Interview with Frederic Wan

Frederic Y. M. Wan of the University of Washington at Seattle took the position of Director of the Division of Mathematical Sciences (DMS) at the National Science Foundation (NSF) in January 1993. In May 1993 he was interviewed by *Notices* Associate Managing Editor Allyn Jackson. The interview, edited for conciseness and clarity, follows.

Additional information on the NSF may be found in the article, "The NSF Budget Request for Fiscal Year 1994", and in the Washington Outlook and For Your Information columns in this issue of the *Notices*. These pieces were prepared during a period of considerable change for the NSF and the DMS. Therefore, the details reported in the various pieces may have changed by the time this issue of the *Notices* reaches its readers.

Notices: How did the recent meeting of the DMS Advisory Committee go?

Wan: I thought it went reasonably well. The most important thing from my point of view was for me to provide the committee members with some information about the Division which I wanted to know myself when I came here. I think the committee found it interesting. Hopefully it allows us to dispel a lot of rumors, misunderstandings, misinformation. It doesn't mean that we don't have problems, [but now we can] focus our attention to address the problem where it is. To be more specific, I have now the data on how the DMS has grown over the last ten years. In particular, it has grown at a much faster rate than the MPS [Mathematical and Physical Sciences] Directorate itself. For example, the MPS Directorate has grown at an average rate of about 5.3% since 1985, and the DMS has grown at twice that rate. So the Directorate has not treated us poorly, and that's a very important piece of information. If there's a problem, it is the fact that MPS has not grown enough. If MPS can do better relative to the rest of the Foundation, DMS will probably do even better.

I reported to the Advisory Committee other information. For instance, the DMS might have grown considerably, but it might have grown only in some areas. Well, I calculated that since 1985 every program has grown at an annual rate of about 5%, and all but one have grown at a faster rate than the average MPS annual growth rate. I also found that during this same period, the expenditure in four of the five so-called "core" programs has decreased as a fraction of the DMS expenditure. [The five "core" programs are Topology and Foundations, Classical Analysis, Modern Analysis, Algebra and Number Theory, and Geometric Analysis.] The only core program not in that situation is Geometric Analysis. It maintained its fraction [during this period]. One might say then that the core programs have lost ground, and a natural conclusion would be that the applied programs must have gained. The two obvious ones are Applied Mathematics, and Statistics and Probability. It turns out their growth rate over the same period is roughly the same as the first four core programs and therefore worse off than the remaining core program, Geometric Analysis.

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So where are the areas of relative gains within DMS? They are in the two remaining programs, Computational Math and Special Projects. DMS benefited from the FCCSET [Federal Coordinating Council for Science, Engineering, and Technology] initiatives, mainly through the HPCC [High Performance

Computing and Communication] initiative, which impacted Computational Mathematics the most, and the SMETE [Science, Mathematics, Engineering, and Technology Education] initiative, which impacted Special Projects the most. Our investment in the educational area in 1992 was $3.4 million. That's a good fraction of the Special Projects budget.

Notices: Why is DMS spending money on education projects when the budget for the NSF's education directorate is rising so much?

Wan: This was new money gotten from the new Foundation allocations. If we don't spend it [in education activities] we would not have gotten it or would have to return it. Also, these are important projects which DMS can do and EHR [Education and Human Resources Directorate] would not do on its own. EHR would not, on its own, fund a mathematics research-related activity even though it is education related. An example is the Research Experience for Undergraduates program. We are not duplicating what EHR does. We also jointly sponsor curriculum reform activities with EHR, principally in the calculus reform movement. Surely, we want mathematicians of all types to be involved in this type of project. EHR is the principal lead in this area, and they welcome our participation to put together a good program. I believe that they put in almost $2.00 for every dollar we put in.

Notices: With the tight budgets here at DMS for this year and possibly next year, will DMS continue to increase investment in educational activities?

Wan: Well, we have to. The Congress mandated the Foundation to do so. This imposed new and severe constraints on our resource allocation within DMS. It's a real challenge when the Congress has required that we do certain things with the money that we have without increasing our budget. We have no choice. If [Congress] is not satisfied with our operating plan, they would not authorize further spending (and NSF was still negotiating with the Congress well into March). NSF is required to spend an additional increment this year in each one of the FCCSET initiatives, and DMS is required to spend incrementally a certain amount on each of them. Every directorate and every division has an assigned investment target on the FCCSET education initiative as well as other FCCSET initiatives.

Notices: I didn't realize it was mandated down to the division level.

Wan: DMS is required to spend an additional sum of $970,000 on education and human resource development in 1993 whether we want to do so or not. This means that all the program budgets for disciplinary research projects will be reduced since there is no budget increase for the DMS this year. We showed the Advisory Committee how each program is affected. We gave some specific details on three programs because they were more or less finished with awards and declinations at the time. For each of the others, which are not quite finished, we have an estimate, and these turned out to be roughly the same as the first three. So every disciplinary program except for Computational Mathematics has roughly the same decline in the number of awards.

Notices: What was the percentage decline in the number of PIs [Principal Investigators], approximately?

Wan: [Note: In early June, after the time of this interview, the budget situation for the DMS was expected to improve somewhat. This was due to the fact that there were unspent reserves in the MPS and the DMS which were returned to the DMS budget. Therefore, the following answer predicts a larger decline in the number of awards than will probably occur. However, specific details about this were not available at the time this issue of the *Notices* went to press.]

[Assuming no return from the unspent MPS and DMS reserves,] the figure is about a 25% [decline] in the number of awards. Some awards have more than one PI, so the answer is probably 15–20%. Now, we did not fund some of the proposals at the normal level. In general we are not awarding a lot of the PIs two full months of summer salary.

Notices: DMS had a 1% drop in its budget this year. Why is there a 25% drop in the number of awards (or PIs supported)?

Wan: There are several reasons; the most important one is the Foundation directive that all the continuing grants must be honored at the original commitment. [This affects about two-thirds of DMS grants.] So, all the burden of reduction is met by the remaining one-third, the new proposals coming in and renewals. It is the practice of many of the program officers to fund junior people who are getting grants of around $19-20,000 by standard grants, which means that we pay the funds for all three years up front, instead of by installments. [Foundation policy dictates that] at least 35% or more grants [be] paid up front, and that reduces the number of awards because when you pay three years at once you "lose" two potential grants. So that's another reason. The third reason is that the program officers do not have as much flexibility as the year before because we require them to fund the "high impact" grants adequately and the outstanding junior investigators adequately. And finally, as the years go by, salaries increase, and a person who's up for renewal has a substantially higher salary now than three years ago. All these factors are having an effect.

Notices: You just touched on aspects of a policy that you formulated for all the programs to follow. Can you explain that policy?

Wan: Yes. On the basis of past experience we normally expect on the average between 10–15% of the awards will be to proposals which are regarded by the reviewers to have "high impact" on the particular field of research. For those awards we insist the program officers fund the proposal adequately—that means if these PIs ask for two months summer support, they'll get it; if they ask for graduate students and/or postdocs, they'll get a reasonable sum for them, and of course some funds for travel and so on. The main thing is that they will be funded at an adequate level to be consistent with the policy of the Foundation. At the other end we also want to make sure that a certain number of outstanding junior investigators are funded adequately. Past experience indicates around 25% of our awards are in that area. The remaining funds available to the program will be at the discretion of the program

officers to fund worthwhile programs in a manner they see as reasonable. For example, if they see a particular proposal deserving adequate funding, they can fund it that way, and if they need to reduce the budget, they would negotiate with the PI for a revised budget. We do not insist that everyone be given two months summer salary for this group, unlike in the "high impact" PIs and the outstanding junior investigators.

The AMS Science Policy Committee has gone over this with me; so has the DMS Advisory Committee. They think that, except for minor adjustments (such as making sure that indirect cost rates of different universities do not play a role in affecting the PI's net funds), this is about as reasonable a policy under the circumstances as one could expect.

Notices: What do the other MPS divisions think of this policy?

Wan: I have told [MPS Assistant Director] Bill Harris about our policy, and he has not indicated any objection so far. Other divisions have other considerations. They often would bite the bullet and fund as many people as they can at an adequate level. If they have a high cut-off rate, they seem to be accepting it. It could well be that for a lot of experimental work you cannot function with a budget that's not adequate; you simply cannot run an experiment unless you have the people to run it. In the DMS the bulk of the money went into summer salaries, and some people may still function with only a fraction of the two months and continue with their research program. One issue that has been deliberated at some length at the Advisory Committee meeting was whether people would still do research during the summer if they don't get the full two months. A lot of people feel they're going to do it anyway; researchers are not going to quit doing research just because they don't have summer support. If you look at the number of people we're supporting, you find it's only a small fraction of the productive researchers in the math community. For this reason, one school of thought would have the available funds spread to support as many deserving proposals as possible with a smaller grant per investigator. The question then would be what incentive would be there for NSF or the Congress to increase the DMS budget to a level which supports all awardees with two months of summer salary; in fact, why should NSF support any summer salary at all if mathematicians would do the research anyway with or without summer salary. These issues were discussed at the Advisory Committee meeting and will continue to be discussed by the science policy committees of the different mathematics and statistics societies as well as JPBM (not to mention the community at large).

I will need some answers to these questions in order to argue for more resources for the disciplinary programs in DMS. For this reason I am thinking about organizing a workshop to bring a group of people together, including some members of the Foundation staff [to explore the issue of what is a reasonable structure and size of a mathematics grant]. They would spend two or three days on this issue to see whether we can arrive at some reasonable conclusions [as well as to address the question of adequate research support for mathematicians other than summer salary and the appropriate size of the research community in the mathematical sciences to be supported by NSF].

There is obviously some relationship between what NSF can do for the mathematical sciences and the science policy of the federal government. For better or worse I see the current research funding position taken by the Congress and the President's Office only as a policy in transition for each. There have been some rapid changes because of the abrupt end of the Cold War and our lack of economic competitiveness. The Congress and the Executive Branch are working hard to reformulate their science policies. The situation in 1992–1993 is only the first iteration of the response to this need for reformulation. Until the policies of the two branches of government converge and reach a steady state, any DMS policy is likely to have to change and adjust to the evolution of the federal policy (or policies). The mathematical sciences community needs to help shape this federal policy. I would encourage the community to respond positively to the national goals and thereby place the mathematical sciences in a positive light. This in turn would generate a favorable climate for the support of mathematical research. The growth of that support is intimately tied to the growth of the basic sciences as a whole.

To respond positively and constructively to our national needs, it is not necessary for everyone to do FCCSET type research. Those who are interested in meeting new challenges are encouraged to do so. The FCCSET initiative areas need the talents and participation of the mathematical sciences community. In general, however, we can contribute constructively and positively without having to change our own field of research; we can do so through a better effort in educating our students.

The Executive Branch as well as the Congress know that to meet some of the national goals we need a better, more skillful workforce. And they also agree that technology, communication, and computing constitute important ingredients of a skillful, educated workforce. I think herein lies a golden opportunity for mathematicians. Mathematical scientists can help the nation toward its national goals by devoting more effort to undergraduate and graduate education besides producing more replicas of ourselves for academic positions. Another area where we can contribute would be to work with the teacher-training community to produce more computer-literate school teachers for our schools. Mathematicians could make important contributions to these national needs without changing the focus of their current research.

My own observation in the five months I have been here is that there is not much payoff in trying to tell the Congress how important basic research is or how important it is to have a balance between support for basic research and applied research. I doubt if most members of the Congress or their staff really understand what research mathematicians do, or agree to their importance if they do. For most of them the main interest in mathematics is in mathematics education, especially at the school level (as both Walter Massey [former NSF director] and Avner Friedman [president of the Society for Industrial and Applied Mathematics] learned from first-

hand experience during their Congressional testimonies on the NSF budget). There will be a much bigger payoff in terms of research support for all mathematical sciences if we can make visible progress in the mathematics education of all scientists and engineers (and not just future mathematicians). Our effort in calculus reform and the availability of the "NCTM [National Council of Teachers of Mathematics] Standards" have already put us ahead of other disciplines in the arena of science education.

Notices: You didn't take this job at a very easy time did you?

Wan: No. But on the other hand, I think I'm the type of person who does not think of good time versus bad time. Everyone knows that resources are tight; it is a matter of how to make the best of a difficult situation. So I do not see it as much as a difficult situation as it is a challenge of doing something useful for the community. My first goal has been to help myself and the community understand the situation better and focus on what needs to be done to make progress. To figure out how to do them is in itself a challenge. It is the challenge that makes the work interesting, and the importance of the issues involved that makes the task worthwhile.