

MIT Faculty Newsletter

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

in this issue we offer an update on the Educational Commons Subcommittee (page 6); “Darwin Bicentennial Events Planned at MIT,” by Jonathan King (page 11); “What is the Global Education and Career Development Center,” by Dan Hastings (page 12); and announcement of the MISTI Global Seed Funds (page 16).



Problems in Evaluating Four-Year Colleges

Les Perelman

RECENT PROPOSALS BY THE federal Spellings Commission to use standardized tests to evaluate four-year college educations have sparked controversy. [See, for example, “Spellings Commission on the Future of Higher Education Hints at National Standardized Testing for Universities,” *MIT Faculty Newsletter*, March/April 2008.] The Commission’s intent was to produce one or two numbers that purportedly would measure an institution’s “value added” in educating its students. They regarded such numbers as potentially analogous to the EPA gas mileage numbers on new car stickers; they both attempt to make it easy for consumers to comparison-shop.

The National Association of State Universities and Land-Grant Colleges (NASULGC) tried to head off this effort

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MIT’s New Supercomputing Network

Mark Silis, Piedad Valencia

HOW LONG DO YOU THINK it would take to download 10 full-length, high-definition movies from the Internet? Well, it could take you an hour, several hours, maybe even several days, depending on your type of network connection and its bandwidth. But if you had access to one of today’s high-speed supercomputing networks, it would take you only 30 seconds.

The MIT Regional Optical Network is one such supercomputing network. This all-optical network provides connectivity to key Internet exchange points at speeds of 10 Gbps and beyond, making it one of the world’s largest and fastest institutional networks for global research and collaboration.

In its simplest terms, the MIT Regional Optical Network is a computer network comprised of network infra-

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Editorial Silence of the Lions

AS THE U.S. PRESIDENTIAL CAMPAIGN heads into its final weeks, we have been disturbed *and* disappointed that neither candidate has adequately addressed the future role of science and technology. Critical driving forces in the social and economic development of all nations, science and technology also play major roles in international competitiveness.

Perhaps even more surprising and disappointing has been the lack of effort by national research universities such as MIT to bring this issue to the awareness of the candidates, as well as to the public at large.

The Importance of Science and Technology

After World War II the United States correctly recognized the importance of science and technology, not only in

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Silence of the Lions
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national defense, but also as a major contributing factor to the economic development and competitiveness of the nation. This recognition came at a time when many other countries considered science and technology – especially science – as curiosities that should be left to those in academia or luxuries in which many developing countries could not afford to invest.

Over the past few decades we have seen the wisdom of that decision, and both the tremendous benefit that it has brought to the U.S. economy and its contribution to U.S. military security. Further evidence of the rewards from supporting science and technology include America's leadership in information and telecommunication technology, biotechnology, aviation, pharmaceutical advances, and agriculture, to name a few.

During the two decades following the War, the U.S. government not only committed a relatively significant percentage of its Gross National Product (GNP) to research and development (R&D), but most importantly recognized the value of developing and educating the human capital necessary to promoting advanced scientific discovery and technological growth. Thus, the mechanisms necessary for meeting this dual objective – human and technological – were set in place.

Examples of this continued strategic success include sponsored research programs at the university level where not only science and technology are being developed, but future scientists and engineers are being educated, as well. The development of the NSF, DARPA, and the NIH are further examples of the success of this strategy. As a result, the U.S. has been able to develop a very large cadre of highly educated scientists and engineers.

Over the past two decades, many other advanced economies have replicated the U.S. model for success. Recently even many emerging economies such as those of China, India, and Brazil are expanding their R&D sectors and increasing the level of their financial commitment to science and technology. Although the gap between the U.S. and many of these countries is still very wide due to a lack of sufficient investment, the gap is being closed in some respects rather rapidly. (See, for

tional institutions such as MIT, which hold large stakes in this domain. Science and technology-based universities have not forcefully articulated the importance of R&D, nor fostered public awareness of the need for our political parties to address this major global responsibility of the U.S. Indeed, it is incumbent upon our major research universities to provide guidance in the public discourse concerning future policies regarding science and technology.

The *Faculty Newsletter* Editorial Board has concluded that a special issue of the FNL will be devoted to providing a forum to address these issues and to articulate clear strategies for the development of science and technology in the twenty-first century.

example, "Innovation in Global Industries: U.S. Firms Competing in a New World," published by the National Research Council [www.nap.edu/catalog/12112.html]).

But times have changed. Investment in science and technology is no longer solely an investment in national economy or national defense. The development of science and technology has become an issue of global common interest, requiring the leadership of the United States to rally other nations to develop global systems of science and technology R&D. To some extent, elements of this global system are already in place, as exemplified by space stations, accelerators established in Europe, concern over global warming, water, agriculture, and many other issues.

This evolution of the globalization of science and technology behooves the current U.S. Presidential candidates to articulate their vision and their strategies toward them. But as mentioned above, the candidates have been virtually silent on these issues, as have the educa-

Given the importance of this topic and the fact that major educational institutions have been silent so far, we strongly urge the MIT administration to take a major lead in developing public awareness of the issue, as well as in working with the candidates' staffs to develop future strategy for this neglected, but critical activity. The *Faculty Newsletter* Editorial Board has concluded that a special issue of the FNL will be devoted to providing a forum to address these issues and to articulate clear strategies for the development of science and technology in the twenty-first century.

We applaud President Hockfield's decision to make renewable energy one of the main thrusts of MIT's research focus. We also need to go beyond this by developing a united front among major research universities in order to meet our commitment to society to develop public awareness and guide future research. President Hockfield's recent Congressional testimony was a significant step in that direction. ■

Editorial Sub-Committee

From The Faculty Chair Agenda Items: New and Old

Bish Sanyal

IT IS INTRIGUING HOW the beginning of a new academic year still evokes in me a sense of excitement mixed with apprehension. Every fall I look forward to meeting new students and faculty, hoping that the freshness of their ideas will blow away the staleness of old ways of thinking accumulated over the years.

As I write this in mid-August, cherishing the remains of the summer even as I get ready for the academic year 2008-2009, it seems worthwhile to refocus our attention on agenda items that would enhance the learning environment we call MIT. I have two such initiatives in mind.

The first pertains to an old but central issue in academia: promotion and tenure. The second addresses a relatively new trend, influenced by the spread of information technology: how to ensure that the knowledge we produce is disseminated widely and on time for scholarly deliberations. Both initiatives will be faculty-led, and hence will require your active involvement.

First, the old challenge: Can we improve the transparency of the promotion and tenure process at MIT? Some may argue that MIT's promotion and tenure processes have worked quite well. After all, nearly 88 percent of the faculty responding to the 2008 Faculty Quality of Life Survey were satisfied with the process. So, why bother to fix a system that seems to work well? Although a reasonable position, one also needs to consider that the survey also demonstrated that: 35 percent of MIT faculty do not think that the criteria for tenure are clearly communicated; 30 percent do not know how different aspects of faculty performance are weighted in their evaluation; 40 percent do not know how committee members

are selected for the review committee; 58.6 percent received no mentoring, and of those mentored only 54 percent found it useful; 35 percent are not aware of MIT's policies and procedures for promotions; and 62.7 percent do not know about MIT's grievance procedure regarding promotion and tenure decisions.

What are the best practices that the five Schools can learn from one another regarding how tenure and promotion cases are put together to ensure fairness, confidentiality, and efficient use of faculty time?

Put another way, even though "the system" is not broken, there may be room for some improvements that would make MIT more transparent. Moreover, if a review of the promotion and tenure process is conducted properly, with genuine curiosity and frank consultation with both junior and senior faculty, that process itself can have a positive impact on faculty morale, even if the review concludes that the current system works reasonably well.

Who should conduct such a review and what should be its scope? The Faculty Policy Committee (FPC), drawing on extended deliberations over the last academic year, came to the conclusion that a special task force should be created with equal representation from all five Schools and from both senior and junior faculty. As for the Committee's terms of reference, three issues emerged from their yearlong discussion. First: What are the best practices that the five Schools can learn from one another regarding how tenure and promotion cases are put together to ensure fairness, confidentiality, and efficient use of faculty time? FPC initiated a conversation on this question last fall, and

invited the deans of all five Schools to share their understanding of established procedures. It was a good beginning, confirming that there is enough accumulated experiences among the five Schools to be shared for mutual learning even if there may be some procedural variations due to disciplinary differences.

Second: What form of mentoring, by whom, and at what stage can make the tenure process more transparent to junior faculty members? This question may appear to be straightforward at first glance but, as I learned from my conversations with faculty last year, there are many elements to this question. For example, relatively new junior faculty members pointed out that what they needed most when they arrived at MIT was not advice about how to get tenure, but information on how to set up their labs quickly. Hence, at that stage, the person they need advice from is not a senior colleague, but rather an administrative officer who can help them procure the instruments necessary for experimentation – at a reasonable price and, most importantly, quickly.

The advising needs of the faculty evolve over time, and their knowledge of how the promotion and tenure process actually works can differ depending on who advises them. For example, by the time a promotion case is discussed at Academic Council, the faculty member whose case is being discussed should have had the opportunity to explain his or her academic

plan and intellectual trajectory not only to his or her department head but also to the dean of the School, as it's the dean who ultimately presents the tenure case to Academic Council. Some deans have already acknowledged the need for this change in the process; others need to be convinced that such procedural changes will not create additional time-consuming steps complicating the existing line of hierarchy by which information on candidates currently filters up.

The central question underlying this initiative is the following: How can scholarly publications of MIT faculty best be disseminated at a time of major changes in communication technologies, while still maintaining the structure and practices of the scholarly publishing industry?

The third question regarding promotion and tenure which emerged repeatedly in discussions with faculty last year: Is there a need to improve the process by which grievances related to promotion and tenure are currently addressed at MIT? As most faculty are not conversant with the intricacies of current process but are generally satisfied with the way the tenure system works, how important is it to scrutinize the grievance procedure? The FPC discussed this question last year and concluded that the issue is so important that it could be the sole agenda item for any review initiative. For the moment, I have included this issue in the terms of reference of the committee I have set up, but it will be up to that committee to decide whether it is so vital that it should be dealt with separately. I am sure that this will not be the only question the committee will need to decide at the outset, and the committee will have to decide what it can really accomplish by the end of this academic year.

Fortunately, I have been able to convince two outstanding faculty members to co-chair the committee and channel the deliberations: Professor Robert Silbey from the School of Science and Professor Thomas Kochan from the Sloan School have agreed to serve as co-chairs. Since

Tom will be the next chair of the faculty (2009-2011), he will provide continuity to the deliberations as they move from discussions of issues to the implementation of the recommendations.

The New Challenge

The second initiative I propose for 2008-2009 is a relatively new challenge. The central question underlying this initiative is the following: How can scholarly publications of MIT faculty best be dissemi-

nated at a time of major changes in communication technologies, while still maintaining the structure and practices of the scholarly publishing industry? Many faculty members have drawn my attention to these changes and their possible consequences. They urge that the MIT faculty should deliberate whether a new approach to dissemination of research is necessary, particularly in light of recent directives from the National Institutes of Health and foundations such as the Howard Hughes Medical Institute, both of which are concerned that such changes may impede rather than promote the rapid diffusion of scholarly research. You may remember that similar concerns led the Faculty of Arts and Sciences at Harvard in February 2008 to adopt a resolution stipulating that faculty authors grant copyright permission to the University to archive and distribute their articles openly, online, on their behalf.

Needless to say, MIT's response must be crafted with full awareness of our institutional particularities; also our response must emerge from campus-wide discussions involving all five Schools. The aim should not be to recommend a set of coercive guidelines, but rather to articulate the faculty's preferences and to utilize the deliberations to enhance their awareness

of how their research can be best disseminated under the changing circumstances.

With that objective in mind, I have convened an ad-hoc faculty committee, co-chaired by Professor Hal Abelson from the School of Engineering and Ann Wolpert, director of Libraries. This committee will address the following question: Is there a need for MIT faculty to be proactive in influencing the trajectory of current trends? Answering this question will require a review of various positions and practices on open access publishing currently held by publishers, key funding agencies, and MIT's peer institutions. Related questions are: Assuming that the shared sentiment of the MIT faculty is to influence the current trajectory, what form of response is likely to have the most impact to ensure large-scale research dissemination? Should MIT faculty consider adopting a resolution for an Institute-wide response to open access publishing? How should such a resolution be worded to signify the faculty's collective commitment to open access publishing as well as to the intellectual autonomy of individual faculty members?

I am aware that to answer such questions, collectively and collegially, will take time and serious intellectual engagement, adding to the workload of the faculty who will serve as chairs and members of the two committees. On behalf of the faculty officers, I want to thank those faculty members for volunteering their time. We expect to work closely with the MIT administration because policy changes cannot be done without their full support. Ultimately, to be effective, both committees would need wide participation by you – the MIT faculty. I realize that you may be overcommitted already, but I hope that you will share your thoughts on both these issues either with the chairs of the two committees or the faculty officers.

Welcome to the academic year 2008-2009. Let us make this year one when we as faculty engage in serious reflection about how to make MIT an even better learning community than it is already. ■

Bish Sanyal is a Professor of Urban Planning and Faculty Chair (sanyal@mit.edu).

An Update on the Educational Commons Subcommittee

Robert Redwine
Charles Stewart III

THE EDUCATIONAL COMMONS

Subcommittee (ECS) is a group of faculty appointed by the Committee on the Undergraduate Program (CUP) to extend and refine the work discussed in the Report of the Task Force on the Undergraduate Educational Commons. ECS Membership includes: Robert Redwine (Physics), *co-chair*, Charles Stewart (Political Science), *co-chair*, John Fernandez (Architecture), Tomas Lozano-Perez (Electrical Engineering and Computer Science), Dava Newman (Aeronautics and Astronautics, Engineering Systems Division), Shreyes Seshasai (student, Electrical Engineering and Computer Science), JoAnne Yates (Management), Dennis Freeman (Electrical Engineering and Computer Science), *ex-officio* (CUP), Diana Henderson (Literature), *ex-officio* (DUE).

We understood our charge to be one essentially of reviewing and refining, with the ultimate goal of proposing to the faculty, a set of concrete changes to the general MIT undergraduate curriculum. Our foundation was the final Report of the Task Force on the Undergraduate Educational Commons, including the background deliberations and research that went into writing that report. The Task Force engaged in a comprehensive review of the undergraduate educational experience at MIT that extended over two-and-a-half years, and we felt no need to re-do the Task Force's work.

The final report of the Task Force covered a range of topics. Some of these are presently being attended to outside of our deliberations, including: global education, classrooms and scheduling, advis-

ing and mentoring, diversity, and change to double majors from double degrees. [See "Moving from Two Degrees to Double Majors," on page 8 of this *Newsletter*.]

While the charge of this Subcommittee is to recommend changes to MIT's policies and regulations concerning undergraduate education using the Task Force Report as its starting point, we have focused our efforts, and thus the substance of our work, on the Science, Math, and Engineering Requirement; the HASS Requirement; and faculty governance issues related to the GIRs.

The release of the Task Force report engendered a lively reaction from the MIT community, expressed in many settings, including Institute faculty meetings, a special edition of the *Faculty Newsletter* in February 2007, and *ad hoc* meetings with departments, faculty committees, and other interested parties. This feedback has greatly influenced our work, and we commented explicitly on it in our Interim Report (May, 2008). In addition, we met anew with many of the same groups that gave initial input to the Task Force and that provided feedback after its report was issued. The response to the Task Force's final report demonstrated that further work was needed to reconcile the structure of the GIRs with the dynamic challenges facing undergraduate education at MIT. The most important of these outstanding issues may be summarized with the following questions:

1. How can we introduce more opportunities for active learning for all MIT undergraduates?

2. If we are to introduce a new element into the GIRs, which one(s) should it be?

3. How can we create an environment in which attention to issues of culture and society hold their own within the GIRs, while maintaining the cherished flexibility currently structured into the HASS Requirement?

4. How can we create greater flexibility for students and faculty in the science core without losing the valuable feature of the current core that, regardless of which specific classes students take to fulfill the requirement, they are prepared to begin work toward any major at the Institute?

5. How can we manage the GIRs to best balance creativity and innovation with predictability and coherence?

We devoted most of our attention to these questions over the past nine months in weekly meetings and over the summer in working groups that included broader faculty participation. We developed several goals for the revised GIRs. Because many individuals expressed concerns about losing material currently in the GIRs, preserving a common core of material that departments can count on became a primary focus during our discussions about curricular change. At the same time, we wanted to provide opportunities and mechanisms for evolution of content and innovative teaching and learning. We considered the student perspective, particularly in their first year,

trying to give students a more active role in their education by providing some freedom to explore personal interests and some flexibility in their choices about subjects.

These deliberations led us to focus on the following set of recommendations, which are detailed in the Interim Report:

• *Science, Math, and Engineering Requirement (SME)*. The SME portion of the GIRs should be changed by: (1) Establishing “flavors” in the existing GIRs to encourage flexibility and innovation in teaching the traditional core material. Flavors, which focus on core knowledge in each subject, allow the introduction of contemporary material or different pedagogies or discipline-specific examples while maintaining the prerequisite value of the GIRs. The existing biology GIR is a good example of flavors. (2) Establishing a new category of required subject, Elements of Design, which will include broad design-related knowledge such as dealing with complexity, approximation, and the design process that will be relevant for any student at MIT. (3) Establishing a new type of GIR, SME Foundations, a small

group of six- or 12-unit subjects which would be valuable for all students and which will also provide prerequisite value to departmental programs. Examples of subjects in this category might include probability, statistics, differential equations, linear algebra, thermodynamics, and computation.

• *Humanities, Arts, and Social Sciences (HASS) Requirement*. The HASS portion of the GIRs should be changed by: (1) Establishing a new type of class intended for, but not restricted to, first-year students that will explore questions and problems of perennial human concern. Some of these subjects, now termed “First-Year Focus” classes, have already been offered on an experimental basis, and more are being developed. (2) Simplifying the distribution requirement to three categories (Humanities, Arts, Social Sciences) and abolishing the separate category of HASS-D subjects. (3) Continuing the development of CI-H subjects, taking into account the findings of the assessment by the Subcommittee on the Communication Requirement (SOCR). The concentration requirement remains the same.

• *Governance*. To govern and encourage continual innovation of the GIRs, the Committee on the Undergraduate Program should establish two new subcommittees, one on the SME Requirement and the other on the HASS Requirement. These subcommittees would assist in the transition from the old to the new GIRs, and help to govern the GIRs in steady state.

We continued to refine these ideas over the summer, and intend to engage in a final round of consultations with the wider MIT community in the early fall. We plan to report to the faculty a series of concrete action items at the November 2008 Institute faculty meeting. For more detailed information, the ECS Interim Report can be found at: web.mit.edu/ecs. We welcome your comments, which you can send us through the feedback section on the Website. ■

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Charles Stewart III is a Professor in and Head of the Department of Political Science (cstewart@mit.edu).

Teaching this fall? You should know ...

the faculty regulates examinations and assignments for all subjects.

Check the Web at web.mit.edu/faculty/termregs for the complete regulations.
Questions: Contact Faculty Chair Bish Sanyal at x3-3270 or sanyal@mit.edu.

No required classes, examinations, exercises, or assignments of any kind may be scheduled after the last regularly scheduled class in a subject, except for final examinations scheduled through the Schedules Office.

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.

For all Undergraduate Subjects, 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 5, 2008 must be scheduled in the Finals Period.

***It is important to define your expectations and academic integrity to your students at the beginning of each semester.**

Moving From Two Degrees to Double Majors

Daniel E. Hastings

IN APRIL 2008, THE FACULTY approved the first curricular change to the undergraduate program as recommended by the 2006 Task Force on the Undergraduate Educational Commons: allowing undergraduate students to earn a Bachelor of Science (SB) degree with two majors.

Historically, pursuing two majors at MIT required a student to undertake a second SB degree which demanded 90 additional units beyond the requirements of the first degree. Under the new double major program, students can earn a single degree with two majors by completing the General Institute Requirements (GIRs) and the requirements of both majors. As part of the April decision, the faculty also voted to phase out the second SB program.

The Committee on the Undergraduate Program (CUP) developed the recommendation to the faculty based on input from both faculty and students, including the Committee on Curricula (CoC), Diana Henderson, dean for Curriculum and Faculty Support, and students from the Undergraduate Association. Based on these discussions, a consensus emerged concerning the intellectual and educational advantages of replacing the second SB program with double majors. The Committee concluded:

- That multidisciplinary education has never been more important, especially as more subjects and fields of study are becoming interdisciplinary in nature. MIT's graduates increasingly face real-world problems whose solutions draw on multiple disciplines, and many new

fields of inquiry lie at the intersection of traditional fields of study.

- That the 90-unit requirement for a second SB has only indirect educational value because there are no clear academic guidelines for those units. At the same time, the fixed-unit second SB program highlights inequities created by different high-school backgrounds, such as the absence of substantial AP credit, and limits the number of students who explore a second major. By eliminating this obstacle, more students are able to explore multidisciplinary opportunities.
- That "two degrees" is not a good description of the current requirement since students do not repeat General Institute Requirements, nor any other general graduation requirements, in pursuing the second degree. Thus, the concept of "double major" more accurately reflects the educational content and purpose of the program.
- That peer institutions offer double majors and there is often confusion about the distinction between a double major and a second degree. As such, there is very little practical advantage to retaining the second SB program.

Because the SB with double majors will replace the current practice of awarding two SBs to MIT undergraduates, a transition plan has been crafted to benefit as many students as possible and to minimize any adverse impact on current students. The Registrar's Office is leading the transition plan in partnership with

Information Services & Technology, Student Financial Services, Undergraduate Advising and Academic Programming, and the Office of Faculty Support. While the faculty decision mandated double majors be available for students graduating in 2010, the necessary policies, advising information, and systems will be in place for students graduating in September 2009 or later. At the same time, the second SB program will continue to be available to students who entered MIT during the 2007-08 academic year or earlier.

The basic guidelines for the double major are very similar to the current requirements for the second SB program, including the guidelines for completing the Communication Requirement. It will be critical for students to understand that completing each major program within the new system will remain as rigorous as it is now. Detailed comparisons, eligibility requirements, and application deadlines for both the new double major program and the transitional second SB program are available at the CoC Website: web.mit.edu/doublemajor.

The CoC will begin accepting applications for double majors on Registration Day of spring 2009. During the fall term, we will communicate more details about the programs with students and faculty, including guidelines on how students can identify and assess the program that best matches their needs and educational goals. Our goal is to ensure well informed decisions can be made relative to pursuing a multidisciplinary educational plan. ■

Daniel E. Hastings is the Dean for Undergraduate Education (hastings@mit.edu).

Two Degrees and Double Majors: A Comparison

What they have in common . . .

GPA Requirement	4.0 or higher to apply.
Combinations allowed	Any combination of programs; both departments must approve student's plan.
Auditing of General Institute Requirements (GIRs)	Based on the primary major.
Communication Requirement	Two CI-H subjects and complete the CI-M subjects that fulfill the communication component of each major.
Advising	Assigned an advisor in each program.
Eligibility for minors	May pursue up to two minors, as long as they are not in the area of either major.
Completion timeframe	Four or five years.

How they differ . . .

	Two Degrees	Double Major
Who is eligible	Students who entered MIT in 2007-08 or earlier.	Students who are graduating in September 2009 or later.
Number of units required	Minimum of 270 units.	180-198 units, depending on requirements of primary major, plus any additional units needed to complete the second program.
When eligibility begins	Must have completed two terms in a department with a declared major.	Must have completed three terms, including at least one term in a department with a declared major. Transfer students must complete at least two terms at MIT, including at least one term in a department with a declared major.
Application deadline	By the Add Date of the penultimate term in which the student intends to receive the <i>first</i> of the two degrees.	By the Add Date of the student's penultimate term. (Exception: Students graduating in September 2009 will be able to apply by Add Date of the Spring 2009 term.)
Can a student switch from a second SB to a double major?	Yes. If the double major is in the same fields, must apply by Add Date of student's penultimate term.	N/A
Awarding of degree(s)	Two degrees may be awarded either at the same time or asynchronously (within a year of each other).	Double major is awarded as a single degree; all requirements of both majors must be completed for a double major degree to be awarded.
Financial Aid	Students are typically supported through eight terms, toward completion of first degree.	Guidelines are being finalized.

MIT 4th Best College, Top Engineering School in Latest *U.S. News* Rankings

MIT JUMPED TO FOURTH (tied with Stanford) up from seventh in the latest *U.S. News & World Report* undergraduate national universities rankings, announced in the magazine's "America's Best Colleges" issue published in late August. The Institute also maintained its place as the number one undergraduate engineering school in the country.

MIT remained second to the University of Pennsylvania in the undergraduate business school category, while Harvard, Princeton, and Yale were ranked first to third, respectively, in the national universities rankings.

Categories (and weights) used by *U.S. News* to judge colleges include:

- Peer assessment (25%)
- Faculty resources (20%)
- Graduation and retention rate (20%)
- Student selectivity (15%)
- Financial resources (10%)
- Alumni giving (5%)
- Graduation rate performance (5%)

U.S. News also rated individual engineering and business departments. [Note that not all programs are rated each year.] Several of the Institute's programs in these areas were ranked in the top five. They are:

Engineering

- Aerospace/Aeronautical/Astronomical (1st)
- Biomedical/Biomedical Engineering (5th)
- Chemical Engineering (1st)
- Civil Engineering (3rd)

- Computer Engineering (1st)
- Electrical/Electronic/Communications (1st)
- Environmental/Environmental Health (4th)
- Materials (4th)
- Mechanical Engineering (1st)

Business

- Entrepreneurship (5th) [tied with U. of Arizona]
- Management Information Systems (1st)
- Productions/Operations Management (1st)
- Quantitative Analysis (1st)
- Supply Chain (1st)

Data was taken from the 2009 edition of the *U.S. News & World Report's* "America's Best Colleges." ■

letters

Why So Few Faculty are Involved in Service

To The Faculty Newsletter:

IN HIS FNL ARTICLE ["Reconsidering the Value of Service to MIT," Vol. XX No. 5], Bish Sanyal asks why so few faculty are involved in service. He proposes a few explanations but not the one I consider obvious: that few people find service interesting. We faculty are gifted with the opportunity to spend a lot of our time

doing just what we want to do – research for many of us, teaching for some. At the same time, we are faced with many responsibilities that we'd rather avoid: raising research money, entertaining funders, getting student fellowships, navigating bureaucracy, writing exams, problems sets, and quals. Service has to compete with all this. Perhaps those who enjoy it will be happy to sacrifice some of

their "fun" research time to it. But for those who find service a burden, it has one big advantage over many other unwanted responsibilities: it is optional. If we already feel saturated with our existing responsibilities, we'll certainly avoid taking on more.

David Karger
Professor of Electrical Engineering

Darwin Bicentennial Events Planned at MIT

Jonathan King

2009 WILL BE THE 200TH ANNIVERSARY

of the birth of Charles Darwin and the 150th anniversary of the publication of *The Origin of Species*. The bicentennial provides a timely opportunity to recognize Darwin's contributions – as important now as they were in 1859 – and the importance of evolution in modern science. Groups opposed to quality science education continue to interfere with the teaching of evolution in our schools; the legislatures of a number of states continue to attempt to weaken the teaching of evolution; the Republican vice-presidential candidate has spoken in favor of teaching creationism in public schools.

To promote the study and teaching of evolution, a group of faculty and students is organizing an MIT Darwin Bicentennial Program. Our goals are not only to bring a deeper understanding of evolutionary processes to students, staff, and faculty, but also to forge stronger links with high school science teachers in neighboring school districts. The opening event in the series was a talk given on Wednesday, September 11, by Dr. Louise Mead of the National Center for Science Education, Oakland, California (natcensci.ed.org). Dr. Mead followed up her talk with a discussion of approaches to teaching evolution in the face of opposition.

MIT Darwin Bicentennial Conference

To inaugurate the 2009 bicentennial year, we have organized a three-day conference, Thursday – Saturday January 22–24. Thursday afternoon's agenda will focus on the history of the Earth, with an evening presentation on climate change.

The Friday focus is on recent advances in understanding the evolution of animals. The Saturday session, to be held at the MIT Museum, will include analyses of Darwin's period and contributions, and culminate with a review of the struggle over teaching evolution in the schools. The latter will be given by Prof. Kenneth Miller of Brown University, the chief witness in the Dover, PA evolution trial.

Darwin's birthday, February 12, is celebrated as Darwin Day at many institutions around the world (DarwinDay.org).

The intended audience for the first two days is the MIT community of students, graduate students, staff, and faculty interested in broadening and deepening their appreciation of evolutionary processes. An IAP class will be offered with the conference lectures as the centerpiece. The Saturday sessions will take place at the MIT Museum, affording accessibility to the Cambridge community. This session will be advertised in the Boston area community, and we hope to attract area high school science teachers.

The draft conference program can be found at: <https://sites.google.com/site/darwinbicentennial>. The organizing committee includes faculty members John Durant; David Housman; Jonathan King (Chair); Susan Lindquist; Harriet Ritvo; James Paradis; Hazel Sive; Maria Zuber. They have been assisted by graduate students Emiko Fire, Sarah Bagby, Erika Erickson, and Administrative Assistant Cindy Woolley.

A series of related activities are likely to develop within MIT during the bicentennial

year. These range from special seminars for undergraduates and graduate students; film showings (*Inherit the Wind*, e.g.); artistic performance-based activities, and formal scientific lectures and seminars. We hope faculty will add material relating to evolutionary analysis and mechanisms to their classes, invite additional seminar speakers in these areas, and otherwise enrich the bicentennial year. Please communicate these activities to Ms. Cindy Woolley (x3-4722)

who will perform a clearinghouse function.

Linking university scientists and high school science teachers

The MIT activities are part of a broader Massachusetts Darwin Bicentennial Project, which involves outreach to colleges and high schools. Participating institutions currently include Brandeis Biology, Northeastern Biology, Harvard Biology, and New England Biolabs. Outreach to other Massachusetts colleges and universities is continuing. Groups in these institutions will be contacting high school biology teachers in the area to plan joint activities, and to enhance inclusion of evolution related themes in the curriculum of area high schools. The talks by Louise Mead were the first step in the effort to prepare faculty and staff to be able to present the arguments for evolution in an effective and sensitive manner, in the diverse environment of a high school or even community forum. ■

Jonathan King is a Professor in the Biology Department (jaking@mit.edu).

What is the Global Education and Career Development Center?

Daniel E. Hastings

IN JULY, THE OFFICE OF THE Dean for Undergraduate Education (DUE) announced the formation of the Global Education and Career Development Center (GECDC). This realignment of the Study Abroad and Distinguished Fellowships Office and the MIT Careers Office into a more integrated organization enhances our ability to impact student development of key global and career competencies.

Cross-cultural knowledge and skills, as well as key career management skills, are foundational to success in today's global economy. As stated in the Report of the Task Force on the Undergraduate Educational Commons:

"It is imperative that every MIT undergraduate understand the global context in which their future lives and careers will unfold. Students must also be comfortable working and living in settings in which they must adapt to differing values, traditions, assumptions, attitudes, and norms that will arise from cross-cultural contact within a new global economy."

Through the synergy of global educational experiences and holistic career development services, the GECDC will contribute to student learning in these areas.

The GECDC is comprised of two offices, the Career Development Center and the Global Education Office. While each office will offer the distinct services to students and faculty described below, they will operate in a coordinated and seamless way that will create a "one-stop" organization guided by a mutual vision

and mission. This collaboration will create a powerful new organization for students to increase personal, academic, and work skill sets and realize their career goals. At the same time, the faculty and others in the MIT community will find active partners for their career development and

the Task Force on Undergraduate Educational Commons: *"ensure that within five years any MIT student who wishes to undertake meaningful study, work, or internships abroad may be able to do so without financial or academic penalty."*

Global Education and Career Development Center

GECDC Vision: "We engage students and alumni in self-discovery to craft lives that are intellectually challenging, personally enriching, and of service to the world."

GECDC Mission: "To empower MIT students and alumni to achieve lifelong success through seamless access to transformative global experiences, comprehensive and holistic career services and mutually beneficial connections with employers and graduate and professional schools."

global education endeavors while student employment opportunities will be better aligned with MIT initiatives and priorities. The end result will be an even greater impact on the nation and the world.

The Global Education Office

The Global Education Office (GEO) incorporates the programs and services of the Study Abroad and Distinguished Fellowships Office but is broader in scope. The mission of GEO is to advance global education at MIT. The office, in concert with the diverse international programs at MIT, will support a seamless experience for our undergraduates as they prepare for, proceed on, and return from a global experience. As part of this mission, the Office will help MIT meet the goal set by

GEO will have two associated faculty advisory committees. The Global Education Faculty Advisory Committee, chaired by Prof. Kim Vandiver, provides advice on expanding the number of global opportunities in a sustainable, safe way and integrating them with our curriculum. The Committee on Foreign Scholarships, chaired by Prof. Linn Hobbs, plays a key role in recruiting and advising candidates for the distinguished fellowships.

As a central force in implementing MIT's strategy for global education, GEO will:

- Provide leadership in facilitating collaboration among MIT programs and offices

engaged in international education as well as a focused direction to address barriers to student global experience.

- Develop infrastructure that can benefit all global education programs. This will include:
 - Policies and guidelines on global education issues and global education best practices
 - Participant tracking system
 - Travel risk management support
 - Cultural preparation
 - Assessment of intercultural competence as a primary student learning outcome for global education experiences
- Raise awareness and excitement among students about the importance of global education and opportunities to go abroad. It will provide the first point of contact for students who are exploring the possibilities to go global.
- Support the expansion of existing programs, such as MISTI, International Research Opportunities, and D-Lab/International Development Initiative, as well as the development of new programs.
- Manage key study-abroad programs as well as provide advising and support services for all MIT students pursuing study abroad:
 - GEO managed programs:
 - Cambridge-MIT Undergraduate Student Exchange (CME)
 - MIT-Madrid Program
 - Study abroad advising and support for students in:
 - Departmental undergraduate student exchanges
 - IAP language programs (IAP-Germany and IAP-Madrid)
 - Study abroad through outside providers
 - Study abroad through direct enrollment
- Work with the Committee on Foreign Scholarships through the Distinguished Fellowships program. This includes recruiting and advising students interested in pursuing prestigious scholarships for study around the world including the Rhodes Scholarship, Marshall Scholarship, Gates Cambridge Scholarship, Fulbright Awards, Chateaubriand Fellowship, Kawamura Scholarship, Merage Foundation for the American Dream Fellowship, Udall Scholarship, and the Jack Kent Cooke Foundation Fellowship.
- Faculty can help get students excited about global opportunities and integrate advice on global opportunities into academic advising.
- Faculty can encourage students to apply for distinguished fellowships and provide information about potential fellowships through academic advising.
- Faculty can serve on the Global Education Faculty Advisory Committee or the Distinguished Fellowships Committee.

GEO will partner directly with faculty who are currently involved in global education programs or would like to start a global education program.

What are the collaborative opportunities with the Global Education Office?

- GEO will partner directly with faculty who are currently involved in global education programs or would like to start a global education program. GEO will be able to provide services related to:
 - Program design
 - Institutional agreements
 - Logistical support
 - Student programming, including pre-departure orientations and re-entry
- GEO will work with faculty and academic departments to foster integration of global education into curricula and academic structures.
- GEO will reach out to faculty to determine how to best enhance and expand the existing study abroad programs.
- GEO will work with faculty to determine how to develop innovative study abroad programs that best respond to students' needs.

The Career Development Center

Similar to the MIT Careers Office, the Career Development Center (CDC) continues to provide career planning and employment search services for students from their first year through graduation, including graduate students and alumni. The Office partners with employers offering internships and full-time jobs.

Current services include:

- Career exploration resources
- Career counseling and assessment services
- Preprofessional advising
- Career workshops
- Career course for Freshmen (F/ASIP)
- Resume critiques and practice interviews
- Internship opportunities
- On-campus recruiting
- Online resume database and job listing system
- Campus-wide career programming, including the Federal Agency Job Fair, networking events, speaker series, and panel discussions
- Recruiting support services to employers

continued on next page

Career Development Center
Hastings, from preceding page

Following a comprehensive review of CDC programs and services, the organization has identified its purpose as equipping students with career competencies foundational to their lifelong learning and success. The CDC will develop a more holistic and competency-based career development program model that incorporates a global perspective. These new initiatives include:

CDC can work with faculty to develop customized career related programs and materials for the department's students. This includes consultation on curriculum needs relevant to labor market trends.

- Providing greater assistance to students in exploring career options, choosing a major or career, applying their academic studies in hands-on work experiences, and developing career plans.
- Maintaining assigned liaisons that will offer targeted programs and services to students within specific disciplines or industries, as well as maintain relationships with key faculty, staff, and relevant student leaders within these areas.
- Collaborating with GEO in creating a coordinated system of developing career management and global education competencies in students. The cumulative effect will be to prepare MIT graduates to be successful in a global economy.
- Enhancing preprofessional advising efforts under a more sustainable model and expanding the success of the Freshman/Alumni Summer Internship Program to assist a broader population of MIT students in obtaining internships.
- Establishing a cross-functional Employer Outreach Team which will implement a coordinated and integrated employer

outreach plan to develop relationships more closely aligned with student aspirations and MIT initiatives, such as the MIT Energy Initiative.

- Employing emergent technology to enhance student learning and development as well as to provide a more seamless and effective delivery of services. This technology-assisted delivery will enhance and supplement CDC services, while removing the barriers of time and place.

- Demonstrating evidence of impact through better assessment and data collection tools.

What are the collaborative opportunities with the Career Development Center?

- CDC will work with departments to understand the career development needs of each department's cohort and what current or suggested resources would be most beneficial to students and their advisors.
- CDC has assigned a staff liaison for each School who has knowledge of discipline related career trends. This includes career paths, hiring trends, and salary trends specific to MIT graduates or national trends. The liaison can also provide information on the top skills and personal values employers seek in entry-level candidates. Similar information can be provided about graduate school.
- CDC can work with faculty to develop customized career related programs and materials for the department's students. This includes consultation on curriculum needs relevant to labor market trends.

- CDC can provide potential employer contacts for collaboration, advisory boards, internship opportunities, and fundraising.
- Faculty can encourage their advisees to consider how curricular, co-curricular, and work experiences contribute to their career development, as well as share information on their own career and professional development.
- Faculty can collaborate with the CDC to integrate meaningful career development and work-based experiences into their instruction to enhance the learning experience, reinforce classroom learning, and help students develop career development and professional knowledge and skills.
- Faculty can serve as mentors for the Freshman/Alumni Summer Internship Program or as prehealth advisors.

Bringing it all together as GECDC

The GECDC will be working to create a coordinated system that will develop both career and global competencies in students. In time, through cross-training and innovative, joint programming, the staff of GECDC will be able to facilitate both career development and global education through the conversations they have with students. At the same time, faculty, staff, and employers will gain access to more unified and expanded programs and services from one collaborative organization. In the end, MIT students should be better prepared to meet the challenges of the competitive global economy.

If you have any questions, please contact Melanie Parker (x3-7519, mlparker@mit.edu), executive director of the GECDC. For questions specific to GEO, please contact Malgorzata Hedderick (x3-9358, malrh@mit.edu), associate dean, Global Education Office. ■

Daniel E. Hastings is the Dean for Undergraduate Education (hastings@mit.edu).

The First Step Toward Solving Global Warming: Getting MIT to Listen

William Schreiber

GLOBAL WARMING, THREATENING the ability of our Earth to sustain human life, has become perhaps the preeminent environmental concern worldwide. There is a rapidly growing consensus – almost universal among a majority of scientists and even among the public when they learn of the real danger to their descendants – that seriously confronting this issue should be our major priority. The awarding of the 2007 Nobel Peace Prize to former Vice-President Al Gore, (sharing

on large mirrors in outer space, where it is available 24/7 and is significantly more intense than on Earth. The sunlight then is redirected to Earth where it is collected on smaller mirrors and used by solar-powered pumps to drive water up behind dams in existing hydroelectric plants. This method would also provide the energy storage needed accounting for the fact that the radiation to Earth is greatly affected by weather. In the September/October

Yet despite this significant independent validation of my proposal, I have been unable to get a hearing at my own institution – MIT! I have never even been invited to a meeting to discuss my views. The Institute currently is sponsoring a large project, the MIT Energy Initiative, and I did have some preliminary discussions with several leading MIT people; but the contacts rapidly frittered away.

Having spent a professional lifetime at MIT, I have devoted a great deal of time and energy to its concerns. Even non-scientist Al Gore, although criticized for his time scale of 10 years, has not been labeled as crazy or not worth listening to. What I believe is the problem, although I cannot be certain, is that many of those working on energy issues everywhere, not only at MIT, have preconceived ideas of what approaches to take, and prefer to pursue those ideas rather than anyone else's. I certainly did not expect to find this at MIT, with its science-based curriculum. Presumably scientists are always open to new ideas.

I would be happy to discuss my proposal with interested parties. Any such party is encouraged to read my articles in the *Faculty Newsletter*, which can be found by using the links above.

I have written this piece with great regret. I did not expect to find what appears to me to be a kind of narrow-mindedness at an institution that I had come to respect for many reasons. The fact that the editorial staff of the FNL allowed me to publish this piece is greatly appreciated. ■

William Schreiber is a Professor Emeritus in the Department of Electrical Engineering and Computer Science (wfs@mit.edu).

Briefly, I suggested that since global warming is caused primarily by the gases produced by using “fossil fuels,” mainly derived from petroleum, a straightforward solution would be to switch to a nonpolluting fuel. In my proposal I chose sunlight, collecting it on large mirrors in outer space

the award with the Intergovernmental Panel on Climate Change), clearly illustrates this consensus.

In response to these concerns, I developed what I believe to be a practical method of attacking this problem. An article describing my idea was published in the May/June 2007 issue of the *MIT Faculty Newsletter* and put into the public domain. (See “Solving the Energy Problem” at web.mit.edu/fnl/volume/196/schreiber.html.)

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2007 issue of the *Newsletter* [Volume XX, No. 1] I followed this up with a proposal to use a “Manhattan” style management scheme that was used so successfully in WWII to develop the atom bomb. and was used after the war for large dams for the TVA and other big dam projects. (See “Is it Time for a New Manhattan Project?” at web.mit.edu/fnl/volume/201/schreiber.html.)

My proposal was validated by its enthusiastic endorsement by the Commonwealth Scientific and Industrial Research Organization (CSIRO), a large Australian laboratory working on global warming, which had previously expressed the need to “de-carbonize” the fuel supply, but had not yet found a practical way to do it. The Organization concluded that my proposal fit the bill.

MISTI Announces the MISTI Global Seed Funds

Suzanne Berger

MIT INTERNATIONAL SCIENCE AND Technology Initiatives (MISTI) is pleased to announce new funding for international faculty collaboration, MISTI Global Seed Funds. MISTI Global Seed Funds is a new initiative that supports faculty research worldwide and encourages student participation.

Globalization makes international research collaboration key to scientific and technological advance. Global issues such as health, environment, energy, and security cannot be addressed effectively without international cooperation. Increasingly, scientists, managers, and engineers participate in research networks across the world. Such networks are critical for advancing knowledge, theory, and practical application. MISTI seeks to build global learning in all fields at MIT through its seed funds. The funding is in keeping with the Institute's effort to enhance its reach in international education and research.

For all seed funds, up to \$10,000 in additional funding is available for undergraduate and graduate student participation. MIT students that receive funding to participate in research abroad will receive cultural preparation through MISTI. Language training will be provided by the Foreign Languages and Literatures Section.

MISTI Global Seed Fund

The MISTI Global Seed Fund is designed to support research and collaboration on any topic focusing on any part of the world. Proposals are welcome from faculty and research scientists in all disciplines at MIT. Preference may be given to applications from younger researchers,

but all faculty members are encouraged to apply. The maximum award is \$20,000 and can be used for a variety of expenses, including exploratory field research, workshop materials, and instrument costs. Salary cannot be covered.

Proposals are welcome from faculty and research scientists in all disciplines at MIT.

Country-Specific Seed Funds

MISTI also offers five country-specific seed funds. These country-specific seed funds are available for faculty interested in collaborative research involving France, India, Italy, Japan, or Spain.

- The **MIT-France Seed Fund** is funded by an endowment established by the French Ministry of Foreign Affairs and MIT. Grant money is for research collaboration between faculty and researchers at MIT and their counterparts in France. Proposals are required to be submitted jointly with French colleagues. Priority is given to projects that involve younger scholars and propose a balanced exchange of research. The fund offers up to \$20,000 that must be expended within one year.
- Proposals that focus on sustainable development in India can apply to the **MIT-India Seed Fund**. The applicants must involve collaboration with the Institute for Financial Management and Research (IFMR) in Chennai. The maximum seed fund award is \$20,000.

- MIT-Italy's **Progetto Roberto Rocca Seed Fund** encourages research projects between MIT and the Milan Politecnico by supporting student fellowships, research stays, workshops, and faculty collaborations. Priority is given to proposals that focus on the novel use of

materials as well as mathematical and physical modeling. The maximum award is \$15,000.

- For MIT faculty members seeking to work in collaboration with Japanese researchers in areas of environmental and oceanic research, MISTI offers the **Hayashi Seed Fund**. Applicants to the Hayashi Seed Fund can apply for up to \$20,000.
- The **MIT-Spain Seed Fund** and the Barcelona Chamber of Commerce offer grants for research collaboration between MIT and companies, universities, and research laboratories in Spain. Funding is targeted towards explorative and collective collaboration involving technological transfer in a start-up phase. Applicants can apply for up to \$20,000 in funding.

The deadline for applications is October 20, 2008. For more information and the application form for all seed funds see the MISTI Website: web.mit.edu/misti/faculty/seed.html. ■

Suzanne Berger is a Professor in the Department of Political Science and Director of MISTI (szberger@mit.edu).

Workplace 2.0: Improving Generativity, Creativity, and Faculty Quality of Life

Suzanne Flynn
Zan Barry

AUTHOR WAYNE MULLER OFFERS this anecdote:

Not long ago I was speaking with Hans-Peter Durr, who for 20 years collaborated with Nobel Prize winner Werner Heisenberg, discoverer of the famous Uncertainty Principle in quantum physics. Himself a noted quantum physicist, Hans-Peter told me that he often had long, impassioned discussions with Heisenberg when they were working together on a particular problem. "We would be talking excitedly about the problem from every angle, and then suddenly Heisenberg would say, 'Wait, I think we have touched something very important here. Let's not talk about it any more. Let's wait for two weeks, and let it solve itself.' Then, when we got together two weeks later, it would invariably be solved." [Wayne Muller, Sabbath: Finding Rest, Renewal, and Delight in Our Busy Lives (1999) p.190, New York: Bantam Books]

When was the last time your creativity had two weeks of gestation time in which to blossom? The notion seems downright luxurious in today's marketplace of ideas, but the nature of academic work requires this type of percolation. However, based on the 2008 MIT Faculty Quality of Life Survey, such creative time is in short supply.

Faculty have low satisfaction with the integration of work and personal/family life and cite "lack of time to think and reflect" as one of their top three stressors, behind secure funding for research and scholarly productivity (which are, of course, interwoven concerns).

- 58% rated their workload as too heavy, with 16% saying it is much too heavy
- 19 hrs/week was spent on scholarship; 44% were dissatisfied (32% very) with time available for scholarly work
- 78% (25% extensive) see lack of time to think and reflect as a source of stress
- 80% (24% extensive) see lack of time for non-work as a source of stress
- 61% (14% extensive) see inability to pursue outside interests as a source of stress
- 29% agreed (8% strongly) that physical presence is important to their department
- 25% disagreed (7% strongly) that their department values non-MIT activities
- 50% (18% extensive) considered "to increase time for research" as a reason for leaving MIT
- 49% (17% extensive) considered "to reduce stress" as a reason for leaving MIT
- 48% were dissatisfied (13% very) with the integration of work life and family/personal life

How can we improve these outcomes? In the fall of 2006, a subgroup ("Workplace 2.0") was commissioned by the Council on Work and Family at MIT to explore approaches for enhancing creativity, engagement, and well-being on campus. We are not suggesting pat answers to complex questions, but rather

signposts that can point the Institute toward a new wave of intellectual incubation and development, and new ways of working.

Our research led us to look at: What are the characteristics of environments that support optimal creative breakthrough with minimum burnout? What are the assets that faculty can take advantage of within their own departments and work styles that are supportive of creativity, productivity, and innovation? A white paper of interdisciplinary research supports several key principles of the optimally creative workplace. The very work style that promotes the greatest breakthroughs and creativity is the same style that enhances personal engagement and fulfillment. Personal fulfillment and academic achievement are not at cross-purposes with each other – at least, they don't have to be. For example:

- "The more hours I work in a day, the more I will get done" is a common mythology. Hammering away at problems by dedicating more and more time quickly reaches a point of diminishing returns; the oscillation of activities and "micro-breaks" produces better outcomes.
- Sacrificing downtime, exercise, and sleep creates cognitive deficit and does not take advantage of the cognitive enhancement of restorative activities, thereby reducing optimum engagement and creativity.
- Nobel laureates (and other prize winners of similar renown) exhibit wide ranges

continued on next page

Workplace 2.0

Flynn and Barry, from preceding page

of experiences (such as cross-cultural experiences) and important non-scientific avocations in the arts and humanities that have the potential to stimulate multi-modal forms of perception.

- There is an (often untapped) power in fostering diverse relationships among committed colleagues at work, which promote creative thinking and vital social support.

This is only a preview of the research that supports both breakthrough and wellbeing. There are key cultural approaches to work at MIT that exacerbate the difficulties faced by faculty members. By addressing them as a community, we can create an upgrade in the world of work. Workplace 2.0 at MIT is not based on the premise of asking faculty to take on more and do more. Rather, it proposes a conversion to environments

and work styles that are more conducive for the demanding creative tasks of the Institute, to help us all not just survive but thrive. ■

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Zan Barry is a Health Educator at the Center for Health Promotion and Wellness at MIT Medical (bars@med.mit.edu).

Problems in Evaluating Four-Year Colleges

Perelman, from page 1

by promoting a Voluntary System of Accountability (VSA), offering one of three standardized tests to measure their contribution to their students' improvement in critical thinking, analytic reasoning, problem solving, and written communication.

This enterprise, however, of trying to measure and then compare the common benefits of a college education among widely differing educational institutions through two-hour standardized tests reaffirms the truth of H. L. Mencken's observation that "For every complex problem there is an answer that is clear, simple, and wrong." These assessments are, at best, useless, and, at worst, subversive to the complex set of abilities that should inform undergraduate education.

The three tests are each about two-hours long. They differ, however, on how they assess these abilities. The *Collegiate Learning Assessment* (CLA) of the Council for Aid to Education (CAE) is composed of three writing assignments, although one of them is broken up into short answers. The *Educational Testing Service's Measure of Academic Proficiency and*

Progress (MAPP) consists entirely of multiple-choice questions, while the ACT's *Collegiate Assessment of Academic Proficiency* (CAAP) combines an argumentative essay with multiple-choice questions on "critical thinking." The "value added" is a single number measured by one of two ways: either giving the test the same year to sample first-year and senior cohorts, or, longitudinally, by giving versions of the test to the same students when they enter and then again when they are seniors. In either case, higher scores by seniors are viewed as "objective" evidence of educational improvement, the greater the difference, the greater the institutional contribution to these general educational objectives.

Both the CLA and the CAAP contain an argumentative essay component. Students respond to a prompt in 40 or 45 minutes, writing what is essentially a first-draft of one or two essays. The CAAP requires students to write two 20-minute argumentative pieces of writing in response to prompts similar to this sample given at the CAAP Website:

"Your college administration is considering whether or not there should be a physical education requirement for undergraduates.

The administration has asked students for their views on the issue and has announced that its final decision will be based on how such a requirement would affect the overall educational mission of the college. Write a letter to the administration arguing whether or not there should be a physical education requirement for undergraduates at your college."

(Do not concern yourself with letter formatting; simply begin your letter, "Dear Administration.")

The CLA "Make An Argument" task asks students to respond in 45 minutes to a prompt such as the one given to me at a recent Web conference:

"Government funding would be better spent on preventing crime than in dealing with criminals after the fact."

Directions: 45 minutes, present your perspective on the issue, using relevant reasons and/or examples to support your views.

Flawed Character of the Writing Tests

Although these exercises differ from each other and both differ from the kind of "universal" writing prompt (e. g., "Is

failure necessary for success?") found on the SAT and other standardized tests, they are fundamentally unlike college writing (and thinking) in two very profound ways. First, all three exercises occur with an absence of relevant and necessary data. Real arguments about the necessity of a Physical Education Requirement depend on various kinds of relevant evidence. First, the prompt mentions the "overall educational mission of the college." Most colleges and universities have mission statements, for example, but how many undergraduates are familiar with them? Are students first supposed to define and argue for their institution's educational mission? Personal experience is one kind of evidence but it is not the primary type found in academic arguments. A real argument requires research and information. The same is true for the prompt on spending money to prevent crime. Indeed, college teaches students how to become information literate in knowing when external data is needed, how to access or create the data, how to evaluate it, and how to use it. Both of these assignments, on the other hand, provide neither data nor any time to seriously think about the topic.

Second, even if there were data, these two questions give students too little time to meaningfully explore and think about the information and revise their argument. No one can do that in 20, 25, or 45 minutes on a topic that they may never have seriously considered beforehand. Students do write timed essays on demand, but they are always writing on topics they have studied, read about, and discussed. Indeed, there are very few real-world situations in which someone out of the blue is going to ask someone else to write a coherent real-reasoned argument on a topic that the writer is not expected to have thought about previously.

MIT students, however, do well on this kind of essay. That is one of the reasons they are here. But doing well on these essays is, at best, largely unrelated to successful academic writing, and is, at worst, subversive to it. Over a year ago, I developed a set of strategies based on both

published training samples and essay scoring machine algorithms to hack the SAT Writing Essay [see page 21]. The key elements are to follow the rigid structure of the five-paragraph essay, fill-up both pages of the test booklet, include lots of detail even if it is made up or inaccurate, use lots of big words, especially substitut-

I classify these kinds of essays as *data-free* writing because although scorers are looking for specific detail, they are usually explicitly told to ignore any factual errors. Our students know that the best way to succeed in writing these essays is to just make up information as needed.

ing "plethora of" and "myriad number of" for "many," and to insert a famous quotation near the conclusion of the essay even if it is irrelevant to the rest of the essay. I then trained several high school seniors to use them. Since then, I have handed out the strategies to scores of students, their parents, aunts, uncles, and friends of the family. The limited results I have seen are frightening. I know of no student who has used my strategies who has scored lower than the 92nd percentile. (See the article on this work "Fooling the College Board" in *Inside Higher Education*: insidehighered.com/news/2007/03/26/writing/.)

I classify these kinds of essays as *data-free* writing because although scorers are looking for specific detail, they are usually explicitly told to ignore any factual errors. Our students know that the best way to succeed in writing these essays is to just make up information as needed. Indeed, they have told me that in these types of time writing situations, it is much more efficient to just make up facts than to try to recall real relevant information.

The Importance of Data-Rich Writing Skills

In contrast, the kind of writing that students perform in almost all their academic experiences at MIT is *data-rich*. Students learn how to explore a topic, gather infor-

mation, identify a central assertion, and then use specific information to shape and refine their argument. This description is equally valid for laboratory reports, design documents, and essays on literature. All academic writing involves a design process. A document is an artifact intended for use. The writer discovers,

selects, and assembles information for a specific audience to use for a specific purpose. As with any other design problem, the writer has to consider the external constraints imposed by the data and also determine various trade-offs, such as how much detail to include in explanations. These tests offer neither the context nor the time for such a design exercise.

The CLA does include an essay which it classifies as a "Performance Task," claiming that it "combines skills in critical thinking, analytic reasoning, problem solving and written communication . . . based on a real-life scenarios" while assessing the ability to use information effectively. In one sample prompt, a student is asked to assume the role of an assistant to the president of a high-tech company. A sales manager has recommended that the company buy a particular plane to transport sales personnel to and from customers, but before the plane was purchased there was an accident involving that particular model. The student is provided with the following documents: 1) a newspaper report of the accident; 2) an FAA report on "in-flight breakups in single engine planes;" 3) e-mails from the president to the assistant and from the sales manager to the president; 4) charts displaying the per-

continued on next page

Problems in Evaluating Four-Year Colleges
Perelman, from preceding page

formance of this particular line of planes; and 5) an article from a magazine for amateur pilots comparing this plane to others in its class.

In essence, students are given a six- or eight-piece puzzle, and we are told that mastering it will tell us how well they can navigate the vast sea of information that surrounds us. These tests do not encourage students to learn how to obtain, assess, and use information appropriately; they teach them to formulaically manipulate prepackaged information bites.

Because the sample prompt just names the documents but does not display them, it is difficult to assess how much information is given to students. A description of another scenario on crime reduction lists the information given to a student as consisting of a newspaper article, a research report, crime statistics and tables, and an annotated bibliography. Academic writing, however, uses an annotated bibliography as a starting point for information gathering not as an end point.

In essence, students are given a six- or eight-piece puzzle, and we are told that mastering it will tell us how well they can navigate the vast sea of information that surrounds us. These tests do not encourage students to learn how to obtain, assess, and use information appropriately; they teach them to formulaically manipulate prepackaged information bites. These kind of essay tests are neither *data-free* nor *data-rich*, but *data-lite*.

The third essay used by the CLA is identical to the format used in both the GRE and GMAT tests, “critique-an-argument.” Students are given 30 minutes to evaluate an argument such as this example given in the CLA brochure:

“The number of marriages that end in separation or divorce is growing steadily. A disproportionate number of them are from June weddings. Because June weddings are

so culturally desirable, they are often preceded by long engagements as the couples wait until the summer months. The number of divorces increases with each passing year, and the latest statistics indicate that more than 1 out of 3 marriages will end in divorce. With the deck stacked against

‘forever more’ it is best to take every step possible from joining the pool of divorcees. Therefore, it is sage advice to young couples to shorten their engagements and choose a month other than June for a wedding.”

This kind of question is easily coachable. Most of the logical problems relate to some form of confusing correlation with causation. Moreover, I doubt that many of our entering students would have problems identifying the logical fallacies in the passage, and, consequently, would perform just as well as seniors.

Limited Value of Standardized Writing for Evaluating MIT Students

Lori Breslow, in the last issue of the *Faculty Newsletter*, stated that MIT would not participate in the VSA. MIT, however, is participating in a grant from the Fund for the Improvement of Post-Secondary Education (FIPSE) to assess the “validity” of these three tests by having 50 first-year and 50 fourth-year students take all three of them during this coming academic year. The results from each of these tests will be compared “to examine the extent to which disparate measurement tools recommended as part of the VSA can be used interchangeably, whether these tools are measuring similar or dissimilar outcomes or levels of achievement, and the

role test format (e.g., multiple choice vs. open-ended/constructed response measures) plays in the correlation among measures.” Neither the students nor the Institute, however, will see the scores.

It seems to me that there is little benefit to anyone in MIT’s participation in this study. The tests, such as the CLA, claim that regressing scores against SAT scores can compensate for response bias because there is a linear relationship between CLA and SAT scores. At MIT, however, over 75% of the entering class has SAT Quantitative Reasoning scores of between 750 and 800, or 2.5 to 3.0 standard deviations above the mean with a standard error of ± 30 points. Consequently, there is insufficient variation in SAT scores among the population for such a regression to be meaningful.

Similarly, given that almost all undergraduates entering MIT have “critical thinking” and “written communication” abilities that would probably score at over two standard deviations above the mean scores of these respective tests, a pre-test / post-test protocol might likely result in false negatives because of regression toward the mean. In addition, because the student volunteers who take this test are paid simply to take these tests and have no motivation to do well, it is possible that many MIT seniors would take the tests less seriously than entering first-year students and perform perfunctorily at best, creating even more opportunities for false negatives.

The literature on these tests also ignores the extent of measurement error, which will exacerbate regression toward the mean, especially in open-ended essay tests. Although essay tests are clearly more valid measures than multiple-choice tests, they possess an additional dimension of error. The ± 30 points on the SAT indicates test/retest reliability; if a student takes the test again, there is a 67% probability that the second score will be in the range of ± 30 points of the first score. With essay scoring, however, there is the additional issue of reader reliability. Even if two readers read each essay, how reli-

SAT Writing Essays Strategies

Basic Assumption: The essay is a completely artificial and unnatural piece of writing.

Strategies:

1. Ignore the short reading. Write your essay responding to the specific prompt, e. g.: Do memories hinder or help people in their effort to learn from the past and succeed in the present? Plan and write an essay in which you develop your point of view on this issue. Support your position with reasoning and examples taken from your reading, studies, experience, or observations.
2. Fill both pages. No matter what the new report says, length matters.
3. Usually, take one side or the other, don't try to equivocate or be complex.
4. Structure your essay as a five-paragraph essay with a topic sentence as the first sentence of every paragraph.
 - a. Short introductory paragraph with a specific thesis sentence that directly addresses the question in the prompt.
 - b. First development paragraph. Use best example.
 - c. Second development paragraph. Put in lots of detail.
 - d. Third development paragraph. Put in lots of detail.
 - e. Conclusion. Restate thesis and include quotation.
5. Prepare two historical biographies and two works of literature to use as examples. If the examples don't fit, change them. Detail counts; factual accuracy doesn't.
6. Use plethora and myriad along with other "big" words. Do not be afraid that the word may have the wrong connotation. Use of infrequently used words counts!
7. Have two or three quotations ready. Insert one in the penultimate or concluding paragraph even if it not completely relevant to your argument. My favorite is FDR's "The only thing we have to fear is fear itself."

Remember, readers for these essays have to read between 20-30 essays per hour in four-hour blocks.

able is the total score? Or to frame the question another way, if the essay is graded again, what is the probability that it will receive the same score? The best that scoring sessions can produce is a reliability of about 80%. When the essays are scored remotely and by a single reader, as are the CLA essays, the reliability is significantly lower.

Scoring the essay by computer eliminates scoring unreliability but is highly dubious. Originally two of the three essays were scored by ETS's machine scoring algorithm E-rater. Last year, 90% of each of the three essays was graded by a single human reader (10% of each were double-scored). This coming year the analytic essay will be scored by E-rater. The major factors used by E-rater in scoring an essay include length, a four- or five-paragraph essay structure, and the frequency of infrequently used words.

That is why an egregious plethora of malapropisms score well on these tests.

Although MIT is participating in the part of the FIPSE grant that is attempting to validate the reductive assessment practices called for in the Spellings Commission Report, the same grant funds the Valid Assessment of Learning in Undergraduate Education (VALUE) initiative sponsored by the Association of American Colleges and Universities (AACU). This organization has already articulated a more complex set of Essential Learning Outcomes that include Inquiry and Analysis, Critical and Creative Thinking, Written and Oral Communication, Information Literacy, Teamwork and Problem Solving, Civic Knowledge and Engagement – both local and global, Intercultural Knowledge and Competence, and Ethical Reasoning.

These skills are meant to be practiced throughout the curriculum in increasing levels of difficulty and, rather than trying to measure these complex outcomes through a series of timed impromptu tests, this initiative formulates assessment as primarily cumulative and plans to implement it primarily through e-portfolios. Such an approach will not produce a single number for national comparison. Instead, it will produce rich and abundant data that can be used to improve teaching to better meet these objectives. The University of Michigan and Rose-Hulman Institute of Technology are among the diverse group of colleges and universities that have taken a leadership role in this project. I suggest that MIT join them. ■

Les Perelman is the Director of Writing Across the Curriculum (perelman@mit.edu).

MIT's Supercomputing Network Silis and Valencia, from page 1

structure connected to a series of cables – but not just any ordinary type of cable: optical fiber cable. An optical cable is a piece of very thin glass or silica used to

campus every day – most of us just don't realize it. The MIT Regional Optical Network extends the concept of supercomputing and MIT's supercomputing network footprint more broadly – and literally – beyond MIT's Cambridge campus.

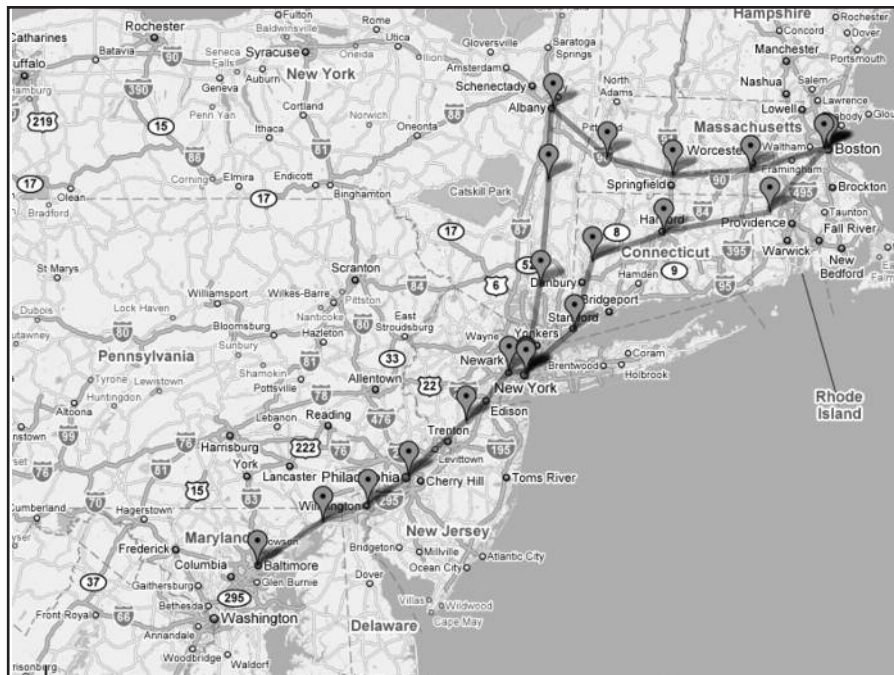
of 2500 miles of fiber provided via optical equipment at 17 locations across seven states. The network is already linked to LHCnet, the research network maintained by the European Organization for Nuclear Research (CERN). Next, plans include linking the Energy Sciences Network (ESnet) and the National LambdaRail, which established and maintains a unique nationwide infrastructure owned and maintained by the research community in the United States.

MIT faculty and researchers working on the Large Hadron Collider (LHC) project, for example, have substantial data sets that need to be analyzed and shared with others in near real time. The LHC smashes protons moving at nearly 100% of the speed of light into each other. Faculty and researchers then wait to see what happens; in particular, they are waiting to see what new particulate matter is found. With data transfer numbers at 2-4 Gbps and 24 hours/day, each collision produces about 2MB of data – the size of a small digital photo. With so much data being generated, high-speed computing capability is required to analyze it. In fact, the LHC project was the biggest driver early on for the creation of the MIT Regional Optical Network.

For a closer look at how faculty and researchers have been using the MIT Regional Optical Network since it was launched in March 2008, refer to the research project profiles for the LHC (www.cern.ch) and the MIT Darwin Project (darwinproject.mit.edu), a new program to develop computational models of how marine microbes live and evolve in the ocean.

Partnering with industry to build the growing network

Information Services & Technology (IS&T) at MIT partnered with Nortel to create this next-generation network, acquiring already-laid fiber-optic lines ("dark fiber") from Level 3 Communications. The result is an adaptive all-optical intelligent network designed to accommodate faster technologies and upgrades as they become



The MIT Regional Optical Network

transport laser light; in practice, this means it's transporting Internet data signals.

The cable runs underground, above telephone poles, above and under bridges, and across many other places, too. It connects Boston and multiple points in New York City, where it then connects to many of the other supercomputing networks in the world.

Extending MIT's computing network footprint beyond campus

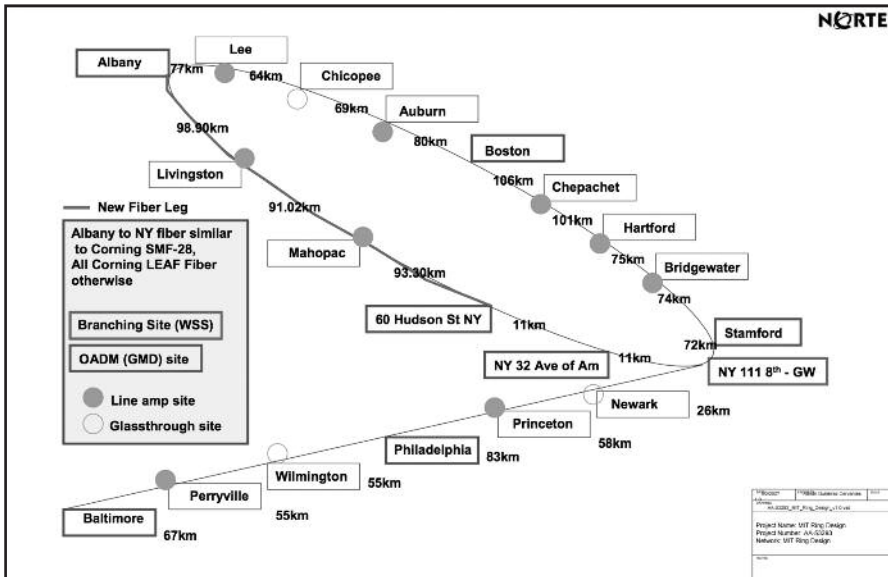
But the optical cable itself isn't the most noteworthy point, nor is it a first. In fact, the Internet is built on this type of networking infrastructure – with interconnected cables running across the United States, under the Atlantic and Pacific Oceans, and around the world. Closer to home, we use this type of computer networking infrastructure on the MIT

The need for speed in global research and collaboration

So, what makes the MIT Regional Optical Network so important to MIT? It enables global research work conducted by MIT faculty and researchers transmitting data over optical fiber at supercomputing high speeds.

Research and collaboration are increasingly conducted on a global scale, with colleagues in various countries working together on computationally-intensive projects. For faculty and researchers, the MIT Regional Optical Network is like having your own high-speed, dedicated fast lane, a lane comprised of dedicated optical light paths that run across the commercial Internet.

The Network is initially being deployed across the northeast United States, connecting MIT's main campus to New York, Washington, D.C., and Baltimore by way



The MIT Regional Optical Network

**The MIT Regional Optical Network:
At a Glance**

- 2,500-mile optical ring connecting Boston, New York City, and 10 other locations – interconnected by optical fiber cable.
- New York City as the main connectivity point.
- Located external to the MIT campus at Level 3 Communications' facility in Cambridge, and connected to the MIT campus.

“The MIT Regional Optical Network represents a big leap for the Institute, solidifying MIT’s leadership in cutting edge physics. The global, high-speed network connection is critical to the success of the LHC project. By having this network, IS&T makes it possible for MIT to host a major supercomputing facility locally, thereby giving MIT a leadership role in research taking place on a global scale. This network literally puts MIT on the world map.”

– Prof. Bolek Wyslouch,
Professor in the Department of Physics,
Laboratory for Nuclear Science (LNS)

“MIT is at the forefront of high-speed network delivery, having constructed a network resource vital to our research community today, with flexibility and redundancy to ensure its reliability and growth into the future.”

– Prof. Bruce Tidor,
Professor of Biological Engineering and Computer Science,
Co-director of MIT’s Computational and Systems Biology Initiative

“The Darwin Project is advancing computational modeling of marine microbial communities. As part of this work, we need to efficiently transfer high volumes of numerical model results across the country and to interact effectively with collaborators on the West Coast. The National LambdaRail and MIT Regional Optical Network will provide the very high-bandwidth needed for seamless collaboration.”

– Mick Follows,
PI of The Darwin Project and a Senior Research Scientist
Department of Earth, Atmospheric, and Planetary Sciences

available in the coming decade.

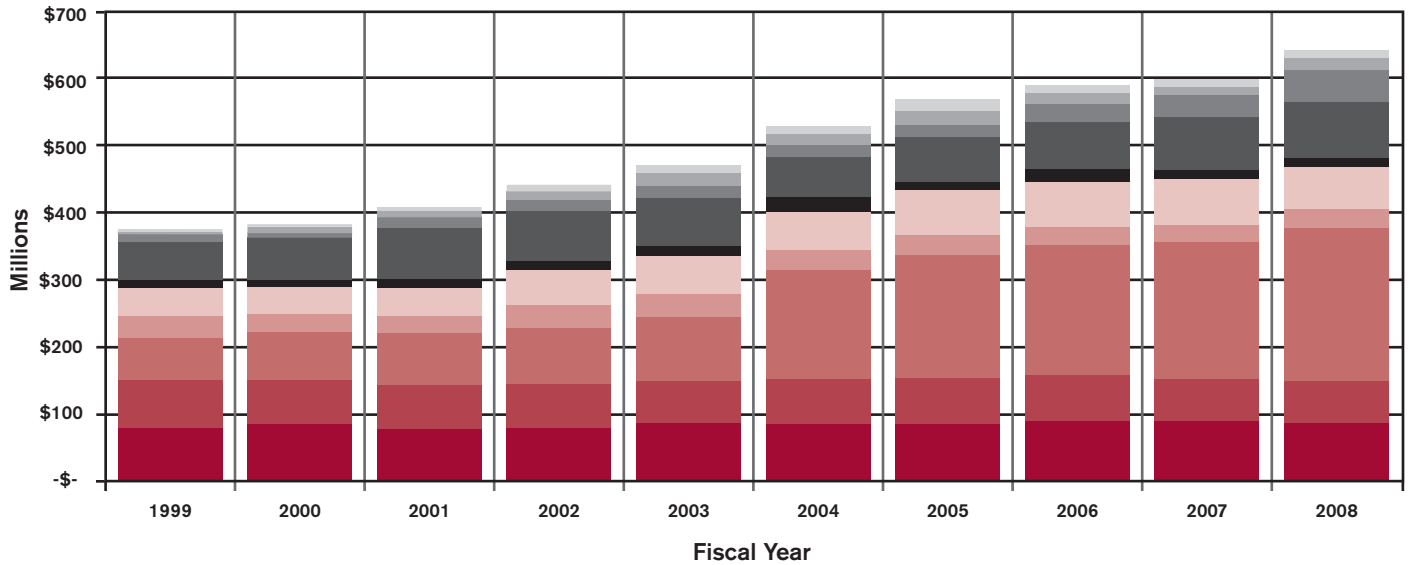
Today, the Network offers 10 Gbps connection speeds; MIT and Nortel have 40 Gbps in their sights, with 100 Gbps as a possibility within a couple of years.

The ultimate objective – according to Jerrold Grochow, Vice President for IS&T – is to help create the fastest and most flexible network possible to further MIT’s mission on a global scale – a network with the potential to revolutionize education and research. He notes, “With the Regional Optical Network as a resource, educators and researchers at MIT are able to collaborate with peers in new ways. The Network’s abundant bandwidth and ability to provide upgrades into the future supports the dynamic exchange of data, whether for seeking new particle matter or explorations of the deep seas.”

If your computationally intensive project or research might benefit from the speed and power of MIT’s regional optical network, contact IS&T’s Infrastructure and Services Team at network@mit.edu for more information. ■

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M.I.T. Numbers Research Expenditures by Primary Sponsor (1999-2008)



Note: Bar colors above correspond to colors in table below.

Major Sponsor	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Internal	\$2,776,393	\$5,018,499	\$5,950,659	\$7,476,293	\$13,317,853	\$10,145,868	\$17,061,921	\$10,431,929	\$8,884,967	\$10,696,714
State/Local/ Foreign Govts.	\$3,412,712	\$6,985,532	\$9,653,225	\$11,164,569	\$15,948,770	\$18,930,431	\$17,911,784	\$15,136,342	\$13,055,429	\$18,549,200
Non-Profits	\$11,444,435	\$8,849,853	\$11,727,774	\$14,428,282	\$18,325,666	\$15,721,218	\$19,743,695	\$24,833,139	\$32,198,679	\$47,694,400
Industry	\$61,623,382	\$61,510,439	\$80,310,841	\$77,684,031	\$73,264,891	\$60,497,827	\$65,107,845	\$72,743,321	\$79,725,395	\$82,194,185
Other Federal	\$8,347,257	\$8,872,099	\$8,642,670	\$12,142,651	\$13,149,017	\$12,113,758	\$11,954,303	\$15,569,962	\$14,431,956	\$14,169,322
NSF	\$40,546,248	\$42,185,465	\$44,036,858	\$52,612,377	\$57,718,368	\$65,442,998	\$66,767,888	\$65,162,840	\$65,057,176	\$64,972,918
NASA	\$33,331,682	\$29,050,187	\$26,970,230	\$34,326,287	\$35,734,657	\$31,442,216	\$32,170,434	\$31,229,214	\$27,888,708	\$25,479,571
HHS	\$62,145,921	\$70,614,062	\$75,234,197	\$83,517,355	\$93,253,564	\$159,028,963	\$180,682,329	\$195,572,516	\$201,557,366	\$226,306,663
DOE	\$71,613,204	\$64,157,549	\$64,402,561	\$65,454,867	\$65,175,340	\$69,182,764	\$69,927,352	\$67,264,569	\$64,898,790	\$65,610,631
DOD	\$80,805,979	\$86,744,020	\$80,494,203	\$80,376,585	\$85,866,327	\$86,948,119	\$86,096,029	\$89,552,070	\$90,570,607	\$87,369,845
Grand Total	\$376,047,311	\$383,987,705	\$407,423,217	\$439,183,297	\$471,754,452	\$529,454,162	\$567,423,580	\$587,495,904	\$598,268,072	\$643,043,447
*Constant \$	\$483,829,002	\$480,183,287	\$492,612,695	\$521,775,554	\$548,417,735	\$602,319,251	\$626,656,356	\$625,021,931	\$620,436,912	\$643,043,447
% Federal	79%	79%	74%	75%	74%	80%	79%	79%	78%	75%

*Constant Dollars: CPI-U 2008 = 100

Source: Office of the Provost/Institutional Research