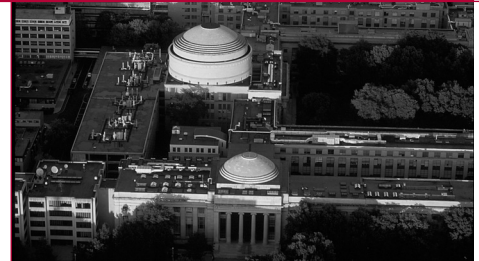


MIT Faculty Newsletter

<http://web.mit.edu/fnl>

this issue offers our Teach Talk feature “Getting More Learning out of Lecture and Recitation Time” by Kim Vandiver (page 8); several articles on diversity at the Institute beginning on page 10 with “Why Diversity Matters” by Karl Reid; and commentary on the James Sherley tenure and grievance reviews, “Faith vs. Facts in the Pursuit of Fairness at MIT” by Michel DeGraff (page 20).



The Saga of the Struggle for Survival of the Faculty Newsletter

FOR ALMOST 19 YEARS the *MIT Faculty Newsletter* (FNL) has provided a forum for expression of faculty concerns and views, a major channel of communication among the faculty, and a means for candid debate on difficult issues. The primary guiding principles have been to provide open access for faculty and emeritus faculty to express views on issues of concern through control of editorial policy by the faculty Editorial Board, independent of influence by the MIT administration.

The members of the FNL Editorial Board view the *Newsletter* as a critical link in the lines of communication at the Institute, because it is the only truly open vehicle for serious faculty discussion of issues that affect us all. We believe that the majority of the faculty agree with us on this point. Nonetheless, the *Newsletter* came perilously close to extinction over the last few months, despite concentrated efforts on the part of the Board. In this article we describe the details of that survival, because we believe that in essence it represents a reluctance of some members of the administration, to have a truly independent faculty voice present on campus. You may view the details that we present below in a different light, but we interpret them this way, and it worries us greatly, because the loss of the *Faculty*

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Editorial

The Management of Change: Institute Facing Key Issues in the Immediate Future

IN THE COURSE OF TIME every major institution faces challenges, the management of which will shape its future – in theory and in practice. The management of change itself amounts to a major challenge, in any context and for any institution. Today MIT must now manage a set of changes, the convergence of which may well be unprecedented in the Institute’s history. Individually, each of these changes is by necessity, not by choice. Jointly, they require the judicious deployment of our intellectual resources as well as our communal goodwill in order to steer the Institute through these challenging times. A brief accounting of key changes provides a sense of the scale and scope of the challenges before us.

First is the effective management of the undergraduate curriculum and its adaptation to our current needs. This is largely a faculty responsibility. It is being addressed by the faculty in consultation with the various stakeholders. It is difficult to envisage an eventual outcome that will please everyone in every part of the Institute, but it is a task vital to its future.

Second is defining a viable trajectory for the internationalization of MIT. As a national institution focused principally around science and technology, MIT is also a global institution with a

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Subscriptions

\$15/year on campus

\$20/year off campus

Vol. XIX No. 5 March/April 2007

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Photo credit: Page 1, Steve Dunwell

The Management of Change
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broad reach. Almost all of MIT's international initiatives in the past have originated from faculty interests and activities. When the central administration makes institutional commitments regarding new directions for research and teaching – as, for example, addressing pressing environmental and energy challenges – international initiatives are also expected to follow. It has become painfully clear, though, that we have as yet no general set of principles, broadly defined, that would guide our overall “foreign policy.” This is neither good nor bad nor indifferent – it is simply a fact. But it must be carefully managed.

Third is the response to the perennial requirement of remaining ahead of the curve in critical areas of science and technology. Clearly, this is the task of the faculty and of its leadership. In the past, MIT has been very effective in forging new trajectories and marshalling intellectual and financial resources in useful and innovative directions. The Institute's new priorities on energy and the environment speak directly to this challenge. That too will create research and teaching changes that must be managed.

Fourth is the nature of the broader national context within which the Institute's mission has been framed since its earliest days. MIT is a national institution. While we do not engage in the political process directly, we do take our leadership role in the domain of science and technology seriously and have a long record of public service. This context is always with us, even if it varies in the extent to which it impinges on our daily activities.

Fifth is the changing global context. At issue is no longer simply dealing with the end of the Cold War, the end of the Soviet Union, and the end of Communism – all central to global conflicts and contentions throughout most of the twentieth century – but rather a broad set of somewhat undefined challenges, potentially powerful threats, and a remarkable dearth of traditional tools for effective response. We have already seen the impact of at least

one of these issues, namely in the area of visas for our foreign students. MIT does not make foreign policy for the Nation, but as a national institution it must respond to any federal government directives of our foreign policy. We do not yet know the full range of the global political challenges or of the changes that we will have to manage.

Finally, and most immediate for us all, are the changes in the MIT administration. Every new President brings new changes, the extent and nature of which vary considerably. We have always weathered these changes well and usually are better as a result. But to our knowledge, this is the first time in the Institute's history that essentially the entire top administration has changed. Put differently, the full cadre of leaders across essentially the entire administrative spectrum is being replaced. Again, this is the prerogative of any new administration, and it is one that has and will continue to be respected by the faculty.

At the same time, however, by a curious accident of history, this is the administration that must provide leadership in the management of the above multiple converging changes now facing the Institute. It must also steer the Institute without creating any added costs or burdens associated with this management.

History also reminds us of the importance of institutional memory, a critical asset in the course of steering through rugged paths assuring not just continuity, but also resolving the challenges created by the very fact of change. This large-scale sweep of the top administration provides little apparent basis for capturing the full power of institutional memory. One can too easily undervalue the power of the past in providing signals for avoiding predictable traps. But any student of organization theory will affirm that organizational memory must never be swept away. It is too powerful an asset in any institution. It is especially important for MIT at this point in time. In this respect, the deep institutional memory embedded in the faculty is a very significant resource. Appropriately tapped by

the administration, this resource can help the Institute avoid the dangers inherent in times of great change.

* * * * *

Diversity at MIT

THIS ISSUE OF THE *Newsletter* features several articles devoted to commentary on diversity at the Institute. Beginning on page 10 with “Why Diversity Matters” by the Director of the Office of Minority Education Karl Reid, and continuing on succeeding pages, we offer articles by two participants in the Martin Luther King, Jr. Visiting Professor program; an article on the results of efforts to recruit underrepresented minority graduate students to MIT; “Filling the Pipeline” by Assistant Dean for Graduate Students Christopher Jones; and a related piece by Prof. Michel DeGraff on the Prof. James Sherley tenure and grievance reviews. There are also two “MIT Numbers” charts and graphs offering statistics on the number and percentage of underrepresented minority students and faculty.

We hope to continue publishing articles on this most important of topics, and welcome submissions on this subject.

A Heartfelt Thanks

OFTEN PEOPLE WHO WORK behind the scenes are not accorded proper recognition, and we'd like to rectify one instance of that. During our entire existence, the people at MIT Mail Services have worked tirelessly to enable the presence of the *Newsletter* in your mailbox in a timely fashion, even when our requests for prompt delivery are somewhat unreasonable, at best. Last issue's Special Edition, requiring delivery several days before the faculty meeting, was a prime example. In particular we wish to thank Assistant to the Manager Deborah Puleo and Ed Pasqual for all their help through the years. ■

Editorial Sub-Committee

The Struggle for Survival

continued from page 1

Newsletter would have been a detriment to MIT.

Since major MIT policy decisions are typically the consequence of the workings of joint faculty/administration committees, including nomination committees, there are considerable constraints on the ability of the faculty to pursue policy directions that diverge significantly from administration positions. The founding of the *Newsletter* 19 years ago grew out of the unilateral decision of the Provost at that time to dissolve Course 20, the Department of Applied Biological Sciences, with insufficient consultation with the faculty. Other areas where the independence of the *Newsletter* has been important include the first public release, on our Website, of the report on the "Status of Women Faculty at MIT"; the publication of the recent Special Edition *Newsletter* devoted to responses to the Report of the Task Force on the Undergraduate Educational Commons, to which more than 40 faculty contributed; exploration of health insurance, pension, and retirement issues; compacts with foreign governments; and minority recruitment and promotion.

Since its inception, the *Newsletter* has been maintained by a volunteer Editorial Board, over time composed of more than 30 members of the faculty from all Schools of the Institute. The actual editorial and production work has been carried out by a Managing Editor. This position carries significant responsibility and requires a wide range of technical skills and organizational experience, in addition to deep knowledge of MIT. Since its inception, the Managing Editor of the *Newsletter* has been David Lewis, who is responsible for all of the organizational, editorial, layout, research, and production tasks, for both the printed and online versions.

Unlike many universities, MIT has no elected Faculty Senate or Council. Thus despite the hundreds of millions of dollars brought in to MIT by faculty, there is no faculty-controlled general

budget for faculty-wide activities such as the *Faculty Newsletter*. In 1996, President Vest made an agreement with the *Newsletter* Editorial Board that a budget for the Managing Editor's salary and for the printing costs would be provided by the administration, with the Managing Editor continuing to report to the Chair of the Editorial Board. The agreement also called for a five-year review of the *Newsletter* by a joint faculty/administration committee. The review was carried out by the Graves Committee in 2002 and a report was presented to the President. That report confirmed the view of the faculty that the *Newsletter* had created a useful, effective, and respected medium.

Our proposal was simple: promote the Managing Editor to full-time administrative staff and locate the budget in the Office of the Provost . . . President Hockfield was sympathetic and believed that the situation could be resolved by late summer, after consultation with the Provost.

The use of the FNL as an effective means of communication between the top administration and the faculty is clearly demonstrated by the frequent submissions by MIT Presidents, the Chair of the Corporation, the Provost, the Deans, and other administrators, as well as the regular column "From The Faculty Chair." The recent Special Edition *Newsletter* devoted to responses to the report on curriculum demonstrates the value of bringing together a diverse set of opinions on important issues.

The success of the *Newsletter* over the long period of its existence clearly shows that the Managing Editor and the Editorial Board have been careful and respectful toward the issues covered, focusing on those of importance and relevance, and avoiding inaccuracy or impropriety.

By 2006, the *Newsletter* Managing Editor had been employed at a half-time hourly support staff level, without promotion, since the position was estab-

lished. During that time he was responsible for all aspects of the production of both the printed and online *Newsletter*, tasks requiring a knowledgeable and mature person. Each year the demands on his time have increased, but the position has remained half time, with salary at the support staff level.

Despite this understaffing, the *Newsletter* has maintained the quality and character appropriate for an MIT faculty publication. Unfortunately, this lack of staffing left us unable to implement significant changes decided upon by the Editorial Board.

At the end of the 2006 spring semester, the May/June Editorial Sub-Committee, composed of *Newsletter* Chair Fred

Movenzadeh, Jean Jackson, Jonathan King, and Stephen Lippard, was informed by the Managing Editor of his inability to continue in his position, due to increasing financial constraints and an inappropriately low salary. The Sub-Committee then met with President Hockfield about correcting this situation. Our proposal was simple: promote the Managing Editor to full-time administrative staff and locate the budget in the Office of the Provost, together with other *Newsletter*-related expenses. President Hockfield was sympathetic and believed that the situation could be resolved by late summer, after consultation with the Provost.

Despite her assurance, this issue dragged on for eight additional months. From that initial meeting in July until early November, all we learned was that the Graves Committee had been reconstituted and that they had submitted their assessment in early September. From November to February, members

of the *Newsletter* Editorial Board were involved in dozens of meetings and e-mail exchanges with representatives of the administration. The general character of these exchanges seems to have been to prolong the final decision on our request for the promotion. Throughout this period, despite our frustration, FNL Board members participated in the negotiations in a patient and principled manner. The participating group consisted of senior faculty with decades of experience in staff appointments, development, promotions, and oversight. The length of the administration's procrastination, the nature of the discussions between the Board members and the administration, and the repeated demand for increasingly trivial information on the part of the administration, clearly demonstrated a lack of respect and trust of the views and judgement of the senior faculty who were representing the *Newsletter*.

The Editorial Board was puzzled by the length and nature of the prolonged negotiations. Within a School, department, or unit, such an overdue promotion would have taken perhaps several weeks, certainly not eight months! We believe the delay represented the reluctance of individuals within the administration to accept the independence of the *Faculty Newsletter*.

The matter was finally resolved when the Editorial Board decided to bring the issue to the faculty at an Institute faculty meeting.

We summarize below some details of the various stages of negotiations to make permanent and full time the position of the FNL Managing Editor. We have documented major points of concern to show our frustration with the procrastination of the administration.

Summary of Negotiations

Our proposal was presented to President Hockfield on July 6. Several weeks later the President reactivated the former Graves Committee to examine the *Newsletter's* request. The Committee's report back to the President in early

September essentially affirmed the value of the *Newsletter*. The FNL Editorial Board was not made aware of the Graves Committee report until early November.

In early November, meetings were held at the request of Faculty Chair Steve Lerman, who was trying to move the issue along. However, lacking authority in the matter, he removed himself from the process. Subsequently we were contacted by the Office of the Associate Provost, who expressed skepticism as to whether the proposal represented the views of the Editorial Board. The Editorial Board then met and formally voted: "To promote the Managing Editor of the *MIT Faculty Newsletter* to full-time Level 3 administrative staff, appropriate to the seniority and responsibility involved, and continuing to report to the Chair of the *Faculty Newsletter* Editorial Board." We were then informed that Human Resources required a more detailed job description, which we duly provided.

In early January, Associate Provost Lorna Gibson called for a need to revise the job description once again. She told us that HR had reviewed the Managing Editor's position the previous spring and found a part-time clerical appointment to be appropriate. However, we were unable to obtain a copy of the alleged evaluation or other confirmation. In fact, neither the FNL Chair nor any other member of the Board had been interviewed by HR or seen the "report."

In mid-January, Associate Provost Gibson informed us that the decision on promotion was the sole purview of HR and promotion could not take place without extensive interviews of Editorial Board members. Given the existence of 93 issues of the *Newsletter* edited and published over more than 18 years as concrete evidence of work performed, this seemed one more means to delay action.

Three members of the FNL Editorial Board participated in separate interviews with Senior HR Officer Jennifer Walsh and her assistant. In late January, Ms. Walsh reported that they were "studying the issue." Associate Provost Gibson and Ms. Walsh subsequently requested

another meeting. In this meeting they raised allegations of a new issue – inadequate attribution by the Managing Editor in two minor *Newsletter* articles from 2002 and 2005. These articles carried information based on Institute news releases and were therefore similar to articles appearing in *Tech Talk*. Very soon thereafter, the FNL Managing Editor provided documentation showing that the HR allegations on inadequate attribution were completely groundless.

Frustrated with the situation, and in danger of losing our Managing Editor, later in January, 13 senior members of the faculty, many of whom are not on our Editorial Board, signed a resolution to be brought to the full faculty, requesting action in support of the *Newsletter*. (Signatories: Prof. Alice Amsden, Prof. John Belcher, Prof. Nazli Choucri, Prof. Nancy Hopkins, Prof. Nancy Kanwisher, Prof. Jonathan King, Prof. James L. Kirtley Jr., Prof. Stephen Lippard, Prof. James Orlin, Prof. Theodore Postol, Prof. Phillip Sharp, Prof. Stephen Tapscott, and Prof. James H. Williams, Jr.)

On the morning when the resolution was to be hand-delivered to Chair Lerman, e-mail arrived stating that the Managing Editor promotion would go forward. On February 21, David Lewis finally received a letter from the Provost confirming the promotion and the level of salary, although the latter was at a considerably lower level than we had requested and deemed appropriate.

Members of the Editorial Board considered requesting that an independent committee of faculty be convened to look further into this matter. However, rather than a faculty committee, we believe that it behooves the administration to investigate this process, and identify what went wrong. ■

Alice Amsden
John Belcher
Gordon Kaufman
Jonathan King
Stephen Lippard
Fred Moavenzadeh

From The Faculty Chair
**The More Things Change
the More They Stay the Same**

Steven Lerman

ONE OF THE INTERESTING things about serving a second term as Chair of the Faculty is the opportunity to look back on some of the articles I wrote for the *Faculty Newsletter* during my first term and ask whether anything I argued for or against has changed. As I started to write this column, I read through several of the pieces I wrote during my earlier term six years ago, and I realized that some of the problems I wrote about are still very much with us today.

In those earlier articles, I expressed my concerns about such seemingly diverse topics as the growth in the size of the graduate student body, the inappropriate uses of e-mail, the expansion of the time and energy needed to secure adequate research funding, and the growing bureaucratization of MIT. The unifying theme of these trends, though, is that they all create additional competition for the already scarce time of the faculty. Collectively, these forces make it ever more difficult for us to spend time on teaching, mentoring, and research, the reasons we chose to become professors in the first place.

My unhappy conclusion in reading through those earlier pieces is that the trends I discussed in those articles have for the most part either not improved or worsened, and that collectively they present a greater challenge now than ever before. I think it's useful to revisit them from today's perspective and explore which of them are potentially remediable and which are forces beyond our control.

Competition for Time

Consider the growth in the size of the graduate student body. I noted in an earlier article that between 1991 and 2000, the number of full-time graduate students (not including special students) had

grown from 4854 to 5566, an increase of 15%. Since that time, the graduate student enrollment has grown to 5973, another increase of 7.3%. In the same 2000-2007 time period, the undergraduate enrollment has declined slightly, by 3%. While the size of the faculty has grown some since 1991, the number of graduate students per faculty member has increased from 5.05 in 1991 to 5.98 in 2007. To a first approximation, each of us on the faculty has on average one more graduate student than we had 16 years ago.

It's important to note that, for the most part, we didn't plan this growth. It happened as the result of largely independent decisions made by individual departments. In many cases, the growth in the number of graduate students was the result of increases in research funding, which in turn created a need for a greater number of graduate research assistants. However, because we didn't plan for this growth, we never made any conscious decisions about how, given all the other

things we each are doing, we would find time to advise and mentor the additional students.

Another trend is the growing time we must devote to securing research funding. The percentage of proposals funded by

E-mail represents yet another arena in which we seem to spend an ever-expanding amount of time. . . . the conventions that have grown around the use of e-mail have some dysfunctional elements that we need to eliminate from the MIT culture.

agencies such as the National Science Foundation and the National Institutes of Health has declined over time, and as a result many of us find ourselves writing more proposals and cultivating alternative sources of research funds from industry, foundations, and international programs. At one level, this diversification of our research sources is healthy, in that at least in some areas we're less dependent on a single funding source. However, anecdotal evidence from my conversations with many of you suggests that this diversification often comes at a price – particularly the additional time we spend preparing proposals and traveling to our research sponsors.

E-mail represents yet another arena in which we seem to spend an ever-expanding amount of time. Part of this is the result of the huge expansion of asynchronous communication that e-mail has enabled. It is easy to send copies of electronic correspondence to many people, particularly when we use mailing lists. A

positive aspect of this is that we often know about things more quickly than before; the negative consequence is that we sometimes spend hours on our correspondence every day.

As with many technological innovations, whether e-mail is “good or bad” for us depends far more on how we choose to use it than on any intrinsic properties of the technology itself. As I argued earlier, the conventions that have grown around the use of e-mail have some dysfunctional elements that we need to eliminate from the MIT culture. One of these is the expectation of immediate response. E-mail speeds the delivery of communications, not the time it takes to read someone’s message, think about the issues or questions that message raises, and compose a response.

E-mail can also encourage a less-than-collegial style of communication. In my experience, e-mail is a terrible medium for dispute resolution. It tends to produce escalation rather than compromise. A minor problem can become a major one in less than a day, and we end up spending a huge amount of time dealing with a deluge of angry messages. Often, the only way to end these exchanges is to have a meeting of the involved parties, once again burdening all of us with yet another meeting. These e-mail firestorms not only consume our time and energy, they undermine the mutual respect that is the foundation of collegiality among the faculty.

My final factor that contributes to the competition for our time is the large number of small pieces of institutional bureaucracy. These seem to fall into two categories. Some are mandated from outside of the university, as is the case with various government reporting requirements, training on environmental safety, conflict of interest statements, and additional procedures for submitting grant proposals. Others, such as surveys from various parts of the administration, additional committees to provide input into various decisions, and meetings to present information that we might find

valuable, are entirely well-intentioned efforts to further engage the faculty in the huge spectrum of activities within a modern research university. We need to recognize, however, that the sum of these

If we decide to continue to expand the graduate population and, as currently planned, to add to the undergraduate population, we should undertake a modest expansion of the size of the faculty.

small demands on our time collectively, inevitably takes time from something else we should be doing.

Some Modest Suggestions

Given all of the above and the lack of progress we have made on these same issues, it is appropriate to ask whether the expansion of faculty’s time commitments is inevitable. My own sense is that this is only partially true. There are things we can do, but they require some changes in decisions we either implicitly or explicitly make. Here is my modest list of proposals:

- Departments that have expanded their graduate enrollments should look seriously at the option of decreasing their size. This is something we, the faculty, control locally. In the long run, MIT is in the business of quality, not quantity.
- If we decide to continue to expand the graduate population and, as currently planned, to add to the undergraduate population, we should undertake a modest expansion of the size of the faculty. This will require careful planning to decide where new slots are most needed as well as substantial new resources for salaries, space, and, in some cases, laboratories.
- MIT may have too many committees for our own good. We should try to separate areas where the faculty has an important and fundamental stake from those that might best be dealt with through purely administrative processes. In some other

areas, we might do better having a single person making wise decisions than requiring constant consultation with a committee. It might also be better to have fewer committees, each with a

broader charter.

- Let’s all agree to use e-mail more wisely. It works best as a way of communicating information, and worst as a way of airing grievances. We need to read the messages we send through the eyes of the recipient, and avoid writing things we wouldn’t say to someone face-to-face. This will ultimately save us all time and reduce emotional stress. It will also give our students better examples for how they communicate with each other.
- We should weigh the value of any new bureaucratic process against its full cost, including the time it takes all of us to use the process. Wherever possible, we should find ways of reducing the unproductive burdens of the operating processes needed to run the university.

The forces that have stretched the demands on the faculty have been with us for a long time. Most of us enjoy our work, and few of us are looking for less to do. The real issue is how we should allocate our time. Some of the things we faculty now do isn’t the best use of our time, either for us individually or for the university. We need to become far more deliberate in our decisions about how our choices change what we spend our time on. The day is still only 24 hours long, and everything we do *more* of means there will be something we will do *less* of. ■

Steven Lerman is Professor of Civil and Environmental Engineering; Faculty Chair (lerman@mit.edu).

Teach Talk

Getting More Learning out of Lecture and Recitation Time

J. Kim Vandiver

MOST MIT FACULTY HAVE never received formal training in teaching, and the demands on our time make it difficult for us to go to the research to look for best practices. The purpose of this article, however, is to draw attention to one area in which there are some easily learned principles and techniques that anyone might try. My target is the dominant educational model in the Schools of Science and Engineering: the lecture, recitation, and weekly problem set model.

The typical distribution of time is three hours of lecture and one hour of recitation. This model dominates the culture. The pressure of weekly problem sets almost always wins out over the chance for students to think hard, to *reflect*, on what they are learning. The amount of *enduring knowledge* (a term used by education scholars Grant Wiggins and Jay McTighe in their book, *Understanding by Design*) that our students take away is disappointingly small. This article both spells out goals for lectures and gives specific examples and techniques to be used to improve recitations.

Challenging Accepted Practice in Lectures

For most of my 32 years on the faculty, I have subscribed to the accepted lecture-recitation model, and I have enjoyed that feeling of giving a good lecture. But I have experimented in my own classrooms in the last few years and have come to believe that more real learning would result if we did less lecturing and spent more time in appropriately crafted recitations. I believe that well-run recitations are where the real learning happens. In order to create more

time for recitations, we have to cut back on lectures and rethink the purpose of the lecture. A growing body of research indicates that lectures are best used to accomplish the following:

1. Motivate learning
2. Provide a framework or roadmap to organize the information of the course
3. Make connections between the physical world, the theories that explain the physical world, and applications of the theory that allow us to do engineering
4. Reinforce the critical big ideas.

This does not require three hours per week. In our rush to cover too much material in lecture, we lose a significant fraction of the students. My colleague, Dr. Lori Breslow, director of MIT's Teaching and Learning Laboratory, reminded me recently that "Experts tend to forget what the novice finds difficult." As faculty at an elite, expensive university, what is our justification for a residentially-based learning experience unless our students truly are gaining from their hours in the classroom? When our students do poorly, the explanation that "They did not work hard enough" has a hollow ring. Might we do better to focus lectures on the goals listed above, and challenge our students to practice the skill of learning some material on their own? Such assignments can be explicit, augmented by well-timed, carefully selected problem sets, and supported by well-run recitations.

Improving Recitations

I believe one of the most important purposes of the recitation is to get students to

reveal what they don't understand, so we can help them. Dr. Breslow puts it this way, "A good recitation allows the student to practice skills he/she will need to become the expert, under the guidance of an expert."

This is not what happens in the typical recitation today. The normal course of events is to do a couple of example problems and then ask: "Any questions?" to an all too often apparently dumbstruck audience, or to an audience that is too afraid to admit they have any questions.

So how can we create recitations that are opportunities for novices to engage the material and learn valuable skills under the tutelage of an expert coach?

First, the lecturer and the recitation instructors need to be on the same page, so that the recitation instructors know what to emphasize. Ideally, the lecturer will have introduced the big ideas and told students what they need to learn on their own. The assigned problems should relate to the application of the big ideas, covered in lecture, as well as the concepts that the students need to learn from independent study. The well-prepared recitation instructor knows where most of the common traps and misconceptions are likely to arise. He or she comes prepared with techniques for getting students to ask questions and reveal what they don't understand (an important skill for teachers to possess), to explain and illustrate those misconceptions, and to engage the students in deeper thinking about the concepts of the week.

Although the instructor who is getting students to reveal their questions has already gone a long way toward improv-

ing the recitation experience, research has shown that learning is strengthened when students are actively involved. To give students the opportunity to engage directly with important skills and concepts, recitation instructors can ask students to work together in small groups in which they could:

1. Share the questions they have and then discuss them with the instructor
2. Critique each other's problem sets
3. Present problem solutions to the class
4. Work with each other on what they found to be the most challenging part of a p-set
5. Make up exam questions
6. Solve a problem

A number of MIT faculty have already devised innovative pedagogy to strengthen recitations. Below are two examples: the first is based on my own experience, and the second from a number of experiments in Course 2 on small-group teaching.

Presenting Problems in Class

In teaching recitations in various engineering dynamics subjects over the last five years (2.003, 2.06, and 2.060J/1.581J), I have had students present the assigned homework for the week. Typically, five students would each present one problem. With 20 students in the class, each student would have the opportunity to make a technical presentation to peers about three times in the term. The best technology I have found for doing these presentations is a Wolf Systems document camera (available from AV), under which the student places the solution written on plain paper. The image is projected on the screen through a standard computer projection system.

There are several keys to making this work:

- At the first recitation, give students a handout on good presentation tips, and assure them your intention is not to embarrass them in front of the class.

- During the presentations:
 - Do not critique the student in front of the class
 - Don't reveal if the solution is correct or not (this is important to success)
 - Have the student sit down, leaving the solution on the screen
 - Ask the others to describe different answers or results

- After getting all the issues on the table give a mini-presentation on apparent misconceptions, while you endorse the correct approach.

The Small-Group Experiments in Course 2

Under the leadership of Professor Warren Seering, experiments in small-group teaching were conducted from 2004-2006 in six (2.001-2.006) of the 12 subjects that compose the Mechanical Engineering core. The experiments were assessed extensively by the staff of the Teaching and Learning Lab, and the data suggest four factors lead to effective, active learning experiences: the instructors create safe environments in which the students are not afraid to appear confused; the instructors ask conceptual questions rather than only questions that can be answered mathematically; they provide timely feedback; and there is a close alignment of lecture with recitation problems.

One of the most successful implementations was Professor Ely Sachs's "Discovery Learning Model" in 2.001, which was studied during the spring semester 2005. Often recitations began with students relating lecture concepts to demonstrations or mini-lab experiences. After reviewing these concepts, students would get together in small groups and work through problems or discuss answers to conceptual questions Professor Sachs had posed. Professor Sachs would rotate among the groups asking and answering questions. During the last segment of the recitation, he would guide the class collectively through the solutions to the problems. Throughout the recitations, he stressed conceptual understanding, the role of visualization in learning, and the

importance of hands-on experience to develop an intuitive feel for concepts.

Although data was gathered through surveys to understand which parts of the small-group experience contributed to the students' learning, perhaps the following quotes from student interviews are more telling:

"The small group recitation helps me reach a deeper understanding. We start from scratch. We are actually doing the problems, not copying the solution. The TA points out equations/features not covered in lecture that helps us understand the concepts."

"I am more engaged in small groups. We are accountable. You can't hide, fall asleep, or escape! You are always doing something."

These responses echo ones that were made by students who participated in an experiment, developed by Professors Hal Abelson and Gerry Sussman in spring semesters 2002 and 2003, to bring case-based tutorials led by MIT alumni to 6.002. As one student said:

"The tutorials force you to take responsibility for figuring out the end point and the steps to take to get there. . . . They break things into pieces. . . . If you don't understand, you need to ask, and you have lots of opportunities to do so. It prepares you to ask the right questions beyond the material. That's empowering!"

These techniques and others allow us to grapple with the students on the hard problems we ask them to master. In coaching them this way, they are bound to sense our commitment to their learning. And it has been my experience that once MIT students know you care about their learning, they will respond.

More information on using the recitation techniques described here can be found on the TLL Website at web.mit.edu/tll/teaching-materials/recitations/index.html. ■

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Why Diversity Matters

Karl W. Reid

UNTIL THE 1960s, MANY U.S. universities expressed little concern for the paucity of minority students attending their institutions. The Civil Rights Act of 1964 accelerated the desegregation of colleges and universities, particularly in states that resisted the 1954 *Brown v. Board of Education of Topeka* Supreme Court decision outlawing racial segregation in public education.

While colleges in the South reluctantly moved to comply with these and other federal mandates, several northern colleges and universities, including MIT, had already begun to aggressively address the problem years before the Civil Rights Act was signed. Clarence Williams' *Technology and the Dream* (2001) chronicles MIT's early efforts first to eliminate bias and discriminatory practices against racial and ethnic minorities, and then to increase the structural diversity of its student body.

In response to Massachusetts Fair Employment Practices Commission legislation, MIT president Karl Compton stated in 1947 that MIT "has no quotas, nor do we limit any group or groups because of race, religion, color, national origin, or ancestry" (Williams, C.G., *Technology and the Dream*, p. 15. 2001, Cambridge, MA: MIT press). A few years later in 1952, the Institute Committee (now the Undergraduate Association) issued a resolution to eliminate discriminatory practices within campus organizations. Still, African American student enrollment in that era remained persistently small, comprising only about one percent of the undergraduate population. Consequently, MIT faculty and senior

administrators responded with more aggressive recruitment efforts. In 1964, the Admissions and Financial Aid committees urged increased contact with Black high schools, forging greater ties with Black organizations, and creating more scholarships earmarked for African American students. Thirty-one percent of the 743 high schools visited by MIT students and staff that year were predominantly Black schools. In the fall of 1964, staff and faculty identified promising African American students from 46 majority Black schools that were visited during that season.

That same year, President Julius Stratton formed the Committee on Educational Opportunity to explore how the Institute could become more involved in addressing problems of race, segregation, and integration. However, not until President Howard Johnson appointed the Task Force on Educational Opportunity in 1968, chaired by then Assistant Provost Paul Gray, did MIT take significant steps toward making the undergraduate student body a more inclusive and diverse community. As a direct result of the Task Force's efforts, the incoming class of 1969 saw a seven-fold increase in African American freshmen from the previous year. Major recruitment thrusts for Latino/Hispanic and women students followed in the ensuing 38 years.

Today, MIT is recognized as having one of the most diverse undergraduate populations among its peer institutions. Still, our racial and ethnic diversity at the graduate and faculty levels is about one-fourth of the Institute's undergraduate high-water mark of just under 20 percent. Only

five percent of graduate students come from underrepresented minority groups, and about six percent of faculty are African American, Latino, or Native American.

Upon accepting my appointment as Assistant to the Chancellor in October 2005, I undertook an effort to map graduate student diversity efforts across MIT. The aim of my interview study was to understand the challenges, opportunities, and most promising initiatives employed by departments and divisions to increase the number of enrolled underrepresented graduate students. I discovered that several departments and offices were extremely committed to the recruitment and success of their graduate students of color, but that the efforts, practices, and commitment employed by units across the Institute were highly variable, making year-to-year improvement inconsistent.

More poignantly, I found that many faculty lacked an empirical (and experiential) appreciation for the merits of diversity. Several faculty I interviewed echoed a prevailing belief among a handful of their most vocal colleagues that an emphasis on diversity would sacrifice research productivity. In short, they believed that diversity was the antithesis to quality. This opinion has the potential to circumscribe the promise of students from underrepresented groups, particularly if this attitude infuses admissions or hiring decisions. More tragically though, the research also shows that such attitudes could also negatively impact the entire MIT community, including its faculty.

It is commonly held in academe that all students benefit when campuses reflect

a broad range of intellectual, cultural, and demographic perspectives. A diverse college campus fosters an environment where stereotypes and biases are challenged, where perspectives are broadened, and where critical thinking skills are sharpened. A campus characterized by

- lead to interactions that expose students to different perspectives
- raise new issues and perspectives (particular to a diverse class)

Still, does having a diverse team benefit the research enterprise for which MIT is

Remaining still are questions about whether GRE scores and Carnegie classifications of undergraduate institutions are as predictive of research productivity for underrepresented students as they are perceived to be for non-minority students.

cultural pluralism stimulates deep learning and better prepares students to thrive in an increasingly diverse and global workforce.

Still, these studies generally do not answer the question why racial and ethnic diversity matters for faculty. How do teaching and research benefit from a pluralistic campus? I sought to answer this question in order to inform the recent Task Force on the Undergraduate Educational Commons during their deliberations about a proposed diversity requirement. Fortunately, there is emerging literature that begins to answer the question.

One survey study of 1,500 Research I faculty found that neither the quality of students nor the intellectual engagement in their classrooms suffer from diversity (Maruyama, G., & Moreno, J. (2000) "University faculty views about the value of diversity on campus and in the classroom": American Council on Education. American Association of University Professors).

On the contrary, between one-third and one-half of the respondents *Agreed* or *Strongly Agreed* that diverse classrooms:

- broaden the variety of experiences shared
- confront stereotypes on social and political issues
- confront stereotypes on racial and ethnic issues
- confront stereotypes tied to personal experiences

most known? In the same faculty study referenced above, a majority of the 1,500 faculty surveyed felt that diverse research teams increase their understanding of their discipline. Furthermore, illuminating the reciprocal link between research and teaching, the study found that faculty research views were strongly influenced by their classroom diversity.

Clearly, more research needs to be conducted to inform our decisions about which factors to look for when making admissions or hiring decisions. Remaining still are questions about whether GRE scores and Carnegie classifications of undergraduate institutions are as predictive of research productivity for underrepresented students as they are perceived to be for non-minority students. How does one account for variation in undergraduate institutional resources when making graduate student admissions decisions? To my knowledge, few have attempted to rigorously answer these questions here at MIT.

Despite these gaps in our understanding, thought-leading institutions like MIT have recognized that their campuses must aggressively pursue capable students who will eventually shape policy or create solutions for societies in which they live and participate. Indeed, the MIT imprimatur ostensibly invites everyone to the table of innovation and discovery regardless of their background, legacy, or wealth. The 2004 faculty resolution, which calls upon the Institute "to take all necessary and suf-

ficient steps to increase the percent of ... underrepresented minority graduate students by roughly a factor of three (3) within a decade" is evidence of this inclusive acknowledgment.

In response to this unanimous faculty resolution, the DUE (Office of the Dean for Undergraduate Education), the GSO (Graduate Students Office), and the OME (Office of Minority Education) have partnered to build on the success of the MIT Summer Research Program (MSRP) and CONVERGE preview weekend in attracting prospective graduate candidates to MIT. The recently launched OME Laureates and Leaders program will identify and cultivate MIT undergraduates' interest in advanced graduate study from as early as the freshman year. Last year, the DUE launched a cross-functional Diversity Team – one of six strategic DUE teams – whose task is to increase UROP participation and to triple the number of underrepresented MIT undergraduates who matriculate in MIT graduate programs.

For almost 40 years, MIT has embedded lessons of inclusion into the social and educational fabric of the undergraduate experience, but it will take a collective effort to similarly realize dramatic improvements in racial and ethnic diversity at the graduate school and faculty levels. In summarizing decades of his higher education research, Alexander Astin (Astin, A. W. (1993) "What Matters in College: Four Critical Years Revisited. San Francisco": Jossey-Bass) maintained "beliefs are fundamental." His statement suggests that our collective first step should be for the faculty to increase its understanding of the benefits of diversity, both as individuals and as a distinctive community. ■

Portions of this article were drawn from an essay written by the author in April 2006, on behalf of the Task Force on the Undergraduate Educational Commons.

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The Martin Luther King, Jr. Visiting Professor Program

“MIT established the Dr. Martin Luther King, Jr. Visiting Professor Program to enhance and recognize the contributions of outstanding scholars. The program honors the life and legacy of Dr. Martin Luther King, Jr. by increasing the presence of scholars at MIT. Since the first appointments in 1995, 34 Visiting Professors have been named.

“Dr. Martin Luther King, Jr. Visiting Professors enhance their scholarship through intellectual interactions with MIT peers, and enrich the intellectual life of MIT with their participation in MIT research and academic programs. They are expected to be deeply engaged in the life of the Institute through teaching, research and other scholarly interactions with the MIT community. Their presence gives them the opportunity to make a significant impact on the growth and awareness of undergraduate and graduate students, as well as the MIT community as a whole. Appointments as Dr. Martin Luther King, Jr. Visiting Professors have been in all of MIT's academic areas of Architecture, Engineering, Humanities, Management, and Science.” web.mit.edu/mlking/www/vpp_index.html

In an attempt to highlight this program and its participants, the *Faculty Newsletter* offers the following articles by one current and one past program participant. We plan to continue featuring MLK Visiting Professors and Scholars in future issues of the *Newsletter*.

Desired End State: Reaching The Goal

William M. Harris, Sr.

DURING A RECENT LUNCHEON meeting with a distinguished faculty colleague (everybody in this environment claims such classification), I was asked what were the motivations for my research at MIT. Three factors serve to stimulate and guide my work. As an academic and professional planner, I am committed during my lifetime to participating in the primary (first order of magnitude) challenge to this nation in the twenty-first century...rebuilding our urban core cities. Another factor is a dedication to giving attention and effort to those most needing and deserving competent intervention in our socioeconomic system...oppressed African Americans who live in the inner cities and rural areas of the nation. Lastly, I am driven to take the courage to confront the barriers and behaviors that limit the full development of people who lack the human and tactical resources to compete favorably in a complex, often hostile environment – the only reliable measure of success gauged by the witness of those most negatively affected.

There are two immediate avenues available that lend themselves to scholars involved in problem solving that is designed to improve the quality of life for people and the ecological environment. The high-risk road that is less traveled, one of the options, is to exercise direct involvement in change movements as an advocate for social and economic justice. This street-fighting approach is often too intense, dangerous, and non-tenure producing for most scholars. The other option is to teach, persuade, and influence the development of policies, devices, and individual and group behaviors to bring about purposeful change.

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MLK, MIT, and Me: A Personal Essay

Ainissa G. Ramirez

MY VISIT TO MIT as a Martin Luther King Visiting Professor was brief but rewarding. This visiting position afforded me new collaborations in thin film shape memory research and the space to think about new directions. I expanded my research efforts by using equipment not available at my home institution; and, I expanded my pedagogy by witnessing exciting new courses in action. The electric environment and the magnitude of efforts I found at MIT encouraged me (or dare I say compelled me) to be more creative in my own research and educational pursuits. It was my awakening.

Before I get ahead of myself, let me provide a bit of background about how I got here. I am a materials scientist trained at Brown (ScB) and Stanford (PhD), which I know is a dirty word in these parts. Nevertheless, I'll admit that I have always admired MIT scientists when I worked with them as a member of the technical staff at Bell Labs, in Murray Hill, NJ. I always appreciated their thorough understanding of the fundamentals and the scientific creativity this understanding enabled. In many ways, my time at Bell Labs prepared me for my visiting professorship.

Before I arrived at the Institute, I had several plans of what I wanted to accomplish. Admittedly, the list was too long, so I reduced it to three basic themes: advancing my shape memory alloy research, my solder research, and my science education efforts. And my underlying goal was to meet as many people as possible.

Currently, my research falls into two thrusts: the development of thin film shape memory alloys, and the development of reac-

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tive solders. Shape memory alloys (like NiTi) exhibit the unique property of “remembering” their original shape by undergoing a reversible martensitic phase transformation when heated. My work is in understanding their thin film behavior and in integrating them into micro-electromechanical systems (or MEMS) as actuation materials. As such, I am interested in exploring the factors that impact their phase transformation behavior, like composition and microstructure. At Yale, we developed schemes to control and predict the resulting grain size after annealing using nucleation theory. These results have helped us generate a map that correlates structure and processing. At MIT, I explored the link between structure and the mechanical properties using nano-indentation.

I also spent time as an MLK Visiting Professor thinking about solders. Solders? Yes, solders. I know that solders do not seem that intellectually intriguing in this age of nanotechnology, but I have found they are avenues for innovation. I learned this lesson at Bell Labs when we needed and developed solders that could bond directly to glass (optical fibers) and ceramics. These rare-earth doped formulations are now commercialized by Adhera Technologies (adheratech.com) and are an enabling technology for the packaging of MEMS, microelectronics, and optoelectronics. I learned then that I was wrong in thinking that all things were done with solder. With this vantage, I re-examined solder again as a means to create micron-scaled 3D metallic structures (or microsolidics). By molding solders into polymer channels one can create flexible yet conductive assemblies. If the polymer is removed, complicated stand-alone metal structures can be made rapidly and cheaply. I enjoyed thinking of clever ways to create with solder and found that metallurgy is alive and well in Cambridge.

In addition to my research, my passion also lies in science education, specifically K-12 efforts. I am committed to convincing all children that science is within their domain. There are systemic factors that



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reduce our pipeline of talent. I am interested in creating modes to prevent students from being discouraged while within this pipeline. At Yale, I created a fun lecture series for kids, called Science Saturdays (sciencesaturdays.org), which attempts to show children (of all ages and hues) the enthusiasm one can have for science. Efforts such as these are still in their genesis at Yale. When I came to MIT, I was surprised to find the vast number of

long-standing science educational programs that existed. This institutional commitment increased my zeal for this type of work.

MLK's Dream

Overall, MIT made me feel like a kid in a candy store with the tremendous amount of resources, expertise, and passion that everyone has for their work. It was reminiscent of my time at Bell Labs. I was impressed with the willingness of researchers to collaborate, to expand ideas, and to connect these ideas to other work. I also appreciated their willingness to meet with me despite their high rank or reputation. Most importantly, I found that the currency for connecting with other scientists was based on the quality of one's ideas.

Thinking about exchanges based solely on “the quality of ideas” reminds me of Martin Luther King, Jr.'s dream for all of us to be judged solely by the “content of our character.” Strangely, unexpectedly, and for an ever-so-fleeting moment, I got a glimpse of that. Now, I need to be careful because I know from experience that biases are very real, very present, and very deeply ingrained. So, I do not want my words to set back causes towards the equality of women and people of color in academia (of which I am a member of both camps). However, I would cautiously propose that there was something unique about being a visitor at MIT. My temporary and unattached “just visiting” status allowed me to peel back these layers and experience a near-bias-free existence, where the basic question was “Is she good?” This was a paradigm shift for this metric has been ethereal for me. The opportunity to briefly taste this quixotic goal made the MLK program so rewarding.

Tips for Future Visitors

If I had one piece of advice to any future MLK visitor, it is to find someone to guide you through this wonderfully peculiar terrain. I was extremely fortunate to have such a guide and I am indebted to my

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Desired End State

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Throughout my career, I have engaged both with varying degrees of success.

Coming to MIT is a welcomed opportunity. The Department of Urban Studies and Planning is the nation's highest ranked and possesses much of the profession's academic leadership. My twin brother [Wesley L. Harris, Department of Aeronautics and Astronautics] is a senior faculty member of the Institute and we share much appreciated time in reflection and catching up. Interacting with students in Simmons Hall, graduate Planning students in class and research discussions, and extending involvement to other area universities are most productive. Equally, having the occasion to both observe and participate in decisions and activities driven by race and fairness challenges has been instructive. All these forces are useful in my research.

As an MLK Visiting Professor, I am convinced that participation in the MIT community is an obligation. That participatory effort may be characterized in three paramount contexts. The most critical context is that of researcher-teacher. The MLK scholar must be aggressive in discovery efforts that result in value-added answers to questions of nature. Wherever possible, these investigative efforts should involve students who will expand their knowledge base and learn to work with people who are frequently different in color, culture, and commitment than themselves. Lastly, the research and teaching enterprises must be measurable. Some form of publication, peer-level recognition, or student assessment is required.

A second context is articulating the Martin Luther King, Jr. principles of advocacy for social justice. In a less than perfect world, less than an ideal institutional setting, and less than fully individual ethical behaviors, the MLK visitor must give voice and action to observed wrongs. To engage scholarship under the banner of Martin Luther King, Jr. without intervention to correct injustice is to be a pimp



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unworthy of presence among intelligent, caring people. Speaking the truth to the often uncomfortable, indecisive leadership is the best of Martin's Dream. To challenge the status quo and demand fairness as a practice beyond statements of principles is the duty of every Martin Luther King, Jr. Visiting Professor. If I were to fail to be a drum major in making at least an effort to bring about purposeful

change in the application of fairness principles at MIT, Martin would hold me in low esteem.

Of course, the third context is the individual work upon which so much of the selection process for MLK visitors is determinant. A simply wonderful part of my effort is currently co-teaching a graduate course related to brownfield revitalization. Working with a seasoned colleague and interacting with eager-to-engage students is highly productive and satisfying. In addition, the findings of the class may actually make a positive difference in the human and ecological environments. Already it is clear to me that teaching at MIT is an excellent way to learn.

The best scholar is an observer who is thorough and intense. The thoroughness is measured as a function of comprehensive factors that may be shown to have relationships. The intensity is a measure of the motivation, sustained effort, and stubbornness to achieve a goal. Wishing to write about an important issue, daring to go beyond current limits set by publishers and misleading scholars, and constructing something of value to those most oppressed in society, I am writing a provocative book dedicated to African American community development. The important issue is racism, not race. White scholars rarely even mention racism in scholarly literature these days. (The words "white racism" have been used less than a dozen times in the past 20 years in the *Journal of the American Planning Association*.) These scholars do, however, on occasion, speak of race as a concern for matters related to public policy or private action. In this same vein, I insist that my work has utility for those outside the academy as well as within. For those who take the courage and expend the effort to challenge wrongs toward making our environment more just, my book is designed for their use.

Now, the book. The presentation is an historical overview, case analysis, and prescription for African American self-induced and sustained efforts to improve their quality of life. The approach is outside the proposals of the past four

decades that offer black social, economic, and political advancement only through the intense involvement of white America.

Thus African Americans were permitted to participate in businesses at the lowest levels, attend previously segregated schools (all levels) in very small numbers, and engage in policy making at trivial levels to satisfy an appetite for fairness. The resultant effort was the death of black-owned businesses . . . within-school segregation . . . and gerrymandered electoral politics.

First, such an approach is not historically accurate for African Americans. During periods of post slavery until post World War II, blacks were primarily self-reliant for environmental advancement. With the coming of desegregation, the “Jackie Robinson effect” took place in the black community. Whites realized that to implement an effective means of limiting competition and expanding their market from and among blacks, programs of selective inclusion were necessary. Thus African Americans were permitted to participate in businesses at the lowest levels, attend previously segregated schools (all levels) in very small numbers, and engage in policy making at trivial levels to satisfy an appetite for fairness. The resultant effort was the death of black-owned busi-

nesses (the former Negro Baseball Leagues), within-school segregation (destruction of Community Control

Movements), and gerrymandered electoral politics.

It is this set of conditions that motivate my writing. My findings levy the responsibility for our race enhancement to us. I prescribe that it is *solely* the members of the black community who must set the goals for future community action. Similarly, once directions are agreed upon and set, outsiders must be employed to work under the direction of the community members. This criterion is necessary to maximize community control of the improvement processes and increase efficiency of operations consistent with community-stated goals. Volunteers will not be permitted. Volunteers are too often fickle; they are self-directed and participate only at their pleasure and leisure.

Technical assistance will be defined, monitored, and revised by the community. The community having set the goals for community development, it must be the community that evaluates and modifies the outcomes resulting from efforts to improve the quality of life in the area.

Many will find the book dangerous and unwanted. White liberals will defend their traditional involvement as necessary, even though the results have been mostly ineffective. White conservatives will welcome the prescription as a justification to wipe their hands clean of the mess, as though they would have made a positive contribution. Black conservatives will be at a loss financially because whites would no longer pay handsomely for a story no longer valid. Many African Americans will be afraid to cut the strings that bind them to dependence for a price. I am convinced, however, that the poor, the oppressed, and neglected will recognize and support the book as a formula worth investment. Besides, in the seventh grade, I had the best teacher this nation could offer. Her wisdom was that a scholar must always teach and tell the *truth*. She smiles upon my effort from her status as an angel. ■

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MLK, MIT, and Me

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mentor, Prof. Samuel Allen. I would also say to future MLK visitors to get connected to other faculty of color. Getting connected was of great benefit to me because the number of black engineering faculty at Yale is one – yours truly. So, it was wonderful to be among colleagues with a common understanding.

The Export Business

Lastly, what did I leave with? In addition to great data, I left with a greater appreciation for the entrepreneurial spirit, which is palpable at MIT. I was particularly inspired by the notion of creating engineering applications for the developing world and have passed this on to my undergraduate advisees. Such projects really motivate students who want to make a difference. On a personal note, I

returned to Yale with a (super) charged battery, a renewed sense of the best practices to do science, and a great appreciation of MIT for what it is today and what it has the potential to become. My time in Cambridge has made me a better professor and a better person.

Thank you, MIT. ■

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Recruiting Underrepresented Minority Graduate Students to MIT

Mandana Sassanfar
Steve Bell
Chris Kaiser

UNDERREPRESENTATION OF minorities at MIT has been a recurrent issue. The perception that MIT is not as accessible to, or as supportive and welcoming of minorities is a serious impediment to efforts at increasing minority student enrollment at MIT. The Department of Biology, and the Institute as a whole, have been working hard to address this situation by reaching out to minorities in a more systematic and committed manner.

The current proportion of underrepresented minorities at the undergraduate level at MIT is between 12% and 18%. This is the result of a deep and sustained institutional commitment to increasing the diversity of the undergraduate student body. While 16% of all Bachelor degrees awarded at MIT in 2006 were to underrepresented minorities, only 2% of all Doctoral degrees awarded that same year were to underrepresented minority students.

Our goal is to achieve the same kind of success at the graduate and postgraduate levels as exists for undergraduates. We believe that by increasing the number of interested and qualified applicants from underrepresented and under-served backgrounds it is possible to increase the number of underrepresented minority graduate students at MIT, without compromising fundamental standards of academic excellence. There is no easy or immediate way to reach out to these students. But we have seen that by taking many small steps along the lines that have already found to be successful, persistence will eventually yield large dividends.

MIT has long been at the forefront of science outreach to students from socio-

economically disadvantaged backgrounds. The creation of the MITES (Minority Introduction to Engineering and Science) summer program in 1974 for rising high-school seniors and the MIT Summer Research Program (MSRP) in 1986 for undergraduates from other institutions, both designed to encourage students to pursue degrees in the sciences, are just two examples. The MSRP now includes more than 50 students per year who perform research in laboratories across the entire Institute – and is specifically designed to encourage students to apply to graduate school at top tier institutions.

In addition to these programs on campus, MIT has, in the last few years, further increased its efforts to reach out to undergraduates from other institutions. These efforts give talented students nationwide greater access to MIT. As a result, the Institute is attracting applicants who would otherwise not apply to MIT. This, in turn, is increasing graduate student diversity.

The results are encouraging. In the Biology Department, for example, the number of underrepresented minority students applying to the graduate program has almost doubled in the past three years, reaching an all-time high of 37 during the last application cycle. The number of minority graduate students in the Biology program has doubled in four years from under 5% in 2003 to 10% this past fall, and is expected to continue rising. The Biology PhD program currently has 19 underrepresented minority graduate students. This number is expected to rise to at least 23 by

September 2007. There is also an increasing number of biology graduate students from disadvantaged backgrounds who have attended community colleges and large state schools.

These increases in numbers are the result of sustained efforts by MIT faculty and administrators to promote an accurate image of MIT's academic, cultural, and social environment, both inside and outside MIT. Institute representatives meet with prospective minority students and faculty on campus, or travel to other institutions and national conferences to give seminars and meet with students and their faculty mentors. Two important points that are communicated to students and faculty at other institutions are:

- 1) MIT is much more than just an engineering school (which comes as a surprise to many students)
- 2) The dream of being accepted into a PhD program at MIT can be a reality.

Many outstanding students never apply to MIT because they are intimidated by our reputation, don't believe they can be accepted, or think of MIT as the exclusive domain of engineers. Although it is true that MIT is the premier engineering institution in the nation and is ranked number one nationally in six engineering disciplines, many departments outside the School of Engineering have reached similar pinnacles of success. All of MIT's Science departments are ranked in the top five in the nation and have their share of Nobel laureates (currently four in biology, one in chemistry, four in physics). The

Linguistics Department, the Economics Department (with two current Nobel laureates), and the business school (Sloan School of Management) are all ranked in the top three in the country. As a result, MIT is becoming increasingly more attractive to students who are from minority or economically disadvantaged groups who have interests outside of engineering. These students are discovering, to their surprise, that MIT offers a friendly and supportive environment and many more disciplines than they expected.

One example of the type of activities that MIT is pursuing to increase its visibility and appeal to diverse groups of students and their mentors is detailed below.

Minority Conferences

This past fall, MIT held exhibition booths at three major annual minority conferences (not including the NSBE [National Society of Black Engineers]): at the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) conference in Tampa, at the American Indian Science and Engineering Society (AISES) conference in Detroit, and at the Annual Biomedical Research Conference for Minority Students (ABRCMS) meeting in Anaheim. MIT has held information booths at these conferences on a regular basis since 2001, but this is the first time MIT sponsored scientific sessions at two of the conferences.

At SACNAS, MIT sponsored two sessions funded by MIT's Computational and Systems Biology Initiative directed by Professors Paul Matsudaira (Biology Department and Biological Engineering Division) and Bruce Tidor (Department of Electrical Engineering and Computer Science and Biological Engineering Division). In addition, Christine Ortiz, an assistant professor in MIT's Department of Material Sciences, was an invited speaker at the conference. These events helped increase MIT's visibility, as the conference had an attendance of over 2500. In total, 13 MIT representatives

attended the 2006 SACNAS conference, including faculty, administrators, scientists, and graduate students.

At ABRCMS, with an attendance close to 2800, MIT sponsored a scientific session that was funded jointly by Dean Silbey and Dean Magnanti from the MIT Schools of Science and Engineering, respectively. The session was chaired by Professor Chris Kaiser, chair of the MIT Biology Department, and featured as speaker Professor Kristala Jones Prather '94, an assistant professor in the MIT Department of Chemical Engineering. The session was extremely well attended and more than 50% of the attendees were African American women.

In addition, nine undergraduate students who spent last summer at MIT in the MSRP program in biology presented posters of their 2006 summer research at these conferences, and three won prizes for their presentations. Hundreds of students and many program directors and mentors stopped at the MIT booths to learn about the graduate program and the summer program, and took advantage of the opportunity to meet MIT faculty and graduate students. The active presence of faculty and graduate students at the MIT booth and at the conference allowed for essential activities: networking with faculty, administrators, and program directors from other institutions, advertising the Institute's summer and graduate programs, and putting a human face on MIT.

The summer research program has become an extremely important mechanism for graduate recruiting. This fall, 12 summer students who worked in MIT's biology-affiliated laboratories between June 2004 and August 2006, applied to MIT graduate programs for the 2007-2008 academic year, and seven of those (including five underrepresented minorities) have been accepted. *Most importantly, it is unlikely that these students would have considered applying to MIT had they not experienced first hand the academic and social environment on this campus.* The number of applicants to the Biology summer program has risen

steadily from 45 in 2004 to over 125 in 2007. The diversity and academic caliber of the applicants has also risen, due to an aggressive advertising campaign by the Biology faculty at meetings such as the ABRCMS and SACNAS conferences, or direct contact with students and faculty at other institutions (some of them alumni of the Biology Department).

Other efforts and programs which are being developed to increase and promote diversity at MIT include CONVERGE, a fall preview weekend funded by the Office of the Provost, a faculty summer sabbatical in the Department of Biology (supported by a grant from the Howard Hughes Medical Institute) for faculty from institutions with a significant proportion of underrepresented minorities, a seminar series that focuses on the problem of underrepresentation of minorities in the sciences, and an increase in the number of minority scientists invited to give a research seminar at MIT. Seminar speakers will meet separately with faculty and students. The Biology Department will start by inviting its own minority alumni, now faculty at other institutions, to speak about their current research.

It is these kinds of sustained efforts, and most importantly, the development of strong and lasting ties to faculty at other institutions, that will eventually make a difference. Faculty mentors play a very important role in advising their students about graduate schools, and they need to be confident that in addition to outstanding training, MIT will provide also a supportive *academic* environment, as well as a good *social* and *cultural* environment where their students can grow and develop into successful scientists. It is only then that they will encourage their best students to apply to MIT. ■

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Filling the Pipeline

Institute Programs Attract Potential Graduate Students

Christopher Jones

“One of the greatest challenges to filling the pipeline is identifying qualified candidates. Occasionally we find underrepresented minority students who fit the bill, but there is no critical mass. Students simply are not out there. In order to get the numbers that we want, we would have to lower standards and we can’t afford to do that.”

WHEN IT COMES TO the issue of recruiting and retaining underrepresented minority graduate students, ideas like the ones above – though often not actually stated – resound loud and clear. Efforts throughout MIT are proving that these assumptions are erroneous at best.

As expressed in its Mission Statement, MIT is “dedicated to providing its students with an education that combines rigorous academic study and the excitement of discovery *with the support and intellectual stimulation of a diverse campus community.*” [Emphasis added.] Sheila Widnall, Institute Professor of Aeronautics and Astronautics, says, “I am proud to be associated with an institution that has as deeply moral and effective a commitment to diversity as does MIT. The Institute has a track record of ‘doing the right thing’ and soaring above the divisiveness that sometimes alienates groups in competition for scarce resources. We celebrate diversity and the absolute belief in the inherent worth of the individual. We are all strengthened and enriched by this commitment. These values bind us together as a community and may be the single most valuable thing that our students take with them when they leave.” By contributing to the creation of a diverse pool of highly qual-

ified scientists, engineers, and academics, MIT is “doing the right thing” while simultaneously contributing to the bottom line of the research enterprise of the Institute and the competitiveness of the nation.

In 2004, the Faculty Policy Committee (FPC) resolved to “take all necessary and sufficient steps to increase the percent of...underrepresented minority graduate students by roughly a factor of three (3) within a decade.” This faculty declaration complements a 1998 joint resolution by the Black Graduate Student Association and the Graduate Student Council that urges all academic departments to “place maximum effort and knowledge into recruiting, matriculating, and maintaining the enrollment of underrepresented minority and women students.” Both resolutions, which passed unanimously, reflect an impressive level of congruence around this issue among students and faculty. These actions were the catalyst necessary to challenge the assumptions mentioned above, and as a result, significant steps have been taken to begin changing the landscape by finding those who “simply were not out there.”

The current landscape includes 6,126 enrolled graduate students, and of this number, 307, or 5%, are underrepresented minorities (African American, Hispanic, and Native American). Programs like the MIT Summer Research Program (MSRP), CONVERGE, and the Amgen-UROP Scholars Program, whose existence rests on the support of faculty and graduate students, are successfully working to fill the national and MIT pipeline.

CONVERGE

A fall weekend on the MIT campus for those seriously interested in applying to MIT for graduate studies, the CONVERGE program was initiated in the fall of 2004. A faculty committee (the 2006 committee chair was Prof. Sam Allen) selects students to invite. Invitees meet faculty, graduate students, and administrators, and have the opportunity to develop contacts within their primary department of interest. Exposure to graduate life and learning is fundamental to the CONVERGE program. Admission to the program includes travel expenses and housing for three nights. Initially run out of the Office of the Provost, CONVERGE is now run out of the GSO (Graduate Students Office). *Filling the Pipeline:* Roughly 40% of the initial CONVERGE participants who applied to graduate school at MIT were admitted. For more information, visit web.mit.edu/converge.

The MIT Summer Research Program (MSRP)

MSRP is a 10-week summer program focused on intense graduate level research, while seeking balance within MIT’s educational triad of academics, research, and community. This program is repeatedly cited by faculty as a promising source of quality research talent. The MSRP operates out of the GSO and works to promote the value of graduate education; to improve the research enterprise through increased diversity; and to prepare and recruit the best and brightest for graduate education at MIT. This summer research assignment, with its faculty-led recruitment and selection

process, fosters mutual familiarity between faculty and students. In addition, the program increases the likelihood that faculty members will advocate for under-represented minority graduate candidates and also builds an affirming peer community that persists beyond the summer.

Filling the Pipeline: Over 150 faculty members from a range of Institute departments have served as mentors to 480 MSRP interns. Almost 95% of all MSRP program participants have gone on to obtain their advanced degrees, with close to 20% attending MIT. Faculty from each of the five Schools are encouraged to serve as summer mentors through the MSRP.

For additional information, please visit web.mit.edu/gso/msrp.

The Amgen Scholars Program

The Graduate Students Office was awarded a \$1 million grant through the Amgen Foundation to serve as the National Program Office (NPO) for a new 10-institute initiative called the Amgen Scholars Program. This initiative seeks to increase the number of students pursuing advanced degrees in science research fields. The function of the NPO is to provide oversight and guidance for the entire program.

MIT will also serve as one of the 10 institutions that will host 25-30 summer

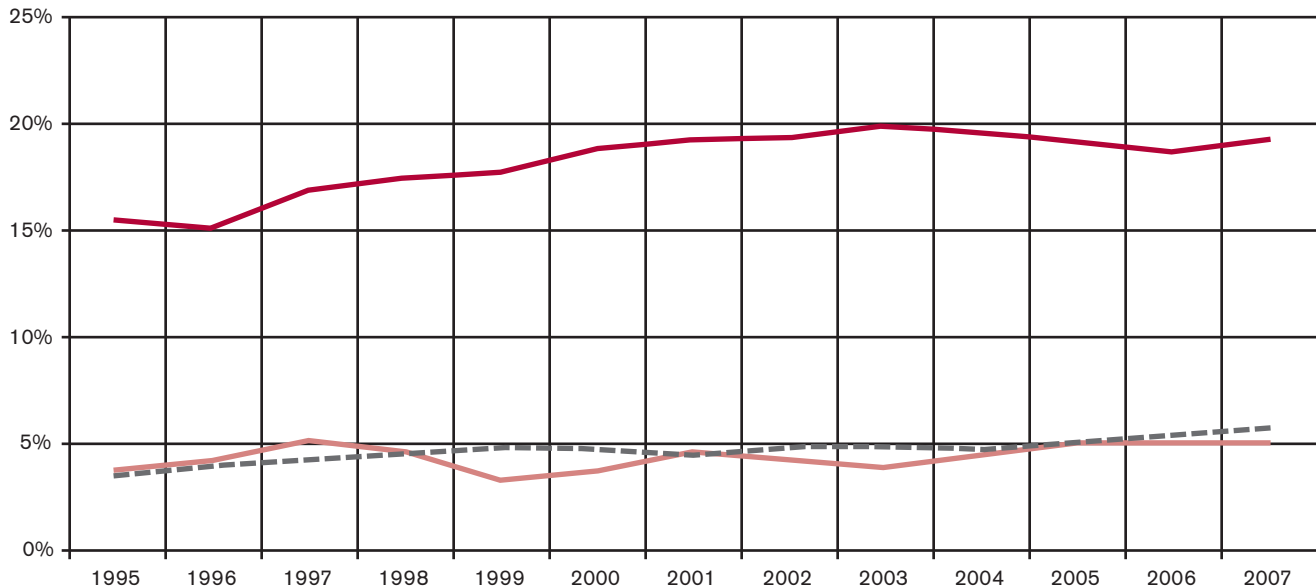
research interns. MIT’s program is called the Amgen-UROP Scholars Program. *Filling the Pipeline:* At MIT, 15 of these slots will go to increase the number of minority students who engage in UROPs and the remaining slots will allow non-MIT students to engage in summer research at MIT. For additional information, please visit mit.edu/urop/amgenscholars.

As we continue *Filling the Pipeline*, we encourage you to join your colleagues in support of these programs. Feel free to contact us at 617.253.9462 or e-mail me for information on how you can participate.

Christopher Jones is Assistant Dean for Graduate Students (cmjones@mit.edu).

M.I.T. Numbers

Underrepresented Minorities* at MIT



*Underrepresented Minorities = Blacks, Hispanics, Native Americans

— Undergraduates — Graduate Students - - - Faculty

Number of Underrepresented Minorities at MIT													
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Undergrads	691	676	746	763	773	808	818	814	829	804	790	758	793
Grad Students	199	228	283	256	179	209	267	256	236	282	309	307	307
Faculty	33	38	38	42	44	44	42	46	47	46	50	53	57

Source: Office of the Provost/Institutional Research

Faith vs. Facts in the Pursuit of Fairness at MIT

Michel DeGraff

Open questions about the James Sherley tenure and grievance reviews

Faith

ON MARCH 8, 2007, Prof. Thomas L. Magnanti, Dean of Engineering and Institute Professor, wrote a letter about Prof. James L. Sherley's tenure and grievance reviews, a letter which he distributed to all Engineering faculty through the Heads of the School's academic units. Dean Magnanti's letter is sprinkled with words and phrases like "*impressed*," "*believe*," "*firmly believe*," "*confidence*," "[h]aving *worked closely* with Professor Lauffenburger for the last eight years [...], I am *confident* that the process in BE was fair and just," "[h]aving also worked closely with the Provost for the past eight years [...], I am *confident* that he too has been fair and just," etc. In his statement, Dean Magnanti also enlisted the February 5, 2007 letter signed by 20 senior BE faculty, a letter in which it is pronounced: "We *believe* in our *hearts* that, as in all tenure cases in our department, it was a fair and honest process executed at the utmost level of integrity and ethics." [emphases added]

It is striking that all the italicized words and phrases in the above paragraph (italics added throughout) seem more closely related to faith, feelings, beliefs, self-assurance, personal acquaintance, and trust than with rigorous logical reasoning based on actual policies and procedures and on documented evidence.

Dean Magnanti forcefully states that he "firmly believe[s] that the Institute handled Professor Sherley's tenure case fairly." He also reports that he "did not see any evidence to suggest that racial discrimination or conflict of interest had played a role in the tenure decision" and

that he "did meet with the [grievance] Committee on two occasions and was impressed by its thoroughness." In his view, the grievance-committee members "took their responsibilities very seriously."

In the same passage where he expressed his confidence in the thoroughness of the grievance review and the reliability of the grievance-review committee, he noted that "none [of its members was] from the Biological Engineering Division." It seems, to me at least, that a grievance committee investigating a tenure-related complaint against any particular unit should, as a matter of principle, not include any member of that unit – that possibility should not even be entertained by any fair-minded administrator. That none of the grievance-committee members was from BE is no evidence that the grievance review was thorough or fair.

Here an apparent paradox emerges: Even as he recognizes that it would have been unfair for any BE faculty to be part of the grievance committee (presumably because of their inherent partiality vis-à-vis Prof. Sherley's complaint), Dean Magnanti endorses *as evidence for fairness* a letter from 20 BE faculty stating their collective belief that Prof. Sherley's tenure review "was a fair and honest process executed at the utmost level of integrity and ethics." Suppose for one moment that after an accusation of gender-discrimination by Prof. X – the lone female faculty in Department Y – 20 of her male senior colleagues had assembled themselves to proclaim their innocence with a similar "in our hearts" statement that Dept. Y's treatment of Prof. X had been perfectly fair and gender-blind. In such a case, I doubt

that their statement alone would carry much weight among MIT women. And neither should it convince any fair-minded MIT man.

Facts and Policies & Procedures

Given the confidentiality of the tenure process there are many facts to which we don't have access. Yet, MIT is an academic environment that, in principle, values honesty, integrity, courage, independent and critical thinking, vigorous inquiry into "truth," etc. Those of us interested about fairness of outcome have no choice but to closely analyze any available and relevant fact in order to check if our confidence in the tenure and grievance reviews is warranted. My working assumption is that a fair and thorough process conducted by senior faculty who took their responsibilities very seriously would have, at the very least, correctly handled the most elementary material facts and the most explicitly stated procedures, lest our confidence in the process be reasonably undermined.

Prof. Sherley's appointment in the history of the Division of Biological Engineering

During the March 21, 2007 MIT faculty meeting's "Report on the Change of the Biological Engineering Division to the Department of Biological Engineering," Prof. Magnanti himself highlighted some relatively unambiguous facts about the history of the Biological Engineering Division – facts that should have, at the very least, put a hint of doubt on his belief and confidence in the thoroughness of the grievance process. If not, then Prof. Magnanti's faith that Prof. Sherley's case

was handled fairly is exactly that: *faith* that seems impervious to the straightforward factual contradictions in the grievance committee's findings.

In his PowerPoint presentation of the history of the Biological Engineering (BE) Division, Dean Magnanti clearly docu-

faculty was by then folded into BEH. It must be noted that the former Toxicology Division was part of Whitaker College, not the School of Engineering. Another basic fact is that the Toxicology Division no longer had any formal existence at MIT in July 1998.

For those of us with an interest in the Humanities, we can't help but be reminded of still prevailing racist and sexist prejudices that partition humanity between [. . .] white males as guided by reason and logic and [. . .] females and non-whites as guided by intuition and emotion.

mented that the Division of Bioengineering and Environmental Health (BEH), the precursor to BE, was formally established in 1998. His presentation confirmed about BEH what was already widely known, except perhaps by the Provost and the aforementioned "thorough" grievance committee. Indeed online records (e.g., Reports to the President, the BE Website, etc.) and various documents in the purview of Dean Magnanti and the upper administration, entail that in July 1998 BEH was already in formal existence. Prof. Sherley's initial appointment letter from MIT gives July 1, 1998 as the starting date of his MIT appointment. That appointment was into BEH. This makes Prof. Sherley the first new faculty member in the recently created division, contrary to the grievance committee's findings as summarized in the Provost's December 23, 2006 letter to Prof. Sherley:

"While you [Prof. Sherley] feel that you should have been acknowledged as the first faculty member hired in BE, the Committee found that you were in fact hired in the Toxicology division, prior to the formation of BE."

Dean Magnanti's PowerPoint slides confirmed the fact that, as BEH was formally established as a new division in the School of Engineering, the Toxicology

Given this simple and well-documented evidence and the related historical facts, as clearly summarized in Dean Magnanti's report at the March 21, 2007 faculty meeting, the Provost's December 23, 2006 statement about Prof. Sherley's appointment is factually inaccurate: Prof. Sherley was never, and could never have been, a faculty member in the Toxicology Division in Whitaker College. Independent of the history of the Toxicology and BEH division *prior* to Prof. Sherley's MIT appointment, from his first day at MIT in early July 1998, his appointment was as a School of Engineering faculty in BEH, as stated in his July 1, 1998 appointment letter. Yet the goal of the Provost's letter was "to convey the results of the [grievance] Committee's review" – the review by the Committee whose "thoroughness" so "impressed" Dean Magnanti. Furthermore, the Provost's factually inaccurate statement robs Prof. Sherley of his distinction of being the first hire into the new BEH division.

As phrased, this inaccurate statement is also demeaning: Why should Prof. Sherley's reference to well established facts, as documented in his very appointment letter into the BEH Division of the School of Engineering, be attributed to his "feel[ings]." For those of us with an interest in the Humanities, we can't help but be reminded of still prevailing racist and sexist prejudices that partition humanity

between, on the one hand, white males as guided by reason and logic, and, on the other hand, females and non-whites as guided by intuition and emotion.

Why is this historical fact about Prof. Sherley's appointment so important? One of the most senior BE faculty, one who was involved both in Prof. Sherley's recruitment and hiring and in the creation of the new BEH division, called the Provost's statement a simple "clerical error." Yet this simple "clerical error" is one that some upper administrators have tried to excuse on the alleged basis that the pertinent facts are "complex." Not so complex, after all! As for its significance? If the matter were so *insignificant*, then why have some senior BE faculty and the upper administration stretched to semantic acrobatics and to articles of faith in order to disguise the facts?

Be that as it may, a grievance committee, as "thorough" as claimed by Dean Magnanti who twice met with them, should have realized that Prof. Sherley, even as a new minority faculty in the School of Engineering, could not have been hired into a *defunct* Toxicology Division formerly in Whitaker College.

The letter "A plea for fairness at MIT" in the February 6, 2007 issue of *The Tech* discusses the additional implications of the inaccurate and demeaning aspects of the above-quoted statement from the Provost. These implications are germane both to the (un)fairness of Prof. Sherley's tenure denial and of the latter's review by the grievance committee and to the larger context of race relations at MIT and elsewhere.

MIT's Policies and Procedures: Conflicts of interests vs. Potential conflicts of interests

In his March 8, 2007 statement to the School of Engineering, Dean Magnanti, as he professed his belief that the tenure and grievance processes unfurled without any (evidence of) flaws whatsoever, explicitly mentioned the issue of conflict of interest:

"I did not see any evidence to suggest that racial discrimination or conflict of interest had played a role in the tenure decision."

continued on next page

Faith vs. Facts

DeGraff, from preceding page

Then Dean Magnanti went on to voice his “confiden[ce] that the process in BE was fair and just and that Professor Lauffenburger has fulfilled his responsibilities as Division Head in a manner that is entirely consistent with our very high standards of quality and integrity.”

Yet, as has been pointed out a few times already, the issue is not whether one can find “evidence to suggest that [...] conflict of interest had played a role in the tenure decision.” Instead, the crucial issue is whether there is evidence to suggest that there existed, at the time of tenure review, the *potential* of conflict of interest.

In Prof. Sherley’s case, what we have in terms of *potential* conflict of interest is a Division Head, namely Prof. Douglas A. Lauffenburger, who is married to a senior BE faculty, Prof. Linda G. Griffith. Prof. Lauffenburger assembled, presented to the BE faculty, and then decided on, Prof. Sherley’s tenure case. Prof. Griffith, who has been in open contention with the tenure candidate, was asked by her husband qua Division Head to submit a letter of evaluation of the candidate’s scientific scholarship.

Here’s what MIT’s *Policies and Procedures* (P&P) prescribe for the handling of such potential conflicts of interest:

Section 4.4 titled “Conflict of Interest” states:

“[...] *potential* conflicts of interest *may* arise from opportunities that an individual *may* have to influence or to be influenced improperly by personal relationships, in ways that are not consistent with the education and employment policies and the principles to which MIT is committed. *Potential* conflicts of interest of a particularly sensitive nature *may* arise out of sexual relationships, especially in the context of educational or employment supervision and evaluation. Because the effects on other people at work or in the classroom are frequently not apparent

to the persons involved in a sexual relationship, anyone with such an involvement should be attentive to the feelings of colleagues and to the *potential* conflicts of interest that *may* be involved.” [emphases added]

This caveat is amplified in Section 7.2 on “Policy on Employment of Members of the Same Family”:

“While general responsibility for assuring adherence to these policies must rest with

. . .the issue [...] is not whether one can find “evidence to suggest that [...] conflict of interest had played a role in the tenure decision.” Instead, the crucial issue is whether there is evidence to suggest that there existed, at the time of tenure review, the *potential* of conflict of interest.

those responsible for appointments and assignments (principally academic and administrative department heads and laboratory and center directors), a particular responsibility for sensitivity to the *potential* conflicts falls on those whose family or personal relationships may give rise to them.” [emphases added]

Thus, given the letter and spirit of MIT’s P&P, it is not the case that Prof. Lauffenburger was, in Dean Magnanti’s words, “entirely consistent with our very high standards of quality and integrity” as he assembled, presented to the BE faculty, and then decided on, Prof. Sherley’s tenure dossier. In my reading of P&P 4.4 and 7.2 which define some of the applicable “standards of quality and integrity,” Prof. Lauffenburger doubly failed his responsibilities. As Division Head and spouse of a senior BE faculty in recurrent and emphatic public disagreements with Prof. Sherley, Prof. Lauffenburger should have recused himself from conceiving, assembling, and evaluating the candidate’s case for promotion to tenure. By not recusing himself, he failed to be “attentive [...] to the potential conflicts of interest that

may [have] be[en] involved” in his putting together and then deciding on Prof. Sherley’s dossier.

The Provost’s December 23, 2006 letter to Prof. Sherley reports:

“The Committee found that it was appropriate for [the BE Head] to solicit an internal reference from [his wife], given the overlap in your research areas and the fact that you had not asked that she be excluded from the list of referees.”

Contrary to the grievance committee’s findings, MIT’s P&P, as quoted above, directly put the onus of preventing potential conflicts of interests, not on the potential victim of said conflicts, but on the relevant unit heads and/or spouses. This is yet more important evidence suggesting that the Committee’s findings are *prima facie* unfair – and certainly less than “thorough” since nowhere in the Provost’s report of the grievance committee’s findings is any reference made to the applicable passages in MIT’s P&P.

One banal, yet central, aspect of marital relationships and their potential influence in promotion decisions is that married couples have private conversations to which no one else is privy, including in their bedrooms. These conversations can end up unduly (positively or negatively) influencing a unit head’s and other senior faculty’s decisions on tenure. Recall from P&P 4.4 that “the effects [of a spousal relationship] on other people at work [...] are frequently not apparent to the persons involved in a sexual relationship.” MIT’s P&P explicitly exhort unit heads *and* spouses in the same unit to be *proactive* in preempting the *potential* of conflict of interest. This point cannot be stressed

enough: once the potential of a conflict of interest (e.g., due to a spousal relationship) has not been preempted, it may be impossible *post facto* to determine whether the potential conflict actually played a negative or positive role in the spouse qua unit head's evaluation of the candidate and his final decision.

Dean Magnanti's letter reminds us that:

"In the School of Engineering, the senior faculty serve in an *advisory* capacity to the department or division head in the promotion and tenure process." [emphasis added]

In other words, in the context of Prof. Sherley's tenure review at the division level, the final decision about his tenure rested exclusively with the Division Head whose spouse had been, in recurrent occasions, in open contention with the tenure candidate. The potential conflict of interest did not, however, arise directly from the *contentious* nature of the relationship between Prof. Sherley and the Division Head's spouse. The potential of conflict arose because the Division Head, in deciding on Prof. Sherley's tenure case, may have been unduly influenced by his spouse's unusual relationship with the candidate.

For completeness it must be emphasized that the period spanned by the recurrent instances of contentious rapport between Prof. Sherley and the Division Head's spouse includes both the time of the tenure review and the recent past – at least until early March 2007. The contention between Professors Sherley and Griffith, which unfurled in faculty and committee meetings and in e-mail, was related to research, funding, and student-related issues, in some of which Prof. Lauffenburger intervened. This contention is not a creation of Prof. Sherley's "feelings": there exists reliable and ample documentation of the substantive and emphatic disagreements between Professors Sherley and Griffith, and much of this documentation was pro-

vided to the Provost and to the grievance committee.

The most recent instance of emphatic disagreement involved a 2003 paper, "Clonal Expansion of Adult Rat Hepatic Stem Cell Lines by Suppression of Asymmetric Cell Kinetics (SACK)." This paper was co-authored by, among others, Professors Sherley and Griffith and was published by *Biotechnology & Bioengineering* (B&B). That paper was

No matter the scientific merits of a tenure case, a tenure decision cannot be assumed to be determined "correct" if there's reasonable doubt based on well-documented facts that due process was breached.

submitted to B&B in 2002, two years before Prof. Sherley's tenure review. Prof. Griffith recently claimed that she "disagreed about many aspects of the B&B paper at the time of submission." She accused Prof. Sherley of submitting the paper for publication "without [her] agreement on the final version" and of "completely inappropriate" behavior for considering the paper's definition of stem cells as shared by the co-authors. In his reply, Prof. Sherley reminded Prof. Griffith that her "only objection was to [his] usage of the acronym 'SACK' . . .", and he offered "to send [Prof. Griffith] a copy of the copyright transfer agreement signed and dated by [her] own hand, which [B&B] required of all authors before publication of accepted manuscripts." According to Prof. Sherley's e-mail records, this disagreement continues a pattern already unfurling before, and around the time of, his tenure review. For example, on November 18, 2004 – less than a month before the BE tenure-review meeting organized by Prof. Griffith's husband – Prof. Griffith wrote to Prof. Sherley: "The lig's have not panned out to be

useful at all . . ." and then went on to describe the relevant research as "a shot in the dark." According to Prof. Sherley, these "lig's" are what the co-authored B&B paper describes as "adult stem cell" lines, and these "lig's," which were derived in his lab, are still in use in Prof. Griffith's research.

Last year, Prof. Sherley's so-called "shot in the dark" research hit the bull's-eye: a

much coveted "Director's Pioneer Award" from the National Institutes of Health in the amount of \$2.5M for, among other things, his work on "the elucidation of mechanisms responsible for the specialized renewal properties of adult stem cells and the use of this knowledge to address major research problems limiting the development of adult stem cells for biomedicine."

(nihroadmap.nih.gov/pioneer/Recipients06.aspx)

Fairness of process vs. scientific merits

Another oft-repeated pernicious argument that seems closer to faith than to facts and logic is one that I've heard endorsed by supposedly well-meaning faculty members who eagerly report feelings from certain faculty members in Science and Engineering as well as the upper administration. The argument goes as follows:

"On scientific merits alone, it's clear that Prof. Sherley didn't deserve tenure at MIT where standards are so exacting, therefore the tenure decision was correct."

continued on next page

Faith vs. Facts

DeGraff, from preceding page

This argument is fallacious and insidious. No matter the scientific merits of a tenure case, a tenure decision cannot be assumed to be determined “correct” if there’s reasonable doubt based on well-documented facts that due process was breached. We just cannot know *a priori* what the *fair* outcome of a procedurally flawed tenure review would have been if due process had applied. Once due process is breached, all bets are off. The claim that one can consider a tenure decision correct in presence of breaches in process seems yet another manifestation of faith – really, prejudice against the particular candidate’s tenure-worthiness. This must be one of the very reasons why MIT has explicit and specific guidelines in order to ensure that our review processes are fair and to guarantee fairness of outcome. Potential conflicts of interests constitute one area where MIT’s guidelines seem the most explicit. Presumably such guidelines were designed to apply with equal force across all academic units in all the Schools at MIT.

Faith vs. facts (redux)

With all this in mind, and while noting that the above-noted facts and procedures have already been brought forward to the upper administration, one should insistently ask:

- How can Dean Magnanti, alongside the upper administration, be so “impressed by [the grievance review’s] thoroughness” and find that “[t]he Committee . . . took their responsibilities very seriously” if this Committee couldn’t get some basic and well-documented facts right about one simple component of Prof. Sherley’s grievance as it relates to his appointment and the documented history of the academic unit that they were investigating? The relevant historical facts were succinctly and lucidly summarized in Dean Magnanti’s presentation at the March 21, 2007 faculty meeting.

- How can Dean Magnanti, alongside the upper administration, be so “impressed by [the grievance review’s] thoroughness” and find that “[t]he Committee . . . took their responsibilities very seriously” if that Committee so disregarded sections in MIT’s P&P that are most pertinent to the sort of potential conflicts of interest instantiated in Prof. Sherley’s case?

As it turns out, one embarrassing blemish in what otherwise seems a stellar history for BE is this: There are some 30 tenured BE faculty, and not one of them is an underrepresented minority.

- If simple historical facts were not handled accurately and if key sections of MIT’s P&P as regard conflicts of interest were dismissed, what about the more delicate matters of discrimination whose empirical bases and effects, because of their very nature, are not as easily documentable?

(For a more comprehensive overview of potential unfairness in Prof. Sherley’s tenure and grievance reviews, see the aforementioned “Plea for fairness at MIT” in the February 6, 2007 issue of *The Tech* and my own letter “A suspicion of unfairness in Sherley case” in the February 27, 2007 issue of *The Tech* – both available on line at www-tech.mit.edu/V127/N1/1facultyopn.html and www-tech.mit.edu/V127/N7/letters.html.)

In pursuit of fairness at MIT?

Dean Magnanti concluded his March 8, 2007 statement with a paragraph about his “commitment to diversity” on the model of recent statements from the upper administration (see, e.g., the Provost’s January 29, 2007 message to the MIT faculty about Prof. Sherley’s grievance: web.mit.edu/provost/letters/letter01292007.html).

As it turns out, one embarrassing blemish in what otherwise seems a stellar history for BE is this: There are some 30

tenured BE faculty, and not one of them is an underrepresented minority.

A “pipeline” problem? Perhaps. But consider the fact that the difference between 0 and 1 in this case is a matter of retention, not recruitment. The inconsistencies I discussed above seem to imply that in this particular case the pipeline problem, if any, may be confounded by attitudinal factors, including the *faith* that

certain members of the upper administration have in the tenure- and grievance-review processes, in spite of robust evidence that, in Prof. Sherley’s case and perhaps others’, suggests that these processes may have been breached in both structural and specific ways.

Another potential factor relates to mentorship and other forms of support (e.g., space) to junior faculty. In this respect Dean Magnanti made this additional comment about minority recruitment and retention:

“I am proud of what the School [of Engineering] has been doing to create a more diverse and welcoming community and I am proud of the programs we have put in place to enhance our diversity [. . .]. I also applaud the initiative that the MIT President and Provost have put in place to undertake a comprehensive, rigorous, and systematic study of the impact of race on the hiring, advancement, and experience of under-represented minority faculty at the Institute.”

One key ingredient to any successful initiative to recruit and retain minority, women, and all other faculty must include reliable support. As it turns out, in Prof. Sherley’s case, this support component failed miserably on several counts, some of which relate specifically

to race and space: for example, lack of full disclosure concerning Prof. Sherley's minority-faculty slot at the time of his recruitment and hiring, inadequate mentorship, inadequate space and, worse yet, the fact that his "independent" lab space could be used to bully him – last summer, one seniormost BE faculty even threatened to take away Prof. Sherley's "independent" lab space, reminding Prof. Sherley that "it was me who gave you access to that lab." (For details, see the aforementioned "Plea for fairness at MIT" in *The Tech*.) Dean Magnanti's proud and enthusiastic comments are inconsistent with the documented failures in Prof. Sherley's case.

How can awareness of the above facts be translated into actions? How can MIT's "commitment to diversity" be effectively translated into actual diversity in ways that do pay attention to the facts? Where do we go from here?

In her presentation at the March 23, 2007 colloquium "Unscripted dialog with Ben Barres and Nancy Hopkins about issues of equality in the university," Prof. Hopkins identified "two types of problems" that "may contribute to the small number of women faculty." Given the even smaller number of underrepresented minority faculty, their much slower increase over decades and added barriers to their access to power, I surmise that the factors below may apply with even greater force to slow down minority recruitment and retention at MIT.

"[Firstly] *Organizational structures and processes* that are inadvertently biased against women. [...] [Secondly] *Attitudes* that are *unconsciously* biased and that lead to i. Undervaluation, ii. Marginalization, iii. Inequities [...]"

Prof. Hopkins rightly noted that one most influential factor in the subsequent watershed progress with gender equity at MIT was what *The New York Times* on March 22, 1999 called an "extraordinary admission." In Prof. Hopkins's words, this was former President Charles M. Vest's

"courage to recognize that this sort of [gender] discrimination exists" and his ensuing bold and concrete actions in the matter – not professions of faith in a documentedly unfair system, not ineffectual pledges of commitment to equity in the face of persistent inequities.

President Vest had the good sense, honesty, humility, and courage to recognize the specific ways in which MIT has failed to live up to its commitment to fairness. In his February 5, 2004 speech at the Martin Luther King, Jr. celebration breakfast, he admitted:

"[...] the one area in which I feel that I have really not succeeded as your president is that we have not accelerated the racial diversity of our faculty or, for that matter, of our graduate students. [...] The real challenge does not lie outside our walls. It lies within our hearts, and in the expectations we set for our students and ourselves, in the ways we teach, in the amount of time and effort we give to supporting our students and our colleagues." (web.mit.edu/president/communications/mlk04.html; also see February 25, 2004 issue of *MIT Tech Talk*)

President Hockfield's upcoming report on minority faculty recruitment and retention should honestly convey the lack of progress, comparatively speaking, to that of women at MIT in the past two decades, as acknowledged by President Vest on several occasions.

The anguish that was voiced at the colloquium with Professors Barres and Hopkins revealed how much extra time, effort, and support is needed by our female students as well. In their ranks, too, the "unconscious biases of the well-meaning" are still sapping some of our best minds.

A trenchant and movingly personal analysis of the problem was provided by Prof. Ben Barres, a neurobiologist at Stanford University, at the aforementioned colloquium. Prof. Barres attended MIT in the 1970s as part of a tiny minority of female undergraduates and then became a man 12 years ago while at

Stanford University. As Prof. Barres puts it, through his transgender transition he experienced another kind of transition: he got to experience first-hand differential attitudes toward female vs. male scientists. Prof. Barres stressed the pervasive effect of unconscious biases on the lack of fairness and diversity in places like MIT:

"... There seems to be some huge effect of denial, an intense desire to believe in meritocracy, that the world is fair. Being well-meaning is not enough. [...] Awareness must translate into actions."

At the very least, it seems to me that our upper administration, like the Bush administration, could start moving away from denial and finally accept that "mistakes were made" in the case at hand. More seriously, and here again I borrow from Prof. Hopkins's March 23, 2007 presentation, what the women initiatives have taught us is that we should "[m]ake it an obligation of faculty to understand what ... bias is, and that it happens." For such understanding to take place, we, as faculty at a premier university in the U.S., should loudly protest when well-established facts and explicitly worded policies and procedures are trumped by faith, confidence, individual beliefs, personal trust, self-assurance, and so on. Any disagreement between established facts and policies, on the one hand, and individual beliefs and personal relationships, on the other hand, should be resolved in favor of the established facts and policies.

If the faith and self-assurance of our upper administrators could ever be constructively challenged by the relevant facts and policies and procedures, perhaps minority faculty – and all faculty for that matter – would be evaluated more fairly, with a resultant increase of minority faculty in MIT's tenured ranks and a concomitant increase in fairness for all. ■

Initial manuscript received on March 26, 2007.

Ed.Note: All letters referenced in this article can be found on our Website: web.mit.edu/fnl.

Michel DeGraff is an Associate Professor of Linguistics (degraff@mit.edu).

MIT Poetry

by David Barber

ODE TO WILLIAM WELLS

William Wells, this is to tell you that the morning wet
Still beads the leaves with precision and abandon.
Comes now your beloved creeping damp, even as I write.

What possessed you, William Wells, what iridescent hypothesis
Sent you out like a serial phantom into London's clammy lanes?
What gists did you distill from the droplet's hieroglyphics?

Doctor, your undertaking absorbs me when I'm up late.
There's a touch of the sublime in your arcane fixation.
I can almost picture you eyeballing pearly spider's lace...

But alas, posterity wipes the slate. Your "Essay on Dew,"
Admired in its day, has gone the way of all condensation.
You're a footnote if you're lucky: foreshadower of Darwin.

Royal Society regular, expatriate physician from the States
With a bent for natural philosophy, a minor evolutionist.
Your proofs are lost on us. Your opus molders in the stacks.

And how on earth could be otherwise? Your chosen field
Was any garden margin at its peak of superficial glisten.
Your realm of inquiry could only prove demonstrably ephemeral.

William Wells, you are obscure – you've turned to mist.
So humor my surmises in these small hours. Hear me out:
Each grass spear in my side yard bears your watermark;

The morning glories I'm letting have their way this year
Batten the pickets in soaking tangles, a diorama in your honor,
Everywhere I look the undergrowth jewels up and there you are.

William Wells, transpire what may before I'm dust,
Let me take a leaf from you: ardent and intent
On noting well what burns away, what cannot last.

Note: William Charles Wells (1757-1817) published his "Essay on Dew" in 1814. Loren Eiseley, Darwin's Century: Evolution and the Men Who Discovered It (New York: Anchor Books, 1961).

David Barber, Visiting Lecturer in Writing this spring, is the poetry editor of *The Atlantic*. His most recent collection of poetry is *Wonder Cabinet* (2006), from which the poem above is reprinted.

In Memoriam Stephen M. Meyer

THE FOLLOWING IS EXCERPTED from a Memorial Resolution for Stephen M. Meyer presented at the March 21, 2007 meeting of the MIT faculty.

We have the sad duty to report that on December 10, 2006 our friend and colleague, Stephen M. Meyer, died after a long and heroic battle with cancer. He was 54 years old.

Steve was raised on Long Island. He graduated from the State University of New York in Stony Brook in 1974, and then attended the University of Michigan, where he received his MA in 1976 and PhD in 1978. He was appointed assistant professor of political science at MIT in 1980, rising to the rank of full professor in 1990.

Steve Meyer's first intellectual adventure concerned the causes of nuclear proliferation. He wrote a major book, *The Dynamics of Nuclear Proliferation*, and published important articles on arms control and verification. In the 1980s and early 1990s he was a leading academic expert on the Soviet military and Soviet defense policy. His writings on Soviet defense decision making, defense industries, and civil-military relations broke new ground in "pulling back the curtain" on the Soviet defense establishment. His publications in the 1980s on Soviet nuclear weapons operations and defense policy were considered the definitive open-source accounts prior to the end of the Cold War.

Steve Meyer's expertise on the Soviet defense establishment attracted a large group of PhD students to MIT's Defense and Arms Control Studies Program (now the Security Studies Program). His work also made him a leading consultant to the U.S. government on these issues, and the recipient of substantial public and private grants. With this grant support, and the assistance of his graduate students, he created the Soviet Security Studies Working Group. MIT became the leading program in

the country for PhD students in Political Science to study Soviet defense policy. Many of these students have gone on to hold important positions in academia, government, and the private sector.

The collapse of the Soviet Union created an intellectual crisis for students of contemporary Russia from which many never fully recovered. Steve took advantage of the situation to change course substantially, turning his talents to the study of environmental policy and politics. At the time of his death, Steve was in the midst of a project, funded by the National Science Foundation, which examined the capacity of local governments to effectively manage environmental problems by closely studying local wetlands regulation in Massachusetts. Steve's research identified the economic and contextual factors that led some communities to adopt more stringent regulations than required by state law, and demonstrated that these regulations resulted in improved environmental outcomes.

Focusing on environmental policy allowed Steve to integrate his intellectual agenda with his own private life. Steve chaired and served on state and local commissions that attended to land use, conservation, and species protection. In 2005 he was awarded the Gov. Frances Sargent Conservation Award from the Massachusetts Division of Fisheries and Wildlife; he was named a "Conservation Hero" by the National Park Service in 2006.

Steve's final book was *End of the Wild*, published by the MIT Press in late 2006. In this book, Steve argued that the earth had passed a tipping point at which incremental forces, such as sexual selection, no longer served as the driving force behind species selection and evolution. The driving force is now us – human beings. This has led to a rapid proliferation of weedy species and a crash in species diversity overall. In response to this sobering state of affairs, Steve laid out

a cogent argument for why – from the broad perspective of the whole biosphere and the narrow perspective of human survival – human beings must manage even more intensely the biodiversity that remains.

Steve Meyer was a demanding scholar and inspiring teacher. Even when he shifted his attention away from security issues, he continued to teach his popular undergraduate class on American National Security Policy. Steve's shift of emphasis to environmental politics led him to create 17.32, Environmental Politics and Policy, which regularly earned him among the Institute's highest teaching scores. Steve chaired the Committee on Curricula from 2001 to 2003 and was the driving intellectual force behind a revamping of the Political Science Department's curriculum in the late 1990s. He was one of the founders of MIT's Public Policy minor. As an organizer of the Burchard Scholars Program, he served as an impresario, bringing together faculty in the humanities, arts, and social sciences with a small, yet highly motivated group of undergraduates who shared interests in these areas.

For his dedication to undergraduate student life and learning at MIT, Steve was awarded the Arthur C. Smith Award in 2004.

Steve's final adventure, his struggle with the cancer that took his life, was undertaken with the determination, curiosity, probing intelligence, clear thinking, and unflappable good humor that characterized everything he did.

As a scholar and a courageous human being, Steve was one of the best. His passing has left a significant hole in the heart of the Political Science Department and in the Institute at large. ■

Donald L.M. Blackmer (emeritus)
Joshua Cohen
Judith Layzer
Richard J. Samuels
Charles Stewart III

CMI – A Bold Experiment in International Partnership

Edward F. Crawley

CMI, THE CAMBRIDGE-MIT INSTITUTE, was envisioned as a bold experiment in international university cooperation. From the perspective of many of our faculty, the principle experiment was that of partnership – could two great peer universities work together, learn from one another, and create a whole greater than the sum of the parts? This view overlooks the arguably bolder experiment, that of learning how to accelerate innovation. This experiment asked: Could the two universities, working together and with many others, understand what it is that makes great universities engines of economic growth? *And*, could they then characterize it in such a way that others may understand it, and, if appropriate, incorporate aspects of the general learning into their own culture and practice. Reflecting on the history of CMI, I would consider it a success, in that we clearly completed the first of these two experiments, and learned a great deal from the second.

CMI came about in 2000, when Cambridge University and the Massachusetts Institute of Technology joined in partnership to create the Cambridge-MIT Institute (CMI). At the request of its principal sponsor, the U.K. government, its mission was to work with other U.K. institutions in a collaborative effort to enhance the competitiveness, productivity, and entrepreneurship of the U.K. economy by stimulating innovation. We identified, refined, and codified approaches to *accelerating innovation* by improving knowledge exchange between universities and industry.

Overall, we explored “making a difference” in three main areas:

- Education for Innovation
- Knowledge Integration in Research
- Engaging Industry in Knowledge Exchange

The *direct outcomes* of our programs – research discoveries, commercializable out-

comes, students educated, new educational programs created, new links with industry, innovation networks created, etc. – constitute the first type of benefits to the U.K. The direct outcomes emerged from more than 110 projects in the three program areas described above.

We seeded these programs with experiments built on three main hypotheses about how to improve industry-university interaction, and operated a program on the Study of Innovation in Knowledge Exchange (SIKE) to monitor these experiments. The SIKE program examined our programs, and other important efforts throughout the U.K., and identified patterns of behavior that support innovation. This led to a second type of benefit of CMI, the *general outcomes*.

Education for Innovation

The CMI Education for Innovation programs helped to accelerate innovation by creating programs to give learners the resources to perform effectively in their roles as knowledge exchange agents, innovators, and potential future entrepreneurs. These programs were developed by investment in postgraduate degree programs, new course offerings, and educational research programs at the undergraduate level, and a range of workshops and other non-degree offerings for students and professionals. Among the lasting products of this investment are the six innovative new Masters degree programs at Cambridge. These programs combine enterprise with technology, and have already graduated 347 students.

In the Cambridge-MIT Exchange – the first direct exchange by either institution – 425 students spent full academic years in the partner institution, building both institutions’ engagement of students in learning. Few of us who teach upper class subjects in departments engaged in the exchange have not felt the influence of these exchange students in class. More subtly, at least 1,850 stu-

dents at MIT and Cambridge have been involved to date in undergraduate programs influenced by CMI, including a new major at MIT in Biological Engineering and a new Engineering for Life Sciences specialization at Cambridge. One-hundred-fifty U.K. students engaged in undergraduate research placements facilitated by the Undergraduate Research Opportunities Program (UROP), and 625 students, drawn from all regions of the U.K., have so far participated in student entrepreneurship workshops.

The generalized learning from these efforts is simple and quite important. If universities are to prepare students to be innovators, they simply must do the best job possible to ensure student learning in three domains. (1) The university should ensure that the students develop a deep conceptual understanding of the fundamentals – so that they can later manipulate this understanding to develop new concepts. (2) The university should ensure that the students learn the appropriate skills – including various modes of thought and how to work together. (3) The university should create opportunities for “pre-entrepreneurial” learning – how to understand needs, create product concepts, work towards delivering an outcome. Underlying this learning, is a need to develop in students a self-confidence in their abilities to apply new knowledge; for students who are confident in their abilities are more likely to take risks, and risk is an essential aspect of innovation.

Knowledge Integration in Research

The goals of the CMI research program were to develop new ideas, with potential contribution to competitiveness, and to educate students who will be potential carriers of these ideas to industry and entrepreneurial enterprise. The investment covered core areas of the economy where the U.K. has a competitive position or strategic national need – energy, communications, transport, health care – as well as pre-competitive and

emerging areas such as micro electrical mechanical systems (MEMS), stem cells, nanotechnology, and quantum technologies.

The general learning from this program was that a strong “consideration of use” enhances the impact of research on competitiveness. Researchers should consider the needs of society and industry in the selection and design of their research. Likewise, it is vital that researchers maintain a strong connection to underlying science, so that they can understand when to “pull through” important new ideas. We emphasized Knowledge Integration in Research – which takes a more integrated view of research intended to impact innovation and competitiveness, and recognizes the important role of knowledge exchange by mainstreaming both the education of students and interaction with industry.

The most focused manifestation of this approach in CMI was the creation of Knowledge Integration Communities or KICs. These were larger research programs that explicitly involved external stakeholders from industry, government, or nongovernmental organizations. Ideally, a KIC also had strong links to an educational program, drew in elements of the industrial supply chain, and included innovations in knowledge exchange. While KICs centered on collaborative research teams at Cambridge and MIT, they also included participants at other universities in the U.K. The intent was to bring together in the integrated community all the participants needed to address the challenge, and to accelerate innovation.

An example of a research project that grew into a KIC is in Quantum Technologies. This network of scientists and engineers at Cambridge and MIT who work with industry, investors, government agencies, and other universities, wanted to accelerate the commercialization of this evolving technology based on quantum science. Quantum devices such as computers, clocks, and communications systems could be more powerful than today’s conventional systems. Realizing the commercial opportunities of quantum technology will require a high degree of interdisciplinary collaboration, and greater public understanding. This community collaborated with the U.S.

National Institute for Standards and Technology to convene a cross-sector group to identify industry standards for quantum information processing – essential to the future commercial prospects of this revolutionary new technology. Participating organizations include Toshiba, Hitachi, Quantum Information Partners, Thales, the U.K. Department of Trade and Industry, and MagiQ. We chose to highlight the Quantum KIC to emphasize that even in areas that might be perceived as more fundamental or pre-competitive, consideration of use and the building of integrated communities can accelerate progress towards commercial innovation.

Engaging Industry in Knowledge Exchange

The CMI programs for Engaging Industry in Knowledge Exchange were designed to actively engage industry in the practice of knowledge exchange and to ensure that the output of universities flow naturally to competitive impact. In pursuit of these objectives, CMI created a series of mechanisms to support and facilitate the spanning of boundaries among the university, industry, and government sectors. This has included the creation of and support for both organizational and digital networks to facilitate knowledge exchange, the development and refinement of processes for university-industry engagement, and programs to educate professionals operating at the university-industry interface. In total, CMI has supported roughly 150 networking events, including workshops, conferences, and professional education programs, engaging close to 10,000 participants.

The general learning which emerged can be summarized by three factors which enhance the engagement of industry in knowledge exchange: actively engaging industry in prolonged interactions around research and education that addresses their needs; educating and empowering people involved in knowledge exchange, including students and professionals; and, most importantly, promoting a culture that values interaction between the university and industry. An important outcome codified by CMI is the process of Systematic Dialog. In this

engagement process, the high level needs of an industry or sector are understood first by listening, and only then by responding with ideas of how the university might help. Using a metaphor of an intellectual supply chain, this allows the beneficiary to “pull knowledge through” rather than put the university in the role of “pushing knowledge out.”

Conclusion

The outcomes of CMI are not necessarily immediate, and will continue to have an impact for decades. While CMI was primarily a partnership of two universities, we worked with many sectors, organizations, and universities in the U.K. CMI had substantial interactions with 103 of the 114 U.K. universities. We engaged with 915 U.K. industrial organizations (of which more than 475 participated in more than one CMI activity) and with all of the U.K. regional development agencies and devolved authorities in the U.K., as well as 33 U.K. national government organizations.

If asked for our summary finding, I would reply that:

It is an *integrated system of activities at a university – the constructive interplay of education and research and formal and informal engagement with industry and enterprise – that has the greatest potential to substantially enhance knowledge exchange and accelerate innovation.*

This conclusion stresses the interaction of these activities, which obviously include direct engagement with industry and enterprise, and a broad and focused research effort. More critically, the finding emphasizes that knowledge exchange builds upon and integrates the long-standing role of the university in education. This finding also highlights the need for informal and human interactions with industry, supported by more formal mechanisms such as publication and licensing, which are a necessary, but not sufficient, condition for effective knowledge exchange. ■

Edward F. Crawley is a Professor of Aeronautics and Astronautics and Engineering Systems; Former Executive Director, CMI (crawley@mit.edu).

letters

Response to Prof. Sussman's Call for Interdisciplinary Research

Dear Gerry,

AFTER READING YOUR contribution to the February 2007 special edition of the *MIT Faculty Newsletter* devoted to responses to the report of the Task Force on the UG Educational Commons, I wanted to let you know that I fully agree with your comments. Interdisciplinary research (IDR) is clearly the wave of the future, and preparing MIT undergraduate students for IDR must become much more important.

I'm also an MIT alumnus (1965, Course 18) who has worked in nuclear arms control and the formation of large research partnerships – the most recent being the Global Cardiovascular Innovation Center, led by Cleveland Clinic and seeded by a \$60 million grant from Ohio's Third Frontier program, the single largest grant ever awarded to Cleveland Clinic. So I have first-hand experience with interdisciplinary research

that crosses the traditional boundaries to which you allude when discussing MIT's Schools and departments.

For those members of the MIT faculty who don't know much about David Botstein, I would have liked you to mention that he taught at MIT during 1967-1988 and currently is director of the interdisciplinary Lewis*-Sigler Institute for Integrative Genomics, having replaced the founding director (Shirley Tilghman, now Princeton's president) a few years ago. And as you state, many of the themes in Botstein's 2004 Science paper are being translated into Princeton's UG curriculum.

The opportunity costs are large when considering the MIT Task Force lack of focus on the increasing significance of IDR and how a boldly revised UG curriculum might better prepare students to undertake IDR activities. MIT has no lack of IDR activities and probably is one of the world leaders in forging ahead in these new research pathways. But much-

improved educational preparation for UG students would appear to be consistent with burgeoning IDR initiatives.

Perhaps Susan Hockfield needs to speak with Shirley Tilghman in the near future so that MIT can learn from Princeton's initiatives through this type of dialogue between two women university presidents, both of whom are life scientists. Dr. Hockfield will be joining us April 30th as our MIT Club of Cleveland celebrates its 100th anniversary, so we might convey this suggestion to her directly at that time. ■

Thanks,
Barry

Barry J. Smernoff, PhD
AlphaOmega Collaboration LLC

*Peter B. Lewis is the 1955 Princeton alumnus who gave \$35 million to establish this new Institute.

Appreciation for Special Edition Faculty Newsletter

To The Faculty Newsletter:

I AM WRITING TO express my most sincere appreciation for your efforts in assembling the recent *Faculty Newsletter* about the Report of the Task Force on the Undergraduate Educational Commons. Undergraduate education is a core

mission for us. The open and free expression of ideas is a core value. Many of us in the MIT community were motivated to express our views on the undergraduate curriculum. Your efforts enabled this expression. Given the number of contributors to be satisfied and the very tight time line for publication, you were

handed an MIT-level challenge. The quality of the *Newsletter* speaks clearly to your having met the challenge.

Nice work! ■

Warren Seering
Weber-Shaughness Professor of Mechanical Engineering and Engineering Systems

Cutting the Pie of Undergraduate Education

To The Faculty Newsletter:

WOW. WHAT A MISSION the Task Force undertook. The articles in the *Newsletter* offered many thoughtful responses. Basically, the problem is that the pie can be cut many ways with many different kinds of cutters. Each has merit given the assumptions that were operative in the responses. As the faculty excavates the topography of the requirements I hope that consideration will be given to some of the following thoughts.

First, we need to separate graduate from undergraduate education and goals. I think undergraduate education is based more on horizontal than vertical thinking. One blends into the other only after we encounter the problem of boundaries. But the student needs to encounter the boundaries before he or she realizes the frustration they impose and their limitations. Everything starts with a boundary. But we hope it does not end there.

Secondly, we need to realize that various courses and subjects are not only about subject matter but modes of thinking and ways to orient our consciousness to the material or projects presented. There are subjects that stress a quantitative mode of thinking and the relationship of our ideas to the plasticity of the existential world. The dialogue between the two effects our thinking as we realize the limits of our thoughts as we apply them to the

recalcitrance of the world we encounter. Engineering speaks directly to this engagement.

Moreover, our academic subjects construct a world. There is a world that physics constructs that is not the world of political science or sociology. There are subjects that stress the metaphoric and analogical mode of thinking. Literature and poetry teach us and force us to exercise this mode of thought as a way of investigating and understanding the world. Sociology and political science construct a different world and ask us to think about different relationships. Mathematics does the same both as a mode of thinking and constructing a world that only mathematics can enter. All attempts to explain it linguistically fail to do justice to its world or mode of investigation. The processes of thinking of philosophy and theology are historically about constructing worlds. They teach us about logical ways of thinking and also about the limits of logic and reason. In the case of philosophy we look at the argument and the premises and the rationale about their linkage. Reason and logic are the emperors of its world.

The world of the arts stresses an engagement between the imagination and the world. At the same time the arts engage the relationship of our thoughts and materials. We think through and by means of photography, painting, and

sculpture, etc. The medium is the mode of its thinking and inquiry. It gives flesh to aesthetic thinking. It embodies thought. The arts teach us that hand(body) and mind are indeed interlocked in their experience. Boundaries of art are the most porous and they teach us about the thinness of our conceptual structures. The work of the imagination is not limited to the arts. Indeed science could not exist without its work. But it is central to the work in the arts and in many of its manifestations. There is no external criteria such as the existential world that limits what it can construct and where it can go. The only limits are the limits of the media and the boundaries of our own structures. Working in the world of literature and the arts develops habits of thought that can inform and extend thinking in the sciences. But the arts, unlike literature, teach us about the limits of language and that there are ways of thinking that go where language cannot enter. (I would say the same for mathematics.)

In resolving the questions of how to construct this curriculum and what form it may take I would hope that the faculty consider how these thoughts may guide the construction of a curriculum. ■

Ed Levine
Professor Emeritus Visual Arts

Getfit@mit with the FNL

To The Faculty Newsletter:

THANK YOU FOR SUPPORTING the 2007 getfit@mit fitness challenge.

The response to getfit@mit has been outstanding this year. Almost 2,400 members of the MIT community are participating on 335 teams. By the end of

Week Three, participants had logged more than two million minutes of exercise, with roughly 90 percent of participants meeting or exceeding the weekly exercise goals.

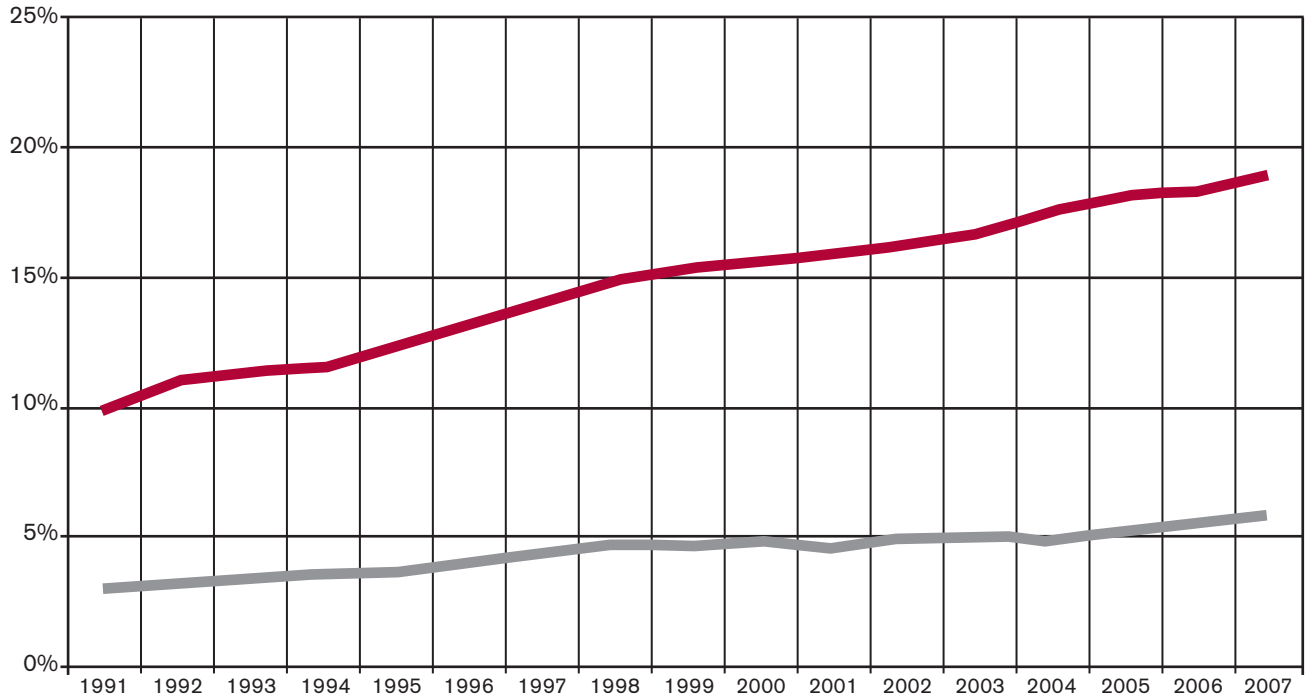
We appreciate your help promoting the program in the *Faculty Newsletter*. The getfit@mit fitness challenge would not be nearly as successful without your gener-

ous support. Thank you again, and we look forward to working with you again next year. ■

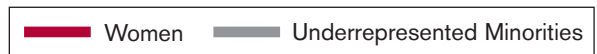
Sincerely,
Lauren Rosano
On behalf of the getfit@mit organizers

M.I.T. Numbers

MIT Faculty: Women and Underrepresented Minorities*
(as of October of each academic year)



*Underrepresented Minorities = Blacks, Hispanics, Native Americans



Number of Faculty as of October of Each Academic Year (Women and Underrepresented Minorities)																	
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Women	95	105	109	110	116	125	124	135	141	144	150	154	160	170	178	181	188
URM	28	30	32	33	33	38	38	42	42	44	42	46	47	46	50	53	57
Total Faculty	961	966	966	964	954	960	896	916	923	931	947	956	966	974	983	992	998

Source: Office of the Provost/Institutional Research