CSWP

Gazette

MARCH 1989
VOLUME 9, ISSUE 1

A Newsletter of the Committee on the Status of Women in Physics of the American Physical Society

CSWP SYMPOSIUM AT SAN FRANCISCO

On 19 January the CSWP co-sponsored a symposium with the AAPT and the AAAS entitled "Women in Physics: Why so Few?" The symposium was primarily organized and chaired by Janice Button-Shafer, University of Massachusetts, CSWP member 1986–1988. In the following article, Ken Lyons of AT&T Bell Laboratories, CSWP Chair for 1989, gives an account of his impressions and thoughts relative to the symposium. The five talks that composed the symposium are listed below:

Scientific Resources for the 1990s: Women, the Untapped Pool
Beverly Porter, AIP

Women in Physics
Vera Kistiakowsky, MIT

Social Influences on Girls' Interest in Math and Science
Jackie Eccles, University of Colorado

How Stereotypes about Science Affect the Participation of Women
Mary Beth Ruskai, New York University

Choosing Physics as a Career: Experiments in Social Pressure
Barbara W. Wilson, AT&T Bell Labs

STEREOTYPES IN PHYSICS: SOCIETY, EQUITY, AND NEED
by Ken Lyons, CSWP Chair-1989

The CSWP symposium on 19 January at the APS/AAPT/AAAS meeting in San Francisco was entitled "Women in Physics: Why so Few?" One question asked in the discussion period afterward was "The Audience: Why so Many?" Indeed, the symposium was the best attended session on Women in Physics that I have ever seen. During the five talks, the audience ranged from two-thirds to a full house with people standing in the door. Many people, both men and women, had decided that the issues under discussion were important enough to warrant their time and attention.

This surge of interest was gratifying to see, although it did not change the fact of the dismal statistics presented. Beverly Porter began the session with an in-depth discussion of the workforce statistics and projections. Her principle point was that the issue of women in physics is moving from one of equity to one of need. The projected shortage of physicists in the late 90s looms very close indeed, given the 10-year lead time to turn a high school student into a Ph.D. physicist. The shortage will not be made up by the dwindling pool of young men. Even now the pinch is being felt in some fields, most notably in experimental condensed matter research.

Perhaps the most telling statistic presented by Porter was the comparison between physics and other sciences. While the average for all active scientists has risen to 14% women, the record for physics shows a rise to only about 3%, followed by a *decline* in recent years! Other related fields such as chemistry, math, and engineering show strong growth, but the subfield of engineering physics languishes along with physics.

The dearth of women in physics is often attributed to the fact that they tend to drop out of the math curriculum in higher numbers than men. This argument is belied by the entry of women in other math-intensive fields (including math itself where 46% of the B.S. degrees now go to women). In fact, even when data are *normalized for math ability* there still exists a significant difference in the ability girls see in themselves to succeed in physics *and* in the frequency with which they choose physics as a potential field. The same difference does *not* persist for chemistry.

As explanations of this difference, Porter identified two factors: a need for hands-on experience and a lack of role models on faculty. In response to the question "Have you tried to fix something mechanical?" only 12% of 7th grade girls answered yes (boys 46%). This is bad enough, but the audience reacted even more sharply to the second piece of news: the number is *unchanged* for 11th grade girls (boys 60%). As for role models, women faculty at Ph.D.-granting institutions have increased by only 10% (2.7% to 3%) from 1975 to 1985, while the average of the increases in chemistry and engineering faculty is 215% over the same period. Furthermore, women tend to be stuck in lower ranks and have not moved upward at the same rate as their male counterparts. Fully 56% of these schools have no women on physics faculty, and only 13% have more than one.

These observations set the stage for Vera Kistiakowsky, who began by presenting some history of the CSWP. She then examined four areas of possible explanation for the paucity of women in physics: innate ability, environmental effects, discrimination, and career conflict. She dismissed the first, since no substantive data has been forthcoming to support the idea. She acknowledged the role of environmental effects, but noted that this effect stems by and large from acceptance of a male-defined idea of success: she challenged her colleagues to question this assumption.

She noted that discrimination has been "driven underground" but is still real, and that career conflicts come down to questions of priority, which are even now considered with far lower frequency by males.

She concluded that successful women have swallowed the male definition of success. She assured her audience that other definitions exist and need to be explored. The latter comment was greeted by a chorus of murmured "thank-you"'s from women around me in the audience. She had clearly struck a well-defined chord.

She also called for honesty in dealing with young women in reference to careers in physics. It is not easy and there are barriers. We must not let our enthusiasm for attracting young women into the field result in deception.

In a natural follow-up to this talk on the response of the physics community, Jackie Eccles discussed the societal responses and the differential socialization that influence female decisions vis-a-vis physical science careers. Her primary point was that much of the problem originates in the *family* environment, but may need resolution in our schools. One of her global points was that more attention needs to be paid to proper scientific study of the social issues surrounding women in physics, and that the people who need to do this are *not* physicists, but social scientists.

The study she described involved 3000 students in Michigan, all of whom were in math courses appropriate to college prep at their grade level. Thus, as grade level increased in the study, so did the selectivity as far as math ability and interest is concerned. Thus, there is a virtually automatic normalization of the study against the "opting out" effect noted above. Moreover, the survey studied not only student attitudes toward physics but also those toward English, a field that more women than men enter, as well as parental attitudes toward both.

From grades 5 to 12, the female students' self-evaluation of ability in math decreases while that for males increases. The opposite progression occurs for English. Moreover, the value of English was rated higher than math by girls at all levels, but not by boys. These two factors, self-evaluation and value rating, turned out to be the major predictors of 12th grade math enrollment—itself a primary factor in science career preparation.

A second revealing result is that these responses were more highly correlated to performance (grades and teacher evaluation) for boys than for girls. In fact, girls showed no correlation between task value and performance in math and in English. That is, girls tend to rate English high in value and math lower, but this response is uncorrelated to their performance in either.

The study also evaluated the influence of parental attitudes on these patterns, using parents of the same students. They found, first, that mothers tend to think daughters have less ability in math and physical science, that they have to work harder, and that success is less important. Eccles emphasized that there are no objective indicators that show a difference in ability or performance, rather the difference appears only in response to subjective questions.

The importance of parental views were studied by controlling for teacher evaluation. In general, the study found that parental evaluations as to ability were accurate, but that a strong *negative* correlation existed between evaluation of ability in math and English. The pattern is the same for boys but stronger for girls. Eccles emphasized that we need somehow to break this "zero sum" idea both in evaluation of ability and also in the estimate of value.

As a useful footnote to the study, attitudes of this same group were rechecked after release of the widely publicized study by Benbow and Stanley, which purported to find gender-linked differences in ability. In an appeal to media representatives to consider the implications of such reports, she noted that exposure to the popular reports of the study had significantly lowered parents' estimates of their daughters' math ability in this follow-up study.

Eccles also mentioned an intriguing correlation between social science technique and the real world. She noted that the existence of small differences in the tail of a distribution, such as those noted by Benbow and Stanley, besides having questionable validity, also have no relevance to the development of attitudes of inferiority on the part of girls. The girl in high school sees only a small sample (her class) where such differences, even if real, are completely lost in the noise. Thus, the use of large samples to achieve "statistical significance" can lead to conclusions irrelevant to the real world of a student in a single class. The far greater implications of societal preparation and stereotyping thus emerge as a decisive factor.

In the fourth talk, Mary Beth Ruskai strongly supported the conclusion of Eccles that the Benbow and Stanley study was poorly performed and reported. She suggested that stereotypes play a major role in dissuading girls from careers in physics. Indeed, 84% of girls decide not to study physics before they ever have encountered the subject or even known a physicist. Many who continue have a close relative in science.

Furthermore, she pointed out that, due to culture-based differences in preparation, even a gender-neutral environment can have gender-specific effects. She noted the positive influence on women that stems from gender-neutral summer programs for junior high students, since the hands-on experience is a first for the 88% of the girls who "never repaired anything mechanical." On the other hand, a computer in a classroom with a teacher who knows nothing about it is likely to benefit the boys, who are more likely to be willing to experiment with it.

In the area of actions to be taken, she advocated exposure of students to science at a younger age, and suggested that industry involvement in this process could make a difference. She asserted that development of role models will not help if society continues to ignore the role models we have. In a series of concluding points, she emphasized the idea of providing a choice of career paths. Likewise, child care, though not only a "women's issue," if provided more effectively, would enable a choice for women contemplating family and career involvement. Finally, the ultimate value of role models is to make students aware of the choices they have.

In the final talk, Barbara Wilson developed further the comparison of the U.S. with other countries. She summarized the status of female physicists in the U.S. by noting that of 250 APS-DCMP prizes she studied in 1985, only one had gone to a woman. Further, only 1 woman in 22 is an APS fellow, vs 1 in 7.5 for men. [Author's note: The situation isn't improving. Of some 200 fellows granted in 1988, only one was female!] In general, women in physics have higher unemployment, longer post-docs, lower salaries, and less prospect of promotion.

The condition of U.S. physics faculty is especially egregious. In 174 Ph.D. departments in 1985, there were 74 women (out of 4157 total faculty). Two-thirds of the schools had none.

The only major university with a respectable record in this regard is MIT (with 7 female faculty). Wilson recalled that this was largely the result of a decision by a single highly placed man. She suggested that other such individuals need to realize the influence they have and use it for constructive change. The same point emanates, in a different way, from the comparison of the U.S. with other countries. The record for female Ph.D. production here is mediocre, near the median of the countries for which data could be obtained. Even in industrial research, we are just below the norm. However, in faculty population fraction we rank with the lowest! I note the probable relation between this fact and the lack of growth in the female physics population fraction.

She predicted that, while numbers may

continue to increase slowly and restrictions may lessen, there is little prospect for immediate change in the faculty situation. This crucial factor will continue to dampen women's progress in physics for the foreseeable future.

My assessment of the symposium is that it was effective, both in raising the issues and in suggesting ways to attack them. There were common threads that ran through all the presentations. One was the urgent need for progress in moving women into physics faculty positions. The present system is simply not working as it should, and we must find ways to change it.

A second common thread was the effect of stereotyping on women's entry and progress in the field. This very difficult problem, which relates to attitudes deeply ingrained in our culture, is one that will only yield to sustained attention over a generation or more.

Finally, it was clear that a general improvement in physics education, especially with emphasis on lab work and modern physics, would yield a greater benefit to women than to men. Those 88% of the girls who never repaired anything mechanical at home might then gain much needed confidence in their abilities. Along this same line, the entire physics community needs to present a more accurate picture of physics as a science to the public at large. Just as the stereotyping of women reduces their entry into physics, the (nearly opposite) stereotyping of physics as a purely numerical abstract set of rules, devoid of any intuitive sense of discovery, merely serves to strengthen the effect.

These points were not lost on the audience. The discussion afterward was lively and constructive, and continued for close to an hour. This, combined with the high attendance (nearly half male) leads me to believe that this symposium may have made a real impact. On behalf of the CSWP, I thank all the speakers for their substantive contributions and their willingness to confront the difficult issues. We can realistically hope that many women will benefit in the future from their efforts.