EOS

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

VOLUME 93 NUMBER 51 18 DECEMBER 2012

You can still use your Fall Meeting mobile app to download information from the 2012 Fall Meeting. Visit http://fallmeeting.agu.org for more information.

IN THIS ISSUE:

Myths in Funding Ocean Research at the National Science Foundation

Every 3 years the U.S. National Science Foundation (NSF), through its Advisory Committee on Geosciences, forms a Committee of Visitors (COV) to review different aspects of the Directorate for Geosciences (GEO). This year a COV was formed to review the Biological Oceanography (BO), Chemical Oceanography (CO), and Physical Oceanography (PO) programs in the Ocean Section; the Marine Geology and Geophysics (MGG) and Integrated Ocean Drilling Program (IODP) science programs in the Marine Geosciences Section; and the Ocean Education and Ocean Technology and Interdisciplinary Coordination (OTIC) programs in the Integrative Programs Section of the Ocean Sciences Division (OCE).

The 2012 COV assessed the proposal review process for fiscal year (FY) 2009–2011, when 3843 proposal actions were considered, resulting in 1141 awards. To do this, COV evaluated the documents associated with 206 projects that were randomly selected from the following categories: low-rated proposals that were funded, high-rated proposals that were funded, low-rated proposals that were declined, high-rated proposals that were declined, some in the middle (53 awarded, 106 declined), and all (47) proposals submitted to the Rapid Response Research (RAPID) funding mechanism. NSF provided additional data as requested by the COV in the form of graphs and tables. The full COV report, including graphs and tables, is available at http://www.nsf.gov/geo/acgeo_cov.jsp.

The Review Process and Management of OCE

COV was impressed with the thoroughness of NSF program officers' evaluations of proposals. Their professionalism provides the community with great confidence that appropriate funding decisions are made. Peer reviews are vital to the process, and thus members of the oceanographic community have a responsibility to respond promptly to review requests and to provide thorough reviews—the return rate for mail reviews ranged from approximately 50% to 70% for the programs evaluated in 2011.

Individual reviewers who were selected at various stages of their careers from relevant areas of expertise, geographic regions, and institutions, generally provided substantive comments to explain their assessments, COV found. Proposals were tracked well, and the process of resubmission effectively utilized peer review to strengthen proposals. When conflicts of interest were recognized, they were treated appropriately. The panel and program officers did a good job of identifying review scores that were poorly matched to review comments and ensuring that proposals were evaluated on substantive comments and not on unsubstantiated scores. Where there was disagreement between the panel and the individual reviews, the panel generally clearly articulated the rationale for its assessment. The documentation provided to principal investigators (PIs) was thorough and provided clear rationales for award/decline decisions.

COV concluded that programs evaluated in OCE were well managed. The panel summary documents, coupled with the program officers' analyses and staff diaries, provide an effective quality control system. Program officers coordinated effectively both within and between programs to maintain an efficient review process that reflects the views of the community, achieves program balance, and incorporates alternative points of view. The use of Intergovernmental Personnel Act (IPA) individuals as program officers is very effective, providing fresh ideas and perspectives and giving the community additional insight into NSF's review and funding process. Program officers balanced risk and potential reward in making decisions, and they appeared to be in touch with trends and developments in the field.

Examining Some NSF Urban Myths

The data made available to COV from FY 2009–2011 allowed COV to examine the statistics behind numerous "urban myths" that exist in the geoscience community.

- Myth 1: The overall success rate of proposals is exceedingly low.

OCE success rates were generally better than those of NSF overall. Success rates in OCE in 2010 and 2011 were 38% and 28%, respectively, similar to those in GEO (35% and 31%) and higher than NSF-wide rates (23% and 22%), even though the OCE median annual award was significantly higher (40% and 25%) than median rates NSF-wide. Success rate did vary by program: for 2011, about 15% for BO to about 30% for CO and PO, with MGG at roughly 27%.

- Myth 2: Multidisciplinary and interdisciplinary proposals are far less likely to be funded than those that follow traditional boundaries.

False. Excluding results from RAPID proposals and the large single-discipline GEOTRACES program (which investigates biogeochemical cycles of trace elements and their isotopes in the marine environment), multidisciplinary proposals in CO, PO, and MGG had success rates of –3%, –2%, and –0.5%, respectively, relative to single-discipline reviewed proposals, while in BO the success rate was +3%.

- Myth 3: Asking for ship time decreases your chances of being funded.

Funding Myths cont. on page 534

Increasing Diversity in Geosciences Through Experiential Learning

Despite national recognition that more underrepresented minority students need to be encouraged to pursue careers in science, statistics for the last decade show only small gains in minority representation in geosciences [*O'Connell and Holmes,* 2011; *Velasco and Jaurrieta de Velasco,* 2010]. While programs such as the Meyerhoff Scholars [*Summers and Hrabowski,* 2006] and Significant Opportunities in Atmospheric Research and Science (SOARS) [*Windham et al.,* 2004] provide the necessary model to mentor minority students, much work is still needed to increase representation of minorities in geosciences.

Organizers from Pennsylvania State University and Howard University recently concluded a 3-year pilot program called Underrepresented Geoscience Education (URGE), designed to recruit and retain underrepresented minority students in geosciences through hands-on activities and mentoring. The core objective of URGE is to increase the number of minority students in geosciences graduate programs by establishing "clusters of learners." Each cluster comprises a faculty member, a graduate student, and an undergraduate student, who work on common research objectives. This grouping formation provides undergraduate students vertical mentoring opportunities (interaction with faculty, graduate students, and other scientists), as well as horizontal interaction (peer-to-peer) when different clusters regularly meet with each other to collaborate and discuss results.

The underlying tenet of this program is that students become successful in geosciences if, at an early stage in their careers, they can acquire academic and technical skills to work with state-of-the-art research equipment; develop problem-solving skills in the areas of instrument development, deployment, and operation; perform numerical modeling studies requiring mathematical tools; and refine written and oral presentation skills to report research findings. With consistent mentoring and scientific experiences throughout the academic year, minority undergraduates are better prepared for taking science courses and gaining admission to graduate school. Conducted from 2010 to 2012, the program included one-on-one mentoring, interactions with professionals inside and outside academia, peer-to-peer collaborations, and faculty-supervised undergraduate research projects. A total of 15 students participated in this program at Penn State University and Howard University.

Summer Research Activities

In this program, undergraduate students are recruited to pursue 10 weeks of summer research focused on atmospheric sciences. For the pilot program, students were recruited from Penn State University, Howard University, and other minority-serving institutions (e.g., University of Puerto Rico and Norfolk State University); the application process is also open to any interested minority at other institutions. Students majoring in subjects such as physics, mathematics, chemistry, and meteorology are selected. Emphasis is placed on selecting second- and third-year undergraduate students who express interest in geosciences research in the program application.

At the start of the summer training the necessary scientific background is established through faculty- and graduate student–led presentations, reading peer-reviewed literature, and faculty-led discussion sessions. Participants focus on broad science themes that include atmospheric thermodynamics of the lower atmosphere, landscape-level energy balance, air chemistry, aerosol physical and chemical attributes, atmospheric boundary layer processes, and atmospheric transport phenomena.

Once students complete the introductory training, they identify interdisciplinary research projects in collaboration with graduate students and faculty members, with an emphasis on data collection using innovative technologies and data analysis. Each cluster of learners pursues research throughout the summer (see Figure 1). Faculty members supervise the research done by undergraduates and graduates. Graduate students assist in the training of undergraduates in instrument deployment and operations, collecting data, reading the peer-refereed

Diversity cont. on page 534

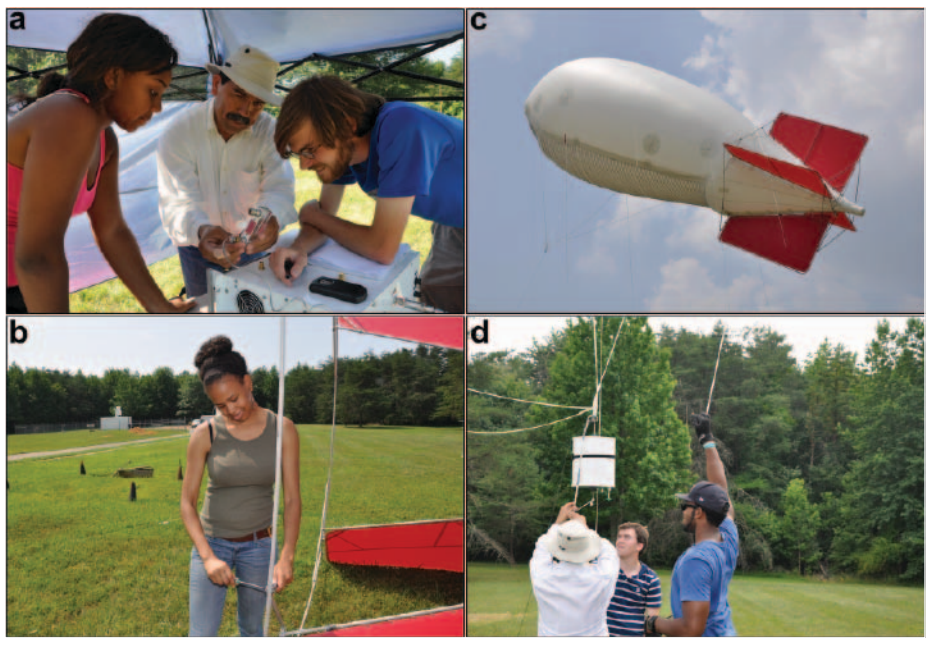

Fig. 1. A group of students in the Underrepresented Geoscience Education (URGE) program prepare equipment (a) to measure ambient levels of air pollutants, assembling fins (b) on a tethered balloon (c) that lifts the necessary instrumentation for their study. (d) Hung from the balloon is a tethered sonde (white cylinder) that houses instruments that determine the vertical distribution of air pollutants and aerosols.

EOS

TRANSACTIONS
AMERICAN GEOPHYSICAL UNION
The Newspaper of the Earth and Space Sciences

Eos, Transactions, American Geophysical Union (ISSN 0096-3941) is published weekly except the last week of December by the American Geophysical Union, 2000 Florida Ave., NW, Washington, DC 20009, USA. Periodical Class postage paid at Washington, D.C., and at additional mailing offices. POSTMASTER: Send address changes to Member Service Center, 2000 Florida Ave., NW, Washington, DC 20009, USA. *Member Service Center:* 8:00 A.M.–6:00 P.M. Eastern time; Tel: +1-202-462-6900; Fax: +1-202-328-0566; Tel. orders in U.S.: 1-800-966-2481; E-mail: service@agu.org. Information on institutional subscriptions is available from the Member Service Center. Use AGU's Geophysical Electronic Manuscript Submissions system to submit a manuscript: http://eos-submit.agu.org.

Views expressed in this publication do not necessarily reflect official positions of the American Geophysical Union unless expressly stated.

Christine W. McEntee, Executive Director/CEO

http://www.agu.org/pubs/eos

Funding Myths

cont. from page 533

Apparently not the case. While there was some variability by program over time, overall, OCE funding rates for proposals without requests for University-National Oceanographic Laboratory System (UNOLS) ship time varied from about 24% to 43% and those with ship time also varied from 24% to 43%.

- Myth 4: You don't have much of a chance of getting funded early in your career.

Junior investigators, take heart! For the period for which we had statistics (the past 3 years), Ph.D. age (years since Ph.D., ranging from 3 to 45 years post-Ph.D. award date) was not correlated with success rate ($R^2 = 0.01$, $p = 0.49$).

- Myth 5: Broader Impacts (BI) must be multifaceted, including K–12, public outreach, undergraduate students, graduate students, underrepresented groups, a Web page, and….

Not really. While reviewer comments varied widely on the merits and scope of proposed BI, the program officers' assessments indicated that it was better to do one (or two) well than to do many superficially.

- Myth 6: Most proposals get a 10% cut in their budget.

Not at all. Across the different programs, between 5 and 25% of proposals were cut by more than 10%. Most (70–85%) were funded within 10% of the original budget.

- Myth 7: Proposals rarely get funded on the first try, so get in the queue.

False. First submissions accounted for 60–75% of funded projects in each program, 20–22% were second submissions, and 5–10% were third submissions. Perhaps surprisingly, the success rate of a resubmission was generally close to that of a first-time submission. The proportion of submitted proposals that were funded did not vary greatly by program.

- Myth 8: The more reviews you end up with, the less likely your project is to be funded.

Again, false. We found no relationship between the number of reviewers for a proposal and funding success. Proposals in OCE had at least three reviews each (which implies, by the way, that you should be prepared to review three proposals for each one you submit).

- Myth 9: It takes more than a year to find out if your project will be funded.

Not usually. Over the past decade, more than 62% of proposals were accepted or declined within 6 months of submission. In 2011 the fraction was 85%. This record was 10–15% better than for GEO overall.

- Myth 10: Projects are not funded for as long as they used to be.

Not with statistical significance. No systematic change in funded project length was observed over the past decade. Across all programs, projects currently average between 2.5 and 3.5 years in duration, with ocean education projects generally being longer and oean drilling projects being shorter.

- Myth 11: One bad review, and your proposal is sunk, or as a reviewer, if you don't give a proposal an "excellent," you are condemning it to failure.

False. The panel and program officers evaluated projects carefully to synthesize input from all sources, paying more attention to specific comments than overall rankings. They balanced program needs and available resources to reach their decisions. Of the more than 6000 reviews submitted during the COV review period, about 80% of scores were "excellent" or "very good," but about 15% of reviews for funded proposals had ratings of "good," and a total of 5% had a rating of "fair" or "poor." The distribution of scores of funded proposals was shifted toward "very good" to "excellent" relative to unfunded proposals, but both funded and unfunded proposals received the full range of available rankings by reviewers. See also Myth 12.

- Myth 12: If you get mostly "excellent" rankings, you will certainly be funded.

Not necessarily, as several factors contribute here. Program officers place more weight on the reviewers' comments than on the overall numerical ranking—some "excellent" rankings may not be backed up by substantial reviews or may include comments that were not consistent with a ranking of "excellent." A ranking of "excellent" for a proposal that other reviewers argue has fundamental problems can diminish the credibility of the review. Each proposal is evaluated in the context of other proposals submitted. The program officers also must balance program needs and available resources to reach their decisions.

- Myth 13: Underrepresented status of the PI affects the likelihood that a proposal will be funded.

Based on the data available, apparently no, but the sample size is still very small. The success rates for proposals submitted by female and minority PIs were generally consistent with success rates for male PIs. However, underrepresentation of women and minorities is persistent in the geosciences and in ocean sciences. While OCE has treated proposals fairly and has worked to increase participation by underrepresented groups, the number of PIs from these groups is still extremely low relative to their proportion within the general population.

Conclusions

Overall, COV was impressed with the thoroughness of the program officers in their assessment of proposals. OCE program officers, many of whom spend only a short time at NSF, knew the urban myths above and may have promulgated them before their NSF rotation gave them new insights. Increasing the diversity of the OCE community, a problem faced by science, technology, engineering, and mathematics (STEM) fields in general, still needs to be addressed. Increasing participation from underrepresented groups will require concerted effort and expanded community involvement.

Program officers and the programs themselves are representative of the OCE community. How can improvements enhance the process? Program officers across OCE specifically asked COV to convince PIs to contact them to ask questions, to explore ideas, and to get feedback. Talking with your program officers is one of the best ways to learn how things really work, to help understand why your proposal was not funded, and to determine how you could improve your project next time. It came as a surprise to COV to learn how infrequently program officers were asked for this advice. The best way to have an impact is to propose good science, be a constructive reviewer, and participate in panels.

Acknowledgments

We thank all NSF/OCE staff, particularly Eric Itsweire and Patricia Engel, for their excellent support during this review.

—Robert A. Duce, Texas A&M University, College Station; E-mail: rduce@ocean.tamu.edu; Kelly J. Benoit-Bird, Oregon State University, Corvallis; Joseph Ortiz, Kent State University, Kent, Ohio; Rebecca A. Woodgate, University of Washington, Seattle; Paula Bontempi, NASA, Washington, D.C.; Margaret Delaney, University of California, Santa Cruz; Steven D. Gaines University of California, Santa Barbara; Scott Harper, Office of Naval Research, Arlington, Va.; Brandon Jones, Environmental Protection Agency, Washington, D.C.; and Lisa D. White, San Francisco State University, Calif.

Diversity

cont. from page 533

literature, and analyzing and interpreting the recorded observations.

In addition to gaining experience with highly specialized instruments (lidar equipment, radiometers, gas analyzers, aerosol probes, mass spectrometers, sonic anemometers, rawinsondes, instrumented tethered balloons, etc.), students learn basic statistics and master data analysis methods using MATLAB or Mathematica. For about half an hour at the start of the summer, a mathematical mini workshop focuses on the salient numerical methods applied in atmospheric science, followed by informal discussions with participants during the lunch break. The goal of the mini workshop is to introduce students to a variety of mathematical concepts used in the numerical modeling of atmospheric phenomena. Students gain a mathematical background during their undergraduate studies, as mathematical and technology-related skills are a necessity for an edge in a competitive postgraduate environment.

Faculty-led scientific weekly discussions allow graduates and undergraduates to share accomplishments, address challenges, and identify additional research initiatives. Continued interactions among cluster members enable undergraduates to discuss their own research ideas and to improve their overall communication skills. In the process, students receive regular advice and input on the accomplished research tasks. As they perform their research, students document completed research tasks. The final outcome is a 10-page report outlining the research objectives or hypotheses addressed, methodologies, key findings, and importance of results. Graduate students and faculty members review the reports and provide feedback on content and style of writing. Summer activities culminate with a 1-day symposium, modeled on the format of AGU meetings, where students present their research results. Undergraduates, graduates, invited guests, and faculty members attend the summer symposium. Before the final presentations, undergraduates receive criticism and feedback from graduate students and peers on research results and presentations.

After completing the summer project, students participate in research symposia at their home institutions, where they make oral presentations on their research. The program also enables the participating students to interact with researchers from other fields to learn about complementary research possibilities and educational and outreach opportunities specific to their own study area. A concrete result of this type of interaction between program participants and the mathematicians involved in the program was the participation of two female students in the mathematical outreach activities of the Association for Women in Mathematics at the USA Science and Engineering Festival Expo organized on the National Mall in Washington, D. C., during the fall of 2010. This experience brought them national visibility and engaged them in a mathematical outreach effort that involved more than 2000 middle school and high school students.

Activities in Support of Student Professional Development

Professional retreats were conducted to discuss opportunities in graduate school and engage students in the geosciences professional ranks. Retreats lasted one full day and were held off campus. All members of the clusters of learners participated in the retreats. Faculty members guided the discussions during the retreats.

One key feature of the retreats is that undergraduates and graduates decide the

Diversity cont. on next page