

Center for American Progress

BerkeleyLaw

UNIVERSITY OF CALIFORNIA

Berkeley Center on Health,
Economic & Family Security



Staying Competitive

Patching America's Leaky Pipeline in the Sciences

Marc Goulden, Ph.D., Karie Frasch, Ph.D., and Mary Ann Mason, J.D., Ph.D.

The University of California, Berkeley Berkeley Center on Health, Economic, & Family Security

and The Center for American Progress

November 2009



Staying Competitive

Patching America's Leaky Pipeline in the Sciences

Marc Goulden, Ph.D., Karie Frasch, Ph.D., and Mary Ann Mason, J.D., Ph.D.

The University of California, Berkeley Berkeley Center on Health, Economic, & Family Security

and The Center for American Progress

November 2009

Contents

Contents

1 Introduction and summary

9 Identifying the problem

- 9 The United States is a global leader in science, but we risk losing our edge
- 10 Demographic shifts in the U.S. academic science workforce
- 12 Leaks in the pipeline to tenure for women Ph.D.s in the sciences
- 13 Rejecting the academic fast track

18 Who or what is to blame for the lack of family responsible benefits for America's researchers?

- 18 The role of research universities
- 23 The role of federal granting agencies

29 The unforgiving lock-step structure of academia

- 29 Grants and contracts in fast-track academic science
- 30 Everybody is very busy
- 32 Academic career timelines are elongating

34 Breaking up the lock-step academic structure

- 34 The role of research universities
- 35 The role of federal agencies

40 A better tomorrow: Joint policy recommendations

43 Conclusion

44 Endnotes

48 Acknowledgments

48 About the authors

Introduction and summary

Premier science largely depends on the quality of the pool of future scientists. For this reason the United States has made a major effort over the past 30 years to attract more outstanding U.S. students, particularly women, into research science.¹ Women have risen to the challenge with significant increases in all physical sciences and engineering, and they have made a huge advance in the life sciences, where they now receive more than 50 percent of all Ph.D.s.²

Women represent a large part of the talent pool for research science, but many data sources indicate that they are more likely than men to “leak” out of the pipeline in the sciences before obtaining a tenured position at a college or university.³ The loss of these women, together with serious increases in European and Asian nations’ capacity for research, means the long-term dependability of a highly trained U.S. workforce and global preeminence in the sciences may be in question.⁴

The Obama administration has made scientific research a major priority, with the 2009 stimulus package, or American Recovery and Reinvestment Act, including billions of dollars to the federal granting agencies, most prominently the National Institutes of Health, the National Science Foundation, and the Department of Energy.⁵ This investment was made to create jobs, to maintain America’s scientific competitiveness in the global market, and to balance a recent decline in real dollars provided by federal granting agencies to support basic and applied research at universities and colleges.⁶ This initiative depends on an innovative, highly trained scientific workforce.

A recent report by the National Research Council of the National Academy of Sciences confirmed that women who receive Ph.D.s in the sciences were less likely than men to seek academic research positions—the path to cutting-edge discovery—and they were more likely to drop out before attaining tenure if they did take on a faculty post.⁷ However, the NRC report stated that their surveys did not shed light on many of the potential reasons why women were more likely to drop out: “The report does not explore the impact of children and family obligations (including elder care) on women’s willingness to pursue faculty positions in R1 institutions or the duration of postdoctoral positions.”⁸

This report, based on extensive original research, addresses this impact and identifies both when and why women and men with caregiving plans or responsibilities drop or opt out of the academic science career path. It provides an extensive examination of the experi-

ences of researchers as well as the role that institutions of higher education and federal granting agencies play in regard to the leaky pipeline in the sciences.

The report is based on data from a number of sources: A national longitudinal survey, the Survey of Doctorate Recipients;⁹ surveys of four academic researcher populations in the University of California system, including doctoral students, postdoctoral scholars, academic researchers, and faculty; a survey of the 62 member institutions of the Association of American Universities, a nonprofit organization of leading public and private research universities in the United States and Canada;¹⁰ and a survey of 10 of the major federal granting agencies.¹¹

Key findings

This report makes an important contribution to understanding how family affects women's ability to make it to the top of the scientific community. First, we examine the role of family formation (marriage and children) on leaks from the academic pipeline to tenure, the experiences of doctoral students and postdoctoral scholars in career path decision making, and the reputation of careers in academic settings. Next, we focus on family responsive benefits, such as paid maternity and parental leave, for researchers at major universities around the country, and the role of the federal granting agencies in regard to these issues. We then examine the structure of academia particularly in relation to time pressures, and finally make clear recommendations on further steps that research universities and federal agencies can take to fully address leaks in the academic pipeline.

Family formation—most importantly marriage and childbirth—accounts for the largest leaks in the pipeline between Ph.D. receipt and the acquisition of tenure for women in the sciences.

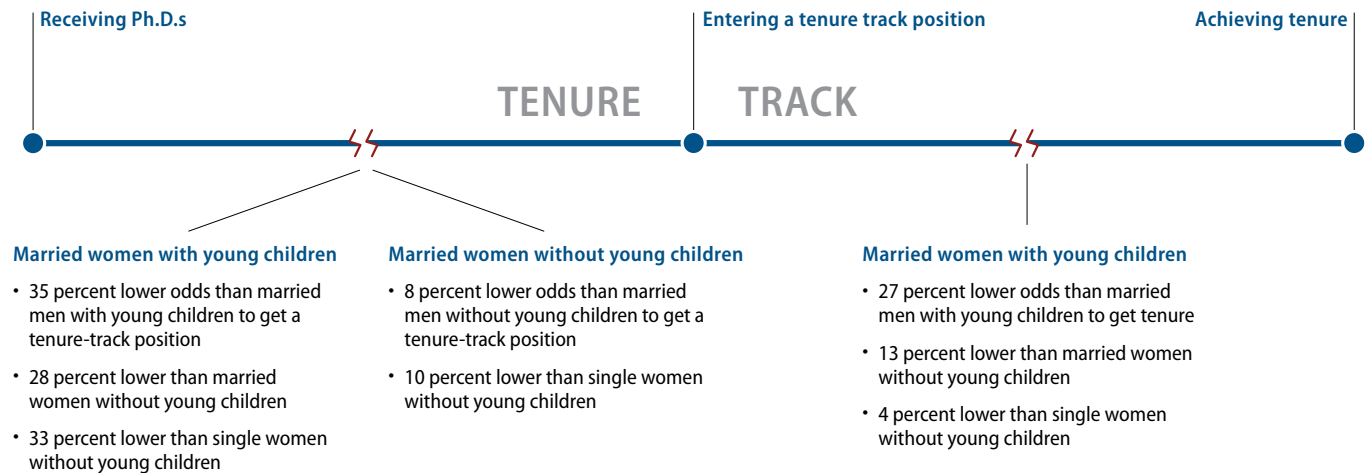
Our findings indicate that women in the sciences who are married with children are 35 percent less likely to enter a tenure track position after receiving a Ph.D. than married men with children (see Figure 1). And they are 27 percent less likely than their male counterparts to achieve tenure upon entering a tenure-track job.¹² By contrast, single women without young children are roughly as successful as married men with children in attaining a tenure-track job, and a little more successful than married women with children in achieving tenure. Married women without children also do not fare quite as well as men.

Scientists often make decisions about their career path while still in training.

In unparalleled surveys of doctoral students and postdoctoral scholars at the University of California,¹³ we found that both men and women report a shifting away from the career goal of research professor, with women's move being more pronounced. Among doctoral

FIGURE 1
Leaks in the pipeline to tenure for women Ph.D.s in the sciences*

Married women with young children are less likely to enter a tenured-track position or become tenured



*Results are based on survival analysis of the Survey of Doctorate Recipients (a national biennial longitudinal data set funded by the National Science Foundation and others, 1981 to 2003) in all sciences, including social sciences. The analysis takes into account discipline, age, ethnicity, PhD calendar year, time-to-PhD degree, and National Research Council academic reputation rankings of PhD program effects. For each event (PhD to TT job procurement, or TT job to tenure), data are limited to a maximum of 16 years. The waterline is an artistic rendering of the statistical effects of family and gender. Note: The use of NSF Data does not imply the endorsement of research methods or conclusions contained in this report. Person-year N for entering tenure track=140,275. Person-year N for achieving tenure=46,883.

students, career-life issues populate four of the top-five most commonly cited reasons why students changed their minds, with women more likely than men to cite these issues as very important, and more than twice as likely as men to cite issues related to children.

In contrast, for postdoctoral scholars career issues populated four of the top-five most commonly cited issues. “Issues related to children” was the only career-life issue in the top five and the only one that the majority of women who shifted their career goal away from research professor cited as very important. Women postdoctoral scholars who had a child while a postdoctoral scholar were twice as likely to change their career goal as men and twice as likely to do so as women with no children and no future plans to have them.

Research-intensive careers in university settings have a bad reputation with both men and women.

The majority of doctoral students and postdoctoral scholars indicated that they were concerned about the family friendliness of possible career paths, but research-intensive universities were considered the least family friendly of a range of possible career choices including tenure-track careers at teaching-intensive institutions, non-tenure track faculty positions, policy and managerial careers inside and outside academia, and research careers

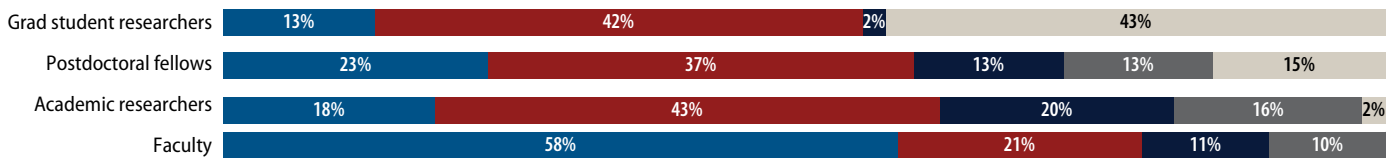
within and outside academia. Only 36 percent of postdoctoral women and 52 percent of postdoctoral men, and 28 percent of doctoral student women and 44 percent of doctoral student men viewed tenure-track careers at research-intensive institutions as family friendly.

America’s researchers receive limited benefits when it comes to family-responsive policies such as paid maternity and parental leave. Young scientists early in the pipeline are the least likely to have these benefits.

Faculty are the only population where a majority of the 62 AAU universities (58 percent)¹⁴ provide a baseline family-responsive maternity leave policy of at least six weeks of guaranteed paid leave following childbirth, *without limitations that prohibit access to it* (see Figure 2). Only a fraction of research universities offer this level of paid maternity leave to graduate students, postdoctoral scholars, and academic researchers, with only 13 percent of universities making this baseline policy available to graduate students (43 percent of them offer only ad hoc paid leave, or no paid leave at all). The level of paid parental leave is even less encouraging—only a tiny number of institutions provide a baseline of at least one week of guaranteed paid parental leave *without limitations* to any of the four populations.

Many universities do provide some maternity and parental leave, but the limitations associated with these policies significantly affect contingent classes of researchers such as graduate students, postdoctoral scholars, and academic researchers. These limitations include requirements that limit the number of individuals who qualify for the policy, limitations on the length of the policy or the percentage of salary paid, and limitations focused on the accrual of sick and/or vacation leave.

FIGURE 2
Provision of paid maternity leave for academic populations at Association of American Universities member institutions
 Faculty are the only population who enjoy paid maternity leave from a majority of AAU institutions



- Entitlement to at least 6 weeks of paid leave.
- Limitations to paid leave (e.g. only for particular groups, partial pay, less than 6 weeks, requirements for previous service time, etc.).
- Paid leave depends on sick and/or vacation leave accruals.
- Delay in availability of sick and/or vacation leave accruals, ie., FMLA.
- Less, ad hoc, or no paid leave available.

Source: Frasch, Karie, Marc Goulden, and Mary Ann Mason. 2008. "University Family Accommodations Policies and Programs for Researchers Survey." (<http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>).

Federal agencies have a shared responsibility with universities in providing adequate family responsive benefits for America’s researchers.

Federal agencies that fund the lion’s share of research at universities across the nation defer to the family responsive policies of the institutions.¹⁵ However, three specific aspects of the role of federal agencies suggest a shared responsibility with universities in these issues: the existence of research fellows under the direct employment of federal agencies and associated institutions;¹⁶ the public commitment of federal agencies to assuring gender equity in the science pipeline; and the role of federal agencies in assuring Title IX compliance by federal grant-contract recipients, including research universities.¹⁷

Some universities may be out of compliance with Title IX requirements.

According to findings from our survey, some universities may not be complying with Title IX, which requires that research universities receiving federal funds 1) treat pregnancy as a temporary disability for purposes of calculating job-related benefits, including any employer-provided leave, and 2) provide unpaid, job-protected leave for “a reasonable period of time” if the institution does not maintain a leave policy for employees.¹⁸

When asked about the provision of unpaid leave to postdoctoral scholar birth mothers, one university respondent indicated that they do not provide it, and six indicated that they did not know whether or not it was provided. All universities and colleges should have in place a clear policy regarding unpaid leave for birth mothers. And Title IX reviews should look at these policies to ensure that universities are in compliance.

The lock-step structure of academia is unforgiving. Parents, but particularly women, experience significant caregiving responsibilities up through age 50, making it hard for them to keep up with academic career pressures.

Federal grants play a critical role in achieving promotion and tenure in academia. However, tenure-track faculty women who are married with young children are 21 percent less likely than tenure-track men who are married with young children to have their work partially or fully supported by federal grants or contracts, and 26 percent less likely than tenure-track women who are married without young children.¹⁹

The time pressures of academia are unrelenting for most faculty in the sciences, who work on average about 50 hours a week up through age 62. When combined with caregiving hours and house work, UC women faculty with children, ages 30 to 50, report a weekly average of over 100 hours of combined activities (—compared to 86 hours for men with children).²⁰ And women faculty with children provide an average of more than 30 hours a week of caregiving up through age 50, while family responsive policies rarely address this long-term career-life issue.

Evidence indicates that the collision course between career timing and family timing may be worsening—the average age for tenure receipt among tenure-track faculty in the sciences was 36 in 1985, and extended out past age 39 by 2003.

Both research universities and federal agencies have taken some initial but uncoordinated steps toward breaking up the lock-step academic structure.

Although much remains to be done, some AAU institutions have put in place family responsive policies, benefits, and resources, including time-based policies and benefits such as stopping the clock (i.e., tenure-clock extension), various child care supports such as on- and off-campus centers, monetary supplements such as tuition remissions, and other resources such as lactation rooms.

Federal agencies have made similar efforts, with some agencies—particularly NIH and NSF—standing above the rest. Some of the efforts include the provision of no-cost extensions for caregiving purposes (typically providing an additional year to complete the project, with no additional funds), grant supplements to support family responsive policies or needs, gender equity workshops, formalized agency policies or statements supporting women in the academic pipeline, allowing part-time effort on fellowships or grants, and extending the fellowship period for caregiving.

However, the lack of coordination between research universities and federal agencies creates inconsistent and inadequate coverage.

Recommendations for federal agencies and universities

Promote clear, well-communicated, baseline family responsive policies for all classes of researchers.

As described at length in this report, America’s researchers do not receive enough family responsive benefits, particularly the more junior researchers. Together, federal agencies and universities can make headway in solving this systemic problem.

Federal agencies, particularly the National Institutes of Health, the National Science Foundation, and the nonprofit organization The American Association for the Advancement of Science, which oversees federally funded research fellows for many of the federal granting agencies, can help by setting equitable, clearly communicated baseline family responsive policies for their fellows. At the same time, universities need to adopt baseline family responsive policies for all of their classes of researchers—not just faculty. Graduate student researchers and postdoctoral scholars receive the most limited benefits and are arguably the most important in affecting the future of U.S. science.

Provide federal agency or university supplements to offset family event productivity loss.

Without providing additional financial supplements in association with family responsive policies, faculty principal investigators, or PIs—those with primary responsibility for the design, execution, and management of a research project—will continue to bear the brunt of supporting family-related absences from their research dollars. This dynamic is unfair to PIs and may create a situation where they will find it to their advantage to avoid hiring researchers who might eventually need family responsive policies. This becomes an unintended form of discrimination against women. To avoid this structural difficulty, supplementary funding needs to be provided when researchers paid off of grants take necessary leaves/modifications.

Collaboratively move toward a full package of family friendly policies that take into account the career-family life course.

All major research universities should look to build a family-friendly package of policies and resources, and federal agencies can provide much more than they already do. Sharing and wide-scale adoption of proven practices are necessary.

Remove time-based criteria for fellowships and productivity assessments that do not acknowledge family events and their impact on career timing.

The lock-step timing of academia needs to be more flexible. Time caps and barriers to entry—such as those that require a postdoctoral scholar position to begin within a certain number of years following receipt of the Ph.D.—that set rigid sequential deadlines should be removed. Universities and federal agencies need to examine all of their policies in this regard and look for ways to encourage reentry into the pipeline for academic researchers who take time off for giving birth or caring for children and promote a more holistic concept of career patterns that honors the larger needs of individuals.

Collect and analyze the necessary data to make sure existing and future policy initiatives are effective in meeting researchers' needs and comply with Title IX.

The lack of necessary data and multiyear commitments to these efforts continues to hamper our delivery of truly effective initiatives. Decisions about family responsive policies, programs, and benefits will continue to be made on intuition and anecdote if they are not tracked by systematic longitudinal data. Both federal agencies and universities need to build and maintain the necessary datasets to assess whether our efforts are yielding posi-

tive results and whether Title IX requirements are being met. Federal agencies can provide more grant programs to help determine whether our efforts are working, and Title IX compliance reviews should include questions on family responsive policies.

Our current inadequate family responsive benefits for America's researchers makes no economic sense. In the world of federal grants individuals who drop out of science after years of training represent a huge economic loss and are a detriment to our nation's future excellence. Given the Obama administration's interest in maintaining America's competitive advantage, future federal investments should be focused on patching the leaky pipeline in the sciences. Doing so will help us preserve our competitive edge.

Identifying the problem

The United States is a global leader in science, but we risk losing our edge

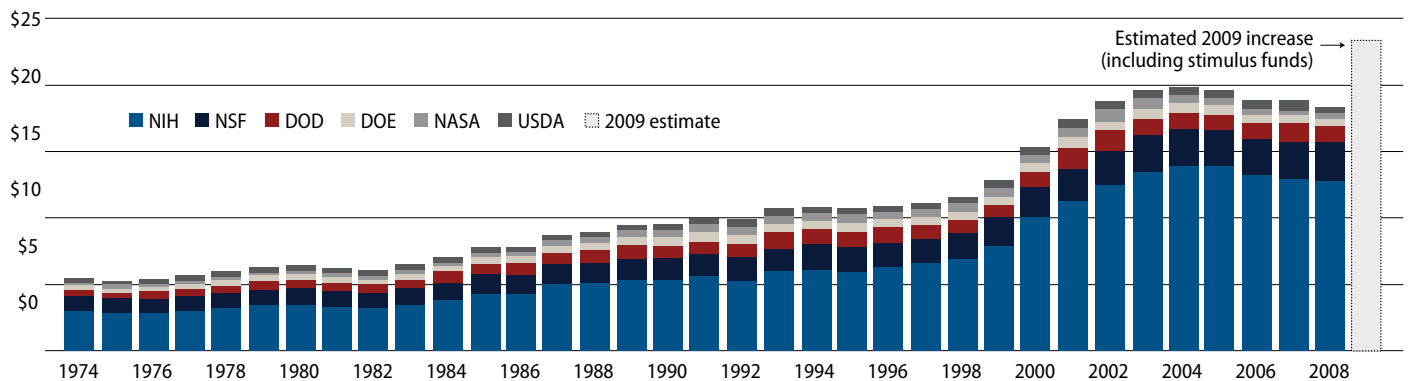
Since the end of World War II, major research universities, federal agencies, and private industry have built a scientific infrastructure across the United States of unprecedented nature. Working together, we have established ourselves as the premier science nation, the master of innovation in areas such as information technology and processing, nanotechnology, biotechnology, genetics, semiconductor electronics, weapons technology, and engineering, and the standard by which other nations measure themselves. Our stellar programs in the sciences attract graduate students and postdoctoral scholars from around the globe, and our commitment to funding both basic and applied science has served as a model to aspiring nations.²¹

After a recent decline in real dollars provided by federal granting agencies to support basic and applied research at universities and colleges (see Figure 3), the new administration—through the American Recovery and Reinvestment Act—has made clear its commitment to maintaining and furthering our scientific preeminence and the primacy of a new

FIGURE 3
Basic and applied research funds awarded by U.S. federal agencies to universities and colleges from 1974 to 2009 (est.)*

After a recent decline in real dollars the new administration plans to boost funding with the American Recovery and Reinvestment Act

2000 constant dollars**



* Based on AAAS analysis of total R&D funds and 2% GDP inflation. ** Fiscal year GDP Implicit Price Deflators (2000 year base), as of 3/08. Source: NSF Survey of Federal Funds for Research and Development, 1974-2008. Retrieved from Webcaspar, 4/20/2009; AAAS, AAAS R&D Funding Update on the 2009 Omnibus Bill. Retrieved from <http://www.aaas.org/spp/rd/omnibus09.htm>, 7/20/2009.

economy powered by cutting-edge technologies that spring from the interstices of biological, physical, and social sciences.²² The age of biology, genomic sequencing, nanotechnology, clean-energy technologies, and health information technology is truly at hand, and the Obama administration has made clear that they will use all necessary tools to further catalyze these developments.

Although recent debate is divided on whether we are maintaining our global preeminence in the sciences,²³ certain patterns are generally accepted. Nations such as South Korea and China are experiencing relatively faster growth than the United States, and the European Union as a whole has achieved a magnitude similar to if not greater than our own.²⁴ Other nations are also investing heavily in higher education, including providing incentives for students to obtain science and engineering degrees.²⁵

Perhaps more troubling, multiple sources of evidence suggest that younger generations of Americans begin their educational careers with interest in science but all too often sour on the enterprise, opting out along the way in pursuit of more attractive endeavors. This trend appears particularly acute among girls and women and among underrepresented minorities.²⁶

This general pattern of domestic attrition in the sciences has received greater attention in recent years, but the periodic sounds of alarm seem to have been subdued because our labor supply of talented scientists has been back-filled with large numbers of newly minted international Ph.D.s and postdoctoral fellows.²⁷ This so-called “brain drain” from other countries that has so greatly benefited the United States appears to have suppressed our concern about the loss of some of our domestic populations from the science pipeline.

Increasingly, however, as high-tech regions have become established in other nations—India, Ireland, China, and South Korea, to name a few of the best known examples—and research universities around the world are seemingly closing the gap in regard to institutional excellence, the long-term dependability of this supply of highly trained readily available international work force is in question.

Demographic shifts in the U.S. academic science workforce

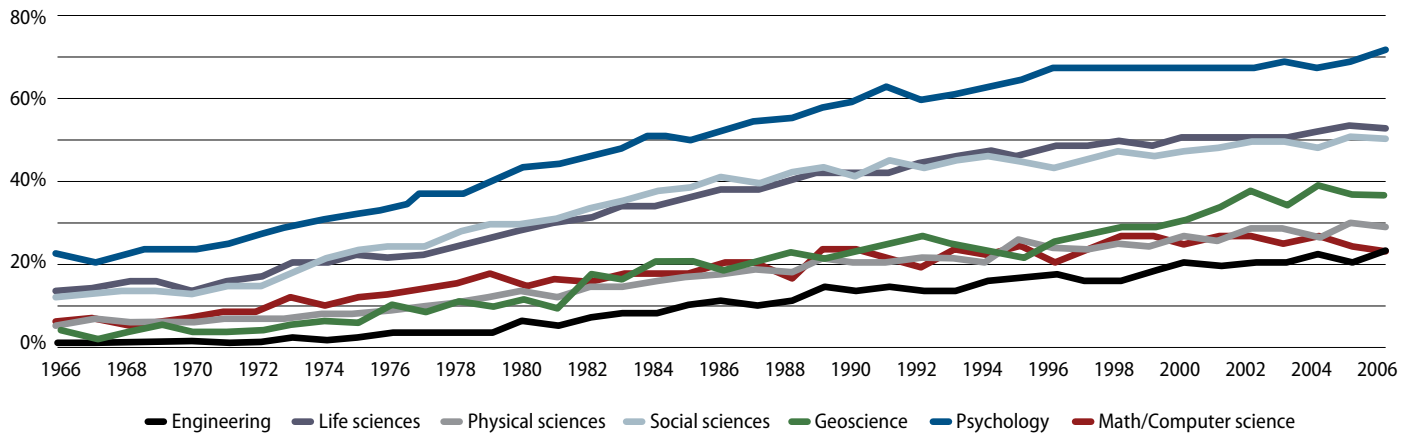
Our domestic supply of highly trained scientific researchers and scholars has undergone a tectonic shift in the last 40 years. Women, who once comprised a tiny fraction of our domestic Ph.D.s in the sciences, are becoming the majority population in large segments of the sciences: psychology, the social sciences, and perhaps most importantly, the large and rapidly expanding life sciences—the cornerstone of the new age of biology (see Figure 4).

The division between the more human-centric and non-human-centric sciences and its associated gender split remains, with women predisposed toward pursuits that tie more

FIGURE 4

Women as a percent of science doctoral recipients in the United States (U.S. citizens only)

Women are becoming the majority recipients of Ph.D.s in several areas of science



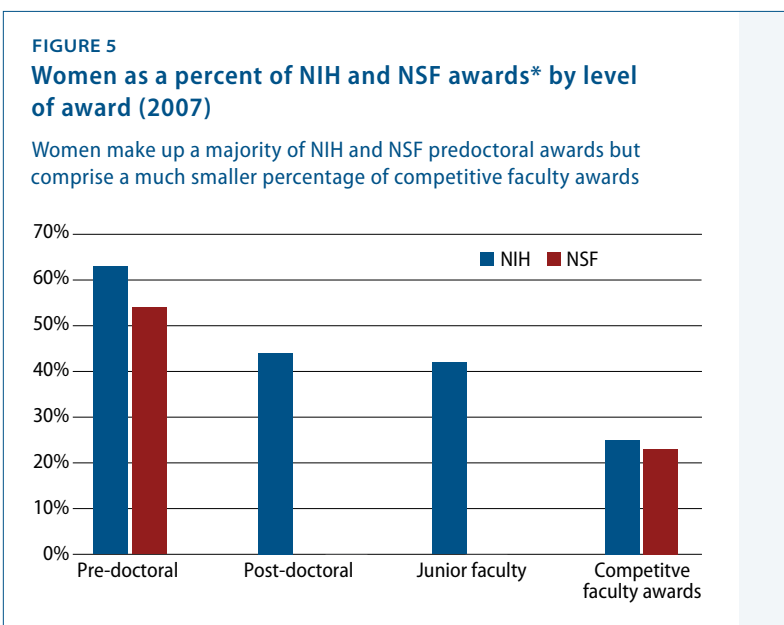
Source: National Science Foundation (NSF), Survey of Earned Doctorates, retrieved from WebCaspar, 4/15/2009.

directly to human experience,²⁸ but even these lines are blurring. Women have made impressive gains in the least tractable of the sciences, breaking through into the once homogenous fields of physical sciences, technology, engineering, and mathematics. Over the last four decades, the relative proportion of women Ph.D. recipients has increased more than 100-fold in engineering (from a scant .2 percent in 1966 to 22.5 percent in 2006), 12-fold in the geosciences (3 percent to 36.6 percent), and 8-fold in the physical sciences (3.7 percent to 27.9 percent). Since these general trends appear unabated (see Figure 4) and women are outperforming men at the baccalaureate and master’s level of education in the United States,²⁹ it seems reasonable to conclude that further gains are all but inevitable.

Despite this fundamental shift in the demographic rules of the game, academic institutions as a whole have been slow to understand some of the implications of a labor supply that is increasingly comprised of women. For example, the “leaky pipeline” for women in the sciences, sometimes referred to as the “pool problem” because of the low number of women in job applicant pools relative to their rates of doctoral degrees granted, has become a point of considerable debate in recent years. Discussions about the reasons for the leaks range from “chilly” institutional and departmental climates to gender bias and discrimination to innate differences in cognition to lack of mentoring to the role of marriage and children.³⁰ This debate was perhaps best brought to national attention in the aftermath of comments by former President of Harvard University Lawrence Summers in 2005, when he referenced theories that women might have less intrinsic aptitude to excel at academic science careers.³¹

In fact, research universities across the country and federal granting agencies are routinely confronted with evidence of a leaky or constricting pipeline for women in the sciences. For example, a recent report by the National Research Council of the National Academies, “Gender Differences at Critical Transitions in the Careers of Science, Engineering and Mathematics Faculty,” discusses in detail the underrepresentation of women in many of the scientific disciplines at academic institutions across the country, particularly in the higher faculty ranks.³²

Data from both NIH and NSF, the two agencies providing the greatest amount of funds to researchers in U.S. universities and colleges (see Figure 5), also suggest that the leaky pipeline is not an aspect of the past. As seen in Figure 5 women comprise a much larger proportion of the predoctoral fellowships given by these agencies than they do postdoctoral fellowships and competitive faculty grants. The drop-off in relative proportion is dramatic, with women comprising 63 percent and 54 percent of NIH and NSF’s predoctoral awards in 2007, respectively, but just 25 percent and 23 percent of the competitive faculty grants awarded in the same year.³³ The recent demographic surge in proportion of women Ph.D.s may account for some but not all of this dramatic drop.



Source: NIH and NSF Accountability Reports, 2008.

* The postdoctoral award information for NSF is missing significant data (39% of awards were to women, 47% to men, and 14% of the sample was unknown in 2007). We chose not to include the data point because it is not comparable to the others. Source: Fae Korsmo, Senior Advisor, Office of the Director, NSF.

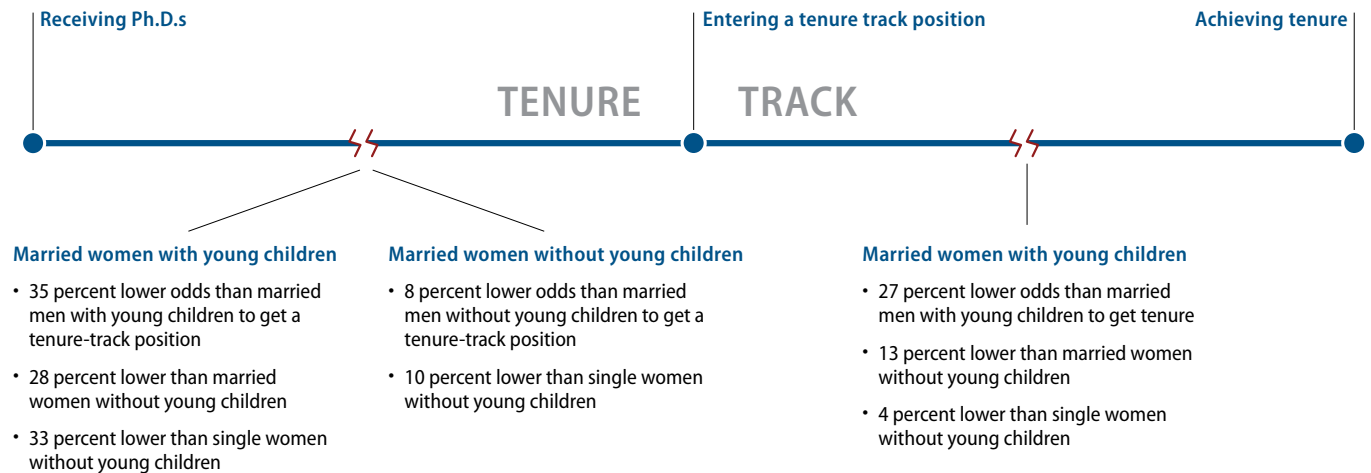
Leaks in the pipeline to tenure for women Ph.D.s in the sciences

The best way to assess what is truly going on in terms of the leaky pipeline for women in the sciences is to conduct careful longitudinal analysis that follows the same individuals over time, from Ph.D. receipt onward. The Survey of Doctorate Recipients, or SDR, sponsored by NSF and other federal agencies, makes this analysis possible.³⁴ The SDR, a longitudinal, biennial, nationally representative survey of Ph.D. recipients’ post -degree employment status with almost 170,000 participants from 1973-2003, has included family related questions since 1981 and is therefore the ideal data source to measure the effects of gender and family on men and women’s academic career progress.³⁵

We have modeled the effects of gender and family on the likelihood of individuals leaking out of the pipeline in the sciences, including the physical sciences, biological sciences, and social sciences, from: (1) Ph.D. receipt to entering a tenure-track position and (2) entering a tenure-track position to the achievement of tenure (see Figure 6).³⁶ These analyses control for disciplinary fields within the sciences, age, ethnicity, Ph.D. calendar year, time to Ph.D. degree, and National Research Council Ph.D. degree program reputation ranking.

FIGURE 6
Leaks in the pipeline to tenure for women Ph.D.s in the sciences*

Married women with young children are less likely to enter a tenured-track position or become tenured



*Results are based on survival analysis of the Survey of Doctorate Recipients (a national biennial longitudinal data set funded by the National Science Foundation and others, 1981 to 2003) in all sciences, including social sciences. The analysis takes into account discipline, age, ethnicity, PhD calendar year, time-to-PhD degree, and National Research Council academic reputation rankings of PhD program effects. For each event (PhD to TT job procurement, or TT job to tenure), data are limited to a maximum of 16 years. The waterline is an artistic rendering of the statistical effects of family and gender. Note: The use of NSF Data does not imply the endorsement of research methods or conclusions contained in this report. Person-year N for entering tenure track=140,275. Person-year N for achieving tenure=46,883.

Our findings show that family formation—most importantly marriage and childbirth—account for the largest leaks in the pipeline between Ph.D. receipt and the acquisition of tenure for women in the sciences. Specifically, women who are married with children in the sciences are 35 percent less likely to enter a tenure track position after receipt of their Ph.D. than married men with children, and they are 27 percent less likely than their male counterparts to achieve tenure upon entering a tenure-track job.

These findings illustrate that family formation, particularly marriage and childbirth, is the most important reason why women with Ph.D.s in the sciences do not begin academic careers with tenure-track jobs. And the findings further indicate that marriage and children, but not marriage alone, keep women from getting tenure.³⁷

Rejecting the academic fast track

In the last four years we have undertaken an ambitious research plan supported by the Alfred P. Sloan Foundation to examine four academic populations in the University of California system, including doctoral students, postdoctoral scholars, academic researchers (nonfaculty employees who are paid off grants or contracts to conduct research frequently under the direction of a faculty PI), and faculty, as well as major U.S. research

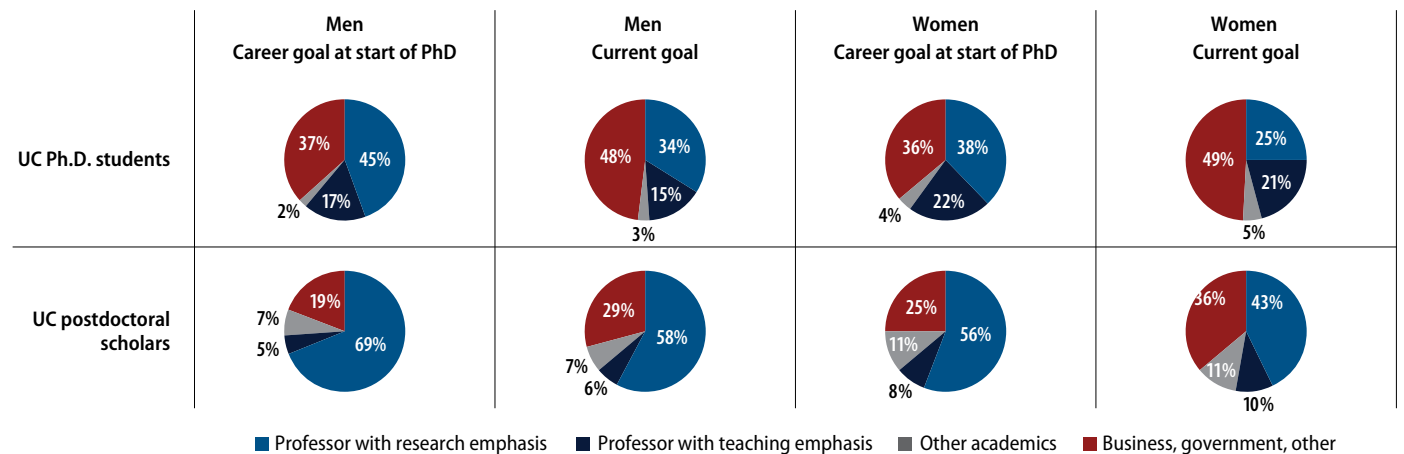
universities (members of the Association of American Universities, or AAU, a nonprofit organization of 62 leading public and private research universities in the United States and Canada)³⁸ and 10 of the major federal granting agencies.³⁹

Our doctoral student and postdoctoral scholar surveys provide unparalleled data on their experiences at the University of California system.⁴⁰ We have found that the problems in the science pipeline are not restricted to the post-Ph.D. pursuit of tenure—they start early and are persistent along the way. In particular, career-life issues in regard to future career goals are of pressing concern to many aspiring academics, particularly women in the sciences.

Our data from both the UC doctoral student survey and the postdoctoral scholar survey indicate that both populations in aggregate report a shifting away from the career goal of professor with research emphasis,⁴¹ with women’s move being more pronounced (see Figure 7).⁴² Professors with a research emphasis are arguably key players in our national science infrastructure, both from the knowledge building and discovery perspective and in training our future scientific labor force. Although private industry plays a significant role, particularly in development, scientists at academic institutions often receive funding to push forward basic research in areas that industry is less likely to pursue because of technical or financial risk.⁴³

In both surveys we asked individuals who had shifted their career goal away from professor with research emphasis what factors were important in their decision-making process.

FIGURE 7
University of California Ph.D. students and postdoctoral scholars in the sciences change career goals
 Men and women both show a shift away from the goal of professor with research emphasis but women’s move is more pronounced



Source: Mason, Mary Ann and Marc Goulden. 2006. "UC Doctoral Student Career Life Survey." (<http://ucfamilyedge.berkeley.edu/grad%20life%20survey.html>). Goulden, Marc, Karie Frasch, and Mary Ann Mason. 2008. "UC Postdoctoral Scholar Career and Life Survey." (<http://ucfamilyedge.berkeley.edu/UC%20Postdoctoral%20Survey.html>).

Among doctoral students in the sciences negative experiences as a Ph.D. student was most commonly cited as very important in their decision. After this item, however, career-life issues populated the remaining top-five most commonly cited factors, including other life interests, professional activities were too time consuming, issues related to children, and geographical location issues (frequently considered a career-life issue because of proximity to family and impact on various quality-of-life issues, such as housing and schools).

In all cases, women doctoral students were statistically more likely than men to cite these career-life issues as very important in their decision-making process. In the most dramatic example they were more than twice as likely as men to cite issues related to children (44 percent versus 20 percent) as very important in their decision to shift their career goal away from professor with research emphasis.

The factors that men and women postdoctoral scholars cited for shifting their career goal away from professor with research emphasis show both similar patterns and notable differences to those of doctoral students. In aggregate, career issues related to advancement, job market, security, and money populate four out of the top five most commonly cited issues as very important (unlike doctoral students), but there are major gender divisions among postdoctoral scholars. Issues related to children was the only career-life issue in the top five that both men and women cited, but for women it was the most important reason for shifting their career goal away from professor with research emphasis.

Several other gender differences among postdoctoral scholars are important to note. Men were statistically more likely than women to cite career advancement issues and monetary compensation, and women were more likely to cite family issues—a classic bifurcation between male-provider and female-caregiver motivations. Every analysis we have conducted in the last 10 years suggests that this gendered-familial pattern remains a powerful force in motivating career-life decisions among academics.

A second gender split is also of interest. Women were more likely than men to cite feelings of isolation or alienation as a postdoctoral scholar and lack of encouragement and/or lack of a mentor as very important in their decision to shift their career goal away from professor with research emphasis. The proportion of women who cited these issues as very important suggests that arguments related to chilly climate or lack of mentoring for postdoctoral women have merit.

Family status

Broken down by family status, the issue of children is even more dramatic in influencing postdoctoral women's decisions to abandon professorial career goals with research emphasis—but not so for men. Among postdoctoral scholars with no children and no future plans to have them, women and men are essentially equally likely to indicate that they

shifted their career goal away from professor with research emphasis, with roughly one in five doing so (see Figure 8).

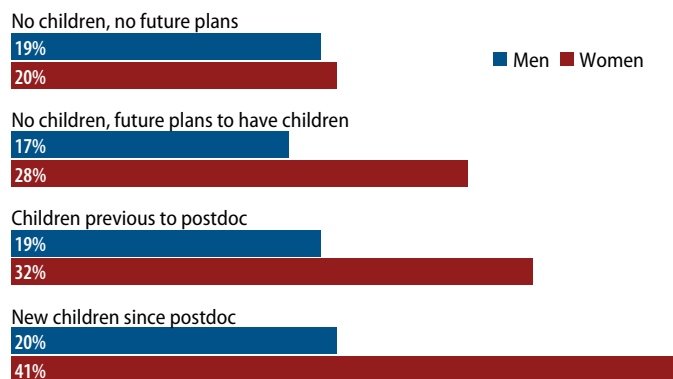
Future plans to have children, however, affect women and men postdoctoral scholars differently, with women more likely to shift their career goal (28 percent of women versus 17 percent of men). Having children prior to entering a postdoctoral position at the UC system and having a new child since entering the position appears to ratchet up the pressure further on women to drop their professor with research emphasis career goal, but not so for men. Women postdoctoral scholars who had children after they became a postdoctoral scholar at the UC system were twice as likely as men who experienced a similar life-changing event to change their career goal (41 percent versus 20 percent), and twice as likely to do so as women with no children and no future plans to have children (41 percent versus 20 percent).

Similarly, women doctoral students who became new mothers and were paid off of federal grants at the time of the birth-adoption event displayed an intensified flight response away from professor with research emphasis. In the case of this small population (only 45 women in the UC system survey population), the reported career shift was particularly marked, with 46 percent of these women indicating that they wanted to pursue a career goal of professor with research emphasis at the beginning of their doctoral studies but just a mere 11 percent still reporting this goal at the time of the survey. Men, too, showed a large decline in relative proportion (from 59 percent to 45 percent professor with research emphasis career goal from start to time of survey) but it paled in comparison to the relative decline among women.

We asked the women in this group to explain in their own words why they had changed their career goal. Thirteen out of the 16 new mothers chose to explain what had led to their career shift. Overwhelmingly these individuals cited family-life issues in their decision to alter their career goals. For example, one woman wrote, “I think it might be easier to balance work and family in a faculty position where the emphasis is on teaching.”⁴⁴ And another said, “I feel that for me, research demands too much time away from my family. Also, as a woman, I don’t feel as if the current academic environments are any more supportive of women with families.”⁴⁵

FIGURE 8
Percent of University of California postdoctoral scholars who shifted away from professor with research emphasis as a career goal, broken down by gender and family status/future plans

The issue of children is a dramatic influence on women’s decisions to abandon professorial career goals with a research emphasis



Source: Goulden, Marc, Karie Frasch, and Mary Ann Mason. 2008. “UC Postdoctoral Scholar Career and Life Survey.” (<http://ucfamilyedge.berkeley.edu/UC%20Postdoctoral%20Survey.html>).

A bad reputation

Among UC postdoctoral scholars and doctoral students in the sciences, research-intensive careers in university settings have a bad reputation. These careers are viewed as the least family friendly of a range of possible career choices (including tenure-track careers at teaching-intensive institutions, non-tenure-track faculty positions, policy and managerial careers inside and outside academia, and research careers within and outside academia). Specifically, only 36 percent of postdoctoral women and 52 percent of postdoctoral men view tenure-track careers at research-intensive institutions as family friendly, compared to the majority who consider policy or managerial careers outside of academia to be family friendly (77 percent of postdoctoral women and 73 percent of postdoctoral men). Doctoral students in the sciences also cast a skeptical eye toward tenure-track careers at research-intensive universities, with just 28 percent of the women viewing these careers as family friendly and 44 percent of the men. In contrast about three-fourths of women doctoral students and men doctoral students in the sciences view research careers and policy or managerial careers outside academia as family friendly.

Since most postdoctoral scholars (89 percent of women and 83 percent of men) and doctoral students in the sciences (86 percent of women and 76 percent of men) indicate that they are very or somewhat concerned with the family friendliness of possible career paths, these findings on the perception of the family friendliness of career types bode ill for fast-track academic careers. Unless a concerted effort is undertaken by research universities and federal agencies to remedy the current situation, women with familial concerns are likely to disproportionately leak out of the science pipeline to the detriment of our future global competitiveness.

Who or what is to blame for the lack of family responsible benefits for America’s researchers?

As the data above show, women are leaking out of the science pipeline in the United States at a disproportionate rate. We anticipate that this will increasingly affect our labor supply of talented scientists because of rapid rates of feminization of higher education and escalating global competitiveness of European and Asian nations. For many women and some men in the United States, issues related to family and in particular children are either cited as major reasons for turning away from fast-track academic careers in the sciences or are directly associated with lower rates of career retention and success.

Our in-depth analysis of these trends, and surveys of the 62 member institutions of the AAU and 10 of the major federal granting agencies,⁴⁶ indicates that a significant contributor to these issues is the low level of family responsive benefits offered to America’s researchers. This lack of benefits is particularly seen in family responsive policies such as paid maternity and parental leave, and individuals earlier in the pipeline are the least likely to have benefits (family responsive policies also include benefits such as modified duties, stopping the tenure clock, flex time, and part-time, among others). A lack of coordination between research universities and federal agencies in providing America’s researchers with family responsive policies appears to be a major part of the problem.

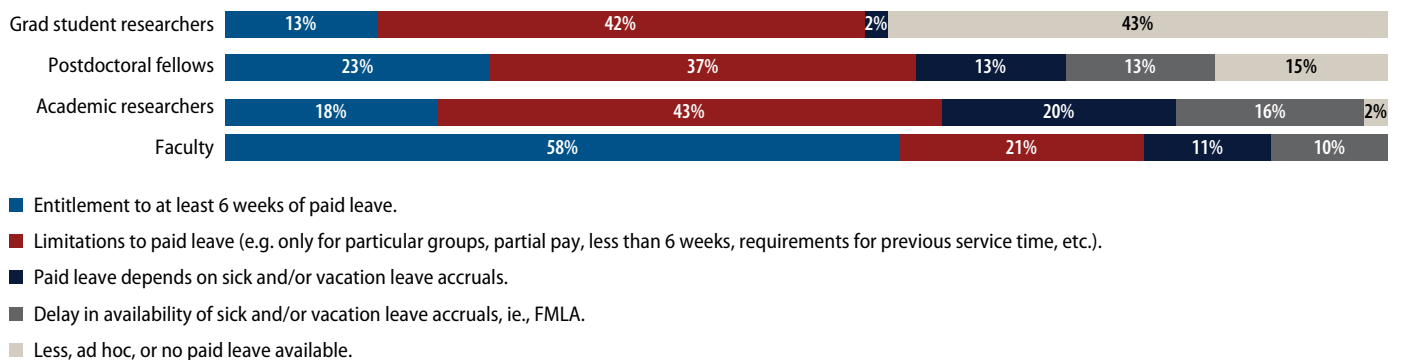
Federal agencies that fund the lion’s share of research activities at universities across the nation defer to the local personnel policies of institutions for fringe benefits, including family responsive policies, based on OMB Circular A-21, Cost Principles for Educational Institutions.⁴⁷ Although this approach has the clear advantage of protecting the autonomy of local institutions—a hard-fought and protected principle among universities and colleges—the lack of guidance and oversight has resulted in porous benefits for America’s researchers that unintentionally reinforces the sense or current reality that fast-track academic careers, particularly in the sciences, are not family friendly.

The role of research universities

Based on our survey of AAU institutions the level of family responsive benefits received by America’s researchers—specifically paid maternity and parental leave at the time of birth or adoption in the case of new parents—is erratic at best.⁴⁸ As seen in the blue bar in Figure 9, faculty are the only population of researchers where a majority of the AAU uni-

versities (58 percent) provide what can be considered a baseline family responsive maternity leave policy: at least six weeks of guaranteed paid leave following childbirth, *without limitations that prohibit access to it*. Six weeks is typically considered to be a minimum normal period of recovery from childbirth (for cesarean sections the length is at least eight weeks).⁴⁹ Less than one-quarter of the research universities offer this standard to graduate student researchers, postdoctoral scholars, and academic researchers (a mere 13 percent of universities offer this baseline policy to graduate students, 23 percent to postdoctoral scholars, and 18 percent to academic researchers).

FIGURE 9
Provision of paid maternity leave for academic populations at Association of American Universities member institutions
 Faculty are the only population who enjoy paid maternity leave from a majority of AAU institutions



Source: Frasch, Karie, Marc Goulden, and Mary Ann Mason. 2008. "University Family Accommodations Policies and Programs for Researchers Survey" (<http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>).

The number of institutions who offer paid parental leave benefits is even less encouraging (see Figure 10). As defined by at least one week of guaranteed paid parental leave without limitations, a tiny fraction of AAU institutions offer researchers baseline family responsive parental leave. A paltry 3 percent of institutions offer paid leave to graduate student researchers and a lackluster 16 percent offer it to faculty.

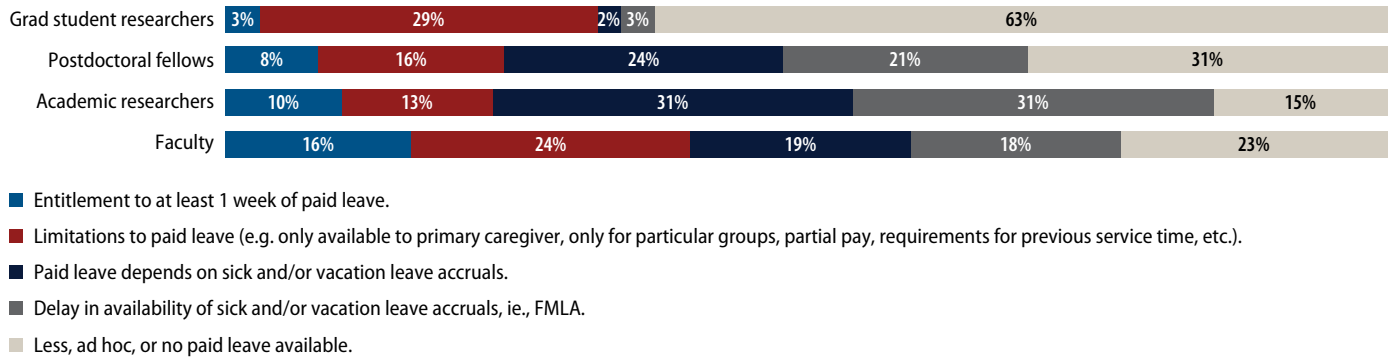
Many universities do provide some level of benefit for paid maternity and parental leave (refer to the red, black, and brown bars in Figures 9 and 10), but the limitations associated with these policies are critical and they affect classes of researchers differently.

Specifically, graduate student researchers and postdoctoral scholars are by definition contingent, or nonpermanent, employees and are normally viewed as trainees, not employees. Although graduate students increasingly focus on their research work near the end of their degree program—and consequently decrease their involvement with their general degree program—postdoctoral scholars are nearly always expected to work full-time. Both groups are assumed to be on limited contract, and postdoctoral scholars are frequently

FIGURE 10

Provision of paid parental leave for academic populations at Association of American Universities member institutions

A very small number of institutions offer at least one week of guaranteed paid parental leave without limitations to researchers



Source: Frasch, Karie, Marc Goulden, and Mary Ann Mason. 2008. "University Family Accommodations Policies and Programs for Researchers Survey" (<http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>).

prohibited from staying in the position for more than a certain time period to encourage career progression and prevent exploitation (for example, the University of California caps the total time in these positions at five years).

The expectation is that these positions typically provide individuals with hands-on research experience that provides the minimum income necessary to continue their academic training. Consequently, the need for baseline family responsive policies are often overlooked because of both the blurring of trainee-employee distinctions and no doubt the fact that when these positions evolved they were overwhelmingly populated by men who were expected not to need them.

In contrast, academic researchers are generally acknowledged to be employees. Their clearly defined status as employees seems to on the whole increase the likelihood that they receive family responsive benefits, frequently similar to those of other staff working at the university. In contrast to tenured faculty, however, they are typically contingent employees, with their future employment status dependent on the availability of future funding. In this sense they might be viewed as similar to lecturers, with their contingent status revolving around research projects rather than teaching activities.

Thus, because of their nonpermanent status all three of the nonfaculty populations can be strongly affected by limitations in family responsive policies.

The limitations to paid maternity and parental leave generally fall into three main categories: (1) particular requirements that limit the number of individuals who qualify for the policy; (2) limitations on the length of the policy or percentage of paid coverage; and (3) policies based on the accrual of sick and/or vacation leave.

Requirements that limit the number of individuals who qualify

Many institutions have a paid maternity or parental leave policy that meets the baseline length of leave (six weeks for maternity and one week for parental), but limits the number of eligible individuals. For example, at some institutions the maternity leave policy only applies to women who are part of a particular division or department in the university (for example, the Division of Arts and Sciences or the Department of Engineering). Other institutions limit the policy to doctoral student researchers as opposed to all graduate student researchers. Most commonly, institutions require individuals to have a certain length of service with the university in order to be eligible—this ranges from one semester to six or nine months to three of the last four quarters to up to two or four years of service. For contingent employees in relatively short-term positions, this limitation can have the effect of making people feel that the window of opportunity for childbearing is too narrow. Finally, some institutions with a paid leave policy require that the person taking the leave be the primary caregiver to the newborn or newly placed child (as opposed to the leave being available any time in the first 12 months after the event). While it makes sense to validate that individuals are devoting the majority of their time to caregiving while on leave, if the leave can only be taken at the time of the birth event it effectively limits most men from using the policy.

Limitations on the length of the policy or percentage of paid coverage

Many institutions provide an entitled policy—meaning that if the stated requirements are met the leave is guaranteed—but it falls short of meeting the baseline (for example, entitling women to only two weeks of paid leave or providing six weeks in total but requiring individuals to use up all of their own sick leave prior to qualifying for a lesser number of weeks). Other institutions use a disability insurance company (or rely on state-funded short-term disability insurance, such as in California, New York, or New Jersey)⁵⁰ to provide paid maternity leave to women.

These policies typically require a waiting period where women must use accrued sick or vacation leave to receive pay (such as 14 days), and then only cover a certain percentage of salary (for example, 60 percent) up to a maximum dollar amount per week. While this leave provides a portion of salary coverage, it forces some women—particularly those in low-paying postdoctoral or contingent researcher positions—to choose between time to fully recover from the effects of giving birth and meeting the basic financial needs of their family.

Policies based on the accrual of sick and/or vacation leave

Policies that depend on the accrual of sick or vacation leave can be equally problematic, particularly for contingent workers. Since accrual requires time many of these classes of researchers are unlikely to have enough available (particularly in the case of pregnant

women at institutions that provide no paid leave *prior* to child birth, requiring them to use existing sick or vacation leave if they need or want that time). For example, a typical full-time postdoctoral birth mother would have to work for about one full year (if she earns a typical one day of sick leave per month and one and a half days of vacation leave per month) with no previous use to have the baseline six weeks of maternity leave.

The equity of policies that cap the total amount of leave for all populations regardless of possible birth/disability/caregiving issues is an area deserving of additional inquiry because requiring birth mothers to draw upon this limited pool of leave time seems likely to disparately affect them. What's more, since most birthmothers serve as the primary caregivers of infants the likelihood that they will need to use existing sick leave and vacation leave is even further increased.

If university policies for these populations copy-cat Family and Medical Leave Act eligibility requirements,⁵¹ many graduate student researchers, postdoctoral scholars, and even academic researchers may not qualify because of their contingent nature. In general, few if any graduate students satisfy the FMLA requirement of having worked for one full year and at least 1,250 hours over this period. Newly appointed postdoctoral fellows, newly appointed academic researchers, and part-time academic researchers are not likely to satisfy it, either. In fact, FLMA was purposefully designed to exclude contingent and most part-time employees from its protections, which makes it a poor choice to use for designing family responsive policies for nonfaculty academic researchers.

We applaud universities for offering paid family responsive policies because not doing so, using ad hoc methods, or leaving decisions up to individual faculty principal investigators (as is the case with 43 percent of institutions for graduate student maternity leave and 63 percent of institutions for graduate student parental leave) creates a very difficult situation for many contingent employees. However, the limitations associated with many of the policies threaten to nullify their potentially positive impact.

It's also important to step back from considering the individual policies for particular populations to question the entire landscape of each university. Does the institution have a holistic, coordinated view of the academic pipeline in terms of what is needed to make it possible for women and men to successfully have and raise children at any academic stage? Or do the policies show a more piecemeal approach to benefitting, such that one group receives one kind of leave, typically fairly generous, while another receives a completely different one or none at all?

In our survey we found the latter to be most common. In fact, when completing our survey many institutions had to pass the instrument around to at least four different individuals—one for each of the populations—to gather all of the necessary information. Each group was viewed distinctly and treated differently with respect to family responsive policies.

The role of federal granting agencies

Based on the preceding discussion one might reasonably conclude that research universities are largely to blame for American researchers' lack of family benefits. Our analysis, however, suggests that federal agencies and other federal institutions may also be at fault.

Three specific aspects of the role of federal agencies and related federal institutions suggest a shared responsibility with research universities when it comes to these issues: (1) the direct employment of research fellows by federal agencies and associated institutions; (2) the public commitment of federal agencies to assuring gender equity in the science pipeline; and (3) the role of federal agencies in assuring Title IX compliance by federal grant/contract recipients, including research universities.

Research fellows under the direct employment of federal agencies

Unlike other federal granting agencies, the National Institute of Health and the National Science Foundation directly support predoctoral, postdoctoral, and senior fellows (faculty or academic researchers). These two agencies are therefore responsible for developing appropriate family responsive policies for individuals who are directly paid—and therefore employed—by them.

But the agencies have taken fundamentally different approaches to this charge. The National Science Foundation has no uniform policy, but instead treats individuals on a case-by-case basis, giving program officers flexibility in their approach to handling necessary leaves due to pregnancy, child birth, or other concerns. However, NSF is considering issuing guidance to grantees to provide clarity on what is possible in regard to family policy and procedures.⁵²

In contrast, the National Institute of Health, under the umbrella of their Ruth L. Kirschstein National Research Service Awards,⁵³ has a parental leave policy that applies to all new parents supported by NRSA. The revised policy that was adopted in 2008 states:

Trainees and fellows may receive stipends for up to 60 calendar days (equivalent to eight work weeks) of parental leave per year for the adoption or the birth of a child when those in comparable training positions at the grantee organization have access to this level of paid leave for this purpose. Either parent is eligible for parental leave. The use of parental leave must be approved by the training program director.⁵⁴

Given the different approaches of these two agencies and the specific policy of NIH, three observations are important to make. First, in the absence of clear policy individuals in need of family responsive policies rely on the goodwill of the individuals they work for and/or are subject to local administrators—with the net effect seeming to be a reduced

likelihood of receiving appropriate benefits. For that reason the absence of a policy by NSF—and also the absence of a policy by the American Association for the Advancement of Science, a third-party nonprofit organization that oversees federally funded research fellows for many of the federal granting agencies (including Congressional Fellows)⁵⁵—is a questionable approach that should be reconsidered.

Second, policies and guidelines developed by federal agencies are increasingly copied by U.S. institutions of higher education. For example, many universities use NIH’s postdoctoral salary scales to set the minimum level of compensation of their own postdoctoral scholars, whether or not they are paid off of NIH funds. To be eligible for federal funds and comply with federal agency and Office of Management and Budget guidelines, almost every major university across the country has established committees for the protection of human subjects and sponsored project offices and funded staff positions to support these efforts. And some agencies have specific mandates that must be adhered to in order to qualify for grants—for example, the United States Agency for International Development requires potential grantees to consider the potential environmental impacts of their activities and discuss the adoption of appropriate safeguards.⁵⁶ Other agencies provide guidance about particular issues, such as NIH’s statement on the use of seat belts, which states, “NIH encourages grantees to adopt and enforce on-the-job seat belt policies and programs for their employees when operating vehicles, whether organizationally owned or rented or personally owned.”⁵⁷

Thus, federal agencies by their examples and policies wield great power in influencing university policies and practices, and they could do more to promote family responsive policies.

Third, even formal family responsive policies are frequently underused. NIH’s parental leave policy, which is commendable in many ways, still needs careful review in certain aspects of its formulation. In particular, the OMB requirement that an existing similar policy needs to be in place at the local institution—“these costs [salaries, wages, and fringe benefits] are allowable to the extent that the total compensation to individual employees conforms to the established policies of the institution, consistently applied...”⁵⁸—greatly limits the ability of many researchers to make use of it. The recent change to the National Research Service Award policy increased the length of parental leave from 30 to 60 days, but as far as we know there is only one AAU institution that provides “access to this level of paid leave for this purpose” to postdoctoral fellows without limitations (the University of Pennsylvania).⁵⁹ Furthermore, the “must be approved by the training program director” clause can be problematic. Faculty principal investigators and sponsors are often conflicted about how to treat researchers who report to them; most would like to support these scholars, but the overall productivity of the research project is tied in part to the efforts of those who work for them. Without a back-filling of researcher time lost to parental leave, faculty PIs and sponsors may find it disadvantageous to grant parental leave or be motivated to keep the leave as minimal as possible.

Beyond the clearly established limitations, the current NIH policy is not tiered separately for birth mothers and parents in general. Birth mothers experience both physical disability due to birth and are still overwhelmingly likely to be a substantial if not the primary caregiver (in our study of University of California faculty, we estimated that less than one-quarter of fathers with an infant satisfy a substantial caregiver standard of providing half or more of the care).⁶⁰ To grant non-birthmothers the same amount of leave as birth mothers, with no express caregiving requirement, is not an equitable approach to a family responsive policy.

Moreover, among college-educated birth mothers the rates of breastfeeding are high (43 percent of college-educated women are still exclusively breastfeeding when their infant is three months of age, compared to 24 percent of women without a high school diploma),⁶¹ and thus breastfeeding birth mothers are clearly in need of additional dispensation. In fact, NIH has funded multiple studies pointing to the importance of birth mothers both breastfeeding their children and receiving the necessary disability leave to assure the immediate and longer-term health of infants.⁶²

Clearly a one-size-fits-all parental leave policy is not taking into account the physical impact of birth, nursing, societal caregiving patterns, and even the potential health of the infant.

The public commitment of federal agencies to assuring gender equity in the science pipeline

Few of the federal granting agencies have easily accessible, formal statements about supporting women in the science academic pipeline. One exception is the Department of Energy, which has a work-life policy statement for one of their subprograms (Basic Energy Sciences).⁶³ NIH and NSF have numerous public materials regarding issues of diversity and the science pipeline, and they are replete with statements of commitment about diversifying the pipeline. For example, NSF has two main funding programs supporting gender equity in science—ADVANCE and the Research on Gender in Science and Engineering program. The program webpage for ADVANCE states: “The goal of the ADVANCE program is to develop systemic approaches to increase the representation and advancement of women in academic science, technology, engineering, and mathematics (STEM) careers, thereby contributing to the development of a more diverse science and engineering workforce.”⁶⁴ The Gender in Science and Engineering program (formally called the Program for Women and Girls) provides “... the largest funding source, public or private, for efforts expressly addressing the need to broaden girls’ and women’s participation in STEM.”⁶⁵

NIH similarly has a number of activities and programs with goals to support women and girls in science, including the Committee on the Advancement of Women Chemists,⁶⁶ WISH-net, or Women in Science and Healthcare Network, a portal website dedicated to

girls and women interested in the field of science;⁶⁷ the Association for Women in Science Annual Seminar Series;⁶⁸ and their grant program “Research Supplements to Promote Re-Entry into Biomedical and Behavioral Research Careers” with the stated objective:

The NIH recognizes the need to increase the number of underrepresented racial and ethnic groups, women, individuals with disabilities, and people from disadvantaged backgrounds in biomedical, behavioral, clinical, and social science research careers. Among the reasons for the low representation of women may be the fact that women bear a majority of the responsibilities surrounding child and family care. To address this issue, this program is designed to offer opportunities to women and men who have interrupted their research careers to care for children or parents or to attend to other family responsibilities.⁶⁹

Despite these efforts much evidence indicates family responsibilities still play a role in women leaking out the science pipeline. Federal agencies can better live up to their stated gender equity goals if they work collaboratively with universities and colleges to establish baseline family responsive policies.

The role of federal agencies in assuring Title IX compliance by federal grant-contract recipients

Even if increasing diversity in the sciences is not a compelling reason on its own, federal agencies bear an additional responsibility to family benefits, protections, and issues of pregnancy discrimination. Title IX of the Education Amendments of 1972 is the law that prohibits gender discrimination in all education programs.⁷⁰ Under Title IX, agencies must conduct periodic compliance reviews of recipients and promptly investigate complaints from individuals that an institution may be engaging in gender-pregnancy discrimination.⁷¹ To enforce Title IX the statute directs every federal agency providing financial assistance to educational institutions to promulgate rules and regulations.⁷² The Department of Justice is charged with coordinating this regulatory effort,⁷³ but until 2000 only four federal agencies had issued Title IX regulations.⁷⁴ That year the Department of Justice issued a final common rule providing for regulations under Title IX for 20 federal agencies.⁷⁵

Now every major science-granting agency has identical Title IX regulations requiring some form of family responsive leaves for employees of educational institutions. For example, universities and colleges must treat pregnancy as a temporary disability and provide unpaid, job-protected leave to birth mothers “for a reasonable period of time” if the institution does not maintain a leave policy for its employees.⁷⁶ What makes these regulations significant is that if they are properly enforced they fill gaps in the law for individuals supported by federal grants facing pregnancy and caregiving responsibilities. Individuals, particularly contingent employees, supported by federal grant dollars who do not qualify for the Family Medical Leave Act still have a right to job-protected unpaid leave.

Agencies responsible for enforcing Title IX are also instructed to look to Title VII case law and Equal Employment Opportunity Commission guidance when determining if a recipient of federal financial assistance has engaged in an unlawful employment practice.⁷⁷ In addition to conducting periodic compliance reviews, federal agencies providing grant assistance should be continuously looking to developments in the law for pregnancy and caregiver discrimination under Title VII. For instance, the recent EEOC enforcement guidance on unlawful disparate treatment of workers with caregiving responsibilities should be looked to by agencies with Title IX enforcement responsibilities.⁷⁸

Federal agencies are supposed to provide universities and colleges with guidance on these issues. In 2004 the Government Accountability Office conducted a review of efforts by several major science agencies (NSF, NASA, DOE, and the Department of Education) to ensure grantee compliance with Title IX.⁷⁹ GAO found that compliance reviews of educational institutions' academic programs have been "largely neglected by agencies" even though these reviews are required under Title IX and its implementing regulations.⁸⁰

GAO found that NSF, NASA, and DOE had never conducted Title IX compliance reviews. In addition, the review found that although the Department of Education had agreements with 17 agencies to conduct Title IX compliance reviews on their behalf, they were not completing them. After the GAO report was issued DOE, NSF, and NASA began conducting their first-ever compliance reviews, though the results of these reviews are not public.⁸¹

In our survey of AAU institutions, one university indicated they did not provide unpaid leave to postdoctoral scholar birth mothers and six indicated they did not know whether they did or not. All universities and colleges should have in place a clear policy for unpaid leave for birth mothers, since the absence of a formalized policy can lead to unexpected and possibly illegal results. Increased enforcement of existing rules under Title IX should require grantees to adopt clear family responsive policies.

Federal agencies should also take note of certain global trends. Clearly, based on NSF indicators, science is increasingly becoming a globalized affair.⁸² The permeability between various nation-states and universities is increasing in terms of authorship and multi-university collaborative relationships. More and more the faculty in the United States includes foreign-born scholars and a reasonable expectation would be that this trend will continue, suggesting that the outflow of academics from the United States may increase.

Many other nations are highly conscious of the growing percentage of women in the academic labor force and are taking a progressive position on providing benefits to their researchers with robust family responsive policies. For example, in Canada, in addition to generous government-provided benefits the federal agencies have paid parental leave poli-

cies that allow students and postdoctoral scholars up to four or six months depending on the agency (—if they are not eligible for government employment insurance benefits).⁸³

In the European Union the European Molecular Biology Organization has provisions for postdoctoral scholars to extend two-year, full-time fellowships to three years part-time for those with caregiving responsibilities, and it provides three months of maternity leave.⁸⁴ In China, a recent amendment to their Employment Insurance Act provides 60 percent of salary for six months of parental leave (after meeting a one-year requirement). Both parents can use the leave, providing a total of 12 months per family.⁸⁵ And in Japan governments are encouraging the full participation of women in the workplace, including in science and technology, where as recently as 2005 they only represented about 12 percent of the Japanese science and technology workforce.⁸⁶

Generally, the countries where the majority of our foreign graduate students and postdoctoral scholars come from provide more generous family responsive policies than U.S. institutions. In our survey of postdoctoral scholars many of the foreign-born scholars commented on this fact.

One male postdoc said, “The absence of a general system for parental leave (in Sweden, the parents get about 18 months to split) is, I think, the main reason why I will not stay in the U.S. after completing my postdoc here.”⁸⁷ Another said, “The benefits and maternal leave are FAR better in Europe than here, which is a major reason for my spouse and me to plan to return to Europe after this postdoc.”⁸⁸

All of these developments suggest the United States will be waging a family -friendly competition with other nations in the future, just as many research universities have done in recent years in their competition over the best and brightest faculty.

The unforgiving lock-step structure of academia

Grants and contracts in fast-track academic science

In 2002 nearly half (48 percent) of tenure-track faculty aged 25 to 45 in the sciences and social sciences (U.S. Ph.D.s only) had work in the previous year that was partially or fully supported by contracts or grants from the federal government, with the largest receiving support from NIH or NSF.⁸⁹ Federal grants play a critical role in achieving promotion and tenure in academia; among tenure-track faculty in the sciences, support from federal grants and contracts is strongly associated with career advancement, particularly at Carnegie Research I institutions, or R1s.⁹⁰

Based on our analysis of the Survey of Doctorate Recipients (from 1981 to 2003), we found that among tenure-eligible faculty in the sciences, individuals whose position was at least partially supported by federal grants or contracts experienced an 18 percent increase in their odds of achieving tenure on a year-to-year basis, and those working at R1 institutions were 65 percent more likely to achieve tenure if they were directly supported by federal monies. Tenured faculty in the sciences were also 44 percent more likely to become full professors at all types of institutions if they were supported by federal grants/contracts, and 60 percent more likely to become full professors on a year-to-year basis at R1 institutions if they were the direct recipient of federal monetary support.⁹¹

As a result of the NSF Authorization Act of 2002 the RAND Corporation conducted and released a report examining gender differences in federal grant funding outcomes at NIH, NSF, and the U.S. Department of Agriculture.⁹² While this study found few or no differences between men and women in funding requested, the probability of getting funded, or the size of the award, it did not examine the likelihood of men and women, with or without children, in securing federal funding, or the population of people who did not apply for these grants.

The RAND report did find that at NSF and NIH, women first-time applicants, whether successful or not, were less likely than men to apply again within two years. This finding is supported by research from two other studies that found that women were less likely than men to apply for funding from federal agencies.⁹³ Using the SDR (from 1981 to 2003) we found that tenure-track faculty women who were married with young children were 21 percent less likely than tenure-track men who are married with young children, 26 percent

less likely than tenure-track women who were married without young children, and 19 percent less likely than single women without children to have their work partially or fully supported by federal grants or contracts on a year-to-year basis.

Everybody is very busy

Although having federal grants is a critical component of success for faculty and researchers in the sciences, finding the time to secure them can be tricky at best and the application process is laborious and competitive. Once a proposal is submitted the revision and resubmission process can take 15 months or longer. Unsuccessful applicants have to decide whether to revise further and submit at a different time, submit elsewhere, or shift the focus of their work. Overall success rates for grants at NIH and NSF hovered around 20 to 25 percent in 2008.⁹⁴

One UC Berkeley soft-money academic researcher in our survey abandoned her career goal of faculty with research emphasis because of the time-intensive nature of securing funds and how she feared it would affect her parenting: “Being a full-time principal investigator is inconsistent with the way I want to mother (I didn’t want someone else to be my children’s primary caregiver), and I became very frustrated with the amount of time I had wasted on unsuccessful funding applications.”⁹⁵

Academics are well known for their long work hours and our data findings suggest that these are rather unrelenting for most faculty in the sciences until they reach the likely age of retirement (see Figure 11). Based on national data from the SDR (2003) tenure-track faculty—defined as tenured and tenure eligible—work on average about 50 hours a week up through age 62. We observed no noticeable drop off in hours worked even after most faculty have presumably secured tenure (average age of tenure receipt in the sciences was past 39 in 2003).⁹⁶ It is not until age 68 that the hours drop to the standard work week of 40 hours a week.

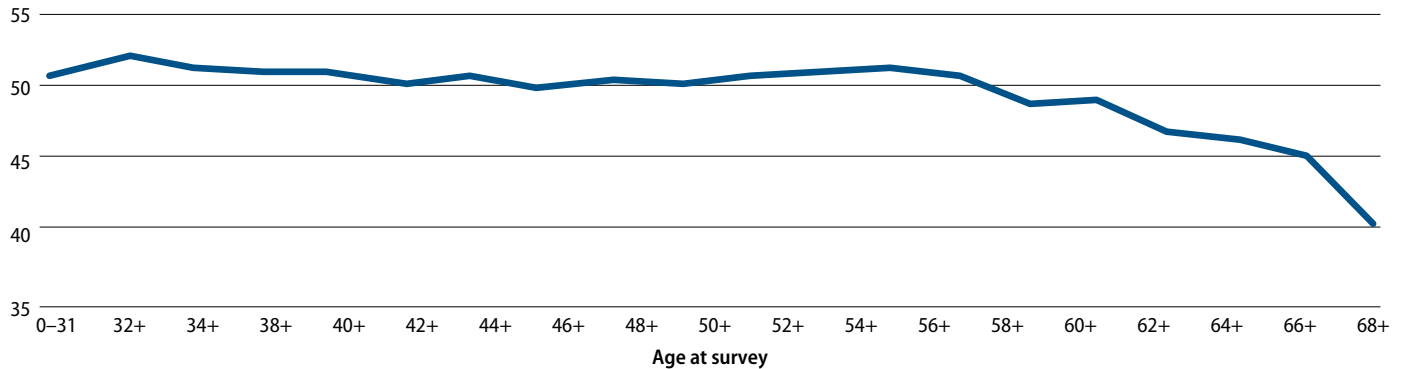
Moreover, our data from the UC system indicate that our faculty in the sciences work around 57 hours a week on professional activities.⁹⁷ When combined with caregiving hours and house work, UC women faculty with children, ages 30 to 50, report a weekly average of over 100 hours of combined activities (in comparison to around 86 hours for men with children). This staggering amount of overall work gives a sense of how challenging it can be for women to combine children with a fast-track career in the sciences.

What’s more, a mismatch exists between the types of policies offered and the actual need among caregivers pursuing fast-track academic careers. Our data from the UC faculty survey reveal that the number of care hours provided by women faculty with children stays very high through age 50, averaging more than 30 hours a week of care. By age 58 women faculty with children still engage in 15 hours a week of care, and a full convergence of care

FIGURE 11

Mean weekly hours worked by science and social science tenure-track faculty in the United States by age in 2003

Most faculty don't work a standard 40-hour week until age 68



Source: SDR Sciences, 2003.

hours provided by all of our faculty, regardless of gender and children, does not occur until the age of 60. Accordingly, offering exclusively baby-centric policies misses the large caregiving load that women with children in particular experience up through their late fifties.⁹⁸

For faculty and researchers in the sciences the need to secure initial grant money and then pursue additional funding to continue research projects and support graduate students and postdoctoral scholars adds an additional layer of unrelenting time pressure. In focus groups conducted by our research team with faculty and academic researchers with federal funding, the theme of never being able to take a break was continually returned to by participants. Several indicated that the nature of this process meant that they could never fully enjoy the benefits of family responsive policies. They felt that if they took the time off that they were entitled to at their institution they would get behind on their federally funded projects, create a productivity gap, and lessen their ability to secure future grants. This fear of a “bias against caregiving” in academia has been well documented.⁹⁹

The principal investigators further observed that when researchers paid by grants need family leave or modification of duties that it puts them in a very difficult position, wanting to support the individual but also knowing that their research projects will likely suffer. With no existing method for receiving remuneration for this loss, faculty PIs reported tremendous frustration with this dynamic. In fact data from our survey of faculty PIs at UC Berkeley make clear the extent to which this is a difficult issue for them—32 percent observed that granting family responsive leave to researchers paid off their grants had a negative impact on their work.¹⁰⁰

Academic career timelines are elongating

As if these factors were not enough to lock fast-track academic scientists on a wheel of unrelenting motion, evidence from the SDR suggests that the collision course between career timing and family timing may only be getting worse. Our analysis of SDR data indicates that while the average age for tenure receipt among tenure-track faculty in the sciences was 36 in 1985, the average age extended out past age 39 by 2003. Similarly, the average age at receipt of the first NIH RO1-equivalent grant (major research project grant) increased from about 34 years of age in 1970 to 42 years in 2007.¹⁰¹

This elongating career timeline creates a host of challenges for individuals, particularly women, who want to pursue fast-track academic careers in the sciences without forgoing childbirth and childrearing. Our data from the UC system suggest that for many years large proportions of women faculty have purposely waited until they knew they would or already had received tenure to have children. In fact, the most common age for women faculty in the UC system to have children is between 38 to 40 years of age.

As the tenure timeline pushes out, the possibility of having a child after tenure receipt but before a significant decline in fertility becomes less likely. Given the fact that delaying fertility is so common among fast-track academic women (only roughly 14 percent of our UC doctoral student women had been parents at the time of the survey), the current strategy of delayed fertility may come under an even greater challenge. This is of great concern because even in 2002-03, 40 percent of our UC faculty women respondents who were past the likely age of fertility indicated that they had fewer children than they wanted (compared to 20 percent of men).¹⁰²

As all of the fast-track academic timelines have pushed out—age at Ph.D. receipt, number of years in postdoctoral positions, and age at start of tenure-track positions—faculty PIs may find themselves in an increasingly difficult situation as the pressure on them may intensify to either deny family responsive accommodations to researchers paid off their grants or completely avoid hiring individuals they fear might end up giving birth to children. Sadly, this will undoubtedly have an additional negative impact on the earlier pipeline in the sciences, with young scholars sensing the tension experienced by the faculty PIs and knowing that choosing to have a family will be met with concern among their mentors (and yet their own career timeline pressures may argue that the time is now or never to have a child).

Our data from the UC doctoral student survey illustrate the fact that among women doctoral students, the perception of how family friendly tenure-track careers are at research-intensive universities is strongly associated with how common they think it is for women faculty to have children. This, along with other findings related to women doctoral students in the sciences—concerns about having children because of its impact

on how their advisors and other faculty might perceive them—leads us to speculate that faculty PIs and their willingness to accommodate researchers paid off their grants may be highly influential in affecting young scholars' future career decisions, particularly among women who seem to be more strongly influenced by these issues. Perhaps this helps to account for the previously discussed dramatic drop in a desire to pursue faculty careers with research emphasis among doctoral students who were paid off federal grants at the time they had a baby.

Breaking up the lock-step academic structure

The role of research universities

Fortunately, many universities have begun to address some of these challenges and their obviously negative impact on retaining women and men with substantial caregiving responsibilities in the science pipeline to tenure and beyond.

Figure 12 shows some of the many approaches that Association of American University institutions have used to respond to the needs of the various researcher populations. These efforts group into various time-based policies and benefits, which give individuals more flexibility with timing issues; child care resources and support, which essentially free up time to work; monetary supplements and benefits, which again can help lessen the professional load between the individual or their spouse; and other types of programs/initiatives.

FIGURE 12

Examples of family responsive policies, benefits, and resources found at AAU institutions

These policies break down into time-based benefits, child care resources and support, monetary supplements and benefits, and other resources

Time-based policies/benefits (and associated review criteria)

- Stopping the clock/extension of acad. progress timelines & funding
- Reentry rights
- Flex time and flexible scheduling
- Part Time/Unpaid Leaves
- Modified Duties
- Sabbaticals and Leave of Absence

Childcare

- On and off-campus centers
- Subsidies
- Referral services
- Emergency backup

Monetary supplements/benefits

- Tuition remission
- Health care, continued coverage, and dependent healthcare
- Dependent care expenses (pretax) and dependent care travel funds
- Adoption reimbursement

Other resources

- Lactation rooms, family housing, caregiver groups, resources lists, etc.

Source: Frasch, Karie, Marc Goulden, and Mary Ann Mason. 2008. "University Family Accommodations Policies and Programs for Researchers Survey" (<http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>).

These various approaches have received good media coverage in recent years, but there remains wide variability in the extent to which individual institutions provide these policies, benefits, and resources. A few model institutions have nearly the whole array of possible supports, while many institutions have neglected to implement many at all. And a concerted effort is needed by researchers to assess these types of initiatives' effectiveness along with more conduits for sharing best practices among universities and coordinating efforts with federal agencies.¹⁰³

The role of federal agencies

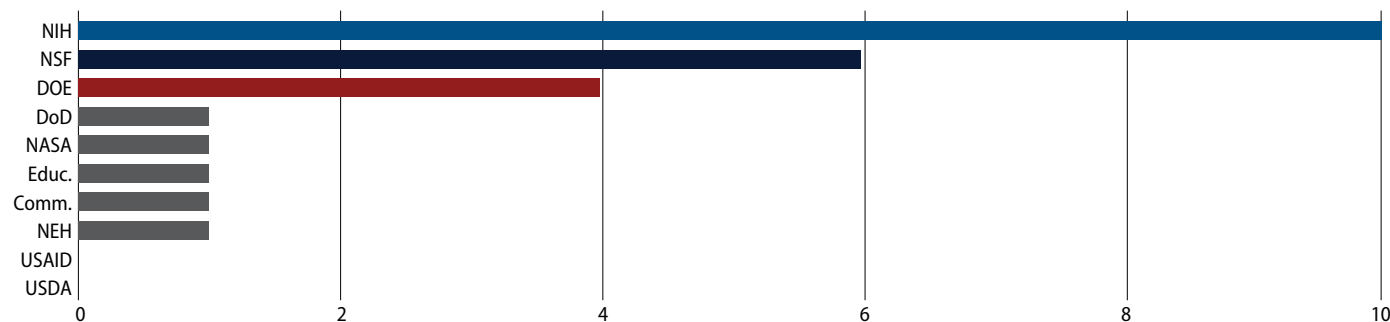
Similarly, various federal agencies have done good work in recent years. NIH stands above the rest in their efforts and NSF and DOE have demonstrated considerably more tangible accomplishments than the other agencies. Figure 13 lays out a framework of possible family friendly offerings that federal agencies should consider to support researchers paid off of grants/contracts. Some topical areas apply only to agencies that employ their own fellows while others can be instituted by all. We'll run through these in more detail below.

FIGURE 13
Possible family friendly offerings by federal agencies to support researchers paid by their grants

Some apply only to agencies that employ their own fellows while others can be used by all

Possible offering	# that offer	Possible offering	# that offer
1. No-Cost Extensions	8	8. Website(s) with clear information on support for family accommodations	1
2. Supplements to support family accommodations	3	9. Clear policy expectations for various classes of researchers (ie., not ad hoc)	1
3. Gender equity workshops	3	10. Allow dependent care expenses to be charged to grants for conferences or meetings	1
4. Formalized agency policy or statement supporting women in the academic pipeline	2	11. Re-entry grants for those who have stopped out for family caregiving needs	1
5. Part-time effort on fellowship or grant to accommodate family caregiving needs	2	12. Discount caregiving gaps in grant reviews	0
6. Extend fellowship period for caregiving	2	13. Provide instructions to peer reviewers on family accommodations	0
7. Defer start of fellowship period for caregiving	1	14. Data collection on gender and family status	0

Number of current offerings from federal agencies



Source: Frasch, Karie, Marc Goulden, and Mary Ann Mason. 2009. "Federal Agencies Survey."

No-cost extensions

Based on the survey we conducted with 10 of the most influential federal agencies in academia, the most common offering by them is no-cost extensions on existing grants. These are generally *pro forma*, in that any one-time request is more or less automatically agreed to by granting officers. However, grant recipients should ideally be entitled to an additional no-cost extension based on family events. For example, if a researcher paid off the grant or the faculty principal investigator experiences a birth or adoption event, the faculty PI should be able to receive a no-cost extension that does not count against use of the standard automatic one. Additionally, all agencies should clearly indicate that caregiving responsibilities such as child birth are a valid reason for requesting and using a no-cost extension.

Supplements to support family accommodations

As useful as no-cost extensions can be they do not solve the productivity loss that was previously discussed when a member of a research team is absent or their duties are modified due to family needs. Clearly, supplements to support family accommodations are also needed, and three of the agencies (NIH, NSF, and DOE) have provided them on a small scale.

NIH is the only agency to provide explicit policy language in this regard:

In general, unless the changes indicate a potential change in project scope, NIH grantees are allowed to re-budget within and between budget categories to meet unanticipated needs and to make other types of post-award changes. Administrative supplements also can be provided if funds are available.¹⁰⁴

One of the NIH institutes (the National Institute of Allergy and Infectious Diseases) also provides formal “primary caregiver technical assistance supplements” to support caregiving for postdoctoral scholars (at \$500,000/year for the total program).¹⁰⁵

Gender equity workshops and formal agency policy statements

Gender equity workshops, formalized policy statements about pipeline issues, and promises to support diversity in the science pipeline are important steps toward patching the leaks in the pipeline. Researchers at all levels will take notice if all federal granting agencies provide information, training, and materials on these issues. But they need to be followed up with tangible initiatives that actually promote diversity. Specifically, the agencies should actively model baseline family responsive policies and work toward a suite of additional offerings that help to support scholars with career-life issues throughout their academic career.

Flexibility during the fellowship period

Part-time options for researchers are usually not a problem for federal agencies except in the case of postdoctoral scholars. Faculty PIs, graduate students, and academic researchers are routinely paid part-time on grants. For faculty, the full-time-or-no-time standard is typically enforced at the institutional level and not the federal grant-making level. Postdoctoral scholars, on the other hand, are generally assumed by both agencies and institutions of higher education to be full-time or no-time.

Agencies with fellows should allow postdoctoral scholars to go part-time temporarily if they desire to help better balance family and career responsibilities, and either defer the beginning or extend out the total period of their fellowship. These types of policies will help bring the flexibility that would support women and men with both training and caregiving responsibilities.

Websites with clear information on support for family responsive policies

One existing offering by NIH can make a big difference to researchers supported by other agencies: a website with clear information about their family responsive offerings. NIH has put together a very accessible frequently asked questions webpage that other agencies should consider copying. It essentially provides a one-stop shopping interface for researchers interested in finding out about the various benefit options, and we believe it has single handedly raised the profile of these issues for researchers paid off grants throughout the country.¹⁰⁶ Of course a website is only as useful as the policies and procedures it has to offer—many other agencies would currently have difficulty filling the content of such a site.

Allow dependent care expenses to be charged to grants for conferences or meetings

NIH has followed Office of Management and Budget cost principles and been proactive about spelling out the allowable use of grant funds for child or dependent care expenses on their FAQ page:

Can institutions use grant funds for dependent care expenses? Yes, NIH grant awards provide for reimbursement of actual, allowable costs incurred and are subject to OMB Cost Principles. Generally, institutions treat child care expenses as an employee or fringe benefit. Fringe benefits are allowable as part of overall compensation to employees in proportion to the amount of time or effort employ-

ees devote to the grant-supported project, provided such costs are incurred under formally established institutional policies that are consistently applied regardless of the source of support. Alternatively child care expenses may be incorporated into indirect costs.¹⁰⁷

Other agencies should consider using a similar policy.

Re-entry grants for those who have stopped out for family caregiving needs

NIH has also taken the lead on helping individuals re-enter the academic pipeline by providing supplements to existing grants.

Principal Investigators holding NIH research grants of the specified types (see announcement) can apply for administrative supplements to support individuals with high potential to re-enter an active research career after taking time off to care for children or attend to other family responsibilities. It is anticipated that at the completion of the supplement, the reentry scientist will be in a position to apply for a career development (K) award, a research award, or some other form of independent research support.¹⁰⁸

Programs such as these send a very clear message that taking time off does not have to mean the end of a potentially productive career. Other agencies should follow this example.

Additional ideas

Several other ideas came up in the course of our research project that could be highly beneficial in the long run if done effectively. Currently, researchers who have productivity gaps due to family responsibilities are evaluated by reviewers on the same footing as individuals without family responsibilities. Almost invariably this brings up the question of whether and how to provide this information to reviewers so that it does not further disadvantage the individual with family responsibilities. Some universities have sought to provide reviewers with instructions regarding these issues, and federal agencies should consider working with universities with direct experience to provide general guidelines to address this challenging problem.

The absence of good data is another significant problem. Until federal agencies collect data on family status in addition to gender it will be impossible to determine whether family effects account for some of the observed patterns of gender inequity in grant application and grant receipt.

For example, studies from NIH indicate that women are less likely to reapply for additional grants. This is a critical issue to examine in detail, but without family status data it is nearly impossible to sort out the various effects. And as previously noted (see Figure 5), the percent of women receiving fellowships/grants from NIH and NSF drops considerably from predoctoral to competitive faculty grants. The best way to discover what accounts for this steep drop off is to construct longitudinal data sets that will allow this type of analysis. Although this can be a relatively costly proposition (relative to one-time surveys), the stakes for researchers are high and the need is great to better understand the loss of women from the science pipeline.

A better tomorrow: Joint policy recommendations

Federal agencies and research universities need to take concerted action to provide a suite of family responsive policies and resources for America’s researchers to change the problems outlined in this paper and keep young researchers in the pipeline to fast-track academic careers in the sciences. During our more than three years of in-depth research and analysis on this complex topic we have discovered an unfortunate absence of university-agency synergy. At research universities many expect that federal agencies will provide clear guidance in this area (besides the Office of Management and Budget Cost Principles) and they are frustrated by the seeming lack of clarity regarding family responsive policies and necessary funding to support them.

Among federal agencies the common sentiment seems to be that it’s up to the research universities to take care of these issues and that federal agencies are best suited to stay out of them—or even must stay out of them. It is clear, however, that the current absence of baseline accommodations and a suite of family responsive resources that support scholars throughout their careers and life course call for immediate joint effort. Given the continuing growth of women in the science pipeline, the presence of an administration interested in these issues,¹⁰⁹ and the continuing growth of science infrastructure in other nations, the time is right to begin to seriously addressing these issues as partners and in association with other critical players including Congress and professional and national associations.

Recommendations

Promote clear, well-communicated, baseline family responsive policies for all classes of researchers.

As described at length in this report America’s researchers currently do not receive adequate benefits in regard to family responsive policies, and this problem is particularly acute among more junior researchers. Together, federal agencies and universities can make headway in solving this systemic problem. Federal agencies, particularly NIH, NSF, and the auxiliary American Association for the Advancement of Science can help by setting equitable, clearly communicated baseline family responsive policies for their fellows.

Universities must adopt baseline family responsive policies for all of their classes of researchers—not just faculty. Graduate student researchers and postdoctoral scholars are the least benefited and are arguably the most important in affecting the future of U.S. science. In fact, postdoctoral scholars in particular are known to generate many new scientific studies.¹¹⁰

These groups are also the least likely to have children (especially graduate students), so the cost of providing benefits to them may not be as high as many fear. To lose talented scholars from the science pipeline because of our failure to provide baseline family responsive policies seems pennywise but pound foolish. If young scholars continue to leak out of the pipeline prior to seeking fast-track careers in the sciences, there is no way to make sure that they are not largely or entirely lost to our nation's capacity to generate new scientific discoveries.

Provide federal agency or university supplements to offset family event productivity loss and help principal investigators.

Without providing additional financial supplements in association with family responsive policies, however, faculty and research PIs will end up bearing the brunt of supporting any family related absence from their limited research dollars. This dynamic is unfair to PIs and may create a situation where they will find it to their advantage to avoid hiring researchers who might eventually need to use family responsive policies. This becomes an unintended form of discrimination against women.

Accordingly, support can either come from federal agencies in the form of supplements to grants—in the case of productivity losses due to researchers' family related absences; from universities through increased benefit rates with set-aside reimbursement pools of money at the university level (available to PIs upon request); or tapping existing overhead to provide reimbursement along similar lines.

Collaboratively move toward a full package of family friendly policies/resources that take into account the career/family life course.

Providing America's researchers with baby-centric family responsive policies will not be enough. They need access to a fuller suite of policy and resource offerings that span the career and life-course. Both universities and federal agencies have been increasingly proactive in this area, but greater sharing and widescale adoption of proven practices are necessary. All major research universities should look to build a family friendly package of policies and resources and federal agencies can provide much more than they already do.

Remove time-based criteria for fellowships and productivity assessments that do not acknowledge family events and their impact on career timing.

The lock-step timing of academia, with its seeming fixation with bean counting and piece-rate productivity—for example, number of peer reviewed articles per academic year—needs to be more flexible. Time caps and barriers to entry that set rigid sequential deadlines should be removed or made more flexible (caregiving slow downs or stop outs should be respected for what they are, not viewed as a lack of commitment or justification for exclusion from career entry). Universities and federal agencies need to examine all of their policies in this regard and look for ways to encourage re-entry into the pipeline and promote a more holistic concept of career patterns that honors the larger needs of individuals.

Collect and analyze the necessary data to make sure existing and future policy initiatives are effective in meeting researchers' needs and comply with Title IX.

Without systematic longitudinal data on all of these issues decisions will continue to be made based on intuition and anecdote. Both federal agencies and universities need to be proactive in building and maintaining the necessary datasets to assess whether our efforts are yielding positive results and whether Title IX requirements are being met. For example, does tenure clock extension help faculty or does it unintentionally disadvantage them later in their careers? How much do family effects explain the drop off of women in federal funding rates at each successive training/career level?

Federal agencies can provide more grant programs to help to determine whether efforts are working—most gender equity and family responsive initiatives remain under-assessed. The lack of necessary data and multiyear commitments to these efforts continues to hamper our efforts to meet our legal obligations and offer truly effective initiatives.

Conclusion

Now is the time to move forward. If we delay we simply continue to lose talented scholars from fast-track academic careers in the sciences—to the detriment of our nation’s future. By taking concerted action we can equitably enhance America’s researchers and reap the rewards of maintaining our nation’s preeminence in scientific training and discovery. This is the hope of young scholars across the country and it will benefit our scientific future.

Endnotes

- 1 Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, National Science Foundation, *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering and Technology* (Washington, D.C.: National Science Foundation, 2000). Ronald Burke and Mary Mattis, eds., *Women and Minorities in Science, Technology, Engineering, and Mathematics: Upping the Numbers* (Northampton, MA: Edward Elgar Publishing, 2007).
- 2 U.S. Census Bureau, "Educational Attainment in the United States: 2008," available at <http://www.census.gov/population/www/socdemo/education/cps2008.html>; National Science Foundation, Survey of Earned Doctorates, retrieved from WebCaspar 4/15/09, <http://webcaspar.nsf.gov/>
- 3 Mary Ann Mason and Marc Goulden, "Do Babies Matter (Part II)? Closing the Baby Gap," *Academe* 90 (2004): 3-7. Mary Ann Mason and Marc Goulden, "Do Babies Matter?" *Academe* 88 (2002): 21-27. Committee on Maximizing the Potential of Women in Academic Science and Engineering, Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* (Washington: National Academies Press, 2007). Stephen Ceci, Wendy Williams, and S. Barnett, "The Underrepresentation of Women in Science: Sociocultural and Biological Considerations" *Psychological Bulletin* 135 (2009): 172-210. American Council on Education, Office of Women in Higher Education, "An Agenda for Excellence: Creating Flexibility in Tenure-Track Faculty Careers" (Washington, D.C.: American Council on Education, 2005). J. Scott Long, National Research Council, *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*, (Washington, D.C.: National Academies Press, 2001). Donna Nelson, "National Analysis of Diversity in Science & Engineering Faculties at Research Universities," available at <http://chem.ou.edu/~djn/diversity/briefings/Diversity%20Report%20Final.pdf>
- 4 Derek Hill and others, National Science Foundation, Division of Science Resources Statistics, "Changing U.S. Output of Scientific Articles: 1988-2003" (Arlington, VA: National Science Foundation, 2007). Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future* (Washington, D.C.: National Academies Press, 2007). James Adams, "Is the U.S. Losing Its Preeminence in Higher Education?" Working Paper 15233 (*National Bureau of Economic Research*, 2009). Matthew Kazmierczak, Josh James, and William Archey, AeA, Advancing the Business of Technology, "Losing the Competitive Advantage? The Challenge for Science and Technology in the United States" (Washington, D.C.: American Electronics Association, 2005). Matthew Kazmierczak, Josh James, and William Archey, AeA, Advancing the Business of Technology, "We are Still Losing the Competitive Advantage: Now is the Time to Act" (Washington, D.C.: American Electronics Association, 2007). Titus Galama and James Hosek, "U.S. Competitiveness in Science and Technology" (RAND National Defense Research Institute, 2008). Neal Lane, "U.S. Science and Technology: An Uncoordinated System that Seems to Work," *Technology in Society* 30 (2008), 248-263.
- 5 The White House, Office of the Press Secretary, "Fact Sheet: A Historic Commitment to Research and Education," Press release, April 27, 2009, available at http://www.whitehouse.gov/the_press_office/Fact-Sheet-A-Historic-Commitment-To-Research-And-Education/.
- 6 American Recovery and Reinvestment Act of 2009, H.R. 1.ENR.
- 7 National Research Council, "Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty" (Washington, D.C.: National Academies Press, 2009).
- 8 Ibid.
- 9 The Survey of Doctorate Recipients is a biennial weighted, longitudinal study following almost 170,000 Ph.D. recipients across all disciplines until they reach age 76. The SDR is sponsored by the National Science Foundation and other government agencies. The use of NSF data does not imply endorsement of research methods or conclusions contained in this report.
- 10 See Association of American Universities, available at <http://www.aau.edu/>.
- 11 National Science Foundation, National Institutes of Health, US Department of Agriculture, National Aeronautics and Space Administration, Department of Defense, Department of Energy, US Agency for International Development, National Endowment for the Humanities, Department of Commerce, and the Department of Education.
- 12 Results are based on Survival Analysis of the SDR, 1979 to 2003 in all sciences, including social sciences.
- 13 Mary Ann Mason and Marc Goulden, "UC Doctoral Student Career and Life Survey" (Berkeley, CA: UC Berkeley, 2006), available at <http://ucfamilyedge.berkeley.edu/grad%20life%20survey.html>. Marc Goulden, Karie Frasch, and Mary Ann Mason, "UC Postdoctoral Scholar Career and Life Survey" (Berkeley, CA: UC Berkeley, 2008), available at <http://ucfamilyedge.berkeley.edu/UC%20Post-doctoral%20Survey.html>. See also, Mary Ann Mason, Marc Goulden, and Karie Frasch, "Why Graduate Students Reject the Fast Track," *Academe* 95 (2009): 11-16. Total respondents for the doctoral student survey were 8,373 with an overall response rate of 43 percent. Total respondents for the postdoctoral scholar survey were 2,390 with an overall response rate of 43 percent.
- 14 Karie Frasch, Marc Goulden, and Mary Ann Mason, "University Family Accommodations Policies and Programs for Researchers Survey" (Berkeley, CA: UC Berkeley, 2008), available at <http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>.
- 15 Office of Management and Budget, "Cost Principles for Educational Institutions," *OMB Circular A-21* (Washington, DC: Author, August 8, 2000).
- 16 National Institutes of Health, National Science Foundation, and the Association for the Advancement of Science
- 17 Title IX, *Education Amendments of 1972*, Title 20 U.S. 1681 et seq.
- 18 Ibid.
- 19 For a full copy of the regression results, contact Marc Goulden at goulden@berkeley.edu.
- 20 Mary Ann Mason, Angelica Stacy, and Marc Goulden, "UC Work and Family Survey" (Berkeley, CA: UC Berkeley, 2002-2003). Mary Ann Mason, Angelica Stacy, Marc Goulden, Carol Hoffman, and Karie Frasch, "University of California Faculty Family Friendly Edge: An Initiative for Tenure-Track Faculty at the University of California" (Berkeley, CA: UC Berkeley, 2005), available at <http://ucfamilyedge.berkeley.edu>.
- 21 Neal Lane, "U.S science and technology: An uncoordinated system that seems to work," *Technology in Society* 30 (2008): 248-263. Shirley Ann Jackson, *Envisioning a 21st Century Science and Engineering Workforce for the United States* (Washington, D.C.: National Academies Press, 2003). Titus Galama and James Hosek, "U.S. Competitiveness in Science and Technology" (RAND National Defense Research Institute, 2008).
- 22 The White House, Office of the Press Secretary, "Fact Sheet: A Historic Commitment to Research and Education," Press release, April 27, 2009, available at http://www.whitehouse.gov/the_press_office/Fact-Sheet-A-Historic-Commitment-To-Research-And-Education/.

- 23 Derek Hill and others, National Science Foundation, Division of Science Resources Statistics, "Changing U.S. Output of Scientific Articles: 1988–2003" (Arlington, VA: National Science Foundation, 2007). James Adams, "Is the U.S. Losing Its Preeminence in Higher Education?" *National Bureau of Economic Research Working Paper No. 15233* (2009). Matthew Kazmierczak, Josh James, and William Archev, AEA, *Advancing the Business of Technology*, "Losing the Competitive Advantage? The Challenge for Science and Technology in the United States" (Washington, D.C.: AEA, 2005). Matthew Kazmierczak, Josh James, and William Archev, AEA, *Advancing the Business of Technology*, "We Are Still Losing the Competitive Advantage: Now Is the Time to Act" (Washington, D.C.: AEA, 2007). Titus Galama and James Hosek, "U.S. Competitiveness in Science and Technology" (RAND National Defense Research Institute, 2008). Neal Lane, "U.S. science and technology: An uncoordinated system that seems to work," *Technology in Society* 30 (2008): 248–263. Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies, "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Future" (Washington, D.C.: National Academies Press, 2007).
- 24 Ibid.
- 25 Ibid. National Science Board, National Science Foundation, "Chapter 2: Higher Education in Science and Engineering," In *Science and Engineering Indicators* (Washington, D.C.: National Science Foundation).
- 26 Mary Ann Mason and Marc Goulden, "Do Babies Matter (Part II)? Closing the Baby Gap," *Academe* 90 (2004): 3–7. Mary Ann Mason and Marc Goulden, "Do Babies Matter?" *Academe* 88 (2002): 21–27. Committee on Maximizing the Potential of Women in Academic Science and Engineering, Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering" (Washington: National Academies Press, 2007). Stephen Ceci, Wendy Williams, and S. Barnett, "The Underrepresentation of Women in Science: Sociocultural and Biological Considerations" *Psychological Bulletin* 135 (2009): 172–210. American Council on Education, Office of Women in Higher Education, "An Agenda for Excellence: Creating Flexibility in Tenure-Track Faculty Careers" (Washington, D.C.: American Council on Education, 2005). J. Scott Long, National Research Council, "From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers" (Washington, D.C.: National Academies Press, 2001). Donna Nelson, "National Analysis of Diversity in Science & Engineering Faculties at Research Universities," available at <http://chem.ou.edu/~djn/diversity/briefings/Diversity%20Report%20Final.pdf>.
- 27 Committee on Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States, Committee on Science, Engineering, and Public Policy, Board on Higher Education and Workforce, and Policy and Global Affairs, "Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States" (Washington, D.C.: National Academies Press, 2005). Geoff Davis, "Doctors Without Orders" *American Scientist* 93 (3, supplement) (2005), available at <http://postdoc.sigmaxi.org/results/>.
- 28 Joshua Rosenbloom and others, "Why are there so few women in information technology? Assessing the role of personality in career choices," *Journal of Economic Psychology* 29 (4) (2008): 543–554. David Lubinski and Camilla Persson Benbow, "Study of Mathematically Precocious Youth After 35 Years: Uncovering Antecedents for the Development of Math-Science Expertise," *Perspectives on Psychological Science* 1 (2006): 316–345. Janis Jacobs, "Twenty-Five Years of Research on Gender and Ethnic Differences in Math and Science Career Choices: What Have We Learned?" *New Directions for Child and Adolescent Development* 11 (2005): 85–94.
- 29 U.S. Census Bureau, "Educational Attainment in the United States: 2008," available at <http://www.census.gov/population/www/socdemo/education/cps2008.html>. National Science Foundation, "Survey of Earned Doctorates," available at <http://webcaspar.nsf.gov/> (last accessed April 15, 2009).
- 30 Mary Ann Mason and Marc Goulden, "Do Babies Matter (Part II)? Closing the Baby Gap," *Academe* 90 (2004): 3–7. Mary Ann Mason and Marc Goulden, "Do Babies Matter?" *Academe* 88 (2002): 21–27. Mary Ann Mason and Marc Goulden, "Marriage and Baby Blues: Redefining Gender Equity in the Academy," *The ANNALS of the American Academy of Political and Social Science* 596 (2004): 86–103. Nicholas Wolfinger, Mary Ann Mason, and Marc Goulden, "Problems in the Pipeline: Gender, Marriage, and Fertility in the Ivory Tower," *The Journal of Higher Education*, (forthcoming). Committee on Maximizing the Potential of Women in Academic Science and Engineering, Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, "Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering" (Washington: National Academies Press, 2007). Virginia Valian, *Why so slow? The Advancement of Women* (Cambridge, MA: MIT Press, 1998). Kelly Ward and Lisa Wolf-Wendel, "Academic motherhood: Managing complex roles in research universities," *The Review of Higher Education*, 27 (2) (2004): 233–257. American Association of University Professors, "Statement of principles on family responsibilities and academic work" (2001). Sari Van Anders, "Why the Academic Pipeline Leaks: Fewer Men than Women Perceive Barriers to Becoming Professors," *Sex Roles* 51 (2004): 511–521. National Research Council, "Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty" (Washington, D.C.: National Academies Press, 2009). Massachusetts Institute of Technology, "A Study on the Status of Women Faculty in Science at MIT" (1999).
- 31 Scott Jaschik, "What Larry Summers Said," *Inside Higher Ed.*, February 18, 2005, available at http://www.insidehighered.com/news/2005/02/18/summers2_18.
- 32 National Research Council, "Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty" (Washington, D.C.: National Academies Press, 2009).
- 33 National Science Foundation, "FY 2008 Annual Performance Report," available at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0922. National Science Foundation, "National Science Foundation Announces Graduate Research Fellows for 2008," Press release, April 15, 2008, available at http://www.nsf.gov/news/news_summ.jsp?cntn_id=111452. Ruth L. Kirschstein, "Women in Research" (National Institutes of Health, 2008), available at http://report.nih.gov/NIH_Investment/PPT_sectionwise/NIH_Extramural_Data_Book/NEDB%20SPECIAL%20TOPIC-WOMEN%20IN%20RESEARCH.ppt and http://report.nih.gov/NIH_Investment/PPT_sectionwise/NIH_Extramural_Data_Book/NEDB%20SPECIAL%20TOPIC-WOMEN%20IN%20RESEARCH2.ppt. Walter T. Schaffer, "Women in Biomedical Research" (National Institutes of Health, 2008), available at www.womeninscience.nih.gov/bestpractices/docs/WalterSchaffer.pdf.
- 34 The Survey of Doctorate Recipients is a biennial weighted, longitudinal study following almost 170,000 Ph.D. recipients across all disciplines until they reach age 76. The SDR is sponsored by the National Science Foundation and other government agencies. The use of NSF data does not imply endorsement of research methods or conclusions contained in this report.
- 35 Sheldon Clark, "Variations in Item Content and Presentation in the Survey of Doctorate Recipients, 1973–1991," Working Paper (Washington, D.C.: National Science Foundation, 1994). National Science Foundation, "Changes to the Survey of Doctorate Recipients in 1991 and 1993: Implications for Data Users" (paper presented at the National Science Foundation, April 12, 1995). National Science Foundation, "Survey of Doctorate Recipients" (2004), available at <http://www.nsf.gov/sbe/srs/ssdr/start.htm>.
- 36 Using discrete-time event history analyses, which is a series of methods for analyzing the length of time until an "event" occurs, while controlling for various factors. P. D. Allison, "Event History Analysis: Regression for Longitudinal Data. Sage University Papers on Quantitative Applications in the Social Sciences, series no. 07-046" (Newbury Park, CA: Sage Publications, Inc., 1984). P. D. Allison, "Survival Analysis using the SAS System: A practical guide" (Cary, NC: SAS Institute, Inc., 1995).
- 37 Results are based on Survival Analysis of the SDR, 1979 to 2003 in all sciences, including social sciences.
- 38 See Association of American Universities homepage at <http://www.aau.edu>.
- 39 National Science Foundation, National Institutes of Health, US Department of Agriculture, National Aeronautics and Space Administration, Department of Defense, Department of Energy, US Agency for International Development, National Endowment for the Humanities, Department of Commerce, and the Department of Education.
- 40 We surveyed both groups at 9 of the 10 UC campuses, with UC Merced excepted because of its small post-baccalaureate populations.
- 41 The data were cut to doctoral students in the sciences because of the substantial proportion of students in nonsciences fields, and the postdoctoral survey was inclusive of all respondents because of the small fraction of nonscience postdoctoral fellows.
- 42 A recent survey of NIH postdoctoral scholars, conducted by investigators at NIH, highlighted many of the same findings with respect to postdoctoral scholar women's shift away from academic careers. See Elisabeth Martinez and others, "Falling Off the Academic Bandwagon: Women are More Likely to Quit at the Postdoc to Principal Investigator Transition," *EMBO Reports* 8 (2007): 977–981.
- 43 National Science Board, National Science Foundation, "Chapter 5: Academic Research and Development." In *Science and Engineering Indicators 2006* (Washington, D.C.: National Science Foundation, 2006). The White House, Office of the Press Secretary, "Fact Sheet: A Historic Commitment to Research and Education," Press release, April 27, 2009, available at http://www.whitehouse.gov/the_press_office/Fact-Sheet-A-Historic-Commitment-To-Research-And-Education/.

- 44 Marc Goulden and Mary Ann Mason, "Doctoral Student Career and Life Survey" (UC Berkeley, 2006), available at <http://ucfamilyedge.berkeley.edu/grad%20life%20survey.html>.
- 45 Ibid.
- 46 Karie Frasch, Marc Goulden, and Mary Ann Mason, "University Family Accommodations Policies and Programs for Researchers Survey" (UC Berkeley, 2008), available at <http://ucfamilyedge.berkeley.edu/AAU%20Family%20Friendly%20Policies%20Survey.html>. Karie Frasch, Marc Goulden, and Mary Ann Mason, "Federal Agency Grants, Contracts, and Family Accommodation Policies and Programs Survey" (UC Berkeley, 2008), available at <http://ucfamilyedge.berkeley.edu/Federal%20Agency%20Survey.html>.
- 47 Office of Management and Budget, "Cost Principles for Educational Institutions," *OMB Circular A-21* (Washington, DC: Author, August 8, 2000), p. A-21.
- 48 We received completed surveys from 56 of the 62 AAU institutions (90 percent), and searched policy documents for the remaining six.
- 49 F. Cunningham and others, *Williams Obstetrics: Twenty Third Edition* (McGraw-Hill Professional, 2009).
- 50 California: http://www.edd.ca.gov/Disability/About_the_Program.htm. New York: <http://ww3.nysif.com/Home/DisabilityBenefits/AboutDisabilityBenefits.aspx>. New Jersey: <http://lwd.dol.state.nj.us/labor/tidiindex.html>
- 51 PL. 103-3 (February 5, 1993).
- 52 Karie Frasch. "Re: Data point on postdocs," Email to Fae Korsmo, Senior Advisor, Office of the Director, National Science Foundation, September 11, 2009.
- 53 "Ruth L. Kirschstein National Research Service Award," available at <http://grants.nih.gov/training/nrsa.htm>.
- 54 "Revised NIH Parental Leave for Policy for the Ruth L. Kirschstein NRSA Awards," available at <http://grants1.nih.gov/grants/guide/notice-files/NOT-OD-08-064.html> (released April 10, 2008).
- 55 AAAS Fellows receive a stipend, travel and relocation allowances, professional development support, and funds for health insurance. Information available at http://fellowships.aaas.org/05_Support/05_index.shtml
- 56 "ADS Chapter 303 Grants and Cooperative Agreements to Non-Governmental Organizations" available at <http://www.usaid.gov/policy/ads/300/303.pdf> (last updated April 10, 2009).
- 57 "Terms and Conditions of NIH Grant Awards" available at http://grants.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part4.htm (last reviewed December 1, 2003).
- 58 Office of Management and Budget. *Cost Principles for Educational Institutions (OMB Circular A-21)*. Section J, General Provisions for Selected Items of Cost, Part 10, Compensation for Personal Services. (Washington, DC: Author, August 8, 2000).
- 59 University of Pennsylvania Almanac Journal of Record, Opinion, and News, "Revision to the Policy for Postdoctoral Trainees Regarding New Child Leave," available at <http://www.upenn.edu/almanac/volumes/v55/n01/postdoc.html#4>
- 60 For more information on this analysis contact Marc Goulden at goulden@berkeley.edu.
- 61 Centers for Disease Control and Prevention, "Final Exclusive Breastfeeding Rates by Sociodemographic Factors, Among Children Born in 2005," available at http://www.cdc.gov/breastfeeding/data/NIS_data/2005/socio-demographic.htm and http://www.cdc.gov/breastfeeding/data/NIS_data/2005/socio-demographic_any.htm
- 62 Sylvia Guendelman and others, "Juggling Work and Breastfeeding: Effects of Maternity Leave and Occupational Characteristics," *Pediatrics* 123 (1) (2009): 38-46. Sylvia Guendelman and others, "Maternity Leave in the Ninth Month of Pregnancy and Birth Outcomes Among Working Women," *Women's Health Issues* 19 (1) (2009): 30-37. Lawrence Berger, Jennifer Hill, and Jane Waldfogel, "Maternity leave, early maternal employment and child health and development in the US," *The Economic Journal* 115 (501) (2005): 29-47.
- 63 U.S. Department of Energy, "Work Life Policy Statement for Basic Energy Sciences researchers," available at http://www.sc.doe.gov/bes/WL_policy.html
- 64 "ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers," available at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383 (last updated September 14, 2009).
- 65 "Research on Gender in Science and Engineering," available at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5475 (last updated August 14, 2009).
- 66 "COACH," available at <http://coach.uoregon.edu/>.
- 67 "WISH-net: Women in Science and Healthcare Mentoring Network," available at <http://wish-net.od.nih.gov/>.
- 68 "AWIS: Association for Women in Science," available at <http://www.awis.affiniscap.com/displaycommon.cfm?an=1&subarticlenbr=230>.
- 69 "Research Supplements to Promote Re-Entry into Biomedical and Behavioral Research Careers," available at <http://grants1.nih.gov/grants/guide/pa-files/PA-08-191.html>.
- 70 Title IX, *Education Amendments of 1972*, Title 20 U.S. Code Sections 1681 et seq.
- 71 Ibid.
- 72 20 U.S.C. § 1682 (Title IX provides that "[e]ach Federal department and agency which is empowered to extend Federal financial assistance to any education program or activity, by way of grant, loan, or contract . . . is authorized and directed to effectuate [Title IX]. . . by issuing rules, regulations, or orders of general applicability.") By contrast, the EEOC, responsible for enforcing Title VII, does not have the authority to make legislative rules or regulations under Title VII. The EEOC can issue interpretive guidance, but the guidance receive less deference by courts reviewing the guidance than would a rule or regulation.
- 73 Executive Order 12250 requires the Department of Justice to coordinate the enforcement of a number of civil rights statutes, including Title IX, that prohibit discrimination by recipients of federal grant assistance. The Coordination and Review Section of the DOJ's Civil Rights Division is responsible for ensuring that federal agencies consistently and effectively enforce Title IX.
- 74 Department of Education; Department of Agriculture; Department of Energy; Department of Health and Human Services, available at <http://www.usdoj.gov/crt/cor/coord/t9final.php>. The Department of Energy replaced its previous regulations with the provisions of the common rule in 2001, 10 CFR 1040.21, available at <http://www.usdoj.gov/crt/cor/byagency/doeix.php>.
- 75 Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance; Final Common Rule, 65 Fed. Reg. 52,857 (August 30, 2000).
- 76 National Science Foundation: 45 C.F.R. 618.530; 45 CFR 86.57 (Department of Health and Human Services, including NIH); 10 CFR 1040.53 (Department of Energy).
- 77 "Procedures for Complaints of Employment Discrimination Filed Against Recipients of Federal Financial Assistance," 28 C.F.R. § 42.604.
- 78 "Placement Guidance: Unlawful Disparate Treatment of workers with Caregiving Responsibilities," available at <http://www.eeoc.gov/policy/docs/caregiving.html> (last updated April 22, 2009).
- 79 Government Accountability Office, "Gender Issues: Women's Participation in the Sciences Has Increased, but Agencies Need to Do More to Ensure Compliance with Title IX" (GAO-04-639, July 2004), available at <http://www.gao.gov/new.items/d04639.pdf>.
- 80 Ibid.
- 81 "Title IX Compliance Reviews--HSF FAQ," available at http://www.nsf.gov/od/oeo/freq_questions.pdf (last updated December 9, 2005).
- 82 National Science Board, National Science Foundation, "Chapter 4: Research and Development: National Trends and International Linkages." In *Science and Engineering Indicators 2008* (Washington, D.C.: National Science Foundation, 2008).
- 83 "Administrative Matters," available at http://www.nserc-crsng.gc.ca/Professors-Professeurs/FinancialAdminGuide-GuideAdminFinancier/AdminMatters-QuestionAdmin_eng.asp.
- 84 European Molecular Biology Association, "Family-Friendly, Flexible and Far-Reaching," Press release, June 22, 2004, available at http://www.embo.org/documents/press04/family_flexible.pdf.
- 85 "Workers on parental leave to receive subsidies for up to 6 months," available at http://findarticles.com/p/articles/mi_qa5478/is_200905/ai_n31965854/.
- 86 "An Overview and Agenda for Change," available at <http://www.interacademycouncil.net/Object.File/Master/11/039/2.%20An%20overview%20agenda%20for%20change.pdf>. "Principles of Strategic Science and Technology Policy," available at <http://www.scj.jp/en/vision2050.pdf> (last updated April 2005).

- 87 Marc Goulden, Karie Frasch, and Mary Ann Mason, "UC Postdoctoral Scholar Career and Life Survey" (UC Berkeley, 2008), available at <http://ucfamilyedge.berkeley.edu/UC%20Postdoctoral%20Survey.html>.
- 88 Ibid.
- 89 National Science Foundation, "Survey of Doctorate Recipients, Sciences." For more information on this analysis contact Marc Goulden at goulden@berkeley.edu.
- 90 Ibid.
- 91 For a full copy of the regression results, contact Marc Goulden at goulden@berkeley.edu.
- 92 Susan Hosek and others, "Gender Differences in Major Federal External Grant Programs." In *Technical Report of the Rand Infrastructure, Safety, and Environment*. (Santa Monica, CA: Rand Corporation, 2005).
- 93 Jonathan Grant and Lawrence Low., "Women and Peer Review: An Audit of the Wellcome Trust's Decision Making on Grants." (London: Wellcome Trust, 1997). M. Blake and I. La Valle, "Who Applies for Research Funding? Key Factors Shaping Funding Application Behaviour Among Women and Men in British Higher Education Institutions" (London: National Centre for Social Research, 2000).
- 94 "NIH Success Rates," available at http://report.nih.gov/success_rates/index.aspx (last updated on September 1, 2009); "Funding Rate by State an Organization from FY2007 to 2008 for NSF," available at <http://dellweb.bfa.nsf.gov/awdfr3/default.asp>.
- 95 Marc Goulden, Karie Frasch, and Mary Ann Mason, "Academic Researcher Climate Survey" (Berkeley, CA: UC Berkeley, 2009), available at <http://ucfamilyedge.berkeley.edu/UCB%20Academic%20Staff%20Survey.html>.
- 96 See our University of California doctoral student career and life survey powerpoint presentation, slide 19, "Elongating Career Timelines," Available at <http://ucfamilyedge.berkeley.edu/>, under "What's New?"
- 97 Mary Ann Mason and Marc Goulden, "UC Work and Family Survey" (UC Berkeley, 2002-2003). Mary Ann Mason, Angelica Stacy, Marc Goulden, Carol Hoffman, and Karie Frasch, "University of California Faculty Family Friendly Edge: An Initiative for Tenure-Track Faculty at the University of California" (Berkeley, CA: UC Berkeley, 2005), available at <http://ucfamilyedge.berkeley.edu>.
- 98 Ibid.
- 99 Robert Drago and others, "Bias Against Caregiving: Faculty Members Rarely Take Advantage of Family-Friendly Workplace Policies. What Are We So Afraid Of?" *Academe* 91 (5) (2005): 22-25. Joan Williams, *Unbending Gender: Why Family and Work Conflict and What to Do About It* (Oxford: Oxford University Press, 2000). Joan Williams, "Hitting the Maternal Wall," *Academe* 90 (2004): 8-12.
- 100 Sheldon Zedeck, Angelica Stacy, and Marc Goulden, "UC Berkeley Faculty Climate Survey" (Berkeley, CA: UC Berkeley, 2009), available at <http://ucfamilyedge.berkeley.edu/UCB%20Faculty%20Climate%20Survey.html>.
- 101 "NIH Data Book," available at <http://report.nih.gov/ndb/index.aspx> (last updated September 1, 2009).
- 102 Mary Ann Mason, Angelica Stacy, Marc Goulden, Carol Hoffman, and Karie Frasch, "University of California Faculty Family Friendly Edge: An Initiative for Tenure-Track Faculty at the University of California" (Berkeley, CA: UC Berkeley, 2005).
- 103 For more information, see for example: American Council on Education, Office of Women in Higher Education, "An Agenda For Excellence: Creating Flexibility in Tenure-Track Faculty Careers" (Washington, D.C.: American Council on Education, 2005). The Women in Science and Engineering Leadership Institute at the University of Wisconsin at Madison website: <http://wiseli.engr.wisc.edu/#url>. The Center for Worklife Law: <http://www.worklifelaw.org/>. The Sloan Work and Family Research Network at Boston College: <http://wfnetwork.bc.edu/>. Karie Frasch and others, "The Devil is in the Details." In Jamie Lester and Margaret Sallee, eds., *Establishing the Family Friendly Campus* (Sterling, VA: Stylus, 2009): 88-104.
- 104 "Frequently Asked Questions, Policies Related to Parental Leave and Child Care," available at http://grants.nih.gov/training/faq_childcare.htm (last updated October 4, 2007).
- 105 "Primary Caregiver Technical Assistance Supplements," available at <http://www.niaid.nih.gov/ncn/training/pctas.htm> (last updated April 3, 2009).
- 106 "Frequently Asked Questions, Policies Related to Parental Leave and Child Care," available at http://grants.nih.gov/training/faq_childcare.htm (last updated October 4, 2007).
- 107 Ibid.
- 108 "Research Supplements to Promote Re-Entry into Biomedical and Behavioral Research Careers," available at <http://grants.nih.gov/grants/guide/pa-files/PA-08-191.html> (last updated May 8, 2009). "Supplements to Promote Reentry into Biomedical and Behavioral Research Careers," available at <http://www.nlm.nih.gov/ep/grantsupreentry.html> (last updated July 17, 2008). "Mentored Career Development Award to Promote Faculty Diversity/Re-Entry in Biomedical Research (K01)," available at <http://grants2.nih.gov/grants/guide/rfa-files/RFA-HL-10-012.html>.
- 109 The White House, Office of the Press Secretary, "President Obama Announces White House Council on Women and Girls," Press release, March 11, 2009, available at http://www.whitehouse.gov/the_press_office/President-Obama-Announces-White-House-Council-on-Women-and-Girls/.
- 110 Gretchen Vogel., "A Day in the Life of a Topflight Lab," *Science* 285 (5433) (1999): 1531-1532. Betsy Mason. "U.S. Postdocs: Young, Gifted ... Broke," *Nature* 428 (2004): 690-691.

Acknowledgments

This report was prepared with the joint support of the Center on Health, Economic & Family Security at the University of California Berkeley School of Law and the Center for American Progress. We would like to thank Kathleen Christensen and the Alfred P. Sloan Foundation for their generous financial sponsorship of this project over the last three years. We would also like to thank Ann O’Leary for her support of the project and very useful guidance and suggestions throughout; Robert Berdahl for his assistance in surveying the 62 AAU institutions, the staff at the 10 federal granting agencies who completed the federal agency survey; Nicholas Wolfinger for his support with statistical analyses that are included in the report; Sharon Page-Medrich for her invaluable research and technical assistance; Angela Clements for her excellent research and writing on Title IX; and members of our advisory group, who have given us helpful comments and insights with the ideas contained in this report (in particular Andrew Szeri and Joe Cerny who offered detailed edits to the report).

About the authors

Marc Goulden is the Director of Data Initiatives in Academic Affairs at the University of California, Berkeley.

Karie Frasch is an academic researcher and policy analyst at the University of California, Berkeley. She is currently the Manager of the UC Family Friendly Edge projects.

Mary Ann Mason is a Professor and Co-Faculty Director of the Berkeley Law Center on Health, Economic, and Family Security at the University of California, Berkeley.

About the Center for American Progress

The Center for American Progress is a nonpartisan research and educational institute dedicated to promoting a strong, just and free America that ensures opportunity for all. We believe that Americans are bound together by a common commitment to these values and we aspire to ensure that our national policies reflect these values. We work to find progressive and pragmatic solutions to significant domestic and international problems and develop policy proposals that foster a government that is “of the people, by the people, and for the people.”

Center for American Progress



Center for American Progress
1333 H Street, NW, 10th Floor
Washington, DC 20005
Tel: 202.682.1611 • Fax: 202.682.1867
www.americanprogress.org

About the Berkeley Center on Health, Economic & Family Security, UC Berkeley School of Law

The mission of the Berkeley Center on Health, Economic & Family Security (Berkeley CHEFS) is to address the increasing insecurity faced by American workers and families through the development of integrated and interdisciplinary policy solutions. The economic security of American families is a growing national concern, but policy proposals to address the needs of working families with regard to health security, economic security, and work-family security are too often advanced separately. With faculty experts in law, social welfare, public health, political science, public policy, medicine, and economics, Berkeley CHEFS initiates robust dialogue and research aimed at developing policy recommendations to assist the engineering of legislative, institutional, and regulatory reforms.

BerkeleyLaw

UNIVERSITY OF CALIFORNIA

Berkeley Center on Health,
Economic & Family Security

Berkeley Center on Health, Economic & Family Security
UC Berkeley School of Law
2850 Telegraph Avenue, Suite 500
Berkeley, CA 94705-7220
Tel: 510.642.8527 • Fax: 510.643.7095
www.law.berkeley.edu/chefs.htm

The footer of the page features a decorative graphic consisting of a blue background with white stars and stripes, reminiscent of the American flag, curving across the bottom.