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University of Michigan

ADVANCE

ASSESSING THE ACADEMIC WORK ENVIRONMENT FOR WOMEN SCIENTISTS AND ENGINEERS

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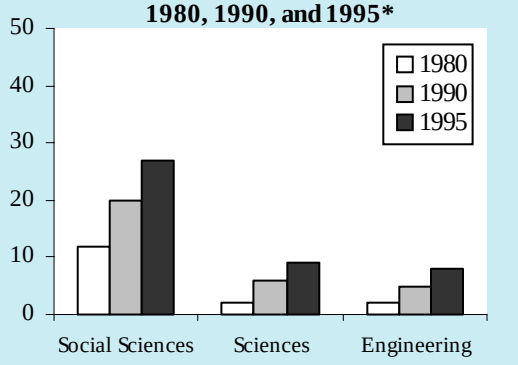
Assessing the Academic Work Environment for Women Scientists and Engineers

EXECUTIVE SUMMARY[1]

Background

Efforts to recruit, retain, and promote women scientists and engineers at research universities have

Figure 1: Percentages of Female Faculty in the Social Sciences, Sciences and Engineering at UM: 1980, 1990, and 1995*

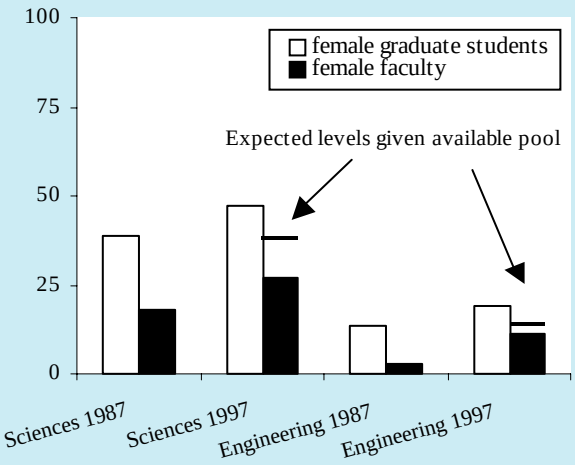


*Source: NSF Reports

had slow and uneven results (Figure 1). The increase in the proportion of women on the tenure track in science and engineering fields, both at the University of Michigan and nationally, has not only lagged far behind gains made by women in non-science fields, but also failed to keep up with the ratio of women earning Ph.D.s in science and engineering fields (Figure 2). Furthermore, studies reveal that women in academic science and engineering, as in academe more generally, are tenured and promoted more slowly, and earn less on average than their male counterparts, even when controlling for productivity.

To address this problem on our own campus, Professor Abigail Stewart, then Director of the UM's Institute for Research on Women and Gender,

Figure 2: National Percentages of Female Graduate Students and Faculty in Science and Engineering: 1987 and 1998*



*Source: NSF Reports

worked with a team[2] that submitted a successful proposal to the National Science Foundation (NSF) for an ADVANCE Institutional Transformation Grant. This new initiative by NSF focuses on improving recruitment and retention of women science and engineering faculty at research universities.[3] The University provided funding to collect baseline data that would enable the project to target areas for change. The data collection included a climate survey administered in the fall of 2001. This report outlines the findings from the climate survey and related interviews and focus groups.

Goals for the Study

The goal of the climate study was to observe how women and men scientists and engineers experience their working environments at UM. The study compared women scientists and engineers with two other groups: men scientists and engineers and women social scientists. This design allowed us to assess whether differences are attributable to gender (e.g., if the experiences of women scientists and engineers resemble those of women social scientists, but not men scientists), or to factors more generally relevant to the science and engineering context (e.g., if experiences are similar for men and women scientists and engineers, and different for women social scientists) or to factors affecting

women in science and engineering only (e.g., if experiences are unique to women scientists and engineers in comparison to both of the other groups).

We also conducted an analysis comparing men and women scientists and engineers on the three faculty tracks at the University of Michigan (the instructional or tenure track; the primary research track, and the clinical track), in order to assess similarities and differences in experiences across the three tracks.

Sample

The sample included:

- all female tenure track science and engineering faculty with paid appointments at the University of Michigan-Ann Arbor as of May 31, 2001; a random subsample of male tenure track science and engineering faculty, and all female social science tenure track faculty from schools or colleges with science faculty;
- all female primary research science (PRS) faculty at or above the rank of research investigator in science and engineering departments and research institutions; a random subsample of male primary research science and engineering faculty;
- all female clinical faculty at or above the rank of assistant professor in science departments; all male clinical faculty at or above the rank of assistant professor in science departments.

Due to the small numbers of faculty of color in academic science and engineering at the University of Michigan, we included nearly all faculty of color in those fields in the sample.

Comparing Women Scientists and Engineers on the Tenure Track with Two Groups

During the first phase of analysis we compared 135 women tenure track scientists and engineers with the two key comparison groups also on the tenure track: 100 male scientists and engineers and 73 female social scientists. In these analyses we controlled for differences between the groups in rank, age, experience, and household compositions.

Similar Career Patterns. All three groups were quite similar in career patterns (professional experience, household characteristics, career experiences, values, and satisfactions). There were no differences among the groups in reports of their own or their departments' view of their productivity, and few differences among them in the areas of career satisfactions, recognition, effort and satisfaction with resources and initial contract negotiation. These similarities provide an important backdrop against which to examine the differences.

Different Household Structures. Differences that are likely to be consequential involve the likelihood of having a spouse or partner, and the likelihood of having a spouse or partner who is employed full-time. Men in science and engineering were much more likely than both groups of women to share a home with an adult who was not employed full-time. Our data suggest that women scientists and engineers are more burdened by household responsibilities than their male counterparts, because they are both more likely not to be partnered (and therefore have no one at home to provide assistance, even if they have no dependents), and more likely to have a partner who works full-time (and therefore operate in a two-career household). More than half of their male colleagues have a partner who is not employed, or is employed part-time. Perhaps for that reason, women were less satisfied than men with the balance between professional and personal life.

Differences in Work Experiences. While they shared many workplace experiences, women and men scientists and engineers differed in the areas of changes in contract terms, service and mentoring, and on nearly all climate indicators.

Changes in Contract Terms. Men indicated that UM provided more items in their renegotiated terms of contract than the women identified, although this difference was small. If these results are verified by comparing the absolute size of renegotiated contracts to men and women (including formal counter-offers), one strategy for improving retention of women scientists and engineers might be increasing the terms of these contracts with women.

Service. Despite reporting a higher rate of service on formal committees than men, women scientists and engineers did not chair committees at a higher rate, even though they reported an interest in leadership roles. Qualitative data suggest that women scientists and engineers also carry an exceptional informal service and advising burden. These results indicate the importance of limiting routine service demands on women faculty, and of providing them with more opportunities to lead.

Mentoring. Among assistant professors, women scientists and engineers received substantially less mentoring than both comparison groups. In particular, these women reported having fewer male mentors in their own departments than men did—an important difference, since the vast majority of senior science and engineering faculty are men.

- While men scientists and engineers reported an average of nearly 5 male mentors in their departments, women reported an average of just over 2 male mentors in their departments, a significantly lower number.
- Women scientists and engineers reported no mentoring in an average of over 3 areas, compared to less than 1 for men scientists and engineers and 1-2 for women social scientists at the same rank.
- Obviously, women scientists and engineers report less mentoring in relative terms. In absolute terms the proportion of women scientists and engineers receiving little or no mentoring in some areas is quite striking. In fact, fewer than half of the women scientists and engineers reported any mentoring of any kind in 5 of the 8 mentoring areas: networking, department politics, obtaining resources, advocating for me, work-family balance.

These findings are significant in light of research connecting effective mentoring and positive career outcomes in science and engineering.

Differences in Climate. Men and women scientists and engineers reported striking differences in the areas of gender discrimination and sexual harassment.

Gender discrimination. Over 41% of the women scientists and engineers, in contrast to 4% of the men, reported experiences of gender related discrimination in the past five years at UM in at least one of the following areas: hiring; promotion; salary; space/equipment or other resources; access to administrative staff; graduate student or resident/fellow assignments. Women social scientists at UM reported levels of gender discrimination nearly as high, slightly over 35%. In each of three areas (salary, promotion and resources), over 15% of women scientists and engineers reported having experienced gender discrimination at UM within the previous five years.

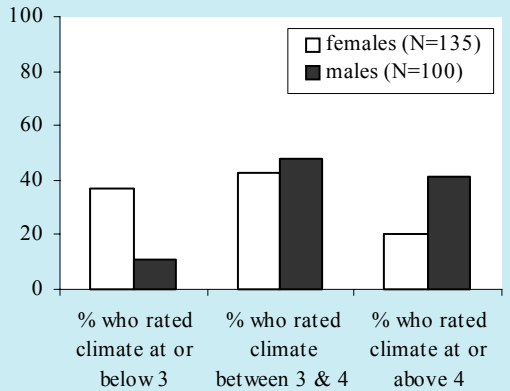
Unwanted sexual attention. About 20% of women scientists and engineers reported having experienced unwanted and uninvited sexual attention at UM during the past five years, compared to about 13% of women social scientists and just over 5% of men scientists and engineers. Over 38% of women scientists and engineers, 29% of women social scientists and 21% of men scientists and engineers reported that others have informed them of instances of unwanted and uninvited sexual attention.

Department climate. We found significant group differences on all but one (scholarly isolation) of the nine features of *departmental climate* we as-

sessed (positive climate, tolerant climate, egalitarian atmosphere, felt surveillance, race/gender tokenism, fairness of the chair, ability of the chair to create positive environment, chair's commitment to racial/ethnic diversity). We created an overall index of climate by combining all nine scales, and found that women scientists and engineers reported the most negative climate.

It is hard to assess the meaning of a mean difference on a 5-point scale. In order to evaluate the size of the difference, we examined the distribution of women's and men's ratings. The middle (mean and median) rating of the climate for women scientists and engineers was closest to 3 on the 5 point scale (1=low, negative to 5=high, positive), while the middle rating for men scientists and engineers (and women social scientists) was closest to 4. Half as many women scientists and engineers rated the climate at or above 4 (about 20%), compared to the men (40%), while three times as many women (37%) rated the climate at or below 3 compared to the men (11%). The difference in felt climate (between women and men scientists and engineers) appears to be substantial (Fig. 3).

Figure 3: Distribution of Climate Ratings by Gender



We also considered whether perceptions of climate are related to overall job satisfaction and found high and statistically significant correlations between negative climate ratings and overall job satisfaction, both for the survey respondents as a whole and for women scientists and engineers.

Finally, we considered whether reports of gender discrimination or harassment over the past five years "predict" current satisfaction and climate ratings. Among all tenure track faculty, and among women scientists and engineers, those who had experienced gender discrimination or sexual harassment reported significantly lower scores on overall satisfaction with UM position, tolerant climate, and gender egalitarian atmosphere, and higher scores on gender stereotyping and race/gender tokenism. In addition, among all tenure track faculty, those who reported either gender discrimination or sexual harassment reported higher scores on felt surveillance, and lower scores on positive climate, fairness of the chair, and the ability of the chair to create a positive environment.

Conclusions - Tenure Track Comparisons

The results show that in many areas pertaining to career patterns and satisfactions, and in terms of the relationship between climate and satisfaction, tenure track women and men science and engineering faculty at UM are similar. However, they differ in household composition, with the women scientists and engineers more likely than the men to be members either of two-career households or solo adult households. Perhaps as a result of this difference in household structure--which implies that women scientists and engineers have less assistance available at home than men--professional/personal issues are especially important to them. In this respect, these women are similar to women social scientists. Women scientists and engineers experience a more negative work environment than men in these fields or women social scientists do. The particular negative features for women include less robust renegotiated contracts, higher service demands, inadequate mentoring, and chilly departmental climates. Women report high levels of gender discrimination and sexual harassment. In most (but not all) of these respects, things are worse for women scientists and engineers than for women social scientists.

Comparing Women Scientists & Engineers on the Three Faculty Tracks

The second phase of data analysis consisted of a track by gender analysis, comparing the experiences of 187 male and 259 female scientists and engineers on the three faculty tracks at the University of Michigan: tenure, primary research, and clinical. Tenure track women social scientists are *not* included in the track by gender analysis.

Results suggest that gender plays a similar role in the lives of women scientists and engineers, regardless of track. While some gender differences seem to pertain only to tenure track faculty (e.g., the lack of mentoring), most others (e.g., service burdens and more negative climate) were similar across all tracks.

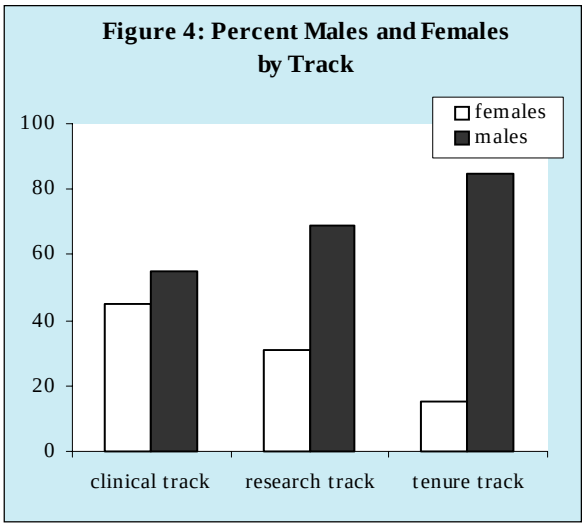
Track plays a significant role in the lives of UM science and engineering faculty. Tenure track faculty seem to be advantaged in several areas, with primary research and clinical track faculty feeling in many ways like second-class citizens.

- Research track faculty find the ambiguities around their title "Research Scientist," teaching roles and access to resources (notably on arrival and in renegotiating their contracts) particularly difficult.
- Clinical track faculty struggle more with a sense of lesser productivity and status.
- There are signs that both groups are more alienated from the institution and its mission than tenure track faculty.

Relative gender ratios in the three tracks (Figure 4), as well as the status differentials felt across gender, suggest that the research and clinical tracks are lower status and more open to women than the tenure track (except in the College of Engineering where the research and tenure tracks both have few women and there is no clinical track).

Implications of the Findings

The results of these analyses, along with those from the salary and space analyses, will be used to make policy recommendations and identify practices that might improve the work environment not only for women scientists and engineers, but for all faculty. The survey findings have already informed the design and implementation of ADVANCE initiatives at the University of Michigan. Perhaps the single most important remedy suggested by our findings is increasing the "critical mass" of women science and engineering faculty by recruiting and retaining more women scientists and engineers. The following remedies are also indicated by our findings:



Work-family interface:

- ensuring that existing family-friendly policies are widely known, and improving the family-friendliness of the science and engineering departments, as well as the university more generally.

Negotiation of contracts:

- ensuring that equitable offers, counter-offers, and contract agreements are made and monitored.

Mentoring:

- increasing commitment to and understanding of mentoring among chairs and senior faculty leaders, as well as younger faculty;
- supporting on- and off-campus mentoring;
- creating formal and informal mentoring programs for tenure track faculty.

Service:

- increasing awareness of the crucial difference between "participation" in committee work and "power" in setting policy;
- limiting routine service demands on women science and engineering faculty, while providing them with more opportunities to lead.

Climate:

- ensuring that departments and colleges have clear and transparent policies and procedures that minimize negative experiences;
- improving training, selection and accountability of chair and senior faculty leaders in areas of mentoring, problem-solving, fair and judicious procedures and practices, and conflict-resolution;
- having departments engage in systematic evaluation of their own climates and take active steps to address their negative features;
- creating new mechanisms for addressing conflicts or difficulties women scientists and engineers face at the departmental level.

Research and clinical tracks:

- consider a change in title from "research scientist" to "research professor";
- create equitable arrangements for research and clinical faculty to teach and participate in governance in their appointment homes;
- provide improved recognition for faculty on these tracks;
- increase support to research faculty for their research activities;
- increase support to clinical faculty for scholarly productivity;
- offer opportunities to women scientists and engineers on these tracks to move on to the tenure track.

A study like this one can only be a beginning. This study examined many important aspects of the work lives of women scientists and engineers at one university. We need comparable data from other universities, and many other features of scientists' and engineers' work lives also need to be studied here and elsewhere: tenure and promotion processes and rates; attrition within and across fields; salary equity, equity in the allocation of space and other research resources; and so on. We believe that the best institutional strategy for improving the academic work environment for women scientists and engineers—as for all faculty—is to create and maintain systematic procedures for assessing that environment and acting on those assessments.

NSF's ADVANCE program provides us with crucial resources to implement some of the suggestions outlined here, but it will take a great deal of collaboration and commitment from many faculty and administrative leaders to put those and other resources to effective use. If we succeed in doing so, this study will have served its purpose—to provide a baseline against which to measure the institution's future success at improving gender equity among science and engineering faculty at the University of Michigan.

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[1] The full report can be read or downloaded from http://www.umich.edu/~advproj/reports.html. Printed copies of the full report can be requested by writing to dlavaque@umich.edu, or Dr. Danielle LaVaque-Manty, ADVANCE, Institute for Research on Women and Gender, 204 S. State St., Ann Arbor, MI 48109-1290.

[2] Co-Principal Investigators, now members of the Advance Steering Committee, are Professor Pamela Raymond (Senior Counselor to the Provost, Professor of Cell and Developmental Biology and former Associate Provost), and Deans Stephen Director (College of Engineering) and Allen Lichter (School of Medicine). Interim Dean Terrence McDonald (College of Literature, Science and the Arts) has joined the Steering Committee, replacing former Dean Shirley Neuman. Dr. Janet E. Malley, Deputy Director of IRWG, provided key support.

[3] Awards were announced in October 2001 for a January 2002 start date. Other recipients include the University of Wisconsin-Madison, the University of Washington, the University of California-Irvine, Georgia Institute of Technology, the University of Colorado-Boulder, New Mexico State University, the University of Puerto Rico-Humacao, and Hunter College of the City University of New York.