Reflections of Departing DMS Rotators

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) now accounts for about two-thirds of all federal funding for academic research in the mathematical sciences. Ensuring that this money is well spent depends on having a highly qualified staff of program officers in the DMS. Visiting scientists—or, in common parlance, "rotators"—are a critical element of the DMS staff. Most rotators have permanent positions in academia and work in the DMS for one, two, or sometimes three years and then return to their home institutions. More than half of DMS program officers are rotators, and they complement the experience and institutional memory of the permanent DMS staff by bringing in fresh viewpoints and first-hand knowledge of current research. And when rotators return to their regular positions, they bring back insights and understanding about how the NSF operates and about policy issues affecting mathematics.

Every year, the DMS needs to fill rotator positions—and every year it is a challenge to find qualified people willing to come to Washington. Jong-Shi Pang of The Johns Hopkins University, who served as a rotator in the DMS full-time during 1998–2000 and part-time during 2000–2001, is enthusiastic about his stint at the NSF. "I had a very good experience and enjoyed my stay there," he remarks. "I would encourage more people from the community to respond to the call for help to serve the discipline."

Shepherding Proposals

The main responsibility of DMS program officers is shepherding through the reviewing process the approximately 2,000 proposals the DMS receives each year. Proposals come in response to solicitations to programs like VIGRE (Grants for Vertical Integration of Research and Education in the Mathematical Sciences) or Focused Research Groups, or are submitted to one of the division's six disciplinary programs: Algebra, Number Theory, and Combinatorics; Analysis; Applied Mathematics; Computational Mathematics; Statistics and Probability; and Geometric Analysis, Topology, and Foundations. In the past, the reviewing process was conducted almost exclusively by mail (meaning postal mail or e-mail). Increasingly, the DMS uses a combination of panel reviews and mail reviews. The mix varies from program to program and depends partly on the judgment of the program officers about which method works best for their particular areas. A proposal under serious consideration for funding needs at least three outside reviews, and those reviews may be written by mail reviewers who each see only that one proposal, or by panel members who can compare the proposal to others submitted in the same area.

Dmitry Khavinson of the University of Arkansas in Fayetteville recalls that in years past, when he was a mail reviewer for the DMS, he would occasionally get "goofy" proposals. But when he served as a rotator in the Analysis program during 1999–2001, he says, "I did not see any proposals that I could easily dismiss," and nearly all mail reviews came back with "very good" ratings. The Analysis program relies primarily on panel reviews, which Khavinson believes is the fairest system. "When the panel meets, they see the whole picture," he notes. "They see the 'very goods' in comparison with the other 'very goods'." During his time in the DMS, Khavinson assembled and oversaw several panels, each of which had 12 to 16 members who met at the NSF for three days to review from 60 to 80 proposals. Sometimes he supplemented the panels' recommendations with mail reviews, and some proposals that were hard to categorize he handled by mail review only.

Joseph Brennan of North Dakota State University in Fargo was a rotator in the Algebra, Number Theory, and Combinatorics program from 1999 to 2001. This program used to be called Algebra and Number Theory and had a tradition of using only mail reviews. However, proposals in combinatorics have been reviewed by panels ever since that area was added to this program a few years ago. The proposals Brennan handled were mostly in algebra and algebraic geometry, and he used mostly mail reviews in his first year at the NSF and some panel reviews in his second. "There are positive and negative aspects to panel and mail reviews," he notes. He found that mail reviews allow for a greater diversity of opinion than do panels and increase the chances of getting proposals to reviewers who have exactly the right expertise. On the other hand, he notes, panels have a better perspective on all the

issues facing the DMS as it tries to compare proposals.

William Smith, who is now the executive director of the American Statistical Association, was on the faculty at Texas A&M University before going to the DMS in 1999 for a two-year stint as a rotator. He worked in the Statistics and Probability program, which is the only DMS program that uses a "screening panel." The screening panel reviews a batch of a couple of hundred proposals and groups them into three categories. In the first category are a very small number of proposals, perhaps half a dozen, that are so outstanding they must be funded. The second category contains proposals deemed to be not competitive—typically about 40 percent of all the proposals. The third category contains all the remaining proposals, and for these Smith used mail review, often drawing on recommendations from the panel about who could review which proposals. The statistics program funded about 25 percent of the proposals it received, which is less than the NSF's general target of funding about one-third of all proposals.

Rotators get an inside view of the state of research in the mathematical sciences today. "I hadn't realized how high the quality of proposals is," remarks Andrew Pollington. "There were hardly any that I could not have funded with a clear conscience." Pollington, who is at Brigham Young University, was in the Algebra, Number Theory, and Combinatorics program during 1999–2000, and he may serve a second year during 2002–2003. During his time at the NSF, he got to see first hand the impact of two developments in number theory: the work of Andrew Wiles in *L*-functions and arithmetic, which led to the proof of Fermat's Last Theorem, and work on the zeroes of the Riemann zeta function, which has been enriched by connections with physics. Going to the DMS, says Pollington, "is a great opportunity to learn about what's going on in your subject."

Other Program Officer Duties

DMS program officers also spend time seeking joint funding from other NSF divisions. A proposal with connections to, for example, biology, could be of interest to the program officers in one of the NSF's biology divisions. "The program officer has the responsibility and the difficulty of taking the proposals around, pitching them, and trying to sell them" to other divisions, Smith remarks. In the same way, program officers outside the DMS pitch their mathematically-oriented proposals to DMS program officers. "So it's a quid pro quo," Smith says, noting that usually the tradeoff ends up even. Grantees are not always aware of the efforts a program officer makes to find ways to fund their proposals. "It's not always a matter of recognizing great work," remarks Brennan. "It's finding the money to make it happen." Finding funding for a good proposal that might otherwise go unfunded is satisfying, he says. "These are things you can point to and say, 'Here's an accomplishment.'"

In addition to overseeing the disciplinary programs of the DMS, program officers work on a variety of projects within the division and across the foundation. For example, Smith was on the management team for VIGRE, a DMS program that supports efforts by mathematics departments to integrate research and education from the undergraduate through the postdoctoral and senior researcher levels. Because he had served on a panel to review VIGRE proposals before he came to the NSF, and because he has extensive administrative experience, Smith was a natural for involvement in VIGRE. During his tenure at the NSF, Smith worked on the VIGRE selection panels and led several site visits. "VIGRE is a long-range program that will train a lot of mathematicians—it will train the next generation of leaders," Smith remarks. "It's exciting to be involved with something like that."

A rotator in the Analysis program during 1999–2001, Peter Polyakov of the University of Wyoming became deeply involved in work on an NSF-wide initiative in nanotechnology. With Joe Jenkins, lead program officer in Analysis, Polyakov organized a workshop that brought together mathematicians and people from other sciences and engineering to discuss how to pool their expertise to attack problems in nanotechnology. Polyakov also began work on a document describing how mathematics can make contributions to solving these problems. Prior to coming to the NSF, Polyakov was not involved in interdisciplinary research, but he enjoyed working on the initiative and getting to know researchers in other areas. "To me, this looked like the direction the NSF is moving in, which is toward more interdisciplinary research," he says.

A Time of Optimism

The last couple of years have been a time of optimism and high hopes for the DMS, as the NSF director, Rita Colwell, has promoted an NSF-wide "Mathematical Sciences Initiative" (technically the initiative has been relabeled a "priority area" because the Bush administration mandated that there would be no new initiatives by the government). The initiative is built around three linked themes: "interdisciplinary mathematics", which addresses problems in science and engineering; "fundamental mathematics", which represents the core of the field and which must be strong if mathematics is to come to the service of other disciplines; and education and mathematical literacy. In the spring of 2000, Colwell appointed James Rosenberger to chair an internal working group, with representatives from across the NSF, to formulate the

Information about applying to be a rotator in the DMS may be found in "DMS Employment Opportunities" in the January 2002 issue of the *Notices*, page 45. Or contact: Bernard R. McDonald, Executive Officer, Division of Mathematical Sciences, National Science Foundation, 4201 Wilson Boulevard, Suite 1025, Arlington, Virginia 22230; telephone 703-292-4851; fax 703-292-9032; e-mail: bmcdonal@nsf.gov. The DMS website is at http://www.nsf.gov/mps/divisions/dms/.

In addition, the Opinion piece "A Time of Opportunity" by Phillip Griffiths (*Notices*, November 2001, page 1149) discusses being a rotator in the DMS.

—*A. J.*

initiative. Rosenberger was a rotator in the Statistics and Probability program during 1998–2000. After returning to his home institution of Pennsylvania State University, he stayed on part-time for another six months to finish work on the initiative.

"One focus of the initiative is to forge links with other disciplines where collaborative work would both benefit the other disciplines and provide a mechanism to bring mathematical challenges back to the mathematics community," Rosenberger explains. He says the initiative enjoys strong support across the NSF, especially from the biological, geological, earth, and atmospheric sciences, all of which face enormous computational, mathematical, and statistical problems. Inspiring more mathematicians to communicate with nonmathematicians is only part of what is needed, Rosenberger remarks. "A mix of people who do that and those who bear down on theoretical work is what makes a rich community," he notes.

If the most optimistic scenario materializes, the initiative could mean a four- or five-fold increase in the DMS budget over the next few years. The initiative will start during the 2003 fiscal year, which begins October 1, 2002. In the aftermath of the September 11, 2001, attacks, all nonmilitary aspects of the government have received lower priority. As a result, the DMS budget will probably rise more slowly than originally hoped. DMS program officers were gratified by and optimistic about the initiative, says Polyakov. But, he notes, the DMS still faces the hard work of developing serious collaborations with other divisions, and, because this is an NSF-wide initiative, the new money will not go only to mathematicians. "This is money mathematicians will have to fight for," Polyakov states.

Some in the mathematical sciences community are concerned that, despite the initiative's emphasis on linking fundamental and interdisciplinary mathematics, core areas of the field might nevertheless lose out. DMS rotators have to confront such concerns all the time. Pang says that, before one can really understand all aspects of the problem of increasing funding for the mathematical sciences, one has to "come and understand [the problem] from the inside" of the NSF. "The program officers, the division director and the community have the same voice, the same goal: to try to grow the budget for mathematics," says Pang. The challenge is how to accomplish that goal. "The DMS is taking a strategy that sees interdisciplinary work as a way to help the mathematical sciences as a whole."

"It's a Lot of Work!"

With all they have to do, DMS program officers are very busy. "On balance, I largely enjoyed the time" at NSF, Rosenberger says. "But it's a lot of work!" Like most rotators, he had to put his own research on hold while he was at the NSF. Pollington reports that he was able to continue his research by working in the evenings, but he was hampered by the lack of a mathematics library close at hand. Rotators can apply for up to fifty days off for research per year; many use this time to go back to their home institutions to advise graduate students and work with colleagues, or to attend conferences. Nevertheless, the reality is that a great deal of energy and discipline are needed to keep up one's research alongside the demands of being a program officer.

Rotators have two options for salary arrangements. The first comes under the "Intergovernmental Personnel Act", or IPA, and stipulates that the NSF pays for a 12-month appointment based on the 9-month base pay of the home institution; the home institution contributes 15 percent of the total cost. IPA rotators remain employees of their home institutions and therefore have no interruption in things like pension fund contributions. The other option is to become a "Visiting Scientist", and then the NSF pays the entire cost at a negotiated rate depending on government pay scales. Because visiting scientists are government employees, they are subject to some pesky regulations, such as clocking in and accounting for hours worked. Both salary options are possible for rotators, and most prefer to be visiting scientists. In any case, rotators never take a pay cut to go to the NSF.

"There is a lot of help for any fresh rotator" in DMS, Pang remarks. "The permanent people are very helpful. You can walk into any office and ask anything…Rotators are very, very welcome." The NSF has its impersonal, bureaucratic side, which is just as immersed in regulations and paper-shuffling as any other government agency. But, says Khavinson, "I didn't see a bureaucratic approach" among the DMS staff, who were all working hard to advance the mathematical sciences. "Mathematics is healthy and well, all areas of it, and a lot of people are doing very exciting things," he says. "And when you see it from the NSF, you see it much more clearly."

—*Allyn Jackson*