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STATUS

A REPORT ON WOMEN IN ASTRONOMY

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A Publication of the American Astronomical Society Committee on the Status of Women in Astronomy

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Speeding up the Long Slow Path to Change

By Meg Urry

IT'S 2003, and there are still physics departments with no women faculty (and many more with no minorities). Why? Progress is not impossible: the trends are generally in the right direction, but change is painfully slow, in marked contrast to progress in the equally demanding disciplines of biology, chemistry, engineering, mathematics, and medicine. Why has physics proved so resistant to change?

When I (gently) ask my colleagues around the country why they hire mostly or only men, they say there simply are no women available to hire.

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Women Partners in Law Firms: Best Practices for Much-Needed Change

By Linda Dakin-Grimm

U.S. LAW SCHOOLS have been educating classes consisting of 50% women, on average, for many years. Women occupy a steadily growing percentage of judgeships as well as legal positions in government agencies and in industry. In private practice, however, notwithstanding the fact that women are proportionally represented in the attorney entering cohorts at most major law firms, women continue to be significantly under-represented at the equity partnership level in those firms. And the numbers are not improving in any meaningful way.

In 2002, the average percentage of women in major law firm "partnerships" is widely reported to be 15%. This statistic is, however, misleading,

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But the top 10 physics departments graduated 138 women with Ph.D.s in physics in the 5-year period 1988-1992 (10.7% of total Ph.D.s). Twenty to thirty of the top physicists produced each year are women. In 2000, 13% of physics Ph.D.s went to women. Women are indeed available.

Recruitment is often targeted, however, perhaps more so in the more elite universities. They want the best, and they are sure they know the best people; they don't expect them to float up through the applications process. In such a situation, hiring women requires

(a) valuing their talents, and

(b) thinking of them when a job (or talk or prize) is at hand. This does not appear to happen automatically.

Why should we care about the number of women in physics? People agree on several good reasons:

- Physics departments want more majors, better graduate students, and more public (federal) support of physics.
- Women (and men) want and deserve challenging, interesting work, and many women love physics.
- No physicist believes, "We already have all the brains we need in our field."
- The law says there shall be equal opportunity.

So where are we falling down? My physics colleagues are good people, who want to do the right thing. They do not discriminate; they would not deny opportunity to women because they are women. So where is the problem?

Let me try to answer this question with three stories.

(1) The powerful act powerless – the system worked for them, and they expect it to work for everyone.

At the March 2002 APS meeting in Indianapolis, the chair of a large physics department at a major Midwestern university points out what he sees as the problem. "At the beginning of my introductory physics class," he explains, "I ask which students are planning to major in physics, and the women do not raise their hands!" His department is responsible for graduating many physics majors and Ph.D.s, yet he is convinced that women simply don't like physics, and there is nothing he can do to change their minds. He and his colleagues feel powerless to affect gender imbalance. Another physicist nods his head in agreement, convinced that women are simply more interested in other fields, like biology and chemistry — "they just don't have an interest in physics." Subtext: There is nothing we can do to change this.

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But the young students in the physics chair's class are new to the discipline. Perhaps they have never had a physics class before, or perhaps their high school class did not catch their imagination. Is it necessary that they know they love physics before they've studied it? Is early certainty of one's vocation a sign of one's talent for it? Should physicists come only from the ranks of those who enjoy what may have been a boring, rote-like class with little connection to modern physics research? Shouldn't physics professors take as their responsibility the mission of showing students how very interesting and rewarding physics can be?

Ah, but most professors teach physics the way they were taught; after all, it caught their imaginations 20, 30, 40 years ago, so surely it will do the same for today's students — or at least, they believe, it will attract the very best students.

This is where the problem starts to become clear. The students in classes today — especially the women (and minorities) — are not junior versions of their professors. Their paths in life have been different, their interests may be different, and their approaches to science may be different. (Or may not; this is controversial, but no doubt there is a much larger range of styles among today's student body than there were in that professor's cohort of physics majors.) Sheila Tobias described this phenomenon in her fascinating book "They're Not Dumb, They're Different."[1]

Well, should we say, never mind, I only want the best students, and those are the ones like me, by definition?!

This solipsistic approach is a danger in contemporary physics. It stems from the relative homogeneity of our physics faculty, and it reinforces that homogeneity. Yet diversity historically has led to intellectual breakthroughs — the greatest new ideas are born in the roiling waters at the confluence of different rivers of thought. A narrow set of views and styles in physics will benefit no one — not women and minorities, and most importantly, not the science. If that doesn't persuade you, read the work of Elaine Seymour and Nancy Hewitt,[2] which demonstrates that many of the best students are leaving science — the notion that "the cream automatically rises to the top" (and majors in physics) is simply wrong.

A narrow set of views and styles in physics will benefit no one – not women and minorities, and most importantly, not the science.

(2) "You're not a member of my club."

Story number two is also from the March 2002 APS meeting. A young woman physicist, an assistant professor at a small but excellent 4-year college — energetic, smart, talented, attractive, and with a friendly personality — goes to the March meeting in Indianapolis to give a talk. From the airport she takes a taxi directly to the convention center, eager to register and find the room where she will speak the next day. Pulling her suitcase behind her, she wanders through the convention center. She separately encounters three women physicists; they all smile and offer to help her, as she is obviously just arriving and looking lost. But they don't have the program, which is what she needs, and the registration desk has closed for the night.

She walks over to a group of young men about her age, who are sitting and talking nearby. She stands politely waiting for them to acknowledge her. She stands for a while. She clears her throat. The men are making fierce eye contact with one another — tunnel vision — and apparently what they are discussing is so earthshaking that they fail to notice her presence. Finally, after a much longer than normal wait, she butts in and asks if anyone has the program for the next day. "Certainly not," answers the first guy, evidently annoyed at the interruption.

"Why would I carry that around? That's the second half of the meeting! It's heavy, of course I don't have it." The second guy chimes in and lets her know how stupid her question is and how her continuing presence is interrupting their important discussion. She turns away, uncomfortable and upset, and the next day is still fretting about this episode.

What is the point of this story? That some young male physicists can be boors, perhaps, but more that it is all too easy for women physicists to feel ill at ease, out of place, in the wrong place altogether. There are few role models for most of us. There are few women faculty and few fellow female students. Women physicists have no clear path in front of them, no clear connection between where they are – pursuing physics — and where they want to be — advancing in the profession.

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It is no wonder that women physicists tend to have greater self-doubt than men. In a study at MIT, graduate students in male-dominated science and technology fields were asked to rate their own abilities, and their professors were asked to rate them as well. The actual distributions of ability for men and women did not differ, according to the professors, but the self-evaluations did. On average, the women rated themselves below average and the men rated themselves above average. (Perhaps all the men were from Lake Woebegone?) The men were sure they were better than the next guy, and the women were sure they were worse.

Look at the difference when male and female students do poorly on a test. The women are likely to say, "Oh God, I blew that test, I am so stupid!" and the men are likely to say, "That test sucked, and that professor is a jerk!" They blame external factors, while women blame internal factors. These are gross generalizations; there are men who act like the women I am describing, and women who act like the stereotypical man. But I think most of you will recognize the aptness of the generalization.

It may not even matter whether the problems women experience are perceived or real. Last spring's Caltech report on the status of women faculty found no gross statistical disparities between male and female faculty, such as had been found at MIT three years earlier. (See **diversity.caltech.edu/CSFWFINALREPORT1.pdf.**) At Caltech, both men and women voiced similar complaints about the institution, but women faculty were markedly more dissatisfied, stemming at least in part from their lack of a voice in the administration. Conclusion: women may feel bad even if, objectively, they are not treated any worse than the men. Perceptions define reality for the women.

In physics departments around the country, women are feeling ill at ease, out of place, not at home. Often it's as simple as statements about what makes a good scientist, or what some famous scientist was like. Think of our heroes: read Richard Feynman's autobiography[3] and tell me what **you** thought. Maybe you liked him, maybe you hated him, maybe you envied him — but probably you didn't feel as uncomfortable as his women readers did. Women appeared to play a remarkably small role in his life — several wives go unmentioned or at least undescribed — except for the ones he's dating or trying to date. Did he even mention his sister, Joan Feynmann — described in the article on page 17 of this issue? (Here the biologists can apparently give the physicists a run for their money, with James Watson's latest book, which, I confess, I can't bring myself to read.[4])

What of the women who pass these barriers, who somehow manage to avoid having their love for physics eroded by feelings of inadequacy or not belonging? What happens to them? When the internal battles are won, what influence is exercised by the external factors? This brings me to my third story ...

3) Sociology holds some of the answers, if physicists would only listen.

... which is really a series of stories about statistical studies and sociological experiments. Some were done some years ago, and it may be that the situation in physics has improved. However, there is rather more evidence that improvement, if any, is glacially slow.

a) Referees judge gender of author, not quality of work.

In 1983, Paludi and Bauer[5] published a revealing study about the influence of gender on perception of excellence. Three-hundred and sixty referees, half men and half women, were each sent a mathematics paper to rate, with the author's name given variously as John T. McKay, Joan T. McKay, or J. T. McKay. On a scale of 1 to 5, 1 being excellent, the reviewers found that the man's paper was considerably better than the woman's! (*See table below.*)

	John T. McKay	Joan T. McKay	J. T. McKay
Men	1.9	3.0	2.7
Women	2.3	3.0	2.6

The neutral, initials-only designation was also rated rather lower than the man's paper (though higher than the woman's), apparently because many referees believed the initials to represent a woman (as they indicated in response to follow-up questions).

Note that both men and women found the paper written by the woman to be markedly less good than the man's paper. It isn't just men undervaluing women's work, it is all of us.

b) Gender-based bias in the literary/artistic world.

The Modern Language Association is the professional association for researchers and teachers of modern languages (including

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English). Unlike the American Physical Society, abstracts submitted to the annual MLA meeting are refereed before being accepted. In 1974, the MLA began "blind" refereeing, in which the referees were no longer told the authors' identities. Prior to this, women had given very few papers at MLA meetings. Shortly after the change, within a few years, women were giving many more papers, in roughly the same percentage as in the submitted abstracts.

A similar shift to blind auditions for the world's great orchestras has greatly increased the number of female musicians accepted.[6] Despite blatant prejudice from prominent male musicians — the well-known conductor Zubin Mehta, formerly of the New York Philharmonic, was once quoted as saying, "I just don't think women should be in an orchestra…" — women turn out to be perfectly equal to men in their musical talent, once the listening ears no longer know the musician's gender. (See L. M. Frattare (1999). STATUS, January; **www.aas.org/~cswa/pubs.html.**)

c) But science is objective, not subjective like art or literature! Can there really be gender bias in science?

A few years ago Nature published several articles about gender bias in applications for research support from the Swedish Medical Research Council.[7]

Two researchers obtained the applications and the grades and comments. They found that women had to have published much more, and had to have been rated much more highly, in order to have an equivalent chance at the fellowship. In quantitative terms, a woman had to be more than twice as good as a man to rank equally on the final list.

These results agree well with longitudinal studies of women and men Ph.D. scientists, closely matched in ability and field, which found strong evidence of lesser advancement for even very talented women. Even taking into account all sorts of variables like family status and productivity, the overwhelming predictor of success was gender.[8]

Women were paid less, were less likely to be hired into faculty positions, took longer to get tenure, and fewer got tenure than the men. My own recent study of the astronomy profession — statistical, not longitudinal — suggests that at best, women are doing as well as men, and consistently they are doing about 1 sigma worse. (See C. M. Urry (2000). STATUS, June; **www.aas.org/~cswa/pubs.html.**)

(Ironically, the Catch-22 of this discussion is that the numbers of women are so low that the statistical significance of any discrepancies is also low.)

d) Who are the leaders?

Another sociological experiment: subjects are shown a series of photographs of people sitting around the table and asked to identify the leader of each group. They overwhelmingly pick the man, regardless of whether a woman sits at the head of the table, or has a pile of documents near her, or is pictured speaking authoritatively. Independent of contrary visual cues, the man is seen as a leader in preference to the woman.

e) Men stand taller.

Even more abstract: subjects of an experiment are shown photographs of men and women and asked to estimate their heights. The photos include some common reference object, such as a doorway or desk, to set the scale. The men and women in the photographs were selected to have the same average height, yet the subjects consistently guess the men are taller. Their expectations (in this case, correct expectations) that men are on average taller than women strongly influence their evaluation of an absolutely objective quantity, height.

Your female colleagues are subjects of sociological experiments every day, when they are interrupted and their speech occupies a smaller fraction of the discussion, when their idea is dismissed or overlooked but lauded if a man suggests it a few minutes later, when students are skeptical of their expertise but unhesitatingly assume male professors are fully competent.

We should not be surprised — the popular image of success, of competence, of science, is male (think Einstein, not Tinsley or Rubin or Wu). We are almost all prejudiced — against women, against minorities — in the sense that we have absorbed the gender and race stereotypes that prevail in our society. As the Paludi and Bauer study shows, women are not immune from feeling this kind of prejudice. The best any of us can do is to recognize it and correct for it, long enough to change the face of science, and thus to render obsolete the present stereotypes.[9]

Toward a Better Future

So what is the strategy for moving forward? We aren't going to change society, or at least, not rapidly, which means substantial inertia in these damaging stereotypes. Instead, we need to raise awareness about the extra barriers for women. Remembering that every physicist has his/her own theory about why women are scarce

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in physics, we must somehow make them aware of the relevant data, which show overwhelmingly that our expectations and evaluations of women's abilities are lower than they should be, and that this has a negative feedback effect on the participation of women.

These sociological barriers affect many other arenas besides physics, of course, so I return once more to the question of why physics is so much worse — that is, lower in the percentage of women and slower/harder to change. My own speculation is that physics is more hierarchical, more elitist (most physicists would simply say "elite"), than other professions, and thus women's feelings of inadequacy (and men's of "over-adequacy," if I may coin that term) are exaggerated. The effect on women is therefore harsher in physics than in, say, medicine, where there are many more opportunities for women. Astronomy has a milder culture, less overtly elitist than physics, and it has about twice the percentage of women at all levels. Two exceptions are the elite sub-fields of cosmology and theory, which have far fewer women. Medicine: many women. Surgery, the elite sub-field? Far fewer women. Law: many women. Law firm equity partners? Very few women. And so on. It's a hypothesis that bears testing, if we can find an objective way to assess elitism.

Meanwhile, the three earlier stories suggest at least a few common-sense recommendations:

1) Let us not assume others are like us. Interest in physics comes at different stages and manifests in different ways. Female talent is out there — let's look for it and nurture it. If girls and women come forward less readily, let's not interpret that as disinterest or reluctance or lack of skill.

2) We must compensate for the lack of role models, offer better support, and teach parents, teachers, and guidance counselors to encourage interest from girl proto-scientists. Today such mentors know better than to push girls away from the natural sciences and toward domestic science, but they may offer subtle cues that have the same effect.

3) Women who have overcome the obstacles may well feel isolated, invisible, and marginalized. (There are highly visible exceptions.) No women or men should imagine the playing field ever really levels out — we hope it will someday, but there is no evidence that it has done so yet.

I believe there is good reason for optimism. The percentage of physics Ph.D.s going to women is increasing, albeit slowly. Some senior male colleagues are taking this challenge as their own, and have helped effect change. The number of women hired as junior faculty may be even be "right," in the sense that women are roughly the same percentage of assistant professors as they are of postdocs. Finally, the dearth of women in physics is receiving serious, concentrated attention, as in the national CAWMSETT report (Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development; see **www.nsf.gov/od/cawmset/start.htm**) and the International Conference on Women in Physics (see **www.if.ufrgs.br/~barbosa/ conference.html**). But we cannot wait complacently for physics to enter the modern era in gender equality — it's too hard a problem and only persistent pressure will make the big beast move. ❖

References:

1 Sheila Tobias (1990). *They're Not Dumb, They're Different*. Tucson:Research Corporation.

2 Elaine Seymour and Nancy M. Hewit (2000). *Talking About Leaving: Why Undergraduates Leave the Sciences.* Boulder: Westview Press.

3 Richard P. Feynmann (1988). *Surely You're Joking, Mr. Feynmann.* New York: Bantam.

4 James D. Watson (2002). *Genes, Girls, and Gamow: After the Double Helix.* New York: Knopf.

5 M. A. Paludi and W. D. Bauer (1983). *Goldberg Revisited: What's in an Author's Name.* Sex Roles 9, 387-390.

6 Claudia Goldin and Cecilia Rose (2000). *Orchestrating Impartiality: The Impact of 'Blind' Auditions on Female Musicians.* American Economic Review, Vol. 90, No. 4, pp. 715-741.

7 C. Wenneras and A. Wold (1997). *Nepotism and Sexism in Peer-Review.* Nature, 387, 341-343.

C. Wenneras and A. Wold (1999). *Taking a Gender Tiger by the Tail.* Nature, 399, 747-748.

8 N. F. Ahern and E. L. Scott (1981). *Career Outcomes in a Matched Sample of Men and Women Ph.D.s: An Analytical Report.* Washington, DC: National Academy Press.

G. Sonnert and G. Holton (1995). *Gender Differences in Science Careers: The Project Access Study*. New Brunswick, NJ: Rutgers University Press.

9 M. A. Paludi and W. D. Bauer (1983). *Goldberg Revisited: What's in an Author's Name*. Sex Roles: A Journal of Reseearch, 9, pp. 387-390.

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and likely inflated. This is because of the growing trend in major law firms to bestow the title "partner" without actually granting any equity ownership in the firms. Such "partners," who often are counted in diversity statistics, are privately called "non-equity partners," and are, in effect, salaried employees with no more job security or power than associate attorneys. Because law firms and the non-equity partners themselves are loathe to discuss this practice, there are no reliable data on how many of the women reported to be partners in major law firms are actually in the non-equity class.

Women enter major law firms at the same rate as men. During the course of what is traditionally an eight to ten year associateship, however, women depart the law firm world at a startling rate. By the time partnership decisions are made, women often are simply not around to be considered. The reasons for the failure of law firms to retain women lawyers are numerous. Two of the most significant are:

Family-related Issues

The typical law school graduate is in his or her mid to late twenties, and has just completed seven years of higher-level education. The average length of time law firms expect lawyers to work as "associates" before consideration for partnership is 8-10 years. In order to have sufficiently good standing even to be considered for partnership, law firms expect their associates to "bill" in excess of 2000 hours per year during this period of associateship, and often significantly more. Because lawyers must spend substantial additional "non-billable" time at work, this translates into 50- to 60-hour weeks, without factoring in time for vacation. The long-established cultures in many law firms dictate that if a lawyer is not willing or able to devote the full-time effort to the firm, that lawyer is not "serious" about the practice of law at the highest level.

Unfortunately, this system, which works reasonably well for men who are not expected to be the primary caregivers in families, often does not work well for women. The years during which law firms expect their associates to devote sixty hours per week to law are the very same years during which most women establish their families and have children. In fact, the dramatic drop in female fertility after 35 would seem to indicate that a woman who wants children would not be wise to postpone having them until after 35 — that is, until after "making partner" in a law firm.

Many women enter firms fully intending to "do it all" — have a satisfying career in a law firm and have children as well. Unfortunately, the system is so inflexible that many of them find that they cannot do it all, so the women leave.

Law Firm Culture-Related Issues

Most experts on diversity in the work place agree that effective mentoring relationships are critical to retention of persons of diverse backgrounds in the work place. Lawyers, like everyone else, have a natural tendency to mentor people who remind them of their younger selves. Thus, men have a tendency to mentor young white men, as women have a tendency to mentor young women. Given that there are few women partners in major law firms (and some are not interested in mentoring young women at all) young women in law firms often feel that they have no role models and mentoring support to encourage and guide them through their early careers.

The most successful law firms have recognized the need to better retain women, and to increase the number of women in their partnerships.

The most successful law firms have recognized the need to better retain women, and to increase the number of women in their partnerships. These firms have implemented a number of practices aimed at improving retention of women and increasing the number of women in their partnerships. These practices are outlined here.

Cultural Practices

1) The better firms institute diversity training programs, with participation mandatory for all lawyers. The goal of such programs is to foster a work environment that is hospitable to women and persons of diverse backgrounds, and to increase sensitivity to and awareness of diversity — and specifically gender — issues.

2) The better firms establish diversity committees to act as an ongoing force to identify, at a relatively early stage, women

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candidates for partnership from all practice groups, and to work to ensure equal opportunities for those candidates.

3) Better law firms explicitly identify as a criterion, for determining existing partner compensation, a partner's efforts to improve diversity within the firm and, in particular, efforts to enhance the retention of women within the practice group.

Flexibility Recommendations

4) The better law firms establish "flex time" policies, which permit associates, in appropriate circumstances, to work from home during both standard and non-standard business hours, to accommodate family needs. To make such policies truly effective, the firms must clarify to their associates that they are committed to making the flex time policy meaningful, and that attorneys who take advantage of the policy will not be stigmatized as a result thereof.

5) The better law firms establish part-time policies, for family reasons, that are not perceived as a "dead end" or "mommy track" program, available "only in the most exceptional circumstances." The part-time policies must state expressly that attorneys who take advantage of the policy will not be stigmatized as a result thereof, and will be considered for partnership.

6) The better law firms allow flexibility in the return to work schedule following a parental leave. Specifically, parents who are primary caretakers are allowed to return to work on a limited schedule after parental leave and, in appropriate cases, to increase their hours gradually as child care demands permit, without jeopardizing their chances of partnership.

Organizational Recommendations

7) The better law firms have established women's groups supported by the interested women partners, to provide women with a forum to discuss issues common to women.

8) The better law firms have adopted formal mentoring programs to make women associates (among others) as comfortable as possible within the firm as soon as possible, with a mentor available to "run interference" for the associate when the need arises and generally to try to replicate the support relationships that come to exist naturally for certain people. In light of the difficulty in retaining women once they are in the partnership, the mentoring process should continue for incoming women partners, to ensure, to the extent possible, that women partners possess the same base of knowledge about how to succeed within the partnership as do male partners.

9) The most successful law firms have implemented steps on the practice group level to ensure that assignments are allocated among associates with a view to fostering training and development on a "gender-blind" basis, and that associate evaluations are compiled with due recognition of gender-based differences in work/communication styles.

10) The most successful firms have made an effort to appoint a woman partner to a visible management role.

While these suggestions will not be a "cure" for the retention of women, they may serve as a beginning. Similar practices are likely to be effective in other male-dominated professions, such as astronomy. ❖

Diane Quinn is an assistant professor of psychology at the University of Connecticut-Storrs. She received her B.A. from the University of Virginia and her Ph.D. from the University of Michigan (in 1999). STATUS editors first became aware of Dr. Quinn's study via the June 10, 2001 Washington Post article, "Mind Over Math" by Richard Morin. A copy of this article can be found in the American Astronomical Society's (AAS) December 2002 newsletter.

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Diane M. Quinn

Women, Math, and Stereotype Threat

By Diane M. Quinn

For many years, social scientists have tried to explain the gender gap on standardized mathematical tests. Explanations have ranged from biologically based to developmentally socialized. For example, researchers have examined differences in brain formation and exposure to neonatal hormones, as well as whether girls are less likely to be encouraged to experiment with math and science outside of the classroom. I am not wholly disputing these or other related possibilities; however, I would like to suggest that, when examining why the best and brightest of women underperform on math tests or drop out of math related fields, the subtle effects of cultural stereotypes have been largely overlooked.

Few would argue that the American culture abounds with stereotypes. When I ask students in my undergraduate psychology classes to name stereotypes, they can spout ten to twenty stereotypes with ease. One stereotype that we all know is that boys/men are better at math and science domains, whereas girls/women are better at English and reading domains. These stereotypical beliefs are transmitted throughout the culture via mass media, books, parents, peers, and teachers.

How might these negative stereotypes account for a gap between men and women on tests of mathematical ability? My colleagues Steve Spencer, Claude Steele, and I believe the answer lies in the interaction between cultural stereotypes and the test-taking situation, what we call a "stereotype-threat" situation. Stereotype threat occurs when a person is in a situation in which a negative stereotype about that person (or that person's group) could be applied to the person and used to judge the person's behavior. In the case of gender and math, imagine a boy and girl sitting down to take the SAT for the first time. They have equivalent math experience. Taking the SAT is a tense, sometimes frustrating experience for both of them. However, as the girl is taking the test she has an extra worry to contend with that the boy does not: a stereotype that she, as a girl, has inferior math skills. As she experiences frustration and difficulty with the problems, she has the burden of knowing that her difficulty could be judged as proof of the veracity of the stereotype. The boy has none of these doubts or thoughts to interrupt his performance. It is important to note that in this situation neither the girl nor the boy has to believe that the stereotype is true. Stereotype threat is not an explanation based on internalized inferiorization. Just the knowledge of the stereotype itself is enough to affect performance in the situation. How do we know this occurs?

My colleagues and I have tested the stereotype-threat hypothesis in a series of studies. In all of our experiments we bring university men and women matched for equivalent math backgrounds and interest into the laboratory. In the first of these studies we simply gave participants an easy or difficult math test. We found that women only performed worse than men on the difficult math test. To demonstrate that it was the threat of the stereotype that caused this underperformance, we gave a second group of men and women the same difficult math test. In order to make stereotypes about math explicit, half of the participants were told that the test had shown gender differences in the past. In order to eliminate a stereotype-based interpretation of the situation, the other half of the participants were told that the test had been shown to be gender-fair — that men and women performed equally on this test. In line with our predictions, when the stereotype was not applicable to the situation, when men and women were simply told that they were taking a gender-fair test, men and women performed equally on the test. When told that the exact same test had shown gender differences in the past, women scored lower on the test than men. Just a simple change in the situation — a different line in the instructions — changed an outcome that many believed intractable. Notably, and perhaps more ominously, we have also conducted studies

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where we have a condition in which we do not mention gender at all — we simply describe the math test as a standardized test. In this situation, women also score lower on the test than men, suggesting that standardized mathematical testing situations are implicitly stereotype-threat situations. Follow-up research in our own and other laboratories has replicated these findings and explicated some of the boundaries of stereotype threat. Stereotype threat occurs most strongly for women who are highly identified with math and are taking a test that is pushing the limit of their skills. When a test is easy or the women no longer care about how they perform on the test, changing the stereotype relevance of the situation is unlikely to affect performance.

We have found some provocative clues to how stereotype threat works to undermine women's performance. Stereotype-threat situations lead to both increased feelings of anxiety and more cognitive activation of female stereotypes. Both anxiety and stereotype activation have been linked to worse performance. When we look at what women and men are actually doing when working on the difficult test, we found that women and men primarily used the same strategies to solve the problems; however, women in stereotype-threat situations were less likely to think of any way to solve a problem. That is, women were more likely to "blank out" or "choke" on a problem when they were in a stereotype-threat condition. Thus research results so far point to the following scenario: when women with a strong interest and identification with math are in a situation in which their math skills could be negatively judged, their performance is undermined by the cognitive activation of gender stereotypes combined with some feelings of stress or anxiety.

Although more research is needed to fully delineate the stereotype-threat process, we do know that women are not alone in being affected by negative stereotypes. Research on stereotype threat has demonstrated its effect on African-Americans and Latinos in intellectual situations, on the elderly in memory testing situation, and even on white men in sports situations.

What can be done about a cultural stereotype? Some might argue that if the stereotype is "out there" in the culture, there is nothing that can be done to stop its effects. However, we are not so pessimistic. In our studies we make very simple changes — for example, adding a line in the instructions communicating that a test is gender-fair or non-diagnostic — that have a dramatic effect. If girls and women encounter fewer situations in which they experience stereotype threat, their increasing performance may one day break the ugly cycle of the stereotype leading to poor performance and the poor performance in turn feeding the stereotype. ❖

Editor's Note

On page 19 of the June 2002 issue of STATUS, a table contained within the "Letter to the Editors of STATUS from the Faculty of the Department of Astronomy, University of Arizona" was incorrectly labeled. The table row headers should have been "Table 1" and "Actual" rather than "Total" and "Caltech." We apologize for this error. The archived PDF file of the June 2002 issue of STATUS on-line has been corrected: **http://www.aas.org/~cswa/pubs.html.**

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"Show Me the Money": Salary Equity in the Academy

By Donna R. Euben

ARE WOMEN BEING PAID less than men? Some recent court cases reveal unequal treatment.

The Bible values a man at "fifty shekels of silver" and a woman at only thirty. Although today's money is different, the financial gap between women and men persists. At many campuses, women continue to be paid less and promoted more slowly than their comparably qualified male colleagues. The AAUP's Annual Report on the Economic Status of the Profession indicates that in 2000 - 2001, women faculty, on average, received 91 percent of what their male colleagues were paid. Corroborating the AAUP's data are three other recent studies on wage disparities between comparably qualified men and women professors, which identify the average salary gap as ranging from 6.2 - 8 percent.

Winn Newman, the eminent labor and employment lawyer, defined wage inequity as meaning "simply that women or minorities are paid less for the work they do than men or non-minorities, because of their sex or minority status and not because of the jobs they perform." Such gender-based salary inequity in higher education appears alive and well:

- In January, the Minnesota State Colleges and Universities system settled for a rumored $830,000 a class-action suit filed by about three hundred women professors at St. Cloud State University, who alleged that they had been paid less and promoted more slowly because of their gender.

- The University of Cincinnati AAUP chapter is currently in arbitration with the University over the finding, by a study the chapter commissioned, that women professors receive salaries up to 4.85 percent less, on average, than their male colleagues.

- In 1998, the University of South Florida settled for $144,000 a pay-discrimination lawsuit brought by five women professors. The professors relied on a study that found that female full professors were paid, in 1997, an average of $8,380 less than their male counterparts.

This article reviews some of the continuing challenges for the higher-education community in achieving salary equity, as illuminated (or made murkier) by recent legal cases. It also suggests issues that institutions — faculty members and administrators — might consider when undertaking salary-equity studies.

The EPA bars gender discrimination in wages, requiring equal pay for equal or "substantially similar" work in public and private institutions.

The Law

Most courts are wary of interfering with the unique nature of academic decision making. One federal appellate court described this concern as fear of "engag[ing] in a tired-eye scrutiny" of academic employment decisions. Another federal district court recently expressed "slight unease" at "thrashing around in the sacred grove of academe looking for possible race or gender bias." Courts have properly recognized that "[q]uestions of promotion and compensation in the academic world are rarely as straightforward as they sometimes are in the commercial world." Nevertheless, colleges and universities are not, as another federal appellate court put it, "immunized" against "charges of employment bias." Legally, they must protect faculty from gender-based salary inequities.

In seeking to rectify gender-based wage disparities, faculty rely mainly on two federal laws: the Equal Pay Act (EPA) and Title VII of the Civil Rights Act. Executive Order 11246, which President Lyndon Johnson issued in 1965, also prohibits discrimination by federal contractors, which includes many colleges and universities. In addition, many states and some localities have anti-discrimination laws and "baby" EPAs.

The EPA bars gender discrimination in wages, requiring equal pay for equal or "substantially similar" work in public and private institutions.

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To establish a claim, a professor must prove that a university or college pays a higher salary to a colleague of the opposite sex for performing work that is, as the U.S. Supreme Court has explained, equal in "skill, effort, and responsibility, and which [is] performed under similar working conditions." At the same time, the law allows for salary differences between women and men based on a number of "affirmative defenses," including merit, seniority, and factors "other than sex."

Title VII protects individuals from discrimination by an employer, including most colleges and universities, on the basis of sex, race, color, national origin, or religion. The law specifically prohibits discrimination "against any individual with respect to his compensation . . . because of such individual's . . . sex." The U.S. Supreme Court has explained that Title VII bars "not only overt discrimination, but also practices that are fair in form, but discriminatory in operation." The Bennett Amendment to Title VII incorporates the EPA's affirmative defenses into Title VII's prohibition against wage discrimination based on gender. Recent litigation brought under these laws has highlighted the challenges involved in achieving salary equity in higher education. To whom, for example, is an allegedly underpaid female professor to compare herself? What is the proper role of market forces in setting salaries? Can merit-pay and promotion systems be "infected" with gender discrimination? Are public colleges and universities "immune" from claims by individual professors under federal anti-discrimination laws? When might "reverse discrimination" claims by male professors lead to salary-equity adjustments?

Point of Reference

Identifying a comparably qualified "male comparator" has proved difficult for many women seeking relief from underpayment. In particular, to whom should a woman professor compare herself when no comparably qualified male colleagues exist in her department?

In 1989 Barbara Lavin-McEleney, who teaches criminal justice, faced such a quandary. She first expressed concern to the Marist College administration about her salary when the school newspaper reported that the average professor's salary was about $4,000 more than she received. In 1996, after having obtained no satisfactory response, she sued the college for pay discrimination under Title VII, the state anti-discrimination law, and the EPA. At trial, both the college's and the professor's experts found a salary differential between her and comparable men, but they disagreed on whether the difference was "statistically significant." The jury awarded her about $120,000 on her EPA claim, and the college appealed. On appeal, the college contended that Lavin-McEleney inappropriately compared herself to a "hypothetical" male comparator, rather than to an actual male colleague in her department.[1] There were, however, no assistant professors of equivalent seniority in her department.

The court disagreed with the college, noting that Lavin-McEleney had identified two male comparators who had positions "substantially equivalent" to hers. The comparators were not in her department but in the psychology department of the social and biological sciences division, the same division in which Lavin-McEleney taught. In its reasoning, the court relied on expert testimony that departmental differences within divisions were not associated with differences in salary. The court affirmed the jury verdict in favor of the professor, concluding that she properly identified a specific male comparator, even though the comparator was outside of her department.

Market Forces

As far back as the early twentieth century, some administrations argued that the market justified salary differences between women and men. So, for example, in 1917, when a survey by the AAUP's Committee on the Status of Women in the Academic Profession found that 47 percent of coeducational institutions of higher education and 27 percent of women's colleges "frankly admitted that women are given less salary and lower rank than men for the same work," some administrators defended the salary inequities as dictated partly by the market. Today, some administrations and faculty unions make similar "market defense" arguments. Their doing so, however, risks perpetuating market-based salary disparities among women and men. As the AAUP women's committee explained in its 1992 report, Salary-Setting Practices That Unfairly Disadvantage Women Faculty:

"[M]arket-determined wages and discrimination that merits correction are by no means mutually exclusive. The prices or salaries that a market sets depend on supply and demand. If persons operating on the demand side of the market — those with the power to make salary offers and to hire — behave in a discriminatory manner because of societal tradition, and if competition is not rigorous enough to eliminate such discriminatory behavior, then the market itself will produce discriminatory results."

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Courts have recently considered whether the "market rate" is a valid measure upon which to base faculty salaries, and the results have been mixed. In 1998, the Nevada Supreme Court relied on market theory to justify a salary differential between a white female professor, Yvette Farmer, and a comparably qualified black male professor at the University of Nevada.[2]

She applied for an assistant professorship in sociology, with an advertised salary range between $28,000 and $34,000. Under a "minority bonus policy," which allowed a department to hire an additional faculty member following the initial placement of a minority candidate, the university first hired as an assistant professor in the sociology department a black male candidate who was comparably qualified to Farmer. He was offered $35,000 a year, with a $5,000 increase upon completion of his doctorate. Farmer was hired the following year at an annual salary of $31,000, with a $2,000 raise after completion of her dissertation.

Farmer and her colleague started with an initial pay differential of $7,000 upon completion of their dissertations, which continued to widen because of the male professor's additional year of teaching and differences in merit increases. At trial, Farmer won a jury verdict of $40,000 against the University of Nevada for several legal claims, including violation of the EPA.

On appeal, the university asserted that because only 1 percent of its faculty were black and 87 percent were white, and because women made up 25 - 29 percent of the faculty, it should hire a black man before a white woman to reduce this racial imbalance. Farmer argued that the wage disparity between her and the black male professor was impermissibly grounded in gender discrimination.

The court, however, agreed with the university that "qualified minority applicants, who are in short supply, can command premium salaries on the open market." It reasoned that the search committee simply "elected to avoid an all-out bidding war with other educational institutions" by offering the male candidate a salary commensurate, in part, with his "overall marketability." The court further observed that the chemistry department had "recently hired a female chemist at a higher salary than a male with similar credentials in order to diversify its faculty. . . . Market forces dictate higher salaries for female Ph.D.s in chemistry due to a shortage of qualified women." The court thus concluded that the pay disparity between Farmer and her black male colleague was permissible based, in part, on market factors.

Another court recently rejected one university's reliance on the market to justify a lower salary for a woman professor.[3] Eastern Michigan University settled a federal EPA case brought by Pamela Speelman, a professor of industrial technology, who contended that she was the second-lowest-paid professor in her department from 1991 - 1997, despite having a higher rank and more seniority than four of her male colleagues. She alleged that her starting salary was below the "target" salary scale, while those of all the male professors were higher than the target scale.

The court noted that Speelman, on average, "taught more students and had larger class sizes" than her male colleagues. Moreover, "she had an additional responsibility as sole female mentor for female students." The court rejected the university's assertion that the male academics could command higher salaries in non-academic positions in the market, which justified their higher salaries. As part of the 2000 settlement, EMU raised Speelman's salary to $55,551 a year, which matched the pay level of her highest-paid male colleagues.

Merit-Pay Debate

The question whether merit pay, like the market rate, replicates or exacerbates gender-based salary inequities also dogs the academic community. As faculty and administration grapple with this issue, the debate is being played out both in court and at the bargaining table.

In 1995, Dorothy Kovacevich, a special-education professor, sued Kent State University, claiming, among other allegations, violation of the federal EPA and Title VII. At trial in 1997, she introduced evidence that she was paid $5,999 less than a comparably qualified male colleague. A jury awarded her close to $12,000 under the federal EPA, but the trial judge promptly overturned the award. The trial court also ruled that Kovacevich had failed to state a proper claim under Title VII.

When she appealed, the federal appellate court ruled on her EPA claim that sufficient evidence existed for a jury to have found that "her lower salary was a result of gender discrimination."[4] The court further ruled that Kovacevich had properly stated a Title VII gender-based wage-discrimination claim at trial based, in part, on the EPA analysis. The case was sent back to the lower court for proceedings consistent with the appellate court's rulings.

The university had argued on appeal that any differences in salary between Kovacevich and her

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male comparators were "due to the school's merit system and across-the-board percentage increases." Kovacevich's evidence, however, suggested that gender discrimination was imbedded in KSU's merit-pay system. The court noted that "rather than a neutral system of merit based on anonymous peer evaluations, the merit award system was driven largely by an opaque decision-making process at the administrative level [that] did not necessarily reflect peers' assessment of applicants' performances, and rewarded men disproportionately to women."

The court also found persuasive Kovacevich's own research on the disparity in merit payments awarded to her department's men and women professors, which indicated that from 1988 to 1992 "forty percent of males in her department received above-average merit awards while only twenty-three percent of its female faculty did so." She also found that her male colleagues were "disproportionately represented among the top salary-earners in her department, even though women made up forty-seven percent of the faculty."

Promotion Lag

Yet another issue facing colleges and universities is whether the promotion system itself is biased. Women professors may have lower salaries because they often advance more slowly than their male colleagues. According to Mary Gray, professor of mathematics at American University, if bias has "infected" salary, and the process for determining rank is similar to that for determining salary, then rank, too, may be "infected."

Gender-based promotion disparity was at issue in the November 2000 settlement between the U.S. Department of Labor and Kent State University. In 1993, the KSU AAUP chapter filed a complaint with the Office of Federal Contract Compliance Programs, which administers Executive Order 11246. The executive order prohibits discrimination "because of race, color, religion, sex, or national origin" and mandates affirmative action for minorities and women; it applies to federal government contractors and subcontractors, including KSU and other colleges and universities.

In filing the 1993 complaint, the chapter relied on a salary-equity study prepared by KSU professors Robert Johnson and Dorothy Kovacevich. The study found an overall "7.38-year gap between women and men in time spent in a lower rank." Among the 464 men eligible for promotion to associate professor, for example, the median time before promotion was 9.55 years, while among the 229 eligible women, the median time was 16.93 years. The delay in the promotion to associate professor cost women faculty up to $10,000 each.

As reported in the media, the terms of the settlement provided that the university pay $219,000 to 24 women assistant professors who had experienced delays in promotion to associate professor between 1991 and 1993. The settlement also required the University to invite women assistant professors who were parties to the complaint and still on the KSU faculty to apply for promotion.

The Sovereign Immunity Hurdle

Professors at state colleges or universities who seek to challenge gender-based salary discrimination must also grapple with the "sovereign immunity" defense. Claiming sovereign immunity, public employers, such as colleges and universities, contend that they are immune under the Eleventh Amendment of the U.S. Constitution from individual suits for monetary damages under federal anti-discrimination laws. So far, however, courts have rejected these administration efforts to defeat the application of the EPA and Title VII to public institutions of higher education.

Reverse Discrimination

In a troubling "Catch-22," some universities' attempts to rectify salary gaps between men and women professors have resulted in claims of "reverse discrimination," especially when underpaid male professors are excluded from applying for any salary adjustments that are offered. A Title VII voluntary affirmative action plan that provides pay raises for women only is permissible when, for example, such a plan is "designed to eliminate a manifest racial or sexual imbalance." Some male professors have challenged institutional findings of such a "manifest imbalance."

In 1992, for example, five male professors at Virginia Commonwealth University alleged that the pay raises totaling about $440,000 that were distributed among 172 of their female colleagues constituted gender discrimination under Title VII. The institution's salary study had indicated that women were paid, on average, $1,900 less than men with the same titles. The federal district court found that this disparity was statistically significant, but in 1996 the federal appellate court reversed the case for further adjudication.[5]

The federal appellate court in this case questioned whether the institution's study established a manifest imbalance, because it failed to

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account for performance factors or for professors' prior service as administrators. In 1996, the university settled the lawsuit with the male professors.

Good Practices

Claims of gender-based wage discrimination persist in and outside of the academy. In 2000, the Equal Employment Opportunity Commission and state fair-employment-practices agencies, which enforce the EPA and Title VII, received 5,357 charges of gender-based wage discrimination.

Instead of litigating, administrations and faculty should work together to design salary-equity studies that consider all of the many factors that can account for salary differences. Litigation should be a last resort. Legal battles over salary equity are extremely expensive and time consuming, and they often yield mixed results for all. Such studies can help to determine whether wage gaps are statistically significant and actually attributable to discrimination as opposed to other causes.

Instead of litigating, administrations and faculty should work together to design salary-equity studies that consider all of the many factors that can account for salary differences.

The University of Louisville, the University of Colorado, and Indiana University-Purdue University, Indianapolis, have recently undertaken voluntary salary-equity studies. And earlier this year, nine leading research universities, including the Massachusetts Institute of Technology and Stanford, Yale, Princeton, and Harvard Universities, announced efforts to abolish salary and other inequities against women faculty in the fields of science and engineering.

Other institutions and faculty exploring ways to rectify salary inequities on their campuses may want to consider the following recommendations:

- *Establish starting salaries.*
  Setting minimum salary scales sometimes helps to mitigate disparities by limiting the pay gap, at least among the lowest-paid faculty in each rank, that often emerges between men and women faculty and leads to careers of underpayment. For example, in January 2001 a gender-equity task force made up of professors and administrators at Marquette University reported that "[b]eing female has the measured effect of lowering initial salary by more than $1,800 on average," and that a "lower initial salary . . . carries through to current salary." Of course, any minimum salaries or "target" salary scales, if established, must be followed.

- *Conduct periodic salary- and promotion-equity studies.*
  Even when minimum starting salaries are established, disparities in pay tend to seep in over time. To avoid such disparities, institutions should engage in regular salary reviews. According to salary-equity consultant Lois Haignere, American University; North Carolina State University, Raleigh; and Tarleton State University have all adopted this practice. In addition, the recent settlement at Kent State University provided for an annual analysis of faculty promotion rates. As the AAUP women's committee recommended in 1992, part of a periodic salary study by institutions should include review of "promotion practices to identify any tendency to . . . promote [women] more slowly than men."

- *Provide briefings on salary practices for new faculty.*
  The AAUP women's committee recommends that "[i]nstitutions . . .disseminate criteria for the setting of pay standards widely, both to those who determine salary and to all faculty members." A recent settlement at St. Cloud University provided for such information sharing.

- *Offer "salary-setting" seminars.*
  Universities should brief academic decision makers, including department chairs, on internal procedures and policies as well as salary discrimination laws. Identify sources of assistance available to decision makers if questions arise during salary reviews.

- *Create equitable merit-pay systems.*
  Be sure that merit-pay programs have

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clear and objective standards that are applied consistently. The Marquette University gender-equity task force recommended that "all departments have written policies in place for distributing merit increases . . . [and] [m]onitor the system to ensure that it does not have a disproportionately negative effect on the salaries of women."

- ***Establish inclusive eligibility criteria for equity adjustments.*** When undertaking salary-equity reviews, all professors — women and men — who are identified as underpaid should be eligible to participate in equity-adjustment plans. Indiana University-Purdue University, Indianapolis, which recently found an unexplained gap of 3 percent in the salaries of men and women, invited all 918 faculty, librarians, and scientists to petition for salary review. Of the 79 applicants seeking equity adjustments from the $100,000 salary pool, 34 reportedly received them: 19 men and 15 women, including 28 white and 6 minority applicants.

Salary equity is a complex issue, especially in academe, and it requires attention. Commenting on a 1999 report on gender inequity in MIT's School of Science, Robert Birgeneau, Dean of Science, said that although gender discrimination, including wage discrimination, at MIT was not "conscious or deliberate… the effects were and are real…. We still have a great deal more to accomplish before true equality and equal treatment will have been achieved." Likewise, faculty and administration must accomplish a great deal more to achieve gender-based salary equity in the academy. ❖

References:

1 Lavin-McEleney v. Marist College, 239 F.3d 476 (2d Cir. 2001).

2 Farmer v. University of Nevada, 930 P.2d 730 (Nev. S.Ct. 1997), cert. denied, 523 U.S. 1004 (1998).

3 EEOC v. Eastern Michigan University, No. 98-71806 (E.D. Mich. 1999); see also Associated Press, "EMU Settles Federal Sex-Bias Case," Detroit News (28 April 2000).

4 Kovacevich v. Kent State University, 224 F.3d 806 (6th Cir. 2000); see also Nota Bene, "Female Professors Victorious Under Equal Pay Act," Academe 5 (November-December 1997).

5 Smith v. Virginia Commonwealth University, 84 F.3d 672 (4th Cir. 1996); see also Lisa Guernsey, "Pay-Equity Dispute Resolved at Virginia Commonwealth U.," Chronicle of Higher Education (4 October 1996).

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My Mother, the Scientist

By Charles Hirshberg

IN 1966, Mrs. Weddle's first-grade class at Las Lomitas Elementary School got its first homework assignment: We were to find out what our fathers did for a living, then come back and tell the class. The next day, as my well-scrubbed classmates boasted about their fathers, I was nervous. For one thing, I was afraid of Mrs. Weddle: I realize now that she was probably harmless, but to a shy, elf-size, nervous little guy she looked like a monstrous, talking baked potato. On top of that, I had a surprise in store, and I wasn't sure how it would be received.

"My daddy is a scientist," I said, and Mrs. Weddle turned to write this information on the blackboard. Then I dropped the bomb: "And my mommy is a scientist!"

Twenty-five pairs of first-grade eyes drew a bead on me, wondering what the hell I was talking about. It was then that I began to understand how unusual my mother was.

Joan Feynman, 1949

Photo courtesy of Joan Feynman/Richard Hirshberg

Today, after more than four decades of geophysical research, my mother, Joan Feynman, is getting ready to retire as a senior scientist at NASA's Jet Propulsion Laboratory. She is probably best known for developing a statistical model to calculate the number of high-energy particles likely to hit a spacecraft over its lifetime, and for her method of predicting sun spot cycles. Both are used by scientists worldwide. Beyond this, however, my mother's career illustrates the enormous change in how America regards what was, only a few decades ago, extremely rare: a scientist who's a woman and also a mother.

To become a scientist is hard enough. But to become one while running a gauntlet of lies, insults, mockeries, and disapproval—this was what my mother had to do. If such treatment is unthinkable (or, at least, unusual) today, it is largely because my mother and other female scientists of her generation proved equal to every obstacle thrown in their way.

My introduction to chemistry came in 1970, on a day when my mom was baking challah bread for the Jewish New Year. I was about 10, and though I felt cooking was unmanly for a guy who played shortstop for Village Host Pizza in the Menlo Park, California, Little League, she had persuaded me to help. When the bread was in the oven, she gave me a plastic pill bottle and a cork. She told me to sprinkle a little baking soda into the bottle, then a little vinegar, and cork the bottle as fast as I could. There followed a violent and completely unexpected pop as the cork flew off and walloped me in the forehead. Exploding food: I was ecstatic! "That's called a chemical reaction," she said, rubbing my shirt clean. "The vinegar is an acid and the soda is a base, and that's what happens when you mix the two."

After that, I never understood what other kids meant when they said that science was boring.

One of my mother's earliest memories is of standing in her crib at the age of about 2, yanking on her 11-year-old brother's hair. This brother, her only sibling, was none other than Richard Feynman, destined to become one of the greatest theoretical physicists of his generation: enfant terrible of the Manhattan Project, pioneer of quantum electrodynamics, father of nanotechnology, winner of the Nobel Prize, and so on. At the time, he was training his sister to solve simple math problems and rewarding each correct answer by letting her tug on his hair while he made faces. When he wasn't doing that, he was often seen wandering around Far Rockaway,

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New York, with a screwdriver in his pocket, repairing radios—at age 11, mind you.

My mother worshipped her brother, and there was never any doubt about what he would become. By the time she was 5, Richard had hired her for 2 cents a week to assist him in the electronics lab he'd built in his room. "My job was to throw certain switches on command," she recalls. "I had to climb up on a box to reach them. Also, sometimes I'd stick my finger in a spark gap for the edification of his friends." At night, when she called out for a glass of water, Riddy, as he was called, would demonstrate centrifugal force by whirling it around in the air so that the glass was upside down during part of the arc. "Until, one night," my mother recalls, "the glass slipped out of his hand and flew across the room."

Richard explained the miraculous fact that the family dog, the waffle iron, and Joan herself were all made out of atoms. He would run her hand over the corner of a picture frame, describe a right triangle and make her repeat that the sum of the square of the sides was equal to the square of the hypotenuse. "I had no idea what it meant," she says, "but he recited it like a poem, so I loved to recite it too." One night, he roused her from her bed and led her outside, down the street, and onto a nearby golf course. He pointed out washes of magnificent light that were streaking across the sky. It was the aurora borealis. My mother had discovered her destiny.

Joan Feynman with brother, Richard.

Photo courtesy of Joan Feynman

That is when the trouble started. Her mother, Lucille Feynman, was a sophisticated and compassionate woman who had marched for women's suffrage in her youth. Nonetheless, when 8-year-old Joanie announced that she intended to be a scientist, Grandma explained that it was impossible. "Women can't do science," she said, "because their brains can't understand enough of it." My mother climbed into a living room chair and sobbed into the cushion. "I know she thought she was telling me the inescapable truth. But it was devastating for a little girl to be told that all of her dreams were impossible. And I've doubted my abilities ever since."

The fact that the greatest chemist of the age, Marie Curie, was a woman gave no comfort. "To me, Madame Curie was a mythological character," my mother says, "not a real person whom you could strive to emulate." It wasn't until her 14th birthday—March 31, 1942—that her notion of becoming a scientist was revived. Richard presented her with a book called Astronomy. "It was a college textbook. I'd start reading it, get stuck, and then start over again. This went on for months, but I kept at it. When I reached page 407, I came across a graph that changed my life." My mother shuts her eyes and recites from memory: "'Relative strengths of the Mg+ absorption line at 4,481 angstroms . . . from Stellar Atmospheres by Cecilia Payne.' Cecilia Payne! It was scientific proof that a woman was capable of writing a book that, in turn, was quoted in a text. The secret was out, you see."

My mother taught me about resonances when I was about 12. We were on a camping trip and needed wood for a fire. My brother and sister and I looked everywhere, without luck. Mom spotted a dead branch up in a tree. She walked up to the trunk and gave it a shake. "Look closely," she told us, pointing up at the branches. "Each branch waves at a different frequency." We could see that she was right. So what? "Watch the dead branch," she went on. "If we shake the tree trunk in just the right rhythm, we can match its frequency and it'll drop off." Soon we were roasting marshmallows.

The catalog of abuse to which my mother was subjected, beginning in 1944 when she entered Oberlin College, is too long and relentless to fully record. At Oberlin, her lab partner was ill-prepared for the advanced-level physics course in which they were enrolled, so my mother did all the experiments herself. The partner took copious notes and received an A. My mother got a D. "He understands what he's doing," the lab instructor explained, "and you don't." In graduate school, a professor of solid state physics advised her to do her Ph.D. dissertation on cobwebs, because she would encounter them while cleaning. She did not take the advice; her thesis was titled "Absorption of infrared radiation in crystals of diamond-type lattice structure." After graduation, she found

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that the "Situations Wanted" section of The New York Times was divided between Men and Women, and she could not place an ad among the men, the only place anyone needing a research scientist would bother to look.

At that time, even the dean of women at Columbia University argued that "sensible motherhood" was "the most useful and satisfying of the jobs that women can do." My mother tried to be a sensible mother and it damn near killed her. For three years, she cooked, cleaned, and looked after my brother and me, two stubborn and voluble babies.

Joan Feynman

One day in 1964 she found herself preparing to hurl the dish drain through the kitchen window and decided to get professional help. "I was incredibly lucky," she remembers, "to find a shrink who was enlightened enough to urge me to try to get a job. I didn't think anyone would hire me, but I did what he told me to do." She applied to Lamont-Doherty Observatory and, to her astonishment, received three offers. She chose to work part-time, studying the relationship between the solar wind and the magnetosphere. Soon she would be among the first to announce that the magnetosphere—the part of space in which Earth's magnetic field dominates and the solar wind doesn't enter—was open-ended, with a tail on one side, rather than having a closed-teardrop shape, as had been widely believed. She was off and running.

My mother introduced me to physics when I was about 14. I was crazy about bluegrass music, and learned that Ralph Stanley was coming to town with his Clinch Mountain Boys. Although Mom did not share my taste for hillbilly music, she agreed to take me. The highlight turned out to be fiddler Curly Ray Cline's version of "Orange Blossom Special," a barn burner in which the fiddle imitates the sound of an approaching and departing train. My mother stood and danced a buck-and-wing and when, to my great relief, she sat down, she said, "Great tune, huh? It's based on the Doppler effect." This is not the sort of thing one expects to hear in reference to Curly Ray Cline's repertoire. Later, over onion rings at the Rockybilt Cafe, she explained: "When the train is coming, its sound is shifting to higher frequencies. And when the train is leaving, its sound is shifting to lower frequencies. That's called the Doppler shift. You can see the same thing when you look at a star: if the light source is moving toward you, it shifts toward blue; if it's moving away, it shifts toward red. Most stars shift toward red because the universe is expanding."

I cannot pretend that, as a boy, I liked everything about having a scientist for a mother. When I saw the likes of Mrs. Brady on TV, I sometimes wished I had what I thought of as a mom with an apron. And then, abruptly, I got one.

It was 1971 and my mother was working for NASA at Ames Research Center in California. She had just made an important discovery concerning the solar wind, which has two states, steady and transient. The latter consists of puffs of material, also known as coronal mass ejections, which, though long known about, were notoriously hard to find. My mother showed they could be recognized by the large amount of helium in the solar wind. Her career was flourishing. But the economy was in recession and NASA's budget was slashed. My mother was a housewife again. For months, as she looked for work, the severe depression that had haunted her years before began to return.

Mom had been taught to turn to the synagogue in times of trouble, and it seemed to make especially good sense in this case, because our synagogue had more scientists in it than most Ivy League universities. Our rabbi, a celebrated civil rights activist, was arranging networking parties for unemployed eggheads. But when my mother asked for an invitation to one of these affairs, he accused her of being selfish. "After all—there are men out of work just now."

"But Rabbi," she said, "it's my life."

I remember her coming home that night, stuffing food into the refrigerator, then pulling out the vacuum cleaner. She switched it on, pushed it back and forth across the floor a few times, then switched it off and burst into tears. In a moment, I was crying too and my mother was comforting me. We sat there a long time.

"I know you want me here," she told me. "But I can either be a part-time mama, or a full-time madwoman."

A few months later, Mom was hired as a research scientist at the National Center for Atmospheric Research, and we moved to Boulder, Colorado. From then on, she decided to "follow research funding around the country,

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like Laplanders follow the reindeer herds." She followed it to Washington, D.C., to work for the National Science Foundation, then to the Boston College Department of Physics, and finally, in 1985, to JPL, where she's been ever since. Along the way, she unlocked some of the mysteries of the aurora. Using data from Explorer 33, she showed that auroras occur when the magnetic field of the solar wind interacts with the magnetic field of the Earth.

In 1974, she became an officer of her professional association, the American Geophysical Union, and spearheaded a committee to ensure that women in her field would be treated fairly. She was named one of JPL's elite senior scientists in 1999 and the following year was awarded NASA's Exceptional Scientific Achievement Medal.

Soon she'll retire, except that retirement as my mother the scientist envisions it means embarking on a new project: comparing recent changes in Earth's climate with historic ones. "It's a pretty important subject when you consider that even a small change in the solar output could conceivably turn Long Island into a skating rink—just like it was some 10,000 years ago."

The first thing I did when I came home from Mrs. Weddle's class that day in 1966 was to ask my mother what my father did. She told me that he was a scientist, and that she was a scientist too. I asked what a scientist was, and she handed me a spoon. "Drop it on the table," she said. I let it fall to the floor. "Why did it fall?" she asked. "Why didn't it float up to the ceiling?" It had never occurred to me that there was a "why" involved. "Because of gravity," she said. "A spoon will always fall, a hot-air balloon will always rise." I dropped the spoon again and again until she made me stop. I had no idea what gravity was, but the idea of "Why?" kept rattling around in my head. That's when I made the decision: the next day, in school, I wouldn't just tell them what my father did. I'd tell them about my mother, too. ❖

Illustration by Ann Feild (STScI).

Notes From A Life

Anonymous Contributions from Our Readers

"Notes From a Life," first printed in the June 1999 issue of STATUS, are anonymous vignettes describing the quotidian life of a woman in science. Here follow more "Notes" sent to us by our readers. We continue to welcome submissions of "Notes" for publication in future issues of STATUS.

♀ During my tenure as a staff scientist for a private observatory, I found myself in an uncomfortable position. The image backdrop on the observatory computers showed a woman dressed only in a bikini. Feeling that this was inappropriate for computers used by all staff in a common area, I complained, and the bikini images were removed. Unfortunately, they were replaced with Playboy centerfolds. During the same time, I learned that pornographic videos were being rented for the mountain staff (all male, except me), and actually paid for by the observatory. I was told that I had "already caused enough trouble, and should keep my mouth shut." I think the thing that disappointed me the most, however, was the fact that I did try to gather support to have things changed from some of the women astronomers who frequently came to observe, and they all declined to get involved. It left a very bad taste in my mouth. I no longer work there, but the situation did not change during my years there.

♀ I was attending a faculty meeting to discuss two tenure cases. After the discussion of the first case, the male chair called for votes and asked a male faculty member to count the votes. After the discussion of the second case, the chair again called for votes and this time he asked me to count the votes. After my counting and reporting the vote, as an afterthought, the chair immediately asked another faculty member (an adjunct professor, and man) to crosscheck the votes. He realized he made a faux pas and apologized, but I thought this action by him was shocking. At a subliminal level, did he think a woman needed to be crosschecked by a man... and for only a handful of votes?

♀ In the year before we set up our Women in Science Roundtable program, I talked to as many female science undergrads at our university as I could, asking them what their experience was like. One of them, who was a smart, resourceful woman majoring in physics, told me of a time when her professor was out of the room in her freshman physics class. All the other students were male, and they gathered around her and told her that she was wasting her time taking physics because she was a woman. This didn't faze her; she just waited until she aced a test and shoved it under their noses, but a shyer or less confident woman might not have found this so easy. She is now one of the leaders in our Women in Science program. I suspect that my university is worse than average in terms of attitudes to women because it is an old engineering school and pretty darn hidebound. But her story surprised me in particular because the opinions were those of a young student, not a close-to-retirement professor.

♀ I was interviewed for a local television piece about our department's observatory and an upcoming anniversary celebration. Although being involved with the filming was a positive and rewarding experience for me, two comments caught my ear as being unfortunate with respect to the issue of women in my field. During the initial filming, upon meeting the male producer, he commented that he didn't care too much about the specifics or details of my work; he was mostly interested in the portrayal of the general project. He said that his viewing public would be more impressed with the fact that "a young, pretty, female astronomer" was involved with such important work. Secondly, the director of our observatory, who was also interviewed, gave a pointed, albeit, grammatically accurate quote of "The success of our project is attributed to the fact that everyone does *his* share."

Send your "Notes" to **meg.urry@yale.edu** or **frattare@stsci.edu**

In the June 2000 issue of STATUS (available at ***www.aas.org/~cswa/pubs.html****), contributing author, Kristy Dyer, provided STATUS readers with an in depth look at the personal and professional life of Caroline Herschel, sister to the 18th century astronomer, William Herschel.*

Novelist and poet, Siv Cedering, has captured the wonder of Ms. Herschel's lifetime accomplishments into a lovely poem entitled "Letter from Caroline Herschel (1750 – 1848)."
Cedering's latest book, Letters from an Observatory: New and Selected Poems, 1973-1998 *(1998, Karma Dog Editions), includes this as well as many other poems, from her earlier published works, that were inspired by her interest in astronomy. This poem has been reprinted with permission from the author.*

Information on many of the women in this poem, including "Hypatia" (as it is usually spelled), can be found at **www.astr.ua.edu/4000ws/**. (see also S. Howard (2000). STATUS, January; **www.aas.org/~cswa/pubs.html**).

Drawing of Caroline Herschel, scanned from "Pioneers of Science", 1893.

Image courtesy of John Lienard's "Engines of Our Ingenuity" (http://www.uh.edu/ engines/).

Letter from Caroline Herschel (1750-1848)

Poem By Siv Cedering

WILLIAM IS AWAY, and I am minding
the heavens. I have discovered
eight new comets and three
nebulae never before seen by man,
and I am preparing an Index to
Flamsteed's observations, together with
a catalogue of 560 stars omitted from
the British Catalogue, plus a list of errata
in that publication. William says.

I have a way with numbers, so I handle
all the necessary reductions and
calculations. I also plan
every night's observation
schedule, for he says my intuition
helps me turn the telescope to discover
star cluster after star cluster.
I have helped him polish the mirrors
and lenses of our new telescope. It is
the largest in existence. Can you imagine
the thrill of turning it to some new
corner of the heavens to see
something never before seen
from earth? I actually like
that he is busy with the Royal society
and his club, for when I finish my other work
I can spend all night sweeping
the heavens.

Sometimes when I am alone
in the dark, and the universe reveals
yet another secret, I say the names
of my long, lost sisters, forgotten
in the books that record
our science—

Aganice of Thessaly,
Hyptia,
Hildegard,
Catherina Hevelius,
Maria Agnesi

—as if the stars themselves could
remember. Did you know that Hildegard
proposed a heliocentric universe
300 years before Copernicus? that she
wrote of universal gravitation 500 years
before Newton? But who would listen
to her? She was just a nun, a woman.
What is our age, if that age was dark?
As for my name, it will also be
forgotten, but I am not accused
of being a sorceress, like Aganice,
and the Christians do not threaten to
drag me to church, to murder me, like they did
Hyptia of Alexandria, the eloquent, young
woman who devised the instruments
used to accurately measure the position
and motion of
heavenly bodies.

However long we live, life is short, so I
work. And however important man becomes,
he is nothing compared to the stars.
There are secrets, dear sister, and it is
for us to reveal them. Your name, like mine,
is a song.

Write soon,

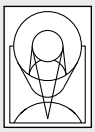
Caroline

*

Review of the Status of Women at the Space Telescope Science Institute

IN LIGHT OF THE RECENT STUDIES done on the status of women in science at the Massachusetts Institute of Technology (see C. M. Urry (2001). STATUS, June; **www.aas.org/ ~cswa/pubs.html**) and the California Institute of Technology (see I. A. Sargent (2002). STATUS, June; **www.aas.org/~cswa/pubs.html**), the Association of Universities for Research in Astronomy (AURA) sponsored a committee to look at the status of women at the Space Telescope Science Institute (STScI) and report on their findings. The Institute, located in Baltimore, Maryland, was founded in 1981, and is home to the Hubble Space Telescope.

The AURA committee visited the STScI and conducted an extensive review over two days in the spring of 2002. AURA has made that report public and AURA and STScI have responded. Links are available from the Institute's web page (**http://www.stsci.edu/institute/**) to the report, AURA's response, STScI's response (printed below), and the Baltimore Charter. ❖



STScI Response to the Review of the Status of Women at STScI

The report commissioned by AURA, *Review of the Status of Women at STScI*, points out deficiencies in the environment for women at the Space Telescope Science Institute. We believe that all members of our staff should experience an equitable work environment, and we will take actions to correct the deficiencies as quickly as possible.

The Space Telescope Science Institute has a heritage of leadership in addressing issues of gender equity for our staff and the astronomy community. We are committed to continuing that heritage, and we are grateful for the advice of the AURA review committee in helping us define constructive solutions to these problems. We commit to pursuing their recommendations with very high priority.

Steven Beckwith, Director, STScI ❖

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