

# Summary of the Report and Recommendations of The Task Force on the Undergraduate Educational Commons

to the President of The Massachusetts Institute of Technology

October 2006

## Introduction

In the winter of 2003–04, the Task Force was charged with reviewing MIT's undergraduate education and making recommendations on how the General Institute Requirements (GIRs) might be altered. Since then, we have conferred with numerous faculty members, students, staff members, and alumni.

The past fifty years of undergraduate education at MIT have been highly successful. Yet, while the curriculum remains robust, developments in the world and changing characteristics of students have brought important tensions to the curriculum. In particular, the Science Requirement has become overly prescriptive; the Humanities, Arts, and Social Sciences (HASS) Requirement has become extremely complicated and has not created an environment in which the study of culture and society is sufficiently valued; and the international environment demands that our undergraduates become comfortable with the culture, attitudes, and norms of other nations and peoples. As well, the past decade has witnessed considerable pedagogical innovation among the MIT faculty, which should be consolidated and incorporated in the mainstream.

We reaffirm the historic understanding of MIT's distinctive educational mission, which is devoted to the advancement of knowledge and the education of students in areas that contribute to, or prosper in, an environment of science and technology. Additionally, we reaffirm eleven specific principles that refine the mission as articulated by MIT's founders, the Lewis Committee, and the Task Force on Student Life and Learning. We distilled these historic principles into five major themes that are intended to capture the spirit of the education we intend to foster at MIT: (1) a persistent passion for learning, (2) intellectual diversity, (3) an innovative approach to core knowledge, (4) collaborative learning, and (5) education for responsible leadership.

In considering how to organize our undergraduate curriculum, we review changes in three major domains that constitute the raw material with which the faculty works: (1) science and technology, (2) culture and society, and (3) the prior preparation and aspirations of students. The proposed curriculum changes respond to developments in these domains and to commonly expressed concerns about the current curriculum. We bring the structure of the Science and HASS Requirements more closely into alignment, and suggest that the first year be regarded more as a unified whole.

Because it is impossible to provide a completely satisfactory professional preparation in four years, our most important task is to construct an educational infrastructure that prepares MIT graduates for a lifetime of learning. The approach to our deliberations has been guided by the words of William Butler Yeats: “Education is not the filling of a pail, but the lighting of a fire.”

## Summary of Principal Recommendations

1. *The Science Core, Restrictive Electives in Science and Technology (REST), and Laboratory requirements will be replaced with a single eight-subject Science, Mathematics, and Engineering Requirement.* The key feature of this requirement is requiring mastery in foundational material by combining a small set of subjects required of all students (single-variable calculus, multi-variable calculus, and classical mechanics) with a limited set of foundational subjects that will be organized into six categories: chemical sciences, computation and engineering, life sciences, mathematics, physical sciences, and project-based first-year experiences.
2. *The Humanities, Arts, and Social Sciences (HASS) Requirement will be changed to an eight-subject requirement that is divided into two major parts, the foundational phase and the concentration phase.* The foundational phase will consist of four subjects – expository writing and three “foundational electives” distributed across the categories of the arts, the humanities, and the social sciences. (Expository writing may be converted into a free HASS elective by passing an MIT-administered exam.) The concentration phase will consist of four subjects taken from a concentration that was sponsored by a department or an interdisciplinary field. (Concentration fields will have the option of allowing students one free HASS elective.) A HASS First-year Experience Program will be created to support a small set of foundational electives that will be designed specifically for the first year; all first-year students will take one of these subjects.
3. *MIT will make it clear that acquiring experience in living and working with people from other countries is an essential feature of an undergraduate education, work to expand current international education programs that have proven successful in the MIT environment, and develop strategies to create other opportunities that are especially relevant to an environment that emphasizes science and technology.* We must aim to allow every MIT student who wishes to undertake a meaningful study, work, or internship experience abroad to do so without financial or academic penalty.
4. *MIT will use this period of curricular renewal to enhance the infrastructure that supports excellent undergraduate teaching.* These efforts include increasing coordinated planning of the first-year curriculum; improving orientation and first-year advising; upgrading the quality of classrooms and aligning the mix of classrooms with our teaching needs; gaining control over counterproductive class-scheduling practices; documenting more completely the contributions our educational efforts make in enhancing the meaningful interactions among students of diverse backgrounds; further extending and professionalizing our efforts to engender educational excellence; and adapting the faculty governance structure to the needs of curricular renewal.

# The New General Institute Requirements

## Humanities, Arts, and Social Sciences Requirement (Eight Subjects)

### *Foundational Subjects*

one subject from each of three categories,  
one of which must be from the First-Year Experience Program

<b>HUMANITIES</b>	<b>ARTS</b>	<b>SOCIAL SCIENCES</b>
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Expository Writing (if necessary) or HASS Elective

### *Concentration Subjects*

four subjects specified for each Concentration;  
Concentrations may allow HASS Elective as fourth subject

## Science, Mathematics, and Engineering Requirement (Eight Subjects)

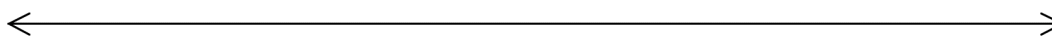
### *Required Subjects*

<b>MECHANICS</b>	<b>SINGLE-VARIABLE CALCULUS</b>	<b>MULTI-VARIABLE CALCULUS</b>
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### *Foundational Subjects*

one subject from five of six categories

<b>CHEMICAL SCIENCES</b>	<b>COMPUTATION &amp; ENGINEERING</b>	<b>LIFE SCIENCES</b>	<b>MATHEMATICS</b>	<b>PHYSICAL SCIENCES</b>	<b>PROJECT-BASED EXPERIENCE</b>
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## Summary of the Report and Recommendations on Scientific and Engineering Preparation for the 21st Century

Three elements of the General Institute Requirements (GIRs) provide an essential education in science and engineering – the Science Core, the Laboratory Requirement, and the Restrictive Electives in Science and Technology (REST) Requirement. Even with these strengths, the set of subjects that is absolutely central to careers at the forefront of science and technology is broader than the set embraced by these requirements. The current approach to the GIRs also causes students to defer for too long a direct experience with the type of creative research and design that produces the most spectacular advances in science and engineering. As a result, a significant number of MIT students graduate without an exposure to the principles and methods of engineering.

Given the size of many major programs, the desire to preserve a reasonable number of free electives, and the constraint of an eight-semester undergraduate program, we cannot require every MIT student to take all of the background subjects identified as essential to an ideal preparation of twenty-first century careers in science and engineering.

Instead, we recommend a new, two-tiered Science, Mathematics, and Engineering (SME) Requirement that defines the scope of the ideal preparation in science and engineering, but recognizes the practical limits of the GIRs in the context of a four-year undergraduate degree. We propose that all students be required to take three subjects: two semesters of calculus and one semester of physics. Students also will be required to take one subject from five of six foundational categories: chemical sciences, computation and engineering, life sciences, mathematics, physical sciences, and project-based first-year experiences.

We further recommend that, with the exception of calculus, MIT students not be allowed to satisfy elements of the new Science, Mathematics, and Engineering Requirement through Advanced Placement (AP) or International Baccalaureate (IB) examinations, that departments be allowed to prescribe a limited number of foundational subjects in the requirement, that a new oversight committee be developed for the implementation of the requirement, and that the faculty and administration work to ensure the continued success of the special first-year programs.

- 1. Formal mechanisms should be established to limit the subjects contained in the six foundational categories to classes that address matters of a foundational nature and limit the number of subjects in each category to three.* The exception to this numerical limitation is the Project-Based First-Year Experience category.
- 2. Students generally should not be allowed to satisfy the new SME Requirement through examination, except through Advanced Standing examinations administered by MIT.* Exceptions can be imagined, such as for Calculus, but they must be grounded in a set of findings that: (1) map the content of the outside exams onto the content of classes as taught at MIT, and (2) document that students who satisfy the requirement through these exams perform well in subjects that require mastery of the foundational material.
- 3. Departments may designate a limited number of named subjects to be used to jointly satisfy the SME Requirement and serve as a prerequisite for required subjects in the major.* However, departments should not be allowed to designate *all* of the SME electives. Departments with large major programs should offer a more flexible degree option that requires fewer subjects.

4. *A subcommittee of the Committee on the Undergraduate Program should be constituted to oversee the SME Requirement.* The subcommittee should include representation from all Schools of the Institute and active participation from the Deans for Undergraduate Education, Science, and Engineering.

5. *The Institute should continue to support the special first-year programs as they adjust to the flexibility required of the new SME Requirement and to allow these programs to continue to serve as a testing bed for experimental approaches to foundational material.*

## **Summary of the Report and Recommendations on Studying Culture and Society at MIT in the 21st Century**

A rigorous curriculum in the humanities, arts, and social sciences is a distinctive feature of MIT's undergraduate program, distinguishing it from most other universities primarily devoted to science and technology. The current HASS Requirement was last changed in 1989, but draws its ultimate inspiration from the 1950 Lewis Committee report, which provided a blueprint for highlighting the understanding of culture and society in the context of a technical education. That blueprint has guided the development of a flourishing faculty in the humanities, arts, and social sciences with a rich legacy of teaching and research.

As a result, MIT undergraduates are challenged by superb teaching and research collaborations in these fields. However, the requirement is overly complex and inadequately structured to achieve its goals. We must also find new ways to encourage the active collaboration of faculties in science and engineering with faculties in the humanities, arts, and social sciences in designing classes that more explicitly bridge these areas.

We propose the establishment of a new requirement in the humanities, arts, and social sciences. This new requirement will explicitly create intellectual communities organized around the exploration of major issues in culture and society, while providing a focused introduction to the intellectual traditions and practices associated with these disciplines. It is organized around four subjects in a "foundational phase" and four subjects in a "concentration phase." One of the foundational phase subjects will be taken from among classes associated with the new HASS First-Year Experience Program, which will encourage innovation in first-year education and oversee developments of distinct first-year opportunities. We also recommend a portfolio of strategies that is intended to facilitate greater collaborations among HASS departments and between HASS and non-HASS faculties.

1. *A HASS First-Year Experience Program should be created to support a small set of foundational electives that would be designed specifically for the first year.* All first-year students would be required to take one of these subjects.

2. *A subcommittee of the Committee on the Undergraduate Program should be constituted to oversee the implementation of the HASS Requirement.* The subcommittee should include representation from all Schools of the Institute and active participation from the Deans of Humanities, Arts, and Social Sciences; Architecture and Planning; and the Sloan School of Management; and Undergraduate Education.
3. *The Dean of the School of Humanities, Arts, and Social Sciences should immediately issue a call to academic units and interdisciplinary committees of faculty to propose HASS concentrations.* These proposals shall specify the structure of the requirement and its academic strengths, show evidence that the concentration will have sufficient budgetary and staff support, provide plans for the establishment of intellectual activities outside the formal curriculum, and demonstrate the long-term commitment of regular faculty to ensure the continued coherence and rigor of the program.
4. *The Registrar should work with the academic deans to develop a plan to ensure that foundational elective subjects have a dedicated time in the schedule that is coordinated with the major lectures in the SME Requirement.*
5. *We recommend that study be given to the establishment of a center to be responsible for developing links between HASS faculty and departments in the Schools of Science and Engineering, for the purpose of developing classes and class sections that will respond more directly to the professional development needs of undergraduates, as well as to the intellectual challenges and responsibility that accompany the practice of modern science and engineering.*

## **Summary of the Report and Recommendations on International Experiences and an MIT Education**

The rising global character of the economy and culture is one of the most compelling developments in the world today. It is made possible largely through scientific and technological changes that MIT has fostered and has a great interest in continuing to affect. Being able to understand and to work with people from diverse nations and cultures are indispensable abilities that will characterize successful leaders in the coming century. We must encourage students, while they are undergraduates at MIT, to encounter the cultures, educational systems, research enterprises, and manufacturing concerns of other countries, as well as to understand the role of the United States within this global framework.

The past decade has seen the development of several highly successful models for accomplishing this goal, which have been adapted to the distinct environment of MIT. These programs allow students with diverse experiences to acquire meaningful encounters with the international system and specific cultures. We encourage the Institute to consolidate these developments and nurture their growth to sustainable size. Institute faculty members are brimming with further ideas on enlivening the encounter of students with other countries; therefore, we must support and fully implement these ideas at all stages of the process. Finally, we must create a prominent information portal that clearly communicates the value of these programs, as well as how to pursue them.

We are confident that these efforts will help us achieve our final goal: to allow any MIT undergraduate who wishes to participate in a meaningful experience abroad to do so without financial or academic penalty.

1. *The Institute should undertake immediate efforts to undergird the efforts of existing programs at MIT that have proven especially effective in creating meaningful encounters between undergraduates and foreign countries.* These efforts include assessing the optimal sustainable scale of these programs, the resources necessary to reach this scale, and feasible strategies for expanding the reach of these programs.
2. *The Dean for Undergraduate Education should convene a committee to develop a comprehensive strategy to 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.* In particular, students who undertake meaningful study abroad should be able to graduate in four years and will be assisted in financing foreign study, especially for summer experiences, where financial aid is generally unavailable.
3. *The Dean for Undergraduate Education should provide intellectual guidance for the expansion of MIT's engagement with international education at the undergraduate level.* The Dean should have the necessary resources to encourage faculty members to explore formal arrangements with comparable universities in other countries, in order to promote undergraduate study and research exchanges.
4. *The Committee on the Undergraduate Program will issue a call to all academic departments, requesting that they provide formal guidance to all majors who may wish to pursue international study.* Departments also should be encouraged to explore developing educational partnerships with universities in other countries and develop avenues for undergraduates to gain international experience during the IAP and the summer. The Dean for Undergraduate Education should ensure that information about each department's international education opportunities is updated annually and widely disseminated to current and prospective students.
5. *The Dean of Humanities, Arts, and Social Sciences should commission a study of current and future demand for foreign language instruction at MIT, with the goal of devising a plan for meeting the demand that may exist.*
6. *The Dean for Student Life, working with the Deans of the Schools, should bolster the internationalizing missions of the Institute's international theme houses and, where necessary, work to strengthen ties between these residences and academic units.*

## Summary of the Report and Recommendations on Further Efforts to Enhance the Educational Commons

The enhancement of our curriculum relies not only on formal changes, but also on attention to the underlying conditions that allow a curriculum to be successful. We highlight six of these conditions: first-year coherence and integrity; upperclass advising; classroom resources and scheduling; diversity; resources for educational innovation, renewal, and assessment; and faculty governance.

The reforms we propose earlier in this report create conditions for establishing an even more unified approach to the first year at MIT, by strengthening orientation, bolstering the advising system, and supporting a variety of efforts to foster coordination among the instructors who teach large numbers of first-year students.

Advising and mentoring all students, not only those in the first year, are critical tasks about which the entire community must be concerned. The advising experience of MIT undergraduates is, at best, varied. MIT must strive to create for each undergraduate a network of individuals who can be counted on to provide the needed advice and counsel to help navigate the passages of a four-year experience. To assist in making this a reality for all students, we must strengthen the existing resources, empower the departmental undergraduate offices, and provide concrete recognition for faculty members in their roles as advisors.

The quantity, quality, and composition of our classrooms are inadequate for our current teaching needs; this is a topic that demands immediate attention if the reforms we propose are to succeed. Also, the time scheduling of classes has become chaotic, which exacerbates the classroom shortage and encourages a nonacademic or even an anti-intellectual approach among students when they choose classes.

We affirm MIT's commitment to recruit a highly diverse student body and the efforts to use that diversity as a resource in the education of our students. Efforts to increase the number and quality of meaningful interactions among students of diverse backgrounds should be vigorously pursued, as should efforts to monitor and document the effects that our curricular reforms have on the ability of students to succeed when they live and work with people of varying backgrounds.

The past decade has brought a new level of professionalism into the development of new subjects and teaching modes and in assessing the success of our efforts. We should expand on these efforts to raise the professional level of our teaching approach by enhancing our capacity to improve the skills of our teaching staff at all levels, making assessment a common Institute practice, working to improve connections between MIT classes, better documenting the teaching experiments that are conducted at MIT and disseminating good practices, as well as strengthening the capacity of the Dean for Undergraduate Education to work with departments and Schools in their efforts to improve the curriculum.

Finally, we must accomplish the enhancement of undergraduate education by forming a leadership partnership among the faculty Committee on the Undergraduate Program, the Dean for Undergraduate Education, and the School Deans. An especially important task in providing leadership for these new efforts is the cultivation of a new generation of academic leadership among our less senior faculty.



### *General recommendations*

1. *The Committee on the Undergraduate Program and the Committee on Curricula should work to bring a plan to the faculty that will allow students who wish to pursue a double major at MIT to do so by simply completing the General Institute Requirements (GIRs) and the programs of the desired majors.*
2. *The Committee on the Undergraduate Program should commission a study of MIT's academic calendar and recommend changes to the faculty that will help undergraduates better allocate their time during the semester and have greater time for reflection on and integration of what they have learned.* Specific issues that should be addressed include the Drop Date, the absence of a true reading period prior to final exams, and formalizing meeting times between advisors and advisees during an extended pre-registration period.

### *First-year coherence and integrity*

1. *The Chancellor should convene a faculty committee to examine first-year orientation and ensure a more equal balance among student life, academics, and research.* As part of this effort, consideration should be given to the impact of the new pre-orientation first-year programs and how they contribute to the important intellectual goals of first-year orientation.
2. *The School Deans and the Dean for Undergraduate Education should undertake a consideration of the factors that will lead to an increased number of faculty members advising first-year students.* Included in this study should be recommendations on ways to materially recognize the efforts of faculty members to advise first-year students.
3. *The School Deans and the Dean for Undergraduate Education should enhance the support given to efforts to coordinate the content of classes that satisfy the GIRs as well as efforts to coordinate this class content with the needs of departmental programs.*

### *Upperclass advising*

1. *The School Deans, along with the Dean for Undergraduate Education, should develop plans to ensure that the efforts made by faculty members to assist in the advising and mentoring of undergraduates are acknowledged in annual salary reviews and in promotion and tenure cases.*

### *Classroom resources and scheduling*

1. *A committee should be appointed to conduct long-range planning of classroom space needs at MIT in light of current and future needs, make recommendations concerning maintenance and new construction, and exercise oversight of these actions, as appropriate.* This committee should give serious consideration to the possibility of constructing a dedicated Teaching and Learning Center, which has been discussed at MIT for many years.
2. *The Faculty Policy Committee should give consideration to how faculty interests about the oversight of classroom resources should be explicitly lodged with a standing committee of the faculty.*
3. *The Registrar should work with the School Deans and the Committee on the Undergraduate Program to examine current class scheduling practices and recommend reforms to more efficiently utilize the classroom space that currently exists and allow for more flexible choice of GIR subjects in the first and sophomore years.*

### *Diversity*

1. *MIT should continue to state clearly the paramount importance of maintaining a diverse student body from the perspective of its educational mission and resist efforts imposed from the outside to diminish or dilute those efforts.*
2. *All new subjects that are created in response to our curricular reform should address directly the relationship between the subject design and the diversity goals of the Institute.*
3. *Macro-level assessment of our curriculum should pay explicit attention to the dimensions of each student's experience that constitute meaningful interactions among diverse groups of students and with issues that bear upon diversity.*
4. *The Office of Minority Education should work jointly with the Teaching and Learning Lab to develop and maintain a database of resources, case studies, and other reference materials that faculty members may access when developing new or modifying existing classes.*
5. *The Committee on the Undergraduate Program should work with the Dean for Undergraduate Education to develop a faculty-led strategy to monitor the contribution of curricular reform efforts in fostering greater comfort on campus among minority group students, and in more generally addressing diversity issues.* The CUP should make an annual report to the faculty on the status of issues related to formal and informal interactions on campus that affect diversity.

*Resources for educational innovation, renewal, and assessment*

1. *MIT should strive to make the improvement of undergraduate education a high priority and support efforts to continue raising the professional standards of these efforts at the Institute.* Among these efforts are expanding programs of teaching improvement at MIT, expecting each department to develop a training program for its teaching assistants, enhancing the capacity to assess the curriculum and classroom teaching and learning, and documenting and disseminating best practices developed at MIT.

2. *The Dean for Undergraduate Education should work with the School Deans and the departments to consider ways to further cooperation between the Teaching and Learning Laboratory and individual departments.* An important question to be considered is how broadly distributed MIT's capability to assess curriculum reform and disseminate the results should be, particularly how to extend these capabilities across the entire common curriculum.

*Faculty governance*

1. *The Faculty Policy Committee should undertake a study of the faculty governance system at MIT to ensure that the structure of faculty governance is fine-tuned to help implement the reforms that flow from this report.*