees (e.g., IGERT), and 30,000 research assistantships (via grants to Principal Investigators)
Initiated in 1952 – oldest NSF program

>50,000 students including FY2013 awards

Currently about 5,000 fellows on “tenure” (taking stipend and cost of education allowance)

Very successful students - high rates of PhD completion, shorter time to degree completion, high placement in faculty positions, high levels of research productivity, high tenure rate, >30 Nobel laureates, 440 National Academies members, etc.
NSF GRF Benefits

READ PROGRAM SOLICITATION CAREFULLY!

Three years of support over a five year period

*Annual stipend of $32,000 - cost of living to student

Tuition support of $12,000 - cost of education allowance paid to institution – remainder covered by university

*Cyberinfrastructure access via XSEDE

*International opportunities through GROW initiative
NSF GRF Benefits

Portable to graduate institutions in the US (not abroad*)
Flexible - your choice of project, advisor, department
No service requirement (national lab or military)
2,700 new awards expected for 2014 competition
Honorable Mention for meritorious applications
(includes Cyberinfrastructure XSEDE resources)
*Specific considerations to support underrepresented populations
*No concurrent federal fellowship support allowed
GRF Eligibility Criteria

**Academic level**
- Level 1 - Seniors, baccalaureates with no graduate study
- Level 2 - First-year graduate students
- Level 3 - Second-year grad students (12 months of graduate study or less by Aug 1 prior to submission)
- Level 4 - >12 months graduate study – extenuating circumstance

**Historic success Level 1>Level 2>Level 3>Level 4**

**Citizenship**
- U.S. Citizen, National or Permanent Resident

**Discipline**
- Research-based Masters or PhD in NSF-Supported Field of study (note changes in various fields, esp. BIO)
NSF-Supported Disciplines

Engineering
Computer and Information Science and Engineering
Materials Research
Mathematical Sciences
Chemistry
Physics and Astronomy
Social Sciences (non-clinical)
Psychology (non-clinical)
STEM Education and Learning
Life Sciences
Geosciences
Some Areas Not Supported

Clinical work
Counseling
Business
Management
Social work
Practice-oriented professional degree programs
Joint science-professional degree programs (MD/PhD and JD/PhD)
Medical, dental, law, or public health programs
Education (except research-focused STEM education)
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? 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.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

Academic performance & background (grades, curricula)
Awards/honors
Communication skills
Research experience
International experience
Independence/creativity
Publications/presentations
Research plan
Choice of institution
References
Broader Impacts Criterion

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?

Prior accomplishments
Community outreach
Impact on society and connectivity
Future plans
Leadership potential
Individual experiences
Integration of research and education
Potential to communicate to diverse audiences
Application Materials
GRFP FastLane

Personal Statement, Relevant Background, and Future Goals Statement (3 pages incl figs)

Graduate Research Statement (2 pages incl figs)

Three Letters of Reference

Transcripts (uploaded into FastLane)

(GRE Scores NOT ACCEPTED!)
Personal Statement, Relevant Background, and Future Goals

Three pages—often the hardest thing to write

Your motivation, preparation, & potential to contribute to scientific research, education, and innovation

Examples of leadership skills, creativity, perspective & unique characteristics (avoid arrogance)

How the GRFP will assist you with career goals

Opportunity for evaluators to see you as a person and understand what “makes you tick”

Chance to respond to broader impact merit criterion – How will you contribute to science and society?
Relevant Background

Emphasize experience relevant to your application but include all examples of “research”, even if not in field.

List experience with hypothesis formulation and testing, experimental design, data management and analysis, interpretation of results, dissemination of findings.

Highlight what you did (independence) but discuss collaborators (teamwork) and leadership.

A global worldview is important – mention international experience, collaborators, research opportunities, etc.

List any publications, posters, presentations, prizes, awards, grants, special recognition, etc.
Graduate Research Statement

Introduce general theory/area of study and importance - a few references will demonstrate understanding of field.

Panelists are experts in general field; *may not* be experts in your specific research specialty - **avoid jargon**.

Describe your motivation to go into that area and discuss plans to prepare for that field of study - mention school(s), degree programs, potential advisor, etc.

Spell out specific details of your research and study plan but avoid jargon, specific experimental details, etc.

Comment on the broader impacts of your activities.

Let the reader know of your career plans, even if tentative.

Demonstrate flexibility ("plan B").
Letters of Reference

Three required - should know you as scientist and person

Will compare you with NSF Graduate Research Fellows & other successful students they have known based on: potential to make unique contributions to discipline; ability to conduct original research; leadership potential; productive member of scientific community; originality of plan of study

Will state their role in assisting with the application

Provide referees sufficient time; share application materials with them; ask for advice

Track letters on FastLane - remind referees about deadline
Panel Review of Applications

Historically, all applications were evaluated on site by 2 panelists after panelists had conducted a calibration exercise using previous year’s applications. The average read time was about 20-30 minutes.

Numerically scored, ranked by avg. of scores (Z-score), top applications given additional reads and scores.

Final ranking is primary determinant of award choice but NSF uses ranking and other factors (e.g., URM) to determine awardees and honorable mention.

Panelists comment on intellectual merit and broader impacts criteria highlighting strengths and areas for improvement – these are provided to applicants.
Panel Review of Applications

NEW FOR 2014:

Webinar orientation session including practice file discussion for calibration among panelists.

Applications will be sent to panelists in December allowing several weeks for review.

Virtual panel sessions will be held in Jan & Feb to permit discussion and recommendations to NSF.

In the past, very little discussion of applications as only 2 or 3 panelists were assigned an individual application. Nature of broader discussion in new format not certain.
Contact Information

NSF GRF description, solicitation (13-584), and links:

http://www.nsf.gov/grfp/

Online application, User guides, & Official announcements:

http://www.fastlane.nsf.gov/grfp/

Operations Center, Outreach, Helpdesk:

http://www.nsfgrfp.org

866-NSF-GRFP (673-4737) help@nsfgrfp.org
National Science Foundation
Graduate Research Fellowship Program

Tips on how to write a successful application

Prof. Elizabeth Hsiao-Wecksler
Dept of Mechanical Science & Engineering
University of Illinois at Urbana-Champaign
September 13, 2013
Components of the Application

- Basic Information
- Personal, Relevant Background and Future Goals (3 pg max)
- Graduate Research Plan (2 pg max)
- Transcripts
- Letters of Recommendation (min 3)
Basic Information

- Gender, Race, Ethnicity
  - Women/Minority specific fellowships
- Undergraduate Institution
- Undergraduate GPA
  - Top GPA (>3.8) helps, but not necessary
  - Include numerical value if possible
- Graduate Institution (proposed or current)
Personal and Research Experience

- 3 pg max
- Succinct, direct, inclusive
- Tie your background and goals (academic and outreach) together
- Highlight how your life/work will have broader impact
  - Bioengineering/bio-medical involvement is not enough
  - Being a woman or minority role model is not enough
  - What have/are/will you be doing to integrate research and education? (Need all three components: past/present/future)
- Talk about your long-term goals
  - Academia: why want to be a professor
  - Industry: have good continued outreach if going this way (reviewers are academics)
Personal and Research Experience

- Highlight involvement/outreach/service learning
  - Emphasize leadership
  - Emphasize innovation
  - Integration of education and research

- Highlight research experiences
  - Undergraduate, Graduate, Industry, High School
  - Publications (the more, the better)
    - Journals
    - Conference presentations
    - Indicate contribution is significant
    - If first author, highlight

- Describe take away skills that learned and can bring to grad research (not specific techniques)
- Explain abnormalities (lower GPA, but 3 jobs)
Research Plan

- 2 pg max
- Succinct, direct, inclusive

Present a complete plan for a research project that you may pursue while on fellowship tenure
  - For undergrads and possibly 1st year grad students:
    - Does not have to be the real thing

Make sure that the writing style matches the other essay

This essay may take the longest to write, but for this competition, it was reviewed the least. (This is not necessarily true for other fellowships.)
Review Criteria

- Intellectual Merit: encompasses the potential to advance knowledge

- Broader Impacts: encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.
Change in format of Research Plan statement in 2013

- **Old:** Very specific vis-à-vis structure:
  - “Must follow specific format: Introduction and problem statement, etc.”

- **New:** fluid structure:
  - “Describe the research idea, your general approach, as well as any unique resources that may be needed for accomplishing the research goal”
Research Plan

- Previous format and general proposal
  - Introduction
  - Problem Statement
  - Hypothesis
  - Methods/Research Plan
  - Anticipated results or findings
  - Expected significance and broader impacts
  - Literature citations
Key points to include in proposals

- Introduction
- Problem Statement
  - Why is this research important?
- Hypothesis
  - Testable question
- Methods/Research Plan
  - Strategy, methodology, and controls
- Anticipated results or findings
- Expected significance and broader impacts
  - Tie this research to societal issues and outreach
- Literature citations
Important questions to ask yourself before starting the essay:

- What issues in the scientific community are you most passionate about?
- Do you possess the technical knowledge and skills necessary for conducting this work, or will you have sufficient mentoring and training to complete the study?
- Is this plan feasible for the allotted time and institutional resources?
- How will my research contribute to the "big picture" outside the academic context?
- How can I draft a plan using the specified research proposal format?

http://www.nsfgrfp.org/how_to_apply/application_materials
Letters of reference

- All letters generally state how great you are and how strongly the writer supports your application
  - Everyone is the same: “best thing since sliced bread”
  - Make your letters stand out
- Ensure that the letter will be “STRONG” and “SUPPORTIVE”
- Ensure that the writer includes your broader impact
  - This is another opportunity to express BI
- If get non-faculty writer, make sure they hit key points. Also helps if they can compare you to other potential graduate students that they know, and maybe express their educational background – did they go to grad school. (Same for grad school applications)
“What type of information should referees include in their GRFP reference letter?”

NSF FAQ for letter writers

- Comment on potential to do the following:
  - Succeed in graduate school
  - Communicate effectively
  - Conduct original research
  - Work cooperatively
  - Make unique contributions to his/her chosen discipline and to society in general

- Comment on the broader impacts ..., including his or her leadership potential in the chosen field of graduate work and in general, as a member of the scientific and technical community.

Note that the more specific (as opposed to generic) a letter you can provide, the better it is for the candidate.

If candidate’s research supervisor, comment on the originality of proposal, and communicate what role you played in assisting the student with the proposal.
Additional comments

- Fill in all parts of online application form
- Fill essays to full page limit
- Do not use small font to fit in everything
- Reviewers cannot/will not read everything
- Make it easy to read
- Bolded subsection topic words
- Have a faculty member review your application
- Get copies of successful applications
- Keep trying! Reapply if unsuccessful
More tips

- Get your points across FAST
  - Show research experience
  - Show broader impact
  - Show that you are a well-rounded scientist
- Get involved in research early (before senior year)
  - Do quality work so you can get published
  - Also helps on grad school applications
  - Also helps if GPA is not super strong
- Get involved in outreach programs early
  - Be an innovator, not just a follower (or even leader)
  - Does not have to be STEM*-related
    - e.g., music, sports, art
  - Show past/present/future involvement
Good luck!
GRFP hints ...
Graduate Research Fellowship Program

Glaucio H. Paulino
Donald Biggar Willett Professor of Engineering
University of Illinois at Urbana-Champaign
CEE Dept., NEWMARK Laboratory
Professor Paulino’s Research Group

Cam Talischi  Lauren Stromberg  Arun Gain  Tomas Zegard  Sofie Leon

Daniel Spring  Junho Chun  Evgueni Fillipov  Will Colletti
Application of pattern gradation to the conceptual design of buildings

- Flexible tool for unique shapes
- Increasing column sizes
- Dominance of shear behavior at top vs. overturning moment at base

In collaboration with Skidmore, Owings & Merrill, LLP

Lotte Tower (China): optimized bracing using pattern gradation concepts
Connecting engineering and architecture using structural topology optimization

Goal: to create unique, innovative designs that are both aesthetically pleasing and satisfy engineering principles

Zendai competition: optimal designs resembling nature
Sofie: Nonlinear Solution Schemes

- No single algorithm is capable of solving all problems
- Unify several schemes into a single space

\[ K \delta u = p - q \]
\[ \delta u = \delta \lambda \delta u_p + \delta u_r \]
\[ a \cdot \delta u + b \delta \lambda = c \]
\[ K \delta u_r = r \]
\[ K \delta u_p = \bar{p} \]

\[ q(u) = \begin{pmatrix}
10u_1 + 0.4u_2^3 - 5u_2^2 \\
0.4u_1^3 - 3u_1^2 + 10u_2
\end{pmatrix} \]

S.E. Leon et al. “A unified library of nonlinear solution schemes” Applied Mechanics Reviews. Accepted
Sofie & Lauren: G.A.M.E.S. Camp

- Makes complex structural engineering concepts accessible to middle and high school students!
4 important aspects in GRFP application

- 1: Idea
- 2: Idea
- 3: Articulation of the ideas
- 4: Integration of essays: personal statement, Previous Research, Proposed Research
GRFP idea – Proposed Research

- Get involved with Undergraduate Research
- Work with a Professor and/or a mentor
- Look (critically) at successful proposals
- Address Intellectual Merit & Broader Impact
- Provide content and context
- National and/or Global priorities
- Major problems in society
- Alignment with other initiatives: NSF, DOD, DOE
- Relevance of your research: why is it important?!
3 Reference Letters

- Choose the letter *very* writers carefully

- Comment on your potential to do the following:
  - Succeed in graduate school
  - Conduct original research
  - Communicate effectively
  - Work cooperatively with peers and supervisors
  - Make unique contributions to your chosen discipline and to society in general

- Prof. that has supervised GRFP fellows is a plus!
  - From GRFP web site: “If you have known or supervised other NSF Graduate Research Fellows, compare this applicant with them.”