Massachusetts Institute of Technology

Vol. XVIII No. 4
March/April 2006

MIT Faculty Newsletter

http://web.mit.edu/fnl

this issue features a retrospective of his term as Dean for Undergraduate Education by Robert Redwine (page 5); a Teach Talk article on "Why Students Don't Attend Class" (page 6); the announcement of a DOD inquiry into Lincoln Lab misconduct charges (page 9); and an article on "International Students at MIT Post 9/11" (page 10).

Diversification of a University Faculty: Observations on Hiring Women Faculty in the Schools of Science and Engineering at MIT

Nancy Hopkins

Abstract

A BROADLY DIVERSE FACULTY is critical to MIT's educational mission, and significant efforts have been made to achieve a faculty whose diversity reflects that of the students we train. To assess the success of some of these efforts, I examined the percent of women faculty in the Schools of Science and Engineering over time. In Science, the increased number (and %) of women faculty today is the consequence of: pressures associated with the civil rights movement in the early 1970s; unusual efforts between 1996 and 2000 by former Dean of Science Bob Birgeneau in response to the 1996 *Report on Women Faculty in Science*; and efforts that sustained the progress made as a result of these two initiatives. The women faculty hired in the School of Science as a result of these pressures achieved tenure at the same rate as men and have achieved at least the same level of professional success as their male colleagues as measured by election to the prestigious National Academy of Sciences. In the School of Engineering, the number of women faculty rose more steadily with time and with the increasing number of women receiving PhDs. However, as in Science, a recent rapid increase in the number of women faculty resulted from the leadership of its Dean, Tom Magnanti, working collaboratively with then Provost Bob Brown, in response to the *Report on Women Faculty in the School of Engineering*. The data suggest that usual departmental hiring processes do not always identify exceptional female candidates. But, women faculty were readily hired by involvement of the central administration, including the use of novel hiring procedures, collaborations among the Provost, Deans, Department Heads, and women faculty committees, all with the visible support of the President.

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Editorial

Squeezing Out the Graduate Students

IN THE EARLY 1980S, MIT was well known as an expensive place to do research. With a high dependence on federal funding, graduate students were very expensive to support. Provost John Deutch made a dramatic improvement in the situation for the faculty by transferring graduate student tuition into the employee benefit pool, but that tactic was eventually disallowed by our federal auditors and costs to research grants and contracts soon escalated. A committee chaired by Professor Robert Weinberg was charged with recommending a long-term solution to the problem, which ultimately led to a tuition remission policy by the Institute.

This policy both removed tuition on graduate students in the summer term and required faculty research grants to cover only 35% of the true cost of tuition, referred to as 65% "tuition remission." To

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Website
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Subscriptions
$15/year on campus
$20/year off campus

Squeezing Out the Graduate Students
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fund the program, the Institute no longer covered the full costs of NSF and other graduate student fellowship shortfalls, instituted a 10% transaction fee on discretionary funds, stopped paying interest on Pool C investment accounts, and revised its schedule of tuition collection during the academic year. But as our endowment eroded following the .com bubble, and the generally conservative Corporation became nervous, the tuition remission was adjusted to 50%, and then to 45% (last year) to cover the costs of rising student health care coverage. As a consequence, it now costs $57,598 per year to support a graduate student at MIT, including stipend ($24,588), tuition ($17,765), and F&A ($15,245), among the highest rates in the country. The transaction fee was not removed nor was the Pool C interest restored.

Some granting agencies, such as the NIH, have a cap on the amount of money they will award to support a graduate student. Others, like NSF, also typically under-fund the cost of graduate student research, at least at the MIT level. In the case of NIH, the direct costs are capped at the minimum starting postdoctoral salary of $36,996, resulting in a gap of $5,357 in direct costs per graduate student. With rising stipend and tuition levels, this gap is likely to widen. In addition, the high cost of research at the Institute puts our faculty in a disadvantageous position with respect to their peers at other institutions. When grant proposal review groups examine our large budgets, they wonder what the relatively high costs reflect, a process that can and has led to recommendations of significant reductions in awarded budget levels for MIT faculty.

Readers with a long history at the Institute may view these facts as old news, and our youngest colleagues on the faculty may be somewhat shielded from these concerns since they run their labs on startup funds. More senior faculty nearing retirement may already be in the process of downsizing their groups and/or switching to more postdoctoral associates. But for the large group of faculty in between, there are once again serious clouds on the horizon. Because of the increase in graduate student tuition, labs are now finding that post-docs are becoming as economical to support as graduate students. As a result, more postdoctoral associates are being appointed and fewer graduate research assistants trained. If we are to retain the talented pool of graduate research assistants who are so essential to the breakthrough research that characterizes MIT, serious action on the part of the senior administration is required in the immediate future to address this issue. Will our newly appointed leaders find the way or will we continue squeezing out the graduate students? ■

Editorial Sub-Committee

letters

Students need dental insurance plan

To The Faculty Newsletter:

I HAVE JUST READ an article in the January/February issue of the *MIT Faculty Newsletter*: "An open letter to the MIT faculty" concerning the Medical Care Task Force by Dr. Ed Seldin. I strongly agree with Dr. Seldin that not having a dental insurance plan is a disservice to the MIT student body. I also agree with Dr. Seldin that the dental health of international students deserves more concern.

I was a student from China and I was the president of the Chinese Student and Scholar Association (CSSA) at MIT for the year '00-'01. My very first dental appointment at MIT was made this January, one year after I graduated from MIT and became a postdoc here. During the seven years of my graduate student life at MIT, I did not see a dentist because: 1) I thought I did not need a dental service since I have attractive teeth; 2) I did not have dental insurance and I was afraid that I could not afford a dental visit. I just joined the MIT dental plan as a staff member on January 1, 2006, and I have visited the dental office four times in the past seven weeks, with three other appointments scheduled. I have had my wisdom teeth removed and I am now waiting for teeth cleanings. I hope these appointments will help stop my gingivitis and periodontitis.

I think many Chinese friends of mine have similar experiences and would visit the dental office more often if dental insurance were provided at MIT. Smart people should have healthy teeth! I believe the dream could come true with help from the President's Office.

Youshun Sun
PhD, Geophysics

Editor's Note: A similar version of this letter was sent by Dr. Sun to President Hockfield.

When Disasters Strike!

Help is on the way . . . or is it?

Ernst G. Frankel

LARGE DISASTERS OCCUR WITH increasing frequency. Most, like last year's Indian Ocean tsunami, the Pakistan earthquake, and the Katrina hurricane, are caused by nature. Each time, governments and institutions including universities rush to help with money, resources, and most importantly promises; promises of funds, supplies, logistics services, and advice. While some funds, supplies, logistic services, and advice are actually delivered, many (and most importantly) solutions usually remain empty promises.

Among the responders are often universities, such as MIT, which announce grandiose plans and make compassionate appeals, form committees or working groups to look into the matter, which after a period of declining member participation in line with reduced public attention usually just goes out of existence or dies. In other words, universities, like some governments and other organizations, often use disasters more as publicity ploys than a commitment of help.

There is a lot MIT could do in these cases, but it requires more than pious promises; it requires real commitments, including assignment of resources. While some of these will always be provided by well intentioned faculty and others, there is a real need for the Institute as a whole to lead and commit to such endeavors. It would be effort and money well spent, not just in enhancing MIT's public image, but also in assuring faculty and staff that they are not alone in providing badly needed assistance. We must consider disaster response not just another academic exercise, but an opportunity to make a real difference and/or immediate impact. It is also an important educational and research activity in line with our primary functions.

Working with the Senate Committee on Homeland Security investigation of the Katrina response, I became painfully aware of the inexcusable delays and mismanagement in the delivery of relief by government agencies during and after the disaster. But I also had to admit that academic institutions could have done much more than issue pious announcements, form study committees, and dispatch of some isolated experts to identify issues.

Most of the damage done by the hurricanes as well as other natural disasters was and is preventable. The failure of the levee system in New Orleans, for example, was the result of a combination of bad design, inadequate construction supervision, inept or non-existent maintenance, and lack of effective inspection. Much of this could have been prevented by expert oversight, which academic institutions (as neutral parties) could provide.

Reconstruction plans now seem to advocate much of the same faulty non-storm resisting building approach and urban planning that fails to consider the long-term threats of ever more violent natural disasters. For example, there is an urgent need for a drastic change over from the traditional nailed stick and plywood home construction that is used in most single family dwellings that were flattened by moderately strong winds and not just flood surges, to solid concrete buildings on piled stilts with utilities located not in basements but in attics. There are similarly major opportunities to ameliorate the effects of storm surges by various coastal barriers. In my opinion, academics could and should play a proactive role in developing real solutions and use their knowledge and prestige to influence government agencies, industry, and the public in adopting meaningful disaster prevention methods as part of reconstruction, relief, and future disaster prevention.

The prestige and reputation of MIT should be used to assure that reconstruction and development decisions are not largely based on political convenience, but on technical requirements and socio-economic realities; not on the interests of the contractor and home building industry, but those of the local population and their future. Universities like MIT, in my opinion, not only carry the responsibility of providing the best possible education to top qualified students and offering unique research and development in science, medicine, engineering, and management, but also the responsibility of leading in guiding government, industry, and the public in the right direction, particularly on issues affecting public safety and security.

Large disaster relief management cannot be left mainly to politicians if the public is to be properly served and protected. There is an urgent need for effective guidance, involvement, and leadership by the intellectual community if the shameful performance of disaster prevention and relief we witnessed in the Katrina episode is not to be repeated. Many colleagues may argue that such involvement deviates from our primary missions of education and research. I beg to differ and contend that this type of activity provides the very core and rationale for our primary missions. If we are not at the forefront of disaster prevention and relief, how do we justify much of our work!

Ernst G. Frankel is a Professor Emeritus, Ocean Engineering *(efrankel@mit.edu).*

Faculty Roles in Administration: A Critical Part of Institute Governance

Robert P. Redwine

I RECENTLY COMPLETED A term of five-and-a-half years as Dean for Undergraduate Education, and am now in the process of re-invigorating my research program and preparing to return to the classroom. When the editor of the *Faculty Newsletter* asked me if I would like to write a retrospective of my experience as Dean, I was initially skeptical. Frankly, I think it is very hard to make such retrospectives interesting to a large fraction of the faculty; while experiences such as serving as Dean for Undergraduate Education are very intense and consuming for the individuals who serve, this does not guarantee that others will find a description of the experience of great interest.

I eventually decided that writing an article would be a good idea, but only if I focused on one particular aspect of my experience and perspective. This certainly does not mean that I do not treasure the many experiences I shared with colleagues from the faculty and staff and with many students during my tenure as Dean. The Dean's job is indeed intense and consuming. Some of the things one can accomplish are important, and certainly the job is always exciting. The best part was the chance to work with so many dedicated, bright people from all parts of the Institute. I will always feel lucky to have had this opportunity.

The aspect of my experience I wish to discuss, has to do with the relationship between faculty members who serve in roles in the senior administration, and their other faculty colleagues. The most surprising (and most disappointing) aspect of my tenure as Dean was the attitude among many faculty colleagues that I had gone over to "The Dark Side" and was therefore not very useful or trustworthy. Somehow, from one day to the next, I had turned into someone who could neither understand nor represent a faculty perspective on important issues. Colleagues I had known for years had little interest in keeping in touch, even when it was straightforward to do so. I heard similar experiences reported by my faculty colleagues on Academic Council. This attitude of many members of the faculty certainly seems illogical, and I believe represents an important lost opportunity for effective faculty governance of the Institute.

There are 14 members of the faculty who serve on Academic Council. Most of them have spent their professional careers on the faculty at MIT. It is my impression that most of them also do not expect to take on additional significant administrative roles after they complete their terms as Dean, etc. They are serving the Institute in their current roles because they are dedicated to the educational and research goals of MIT and because they believe it is important that these jobs be done well. In addition to carrying out their individual responsibilities, these colleagues have the opportunity to participate on a regular basis, through Academic Council, in discussions and decisions which shape the Institute in critical ways.

This tradition of senior academic and administrative leaders coming together regularly to compare notes, reach consensus on important issues, and advise the President of MIT, is a major strength of our system of governance. I do not know of any other university which has a more effective way for faculty to participate strongly in the governance of the institution. The system is most effective when faculty who serve in these positions bring with them a perspective which has been formed by their many years teaching and doing research. It is my observation that this is exactly the perspective brought by our faculty colleagues on Academic Council. Most faculty members serving at the Dean level do not view that role as their career goal. Deans at MIT are typically first and foremost faculty members at MIT; the role as Dean is an interesting and exciting one, but temporary.

Clearly, some of our colleagues do end up going on to other administrative leadership positions at MIT or elsewhere, and we are proud that they do. But my experience is that these individuals also bring with them the perspective of having served on the MIT faculty, which informs in important ways their judgment and decisions as they move into other positions.

So we have an enviable system of faculty participation in the governance of the Institute. How can we make it function to its full potential? One way is clearly to continue to recruit wise, dedicated colleagues to serve in important administrative positions. But along with this should come the recognition by the faculty in general that these colleagues are representing our interests and opinions in an important setting. They need to continue to feel that they have faculty colleagues who view them as members of the faculty and who will keep them in contact with faculty concerns. It would be highly desirable to reduce the needless barrier between the faculty and those colleagues who serve for a time in administrative roles, a barrier which is felt strongly by many. We will all benefit, and our system of governance will be the stronger.

As I have said on other occasions, it was a great privilege and pleasure for me to have served as Dean for Undergraduate Education. I highly recommend such a role for those who may be interested.

Thanks for reading this far. And don't forget to keep in touch with your friends on The Dark Side.

Robert P. Redwine is a Professor of Physics *(redwine@mit.edu).*

Teach Talk

Why Students Don't Attend Class

Tom Clay
Lori Breslow

ARE YOU DISSATISFIED WITH the attendance at your lectures? Do you wonder what your students are thinking when they skip your lectures? If you answered "yes" to either question, you'll be interested in what 47 undergraduates said in response to a recent e-mail survey on their attitudes toward attending lectures. This article addresses the results of that survey, including (1) the students' general attitudes about lecture attendance; (2) the importance of various factors they consider in deciding whether to attend; (3) the thinking process they use to make those decisions; and (4) their recommendations for ensuring high attendance rates.

Students' General Attitudes about Attending Lectures

We found that students' attitudes toward lectures vary widely, from "I never miss them" to "they're worthless," with most responses falling somewhere in between. Most students reported they try to attend lectures, and usually do, missing them from time to time as the result of academic, extracurricular, or personal conflicts. When asked to estimate what percentage of lectures they attend, about two of every three respondents (67%) estimated that they attend at least 90%, three of every four (76%) that they attend at least 75%, and more than nine in 10 (93%) that they attend at least half.

Factors in Decision Making and their Importance

The survey results indicate that the most important factor in deciding whether to attend lectures is the lectures' quality and clarity, followed by conflicting deadlines for other classes, the professor's use of relevant examples, and the professor's ability to engage and entertain the students. The figure below lists various factors from the highest mean importance score to the lowest (based on a five-point scale in which 1 was "not at all important" and 5 was "extremely important").

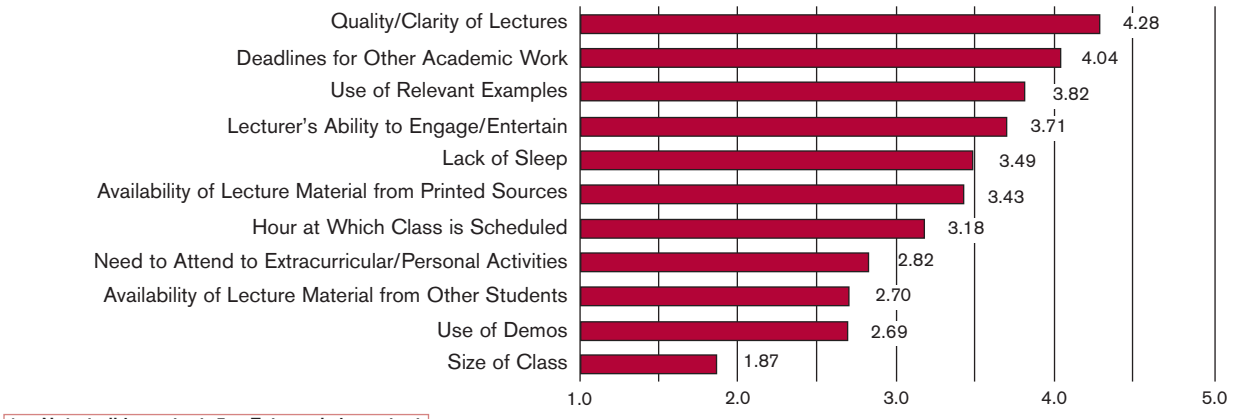
In creating the list of factors we asked students to rate, we tried to adopt their viewpoint, but we discovered from their write-in comments that we had not anticipated the following:

• *Whether the students expect to learn from the lecture* – If students do not expect to learn from lectures, they are less likely to attend. "The absolute most important thing," according to one student, "is if I feel that I am learning something in the class." A second student echoed this opinion, adding, "If I'm not learning, why go?"

• *The difficulty of the class and the material* – Students say that if they don't find the material challenging or if they are doing well in the class, they may decide to allot time they would otherwise spend on the class – including attending lectures – to classes they find more challenging, especially at the busiest and most pressure-filled times of the semester.

• *How the lectures relate to psets and tests* – Students felt that the lectures

Relative Importance of Factors Used to Decide on Lecture Attendance



1 = Not at all important; 5 = Extremely important

should be aligned with what appears in the homework and on tests. As one student put it, "[H]aving the lectures directly relate to the problem sets and test materials is probably the most motivating factor in going to lecture. Because that way, what is said in class can be processed in doing the problem sets and I can see that they are both useful and applicable."

on their workload, and attempting to optimize their use of time. While students may or may not be deliberate or systematic in making their decisions, they do explain them this way in retrospect. In light of this process, the mean importance scores discussed above may best be seen as reflecting, at an aggregate level, the weights the students place on the various factors in their overall decision-making "calculations."

When asked to estimate what percentage of lectures they attend, about two of every three respondents (67%) estimated that they attend at least 90%, three of every four (76%) that they attend at least 75%, and more than nine in 10 (93%) that they attend at least half.

• *How interested the students are in the subject matter* – Not surprisingly, students are more likely to attend classes they find interesting. At first glance, this may appear to be beyond the professor's control, but at least one student would disagree:

"What matters most for me is how much I like the class. Sometimes a class is good because it is simply an interesting topic. However, an otherwise boring subject can become an interesting class if the lecturer is able to present the course material in such a clear and cogent manner that students cannot help finding it interesting. Generally I have found that if a lecturer genuinely finds the material he/she is teaching [interesting], and he/she is able to connect with students through lectures (present material in a way that makes sense), then he/she doesn't have trouble making the material interesting for students."

The Decision-making Process

The decision-making factors are discussed above as though each influences the students independently of the others, but that is not the case. To the contrary, the write-in comments make it clear that students typically use a very practical decision-making process that considers a range of factors in combination, comparing the advantages and disadvantages of lecture attendance, calculating the impact

Recommendations for Ensuring High Attendance Rates

A number of students offered observations on how professors can ensure high attendance rates. Some of those methods – pop quizzes, taking attendance, and giving away test questions in class – force students to attend. Students referred to these methods as "cheap" and "mean," the implication being that a professor using them might achieve high attendance rates, but would not be earning them. Other methods, they said, make the students want to attend. How can a professor do this? The easy answer is to say that he or she should lecture well and clearly, use relevant examples, engage the students, schedule classes in the afternoon, use a lot of demos, and align the lectures with the psets and tests. This is sound advice as far as it goes, but is of only limited usefulness, since it does not suggest how these things can be done. Fortunately, some of the same students who provided the other insights in this article also offered specific advice on how to give great lectures. Their suggestions include:

• *"It's a real pleasure to be able to walk out [of class] . . . and know what happened, and how it all fits together. … One way to do this might be to finish the lectures by stepping down from the position of professor, and taking the view of the students, to try to talk more on a level with them. As a 'student' [the professor] could run through everything he had 'learned' in that class, describing it in broad, quick strokes. Then the students could leave, confidently knowing that what seemed so new and overwhelming just a few [minutes] ago could be explained very simply."*

• *"[T]o make the lectures useful, the new knowledge must be integrated into what we already know. . . . [It] must be continually related back to known material, so the students can make the small connections that keep the new facts/concepts tied into the existing knowledge structure. This can simply be done by verbally giving the equivalent of directions after every new small concept is . . . introduced. . . . Simply add, so this equation came from ___ . . . and tells us ___."*

• *"The most important thing to come away from a lecture with is the overall structure of the new knowledge gained – in essence how all the parts fit together. … [W]ithout this overall super-structure …, the [information is] no more than disjointed facts that seem pointless and frustrating. [T]hen the lectures become both meaningless and frustrating and people stop going."*

About the Survey

The survey was conducted by Tom Clay & Associates, Learning Consultants, in association with the Teaching and Learning Laboratory in the spring of 2005, and underwritten by the Cambridge-MIT Institute (CMIT). Short questionnaires were sent by email to 116 students in one subject. Forty-seven students responded for a 41% response rate. The questionnaire consisted of three questions, each of which afforded opportunities for write-in comments; the information in the write-in comments proved especially rich. Analysis was also informed by interviews conducted with students in the same course.

Tom Clay is a principal in Tom Clay & Associates, Learning Consultants, and an Associate of the MIT Teaching and Learning Laboratory *(tom.clay@gmail.com).*
Lori Breslow is the Director of the Teaching and Learning Laboratory and a Senior Lecturer, MIT Sloan School of Management *(lrb@mit.edu).*

MIT Poetry

by William Pounds

Life in the Lowlands

When corporations fail
Many drown.

The Party tried with only one
Run for the people
Without success.

Those who do without
Live on higher ground
Eating roots and berries.

We who prefer the good life
Advocate virtue,

But just in case,
Stuff old leaks
With laws.

Knowing the sea waits.

Professor Emeritus William Pounds has been at MIT since 1961. Along the way, he has served as Dean of the Sloan School, on several corporate boards, and as Senior Advisor to the Rockefeller Family. He currently teaches a course on corporate governance.

Provost Announces Government Inquiry Into Lincoln Lab Misconduct Charges

IN AN E-MAIL LETTER to the MIT faculty on March 3rd of this year, Provost L. Rafael Reif announced that the federal government is going to investigate charges of research misconduct at MIT Lincoln Laboratory regarding the test results of the 1FT-1A (Integrated Flight Test 1A) missile conducted in June 1997. The investigation is in response to an MIT request for classified data that the Institute states it needs to complete its own inquiry into charges leveled by MIT Professor Ted Postol beginning in April of 2001.

In his letter to the faculty, Provost Reif writes: "Despite the difficulties in resolving the allegation, the MIT administration has never ceased to press for a satisfactory conclusion. To remind you, MIT had followed its procedures (which conform to federal guidelines) by completing an inquiry into the allegation. The inquiry did not find that misconduct had occurred, but concluded that further investigation into the facts was needed to address several open questions. MIT's subsequent attempts to initiate an investigation by non-MIT personnel have been stymied by the Defense Department's restrictions on access to certain documents essential to the investigation. This has led to the unfortunate delays."

In announcing the federal investigation, Reif continues: "The Department of Defense has now agreed to conduct an investigation into the open questions enumerated in MIT's inquiry. . . . In this case, the Department has been willing to work with MIT to define a process that meets our concerns as well as theirs."

In a letter to MIT President Susan Hockfield dated March 7th and made available to the *Faculty Newsletter*, Professor Postol takes exception to the Institute's response to the announcement by the government. "As you well know, I have been trying for nearly 5 years to get MIT to investigate a serious matter of scientific fraud and misconduct at MIT Lincoln Laboratory regarding national missile defense. Now a letter to the Faculty dated March 3, 2006 from Provost Reif states that MIT's attempts to initiate such an investigation have been 'stymied' by the Defense Department's restrictions on access to certain information 'essential to address the questions identified in MIT's inquiry report.' However, the fundamental question that really needs to be answered is why you refuse to proceed with an investigation and analysis of the ample existing public data that shows that fraud occurred."

The structure of the investigation, states Reif, will be as follows: "The investigation will be conducted by Dr. Brendan Godfrey, a high-level, civilian employee of the Department with strong technical credentials who is independent of the Missile Defense Agency (which was the sponsor of the test that the Lincoln scientific staff reviewed). . . . The investigator will be granted access to all relevant documents, including documents for which the state secrets privilege was asserted in 2003. He will submit a report to the Under Secretary of Defense for Acquisition, Technology and Logistics, Mr. Kenneth Krieg, who under the federal guidelines makes the final decision on the question of research misconduct."

An additional key part of the investigation process is the appointment of an advisor and consultant to Dr. Godfrey. Continues Reif: "MIT has advocated, and the Department has agreed, that a mutually acceptable outside party act as an advisor and consultant to the investigator, to help assure an impartial and thorough investigation. This advisor will have full access to all classified and unclassified documents, except those specifically subject to the state secrets privilege asserted in 2003. We are extremely fortunate that Mr. Norman Augustine has agreed to serve as the advisor."

The appointment of Augustine, a former Army undersecretary under President Ford, past Chairman and CEO of Lockheed Martin Corporation, and a past member of the MIT Corporation, draws nothing but rancor from Professor Postol in his letter to President Hockfield: "You have now decided to turn your responsibilities over to the Pentagon and have the 'investigation' watched over by a former CEO of Lockheed-Martin who wrote an editorial in *The Wall Street Journal* asserting falsely that the Patriot anti-missile defense had performed successfully during the Gulf War in 1991. Can anyone who knows about these biased and misleading claims and the lies the Pentagon tells about this and other programs expect an objective investigation of this matter? Can you?"

In *The Wall Street Journal* editorial referred to by Postol ("How We Almost Lost the Technical War," June 14, 1991) Augustine writes: "Critics who for years have been telling us that our military technology won't work are now telling us that, in the Persian Gulf, it didn't work. Fortunately, Saddam and his troops didn't get the word. We are told that the cruise missile, the Apache helicopter and the Stealth fighter didn't perform up to par. Neither, it seems, did the Patriot missile – which some apparently would have us believe was repeatedly knocked out of the sky by Saddam's Scuds." Augustine continues: "Perhaps the best example of all [of what the defense acquisition system can accomplish when it is unfettered] is the Patriot 'Scudbuster.' The Patriot missile is assembled by Martin Marietta under contract to Raytheon Corp., the system's prime contractor."

Provost Reif completed his letter to the faculty by promising to keep them informed. ■

International Students at MIT Post 9/11

Danielle Guichard-Ashbrook

Have increased security measures affected our student population?

THERE HAS BEEN CONCERN expressed across the Institute about the potential effects of the U.S. government's post-9/11 security measures on international students. The good news is that international students continue to apply to and matriculate at MIT in significant numbers. In the immediate aftermath of 9/11, we did not see our numbers plummet, as did many schools across the nation.

A quarter of the students at MIT are international; nearly 37% of graduate students are international. Those percentages have remained fairly constant over the past 10 years. Numbers of students from specific countries have fluctuated slightly over the years. Currently, the numbers for Canada and the United Kingdom are down, while India's and Korea's have increased. (See M.I.T. Numbers, back page.) International graduate applications declined noticeably in 2004, but those numbers are beginning to recover, climbing again in 2005. (Source: Office of the Provost, Institutional Research.)

MIT still retains its enormous appeal to the best and brightest around the world in nearly all science and engineering fields. In spite of onerous post-9/11 visa regulations and processes, our students do secure their visas and arrive with very little trouble. In 2002, nearly 100 of our international students were subjected to extra security clearance procedures, eliciting significant visa delays. By this year that number has trickled to fewer than a dozen. This past academic year, all of our 800 or so incoming students who accepted offers of admission, and could identify funding resources, arrived by registration day. No one was denied a student visa. The oft-discussed "visa problem" for international students is not a significant issue at MIT. Our students get their visas. And the vast majority arrives in a timely fashion.

There is growing anecdotal evidence that while our international student population is, by and large, very happy at MIT, they are ambivalent about being in the United States. Many of our students report a distinct feeling of unease about the political and cultural climate in the U.S.

So what's to worry?

There is growing anecdotal evidence that while our international student population is, by and large, very happy at MIT, they are ambivalent about being in the United States. Many of our students report a distinct feeling of unease about the political and cultural climate in the U.S. That unease surrounds their stay at MIT, as they come to understand just how extensively their activities and whereabouts are tracked and recorded by federal authorities; and as their motives for studying in the U.S. are questioned by those authorities. Our students are keenly attuned to an atmospheric shift in the American environment, one tilted toward suspicion of foreign nationals, and in the extreme, even menace. Why, we hear some international students asking themselves, should we commit to this less-than-fully welcoming environment?

Once in the U.S., it is relatively easy for an international student to run afoul of immigration laws. If you pass your qualifiers, but forget to apply for a new immigration document that reflects the higher degree, or if you move and fail to update your address within 10 days, or if you allow your documents to expire by as little as one day, your legal status in the U.S. will be "terminated." Such oversights, though often redeemable through a lengthy and costly reinstatement process, can potentially plague a student throughout a career in the U.S. The record of the "mistake" never goes away. You will likely be asked about it in future applications.

The Student Exchange Visitor Information System (SEVIS) is the government's student tracking database. It is often inaccurate and chronically out of date. It is also unforgiving. A few examples:

- A returning African student was told at a U.S. Embassy that his status in SEVIS was "deactivated" and he was no longer entitled to a student visa. In fact, though the student had been a graduate student for nearly a year, it was his undergraduate record that the Consular Official had accessed. Urgent faxes and e-mails from MIT, even a copy of the active record in SEVIS itself, would not dissuade this particular consular official. The SEVIS record he could see was all that mattered.

• A PhD student was stopped during a random security check in upstate New York. After a cursory check in SEVIS, the border official bluntly told her that she was in the U.S. illegally, and promptly arrested her, holding her in a makeshift cell for several hours. Her young friend and boyfriend were witness to the events, were shocked and frightened, and won't forget it any time soon. A year earlier the student had withdrawn from MIT for a term and departed the U.S. to care for an ill parent. The authorized withdrawal was duly noted in SEVIS, as was the fresh entry to the U.S. when the student returned to full-time registration. According to the student, the agent simply didn't believe her and refused to allow her time to secure documentary evidence of her status before placing her directly into deportation proceedings. She was, in the agent's view, "unlawfully present in the United States." When I spoke to the agent a few days later confirming her MIT status, he told me over the phone that "she didn't look like a PhD student at MIT."

• A pregnant PhD student was re-entering the U.S. after a visit home. While the border official acknowledged that her SEVIS records were in order, he proceeded to aggressively question her about her pregnancy, accusing her of "using her student status" to ensure that her baby was born in the U.S. This demeaning encounter left our student so shaken that it was weeks before she could speak about the experience without sobbing.

Of course, cases such as these get eventually "resolved." The beleaguered student arrives back at MIT and returns to his or her research. The anger and hurt retreats. But the experience leaves a sting, not easily forgotten. And of course these stories have legs. They are told and retold to other students, to anxious faculty and staff, and to family back home.

Unwelcoming and disconcerting experiences such as these are having a perceptible impact on our students. Some are beginning to openly question whether or not they want to pursue education, careers, or lives in the U.S. They are increasingly considering internships, research and employment opportunities outside of the U.S. ". . . to hedge my bets," as one student put it to me, "in case I find I don't like it here." Recently, three different students married to U.S. citizens have indicated that they have no desire to pursue opportunities in the U.S. after graduation. One of them, a Russian national, said he had no intention of ever applying for a green card. Another, a PRC national, is going off with her husband to a post-doctoral position in Finland after graduation. This kind of rejection of even considering opportunities in the U.S. was unthinkable as little as three years ago.

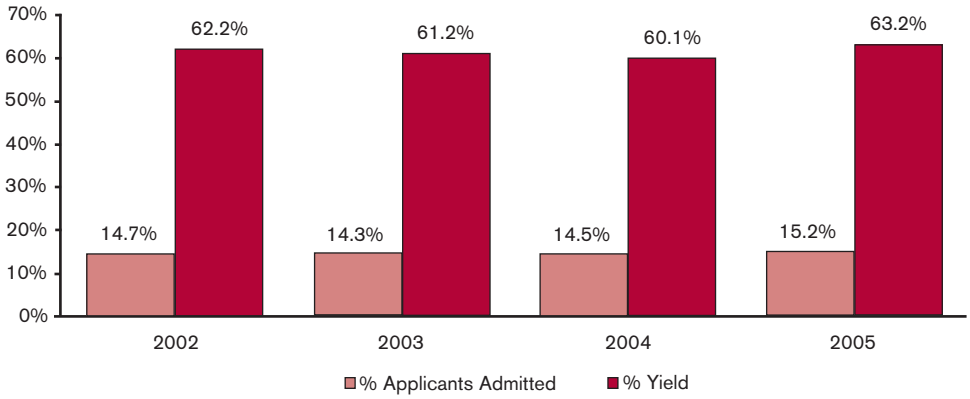
Should we be concerned that foreign students feel less welcomed and at ease in a security-minded America? Other countries have always coveted our highly talented students, and our students have always had choices. But now competing countries have more to offer than in the past. With stronger economies, aggressive global recruitment strategies, and enhanced academic and research infrastructure in places such as Canada, India, China, and much of Asia, "our" students are actively wooed. These countries are also pointedly liberalizing their visa polices as U.S. immigration policy becomes more prohibitive. Friendly immigration policies in Canada, the UK, and Australia specifically target scientists and engineers. Other countries will no doubt follow suit. The message implicit in these polices resonates deeply with MIT's international students: "We want you. We will value you when you are here."

Why wouldn't our students begin to respond to this welcome?

Wouldn't you?

MIT provides an extraordinary and effective environment for research and education to all of our students, including our internationals. Within MIT, international students feel valued and vital to this vibrant academic community. Many will build lasting relationships with the Institute, and many with the United States. But we cannot ignore the troubling implications of the broader American environment to the well being of our community. ■

International Graduate Students Admissions and Yield



Source: Office of the Provost, Institutional Research

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A Failure in Communications

Brian Evans

The metamorphosis of academic publishing

I REALLY HAVE TO lean into the wind to make some headway as I come through the wind tunnel at the base of the building. Well, what do you expect? After all, it's March, and this is Building 54. Instead of waiting for the elevators, I decide to walk up to the seventh floor. There is not going to be any time for any other exercise today. How can you work for 12 hours each day, and get further and further behind?

Trudging up the stairs, I go over my list of things to do. Actually the hike is more like 10 floors, but my list is long enough to last the entire trip. On the way past the mail room, I grab my pile of incoming. Let's see: junk, junk, the *Faculty Newsletter* – put that aside to read cover to cover later – junk, junk, some papers to review, a few proposals to read, a couple of manuscripts to revise . . . Wait, what's this? A letter from the publisher. Great, our paper was accepted! Here's the copyright agreement. Man, who writes this stuff? Well, at least I can sign this, get it out of here, and get on with life. After all, you don't really have a choice about these agreements, right? There isn't anything you can do, and the media rights don't matter, anyway. Nobody's going to make a movie out of my research.

Well, actually, most of those comments are dead wrong. There is a choice, those agreements do matter, and you, the author, are not powerless. There are things you can do about it; but first, a little history.

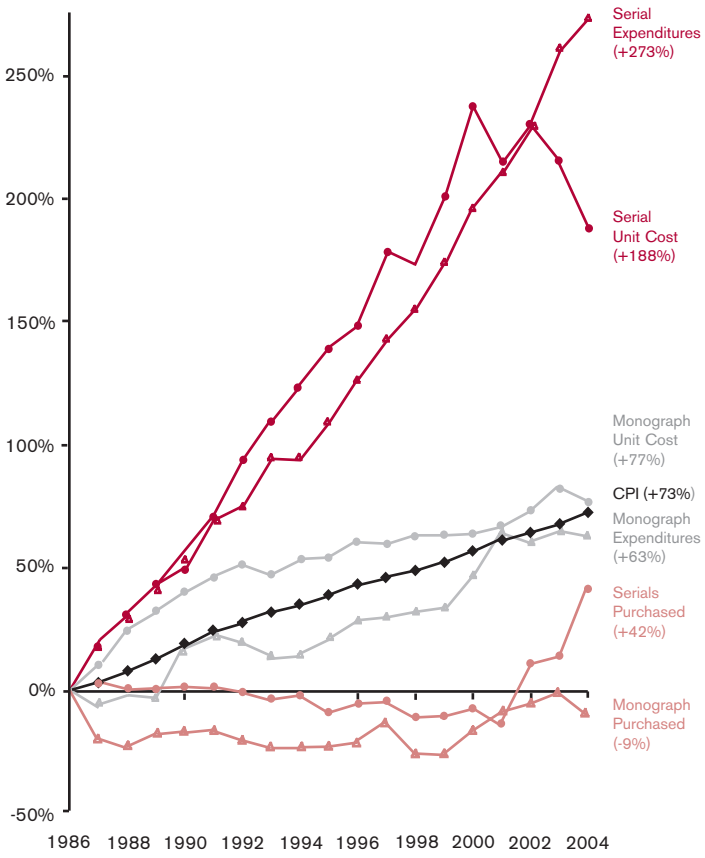
For perhaps the last 10-15 years, academic publishing has been metamorphosing in dramatic fashion. Most of us are aware of the transition from print to electronic media. For those with the right institutional connections, access to most major research journals is now possible from our offices or, even, at home. Less apparent to end-users in academe has been the transfer of publication costs from the single subscriber to multiple-journal, multi-user access licenses by libraries, institutions, and systems. These fundamental changes in the business strategies of the commercial academic publishers have caused extraordinarily large increases of cost for colleges and universities (see graph, next page). Additionally, globalization of the scholarly printing trade has dramatically reduced the number of publishers, even as the number of journals has increased.

Intellectual property rights are also in transition. The advent of the Internet and its promise of large amounts of freely accessible information have triggered a movement to replace copyright law with contract law. Access to scholarly publications is now rented yearly, rather than purchased. The right to own print copies now incurs charges in addition to simple subscription costs, and many publishers are moving to eliminate traditional print versions entirely. Thus, if a library drops a journal subscription, access to the entire electronic version may be lost, and recourse to a printed copy is much less likely. Subscription rates are now negotiated individually by institutions, rather than being based on standard values for all colleges. A small community college is likely to pay much less for a given journal than a major research institution. Of course, the research institution also has less flexibility in cutting important journals and, consequently, has less leverage in threatening to cut subscription costs. As publishers strive to protect access to journal content, the contract and copyright agreements have become much less standard and, generally, more restrictive.

In response to these trends, a grassroot, "open-access" movement has developed with the loosely defined goal of providing freely accessible repositories of intellectual material, governed by less restrictive copyright assignments, as defined by a broader portion of the academic community (for example, see ***sciencecommons.org/***). The open-access movement is driven by a wide variety of forces, amongst which are desires for fewer restrictions on the use of published material in the classroom, increased accessibility, decreased cost, and greater clarity in copyright issues. Open access journals tend to be concentrated in, but not exclusively restricted to, health, medicine, and biological sciences. Concern for public access has been most visible in these medical fields, with the argument being made that access to publicly funded research should not be overly restricted by private copyright interests. Private funding foundations, including the Wellcome Trust, and other public agencies, e.g., the UK Research councils, are also moving in this direction. In the last year, the National Institutes of Health (NIH) have instituted a policy requesting deposit of final peer-reviewed manuscripts into a repository called PubMed Central (NLM). Although the NIH policy stops short of requiring deposits, submission is strongly encouraged.

But what, exactly, are the roles of MIT, its faculty, students, and researchers in all

Monograph and Serial Expenditures in ARL Libraries, 1986-2004*



Source: *ARL Statistics 2003-04,* Association of Research Libraries, Washington, DC
*Includes electronic resources from 1999-2000 onward.

this? First, if the Institute can provide mechanisms to clarify copyright issues and to increase the efficiency of scholarly output of our staff and students, it should do so. Second, it is in the best interest of the Institute to retain control of its intellectual output while insuring broad dissemination, but only if it can be done in ways that are responsible to individual investigators, to the academic community, and to the general public. Finally, it is in the best interests of the entire academic community to encourage balance and cooperation amongst all members of the scholarly publishing community, whether private or public, and if MIT can provide leadership within academe, we should not shirk.

Fortunately, progress on the first item has been made. Owing to hard work on the part of Ann Wolpert and the staff of the MIT Library Systems, the Committee on Intellectual Property, Vice President for Research Alice Gast, and the Office of the Provost, there are now systems being developed to help investigators respond to the NIH policy. In part, the purpose of this article is simply to alert faculty and staff to the fact that there are some tools designed to help the individual investigator. One of the most recent developments is a standard amendment to publication agreements, drafted by the Intellectual Property Counsel, which is available online at ***web.mit.edu/faculty/research.html***; ***web.mit.edu/faculty/agreement.pdf***; ***libraries.mit.edu/about/scholarly/amendment.doc.***

The last of these sites also has information about the open-access movement, clarification of the NIH initiative, and discussion of scholarly communications in general. The amendment to publication agreement provides a relatively easy method to standardize copyright assertions for your own work. In addition, library systems staff are available to assist NIH investigators and others in the submission of work to Dspace. Bearing in mind that Dspace is available for all MIT faculty members, such a repository could be used for a much broader spectrum of the research output of the MIT community, an option that is particularly attractive given the commitment of Dspace to providing a robust and durable Website with upward migration of data.

Progress in the broader community is also possible, I believe. With increased awareness of the issues confronting academic publishing, MIT faculty are in a position to exert responsible leadership with our colleagues at other universities. Tempting as it might be to grab pitchforks and torches and march off to man the barricades, we, as a faculty, need to be thoughtful and constructive in our approach. What we cannot do with any sense of collective responsibility is simply watch. The issues are too important for scientific and engineering research, for universities and colleges, and for the fulfillment of MIT's core mission, to allow outside forces to decide the outcome. It is time for a broad discussion involving a large portion of the faculty and staff to formulate a constructive statement of policy. With general faculty support and awareness, we can exert force for positive change.

Sadly, though, I have been forced to realize it is probably true that no one is going to make a movie of my research. What a shame! Harrison Ford would have been perfect for the lead. ■

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Peer Support: Taking Advice from a Friend

Barun Singh

AS THE ROLE OF graduate education in our society continues to evolve, the needs of graduate students are changing too. Support for graduate students is no longer restricted to academic and financial issues – MIT must also consider how it might help this changing demographic deal with the amorphous pressures and stresses of graduate school. An examination of advising issues done by the Graduate Student Council last year points to peer support as the single most effective mechanism for doing this, and it comes with the added benefit of teaching valuable mentoring skills. MIT has the opportunity now to adopt formal peer support programs and thereby add great value to its graduate programs – but doing so will require the full backing and active involvement of the faculty.

Sources of Stress and Sources of Support

Institutions of higher education have long recognized the varied forms of support that must be provided to undergraduates. The modern graduate student faces issues that are different in nature from those faced by undergraduates, but are no less complex or challenging. For over a third of first-year graduate students, MIT presents their first time away from their native culture and country. The very nature of conducting research, in which the student must be responsible for keeping themselves on target without the aid of regular problem sets or exams, can present a major challenge to most graduate students. Picking an advisor, and indeed a research area, can be a very stressful decision. Confusion and potential conflicts are commonplace in dealing with research collaborators and advisors. Uncertainty regarding career paths is equally if not even more prominent for graduate students than undergraduates, and the common notion that "MIT must have made a mistake in admitting me" is nearly universally prevalent.

For over a third of first-year graduate students, MIT presents their first time away from their native culture and country.

Support for these issues comes from a number of places. Last year, the Graduate Student Council conducted a survey of all MIT graduate students that sought to determine, among other things, which of these sources of support is most useful. What this survey found was that students seek out the support of their significant others, families, advisors, and mentors, but the largest number of students – over 80% – turn to their peers. Institutionally, students' satisfaction levels for graduate student groups and peer support groups (where available) are among the highest of all resources available at MIT. In an article published in the March/April 2005 edition of the *Faculty Newsletter*, I used the data regarding peer support to draw a simple conclusion that I repeat again now: In many cases, the best way to support graduate students is to empower them to help themselves as a community.

Defining Peer Support

So what exactly is a "peer support program?" There are a few currently in place at MIT that may be used as exemplars. One that has received much attention over the past year is the "Resources for Easing Friction and Stress" (REFS) program located in the Department of Chemistry. REFS consists of a group of volunteer graduate students, trained in mediation skills, who meet regularly with students and work with department faculty as well. The volunteers are also trained with regards to the various support options available at MIT. This program has proven its effectiveness since its inception five years ago, both through a dramatic reduction in the number of cases reported to the Ombuds office from Chemistry, as well as very high satisfaction ratings from Chemistry graduate students.

Many departments have adopted very different sorts of peer-support programs that are not as formal as the REFS program. For example, HST has a "big buddy" mentorship program that partners every first-year graduate student with an experienced upperclassman. Similar one-on-one mentorship programs can be found in other departments as well, including Mechanical Engineering, Materials Science, EAPS, and Economics.

All of these programs rely on the fact that students feel much more comfortable discussing their concerns with a peer they trust than they do with faculty, adminis-

trators, or mental health providers. By acting as a first contact, the peer is often then able to direct the student to a more knowledgeable Institute resource, and provide the student with the encouragement they need in order to seek out that resource. Even more valuable, however, is that these programs allow students to get support without having to explicitly ask for it. Because of the localized nature of peer support programs, students will run into their upperclassman mentor, or their lab's REFS volunteer, on a regular basis. These chance encounters provide an opportunity for the volunteer to ask the student how they're doing, and follow up on concerns the student might have expressed at some point in the past. For many students who feel especially isolated, these simple acts can make a world of difference.

A Mechanism for Skills Training

Unlike other alternatives, peer support programs place students at both sides of the equation. Not only do they receive the benefits of a supportive environment, they are also responsible for providing that support. In fulfilling this responsibility, students are taught valuable mentoring skills. They learn how to deal with difficult situations and they gain new perspectives on the conflicts and issues that arise around them – all of which helps prepare them for future careers both within academia and outside of it.

Most faculty will agree on the importance of advising and mentoring – not just as services to provide to students but also as skills to teach. Peer support fits within that framework quite nicely. It provides students a unique opportunity to learn by doing, as is the MIT way.

Necessary Next Steps

Though peer support programs by definition involve student-student interactions, the creation and success of these programs will require a great deal of faculty support. Last year, the Graduate Student Council recommended faculty to espouse the development of formal peer support programs within their departments. In a variety of forums, faculty members have expressed agreement with this proposal, and we are now presented with an opportune time to transform this into action. A large quantity of feedback, from students, faculty, and administrators, has suggested the following steps in order to move forward:

- *Department faculty must reach out to interested graduate students.*
  This is the single most important step. Students must know that their advisors and their department as a whole support (both in theory and in practice) their involvement in a peer support program. The most effective way to do this is to send general messages to all graduate students in the department as well as more focused messages aimed at those students known to be active participants in student life issues (if you have a departmental graduate student group, many of the active students will be members of it).
- *Involve students, faculty, and graduate administrators throughout the process.*
- *Survey what exists currently within your department.*
  Even if a program exists within your department, it is important to consider how that program might be augmented or altered to better meet students' needs.
- *Survey what exists in related departments.*
  The Graduate Student Council may be able to assist you with this task.
- *Determine what structure works for your department.*
  Each department has its own culture and a single solution is unlikely to be optimal for all of them. Each program must create an environment where students feel comfortable and familiar with those whom they might turn to for support. Will formal mediation training help in your department? How should faculty be involved in the long run? What about existing departmental student groups?
- *Encourage Institutional support for your departmental program.*

Unlike other alternatives, peer support programs place students at both sides of the equation. Not only do they receive the benefits of a supportive environment, they are also responsible for providing that support.

The only component of a departmental peer support program that might constitute a non-negligible cost is the mediation training. A practical implementation of departmental programs would fund and coordinate this training at an Institute-level, most logically within the Office of the Provost and perhaps the Office of the Chancellor, and require departments to work with this central office and their graduate students regarding the details.

Peer support ought to be seen as not only a possible mechanism for the advising, mentoring, and support of graduate students – but as a vital component of the Institute's overall vision. It has the potential to provide an incredibly effective way to improve the quality of graduate student life, and it also poises MIT graduate students to act as mentors in their future careers. Effectively implementing these programs requires leadership by both faculty and students, and work at both the departmental and Institute level. ■

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Editor's Note: Barun Singh was President of the MIT Graduate Student Council in 2004-05, where he oversaw its Advising Initiative, a component of which examined peer support issues. He would be happy to discuss ideas and concerns regarding the development of peer support programs at MIT, or to help link faculty and administrators with appropriate resources.

Diversification of a University Faculty
Hopkins, from page 1

I. Introduction

(a)Context

A broadly diverse faculty, including gender, racial, and all other aspects of diversity, has been determined by the faculty and the administration of MIT to be critical to the achievement of the Institute's educational mission. A diverse faculty is essential in order to offer the best education to all of MIT's students. It is also essential to serve the nation's needs for a broadly diverse and highly qualified labor pool, including the academic work force. MIT employs many approaches to recruiting and retaining an exceptional faculty. However, as discussed below, the regular approaches to recruiting and hiring faculty may not be adequate to recruit women. It can be difficult to know how effective particular processes are at recruiting the women and racial minorities needed to achieve the gender and racial diversity essential to our educational mission. As Co-Chair, with Provost Reif, of the Council on Faculty Diversity, I have been interested in assessing the effectiveness of some of these processes. To do so, I looked at overall trends in the hiring of women faculty in the Schools of Science and Engineering.

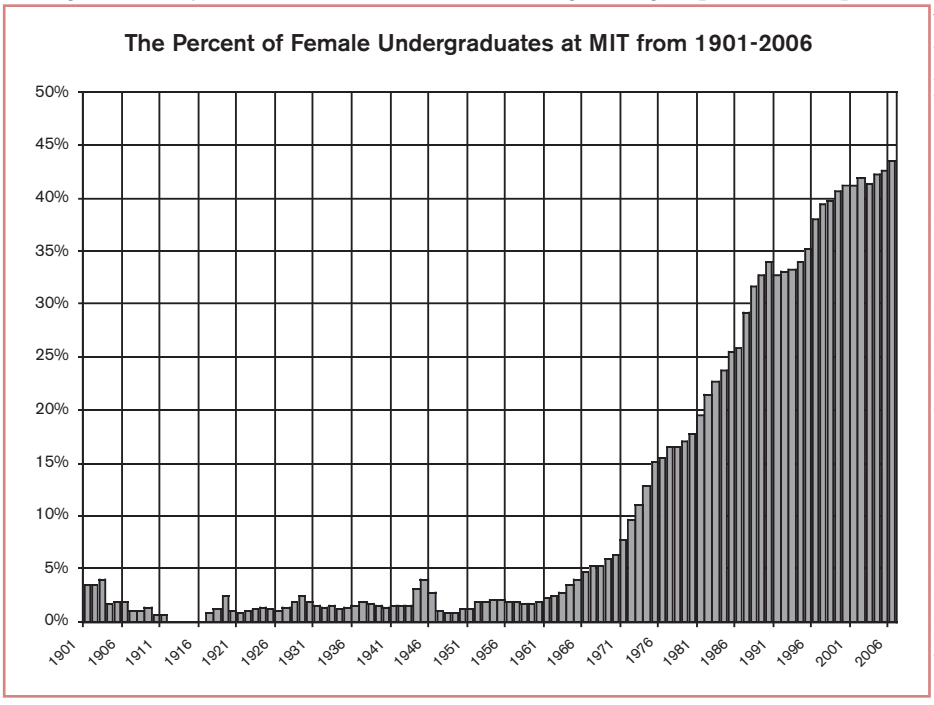
(b)Percent women faculty and students in Science and Engineering at MIT

Beginning around 1970, the percent of female undergraduates at MIT began to rise sharply: in 1966, fewer than 5% of MIT undergraduates were women, today, 40 years later, 43% percent are women (Figure 1). In the School of Science at MIT today, 51% of undergraduate majors are women, in the School of Engineering, women comprise 36% of undergraduate majors. The dramatic increase in the number of women in the MIT undergraduate student body was soon accompanied by an increase in the number of women obtaining PhDs in science and engineering at MIT, although increases vary considerably depending on the specific field.

Despite the increases in the number of women in many undergraduate and PhD science and engineering programs over the past 40 years, the percent of women on the science and engineering faculties of research universities, including MIT, remains small: only 13% of the Science faculty and just under 14% of the Engineering faculty at MIT today are women. Table 1 (next page) shows the percent of female PhD students in each Science department at MIT and the percent and number of women faculty in each of these same departments.

In part, the small number of women faculty in Science and Engineering can be explained by (1) the fact that the "pipeline" began to fill only about 40 years ago; and (2) faculty turnover rates are slow, with many faculty who achieve tenure staying at MIT for 30-40 years. Only about 5% of the MIT faculty leave each year due to retirement, failure to achieve tenure, or other factors. At this rate, and assuming a 50% tenure rate, it would take approximately 40 years for a department that had no women faculty to have a faculty that has the same percentage of women as the PhD pool.

Despite this explanation for the small number of women faculty in Science and Engineering, people who study the hiring of women faculty, and also the hiring of under-represented minority faculty, arrive at shared perceptions about the process, namely: that increases in the representation of women and minorities don't just "happen," but result from specific pressures, policies, and positive initiatives designed to increase hiring of women or minorities; and that when these pressures abate or expire, hiring progress stops or even reverses.



(c) A brief history of some recent efforts to increase faculty diversity

In 1995, at the request of tenured women faculty in the School of Science, a Committee was appointed by then Dean of Science, Robert Birgeneau (now Chancellor of Berkeley) to study the status of women faculty in Science at MIT. In their 1996 report to the Dean (*The First Report of the Committee on Women Faculty in the School of Science on the Status and Equitable Treatment of Women Faculty*), in addition to identifying factors affecting status, this Committee took note of the very small number of women faculty in Science at that time (22 women and 252 men). They also noted that the number of women

Department	% Female PhD Students	% Female Faculty	# Female Faculty/Total
Biology	52%	21%	11/52
Brain & Cognitive Sciences	43%	24%	8/33
Chemistry	35%	20%	6/30
Earth, Atmospheric & Planetary Sciences	38%	8%	3/38
Mathematics	22%	6%	3/53
Physics	12%	7%	5/70

Table 1. Percent of PhD students and faculty who are women in each of the six departments in the School of Science in 2006. The number of women faculty and the total number of faculty are shown in the third column.

faculty had not changed significantly during the previous decade. Dean Birgeneau concluded that increasing the number of women faculty in the School of Science was a critically important element to remedy the unintended marginalization, undervaluation, and exclusion of senior women faculty documented by the report. As discussed below, he made considerable and successful efforts to hire highly qualified women scientists until his departure from MIT in 2000.

In 1999, a summary of the report on the status of women faculty in the School of Science was published in this *Newsletter*. The summary came to be known as the *MIT Report on Women in Science*. This Report, with validation from then MIT President Vest, had a substantial impact outside MIT, because when news of it appeared on the front pages of *The Boston Globe* and *The New York Times*, its content resonated with professional women both in the U.S. and abroad. The *MIT Report on Women in Science* provoked similar examinations at many other universities, helped to inform the design of the ADVANCE program at NSF, and resulted in the formation of a network of 9 Universities whose Presidents and women faculty have continued to meet to analyze and discuss this topic and to formulate policies.

Within MIT, the *Report on Women in Science* led to initiatives to try to ensure equity and prevent marginalization of women faculty, to facilitate easier family-work integration, particularly for junior faculty, to increase the number of women faculty in administrative positions, and to increase the number of women and under-represented minority faculty. Major initiatives included: (1) increasing the number of women faculty in academic administration; (2) establishing committees called Gender Equity Committees within each School to report on the status of women faculty and to review equity in working conditions, including salaries, on an ongoing basis with the Deans; (3) establishing a Council on Faculty Diversity, co-chaired by a tenured woman faculty member who sits on the Academic Council and by the Provost, to address Institute policies that impact the quality of life, status, and numbers of women and under-represented minority faculty; and (4) increasing day care facilities (an effort promoted by, among others, Professor Leigh Royden, Dean Birgeneau, and Provost Brown). More recently, under President Hockfield and Provost Reif, and in accordance with a faculty resolution sponsored by former Faculty Chair Rafael Bras, Associate Chair Paola Rizzoli, and Secretary Kenneth Manning, committees have been established to focus on the hiring and retention of under-represented minority faculty. The network of Committees now under the auspices of the Provost and the Council on Faculty Diversity are shown in Figure 2.

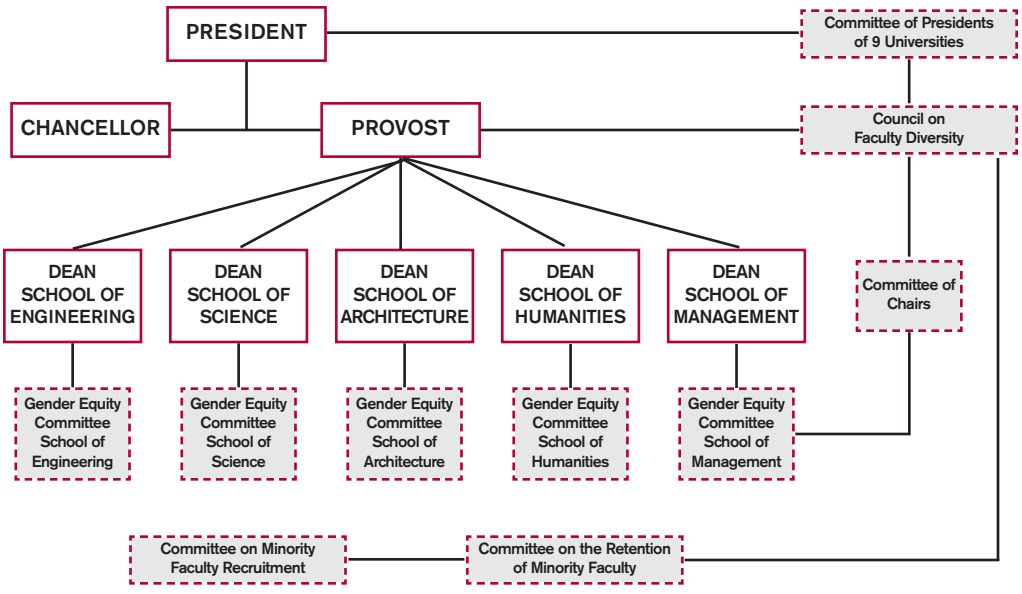


Figure 2. Members of the MIT academic central administration (white boxes) and committees (grey boxes) that have been established to address the under-representation of women and under-represented minorities on the faculty.

It has been a full decade since *The First Report of the Committee on Women Faculty in the School of Science* was presented to Dean Birgeneau. Given the considerable efforts in response to this report, I decided to examine the impact on the number of women faculty at MIT. Here I present some of the initial findings and discuss what they suggest about ways in which universities can achieve a diverse faculty.

continued on next page

Diversification of a University Faculty
Hopkins, from preceding page

II. Observations on Hiring of Women Faculty in the School of Science

(a) The Percent of Women Faculty in the School of Science is the consequence of two actions: A response to pressure associated with the Civil Rights Act, and Dean Birgeneau's response to the 1996 Report on the Status of Women Faculty, combined with efforts that sustained the resulting progress

Figure 3a (next page) shows the total number of tenured and untenured women faculty in all six departments in the School of Science from 1963 (when there was a single woman faculty member) through 2005 (when there were 36 women faculty). The curve rises steeply twice: once between 1972-1976 and once between 1997-2000. These rises do not reflect contemporaneous increases in the size of the faculty during those periods: The number of male faculty at several relevant years is shown in the numbers at the top of the graph. The number of male faculty actually decreased (from 259 to 229) during the rise in female faculty between1997-2000, due to an early retirement program. As of 2006, there were 36 female faculty and 240 male faculty in the School of Science at MIT.

I deduce that the first sharp rise in the number of women faculty in Science, beginning in 1972, is the result of pressures associated with the Civil Rights Act and of affirmative action regulations. In particular, in 1971 Secretary of Labor George Schultz ordered compliance reviews of hiring policies of women in universities. All institutions receiving federal funding were required to have such plans in effect as of that year. In addition, a group of women faculty and staff worked to persuade MIT to hire more women faculty at this time (M. Potter, personal communication). The second sharp rise, between 1997-2000, directly resulted from Dean Birgeneau's response to the 1996 *Report on Women Faculty*. Despite the small numbers, the increase in women faculty that resulted can be seen in five of the six departments of Science: Table 2 shows the percent of women faculty in each department in 1996 and the percent just four years later, in 2000, the year Birgeneau left MIT. Significant increases in the number and percent of women faculty were achieved in five departments in just four years. They ceased when Birgeneau left, except in Chemistry where they continued under Department Head Steve Lippard.

The data show that significant and rapid increases in the number of women faculty can result from intentional targeted actions and responses to external pressures. However, this alone cannot explain the shape of the curve in Figure 3a. This is because MIT hires primarily junior faculty, not all of whom achieve tenure or choose to stay. Tenure rates vary in different departments, but average roughly 50% in both the Schools of Science and Engineering. The rates of attaining tenure are the same for women as for men in Engineering and the same or slightly higher for women than men in Science. To maintain the progress that is achieved in response to unusual hiring pressures requires that additional women be hired.

	1996	2000	2006
Biology	15%	22%	21%
Brain & Cognitive Sciences	17%	26%	24%
Chemistry	6%	13%	20%
Mathematics	2%	8%	6%
Physics	4%	7%	7%
Earth, Atmospheric & Planetary Sciences	13%	11%	8%

Table 2. Increases in the percent of women faculty in five of the six departments of Science as a result of Dean Birgeneau's response to the 1996 *Report on Women Faculty in Science*. Note that after 2000 the percent of women faculty continued to increase in only one of the five departments, namely Chemistry.

(b) Women faculty hired in the School of Science in response to intentional targeted actions and pressures are as scientifically successful as their male colleagues

A critical question is whether in response to extraordinary pressures universities ever hire, or even worse, tenure individuals of lesser ability or accomplishment. Clearly, at the faculty level it is imperative that the criteria for hiring and tenure remain identical for all individuals. While this necessity should be obvious, opponents of targeted actions to increase gender diversity routinely argue that increases in the number of women on university faculties as a result of external pressures may lower academic standards.

As already noted, overall the tenure rates for men and women are almost identical in both the Schools of Science and Engineering. However, to ask specifically whether standards for hiring and tenure were compromised to achieve rapid increases in the numbers of women faculty, I examined the success of women hired in the School of Science between 1996 and 2000. Fifteen women were hired in this period, and eight are now tenured faculty. Of these eight, three have been elected to the National Academy of Sciences and one (other) has won the Waterman award (for a young United States scientist or engineer of exceptional accomplishment). Since the women are still relatively young, it seems almost certain that others of them will be elected to the National Academy of Sciences. These levels of accomplishment are already comparable to the tenured MIT Science faculty (see below and Table 3 [page 20]).

In 1999 when the *MIT Report on Women in Science* was released, some individuals and several groups outside MIT attempted to discredit the Report's findings by claiming that the women faculty involved in writing it were less successful than

their male colleagues and that this explained or justified their lower status and unequal treatment in previous decades. Judith Kleinfeld (University of Alaska) made particularly negative criticisms of the report (labeling it "junk science") and of its authors, and she has continued to do so, as have Christina Hoff Summers (Clark University), Cathy Young, and other right wing political writers and organizations such as the Independent Women's Forum and American Enterprise Institute. To put to rest any concerns such criticisms may have raised, we reviewed the objective academic credentials and achievements of the authors of the Report, as determined by their comparative membership in the prestigious associations and Academies. As Table 3 shows, this group is, on average, at least as accomplished as their male colleagues. Of the 16 tenured women faculty in Science who participated in the study that resulted in the 1996 *Report on Women in Science*, 10 are members of the National Academy of Sciences, two are members of the Institute of Medicine of the National Academy, 11 are members of the American Academy of Arts and Sciences, and two have won the Presidential Medal of Science. As the table shows, these frequencies are higher than the overall tenured Science faculty. Thus, by these criteria, these women faculty are somewhat more successful than their male peers. Moreover, given the scientifically well-documented under-valuation of women's academic accomplishments, it is likely that these women may, in truth, be still more accomplished than the table indicates. Many of the women who participated in the 1999 study were hired during the first wave of affirmative action in the 1970s, showing that such efforts do not result in lowering standards at elite research universities such as MIT. I conclude that unfounded criticisms of these highly successful women's accomplishments and of their *Report on Women in Science* were motivated by ignorance, intransigence, a political agenda, or by gender bias itself on the part of these critics: namely, the inability to recognize equal accomplishment in women, despite overwhelming evidence.

In summary, women faculty hired in Science at MIT as a result of unusual pressures and intentional targeted procedures and actions are as scientifically successful as their male colleagues.

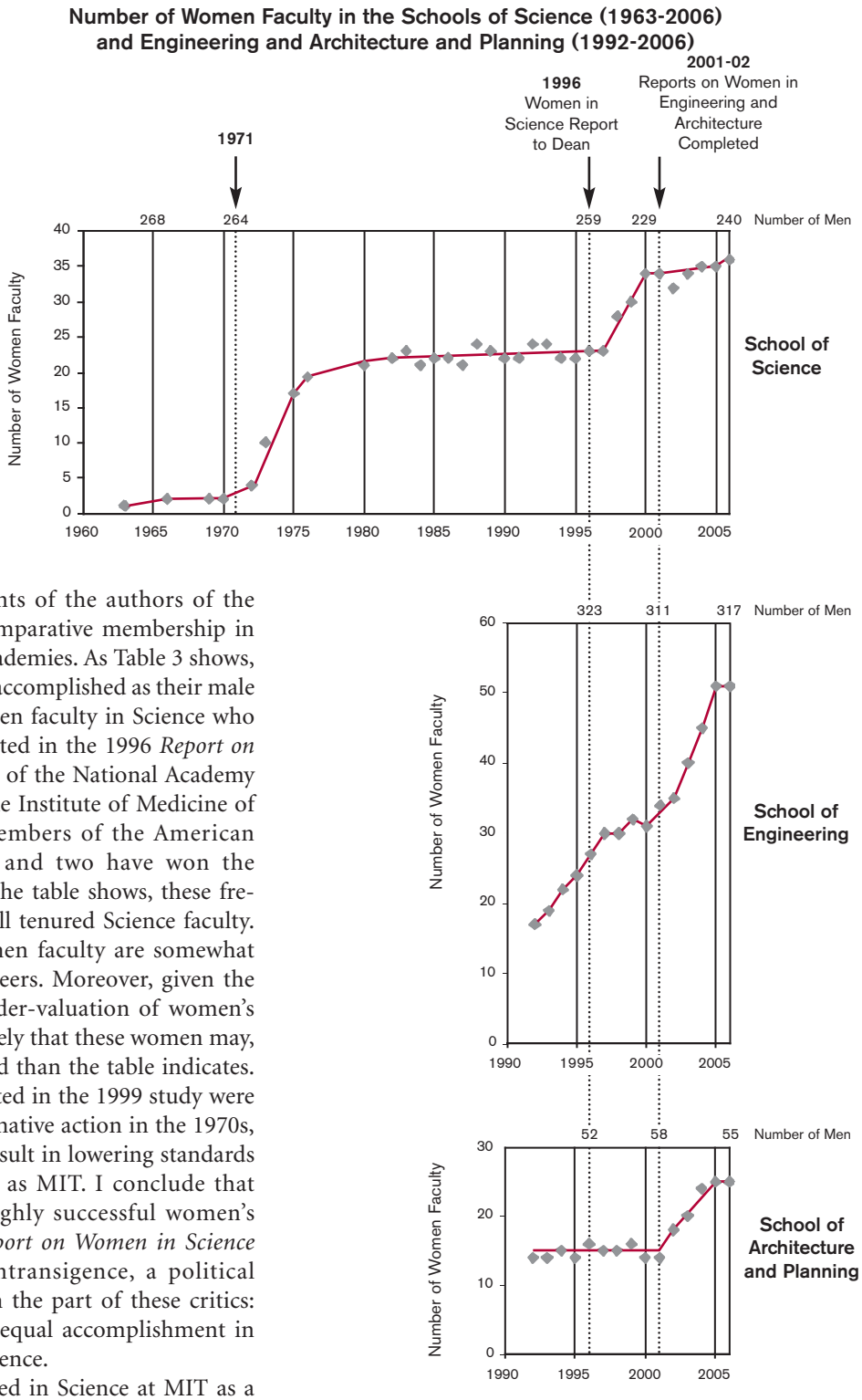


Figure 3. The number of women faculty in the Schools of Science (a), Engineering (b), and Architecture and Planning (c) over time. The number of male faculty in each School is indicated for certain years near the top of each graph. The years of key events that led to rapid increases in the numbers of women faculty are indicated by the dotted vertical lines. Note that the three graphs are positioned so that the calendar years are aligned.

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(c) Relationship between the PhD pipeline of women scientists and the hiring of women faculty in Science at MIT

Hiring women faculty depends upon there being a highly qualified pool of women PhDs to hire from. Could the unusual shape of the curve in Figure 3a reflect the availability of women PhDs in Science? To fully understand the pipeline for this purpose, one would need to know the percent of women receiving PhDs in science over time from the types of universities whose graduates we hire. I did not obtain these data. However, I did look at the percent of PhD students who are women in departments of science at MIT from 1985-2005. MIT is the type of school whose graduates we hire, and its numbers of women PhDs are likely to be similar to those of the other schools we hire from. There is no sharp rise in the percent of women receiving PhDs in Science that correlates with the sharp increase in the number of women faculty in Science between 1997 and 2000. Nonetheless, the pipeline curves (not shown) are informative: As early as 1985, 37% of PhDs in Biology, 28% of those in Chemistry, and 13-15% in Math went to women. These numbers continued to climb over the next decade to 45%, 32%, and 19-20%, respectively. During this period, however, the percent of women faculty in Biology remained flat at 13-15%, the percent in Chemistry did not move from 7% (two women faculty), and the percent in Math remained between 0 and 2%. Only when the Dean intervened did the percent of women faculty in these departments increase. The gap between the percent of women obtaining PhDs and the small percent on the faculty is an example of what is often referred to as the "leaky pipeline" of women – the fact that a higher fraction of women are trained than go on to be faculty. While the leak is most often attributed to women opting out of these careers, the data in Figure 3a and the data just cited for individual departments show that at least part of the leak is due to a failure of search committees to identify and hire exceptional women faculty candidates in the pool.

Physics may present a different situation from Biology, Chemistry, or Math: the percent of women obtaining PhDs in Physics has remained low and the percent hired may be closer to the available pool. Clearly, a much more thorough understanding of the pipeline is important, as it provides a guide to the upper limit of what the faculty could look like, and these studies should be undertaken for each department at MIT.

III. Observations on Hiring of Women Faculty in the School of Engineering

A recent increase in the number of women faculty in Engineering reflects the response of Dean Tom Magnanti to the Report on Women Faculty

I did not obtain data back to the 1960s and '70s for the number of women faculty in the School of Engineering, but obtained it for the past 25 years. The number of women faculty does not show the 20-year-long plateau seen in Science, but increases much more steadily, presumably reflecting more closely the increasing number of women obtaining PhDs in Engineering, and the fact that individual departments were successful at hiring them. However, the curve does show variation in the rate of hiring. The variation that is useful for the purpose of this article is shown in Figure 3b. Very recently, for a five-year period ('00-'05) the School hired women at the rate of five women faculty/year vs two women faculty/year for the previous 15 years (including in each preceding five-year period). The rates of hiring of men in these same intervals were 11.4 male faculty/year for the past five years and 12/year for the preceding 15 years. The increased rate of hiring of women was primarily due to the efforts of Dean Tom Magnanti following the *Report on Women Faculty in the School of Engineering*. This report, prepared by a Committee appointed by the Dean in 2000, was presented to Magnanti in 2001 and to the MIT faculty in 2002.

Given the impact of the Reports by women faculty committees on the hiring of women faculty in Science and Engineering, I looked at other Schools of MIT as well, since such Reports were made in all five Schools. Figure 3c shows the number of women faculty in the School of Architecture and Planning over the past 14 years. The curve reveals a sharp increase under Dean Mitchell and Associate Dean Knight following the 2001-2002 *Report on Women Faculty* in that School. The number of women faculty in the School of Architecture was 14 for about a decade, then rose quickly to 25 as shown in the figure. In the Sloan School there was a modest rise in the number of women faculty following a *Report on Women Faculty* (data not shown). In the School of Humanities, Arts and Social Sciences there was no rise, and the percent of women faculty remains about the same today as a decade ago (28% in 1997, 29% in 2006). I did not examine overall hiring rates and trends in these Schools.

	# Out of 16 Women Faculty	# Out of All 208 Tenured Faculty in Science
Presidential Medal of Science	2 (13%)	8 (4%)
National Academy of Sciences	10 (63%)	60 (29%)
Institute of Medicine of the National Academy	2 (13%)	23 (11%)
American Academy of Arts and Sciences	11 (69%)	115 (55%)

Table 3. Measures of scientific success of the 16 tenured women faculty in Science who, in 1994, asked the Dean to allow them to study the status of women faculty and who authored the 1996 and 1999 *Reports on Women in Science*, relative to the same measures of success among all tenured faculty in Science at MIT as of 2006. Currently there are 208 tenured faculty in Science, including 182 men and 26 women.

IV. Different Hiring Processes Yield Different Numbers of Women Faculty but Any Process may Depend on Specific Individuals and Circumstances

(a) Explaining the shapes of the curves in Figure 3

In response to external pressures or engagement of their Deans, how did the Schools of Science and more recently Engineering and Architecture succeed in hiring so many highly qualified women faculty in just 3-4 years? And why did many departments fail to increase the percent of women faculty between these bursts, even though many were able to sustain the increased levels of women hired as a result of external pressures? We know quite a lot about the answer to the first question, which informs speculation about the second. Importantly, the processes used to identify and attract women candidates and the hiring processes for faculty are very different during periods of increased hiring of women. Below I use the example of the recent jump in women faculty in Engineering, since, through my role on the Council on Faculty Diversity, I am familiar with many of the administrative procedures that produced it.

On average, as noted above, faculty turnover is about 5% a year at MIT, so the number of hires required to maintain faculty size is small: for example, a department of 40 will hire about two (usually junior) faculty a year, about half of whom will later get tenure. Faculty searches are conducted by a committee appointed within the department, and each search process is independent of any other. Even if the applicant pool were 50% women PhDs, the hiring of a man in any one search would be unremarkable and statistically insignificant. In fact, even to notice that women are not being hired in numbers equal to their availability requires oversight over a period of time, and at a level above, the individual search committee's perspective or mandate. Even today, in some fields of science, only about 10, 20, 30, or 40% of PhDs go to women (see Table 1). For a department of 40, these numbers translate to hiring rates of only 1, 2, 3, or 4 women *every five years*, assuming no leakage from the pipeline. Given that the number of women one might expect to hire is too small to be significant annually, and in some fields too small to be significant over even longer periods of time, one can see how a department might suddenly realize that it had not increased its number of women faculty in a decade. Assuming that a Department Head's term is five years, and that an understanding of this issue takes time to master, one can see how a departmental administration could turn over without knowing if it had significantly increased the hiring of women faculty, or whether a potential increase was sustainable. The data for individual department hires in the School of Science that I examined (not shown) suggest that when the percent of female faculty in a department begins to fall, efforts are made to replace the women who have left, though how and why this occurs is unclear.

The processes that led to a rapid increase in the number of women faculty in the School of Engineering between 2000-2005 were different from those just described for how departments usually hire faculty. They involved unusual administrative approaches by the Dean of Engineering, Tom Magnanti, with additional administrative actions and support from then Provost Bob Brown. Several key aspects of the processes are revealing: 1) the Dean made it known to department heads that hiring women faculty was a high priority for him, and he reinforced his commitment by returning a chosen male candidate to a department because he concluded that the search committee had failed to interview qualified female applicants. 2) The Dean focused particular effort on two departments that had been identified by the *Report on Women Faculty in Engineering* as having particularly poor records of hiring and retaining women faculty. 3) The Dean pooled open faculty slots and made as many slots available for the pool as possible, so that search committees could look for more than one candidate at a time, and the Provost encouraged this practice. 4) When canvassing Department Heads and colleagues at other universities to ask informally for names of potential outstanding candidates (a standard process during job searches), search committees specifically asked for names of outstanding female candidates, which they found were sometimes omitted unless specifically requested. 5) The Dean made it clear that (a) all candidates for a faculty position have to be evaluated under the same criteria, including both academic qualifications and whether the candidate would contribute to high priority needs of MIT, the School and the Department at the time, such as gender and racial diversity and extraordinary excellence in a field (even by MIT standards); (b) for individuals who could make contributions to such needs, in addition to satisfying many other criteria, the Dean made clear that excellence was far more important than their specific field of research. 6) Efforts were made to identify exceptionally talented women candidates who had not applied for the jobs in the conventional manner or whose names did not surface through other standard informal inquiries. These approaches are routinely used for hiring, but possibly used less often or less successfully for women and minority candidates. Importantly, many women who were hired in this period did not think to apply for the job at first. Some have even noted that they would not have thought the department would be interested in them, due to their field of research or

This raises the profoundly important possibility that exceptional women may not apply for faculty jobs in the same way that has worked for recruiting exceptional male faculty candidates. If true, such women candidates might very well not be found by conventional departmental search committee methods.

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other reasons. This raises the profoundly important possibility that exceptional women may not apply for faculty jobs in the same way that has worked for recruiting exceptional male faculty candidates. If true, such women candidates might very well not be found by conventional departmental search committee methods. 7) Finally, the Dean made exceptional personal efforts to work with Department Heads to help them attract outstanding faculty candidates to MIT once offers had been made. The issues that determine acceptance rates for faculty candidates are highly variable, as are acceptance rates over time, and success in recruitment may require a greater knowledge of the system that some Deans may possess.

Nevertheless, no woman heads any unit of seven units of the biological sciences in Science today, and only one woman professor (vs three just a few years ago) occupies a major administrative position within these Departments, Centers, or Institutes.

MIT has long had mechanisms to hire exceptional women and under-represented minority faculty candidates whenever they are found in fields where they are severely under-represented on the faculty. However, these had seldom been used by individual departments in Science and Engineering. But, in the wake of the *Reports on Women Faculty*, these mechanisms as well as those devised by Provost Brown were more heavily used, perhaps because of the involvement of Deans in search processes.

In summary, the data show that the regular processes by which departments hire faculty may be less likely to identify and attract exceptional women candidates than the effort of a School Dean, using innovative approaches in collaboration with Department Heads and the Provost, all in a context in which the Institute has made it clear, through the words and actions of its President, that diversity is a high priority.

(b) Impact of hiring additional women faculty on a department and potential fragility of progress

When will the hiring of women faculty cease to be an issue that requires special attention? Is there some percent of women faculty that constitutes a critical mass, after which the process becomes self-sustaining? In addition, what is the impact of additional women faculty on a department? The biological sciences are the best place to look for answers to these questions because among the sciences, the number of women undergraduate and PhD students, hence the number of women faculty, has been highest there. Between 1975 and 1995 the percent of women faculty in the Department of Biology remained flat at 13-15%. During this interval no woman served as Department Head, Associate Head, or Head of a Center or Institute within the department. Within a few years of the 1996 *Report on Women in Science*, the percent of women in the department rose to 22%. Furthermore, a woman faculty member became the first female Associate Head of this department, a woman became the Head of the Whitehead Institute, and a woman became Associate Head of the Center for Cancer Research. These appointments changed the professional experience of women in the department. However, such progress is not necessarily permanent.

In recent years the biological sciences in the School of Science, including the two departments, Biology and Brain and Cognitive Sciences (BCS), have expanded to include faculty in several new Centers and Institutes. Nevertheless, no woman heads any unit of seven units of the biological sciences in Science today, and only one woman professor (vs three just a few years ago) occupies a major administrative position within these Departments, Centers, or Institutes. Particularly concerning is that in some new units, where, given many recent hires, one might expect to see more women than in the sections that now contain most of the very senior faculty, the percent of women faculty is extremely low. Overall, as of 2006, 21% of the Biology faculty and 24% of the BCS faculty are women. The Cancer Center, Whitehead Institute, and McGovern Institute have 30, 27, and 23% women faculty, respectively, but the Picower Center for Learning and Memory has only 10%, and the Broad has had a small but entirely male core faculty since its inception, and has an associated faculty (of over 60) that is 15% women. These latter numbers rival those of the 1970s, and show how rapidly gains in diversifying the faculty can be lost. They also demonstrate the need for continued leadership from the Dean, the Provost, and the President, as well as for accountability of the system at some high level.

Conclusion

Achieving faculty diversity, particularly in science and engineering fields, consumes considerable amounts of faculty and administrators' time, effort, and resources, often with frustrating results. It also receives considerable attention at the National Academies, the NSF, other government agencies, and even Congress, because the issue could affect the future technological competitiveness of the United States. As recently documented in *Rising above The Gathering Storm*, the highly influential, congressionally requested report from the National Academies, this country faces ever-stiffer worldwide competition for talent in STEM (Science, Technology, Engineering, and Math) fields. Thus, there is a pressing need to utilize the talents of women and

under-represented minorities at all levels of these professions. Together, women and under-represented minorities comprise nearly 70% of the U.S. labor force. A diverse faculty is not only critical to the best educational experience for all MIT students, it is also seen as critical to our ability to remain competitive as a university and a nation.

While the data here show that the hiring of women faculty under certain circumstances can be successfully overseen and advanced at the level of School Deans, it may be that to increase the number of under-represented minority faculty significantly will require oversight and assistance at a level above the Schools, namely the Provost.

The observations presented here suggest that historical methods of faculty hiring within individual departments are not always as effective as they could be in addressing this problem. The obstacles remain: 1) the continuing small numbers of women applicants in some fields; 2) the lack of awareness and understanding of the problem by most faculty and search committees, despite good will and intentions; 3) the well-documented, but not widely appreciated under-valuation of women of equal or even greater merit, particularly, perhaps, in search processes that seek a single candidate; 4) the slow rate of faculty hiring relative to administrators' terms of office; 5) possibly, the failure to use optimal strategies to identify and to attract the best candidates when they are different from the more typical candidate; and 6) perhaps the misperception that any solution is more likely to be seen as a general institutional and national responsibility, rather than a departmental imperative. The finding that Deans, with the backing of the Provost and the input of highly knowledgeable faculty committees, have been able to significantly increase faculty diversity in a short time and to assist departments to hire exceptional women, shows that solutions exist beyond the more widely known, equally essential efforts by individual departments. Critical to both types of efforts, in order to keep moving ahead, is a system that includes accountability at some level. While all can agree that diversity is an essential goal, this is insufficient to achieve the goal in the absence of 1) concrete plans for how to do so, 2) a method to measure progress, given that the number of individuals being hired is so small, and 3) a system of accountability at the level of Department Heads and School Deans.

While the data here show that the hiring of women faculty under certain circumstances can be successfully overseen and advanced at the level of School Deans, it may be that to increase significantly the number of under-represented minority faculty will require oversight and assistance at a level above the Schools, namely the Provost. The relative scarcity of qualified minorities in the pipeline may mean that yet different innovative search processes will be necessary. Monitoring of progress will be needed at the Institute rather than School level, simply to obtain significant data to ascertain whether progress is being made.

It has been suggested recently that meeting the national need for a diverse STEM workforce, including on university faculties, will require the use of Title IX. This approach has been proposed by Oregon's Senator Wyden, among others. Such approaches would require affirmative action plans to be developed and affirmative actions to be taken in order to remedy any manifest imbalance in the representation of women and minorities in, for example, MIT's workforce in relation to the representation of women and minorities in the available qualified pool of candidates. While this might prove to be an effective means of achieving diversity, it is encouraging that, during certain periods, rapid progress in diversifying a science and engineering faculty in terms of gender has been accomplished at MIT without governmental intrusion, by the use of innovative approaches of the central administration in collaboration with departments and in response to coordinated efforts by women faculty dedicated to faculty diversity.

Acknowledgment

Although this article focused on unusual advances in hiring women faculty that depended on members of the central administration, in no way is this meant to detract from the essential contributions and successes that individual departments have made in increasing faculty diversity at MIT. I thank Lydia Snover whose office (Office of the Provost, Institutional Research) provided most of the data used in this article, and particularly Sonia Liou, Professor Lotte Bailyn (Sloan) with whom I have discussed these issues for many years and whose ideas have profoundly influenced my thinking, and Dinny Adams and Professor Lorna Gibson for a careful editing and reading of the text. I thank Professors Steve Graves and Molly Potter for helpful discussions of the pipeline. Finally, I express my thanks to the many remarkable women faculty of MIT with whom I have been privileged to work on these issues for the past 12 years.

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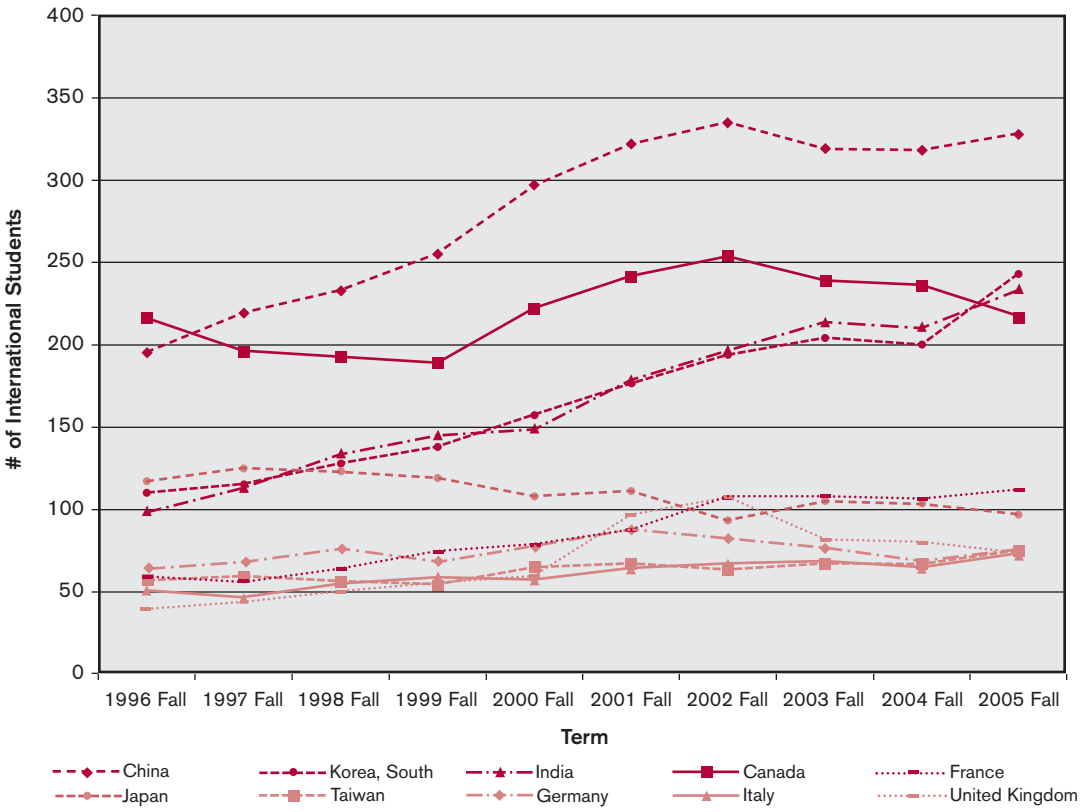
M.I.T. Numbers
International Students at MIT

Top 10 International Countries Over 10 Years (1996-2005)



Top 10 International Countries (2005)

Rank	Country	Undergraduate	Graduate	Total
1	China (People's Republic of)	20	308	328
2	Korea, South	18	226	244
3	India	13	221	234
4	Canada	17	200	217
5	France	6	106	112
6	Japan	5	92	97
7	Taiwan	6	70	76
8	Germany	6	70	76
9	Italy	5	69	74
10	United Kingdom	27	45	72