Report of the Task Force on the Status of Women Faculty in the Natural Sciences and Engineering at Princeton

Submitted to President Shirley Tilghman on 3/27/03

Virginia Zakian, Molecular Biology, Task Force Chair
Bruce Draine, Astrophysical Sciences
Lin Ferrand, Associate Dean of the Faculty
Joan Girgus, Psychology
Ruby Lee, Electrical Engineering
Christina Paxson, Economics and Woodrow Wilson School
Catherine Peters, Civil and Environmental Engineering
Dan Rubenstein, Ecology and Evolutionary Biology
Sandra Troian, Chemical Engineering
Suzanne Walker, Chemistry
Bess Ward, Geosciences

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Executive Summary

In the fall of 2001, President Shirley Tilghman appointed a Task Force to investigate the status of women faculty in Science and Engineering and to make recommendations that would enable Princeton to reach the long-term goal of a faculty which reflects the gender profile of the student body. The Task Force collected data from: the University's Personnel and Registrar's databases; an on line survey of current and former faculty perceptions of their Princeton experiences; departments and department chairs; and conversations with individual faculty. This report identifies a set of issues pertaining to the lives of women faculty in Science and Engineering, describes our analyses of the data relevant to those issues, and proposes recommendations designed to move Princeton forward to greater inclusion of women.

Representation and hiring of women faculty in Science and Engineering. In 1992, 8.4% of the faculty in Science and Engineering were women; by 2002, this percentage had increased to 13.9%. During this same period, the percentage of tenured women increased from 6.0% to 12.7%. In 1992, eight of the 13 Science and Engineering departments had no tenured women (and four departments had no women faculty at all); in 2002, only one of the now 14 Science and Engineering departments had no tenured women. This overall progress is unevenly reflected in the individual Science and Engineering departments: only nine of the departments had more women faculty in 2002 than they had 10 years earlier. Furthermore, the overall percentages of women continue to be quite low, as do the percentages in each department. Only in Ecology and Evolutionary Biology and in Psychology are the faculty more than 20% female. An analysis of women receiving Ph.D.'s in fields taught at Princeton showed that five of the 14 Science and Engineering departments substantially underutilized the available talent in their hiring over the last decade.

Perceptions of Princeton's recruitment, hiring, tenuring, and promotion practices and policies differ between men and women faculty. In the survey, women were much less likely than men to think women are advantaged in these processes (5.0% versus 46.5%), and much more likely than men to think women are disadvantaged (40.0% versus 7.1%).

Tenure, promotion, and retention. Analysis of tenure rates for assistant professors hired in the Science and Engineering departments between 1980 and 1994 showed that, overall, women were granted tenure at a somewhat higher rate than men (37% versus 29%). This difference is driven entirely by the fact that tenure rates are very low in Mathematics and Physics, which have large numbers of assistant professors but small numbers of women. When Mathematics and Physics are removed from the analysis, the tenure rates for men and women are essentially equal.

Analysis of time to promotion showed that women have slightly longer times to tenure than men but the difference is not significant[1] (although the small number of women limits the power of statistical tests). On the other hand, the time between promotion to associate professor and

[1] Unless otherwise indicated, throughout the report, differences are said to be significant if the p-value on the associated statistical test is 5% or less.

promotion to full professor is longer for women than for men (by 1.4 years on average). This gender difference in time to promotion for associate professors is significant at the 8.8% level.

Women who are full professors in Science and Engineering leave the University at rates higher than their male peers (2.2% versus 1.4% per year), although the number of female faculty involved is too small for statistical analysis. According to the current and former faculty survey, after corrections for rank and number of years at Princeton, women are 9.8 percentage points less likely than men to receive an outside offer, a difference that is not statistically significant. Men and women are equally likely to experience a retention effort by the University upon receipt of an outside offer.

University and departmental leadership. Although the gender makeup of the senior administration positions that impact Science and Engineering has changed dramatically over the last two years (currently the President, the Provost, the Dean of the College, and the Dean of Engineering and Applied Science are women), the leadership in the Science and Engineering departments continues to be largely male. Only two departments have had women chairs (Geosciences, 1988-91 and Psychology, 1992-present). This picture was also reflected in the survey data, with men and women faculty reporting similar levels of service on University committees or in University leadership positions but tenured men reporting significantly more frequently than tenured women that they have served on an important departmental committee or in a department leadership position (91% versus 67%). Senior women also hold a smaller percentage of endowed chairs than their presence in the faculty would warrant: in 2002, women comprised 12.7% of the tenured faculty but held only 5.7% of the endowed chairs.

Compensation and resource allocation. Extensive analyses by an outside consultant of the salary data for the last 10 years showed no significant differences between the salaries of women and men, once years since Ph.D., departmental affiliation, and rank are taken into account. The fact that women have slightly lower salaries than men (a mean difference of –3.5% over the ten year period) when rank is not included in the analyses is probably explained, in large part, by the fact that women have longer times to promotion to both associate and full professor.

In the survey of current faculty, more men than women thought they had “better than average” overall resources (15.7% versus 5.1%) such as space and start up funding while more women than men thought they had “worse than average” resources (25.6% versus 6.6%). In contrast, women and men perceived their teaching, advising, and department committee workloads to be equal. Both the Task Force and department managers devoted considerable time and effort to gathering data about the allocation of resources and workloads. In the end, fairly complete data were available from only five departments. It was clear to the Task Force that systematic information about the allocation of departmental resources and workloads was not readily available, even though these factors almost surely have a major impact on the success of faculty. The data for the five departments for which fairly complete information was available, were sufficiently complex and individualistic to suggest that analyses are best done on a department by department basis.

Climate. In the survey data, approximately 50% of currently tenured faculty in Science and Engineering (both men and women) reported having been mentored as assistant professors.

However, among both currently untenured faculty and former faculty who were untenured when they left Princeton, the percentages were quite different: in these groups, approximately 64% of the men but only 33% of the women reported receiving mentoring. Survey respondents – male and female, former and current faculty – overwhelmingly reported that mentoring is valuable.

At Princeton, both men and women assistant professors are allowed to request a one year extension of their time as an assistant professor for the birth or adoption of a child, and any faculty member who is the primary caregiver of a newborn can request a semester of workload relief from classroom teaching and administrative duties. During the last five years, six men and one woman in Science and Engineering requested a tenure extension. Thus, during this time, when women were 23% of the assistant professors, they requested and received only 14% of the tenure extensions. There is considerable ambivalence about the tenure extension policy as currently implemented. In the survey, women faculty who had younger children while at Princeton were slightly more likely than similarly situated men to view tenure extensions as beneficial (56% versus 47%), but were much more likely than their male colleagues to view such extensions as detrimental (27.8% versus 3.8%). During the last four years, seven men and six women in Science and Engineering requested workload relief (about half were assistant professors and half were associate professors). During this time, then, when women were 23% of the assistant and associate professors, they received 54% of the workload reliefs.

The survey also asked current and former faculty whether they had experienced problems with day care: 38% of men and 54% of women who had pre-school-age children while at Princeton reported that they had "somewhat," "moderate," or "substantial" problems. The last question on the survey asked respondents what changes at Princeton would make a significant impact on the climate for women. While hiring more women was the most frequent suggestion, improving day care options was the second most frequent. About 45% of men and women with young children while at Princeton reported having some conflicts between the schedule for faculty meetings or seminars and childcare hours, with women more likely than men to report such conflicts.

In the survey, approximately 24% of the women faculty in Science and Engineering reported that their colleagues "occasionally" or "frequently" engage in unprofessional behavior on gender-related matters; a similar percentage reported that their colleagues "occasionally" or "frequently" exclude women. These rates are much higher than those reported by men (5.1% and 2.0% as compared to 24% and 24%). Moreover, men in the Physical Sciences and Engineering (where there are fewer women) were much more likely than men in the Life Sciences to say that faculty members in their departments "never" engage in unprofessional behavior on gender-related matters (56% versus 23%), even though the responses of the women in these two groups were very similar (30% and 28%). Women faculty rated their departments as being less collegial than men did: 29% of women and 52% of men rated the collegiality in their departments as "very good." Here too there were differences between the Physical Sciences and Engineering and the Life Sciences: 22% of the women in the Physical Sciences and Engineering rated collegiality in their departments as "poor" while 0% of the women in the Life Sciences gave this response (less than 1% of the men in both groups rated collegiality as "poor"). Women faculty are also less satisfied with their jobs than men are: 39% of women versus 63% of men reported being "very satisfied," while 7.3% of women and 0% of men reported being "very dissatisfied." The gender

difference in job satisfaction is significantly larger among tenured than among untenured faculty members, which mirrors findings at other universities.

Recommendations. The following are the major recommendations from the Task Force. The Task Force believes that implementation of these recommendations, along with a number of smaller, but still important, additional recommendations listed in the report, will substantially improve the situation for women faculty – indeed for all faculty – in Science and Engineering over the coming decade.

Hire more women. The Task Force recommends that the University hire more women faculty in Science and Engineering with the goal that in ten years women comprise at least 20% of the faculty in both the Physical Sciences (Astrophysics, Chemistry, Geosciences, Mathematics, and Physics) and Engineering, and 40% of the faculty in the Life Sciences (Ecology and Evolutionary Biology, Molecular Biology, and Psychology). We believe these goals are ambitious but achievable. In order to reach them, we estimate that approximately half of the appointments in the Life Sciences and a quarter of the appointments in Engineering and the Physical Sciences will have to be women over the coming decade. Although this will not be easy, especially for those departments in the Physical Sciences and Engineering that have small pipelines, these hiring rates do not differ enormously from the rates of the past ten years. To reach these goals, women must be hired at rates that are 1.4 (Life Sciences), 1.5 (Engineering and the Physical Sciences other than Mathematics and Physics), and 1.6 (Mathematics and Physics) times greater than in the preceding decade.

Provide financial incentives to hire women. The Task Force recommends that a ten million dollar Women in Science and Engineering Fund (WSEF) be created for use in the recruitment and retention of women faculty over the next decade. The Task Force specifically recommends that the WSEF return to the department an amount equal to one half the departmental contribution to the start up costs whenever a woman faculty member is hired; this money is intended to be used to support research in the department. Although the most frequent recommendation for improving the situation for women at Princeton, both from men and women, was to hire more women, there are currently no incentives for individual departments to focus special attention on identifying and recruiting well qualified women scientists and engineers. We hope the WSEF will provide such incentives.

Facilitate flexible hiring practices. The Task Force recommends that the University continue, and if necessary expand, its existing programs to loan faculty lines to departments that have opportunities to hire women but lack the faculty lines to do so. These lines should remain with the departments until the faculty members leave the university.

The Task Force also recommends that, when faculty are being recruited, the University take an active role in helping their spouses find suitable positions, including making new faculty lines available for recruiting qualified spouses. This is especially important for the recruitment of women faculty. Men and women faculty have a similar probability of being married, but 100% of married women faculty have working spouses, with 85% married to someone who works fulltime, while 70% of married men faculty have working spouses, with 48% of their spouses working fulltime.

Appoint a Special Assistant to the Dean of the Faculty. The Task Force recommends that a tenured member of the Science and Engineering faculty be appointed as a Special Assistant to the Dean of the Faculty to help the administration and the Science and Engineering departments implement the recommendations in this report.

Make the University a more family-friendly environment. The Task Force recommends that the University provide affordable child care on campus for faculty, staff, post doctoral fellows, and graduate students, subsidized on a sliding scale based on family income.

The Task Force recommends that all assistant professors who become parents automatically receive a one-year tenure extension (with the understanding that the faculty member would retain the right to come up for tenure earlier).

The Task Force recommends that faculty, research and technical staff, and post doctoral fellows who are the primary care givers of young children be given preference for University housing and parking.

Improve department and University policies and practices. The Task Force recommends that each department develop a mentoring program for assistant professors. The Special Assistant to the Dean of the Faculty should be charged with providing departments with information about mentoring practices at Princeton and elsewhere.

The Task Force recommends that the University explicitly assess the gender equity position and policies of individuals being considered for appointment or reappointment as department chairs or as directors of programs, institutes, or centers.

The Task Force recommends that the University work toward greater representation of women among department chairs, and that departments work toward greater representation of women in leadership positions.

The Task Force recommends that departments and the Dean of the Faculty conduct an automatic review of all associate professors in the beginning of their fifth year as associate professor.

The Task Force recommends that the University and departments consistently publicize, observe, and enforce Princeton's policies regarding abuse of power and sexual misconduct.

Ensure equity in compensation and resource allocation. The task force recommends that the University eliminate altogether the small gender gap in salaries. The task force further recommends that the compensation analysis be updated annually.

The task force recommends that a streamlined process be developed to gather data on the distribution of departmental resources and workloads, and that the Dean of the Faculty review these data yearly with each department chair with the goal of maintaining equity.

Report of the Task Force on the Status of Women Faculty in the Natural Sciences and Engineering at Princeton

I. The Goals of the Task Force

In January 2001, the representatives of nine research universities[2] met at MIT to discuss the status of women in their Science and Engineering departments. At the end of the meeting, the presidents and provosts of the nine universities issued a statement that said, in part, "Institutions of higher education have an obligation, both for themselves and for the nation, to fully develop and utilize all the creative talent available. We recognize that barriers still exist to the full participation of women in Science and Engineering." They pledged to work towards the full inclusion of women within these disciplines. In response to this pledge, in fall 2001, newly elected Princeton University president Shirley Tilghman commissioned a Task Force on the Status of Women in the Natural Sciences and Engineering to help the President and Dean of the Faculty develop a long term strategy to attract and retain highly talented women faculty in these areas. The Task Force was asked to collect and analyze data on the status of women faculty in Science and Engineering and to make policy recommendations for initiatives that would lead to the long-term goal of the faculty reflecting the gender profile of the student body.[3]

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Although the Task Force was not asked to articulate the case for increasing the representation of female faculty in Sciences and Engineering, here we list some of the reasons why doing so is important.

- To fulfill our educational mission for undergraduates. Roughly half of Princeton's undergraduates are women. In 2001, the Undergraduate Student Government's committee on women's issues used an anonymous survey to gauge the concerns of undergraduate women at Princeton. "When asked how the academic environment could be improved for women, the overwhelming response is demand for more female professors."[4] The small number of women faculty in the School of Engineering was noted as a particular problem in the USG report. Our Task Force found that in at least some departments, women are particularly sought after as undergraduate research advisors. For example, in Electrical Engineering, the mean cumulative number of senior independent research projects from 1999-02 was 13.50 for female faculty and 5.53 for male faculty. In the 2001 Undergraduate Student government's report on women's issues, Princeton undergraduates repeatedly articulated the need for women role models. The following quotes are taken from that report:

[2] California Institute of Technology, Harvard University, Massachusetts Institute of Technology, Princeton University, Stanford University, University of California at Berkeley, University of Michigan, University of Pennsylvania, Yale University.

[3] We thank the Survey Research Center for donating their services for the design and implementation of the surveys, the Dean of the Faculty's office for providing the personnel data used in the analyses, the Office of the Registrar for providing student data, the department managers who provided information on resource allocations within their departments, Sandra Johnson for her work with the task force, and Meredith Stone for help in compiling the report.

[4] From 2001 Report on Women's Issues by Princeton University Undergraduate Student Government

"I think that female professors are an important role model for students. Women in positions of such leadership and status show students what they can do, and help to promote the idea that men and women are equal. At Princeton we are all smart enough to know that women can do anything men can do academically, but when there is such a discrepancy in the number of male vs. female professors it suggests that women will not be hired as much as men, and that their work isn't valued as much as men's work. In addition, women bring a different perspective to the classroom that is important in forming a comprehensive education."

"My female professors are my mentors - I look up to them and hope to one day be like many of them - they make me feel like I, too, can achieve greatness and success."

"We need more female professors. Look at the departments with higher numbers of female profs, there is a direct correlation here with higher numbers of female majors. The only way to break the traditional association of certain departments with the male gender is to get more female profs in those departments so that female students can see themselves belonging in such disciplines.."

- To fulfill our educational mission for graduate students. Training graduate students is also a critical part of Princeton's educational mission. The scarcity of successful women at Princeton provides a strong, negative message to female students about their chances for success upon graduation. Again, we found that in at least some departments, female faculty are particularly sought after as graduate student advisors: for example, in Molecular Biology, the mean cumulative number of graduate students from 1999-02 was 10.86 for female and 5.63 for male faculty. The importance of role models noted by the undergraduates is surely just as important at the graduate level.

- To increase Princeton's ability to recruit top graduate students and post doctoral fellows. Princeton has strong graduate programs in Science and Engineering. We face fierce competition with other universities to attract the top students. Many of these top candidates are women. Increasing the number of women in our faculty will improve our ability to recruit the best students and post doctoral fellows.

- To improve the climate for women faculty who are already here. The surveys of current and former faculty conducted by the Task Force revealed that women view their departments as being less collegial than do men and express a lower level of satisfaction with their jobs, especially in departments where there are few women. Hiring more women will improve the environment for women who are already at Princeton, making it more likely that they will achieve to their full potential.

- Because it's the right thing to do. A diverse faculty benefits everyone – male and female – students, faculty, and staff.

II. Task Force Activities

The analyses and recommendation in this report are based on work the Task Force did from October 2001 to February 2003. During this time, the Task Force:[5]

- Collected and analyzed information on the representation of women at Princeton using the University's personnel and Registrar's databases
- Analyzed the salaries of Princeton faculty with the aid of an outside consultant
- Obtained information on faculty perceptions of their Princeton experiences by conducting an on-line survey of current faculty in Natural Sciences and Engineering
- Obtained information on the perceptions of former Princeton faculty of their Princeton experiences by conducting an on line survey of former Princeton faculty
- Obtained data from departments on research and work allocations
- Met with department chairs
- Met with individual faculty who requested personal meetings with Task Force members

Appendix B contains reports that summarize the details of our analyses in each of the above areas. Although a few of the analyses (for example, the compensation analysis) were conducted for the entire University, the focus of this report is on Princeton's eight Natural Sciences departments and six Engineering departments (Table 1). The eight Natural Sciences departments are: Astrophysical Sciences, Chemistry, Ecology and Evolutionary Biology, Geosciences, Mathematics, Molecular Biology, Physics and Psychology. In some parts of this analysis, the departments in the Natural Sciences are divided into Life Sciences (Ecology and Evolutionary Biology, Molecular Biology and Psychology) and Physical Sciences (Astrophysics, Chemistry, Geosciences, Mathematics and Physics)[6]. The six Engineering Departments are: Chemical Engineering, Civil and Environmental Engineering, Computer Science, Electrical Engineering, Mechanical and Aerospace, and Operations Research and Financial Engineering.[7]

Table 1. Natural Science and Engineering Departments at Princeton University.

Natural Science Departments		**Engineering Departments**
Life Sciences	**Physical Sciences**	
Ecology & Evolutionary Biology	Astrophysical Sciences	Chemical Engr.
Molecular Biology	Chemistry	Civil and Environmental Engr.
Psychology	Geosciences	Computer Science
	Mathematics	Electrical Engr.
	Physics	Mechanical and Aerospace Engr.
		Operations Research & Financial Engr.

[5] A brief summary of our methods is in Appendix A; details of each analysis are in Appendix B.

[6] This division reflects the fact that for decades women have been well represented in PhD programs in the Life Sciences but continue to be underrepresented in the Physical Sciences. We decided to group Chemistry with the Physical Sciences because although women receive a large fraction of Chemistry PhDs, nationally the fraction of female faculty in Chemistry is more similar to the other Physical Science departments than to Life Sciences departments.

[7] In 1999 Civil Engineering & Operations Research split into two departments (Civil & Environmental Engineering and Operations Research & Financial Engineering). Thus, in the analyses in this report, there were five Engineering departments prior to 1999 and six Engineering departments after that date.

III. Representation of Women Among Princeton Faculty in Science and Engineering

In 1992 a faculty committee, chaired by Professor of Psychology Joan Girgus, studied the status of women in Science and Engineering at Princeton. The committee noted the relatively small number of women faculty in Sciences and Engineering and concluded that "Princeton's ability to maintain its place as a first rank University...will depend in part on our ability to increase these numbers." In this section, we examine the progress made in the Natural Sciences and Engineering in the decade following the Girgus report. There was ample opportunity for change over this decade: of the 324 faculty in Natural Sciences and Engineering in 2002, about 45% came to Princeton between 1992 and 2002.

Information from the University's personnel database was used to determine the total number of women and the total number of tenured women in three "snap shot" years: 1992, 1997, and 2002 (Table 1 and Appendix B1)[8]. These data confirm that in the early 1990's there were few female faculty members in the Natural Sciences and Engineering. In 1992, 8.4% of the 296 faculty in Sciences and Engineering were women: 3.0% in Engineering, 5.8% in Physical Sciences and 24% in Life Sciences. At that time, four of the thirteen departments had no women faculty (Chemical Engineering, Ecology and Evolutionary Biology, Electrical Engineering, Mechanical and Aerospace Engineering); four other departments had no tenured women (Chemistry, Civil Engineering and Operations Research, Mathematics, Physics).

Over the next decade, the number of female faculty in Natural Sciences and Engineering increased 1.8-fold. In 2002, 14% of the 324 faculty were women: 10% in Engineering, 10% in Physical Sciences, and 27% in Life Sciences. Only the recently formed Operations Research and Financial Engineering Department had no women; the remaining 13 departments each had at least one tenured woman. The fraction of tenured women doubled in this period: in 1992 and 2002, women were respectively 6% and 13% of the tenured faculty in Natural Sciences and Engineering. Thus, in the past ten years, the University was nearly successful at ensuring that all Science and Engineering departments have tenured female faculty.

However, the progress of individual departments was quite uneven. The most impressive gains were in Ecology and Evolutionary Biology (from 0 to 29% women faculty) and Chemical Engineering (0 to 17%), while Psychology showed a steady increase in the fraction of women throughout the decade (from 29 to 36%). Four departments had no change in the fraction of women faculty (Astrophysics, Computer Science, Geosciences, Operations Research and Financial Engineering[9]). The lack of change in Computer Sciences was especially disappointing as Computer Science was the department in the Sciences and Engineering that had the largest growth, with the overall size of its faculty increasing 44% over the decade. Another disappointment was Molecular Biology, which showed a steady decline in the fraction of women

[8] Throughout this study, Science and Engineering faculty who held major administrative positions at Princeton during the period of analysis, including President, Provost, Dean of the Faculty, Dean of Engineering, Dean of the Graduate School, and Dean of the College are classed as administrators, not faculty. The rationale for this is that these individuals are not treated as faculty in terms of compensation or in terms of FTEs.

[9] Operations Research and Financial Engineering was only formed in 1999. It had no women in 1999, and none of the five hires between 1999-02 were women.

faculty over the ten year period from 30% in 1992 to 19% in 2002, despite a 15% increase in the overall size of the Molecular Biology faculty. Even though by 2002 all but one Science and Engineering department (Operations Research and Financial Engineering) had women faculty, women were still present in small numbers in most departments: in 2002, women were fewer than 20% of the faculty in all but two of the fourteen Science and Engineering departments (Ecology and Evolutionary Biology and Psychology).

Table 2

Representation of Females in Faculty
Princeton University, October 1992, 1997 and 2002

	Total # Faculty	**Female # (%)**	**Total # Full and Associate Faculty**	**Female # (%)**
Physical Sciences				
92	137	8 (5.8%)	100	4 (4.0%)
97	134	12 (8.9%)	94	5 (5.3%)
02	136	14 (10.2%)	105	11 (10.4%)
Life Sciences				
92	59	14 (23.7%)	42	8 (19.0%)
97	66	16 (24.2%)	52	10 (19.2%)
02	70	19 (27.1%)	54	14 (25.9%)
Engineering				
92	100	3 (3.0%)	77	1 (1.3%)
97	102	8 (7.8%)	86	1 (1.1%)
02	118	12 (10.1%)	92	7 (7.6%)
Humanities				
92	192	51 (26.5%)	138	24 (17.3%)
97	190	50 (26.3%)	152	35 (23.0%)
02	204	62 (30.3%)	148	39 (26.3%)
Social Sciences				
92	166	32 (19.2%)	108	17 (15.7%)
97	162	42 (25.9%)	113	22 (19.4%)
02	172	39 (22.6%)	119	21 (17.6%)

IV. Factors that Impact the Number of Women Faculty at Princeton.

The number of women on the faculty at any time is the result of past practices surrounding hiring, promotion and retention. This section of the report investigates Princeton University's experience in each of these areas in the Natural Sciences and Engineering.

A. Hiring.

Experience over the past decade

Over the past decade, each Science and Engineering department had, in principle, multiple opportunities to hire women: the hiring rates for individual departments in 1991-02 ranged from 3% to over 13% per year.[10] Between 1991 and 2002, 230 faculty were hired in the Natural Sciences and Engineering, approximately 70% as assistant professors. Of these, 19% of the newly hired assistant professors and 20% of the newly hired tenured faculty were women. These data are a composite of very different hiring patterns by individual departments.[11] Two departments hired no women (Astrophysics, 0/3 hired were women; Operations Research and Financial Engineering, 0/5[12]). In six departments, women were fewer than 20% of the newly hired faculty (Chemistry, 2/11; Computer Science, 1/18; Geosciences, 1/10; Mathematics, 11/57; Molecular Biology, 3/18; Physics, 4/41). In five departments, 33% or more of those hired were women (Chemical Engineering, 3/9; Civil and Environmental Engineering, 1/2[13], Ecology and Evolutionary Biology, 5/11; Electrical Engineering, 4/10; Psychology, 7/15).

In any given job search, the probability of hiring a woman is influenced by: (1) the fraction of women in the applicant pool; (2) the fraction of women among those invited for interviews; (3) the fraction of offers to women; (4) the fraction of offers to women that are accepted. Under-representation of women at any of one of these steps will affect a department's ability to increase the number of women on its faculty. There were two factors that made it difficult for the Task Force to assess departments records at each of these levels. First, the University administration only maintains applicant records for successful searches; records are not maintained for searches in which no one was hired. Second, even for successful searches, in many cases, a substantial percentage of applicants are reported by academic departments as 'gender unknown.' As a result, the Task Force could only assess departments' progress in hiring women by examining the fraction of new appointments that went to women.

Pipeline issues

Historically, women have been under-represented in Math and Sciences graduate programs, although their proportion has steadily increased. In addition, the fraction of PhDs that are

[10] Rates were calculated from data obtained from the University's personnel database.

[11] The number and gender of individuals hired at the tenured and assistant professor level in each Science and Engineering department from 1992 to 2002 are presented in Appendix B1.

[12] The Department of Operations Research and Financial Engineering was formed in 1999; this department had no women at that time and none of the five faculty hired since its inception were female.

[13] The Department of Civil and Environmental Engineering was formed in 1999; only two faculty members were hired between 1999 and 2002.

awarded to women varies enormously by discipline.[14] At Princeton in 2002, women were substantially underrepresented (<25%) among the graduate students in seven of the fourteen Science and Engineering departments: Astrophysics (18%), Computer Science (21%), Electrical Engineering (16%), Mechanical and Aerospace Engineering (18%), Mathematics (21%), Operations Research and Financial Engineering (23%), and Physics (12%). The fraction of female graduate students was higher in the remaining departments, ranging from 33% in Chemistry and Chemical Engineering to essentially parity in Civil and Environmental Engineering, Ecology and Evolutionary Biology, Molecular Biology, and Psychology (Appendix B1).

Do pipeline problems account for the hiring patterns observed at Princeton? Unfortunately, it is difficult to assess the size of the "pipeline" to individual departments. An alternative approach is to compare, within each discipline, the fraction of faculty who are female to the fraction of PhD recipients who are female. For each department we computed "Utilization Factors," equal to the fraction of female faculty in 2002 divided by the fraction of PhDs awarded to women *at Princeton* in that department between 1991-96.[15] We used PhD attainment between 1991 and 1996 (rather than more current data) to allow for the lag between the receipt of the PhD and a faculty position. We use recipients of PhDs from Princeton because the gender composition of Princeton's PhD recipients provides a measure of the gender composition in research areas in which Princeton is likely to hire.[16] For comparison, we also computed Utilization Factors using the fraction of women in a given Princeton department divided by the National Science Foundation data on PhD attainment by discipline in the US between 1991 and 1996. If the Utilization Factor is one or nearly one, the fraction of female faculty in that department in 2002 is similar to the fraction of females in the 1991-96 PhD pool. Small Utilization Factors indicate that the department has a small number of female faculty relative to the size of the pool of potential female hires.

Utilization Factors are shown in Table 3. Three groups of departments stand out. The first is a group of five departments with small (less than 0.5) Utilization Factors: Chemistry, Computer Science, Geosciences, Molecular Biology, and Operations Research and Financial Engineering. These results suggest that these five departments are failing to tap into the existing pool of female candidates. The second is a group of seven departments, including

[14] For example, in Psychology, the scientific field where women are the best represented, women received 24% of the PhDs in the US in 1970, 49% in 1985, and 67% in 2000. In Mathematics, a discipline where representation of women is very low, women received 6% of the PhDs in the US in 1970, 15% in 1985, and 25% in 2000. Data are from the National Science Foundation/Division of Science Resources Statistics; http://www.nsf.gov/sbe/srs/nsf02327/sectb.htm

[15] Patterned after analyses by D. J. Nelson, U of OK; "The Nelson Diversity Surveys" 2002.

[16] Although the data set is smaller, we used the numbers at Princeton rather than national data on PhD attainment because many Princeton departments are skewed in terms of the areas of expertise. For example, the Princeton Astrophysics department is more theory-based than Astrophysics nationally while many subfields in psychology (e.g., clinical psychology) are not at all represented in the Princeton Psychology Department but have large numbers of graduate students nationally.

Table 3. 2002 Utilization Factors for Princeton PhDs and US PhDs 1991-1996.

	% Women Faculty	% Women PU PhDs	% Women US PhDs**	Utilization Factor	
Department	**2002**	**91-96**	**91-96**	**Princeton**	**US**
Astrophysics (Table 36)	14.29%	10.17%	16.87%	1.41	0.85
Chemical Engineering (Table 28)	16.67%	18.46%	14.94%	0.90	1.12
Chemistry (Table 37)	10.71%	35.88%	27.22%	0.30	0.39
Civil & Environmental Engineering* (Table 29)	16.67%	12.96%	9.92%	1.29	1.68
Computer Science (Table 46)	7.69%	20.00%	15.59%	0.38	0.49
Ecology & Evolutionary Biology (Table 49)	28.57%	36.84%	40.19%	0.78	0.71
Electrical Engr (Table 30)	11.11%	11.00%	8.44%	1.01	1.32
Geosciences (Tables 42, 41, 43)	11.11%	24.49%	21.15%	0.45	0.53
Mathematics (Table 45)	10.53%	14.10%	20.98%	0.75	0.50
Mechanical & Aerospace Engr (Tables 32, 27)	8.33%	7.69%	5.96%	1.08	1.40
Molecular Biology (Table 49)	19.35%	61.25%	40.19%	0.32	0.48
Operations Res. & Financial Engr*	0.00%	12.96%	NA	0.00	NA
Physics (Table38)	7.89%	8.00%	11.95%	0.99	0.66
Psychology (Table 50)	36.00%	51.02%	62.38%	0.71	0.58

* Used Civil Engr. & Ops. Research % for PU PhDs 91-96. NA = no equivalent NSF tables for ORFE Department.

** **SOURCES:** Table Numbers refer to tables on NSF website below. Tabulated by National Science Foundation/Division of Science Resources Statistics; data from Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Survey of Earned Doctorates. http://www.nsf.gov/sbe/srs/nsf02327/sectb.htm

Astrophysics, Chemical Engineering, Civil and Environmental Engineering, Electrical Engineering, Mathematics, Mechanical and Aerospace, and Physics with high Utilization Factors (0.75 to 1.4). In these departments, female PhDs are grossly underrepresented (<20%) in that discipline both at Princeton and nationally. Thus, while these departments have female faculty in proportion to their representation among PhDs, they have very small pipelines. Long-term

solutions to the low representation of female faculty in these departments will require increases in the number of undergraduate and graduate women receiving degrees in these disciplines. The last group, consisting of only two departments—Ecology and Evolutionary Biology and Psychology—have relatively high Utilization Factors (0.78 and 0.71) and a large pipeline. These two departments have utilized the large existing pool of women PhDs in their disciplines reasonably well, and continuing to do so should result in a faculty that reflects the gender composition of the student body.

The two-body problem

In our conversations with individual faculty (Appendix B8) and our lunches with department chairs (Appendix B7), we heard repeatedly that hiring women faculty is complicated by the fact that most female faculty candidates are married to someone who also has a career. Our survey of current Natural Science and Engineering Princeton faculty revealed that, although men and women have a similar probability of being married, 0% of women faculty have a non-working spouse (compared to 30% of male faculty); 85% of women faculty are married to someone who works fulltime while 48% of men are married to someone who works fulltime. Because female faculty are more likely than male faculty to be married to someone who works fulltime (Table 20, Appendix B4), the ability to identify suitable employment for spouses is especially important for recruiting women faculty. During discussions with individual faculty and department chairs, we heard that the University is not seen by chairs or faculty as doing enough to help solve this "two body" problem. In our lunches with department chairs, several noted that flexibility and resources for spousal placement would help them compete with other universities for women.

Faculty perceptions of hiring and promotion policies

In our survey of current Princeton faculty, we asked respondents whether women are disadvantaged or favored by practices and policies for recruitment, hiring, tenuring and promotion.[17] Men and women have very different responses to this question: 40% of women and 7.1% of men think women are "very" or "somewhat" disadvantaged; 5% of women and 46% of men think women are "somewhat" or "very" favored. In the written comments on the survey[18], a number of men commented that their departments recognize the importance of hiring more women, and that special efforts were made during the recruitment stage to ensure that women candidates were included in the pool. However, two men noted that unless there is a systematic effort to include female candidates, men would always be at an advantage in hiring. In the survey of former Princeton faculty, one man stated that in his department there were no open searches and this put women at a disadvantage in the hiring practice because when men are thinking about who to recruit, other men tend to come to mind. Another man said, "When given a direct question, male faculty would give the impression that women had to do less to be successful. But indirectly, the male faculty said things that clearly indicated that they expected women to do more."

[17] Table 17, Appendix B4

[18] Analysis of the written comments on the survey are presented in Appendix B5.

The survey ended with an opportunity for faculty to provide suggestions about what could be done to improve the climate for women at Princeton. By far, the number one suggestion, by both men and women, was to hire more women. A sample comment from one tenured woman: "Make the department more balanced in terms of women and men. Fifty/fifty would be ideal but at the very least the number of women should be above critical mass. Critical mass is achieved when there are enough women that the department doesn't feel male-dominated. I think critical mass is about 35%."

From our discussions with faculty and department chairs and from the faculty survey, it is clear that a large fraction of the Princeton Science and Engineering community agree that it is desirable to increase the fraction of women faculty in their departments. However, although men and women perceive increasing representation of women as an institutional good, it is our sense that in individual hiring decisions, most faculty do not have a vested interest in hiring women. Rather, other considerations, such as area of expertise and chances for collaboration have a much stronger impact on individual hiring decisions. One of the Task Force's goals was to identify mechanisms that would engender a personal stake among individual faculty to help the University's achieve its perceived obligation to increase the fraction of women faculty.

B. Promotion

Tenure

The representation of women among the senior faculty is affected by the rates at which female assistant professors are tenured. We checked for gender bias in the tenure process by examining whether cohorts of men and women who are hired as assistant professors at Princeton are equally likely to be tenured. Our analysis of the tenuring of assistant professors is based on a sample of assistant professors hired between July 1 1980 and October 1 1994. All members of this group had either been granted tenure or were no longer Princeton faculty members by October 1, 2002.[19] Details are in Appendix B2.

[19] The analysis excludes individuals who were recorded as having left the University in 3 months or less after the date of their appointments, since it is likely that they never took up their positions. We include three individuals who were promoted directly from assistant to full professor. Individuals who left the University after a promotion are included, provided they appeared as an associate or full professor in the personnel database in the October following their promotions.

Overall, men have lower rates of achieving tenure than women: 29% of men and 37% of women hired as assistant professors were eventually granted tenure. This gender difference is driven by the fact that tenure rates are very low in mathematics and physics, which have large numbers of assistant professors but small fractions of women. Within the Life Sciences (Molecular Biology, Ecology and Evolutionary Biology, and Psychology) the tenure rate is 45% for men and 47% for women. Within the Physical Sciences, excluding Mathematics and Physics, 61% of men and 50% of women were granted tenure. Within Engineering, 44% of men and 45% of women were granted tenure. As seen in Fig. 1, there are no significant differences in the tenure rates of men and women once Math and Physics are treated separately.[20]

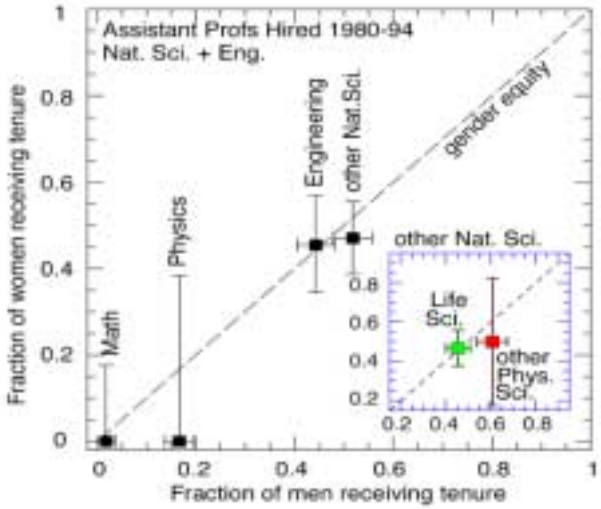


Figure 1. For assistant professors hired 1980-94, points show fractions of men and women receiving tenure in Math, Physics, other Natural Sciences, and Engineering. The error bars show upper and lower bounds on the tenure probabilities for men and women in each of these groups (see footnote 20); the error bars are large because the numbers are small. In all cases the "gender equity" line intersects the error bars, indicating that the actual promotion outcomes are consistent with equal probabilities for male and female assistant professors to receive tenure in each of these four departmental groupings. The inset shows separation of "other Natural Sciences" (see text). For these groups of departments the outcomes are again consistent with no gender bias in promotion outcomes.

[20] The error bars in Fig. 1 indicate the range of tenure probabilities which would be consistent with the actual numbers of men and women receiving tenure. Suppose that there are N candidates, and M received tenure. The best estimate of the tenure probability is P=M/N. We take the upper bound on the probability, P_{max}, to be such that if the true tenure fraction (in an infinite sample) were P_{max}, there would be a 32% chance of drawing M or fewer tenure recipients in a random sample of N candidates. Similarly, the lower bound P_{min} is such that there would be a 32% chance of drawing M or more tenures in a random sample of N.

However, it should be stressed that in some of these department groupings (especially Math and Physics, and other Physical Sciences) the numbers of women are so small that statistical tests have very low power. For example, in Mathematics and Physics roughly 1 in 11 male assistant professors have been tenured. The fact that 0 of 7 female assistant professors have been tenured is consistent with females having a 1 in 11 tenure probability, but is also consistent with women having a zero probability of receiving tenure.

With the caveat that the numbers in some departments are very small, there is no evidence for tenure bias in Natural Sciences or Engineering or in any of the subgroups of Natural Sciences. Although these data do not mean that gender had no impact on the tenure decision of any one person, male or female, the University and its faculty can feel confident that on average males and females are tenured at equal rates.

Time to tenure and promotion[21]

We examined both the time to tenure for assistant professors, and the time to promotion to full professor for associate professors.[22] In both Natural Sciences and Engineering, women have slightly longer times to tenure than do men: 0.69 years longer in Natural Sciences, and 0.23 years longer in Engineering. However, these differences are not statistically significant. Small samples (especially in Engineering) limit the power of the statistical tests.[23]

[21] The details of the time to promotion analysis are presented in Appendix B2.

[22] Our analysis of the time to tenure for assistant professors is based on a sample of assistant professors hired between January 1, 1980 and December 31, 1994. All members of this group had either been granted tenure or departed from the University by October 1, 2002. The analysis of promotion of associate professors is based on a sample of 70 individuals who were associate professors in at least one year between 1980 and 1994 and who had been promoted to full professor within 8 years (96 months) of becoming an associate, plus 2 individuals who were promoted directly from assistant to full professor during the 1980 to 1994 time period. The reason for looking only at promotions that occur within 96 months is that those promoted to the rank of associate in 1994 can only be observed for 8 years (96) months. See Appendix B2 for further details.

[23] Extensions to the tenure clock due to childbirth or adoption do not appear to have a large impact on gender differences in time to promotion. We only have information on extensions between 1977-2002: 2.46% of male assistant professors and 1.35% of female assistant professors in Sciences and Engineering requested tenure extensions each year between 1997-2002.

We found that the average number of years to promotion for associate professors is 1.39 years longer for women than for men (Fig. 2). The gap in promotion rates is largest between 6 and 7 years after appointment to associate professor, by which time nearly 80% of the promotions for males but only 45% of the promotions for females have occurred. This gender difference in time to promotion for associate professors is significant at the 8.8% level.

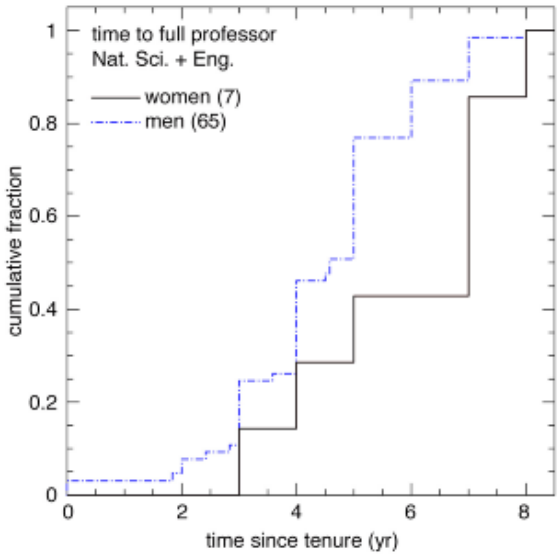


Figure 2. Cumulative fraction promoted to full professor, as function of time since promotion to associate professor, for a sample consisting of those men and women in Natural Sciences and Engineering who were promoted to full professor at Princeton within 8 years of receiving tenure at Princeton (see footnote 22 for sample details). Although the sample is small, the gender difference in time to promotion is statistically significant (see Appendix B2).

Retention[24]

Another parameter that might impact the fraction of women faculty is retention of tenured women. We used the University's personnel database to determine the numbers of departures for male and female full professors from the Natural Sciences and Engineering between 1981 and 2002. We found that the rate of departure for reasons other than retirement or death is 1.4% per year for men and 2.2% per year for women. Unfortunately, the sample of female full professors in Natural Sciences and Engineering is too small to provide a statistically meaningful analysis of these data.

In the survey of current faculty, we asked respondents about outside offers and found that many Princeton faculty, men and women, receive outside offers. Princeton faculty, male or female, can pursue outside offers either because they are interested in leaving Princeton or as a strategy to improve their position at Princeton. Although tenured women faculty are significantly less likely than men to have received an outside offer (50% of women and 71% of tenured men report having received an offer), this difference is in part due to the fact that women have been at Princeton for shorter periods of time than men, coupled with the fact that the probability of having ever received an outside offer while at Princeton increases with the number of years at Princeton. When controls for rank and years at Princeton are included, women are only 9.8 percentage points less likely than men to have received an offer, a difference that is not

[24] The details of analysis of retention data are in Appendix B2.

statistically significant.[25] The survey also found that women and men are equally likely to have experienced a retention effort by the University upon receipt of an outside offer.

Given the difficulty in hiring women in many Science and Engineering departments, it is important that those who are tenured be retained. However, because the sample of senior women in the Natural Sciences and Engineering is so small, we cannot answer a number of important questions regarding retention. For example, we cannot reach general conclusions about whether women are less likely to pursue outside offers simply to improve their status within the University nor, if this is true, if it is related to the fact that women are more likely than men to be married to someone who also has a career. We also do not have data on the reasons why women depart the University nor if these reasons differ from those driving men to accept outside offers.

V. Representation of Women in Positions of Authority Within the University

Department and University leadership positions

The Task Force examined two sources of information on the participation of women in leadership positions: the survey of faculty (Tables 8 and 9, Appendix B4) and, for five departments, departmental administrative records (Appendix B6). These two data sources yielded somewhat contradictory results.

In their responses to the survey, women are significantly less likely than men to report having served on important departmental committees or to have taken leadership positions in their departments (Table 8 in Appendix B4). For untenured faculty, these gender differences are not statistically significant. There are, however, pronounced, statistically significant gender differences among tenured faculty members, who as a group are more likely than untenured faculty to have served in important departmental positions. Of tenured women, 62% report having served on an important committee or leadership position in their department, whereas for tenured men this figure is 89%. This difference remains even among tenured faculty members who have been at Princeton for 13 years or more.

In contrast, men and women report similar levels of service on University committees or leadership positions (Table 9 in Appendix B4). Women and men have similar views about the value of departmental service, but women are more likely than men to view University service favorably (Table 10, Appendix B4). These differences between the responses of men and women are statistically significant. Perhaps University service provides women with more visibility, better connections, or an enhanced understanding of policies and procedures in place at Princeton.

We also queried departments about the distribution of departmental roles such as chair, assistant chair, departmental representative, director of graduate studies, and membership on search committees (Appendix B6). (However, we did not ask either in the survey or of the departments if women are equally represented among search committee heads; in hindsight this is an important question.) Although we analyzed data from only the five departments for which

[25] Table 18, Appendix B4

complete data were available, in these five departments, with the exception of department chairs, women are well represented in departmental roles. The only robust difference was in Molecular Biology, where women are disproportionately represented on search committees.

There are (at least) four reasons why the survey and administrative data yield somewhat different results. First, the survey represents women from all fourteen Science and Engineering departments, whereas the administrative records are for only a subset of five departments. Second, the definition of "leadership position" used in the analysis of administrative records may differ from the self-defined concept used by survey respondents. Third, the survey asks about whether an individual has ever served in a leadership position, whereas the department records look at recent experience. It is possible that leadership positions have recently become more accessible to women. Fourth, department records and/or faculty memories may be inaccurate or incomplete.

Department chairs

The results of the faculty survey and conversations as well as the experiences of individual Task Force members suggest that department chairs are the single most powerful influence in determining the departmental climate for women. However, only two Science and Engineering departments have had woman chairs. Since 1992, the chair of Psychology has been a woman (Nancy Cantor, 1992-96; Joan Girgus 1996-02; Deborah Prentice 2002-date). Alexandra Navrotsky was chair of Geosciences from 1988-91.

Major University administrative positions that impact Science and Engineering

The gender makeup of the Princeton administration has changed dramatically over the past two years with women well-represented among positions that most impact Science and Engineering. In June 2001, Shirley Tilghman was named University President and Amy Gutmann was named Provost, the first women to hold these positions. In January 2003, Maria Klawe became Dean of the School of Engineering and Applied Science, again the first woman to hold this position. There has been one female Dean of the Faculty, Amy Gutmann, who held the position from 1995-96. The Dean of the College has been a woman since 1977. Joan Girgus, the first female Dean of the College, held the position from 1977-87; Nancy Malkiel has held this position since 1987. Nina Garsoian, the only woman to hold the position, was Dean of the Graduate School from 1977-79.

Endowed chairs and other honors

Although Princeton faculty with endowed chairs do not generally receive additional funds for salary or research support, these honorifics add to an individual's professional stature both within Princeton and in the larger scientific/engineering community. In 1992, when women comprised 5.9% of the tenured faculty in Science and Engineering, they held two of the 53 (3.8%) endowed chairs in the Natural Sciences and Engineering. In 2002, when women were 13% of the tenured faculty in Sciences and Engineering, there were seventy endowed chairs, four (5.7%) held by women.[26]

In our survey of the faculty, we asked respondents if, to their knowledge, they had been nominated by their department or the University for an internal or external honor or award. Although the differences between the responses of men and women to this question are not significant, when asked if they believe nominations for awards are merit-based, women are more likely than men to report that they do not know if honors are merit-based (46% versus 24%) and to report that awards are not usually or not merit based (32% versus 21%). These differences between men and women are statistically significant.[27]

VI. Distribution of Resources

Salary[28]

The salary analysis was carried out by Dr. Mark Killingsworth, using the University's salary records for 1991-2002.[29] In Fig. 3A, we examine gender differences in the salaries of all University faculty, including faculty in Humanities and Social Sciences. Fig. 3B presents gender differences in salaries for faculty in Natural Sciences and Engineering. Here we discuss gender differences in salary across the entire University; analysis of the data for Science and Engineering gives similar results, although because the samples are smaller the statistical uncertainties are larger.

[26] Information on endowed chairs is from the 2002-03 Princeton Registrar. Although in other sections of this report (eg., compensation analysis), major administrative officers, such as President, Dean of the Faculty, and Provost, are not included with faculty, those officers that hold endowed chairs are included in the endowed chair analysis.

[27] Table 11 and 12, Appendix B4.

[28] The details of analysis of compensation data are presented in Appendix B3.

[29] Dr. Mark Killingsworth is from the Department of Economics, Rutgers University and the National Bureau of Economic Research; his report is Appendix C1; Major administrative officers of the University, such as President, Dean of the Faculty, and Dean of Engineering are not classified as faculty for purposes of compensation and hence are not included in the compensation analysis.

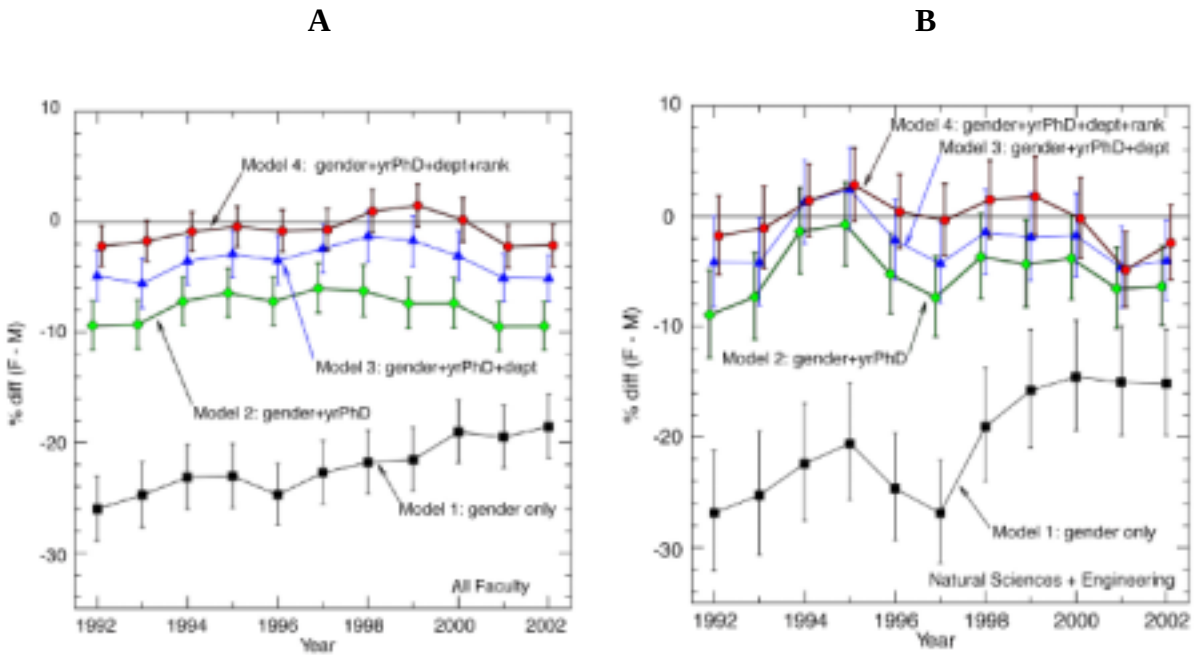


Figure 3. Gender differences in salaries (%) for all faculty (A) and faculty in Natural Sciences and Engineering (B), as a function of time. Gender differences are shown for four models. As discussed in the text, model 3 (allowing for dependence of salary on time since Ph.D. and on academic department) provides a bound on possible gender bias. For more details, see Appendix B3.

The mean difference between the salaries of all female and all male faculty employed by Princeton University, including all ranks and departments between 1991 and 2002, is 22 % (Fig. 3A: Model 1). Although the gap narrowed over time, in 2002, women still earned on average 18% less than men.

Several factors in addition to gender could contribute to this observed difference. For example, salaries are expected to vary with experience and accomplishment. Since the fraction of women in the Princeton faculty has been growing with time (and recent hires are on average younger), female faculty members at Princeton have on average fewer years of experience than male faculty. We used years since receipt of the PhD as a measure of the effects of experience and accomplishment on salary. When years since PhD are included in the salary analysis, the gender difference University wide is reduced to about -8%, and appears to be relatively stable over the 11 year period (Fig.3A: Model 2).

Salaries are also not uniform between departments. Since women are not uniformly represented across departments (for example, women constitute 30% of the Humanities faculty, but only 8.8% of the Engineering faculty), departmental affiliation might also influence salary differences. Salaries are also not equal in the different scientific disciplines: nationally, engineers have the highest average salaries followed by physical scientists, mathematicians, life

scientists, and behavioral scientists.[30] When departmental differences are also considered, the gender difference in salaries at Princeton is reduced even further with a mean difference between men and women over the ten year period of -3.5% (Fig. 3A: Model 3). Of course, departmental differences in salaries may be due in part to gender bias. There is evidence that society tends to undervalue women's work such that fields with a high proportion of women have lower salaries than fields where there are few women.[31]

Salaries also vary across ranks, and part of the gender difference in salary may be due to differences in the representation of men and women across ranks. Gender differences in salaries are reduced even further once salaries are rank-adjusted. Although these differences vary from year-to-year, they have an average value of -0.7% (Fig. 3A: Model 4). The results of this model indicate that there are essentially no differences in average salaries for women and men with equal years of experience, the same departmental affiliation, and with the same rank.

It is not clear that it is appropriate to control for rank in the salary analysis. On the one hand, rank is a measure of accomplishment, and is therefore a valid determinant of salary. On the other hand, there could be gender biases in promotion, in which case controlling for rank will mask gender differences that are not based on accomplishment. Our analysis indicates that the promotion process at Princeton is affected by gender: in Natural Sciences and Engineering, the average number of years to promotion to both associate and especially to full professor is longer for women than for men (Fig. 2; Appendix B2). Provided that this pattern also appears in the Humanities and Social Sciences, it could possibly explain why the gender gap in salaries is larger without the adjustment for rank. However, without information on the reasons for the disparity in time to promotion, we cannot judge whether it reflects gender bias or gender differences in accomplishment. Therefore, our best guess is that the University-wide gender difference in salary falls somewhere between the 11-year average of –3.5% indicated by Model 3 (without adjustment for rank) and –0.7% indicated by Model 4 (with adjustment for rank.) Thus, while there may be some gender bias in salaries, it does not exceed 3.5% when averaged over the entire faculty. This of course does not exclude the possibility that there may be substantial individual inequities, and some of these may be gender related.

The same salary analysis was repeated on four subsets of the faculty: all Natural Sciences, Life Sciences, Physical Sciences, and Engineering (Table 3; Fig. 3 in Appendix B3). As with the University-wide analysis, women received on average modestly smaller salaries, ranging from –1.7 to –5% when analyzed by Model 3 or 4, but the differences are not statistically significant by either Model in any single year. However, in many of the departmental groupings (especially Physical Sciences, and Engineering) the numbers of women are so small that statistical tests have low power.

[30] Long, J. S. (Ed) From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers, National Research Council, National Academy Press. 2001. Chapter 7: Gender differences in Salary, p. 196.
[31] Ibid. p. 189.

Table 4: Percentage Difference Between Womens' and Mens' Salaries in Sciences and Engineering
(negative entries indicate lower salaries for women)

	Average over 1991-2002		Average over 2001-2002		Average over 2002-2003	
	Model 3	Model 4	Model 3	Model 4	Model 3	Model 4
All Natural Sciences	-3.3%	-1.7%	-7.1%	-7.4%	-8.8%	-5.8%
Physical Sciences	-3.5%	-2.9%	-8.6%	-7.6%	-12.2%	-7.0%
Life Sciences	-4.3%	-2.1%	-6.8%	-7.9%	-6.7%	-5.3%
Engineering	-5.1%	-2.1%	-3.2%	-1.9%	-0.6%	-0.8%

Note: Model 3 adjusts for years since PhD and department. Model 4 adjusts for years since PhD, department, and rank.

Given the 11-year history indicating that gender bias in salary does not exceed 3.5%, it is disconcerting to observe a downward trend in salaries for women in the Natural Sciences in 2001 and 2002 (Table 4). This trend is seen in both Life Sciences and Physical Sciences (but not Engineering) for both Models 3 and 4. Life Sciences had a gender difference (Model 4) of about -8% in 2001, and -5% in 2002. Physical Sciences had a gender difference (Model 4) of about -7% for years 2001 and 2002. Differences in these years using Model 3 (i.e. with no adjustment for rank) are somewhat larger. Because this trend is seen in both Life Sciences and Physical Sciences, it is not due to a single event. Although the pronounced decline in the relative salaries of women in these years may have a reasonable explanation (e.g., retention and recruitment of senior men, loss of senior women), it is still worrisome, particularly in view of the relative stability in salaries during the nine preceding years.

Departmental resources

Experimental science is heavily resource dependent. Consequently, in many departments, an individual's success is highly dependent on his/her access to space, equipment, supplies, students, post doctoral fellows, and other laboratory personnel. At the time faculty members are hired, experimentalists are given laboratory space and start-up funds, which are used to purchase equipment and supplies as well as to support personnel. Funds for future support of the lab usually come from research grants, which are obtained from external, not University, funding. For faculty hired at the assistant professor level, additional laboratory space is usually needed to allow growth of research programs. Most experimentalists also require expensive equipment (e.g., electron microscopes, mass spectrometers, multi-node parallel processors) or services (animal care facilities, instrument specialists, technicians for common facilities and analytical labs) that are beyond the means of individual faculty members and that are purchased and/or maintained on a departmental basis. In addition, an individual's research success will be affected by his/her departmental responsibilities, such as teaching, advising, and departmental committees.

The survey queried faculty about research resources.[32] Each respondent was given a list of department or University supplied resources and asked to indicate whether the quality of each resource was better-than-average, average, or worse-than-average relative to that of their

[32] Survey data on resource allocation and work load are presented in Tables 1, 2, 3, 6 and 7, Appendix B4.

Princeton departmental colleagues. In addition, respondents were asked if their overall quality of research resources was comparable to those of their departmental colleagues. Men and women responded very differently to these questions: 5.1% of the women indicated that they have "better than average" overall resources, and 26% indicate that they have "worse than average" overall resources. In contrast, 16% of men rated resources as "better than average" and 6.6% rated resources as "worse than average." These differences are statistically significant and are not explained by gender differences in tenure status, history of receipt of outside offers, years worked at Princeton, or differences across departments. For all resources except summer salary, men were more likely than women to rank themselves as having better-than-average access to the resource. Thus, the worse overall resource rating for women relative to men is due to the accumulation of differences across many items, not to inequities in one or two individual resources. Similar results were seen among the former faculty, with a much higher fraction of women reporting worse-than-average resources. Women were also more likely to report that the processes by which departments allocate resources are unclear and unfair.

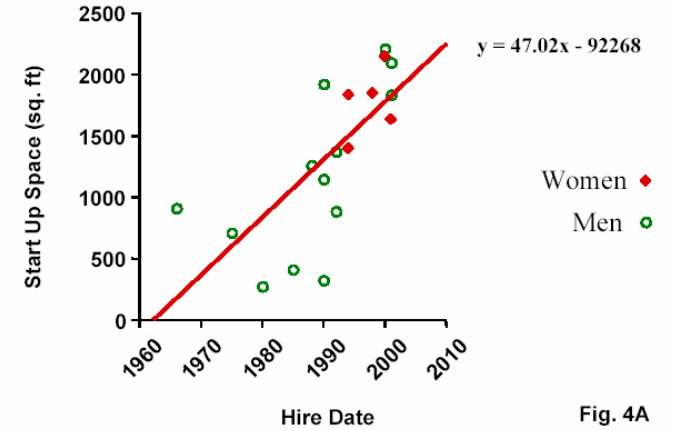
The survey also asked respondents whether their teaching, advising and departmental committee duties were higher-than-average, average, or less-than-average relative to those of their departmental colleagues. We found no evidence that women perceive their departmental workloads to be greater than those of men (although women were more likely to report that the policies and procedures for assigning departmental duties are unclear).

In our discussions with department chairs, several noted that there is heavy competition from top schools to hire talented women faculty, and Princeton is often "out-gunned" in terms of startup packages. In addition, several chairs, especially in Engineering departments noted that space is seriously lacking and that this lack is a major negative factor when recruiting women[33] (and presumably men as well).

The Task Force planned to collect information from individual departments to determine whether the perceptions on resource allocation revealed in the survey were supported by departmental data. Our goal was to examine start up packages, initial and current space, number of undergraduate and graduate students, and service on department committees over the past decade and to aggregate these data across departments to determine if there were gender specific differences in resource distribution. However, we found that in most departments, these data are not readily available. With considerable help from department managers, we collected reasonably complete data from five departments: Astrophysics, Electrical Engineering, Ecology and Evolutionary Biology, Molecular Biology, and Psychology for 2000-02. The limited nature of this data set precluded any University wide analysis. However, in the five departments examined, we found no statistical support for gender differences in startup space, current space, or startup financial packages. However, we did detect certain trends. For example, the largest startup packages have generally gone to men.[34]

[33] Details of the analysis of meetings with department chairs is presented in Appendix B7.
[34] Details of analysis of departments' distribution of resources are presented in Appendix B6.

Even if we had been able to collect data from all departments, it is questionable if the data would have allowed us to detect statistically significant differences in resource distribution, even if such differences exist. The important resources and their distribution vary dramatically among different Science and Engineering departments. Even within a given department, faculty needs differ enormously depending on the nature of their research. For example, experimentalists, field workers, and theorists have very different resource needs. These differences combined with the low number of women in many departments would have made it difficult to detect gender bias in resource allocation.



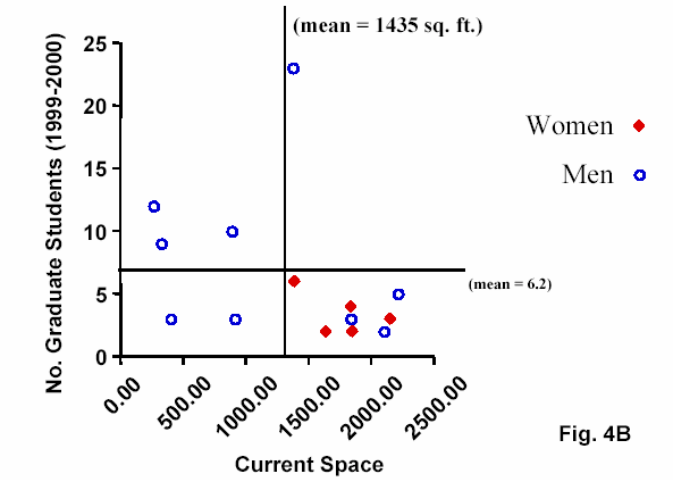


Figure 4A. Comparison of startup space over time for individual faculty in a Princeton department. Historical trends in startup space are illustrated by linear regression analysis. If deviations of male values are not different from the deviations of female values about the regression line, the initial allocations of space are gender neutral.

Figure 4B. Comparison of space and cumulative number of graduate students for individual research groups in a Princeton department between 1999-2002. Inspection of quadrants reveals whether space is proportional to the number of graduate students in faculty research groups. If space is proportional to the number of graduate students, the points will lie in the lower left and upper right quadrants.

Although small sample size hampers the ability to assess departmental data for statistically significant gender bias, these kinds of data are potentially very useful in evaluating how individual faculty members, male and female, are treated relative to their departmental colleagues. We illustrate this by examining two plots based on the departmental data we collected. In Fig. 4A, we plot the amount of startup space allotted to new faculty, regardless of rank or nature of research, in a given department versus time (1960 to 2002). Individuals above the red regression line received more than the average startup space and those below received less. This analysis reveals a department wide trend where more recently hired faculty received more space than faculty hired earlier in the department's history. (A positive correlation of startup space with time was not found in all departments.) These data can also be used to determine if there are gender differences in allocation of startup space. Between 1990 and 2002, 13 new faculty were hired, five women and eight men. Two of the women received slightly less than average space and three slightly more. Only the two men farthest from the regression line received significantly different than average startup space: one male received significantly less

and one significantly more space than other new faculty hired between 1990 and 2002. The other eleven male faculty received average or close to average space, a pattern similar to that of the five women.

Fig. 4B examines current research space in relationship to the cumulative number of graduate students in the research group in one department over a three year period (1999-2002). Based on overall departmental data, two lines are drawn: one is the mean number of graduate students per faculty member and the other is the mean space per faculty member. Their intersection defines four quadrants. If a faculty member is in the lower left quadrant, he/she has relatively few students and relatively small space. A faculty member in the upper right quadrant has a relatively large number of students and relatively large space. The outliers are those that fall either in the upper left quadrant (small space, many students) or the lower right quadrant (few students, generous space). In this analysis, the five women in the department are all in the lower right quadrant as are three men (few students, large amount of space). The three males in the upper left quadrant are possibly disadvantaged, having less than the average space per graduate student. The analysis shown here does not include post doctoral fellows, technical staff, or undergraduate students, all of whom impact the size of a faculty member's research group and hence the group's space needs.

The value of these types of plots is that they identify broad trends and outliers. However, they do not identify the reasons for differential treatment of individuals. In the case of the male in Fig. 4A who received a relatively small startup space, his small research space could be due to the nature of his research (e.g., theory versus experimentation) or he might have been treated unfairly. Likewise, the three individuals in Fig. 4B whose space appears insufficient for the size of their research groups, might need more space or their small space per student might reflect the nature of their work. Indeed, we suspect that many of the discrepancies that are detected with these type of analyses will be easily justified.

These kinds of analyses have several benefits. First, they provide a systematic method to assess if resources are fairly distributed within a given department. In all departments, there will surely be individuals who receive significantly more or less than the average allotment of resources. However, if resources are distributed rationally and fairly, it should be possible to justify these differences. These types of assessments can be used by department chairs and by the administration to determine if individuals, male and female, are equitably treated. They can also be used by chairs to address the complaints of disgruntled faculty members, by showing them how their resources compare to those of the rest of the department or to explain to senior faculty why their lab space needs to be reduced. They might also help departments in their negotiations with the administration – for example, to support an argument that a department has too little space for the size of its research groups.

VII. Climate

Mentoring[35]

The survey asked faculty who were currently or had formerly been untenured faculty at Princeton if they had received mentoring while at Princeton and, if so, whether it had been beneficial or detrimental to their careers. Approximately 50% of currently tenured faculty members, both women and men, report having been mentored when they were untenured. However, among currently untenured faculty, 64% of men and 33% of women report receiving mentoring. A very similar gender difference in mentoring was reported by former faculty (all of whom were untenured at the time of their departure from Princeton).[36]

Survey respondents -- male and female, former and current faculty -- overwhelmingly report that mentoring is valuable. The positive view of mentoring was reinforced by written comments on the survey. For example, a tenured woman wrote "junior faculty with very supportive mentors have an easier time during tenure decision than those with less vocal and supportive mentors." Department chairs also stressed the importance of mentoring but noted that assigning mentors is not straight forward. Likewise, mentoring (or the lack thereof) was brought up in several of the conversations with individual faculty; in support of comments from department chairs, individual faculty noted that while mentoring was potentially very helpful, the wrong mentor was harmful. Department chairs also commented that in departments where there are few women faculty, mentoring/networking on an extra departmental level is also desirable (e.g., a women's caucus in Engineering was given as an example of the kind of group that might provide mentoring/networking on an interdepartmental level).

The Task Force found it noteworthy that the survey data indicated that only a third of women who are currently untenured or left without tenure report being mentored. Although these data cannot be used to test the hypothesis that mentoring improves tenure chances, the fact that tenured women experienced higher rates of mentoring than those who are untenured or who left without tenure is consistent with this possibility. During our discussions with chairs, it became clear that different departments have very different mentoring strategies, but there appears to be no systematic, University wide analysis of the effectiveness of different policies.

Family Issues

Even in disciplines with healthy "pipelines"(i.e., good representation of women in the PhD pools), the fraction of women decreases as one goes up the academic ladder (i.e., the pipeline "leaks"). A typical assistant professor in the Sciences or Engineering has spent 4-6 years obtaining a PhD and, in most departments, an additional 2-5 years in post doctoral training. As a result, the median age at time of hire for both men and women assistant professors in Sciences and Engineering at Princeton is 31 years. In the Life Sciences, assistant professors are even

[35] By mentoring we mean having available more experienced colleagues who are willing to be supportive in a variety of ways (e.g., reading and commenting on a younger colleague's papers and grant proposals, nominating a younger colleague for awards or as a participant in an invited conference, providing advice on teaching or running a lab, etc.).

[36] Table 14, Appendix B4

older (median age is 33).[37] During the next five to six years, assistant professors must develop an independent research program and gain international recognition in their field, if they are to receive tenure. However, for women, the time as an assistant professor likely coincides with their child bearing years. Various studies have shown that many women feel that they have to choose between parenthood and academic success, a choice that contributes to the leaky pipeline at the transition to faculty status.

A recent study[38] supports the notion that combining parenthood and academics is particularly difficult for women. The authors found that women faculty who have a child early in their careers (within five years of earning their PhD) are much less likely to receive tenure than women who do not have "early" babies. This pattern exists for female faculty in Social Sciences and Humanities but is more pronounced for scientists. In contrast, men who have children early in their careers have a modestly improved chance of gaining tenure. Perhaps not surprisingly, the study found that the majority of women who receive tenure do not have children.

Our survey of Princeton faculty found that while men and women have similar rates of marriage, men are more likely to have children: 78% of men and 57% of women have at least one child (Table 20 in Appendix B4). This difference is even greater for the tenured faculty: 89% of tenured men and 69% of tenured women have children. Another major difference in the family lives of Princeton faculty is that married men are much more likely than married women to have spouses who do not work or who work part-time.[39] These findings suggest that male faculty with children are less likely than their female counterparts to shoulder an equal share of parenting responsibilities. In the written answers to the survey, an untenured woman who stated that she wants to be a leader in her field and wants to have a family said "I have not met a woman who is a leader in my field and who had babies prior to tenure."

In the written comments on the survey as well as in our conversations with female faculty, women perceived themselves as disadvantaged in the tenure process both because the assistant professor years coincide with the years when many women start families and because, if they have children, they are more likely than men to assume childcare responsibilities. These sentiments were reflected in comments by department chairs; several stated that they considered women disadvantaged because "they care more about child care than men". In discussions with both department chairs and individual male faculty, we were disturbed that several stated that child care is not compatible with success in Science and Engineering.

Tenure extension and work load relief

In 1970, Princeton established a tenure extension policy that allowed women the right to request a one year extension in the rank of assistant professor for each pregnancy (up to two pregnancies). In 1991, this policy was extended to adoptions and to men. The workload relief policy, adopted in 1998, allows the primary care giver of a newborn child or a newly adopted child to request a semester of workload relief from classroom teaching and administrative duties (or two semesters of half relief from such duties) for up to two children. In addition, the

[37] Median age for assistant professors hired between 1992 and 2002 was determined using the University's personnel database.
[38] Mason, MA and Goulden, M 2002. "Do Babies Matter?" Academe pp. 21-27.
[39] Table 20, Appendix B4.

University provides paid maternity disability leave from three weeks before to 6-10 weeks after a birth, and parents of either sex can take up to one year of unpaid parenting leave.

Between 1997 and 2002, in Natural Sciences and Engineering, 6 males and one female requested a tenure extension due to birth or adoption. Since during this time period, women were 23% of the assistant professors in Natural Sciences and Engineering, the fraction of tenure extensions that went to women (14%) is less than their representation among assistant professors.[40] Since the inception of the work load relief policy in 1998, thirteen Science and Engineering faculty, 6 men and 7 women, have used this policy. Those using the policy were divided about equally between assistant and associate professors. During this period, women were 23% of the assistant and associate professors in Sciences and Engineering and received 53% of the workload reliefs.[41]

Tenure extensions and work load relief policies are only helpful if parents feel they can take them without jeopardizing their careers. The survey queried faculty about the University's family policies, asking if faculty are encouraged or discouraged from using them in their departments. A large fraction of respondents, in particular those without children, answered "don't know" to these questions. For that reason, we tabulated results only for those faculty members who had pre-school or primary school-aged children while at Princeton. Even among this group, many report not knowing whether the use of these policies is encouraged or discouraged, although most did not think their use was discouraged. Although this uncertainty was echoed in the written comments on the survey, some did write about their personal experiences. One former faculty member reported: "During my pregnancy (my last year on the tenure clock) I was never given the option of an additional year. In fact, once I had the child, I was harassed by the Chair to return to work which I did 2 weeks after my child was born." In our meetings with department chairs, several chairs said they were uncertain how the University's tenure extension and work load relief policies were conveyed to the faculty in their departments.

The survey also asked whether delays in the tenure clock are viewed as being beneficial or detrimental to the careers of assistant professors.[42] Among women who had younger children while at Princeton, there is no clear consensus on this issue. Although 56% of women report that delays are beneficial, 28% report that delays are harmful. Women are slightly more likely than men to view delays as beneficial (56% versus 47%) but are much more likely than men to think that delays are detrimental (28% versus 3.8%). The written survey responses to this question ranged from very strong advocacy for delaying the tenure clock to very strong discouragement for delaying the tenure clock. The uncertainty surrounding the impact of delaying the tenure clock is perhaps best expressed by one untenured woman who wrote, "I don't know the answer to this, and I wish I knew." This uncertainty might also explain the surprising finding that between 1997 and 2002, none of the assistant professors who took workload relief also requested tenure extensions.

[40] For comparison, University wide, between 1997-02, women accounted for 38% of tenure extensions and comprised 34% of assistant professors.
[41] Tenure extension and work load relief data are based on Dean of the Faculty files of the requests for these benefits.
[42] Table 20, Appendix B4

Individuals who believe the policy should be discouraged made comments such as: "Delaying the tenure clock breaks research momentum, and this is detrimental to tenure considerations." One tenured woman summarized why delaying the tenure clock is detrimental: "(1) chairs and individual faculty mindsets do not jibe with official University policy, (2) outside reviewers do not take such practices into account in their expectations, and (3) the impacts of family responsibility go so far beyond the first year of life." One tenured male stated, "Even if an assistant professor takes an extension of the tenure clock, it will be ignored. You will be evaluated based on the years since Ph.D. regardless of what you did during those years." Another tenured male also felt that a delay in the tenure clock is detrimental because: "If research were to cease for one year that would be very hard to recover from. On the other hand, if there is reasonable continued activity during the year, then the delay can be an important advantage." A tenured male wrote "… the perception that the faculty member is trying to gain an unfair advantage by having more time to do research before the tenure decision can backfire." Similarly, one tenured woman wrote, "It would give ammunition to those who might want to shoot her down."

These discussions raise difficult dilemmas for parents, especially for women. If a female assistant professor chooses to have or adopt a child but does not delay the tenure clock, then she may be unable to meet the level of achievement that is expected for a positive tenure decision. On the other hand, if she opts to delay the tenure clock and she allows her research productivity to decrease for one year, she may not meet expectations because some individuals will set expectations simply based on the number of years at Princeton and will ignore the purpose of the delay. Finally, if she opts to delay the tenure clock and she manages to sustain a high level of research productivity throughout her assistant professorship, she may be criticized for having an unfair advantage over others.

The Task force was surprised to learn that Princeton's family leave and work load relief policies are so controversial. We are convinced that these policies are important for men and women who want to combine family and career, but believe they are especially critical for women who bear all of the physical burdens associated with child birth and often a disproportionate share of child care duties.

Daycare

The survey asked current and former faculty if they had experienced problems with daycare.[43] Approximately 40% of respondents with younger children report some adverse effects of problems with daycare. Among those who had pre-school-aged children while at Princeton, 27% of men and 36% of women say they have been "somewhat" adversely affected; 10% of men and 19% of women report either "moderate" or "substantial" adverse effects. The survey also asked whether faculty meetings or seminars conflict with daycare hours. Among men and women with young children while at Princeton, 45% reported having had some conflict between faculty meetings or seminars and daycare (34% say they do not know). Women are more likely than men to report conflicts. Even among faculty members with spouses who work full-time, women are more likely to report conflicts between work and daycare.

[43] Table 21, Appendix B4

Many faculty members elaborated on problems with daycare in the written comments to the survey. Seven respondents, men and women, expressed frustration at not being able to get a daycare slot at the two programs for pre-school aged children that have a University affiliation (U-Now and University League) even though they had applied well before the birth of their children. Men and women also expressed frustration with both the hours of coverage and the age ranges of children accepted at these programs, and noted that they would value "emergency daycare" that would cover children on holidays, sick days, and bad weather days. Several men noted they do not have daycare problems, but this was because their wives left the labor force or cut back on their hours after the stress of juggling two careers became too difficult. Several other men stated that daycare problems had adversely affected the careers of their female colleagues and post-docs in their labs.

The last question on the survey asked respondents what changes at Princeton would make a significant impact on the climate for women. The second most frequent suggestion was to improve child care (the first was hire more women). The survey ended by inviting faculty to share any additional thoughts. Again, the need for childcare was raised by men and women.

Professional environment

The survey asked respondents whether people in their department display unprofessional behavior on gender-related matters and whether women are excluded from professional activities. These questions were followed by a comment box, to allow respondents to provide further details. The survey revealed that 24% of women report that their colleagues "occasionally" or "frequently" engage in unprofessional behavior; the same fraction says that their colleagues occasionally or frequently exclude women. These rates are much higher than those reported by men. Moreover, men in Physical Sciences and Engineering are much more likely than men in the Life Sciences to say that faculty members in their departments never engage in unprofessional behavior (in contrast, the responses of women in these two groups are very similar). It may be that men with larger numbers of female colleagues are more likely to become aware of behaviors that women view as problematic.

Of the individuals who chose to write a comment in response to this question, 24% of the men's comments and 17% of the women's comments indicated that they knew of one or more incidents of male faculty "taking advantage of women graduate/ undergraduate students" in a sexual manner. In terms of professional activities, men and women noted that fewer women are invited to participate in joint grants, fewer female graduate students are encouraged to pursue faculty positions, fewer women faculty are nominated for awards. For the nine responses from former faculty on this question, half of the males cited specific incidents or causes of unprofessional behavior and lack of respect towards female faculty.

The survey asked a set of questions on the general professional environment, including a rating of departmental collegiality and overall job satisfaction. Women rate their departments as being less collegial than do men: 29% of women rate the level of collegiality in their departments to be "very good," whereas 52% of men do so; 12% of women rate the level of collegiality as "poor", in contrast to 0.5% of men.[44] There are striking differences between the Physical Sciences and

[44] Table 26, Appendix B4

Engineering and the Life Sciences. Although in both groups women are more likely than men to report that collegiality is fair or poor, 22% of women in the Physical Sciences and Engineering report collegiality as "poor", whereas no women in the Life Sciences do so.

Women are also much less likely than men to be very satisfied with their jobs: 39% of women versus 63% of men are very satisfied, and 7.3% of women are very dissatisfied versus 0.0% of men. These differences persist even after controlling for tenure status, years at Princeton, and department. The patterns of responses mirror those for collegiality, with the women in the Physical Sciences and Engineering and female former faculty members as most likely to report they are or were very dissatisfied with their jobs. The gender difference in job satisfaction is larger among tenured faculty members: tenured women are 30 percentage points less likely than tenured men to be very satisfied (untenured women are only 4.5 percentage points less likely than untenured men to be very satisfied with their jobs).

VIII. Goals and Recommendations

On the basis of the previous analyses, the Task Force has developed a set of goals for Princeton University that pertain to the status of women in Natural Sciences and Engineering

- Increase the representation of women in Natural Sciences and Engineering.

Although there has been some progress in the representation of women in Natural Sciences and Engineering, this progress has been slow and unevenly distributed across departments. Our analyses indicate that women are tenured at similar rates to men, so that increases in the numbers of women can be accomplished through greater hiring at the junior and senior levels and with additional attention to retention of tenured women. The goal of greater representation is shared widely among the Princeton faculty. The most frequent recommendation for improving the situation for women at Princeton, from both men and women, was to hire more women. That said, there are currently few incentives for individual departments to focus special attention on identifying and recruiting well qualified women scientists and engineers.

- Make Princeton a more family-friendly environment

There is widespread sentiment among men and women, from junior faculty to department chairs, that it is very difficult for women to succeed professionally and to have children. Our research points to a variety of problems that contribute to these difficulties. The lack of affordable childcare that fits with the schedules of faculty is an important problem for both women and men. The second most frequent recommendation on the faculty survey was to improve childcare at Princeton. Other important issues include the "two body" problem of finding appointments for the spouses of women whom Princeton is trying to recruit; the perception that delays of the tenure clock after the birth or adoption of a child are detrimental to women's careers; and the scheduling of faculty meetings that conflict with childcare hours. Making the University a more family friendly environment will aid in recruiting women faculty as well as in helping them succeed once they are here.

- Make departmental and University policies and practices more clear and equitable

Our analyses indicate that, along most dimensions, Princeton has policies and practices that are equitable to women. We found no evidence of gender differences in salaries and promotions, a record of which the University should be proud. And, although our analysis of research resources was limited to a subset of departments, in these we also found no evidence of gender inequities in the distribution of resources. However, the Task Force identified several areas where improvements can be made. These include better mentoring for junior faculty; greater representation of women in positions of leadership within departments; and greater attention to the allocation of endowed chairs to women. In addition, our survey results indicate that women are much more likely than men to perceive policies and practices to be unclear and unfair. The development of transparent, well-publicized policies and practices would be beneficial to all faculty members, but especially to women.

- Improve the environment for women faculty

We found that women are more likely than men to report that their colleagues exclude women and engage in unprofessional behavior on gender-related matters. Furthermore, we found that women, especially tenured women, are less likely than men to consider their departments collegial and to be satisfied with their professional lives, results that mirror findings at other Universities. Hiring more women and integrating women more fully into the power structure of departments will improve the climate for all women, and especially for senior women.

- Increase the flow of women into academic positions in Natural Sciences and Engineering

Women are under-represented in PhD programs in many disciplines within Natural Sciences and Engineering. The representation of women in Physical Sciences and Engineering is especially low. Princeton, together with other Universities, should work to change this situation. Hiring more female faculty members who can serve as role models is an important part of accomplishing this goal. In addition, making Princeton a more family-friendly environment for graduate students and postdoctoral students, many of whom are in their childbearing years, may be beneficial.

The following specific recommendations are designed to accomplish these goals over the coming decade:

Recommendation 1: Hire more women. The long term goal of the University is to have the faculty reflect the gender composition of the student body. However, given the current number of women faculty and the small pipelines in many Science and Engineering fields, this goal can not be achieved in the next decade. As an intermediate goal, we recommend that Princeton hire more women faculty in Science and Engineering with the aim that, in 2013, women comprise at least 20% of the faculty in the Physical Sciences and Engineering and at least 40% of the faculty in the Life Sciences.

Simulations were carried out to estimate the hiring rates needed to achieve these goals.[45] Assuming that faculty growth, tenure rates, and exit rates are the same in the next decade as they were between 1980 and 2002, to meet these goals, about half of the appointments in the Life Sciences and about a quarter of the appointments in the Physical Sciences and Engineering must be women. Although these are ambitious goals, especially for those departments in Engineering and Physical Sciences that have small pipelines, the hiring rates they imply do not differ enormously from the hiring patterns of the past ten years: to reach these goals, women must be hired at rates that are 1.4 (Life Sciences), 1.5 (Engineering and the Physical Sciences other than Physics and Mathematics), and 1.6 (Mathematics and Physics) times greater than in the preceding decade. Thus, we feel these goals are ambitious but achievable.

To reach these hiring goals, we recommend that each department develop a specific plan on how it will increase the presence of women faculty. In recruiting women faculty, departments and the University should highlight the University's gender equity (or near equity) in compensation,

[45] Summary of the methods and results of the simulations are in Appendix B9.

tenuring, and resource allocation and its plans to make Princeton a more family friendly institution.

To help departments meet their goals, we recommend that for the next ten years the University do the following.

Provide financial incentives to hire women

- We recommend that Princeton University establish a ten million dollar fund, the Women in Science and Engineering Fund (WSEF) that will promote the hiring of women in these disciplines. The WSEF should terminate when its funds are depleted.
- Currently, the department and the administration each contribute half of the research startup funds to hire new faculty. When seeking to hire a female candidate, we recommend that the WSEF be used to give departments in Science and Engineering an amount equal to one half their contribution to the candidate's start up funds to be used to support research in the department. The WSEF funding would be in addition to the matching funds now available from the Science Fund (in Natural Sciences) or the School of Engineering and Applied Sciences, which should continue to be administered in a gender-neutral way.
- The WSEF could also be used to subsidize the departmental costs of retaining women faculty.

Facilitate flexible hiring practices

- We do not believe that departments should have to forgo opportunities to hire women faculty for lack of faculty lines. The University should continue and, if necessary, expand, its existing programs to loan faculty lines to departments with the goal of increasing the diversity of Science and Engineering departments. The faculty lines should remain with the department until the faculty member leaves the University.
- The "two body" problem hampers the University's ability to hire women faculty. We recommend that when women are being recruited to the professorial ranks in Science and Engineering, the University take an active role in helping their spouses find suitable positions, including making new faculty lines available for recruiting qualified spouses and providing contacts and networking with alumni for professional opportunities for spouses.
- Departments are encouraged to name tenured women as heads of search committees. Doing so will make it clear to women candidates that Princeton is serious about women in general and about hiring women in particular.
- We recommend that the Dean of the Faculty devise and administer an exit questionnaire for tenured faculty who leave Princeton with the goal of identifying and correcting issues that lead to departures. Given the difficulties of hiring women in Sciences and Engineering, it is especially important to understand why women leave the University. The Special Assistant to the Dean of the Faculty (see below) should oversee the development and implementation of this questionnaire.

Recommendation 2: Name a Special Assistant to the Dean of the Faculty to act as a liaison between each Science and Engineering department and the administration.

- We recommend the naming of a senior member of the Science/Engineering faculty as a Special Assistant to the Dean of the Faculty.

- The Special Assistant should be provided with administrative and clerical support, and discretionary funds, as needed.

The Special Assistant to the Dean of the Faculty will

- Meet twice yearly with each department chair to help develop and assess a department specific, strategic plan to hire women faculty and, in departments where women are under-represented among undergraduate majors and/or graduate students, to increase the number of women students.
- Act as an advocate between departments and the administration to obtain resources to help departments meet their strategic plans for hiring women.
- Participate in yearly meetings of the Dean of the Faculty with individual department chairs to assess the status of individual female faculty in terms of resource allocation and promotion, based on yearly updates of information from departments.
- Meet yearly with the Academic Planning Group to discuss the status of departments' progress in hiring women faculty
- Actively participate in recruiting female faculty by meeting with successful women candidates and by coordinating attempts to find spousal employment.
- Coordinate activities that promote women's achievements and their interactions with each other and consider strategies for ways the University can fix the leaky pipeline for women in Science and Engineering.

Recommendation 3: Make the University a family friendly environment. We anticipate that these recommendations will be applied University wide

- We recommend that the University establish affordable child care on campus that is available to faculty, graduate students, post doctoral fellows and staff on a sliding scale based on income. This child care should be organized to accommodate hours and vacation patterns of academics.
- We recommend that all University and department meetings take place between the hours of 9 a.m. and 5 p.m. to avoid conflicts with child care
- We recommend that when assistant professors become parents, they automatically receive a tenure extension (with the understanding that faculty members would retain the right to come up for tenure earlier, if they so choose). We also recommend that departments make it clear to both assistant professors and tenured faculty that tenure extensions do not change the threshold of accomplishment for tenure.
- Some of our peer Universities have a longer time to tenure than Princeton. We recommend that Princeton investigate whether the time to tenure at Princeton should be increased, especially in light of issues concerning child rearing. Princeton should consider that the time to tenure need not be uniform University wide.
- We recommend that faculty, post doctoral fellows, and research and technical staff who are the primary care givers of small children be given preference for University housing and parking. The Special Assistant to the Dean of the Faculty should work with the appropriate members of the administration to implement this policy.
- We recommend that the University sponsor programs to counter the notion among both faculty and students that people who actively engage in parenting can not succeed in

Science and Engineering. It is important to highlight both male and female parent-scientists. The Special Assistant to the Dean of the Faculty should oversee these programs.
- We recommend that departments highlight the University's family friendly policies—tenure extension, work load relief, and on site child care—during faculty recruitment.

Recommendation 4: Improve department policies and practices.
- We believe that providing professional mentoring for junior faculty is of critical importance. We recommend that each department be required to develop a mentoring program, if it does not have one already, and that written descriptions of the departmental programs be collected by the Special Assistant to the Dean of the Faculty. We also recommend that the Special Assistant to the Dean of the Faculty be charged with providing departments with information on different mentoring practices at Princeton and elsewhere so individual departments can develop an approach that is best suited for them.
- We recommend that the University explicitly assess the gender equity position and policies of individuals being considered for appointment or reappointment as department chairs or as directors of programs, centers and institutions.
- We recommend that the University work towards greater representation of women among department chairs.
- We recommend that departments work towards greater representation of women in department leadership positions, such as deputy chairs, heads of search committees, and directors of graduate studies.
- When endowed chairs become available, the University should work with departments to make sure that women are considered for them with the goal that eventually women hold these chairs in the same proportion as their representation in the tenured faculty.
- We recommend that departments and the Dean of the Faculty conduct an automatic review of all associate professors in the beginning of their fifth year as associate professors.
- We understand that departments are currently required to document their reappointment, tenure and promotion policies. With the goal of making tenure and promotion decisions more transparent, we recommend that departments provide a copy of this document to each assistant professor at the time of hiring as well as to individuals one year before the reappointment, tenure, or promotion decision will be made. The Special Assistant to the Dean of the Faculty should oversee the publicizing of these procedures.
- Departments should develop methods to clarify and publicize policies and procedures surrounding the allocation of resources, the nominations for internal and external awards, and the assignment of teaching and other departmental duties.
- Princeton University already has strong policies in place regarding abuse of power and sexual misconduct. We recommend that the University and departments consistently publicize, observe, and enforce these policies, even when doing so might result in adverse publicity for the University.

Recommendation 5: Ensure equity in compensation and resource allocation.
Compensation:
- Although the gender gap in salaries at Princeton is small, we recommend that the University work towards eliminating it altogether. In particular, the administration should understand the basis of the larger gender difference in Natural Sciences salaries for academic years 2001/2 and 2002/3.

- The compensation analysis should be updated annually and provided to the Advisory Committee on Appointments and Advancement (C/3) prior to the setting of salaries for the coming year.
- The University should publicize the existing gender equity in salary both to current and potential faculty.

Resources:

- We recommend that departments be required to maintain data on research and office space, laboratory personnel, research expenditures, departmental and University leadership roles, teaching loads and other work assignments. The template developed by this Task Force (Appendix B6) might be a useful starting point for this effort.
- Given the difficulties the Task Force had in gathering departmental data, the University should identify ways to streamline the process and determine how central administrative offices can help assemble this information in order to minimize the burdens on departments. This process should be supervised by the Special Assistant to the Dean of the Faculty.
- As part of the Dean of the Faculty's yearly review of departments, we recommend that the Dean and the department chairs review the data for each faculty member on resource allocation, work load, and salary with the goal of maintaining equity.

Appendix A

Summary of methods of data collection and analysis:

1. University Hiring and Retention. We used the University personnel database to obtain information on representation of women among Princeton faculty and to analyze hiring, tenuring and time to promotion. Data on female representation among Princeton undergraduate and graduate students were obtained from the University Registrar (Appendices B1, B2)

2. Compensation Analysis. This analysis was used to determine if male and female Princeton faculty are equally paid. The original data collection and statistical analysis were done by an external consultant to ensure confidentiality. Analyses were refined by controlling for parameters such as years since Ph.D., rank and department (Appendix B3; C1).

3. On line survey: Current Faculty in Science and Engineering. The Task Force designed a survey that was implemented by the Princeton Survey Research Center (SRC) with the goal of collecting quantifiable data on male and female faculty's perceptions of their experiences at Princeton. The survey, administered during a two week period in late February/early March 2002, asked questions on a broad set of topics, including research resources, work assignments, mentoring, retention efforts, and other dimensions of the professional environment. A total of 248 individuals took the survey, an overall response rate of 76%. All but 1 of the 42 women surveyed responded. While the survey was designed primarily to collect categorical answers, respondents were given the opportunity to provide written responses on a variety of issues. These were categorized and are reported separately. Analysis of the survey data is presented in Appendices B4 and 5; the survey itself is Appendix C2.

4. On line Survey: Former Faculty in Science and Engineering. The description of this online survey and its analysis parallels that of the current faculty survey. Its purpose was to collect data on former male and female faculty's perceptions of their experiences at Princeton. E-mail invitations were sent to 191 individuals who had left the University between 1992 to 2001; 176 were successfully contacted; of these, 43% responded. Since the samples of men and women who responded to the survey differed significantly with respect to tenure status, we restricted our analyses of former faculty respondees to the 14 women and 39 men who were untenured at the time of their departures. The results are combined with those from the survey of current faculty (Appendices B4 and 5). The former faculty survey is Appendix C3.

5. Departmental Resource Allocation. This analysis was designed to determine if male and female faculty have equal access to space and support from their departments. The goal was to collect quantitative data from department managers on resource distribution in each of the fourteen Science and Engineering departments. We initially asked departments for 10 years of data, but it became clear that gathering these data was not possible. Even when we revised the request to cover only 2000-2002, data sets from most departments were incomplete. Data from five departments were complete enough for analysis: Ecology and Evolutionary Biology, Molecular Biology, Psychology, Astrophysics and Electrical Engineering (Appendix B6).

6. Lunches with Department Chairs. The Task Force met informally in groups with each of the 14 Science and Engineering department chairs over three separate lunches held in Feb-Mar 2002. Discussions were aimed at gathering the chairs' insights into the status of women in their departments and at identifying ways in which the University could aid them in attracting and retaining qualified women (Appendix B7).

7. Conversations with Faculty. Conversations were held with individual Science and Engineering faculty to provide an opportunity for them to share personal information about their Princeton experiences. In mid-March and again in April 2002, all 42 women and 283 male faculty of Divisions III and IV were invited to participate. Conversations were scheduled with two members of the Task Force, one of whom took notes during the conversation. A total of 22 conversations were held, 14 women and 8 men, representing 12 of the 14 Science and Engineering departments. There were no predetermined questions or topics. These conversations were analyzed for content and were found to contain 15 different themes. The analysis of these conversations was provided to the Task Force to give them background for their other findings, but the report of the conversations remains confidential (a short summary of analysis of the conversations is in Appendix B8).

8. Simulations of the Representation of Women Over Time. Simulations were carried out to estimate the hiring rates needed to meet the recommended goal of having 20% of the faculty in the Physical Sciences and Engineering and at least 40% of the faculty in the Life Sciences be women by 2013. For this analysis, departments were divided into three groups: Life Sciences, Mathematics and Physics, and Physical Sciences (except Mathematics and Physics). These groupings were based on current representation of women and tenuring rates. Methods and details of the Simulations are presented (Appendix B9).