

**Women and Mothers in University Science:
Battles, Babies and Biases**

By

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Abstract

This literature review examines the status of women in academic science particularly at the Research I universities. A range of books, articles, conference reports and national reports are reviewed regarding the challenges and struggles women face along the tenure ladder. The review begins with an overview of women in science. Special attention is given to mothers in university science. The challenges faced by mothers in science are more daunting than those of any other group of university personnel, yet viable solutions for them would also be viable for a variety of faculty members who might be seeking work-life balance. Finally, policy recommendations are offered to make academic science more welcoming of women and “others” desiring a better work-life balance.

Introduction

*Societal acceptance of women as mothers and professionals must be fostered to allow family and scientific lives to become more integrated. –
Marlene Belfort, scientist and mother of three*

Women have “worked” in science throughout history. Whether grinding medicines and poultices for sick family members, experimenting with just the right amount of yeast in a recipe or combining clay and water in the proper ratio to form a brick that would withstand pressure and time, science has been practiced as a natural part of life. Even as a “career,” there have been women in science for well over a century. In 1903, Marie Curie shared in the Nobel Prize for Physics and won again in 1911 for Chemistry. Her endeavors, and those of her sisters in science clearly demonstrate that there is not a biological or gender impediment to scientific achievement.

One of the greatest periods for the advancement of women in science occurred during the Second World War. The demand was so high for help in both industry and the academy that in the United States “twenty-nine engineering schools that had hitherto excluded women, including the Carnegie Institute of Technology, Columbia University

School of Engineering and Rensselaer Polytechnic Institute, began to admit them between 1940 and 1945” (Rossiter, 1995, 14). Unfortunately, Rossiter also describes how these same women failed to take full advantage of the wartime need due to leaders who lacked “confidence, commitment and an effective strategy to deal with the new demand and settled instead for a continuance of the marginal status they had held for several decades” (Rossiter, 1995, 20). Perhaps the academic situation of women in science would have been radically different today if a few women had seized the wartime opportunity to grab a foothold in academe and not release it; instead, as men returned from the war and flooded the same universities thanks to the GI Bill, women were relegated once again to the margin.

And it is on the margin, in science departments across our nation, where women still reside. Have women made progress? Yes. According to the National Science Foundation (NSF), in 1983 women represented about 35% of the science and engineering graduate students; in 2003 they were close to 50% of all S&E graduate students (NSF, *Science and Engineering Indicators*, 2006). Is their faculty representation consistent with the number of science doctorates awarded? No. Women constitute less than a quarter of the full time faculty at research universities--up from 10% in 1970 (Trower and Chait, 2002, 2). In fact, the low numbers of women on university faculty propelled the National Science Foundation to create the ADVANCE program as an “investment to institutionalize the presence of women in academe... (where we) need to include a larger proportion of women, underrepresented minorities and persons with disabilities in the science and engineering workforce” (Bordogna, 2003). Does the low number of women professors have a cyclically negative effect on women in science? Yes. According to a

recent study, “Who teaches matters. In fact, the most accurate predictor of subsequent success for female undergraduates is the percentage of women faculty at their college” (Trower and Chait, 2002, 2). Yet a quick glance through any science faculty pictorial directory at a research university reflects a reality: white men teach. Madame Curie aside, perhaps it really is biological? Again, this notion is challenged in *Women in Science*:

For biological influences to be proven, both of the following two assumptions need to be true: 1. The relationship between the measured aspects of brain functioning and math/science achievement is causal. 2. Gender differences in these aspects of brain functioning are biologically based. Neither of these is supported by the scientific evidence (Xie and Shauman, 2003, 41, 42)

I argue that the largest roadblock is often due to an inherent fact of a woman’s physiology: *women carry babies*. They are the mothers and will be the bearers of children until such time as an artificial womb is invented. While not all women want to become mothers, opportunities for women should not be proposed without some consideration for those who choose to parent.

Over the years, many women have been both mothers and scientists. Yet a quick review of top scientists from the twentieth century reveals that a majority of top scientists *chose* not to have children (Reynolds, 1999). One reason is that it is downright daunting for a mother to make it to the top of university science. Susan Maushart explains this challenge in *The Mask of Motherhood: How Becoming a Mother Changes Everything and Why We Pretend It Doesn’t*. She asserts: “as the gaps in ‘equal opportunity’ between males and females continue slowly to close, a more subtle fault line has emerged, dividing mothers from all others. The buck stops, as it were, with babies”

(Maushart, 1999, 178). Joan C. Williams, who directs the Program on Work-Life Law at American University, echoed this sentiment when she wrote, “many women never get near that ‘glass ceiling’ because they are stopped long before by the maternal wall” (Belkin, 2003, 44). In the tenure environment, populated largely by white men, women scientists may be best suited looking for a “wife” of their own, since breaking through the wall or getting across the fault line poses such difficulty for women, not men, with children. Roughly 45% of tenured women are childless – a rate much higher than tenured men and reflective of the belief that young females in academe must choose between tenure and children (*Beyond Bias*, 2006, 5-13). The point is that women, to succeed, need the support and services similar to the traditional breadwinner dad, with a wife at home.

Overview of Academe – University Science

If your work is good enough, men will respect you and grant you what is due you. – Helen Taussig, Johns Hopkins University, never married; childless

Research conducted over the past three decades shows that girls perceive their future family roles, where desired, as incompatible with science and engineering (S/E) (Xie and Shauman, 2003, 48). In fact, this is the most frequently cited explanation for women’s under-representation in academic science. The widely held belief is that many girls who have received improved, more-easily accessed science educations in K-12, and even young women in competitive undergraduate science programs, ultimately choose a field perceived as “family-friendly.” Of those who progress through the doctorate level in science, they are still much less likely to remain in academe than their male peers. Could it really be because university science is such a family-hostile workplace? Studies indicate this is the sad truth.

Studies across many years consistently show that “in general, while women and men seem to be completing doctorates with similar credentials and experience, the positions and rewards they find are not comparable” (Eisenhart and Finkel, 1998, 21). Armenti found that young women at the junior professorial level receive the message that “taking time off from work for childcare can be harmful to their career progression” (Armenti, 2004, 75). Even if they do not have children, women find the science environment unfriendly. In addition to the difficulty of balancing family and the pursuit of tenure and promotion, women face the “perceived competitiveness in science jobs and the related perception of science as a male domain, (the) difficulties in finding jobs for women in two-career families and continued beliefs about women’s lesser abilities in science” (Hanson, 1999, 188). The question is not simply whether women and mothers can compete for top assignments with men, but also, as Debra Rolison asks, why “should the American taxpayer still support institutions that continue to hire white men preferentially”(Rolison, 2000, 74)?

Key Elements of Academe: Pay, Publication and Tenure

In my view, tenure should be abolished, with job security, and the heart of merit compensation, related to scholarly and educational contributions. – Debra Rolison

When it comes to the general work environment, the university setting has long been sought for its intellectual freedoms, its camaraderie, and the sense of its place as training ground for the world’s future intellects and leaders. Top professors, particularly at research universities, also welcome the opportunity to continue to research and publish, thus advancing their field’s body of knowledge. Unlike most employment situations, academe offers a relatively unique job security through tenure, if that level can be

attained. The prestige and political/community connections can also be a desirable perquisite in academe.

Unlike the top Division I football coaches, who routinely make hundreds of thousands of dollars, if not millions per year, top science professors make a fraction of that salary, often within the same university, and often with pressure to write grants and bring in more money to their departments. Women, meanwhile, face even longer odds in the salary department, with studies reporting that in all disciplines throughout a variety of institutional types, they earn less than men, and the inequities are progressive, with increasing gaps as higher positions are achieved (Trower and Chait, 2002, 7).

Women must also be committed to working twice as hard in academe, as measured in publications. One study of post-doctoral applicants found that “women had to publish approximately twice as much as men to be perceived to have achieved the same success rate” (Wenneras and Wold, 1997, 342). Additionally, collaboration, a key factor in many papers, is more difficult for women who to some degree “are excluded from collegial channels and collaborative opportunities, (with the result that) their productivity can suffer” (Fox, 1992, 189). Fox argues that collegiality rather than parenthood is more of a factor affecting publication. Creamer’s review of prior research also found the results of the impact of parenting on publication mixed. In her review of ten studies on the relationship between having children and publishing productivity, five showed no significant relationship, three found a positive relationship and only two found a negative relationship (Perna, 2001, 587). Ironically, what does not seem to count as much as the quantity of publication is their quality. In a study involving biochemists, the researcher “found that articles by women received, on average, more citations than

articles with men as primary authors” (*Beyond Bias*, 2006, 4-10). Also cited in this recent report is that when comparing apples to apples, women to men who are full professors at Research I institutions, the difference in publication productivity was less than 5% (*Beyond Bias*, 2006, 4-10). Clearly women can hold their own, if allowed to rise to the top.

Tenure is probably both the greatest prize in academe, and the one with the highest cost to women. It has been found that “the proportion of women with tenure lags the rate for men by 20 – 27 percentage points across all types of institutions, with the greatest imbalance at universities” and that numbers remained similar between 1975 and 1995, finding that in science and engineering, “only one quarter of women had been awarded tenure, compared with one half of men” (Trower and Chait, 2002, 5, 6). Add marriage and kids, and the equation becomes even clearer. Mary Ann Mason, dean of graduate studies at University of California at Berkeley, found that across disciplines, married men with children were most likely to receive tenure, while married women with kids under six years old were the least successful at achieving tenure (Ellison, 2005, 163). Clearly this can be understood for a field that requires intense, “unbroken concentration on work during the peak female reproductive years” (*Beyond Bias*, 2006, 5-5). The maternal wall in tenure is not a myth.

In an era where young women have grown up with the benefits of the feminist battles fought by previous generations for equal rights, pay equity and reproductive freedom and choice, their choice, upon entering the science academy is often one between tenure and motherhood. Recent data from the National Survey of Post-Secondary Faculty showed that “only 31% of women faculty have children” (Ropers-

Huilman, 2003, 119). Joan Williams describes this dilemma as a zero-sum game, where “some women get to have children, but they pay the price of career marginalization, (while) others get to have a career, but they sacrifice motherhood. Men don’t pay either price” (Cohen, 2002). The bitter pill women must swallow: men and women are not equal when it pertains to family and work.

Motherhood and University Science

The glaciers have receded and mammoths are extinct, but this relic of the Pleistocene still slouches across our living room. Mom raises the kids. – Rhona Mahoney

Belkin, writing in *The New York Times*, acknowledges motherhood as the “new” obstacle for career women. While the nineties focused on women pushing through the glass ceiling to achieve the highest levels of power, she claims, “this new decade is less about the obstacles faced by women than it is about the obstacles faced by mothers” (Belkin, 2003, 44). Unfortunately, many of those women feel pressured and/or coerced to not strive toward full, tenured positions in universities, where, in 2003, only 18% of full professors in science and engineering were women (NSF, Science and Engineering indicators, 2006, Figure 5 - 24). Why?

One reason is the strong foothold of white males in academe. Controversial for her demand to invoke Title IX in faculty hiring in academe, Debra Rolison describes it this way:

Men also need to recognize a chemical truism: like dissolves like. Like likes like. Like does not like unlike. When something in an applicant’s package reminds a committee member of himself, he immediately becomes a champion for that package – and most men are not going to see something in a woman’s application package that reminds them of themselves (Rolison, 2000, 83).

Rolison supports this argument with several examples of other fields, such as symphony orchestras, where gender-blind processes resulted in gains for women. The obvious difference in academe is that women working through the tenure process are seen and recognized as women by their male superiors who will vote in favor or against their tenure. Hiding behind a screen for an orchestra audition may have opened up symphonies to women musicians, but no similar mechanism seems possible in academe, where tenure is so heavily dependent on work, time, publications and collaborations within the university setting. The collegiality factor, as earlier described, is very much in play. In one recent survey of female tenured and non-tenured faculty at a Research I university, 95% of respondents said “personal” factors figure into advancement, factors which they “characterized, variously, as going along and getting along, as old boys’ network, and as preferred personalities” (Fox and Collatrella, 2006, 383).

A second reason women struggle to succeed in science academe is the work itself, requiring long hours, early morning and evening classes and meetings, research and writing balanced against teaching, mentoring and committee responsibilities; in short, a mom-unfriendly environment. Experts in the field argue that this does not have to be *de rigueur*:

We see no reason why science curricula, degree programs, or occupations must necessarily be so demanding as those of elite science are. We also do not think it justifiable to provide generous support only to tight educational and occupational arrangements that are easier for white men than anyone else to enter and succeed in (Xie and Shauman, 2003, 235).

Reason two is closely linked with reason one: standards established and maintained by the male hierarchy are unreasonable and very possibly unnecessary for strong academic programs.

Finally, one of the reasons women scientists move away from academe is that stimulating, well-paying and family-friendly alternatives for earning a living exist. For instance, industrial bio-technology employs a nearly equal balance of men and women scientists, primarily because of good pay and reasonable hours. As one female Ph.D. biochemist explained, “It’s tough for a woman to get tenure in academia. I had friends in academe and friends in industry. I didn’t want to work 80-hour weeks (in academe) and not get tenure” (Eaton and Bailyn, 1999, 163). Likewise, it is difficult to plan every child’s delivery to be a “May baby.” As a Canadian academic described:

There was a time when I used to go to women’s caucus meetings and they would talk about [May babies] so that was where I discovered that all the junior faculty were trying to have their babies in May, so it wouldn’t interfere with their teaching and upset their colleagues (Armenti, 2004, 72).

As anyone who has planned a pregnancy would attest, precisely hitting a certain month is a difficult prospect, particularly when in academe it involves women often past their prime years of fertility. One researcher in regard to this issue wrote that in the best of situations, women carefully work to integrate family and children with their science, and “at worst, the inability to establish a balance drives them out of academic science” (Etkowitz, 1994, 49). With corporate and government settings looming as viable alternatives for mothers who are scientists, academe, with its white-male wall and difficult working environment, will struggle to represent gender equity among its faculty.

Recommendations for Change

But in science the credit goes to the man who convinces the world. – Francis Darwin

At the heart of any discussion of the changes that must be made in scientific academe are the men in power. Women, mothers, minorities, and anyone else outside the scientific “norm” were not “considered when those who ruled made the rules. And those rules, barely tweaked over the last century, are now so deeply entrenched in the culture of the academy as to be orthodoxy” (Trower, 2003, 1). Rolison agrees, “Men are the ones who run the system. They are the ones who are rewarded by the system. They are the ones who are going to have to agree to change the system” (Rolison, 2000, 85). One possible way to make inroads with men, who as scientists are trained to respect data, is to collect and present hard numbers to them regarding the true position of women within their institution. A man who regularly sees women faculty around campus and in meetings might not differentiate that many of them are adjuncts or associates, not full tenured professors. As one senior academic administrator described this need to incorporate data on faculty employment, “we can take a hard look at real data, not just base our arguments on what we think or feel. We are now in a position to use data to make decisions that are good for faculty and good for the institution”(Trower and Honan, 2002, 278,279).

Numbers alone may help convince some men that women need to be invited and even recruited into the club, but not enough has been accomplished, even with statistical evidence. Some argue for legal or financial steps to be taken, particularly where public institutions using taxpayer money are involved. A recent report that concluded women were capable to succeed in academic careers, if given the opportunity emphasized:

Reducing the homogeneity of faculty enhances problem solving, teaching and research. The need to eliminate bias against women scientist and engineers – whether explicit, covert, or unexamined – is therefore more than a moral or legal obligation of universities. It is a requirement for assuring a scientific workforce of the highest quality (*Beyond Bias*, 2006, 4-38).

The reference to “explicit, covert or unexamined” bias is worth emphasizing. Both men and women in academe are guilty of one or more of these biases, often while unaware of them.

If women can find common ground with men who want to have time and energy for a personal life outside of work, or perhaps even shoulder the larger share of household and childcare duties, the efforts to improve academe can be made jointly, to benefit all involved, not just women. Currently a “large number of women scientists (face) the “two-body problem of finding two science positions in the same geographical area... (where) priority is typically given to the husband’s career opportunities” (Sonnert, 1995, 19). Women would be wise to emphasize the personal interests not just of themselves as wives, mothers, and daughters, but also of their male peers who are fathers, husbands, and sons. Dual-career issues among married scientists occur often enough that some universities are already addressing it in hiring practices and recruitment strategies. It is merely one more area where, if men felt they were privy to some of the changes instituted for work-family balance, they might be less inclined to work against the success of women within their university setting and more motivated to improve working conditions for all.

But men are not entirely at fault. Young women entering university science are discouraged not only by the male hierarchy they find, but also by the negative and life-

limiting lessons the senior women project and verbalize. In a study of Canadian university women, Armenti reports that the young women received messages about inadequate benefits, unreasonable tenure clocks, poor child care availability and “that having children before tenure can reduce the likelihood of achieving tenure” (Armenti, 2004, 76). On my own campus, I have heard young women repeat the mantra that they will not have a baby until they have achieved tenure. As a mother of three who has returned to academe, I have been told that I am too old to ever get tenure-track at a Research I university. These types of messages to women, young and old(er), are never presented to men. Do the same senior faculty members who convince women to wait until tenure to start a family tell their male students to wait? I think not.

If women are going to succeed in science, particularly mothers, the senior men and women they interact with need to support them, encourage them and exhibit flexibility with them. This will never occur unless the university structure itself, from the top administrator down, is designed with an eye to family-friendly employment. Etkowitz defines this situation where, “achieving equality is not just a matter of opening up opportunities but of changing the structure of the academic system” (Etkowitz, 1994, 51). One would hope that studies and reports and conferences on this topic would have kick-started these procedures, and in some universities it has. The more radical approach, the one advocated by Debra Rolison, is to use Title IX to compel universities to end the bias against women in academe; that is, if discrimination is occurring, cut off National Science Federation grant money or even *all* federal funding until compliance is reached (Rolison, 2000, 75). Whether compelled by conscience, legal means or withdrawn funding, the desired outcome is for university leadership to publicly declare support for

women and men who have families, to put in place mechanisms of support such as quality day care, paid leave, tenure “stop-clocks” and flexible benefits, and perhaps, most importantly, to train existing, senior staff and faculty to project optimism about a variety of possible career paths rather than pessimism rooted in traditional, inflexible platitudes.

Nine top universities, including California Institute of Technology, Harvard University, Princeton University and the Massachusetts Institute of Technology, pledged in 2001 to “develop and utilize fully all the creative talent available,” and reaffirmed this in 2005, when they reported that:

In the summer of 2005, representatives from our nine universities convened to share best practices and specific initiatives addressing faculty with family responsibilities ... We acknowledge that there are still significant steps to be taken toward making academic careers compatible with family caregiving responsibilities. Our goal as research universities is to create conditions in which all faculties are capable of the highest level of academic achievement (*Beyond Bias*, 2006, Box 5-1, 5-15).

These nine universities have made a public commitment to doing all they can to attain equity. They specifically cite the need for “academic personnel policies, institutional resources, and a culture that supports family commitments” (Ibid). At all levels, the reality must be faced that many qualified applicants for science faculty positions are turning from the university option to pursue more welcoming, financially rewarding and family-flexible positions within industry, government and even small business settings. These changes and adaptations must be implemented in a way that is meaningful and available for all faculty, whether those with children, those with elderly parents, those with a sick partner or spouse, and those with any number of family situations that dictate

leeway and flexibility. In short, universities must implement policies that recognize and mitigate the disadvantages imposed by caregiving” (*Beyond Bias*, 2006, 5-14).

The work environment of academe must be designed to be attainable as well as attractive to all types of people, without discrimination or bias against any group. Universities of all sizes, colleges and junior colleges, all levels of academic settings, must stand together and lead the equity battle from the top administrator to the most junior professor and across faculty and staff lines. Meanwhile, those at the top must not forget the admonition of Trower and Chait that “who teaches matters:” all great scientists learned from exciting, inspiring and influential teachers. Rather than simply focusing on who is named in publications, university presidents and department heads need to recognize those professors “named” by the next generation of scholars. Impacting and inspiring lives of curiosity, creativity and contribution at a time when so many bright students are leaving academe should be a top priority at all schools and particularly at Research I schools known for cultivating the “best and the brightest.”

And surely this group must include women and mothers, alongside the men and fathers already firmly ensconced in the ivory tower. Men in academe have children; women must be allowed that same privilege. If we continue to allow current practices to be the norm, women who desire children will either not fulfill that desire, or fulfill it outside academe, working in areas where their gifts and talents will be appreciated without cutting off their maternal drive. And as the baby-boom generation moves toward retirement, who will be there to replace the men? Men will leave departments struggling to replace them with qualified applicants, particularly as business and government

interests open their arms with similar demographic issues, but more cultivated strategies for work-family balance.

It is not in the best interest of the scientific community to continue to propagate the academic environment where women are forced to choose between tenure and children. Within academe there are scientists, even tenured women scientists, who would argue some research cannot be interrupted, cannot be flexible, and cannot remain cutting edge if the lead researcher needs several weeks off for maternity leave. In these areas of science, if collaboration is not a viable strategy to cover for maternity leave, women who enter these areas should be made fully aware of this possibility, so that they can choose to redirect their careers accordingly. Increasingly, with advances in technique and technology, one would hope these instances would grow rare. Academe should be most interested in creating a work environment for mothers, even more so than “Corporate America” or “American Government.” “Academic America” needs to focus on welcoming parents, both the fathers who have dominated the academic ranks, and mothers who want to participate in increasingly large numbers, as fully engaged, tenured professors. The changes made to accommodate parents will likely add “quality of life” improvements for the single or childless by choice, whom, nonetheless, strive for a balanced life composed of relationships with family and friends, outside interests, rest and recreation as well as stimulating science. As the leader in education, Research I institutions should also lead the fight for equality within its ranks, and by so doing, lead the way for all institutions of higher learning. Science academe will benefit, and so will the scientists of tomorrow, especially the ones born of tenured professors!

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