

STATUS

A REPORT ON WOMEN IN ASTRONOMY

CONTENTS

A Graduate Student's Perspective on the Women in Astronomy II Conference

Jane Rigby

1

The Postdoc Perspective on the Women in Astronomy II Conference

Beth Holmes

5

Pictures from the Women in Astronomy II Conference in Pasadena

6

A Proven and Practical Approach to Hiring Women and Minorities

Kathryn Johnston

7

Attracting and Retaining Women in Science and Engineering

Sue V. Rosser

9

Do Babies Matter? The Effect of Family Formation on the Lifelong Careers of Academic Men and Women

Mary Ann Mason and Marc Goulden

13

Notes from a Life

Anonymous Readers' Contributions

19

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

"Summary of Women in Astronomy II Conference: Diversity Breeds Excellence" by Meg Urry available in the October and December 2003 AAS Newsletters

Editor's Note: Patricia Knezek

I would like to draw attention to the fact that Meg Urry provided an excellent and comprehensive two part summary of the Women in Astronomy II Conference (WIA II) held June 27 & 28, 2003 in Pasadena, CA, for the AAS Newsletter. Part I, entitled "Where do we stand?" was included in the October 2003 issue, in the Committee on the Status of Women in Astronomy (CSWA) section. Part II, entitled "Where do we go from here?" appears in the December 2003 issue, also in the CSWA section. Not only does that summary provide an overview of the conference as a whole, but it also is an effective complement to the first two articles that appear in this issue of STATUS. These first two articles discuss the graduate student and postdoc views of the WIA II



Photo by Fran Bagenal

Meg Urry is currently a Professor of Physics and the Director of the Yale Center for Astronomy & Astrophysics. She does research on active galaxies, notably multi-wavelength studies of blazars. She was the chief organizer of the 1992 conference on Women in Astronomy, which resulted in the Baltimore Charter. She was recently involved in organizing the 2003 Women in Astronomy II: Ten Years After meeting.

meeting, while Meg's article covers the senior scientist point of view. The AAS Newsletters are archived on the web at <http://www.aas.org/publications/newsletter.html> and I encourage those who haven't already read this outstanding review to do so. For more information on the meeting itself, please see <http://www.aas.org/~cswa/WIA2003.html>. ❖



Jane Rigby is a graduate student in astronomy at the University of Arizona. Her interests include the star formation and metal formation histories of the Universe.

A Graduate Student's Perspective on the Women in Astronomy II Conference

By Jane Rigby



Jane Rigby

The status of women in astronomy is changing fastest at the entry levels: there is a demographic swell of young women scientists. They are moving through the lower ranks; they worry about balancing career and family; they hope for the opportunity to do good science and to be judged fairly on that science. Here are highlights of the Pasadena meeting as seen from a graduate student's perspective.

1. The tidal wave of young women astronomers

In the meeting's first hour, I learned something amazing:

- 35% of all AAS members under 35 years of age are now women.
- 42% of AAS members ages 23-28 are women.
- Of all Astronomy doctorates earned by women since 1960, half were awarded after 1995.

Compare these numbers to the fraction of Astronomy faculty who are women: 14%. Clearly, the demographics of US astronomy are quickly changing; we are not far from gender parity at the entry-level. The hanging question of the meeting

Student's Perspective continued from page 1

is what will happen to this wave of young, talented women scientists?

These encouraging demographics do not guarantee success: though business schools have had > 20% female enrollment for 25 years, only 0.6% of the Fortune 500 CEOs are women. And although law schools have had 50% women enrollment for years, only 14% of partners at major law firms are women. Our field needs to do better than law or business at treating women fairly and retaining their talent.

These demographics place a clear burden on search committees: take note, your talent pool is one-third women! If search procedures are fair, hiring should reflect the talent pool, and the tidal wave should reach the more senior ranks. Statistics presented at the meeting show that this hasn't yet happened; the fraction of junior faculty positions held by women has stagnated over the past decade. If women aren't applying for particular positions, search committees need to ask why and actively recruit women to apply. "It's a search committee, not a envelope-opening committee" was a notable quote from the meeting.

Female astronomers do not advance as fast as their male counterparts, in part because of... the weight of family responsibilities (which includes caring for children as well as aging parents).

2. Why should anyone care?

Isn't the status quo good enough? If few women do theory, or land tenured jobs, what's the problem? Aren't there lots of smart men willing to fill those jobs?

There are still adherents to this view, and plenty more who know they should support women in astronomy because it's politically correct. Both of these perspectives decouple the fraction of women astronomers from the quality of science. Let me present an argument from the meeting, not a moral argument but a practical argument, aimed at the status-quoers.

Simply put, we need the best minds available to solve the problems of modern astrophysics. Twenty-five percent of the U.S. population is Black or Latino, but only 2% of U.S. astronomers are; that's a talent loss. Only 14% of astronomy faculty are women--another talent loss. If the talents of women and minorities are systematically under-utilized, *the science suffers*.

Given that we still don't know the identity of 85% of the Universe's matter, and that we're even more ignorant of dark energy, I find the status quo argument, that our profession's lack of diversity doesn't matter, a bit hard to swallow.

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<http://www.aas.org/~cswa/status>

3. Climate

Female astronomers do not advance as fast as their male counterparts, in part because their work is judged differently and in part because professional women in the U.S. bear the weight of family responsibilities (which includes caring for children as well as aging parents).

Women also leave astronomy at higher rates than men. Why? It's difficult to address this question, because, as we learned at the meeting, the AAS and the American Institute of Physics do not survey people who've left astronomy. If we want to know why people leave, we should be asking folks who left, not those who remained. Since one-third of astronomy Ph.D.s leave for other fields within eight years of obtaining their Ph.D., and since women tend to leave at higher rates than men, it seems that we should be keeping track. If this is an important question, we should lobby our professional organizations (the AAS and AIP) to study who leaves our profession, why, and where they find jobs outside astronomy.

Much of the meeting discussed why women leave astronomy, and if they stay, why they are often undervalued as scientists because of their gender. These two issues aren't orthogonal and certainly affect different individuals to varying degrees. Other STATUS articles will discuss why women scientists are often taken less seriously than their male counterparts; I'm going to focus on other questions of climate.

In varying forms, this question surfaced repeatedly at the meeting: *why is astronomy so anti-family and anti-life?* Many talented people leave astronomy because of its perceived anti-family, anti-life attitude. If growing numbers of astronomers want partners, children, and life outside astronomy (as my male and female grad student colleagues generally want, and many have), why is the culture so resistant to change?

A good quote from the meeting: "Academia was invented by monks, and it shows." It shows in our attitudes, when we prize spending 16 hours a day in the office. Monastic assumptions also show up in institutional policies (like the tenure system) which assume that most scientists either have no families, or have a wife at home to manage family matters. How will these attitudes change as the fraction of astronomers who are active parents continues to grow? Are the best astronomers really the ones who never go home and are those the only excellent researchers? I hope to see active discussion about these questions of mindset within our field.

Regarding institutional policies, I think answers are much clearer: many policies are outdated, anti-family, and need to change. These reforms are almost embarrassingly mild: affordable on-campus childcare; family leave policies to accommodate parenting and family crises (not just maternity leave); tenure clock slowdown for new parents, without stigma; affordable health care for astronomers (especially graduate students) and their families, including domestic partners. Such accommodations

are common to standard at Fortune 500 companies. Why are they so difficult to gain for academia?

Since family policies are set at the institutional level, a single department can't bring change. But family issues aren't exclusively women's—many male astronomers care about these issues, too. What if astronomers who value family and outside life joined forces to improve the climate? What if departments identified these reforms as critical to recruiting faculty and students? What if department leaders aggressively advocated reform on family policies to deans and presidents?

4. Mentoring

For over a decade, about half of the entering graduate students at my department have been women -- commendable! Thus, we're well above "critical mass" -- female students don't feel alone as women. Still, graduate school can be humbling and hard. Each student copes differently, but many fit a pattern: they start doubting their abilities, they blame themselves, and they lose perspective on their progress. In my experience, such students are more often women. Whether male or female, these students desperately need good mentoring—advice from senior grad students, post-docs, or faculty. (Mentoring may be less effective from research advisors, since students don't want to admit problems to their supervisor.)

The Pasadena meeting stressed the importance of mentoring junior faculty and acknowledged difficulties making this work. In a breakout session, I learned several ways to build *unsuccessful* mentoring programs at the grad student level. Simply assigning a new grad student a more senior mentor often fails, it seems, as the students are reluctant to share concerns with a stranger, and well-intentioned mentors assume everything's fine.

Rarer were examples of grad-level mentoring programs that work. Two key elements seem to be:

- a) introduce new grad students to many potential mentors (especially senior grads and post-docs) as soon as possible.
- b) encourage a forum where common grad problems can be discussed.

For example, at Steward Observatory, the students organize a round-table lunch for the incoming grad class. One by one, the older students introduce themselves and give a piece of advice they wish they'd known earlier. New students learn the unwritten rules, and meet the other students as potential mentors. We also have lunch discussions (organized by a professor) on career topics like how to apply for post-docs and how to give good talks. Perhaps we should also hold discussions on a wider range of topics (like time management strategies and balancing career/family).

Continued on page 4

Student's Perspective continued from page 3

These are good starts, I think, but what more should we be doing?

5. What's missing?

The meeting organizers commendably covered many topics in considerable depth. Intending zero criticism, in order to suggest strategies for future progress, I need to discuss some limitations of the meeting.

First, there was almost no discussion of the status of women in non-U.S. astronomy. Such a discussion would be fascinating, given the range of cultures that support astronomical research. I would like to hear more about the recent special luncheon session on Women in Astronomy held during the IAU 25th General Assembly, and about other discussions on this topic.

Second, I worry that, by focusing only on the status of women in astronomy, we don't see the larger context: the problems of "otherness". In a field that traditionally belonged to white men, how do the experiences of women compare to the experiences of astronomers who are ethnic minorities, who are gay, who were born in the developing world?

Not to say that these problems are identical; they're not. For example, failing schools alone make it much harder for Black, Latino, and Amerindian students to become astronomers. But I think these diverse groups share experiences and face many of the same obstacles to equity. As astronomers, we *want* to value diversity, but it's easier to deal with people who are like us. Without meaning to, we over-value scientists who are like us (or young versions of us). Given this, minorities have harder times getting ahead, feel isolated, and leave the field at higher rates than the majority.

Maybe this is more than we can chew; perhaps we should concentrate on one group at a time. But as individual small groups, frankly, we're ignorable. And our field emphasizes the unification of seemingly different problems! I wonder how well we would understand core collapse supernovae if, deciding that the combined mysteries of Types Ib, Ic, and II were too much, we had concentrated our attentions only on Type Ib SNe.

For example, I overheard several groups at the meeting wondering why there was no discussion of how the issues of women in astronomy relate to issues facing lesbian, gay, bi, and transgender (LGBT) astronomers. Some of my older readers may find this question inappropriate, but astronomers my age generally see it as an obvious question of workplace diversity and fairness. Below are two obvious examples of how considering these groups together identifies strategies to improve the climate for women.

As one example, it is still legal in 37 states to fire, refuse to hire, or refuse to promote based on sexual orientation. This helps keep LBGT astronomers and staff silent. "As long as it's dangerous to your career

to be a lesbian, then any opinionated, outspoken woman astronomer, gay or not, can be labeled a lesbian and thus marginalized or silenced," (- a female full astronomy professor). When labels commonly used against strong women ("too bitchy", "too masculine", "a real ball-breaker", "a dyke") lose their power, then and only then all women will feel safer speaking up.

As another example, do you remember the call to reform institutional policies regarding families? Well, existing policies which are 'family-friendly' (like providing health insurance benefits) often exclude LGBT spouses and their children. Therefore, if female astronomers and their allies seriously attempt to reform the anti-family climate of academia, they will have strong allies in LGBT faculty, students, and staff, who feel these pressures more acutely.

Conclusions:

Young women are becoming astronomers in ever-increasing numbers. As a profession, to maximize the scientific contribution from these women, we need to notice whether they are being treated fairly and support them in the following ways:

- Monitor whether our institutions are hiring women fairly (in accord with the talent pool demographics), especially at the post-doc and junior faculty levels.
- Search for and mainstream better solutions to the two-body problem.
- Lobby, with allies, for reform of institutional policies regarding families.
- Improve mentoring of young astronomers, with the aim of especially reaching women and minorities.
- Remember that women are not the only "outsider" groups in astronomy, and search for common ground and common solutions.

Lastly, women astronomers should remember that many male colleagues are strong supporters of equity--they want women astronomers to succeed. We need to welcome these allies to our discussions and encourage their participation, as we work to encourage diversity and create fairer work environments. If we dedicate ourselves to the quality of astronomy research and fairness in our profession (as the AAS bylaws boldly ask of us), the next few decades may be an amazing time to be astronomers. ❖

The Postdoc Perspective on the Women in Astronomy II Conference

By *Beth Holmes*



Photo by Samantha Lawler

Beth Holmes

Sitting on the lawn at the edge of the lily pond outside Baxter Hall at Caltech, I was among a group of graduate students and postdocs talking about the Women in Astronomy II conference (WIA II) during the meeting's lunch break. I started to notice some common themes as our conversations evolved on that sunny June California afternoon. As young scientists attending WIA II, we were struck by the differences in perspective that older women scientists and younger women scientist had. Could some of these dissimilarities help account for the leaky pipeline?

One difference was the acceptance the older women had for the idea of a period of postdoctoral research in one's career. In contrast, some of the younger women felt that the astronomical community should try to lessen the postdoctoral period since it can be very disruptive to a scientist's family life. Often in these situations, it is women who end up giving up their careers when two partners are faced with multiple moves across the country in pursuit of postdoctoral positions. Does the existence of a long postdoctoral period help contribute to the leaky pipeline? Obviously, minimizing the postdoctoral period would involve a community wide change. Another question that arises is whether the postdoctoral period is longer now than it was in the past. Today many young scientists have more than one postdoc before obtaining a permanent position or leaving the field. Is this more than in the past? Could this account for the different views of the older and younger women?

Another difference was that many of the older women scientists focused on how much less discrimination there was against women now than when they first entered the field. While the younger women we talked to were very appreciative of the trail blazing of the older women, they weren't entirely

convinced that discrimination had been eradicated. Occasionally some of us faced situations in which we wondered whether we were being treated equally. In addition, some of us faced awkward situations at work when a male colleague acted inappropriately. As young women scientists, we were still interested in talking about these situations and figuring out how to deal with them, whether the situations were subtle and left us guessing or were clear cases of harassment or discrimination.

Another issue that was discussed was the role of the scientist in the family. We were interested in how women dealt with this issue in the past, but we were also willing to explore new options. The workplace has become, in many cases, more flexible than in the past. Women have the option to work at home or to use day care. Taking time off from a career doesn't seem to be an option for astronomy. However, there are some fellowships that specifically target women scientists who have taken a career break to raise a family. Another related issue is the feasibility of situations such as job-sharing or employing a trailing spouse. Some institutions, notably my Ph.D. institution, actively recruit spouses because they know it makes them attractive to couples dealing with the two-body problem. Lastly, today men are investing more time in child care than in the past. So far, these options have been individual choices but maybe its time they get looked at in a larger study. We want to explore the family-work parameter space.

Many of these issues, especially the ones involving family, affect women (and men) on a very personal level, so it is important to continue exploring these issues and searching for creative solutions. A core group of the Los Angeles-area women who attended WIA II are planning meetings of young women and men in astronomy to talk about women's issues in astronomy. Perhaps you could consider starting a group in your area. ❖



Beth Holmes is a National Research Council Research Associate at the Jet Propulsion Laboratory. She received a Ph.D. in Astronomy from the University of Florida in 2002 and an S.B. in Physics from MIT in 1995. Her current research interests include modeling asymmetries in planetary debris disks and applying her models to upcoming SIRTf data.

Pictures from the Women in Astronomy II: Ten Years After Conference



From left to right, facing the camera are Melinda Kahre (NMSU), Amy Simon-Miller (GSFC), Lisa Frattare (STScI), Marla Geha (UC Santa Cruz, partially blocked), and Tammy Bosler (UC Irvine).



Fran Bagenal (U Colorado) and Carolin Crawford (IoA Cambridge) at the reception held prior to the conference banquet. Bagenal did a superb job as chair of the WIA II Program Committee.



From left to right, Nicole van der Blik (NOAO), Cathy Petry (Steward Observatory), and Jessica Rosenberg (U Colorado) at cocktails before the conference dinner.



From left to right are Marla Geha (UC Santa Cruz), Tammy Bosler (UC Irvine), Nancy Chanover (NMSU), Erika Gerken (NMSU), and Melinda Kahre (NMSU).



Charlotte Fishman (Equal Rights Advocates) is in the foreground. To the left of her is Wal Sargent (Caltech), who led the local organizing committee. Anneila Sargent and Margaret Burbidge are visible to the right and far right of Wal Sargent.



From left to right, Charlotte Fishman (Equal Rights Advocates), Meg Urry (Yale) and Alice Huang (Caltech). Fishman and Huang spoke at the conference. Meg Urry played a key role organizing the meeting as chair of the AAS Committee on the Status of Women in Astronomy, a position she held through June of 2003.



From left to right, Elaine Seymour (U Colorado), Debra Rolison (NRL) and Cathy Pilachowski (Indiana U and AAS President) chat after the banquet dinner and speech. Seymour and Rolison were invited speakers at the conference.



From left to right, Silvia Torres-Peimbert (UNAM), Margaret Burbidge (UCSD), and Elizabeth Griffin (DAO) were among the senior women scientists who actively participated in the conference.



From left to right, Mia Bovill (U Maryland/NOAO REU program), Richard Green (KPNO), David Shaffer (CCSN), and Colleen Gino (Dudley Observatory) engage in a discussion during the banquet dinner.



American Astronomical Society President Cathy Pilachowski (center) spends some time with young conference attendees.



Kathryn Johnston works on galactic dynamics, with a particular interest in the role that dwarf galaxy destruction plays in galaxy formation. She is currently an assistant professor in the astronomy department at Wesleyan University.

A Proven and Practical Approach to Hiring Women and Minorities

By Kathryn Johnston

(With helpful comments from Daniela Calzetti and Julianne Dalcanton)

In 1996, Denice Denton arrived as the new Dean of Engineering at the University of Washington (UW). At 37 she was the youngest dean at UW and the first woman dean of engineering at a major U.S. research institution. These might seem like challenges enough in a new job, but they were really incidental compared to the expectations of her employers: Denton was hired to take a traditional engineering division and mould it to provide a model of how excellence can be achieved through diversity.

This article, inspired by her presentation to the CSWA at the AAS in January 2003, summarizes Denton's own description of how such changes can be achieved.

Inspirational Numbers

As in Astronomy, the percentage of Ph.D.'s granted to women and minority candidates graduating from the engineering programs (17% and 21% respectively in 2001) is typically far greater than the percentage of women and minority faculty in the same departments (8.6%). At UW, the emphasis on reforming hiring practices has already made some significant differences - by 2000, women and minorities accounted for 13% of the 200 engineering faculty. Among the most recent 22 hires, the UW Division appointed 7 women and 2 African Americans (searches for 50 positions in the equivalent division at UC Berkeley over the same time-frame resulted in zero women or minority hires).

So much for diversity, how about excellence? A common misconception is that rapid change can only be achieved through biased hiring practices, resulting in a lowering of academic standards. Yet, in a recent year, when UW junior faculty in the division submitted fourteen applications for the prestigious NSF CAREER grants, nine were awarded. This is a phenomenal success: NSF gave out 122 such grants nationwide in engineering in 2000.



Photo by Alexander Bogdanovitsch

Kathryn Johnston

Essentials for Success

Throughout her talk at the January AAS, Denton highlighted two components that she considered essential to the success of any effort to diversify on an institutional scale: commitment of time, staff and resources from the governing bodies of the institution at the level of the Deans through the President; and a complementary program of genuine change to the culture of the institution to provide a supportive environment for the incoming faculty and sustain the initiative beyond the lifetime of the current generation.

At UW these essentials are provided by the "Center for Institutional Change" (CIC), which coordinates many of the programs for hiring and retention of minority faculty outlined below. The Center was created in 2001, supported in part by an ADVANCE award from the NSF, which is used to fund staff salaries. Of equal importance was the reassignment of duties of existing staff within UW to this program.

Yet even the creation of such a center would be ineffective without the corresponding power to affect genuine change. Some illustration of the level of backing that the program enjoys from UW comes from anecdotes within the institution: according to Julianne Dalcanton (UW Astronomy), it is a local legend among the faculty at UW that Denton was able to remove several department chairs when she took control of the School of Engineering. Whether this legend is true or not is somewhat irrelevant - its very existence sends the message that Denton has the determination to make significant (and initially unpopular) changes and the backing from the University to see them through.

The Practical Approach

Once the institutional support is in place, implementing and sustaining diversity can be broken down into three areas: hiring practices; retaining new faculty; and cultural change. Some of the ideas used at UW are summarized below and more can be found in the "Faculty Recruitment Toolkit" link at the end of the article.

Continued on page 8

Proven and Practical continued from page 7

– Hiring Practices –

The first step of any search at UW is a meeting with the search committee to outline the best approach. Committees are encouraged to actively recruit candidates rather than follow the traditional route of simply filtering applications once they arrive. (Note: phone calls to colleagues are NOT considered active recruitment as they usually result in a reflection of the characteristics of the current department.) During this meeting the issue of diversity and excellence is discussed explicitly. A common outcome of such a discussion is that committee members assume that they are expected to hire a woman or minority candidate. This misconception needs to be dispelled - in Denton's experience targeted hires typically back-fire as the new faculty is stigmatized and never accepted on equal terms. Instead, she advocates presenting clear statistics on the applicant pool (e.g. the number of Ph.D.'s granted in the subject in the last five years, broken down by gender and ethnicity - data that is available at the NORC website listed at the end of the article) that allows the committee to see whether their search is producing a fair representation of that pool. Finally, the committee is led through a list of questions that are inappropriate to ask the candidate during interview (available through the "Faculty Recruitment Toolkit" – see resources below).

A second key element to a successful search is how candidates are treated. Once on the short list, each candidate is assigned an "ambassador" from the faculty who they can contact at any point to assess their progress. They are asked in advance of the interview who they would like to meet and what questions in particular they would like answered. During the interview they are given a hardcopy of a list of benefits that they might otherwise be hesitant to ask about. If they are offered a position they are also assigned an "advocate" to help lead them through the bargaining process (historically, women and minorities have accepted lower wages and startup packages). Overall, the emphasis is on accommodating the candidate rather than grilling them.

For example, among the list of benefits is a discussion of the common (and difficult to address) problem of dual-career couples. UW has

instituted a (modestly-funded) "dual-career program" which includes a commitment to working across departments and divisions to try to accommodate spouses. Although this issue cannot be asked about during the interview, the benefit descriptions allows the interviewer to describe the program. This can encourage the candidate (if it is relevant) to raise the issue at an early stage. This may be beneficial both to the candidate and to the institution.

– Retention of Incoming Minority Faculty –

It is hardly a surprise that a key to retaining minority faculty is to ensure that they have every opportunity to fulfill the promise that they were hired for. Some obstacles to success may not be easily pointed to or simply addressed (such as the working environment in the department - see below). However, one element missing at many universities that can easily be filled in is support for incoming faculty. This may be as straight forward as making sure their office is ready when they arrive, and that the housing office is helpful. At UW, in addition, each new faculty is assigned a faculty mentor to turn to with whatever problems they encounter or questions that come up. The CIC runs week-long workshops for incoming faculty, and these are followed by quarterly workshops that continue indefinitely.

Other challenges come from trying to fit a traditional career path around life outside academia. In recognition of such conflicts, UW has created a transitional support program for those adjusting to new childcare or eldercare responsibilities.

– Changing the Environment –

Changing the environment of an institution to make it more welcoming to minority faculty is perhaps the trickiest part of the process. In an ideal world, there would be sufficient minorities in positions of authority for the environment to be comfortable for them. Until this is achieved, strong leadership is crucial.

When Denton arrived at UW she explicitly talked to the faculty about the need for a working atmosphere that was comfortable for all members and stated what types of behavior were unacceptable in this context. She also made it clear that all faculty who ignored these guidelines would be held

The key to retaining minority faculty is to ensure that they have every opportunity to fulfill the promise that they were hired for.

accountable for their actions. This strong stance soon produced complaints to the Dean's office from current faculty about problems of discrimination that had been left unaddressed for years (and in a few cases, decades).

The CIC is maintaining this initiative in several ways: leadership development workshops for faculty chairs and deans; mentoring programs for women and minorities to prepare them for leadership positions; and money to support visits from outstanding minority scholars from other institutions who might be interested in moving to UW.

The Overall Philosophy

Looking back over Dean Denton's talk it is striking to note that very few of the practices she describes are applicable only to minorities. The UW program focuses on giving early and ongoing support to *people* throughout their careers rather than giving *things* early on (e.g. large startup

packages) and then leaving them to sink or swim. It is hard to object to such a philosophy, and hard to argue that it is discriminatory. Rather, in fostering excellence through diversity UW is creating a vibrant and vivacious workplace. ❖

Resources

NORC Career Outcomes of Doctoral Recipients.

< <http://www.norc.uchicago.edu/issues/docdata.htm>>

University of Washington's ADVANCE program.

< <http://www.engr.washington.edu/advance/index.html>>

University of Washington Faculty Recruitment Toolkit.

< http://www.washington.edu/admin/eoo/forms/ftk_01.html>

This article first appeared in the July-August 2003 issue of Academe, the bulletin of the American Association of University Professors. It has been reprinted here with permission from the publisher of Academe, and the author, Sue V. Rosser.

Attracting and Retaining Women in Science and Engineering

By Sue V. Rosser

Fiscal year 2001 marked an important milestone in policies to attract and retain women in science and engineering. That year, the National Science Foundation (NSF) initiated an awards program called ADVANCE at a funding level of \$19 million. The program supports efforts by institutions and individuals to empower women to participate fully in science and technology. The NSF explained in announcing the program that a category for institutional awards was needed because of an "increasing recognition that the lack of women's full participation at the senior level of academe is often a systemic consequence of academic culture."

Women are underrepresented in science and engineering faculties. Improving their representation depends on acknowledging and resolving institutional barriers.

At the end of a special meeting held at the Massachusetts Institute of Technology in January 2001, a statement was released on behalf of nine U.S. research universities (the California Institute of Technology; MIT; Harvard, Princeton, Stanford, and Yale Universities; and the Universities of Michigan, Pennsylvania, and California, Berkeley) suggesting that institutional barriers have prevented women scientists and engineers from having a level playing field in their professions. "Institutions of higher

education have an obligation, both for themselves and for the nation, to fully develop and utilize all the creative talent available," the statement declared, explaining that the signatories "recognize that barriers still exist" for women faculty, and that "this challenge will require significant review of, and potentially significant change

in, the procedures within each university, and within the scientific and engineering establishments as a whole." For the first time in public and in print, the leaders of the nation's most prestigious research universities acknowledged the existence of institutional



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Continued on page 10

Retaining Women continued from page 9

barriers for women scientists and engineers, suggesting that science and engineering might need to change to accommodate women.

The NSF publication *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2002* reports that the percentage of women majoring in scientific and technological fields has increased since the 1960s. By 1998, 49 percent of the undergraduates enrolled in these fields were women. Yet the percentage of women in computing, the physical sciences, and engineering remains lower than in other science-related disciplines. In 1998, women received 74.4 percent of the bachelor's

The percentage of graduate degrees earned by women in these fields is even lower. *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2000*, published by the NSF, found that although women earned 55.5 percent of the master's degrees in all fields in 1996, they earned only 39.3 percent of the degrees in science and engineering. By specific field, the percentages were as follows: psychology, 71.9 percent; social sciences, 50.2 percent; biological and agricultural sciences, 49.0 percent; mathematics, 40.2 percent; physical sciences, 33.2 percent; geosciences, 29.3 percent; computer sciences, 26.9 percent; and engineering, 17.1 percent.

The same publication reported that women earned 40.6 percent of the Ph.D. degrees in all fields in 1997 but only 32.8 percent of the Ph.D.'s in science and engineering. The percentages for specific fields were 66.6 percent in psychology, 58.7 percent in the social sciences, 40.7 percent in biological and agricultural sciences, 23.7 percent in geosciences, 23.4 percent in mathematics, 22.4 percent in physical sciences, 16.2 percent in computer sciences, and 12.3 percent in engineering.

The small number of women receiving degrees in the sciences and engineering translates to an even smaller percentage of women faculty in these fields. The NSF reported in *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2000* that only 19.5 percent of science and engineering faculty at four-year colleges and universities in 1997 were women. Women accounted for just 10.4 percent of full professors, 21.9 percent of associate professors, and 32.9 percent of assistant professors in science and engineering at these institutions. Although the bulk of science and technology research occurs at research universities, barriers for women such as insufficient lab space, salaries that lag behind those of men, and fewer prestigious opportunities for women than men are endemic to these institutions. The statement released after the January 2001 MIT meeting showed a dawning awareness that the best way to address these barriers is through institutional rather than individual change.

Table 1

Percentage and Number of Affirmative Responses to Survey of Most Significant Issues, Challenges, and Opportunities Facing Women Scientists and Engineers

	Categories	1997 % of responses	1998 % of responses	1999 % of responses	2000 % of responses
1	Balancing work with family responsibilities (children, elderly relatives, etc.)	62.7 (42/67)	72.3 (86/119)	77.6 (76/98)	71.3 (77/108)
2	Time management (e.g., balancing committee responsibilities with research and teaching)	22.4 (15/67)	10.1 (12/119)	13.3 (13/98)	13.0 (14/108)
3	Low numbers of women (resulting in, e.g., isolation and lack of mentoring)	23.9 (16/67)	18.5 (22/119)	18.4 (18/98)	30.6 (33/108)
4	Gaining respect from peers and administrators and establishing credibility	22.4 (15/67)	17.6 (21/119)	19.4 (19/98)	21.3 (23/108)
5	"Two career" problems (balancing one's own career with that of spouse or partner)	23.9 (16/67)	10.9 (13/119)	20.4 (20/98)	20.4 (22/108)
6	Lack of or inability to get funding	7.5 (5/67)	4.2 (5/119)	10.2 (10/98)	8.3 (9/108)
7	Job restrictions (e.g., limits based on location or salary)	9.0 (6/67)	9.2 (11/119)	7.1 (7/98)	5.6 (6/108)
8	Networking	6.0 (4/67)	<1 (1/119)	0 (0/98)	4.6 (5/108)
9	Affirmative action backlash (e.g., discrimination)	6.0 (4/67)	15.1 (18/119)	14.3 (14/98)	12.0 (13/108)
10	Active recruitment of or more opportunities for women (resulting in, e.g., backlash)	6.0 (4/67)	10.1 (12/119)	9.2 (9/98)	14.8 (16/108)
11	Establishing independence	3.0 (2/67)	0 (0/119)	6.1 (6/98)	2.8 (3/108)
12	Negative social images	3.0 (2/67)	3.4 (4/119)	2.0 (2/98)	<1 (1/108)
13	Trouble gaining access to nonacademic positions	1.5 (1/67)	1.7 (2/119)	1.0 (1/98)	1.9 (2/108)
14	Sexual harassment	1.5 (1/67)	<1 (1/119)	2.0 (2/98)	1.9 (2/108)
15	No answer	0 (0/67)	<1 (1/119)	1.0 (1/98)	1.9 (2/108)
16	Cutthroat competition	--	--	1.0 (1/98)	1.9 (2/108)

This table, earlier versions of which have been published elsewhere, is based on the results of an e-mail survey disseminated to 1997, 1998, 1999, and 2000 recipients of grants from a National Science Foundation program entitled Professional Opportunities for Women in Research and Education.

degrees in psychology, 52.7 percent in the biological and agricultural sciences, 52.5 percent in the social sciences, 39 percent in the physical sciences, and 37 percent in the geosciences, but they received only 18.6 percent in engineering. A July 2, 2000, article in the *New York Times*, "Computer Science Not Drawing Women," reported that the percentage of computer science degrees awarded to women had dropped from 37 percent in 1984 to 20 percent in 1999.

Roadblocks to Success

The ADVANCE awards program replaced another NSF program titled Professional Opportunities for Women in Research and Education (POWRE). Women scientists and engineers who were U.S. citizens in tenured, tenure-track, or non-tenure-track positions at any rank at any four-year college or master's or research university were eligible to apply to POWRE. Although a few tenured full professors, faculty from four-year institutions, and non-tenure-track faculty members received awards, most POWRE awardees were untenured assistant professors in tenure-track positions at research universities.

I disseminated an e-mail survey among award recipients for 1997, 1998, 1999, and 2000 asking them to identify the "most significant issues/challenges/opportunities facing women scientists today as they plan their careers." The quantitative and qualitative data collected from the nearly four hundred respondents illuminate the changes that institutions need to make to empower women scientists and engineers.

As Table 1 reveals, overwhelming numbers of survey respondents found "balancing work with family" to be the most significant challenge facing women scientists and engineers. Interestingly, the responses remained remarkably similar across disciplines: balancing work with family responsibilities was the major issue for women from all the fields of study covered by the survey.

Table 2 groups the sixteen issues or challenges listed in Table 1 into four categories. When restrictions stemming from spousal situations (issues 5 and 7 of Table 1) are combined with "balancing work with family responsibilities" (issue 1), it seems that Category A—pressures women face in balancing career and family—poses the most significant barrier to the careers of women scientists and engineers. (Issue 7—job restrictions—relates to spousal situations in that many women do not want to pursue positions in locations in which their spouse will not have employment opportunities.)

Category B covers a second group of issues (3, 4, 8, 10, and 12) related to the low number of women scientists and engineers and the stereotypes that surround expectations about their performance. Although issue 10—active recruitment of women—would seem to benefit women faculty, it sometimes leads to a backlash, including difficulty in gaining credibility from peers and administrators who assume a woman obtained her position because of affirmative action. Such difficulties, as well as women's isolation and lack of mentoring, typify Category B.

Category C includes issues (2, 6, 16) that both men and women scientists and engineers face in the current environment of tight resources, but which may pose particular difficulties for women. For example, time-management challenges, such as balancing committee responsibilities with research and teaching (issue 2), can be a problem for male as well as female professors. However, as the NSF reported in 1997 in *Professional Opportunities for Women in Research and Education*, women scientists and engineers, because of their scarcity, are often asked to serve on more committees than their

male colleagues in order to meet gender diversity requirements, even while they are still junior faculty, and to advise more students, either formally or informally.

Cutthroat competition makes it hard for men and women to obtain funding. But women's socialization to be less overtly competitive than men may make it more difficult for a woman scientist or engineer to succeed in such an environment. Category D (issues 9, 11, 13, 14) identifies barriers caused by overt harassment or discrimination that women scientists and engineers face. Issues 11 and 13 are included in this category because some male scientists and administrators hold stereotypical views of women and expectations about their roles in the family and the workplace. Such male colleagues may discriminate against women by assuming that women will have difficulty establishing an independent research agenda, traveling, or working in the evenings and on weekends.

Table 2

Categories	Response Numbers ^b	Means of Responses			
		1997	1998	1999	2000
A Pressures women face in balancing career and family	1, 5, 7	27.1%	30.5%	35%	32.4%
B ^a Problems faced by women because of their low numbers and stereotypes held by others regarding gender	3, 4, 8, 10, 12	12.3%	10.1%	9.8%	14.5%
C ^a Issues faced by both men and women scientists and engineers in the current environment of tight resources, which may pose particular difficulties for women	2, 6, 16	10.8%	4.8%	7.9%	7.7%
D Overt discrimination or harassment	9, 11, 13, 14	3.0%	4.4%	5.8%	4.6%

An earlier version of this table was published in 2000 in v. 6, n. 2, of the *Journal of Women and Minorities in Science and Engineering*. The table appeared in an article by S. V. Rosser and M. Zieseniss titled "Career Issues and Laboratory Climates: Different Challenges and Opportunities for Women Engineers and Scientists." In this table, the alphabetic designations for categories B and C have been exchanged compared with that article. In addition, two issues from category B and D were exchanged as a result of faculty comments at various presentations of this research.

The following quotations from the respondents to the POWRE survey provide a qualitative context for the issues raised. In these quotations, women describe specific barriers to their careers.

Career and Family

Referring to the struggles of women scientists and engineers to balance their work and family responsibilities, one 2000 POWRE awardee wrote: "At the risk of stereotyping, I think that women generally struggle more with the daily pull of raising a family or caring for elderly parents, and this obviously puts additional demands on their time. This is true for younger women, who may struggle

Retaining Women *continued from page 11*

over the timing of having and raising children, particularly in light of a ticking tenure clock, but also for more senior women, who may be called upon to help aging parents (their own or in-laws). Invariably they manage, but not without guilt."

Another 2000 award recipient saw as a major challenge "managing dual-career families (particularly dual academic careers). Often women take the lesser position in such a situation. Ph.D. women are often married to Ph.D. men. Most Ph.D. men are not married to Ph.D. women."

Low Numbers and Stereotypes

Referring to gender stereotypes against which women scientists and engineers struggle, a 2000 awardee noted that "the biggest challenge that women face in planning a career in science is not being taken seriously. Often, women have to go farther, work harder, and accomplish more in order to be recognized."

Another 2000 award recipient commented on the effect of there being so few women scientists and engineers on university faculties: "In my field (concrete technology), women are so poorly represented that being female certainly creates more notice for you and your work, particularly when presenting at conferences. This can be beneficial, as recognition of your research by your peers is important for gaining tenure; it can also add to the already large amount of pressure on new faculty."

Resource Differentials

Commenting on issues faced by men and women scientists and engineers in the current environment of tight resources that may pose particular difficulties for women, a 1997 respondent wrote, "I have noticed some problems in particular institutions I have visited (or worked at) where women were scarce. As a single woman, I have sometimes been viewed as 'available,' rather than as a professional co-worker. That can be really, really irritating. I assume that single men working in a location where male workers are scarce can face similar problems. In physics and astronomy, usually the women are more scarce."

A 2000 awardee commented, "I still find the strong perception that women should be doing more teaching and service because of the expectation that women are more nurturing. Although research as a priority for women is given a lot of lip service, I've not seen a lot of support for it."

Discrimination

A 1998 awardee commented that "there are almost no women in my field, no senior women, and open harassment and discrimination are very well

accepted and have never been discouraged in any instance I am aware of."

A 1999 award recipient wrote: "I have often buffered the bad behavior of my colleagues—and over the years I have handled a number of sexual harassment or 'hostile supervision' cases where a more senior person (all of them male) was behaving inappropriately toward a lower-social-status woman (or, in rarer cases, a gay man)."

Policy Considerations

The data from the POWRE awardees indicate that the most pressing, immediate concern that institutions must address to attract and retain more women science faculty is the difficulty women face in balancing work and family. At first blush, problems with balancing a career and a family, or balancing two faculty careers, may appear to result from the choices made by women individually or in conjunction with a spouse or partner. But the high percentage of POWRE awardees who identified problems in this area suggests that addressing the issue at the level of the individual will be inadequate. Institutional responses are needed to resolve these family-centered challenges cited by overwhelming numbers of POWRE awardees from each year covered by the survey.

As the responses from the survey show, the scarcity of women in science and engineering can lead to isolation, lack of mentoring, stereotypes about women's performance, and difficulty gaining credibility among male peers and administrators. Considerable variation among fields makes it hard to address such problems at the institutional level. The numbers of women have increased markedly in some disciplines (psychology, sociology) and begun to approach parity in others (life sciences). But in other disciplines (engineering and computer science), the numbers have remained relatively low.

Small numbers make women visible; visibility draws attention to successful performance, but it also spotlights errors. The variance from field to field in the number of women suggests that institutions may need to establish different priorities and policies for women in different disciplines in science and engineering. For example, a one-size-fits-all policy may not work equally well for women in engineering and their counterparts in biology.

Active recruitment of women into areas that have few female faculty members can have positive and negative consequences. Overt and subtle harassment must be dealt with at the institutional level. Institutions and professional societies need to establish policies against sexual harassment and gender discrimination, including—as S. T. Elliott points out in a 2001 article published in *Women in Higher Education*, "Does Your School Discriminate

Against Pregnant Faculty?"—policies prohibiting discrimination against pregnant faculty in hiring, promotion, and tenure.

Flexibility and acceptance of differences between men and women are crucial to advancing the numbers and careers of women in science and engineering; such tolerance can also serve as the key to new approaches to collaboration and creativity. Institutional policies against sexual harassment and gender discrimination must be implemented and enforced. Senior administrators play critical roles in terms of allocating human, financial, physical, and time rewards for those who enforce such policies.

Recognition of such policy issues is only a first step toward overcoming the institutional barriers that keep women from participating fully in science and technology. These issues should inform the

conferral of ADVANCE awards to institutions. In October 2001 the NSF announced the first eight university recipients: Georgia Institute of Technology, New Mexico State University, and the Universities of California, Irvine; Colorado, Boulder; Michigan; Puerto Rico; Washington; and Wisconsin, Madison.

The respondents to the POWRE survey revealed tremendous love for science and technology and dedication to their research and profession. Most seek to have the barriers to women's advancement removed so that they can be productive researchers who take creative approaches to the physical, natural world. The shift from solutions focusing on individuals to those that concentrate on institutional change should make a difference for women in science, mathematics, engineering, and technology. ❖



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Do Babies Matter?

The Effect of Family Formation on the Lifelong Careers of Academic Men and Women

By Mary Ann Mason and Marc Goulden

When I first became the dean of the graduate division at Berkeley last year, I had an extraordinary experience. Fifty-one percent of the 2,500 new graduate students whom I welcomed were women. Thirty-five years ago that number would have been closer to 10 percent. The graduate students included not only those pursuing doctoral studies, but also those seeking professional degrees in law, public health, social welfare, optometry, and other areas. Berkeley has no medical school, but if it did, women would be close to the majority there as well.



Photo by Peg Skorpiński

Mary Ann Mason



Photo by Peg Skorpiński

Marc Goulden

For women academics, deciding to have a baby is a career decision. Traditional narratives of the academic career must adapt to new demands and new constituencies.

The sharp increase in women's participation in graduate education is a striking national trend. There are significant differences by discipline—engineering, for instance, has produced far fewer women Ph.D.'s than English literature. Overall, women's participation in higher education, and particularly in doctoral and professional programs, has risen dramatically since 1966. The percentage of doctoral recipients who are women has risen from 12 percent to 42 percent, while the percentage of women among recipients of professional degrees has risen even more sharply.

Continued on page 14

Do Babies Matter? continued from page 13

Women law school graduates, for instance, made up only about 5 percent of their classes thirty years ago, but they now make up almost 45 percent.

Does this steady climb in all disciplines and in all professional schools over the last thirty years indicate that women are on a winning streak? Are women finally achieving equality in the academy?

The employment patterns at the University of California, Berkeley, which are representative of those at other major research universities, indicate that while gender equality may be the reality for

graduate students, it is a far different story for ladder-rank faculty, non-ladder-rank academic personnel, and staff. Using a body profile to illustrate employment demographics makes it clear that the experiences of men and women are in dramatic contrast.

The drawing in Figure 1 illustrates a composite profile of all employees. In the drawing on the left, the head, at 1,283, represents the total faculty count on campus, including both tenured and nontenured ladder-

rank faculty. The middle drawing in Figure 1 represents women employees. There are only 281 women faculty on campus, so the head is small. The drawing on the right represents men employees. This large-headed profile indicates that Berkeley has 1,002 male faculty members.

Moving down the body profile to the neck, the drawing on the left indicates that Berkeley employs a total of 386 non-ladder-rank academic personnel. These include lecturers, adjuncts, and an assortment of other academics, most of whom teach. The neck is particularly important since non-ladder-rank faculty is the fastest growing segment in higher education. The women's profile in the middle demonstrates a substantial neck compared with the head, reflecting 256 non-ladder-rank personnel compared to 281 faculty, while on the men's profile at right, the neck is slender compared to the head, reflecting 130 non-ladder-rank academic personnel compared to 1,002 faculty.

In the three drawings in Figure 1, the torso represents the staff. The torso on the profile at left represents Berkeley's total number of staff: 7,000. The shoulder regions represent the highest levels of management, where men prevail. The middle drawing shows us that women are overrepresented among the staff, particularly in the lower, nonmanagerial region. Women, it appears, have a body problem: they're small of faculty head, fairly large in the lecturer neck, and exhibit a substantial staff torso. The drawing at right shows that men, in contrast, have a large faculty head and a very small lecturer

neck. The bottom of their staff torso is slimmer than that of women but they exhibit large shoulders since they are better represented among the directors and professional staff. Men taper down to buildings and grounds jobs at the bottom, while women spread out at the hips with a higher representation of clerical employees and food-service workers.

We should note that the "neck problem" is even more significant at other types of four-year institutions. At a large state university without a research focus, for example, the number of part-time and non-ladder-rank faculty, the neck, would be much larger than the number of ladder-rank faculty, the head. A majority of this segment of the teaching staff, sometimes referred to as the second tier, is composed of women, and the tier is growing. Recently the Coalition on the Academic Workforce announced that more than 50 percent of all undergraduate courses are now taught by non-ladder-rank instructors.

Underrepresentation of Women

Some analysts suggest that women in the professoriate are not as well represented as men because they have only recently gained degrees in large numbers. Time will take care of the problem, they predict, as more young women professors are hired and the older cohort, mainly male, retires.

Data from the National Center for Education Statistics, however, indicate that the gap between the percentage of all men faculty who are tenured and the percentage of all women faculty who are tenured has been fairly consistent over time, even though the relative numbers of women faculty have grown. While the percentage of women among doctorates has grown, the percentage of women among tenured faculty looks very much the same as it did in 1975. A similar phenomenon occurs when examining salary data. The gap between men's and women's

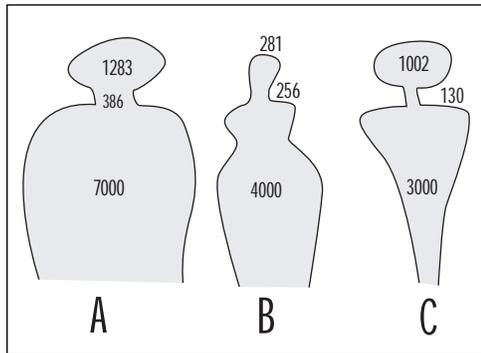


Figure 1 Employment Patterns of the University of California, Berkeley

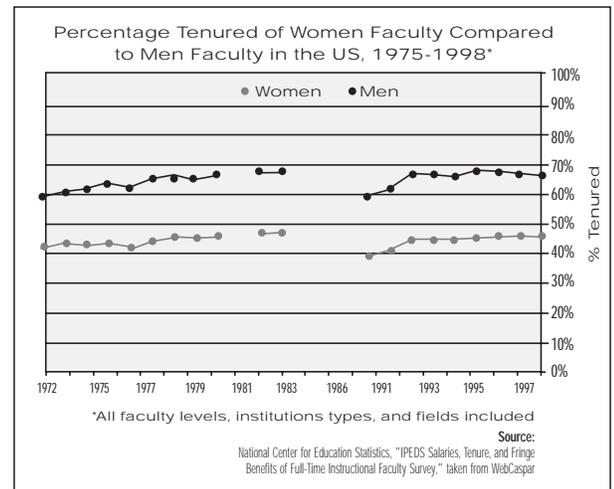


Figure 2



Figure 3

salaries has actually grown wider in the last 30 years.

What accounts for the consistent gaps in tenure and salary? Currently, two leading theories, not necessarily contradictory although sometimes perceived to be, attempt to explain these persistent gaps.

The first theory, classically known as the "glass ceiling" theory, focuses on an alleged inherent pattern of discrimination, which bars women from top positions in academic and other institutions. This theory's proponents analyze the ways in which women are persistently treated differently from birth. For example, they claim that girl babies are smiled at more than boy babies to encourage pleasing behavior; that girls are later discouraged from taking "hard math" classes and steered to more "feminine" pursuits. Reports issued by faculty committees at the Massachusetts Institute of Technology in the past few years have suggested that even the most successful, tenured women scientists at that prestigious university were systematically excluded from important leadership roles and treated differently when spaces and resources were allocated. One commentator described the slights as a "thousand paper cuts," both small and large, that kept women in a subordinate position. In this theoretical framework, family issues are given peripheral attention.

The second school of thought, the "work versus family" school, believes it is the unbending nature of the American workplace, configured around a male career model established in the nineteenth century, that forces women to make choices between work and family. Rather than a thousand paper cuts, it is the sixty-hour work weeks and the required travel that force women with children to leave professions, including academia. Because the academic job market demands that workers relocate for their jobs, women with families face an additional difficulty. According to proponents of this theory, most women

do not get as far as reaching tenure at MIT, but take a different route earlier. In her recent book *The Price of Motherhood*, Ann Crittenden points out that at MIT, only seven of sixteen tenured women professors had children in 2000, suggesting that most women scientists who have children do not make it that far.

There has not been much data to back up these heated debates, because until recently, there has been very little research on career patterns of most women in the academy. While women scientists and engineers at major research universities have gotten a fair amount of attention, women in the humanities, social sciences, and professions, almost half of all Ph.D.'s., have rarely been examined for work-family conflict, nor have women in smaller, non-research-oriented universities. In addition, almost no attention has been paid to the growing number of women in the second tier of non-ladder-rank faculty, the "neck" issue.

Work and Family Conflict

Our research examines family formation and its effects on the career lives of both women and men academics from the time they receive their doctorates until twenty years later. Our data source is the richest available longitudinal employment database on Ph.D. recipients, the Survey of Doctorate Recipients (SDR), an ongoing weighted, biennial longitudinal study sponsored by the National Science Foundation and other government agencies. Using data from 1973 to 1999, we tested the theory that the workplace structure does not accommodate families with children. We looked at academics in the sciences, the social sciences, and the humanities.

Our findings illustrate, not surprisingly, that babies do matter—they matter a great deal. And what also matters is the timing of babies. There is a consistent and large gap in achieving tenure between women who have early babies and men who have early babies, and this gap is surprisingly uniform across the disciplines and across types of institutions. While there are some differences among the sciences, the social sciences, and the humanities, and there are some differences between large research universities and small liberal arts colleges, the "baby gap" is robust and consistent. By our definition, an "early baby" is one who joins the household prior to five years after his or her parent completes the Ph.D. For most academics, this represents the time of early career development: graduate school and assistant professor or postdoctoral years. These are years of high demands and high job insecurity.

In the sciences and engineering, among those working in academia, men who have early babies are strikingly more successful in earning tenure than women who have early babies. As Figure 4 shows, there is an overall 24 percent gap between men's and

Do Babies Matter? continued from page 15

women's rates of having achieved tenure twelve to fourteen years after receiving the Ph.D. This comparative finding focuses on that relatively small group of women who receive Ph.D.'s in the sciences. The gap would be even larger if we simply compared all men in science with all women in science, since men Ph.D.'s greatly outnumber women Ph.D.'s. The same phenomenon exists in the humanities and social sciences, where the gap in tenure achievement between men and women who have early babies is close to 20 percent. Surprisingly, having early babies seems to help men; men who have early babies achieve tenure at slightly higher rates than people who do not have early babies.

The effects of having late babies, those who join the household more than five years after the Ph.D. is

earned, are far less dramatic. Overall, women with late babies and women without children demonstrate about the same rate of achieving tenure, a rate higher than women with early babies. Presumably, women who have babies later in their career life have already achieved job security. They are also more likely to have only one child.

Overall, women who attain tenure across the disciplines are unlikely to have children in the household. Twelve to fourteen years out from the Ph.D., 62 percent of tenured women in the humanities and social sciences and 50 percent of those in the sciences do not have children in the household. By contrast, only 39 percent of tenured men in social sciences and humanities and 30 percent of those in the sciences do not have children in the household 12 to 14 years out from the Ph.D.

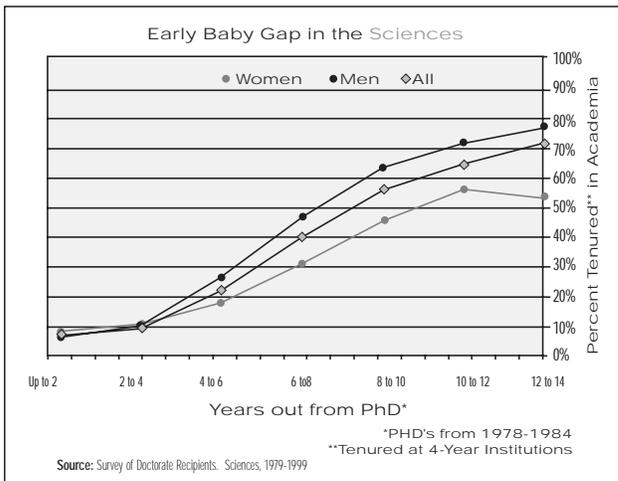


Figure 4

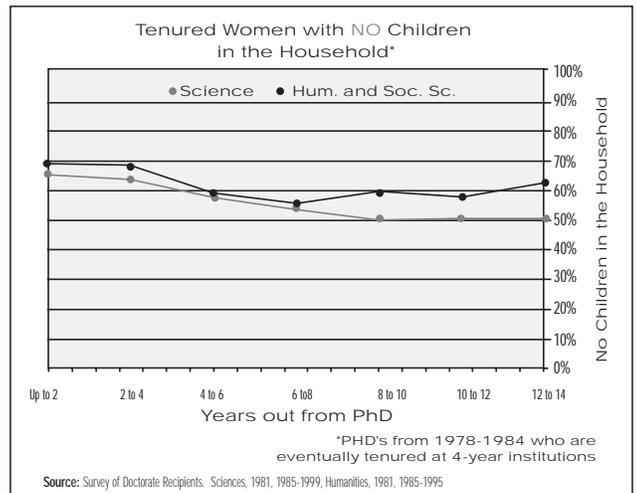


Figure 6

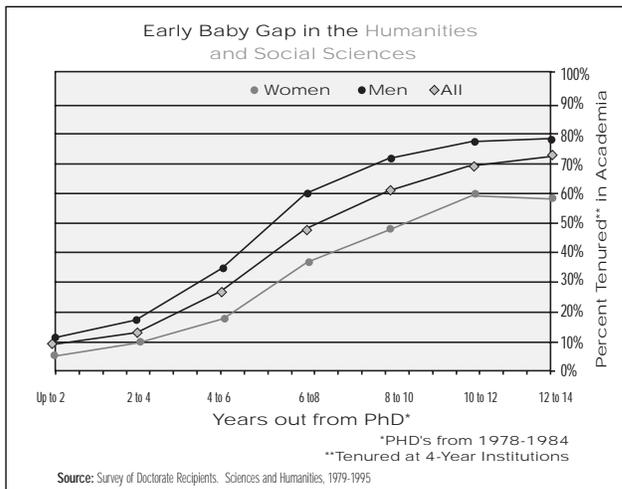


Figure 5

Tenured women in science are twice as likely as tenured men to be single, and more tenured women remain single in the social sciences and humanities, as well. There are many reasons why women are more likely to remain single and less likely to have children, but one may assume that for many it is a realistic career choice based on their observations of who gets tenure.

Neck Issue

Women with early babies often do not get as far as ladder-rank jobs. They make choices that may force them to leave the academy or put them into the second tier of faculty: the lecturers, adjuncts, and part-time faculty. Across the disciplines, women with early babies are more likely than those who have late or no babies to be part of the neck rather than the head.

Women with late or no children are found in this second tier at lower rates than those who experience early family formation. But although they are more

successful than women with early babies, such women still lag behind men. Men across the disciplines are more likely to be tenured faculty, and less likely to part of the second tier. This suggests that babies are not completely responsible for the gender gap, and that there are other factors at work, perhaps including the thousand paper cuts of discrimination.

Decision Making

The SDR data reveal large-scale trends over time. The question then arises, how do people make career decisions, and at what point? To answer this question, we analyzed data from a survey of the attitudes of more than 800 postdoctoral fellows at Berkeley in the year 2000.

Most postdoctorates surveyed were in the biological and physical sciences, with a few in the social sciences. About 35 percent were women; and of these, 32 percent already had at least one child. The majority of those surveyed, both men and women, were married. Within this group, many of whom were in the beginning of their family formation cycle, we found a wide range of responses to issues of family and future career path.

Fifty-nine percent of married women with children indicated they were considering leaving academia. Married women with children were far more likely than others to cite children as one of the reasons they changed their career goals away from academia, and they were the most likely to indicate that balancing career and family was a source of high stress for them. Such women worked significantly fewer hours per week in the laboratory (averaging a little over forty hours per week in comparison to more than fifty hours a week for the other groups) and presented research findings at far fewer national conferences (45 percent of married women with children did not present findings at national conferences in the last year in comparison to only 24 percent of other groups). With these performance indicators you can imagine that their mentors, professors, and others would be less likely to recommend them for research university positions.

Married women without children also expressed more ambivalence than their male counterparts about remaining in academia, often mentioning location as an important factor in their decision making. The dual-career dilemma is more of a problem for women than men, since, as other studies have established, most women academics are married to men with advanced degrees, and most academic men are not married to women with advanced degrees.

Single women without children were also more likely than men to consider leaving academia. There was less of a predictable pattern here, but some such women mentioned social isolation as a negative factor. Bench laboratory science, the chosen specialty of most of these postdocs, can be very isolating—

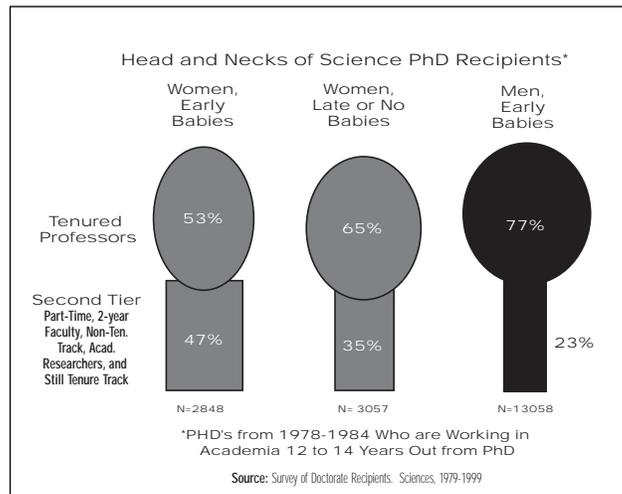


Figure 7

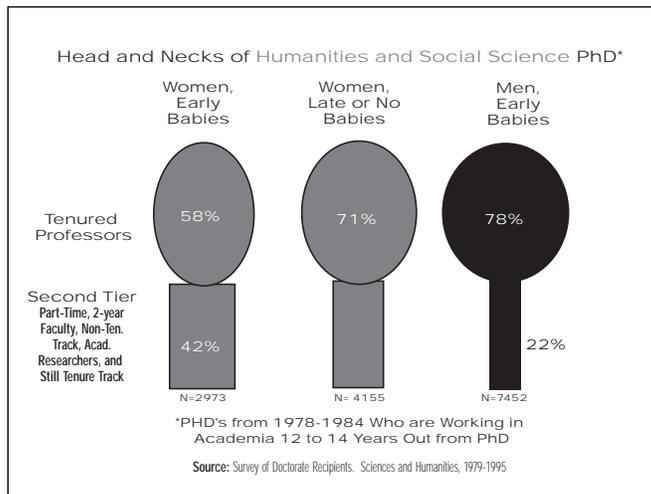


Figure 8

postdocs may meet few people outside of their laboratory. This is the group of women that is most likely to achieve tenure; but its members are also more likely than single men to remain single. All three groups of women expressed concerns about mentoring, and 32 percent of women were dissatisfied with their relationships with their mentors in comparison to 18 percent of men.

Policy Considerations

What do these findings mean for graduate students and for young faculty? Do they show that men can have babies, but women can't? That early babies are the academic kiss of death for women? Do they tell men that it is good for their careers to have children early?

There is a danger that these findings could help to revive the old saw that ruled the academy for most

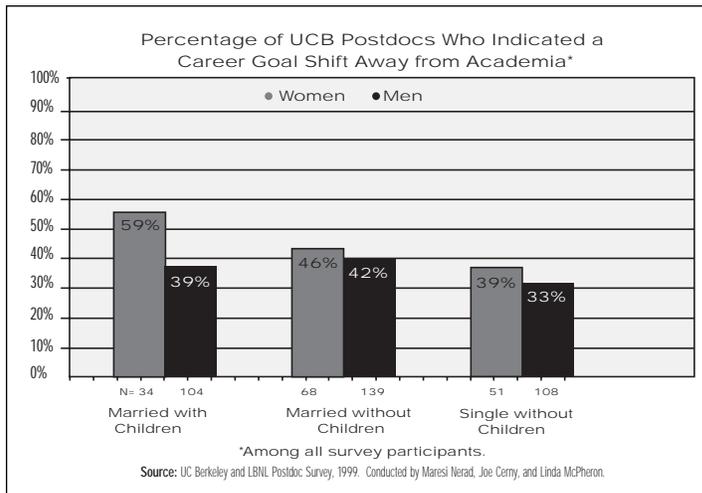
Do Babies Matter? continued from page 17

Figure 9

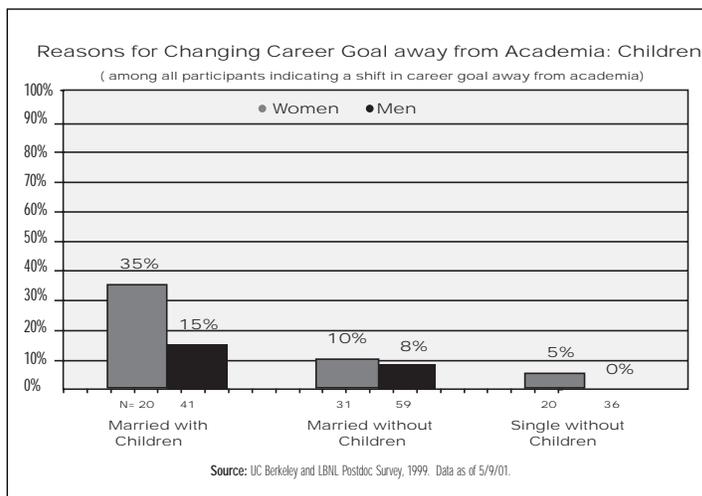


Figure 10

of history: "Don't waste your time on women graduate students—they will only have babies and drop out." Large numbers of academic women are clearly already getting that message—they are not marrying and they are not having children, while men are.

We have done a better job of opening up the competition to women than we have of leveling the playing field. Merely opening up graduate education is not enough to assure equal opportunity in the long run for those women who choose to have children. Policy recommendations must focus on all three levels of the body: the faculty head, the part-time and adjunct neck, and the staff torso. While the recommendations are different for each body part, the common theme is time. Raising children takes time and only an accommodation to that basic fact can ultimately allow women to achieve their career goals.

Recommendations for Head Problems

Recently, the AAUP offered an important policy statement on principles of family responsibilities and academic work, which expresses concern that junior faculty, especially women, sometimes have a hard time in the probationary period before tenure—the years of struggle as an assistant professor, which coincides with the time period in which many women have babies. The statement recommends leave policies, active service with modified duties, stopping the tenure clock for a maximum of two children, and other solutions primarily designed to address the fact that children, particularly babies, are very time consuming.

Our findings suggest additional recommendations for ladder-rank faculty both earlier and later in their careers. A large proportion of women drop away before taking on a tenure-track job. They need to be counseled and supported much earlier, as graduate students, when they are making difficult decisions. Women face difficulties after achieving tenure as well, and they need support in taking full advantage of opportunities presented and in moving into leadership roles. As noted, women with Ph.D.'s are far more likely to marry men with advanced degrees than are men and in the early child-raising years women are far more likely to defer to a spouse's career than are men. Therefore, accommodating two-career couples becomes an important "family friendly" policy.

More radically, we recommend that institutions both provide a part-time track for early child-raising years, with re-entry rights to full-time, and discount "resume gaps," which indicate the candidate has been largely inactive for few years. These recommendations require a very different look at the linear career clock that has persisted, almost unchanged, in the face of a radical demographic gender shift.

Recommendations for Neck Problems

Virtually every four-year institution is supported in part by a cadre of mothers in non-ladder-rank positions. More and more they are teaching the undergraduate classes, and their temporary name cards can be found on office doors throughout the academy. Yet, for the most part, they are treated as if they are invisible, and almost all the debate about family-work conflict has focused on ladder-rank faculty. The second-tier issue is difficult because we would all like it to disappear. In the ideal academic world, all faculty are fully employed, perhaps with a flexible or reduced schedule, fully secure with tenure, and fully benefited. But we also know that those part-time and adjunct faculties are not going to disappear. The economics of the university dictate that the second tier is indispensable to most institutions.

Rather than ignoring the second tier, we should implement policy measures to relieve some of the

problems faced by its members. Part-time and adjunct faculty often choose this track because it provides them with the flexibility and the time that ladder-rank faculty are not offered, and for some, it would be an acceptable career track if the problems of job security, benefits, and participation in the framing of the curriculum, and in the departmental and university community, could be resolved.

Accordingly, we recommend that non-ladder-rank positions consisting of half or more of a full-time teaching load should have full benefits, including family leave benefits. Employment should be secured by long-term contracts after an appropriate period. Non-ladder-rank faculty should be eligible to participate in departmental affairs, and should have their research and publication efforts recognized. Departments should adhere to regularized standards of appointment, review, and retention.

Recommendations for Torso Problems

Efforts at developing a family-friendly university should include staff, the infrastructure upon which institutions function. Staff were not included in the scope of this study, but we do know that staff members are more likely to be female than male. We can also guess by observation that they may be more likely to be mothers than the tenured women. Staff are better protected in many ways than second-tier faculty. Usually they have full pay, benefits, and fairly good protection against arbitrary dismissals. But they lack one very important benefit that faculty and part-time women enjoy: flexibility. During the holidays, most academics will have a month or more when they do not have to be at the university and can

attend to their families. Staff get days, not months, off from work each year. They share the lack of childcare with faculty, but they have no ability to organize their work lives around their children's school schedules. Staff with families, in universities and in all other institutions need more flexibility and more economic support for family matters, paid parental leave for childbirth and family illness, flexible hours, and subsidized childcare.

Finally, it is important to observe that the body problems introduced in this article are not unique to academia. The same small head, thick neck, and large hips would symbolize women's relative representation in most institutions. We know it represents most large law firms and hospitals, but further analysis would probably show that this imbalance exists in the Federal Bureau of Investigation, the Central Intelligence Agency, and the armed forces.

This article focuses on a very large social issue: how to deal fairly with the great majority of working women who are also mothers. The academic world has some particular twists to it: its up-or-out system of tenure and the fact that academics, more than most workers, cannot choose a place to live—they must go where the job is. Yet most of the issues faced by academic workers are not unique to the academic world. The academic world, however, in its role as the purveyor of enlightened ideals, is in a position to provide a new model for the successful balance of work and family. ❖

Note:

The use of NSF data does not imply NSF endorsement of research methods or conclusions contained in the report.

"Notes from a Life," first printed in the June 1999 issue of STATUS, are anonymous vignettes describing quotidian life of a woman in science.

Notes From A Life

Anonymous Contributions from Our Readers

♀ At a post-colloquium dinner this week, a female faculty member at the large research university where we both work commented on something that happens to her pretty much every time she teaches an undergraduate "Intro to Astronomy" class. Early in the quarter some students will invariably show up late to a lecture. Sometimes, in an effort to get her attention they will interrupt with "Oh Miss, Miss!"

It bothered the professor that many students rarely referred to her as "Doctor" or "Professor".

Even though she takes care to write her name and title on the board, this doesn't seem to help.

Those of us at the table sighed grimly about this and realized we still have a ways to go towards equality. This was driven home at the end of the meal when our waiter absent-mindedly put the leather wallet containing the female professor's credit card in front of the male colloquium speaker. We all had to laugh -- the alternative would've been too unpleasant!

♀ I'd be interested to know if my academic female colleagues experience manifestations of a lack of respect. I know that my students assume the male professors know what they are talking about whereas I have always to prove it. Their first assumption is that I don't know what I am talking about. I don't think it is my affect or approach -- it really seems to be a matter of expectations for a science professor.

Send your
"Notes" to
knezek@noao.edu

♀ I recall thinking after the Baltimore Charter came out that at least I would no longer have to worry about unprofessional behavior at national facilities. Yet when I was observing at one of the telescopes supported by our national observatory last year, I caught my telescope operator downloading images of topless women while we were observing. I mentioned the incident to a staff scientist I knew in the hopes that a "reminder" of appropriate behavior would be sent out.

On another occasion I was pointed to a visitor account to copy over some software that was needed for the observing program. I copied over everything in the directory, since I wasn't sure what files I needed. It turned out that a bunch of the files that I had thought were image files giving examples of the results of the software processing were actually images of nude women. In this case, I sent a note to the scientist who had pointed me to the account and suggested that the files should be deleted.

I'm not sure if I acted appropriately in either case. But I certainly found the incidents disturbing, especially in this day and age. ❖

There is also a Women in Astronomy Narratives website open and accepting submissions, see: <http://members.fortunecity.com/jmckay1/index.html>

This site provides female astronomers with an anonymous forum to share their experiences of being a woman in astronomy. Narratives may be anything from anecdotes about particular experiences, to ideas, general thoughts and impressions. Pieces can be submitted using the anonymous form provided on the website.

The first narratives were posted on June 30, 2003. The webpage will be updated on a regular basis after this date. All narratives received will be posted, provided that they do not contain the names of specific individuals or institutions.



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