

BI 165, Fall 2019 Course Schedule

Kirckhoff 101, Mondays 11:00 – 11:50am.

NSF GRFP grant submission deadline (Life Sciences, Geosciences): October 21, 2019, 5p Pacific.

Taught by Dr. Julie Hoy, hoyj@caltech.edu

No final, Pass-Fail

Fellowship Details

1500 awards. 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. Exemption from tuition and fees.

Week of October 1:

- Since there is no class Monday of this week, I will email this syllabus so you can get started on the tasks below. Feel free to contact me this week with questions.
- Read all provided information
 - Program page: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201
 - **Solicitation:** <http://www.nsf.gov/pubs/2016/nsf16588/nsf16588.htm>
 - www.nsfgrfp.org
 - www.nsfgrfp.org/applicants/tips_for_applying
- Read additional information
 - A site with good tips: <http://grfpessayinsights.missouri.edu/personal.php>
 - <http://grfpessayinsights.missouri.edu/Grad-Research-Worksheet.pdf>
 - Successful examples
- **Verify eligibility** (Solicitation)
- **Enroll in FastLane** system: <https://www.fastlane.nsf.gov/grfp/Login.do>
- **Find a topic** (discuss this with your PI)
- **Decide on and contact (3) references:** November 2, 2018, 5pm Eastern reference deadline. Give plenty of advanced notice.
- **Gather required submission information**
 - Education, Work and Other Experience
 - Electronic Transcripts
 - Proposed Field(s) of Study
 - Proposed Graduate Study and Graduate School Information
- **Decide on topic for Research plan, begin outline**
 - Use the Worksheet for the Graduate Research Statement from Missouri (additional information above) to create outline

Week of October 7:

- In Class: How to Sell Yourself with Kim Caldwell
- Meet with me to work on outlines/drafts of statements to bring to next class
 - Define and outline topic for Graduate Research Plan Statement (2 pages)
 - Discuss what is relevant for the Personal Statement (3 pages)
- Write drafts of both statements
- Contact References (if you haven't already)
- Make appointment with FASA (Fellowship Advising and Study Abroad office)
 - <https://fasa.caltech.edu/>

Week of October 14:

- In Class: Pass around Research Plans and Personal Statements for editing
- Meet with me to edit drafts
- Have someone outside of science read drafts
- Have multiple people in your lab read your drafts
- Meet with FASA for feedback
- Send information to References

Week of October 21:

- Last chance to polish drafts
- Check in with references
- Celebrate submission!

October 28:

- Information on talks for second half of semester

November 4, 11, 18, 25, Dec 2:

- Practice giving Talks

My Advice for NSF GRFP preparation

Research Statement

- Know the field, read pertinent research papers
- Once you have picked your topic, explain your research to a friend or relative outside of science.
- Create one thesis sentence that explains the problem you are working to solve.
- Tell a complete story
 - Answer these questions:
 - Should this research be done? Is there a strong scientific foundation to support the proposed studies (preliminary data, published literature)? Will the studies/findings be impactful to an important field? Does the project address an important problem, technical capability, or critical barrier to progress in the field?
 - Can this research be done? Do the Investigators have the appropriate expertise and are they capable of completing the project?
 - How will this research be done? Is the Research Design rigorous and appropriate for the Aims?
 - Introduction:
 - Provide justification for the proposed work (introduce broader impacts), cite appropriate work and/or preliminary data, identify strengths and weaknesses in prior work, propose to fill a significant gap in the field.
 - What are your research Aims (1-3)?
 - What is the question you are addressing? What is your hypothesis?
 - What is the proposed solution/strategy? Why will it work?
 - What is the method/design for achieving it
 - What knowledge/equipment/material is needed for the method?
Where/how will you access the above (feasibility)? What internal/external research expertise/support do you have?
 - What are the expected results: address potential problems, alternative strategies and benchmarks for success
 - Exactly what will the results tell us, what questions will they answer?
 - What would be the meaning of other possible results and how would they change the course of the research?
 - How long will it take to get a meaningful result
 - What will you do (or what can be done) next from these results
- What are your future goals – why are you a good investment
- How will your research impact the field
- **Intellectual Merit: The Intellectual Merit criterion encompasses the potential to advance knowledge;**
- **Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.**

- Standard 8.5" x 11" page size
 - 12-point, Times New Roman font or Computer Modern (LaTeX) 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. Applicants should not use line spacing options such as “exactly 12 point,” that are less than single-spaced.

Personal, Relevant Background and Future Goals Statement

- Describe your personal, educational and/or professional experiences that **motivate your decision** to pursue advanced study in science, technology, engineering or mathematics (STEM).
 - Anecdote on the events/people who got you hooked on science
 - What aspects of science draw you
- Specific examples of **research and/or professional activities** in which you have participated
 - Concise **description**
 - **Specify your role** in the activity including the extent to which you **worked independently** and as **part of a team (Posters, presentations, invited talks, public interaction)**
 - Highlight the **results (Hypothesis, Goal, techniques, mentoring, experimental results, broader impacts)**
 - Discuss how these activities have **prepared you to seek a graduate degree**
 - Describe the contributions of your activity to **advancing knowledge in STEM fields (intellectual merit) as well as the potential for broader societal impacts**
 - **Intellectual merit**
 - **Advance knowledge/understanding** within field or across different fields
 - **Creative, original, or potentially transformative concepts**
 - **Broader impacts**
 - Activities that are directly related **to specific research projects**
 - Activities that are supported by, but are complementary to, the project
 - **Scholarly articles, conference presentations and scientific posters**
 - Achievement of **societally relevant outcomes?**
 - **Participation of women, persons with disabilities, and underrepresented minorities?** Engage people from **diverse backgrounds.**
 - **Globally engaged** knowledge expert and leader?
 - Contribute significantly to **research, education, and innovations** in science and engineering? Employ novel theoretical concepts, approaches, methodologies, instrumentation?
 - **Teach or mentor** younger STEM researchers
 - Improved STEM **education and educator development?**
 - Increased **public scientific literacy** and **public engagement** with science and technology?
 - Improved well-being of individuals in society?
 - Development of a diverse, globally competitive STEM workforce?
 - Increased **partnerships** between academia, industry, and others?
 - Improved national security?

- Increased economic competitiveness of the US?
 - Enhanced infrastructure for research and education?
 - Demonstrate your potential to do the above, and
 - Show **leadership** potential, self-starter capabilities, and the ability to work well with others
 - Show passion, motivation for a STEM career, and **initiative**
 - Show you are **prepared** for graduate research
 - Faced **adversity**, solved problems and moved past barriers
 - Demonstrate a **commitment** to broadly benefit society and/or advance societal outcomes?
- Outline your **educational and professional development plans and career goals**.
 - How do you envision graduate school **preparing you for a career** that allows you to
 - contribute to **expanding scientific understanding**
 - as well as **broadly benefit society**?
 - Why are you a good investment?

Professional Development Opportunities

Over the course of the five-year GRFP fellowship period, Fellows are encouraged to apply for professional development opportunities offered through the program: Graduate Research Opportunities Worldwide, or **GROW** (<https://www.nsf.gov/grow>), and the Graduate Research Internship Program, or **GRIP** (<https://www.nsf.gov/grip>).

- GROW provides supplemental funding for Fellows to take advantage of expertise, facilities, data, and field sites located abroad; to develop an international network of collaborators early in their career; to address problems of a global nature that require international cooperation; and to be prepared to collaborate successfully in international teams upon joining the United States science and engineering workforce.
- GRIP provides supplemental funding for Fellows to participate in mission-related, collaborative research under the guidance of host research mentors at federal facilities and national laboratories. In addition to developing research expertise, Fellows can enhance their professional skills, develop new networks, and prepare for a wide array of career options in areas of national needs.

Non-Academic Research Internships for Graduate Students (**INTERN**) Supplemental Funding Opportunity: With rapidly accelerating changes in technology-driven global and national economies, today's graduate students will have a wide choice of career paths to pursue over their professional lives. Graduate students have the potential to make important contributions in careers outside academia, in organizations including: startup businesses, small and large corporations, government agencies, and non-profit organizations. NSF's [2018 Science and Engineering Indicators](#) report reveals 79 percent of master's level STEM graduates and 57 percent of doctoral degree holders work in industry or government. It is therefore important that graduate students supported by NSF grants be provided opportunities to develop skills that prepare them to be successful for a broad range of academic and non-academic career paths. In addition to deep and broad preparation in their technical areas of expertise, skills and knowledge regarding communication, innovation and

entrepreneurship, leadership and management, and policy and outreach are becoming increasingly valuable to enter any sector of the workforce.

- Available to graduate students supported through any active NSF award after completing at least one academic year in their graduate programs.

Information from the NSF

http://www.nsf.gov/pubs/policydocs/pappguide/nsf15001/gpg_3.jsp#IIIA2

Merit Review Criteria

When evaluating NSF proposals, reviewers will be asked to consider **what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue** if the project is successful. These issues apply both to the **technical aspects of the proposal and the way in which the project may make broader contributions**. To that end, reviewers will be asked to evaluate all proposals against two criteria:

Intellectual Merit: The Intellectual Merit criterion encompasses the potential to advance knowledge;

Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

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)?
2. To what extent do the proposed activities suggest and explore **creative, original, or potentially transformative concepts**?
3. 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**?
4. How well **qualified** is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate **resources** available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Personal Statement, Relevant Background, and Future Goals: Essay Prompt from FastLane

Please outline your **educational and professional development plans and career goals**. How do you envision graduate school **preparing you for a career** that allows you to contribute to **expanding scientific understanding** as well as **broadly benefit society**? Page limit - 3 pages

Describe your personal, educational and/or professional experiences that **motivate your decision** to pursue advanced study in science, technology, engineering or mathematics (STEM). Include specific examples of any **research and/or professional activities** in which you have participated. Present a concise **description** of the activities, highlight the **results** and discuss how these activities have **prepared** you to seek a graduate degree. **Specify your role** in the activity including the extent to which you **worked independently and/or as part of a team**. Describe the contributions of your activity to **advancing knowledge in STEM fields** as well as the potential **for broader societal impacts** (See Solicitation, Section VI, for more information about Broader Impacts).

NSF Fellows are expected to become **globally engaged** knowledge experts and leaders who can contribute significantly to **research, education, and innovations** in science and engineering. The purpose of this statement is to demonstrate your potential to satisfy this requirement. Your ideas and examples do not have to be confined necessarily to the discipline that you have chosen to pursue.

If you have completed more than 12 months of graduate or post-baccalaureate study or a professional degree and an interruption of at least two consecutive years (fourth option under Completed Study in the NSF GRFP Program Information section), please address the reasons for the interruption in graduate study here. Please refer back to that section for details.

Extra details on Broader Impacts (Solicitation, Section VI):

Broader impacts may be accomplished through the **research itself**, through the **activities that are directly related to specific research projects**, or through activities that are **supported by, but are complementary to, the project**. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the US; and enhanced infrastructure for research and education.

Graduate Research Statement: Essay Prompt from FastLane

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. The research discussed must be in a field listed in the Solicitation (Section X, Fields of Study).

- <http://www.nsfgrfp.org/>
 - Be **concise** and format your statements effectively. Remember that reviewers will have limited time to read your application. Clearly labeling different sections and addressing explicitly each requirement will make the statement more effective and clear for reviewers.
 - Keep in mind that NSF does not just seek to fund scientists and engineers; NSF seeks to fund **future STEM leaders**. Use the statements to show leadership potential, self-starter capabilities, and the ability to work well with others (scientists, students, people in the community, etc.). Show passion, motivation for a STEM career, and initiative in your past research and other experiences.
 - Develop a consistent theme in both of the statements, weaving together your personal story with your academic and career plans and past experiences to make a compelling case why NSF should award you the fellowship.
 - Instead of elaborate details on theory, focus on the **rationale** for your studies and the existing literature as it supports your proposed work.

Advice from Another University

<http://grfpessayinsights.missouri.edu/personal.php>

Questions a reviewer might pose about the Personal Statement...

Intellectual Merit

- What **motivated** this applicant to pursue advanced studies?
- How **prepared** is this student to commence with graduate studies?
- How does the chosen degree program fit with the student's **career goals**?
- Does this person **learn from mistakes**? Seek advice? Collaborate with others?
- How does this applicant face **adversity**, solve problems and move past barriers?
- What is the scope of this applicant's previous research **experience**? What was the intellectual merit of his/her **previous research** projects?
- Has this student explored creative, original or transformative concepts **independently** or as part of a **team**?
- How did this student share scientific knowledge through **scholarly articles, conference presentations and scientific posters**?
- Does this student's academic or career goals include an aim to **advance scientific knowledge**?
- Might this student become a **scientific leader** within or across disciplines?

Broader Impact

- What are the broader impacts (societal benefit) of this applicant's previous research topics and research activities?
- To what extent did this student engage in BI activities? For example, did this applicant engage people from **diverse backgrounds** in research activities? Conduct **educational outreach** aimed at improving **public scientific literacy**?
- Did this student **teach or mentor** younger STEM researchers from diverse backgrounds? Is she/he likely to continue mentoring and teaching?
- In what ways has this student been a **leader** in various settings (on/off campus)?
- In what other ways did this student demonstrate a **commitment** to broadly benefit society and/or advance societal outcomes?

<http://grfpessayinsights.missouri.edu/proposed>

Questions a Reviewer Might Pose Related to the Graduate Research Statement

Intellectual Merit:

- Has the student presented a **well-organized statement**? Writing clear? Definitive?
- How did the student **justify the need** for this research topic?
- Is the "general approach" appropriate for the topic? Are **methods rigorous**?
- Has the student identified possible pitfalls or **limitations** with this topic?
- Is this student **ready** to conduct a graduate research project on this topic?
- What is **the mentor's expertise** and how strong is the mentor's support of this research?
- Do the reference letters confirm that the student will have **adequate research resources**?
- How will the student **publish/present scholarly findings** within and across disciplines?
- How will this research help the student acquire new **knowledge** and **skills**?

Broader Impacts:

- What are the inherent broader impacts (or societal benefit) of this research topic? How will society benefit from this research topic - **directly and/or indirectly**? Does the topic address a significant global problem, societal need or **NSF priority**?
- What broader impacts (or societal benefit) may be realized through the research activities? For example, will research activities **broaden participation of people from underrepresented groups**?
- Are the proposed, complementary BI activities **realistic**? **Sustainable**? Specifically, what groups will be reached and how will they benefit from the BI activities?
- Does this applicant propose to teach **public** audiences about science and discoveries?
- Might this study enhance research and **education** infrastructure (e.g., facilities, instrumentation, networks, and partnerships)?
- What is the applicant's **record** of broader impacts efforts to date? Is this applicant likely to be **proactive** and **consistent** with BI activities in the future?
- If the GRFP makes an **investment** in this student, how will this student help the NSF work toward "desired societal outcomes"?