Final Written Assignment Project

June 25, 2021

Outline

- Rationale
- Options
  - GRFP Research Proposal
  - Research Statement or Cover Letter
  - Research Highlight (for website or social media)
- Resources and Support

Final Writing Assignment Rationale

- An opportunity to reflect on and summarize your full research experience
- Practice translating your research experience and skills to a variety of future communication tasks
  - Job applications
  - Graduate school or fellowship applications
  - Science communication to a general audience

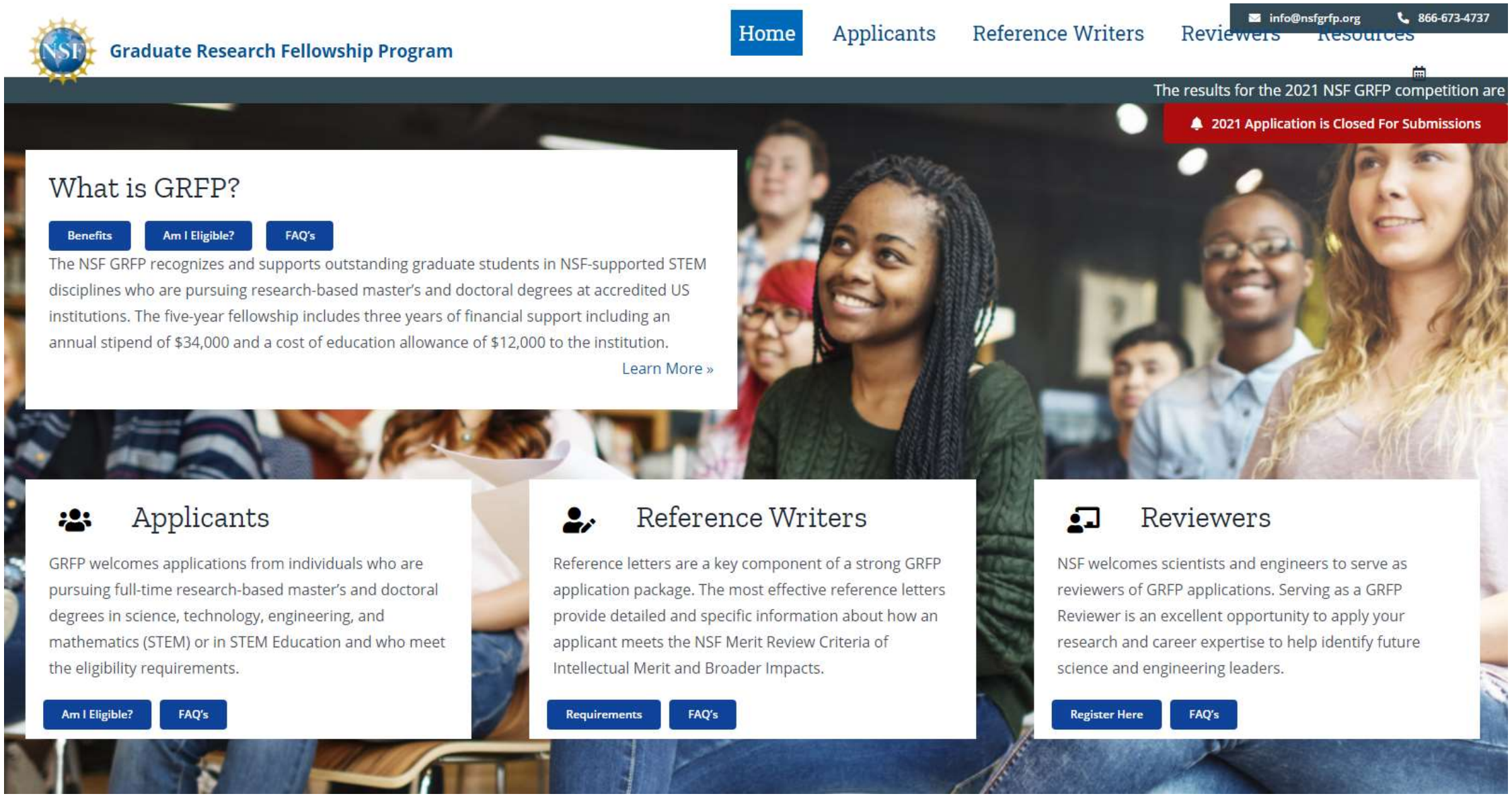
Writing Assignment Options

- GRFP Research Proposal
  - Two-page statement about an original research topic you'd like to pursue in graduate school
- Research Statement or Cover Letter
  - For graduate school, or your choice of specific job type and sector
- Research Highlight (for website or social media)
  - Approximately one page (plus figures) research summary for a general audience, to be highlighted on the STROBE or PEAQS websites, and/or social media

You do not have to use these *exact* documents for your future applications, but this practice will help you learn how to write about science generally, and your research areas specifically.

Note that *none* of these options is a research paper or report, which is likely the format you are most familiar with.

NSF Graduate Research Fellowship Program



NSF Graduate Research Fellowship Program

NSF GRFP: A prestigious 5-year fellowship for students pursuing an advanced degree in STEM (MD, MD/PhD, MPH, and other "practice-oriented professional degree programs" are not eligible)

Graduate Research Plan Statement (2 pages)

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.

Merit Review Principles and 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.

NSF Graduate Research Fellowship Program

Consider this option if:

- You are planning to apply for graduate school this fall (or next fall if you want to get a head start)
- You want practice (and support/feedback) writing a scientific proposal

Research Statement or Cover Letter

A summary of your research and professional experiences to date, including relevance for the program/job to which you are applying (1-2 pages)

- Must be specific to a field and/or job sector
- Can include more than just this summer's experience

Research Statement or Cover Letter

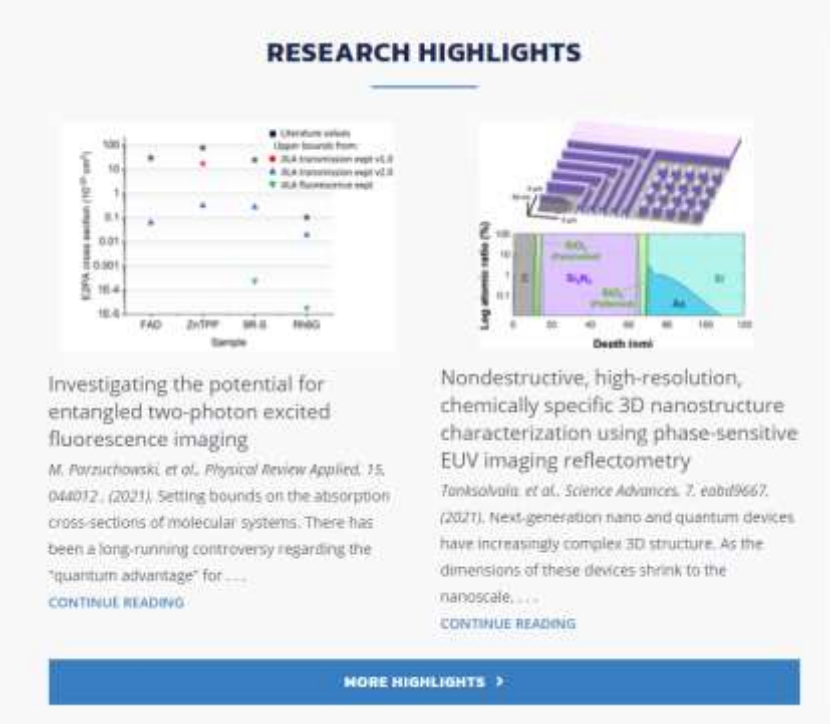
Consider this option if:

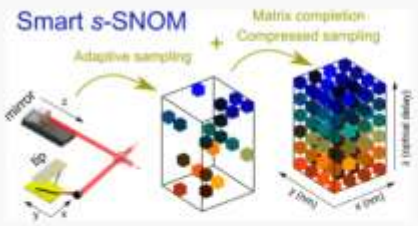
- You are planning to apply for jobs and/or graduate school this fall
- You want practice and feedback for future applications

Research Highlight for a general audience

Summary of your research intended for a general/public audience

- Approximately one page (or less) of text, plus figures
- Visit strobe.colorado.edu for examples
- Aim for an interested but not STEM expert audience





Compressive and adaptive nano imaging for enhanced speed and content

May 18, 2021

Scattering scanning near-field optical microscopy (s-SNOM) provides for spectroscopic imaging from molecular to quantum materials with few nanometer deep sub-diffraction limited spatial resolution. However, conventional acquisition methods are often too slow to fully capture a large field of view spatio-spectral dataset. Through this collaboration, STROBE researchers, at CU Boulder and the ALS –Berkeley, demonstrated how the data acquisition time and sampling rate can be significantly reduced while maintaining or even enhancing the physical or chemical image information content. The novel data acquisition and mathematical concepts implemented are based on advanced data compressed sampling, matrix completion, and adaptive random sampling. This research is of particular interest in synchrotron based nano-imaging facilities. This work paves the way to true spatio-spectral chemical and materials nano-spectroscopy with a reduction of sampling rate by up to 30 times.

> *Labouesse, S. C. Johnson, H. A. Bechtel, M. B. Raschke, R. Piestun, "Smart Scattering Scanning Near-Field Optical Microscopy," ACS Photonics, 7, 3346-3352, (2020).*

Research Highlight for a general audience

Consider this option if

- You aren't sure of your future plans
- Are interested in communicating to a broad public audience and want feedback and practice
- Want to have a summary of your work for social media or other general applications

World's Smallest 'Refrigerator'

August 4, 2020

Thermoelectric devices represent a potentially transformative technology, one that could revolutionize power generation and temperature control. While they are robust, compact, noiseless, and have no moving parts, thermoelectric devices are implemented only in a few niche applications because of their low efficiency compared to conventional, compression-based heat engines. According to well-grounded theoretical considerations, thermoelectric materials might be made more efficient than their bulk counterparts via tailored nanostructuring. Given the large upside, even small improvements in thermoelectric materials might bring us to a tipping point where thermoelectric devices are routinely employed for recovering waste heat and refrigerating food.

A STROBE team led by Chris Regan (UCLA) has developed new imaging techniques for characterizing thermoelectric devices at the nanoscale, and has demonstrated these techniques on the smallest refrigerator ever constructed. Their thermoelectric refrigerator has an active volume of about 1 cubic micrometer, which is too small to be seen with the naked eye. Viewed in a microscope, it demonstrates its cooling abilities by forming a single dewdrop instantaneously when electrical power is applied. This work is continuing in collaboration with researchers at the STROBE/PEAQS partner institutions Fort Lewis College and Norfolk State University.

> *Electron-Transparent Thermoelectric Coolers Demonstrated with Nanoparticle and Condensation Thermometry, Hubbard, et al., ACS Nano, 11510-11517, (2020).*

Molecular Syringe

April 29, 2020

Bacteriocins are contractile molecular syringes — nanomachines produced by one bacterium that can puncture the cell membrane of another bacterium to deliver a lethal punch. In this week's issue of Nature and featured on the cover, STROBE UCLA scientist Hong Zhou and his colleagues present high-resolution structures of the bacteriocin pyocin R2 from P. aeruginosa – in both its preand post-contraction states. The results allow the researchers to suggest in detail how the molecular syringe works, offering insight into how R-type bacteriocins might be developed into a new class of antimicrobials. This work was featured in the April 2020 cover of Nature.

> *Ge et al., Action of a minimal contractile bactericidal nanomachine, Nature 580, pages 658–662 (2020).*

Resources and Support

- Second check-in to help you choose an option and get started
- Assistance and feedback from SURS staff, and from STROBE graduate students and postdocs
- General Science Communication seminar (will be repeated on July 29)