

Physics 4601

writing proposals

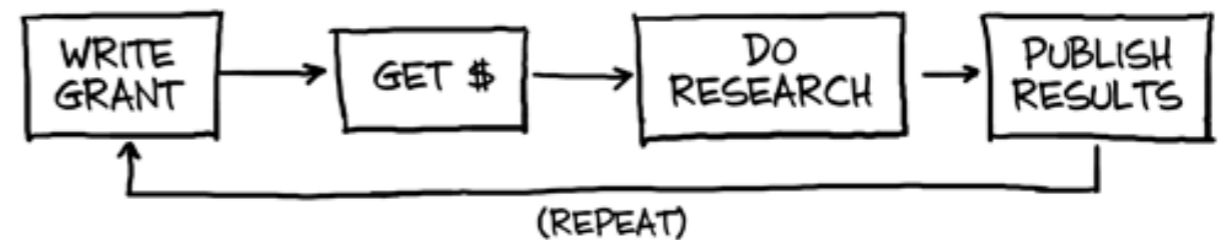
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<http://simbac.gatech.edu/phys4601/>

School of Physics |
Georgia Tech | Spring 2024

THE GRANT CYCLE

HOW IT'S SUPPOSED TO WORK:



HOW IT REALLY WORKS:



WWW.PHDCOMICS.COM

some material taken from UIUC Grad College

http://illinois.edu/cms/4931/nsf_grf_wrkshp_2015_kv_bh_slides.pptx

and from Simon Sponberg (GT)

What is a proposal?

it's an offer to carry out a specific project or projects in exchange for resources to do so

It should

- address a well defined “knowledge gap” **AND** why they should be interested in it
- meet the criteria and requirements of the announcement
- have reasonable and clearly stated goals
 - are you capable of carrying out the work?
 - are the goals achievable in the time frame of the proposal?
 - will achieving the goals address the knowledge gap?
- be specific without being too jargon-y (know your audience!)
- **BE EXCITING!**

What is a proposal?

It typically contains

- a brief synopsis
- background/lit. review - needed to understand the context
 - *this should make it clear that there are questions that remain to be addressed!*
- a research plan
- something addressing significance of the work (why should they fund yours over someone else's?)

The National Science Foundation

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

Supports research and education in Science, Technology, Engineering and Math (STEM) disciplines - all fields but clinical biomedical areas (covered by NIH)

NSF annually awards about 10,000 research grants, **2,000 new graduate fellowships (student as awardee)**, and ~30,000 grad research assistantships (via grants to Principal Investigators)

Has a budget of ~~~\$9.9 billion~~ **\$9.06b (2024)**
NIH is \$47b, NASA is \$25b (majority is for missions), DOE Office of Science is \$8.1b

<https://www.sciencemag.org/news/2019/12/final-2020-spending-bill-kind-us-research>



Why a proposal needs to be excellent

Funding Rate by State and Organization
from FY 2018 to 2019
for NSF

Org (Drill to Next Level)	FY	Number of Proposals	Number of Awards	Funding Rate	Average Decision Time (months)	Mean Award Duration (years)	Median Annual Size
NSF	2019	41,032	11,252	27%	5.76	2.67	\$134,980
	2018	48,334	11,716	24%	5.63	2.75	\$129,912
▼ BIO	2019	3,115	1,051	34%	5.50	2.99	\$175,108
	2018	4,767	1,192	25%	6.09	2.97	\$166,460
▼ CSE	2019	8,616	2,009	23%	5.73	2.66	\$159,519
	2018	9,149	2,097	23%	5.72	2.75	\$152,740
▼ EHR	2019	3,782	843	22%	5.58	3.25	\$199,303
	2018	4,161	893	21%	5.44	3.39	\$204,876
▼ ENG	2019	9,029	2,385	26%	4.73	2.24	\$129,991
	2018	13,091	2,457	19%	5.09	2.42	\$121,481
▼ GEO	2019	4,102	1,537	37%	6.74	2.75	\$149,530
	2018	3,785	1,418	37%	6.71	2.85	\$156,002
▼ MPS	2019	8,045	2,415	30%	6.81	2.95	\$115,001
	2018	8,805	2,595	29%	6.10	2.89	\$111,685
▼ O/D	2019	607	138	23%	5.58	2.12	\$351,527
	2018	444	119	27%	5.58	2.54	\$99,999
▼ SBE	2019	3,736	874	23%	5.41	2.29	\$86,380
	2018	4,132	945	23%	4.88	2.29	\$74,000

NSF Graduate Research Fellowship

<https://www.nsfgrfp.org/>

to help ensure the vitality and diversity of the scientific and engineering workforce of the United States.

recognizes and supports outstanding graduate students pursuing research-based master's and doctoral degrees in STEM fields and in STEM education.

three years of support for graduate education of individuals who have demonstrated potential for significant research achievements in STEM and STEM education

NSF especially encourages women, members of underrepresented minority groups, persons with disabilities, and veterans to apply.

NSF also encourages **undergraduate seniors** to apply.

NSF GRF benefits

**READ PROGRAM SOLICITATION
CAREFULLY!**

<https://www.nsfgrfp.org/>

- Three years of support over a five year period
- Annual stipend of \$37,000 - cost of living to student
- Tuition support of \$12,000 - cost of education allowance paid to institution - remainder covered by university

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)
 - **NOTE: only Level 2 OR 3, not both!**
 - Level 4: >12 months graduate study - extenuating circumstances
- **Citizenship**
 - U.S. Citizen, National or Permanent Resident
- **Discipline**
 - Research-based Masters or PhD in NSF-Supported Field of study

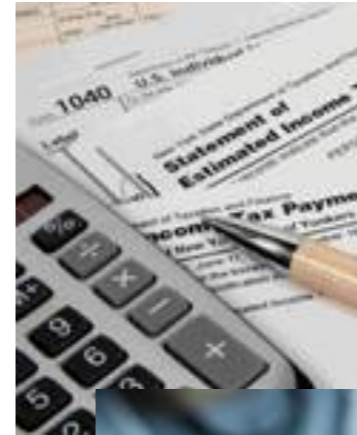
NSF-supported disciplines

- 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 are 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)



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 research.gov)

(GRE Scores NOT ACCEPTED!)

<https://www.nsfgrfp.org/applicants/application-resources/>

Graduate Research Plan Statement

“Present an original research topic that you would like to pursue in graduate school. 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.”

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1. Research Idea
2. Approach
3. Intellectual Merit
4. Broader Impacts

Graduate Research Plan 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, 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”)

Graduate Research Plan Statement (cont.)

- Have a short abstract to set the stage along with an **overarching hypothesis** (use the words “The hypothesis is...”)
- Have 2-3 concrete aims
- Connect your work to a broader scientific context (why should anyone care?)
- Develop alternatives if the research doesn't work out as expected
- bold key statements (reviewers have limited time! Make their job easier!)

Personal Statement, Relevant Background, and Future Goals (**NOT REQUIRED FOR THIS CLASS**)

- Three pages--provide the narrative of your story
 - 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 broad (including global) worldview is important - mention collaborators, international experience, research opportunities, etc.
- List any **publications**, posters, presentations, prizes, awards, grants, special recognition, etc.

Review criteria

- What is the potential for the proposed activity to
 - a) advance knowledge and understanding within field or across different fields (**Intellectual Merit**); and
 - b) benefit society or advance desired societal outcomes (**Broader Impacts**)?
- To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
- Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale?
- **Does the plan incorporate a mechanism to assess success?**
- How well qualified is the individual, team, or organization to conduct the proposed activities?
- Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Indicators of Intellectual Merit

- academic preparation, performance, and honors
- previous research experiences
- engagement with international researchers
- mentoring younger researchers
- quality/rigor of proposed graduate research projects

Generally, highly competitive applications also have:

- scholarly publications, presentations, and/or posters
- *exceptional* reference letters

Broader Impacts Criterion

- “advance societally relevant outcomes”
- Accomplished through the research itself, activities directly related to specific research projects or that are complementary to the project.
- Full participation of women, persons with disabilities, and minorities underrepresented in STEM fields
- STEM education and educator development at any level - increased public scientific literacy & development of STEM workforce
- Partnerships between academia, industry, and others
- Improved national security
- Increased economic competitiveness of the US
- Enhanced infrastructure for research and education

Indicators of Broader Impacts

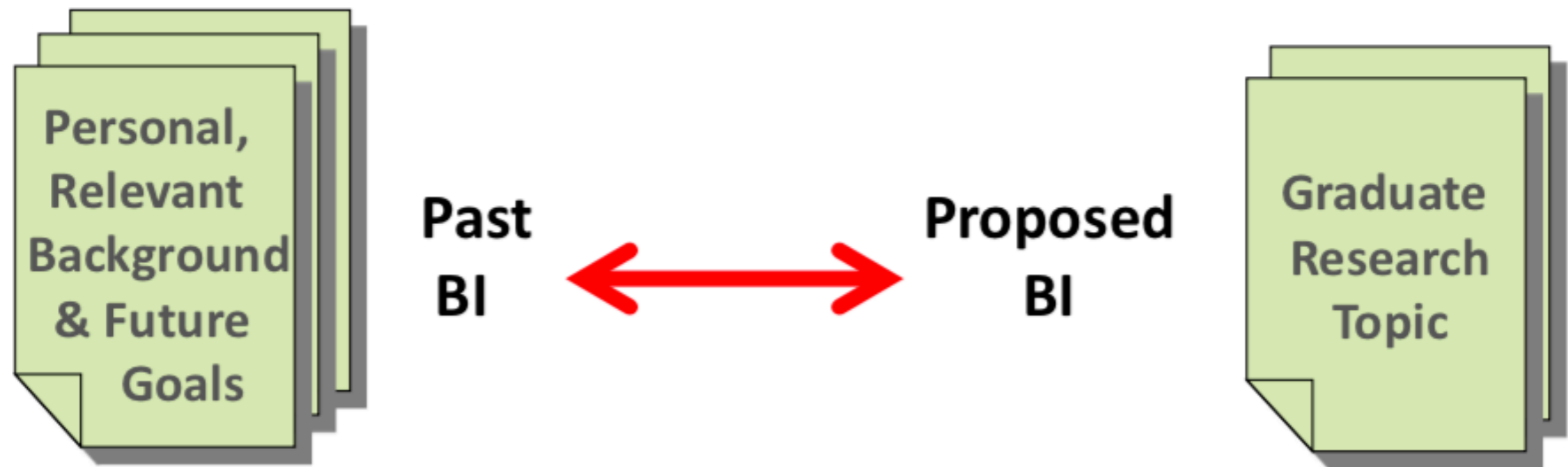
- previous and proposed research with BI outcomes
- educational outreach with lay audiences
- engagement with diverse audiences
 - age, race, ethnicity, gender, disabilities, income, veterans, or underserved individuals living in isolated areas

Some reviewers also make note of:

- service learning and study abroad (global engagement)
- leadership and teamwork; communication skills
- teaching any age, any level

Broader Impacts Criterion

A track record of BI efforts is a good indicator that the applicant will follow through on the *proposed* BI activities!



Undergrads: create a program they can continue into grad school and early career

Grads: plan for sustainability or replication of project following graduation

I LIKE ROCKS AND ME AND MY FRIENDS LOOK AT ROCKS ALL THE TIME AND SOMETIMES THE ROCKS ARE NEAT AND WE TELL OUR OTHER FRIENDS ABOUT IT AND OUR FRIENDS ALSO LIKE ROCKS AND SOMETIMES WE HAVE ROCK PARTIES AND SO NOW WE KNOW A LOT ABOUT ROCKS.



Don't be this person!

The life of a scientist sounds way more fun when you describe it like you're a six year old.

<http://www.smbc-comics.com/comic/rocks>

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, and 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 [research.gov](https://www.research.gov) - remind referees about deadline

Panelist Review of Applications

- Applications are sent to panelists in December allowing several weeks for review
- Applications are scored numerically (1-50) for overall merit by three panelists. Applications are also ranked by each panelist using standard NSF categorical ranks (poor/fair/good/very good/excellent)
- Panelists comment on intellectual merit and broader impacts criteria highlighting strengths and areas for improvement - comments are provided to applicants

Panelist Review of Applications

- Program office normalizes the numerical scores using a z-score approach and ranks applications by an average of these scores
- Virtual panel sessions held in Jan & Feb to permit discussion and recommendations to NSF
- Applications with inconsistent scoring (Z-score) are discussed and/or re-evaluated
- Final ranking is primary determinant of award choice, but NSF also uses other factors to determine awardees and honorable mention

Award Announcement

Usually in late March or early April

Awardees and recipients of Honorable Mention listed on the program FastLane website

Final numbers dependent upon funding made available to the program office

Success rates across disciplines not always equal, but overall, it is ~10-15% (2016: 2000 awards/16,800 apps; 2019: 2000 awards/12,200 apps)

For this course

You will write a 2-page research proposal suitable for the NSF GRFP

The proposal will be due on the last day of class, but we will have multiple intermediate deadlines through the semester (see the website!)

The proposal will be written in Latex (**strongly encouraged**)

