Women, and Some Men, Ask Why Women Don't Flock to Physics

At the first International Conference on Women in Physics, participants traded stories and statistics and forged personal and professional contacts.

Why are women underrepresented in physics? What can be done to change the situation? Those and related questions were the focus of discussions in Paris this past March, when some 300 physicists—most of them women—from 65 countries convened for the first International Conference on Women in Physics.

They found that the problems facing women in physics depend on the economy and society in which they work, but that some problems cut across countries and cultures. Among the universal challenges experienced by women physicists are the balancing of career with housework and child rearing, discrimination in the workplace, professional isolation, and a lack of representation at all levels of decision making.

"We are not alone anymore. Now I know that the women at MIT have the same problems I have in Brazil," says Marcia Barbosa, a statistical physicist at the Universidade Federal do Rio Grande do Sul in Pôrto Alegre and chair of the International Union of Pure and Applied Physics (IUPAP) working group on women in physics, which organized the conference. "Even in different cultures, women face absolutely the same challenges. Suddenly, you don't feel that you have challenges because you are stupid. You realize it's a common thing faced by women in physics."

"There are common points," says Claudine Hermann, a solid-state physicist and the first woman to reach the highest echelon at the prestigious Ecole Polytechnique in France—a country with one of the best records for women in physics. "But the way to deal [with problems] depends very much on the culture. People from western Europe and the US tend to think it's like their culture everywhere. Even if the questions are general, the solutions are not."

Missing good brains

The Paris meeting touched on both locale-specific and more general problems. A delegate from India, for example, reported that, in her country, physics is not seen as unfeminine; indeed, for women, earning a master's degree is considered advantageous for marriage, but continuing to a PhD is not. Communication among physicists, particularly in the US, was described as "combat physics": At talks and in individual conversations, explains Kim Budil of Lawrence Livermore National Laboratory, "you'd like people to engage in scientific discourse, but it often goes beyond that to become a fight for ego, to decide who is the smartest person in the room." And a widely reported 1999 study showed that female scientists at MIT had less lab space and lower salaries than their male counterparts; other universities are no better, as subsequent studies in the US and elsewhere continue to show. "No one understood the problems women faculty encountered until the women began to talk to each other and to work with the administration to collect the relevant data," says MIT biologist Nancy Hopkins, one of the original study's authors. "MIT has corrected the inequities found and now focuses on preventing them from arising."

In some former Soviet Union countries, says Erna Karule, who heads the theoretical physics lab at the University of Latvia's Institute of Atomic Physics and Spectroscopy, "the lack of research funding is leading to low salaries and no possibility to buy new equipment. It is making research unattractive to the younger generation and overshadows gender inequalities." In other poor countries, schools lack even electricity. Attendees from developing countries, for their part, were shocked to learn that child care is not readily available in places like the US. Indeed, says Jaynie Padayachee, who is working on her PhD in physics at the University of Natal in South Africa, "I personally was a bit disappointed [in the conference]. The focus was on problems experienced in developed countries, which were not entirely relevant to the developing countries." Broadly, though, changing both the climate and the nerdy image of physics, conference attendees say, would make the field more attractive for women—and men.

Data gathered for the meeting showed, among other things, that four out of five women physicists in developing countries are married, compared with two out of three in developed countries; one-third of respondents older than 45 in developed countries had no children, com-

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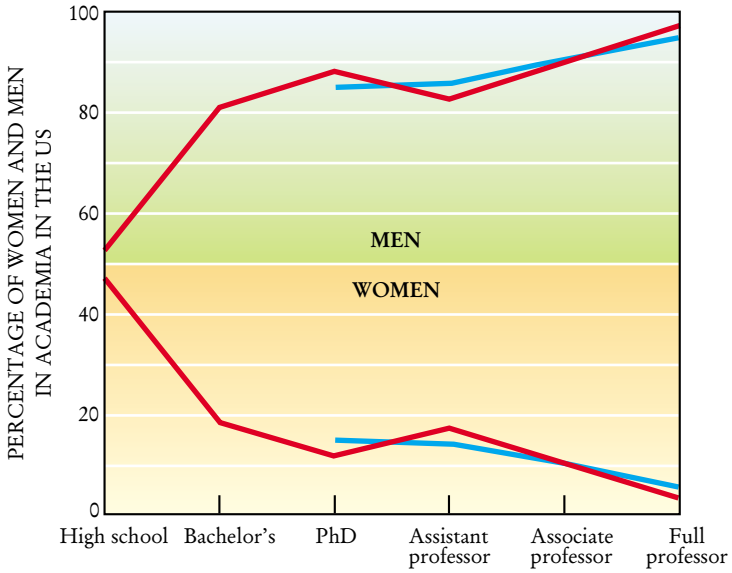
MORE THAN 300 PHYSICISTS, about 15% of them men, turned out for the first International Conference on Women in Physics in Paris in March.

pared with one-tenth in developing countries; and overall, three out of four women said they would choose physics if they had it to do all over again.

Some trends are surprising: In Scandinavian countries, where women have made deep inroads in politics and other fields, few women pursue physics. The delegation from Iran reported the highest level of women undergraduate physics majors: 56%. Japan, South Korea, the Netherlands, Germany, and Switzerland award among the lowest proportions of physics PhDs (8–10%) to women, while Australia, France, India, and Poland award the highest proportions (20–30%).

"Discrimination tends to be subtle—it's more sins of omission than of commission," says Meg Urry, director of the new Yale Center for Astronomy and Astrophysics. "Women tend to accumulate disadvantage. Minor differences add up." It's a critical issue, she adds, "not just for fairness and justice, but for the health of our field. We are missing good brains."

"My male colleagues don't want to hear about anything affirmative action–like," Urry says. "The most infuriating thing is when you say, 'Can we think about hiring women?' and they say, 'Sure, but our first priority is excellence'—as if there were an inherent conflict between the two. I think if they thought hard about how physics works, they'd get it: You put in 13% and you get out 6% [the proportions, respectively, of US physics PhDs going to women and of women physics faculty at the top 20 US universities]. It's the top universities that are falling down on the job. If you assume no innate difference in ability, then you have to assume that the men you are hiring are less good than the women you are not hiring."



LEAKY PIPELINE? This "scissors diagram" shows how the proportion of women in physics drops and that of men rises on the way up the US academic career ladder. Still, according to the American Institute of Physics Statistical Research Center, things are not as bad for women as they look: The data, from the late 1990s (red), are not so far off from projections (blue) based on the numbers who pursued physics during an earlier time period and thus make up the pool of potential female professors. In the US, the real leak in the pipeline, says AIP's Rachel Ivie, is between high-school and college graduation. The dearth of women at the top is nearly universal, although the slopes of the scissors, the leaky spots, and the discrepancies between actual and expected numbers vary from country to country. (Courtesy of AIP's Statistical Research Center.)

Attracting and keeping women

At the Paris meeting, the delegates unanimously passed eight resolutions calling for fair treatment of girls and women at every level of physics education, employment, and policymaking. (The resolutions, country reports from delegates, and related information are on the conference Web site, http://www.if.ufrgs.br/~barbosa/conference.html.) The plan is to use the resolutions—which advocate, for example, transparency in hiring, promotions, and awarding of research funding—to exert pressure on schools, employers, scientific societies, funding agencies, and governments. Judy Franz, executive officer of the American Physical Society, the first woman to serve on IUPAP's council, and a chief organizer of the conference, says the resolution aimed at IUPAP may have the biggest teeth: "Some years ago, we found that women don't get invited to talk at large international conferences. If IUPAP would only sponsor and fund international conferences that had a fair representation of women on their organizing committees, I think that would begin to have an impact. It's an important thing you can put on your vita."

On the heels of the meeting, the European Physical Society voted to form a working group on women in physics. The idea is to strengthen personal and professional connections among women physicists and pool strategies from different countries on such things as how to minimize the postdoc period so that physicists can land stable academic jobs at a younger age. That would help women, says the group's interim head, Gillian Gehring, a condensed matter physicist at the UK's University of Sheffield, because they are more likely to give up their career in favor of their male partner's. "If people get permanent jobs before they form permanent two-body relationships, they are more likely to form a relationship with someone in the same town. It doesn't solve the two-body problem, but it helps."

Indeed, the Paris meeting has set off a flurry of activity aimed at achieving equity for women physicists. It gave a boost to networking efforts by women at the three US weapons labs, where, says Budil, "we have learned the power of supporting one another and have used this to build a strong relationship with our management. We want to have more influence across NNSA laboratories [National Nuclear Security Administration, the new Department of Energy body established to oversee the weapons program]." And in Latin America and other parts of the world women are forming regional networks. The various groups will be linked via the conference Web site, which is turning into a networking hub. A follow-up meeting in Brazil is in the fledgling planning stages.

In Japan, Hidetoshi Fukuyama, a member of IUPAP's working group on women in physics and director of the Institute for Solid State Physics at the University of Tokyo, says industry has responded better than academia to equal opportunity laws introduced a few years ago. But activities leading up to the Paris meeting triggered changes, he says, and "both the Japanese Physical Society and the Japan Society of Applied Physics are now deeply involved." For example, when the government asks the Japanese Physical Society to recommend reviewers for research propos-

als, says Fukuyama, "they can work immediately to get more female scientists involved in reviewing. There are a lot of things to do on both the long and short term." As in many countries, Fukuyama adds, "the most important thing is to increase the number of women in physics. And once we have them, we need to encourage them to stay."

To do that, says IUPAP President Burton Richter of SLAC, "it's essential that men help. There will be considerable resistance from men, who may feel that women are whining. If a male colleague says things have to change, [men are] more likely to say yes, it's true." These days, such resistance might actually be lower than in the past, what with physics enrollments shrinking worldwide and many departments trying to woo students by, for example, introducing degree programs that combine physics and business. The time may be ripe for engendering a welcome for women in physics, says Urry. "It's a good moment. Frankly, I think [male physicists] are interested."

TONI FEDER

Orbach Brings Enthusiasm for Research and Desire for Increased Funding to Office of Science

The DOE's new Office of Science director expresses particular interest in nanoscience and fusion research and wants the US involved in ITER.

Two weeks after being sworn in as the director of the Department of Energy's Office of Science, theoretical physicist Raymond Orbach was still brimming with excitement about his new job. "First of all, the science in the Office of Science is beautiful," Orbach responded when asked why he'd left his previous position as chancellor of the University of California, Riverside. DOE is a "magnificent enterprise and it's just delightful to be a part of it," he said to a small group of journalists gathered around a table near his new office. "I'm like a kid in a candy factory."

After more than 40 years of working as a self-described "bench scientist" supported in large part by federal funds, Orbach said "this was an opportunity for me to try and return the wonderful support I've had and hopefully respond to the needs of the government in terms of science." While he was enthusiastic about his new circumstances, he was not Pollyannaish. The Office of Science has a substantial $3.3 billion budget, but the administration's fiscal year 2003 budget proposal calls for only a 0.1% increase for the office, and overall DOE R&D funding would actually decline by 0.5%.

"We have essentially a flat budget, as have the physical sciences across the government for the last decade, and it's become very tough," Orbach said. "I know what it's like from a university perspective. It's been very difficult to support the research efforts at universities . . . and it's been no less difficult in the [DOE] laboratories. There is a special role that I see the Office of Science playing in the support of basic research in the United States."

Orbach said one of his key priorities is "developing new initiatives that will build on the base of science to provide more funding and more support for university science and for the laboratories." He said he was "in tune" with calls on Capitol Hill to increase physical science funding above the level proposed by the administration. While his funding goals for the Office of Science are not as lofty as the five-year budget doubling that is occurring at the National Institutes of Health, Orbach would like to see his budget increase by 30% or 40% over the next five years.

He is aware of concerns among physical scientists that the large jump in the NIH budget—17% proposed for FY 2003—and the flat funding for most physical sciences is creating an overall imbalance in federal science funding. The seeming imbalance can be explained in part by the science itself, he indicated. With the dramatic advances in biological sciences, especially in the new field of protein research called proteomics and in the wide-ranging bioinformatics, the traditional divisions between biology, chemistry, physics, and other fields of science are blurring, Orbach said. When the Spallation Neutron Source comes online, he said, "there will be as many biologists as there are condensed matter physicists and chemists" using the machine. The same is true of synchrotron light sources, he said. "I believe there are more biologists working with light sources for structural determinations and dynamics [in cells] than there are physicists."

UC RIVERSIDE

RAYMOND ORBACH

Enthusiasm for both physical and biological sciences is high in the administration and Congress, he said, and the success of the health sciences depends on the "vitality of the fundamental physical and life sciences. They are the underpinnings of health science. What I hope is that physical and life sciences can be funded at a sufficient rate that we cannot only do our thing, but also help the health sciences do their thing." He also said that he is an "advocate of a diverse funding base for science. I think the great strength of the United States science programs is the multiagency support." Having science funding spread over several agencies, Orbach said, "avoids the possibility of fads or attitudes that a single funding agency for science might develop. I think in large part the vitality of American science can be laid to the diversity of funding sources within the federal government."

Orbach stressed nanoscience and fusion as two research areas in which he is particularly interested. There is $24 million in the administration's budget proposal to begin construction of the Center for Nanophase Materials Sciences at Oak Ridge National Laboratory and, Orbach said, that center will be the first of five nanoscience centers to be supported by his office. The other four are expected to be at Lawrence Berkeley National Laboratory, Sandia–Los Alamos (run jointly by the two labs), Argonne National Laboratory, and Brookhaven National Laboratory. "What we will be creating is a nanoscience network that uses the