An Interview with David Bressoud, MAA President

Ivars Peterson

David Bressoud is DeWitt Wallace Professor of Mathematics at Macalester College. He served in the Peace Corps, teaching math and science at the Clare Hall School in Antigua, West Indies before studying with Emil Grosswald at Temple University and then teaching at Penn State for 17 years, eight of them as full professor. He has held visiting positions at the Institute for Advanced Study, the University of Wisconsin-Madison, the University of Minnesota, Université Louis Pasteur (Strasbourg, France), and the State College Area High School. Bressoud served as MAA's President-Elect in 2008 and is now President of the Association.

Ivars Peterson: Were you interested in mathematics at an early age, or did that develop later?

David Bressoud: It really started for me in seventh grade. I was extremely lucky to have a great seventh-grade teacher who realized I had an aptitude for mathematics. He encouraged me to come in after school, and he gave me good, challenging problems to work on.

> *"The times when I am happiest are when I am working on a book."*

Between my junior and senior years of high school I participated in Albert Wilanksy's NSF summer program at Lehigh University. I grew up in Bethlehem, Pa., so it was easy to get to Lehigh. I remember the program vividly. They gave us great problems to work on. You'd go in for three or four hours every day during the summer and spend the rest of the day just working on those math problems.

I was intrigued by mathematics, and I knew I was good at it. But when I got to college, I wasn't certain I was going to major in mathematics. I was at Swarthmore, so I took lots of different courses in lots of areas. I went through a severe sophomore slump and decided that I wanted to get through college as quickly as I could, so I decided to finish up in three years. Having decided that, I didn't have much choice other than a math major. That was the easiest way for me to get a degree.

IP: After you graduated, you went into the Peace Corps.

DB: I wanted to get out of college. By the time I graduated the one thing I knew I would never do is go back to graduate school. I didn't bother taking the GRE, and the Peace Corps was a great way of getting overseas and feeling like I was doing something useful. It also gave me two years to decide what I wanted to do. So I was in the West Indies on the island of Antigua teaching at the Clare Hall School. I was their first math and science teacher… It was a great experience.

I found that I missed mathematics while I was there. I had stayed in touch with Dave Rosen [from Swarthmore]. He kept sending me problems from the *Monthly*, and I'd taken a couple of my textbooks from Swarthmore… When I decided to do some mathematics on my own, the first thing I did was to solve every single exercise in [Gemignani's book on point-set topology]. That really helped me understand proofs.

I had never taken a course in complex analysis as an undergraduate, so I had picked up a copy of Nevanlinna and Paatero's book on complex analysis. I decided to work out every exercise, but it was so frustrating. I'd read a section and try to do a problem, go back and reread the section to try to figure out what was going on. I made virtually no progress. But when I did go to graduate school and took a course in complex analysis, suddenly all the pieces fell into place. I had done all that spadework in advance to try to figure out what's going on. When I then got into a class it went beautifully for me, and I fell in love with complex analysis.

IP: Once you got to graduate school, your interests went more in the direction of number theory and combinatorics.

DB: They did. My undergraduate record was not that strong. Dave Rosen had suggested that I apply to Temple University and connect with Emil Grosswald. He and Jim Stasheff were the two outstanding mathematicians at Temple at that time. I took that complex analysis class in my first year with Grosswald, so it became natural to follow him. I knew nothing about number theory when I got to graduate school. I really went after the person, not the subject.

IP: What was it about number theory that captured your interest?

DB: I love the simplicity of the questions: how you can compose questions that are so easy to state and then draw on so many different areas of mathematics. That's what I've loved my entire career working in number theory and other related areas of mathematics. You get to see how the different parts of mathematics tie together and how you can get an answer from an unexpected direction. I could tie my discovery of complex analysis to these questions of number theory and see how very concrete questions about the structure of the integers can be answered by doing sophisticated work in complex analysis.

Things like the prime number theorem excited me. So my initial intention was to work in analytic number theory because that's the area that Grosswald worked in. But in my thesis I started moving toward enumerative combinatorial number theory, and that's the direction I took off in.

IP: A lot of your interests now are in the teaching of mathematics. Was that interest there from the start?

DB: Teaching in the Peace Corps was something I loved doing. I realized that at heart I'm a teacher. I also realized during the Peace Corps that I missed higher mathematics, that I would not be happy teaching at the high school level for the rest of my career. When I first went to graduate school, I didn't expect that I'd become a research mathematician. My plan was to get my PhD, and work with future teachers. Then I was bitten by the research bug. That was my focus at Penn State for many years. I was always a good teacher, and I put a lot of attention and effort into my classes, which were important to me. But the research was also there.

There came a point in the late 80s when I realized that staying on the cutting edge of research was more of a drain than a reward for me. I wasn't enjoying having to bring something new to every research conference, and I wasn't enjoying putting together the proposals to NSF or NSA for funding. The search for grants was something that I worried about excessively.

I made a very conscious decision in the late 80s that I would do what I really wanted to do. I was a full professor at this point. I was getting more interested in teaching; I was thinking about how to put together a number theory course that was based on factorization and primality testing. I wanted to write textbooks…

In my last year at Penn State, 1993–1994, David Smith from Duke had a sabbatical there. That was a transformative experience for me. David was so enthusiastic about teaching and had such great ideas about how to do it effectively, to be able to spend an entire year with him was great. We regularly went to lunch together and talked about what was going on in our classes. I was trying out his Project Calc material, then talking over what was happening in the classroom directly with him and getting ideas from him. That's what convinced me that Penn State was not where I needed to be.

I needed to be in a place that had a strong focus on teaching and a community of people for whom teaching was what they were most interested in. And that meant Macalester College. Macalester in many ways was a very natural fit because I knew Wayne Roberts; I had interacted with him through the calculus reform movement. Also, my wife is from St. Paul and her mother just happened to live a mile from the college.

IP: You have done quite a lot of writing, especially books.

DB: It started with my book on factorization and primality testing, which came out of teaching the course. For years I went to the West Coast Number Theory Conference. The people who were working on factorization and primality testing during the 80s all went to that meeting. So I learned a lot about what was going on, and back in the early 80s the methods were very simple. They were methods you could teach in an undergraduate course. So I got the idea of building an undergraduate number theory course around the problem of how you decide if a large integer is a prime or not, and if you know it's not prime how you find its factorization. After teaching the course for a few years, I ended up turning my set of notes into a book.

I found that I enjoyed that, and almost immediately started working on *Second Year Calculus*, looking at vector calculus from a historical point of view… I enjoyed writing that book so much I couldn't stop. I think the times when I am happiest are when I am working on a book, to be able to immerse myself in the research and the writing. I especially love the

rewriting. I like to spend time on how the words sound as well as the structure.

IP: How do you see your role as President of the MAA?

DB: It's a great opportunity to be able to talk about and have some influence on the issues that I care about, in particular undergraduate education. I love the fact that we've got this organization for which the emphasis is mathematics at the undergraduate level, communicating the excitement of this mathematics to a broad audience and thinking about how we can teach it more effectively.

We need to rethink what goes on in undergraduate mathematics. I think we've been tied exclusively to supporting the engineering colleges for too long. There are so many exciting opportunities and challenges out there for mathematics to broaden its involvement with the biological sciences and the social sciences. I want to see that pushed, and this is an opportunity for me to do that.

The complete interview is available online at http://www.maa.org/news/010209bressoud.html.

Ivars Peterson is the MAA's Director of Publications for Journals and Communications.

Call for Proposals

MAA, Tensor Foundation, and SUMMA

Grants are available to support:
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The Tensor Foundation has provided funding for the MAA to award grants for programs designed to encourage the pursuit and enjoyment of mathematics among female middle school students, high school students, and/or beginning college students, and among those from other groups traditionally underrepresented in mathematics. College and university math faculty and their departments and institutions may submit proposals. They should collaborate with secondary and middle school mathematics faculty, as appropriate. Proposed programs may replicate existing successful programs, adapt components of such programs, or be entirely new.

For more information on grants to support women in math, please write to ffasanelli@verizon.net, or visit:
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The Wolfram Demonstrations Project

Olivia M. Carducci

I have never felt compelled to evangelize about a mathematical tool before. Oh sure, I love to talk about my research and my teaching innovations, and I like to publish my work so others can read about it. But I understand that not everyone is as interested in my work as I am. However, the Wolfram Demonstrations project is so far-reaching and so exciting that I am spreading the word to everyone I know who has any connection to mathematics. I have barraged my colleagues, my children's teachers, my students, my children, and some of my children's friends. And now I'm writing this article.

The Wolfram Demonstrations project is a web site at http://www.demonstrations.wolfram.com with thousands of *Mathematica*® Demonstrations on an amazing range of topics. A Demonstration is a *Mathematica* notebook that takes advantage of *Mathematica*'s Manipulate command. The Manipulate command makes it astonishingly easy to create sliders or buttons or checkboxes that change the values of parameters in the displays in the Demonstration. The result is a user-controlled animation. The other key to this project was the development of the *Mathematica* Player, which allows those without access to *Mathematica* to run the Demonstrations. This makes the Demonstrations available to my students, high school teachers, elementary school children, in fact anyone with Internet access.

Demonstrations are available on topics ranging from odd and even numbers to odd and even functions, from fractions to fractals, and from linear functions to linear algebra and linear programming. A recent search on "differential equations" yielded over a hundred Demonstrations. A search on "statistics" yielded over 200! In addition to mathematical topics, there are Demonstrations illustrating the time in different cities around the world, global demographic information, and the solar system. There are two different hangman games. The possibilities are endless.