
Report of the School of Engineering

Reports of the Committees on the
Status of Women Faculty

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Massachusetts Institute of Technology

Statement from the Dean of the School of Engineering

Embracing Gender Diversity

For most of history, Anonymous was a woman.

—*Virginia Woolf*

In my youth, I was surrounded by engineers. My father worked for the engineering division of a large chemical company and I had many opportunities to watch him and his colleagues at work and at play. I have long held two impressions of those days. First, engineering seemed exciting: engineers were developing new chemicals, introducing new processes, and launching new equipment, new plants, and new products. They had opportunities to work on interesting, challenging problems. They were truly engaged in their work and seemed to be having fun. My second impression was that engineering was for everyone. I saw no barriers. If you had talent, interest, and the right training, then engineering could be for you.

Now as I look back on those days, I realize that I was wrong. Not about engineering being exciting. It was exciting then, and it is even more exciting now. But engineering, it seems, was not for everyone. All the engineers I knew were white men. Clearly, barriers did exist.

Today engineering does attract women and it does attract minorities, but not enough of either. Barriers persist and all too many of us remain oblivious to them.

In the wake of the noted MIT Women Faculty in Science report, about a year and a half ago I convened a similar committee to assess the situation in engineering. The enclosed report summarizes the Committee's findings. Some of these findings are heartening. MIT engineering has about twice as many women undergraduate students, twice as many women graduate students, and twice as many women faculty as the national average. Women faculty performance is comparable to that of men (e.g., tenure rates, time to promotion, percentage of faculty with chairs). Women are compensated equally with men.

But some of the Committee's other findings are very disturbing. Many of our women faculty, and especially the senior women, feel marginalized. We learn, for example, about some of our women faculty colleagues, who despite their superb professional standing and despite the fact that they are highly valued by their faculty colleagues, have *never* been asked to serve on the Ph.D. committee of even one of their colleagues' students. Stunning. We learn that women faculty candidates reject a far greater percentage of our faculty offers than male candidates. And, we learn that on a percentage basis, we make about half as many offers to our female Ph.D. graduates as we make to

our male Ph.D.s. In sum, we learn that there is bias and that MIT is not a hospitable environment for many women faculty.

Simply put, this situation is unacceptable. The strongest, most resilient human systems exhibit the highest degree of freedom, opportunity, and diversity. For the sake of the engineering profession, for MIT's sake and, quite simply, because it is the right thing to do, we should and we must do better. I ask each of my male colleagues at MIT and elsewhere to try to put themselves in the position of our women colleagues. How would you react in similar circumstances? How would you feel about your environment if you were subjected to such behavior? What kind of signals would you be sending to your students if you felt thus marginalized?

In the past decade we have doubled the percentage of women faculty in engineering at MIT. I am firmly committed to doing so again in the decade ahead. I am also committed to making MIT a more welcoming environment for women faculty. We need to educate ourselves about the current situation and about the gender biases that we all hold, women and men alike. We need to put in place administrative processes to promote the objectives we seek and to monitor our progress. But, most importantly, we need to ensure that developing a more diverse community, in both gender and race, remains a high priority. We have begun down this path, but we have much more to do.

In closing, I would like to thank the members of the Committee on Women Faculty in Engineering, and especially its chair, Professor Lorna Gibson, for the significant time and energy they have devoted to this important task and for the forward looking, constructive perspective that has characterized our interactions during the development of the report. You have done an enormous service for the School and Institute and, I hope, more broadly for the academic engineering enterprise.

Thomas L. Magnanti
Dean
MIT School of Engineering
January 15, 2002

**REPORT OF THE COMMITTEE ON WOMEN FACULTY
IN THE SCHOOL OF ENGINEERING
AT MIT**

March 2002

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EXECUTIVE SUMMARY

Academic leadership can both implement policy changes as well as foster a change in the culture of the institution. Following the 1999 publication of the report on gender inequities in MIT's School of Science, the Dean and senior administration at MIT not only acknowledged the problems but addressed them in concrete ways.ⁱ In addition, the President and Provost called for the formation of similar committees in the other four Schools at the Institute (Architecture and Planning; Engineering; Humanities, Arts and Social Sciences; and Management) and the Provost created a Council on Faculty Diversity.

The Committee on Women Faculty in the School of Engineering was asked to assess the status and equitable treatment of women faculty in the School through data collection and interviews. The Committee found similar patterns to those described in the School of Science report: low numbers, past salary discrepancies, marginalization and problems in balancing work and family responsibilities.

This report summarizes the findings of the Committee and the institutional changes that MIT is implementing to address the issues.

Faculty Hiring and Retention

The percentage of women faculty in the School of Engineering increased from 5 percent in 1990 to 10 percent in 2001. While the percentage has doubled, it is still small. Overall, hiring in the School has been in line with the percentage of women awarded PhDs in engineering at our peer institutions, from which MIT hires.

ⁱ The Dean of Science, working with the Department Heads, took action to address the findings of the Committee on Women Faculty in the School. He hired more women faculty (increasing the percentage from 8 to 13 percent), increased the salaries of some women faculty and addressed individual issues of space, resources and outside offers. The inclusion of women in influential departmental activities has also increased.

The committee found two particular areas of concern with regard to hiring:

- The two largest departments in the School, which account for half the faculty, had a net gain of only two women over almost a decade. Between 1990 and 1998 one of these departments hired 28 men and 0 women. The other department lost one of the two women it hired in the late 1980s and failed to retain any of the other three women hired during the 1990s.
- There were disparities in the hiring patterns between men and women: for instance, men with PhDs from MIT were hired onto the faculty at almost twice the rate as women with PhDs from MIT.

There are some signs of progress: the number of women faculty has increased from 31 in 1999 to 34 as of September 2001. Three additional women have already accepted faculty positions to begin during the 2002 calendar year; one of these is tenured. The department that hired no women over an 8-year period has hired 3 women since 1999, two with tenure. In addition, the tenure rate and time for promotions are similar for women and men.

In response to the Committee's findings, the Dean of Engineering has enforced the affirmative action policy more strictly, personally reviewing applications from women candidates and turning back proposals to hire specific candidates from departments that have not searched sufficiently for women or given appropriate consideration to women candidates. The Dean has also agreed to a target of women making up 20 percent of the faculty in the School of Engineering by 2010.

The Council on Faculty Diversity is developing guidelines for faculty searches outlining appropriate search procedures. The Provost has developed standards for faculty searches that include diversity on the search committee, broad searches and justification of the candidate selection (including describing the relative merits of the candidates, especially women and minorities). The Provost's standard indicates that searches that identify no women or minority candidates should be viewed skeptically by the Dean.

Compensation

The salaries of women and men on the faculty in Engineering are comparable at the lower ranks. A number of senior women report experiencing unexplained salary jumps at various times which they believe were made to make up for past inequities. (It appears that small differences, compounded over a number of years, produce differences that are large enough to be noticed and are then corrected.) Faculty salaries are now being reviewed by one or more members of the Committee on Women Faculty in each School.

Compensation also includes benefits. The very different demographics of the women faculty lead to inequitable subsidy of benefits such as health insurance and the Children's Scholarship Program that provides tuition for the children of faculty. One potential benefit that many women faculty need and is not currently subsidized is child care. The Council on Faculty Diversity is planning to review options for modifying the benefits plan.

Marginalization

Marginalization is manifested in a variety of ways. In our interviews with women faculty, we heard of women not being included in research activities (e.g., participation in group research grants or PhD thesis committees) and in departmental activities (e.g., women never being invited to give a presentation at annual departmental retreats; lack of representation on influential committees). Some women noted that they were asked to teach lower level undergraduate subjects rather than specialized graduate subjects relating to their own research. Some were asked to change their teaching assignments more often than their male peers. A few women reported no feelings of marginalization; they felt that they had been appropriately included on key committees. One woman in particular felt that MIT worked hard to give her more opportunities for visibility than her male counterparts.

Marginalization also compounds over time: for instance, women who are not invited to be on influential departmental committees do not develop the experience needed to move on to higher level administrative positions. At the start of the study the Committee found that there were few women in line academic leadership positions - with only one woman on the Engineering faculty in such a position (and that program was not in the School of Engineering). Currently,

there are three women in Engineering in line academic leadership positions. In addition, three women on the Engineering faculty now have non-line positions with substantial administrative responsibility.

The role of the Department Head in ensuring that women participate fully and fairly in the departmental activities is crucial. Addressing the marginalization issue is perhaps the most difficult of all as it occurs on the level of individuals, in many cases unconsciously. As one step, the Dean is sponsoring a workshop on gender schemas and marginalization of women for Engineering Council (made up of all the Department Heads and the Directors of some of the larger Centers in the School). The Council on Faculty Diversity is considering ways of addressing marginalization.

Work and Family Issues

Almost all of the women we interviewed spoke of the difficulties in balancing work and family responsibilities. Roughly half of the women faculty in the School of Engineering do not have children; among the tenured women faculty the percentage decreases to about 40%. About 20% of the men on the faculty at MIT reported that they did not have children in the last MIT survey on family and work. At the time the Committee began its study, family leave policies varied throughout the Schools at MIT. In Engineering, faculty were allowed one semester release from teaching and administrative duties at full pay to spend time at home caring for a new child. In December of 2001, MIT adopted two policies designed to address some of the issues associated with balancing work and family: extension of the tenure clock for childbearing (and, by request, for adoption) and part-time appointment with tenure for family care. MIT is also increasing the on-site day care facilities: the new child care center in the Stata Center currently being constructed will accommodate 73 children beginning in January 2004, to bring the total number of day-care slots to 132.

INTRODUCTION: How the Committee Formed and Why Its Findings Matter

"A number of my colleagues dismissed the value of my work even though it was crucial to the work of other faculty." --- Comment from a senior woman on the faculty.

In March of 1999, the Committee on Women Faculty in the School of Science published a report in the MIT Faculty Newsletter describing their study on gender inequities in that School and the response of the MIT administration to their findings. At a meeting of the women faculty in the School of Engineering shortly after the Women-in-Science report was issued, the vast majority of participants called for a similar investigation into the status of women faculty in the School of Engineering. The Dean of the School, Thomas Magnanti, approved such a study and in the fall of 1999, the Committee on Women Faculty in the School of Engineering was formed. The findings of that study, as well as MIT's efforts to address the gender inequities uncovered, are summarized in this report. The Committee was asked to assess the status and equitable treatment of women faculty in the School through data collection and interviews; to make proposals to increase the proportion of women faculty in the School; to act as a resource for the Dean of Engineering and department heads on issues that concern women faculty in the School; and to act as a resource for the MIT community about these issues for the Institute at large. Of the seven Committee members, five are tenured women faculty from five of the eight departments in the School of Engineering; two are tenured male faculty who are current or former administrators in the School.

In brief, the findings of the Committee reinforce those of the Women-in-Science report. Consider the following examples:

- The two largest departments in the School of Engineering, which account for about half of the faculty in the School, had a net gain of only 2 women faculty between 1990 and 1999.

- From 1990 to 1998, one department hired 28 men and no women.
- In another department, women are rarely on faculty search committees; a female professor in this department reported that during faculty searches, she was only asked to talk with a candidate if that person was a woman.
- When we started our study in 1999, there was only one woman faculty member in the School of Engineering in a line position of academic administrative leadership and she ran a program that was not in the School of Engineering. The only other woman who had ever held a line position of academic administrative leadership in the School of Engineering did so in the early 1970s.
- There is evidence that inequities in compensation for women faculty existed in the recent past. Over half the women full professors received substantial increases in their salary following a request for a salary review in 1995. Women faculty still receive substantially less subsidy of their benefits than male faculty.

Most important, just 10% of the School of Engineering's 2001 faculty are women. These low numbers mean women faculty remain outsiders or tokens in their departments. Yet this is not just a pipeline problem. The Committee also found that a much higher percentage of female job candidates reject offers to come to MIT - 40% of women as compared with 14% of the men offered jobs. Given MIT's status as one of the premier research universities in engineering in the world, these results are disturbing.

In November 2000, the Committee submitted its first confidential report to the Dean and other administrators. The report included recommendations for hiring of women faculty, increasing the number of women faculty in academic administrative leadership positions, ensuring equity in compensation, improving the environment for women faculty and addressing family/work issues. By that time, positive changes to address gender inequities were already underway. For instance, a number of women in the School of Engineering had already received salary adjustments. Dean Magnanti insisted that qualified women be considered during faculty searches and urged departments to nominate women faculty for awards. Since the November 2000 report, the administration has begun acting on a number of the recommendations. Here, we

summarize the findings of the committee, list the recommendations and describe the progress made to date in implementing them. Gender inequities that have existed for decades are difficult to eradicate without an institution's sustained commitment over many years. Still, documenting what has occurred is a useful place to start, and can lead to the kinds of changes that eventually create an equitable working environment for all.

BACKGROUND: WOMEN IN SCIENCE LEAD THE WAY

The discrepancies in treatment of male and female faculty have much more to do with small, unconscious biases than blatant sexism. In many cases, male faculty are simply unaware of the ways in which these inequities occur on a daily basis for their female colleagues. Yet there is strong evidence that they do occur.

The main finding of the 1999 Women-in-Science report, which was based on data and interviews with women faculty and department heads gathered over the previous four years, was a progressive marginalization of women faculty members in the School of Science as they moved through their careers. According to the report, marginalization during the period studied was often accompanied by “differences in salary, space, awards, resources and response to outside offers between men and women faculty with women receiving less despite professional accomplishments equal to those of their male colleagues.”

The findings presented in the Women-in-Science report, as well as those for the School of Engineering, are consistent with a number of studies documenting how women are undervalued in academia. Virginia Valian's (1998) book *Why So Slow?* describes the ways in which gender schemas, or implicit hypotheses about sex differences, lead to inequities in the evaluation of the accomplishments of men and women. Even small differences in evaluation and treatment effectively “compound” over the course of a career, leading to large disparities for individuals at later stages in their careers.

Take one recent study, in which a curriculum vita was distributed to two groups

of faculty from the same field throughout the United States who were then asked if they would hire the candidate (Steinpreis *et al.*, 1999). Both groups had similar numbers of male and female faculty. All copies of the curriculum vita were identical, except that half had a man's name while the other half had a woman's. Fewer than half the faculty who reviewed the woman's curriculum vita said she should be hired, while nearly three-quarters of the faculty who reviewed the man's curriculum vita said he should get the job. Strikingly, it wasn't just the male faculty members who favored the male candidate. There was no statistically significant difference in the evaluation of the curriculum vita by male and female faculty. These and many other studies demonstrate the power of unconscious bias in evaluation processes, with bias usually working to the disadvantage of women.

Given how endemic such biases are, the efforts of the MIT administration to address gender inequities, as well as the impetus provided by the Committee on Women Faculty in the School of Science, are notable. The Women-in-Science report has had a remarkable impact. At MIT, the Provost, in collaboration with the Deans, supported similar "gender equity" committees in the other four Schools, including this committee in Engineering. In addition, the President established a Council on Faculty Diversity to address issues pertaining to the under-representation of both women and minorities on the MIT faculty. Professor Nancy Hopkins, the first Chair of the Women-in-Science committee, has been appointed Co-chair of the Council on Faculty Diversity and now sits on Academic Council. The Women-in-Science report has also had a broader impact outside of MIT, generating widespread press. A number of other institutions are now undertaking their own gender-equity studies. Professor Hopkins has given talks on gender-equity issues at dozens of universities, at the White House and at the California State legislature.

As the Women-in-Science report emphasizes, *"This collaboration of faculty and administration could serve as a model for increasing the participation of women, and also of under-represented minorities, on the faculty of other Schools at MIT. This is an*

important initiative since, even with continued effort of this magnitude, the inclusion of substantial numbers of women on the Science and Engineering faculties of MIT will probably not occur during the professional lives of our current undergraduate students.”

On reading the Women-in-Science report, MIT President Charles Vest commented *“I have always believed that contemporary gender discrimination within universities is part reality and part perception. True, but I now understand that reality is by far the greater part of the balance.”*

THE FINDINGS IN ENGINEERING: Low Numbers Underlie Other Problems

The Committee on Women Faculty in the School of Engineering completed its study in November 2000. The Dean's office provided extensive personnel data, allowing committee members to examine the number of degrees granted to women and men, number of female and male faculty, hiring of faculty, years from doctorate to tenure decision, tenure success, time for promotion, compensation, and committee assignments. Most of the data covers the 1990s, but some go back as far as 1981. During the course of the study, committee members interviewed almost all of the female faculty members in the School of Engineering. Since November 2000, the Committee has updated certain figures, and the most recent available appear in this report.

The Committee's quantitative findings are summarized below, including the number of women faculty, hiring patterns, women in academic leadership positions, promotion and tenure, compensation, benefits/demographics, and outside professional activities. The interviews conducted with women faculty provide additional qualitative findings.

Numbers of Women Faculty

In July 1990, there were 17 female professors with primary appointments in the School of Engineering out of a total of 357 faculty, or 4.8% women. As of September 1, 2001, there are 34 female faculty out of a total of 348, or 9.8%. Although this doubles the percentage, the number of women faculty remains strikingly low. The conventional explanation for the scarcity of female faculty in the “male” discipline of engineering is that not enough qualified female candidates are in the pipeline. Yet the pipeline is growing, at least in a limited fashion. For instance, at MIT the percentage of PhD degrees in engineering awarded to women grew from 13% in 1990 to 18% in 2000, averaging 15% over that period (**Fig. 1**). The fraction of PhD degrees awarded to women at peer institutions, such as Stanford, Berkeley, and Caltech, was similar in 2000 (18-21%).

Hiring of women faculty in engineering at MIT has been consistent with these numbers: 14% of the faculty hired between 1990-1999 were women. However, closer examination of the data reveals variability between departments. From 1990-1999, there was a net gain of 12 women faculty in the School of Engineering. During this period, three mid-sized departments (Chemical, Civil and Environmental, and Materials Science and Engineering) accounted for 9 of the net gain of 12 women faculty in the School. All three department heads made a commitment to hiring women faculty. But the two largest departments, Electrical Engineering and Computer Sciences (EECS) and Mechanical Engineering (ME), which together account for roughly half the faculty in the School, added only 2 of the net gain. The percentage of PhD degrees awarded to women in these two fields in 2000 at MIT, Berkeley and Stanford, the schools from which MIT's School of Engineering hires most of its faculty, was 14% and 16%, respectively. Between 1990 and 1998, EECS hired 28 men and 0 women. Within EECS, faculty are associated with a Laboratory; the Laboratory for Computer Science did not add any women in EECS between 1983 and 1999. It should be noted that the situation in EECS has improved considerably since 1998. Three women have recently been hired, two tenured and one

untenured. A fourth woman recently transferred from another department to EECS.

In Mechanical Engineering, however, while women have been hired onto the faculty, only one of the five ever hired up until 2001 is still at MIT. The first woman was hired by the department in 1987 and is now a full professor with an endowed, 5 year, chair in the department. All of the other four women hired between 1987 and 2000 have left MIT. Mechanical Engineering hired another woman faculty member in 2001.

Hiring Patterns

In addition to low numbers and variable hiring rates in departments, the Committee found a number of gender-based differences in the hiring pattern of faculty within the School of Engineering. Between 1986 and 2000, 64% of the men hired obtained their PhDs at MIT, Stanford, or Berkeley, while only 33% of the women hired obtained PhDs at these three schools. The data suggest that the School is much less successful in recruiting women than men from top engineering schools.

The discrepancy between male and female MIT PhDs who are hired by the School is particularly telling. Between 1986 and 2000, 43% of the men hired had MIT PhDs, while only 21% of the women did. Between 1990 and 1999, the School of Engineering granted 2,025 PhD degrees to men; 40 of these men were hired as faculty, representing 2.0% of the pool of male PhDs. During the same period, MIT granted 351 PhDs degrees to women; 4 of these women were hired as faculty, representing 1.1% of the pool of female PhDs. While the School of Engineering's overall hiring rate for women matches the national percentage in the pipeline (14%), the School is not taking advantage of the available pool of women within MIT.

The Committee also compared the acceptance rates of faculty offers for men and women. Between 1981 and 1999, 14% of the men and 40% of the women rejected an offer of a faculty position at MIT: women reject our offers at almost 3 times the rate that men do. For example, during the 1990-1998 period when no women were hired in EECS,

four offers were made to female candidates but all were rejected. Clearly, MIT faculty positions are less attractive to women than to men. In fact, very few of the women currently on the faculty who did their PhDs here were initially enthusiastic about joining MIT. One told the Committee *"when I finished my PhD at MIT, I didn't think of becoming a professor: my academic advisor looked too stressed out and I didn't want an academic job initially"*. Interviews with the women faculty suggest a number of reasons why: family considerations, problems with relocating because of a partner's career, the high stress associated with an MIT faculty position, and the difficulty in collaborating with colleagues at MIT. More research is needed to understand what role outside societal factors, as well as internal MIT factors, play in candidates' decisions to accept or reject faculty positions at MIT.

Women in Academic Leadership Positions

When the Committee's study began in the fall of 1999, only one woman in the School of Engineering held a line academic administration position and that woman was co-director of a program that was not in the School. These positions include the Provost, Deans, Department Heads, and some Lab and Center Directors. That one woman made up 2.6% of these positions at a time when 6% of the full professors in engineering were women.

In the last two years, however, the number of women in such academic leadership positions has increased dramatically. Three currently have line academic administration positions. Two now sit on Engineering Council and one sits on Academic Council. In addition, three other women in the School have been appointed to positions with substantial administrative responsibilities.

Promotion and Tenure

The pattern of promotion and tenure for women on the engineering faculty is

similar to that for men. From 1986 to 2000, the length of time from PhD degree to a tenure decision was 9.4 years for men and 9.2 years for women. The tenure success rate is also similar: 46% of men and 50% of the women hired between 1977 and 1993 in the School were tenured. In addition, women are promoted to full professor more quickly (4.3 years for women versus 5.4 years for men).

Compensation: Salary

The Committee had access to a plot of salary versus age, by gender, indicating the different ranks of faculty. On average, the salaries of male and female faculty were similar at a given rank. However, the Committee noted that a number of corrections had already been made to women faculty's salaries. In late 1995, the tenured women had concerns about salary inequities and requested a salary review. Data for the percentage increases of the women who were full professors (in departmental faculty, rather than in line academic administrator, positions) from 1990-1999 indicated that over half of them had received significant increases in their salaries in the two subsequent years. In addition, a more detailed review of the salaries of individual women and men of similar rank and age by the Chair of the Committee and the Dean in the spring of 2000 resulted in a small number of women, at various levels, receiving additional salary increments.

Several of the more senior women on the faculty indicated that at various times in their careers at MIT they had received substantial increases in their salaries, or "out-of-season" increases not associated with a promotion or tenure which were thought to make up for past inequities. For example, this committee had access to one female full professor's salary increases over the course of more than 20 years. The data indicate that she received a 17% increase the year she was promoted from Assistant to Associate Professor, including the additional salary increment (typically 7%) associated with the promotion. The following year, when there was no raise associated with promotion, her salary increased by 16%. The same pattern occurred at promotion from Associate to Full

Professor: the year of the promotion her raise was 16% and the following year it was 15%. Later on in her career, she received an "out-of-season" raise, mid-year, out of the normal salary cycle. A second senior woman told us that at three times in her career she had also received remarkably large increases in her salary, which she thought were to make up for past inequities.

Together the data suggest that salary inequities have occurred in the School of Engineering. The need for sudden corrections could be due to the chronic undervaluation of female faculty. The correction is made when someone, such as a new department head, notices a discrepancy. This represents good faith on the part of MIT, but individual salary adjustments do not address all discrepancies in compensation, nor do they account for the full loss of salary (eg. backpay, retirement contributions).

Compensation: Benefits and Demographics

In 1989, 82% of the male MIT faculty had children compared with 53% of the female faculty (Final Report of Ad Hoc Committee on Family and Work, 1990). As of Spring 2000, 52% of the School of Engineering's female faculty had children - essentially no change from the Institute's percentages of ten years before - and the number goes down to 42% for the School's twelve untenured women. (The U.S. Census Bureau reports that nationally 82.5% of women aged 40-44 have borne a child). While MIT's current benefits plan was designed for the traditional family and addresses their needs extremely well, it does not do so for many women faculty.

Data for two benefits illustrate the situation. In 2000, MIT subsidized medical insurance by roughly \$1,900/year for an individual subscriber and \$4,700/year for a family. In 2000, 49% of the women faculty were individual subscribers (compared with 21% of the men); 35% of the women faculty were family subscribers (compared with 72% of the men). In addition, 17% of the women faculty (compared with 7% of the men) didn't make use of the medical benefit at all, presumably because they were insured under

the plans of spouses or domestic partners. The net effect was that, on average, men were subsidized \$1,400/year more than women. (**Fig. 2**).

Another benefit, the Children's Scholarship Program, contributes to college tuition for children of faculty. Institute-wide data provided by the benefits office indicate that in a typical year, male faculty receive 97% of this benefit. Note that the amount of the subsidy is quite significant: for example, a faculty member with two children who attend four year college or university programs, can expect to receive over \$100,000 tax-free towards the cost of tuition over the time the children are in college or university.

As described above, the demographics of the women differ from those of the men on the faculty; consequently, the current benefits package doesn't meet their needs as well. A number of companies and institutions have instituted a cafeteria-style benefits programs to rectify inequities in benefits options. A single professor with no children, for example, might choose to use more of her benefits points for her pension plan, improved disability coverage; or reduced health insurance premiums. Other women might use their points for mortgage/rental subsidies or child care—benefits options that don't currently exist at MIT. Faculty members with families could continue to spend their points on family health insurance, tuition assistance, or other benefits that are now part of the Institute's program.

Outside Professional Activities

Salary and benefits provide the bulk of faculty compensation, but in the School of Engineering access to outside consulting work and start-ups can also make a significant difference. The Committee's analysis shows that the compensated outside professional activities of male professors increase steadily with rank, and that at all ranks male professors do more compensated outside professional activities than female professors. At the assistant professor level, there is a factor of 8 difference in the number of days of outside professional activity between men and women while at the full professor level,

there is a factor of over 4.5 difference.

Consider also the disparity between how much time male and female faculty spend on uncompensated outside professional activity (such as professional society committees and panels). In 1999, the number of days of uncompensated outside professional activity that female faculty performed increased steadily with rank. The number of days of uncompensated outside professional activity that male faculty performed remained constant for all ranks. Female faculty did less uncompensated outside professional activity than male faculty at the assistant professor rank, but did more at the full professor rank. In summary, senior male faculty spend more time doing compensated outside professional activity than female faculty while senior female faculty spend more time doing uncompensated outside professional activity than male faculty.

DISCUSSION: HOW AND WHY WOMEN ARE MARGINALIZED

"I was humiliated by my department head at a department meeting. I received the lowest raise in the department in spite of my research going extremely well and receiving a national research award."-- Comment from a senior woman on the faculty.

This woman faculty member is not alone in feeling ill used by her department or simply ignored. Professional marginalization is insidious, because it so often sounds like complaints about an individual's specific situation. Yet the cumulative impact of the Committee's interview data is strongly suggestive, demonstrating a consistent pattern of marginalization for many of the women faculty in the School of Engineering.

Professors naturally want to work with students and colleagues they're comfortable with, and in the traditionally masculine world of engineering, that often means other men with similar backgrounds. Senior male professors tend to take young men under their wings, providing mentorship and access to informal research networks. The result of such natural affinities, however, is that people who seem different - women

and minorities - remain outsiders.

For example, several women professors noted that male faculty who had done their PhDs at MIT got more assistance from their former advisors and PhD committee members. Help from their academic “parents” yielded research contracts and consulting, introductions to influential colleagues, nominations for awards, and protection from unusual teaching and service commitments. Since a far lower percentage of women with MIT PhDs ends up on the faculty in the School of Engineering, fewer women have the same access to academic parents or such informal mentoring networks. It's also striking that four of the six women with MIT PhDs hired from 1986 to 2000 told committee members "I was on my own."

This section discusses the School's academic environment, connecting the Committee's quantitative findings with the individual stories gleaned from interviews. For example, the increasing number of women in academic leadership positions is encouraging, helping to ensure that the concerns of women faculty are considered. Also, once women accept faculty jobs at MIT, they appear to be treated equitably during the formal promotion and tenure process. But the continued low number of women faculty in the School means that female professors often remain isolated; there isn't the critical mass of women in place to change the current work culture, and that culture appears to drive away some promising female candidates. Trouble spots for women faculty include uneven teaching loads and participation in committees; exclusion from participation in research activities with colleagues; lack of mentorship; and work/family issues.

Academic Duties: Research, Teaching Loads, and Committees

Many women faculty interviewed reported problems in setting up and running their research programs, in part because they were not invited to participate in the research activities of male colleagues. Three women full professors said they had not been asked to be on PhD students' doctoral committees in their own research areas within their

departments. This marginalizes women by sending a subtle message of lack of respect to women faculty which also permeates into the graduate student population. Some women commented that they had not been asked to participate in group research grants; exclusion of women from PhD thesis committees means that in some cases, women are not at the table when ideas for new research grants are discussed. Several women have not taught graduate subjects in their own areas, an important step in building a research group. One woman turned down a faculty offer in large part because of her perception that MIT is not conducive to collaboration. People didn't want to work with her here, while they were eager to do so at peer institutions. In contrast, another woman accepted a position at MIT because of the spirit of collaboration that she perceived at MIT.

Some women in the School of Engineering were also concerned about the number of different subjects they were asked to teach; many believed they have taught more undergraduate than graduate subjects compared with their male colleagues. The evidence for such discrepancies is anecdotal but compelling. One woman reported teaching a subject with a hundred students along with her regular teaching load; later, when a male colleague taught the same subject, he was allowed to do so in lieu of his regular load.

In one department, numerous problems in teaching assignments were noted. A junior woman has taught seven different subjects in seven years; when senior men went on sabbatical, she was asked to teach their subjects. A senior woman in the same department taught one of the core undergraduate subjects, as well as three new subjects in three consecutive years when colleagues were on sabbatical or left the department. When she brought this up with her department head, he said he didn't see anything wrong with it. Another woman taught four subjects in a single year while the usual teaching load was two subjects a year.

There was a common feeling among many, but not all, of the senior female faculty that they were not asked to be on influential committees in their department. In one department, presentations at departmental retreats are only given by men, including junior

men who have been in the department less than two years. None of the women, including the senior women, has ever led a discussion at one of these retreats. When one woman suggested inviting a woman to speak at a department-sponsored special symposium with international invited lecturers, the women faculty were told that there were no women anywhere in the world sufficiently qualified to speak at the event. One woman reported that she was included on influential committees in her department, but felt that her contributions to those committees were not valued. In contrast, one woman thought that not being assigned to committees was a positive thing, giving her more time to focus on other activities; she felt that she had input on important departmental decisions by making suggestions to committee members.

Exclusion of female colleagues from collaborative research activities and influential committees, as well as disproportionate teaching assignments, all act to marginalize women. As with compensation, small inequities compound over time. For instance, while not being asked to be a member of a single thesis committee probably has little impact by itself, continued exclusion from thesis committees over a period of years can lead to further exclusion from group research grants and other important professional opportunities.

Mentorship and Department Heads

Mentorship can make all the difference in a work environment, especially for junior faculty grappling with the many demands of being a professor. Yet both the junior and senior faculty women interviewed by committee member expressed concern about the lack of mentoring in the School of Engineering. Several of the junior women didn't seem to understand what was required for promotion and tenure. About half of the junior women spoke of problems such as lack of advice and feedback, conflicting advice from different senior faculty, and the refusal of one senior faculty member to act as a mentor. One mentor told a junior woman that she shouldn't ask for her case to be put up that year

because another woman in the department was already being considered for promotion. The Committee did not determine whether male faculty also suffer from a lack of adequate mentoring, but this important issue should be pursued in the future.

The tendency of quite a few women faculty to work in interdisciplinary or nontraditional areas presents an additional hurdle to effective mentoring. In these cases, it's easy for the female faculty member to become isolated because there is no existing group of faculty to interact with. That means she is solely responsible for selling the work to graduate students and her colleagues, for starting and teaching relevant subjects, and for building research funding. Those in charge may not value her work precisely because it is different and doesn't fit the standard disciplinary molds, and this in turn can lead to problems obtaining departmental resources; it can also affect compensation. On the other hand, one woman reported that she felt that her interdisciplinary work allowed her to interact with a number of different communities to find one that fit well; she reported feeling highly valued precisely because of the interdisciplinary work she did.

Formal mechanisms instituted by the School or larger MIT administration will shift some imbalances in the academic environment. But how an individual faculty member interacts with her department head or lab director still has the most impact on her daily professional life. Department heads who include women in decision-making, provide concrete assistance in fund raising, and have constructive conversations about professional development can be a tremendously positive influence. However, interviews with women faculty indicate there is still much room for improvement on this front.

Work/Family Issues

Virtually all the female engineering faculty who have children, and many who do not, told the Committee how hard it was to balance family obligations with an MIT faculty career. This problem is especially acute before tenure, causing stress and exhaustion. The following quotes are typical: *"I couldn't see a way to have kids as an*

untenured faculty member but I did notice that most of the junior male faculty in the department do have kids.... MIT was not the only reason I didn't have children but it is a big reason", "Although I knew that having children in graduate school wasn't strictly forbidden, I received very strong messages that having children while in graduate school would be severely frowned upon. I believed that if I did have children in graduate school, it would severely compromise my future career opportunities." and "I thought for years that working the way I did precluded having children".

This situation hurts not only the women on the MIT faculty but also affects the pipeline and hiring. MIT women PhD students, prime candidates for faculty positions here and elsewhere, observe the time stresses of a faculty career first-hand and some opt out of academic careers entirely. MIT's existing family leave policy only provides a short time off (one semester), yet ongoing child-care obligations take the greatest toll. The current policy is gender blind; some women expressed the concern that some men who take the leave use it to further their careers (by traveling the world to give seminars promoting their research or to start companies) rather than to care for the new child. This further tilts the playing field, rather than leveling it. Incremental changes to the existing policy are not enough, which is why the Committee advocates a half-time position for faculty caring for children.

Or consider MIT's current benefits package. The demographics make clear that far fewer female MIT professors have children than the national average for women. It is ironic that the women on the faculty, who find it more difficult to have children than men partly because of the pressures of their MIT positions, are, in effect, subsidizing the families of their male colleagues. This committee therefore supports a cafeteria-style benefits package as an alternative. The basic idea is that employees all receive the same number of benefits points; they can then choose how to spend those points from a broad menu of benefits options. For instance, many of the women faculty who do not use the medical insurance benefit have children; being able to put more of their points towards a

child-care subsidy, rather than medical insurance, would be more appropriate for them.

RECOMMENDATIONS

Opening the pipeline is easier said than done. It is not just a matter of seeking out more women for faculty slots; women need to have good reasons for coming to MIT's School of Engineering. The administration clearly takes this issue seriously. However, in order to attract a higher percentage of women faculty, past gender inequities in pay and benefits still need to be adjusted; unequal teaching loads, committee participation, and research-project access must be addressed; and the strain on women when they're building a career and raising children should be acknowledged. The Committee's recommendations for addressing the issues arising from this study are detailed below.

Hiring Women Faculty

- We recommend a target of 20% women on the faculty in the School of Engineering over the next 10 years. The small number of women faculty increases the problems of marginalization.
- Create a new program for junior as well as senior female hires.
- Provide departments with the best practice search methods. For example, hire a professional at the SoE level to assist search committees in identifying potential female candidates. The SoE hires from a relatively small number of institutions. The pipeline data for those institutions should be obtained.
- The affirmative action policy should be reviewed and enforced more strictly. The Dean's office should track the progress of credible women candidates through the search.
- Programs to attract women to doctoral programs need to be implemented.
- There should be an effort to discover the reasons men and women reject faculty offers, where they go and why.
- Ameliorate work/family conflicts.

Women in Academic Leadership Positions

- Increase the number of women in powerful academic leadership positions in the SoE. Offer such opportunities to senior women who are already here. Include women in positions that prepare people for major leadership positions, such as associate department heads or associate lab directors. Increasing the number of women on the faculty should increase the pool of women with the right skills and the inclination to accept such positions. The SoE should also consider hiring women from outside for leadership positions. Women should be represented on Engineering Council, preferably in two or more positions.

Compensation

- The process and criteria for determining salary increases should be made clear to the faculty. The end-of-year interviews that department heads hold with their faculty to discuss performance and salary raises are ineffective. Current reviews of salary at the level of Dean and Academic Council do not appear to be adequate to identify salary discrepancies among women faculty. There should be an improved review process for salaries.
- The benefits package should be modified so that the women on the faculty receive the same subsidy as the men. Further information on what benefits the women faculty would use is needed. A cafeteria style benefits plan could address this issue.

Academic Duties

- Women should be included in group grants and other broad funding opportunities where they have appropriate expertise to the same extent as men.
- We recommend that department heads review teaching assignments to ensure that male and female faculty have similar teaching loads.
- Women should be appointed to more influential departmental and School committees. One possibility is to ask the women which committees they want to serve on and, unless there is some reason not to, offer them that post.

Mentoring

- There should be more School-wide mentoring. One part of this should be a tenure workshop for junior faculty, in which the faculty personnel records (rendered anonymous) of a successful case and of an unsuccessful case are reviewed by senior faculty. There should be some program in place for the professional development of faculty who are interested in administrative positions.

Department Heads/Lab Directors

- Department heads have a significant influence over the hiring of faculty. They must be responsible for creating and maintaining a good working environment within their departments for all faculty members. Commitment to doing this should be an important criterion for selecting new department heads and lab directors. Department heads should be held accountable for how well they carry out this responsibility and this should be reflected in their salary raises.
- Education of Department Heads in the way gender schema operate could improve the environment for women on the faculty.

Work/Family Issues: Faculty with Children

- The SoE should institute a new release policy for faculty with children, allowing them to work half time at half time salary. There are several issues that need to be resolved in implementing the proposed policy; a committee should be formed for this purpose. The Committee recognizes that a major policy change of this order would be challenging. But it would undoubtedly attract more women faculty to the School of Engineering. This, in turn, would encourage more female graduate students to pursue academic careers, opening the pipeline of women into faculty positions.
- The current child care system is insufficient for the needs and demands of women on the faculty. The number of slots available needs to be expanded. A revision of the benefits to make them more equitable for women faculty might include partial subsidization of child care.
- Until a new family leave policy is in place, there is a need to oversee the current policy to ensure that it is not abused.

PROGRESS: WHAT MIT IS DOING TO ACHIEVE GENDER EQUITY

MIT has already made substantial progress in implementing the recommendations of the committee. The actions of the Dean of Engineering, as well as the formation of the Council on Faculty Diversity last year, have been particularly helpful.

Hiring women faculty

The number of women faculty in the School of Engineering has increased from 31 in 1999 to 34 as of September 2001. Three additional women have already accepted faculty positions to begin during the 2002 calendar year; one of these is tenured. In particular, the Department of Electrical Engineering and Computer Science has hired three women since 1999, two with tenure.

The Dean has agreed to a target of 20% women faculty in 10 years.

The Council on Faculty Diversity is preparing a search committee handbook outlining appropriate search practices. This handbook will have data on the pool of women completing PhD degrees at the top 5 schools in each department in Engineering.

Dean Magnanti has hired an outside consultant to assist with the search for a new DH in CEE.

The affirmative action policy is being enforced more strictly, with Dean Magnanti reviewing applications from women.

Dean Magnanti has agreed to hire a consultant to discover the reasons men and women reject faculty offers, by performing a retrospective study of previous candidates who rejected our offers.

The Institute has recently implemented new policies for faculty with children, including extension of the tenure clock for childbearing and part time appointments for tenured faculty.

Women in Academic Leadership Positions

The number of women in line academic administration positions has increased from one in 1999 to three this year (2002). One of the new line academic administration appointments is on Engineering Council, the other is on Academic Council. In addition, three women were appointed to other administrative roles since September 1999.

Compensation

The salaries of several women faculty have been adjusted to address inequities. The Subcommittee on Faculty Quality of Life of the Council on Faculty Diversity will be considering possible changes to the benefits policies.

Mentoring

The Committee on Women Faculty plans to hold mentoring workshops for junior faculty this year.

Department Heads/Lab Directors

The Dean is arranging a workshop on gender schema for this academic year for Engineering Council.

Work/Family Issues: Faculty with Children

The Institute has recently implemented several new policies for faculty with children, including extension of the tenure clock for childbearing and part time appointments for tenured faculty.

Rectifying gender imbalances is important to the future excellence of MIT, because it opens up a new pool of talent. More important, establishing an atmosphere of fairness will make the School of Engineering a better place for all. Both male and female junior faculty will benefit from improved mentoring and knowledge of the tenure process. Increasing support for interdisciplinary research and professional collaboration makes sense for an engineering school of MIT's caliber, especially during a time of rapid technological innovation.

The findings of this study indicate a cumulative pattern of gender discrimination over many years, one that cannot be accounted for by lesser qualifications or personal

choices. But the fact that change has occurred at MIT is encouraging. It speaks to what good leadership can achieve and how academic institutions can lead the way in establishing parity, acceptance of differences, and a more open work culture.

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Fig. 1: Percentage of degrees awarded to women and percentage of faculty who are women in School of Engineering.

Fig. 2 Health care benefit subsidy to female and male faculty.