# Surprises Across the Cultural Divide

**"Advanced" countries aren't so advanced in providing opportunities for female scientists**

In his career as a physics professor and finally chairman of physics at York University in Ontario, Jim Megaw saw a lot of undergraduates and graduate students. And he was dismayed to note how few were women. But Megaw didn't simply lament the situation and go on to other pursuits: He put on his scientist's hat and set out to collect data on whether the situation was similar in other countries. After he retired in 1989, Megaw sent questionnaires to more than 1000 physics departments around the world, asking what proportion of their faculty and students were women.

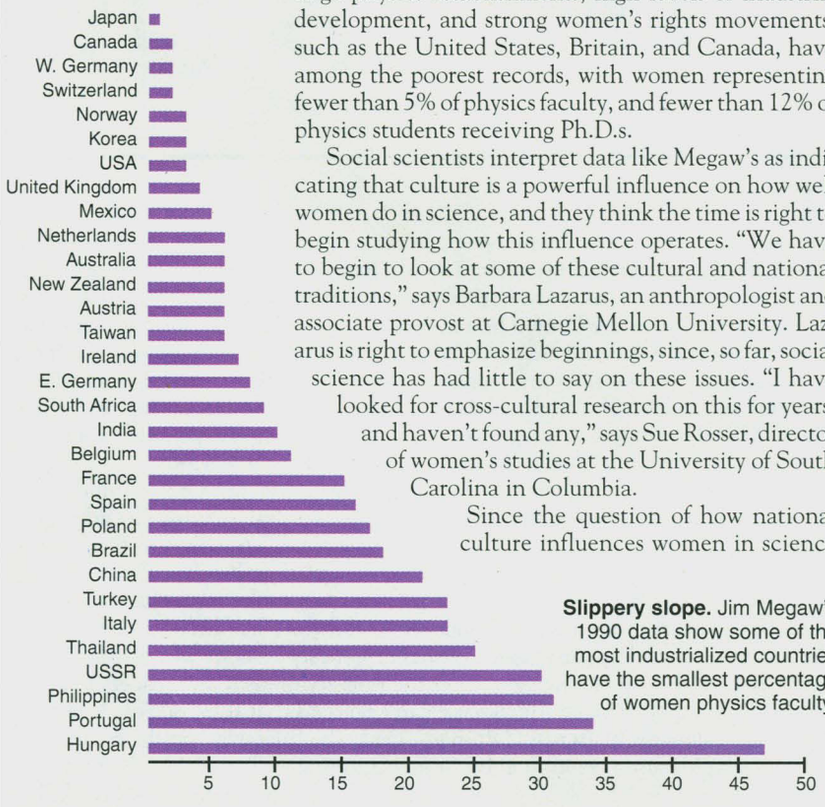
You might think it wouldn't be necessary for Megaw to go to such lengths. After all, aren't there lots of good statistics on women in science around the world? The answer is no. As a matter of fact, Megaw's data, from 400 departments that responded to his request, is one of the few studies comparing representation of women in specific scientific disciplines around the world. And in those data, valuable partly because they are rare, are findings that seem to contradict stereotypes about national cultures and how they treat women.

For example, among the countries with the most women physicists were unexpected entries: Hungary, Portugal, and the Philippines, where women represent 30% to 47% of faculty and 27% to 60% of physics students receiving Ph.D.s (see article on the Philippines, page 1491). On the other hand, countries with large physics establishments, high levels of industrial development, and strong women's rights movements, such as the United States, Britain, and Canada, have among the poorest records, with women representing fewer than 5% of physics faculty, and fewer than 12% of physics students receiving Ph.D.s.

Social scientists interpret data like Megaw's as indicating that culture is a powerful influence on how well women do in science, and they think the time is right to begin studying how this influence operates. "We have to begin to look at some of these cultural and national traditions," says Barbara Lazarus, an anthropologist and associate provost at Carnegie Mellon University. Lazarus is right to emphasize beginnings, since, so far, social science has had little to say on these issues. "I have looked for cross-cultural research on this for years, and haven't found any," says Sue Rosser, director of women's studies at the University of South Carolina in Columbia.

Since the question of how national culture influences women in science seems like such an important one, and since there seems to be little formal data, *Science* turned to a less formal resource: female scientists who have experiences in more than one culture. By interviewing two dozen women about dual-culture experiences, and combining those interviews with the available data, we were able to point to several factors that appear to be influential across cultures. Among them: a country's level of economic development, the status of science there, class structure, educational system, and the presence or absence of support systems for combining work and family life.

In an informal effort of this kind, based on individual experiences, contradictions abound, and our Women in Science 1994 issue cannot purport to support any particular conclusion or viewpoint. Nevertheless, in the absence of hard data, these experiences hint at issues affecting women in many countries—and point up the need for research on this crucial, neglected topic.




**Slippery slope.** Jim Megaw's 1990 data show some of the most industrialized countries have the smallest percentage of women physics faculty.

### Advanced countries, entrenched systems

Though there is little systematic data internationally on women in science, a few sociologists have tried to compile such statistics. One who has is Beatriz Ruivo, who works for the National Board for Science and Technological Research in Portugal. In the mid-1980s, Ruivo was puzzling over why some countries like her own, latecomers to the industrial and scientific scene, have a high percentage of female scientists.

In Portugal, government statistics showed that, as of 1978, 36% of researchers were women. And the pipeline was full: During the 1980s, more than 50% of the Ph.D.s in math, physics, chemistry, and biology were awarded to women. When Ruivo tried to find data from other countries, she was frustrated, so she culled what she could from reports by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). "I realized, looking at the UNESCO publication, that Portugal was not a unique situation," she says. In countries now undergoing economic development, including Mexico, Argentina, and the countries of Eastern Europe, women made up from 20% to 50% of the scientific researchers, compared to fewer than 10% in the United States and northern European nations such as Germany (see article on Germany, p. 1475).

Ruivo's speculation is that in countries that have had large scientific establishments for centuries, science and technology became firmly established as a male domain during an era when women weren't in the labor market. Nations like Portugal, she argues, only began developing science and technology during the 20th century, when "society was more open to women's participation in general." As a result, women were able to establish themselves in these fields.

Despite this apparently hopeful picture, Ruivo says she is "not so optimistic as I was in 1987." Back then, she says, she assumed women in newly industrialized

countries would continue to advance. But she no longer thinks so. Although there are plenty of women in science, she says, she has observed that the glass ceiling is firmly in place in Portugal: Women are concentrated in the lower levels of the scientific establishment and are not rising to the top ranks.

### Science as a low-status occupation

Ruivo says that the glass ceiling she sees in Portuguese science partly reflects the absence of a strong women's movement agitating for equality and condemning sexist attitudes. In addition, she suggests, in Portugal and some other developing countries, the high numbers of women in science may not reflect society's high regard for women, but, conversely, the low esteem in which academic science is held, compared with jobs in business or industry (see article on Turkey, p. 1487).

In countries that are still undergoing economic development, basic science isn't as closely integrated into the production of goods and services as it is in the advanced economies of Europe, Japan, and the United States. In developing countries, she says, "to work in scientific research has a different meaning than in advanced countries. It is more of a cultural activity." Not only does it have low status, in some countries it is quite low-paying, making it a pursuit undesirable to men and therefore left open to women.

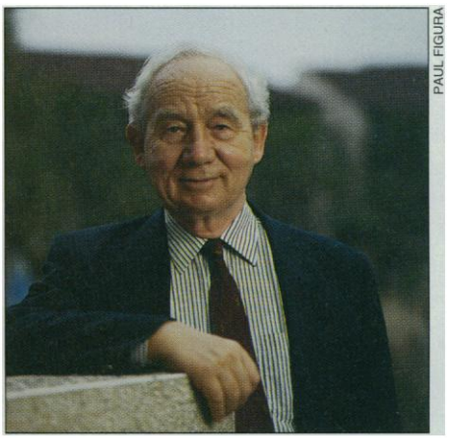
Shobhana Narasimhan, a physicist at Brookhaven National Laboratory, says she saw this situation when she was growing up in Bombay. While women are well-represented in Indian science, she says, there are few women in engineering, which is a more prestigious and lucrative profession than basic science (see article on India, p. 1495). "As a student in India, I knew many men who desperately wanted to do research in physics or mathematics or some other pure science," Narasimhan says. "However, there was very strong social pressure from their families to pursue a 'real' career." A 'real' career meant designing factories or bridges, not studying DNA. Girls, not subject to the same pressures, were free to pursue academic science or math.

Several sociologists interviewed by *Science* noted that there is a growing sociological literature, across cultures, showing that the lower the status and pay of an occupation, the more likely it is that women will be found there—and that seems to hold for science. South Carolina's Rosser says several studies have shown that in the former Soviet Union, "a very high percentage of the physicians were women....But that was not considered a high prestige position. The pay wasn't good. It was considered more like we view nursing. The scientific occupations that were highly valued were held by men."

### That touch of class

The relatively low status of science isn't the only factor that may open the field to women. Another is class. In some countries, such as India, the nations of southern Europe, and Latin American countries, social class counterbalances gender. Class loyalties provide a bond between men and women of the well-educated upper classes, benefiting women who are born into the elite. University of Arizona astronomy student Sally Oey came away with this impression from a conference on women in astronomy last year: "In certain countries, the pecking order is rich men, poor men, rich women, poor women; and in other countries it's rich men, rich women, poor men, poor women. In the first case, gender is dominant in determining one's standing, and in the second, class is dominant."

During a postdoctoral stint in Mexico, Canadian astronomer Robin Kingsburgh observed how the class system worked to the benefit of educated, privileged women. "In Mexico the class system is very strong, and education is limited to the upper classes," says Kingsburgh, who received her Ph.D. in England in 1992. In Mexican academia, she says, women fare better than in Britain. The chair of the astronomy department at the University of Mexico is a woman, as are about one-third of the faculty, Kingsburgh notes, compared with only six women of 64 faculty members in physics and astronomy at University College, London, where she was a graduate student.



PAUL FIGURA

**Amateur sociologist.** York University physicist Jim Megaw, who collected data on women in physics in many countries.

That apparent equality, however, prevails only within the academic scene, which Kingsburgh says feels like an island in a society where women are hardly equal to men. The middle-class male observatory technicians treat her with respect, she says, because of her class status, not because of her gender. The same technicians, riding down the mountain in a truck, "stop and whistle at every woman on the street....Only the upper classes are viewing women as equals."

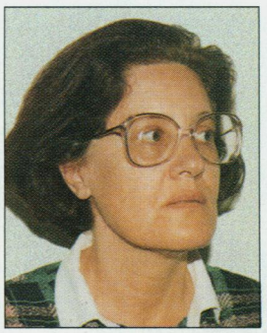
### Satisfying the requirements

Even if a society is fairly open to women, however, young women will never succeed in science as a profession unless they have taken lots of courses in science and math at school. Polish-born physicist Iwona Sakrejda, who recently took a position as an assistant professor at Creighton University in Omaha, Nebraska, thinks the high numbers of female researchers in former communist countries are due partly to educational policies requiring both boys and girls to study math and science through secondary school. That policy, which was in force in Poland when she was growing up, gives students the chance to see whether they like science and can excel at it. "Both boys and girls learned much more at school" in Poland, says Sakrejda. "We had to have science. We had very little choice."

Sakrejda's biggest criticism of schools in the United States, where her two sons are now in junior high, is that physics and math are optional—not mandatory. "It is too easy to get out of science," which students do too often, she says, because it "has a tough reputation."

Chiara Nappi, born and educated in Italy and now a theoretical physicist at Princeton's Institute for Advanced Study, thinks mandatory math and science classes, combined with a policy of teaching all science subjects every year, are the most important factors in her country's excellent record in awarding advanced degrees in science and math to women (see story on women in physics in Italy, p. 1480). Since all students are required to take math and science every year, she says, girls can't "chicken out" of science, and therefore don't close doors on themselves before they reach university.

She contrasts the Italian situation with what she sees in the United States, where chemistry and physics are served up in demanding, 1-year "crash courses,"



**Portugal's Beatriz Ruivo is less optimistic than she was 7 years ago**

which are optional, and consequently avoided by all but the most gifted students. In the United States, "the feeling is either you have [talent in math and science] or you don't," says Nappi. "If you have it, you can take any amount of that subject. If you don't, you should take none." In Italy and other southern European countries, she says, "the feeling isn't that you have it or you don't; the philosophy is that you can learn." Under those conditions, she says, girls tend to do better.

Course requirements seem to work well in some places. But the carrot may work as well as the stick. And one way science can be made more palatable is by teaching it to girls without boys present. Indian-born physicist Narasimhan, for example, says she benefited from an all-girls secondary school in her home town of Bombay. In that environment, she recalls, no subject was considered "unfeminine" and "it never occurred to me that being female had anything to do with whether I would go into arts or sciences."

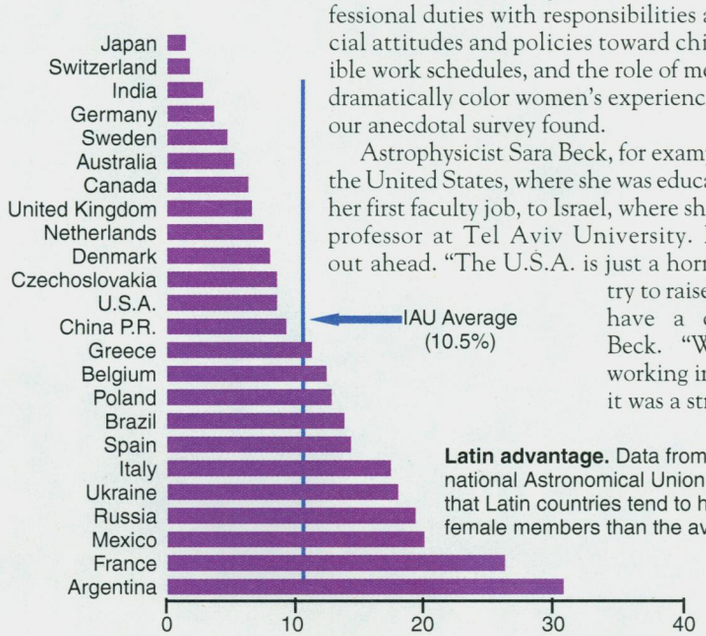
York's Megaw also thinks all-girls' schools hold benefits for women across cultures. When he pondered results of his international survey of 400 physics departments, he perceived that women were better represented as both students and faculty in predominantly Catholic countries. In those countries, children are more likely to attend single-sex schools than they are in other countries, and Megaw hypothesized that single-sex schools are what make the difference.

As in other areas of this cross-cultural subject, there isn't much data for testing hypotheses, but some support for Megaw's notion does exist. A 1992 survey found that 58% of the female members of the British Institute of Physics had attended girls' schools through age 16—dramatically higher than the national average of 13%. Similarly, a survey by the U.S. National Coalition of Girls' Schools found that 25% of girls' school graduates plan to pursue careers in math or science—four times the national average.

### Family-friendly societies

All-girls' schools may help prepare women for scientific careers, but even a well-prepared female scientist may find her career foundering if she cannot combine professional duties with responsibilities at home. Social attitudes and policies toward child care, flexible work schedules, and the role of men in families dramatically color women's experiences in science, our anecdotal survey found.

Astrophysicist Sara Beck, for example, contrasts the United States, where she was educated and held her first faculty job, to Israel, where she is a tenured professor at Tel Aviv University. Israel comes out ahead. "The U.S.A. is just a horrible place to try to raise a family and have a career," says Beck. "When I was working in the U.S.A., it was a struggle to find decent day care...and if I missed a half-day of work [because] my kid had a temperature of 104, I was lectured on how this let down the [department]. In Israel there is 3 months paid maternity leave, day-care centers on every block, and if you *don't* take off from work for your kid's birthday party the department chairman will lecture you on how important these things are to kids and how he never missed one while his kids were little."




**Latin advantage.** Data from the International Astronomical Union (IAU) show that Latin countries tend to have more female members than the average.

SOURCE: JUDITH PERRY

Beck's contrast between Israel and the United States resembles observations by other women on the contrast between southern Europe and Latin America and countries where the "Protestant ethic" prevails, including the United States, Canada, the U.K., and Germany. "Women in France have more help in terms of having their children taken care of," says Therese Encrenaz, director of space science at the Paris Observatory, who has spent her career in France and traveled extensively in other countries. "It is much easier to get a woman to take care of your children after school...so you can have a regular day of work. In the United States, the school day ends earlier, and day care is more expensive."

Beyond availability of day care, women speak of a general view of the integration of work and family life that makes more allowances for family in Latin and Mediterranean countries. And that, they say, levels the playing field for the genders. "Here in the United States, the way the universities are structured, the kind of demands that are put on faculty are the kind of demands that can be fullfilled by someone who has a wife at home," says Italian-born computer scientist Maria Paola Bonacina, now an assistant professor at the University of Iowa. The "more relaxed attitude," in Italy and other Latin countries, she maintains, makes it easier for women to maintain a serious career and an intact family.

University of Cambridge astronomer Judith Perry found corroboration for this idea in data gathered by the International Astronomical Union (IAU). "If you look at the percentage of the delegation to the IAU which is female, the thing that is striking is that the international average is around 11%," she says. "If you then separate the Latin countries—France, Spain, Argentina, Mexico," they are, with few exceptions, "above the international average." Trailing well behind that average are the United States, Britain, Canada, and most northern European and Asian countries.

The Protestant work ethic, argues Perry, makes life revolve around work in countries such as Germany, Canada, and the United States. "To what extent is the Protestant work ethic predicated on the service of women behind the men who are working?" she asks. "A lot of northern Europeans say the Latins...don't do as much," she continues, "but is that true if we look at the whole society and not just individuals? One of the reasons women are more integrated may be that they are leading a healthier life as a society."

In general, a healthier life for societies surely must include changes that enable women to achieve economic equality with men and support systems for balancing the competing demands of work and family life. How those changes will be accomplished remains very much an open question. The answers, no doubt, will depend on class structure, work ethic, and systems of education. For those interested in bettering the position of women in science, all these areas provide a rich—and almost untapped—vein that invites further digging.

**–Marcia Barinaga**