Presidential Views: Interview with James Arthur

Every other year, when a new AMS president takes office, the *Notices* publishes interviews with the outgoing and incoming presidents. What follows is an edited version of an interview with James G. Arthur, whose two-year term as president ends on January 31, 2007. The interview was conducted in fall 2006 by *Notices* senior writer and deputy editor Allyn Jackson. Arthur is a University Professor of Mathematics at the University of Toronto.

An interview with president-elect James G. Glimm is scheduled to appear in the March 2007 issue of the *Notices*.

Notices: *What were your main activities as president?*

Arthur: One was the Einstein Lecture Series, which we started in 2005. That year was the 100th anniversary of Einstein's so-called *annus mirabilis*, in which he published three fundamental papers that changed the course of twentieth century physics. The idea is to present some aspects of mathematics in the broadest possible sense to a large public audience who might not realize how encompassing mathematics is. We have been very lucky to have people who have made it a great success so far. Michael Atiyah gave the first Einstein Lecture in October 2005 at the University of Nebraska, a brilliant talk on relations of mathematics with fundamental physics. It was a huge success, with eight hundred people in the audience. Much of this we owe to the people at the University of Nebraska. John Meakin was chair, and he and others there did a wonderful job. Benoît Mandelbrot spoke at San Francisco State University in May 2006. That was in a smaller room, with a capacity of four hundred, but it was filled. He gave a remarkable lecture. I was not familiar with his work, so it was really a revelation for me to see the following that he has. After the lecture thirty or forty people crowded around the podium and wouldn't let him leave for half an hour. They treated him a bit like a mathematical rock star. The next Einstein Lecture will be at Rutgers University in the fall of 2007, and we are very pleased to have Roger Penrose give that one. The fourth one will take place in the fall of 2008 in Vancouver.

Notices: *So you were thinking a lot about the Einstein Lectures. What else did you work on?*

Arthur: Among the things that have taken time have been activities related to the policy committees. The president serves on all five policy committees. For the Science Policy Committee, this has been a pretty interesting time in Washington. Sam Rankin runs the Washington office. After some years of doing this, he has a very good understanding of how Washington works and how best to make the case for mathematics. There has been a turnover at NSF [National Science Foundation]: Peter March is now director of the DMS [Division of Mathematical Sciences], and Tony Chan now heads MPS [Directorate of Mathematical and Physical Sciences]. These are two prominent mathematicians whom we feel fortunate to have serving in these positions of leadership. We are looking forward to seeing what directions they take over the next few years. NSF is critical for many, though not all, of our members. It is the agency that puts the most funding into the mathematics that our members do. However, I think that it also has larger symbolic importance.

The Bush administration came to a conclusion earlier in the year that the teaching of mathematics was of great strategic importance and created a panel to examine it. There have been various meetings about this. We have tried to use it to make mathematics a part of the broader discussion in Washington.

Notices: *Were you or the AMS Committee on Education involved in the appointment of the panel?*

Arthur: I was not, and I don't believe the Committee on Education was. The COE has been involved in other related things, for example, in the work of a committee chaired by Richard Schaar. This committee attempted to reach an agreement among research mathematicians and mathematical educators about what would be an appropriate curriculum for kindergarten through eighth grade. They produced what seemed to many to be a very sensible list of recommendations. This is now getting wider discussion, and I would expect it is

part of the deliberations of the national panel for mathematics education.

The COE has in recent years been concerned about K-through-12 education, although traditionally the focus was more on undergraduate and graduate education in mathematics. Many of our members are worried that the level of preparation of the students they see is not what it used to be. But I think the long-term focus of the COE really ought to be undergraduate and graduate teaching.

Notices: *Can you tell me about your work on the Council and the Board of Trustees?*

Arthur: It has been generally a great pleasure. I chair the Council and the Executive Committee, and I also serve on the Board of Trustees. The Board is involved in any matter that is financial, whereas the Council deals with all other matters before the AMS. People don't realize that the AMS has a budget of something like US$23 million. In principle, how that money is spent is at the discretion of the Council and Board of Trustees, which are elected by the 30,000 members. So the work of the Council and the Board is very important.

One example of something that occupied a great deal of time was the question of whether there should be a fellows program in the AMS. Many other professional societies have such a program, whereby members who have achieved great distinction are designated as fellows of the society. For good reasons, mathematicians feel very strongly about this, in both directions. An AMS committee, chaired by Susan Friedlander, made an explicit proposal for an AMS fellows program. The proposal was discussed at the Council meeting in San Antonio [in January 2006], and it was really quite impressive how thoughtful people were. Whatever their views—and they were strong on both sides—people had a very good idea of and respect for the views from the opposite side. In the end the Council decided to put the matter up for a vote, with the pretty tough requirement that the proposal would go forward only with a two-thirds majority of the voting membership. This will have been resolved by the time this interview appears in the *Notices*, but as we speak today, the polls are still open. There are no exit polls, so we don't have any idea how it's going! But indications are that there is an extremely heavy vote, perhaps much greater than in any other election. Whichever way it goes, I hope we will be the stronger for it. I think discussion of matters like this is very healthy for the AMS, and I trust that members will respect whatever decision is eventually voted on.*

Notices: *You see many aspects of the culture of mathematicians come out in the debate over the fellows program.*

Arthur: Yes, you do. On the one hand, mathematics is somewhat hierarchical, more so than in other subject areas, perhaps because it's easier to assess how important mathematical discoveries are, and so there is perhaps less dispute about them. On the other hand, mathematicians have a strong egalitarian streak. Both are influencing the discussion. The discussion of the fellows program has perhaps symbolized these sometimes contradictory feelings. ***Notices:*** *What challenges do you see for the AMS?*

Arthur: One challenge is attracting younger members, who are not joining the AMS in the numbers that they used to. The AMS has to persuade them somehow that it is important to their concerns and that as mathematicians they are better off being members of the AMS. There are many concrete ways the AMS serves mathematicians. What people think of less is that the AMS is also a network of moral support for mathematicians. It is a way of banding together to make the case for mathematics to others, but it also serves to amplify our own very personal feelings for the subject. We see other mathematicians at meetings, read their papers in journals, and even just know that there are many who share the same values we do and who are part of the same enterprise. Knowing that there are others in the society you belong to who love mathematics and who are working on many of the same concerns that you have can be potentially a very powerful force of encouragement for individual mathematicians.

We also have a problem of membership among the most senior and distinguished mathematicians, who do not always remain members. Perhaps this has always been the case. I worry that some people may not see the AMS as being relevant to their mathematical interests, a view that I think is not at all correct. We need to persuade senior distinguished mathematicians to join so that at the very least they set an example for young mathematicians.

Notices: *You have been concerned about public awareness in mathematics. What do you see as the AMS's role here?*

Arthur: The AMS has a Public Awareness Office, and there are just two people in it. They do a very good job, but the size of the operation precludes very many major projects. They create wonderful Web resources on the AMS site: Mathematical Moments, Mathematics in the Media, and several others as well. Many people don't know about these things. It would be useful to try to figure out some way to make them more visible, both to our members and to nonmathematicians.

There is some interest now on the part of the Clay Mathematics Institute and other institutions of working with the AMS on the public awareness of mathematics. One idea is to figure out a more systematic way, perhaps a training session, for mathematicians to learn how to talk effectively about mathematics to the media. When we mathematicians talk about mathematics to a broader audience, in particular to the media, we see our

colleagues peering over our shoulders, and we think anything we say is going to be criticized for inaccuracy or grandstanding, and probably both!

But I think this is changing. Mathematicians are now coming to the view that any publicity within reason for mathematics is good. Our greatest enemy in the past has simply been the total ignorance of how important mathematics is. For example, the coverage of the recent proof of the Poincaré conjecture tended to focus on the controversy and also on the idiosyncrasies of the individuals involved. We shudder a bit at that, perhaps feeling that it is not doing the subject any good. I think that this perception is incorrect. It may be that the human side of the subject is needed as a hook to get the public interested.

Notices: *Often it is difficult for mathematicians to communicate the beauty and mystery of their subject.*

Arthur: Those are the things that appeal to mathematicians, but they also potentially are of great appeal to the public. I think the excitement over the Poincaré conjecture and Fermat's Last Theorem taught us that there really is a public appetite for deep mathematics. I think the public is prepared to be astonished by the mystery and the beauty of mathematics. Often when mathematicians try to speak to the press, there is a disconnection between their own motivations for their work, which are probably much closer to what the public could identify with, and how they express the mathematics, which tends to be in rather formal and technical terms.

Notices: *Any final thoughts?*

Arthur: I sometimes worry that every new president is going to feel an expectation that he or she create something new, a monument, that will be grafted onto the AMS. The motivation is of course good, and it is certainly the way I felt. In fact, I know that during my early days I had some pretty harebrained schemes! At times I must have made life difficult for John Ewing and Bob Daverman! John is the AMS executive director, and Bob is the AMS secretary. They are extraordinarily good at what they do, and it is a great privilege to serve with them. But the AMS president is first and foremost a public spokesperson for the AMS and, by extension, for mathematics itself. One important role for the AMS, as I mentioned before, is to be in subtle ways a moral support to mathematicians. The president of the AMS is in an ideal position to bring this out.

I am looking forward to Jim Glimm taking over as AMS president. He has some interesting ideas for the future of the AMS and a great deal of energy and dedication. There have been some really wonderful presidents in the past—I would mention my predecessor, David Eisenbud, to whom I am very grateful for helping me learn the job. And there have been others, going back ten or fifteen years, who, partly with the AMS staff and partly through their own efforts, have brought the AMS into a position now where it is an extremely well-run organization. Just look at publications, for example. We publish a number of journals, including one, *Journal of the AMS*, which is arguably the best—or the second or third best—mathematics journal in the world. This is the work of a democratically elected scientific society! We also publish other journals that are important, and they are all sold at reasonable prices. We also have Math Reviews, an extraordinary database used all over the world. These are things for which the world mathematical community relies on the AMS. I mention them to point out that the AMS really is a remarkable organization. There is no doubt room for improvement, but we should also not forget that we really do have something quite special.

I should say that I am also proud to be a member of the Canadian mathematical community. The Canadian Mathematical Society [CMS] works closely with the AMS. Canadian mathematics has really blossomed in the last thirty years. There are also some very good mathematicians in Mexico, and it is good to see relations developing among three North American societies: the AMS, the CMS, and the Mexican Mathematical Society [MMS]. The MMS invites two or three AMS representatives to come and speak every year at its annual meeting. There is also going to be a joint meeting next year between the AMS and the MMS in Mexico.

We collectively as mathematicians should be pretty excited about what's happening in our field. In the past ten years there have been two extraordinary mathematical breakthroughs. We have seen a proof of Fermat's Last Theorem, which, even though it has a very simple statement, uses some of the deepest mathematics ever discovered. We now have the Poincaré and geometrization conjectures apparently resolved, with a union of analysis and geometry and topology that would have been absolutely unheard of thirty years ago. These both—with apologies to Andrew Wiles and Grisha Perelman!—now belong to all of us. We should not lose sight of the fact that these are remarkable times in mathematics. The AMS is a part of it all. It plays a major role in helping all mathematicians—not only its members, but mathematicians the world over—better serve their profession.

*Added in postscript: Of members who voted on the fellowship program, 63.2% were in favor, a figure that falls just short of the required two-thirds majority. Besides being very close, the vote was substantially larger than for any election in recent memory. My reading of the results is that the question will remain with us for some time. —*J.A.*, Dec. 2006.*

Interview with William Rundell

William Rundell served as director of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) from the fall of 2002 until the summer of 2006, when he was succeeded by Peter March of the Ohio State University. Rundell has now returned to his home institution, Texas A&M University. What follows is the edited text of an interview with Rundell conducted in fall 2006 by *Notices* deputy editor Allyn Jackson.

Notices: *What was the budget climate like in the NSF when you went there in the fall of 2002?*

Rundell: The first year was an incredible roller coaster. Over the previous forty years, DMS had gone up roughly with NSF, but probably a percentage point or two behind per year. You see little blips of inspiration. For example, after the David Report [published in 1984] there was a little budget boost. After some of the experiments the DMS did in the early 1990s, there was a decline—they didn't sell well. But this was tinkering with percentages, not major structural changes. But with the Mathematical Sciences Priority Area being declared and with [then-NSF director] Rita Colwell's promotion of it starting in 2001, the DMS went from about US$100 million up to US$150 million at the start of 2002.

The [fiscal year] 2003 budget was waiting to be passed by Congress when I came in. There was a US$30 million request from NSF for the priority area, and in the Senate version of the bill someone had written in that DMS would only get a US$10 million dollar request rather than US$30 million. There was a big fight over this and an ensuing battle to try and restore the US$30 million dollars. For the first several months it wasn't clear whether we were getting the US$10 million or the US$30 million. But that got resolved positively, and we got the US$30 million increase, so the DMS budget was US$180 million.

In December 2002 the president signed the authorization bill to double the NSF'S budget in five years. This meant DMS surely would get at least the NSF average increase. We had already almost doubled the DMS budget, and in fact at the end of that next fiscal year it was going to be US$200 million. If we got the doubling after that, it would be US$400 million, and we would be in great shape. There was a sense of euphoria around the NSF that we had seen some good times, and they were going to get better.

You can achieve a doubling of the budget in five years with an increase of 15 to 18 percent per year. Instead, we got 2 percent. That burst the bubble. In subsequent years the NSF had a flat or declining budget. Things changed very quickly around the foundation. All the plans—you just saw them getting shelved. People were in the mode of, What can I cut?

Notices: *How did DMS deal with these changes?*

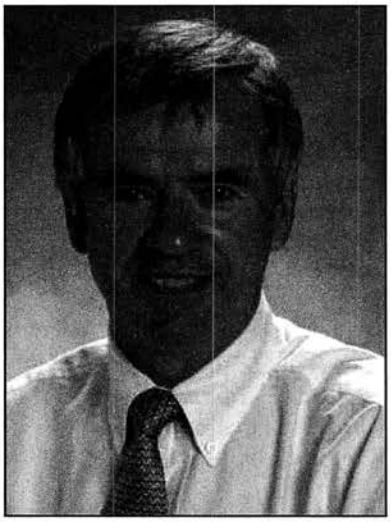
Rundell: Well, it certainly was problematic. It did cramp us making new programs. So for example, I inherited VIGRE [Vertical Integration of Research and Education]. VIGRE was being run at a pace that was commensurate in the long term with probably a US$300 to US$400 million budget. It was a very popular program in the foundation and Congress. The DMS was tackling the obvious problem of how to get U.S. citizens into science, in particular hard sciences. We were at least trying to do something about the problem, and there was a certain sympathy for that. So to cut off VIGRE would be stupid, and yet we had a program that required an increasing budget for its sustainability at then-current levels but that was overgrown for the actual budget. I also knew that VIGRE shouldn't be sustained. VIGRE was there to transform, and after that had been achieved, it had to be mainstreamed. So I brought in the Research Training Groups, which are similar to VIGRE but done within a smaller group. I thought this could be a useful addition to VIGRE and possibly an answer to, what will VIGRE transform into? At that time I had no idea what the budgets were going to be like in future years. But there was no intent

to cut the amount of money being spent on work force programs.

The DMS's move to put in a high-profile program to attract domestic talent into the discipline was a really, really important move. You can argue endlessly whether VIGRE was a good program or whether it was implemented well. But I think it's absolutely clear that the attempt to do something was viewed very positively.

Notices: *You did not cut the work force budget during this time. What did you cut in DMS?*

Rundell: Basically what we did was, we kept everything flat. I was an optimist, and I think we are probably going to see now better times ahead. It takes time to put programs in, and when the money does come, sometimes you have got to have an idea for grabbing it. To sit back and do nothing until good times come along isn't necessarily a good strategy. So a certain optimism has to be there.



William Rundell

But when I came in in 2002 the number of expansion programs already in place through the priority area was huge. We didn't need more programs as much as making sure the existing ones were working well. We were doing business with every single research directorate in the foundation, partly through the priority area, but partly just through regular business. We were working with NIH [National Institutes of Health]. The DMS interaction with NIH is by far the largest interaction that has ever taken place between the two agencies.

Notices: *You mean even between the NSF biology directorate and NIH?*

Rundell: Yes. When biology puts something together, it's a few million dollars, and it lasts for a fixed period. We have been running this for five years now, and we are going to continue it. The level of money has been around US$20 million, of which NIH has been putting in US$2 to our US$1. This is a huge program by almost any standards. During a visit to Congress, NIH director Elias Zerhouni gave three examples of NIH's innovation, and one of them was the interaction with DMS. So that is high value, and it's something that is a success.

Notices: *Most mathematicians believe PI grants are the most important part of the DMS. How did PI grants fare in this budget climate?*

Rundell: I'd rather not call them PI grants, although it is a good term. I would call them single-investigator grants. They include summer salary support, travel, sometimes graduate student support and visitor money. These are sometimes complicated grants. If you take any block of time from NSF's beginnings to now and you ask, what were the best years for DMS single-investigator grants or for senior researcher increases?, the answer is the period of 2001 through 2005.

Notices: *You mean in terms of numbers of PIs supported?*

Rundell: No—the amount of money in it. The number of single-investigator grants went up somewhat, maybe 10 percent. But the amount of money available in the grants went up considerably. Before that time, we were really cutting back on the amount of summer support. It was basically a month, maximum. We are now giving junior people two months, and senior people sometimes a month, but often a month and a half and even sometimes two months. We are much more likely to give generous travel, and we are giving money for bringing in visitors. The value of the grants went up enormously. The foundation had been worried not just about the lack of support for mathematics in general but about the low value of each grant. So in the priority area there were goals of increasing the money available globally to mathematics, about the work force, about interactions with other disciplines, and about funding grants at a better level. The next level of priority would be to increase the number of awards. But that was never one of the main priorities.

And remember inflation here is a huge factor. You view inflation costs as being 2 percent, right? But in fact the inflation costs that DMS was seeing were nearly 6 percent.

Notices: *Why?*

Rundell: The average raise in universities is 2 or 3 percent, but the stars are getting 6 or 7 percent raises. They are getting a 10 percent promotion raise, and if they move, they are getting a big hike in salary. These are the people we are funding. The single biggest thing we pay is single-investigator grant salaries—and you add on fringe benefits and indirect costs, which are prorated to the increase in salary. So the whole budget goes up basically as that block. We need in other words to double the budget every eleven or twelve years just to stay even.

One of the drivers of the priority area was to improve graduate student support. The numbers are difficult to come by, but I would say that essentially we doubled the amount of money spent on this. All of my predecessors and I worried enormously about what damage inactivity here was doing to U.S. mathematics. We knew that if we didn't do something for graduate student support, then we would not be able to attract the best students from

abroad, and we would not send a good message to domestic students. And we will suffer in the long term.

If we had US$400 million, we would use part of it to enrich the grants, we would support more graduate students, we would support more postdocs, and we would manage to slightly increase the number of people supported. It would be nice for mathematicians to have the same level of support as chemists, biologists, computer scientists, and physicists—but not on US$200 million, not on US$300 million, and, to tell you the truth, not on US$400 million. The idea of spreading it like butter doesn't look like we are supporting the best stuff. We would be perceived as not making the decisions, but just giving it out almost like a charity.

Notices: *Few mathematicians get grants. Does this inspire apathy among people who feel they will never have a chance to get a grant? Does this apathy mean a lack of pressure to increase the budget for math?*

Rundell: Sure. It's a vicious circle. About half of DMS support goes to about twenty universities, three-quarters goes to forty universities, and so on down the line. That means that the stakeholders are relatively few in number. If we spread the money out, would it make a difference? Yes, but then the amount of money would be so insignificant it would not be on the radar map. But I think it is probably true that the mathematicians who get the money aren't pulling their weight for justifying us to get more. And on the other hand, those people who are disenfranchised have no incentive to do that.

We don't make the case. If you find a staffer on Capitol Hill who has a science background, I would guess there is a 50 percent chance the person is a physicist. I don't know what the chance is that the person is in mathematics, but it's less than 10 percent. The fact that a lot of information flow is coming through the physics community and is filtered by that perspective is on the long haul going to make a difference for that discipline. It's not just that we don't work Capitol Hill well enough. We don't work the whole process. Math departments in universities are notorious for not promoting themselves as well as they should. It goes beyond just federal funding. It's that the discipline doesn't promote its case well enough, whether at universities or for the funding situation.

So the problem isn't that the US$200 million budget is small. The problem is that we haven't been proactive in promoting the discipline, and that's why it's small. And it is criminally small. But I think the fault here is not the outsiders. We are in a situation where you have to promote yourself, and we just haven't done that effectively. We haven't done it effectively in a sustained way, the way others have.

Notices: *Some say that while the people who go to DMS are good and dedicated, they are not at the top of the field. How would you respond?*

Rundell: I am going to react strongly to the insinuation that the program officers aren't coming from a good research background. One of the things I worked at enormously hard was recruiting. We were not hiring people who we were not supporting. These are people who have a long history of support. We have got people who have been graduate chairs and chairs of departments, some of them very good departments. I don't think we need to get Fields Medalists to come in to be program officers. But we absolutely have been hiring people who not only are potentially fundable but have been funded by NSF. So the people making the decisions are on average quite a bit better than the people submitting proposals. They don't have to be at the very top of that list, but they are certainly better than the average submitting mathematician. And several of them have absolutely stellar records of research. You've got to print this in 24-point bold, that the people making decisions are people who have been successful.

It's very hard to recruit. In academia—and hiring at NSF is like hiring in academia—if hiring is not the hardest thing you are doing, you are not doing it well enough. It's going to be hard, because you are looking for better and better people all the time. One of the things I spent a lot of energy on at the NSF was to get every permanent program officer a window office, get everyone a nice office, and give them a lot more time to do their own work, and fairly generous travel money. The program officer environment is actually quite good, and the people we have been getting are really very good.

I had dealt with NSF a lot before going there. I had been on panels, I had a long history of NSF support for my own work, and I was a VIGRE PI. So I felt I knew NSF to some extent, and I felt very good about it. That's why I went. Did I feel better or worse about NSF after I left? The answer is, I felt even better. As an institution, it's absolutely without question the best funding agency on the planet. It's totally professional, and the dedication of the people really is high. And the quality of the people is much higher than the outsiders think.

You submit a proposal to NSF, and the level of justice you get is superb. DMS gets 2,700 proposals a year. I am not saying that every single one of those is handled superbly. That would be impossible. But the level of professionalism and the number of those proposals that are handled in an absolutely first-class way is astoundingly high. And I think the important factor is that there are good people. That's why it works.