

The MIT Faculty Newsletter

Vol. XIII No. 2

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Managing Space Changes at MIT

Lawrence S. Bacow

Recently I encountered a member of the Class of 1931 who had returned to the Institute for the first time since graduation. He remarked how little things had changed as he walked the hallways of the main building. Unfortunately, his observation is all too familiar for those of us who work and study here. I often walk past the classroom where I took Differential Equations in 1970. It has not changed at all since I was a student, and very little since it was last renovated in the 1940s. MIT students still encounter the same uncomfortable highback, black chairs and long, narrow, black tables. On warm days, the windows still must be opened, and noise from outside the room disrupts the class. We can do better. Many of our classrooms, offices, laboratories, and public spaces are in need of renovation. Some of these needed changes are being driven by programmatic evolution. New scholarship often requires new facilities. Similarly, the development of new educational technologies requires new teaching facilities. But we also have a backlog of deferred maintenance that simply must be addressed.

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On October 4th the Committee on the Undergraduate Program received the report of its Subcommittee on Pass/No Record Grading and Advanced Placement Credit. The next several months will be devoted to reviewing feedback from the MIT community. Faculty are encouraged to offer their opinion at <<http://web.mit.edu/faculty/reports/pnrap/>>.

MIT Report on the Status of Women Faculty in Science Leads to New Initiatives to Increase Faculty Diversity

Nancy Hopkins

In March of 1999 an article entitled "A Study on the Status of Women Faculty in Science at MIT" appeared in a special edition of the *Faculty Newsletter*. It described how a committee, appointed by the dean of Science, had documented that tenured women faculty in Science had been the object of a subtle form of gender bias. The article, which has come to be known as "the MIT Report," was accompanied by comments from President Vest, from then Dean of Science Robert Birgeneau, and from the Chair of the Faculty Lotte Bailyn. Vest wrote, "*I have always believed that contemporary gender discrimination within universities is part reality and part perception. True, but I now understand that reality is by far the greater part of the balance.*"

The MIT Report, and particularly the administration's acknowledgment of gender bias, was immediately the subject of articles on the front pages of *The Boston Globe* and the *New York Times*. The reaction to these stories was overwhelming. Intense media coverage continued for more than a year. Women faculty who had been involved in the committee's work and the release of the report, particularly myself as chair of the first Committee on Women Faculty in Science, were deluged with e-mail from professional women in the U.S. and other parts of the world reporting that they too had experienced gender bias.

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Address: MIT Faculty Newsletter, Bldg. N52-419a
Cambridge, MA 02139; (617) 253-7303.

E-Mail: fnl@mit.edu.

FAX: 617-253-0458

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

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Authors

Lawrence S. Bacow is Chancellor.

Joe Haldeman is Adjunct Professor, Program in Writing.

John Hildebidle is Professor of Literature.

Nancy Hopkins is Professor of Biology.

Kristin Joyce is Communications Officer, The Lemelson-MIT Program.

Soulaymane Kachani is a graduate student, Operations Research Center; President, Graduate Student Council.

Steven R. Lerman is Professor of Civil and Environmental Engineering; Faculty Chair.

Ruth K. Seidman is Libraries Communication Coordinator.

Peter Shulman is a senior, Course 18; President, Undergraduate Association.

William Van Schalkwyk is Director, Office of Environmental Management.

From The Faculty Chair

What to Do during the Seven Years of Plenty

Steven R. Lerman

By any financial measure, last fiscal year was a very good one for MIT. The Report of the Treasurer for Fiscal Year 2000 documents that our "total net assets" rose by over \$2,700 million, a whopping 49.6% increase. This figure reflects both depreciation of our facilities and the value of new facilities, the net of which is fairly minor. This truly extraordinary change arose primarily from incredible investment gains in the MIT endowment (\$2,478 million) and a record level of gifts from the Campaign. Put another way, the yield on our endowment last year was 57.7%, one of the highest of all universities and colleges in the nation. This tremendous gain in the financial base of the Institute is a result of the acumen of MIT's key financial decision-makers, particularly Alan Bufferd, the Corporation Investment Committee, and our outside advisors. We all owe them our thanks.

These enormous gains in MIT's financial position naturally lead to questions about what we, as an institution, should do with them. In some odd way, a large increase in financial opportunities presents as many issues for the leadership to grapple with as a decrease might. The big difference, of course, is that the problems posed by a large increase in available funds are a lot more fun to deal with. Before we go on a major collective spending spree, however, we need to put this extraordinary year into a larger context.

First, we need to acknowledge that the successes of last year are not going to be repeated soon; indeed, they may

never be repeated. We benefited from a sustained bull market and fantastic performance in the portion of MIT's endowment invested in venture capital funds. Anyone who has watched the markets recently is aware that some of the stocks rising most rapidly in the late part of the 1990s are those that are declining rapidly now. The near-term, future returns on endowment are very uncertain, and there may be more bad news than good news in the next year or two. This isn't a very good time for a round of what Alan Greenspan called "irrational exuberance."

Second, we need to continue to think long term rather than short term. Endowment yields will go up and down, but averaged over the long term it is reasonable to assume that the future will be much like the past. This means endowment returns in the 9% to 10% range. President Vest has worked with the Corporation Executive Committee over the past two years to develop a financial plan that relies on reasonable long-term assumptions but provides somewhat greater financial flexibility to the Institute in the next 10 years. In particular, the Corporation's Executive Committee has authorized a higher-than-usual payout of yields from the endowment that will be devoted largely to a set of core needs. The administration has already put in place actions such as the elimination of summer tuition for graduate research assistants not taking courses, a significant number of new presidential graduate fellowships, and a sustained increase in the level of maintenance of the physical facilities. Two of these

actions are positive steps that make MIT more competitive in seeking research funds and the best graduate students to work with on that research. The third step reverses the long-term trend of deferred maintenance that has characterized the Institute's budgets over the past 20 years. We have also embarked on the most ambitious construction program since MIT was founded, including the Stata Center complex of buildings, a new undergraduate residence, two new graduate residence facilities, the new sports and fitness center, a second Media Laboratory building, and several additional projects in the works. Once completed, these new facilities will revitalize many parts of the campus in significant and exciting ways.

With all of the above as background, the question remains about our priorities for further investments. The senior administration has been actively seeking the views of the faculty on this question by speaking at various School and Department meetings. President Vest made a presentation at the October meeting of the faculty that was identical in substance to the presentation he gave to the MIT Corporation earlier that month. These discussions will continue to elicit diverse views on what we can and should do over the coming years to make the best use of any increased financial flexibility resulting from the success of the Capital Campaign and the growth of the endowment. The consultative approach being taken by the senior administration should be

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What to Do during the Seven Years of Plenty

Lerman, from preceding page

commended by all of us. It is important that we, as faculty, be active participants in such discussions.

My own views on what we can and should do reflect the following priorities:

We should continue to focus on the problems of deferred maintenance. Even with the budget increases of recent years, the physical facilities of MIT show more “wear and tear” than is appropriate. Admittedly, a large part of our recent investments in maintenance have been in improvements in crucial life safety systems that aren’t cosmetically visible but are clearly of the highest priority. These improvements need to continue, but we also need to ratchet up the more general maintenance activities above and beyond the sizable increases that have already been put in place. As Dean Schmalensee [School of Management] put it, “In good times, you should fix the roof.” This should be a period where we catch up with the deferred maintenance of all our buildings, or at least those buildings we plan to keep. It would be irresponsible to commit to new programmatic initiatives at this point in time while we still have facilities that might be charitably described as shabby.

MIT also needs to re-examine the formulas we use for undergraduate financial aid. One of the disturbing trends in our undergraduate enrollments is that we are drawing an increasing fraction of our student body from the upper end of the socioeconomic spectrum. Data from the Admissions Office suggests that our offers of financial aid are in many cases lower than those of the universities with which we compete most intensively.

I have always been proud of the fact that, compared to our peers, MIT has always attracted a larger share of first-generation college students, many of whom do not come from affluent families. We need to put the resources into financial aid to ensure that we remain a place that is accessible to every talented high school student. This may well mean that we must shift more of our resources into helping students and their families.

There are several ways in which we might make an MIT undergraduate education more affordable. One approach is to hold the actual tuition (or what we might think of as the sticker price) for undergraduate education level for some period of time. We might even consider decreasing tuition. This approach has no effect on the costs of education for the poorest students since they never pay the full tuition. Another option is to reduce what is called the “self help level” – the amount of money every student is expected to be able to provide no matter what his or her financial circumstances are. A third approach, taken by some of our peers, is to remove some assets, particularly home equity, from the calculation of a family’s assets when computing the amount of financial aid we will offer. Yet another option is to shift the mix of types of aid, reducing the fraction in the form of loans and work-study funding to more outright grants. There are discussions underway within the administration about this issue, and we may well end up with some blended strategy.

Whatever we do in this area, it is important that our actions be guided by three core values. First, we must continue to attract absolutely the best students who want to study the types

of curricula we offer. This is unequivocally one of the things that makes MIT great. Second, we must ensure that an MIT education is financially accessible to all qualified students regardless of the economic standing of their respective families. Lastly, we need our financial aid system to attract a student body with the diversity of backgrounds that reflects our entire society.

It is quite likely that, barring a very large downturn in the value of the endowment, all of the above can be done within our new resources. If the capital campaign continues to remain ahead of schedule and the financial markets simply return to their historical levels of growth, we may well be able to afford one or two other major initiatives. I propose that we wait a year or two to see if this is what actually happens. If we can afford it, my own priorities would suggest two new initiatives.

First, I believe that the original complex of MIT buildings, particularly the Infinite Corridor, are an under-exploited resource. We should think about transforming this centerpiece of MIT’s facilities into a sort of MIT Main Street. Imagine this corridor as a row with coffee houses, sitting areas where students, faculty and staff meet and talk, and facilities that serve visitors and members of the community alike. The lobbies of Buildings 7 and 10 have huge unrealized potential that, with appropriate design and a substantial sum of money, would be spectacular focal points for the creation of a sense of shared community.

The second item on my wish list is a new facility designed to promote better teaching and learning. Such a building was originally conceived of as part of

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What to Do during the Seven Years of Plenty

Lerman, from preceding page

the Stata Center but was unaffordable at the time our plans for that facility needed to be put into place. I view it as far more than a place with first-rate classrooms and teaching laboratories. It should also serve as an incubator site for innovations in teaching, a place where faculty and students with interests in the process of learning might come together, and a site where key educational services such as video production, digitizing, media

creation, educational Website design, and distance learning support for alumni would be located. This facility would give us some surplus of classrooms, making it far easier to renovate our existing classrooms during the academic year. It would also provide some rooms designed as flexible, reconfigurable places that could be used for experimental modes of teaching.

This is truly a time of real opportunity for the Institute. As President Vest has pointed out, we are in a period of historic change in the way the university is supported. In the coming years, far less of our costs will be borne by sponsored research and far more will be supported by gifts and our endowment. If we manage our resources well, MIT will be a much better place to study and work. ♣
[Steven R. Lerman can be reached at lerman@mit.edu]



Teaching this fall? You should know ...

the faculty regulates examinations and assignments for all subjects.

Check the Web at <http://web.mit.edu/faculty/termregs>.

Questions: contact Faculty Chair Steven Lerman at x3-4277 or lerman@mit.edu.

THE FACULTY APPROVED THESE RECENT CHANGES FOR UNDERGRADUATE SUBJECTS:

First and Third Week of the Term

By the end of the **first week** of classes, you must provide a clear and complete description of:

- required work, including the number and kinds of assignments;
- an approximate schedule of tests and due dates for major projects;
- whether or not there will be a final examination; and
- grading criteria.

By the end of the **third week**, you must provide a precise schedule of tests and major assignments.

Tests Outside Scheduled Class Times:

- may begin no earlier than 7:30 P.M., when held in the evening;
- may not be held on Monday evenings;
- may not exceed two hours in length; and
- must be scheduled through the Schedules Office.

No Testing During the Last Week of Classes

Tests after Friday, December 8 must be scheduled in the Finals Period.

. . .an excerpt from *The Coming*

Joe Haldeman

[*The Coming* will be published in December as an Ace hardcover.]

Professor Bell

Reporters. Normally her desk was no neater than it had to be, a comfortable random pile of notes, journals, and books. So long as she knew where everything was, who cared? But she had just spent fifteen minutes nervously straightening things up, desk and work table. It was not quite six in the morning.

There would be reporters.

She looked at the coffee machine in the anteroom. The smell was a magnet. No, not now. Her heart was already racing. Doctor said two cups a day. She pushed a button on the desk. "Previous," she said, and the diagram on the wallscreen was replaced by a double page of equations and numbers. "Previous," she said again, and got a double page of numbers and words. "Left." The screen reconfigured and gave her a single magnified page of words. She stared at it and shook her head. It was a somewhat old office, dating from before the turn of the century. It had a blackboard that she enjoyed using, and one whole wall was built-in shelves for paper books. Some of that space had been converted, but she did have hundreds of paper volumes bound in leather, cloth, and cardboard. The head of the department can be eccentric. "Music," she said; "random Vivaldi, then random Baroque." An oboe began a familiar figure. "Louder, ten percent."

She sat down for a minute, listening, and then got up and slid a large book from the shelf, one she'd bought on impulse yesterday. She leafed through the yellowing pages carefully. It was a book of news photographs from the old *Life* magazine, documenting a war that her great-great-grandfather had fought in. Grainy patriotic pictures and ads with meaningless prices. *Lucky Strike Green Has Gone to War*. What on Earth did that mean?

At the sound of the elevator, she closed the book and returned it. Her husband came into the outer office. "Coffee any good?" "Just made it." He poured a cup. White stubble on his chin, rumpled work clothes. He got up almost as early as she did, but didn't bother to shave and dress till noon.

"I didn't quite understand your message." He sat down on the chair normally reserved for nervous graduate students. "Or quite believe what I heard." She always expected to get the answering machine when she called home. Norman was a cellist and composer, and spent the

first hour of his work day warming up, meditating over scales and intervals. But he'd called back immediately and said he was coming over. He looked around the neat office. "You have someone in?" She laughed. "I've been tidying. Waiting for a longer parallax verification."

"Parallax, yeah. Relax. Sit down, you make me nervous." He gestured at the wallscreen. "This is it?"

She nodded. It was a neat column of words: "WE'RE COMING," repeated sixty times.

"Well...by itself, it doesn't exactly make one—"

"Norman. The signal came from half a light-year away. In English." "Oh." He sipped his coffee. "We don't have anyone that far out?" "Of course not."

"Creatures from outer space."

"Something from outer space." The phone rang and she picked up the wand. "Bell." She leaned forward, elbow on desk, staring at the column of words. "Anytime is okay. Is he the science reporter?" She rolled her eyes. "Please. Can't we wait for a science reporter?" She exhaled slowly. "I understand. You have the address? Right. 'Bye.'" Norman smiled. "Science reporters aren't up at six?"

"They're sending their 'night man.' He's probably used to murders and things."

"They couldn't wait?"

"No, it's out on the nets. I called the Marsden Bureau in Washington as soon as I was sure what it was."

"Oh, you're sure what it is?"

"No, no." She stood up and sat back down. "Just how far away, how fast. You know what the blue shift is?"

"An article of clothing?" She gave him an exasperated look. "I guess it's like the red shift, but blue."

"Right. It tells how fast something is coming toward us." She pointed at the column of words, stabbing. "This thing came in a burst of gamma rays. Its source is coming at us with almost the speed of light." "Sounds dangerous."

"It's slowing down. If it weren't, I couldn't say anything about the blue shift — I mean, they could just be broadcasting in gamma rays." He frowned. "I don't understand."

"It's complicated." She waved the complications away. "What it boils down to is that this thing popped into existence going the speed of light, okay? It was exactly, *exactly*, one half light-year away, got that? And it's slowing down at such a rate that it will reach Earth in exactly one year."

"No coincidence."

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. . .an excerpt from *The Coming**Haldeman, from preceding page*

“Of course not. They’re giving us a creepy message. Those two words, combined with the blue shift and position, say ‘We know a lot about you, and we are vastly superior technologically. Ready or not, here we come.’”

He rubbed the back of his neck. “Jesus.” They both looked up when the elevator door chimed.

Daniel Jordan

Dan didn’t like the way the old elevator squeaked and shuddered. They were supposed to be failsafe, but he’d covered a story over in Jax a few years before, where one newer than this had dropped twenty floors. Broken necks and fractured skulls and only one survivor, her muffled screaming terrible as the Rescue Squad rappelled down to cut open the roof. He pushed on the squealing door to speed it up, then held the door for the cameras to roll out behind him. He checked his watch; 6:17. The Kampus Kops wouldn’t start ticketing until seven. Maybe the PRESS card on his windshield would protect him. The station only paid for two tickets a week, and he’d already had them.

Dr. Bell, 436. He turned to the right and the cameras followed. The small one stopped every couple of meters to take atmosphere: bulletin boards, an empty classroom, the sign that said DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS. Dr. Bell was waiting for him in a doorway, a small stocky woman with short black hair streaked with white; a kindly face with an expression difficult to read. Dan introduced himself and they went into the office.

The guy sitting by the desk looked like the janitor, and on a bad day at that, but Dan had a good memory for faces and made the name connection. He held out his hand. “Norman Bell, of course. I went to your concert in the park last spring.”

The man shook his hand and looked amused. “You cover music as well as astronomical anomalies?”

“No, sir.” Something about the man compelled honesty. “Actually, I’m tone-deaf. It was a date.”

He laughed. “She must have been worth pursuing.” He stood up. “Well. I’ll get out of your way.”

“Please stay, Norman.” She looked at Dan. “Is that all right?” He shrugged. “As long as you don’t stand or sit together. Confuse the cameras’ tiny brains.” The semi-intelligent machines would scurry around getting two-shots, long shots, intercuts, reaction shots. Half the footage would be of a scruffy-looking man in gray work clothes, temporarily irrelevant. “I think it would shoot best with

you at your desk, Professor. I’ll sit over here.” He took the chair that Norman had just vacated.

“I’ll go lurk by the coffee machine. Want some?” “No thanks. Just came from Krystal.”

“That’s how you got here so fast,” Dr. Bell said. “I hope it didn’t interrupt your breakfast.”

“Oh no,” he lied, “just hanging out with the city cops. Trade gossip.” He looked at the big camera and whistled, then spoke slowly: “Establishing shot. Bee Gee two-seventy from behind subject to my left.” The camera drifted behind Bell and then wheeled out in an arc. “That’s for editing back in the studio. I just repeat the questions there and they can paste my face in from any angle. So the cameras don’t have to worry about me, now.”

The camera completed its circuit and said “okay” in a monotone. “Begin at the beginning,” Dan said.

“How much do you know?”

“Almost nothing. You got some weird signal from outer space and the night desk thought it was important.”

“It is.” She leaned back. “I got to the office a little after four. The screen was blinking for attention.”

“Can you recreate that?”

“Sure.” She pushed a button on her desk. “Find today, 0405.” The screen began to blink red, saying ANOMALY RECORDED GRB-1 0355 EST. Dan whistled and pointed at the screen. The large camera rolled up to it and seemed to concentrate. “Daniel,” it said in a soft woman’s voice, “please come adjust my raster synchronization.”

Dan rolled his eyes. “That’s automatic in the new models.” He got up and peered through the camera and fiddled with a pair of knobs until the picture of the wallscreen settled down.

He returned to his seat and the small camera climbed up onto Bell’s desk and stared at her, humming just loud enough to hear. She looked at it warily. “Am I supposed to talk to it?”

“No, just talk to me. What does the message mean?”

“GRB-1 is a gamma ray burst detector. The ‘One’ was optimism; we never got money for the second, which would be a back-up.

“Anyhow, some stars send out bursts of gamma rays, sometimes for hours, sometimes minutes, sometimes just seconds. This satellite detects and analyzes the radiation. It has a small telescope, essentially a fast wide-angle lens, that covers the whole sky every two seconds. If it detects a gamma

(Continued on next page)

. . .an excerpt from *The Coming*

Haldeman, from preceding page

ray burst, the bigger telescope can be on it in about a second.”

“Does it have any practical applications?”

“One never knows, but I doubt it. Except that if the Sun ever did that, it would fry everyone on the daytime side of the planet. It would be nice to have a few hours’ warning.”

“Do you have a picture of the satellite?”

“Sure.” She pushed the button. “Find GRB hyphen 1 comma artist’s conception.” A dramatic picture of the satellite appeared, silhouetted against the Sun peeking crimson from behind the curve of the Earth. Dan pointed at it and the big camera, which had been tight on Bell, gimbaled around and got a shot of the wallscreen.

“That’s pretty but falsado,” she said. “GRB-1’s up in geosynchronous orbit; the Earth’s just a big ball that gets in the way.”

“So what’s this anomaly? I mean, what does the word mean?” “It means something unexpected, a mystery. In this case, we recorded the gamma ray burst, but when the computer tried to find out which star it was, there was no star there, in previous records. I mean down to 25th magnitude, which is about as faint as they get.

“That was the first anomaly, which was interesting. The second was startling. Whenever we get a burst that’s more than a few seconds long, we send out a request to the Japanese gamma ray observatory on the Moon, for backup data. Their detector’s more powerful. It found the burst but said that our position was a tiny hair off. We checked and no, our position was accurate. What it was, was parallax.” She anticipated the question. “You hold your finger up at arm’s length, and look at it first with your right eye; then with your left.” She demonstrated, blinking. “The finger appears to change position with respect to things farther away. That’s parallax.

“Stars are too far away for there to be a measurable parallax between the Moon and GRB-1, the right eye and the left. This thing was apparently about a half light-year away. It’s not a star, no way.” “So what is it?”

“That’s the third anomaly, the fantastic one. I went to analyze the spectrum of...I went to analyze the signal. It was a long steady beep for sixty seconds, and then a jumble for sixty seconds, and then another steady beep, and then an identical jumble.” She paused. “Do you know what that means?”

“You tell me,” he said quietly.

“It means the signal isn’t natural. The human minute is not an interval that occurs in nature.”

“Yet it was coming from somewhere farther than humans have ever been?” “That’s right. And it’s obviously a signal. I put it through a decryption, what we call a Drake program. It’s simple frequency modulation, like FM radio. This is the message.” She held down a button and said “Previous previous.”

Dan pointed at the screen and the camera obeyed. “They’re coming?” “Yes, at the speed of light. At the rate they’re slowing down, they’ll be here in exactly one year.” He was silent for a moment. “Suppose it’s a hoax. Could it be a fake, a joke?”

“Well, somebody could get to my computer, verdad, and set me up for a practical joke. But they couldn’t get to the Moon. I mean, I just told them where to look, and there it was.”

“So something’s out there.” Dan laughed nervously. “An invasion from outer space.”

“We’d better hope it’s not an invasion. You extrapolate back from the first signal, and when that thing first appeared it was going point nine nine nine...fifteen or sixteen nines...of the speed of light.” She leaned toward the little camera and spoke carefully. “If you took all of the energy that all of the world produces in one year, and put it all into a space drive...we couldn’t make a golf ball go that fast. If it’s an invasion, we’ve had it. Perdido.”

“Dios,” Dan said under his breath. “Use your phone?” He reached past her and picked up the wand; checked his watch while he was punching. “Mary. Listen once. You have to cut me a fifteen-second teaser on the seven o’clock. Then a three-minute lead at eight, and a five-minute lead at nine. And get...listen, it’s my pretty ass, not yours. And get Harry and Rebecca down here right now for depth and color, for nine.” He listened. “You just tell Julie to be down in Room Six in fifteen minutes. I’m gonna show him two crystals that’ll blow him into the next county. The next *century*. We’re gonna scoop the whole fucking world.”

He nodded at the phone. “The Second Coming, bambino. The Second Coming.” He hung up the wand and pulled a data crystal out of the small camera, and then stood and extracted a similar crystal from the large one.

“Thanks, Professor, you were great. Gotta run. Couple science types be here in a half-hour.” He started for the door.

“Your cameras?”

“They’ll use ‘em.” He sprinted down the hall, crashed through an emergency exit, and ran down the stairs.♣
[Joe Haldeman can be reached at haldeman@mit.edu]

Environmental Management System Will be Required by the EPA

William Van Schalkwyk

As many of you know, the U.S. Environmental Protection Agency (EPA) conducted what is called a multimedia enforcement inspection at MIT in May 1998. This inspection addressed our compliance with several environmental regulations and reviewed approximately 25 percent of MIT's laboratories, the Cogeneration Plant, and many operations in the Department of Facilities. As a result, EPA is requiring MIT to implement an Environmental Management System (EMS) that satisfies EPA's standards.

EPA's standards require MIT to develop clear Institute accountability for and oversight of compliance, incentives for good performance and consequences for poor performance by the regulated community at MIT, and measurable progress to reduce hazardous waste and pollution and to make our campus more sustainable.

MIT already has taken steps to address the issue of providing clearer accountability for and oversight of compliance. As noted in the last issue of the *Faculty Newsletter*, an Environmental Health and Safety team has been formed, and it reports to Jamie Lewis Keith, managing director for Environmental Programs, Risk Management/Senior Counsel. The team includes the Environmental Medical Service, Environmental Management Office (EMO), and the Safety Office.

The next major piece of work will involve the Environmental Management System. There are many available industrial-based systems that may work for an industry or business

but are poor models for an academic institution. That is because these systems depend too heavily on central "command and control" by management. To avoid the imposition of one of these models that won't work here, Ms. Keith intends to work with faculty, researchers, administrators, and students to design our own management system that preserves the independence of departments, laboratories, and centers. All of the relevant parties need to be able to use this system to ensure safe and healthy operations, a reduction of environmental impacts, and compliance with governmental regulatory programs without overburdening the research or educational process.

Faculty participation and input in the design process is critical to the development of a system that will serve MIT effectively. Ms. Keith has consulted with several faculty members, the Vice President for Research, and the Provost to determine the best way to seek input in this process. Vice President for Research David Litster has agreed to expand the existing Institute Committee on Environmental Health and Safety for 18 to 24 months. This group, which includes senior representatives of major departments, labs, and centers as well as relevant administrators, will become the Ad Hoc Subcommittee that will be co-chaired by Dr. Litster and Ms. Keith and will oversee the development of MIT's Environmental Health and Safety Management System (EHS-MS).

Working with the Ad Hoc Subcommittee will be a working

committee that will develop the specifications and recommendations for each component of the EHS-MS for consideration by the Ad Hoc Subcommittee. The working committee will consist of representatives of faculty, administrators, IS professionals, and students.

A number of staff already are beginning background work for the new system. Myself, director of the Environmental Management Office (EMO), Lou DiBerardinis, director for Operations of the Environmental Medical Service, Jim Curtis of the EMO, Mitch Galanek of the Radiation Protection Office, and Ann McNamara of the Environmental Programs Office have been working with Rocklyn Clarke and Rob Smeysen of Information Systems and with others to determine what other universities, industry, and market options exist. In consultation with some faculty members and senior leaders, Ms. Keith has developed a concept as well as questions and issues for consideration by the Ad Hoc Subcommittee.

The effort to build the working committee is now beginning in earnest. The key to a successful EHS system at MIT will be the participation of knowledgeable representatives from each of the constituencies that the system will serve. Faculty members are encouraged to contact Ms. Keith by phone, at x2-2081, or via e-mail, to jlkeith@mit.edu, if they have questions or want to discuss their interest in participating in the project.♣

[William Van Schalkwyk can be reached at billv@mit.edu]

Managing Space Changes at MIT

Bacow, from Page 1

Two years ago, the Executive Committee of the Corporation authorized an additional distribution from the endowment to permit us to tackle these problems in a serious way. The budget for the Committee for the Review of Space Planning, known by the acronym CRSP, increased at that time from \$3.5 million to \$24 million annually. [CRSP membership includes myself as Chair, Bob Brown as Provost, John Curry as Executive Vice President, Victoria Sirianni as Director of Facilities, Doreen Morris as Assistant Provost for Administration, and John Dunbar as Space Administrator.] The Institute invests these funds for programmatic changes, a portion of which renew our physical plant as well. Departments, labs, and centers also contribute on average about \$9 million annually in cost sharing for space changes, and the Department of Facilities allocates \$15 million for non-space change infrastructure renewal. Projects in this last category include replacement of air handling units, fire- and life-safety improvements in the residential life area, roof replacement, façade repair, and dorm window replacement. Thus, in the aggregate, the Institute is now spending approximately \$48 million annually to upgrade its physical plant. In addition, some of the new buildings we are constructing also represent efforts to address decades of deferred maintenance. As Bob Brown likes to observe, replacing Building 20 with the Stata Center is our largest “deferred maintenance” project on campus.

Two years ago, CRSP instituted a new process for allocating resources for space changes. We continue to try and improve this process as we receive feedback from the faculty. Under the old process, space change requests

could be submitted at any time, and were addressed by CRSP in the order in which they were received. There were several problems with this process. First, it led to a crowded and undisciplined queue. People often competed to get to the head of the line. Without knowledge of future requests, CRSP could not assess the true opportunity cost of individual decisions. Second, the old process did not engage the Deans and VPs in helping to prioritize requests from their units. Since space

letter typically written by the relevant department head, center or lab director. For changes to existing space, this letter describes the following: the research or function currently taking place in the space; the proposed future activity; the rationale for the change, including a description of the likely benefits of the change and the consequences of not undertaking it; an explanation of why this specific request is important to the mission of the department, lab, or center;

The new process instituted two years ago requires all space change requests for the following fiscal year to be submitted in a consistent format and at the same time in January. The request to CRSP must be accompanied by a letter typically written by the relevant department head, center or lab director.

change requests dribbled in throughout the year, most Deans and VPs just forwarded requests to CRSP for processing as they came in. Third, the old process often forced departments, labs, and centers to invest considerable resources of their own in developing plans to present to CRSP. CRSP had no way of supporting planning for space change requests independent of making major funding decisions. And fourth, because of the discrete nature of CRSP funding decisions, it was impossible to economize on infrastructure renewal by considering the renovation of multiple adjacent spaces simultaneously.

The new process instituted two years ago requires all space change requests for the following fiscal year to be submitted in a consistent format and at the same time in January. The request to CRSP must be accompanied by a

and finally, a description of available sources of non-CRSP funding to support the change.

Upon receipt of all of these space change requests, Design and Construction Services of the Department of Facilities does a preliminary estimate of the cost of each project. This estimate is based upon a simple cost model. We categorize projects by type, i.e., classroom, office, wet lab or dry lab, and then, based upon an understanding of the per square foot costs of similar projects completed at the Institute, we do a rough estimate of what the job is likely to cost. This rough estimate is provided to the Deans and the VPs who are then asked to prioritize all the space change requests generated by their departments, labs, and centers.

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Managing Space Changes at MIT

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[While there is a high degree of variability between cost model estimates and actual costs for each individual project, in the aggregate, the cost model has proven to be quite accurate. As one would expect, some projects are overestimated, and others underestimated. As a practical matter, we cannot afford to design and bid each project submitted to CRSP. Moreover, we need some rough estimate of the likely cost of each project in order to make funding decisions. The cost model allows us to be reasonably certain that the aggregate cost of the approved projects will be within the overall CRSP budget.] After receiving input from the Deans and VPs, CRSP makes its funding decisions for the next fiscal year. These funding decisions are then shared with all of the Deans and VPs in a meeting of Academic Council in which CRSP explains its decisions. Each Dean and VP gets to see the entire CRSP allocation, as well as the prioritization given by their colleagues to specific space change requests. We have tried to make the decision-making process as transparent as possible.

In deciding what to fund, CRSP looks first to the priorities of the Deans and the VPs. In the past two years, CRSP has not funded any request that was not given the highest priority by the relevant Dean or VP. CRSP also looks to the past history of renovations in the relevant unit in allocating resources, to ensure that funds are distributed equitably. CRSP considers the intensity of current utilization of space as well as changes in the activity level within the unit (e.g., indirect cost recovery per NASF, research volume per faculty member, NASF per headcount, etc.). Finally, CRSP tries to economize on infrastructure funds by clustering

projects. For example, it is much cheaper to renovate three adjacent offices, laboratories, or classrooms than to do three projects in three separate buildings.

Once approved, projects are taken to the next step so that a more refined estimate can be generated. A project manager is assigned, an architect is hired, the project is designed, and then it is competitively bid. CRSP typically does not formally approve a

12-16 percent. All projects also include a construction contingency of 10 percent. This is intended to cover unanticipated costs encountered during the construction process.

Faculty are often surprised to learn of the cost of a relatively modest renovation. Why are space changes so expensive at MIT? There are a number of reasons. First, many of our buildings are quite old and renovating older buildings is

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budget until after bids have been received. [One exception to this rule is when departments, labs, or centers seek funds for renovation of space for a new faculty hire. Often the unit will look for a commitment from CRSP for a space change before the faculty member has formally accepted his or her position. In such cases, CRSP will typically commit a fixed dollar amount to the project. (Since the project has yet to be designed, it cannot be bid.) The unit must then either design to this budget, or come up with additional funds from other sources if the project budget is to be exceeded. CRSP cannot afford to support open-ended commitments for space changes for new hires.] The final budget approved by CRSP includes construction costs, a project manager's fee (3-5 percent), and may include an architect's fee, typically

expensive. Second, MIT is required to renovate to an institutional standard which incorporates more durable materials, equipment and finishes than any of us might put in our own homes. Third, we are often required, as part of routine space changes, to retrofit new mechanical systems into older buildings. This is always very expensive. Fourth, renovations to older buildings usually require making the building ADA compliant. Fifth, construction activity at MIT must be scheduled around the needs of adjacent users. Rarely is it possible to close down whole sections of a building in order to perform needed work. Instead, construction must be scheduled so as to minimize the disruption to classes, laboratories, offices, and other Institute activities. A

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Managing Space Changes at MIT

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significant portion of our construction must be completed in a relatively short period of time during the summer and during vacations. This often necessitates additional expenditures. Finally, we find ourselves in a very difficult construction market where costs seem to be escalating monthly.

Recently, CRSP commissioned a study to compare per square foot costs for renovating laboratories and offices at MIT with similar projects at neighboring

funds from donors to renovate their space and the Institute has provided matching funds to address improvements to infrastructure.

As we go forward in renovating more space at MIT, we must be far more attentive to managing the construction impact of these projects. We are all living in a massive construction site. We are building new buildings (the Stata Center, the new undergraduate residence, and the Sports and Fitness Center); we

Research. Music and Theater Arts has relocated from cramped quarters in Building 14 to new space in Building 10. We are about to undertake major improvements to the public spaces in many of our lobbies and corridors. It is clear that we still have much to do. It will require patience by all concerned. It will also require substantially greater resources than we currently have available. We are committed to providing our students, faculty, and staff with the world class facilities that we expect from an institution of the caliber of MIT. It will take time, but we will do it.♣

[Larry Bacow can be reached at bacow@mit.edu]

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Increasingly, CRSP is tackling more complicated and comprehensive projects. The recently completed Building 33 renovations for the Department of Aeronautics and Astronautics included renovation not only of the offices and lab space in the building, but complete renovation of the entire mechanical systems for the building as well. CRSP is about to undertake a project of similar scale on behalf of the Department of Physics in Buildings 4, 6, and 8. This latter project will be undertaken in phases over a number of years. In the case of both Physics and Aero and Astro, these departments have raised considerable

are renovating entire buildings like Building 18; and we are undertaking many smaller projects throughout the campus. Some of our earlier projects caused serious problems for their neighbors. We have tried to learn from these experiences. In our new projects, we are trying to be far more aggressive in both managing and mitigating construction impacts. Nonetheless, there will be disruption and we all must be patient. It is one of the prices we must pay to renew our working environment.

Over the course of the next several years, our campus will be transformed. We are already seeing the benefits of investments in new classrooms in the original main building. New laboratories are coming online in Buildings 2, 4, and 6, as well as in the Center for Learning and Memory and the Center for Cancer

Weekly updates on construction impacts are published in both *TechTalk* and *The Tech*. Also, please check out the new Website for construction projects that details current activity, activity planned for the coming week, as well as mitigation measures scheduled. It can be found at <<http://web.mit.edu/facilities/www/construction/>>. E-mail can also be sent to construction@mit.edu.

MIT Report Leads to New Initiatives to Increase Faculty Diversity

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I was invited to an event at the White House where President and Mrs. Clinton and Labor Secretary Herman praised MIT's handling of gender bias and praised the courage and the data-gathering approach of the tenured women faculty. The Ford and APS Foundations called to offer their support and to encourage MIT to help bring change to the rest of academia. I received more than 150 requests to speak on university campuses, at annual meetings, at companies, law firms, a music school, and a military base. Several of these requests were for joint appearances with the president, dean, and chair of the faculty, all of whom also received numerous communications. Two short movies were made about the MIT story, one for American and one for Chinese television.

Here I describe two initiatives established this year to address issues raised by the MIT Report. I believe these initiatives have the potential to improve the professional lives of *all* faculty at MIT, to initiate change that is critical to maintaining the excellence of the Institute, and perhaps even to contribute to bringing about important societal changes.

Lessons Learned About Gender Bias and About the Under-representation of Women in Science

Our analysis of the status of women faculty in Science at MIT, similar analyses by scientists at many other universities, and studies by sociologists that, with hindsight, all but predict the findings of the MIT Report, have led to the following realizations about gender bias and the under-representation of women on science faculties at academic institutions.

1. This problem will not go away by itself with time. Rather, progress will continue to be made only with significant effort by the administration and increased awareness among faculty.

2. The lack of female faculty members in science is not the result of a small number of women being drawn

These realizations have led President Vest and Provost Brown, in collaboration with women faculty and members of the administration, to establish two new mechanisms to ensure a bias-free work place for women faculty and to address the under-representation of both women and minorities on the faculty, particularly in science and engineering.

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to science or a shortage of women who excel in science.

3. The exclusion of women from positions of academic leadership in science is not simply the result of the small number of women on the science faculties.

4. Greater family responsibilities can not explain the marginalization that women scientists experience, since many senior women faculty chose not to have children in order to be scientists.

5. Most gender bias is unconscious, and it can be practiced by both men and women.

6. Gender bias can be difficult to identify in the individual case. It becomes apparent in the aggregate, where a pattern of differential treatment can emerge.

New Initiatives to Ensure Equity for Faculty and to Address the Under-representation of Women and Minorities on the Faculty

Since we know now that unconscious bias can lead to inequalities in the distribution of resources and compensations to women vs. men, last year Vest and Brown, in consultation with the Deans, established Committees on the Status of Women Faculty in all five Schools of MIT. Patterned after the highly effective first and second Committees on the Status of Women Faculty in Science, but also uniquely tailored to the culture of each School, the five committees consist of tenured female and male faculty. The committees are conducting interviews with faculty and department heads in their respective

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schools to identify areas of particular concern to women faculty, and working closely with their respective Deans to collect and review data pertaining to the status of women faculty. Reports from these committees are expected to be completed during this academic year. The chairs of the five school committees meet regularly with Provost Brown and Chair of the Faculty Steve Lerman to discuss the ongoing work. The goal of the Committees is ultimately to establish permanent mechanisms that will ensure equity for all faculty in terms of resources and compensations, committee assignments and leadership roles within their departments and the Institute.

While the School Committees are a critical part of the solution to the problems documented in the MIT Report, and while they are already playing an important role in raising awareness of important issues, as President Vest has noted, "fixing inequities is the easy part of the solution." Like the School of Science Committee before them, these committees are charged primarily with addressing the symptoms of a problem rather than its underlying causes. How does one address the underlying causes of the problem and institutionalize changes that will ultimately remove them? Specifically, how does one prevent the marginalization of women faculty, stop the leaky pipeline for women students, and reverse the processes that seem to almost invariably exclude women from leadership roles, particularly in science and engineering? Also critical will be to study mechanisms to further reduce family-work conflicts for both women and men faculty, but particularly for

women, many of whom still shoulder a greater share of family responsibilities and hence do not operate on a level playing field at work.

In considering how to address these complex issues, President Vest and Provost Brown have chosen to establish a Council on Faculty Diversity. The council mechanism, which has been used previously during Vest's administration, brings highly knowledgeable faculty together with administrators who have

important area.

The Council on Faculty Diversity will begin to meet within the next few weeks. It will begin by dissecting and then addressing the issues listed above for women faculty, as well as issues for minority faculty. The latter include pipeline, retention, quality of life, the racial climate of the city as it impacts hiring, and others to be determined with additional input from minority faculty. The goal of the Council will be

In considering how to address these complex issues, President Vest and Provost Brown have chosen to establish a Council on Faculty Diversity. . . .It was immediately apparent that the Council should address the under-representation of both women faculty, including specifically minority women, and minority faculty. . . .In addition, an important new Task Force was established by Vest this year to address specific issues for minority undergraduates. Together, the two efforts will bring new energy to this critically important area.

the capability to devise mechanisms for institutional change.

It was immediately apparent that the Council should address the under-representation of both women faculty, including specifically minority women, and minority faculty. Although there are different issues for the groups, there are also common ones, and moving forward together should provide an infusion of new ideas that could benefit all the efforts. In addition, an important new Task Force was established by Vest this year to address specific issues for minority undergraduates. Together, the two efforts will bring new energy to this critically

to devise solutions, execute them, and review them regularly to assess effectiveness. As ideas and programs are developed, we will continue to report on them through this newsletter.

Broader Significance of the Council on Faculty Diversity

When Civil Rights and Affirmative Action opened the doors of the academy to women and minorities, many thought that the number of women and minorities on the faculty would soon rise to reflect those of the students being trained. Despite progress, when one looks at the faculty, particularly in the fields of science and

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engineering, clearly this has not happened. Furthermore, efforts that produced progress in the past, seem to have stalled. In addition, we see brilliant women and minority students leave the academic profession disproportionately.

The MIT Report described two major issues that impact the status of women faculty and the quality of their professional lives, and it is highly likely that these issues contribute to the under-representation of women in science and engineering. The first, to many people's surprise, was gender bias. The second, less surprisingly perhaps, stems from the fact that the jobs women were hired into had been designed in another era for a man with a full-time wife at home. Despite many adjustments to the work place, the playing field is not yet level for most women who wish to have a family and a

career. Nor is work-family balance as easy for young men in academics as it used to be, since many of them are part of a two-career family.

Women have known for decades that gender discrimination and inequality in family-work balance probably drive many women out of science and other demanding professions and prevent them from rising to the top. But it took women going through the system for 20-30 years to arrive at positions from which they could begin to re-shape the professions to make them as compatible for women as they have traditionally been for men. I believe the national resonance of the MIT Report among professional women reflects the fact that professional women everywhere have arrived at the same truth, and the realization that it is time for change. I believe the

Council on Faculty Diversity is poised to contribute significantly in this area and thus help to complete the unfinished work of civil rights and women's liberation. These are hard problems, because they require changing social systems that have existed for decades. But what better place to tackle hard problems than MIT.

Recently, while discussing the difficult problem of marginalization of women faculty with Provost Brown, I noted that some days I feel this problem is so hard that I question if we can really impact it in my lifetime. The Provost's reply was the one that convinced me to agree to co-chair, with him and Associate Provost Phil Clay, the Council on Faculty Diversity: "*But Nancy,*" he said, looking quite taken aback. "*This is MIT. We're engineers. Engineers solve problems.*" Stay tuned.♣

[Nancy Hopkins can be reached at nhopkins@mit.edu]

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M.I.T. Numbers

Faculty Members (as of 10/31/99)

There are 931 faculty members (professors of all ranks), including 144 women, 15 of whom are members of U.S. minority groups.* One hundred six men on the faculty are members of U.S. minority groups.** The Institute's total teaching staff for 1999-2000 of more than 1,500 individuals (excluding visiting appointments) includes:

Professors	584
Associate Professors	178
Assistant Professors	169
Senior Lecturers, Lecturers, and Professors Emeriti	423
Instructors***	102
Adjunct Faculty	6
Teaching Assistants and Graduate Instructors	706

*Five Asian Americans, 6 African Americans, 3 Hispanic Americans, and 1 Native American.

**Seventy-two Asian Americans, 19 African Americans, and 15 Hispanic Americans.

***Includes Technical Instructors.

Source: MIT Facts 2000

Science and Poetry: Suggested Readings

John Hildebidle

Some months ago, in these pages, I argued that Science and the “Humane” art of poetry are in fact congruent activities. I mean now, and perhaps belatedly, to offer some data by which that conclusion might be tested, and (typically, for a teacher of literature) to offer a list of “suggested readings.”

The first is an anthology, edited by Cambridge poet Kurt Brown and published by Milkweed Editions of Minneapolis. Its title offers the key: *Verse and Universe: Poems About Science and Mathematics*. Brown construes that “about” broadly, it must be admitted. He might have taken, as his epigraph, one of the assertions I quoted here: “Both science and art have the habit of waking us up, turning on the lights, grabbing us by the collar and saying *Would you please pay attention!*” (Diane Ackerman). But instead, Kurt Brown invokes, as tutelary spirits Edward Abbey (“Any good poet, in our age at least, must begin with the scientific view of the world, and any scientist worth listening to must be something of a poet.”) and George Steiner (“The notion that one can exercise a rational literacy in the latter part of the twentieth century without a knowledge of calculus, without some preliminary access to topology or algebraic analysis, will soon seem a bizarre anachronism.”). Lest it be thought that Brown dips into the lower ranks of poets, the table of contents contains such names as Charles Simic, Albert Goldbarth, A. R. Ammons, Howard Nemerov, Forrest Gander, Jorie Graham, John Updike, William Stafford, and Billy Collins. The titles are a delight: “This Is Your Geode Talking,” “The Possible Advantages of the Expendable Multitudes,” “Somebody Ought to Write a Poem for Ptolemy,” “The Leaves of a Dream Are the Leaves of an Onion,” “The Monkish Mind of the Speculative Physicist,” “The Sciences Sing a Lullaby.” And, perhaps my favorite, because I haven’t a clue what it means: “The 9 + 2 Roseate Anatomy of Microtubules.”

Not that all the poems are arcane, however – consider this one, by Howard Nemerov:

MOMENT

*Now, starflake frozen on the windowpane
All of a winter night, the open hearth
Blazing beyond Andromeda, the sea-
Anemone and the downwind seed, O moment
Hastening, halting in a clockwise dust,
The time in all the hospitals is now,
Under the arc-lights where the sentry walks*

*His lonely wall it never moves from now,
The crying in the cell is also now,
And now is quiet in the tomb as now
Explodes inside the sun, and it is now
In the saddle of space, where argosies of dust
Sail outward blazing, and the mind of God,
The flash across the gap of being, thinks
In the instant absence of forever: now*

And the volume, having wandered through physics, biology, Boolean algebra, fractals, “The Anthropic Cosmological Principle,” “Genetic Sequence,” “Astrophysicists,” “Chaos Theory,” and many another subject about which my MIT students could and no doubt should educate me, ends rather poignantly:

THE MATHEMATICIAN’S DISCLAIMER

*What I would give for a clear field
of vision, to rid myself of the crippling
disorder of my desk, my only child
standing before my wife, the wild
grass growing slowly over my shoetops.
I have given my life to numbers, and these
numbers, in return, have given me a life
I cannot control. But that is all
beside the point. Nothing is really solved;
as the photograph resolves in its pan,
the plan to map the path of the sun
cannot be won. What a relief to know
that if my days are numbered I have numbered
them myself, the pleasure of the music
of my life is not left in the clock, nor
the tock of the metronome, but in the moment
between moments, the measure left unmeasured.*

(Ira Sadoff)

A former student of mine, now a professor of computer science and other applied mathematics, observes about this poem that it limns the dilemma of almost any creative person, full of a conviction of the value of his/her enterprise, and as well of the impossibility, or at least improbability, of achieving breakthroughs, given the distinguished other workers in the field, past and present. Maybe, as I have long suspected, the “two cultures” are not so distinct as the common mythology would have it. Or, as Marge Piercy has

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Science and Poetry: Suggested Readings

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said, “There are no poetic subjects, only subjects to which we pay the right kind of attention.”

My second set of test cases, also from Milkweed, and (as it happens) edited by Brown’s wife, Laure Anne Bosselaar, is entitled *Urban Nature: Poems About Wildlife in the City*. This collection is at once broader and more sharply-focused. A sample of titles will demonstrate the former quality: “Pigeons,” “The Cabbage Butterfly,” “The Taxidermist at the Zoo,” “Watching Ants Play Soccer in Central Park,” “A Diver for the NYPD Talks to His Girlfriend.” Such an assortment of observers, and such an assortment of things observed. As Emily Hiestand observes, in a lucid and informed prefatory essay to the volume, “Ideas about nature are famously malleable. . . . The word ‘nature’ can mean ‘everything that is,’ . . . Just as often ‘nature’ is used in contradistinction to ‘culture.’” I like to challenge my students to write an adequate definition of the word, usually just before we take up Wordsworth (I do the same with *love* as we are about to take up Shakespeare’s sonnets). The results are always fascinating.

As the first poem in the anthology wittily reminds us, “nature” is omnipresent in our urban lives, and even in our contemporary idiom – “it’s a jungle out there,” as we are given to saying. But if the poems in this anthology necessarily range widely, they also pay close attention to detail (like that cabbage moth or the soccer-playing ants). And how rewardingly they help us do so, as when Larry Levis observes “The Oldest Living Thing in L.A.”:

*At Wilshire & Santa Monica I saw an opossum
Trying to cross the street. It was late, the street
Was brightly lit, the opossum would take
A few steps forward, then back away from the breath
Of moving traffic. People coming out of the bars
Would approach, as if to help it somehow.
It would lift its black lips & show them
The reddened gums, the long rows of incisors,
Teeth that went all the way back beyond
The flames of Troy & Carthage, beyond sheep
Grazing rock-strewn hills, fragments of ruins
In the grass at San Vitale. It would back away
Delicately & smoothly, stepping carefully
As it always had. It could mangle someone’s hand
In twenty seconds. Mangle it for good. It could
Sever it completely from the wrist in forty.
There was nothing to be done for it. Someone
Or other probably called the LAPD, who then*

*Called Animal Control, who woke a driver, who
Then dressed in mailed gloves, the kind of thing
Small knights once wore into battle, who gathered
Together his pole with a noose on the end,
A light steel net to snare it with, someone who hoped
The thing would have vanished by the time he got there.
(P. 240)*

Or this unexpected epiphany, recorded by Bruce Berger:

SILVER-PACED

*Every weekday morning heading east
Onto the bridge’s six lanes
Of bored connivers at the wheel,
Steeped in exhaust,
Aware he must head back
Among the bridge’s six opposing lanes
Gridlocked before dark,
Upholstered and encased, he still can feel
How ropes of iron soar to a peak, then swoop
As he nears the central span,
Least girded spot between his sedan
And water, twice-daily terror
That gapes through his entrails; while overhead,
On top of the oncoming tower,
Peregrines – long-driven away
From this stretch by the species that makes –
Have laid four eggs in a box
Put up by the makers. From its rim they stoop
Headlong at gulls and orioles, prey
That trusts to sheerest air, like them.
Talons snug in stunned meat, they speed
To their pinnacle of steel,
Their new home.*

It is a mixed moment – but are not such encounters with the (possibly) sublime often so – remember the shepherds who were “sore afraid.” As it happens, I had a remarkably parallel experience one morning on my way from the T to Building 14, when I (and other passers-by) encountered some variety of hawk on the railing of a fire escape at East Campus:

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Science and Poetry: Suggested Readings

Hildebidle, from preceding page

AT FIRST I WAS SURE IT WAS STUFFED

<life is what happens while you're making other plans. John Lennon>

or one of those plastic "keep the squirrels out of your strawberries" owls you can pick up cheap at Home Depot. Perched on a fire-escape, at the end of a dormitory hallway – hardly Mutual of Omaha's Wild Kingdom, where one imagines such creatures ruling.

Then it moved, slowly, grandly, just its head, surveying what it clearly took to be its own well-merited kingdom. Peasants – well, all right, students and researchers, stopped in their tracks en route to some dreary lab –

could only peer in amazement and ignorance. A hawk, surely. Too small, too broad in the girth to be a peregrine. Too hefty, too cream-breasted, I thought, to be a red-tail, although, perversely, they favor this urban terrain.

Not so much a rare bird as a bird rarely, magnificently placed. Proof, if it were needed, that what is will fool you, every time.

But I let my own ego urge me into digression; Bosselaar's collection, having begun with an ironical rebuttal of the idea of the unnaturalness of the urban landscape, ends with what seems like a dark prophecy of "The End of Civilization As We Know It." But that poem too has a punch line, recounting as it does the state of monkeys taken to Florida to help make Tarzan films, now left bemoaning – praying, indeed – "Tarzan! Tarzan! Why has thou forsaken us?" (P. 244).

One more recommendation, of a book by a card-carrying teacher of science but an unabashed devotee of poetry, as well. Finding myself, somewhat quizzically, as a teacher of the Humanities at what announces itself as the Finest Technological School in the known universe, I turn regularly to Chet Raymo's column, "Science Musings," in *The Boston Globe*. One column in particular – it must be more than five years old, by now, I regularly xerox and distribute at the first meeting of any class devoted to the study of poetry. Its title presents its argument, pithily: "A little poetry with the facts, Ma'am." Raymo, as it happens, teaches physics and astronomy at a small college in exurban Boston. But he is also an avid and voracious reader. Preparing for this review, I made a quick list of the "authorities" Raymo cites. Rilke, Emerson, Thoreau (repeatedly), Mary Oliver (a particular favorite of his), Merton, Tielhard, Dylan Thomas, Updike, Ruskin, Lewis Thomas, E.

O. Wilson, the propounders of the so-called "Gaia Hypothesis," Thomas Huxley, Virginia Woolf, Darwin, Gary Snyder – that only in about the first third of the book, at which point I let myself sit back and just *read*. I inflict the list on you now not just to demonstrate my diligence, but to represent the pure *reach* of these witty, low-key, meditative essays.

Or perhaps one should say *homilies*. The title is misleading – this is no sort of devotional guide, in the customary sense (although Raymo does admit to a Catholic rearing). Late on, spinning a tale about an obscure Irish naturalist named Robert Lloyd Praeger, Raymo remarks that "[h]is account of his travels . . . affirms the value of 'stopping often, watching closely, listening carefully' – in short, what I have called her natural prayer." To that brief catalog of necessary virtues should be added one more – thinking subtly and meditatively.

I proposed the label "homily" for these essays, and like any good homily, these pieces "open" a text. As it happens, the text comes from the poet Mary Oliver, not the Gospels or the Psalms. It forms the first sentence of the first essay: "To pay attention, that is our endless and proper work." That paying of attention does lead Raymo to a sort of belief – in the fundamental and rich interdependence of things. He worries about the perception of science as a disassembler, a work of destroying rather than enhancing and enriching the whole. He cannot help but ponder large issues – the origin of life, the origin of the universe [one of his most delightful propositions is a variation on the Big Bang, namely "the Big Sneeze"], the issue of animal rights. Near the end of the book, he finally reaches what he offers as the Largest Philosophical Issue of Our Time – "What is a weed?" He knows he is being jocular, but (in the spirit of the best comedy) the joke leads to a serious consideration of the ethics of being human.

To me, the best thing that can be said about this utterly admirable and enlivening book is that it compels the intense desire to re-read it, and to experience once again the particular pleasure to be found in the best writing of Lewis Thomas, John McPhee, and Stephen J. Gould – the possibility of learning while feeling delight. And my polemical intent in urging all three of these volumes on my colleagues is to seduce them into a fuller and richer understanding of the way that thinking, be it in pure Math, Chem E, the sonnet, the personal essay – that thinking is, at a fundamental level, thoughtful in much the same way, despite wide variations in terminology.♣

[John Hildebidle can be reached at jjhildeb@mit.edu]

From The Libraries

Document Services Developing Extensive Collection of Digital Theses

Ruth K. Seidman

MIT's Digital Library of Theses is by far the largest such online collection in any university. Currently it contains over 4,600 theses. The collection has been created by scanning original theses when copies are requested within the Institute or from outside, and by a pilot project, now an ongoing service of the Libraries, through which students submit electronic copies of their theses.

In 1998, a group of staff from the Libraries and from Information Systems, with the support of the Laboratory for Computer Science, proposed an e-thesis project to the Committee on Graduate School Policy. This was approved and was implemented by the Libraries Document Services department as a pilot project with three academic departments: Brain and Cognitive Sciences, Chemical Engineering, and Electrical Engineering and Computer Science. The project began with the theses of doctoral students for February 1999 degrees.

This was an optional program, run in parallel with the existing paper-based procedure. Those participating submitted their theses in electronic format, with one rather than two paper copies going to the Libraries. The "official" copy still remained the paper document held by the MIT Archives; an electronic version then became available for online viewing. To submit the thesis, the student was asked to render the document in Adobe Portable Document Format (PDF), then to visit the secure e-thesis Website and fill out information about the thesis on a

Web form. The PDF document was then uploaded to the digital library server. Today the e-thesis option is open to all graduate students, for masters as well as doctoral degrees, and in all academic departments.

The pilot project was successful in adding to the valuable database of MIT e-theses, and it was successful as a learning experience that is helping the Libraries to understand the technical barriers to the full success of the program.

What were the lessons learned?

First, on the technical side, for those theses not written with standard word processing software, there is difficulty converting the file into PDF format. About half of the MIT theses submitted use software such as LaTeX which does not convert readily to PDF; this constitutes a significant limitation.

Keith Glavash, head, Document Services, indicates that the Networked Digital Library of Theses and Dissertations (NDLTD), a national program that MIT joined in January, 2000, is working on the conversion problem, and he believes that ultimately a solution will be developed. Most likely, in the future there will be choices, either to convert to PDF or to convert to a mark-up language such as XML.

In the meantime, the MIT Libraries are going ahead with those theses that can be readily accepted with the technology available. In addition, the Libraries are about to start a new project that involves scanning groups of new theses. The plan is to do this for some disciplines for which theses are in

particularly high demand, such as computer science and biotechnology. Ultimately, the Libraries would like to scan all new MIT doctoral theses that have not already been submitted by students; Document Services is working to find a way to make this happen.

A second barrier to full-scale implementation of e-theses, discovered in the pilot phase, is that there was little motivation for the student to submit an electronic copy of the thesis. It was not a requirement, and it appeared to be time-consuming. In the final stages of thesis submittal, the student generally does not want to do anything that will add time or complexity to the process – understandably, he or she just wants to finish.

What are the advantages of submitting the thesis electronically? The result is a higher quality product because it is a direct digital rendering, not a re-formatting that takes place through scanning. Another advantage is that the thesis can be made available more quickly.

Glavash asks that faculty encourage both masters and doctoral students to consider submitting electronic copies of their theses. Guidance on whether or not this is feasible in a particular case can be found at the Website: "Submitting an Electronic Thesis at MIT" <<http://web.mit.edu/etheses-home.html>>. For those who want to see what e-theses are currently available, see the Website "MIT Theses Online" <<http://theses.mit.edu>>.♣

[Ruth K. Seidman can be reached at rks@mit.edu]

Student Leaders Report

Undergraduate Association

Student Space: Personal and Academic

Peter Shulman

Ask any student, faculty member, or administrator what is considered the most valuable commodity at the Institute, and you are almost guaranteed to hear “space” as a response. Space to work, to play, to study, to experiment, to store, to claim as “personal”; no one has enough. It is this last use of space that is most problematic, “personal.” What constitutes personal space? What makes it effective? How much is needed, for whom, and at what expense? I want to call attention to the central importance of personal space for both students and faculty at the Institute, and make a plea for an increased commitment to ensuring its existence.

Right now, the Institute is moving into a period of construction unique in its history. With ground already ceremonially broken for the new Zesiger Sports and Fitness Center, work underway on the new Simmons Hall Undergraduate Residence, and crews constructing the lower levels of the Stata Center, every member of the MIT community is more conscious of space (or lack thereof) issues. In conjunction with these exciting building projects, the influx of funds into the Capital Campaign and other large grants, such as the Microsoft I-Campus and d’Arbeloff gifts, have allowed unprecedented use of experimental teaching and learning projects.

But these projects need space, and it’s still hard to come by.

Several general kinds of spaces exist at the Institute; it is not hard to identify libraries as distinct from dining halls and laboratories as distinct from athletics facilities. Each space engenders its own atmosphere, rules of behavior, and population. But while the same student might use these spaces radically differently, all may at some point be considered “personal,” space that is safe, comfortable, and to which one bears a loyalty.

As noted in the *President’s Task Force on Student Life and Learning*, MIT students have a strong loyalty to their residence groups, be it dormitories, fraternities, sororities, or independent living groups. But this loyalty is but a subset of a greater tendency to develop connections with any space that can be claimed as “personal.” In order to successfully navigate through four years of an MIT

(Continued on next page)

Graduate Student Council

Pressing Issues for Graduate Students

Soulaymane Kachani

Over the past five years, the cost of living for MIT students has increased dramatically. Stipends, however, have not. We are now in a situation where graduate students can barely break even at the end of each month, simply after paying for rent and feeding.

The Institute is being made aware of this problem. Recently, the MIT senior administration has been trying to address this issue. For example, the approval of construction for the NW30 and the Sydney-Pacific dormitories will remove some of the pressure on the tight Cambridge and Somerville housing markets and will provide nearly 900 graduate students opportunities for more affordable housing close to campus.

However, the financial loss of the current MIT housing system is a burden that the administration is no longer ready to carry. Executive Vice President Curry and Chancellor Bacow are working towards achieving self-sustainability of the housing system. The plan is to increase on-campus rents by as much as five percent a year for the next five years. Compounding this increase over the five years will constitute a significant chunk of the graduate students’ stipend.

Then, there is the cost of feeding. The price of meals in the MIT dining system (Lobdell, Networks, and Walker) have reached levels higher than neighboring cafes and restaurants (Au Bon Pain, Rebecca’s, Thailand Cafe). Given that graduate students spend a large part of their time on campus, and dine in the nearest available facilities (i.e., the Lobdells and the Rebeccas), another significant part of the stipend is spent feeding on campus. Deducting the rent and the cost of meals leaves very little or nothing in terms of pocket money for purchasing study items (text books, stationery, etc.) and for entertainment.

Other schools similar to MIT, like Stanford and Northwestern, for example, offer significantly higher stipends not only to adequately cover for rent and feeding but also to leave behind more “pocket money” for students. This very stark contrast makes it harder for MIT to attract the best and brightest graduate students.

The MIT Graduate Student Council (GSC) is advocating an increase in stipend rates. As part of this increase, our

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Student Space: Personal and Academic

Shulman, from preceding page

education, developing a comfort with particular areas of the Institute is critical.

I would like to officially contest the claim, often made of MIT students, that undergraduates object to any change at the Institute affecting the “way things were when we arrived as freshmen.” This is a claim thrown about regarding the negative (as an understatement) student response to the 2002 changes to the residence system, summer alterations to the Student Center Coffeehouse, and the camping protests protecting “the Dot,” or McDermott Circle, last spring from the threat of years of pavement. These changes were indeed contested. But characterizing students’ responses as overwhelmingly conservative or reactionary ignores the positions taken by students applauding changes at the Institute. For this, consider the powerfully positive student positions on the Zesiger Center, the Student Street in the Stata Center, and construction of the CopyTech branch in the Student Center.

I suggest instead, that student response is a function of personal investment in space.

Among the exciting new programs funded through the I-Campus and d’Arbeloff initiatives is Professor John Belcher’s “Teaching Enabled Active Learning,” or TEAL project. Leaving the exciting details of this project aside (which utilize a radical new form of teaching space and educational dynamic to more effectively teach freshman physics), let us focus instead on the particular logistical-space issue involved. After reviewing the few even potential spaces for this project (two 3,000 square foot classrooms are needed) it was determined the most promising location would be the

Student Center Fifth Floor Reading Room. In return for its classroom use several hours each day, the room would be entirely renovated, and its continued use as a study space during the majority of the day would be ensured.

Student response has been mixed, though ranging from mostly ambivalent to strongly against the encroachment of academic space into the Student Center. Lest you respond with, “But isn’t the fifth floor reading room already academic space?” I will

It is the construction of personal space, mentally and not physically, that invests members of the MIT community in the world around them.

parry with, “Yes, but it is space that already hundreds of students have staked as personal.” More clearly, finding a space to work is not always easy at the Institute. Some students need the silence of the several libraries, some in their rooms (and living groups), some in the reading room. Many students have favorite Athena clusters, not because of the quality of computers (they are mostly comparable) but because the space of that cluster is associated with working, and is comfortable, it becomes personal space.

It is the construction of personal space, mentally and not physically, that invests members of the MIT community in the world around them.

In the case of the TEAL project, a student-held conception of space that distances “classroom” from personal space needed for study hinders student acceptance of this initiative in its

suggested location. I heard of a student who will not attend LSC films, despite their wide spectrum of movie choices and low prices, simply because she cannot associate 26-100, a large lecture hall seen by most if not all freshmen, with “fun,” only academics. This may sound silly, but it is a specific case of the general construction of space and personal space here at MIT.

The Task Force addresses the notion of space with an eye towards community interaction: “All programs aimed at bringing faculty and students together over academics, research, and community activities will ultimately fail if there are not enough attractive spaces for such interactions to occur.” But the Task Force does not go far enough; the Fifth Floor Reading Room may indeed be the ideal temporary space for the TEAL classrooms (until the new Teaching and Learning Center is constructed), but what must be ensured in the change is that the new space can quickly become once again, personal.

In this regard, we as a community face a more challenging task: the alteration of traditional classroom space to personal space. As the Task Force calls for a greater intertwining of life and learning, utilizing dining halls and residences for educational purposes, we must not forget the opposite goal, utilizing traditional academic space for recreation and personal growth. Eventually, we may see these traditional categories of “academic” and “personal” break down, in favor simply of “space,” but until then, we must actively work both to understand the need for personal space and to create space that may be used personally.♣

[Peter Shulman can be reached at skip@mit.edu]

Pressing Issues for Graduate Students

Kachani, from Page 21

number one priority is to achieve coverage of MIT health insurance for all graduate students. Other peer institutions already offer this benefit to their students. Up to 20–30 percent of research grants can help cover medical insurance and decrease the cost for MIT.

Medical insurance coverage and stipend increase are actively endorsed by Dr. Isaac M. Colbert, dean for Graduate Students, and Dr. Larry Benedict, dean for Student Life.

The current situation is critical and requires firm action. A lot of courage is required on the part of the faculty and the senior administration to approve the above issues. This will prove your genuine concern for caring about the quality of life of graduate students. It will also ease the problems of recruiting

talented students. Please help us achieve this goal.

Recently, the GSC passed a Funding Policy resolution and passed it on to the faculty. If approved by the faculty, this resolution will require graduate students who receive funding from a research advisor to meet with their advisor, once a term, before TA application deadlines, to discuss their funding situation. At the meeting, the advisor would complete a form indicating if he/she is/not going to fund the student for the following term or if he/she is not sure about it. This latter situation may occur when a faculty member is not sure of a funding source or when he/she is not totally satisfied with the performance of the student and requires some tasks

to be accomplished before the term ends.

Several departments, like Material Sciences and Engineering and Mechanical Engineering require such meetings every semester. These meetings, in addition, pave the way for dialogue between the graduate students and their advisors about funding and other relevant issues. In case there is no funding available or there is a doubt, students can duly look for other research opportunities or apply for teaching assistantship positions in time.

Please help support this resolution as it will definitely contribute to a healthy research experience.✦

[Soulaymane Kachani can be reached at kachani@mit.edu]

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M.I.T. Numbers

Graduate Student Enrollment

	<u>Master</u>	<u>Doctoral</u>	<u>Special</u>
Architecture and Planning	358	184	11
Engineering	1,408	1,096	50
Humanities and Social Science	21	290	4
Management	788	119	14
Science	31	935	8
Whitaker College	5	276*	10
CAES			64

TOTAL Graduate Enrollment

5,672

*This number includes 181 students working on Harvard degrees.

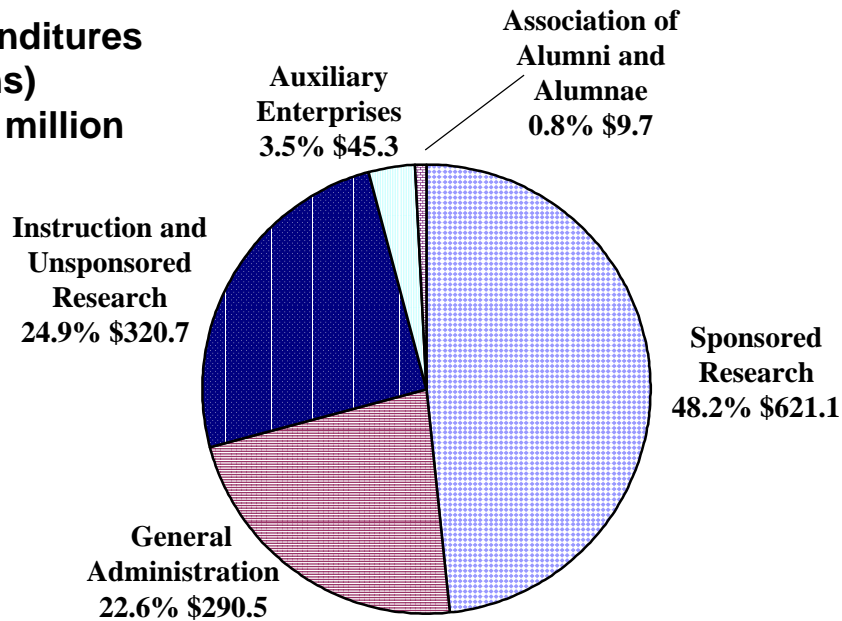
Women have attended MIT since 1871. In 1999-2000, there are 1,519 women enrolled as graduate students (27 percent). United States minority groups are represented by 673 graduate students (12 percent):

Native American	6
Asian American	464
African American	100
Hispanic	103

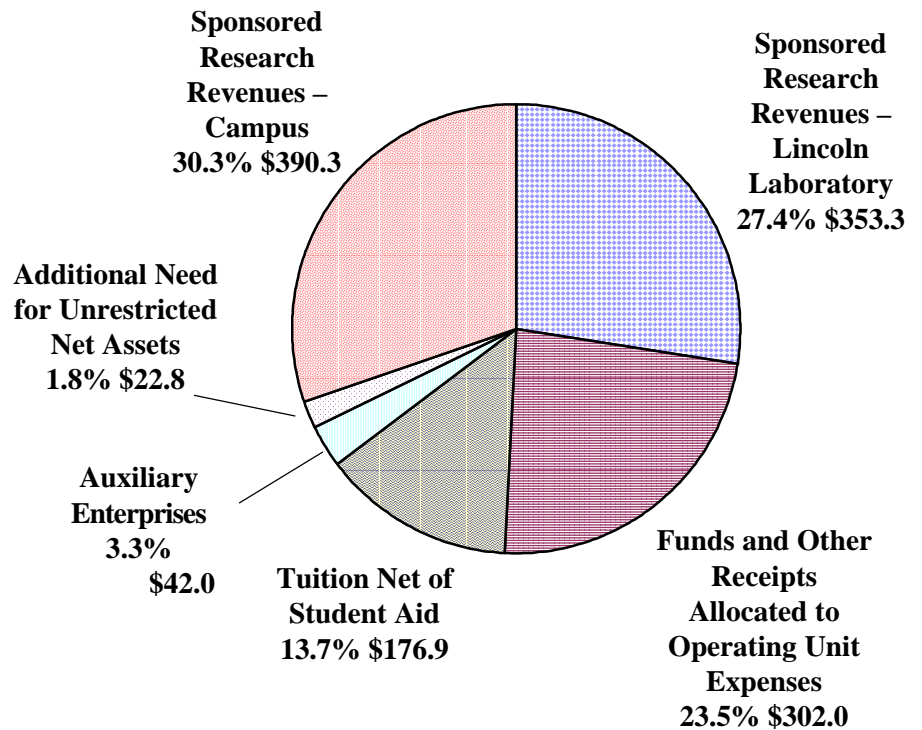
Source: *MIT Facts 2000*

M.I.T. Numbers Financial Data Fiscal 1999

**Operating Expenditures
(in millions)
Total: \$1,287.3 million**



**Revenues and Funds Used
(in millions)
Total: \$1,287.3 million**



Source: MIT Facts 2000