AMS Celebrates—and Worries

The American Mathematical Society is concerned about the dwindling supply of U.S. mathematicians

THE AMERICAN MATHEMATICAL SOCIETY celebrated an uneasy centennial this August. Despite the current vigor and remarkable record of research in the United States, there is concern among the AMS leadership that American mathematics is running out of gas and risks settling into second-rate status during its second century.

The chief concern: a lack of support for mathematical research, which is discouraging many already in the field and dissuading young people from entering. "American mathematics is strong—way out of proportion to its numbers, way out of proportion to its level of support *today*," Edward E. David, Jr., a former science adviser to President Nixon, said in an opening address at the AMS centennial. "But will it be able to *sustain* and *renew* itself in the future? Unfortunately, that problem has not gone away. It is in fact more pressing than ever."

Should anyone outside the mathematics community care? David says yes: "Mathematicians follow abstractions where they lead. But they invent mathematics with powerful uses in the real world, and they do it in an astonishing percentage of the time." The question is whether or not there will be enough mathematicians to explore the possibilities.

In 1984, a National Research Council committee chaired by David issued a scathing assessment of then-current mathematics funding. "The country had undernourished mathematics research to the point that it was in danger of not being able to continue its role," David says. The mathematical community has made progress in the last 4 years—including a 50% inflation-adjusted increase in federal support, with a doubling in the number of graduate students and postdocs being supported—but still has "a long way to go, and the hour is late."

The major shortfall is in the number of senior investigators receiving government research support, which is essentially unchanged since 1983. William Browder of Princeton University, a member of the David committee and currently president-elect of the AMS, estimates that between 4000 and 5000 members of the AMS are engaged in research potentially qualified for support. The David committee had set a goal of 2600 senior investigators by 1988. Instead the number has remained at around 2000. Some Ph.D.-granting mathematics departments have no one on their faculty with outside research support. The result, Browder says, is a "darkening mood" among young and midcareer investigators. "People in the pipeline are getting squeezed."

Edward E. David, Jr. *He says the mathematical community has made progress but has a long way to go.*

That squeeze, many feel, is partly responsible for what they regard as a dangerous decrease in the number of Ph.D.'s in mathematics granted to American-born students. In 1987, fewer than half the roughly 800 Ph.D.'s in mathematics given by U.S. universities went to U.S. citizens; 10 years earlier the figure had been three-quarters. A large percentage of graduate students is currently coming from the People's Republic of China; "the fraction of the best [graduate students] is even higher," Browder says. "We're in the situation of an intellectual trade deficit." Right now, he adds, the United States benefits from the influx of foreign mathematicians, but European schools will soon compete for candidates. "We're basically at the mercy of other countries," Browder says. "Even a small action on the part of the Chinese would put us in trouble."

The dwindling supply of mathematicians has led the mathematical community to an increased interest in educational issues. Kenneth Hoffman, who heads the Office of Governmental and Public Affairs at the Joint Policy Board for Mathematics, points out that mathematics is a $23.5 billion per year operation in the United States; of that, the .5 goes to research, the 3 goes to college education (calculus being the mainstay), and the 20 goes to elementary and high school education. More research mathematicians are taking note of where the bulk of that money goes and want to see a better "return" on it.

The National Research Council established the Mathematical Sciences Education Board in 1985, with primary and secondary education as its main concern. The MSEB and another NRC Board, the Board on Mathematical Sciences, have jointly sponsored a project called MS2000 to study collegiate mathematics education. The MSEB and MS2000 will issue a first "Report to the Nation" next year on the state and future of mathematics education in the United States. Hoffman expects the report to jolt the mathematics community even more than the David report.

Mathematicians are also concerned more than ever with their "image problem," which they feel contributes to their funding woes. Far more than other sciences, AMS leaders say, mathematical research is "invisible" to the general public. The public perception of mathematics is conditioned by public education in mathematics, which leaves all too many people with a negative attitude toward the subject. "Math is one of the few disciplines where you can gain support by saying you can't do it," says Ronald Douglas of the State University of New York at Stony Brook.

In spite of the grim forecasts, there is agreement that mathematics is still flourishing in the United States. "This is the *era* of mathematics that we've entered," Hoffman says. It is hard to tell when the crunch will come—"in terms of the intellectual output, you don't feel it right away," Hoffman adds. Browder notes that a former student recently called him with some bad news and some good. The bad news was he had just lost his grant. The good news was he had just proved some theorems. On balance, Browder says, his student was happy with his work. "The fact that the field is very exciting scientifically keeps people going."

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