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NSF's Graduate Student Support Programs

An Overview and Reflections from a Former Fellow

By Susan B. Cook

The National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) and the NSF Research Traineeship (NRT) program are the two primary vehicles through which NSF is addressing its fiscal year 2017 Agency Priority Goal (APG) of improving graduate student preparedness for entering the workforce. Such efforts to prepare young professionals for challenging twenty-first century career pathways are critically needed to enable all science, technology, engineering, and mathematics (STEM) disciplines to respond to the educational and workforce realities of the future. This article provides an overview of the GRFP and the NRT program and some reflections on the progress that the GRFP in particular has made since I was an NSF Fellow at Duke University 50 years ago.

THE GRADUATE RESEARCH FELLOWSHIP PROGRAM

NSF considers the GRFP to be critical to the Foundation's overall strategy of developing the workforce necessary to maintain and strengthen the nation's leadership in advancing science and engineering research and innovation both nationally and internationally. Since the GRFP was first established in 1952, it has supported more than 50,000 students in STEM fields.

The GRFP provides fellowships to individuals selected early in their graduate careers based on their demonstrated

potential for significant research achievements in STEM or in STEM education. The program provides three years of support for graduate study that leads to a research-based master's or doctoral degree. One of the program's goals is to broaden participation in science and engineering of underrepresented groups, including women, minorities, persons with disabilities, and veterans.

According to GRFP Program Director Gisele Muller-Parker, NSF currently supports 127 Graduate Research Fellows in ocean-related disciplines. Over the last five years, the GRFP has awarded approximately 30 new five-year fellowships each year to applicants in the fields of ocean engineering, biological oceanography, chemical oceanography, marine biology, marine geology and geophysics, and physical oceanography. Information on GRFP recipients can be found in the online NSF FastLane GRFP database.

Graduate Research Opportunities Worldwide (GROW) provides NSF Graduate Research Fellows with opportunities to collaborate with investigators in 17 partner countries. Students enhance their professional development by working with top scientists in international research settings and cultures. GROW offers funding for in-country stays of two to 12 months, with the duration varying by country and partner organization. Details for each partner organization, including eligible institutions and

organizations, levels of in-country support, and any restrictions on the duration of stays, are available through links to partner websites that can be found on the NSF GROW Web page.

The Graduate Research Internship Program (GRIP) facilitates professional development of NSF Graduate Research Fellows through internships partnered with other federal agencies. Through GRIP, Fellows participate in mission-related, collaborative research under the guidance of host research mentors at federal facilities and national laboratories. GRIP enhances the Fellows' professional skills, professional networks, and preparation for a wide array of career options. The sponsor agencies benefit by engaging Fellows in applied projects, helping to develop a highly skilled US workforce in areas of national need.

In addition to GROW and GRIP, NSF supports the Career-Life Balance (CLB) Initiative. CLB supplemental funding may be awarded to sustain the research of NSF Graduate Research Fellows who have been granted an NSF-approved medical deferral for dependent-care (family leave) situations. Fellows may also be eligible for access to cyberinfrastructure resources through the NSF-supported Extreme Science and Engineering Discovery Environment (XSEDE) program and the Facilitation Awards for Scientists and Engineers with Disabilities (FASSED).

THE NSF RESEARCH TRAINEESHIP PROGRAM

The goals of the NRT program are to support effective training of STEM graduate students in interdisciplinary research areas of national priority as well as to create and promote new, innovative, effective, and scalable models for STEM graduate student training. The NRT program is distinguished from prior traineeship programs (i.e., the Integrative Graduate Education and Research Traineeship [IGERT] and programs funded by individual research directorates) by its emphasis on training for multiple career pathways, rotating priority research themes, inclusion of both master's and doctoral students, a broader definition of trainees, and greater budgetary and programmatic flexibility. In 2015, the NRT program funded 18 new projects, including a five-year award to Oregon State University focusing on "Risk and Uncertainty Quantification in Marine Science and Policy" that is projected to train more than 60 master's and doctoral students.

In fiscal year 2015, the scope of the NRT program was expanded to add the Innovation in Graduate Education (IGE) Track. The IGE Track funds proposals to test, develop, and implement innovative and effective STEM graduate education models and conduct fundamental research on potentially transformative approaches to both disciplinary and interdisciplinary graduate education. Over the next two years, the NRT program expects to support 28 new STEM graduate education pilots and models for training and professional development in order to transform current practices in graduate education.

EXPANDED OPPORTUNITIES FOR GRADUATE STUDENTS OF PRINCIPAL INVESTIGATORS SUPPORTED BY RESEARCH DIRECTORATES

Currently, approximately 20% of graduate students supported by NSF are funded through the Foundation's fellowship and

traineeship programs, while the rest are funded through awards to principal investigators for specific research projects, centers, or facilities. In addition to the professional development opportunities for graduate students offered by GRFP and NRT, NSF will support several pilot activities as part of its APG to expand professional development for graduate students. By September 30, 2017, NSF will fund at least three summer institutes and 75 supplements to existing research awards to provide STEM doctoral students with opportunities to

FELLOWSHIP COHORT 2014 Elizabeth Ann Keatinge Murphy

Department of Environmental Sciences,
University of Virginia

I work on biofluidics. I study how organisms interact with their fluid environments. Through the NSF Graduate Research Internship Program (GRIP), in conjunction with the Navy Undersea Research Program, I study how fouling biofilms create a large drag penalty for

ships at the United States Naval Academy in Annapolis, Maryland. Biofilm coats the hull of most ships, so we grow biofilm on acrylic plates and use advanced turbulence analysis techniques to visualize and quantify the effects of biofilm on the turbulent boundary layer. Biofilms create a rough and compliant surface with oscillating streamers protruding into the flow, so the hydrodynamics are complex and fascinating.



Photo credit: Julio Barros

FELLOWSHIP COHORT 2012 Alexandra Davis

Oregon State University

My doctoral research focuses on the ecological impacts of the Indo-Pacific red lionfish (Pterois volitans) in the Bahamas and the Caribbean. I use scuba and manipulative experiments to understand how the presence of this invasive fish is impacting local reef communities. As part of a multiyear project, I am studying how

lionfish interact with their habitat, and I am now creating a model to predict their distribution that can help management with removal efforts.

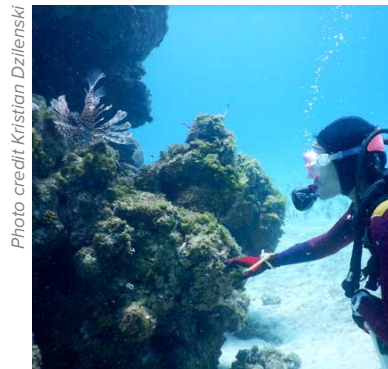


Photo credit: Kristian Dzilewski

expand their knowledge and skills to prepare for a range of careers. These new initiatives will help support the strategic framework for graduate education that will be released in the spring of 2016. In fiscal year 2017, this new framework will guide the review, renewal, and development of solicitations for fellowship and traineeship programs, promote effective collaboration across the NSF directorates, and enhance professional development opportunities for graduate students.

FIFTY YEARS AGO AND NOW

In the 50 years since I began my career as an NSF Graduate Fellow at Duke University, two important aspects of the GRFP have remained unchanged: (1) the fellowship's portability, which allows students to use the award for graduate education in STEM at any institution in the United States to which they have been accepted, and (2) the independent funding, which allows students the flexibility to follow their own research interests. What has changed—importantly and significantly—are the program's demographics. In my 1966 cohort, 12% of the 1,339 GRFP awardees were women (an estimate based on counting the number of feminine and masculine first names

in NSF's FastLane GRFP awardee database). In contrast, 53% of the 2,000 individuals offered fellowships in 2015 were women (National Science Foundation, 2015). Also very encouraging is that 25% of the 2015 GRFP cohort were underrepresented minorities. Although not yet at the 31% level projected by the Bureau of Labor Statistics for Black and Hispanic working age adults in 2020 (US Department of Labor, 2012), this figure represents significant progress.

FINAL THOUGHTS

As a former Fellow, I encourage senior undergraduates and graduate students with a career interest in the ocean sciences to apply to the GRFP. The work

needed to craft a competitive application is well worth doing given the opportunities and benefits you receive if selected as a Fellow. Even if you are not selected, thinking carefully about your goals and interests is still valuable as a first step toward a productive, successful career.

As a long-time member of The Oceanography Society, a TOS travel award sponsor, and the current broader impacts coach for COSEE Florida, I am interested in hearing from TOS student members and other ocean sciences graduate students about your interactions with and thoughts about the GRFP program. Are you thinking about applying? If not, why not? If you have already applied, what has been your experience?

Finally, as a former NSF Ocean Sciences program administrator, I can't resist providing a few words of advice:

- **For faculty advisors and mentors:** Encourage your most promising students to apply to the GRFP and help them develop competitive applications. Consider serving as a reviewer for the program. Work with colleagues and program administrators to seek support to develop and pilot an innovative NRT program at your institution.
- **For students:** Both advanced undergraduates and graduate students are eligible to apply for fellowships. To maximize your chances of selection, *start early* and tap into the support resources available at your university and on the GRFP website. When preparing your application, think like a scientist but write like a science journalist. Keep in mind that all NSF proposals and GRFP applications are really scientific sales documents that need to convince reviewers to support your unique approach to science and your future career. To identify graduate programs that offer NSF-funded research traineeships, check the NSF Awards database for the current list of NRT-funded projects.
- **For graduate students:** The GRFP eligibility rules that apply to you have recently changed (see <http://www.nsf.gov>).

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FELLOWSHIP COHORT 2011 Richard Coleman

Hawaii Institute of Marine Biology,
University of Hawaii at Manoa

My research uses advances in genetic methods to look at the connectivity of reef fish in the Hawaiian Archipelago across spatial scales of tens to thousands of kilometers. The results of my research will provide information about dispersal patterns for recreational fisheries and species targeted for subsistence fisheries. In turn, this information will be used to inform Native Hawaiian community-based management strategies as well as state fisheries management by identifying critical areas for fish production and recruitment.

Photo credit: Molly Bogeberg



FELLOWSHIP COHORT 2012 Stephen A. Timko

University of California, Irvine

My work involved studying the biogeochemistry of natural organic matter (NOM) in wetlands. By understanding how NOM reacts with sunlight, we can better design and optimize constructed wetlands as low-energy, sustainable water treatment systems. My Graduate Research Internship Program work was

conducted at the Smithsonian Environmental Research Center in Maryland.

gov/pubs/2016/nsf16050/nsf16050.jsp); you can now only apply once as a graduate student. Be sure to heed the excellent advice in the relevant NSF FAQ (<http://www.nsf.gov/pubs/2016/nsf16051/nsf16051.pdf>). Be strategic and talk with your advisor about the best time to apply to a GRFP competition. As an incoming student, have you already shown evidence of excellent potential and a strong record of accomplishment? Or, will your application be stronger if you submit it at the start of your second year?

- **For NSF program officials in research directorates:** Is there a way (perhaps via informal guidance or a Web-based advisory statement) that NSF can encourage principal investigators to consider and briefly describe how they will mentor their graduate students and foster career planning activities as part of the broader impacts sections of their proposals? ☺

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US Department of Labor. 2012. Labor force projections to 2020: A more slowly growing workforce. Pp. 43–64 in *Employment Outlook 2010–2020*. Monthly Labor Review, January 2012, US Bureau of Labor Statistics, <http://www.bls.gov/opub/mlr/2012/01/art3full.pdf>.

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This article represents the author's interpretation of information found on the NSF website and/or from fact-checking discussions with NSF program officials. I wish to thank NSF program directors Gisele Muller-Parker and Richard Tankersley for directing me to relevant facts and figures as well as providing valuable insights about NSF's goals and programs for graduate education. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. This article is not an official NSF publication and any unintentional errors of fact or interpretation are the author's responsibility.

RESOURCES

- **Awards Searches:** <http://www.nsf.gov/awardsearch>
- **CLB:** <http://www.nsf.gov/career-life-balance>
- **CLB for GRFP:** <http://www.nsf.gov/pubs/2013/nsf13099/nsf13099.jsp>
- **FASED:** https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5516
- **GRFP:** <http://www.nsfgrfp.org>
- **GRIP:** <http://www.nsf.gov/grip>

Photo credit: Mike Maher



FELLOWSHIP COHORT 2014

Anna K. McLaskey

University of Washington

I am investigating the effects of ocean acidification on krill and copepods in Puget Sound, Washington, and the California Current through a combination of laboratory experiments and field observations. I am excited to be doing research with both global and local implications, and enjoy teaching com-

munity members about the importance of organisms at the base of the food web and how the environment affects them.

Photo credit: Elisabeth Wulffeld



FELLOWSHIP COHORT 2012

Stephanie Snyder

Scripps Institution of Oceanography,
University of California, San Diego

My research brings together academic, government, and industry perspectives to understand juvenile albacore tuna migration within the context of their physiology and their environment.

Through the NSF GROW fellowship, I had the opportunity to bring data analysis techniques from bird migration experts at the University of Copenhagen in Denmark to quantify migration patterns and phenology with respect to changes in the physical environment. My research has contributed to our ability to answer questions concerning basic pelagic ecology and fisheries management.

- **GROW:** <http://www.nsf.gov/grow>
- **IGERT:** <http://www.igert.org>
- **NRT:** http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16503
- **NSF Graduate Research Fellowship Program List of Awardees (1952 to present):** <https://www.fastlane.nsf.gov/grfp/AwardeeList.do?method=loadAwardeeList>
- **NSF Awards Database:** <http://www.nsf.gov/awardsearch/simpleSearchResult?queryText=NRT&ActiveAwards=true>
- **Science and Engineering Statistics:** <http://www.nsf.gov/statistics>
- **XSEDE:** <https://www.xsede.org>

(COSEE Florida). Previously, she served as an NSF Associate Program Director in the Division of Ocean Sciences, and she directed educational programs at Harbor Branch Oceanographic Institute and the Bermuda Institute for Ocean Sciences (previously the Bermuda Biological Station for Research).

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AUTHOR

Susan B. Cook (suecook1023@gmail.com) is Senior Associate, Ocean Research and Conservation Association (ORCA), Fort Pierce, FL, USA. She is currently the secretary for The Oceanography Society and a primary broader impacts coach for the Florida Center for Ocean Sciences Educational Excellence