

Recompetition of the NSF-Funded Mathematics Institutes

Come 1999, the way that the National Science Foundation (NSF) supports mathematical sciences research could look very different. This summer, the NSF's Division of Mathematical Sciences (DMS) announced that it would open a new competition for the two institutes it funds: the Institute for Mathematics and its Applications and the Mathematical Sciences Research Institute. The call for proposals [FR f1 M=205.457pt][E f1]¹ indicates that in the new competition the DMS is open to considering a variety of ideas. At the same time, the popularity and success of MSRI and IMA ensure that they will be strong competitors in the new bid. These changes will provide an opportunity to bring forward new ideas for supporting mathematical sciences research. These ideas will have to be carefully constructed to fit the DMS budget outlook, which at this point is hazy at best.

Why Recompete?

The DMS has decided to "recompete" the institutes not because of a failure on the part of the institutes to fulfill their missions. Indeed, the consensus is that the institutes have been very successful. The main reason for the recompetition is that the institutes have received fifteen years of continuous NSF funds without having to compete for them. "After fifteen years, you ought to go back and rethink what you're doing and whether it's appropriate now," says DMS Director D. J. Lewis. He also points out a second

reason, having to do with a policy set by the National Science Board, the governing body of the Foundation. The policy states that, with such grants, reviews must take place every five years and a recompetition must be held every ten years. One can avoid recompetition only if, at the first five-year review, a special case is made that a recompetition at the ten-year mark would have dire effects on the activity. No such case was made, and yet the funding has continued for fifteen years. Under these circumstances there was no way to put off a recompetition. MSRI and IMA are presently being considered for three-year grants that would begin in July 1997. Proposals for new institutes are due in February 1997, and the expectation is that the grants will begin in 1998.

Established in 1980, MSRI and IMA grew out of intense debate within the mathematical community about modes of support for mathematical sciences research. Three different panels were involved in the review of the institute proposals. One of these panels considered not just the ten proposals for institutes but also the broader picture of how the NSF's mathematics division should spend its funds to support mathematics research. This panel recommended funding two institutes, rather than the one the NSF had originally envisioned, and also made recommendations about the DMS postdoctoral fellowship program, short conferences to be organized by the AMS, and other matters. The institute concept had to contend with skeptics in the community, who thought that the NSF should concentrate on traditional principal in-

¹See the *Mathematics Opportunities* section of this issue of the *Notices* for more information on the program solicitation.

investigator grants. Today, though worries about PI grants remain, there is a strong consensus that the institutes are a worthwhile use of DMS funds.

The IMA was established as a part of the University of Minnesota, originally under the directorship of Hans Weinberger. The present director, Avner Friedman, has served in that capacity for the past ten years, and recently he announced his decision to retire from that post. He will continue to head the Center for Industrial Mathematics, which is housed in the Department of Mathematics at Minnesota. The IMA has earned a reputation as an important center for applied mathematics research. As an example of what IMA does, one can look at last year's program on mathematical methods in materials science. In that program, tools ranging from statistical mechanics and differential equations to topology and geometry were applied to problems in composites, disordered materials, polymers, and the like. Next year the IMA will host a program on new applications of dynamical systems, including problems from medicine and biology. Such programs are the centerpiece of the IMA effort.

Under Friedman's leadership the IMA has also become well known for its success in bringing industry people together with mathematicians to address problems from industry. These interactions have produced real gains for some industries; for example, work at IMA on a problem from Ford Motor Company resulted in a patent on a scheme for analyzing air quality. The success of this program is largely due to the sustained attention Friedman devoted to it. In fact, many credit the IMA with increased acceptance within the mathematical sciences community of the validity of industrial mathematics. An indication of this greater acceptance is the number of mathematics departments that are starting programs in industrial mathematics or hiring faculty who engage in this activity. For example, the University of North Carolina at Chapel Hill recently hired Greg Forest, who has worked for several years on mathematical problems arising in industry. Forest says it is very important that the mathematical sciences community approach this cultural change with the attitude of developing new collaborators, being open to new types of problems, and committing the time and effort necessary to make significant contributions. There is the danger of the attitude that says, "The mathematicians are going to ride up on their white horse and solve industry's problems," Forest notes. "This would have messed up this opportunity for change." He says that on the whole the IMA and Friedman have done a great service. Industrial mathematics "is now perceived as a legitimate thing to do," says Forest, "and I don't

think that would have happened without the IMA and Friedman's persistence."

MSRI was set up as an independent corporation separate from the University of California. However, the building it occupies—perched in the Berkeley Hills with spectacular views of the San Francisco Bay—is owned by the university and occupies university land. The original directors of MSRI were S.-S. Chern and Calvin Moore; later Irving Kaplansky became director, and the current director is William P. Thurston. MSRI has put its efforts into running programs focused on the frontiers of research in mathematics. Currently there are year-long programs in low-dimensional topology and combinatorics. Postdocs are one of the main emphases at MSRI, with twenty-two receiving support this year. A postdoc at MSRI can be especially valuable for a young mathematician, who may end up taking a permanent job at an institution where there is not much research going on. Getting a start on a research program while at MSRI can help them to survive mathematically later on.

Since coming to MSRI in 1992, Thurston has made outreach and education themes of his tenure. MSRI has sponsored a series of informal meetings between mathematics researchers, teachers, and others involved in precollege education. A workshop for minority mathematicians held at MSRI in June 1995 has been copied at other institutions. Perhaps the most spectacular example of outreach was the MSRI-sponsored "Fermat Fest", which attracted one thousand people to hear talks and discussion about Andrew Wiles's proof of Fermat's Last Theorem. Robion Kirby of the University of California, Berkeley, was on the MSRI Scientific Advisory Council about five years ago. At that time, he says, the NSF put "a large amount of pressure on MSRI to stop being an institute whose sole focus was doing excellent mathematics" and to expand in exactly the directions that Thurston has been pursuing. But today, while there is little disagreement that these activities are valuable, some are questioning whether MSRI is losing its focus on research by diverting already-scarce resources from research. This issue has produced friction between Thurston and the MSRI Steering Committee. When his five-year term as director ends in 1997, he will move to UC Davis. A search for a new director has begun.

Alternative Ideas

MSRI and IMA have their share of problems, but generally they have been very successful. If imitation is the sincerest form of flattery, MSRI and IMA seem to have many admirers, for they have served as models for institutes in other countries, such as The Fields Institute in Canada

and the Newton Institute in England. There is also talk among European mathematicians of starting an MSRI-like institute on the European continent. At the Seattle Mathfest in August the AMS Committee on Science Policy sponsored a focus group on the recompetition of MSRI and IMA to get a sense of the value the community puts on the institutes. The response was overwhelmingly in support of the institutes, with very few criticisms. Asked if their outlook on the institutes would change if the DMS budget dropped by 10 percent, participants responded that with such a cut the institutes would become more important than ever. A smattering of interviews with mathematicians also indicates that support for the institutes is very strong. In fact, it has proven difficult to find anyone who thinks the institutes are a bad idea.

While there appears to be no outright opposition to the institutes, some in the community wonder whether other modes of funding might stretch DMS dollars further. Peter Li of the University of California, Irvine, wonders whether it might be more cost effective to “farm out” conferences presently held at the institutes to mathematics departments around the country. Such a scheme would avoid the costs of running the institutes on a continuing basis, and universities are usually willing to absorb much of the indirect costs in order to attract such conferences. Li emphasizes that he is not against the institutes in their present form. “I am just raising the question, considering how tight the money is, that maybe there are more cost-effective ways of doing things,” he says.

Li also asks whether the money now supporting postdocs at MSRI and IMA might be put to better use in the DMS postdoctoral fellowship program, which allows a recipient to use the fellowship in any mathematics department. “I see NSF postdocs working just as well as those spending a year at the institutes,” he notes. One might think that postdocs would have more contact with senior mathematicians if they went to an institute rather than if they were in a mathematics department. However, this is not necessarily the case, because funds for senior visitors at the institutes have been stretched so tight that most can visit only if they happen to be on sabbatical. This means that often senior people come for only a week or so at a time to participate in a conference rather than to stay a semester or a year.

The recompetition provides an opportunity for reconsideration of the various support modes in DMS and the balance among them. In formulating the program solicitation for the new competition, the DMS has indicated that it is open to many different possibilities, including traditional institutes in the mold of MSRI or IMA, re-

gional institutes, conference centers, and “centers without walls”. Lewis has also said that the DMS is open to the idea of funding more than two institutes and investing more money in this activity. Another factor that will influence the funding structure in DMS is a “benchmarking” study of mathematics, which the DMS is about to undertake. The study will attempt to identify which areas of mathematics are currently very active and will also examine the DMS portfolio of support mechanisms and make recommendations about which are the most likely to advance mathematics. The study is part of the Government Performance and Results Act (GPRA), which requires federal agencies to link what they do to a set of goals and spell out ways of measuring whether they are reaching those goals. The GPRA is just one indication of the trend toward increased accountability on the part of federal agencies. This trend was surely one of the factors moving the DMS to open a new competition for the institutes.

The lack of specificity in the call for proposals may prove frustrating to some who envision pouring a great deal of time into developing a proposal, only to find that the DMS is interested in something completely different. On the other hand, the DMS would like the ideas to arise from the community, rather than prescribing what ought to be funded. In addition, the question of just what the DMS will fund will depend largely on what the budget will be, and that is a matter of great uncertainty. Currently the institutes comprise about \$5 million out of the \$90-million DMS budget. According to Lewis, the pessimistic view of the budget says that there will be a decrease of 3%–5% every year for the next five years, and a further erosion of 3%–5% in yearly inflation. At that rate, the DMS might have a budget of \$60 million by the end of the decade. “At that point it may be that the best way we could spend our money is to have a lot of institutes where people could go and at least keep in contact with where the discipline is going,” Lewis remarks.

The optimistic scenario is that a lot of money will be poured into science and the DMS budget will rise. In that case, if there is much more money available for PI grants, says Lewis, “maybe you don’t need so many institutes.” Right now Lewis is operating under the assumption that the DMS budget will remain flat. The uncertainty of the budget “is why I’m open at the moment to increasing the number of institutes, especially if I get some glimpse that the budget is going to go downward,” Lewis says. In that case, “I’ve got to find a way to reach out to the maximum number of people.” The DMS is also keeping open the possibility of having no institutes at all, though Lewis says he considers that very unlikely, given

the feedback that the DMS has gotten on MSRI and IMA.

Recompetition: Good and Bad

While there is a great deal of support in the mathematical sciences community for MSRI and IMA, there is also a general agreement that the recompetition makes sense. “Generally I think it’s a good idea to put them up for rebids, just to keep them on their toes,” says Li. Kirby expresses mixed feelings about the recompetition. As a taxpayer he believes that a recompetition is a good idea, to be sure that the money is being spent in the best way possible. On the other hand, he is “very fond” of the institute in the hills above his campus. He points out that a great deal of time and effort have gone into developing the institutes over the years. “You don’t want to throw away the traditions and the goodwill that has been built up, unless there is a good reason,” he says.

The recompetition could pose other threats. Ettore F. Infante of the University of Minnesota served as director of the DMS in the early 1980s and has held several administrative positions at Minnesota, most recently as senior vice president and provost; currently he is on sabbatical at Brown University. He believes that the institutes have been a good thing for mathematics and also sees the recompetition as inevitable, given the present climate of increased accountability. Nevertheless, he is wary about what could happen. “The problem is that recompeting implies bringing about a considerable shakeup, and the question is, what is the right time to do that?,” Infante asks. “I very much sympathize with the feeling at the NSF that at a certain point there has to be a recompetition, but certainly this is not the very best possible time for a recompetition.” He points out that the era in which the institutes were established was one of growth for universities and for the NSF. It was also a time when the government sponsorship of university research was seen as an unquestionable boon to the nation. Today, not only have budgets dropped, but the political leadership of the country no longer places such a high value on the intellectual contributions of universities.

In the early 1980s, says Infante, deans and provosts could go to their presidents, or even to their state legislators, and find a receptive ear for funding new research projects. “The last time that I made a very serious argument along these lines to state legislators in Minnesota,” he remarks, “they turned the conversation to undergraduate education. ‘What was the IMA going to do for undergraduate education at the calculus level?’ they asked.” The new climate might not prove hospitable to the institutes. The original competition “took place at a time when uni-

versities—both Berkeley and Minnesota—made significant commitments and investment,” says Infante. “I’m wondering whether in this day and age there are going to be similar levels of investments in new proposals.”

These problems make it all the more important that the community consider carefully how the DMS can best support the mathematical sciences. As the competition gets under way, the community will have opportunities to contribute to the process. Lewis stresses that, while the DMS cannot consult everyone, mathematicians will—via mail review, panels, and site visits—have significant input in the decision as to the number of institutes and the types that will be supported. They will need to weigh these considerations in light of the budget scenario as best one can judge it at the time. Says Lewis, “The recompetition does open the door to the community to add some thoughtful directions as to where the DMS should go with the funds it has available.”

—*Allyn Jackson*