Career Patterns of Women and Men in the Sciences

Even women who earn elite postdoctoral fellowships encounter social obstacles and may pay penalties in career success for a careful research style

Gerhard Sonnert and Gerald Holton

The current status of women in science is a blend of decisive advance and unfulfilled promise. For more than two decades, discrimination against women in the sciences (as in other professional fields) has been outlawed in the United States, and consequently the gender gap has shrunk. Nevertheless, disparities remain in several areas and fields. A recent National Science Foundation report on women, minorities and persons with disabilities in science and engineering concluded, "On essentially all variables examined here, women fare less well than men." Whether the glass appears half full or half empty, a gender gap persists.

Why is it so? The explanations that have been advanced in the social-science literature can be categorized under two main headings. One, which we call the *deficit model*, is based on structural explanations of scientific careers. It posits the existence of mechanisms of formal and informal exclusion of women scientists. Women as a group, according to this model, receive fewer chances and opportunities along their career paths, and for this reason they collectively have worse career outcomes. The emphasis is on structural obstacles—legal, political and social—that exist (or that, in their most blatant forms, existed earlier) in the social system of science.

The *difference model*, on the other hand, posits the existence of deeply ingrained differences in behavior, outlook and goals between women and men. In this model the root cause of gender disparities in career achievement is internal to the individual. It is said to lie in gender differences—be they innate, or the result of gender-role socialization or cultural patterns. To a significant degree, the argument goes, these differences shape the behavior of individuals as well as the character of social institutions.

Within the difference model, the literature has discussed the possibility of several types of gender differences, of which we find three particularly relevant. First, females may be more likely than males to be socialized with general orientations and attitudes that serve to reduce the drive for professional success in any field. Second, particular attitudes about science may define it as a male field and thus tend to encourage males to participate while discouraging females. Third, some writers assert that deep-seated epistemological gender differences exist that may make science, as practiced today, not sufficiently compatible with "women's ways of knowing."

These two main explanatory models should not be regarded as mutually exclusive. Elements of both can be reinforcing factors in shaping career outcomes. In its dynamics over time, a scientific career path can be viewed in terms of the "kick-reaction" model developed by Jonathan R. Cole and Burton Singer: It is formed by a sequence of (positive or negative) "kicks" from the environment, followed by reactions to these kicks by the individual. Deficit-model obstacles would roughly correspond to negative "kicks" and difference-model obstacles to inopportune reactions.

A good reason to pay attention to the possibility of interactions between structural impediments and behavioral-attitudinal issues is that it seems no longer possible to explain gender disparities by pointing to a few dramatic and clear-cut career obstacles for women scientists. Blatant barriers have receded, although they have not disappeared, as discrimination has been formally abolished. So one must look closer, considering the possibility that small and subtle disadvantages might accumulate over the course of a woman's career in science, along the lines of Robert K. Merton's concept of the accumulation of advantages and disadvantages.

The Project Access Study

In this article we take such a closer look by reviewing the results of our research project, named Project Access, which studied in detail a sample—the largest of its kind—of female and male scientists, to determine both the degree of gender disparity in the average career outcome and the causes for the disparity. The results of the study suggest that significant differences in outcomes can indeed be found by

Gerhard Sonnert studied sociology, history and geography in Germany and the United Kingdom. He received his doctorate in sociology from the University of Erlangen, Germany, and a master's in public administration from Harvard University in 1988. Since then he has worked at Harvard for Project Access, a large-scale research project on scientists' career patterns. Gerald Holton is Mallinckrodt Professor of Physics and professor of the history of science at Harvard. His research has focused on the scientific, social and epistemological roots of the achievements and failures of major 20th-century scientists. Address for both: Jefferson Physical Laboratory, Cambridge, MA 02138. Internet: sonnert@physics.harvard.edu; holton@physics.harvard.edu.

Figure 1. Marie Curie, carefully elucidating the nature of radiation in decades of laboratory work, stands as a popular icon of the woman scientist. Since her death in 1934, legal obstacles to discrimination against women in science have fallen in the United States, but women as a group continue to fare less well than men as they proceed along scientific career paths. In a study that examined closely the careers of scientists who had received prestigious postdoctoral fellowships, the authors found that two models—one emphasizing mechanisms of exclusion and the other differences related to gender—each explain part of the disparity in outcomes. Obstacles encountered by women often are subtle and rooted in informal interactions, and choices more commonly made by women—such as taking a fellowship to be with a spouse—appear correlated with diminished career success. (Photograph property of the Radium Institute, reproduced by permission of the Emilio Segrè Visual Archives.)

comparing, in particular, the careers of highly promising women and men in science. The disparities appear to result chiefly from a series of subtle but identifiable (and sometimes counterintuitive) impediments and slight gender differences in socialization.

Project Access focused exclusively on a group of female and male scientists who had the same kind of auspicious starting positions as they began their careers as professional scientists: They had received prestigious postdoctoral fellowships. To illuminate the fine structure of their career paths, we augmented a quantitative research approach with a qualitative one. Our results, described briefly below, are based on 699 replies to a structured questionnaire, as well as on 200 open-ended, face-to-face interviews. The questionnaire responses were obtained from 460 (361 men, 99 women) former awardees of an NSF postdoctoral research fellowship, from the inception of the program in 1952 through 1985, and 239 (147 men, 92 women) former recipients of a National Research Council postdoctoral associateship from the start of the program in 1959 through 1986. We attempted to reach every woman who had received such an NSF or NRC fellowship, as well as a control group of men. In addition to the questionnaire survey, we conducted personal interviews lasting two to three hours with 92 men and 108 women who had received postdoctoral fellowships in the sciences from NSF, NRC or the Bunting Institute of Rad-

cliffe College, or who had been Bunting finalists. Our sample included scientists in all fields as well as mathematicians and engineers; here we shall use the term "scientists" to encompass all these groups.

In focusing on a group of especially promising scientists who had, so to speak, set forth from the same starting line, our study differs from those that concern themselves with samples representing the whole population of scientists. We aimed to complement such studies by providing an in-depth look at an important subgroup. It seemed sensible to try to track and understand the causes for attrition or other disadvantages among that relatively small fraction of women who had stayed in science to the point of gaining prestigious postdoctoral fellowships, if only to find out what became of the heavy investments they and society had made in their scientific careers.

A study of this group, we reasoned, ought also to help sort out the merits of the "glass ceiling" and "threshold" hypotheses. The glass-ceiling hypothesis postulates an invisible but real barrier that impedes women from reaching top positions in their professions. The alternative hypothesis rests on the concept of a threshold. In this view, women who have succeeded in overcoming earlier barriers might have passed a threshold beyond which gender no longer matters in careers.

Women scientists who have been awarded prestigious postdoctoral fellowships should have accumulated significant advantages up to that point, and should be highly qualified and motivated to pursue a successful research career. If these promising women scientists as a group turn out to be less successful than comparable men in attaining high positions, this may indicate the existence of a glass ceiling of gender-specific obstacles in the later stages of their professional careers. On the other hand, if they have overcome certain earlier barriers and passed a threshold beyond which gender no longer matters in careers, one might expect to see less evidence of later professional stratification along gender lines.

Here we shall consider first what our study suggested about the persistence of the gender gap. Then we shall look at factors that may be at play in different ways in different fields of science—at gender-influenced social and professional styles, the self-perceptions of scientists, the interaction of career and family life and the role of serendipity.

Career Outcomes of the Study Group

As we turn now to summarizing a few key results from Project Access (whose findings are presented in detail in two books, Sonnert and Holton 1995a and 1995b), we should emphasize that we did not find monolithic blocks of women scientists on one side and men scientists on the other. Rather, we typically observed great variations within each gender group and a great deal of overlap between them. Yet, as will be shown, some differences between the average experiences are striking, and overall

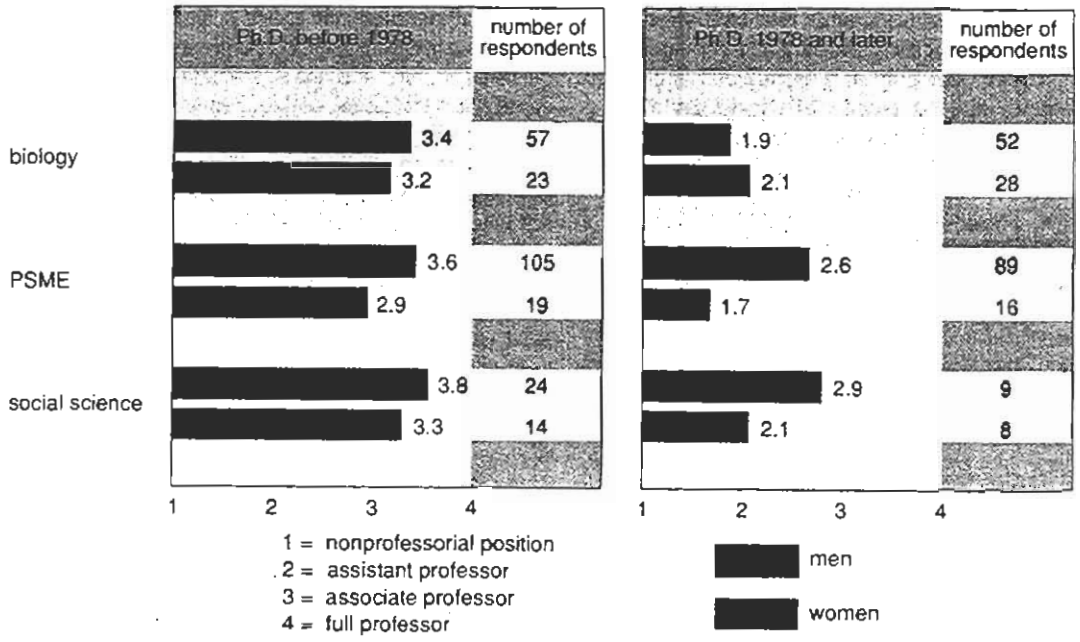

Figure 2. Statistical differences between the career outcomes of men and women appeared in the Project Access sample when the academic-rank achievement of the recipients of postdoctoral fellowships was compared. In biology, virtually no differences appeared between the career progress of men and women; however in the physical sciences, mathematics and engineering (lumped together as "PSME" above) a significant gap separated the average academic rank achieved by women and men, particularly among the younger cohort. The disadvantage in PSME persisted when the authors controlled for the level of publication productivity.

the career outcomes of women in our sample must be regarded as less desirable than those of their male cohorts. For example:

In terms of institutional prestige, the women of our questionnaire sample were well represented at top-rated departments. Twenty-nine percent of the women working in academe, compared with 27 percent of the men, were located at institutions ranked among the top 15 percent in a large national survey (Jones, Lindzey and Coggeshall 1982). But women, as a group, "paid" for prestigious affiliation with disadvantages in rank achievement, whereas men did not experience such a trade-off.

In academic rank achievement, we found substantial variation among academic fields. In biology, our group of women appeared to have passed a threshold. There were no statistical differences in their career progress through the academic ranks, compared with their male cohorts. However, great gender disparities were found in physical sciences, mathematics and engineering (labeled "PSME" in *Figure 2*), even in our elite sample. Among the younger cohort of scientists in these fields, for instance, the women's average academic status was almost one full rank below the men's. Here a glass ceiling became clearly visible. Controlling for the level of productivity in scientific publication, women were still at a disadvantage in rank—again with the exception of biology, where the situation was more favorable for women than in other sciences. (The issue of publication productivity will receive special attention below.)

The attrition rate (the proportion of former fellows who are no longer research scientists) was 10.5 percent for women and 8.5 percent for men in our questionnaire sample. This gender difference did not reach statistical significance. As a group, the female former fellows were remarkably persistent in their pursuit of a science career. A considerable gender difference existed, however, in the reasons given by those who had left science. As one might expect, leaving science was more strongly connected with family responsibilities for women than for men.

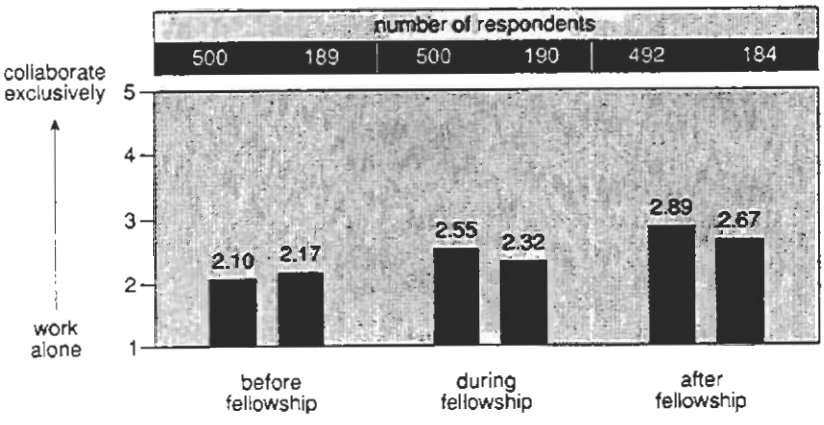

Figure 3. Some scholars have proposed that it may be harder for women to establish egalitarian, collegial collaborations. Responses to the authors' questionnaire supported this view. Women *(red bars)* reported a slightly more collaborative research style during graduate school than mendid *(brown bars)*. However, during and after the postdoctoral-fellowship period, they collaborated noticeably less than men. Therefore they experienced more collaboration as a junior partner and less as an equal or senior partner.

Discrimination, Exclusion and Tokenism

One of the first questions to be considered in a study such as this is to what extent gender discrimination persists as a structural obstacle to a woman's career in science. Despite the legal prohibitions, 72.8 percent of the women interviewees reported that they had experienced discrimination. Among the men, 12.9 percent said they had been subject to reverse discrimination.

What forms does discrimination take? There were reports of a few egregious cases, such as the denial of jobs and tenure for women who considered themselves well qualified for a positive decision. But in the interviews there were many more accounts of very subtle exclusions and marginalizations. The area of scientific collaboration provides a good example. When we asked about the extent of collaboration in our participants' careers, the women as a group reported a slightly more collaborative research style than the men did when recalling the period before the postdoctoral fellowship—that is, during graduate school. On the other hand, the women collaborated noticeably less than the men both during and after the postdoctoral period *(Figure 3)*.

Thus, compared with men, women on average experienced less collaboration as an equal or senior partner but more collaboration as a junior partner. It has been proposed that it may be harder for women scientists to establish egalitarian, collegial collaborations. Comments in our interviews supported this suggestion. More women than men said that their postdoctoral advisors ignored them or that their advisors treated them as subordinates.

Another structural question deserves special mention. R. M. Kanter has suggested that rare representatives of a social group, called tokens, tend to face particular difficulties in obtaining career success in their fields. This view is consistent with the striking statistical contrast we found between women's career outcomes in biology and those in the other sciences. For women biologists, whose numbers may have reached a "critical mass" some time ago, gender stratification within the discipline seems attenuated. Women have a relatively long and strong tradition of professional participation in biology, as compared with the other natural sciences, and one might speculate that this has contributed to the reduction of the gender gap in career success in this field.

But numbers alone may not be enough to make a difference. In accordance with recent research results (Etzkowitz *et al.* 1994), we found a

picture that was partly counterintuitive and certainly more complex than any simple relation between women's numbers (and the resulting availability of mentors and role models) and women's success. Women in our questionnaire sample who had been affiliated with female advisors during their postdoctoral fellowships later left science at a *higher* rate than those who had not (16.7 percent *vs.* 9.7 percent), whereas the reverse was the case for men with female advisors (0 *vs.* 8.7 percent). The small number of respondents with female advisors limits our confidence in this finding, but it was echoed in the comments of a woman interviewee who eventually left science. She indicated that she was deterred, rather than attracted, by the example of her female advisor in college. "The more you got to know her, the more you realized she'd given up all personal life to be a scientist. She had a very lonely and isolated life." On the other hand, reports of the positive influence of female mentors and role models were more common.

Socialization

Socialization is a key issue in discussions of women's career paths. It is often reported that many women are hampered in their careers by a lack of confidence in their own abilities. We found evidence to support this statement: Even our group of women, who had achieved recognition for their accomplishment at the doctoral level, differed on average from their male cohorts in their estimation of their own self-confidence, ambition and related traits.

Substantially more men than women among our interviewees reported that they considered their scientific ability to be above average (men, 69.7 percent; women, 51.5 percent). More women considered their ability to be average (men, 18.0 percent; women, 34.7 percent). And when asked whether they should have handled their career obstacles in a different way, many more women than men thought they should have had more confidence or should have been more assertive (25.3 percent *vs.* 4.6 percent of the men). In addition, more than three times as many women as men (15.9 percent *vs.* 4.4 percent) in our interview sample said they had vague or unclear career aspirations when they started out in science.

These self-assessments can be looked at in two ways. Approaching the evidence using the difference model, one would consider such attitudes to be among the causes that make women scientists, on average, less successful than men in career achievement. But the deficit model also offers an explanation: Women whose careers were impeded by structural obstacles may have adjusted their ambitions and self-expectations downward. Our data cannot determine causality. But they suggest that it is useful to look at whether internal and external processes at work in women's and men's science careers might interact to develop a tendency for gender-specific ways of doing science.

Scientific and Professional Styles

Do men and women "do science" differently? Yes, said many of our interviewees. Somewhat more women than men (60.8 percent *vs.* 49.4 percent) said that they believed in the existence of gender differences in the work of scientists in general.

In addition, substantially more women than men interviewees thought that their own gender influences the way they pursue their work. Of the women interviewed, 51.2 percent thought their gender plays a role in their own professional conduct and interaction with other scientists, whereas 25.6 percent of the men perceived such an influence. Fewer interviewees thought that their gender influenced their choice of research subjects (men, 15.7 percent; women, 40.0 percent) and their ways of thinking in science (men, 20.0 percent; women, 36.0 percent). Still fewer interviewees perceived gender differences on the methods they used in their scientific work (men, 9.9 percent; women, 34.8 percent).

Scientists' perceptions and self-reports are not, of course, necessarily based in reality. Nonetheless, it is worth noting that a sizeable proportion of the scientists in our study considered gender a relevant variable for interpreting the behavior of working scientists.

When the people we interviewed talked about these gender differences in "scientific style," certain themes emerged. Both men and women commonly observed that, in their professional style, men seem to have what one woman called more "entrepreneurial spunk." Male scientists are, in this view, more aggressive, combative and self-promoting in their pursuit of career success, and so they achieve higher visibility. In short, they are better at playing the political game of career advancement.

Some women interviewees reported that men have a way of "showing off" at conferences. The

A woman describing "professor talk":

A lot of the connections that people make at meetings and so on, I couldn't do, because what men did is they stood in the hallways and found the great men and went over and shook their hands or asked them to have a drink with them or something, and women couldn't do that in my day. So you couldn't initiate anything.... But if you were in a group of people who managed to connect with that person, then you could try to talk to him. But more often than not, when you were in a group like that, the men showed off for each other. They took themselves terribly seriously and they said any kind of thing that came to their head. I call it "professor talk"... and I found that a waste of my time.

A senior woman professor:

I think I'm a careful scientist ... Sometimes I get an idea, and I'll do the experiment. And then I think that tells me one thing, and then I'll do another experiment. But sometimes, for instance, even though I know the answer—I can see it—I wouldn't publish it. Then I become a perfectionist. That can become a detriment.

I think the females tend to work harder, in the sense that they want things to be more complete when they publish than men sometimes do ... [Men] go in there and do something and then worry about the controls and all the possibilities of things that might have gone wrong afterwards, rather than worrying about them in the beginning.

When men come to graduate school, you know that's their career.... But I think some of the females still have a real conflict about what are they going to do when they get out.... I think in spite of women's lib and everything, the conflict [between a science career and a family] is still there, whereas that conflict doesn't seem to be there [for men]. A guy can get married, he can have a family, he can even spend time with his family, but somehow it's not as big a decision.

following comment by a female scientist illustrates this observation as well as the relatively greater difficulty experienced by women, on average, in initiating collegial contact with male scientists: "Men ... stood in the hallways and found the great men and went over and shook their hands or asked them to have a drink with them or something, and women couldn't do that in my day.... They took themselves terribly seriously and they said any kind of thing that came to their head. I call it 'professor talk'... and I found that a waste of my time."

"Professor talk" may indeed be a waste of time in terms of exchanging research information or gaining scientific insights. But it may be anything but wasteful in terms of its hidden agenda. What other women respondents called a "bull session" or "chatty self-promotion" may have the function of a bonding ritual. And the social bonds thus forged may have beneficial effects on a scientist's research and career.

An important aspect of a career in science is one's choice of a subfield and research problem. A number of our male and female respondents perceived a gender difference here, agreeing with a woman who noticed "fewer women in highly theoretical/mathematical subfields." But gender differences appeared to go beyond differences in mathematics interest or training.

In selecting a problem, many women reported that they had followed a "niche approach," creating their own area of research expertise. One respondent observed that "women may shy away from very competitive projects more than their male counterparts." A good example is a woman who said she liked "to sense that I had my own area, that I wasn't just a cog." Another woman respondent said she was predisposed to selecting research problems that were completely her own because "I very much dislike working on problems that I know other people are working on." Rather than competing with other investigators and research groups in a race toward the solution of the same problem, she carved out a niche for herself. Of course, following a niche approach is not an exclusively female tendency. And as the example of Marie Curie shows, it is not necessarily disadvantageous for career success.

Women's Methodology: Perfectionism

Some scholars have suggested that women's participation in the sciences might be enhanced if an alternative or "non-androcentric" sort of science was developed. Our interviewees, however, hardly ever implied a belief in a feminine methodology or way of thinking. Rather, the overriding theme that emerged from the responses of both men and women who saw gender differences in this area had to do with scientists' ways of applying traditional methodology. Women were considered to be more cautious and careful in their methods, and to pay more attention to details. A woman respondent believed that "women are often more careful in their research and more hesitant to make statements until they feel they can really 'prove' them."

Many women acknowledged that they have a tendency to be perfectionists in their scientific work. Some said they were perfectionists because they wanted to avoid failure or criticism. One stressed women's attention to detail. "Women are more meticulous," she said, "... and so I think that does affect how you do science. I don't know why that is; it just seems that for me, and the other women scientists I've dealt with, we tend more to deal in the minute details, fine points."

It does not follow that women scientists exclusively concern themselves with details. On the contrary, along with the theme of greater thoroughness, the interviews also emphasized a tendency among women to look for the broader picture and do work that is more comprehensive. In the words of a woman scientist, "women tend to work longer on individual projects and take on projects that are broader in scope than do men. Women seem to find it more difficult to break projects into small parts."

These results suggest a reinterpretation of the often-observed gap between the genders in publication productivity. We too found a gap in our group of scientists: The male questionnaire respondents who now work in academe produced an average of 2.8 scientific publications per year, as compared with the women's average of 2.3 publications per year. If it is true that women are more thorough and perfectionist, on

average, and inclined toward more comprehensive and synthetic work, one would expect that they would produce a smaller number of publications per year. And this fact might have a deleterious effect on career progress whenever the sheer number of publications is taken to indicate excellence—for instance, during a competition for an academic position.

A research scientist's claim that he or she trades off quantity for quality can, of course, be a self-serving explanation of low productivity. However, we found some indirect factual evidence that women scientists may tend to publish articles that contain more substantial or comprehensive work. In a small study using a subsample of 25 former NSF fellows in biology who are now academic scientists, we examined (among other inquiries) the citations in the scientific literature to these biologists' articles. The articles written by women in this small sample received significantly more citations per article, on average, than did men's articles—24.4 *vs.* 14.4 citations (Sonnert 1995). This greater citation impact might indicate that the content of the women's articles, on the whole, was more noteworthy. We cannot place a great deal of confidence in this statement, given the small sample size. But in a study of a large sample of biochemists, J. S. Long found a gender difference in citations per article in the same direction (Long 1992). Such results support current efforts to shift the scientific reward system toward a more qualitative evaluation of publication productivity when important decisions about scientists' careers are made.

The Roots of Scientific Style

In sum, our respondents reported gender differences in scientific style, but the differences were much more in the social aspects of science than in the areas of epistemology and methodology. Rather than being iconoclasts, women tended to uphold to a particularly high degree the traditional methodological standards of science, such as carefulness, replicability and connection to fundamentals. As a group, women, as relative newcomers to science, adopted—or were taught to adhere to—an extra-high measure of conformity to the formal norms of conducting research. All the while, they may still be standing somewhat on the margins in regard to the more informal aspects of social interactions and professional conduct among scientists, but these aspects may be crucial elements in the search for career success.

Differences in the ways women approach science may spring from various roots. Approached from the perspective of the difference model, women might be seen as socialized to be less competitive, so that they choose their own niche rather than enter the fray with numerous competitors working on the same topic. They may be more sensitized to criticism and therefore try harder to produce perfect work that is above any possibility of criticism.

Viewed in terms of the deficit model, the same difference may be thought to arise from a collegial environment particularly hostile to women who deviate from accepted standards. A woman scientist reported that "there's always somebody watching for me to make a mistake." Another woman concurred that women scientists find themselves often "under the magnifying glass." In the view of these scientists, the burden of proof is reversed for women: Whereas male Ph.D.'s are considered competent scientists until proven otherwise, their female counterparts have to demonstrate their competence fully before it is generally accepted.

Figure 4. A harmonious marriage is widely thought to have boosted the career of Antoine Laurent Lavoisier, the founder of modern chemistry. Marie Anne Pierrette Paulze, who married Lavoisier at 14, took notes, translated scientific works from English into French and made illustrations. A large group of the former postdoctoral fellows interviewed as part of Project Access, both men and women, considered marriage a positive factor in their success in their scientific careers; in particular, male and female scientists valued the intellectual support of a spouse who was also engaged in science. The most common disadvantage mentioned was a loss of mobility. (Portrait, *Antoine Laurent Lavoisier and His Wife*, by Jacques-Louis David.)

Obstacles rooted in both the difference model (internal gender differences) and the deficit model (scientific environment) surely apply to different women scientists' careers to different extents. What seems more important than gauging the relative weight of these explanations is realizing that they compound in ways described by the kick-reaction model. If women scientists tend to receive fewer positive and more negative kicks during their careers than do men, and if their reactions to these kicks are less than optimal, those elements combine in bringing about considerably worse overall career outcomes.

Marriage and Parenthood

Many scientists face the challenge of combining a particularly demanding career and a family life. We investigated with our questionnaire sample whether respondents' current marital and parental status were related to some basic career outcomes (employment area, academic rank, publication productivity and whether they had left science). In general, we found that marital and parental status were unrelated to these career outcomes, both for men and (what is more surprising) for women. The overall analysis failed to show any strong relations between the family and career spheres for women scientists, but does this mean there are none? We believe that interactions between family and science career do exist, but that they have become too complex and idiosyncratic to be captured by such broad variables as marital or parental status. If a career in science is considered as a path that takes many turns, it is clear that at certain points family factors do have an effect on the path.

For example, consider the respondents to our survey who took their particular postdoctoral fellowships to be with a spouse. This group of respondents turned out to be less successful in terms of later academic rank than were those who did not give this motivation. Women were far more likely than men to take their postdoctoral fellowship for this reason (24.5 percent *vs.* 8.5 percent). Moreover, in the presence of children, the husband's career assumed a much clearer priority over the wife's career. Women with children were more likely to take the postdoctoral fellowship to be with a spouse than were women without children (30.1 percent *vs.* 22.0 percent), but the opposite effect was observed for men (3.0 percent *vs.* 12.2 percent). Being a parent during the postdoctoral fellowship thus appeared to shift the pattern toward traditional gender roles, with the emphasis on the husband's career.

Most of our interviewees (93.4 percent of men, 86.8 percent of women) were married at some point in their lives, and almost half of these—men and women—said marriage had a positive effect on their careers (men, 45.7 percent; women, 49.4 percent). Only a smaller group mentioned an explicitly negative impact from marriage (men, 14.8 percent; women, 17.6 percent).

A likely scenario for women scientists is to be married to another scientist, often in the same field. In our questionnaire sample, 62.0 percent of the married women, but only 18.9 percent of the married men, had a spouse with a doctorate. Spouses who were also scientists were often described as understanding and supportive of the work-dedicated life-style of scientists. Among the drawbacks of marriage, restrictions in mobility figured prominently.

Single women seemed to face particular disadvantages within the social system of science, although the small number of single interviewees in our sample limits generalization. A man reported observing "enormous pressure on an unattached woman scientist to date her colleagues and no pressure for a comparable male scientist."

A similarly complex picture emerged in respect to parenthood. Our interview and questionnaire results suggest that marriage and parenthood might be seen as a set of opportunities and problems for careers. The set is somewhat different for women scientists, who are faced with the dilemma of synchronizing the often-conflicting demands of three clocks: the biological clock, the career clock (as in timetables for tenure) and a spouse's career clock. These complications can be offset, our respondents reported, by the emotional security and financial stability that a husband and family can provide, as well as by the possibility of intellectual support if the spouse is a scientist in the same field. Largely depending on how the problems are resolved and the opportunities are utilized, the effect of marriage and parenthood on women scientists' careers may be positive or negative. Some women's choices turned out to be more fortuitous than others.

A successful scientist in her late 40s:

I'm not as smart as I'd like to be. I can't do things as fast as I'd like to do them. I can't remember as much as I should remember. I can't speak extemporaneously well enough. I'm not funny, can't make jokes easily.

I very much dislike working on problems that I know other people are working on. This is also something that I've noticed in my excellent female students ... in choosing a subject, there has been a deliberate and very strong desire to choose something that can be completely one's own.

My husband [a scientist in the same field], of course, has always been very supportive, which is wonderful.... I think it helps a lot to be married—to have someone there, especially if that's someone who is supportive and is helpful. A lot of unmarried women in my field do run into problems with men, basically because they're considered fair game for anybody.

Getting and Taking Chances

Any analysis of the factors that impinge on science careers must emphasize the role of luck. Many of the people we interviewed mentioned that they had benefited markedly from luck and serendipity during career decisions, a fact that makes overall statistical conclusions particularly difficult. An overwhelming majority of both men and women acknowledged that good luck had affected their careers (men, 89 percent; women, 85 percent). Bad luck was acknowledged by a higher proportion of women than men (men, 34 percent; women, 49 percent).

Luck in a science career can take various shapes. Both conceiving a creative hypothesis and having that hypothesis quickly corroborated by experiment depend to some degree on luck. Good luck may be being in the right place at the right time, for instance, in a research program or a field that is "hot." Serendipity is also often involved in meeting the right people—leading scholars who inspire a young scientist, powerful figures who make introductions and connections, people who make an impact with personal integrity and kindness, or mentors who teach the young scientists how to play the political career game.

A key problem for career-minded scientists, then, is to recognize and take advantage of serendipitous situations—to realize the potential effects of a "kick" and respond with a proper reaction. In a male interviewee's words, "the way people really succeed is being able to recognize when a good thing has happened, and take advantage of it."

Do women scientists have equal access to such chances, and are there obstacles that keep them from taking advantage of them? The collective outcomes suggest a larger accumulation of disadvantages than of advantages, although gender disparities were not uniform across the board. They were concentrated in the top ranks of achievement and in fields outside of biology. Very large and very obvious gender differences and disparities were absent. But even the women in our specially selected group faced gender-specific career obstacles, particularly in fields where women are greatly underrepresented.

It may now be futile to search for the "big remaining obstacle" to women's career parity in the sciences. Rather, the accumulation of subtle structural disadvantages, as suggested by the deficit model, together with the attitudinal and behavioral disadvantages offered by the difference model, may afford a partial explanation of the glass ceiling where it persists. Policymakers should keep this in mind when trying to influence the social system of science. No single policy can be expected to produce general success. A great variety of targeted efforts may be more advantageous. And in the lives of individual scientists, our study shows that attention paid to career strategies can be important—a lesson of particular use, perhaps, for women who are making their way as strangers through territories of science that are relatively new to their gender.

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