# Profile of a Field: MATHEMATICS

## Heroism Is Still The Norm

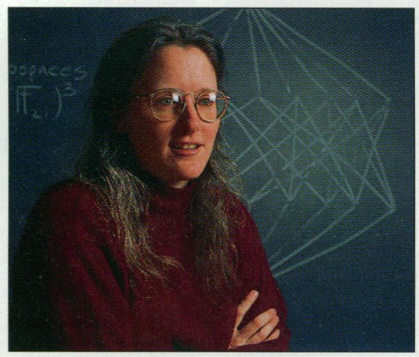
by Paul Selvin

Lynne Butler, a 32-year-old assistant professor of math, is leaving Princeton University—one of math's elite bastions—for Haverford College. "There's a perception in the math community that I'm taking an enormous step down for no reason," she says. But, in fact, there are good reasons why Lynne Butler is leaving Princeton. Indeed, her time there seems to have been something of a nightmare—because she's a woman. "While in the hall, one junior faculty came up to me and said, 'I feel bad about it, but I really do feel women are genetically inferior in math'....Other junior faculty would say similarly upsetting things....I'd thank them for sharing their personal prejudices with me." Eventually, Butler says, "I just locked myself in my office and didn't come out for 4 years."

The kind of up-front sexism Butler encountered in the halls of Princeton's math department is on its way out in most areas of science. Yet it survives in mathematics, along with less overt—but pervasive—form of discrimination. Dozens of interviews with female mathematicians around the country show that almost all of them encountered a climate of hostility that they had to fight their way through on the way to professional success. And the same obstacles they encountered are keeping other women from reaching the top in spite of a dramatic increase in the number of women entering the field: Some 38% of undergraduate math majors are women, along with 22% of Ph.D.s, up from 10% two decades ago.

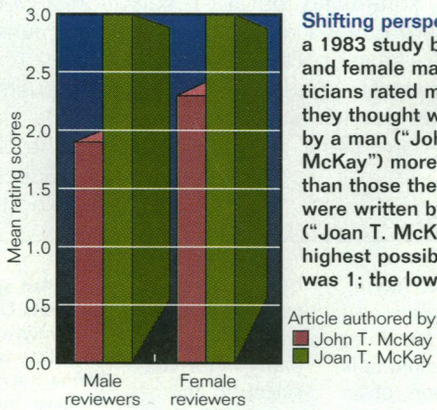
These newly minted Ph.D.s run into a well-reinforced glass ceiling that keeps them from reaching the pinnacle of academic success: tenured professorships at top universities. At the top 10 math departments in the United States, there are 300 tenured men—and only two women. And the situation at the entry level isn't much better. In the 1990-91 academic year, the top 10 departments had approximately 50 men with tenure-track assistant professorships—and three women. The situation is only a bit better in the next rank of success—the top 40 schools—where women make up 4.5% of the tenured faculty. And many of them are concentrated at just a few universities, including Rutgers, the University of Illinois at Chicago Circle, Stony Brook, and the University of Texas, Austin.

It doesn't take a Ph.D. in math to figure out that there's something wrong here. But what? Part of the problem clearly lies outside academics in the larger culture, where math is not considered feminine. Even Karen Uhlenbeck of the University of Texas, Austin, a MacArthur "genius" award winner and the only female mathematician in the National Academy of Sciences, concedes she is "always aware that I was brought up to do something different than I'm doing now."



HAVERFORD COLLEGE

**Prisoner of math.** Lynne Butler locked herself in her Princeton office to avoid the attitudes of some of her male colleagues.




**Shifting perspectives.** In a 1983 study both male and female mathematicians rated math papers they thought were written by a man ("John T. McKay") more highly than those they thought were written by a woman ("Joan T. McKay"). The highest possible score was 1; the lowest 5.

SOURCE: PALUDI AND BAUER, 1983

The lack of encouragement in the general culture—the sense that mathematics is somehow "unfeminine"—only intensifies on entry to the academic world. Graduate school, in particular, is a "minefield" for female mathematicians, says Rhonda Hughes, chairperson of math at Bryn Mawr and a past president of the Association for Women in Mathematics (AWM). The land mines concealed under the surface include a lack of encouragement from faculty members, sexual advances of mentors—and a suspicion on the part of male colleagues that women can succeed only by sleeping with male mathematicians.

Women aren't the only ones who perceive sexist attitudes. Jerry Marsden of Berkeley, winner of the 1990 Norbert Wiener prize—the top prize in applied math—says, "I had a female graduate student who wrote a fine thesis. Around the time it was being completed, a graduate student told me that it was 'common knowledge' that I wrote her thesis for her in exchange for sexual favors—which of course was not true." Some women at the beginning of their careers, like Jenny Harrison of Berkeley, who is now suing the university on grounds that she was denied tenure in the mathematics department because of sexism, say they shy away from coauthoring papers with men for fear that rumors about sex will entangle them (see *Science*, 28 June 1991, p. 1781).

Tough as the problems are that women face in math in the early part of their careers, things often get worse thereafter. "The trouble really starts when you solve your first big problem," says a woman mathematician who didn't want to be identified, because "then you're competition and a threat."

The treatment Joan Birman received is an example of what happens to women mathematicians later in their careers, after they've achieved senior status by solving major problems in mathematics. Birman, a tenured professor at Barnard College, says that when she was hired she was promised a position in the affiliated Columbia University department, where she also teaches. That was 18 years ago—and the promise is yet to be fulfilled. Birman, who is internationally known for her work in knot theory, notes that the two men who preceded her as chairs of the Barnard department were given appointments at Columbia.

"There is a subtle and underlying prejudice against women at Columbia," says Birman. When hiring decisions are made, she adds, "women are put aside, not with anybody saying, 'We don't want a woman,' but by someone saying at a crucial moment that their math is not the greatest—and that's a sure way to kill anybody." Birman says she can't say for sure whether that kind of treatment is due to honest judgments or to sexism, but she argues that Columbia's overall record (it has no women math faculty) speaks strongly for the latter. Although she is treated well on a daily basis in the Columbia department, she says, the appointment is a matter of pride and principle. "The thing that bothers me is that I'm a second-class citizen in the Columbia department. That's a terrible message to send to young women: No matter what they achieve, they will be held down."

Joan Birman isn't the only tenured woman with an international reputation who has run into difficulties. There is a long history of women being invited to talk at math confer-

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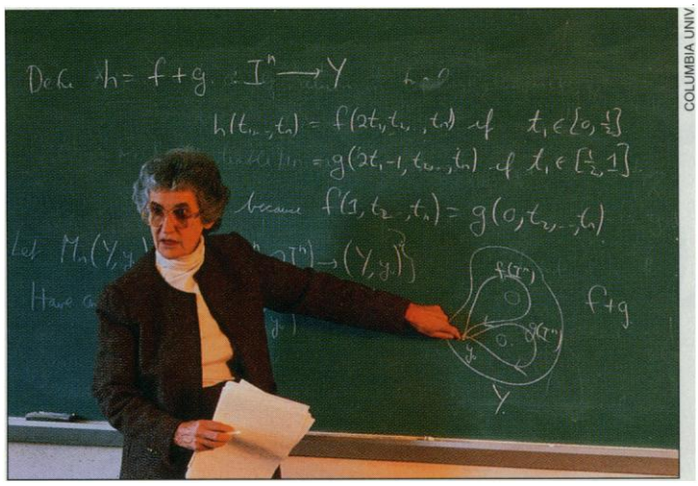


Promises, promises. Barnard mathematician Joan Birman says she was promised a position at Columbia 18 years ago—and she's still waiting.

ences only after organized protests. In 1978 no women (and approximately 100 men) were invited to talk at the prestigious International Congress of Mathematicians, held every 4 years. Before the next meeting, in 1982, women protested, and a few were invited. In 1986 only one woman was invited and she spoke on the history of math. "We didn't make a fuss, and here they go again," recalls Linda Keen, president of the AWM at the time. Keen organized a protest, and, according to Marina Ratner, Berkeley's only woman mathematics professor, "at the last minute three women were grudgingly invited." Ten women were invited in 1990 after the American delegation "reminded" the organizing committee to invite women.

The persistence of rampant sexism seems almost unique to mathematics among scientific disciplines today. But in addition to that burden, there are other factors, not directly attributable to male colleagues, that make the life of women in math far less than ideal—factors that are shared with other disciplines. One is a lack of self-confidence on the part of women. In math, that lack of confidence causes women to submit their best work not to the leading journals but to lesser publications. Sue Geller, a math professor at Texas A&M and head of a committee on the status of women sponsored by seven national math organizations, surveyed more than a dozen editors of math journals. "I've been told by a number of (male) editors [at the less prestigious journals] that they have found their best papers written by women," says Geller. "In many cases they asked, 'Why didn't [these women] submit to more prestigious journals?'"

The other problem mentioned by many women interviewed for this article is what is known throughout science as the "two-body problem"—the difficulty of finding jobs for two professionals who are frequently in the same field (*see article on two-career marriage, p. 1380*). "Sexism knocks women out of the top five" departments, says Princeton's Butler, meaning that any pretext can be used to disqualify a woman from getting a job at the very best schools. But, she adds, "the two-body problem knocks [women] out of the top 20." The problem is that many female mathematicians are married to male mathematicians—forcing them to face the dictates of the two-body problem. And in the world of academic math, the competition is so fierce (last year UCLA received some 1500 applications for a few positions) that any compromise in a young woman's career can make her an also-ran.

In the face of problems like these, the solutions that are being tried out now seem lukewarm. Some universities—including Berkeley—give untenured professors who want to have a family an extra year to get tenure. Another alternative is to change the reward structure to give teaching positions tenure or the equivalent (as Harvard did in 1982 with Deborah Hughes Hallett, who is instrumental in undergraduate teaching). Since many female mathematicians are in teaching positions that are currently non-tenure-track, such a change could dramatically increase the number of tenured women.

Some universities are also trying affirmative action in mathematics. At the instructor and junior faculty level, Princeton has an affirmative action program that brought five women into the department in the past 2 years. "We're absolutely not bending standards," says Robert Gunning, dean of the faculty at Princeton and professor of math. "The program does not function that way." Instead, he says, the university gives "free slots" to departments that may be "searching in one field, but an opportunity comes along in another field." These positions, however, offer little hope of tenure, since Princeton rarely promotes assistant professors—preferring to bring in big names from outside.

Critics of affirmative action usually argue that it will decrease standards. But that may not be the case in math, according to some female mathematicians. It certainly isn't at Princeton, says Lynne Butler, who taught there: "I think it's just the reverse." Butler (who was not hired under affirmative action) says that of the three women she knows who were, one "was better than almost all of the men they hire...and is a hell of a lot better than I am," another was equal to her in mathematical talent, and one would have been hired without affirmative action. The explanation for this paradox, she says, is that most candidates (of either sex) are rejected not because of their lack of qualifications but because of tight departmental restrictions (the candidate isn't in the right subfield, for example) or departmental politics. Affirmative action loosens those restrictions and expands the pool of applicants: "You can get better quality people [through] affirmative action by breaking power plays," says Butler.


Different expectations. Karen Uhlenbeck is "always aware" that she wasn't brought up to be a mathematician.

In spite of these apparent virtues, many women say affirmative action is now being given only lip service at the math departments of major universities. In fact, says Rhonda Hughes, women have to be "sure things before they're willing to hire them." Department chairmen like Alberto Grunbaum at Berkeley readily list half a dozen women they've tried to hire—without success—but many women say part of the problem is that the chairmen are focusing in on the same few already famous female mathematicians.

One of the handful of women who is constantly being offered such positions is Uhlenbeck of Texas. She's vitriolic about Berkeley's affirmative action efforts. "Berkeley does not have a worse record than many other departments," she says. "The problem is that they claim to have an affirmative action program. Bull!...It's one thing to ignore the problem, which is what most places have done, more or less. But [at least] they're not saying, 'We have searched the world and there are no women, or no women good enough.' "

When will the climate in the top math departments change for women? Lenore Blum, past president of the AWM, thinks change could come in this decade, now that women have reached a "critical mass" and have risen in math's political hierarchy. (Women hold several key posts in American math societies.) In fact, she says, it could be a "golden decade" for women in math. What that means in practical terms is that mathematics could become much like other scientific disciplines today, with subtle sexism and societal expectations, rather than explicit discrimination, being the chief obstacles. Others, like Uhlenbeck, see change coming more slowly. "Heroism," she says, "is still the norm."