

The MIT Faculty Newsletter

Vol. IX No. 5

May 1997

Lotte Bailyn New Faculty Chair

Newsletter Staff

The new chair of the faculty for a two-year term beginning June 15th is Lotte Bailyn, the T Wilson (1953) Professor of Management. For the past two years she has also been the Matina S. Horner Distinguished Visiting Professor at Radcliffe College.

Born in Vienna, Bailyn was brought up in New York City, from where she went to Swarthmore and majored, with honors, in math. But she turned to social psychology in the Harvard Graduate School, with a dissertation on the cognitive effects of the mass media on children. This was long ago, and her dissertation director told her she had a sterling record and they wanted to appoint her to an instructorship at Harvard but that since that required tutorial work in the Houses, which only men could do, it was impossible.

So she spent a number of years on various research and teaching jobs in the Boston area, one of which was in the old Department of Economics and Social Science at MIT. Her work dealt with such subjects as the social concerns of high school students, the attitudes of

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MIT Education in the Age of Information

Alan Lightman

In 1936, on the occasion of the tricentennial celebration of higher education in America, Albert Einstein presented this view of education: "If a person masters the fundamentals of his subject and has learned to think and work independently, he will better be able to adapt himself to progress and to changes than the person whose training principally consists in the acquiring of detailed knowledge." Einstein's insight has profound relevance today, at a time of rapidly increasing knowledge in the professions and of unprecedented new information technologies able to deliver that knowledge at astonishing quantity and speed. If we do not wisely plan our educational strategies for the future, our students will turn out to be computers rather than thinkers.

MIT's senior administration has recently commissioned a task force to reexamine and articulate our educational mission for the next generation. We have carried out such studies three times in the past: the Lewis report of 1949, responding to questions raised by the huge expansion of research and resources at MIT during World War II; the Zacharias report of 1964, responding to a perception that the MIT undergraduate education had become too passive, rigid, and hurried; and the Hoffman report of 1970, responding to the intensified sense of social responsibility following the tumultuous upheavals of the 1960s.

A stated motivation for the new study underway is the continuing decline in public support for science and technology, together with the associated reduction in federal funding of those activities. This gradual erosion began in the 1970s and has been driven by, among other forces, a peaking of the arms race with the Soviets, a new environmental consciousness that has brought concerns about all science and technology, and a broad public shifting of national priorities and values. No longer can research universities, and especially technically oriented research universities, assume the same kinds of support that we enjoyed in the past. Correspondingly, all

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Editorial

Re-inventing Ourselves

Learning and discovery are truly inseparable processes, and both lie at the heart of research universities' missions. We also know that the 21st-century U.S. workforce will require skills such as solving complex problems, dealing with uncertainty, and probing the unknown that are best acquired through discovery-based learning experiences. Committing ourselves to the integration of research and education will help secure our nation's future by reinvigorating a traditional strength of our great universities.

Anne Peterson
"Research, Education, and
America's Future"

Science, 274, 11 October 1996, p. 159

The title of this editorial implies its main conclusion: In order for MIT to maintain and enhance its contribution, we need to preserve and protect its distinctive character among large private research universities.

Our contention here is that this means constantly, explicitly, self-consciously, systematically, proactively, and publicly re-inventing our core education and research programs.

Echoing concerns that are also being widely expressed by others elsewhere, members of the MIT community have lately been filling the pages of this *Newsletter* with a plenitude of information and opinion on the present state of research and education in the United States and its relation to the future of MIT. During the past year, a particularly strong point of emphasis has been on the need to ensure that the quality of our undergraduate education programs remains second to none.

Many of the relevant articles we have printed during the past year focus more

specifically on the first year program. Noteworthy among these are pieces by John Belcher ("Trends in Science Education"—September 1996); Martin F. Schlect ("Making Student Services Better"—September 1996); Arthur Steinberg ("Hands-on Learning at the Integrated Studies Program"—January/February 1997); Leon Trilling ("TILT and the Role of MIT in K-12 Education"—March/April 1997); Lawrence M. Lidsky ("It Is Broken, and We Should Fix It"—March/April 1997); Alan Lightman ("MIT Education in the Age of Information"—May 1997); as well as our regular "Teach Talk" feature, which have argued, among other things, that we here at MIT need to:

- take a leading role in dealing with the nationwide crisis in introductory secondary and post-secondary science, mathematics, engineering, and technology education;
- maintain and improve the quality of our own first-year undergraduate program in the face of changing student demographics and educational priorities; supplement lecture/recitation format with other pedagogically sound learning/teaching modalities (e.g., "hands-on," project-based, discovery-based, or inquiry-based approaches);
- devote more of our limited resources to curriculum reform efforts;
- strengthen communication skills, foster "systems thinking", and improve learning/teaching of disciplinary fundamentals;
- find ways of giving our students more and better opportunities to learn how to learn;
- slow down to see where we are and where we are going;
- make time available to students and faculty, to listen to our own thoughts, to reflect, to invent

As all who have survived it will attest, the experience of getting an MIT undergraduate education has always been intellectually, emotionally, and behaviorally demanding. To many of us it seems to have become even more so in recent years; all of us know it has become much more costly!

So long as the benefits of earning an MIT degree continue to be seen as outweighing the personal and financial costs involved, students will remain willing to invest their time and effort in the process. By the same token, so long as parents and other parties possess the means to do so, they will presumably continue to be willing to pay the attendant tuition and living costs.

However, particularly at this moment, with our annual commencement exercises soon upon us, and with a new century fast approaching, it seems appropriate to take another look at our predicament as an institution.

For MIT, institutional survival (not to mention prosperity) will at least partly depend upon our ability to retain the moral and financial support of the larger society of which our local academic community is a part. In order to justify that support—in order to deserve public trust—we must continuously show ourselves to be creatively responsive to the academic challenges we face. First and foremost, the core challenges are educational. Thus, the students we educate must be well schooled in a wide range of disciplines, must be experienced in defining and *solving complex problems, dealing with uncertainty, and probing the unknown*. In satisfying the General Institute Requirements, candidates for an MIT undergraduate degree must continue to demonstrate a readiness, willingness, and ability to

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Re-inventing Ourselves

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work long hours and to put a lot of time and effort into the learning process. They must also learn to work well and effectively with others in a wide range of educational and research contexts.

Make no mistake about it, the future status of MIT (and likewise the value of an MIT undergraduate degree) will depend not so much upon the Institute's well-earned reputation for academic rigor, but rather upon the consistency, diligence, and proficiency with which we and our students and alumni continue to make meaningful, valuable, and effective contributions to the process of defining and dealing with a wide range of pressing human problems of broad scope and great complexity.

The present crisis in U.S. education – and most especially in secondary and post-secondary education in what has come to be called SME&T (science, mathematics, engineering, and tech-nology) – presents MIT, as “a university polarized around

science,” with both dangers and opportunities.

Included among the dangers is one about which our colleague Woodie Flowers has lately been warning us: the possibility that some or all of the traditional educational functions of colleges and universities (e.g., intergenerational knowledge transfer) will increasingly be supplanted by powerful commercial interests more efficiently utilizing a wide array of emerging communications, information, and media technologies.

Included among the concurrent opportunities is a chance for us to use the unique conceptual and material resources at our disposal to take a systematic, collaborative, approach to the task of improving the quality of our introductory undergraduate offerings (the freshman core curriculum).

We believe that the informed opinions and proposals that we've already heard are only the tip of the iceberg, and that the

voices of many more people with pertinent alternative ideas, visions, and plans remain to be heard. As a first step in this direction, we join with others in urging all concerned MIT faculty and staff members, students, alumni/ae, and members of the administration and corporation, to make their views on these issues known to the Committee on the Undergraduate Program (CUP) and the Task Force on Student Life and Learning.

We need to ensure that due attention is paid to the widest possible array of good ideas, and that an appropriately collaborative process is employed in determining what is to be done by way of implementation. In the end, the outcome of our efforts to re-invent ourselves will be no better than the quality of the time and effort we put into the process. For this reason, the entire approach needs to be just, sustainable, and as participatory as possible.

Editorial Committee

Re-invention: A Note on Process

Stephan L. Chorover

Like most of my colleagues, I have some ideas about what an improved first year MIT undergraduate experience might look like.

My vision of such a program may or may not resemble those entertained by others, but precisely because there clearly is no shortage of good ideas about improving the quality of “the first year program” as a step toward enhancing the quality of “student life and learning,” it is not my aim here to outline or to advocate any particular model(s).

I simply want to note that means and ends are systematically related. Among other things, this means that the quality of the intended outcome of any given effort to review (and even moreso to redesign) MIT's first-year program will be determined, in large part, by the soundness,

creativity, and effectiveness of the methods of procedure employed in the process. In an effort to contribute constructively to the review/recommendation process currently underway, I want to argue that in order to achieve the desired outcome, the means and ends involved need to harmonize and to be harmonizable.

If some creative educational re-invention is in order—as the above editorial argues – and if we are committed to attaining a salutary outcome, it behooves us to proceed in an intentionally collaborative manner. Happily, shared goal-setting and learning processes, as well as other scientifically credible, informationally open, institutionally appropriate, and educationally effective methods of procedure are available for this purpose.

Pertinently, at least some of the relevant theories and practices have been and are being developed, used, and taught here at MIT by our colleagues in the Sloan School, and elsewhere. A particularly noteworthy early example is the action research paradigm first developed more than a half-century ago by Kurt Lewin and his colleagues [Lewin, K. “Channels of Group Life: Social Planning and Action Research” *Human Relations I*, 1947, 143-153].

This is not the place for any detailed description of the theoretical foundations and practical entailments of the action research approach to problems of organizational learning and organizational change. Suffice it to say here that the approach to individual and institutional

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change that action research offers resembles nothing so much as a recursive design/implementation/feedback/redesign process.

Thus, a diverse group of faculty members interested in applying Lewin's approach to the present situation, might join together with others (including some interested students, staff members, facilitators, and administrators) for the purpose of designing and implementing a self-organizing collaborative education action research project. Project participants might begin by working together toward the development and articulation of a collaboratively shared vision of what a new departure in MIT undergraduate education might look like if we had it. They could next go on to come up with some realistic plans for its collaborative realization.

Such an initial effort might culminate with the drafting of a detailed proposal describing the designers' shared vision of a "new departure in MIT undergraduate education" and outlining an appropriately detailed plan for realizing it. Successful proposals would ideally be enabled to proceed to the point of actual implementation (e.g., in the form of a suitably scaled educational experiment involving an appropriately chosen cohort of incoming first-year undergraduate student volunteers).

There are many questions that would have to be addressed before any such alternative first-year program could be offered. For example: Would the students enrolled in it have a fair chance of learning what they need to learn in order to satisfactorily complete the first-year core portion of the General Institute Requirements? Further, given a seemingly workable plan with a consensus that the attainment of indicated first-year learning/teaching objectives is possible, and given a modicum of official support, is it reasonable to anticipate having such a program in place by the fall of 1998?

Meanwhile, many other important questions remain to be addressed, and many substantive and procedural particulars remain to be worked out. However, taking a cue from Lewin, active involvement in the process of defining a problem is invaluable in creating the individual and collective sense of enrollment, recruitment, and ownership that effective problem solving requires. This means that the task of defining the overall shape and texture of any experimental program should be left largely to those who are committed to its actual design and implementation.

My own experience as a scientist, classroom teacher, and freshman advisor convinces me that many of the problems we face in respect to MIT undergraduate education have their origins in the context of "the first-year experience." Two recent reports by different cohorts of under-graduates identified several critical tensions, conflicts, and attitudinal shifts that are experienced by many incoming first-year undergraduate students [*The First Year Undergraduate Experience: A Social Psychological Perspective*. A collaborative end-of-term report (43 Authors) by students in the Tuesday Section of 9.70-Social Psychology, May 15, 1997; *MIT Freshman Year: Some Social Psychological Implications*. Collaborative End-of-Term Project (50 Authors); Thursday Section, 9.70-Social Psychology, May 15, 1997].

I also agree with the recommendation made in yet a third student report [*Toward a New Departure in MIT Undergraduate Education*. Collaborative end-of-term report (20 Authors): 9.06 - Conflicting Images of Humanity and Nature, December 15, 1996] that any such innovative program be both residentially-centered and inquiry-based (or "discovery-based"). Principled reliance on an experientially grounded inter-

disciplinary model systems approach is theoretically and practically warranted in this case. Such an approach would enable students and instructors to work together "across the curriculum," devising and implementing pedagogically sound learning and teaching activities focused around a thematically coherent system (or set of systems).

A further point about process: In its organization and development, any such educational experiment would necessarily involve a diverse group of faculty, students, and others. Unfortunately, many and varied communication impasses frequently attend most serious efforts at meaningful discourse across academic and professional boundaries. Fortunately, methods of procedure exist – and others could be designed and implemented – to facilitate more meaningful and effective interdisciplinary communication. Again, the action research paradigm entails methods of procedure that not only serve to facilitate interdisciplinary communication, but also allow for consensual validation or disconfirmation of relevant working hypotheses.

The educational challenge before us presents real problems that we should define and deal with in thematically coherent and practically effective (heads-up/hands-on (*Mens et Manus*)) ways.

As I see it, the initiation of a self-organizing collaborative learning/teaching process is an indispensable precondition for the organization and development of a high quality new departure in MIT undergraduate education. If we truly aspire to make some fundamental and wide-ranging changes in our approach to introductory education in science, mathematics, engineering, and technology, we must learn to work together across the disciplinary boundaries that too often serve to separate us.♣

[Stephan L. Chorover can be reached at chorover@mit.edu]

Facilities Expansion and Renewal at MIT

William R. Dickson

The following article was kindly provided to the Faculty Newsletter by Vice-President Dickson in response to a request by this issue's Editorial Committee.

Although the Institute has remained relatively stable in the size of its student, faculty, and employee populations over the last decade, the demand for new construction, major building renewal, and alterations to existing space continues to grow. There are several reasons for this. Among them are the need for modern research facilities, particularly in laboratory sciences such as biology and chemistry, which is exacerbated by the aging of our existing facilities; the growth of new or expanding areas of research; the demand for community facilities such as the proposed new swimming pool and athletic center; the need to provide housing, for graduate and undergraduate students because of the scarcity of housing near MIT; and the demand for more specialized facilities for the Arts.

Who decides what gets accomplished and in what order? Let's start with space changes. All non-housing space at MIT is Institute space that is assigned temporarily to departments, labs, and centers. The keeper of space is the provost, and changes to all non-housing space are overseen by the Committee for the Review of Space Planning (CRSP). Over time, CRSP membership has varied, but its core and current membership is the provost (chair), senior vice president (vice-chair), director of Physical Plant, director of Planning, assistant provost for

administration, and the space administrator and secretary, usually a full-time Physical Plant employee.

Space requests are department-initiated. After being endorsed at the departmental level, a request is forwarded to the respective senior officer (dean or vice president) for consideration and prioritization. If the request is endorsed by the senior officer, it is then forwarded to CRSP for consideration. CRSP usually meets twice monthly at which time it will review the reason for the request, the estimated cost of the renovation, the Committee's financial resources, and then approve or deny the request. Often there is much back-and-forth between a department and the space administrator before a request reaches CRSP. Currently, the CRSP budget is \$4.4 million annually. Since that is an insufficient amount to cover the full cost of proposed projects, it is often necessary for departments, deans and vice presidents, and CRSP to pool resources to fund a project.

Major renovation projects, while still reviewed and approved by CRSP, are generally treated as capital projects. Several current projects related to clearing Building 20 for demolition in the spring/summer of calendar 1998 are in this category.

Renovation of an entire building (such as Buildings 16 and 56) and construction of all new facilities fall under the purview of the Institute Building Committee. Over the past four decades, this Committee has consisted of the chairman, president, provost, treasurer, vice president for operations (convenor), director of Physical Plant, and director of Planning. Currently,

the Committee also includes the vice president for Resource Development and the dean of Architecture and Planning.

The Academic Council actively participates in the decision-making process that establishes the overall need for new facilities and also advises the president and provost as to priorities. In the end, however, it is the president and Executive Committee of the Corporation who ultimately decide the issue based on need, funding requirements, and the potential availability of financial resources.

Currently, the Institute is committed to the following projects: completion of the Building 16 renovation early in calendar 1998, demolition of Building 20 in the spring/summer of 1998, construction of a new building on the Building 20 site to be completed early in the next century, construction of Phase I of an expanded athletic complex (a swimming pool with a fitness center and attendant locker facilities), and construction of graduate housing near University Park.

Responsibility for design and construction of major capital projects rests with the senior vice president in conjunction with Physical Plant and the Planning Office. The process is facilitated on each project by a client team which includes personnel from potential user groups. All new construction is based on an Institute Master Plan that is continually updated by the Planning Office.

I hope this brief explanation of the facilities expansion and renewal process at MIT will prove helpful to the readers. ♣
[William R. Dickson can be reached at wrd@mit.edu]

MIT Grounds Services Keeps Campus in Full Bloom

Eve Sullivan

Special to the Faculty Newsletter

Cherry trees were not alone in weeping after the April Fools' Day blizzard. There are 420 major trees on campus, "or at least," as John Butts, one Grounds Services supervisor, commented ruefully, "there were before the April 1st storm." During a light winter, Institute grounds crews do dormant pruning of trees within ladder reach, according to Norman Magnuson, the other Grounds Services supervisor. He is "certain that our regular pruning prevented worse damage."

While the department contracts out high climbing and crane work, gardeners Tom Coppi, Rob Lyons, Ken Manning, and Ernie Morrison, are busy year-round with more than trees. In spring they plant 4000-plus geraniums, pansies, impatiens, and marigolds and in fall replace these with over 400 mums and nearly 500 purple and white cabbage which hold color into cold weather. In winter the 7:30 a.m. daily assignments meeting often consists of two words, "Move snow!"

Even without winter weather, the Grounds Services job is a big one. Magnuson, an "early decision" Institute employee since high school, and Butts, who joined MIT Physical Plant after 19 years in groundskeeping for the Commonwealth, supervise a staff of 30 full-time employees. Athletic fields alone account for 18 of MIT's 153 acres and keep five men busy. In addition, six men under Ken Brammer's supervision are responsible for on-campus moving operations and maintenance of 29 trucks and vans, 25 assorted farm vehicles, and numerous other pieces of small motorized equipment.

Almost every event on campus, whether with the Athletic Department, Campus Activities, or Conference Services involves grounds crews in some way. Commencement preparations take a full month on their calendar and this year's tasks included moving two apple trees from the back of E53 (Dewey Library) to replace those on

either side of Killian Court so severely damaged they had to be removed.

Reengineering, according to Magnuson and Butts, will soon get underway in their department. In all likelihood their staff will eventually work in teams, as Physical Plant now does, rather than in one-man/one-area assignments. They noted (counter-intuitively) that with increased construction on campus, landscaping requires more attention rather than less.

None of the storms, however, either climatological or administrative, can diminish the benefit to the Institute of the experience and dedication of long-time employees. Some, like mechanic James Young who has worked at MIT since 1965, follow a family tradition: Young's father was a metal worker at the Institute from 1958 to 1978. Cumulative service of the Grounds Services staff must amount to over five hundred years. Thanks, guys!♣

[Eve Sullivan can be reached at annals@mit.edu]

Test Your MIT Horticultural I.Q.

Match the following four trees with their location on campus. (25 points each)

1. Apple Tree descended from Isaac Newton's
2. Gingko
3. Larch
4. Witch Hazel

- A. by Building 2 walkway to Building 14
- B. in the Hosta Garden outside Buildings 3 & 11
- C. between Buildings 20E and 20A
- D. in front of Building 34

Extra Credit: Give three names for those tall trees with patchy trunks.

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MIT Education in the Age of Information

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of us must consider new ways of doing business and new types of structures for education and research.

An even stronger imperative for reexamining our educational philosophy at this moment is the exploding knowledge and information culture. Here, we face both opportunities and perils. Four years ago, in recognition of the dramatic advances of molecular biology, biology was added to physics, chemistry, mathematics, and subjects in humanities and social sciences as a mandatory part of our undergraduate curriculum. Further demands have come from the increasing competition with other engineering schools, which are reacting, like us, to the volume of new specializations and technologies and moreover do not devote as much of their required curriculum to humanities and social sciences. These pressures have stuffed our four-year engineering courses to the seams and raised insistent new pleas for unbuttoning and expanding into an additional year.

At a recent department heads lunch, we were advised that MIT is slipping behind on the information highway. New multimedia technologies can now transmit facts and figures, graphs, images, video clips, and perhaps even entire areas of knowledge from one place to another, instantly, at the press of a button. To keep up, we will soon need to install new networks of computers, new devices to scan and display information, new communication channels for our students and faculty. In a few years, the Athena work stations of the recent past will seem like a pack of tired plow horses.

With the emerging reality of an instant information-based culture, what should be the educational curriculum of the future? The classroom of the future? The

professor of the future? The student? In considering these questions, I urge that we keep two critical principles always in mind: (1) Our students should focus primarily on the fundamentals of their subjects, not the details, and (2) Our students need substantial unconstrained time to reflect on what they are learning and to develop as independent and creative thinkers. These two principles

mastered the fundamentals of a subject, rather than the details, will be more adaptable to progress and change. This principle does not mean that we should refrain from giving rigorous problem sets to our students. Every scientist and engineer knows that understanding these disciplines absolutely requires the ability to work problems through in quantitative detail. Nor does the principle mean that

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have been stated in varying forms in every one of our past educational surveys, but they deserve to be constantly restated and rethought, especially at this turning point in our history.

For at least the last several decades, we have recognized that it is impossible to convey to our students any approximation to the full range of knowledge in any of the professions. There is simply too much to learn. More importantly, this information is rapidly changing, and it will be changing at accelerating speed with the new information technologies. In such an environment, we should recall Einstein's wise observation that a student who has

we should discontinue the assignment of rigorous laboratory projects, perhaps utilizing information and real-world specifications fresh from the Internet. It does mean, however, that we should avoid trying to cover too many topics, avoid broad shallow surveys at the expense of deep explorations.

The greatest preparation we can give to our students is to learn how to learn. Or, in the words of James R. Killian, Jr. fifty years ago, "students need not only to meet rigorous requirements; they also need opportunities . . . to develop the intellectual maturity that comes only from self-education under adequate

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stimulus.” For this goal, we should teach less, but more deeply. Likewise, we should resist downloading information simply because the information is there, resist expending resources to access information until we know what we wish to accomplish with that information. Our subjects should not be revised too quickly in response to new information. The thermal properties of new materials change, the second law of thermodynamics does not. Our foremost concern should be grounding our students in basic principles and teaching them how to learn and to think on their own. The more they have learned of what does not change, the more they will be prepared to meet change.

No less important is the need of more time for reflection and creative thought. The Zacharias report of 1964 begins with a dialogue between several Professors, the Dean of Undergraduate Students, and a Guest. The Guest asks Engineering Professor A, “Just what kind of graduate do you want to see produced?” and Professor A replies: “Well, there are many kinds of engineer, and many different kinds of ability and resource. But there are certain common threads. My own ideal engineer is primarily an innovator.” What is the innovative engineer, and what do our students need to become that ideal? (I focus here on engineering, but much of what follows applies to all of our disciplines.)

In his book, *The Tower and the Bridge*, the Princeton civil engineer and historian of technology David Billington thoroughly demolishes the sometimes heard view that engineering is applied science, that the scientist is the creative genius while the engineer is merely the technician. “The discipline of engineering,” writes Billington, “goes

together with the play of the imagination to create new forms. . . . Engineering or technology is the making of things that did not previously exist.”

One of Billington’s favorite examples (coming, of course, from his own specialty within engineering) is the work of the Swiss structural engineer Heinz Isler, born in 1926. Isler designs thin concrete shells. His vaults and roofs are economical yet graceful, fully unprotected from the weather yet without cracks and leaks. Above all, they are

No one understands very well how creativity works, but it seems to require first a prepared mind, and then room in the mind to imagine and play. Both steps seem critical. The preparation we accomplish with our teaching the fundamentals of subjects and the practical skills to find information. A mind prepared to create should also be trained in different kinds of thinking. Chemists do not approach problems in the same way as physicists; physicists work differently from mechanical engineers,

Once the mind is prepared, it must disconnect from the external computer screen placed before it and gaze into its internal mental screen. And only there, while taking a shower or reading a book or talking to others, we can roam through the hundreds of possibilities, the unexpected analogies and connections, the different modes of thought that magically produce an invention.

original. Isler works by physical analogy. He may stretch a cloth between seven points, coat it with wet plastic, and wait while it sags. When the plastic has hardened, he has created the form of a thin-shell roof on seven supports. The solidified form automatically satisfies the laws of gravity and concrete. “His is a scientific theory of play, for all of the laws of nature are obeyed. As rules, they are strict but they determine nothing; and it is through these rules learned ever more thoroughly as he plays, that the player discovers moves that he never before dreamed of.” Innovative engineers create useful things that did not previously exist, and they create from their minds.

or historians. Isler’s mind was trained in the arts as well as in structural engineering. The ability to think and understand the world in many ways is a vital tool for the prepared mind, no less vital than a working knowledge of fundamental scientific principles. It is for this reason, as well as for “cultural broadening,” that we ask our science and engineering majors to have substantial experiences in the humanities, arts, and social sciences.

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MIT has always been a place of intense creativity, we are known throughout the world for our innovations, our faculty brims with talented and imaginative men and women. We ought to make sure that we continue training our students in the same mold. To do so, it is essential that we give them free time to reflect on what they are learning, to think, to invent like we do. We cannot accomplish this aim by packing their days and evenings too full of different topics or requirements, or supporting a learning environment that fastens them constantly to computer screens and data bases. "MIT does more information transfer than anything else," says Woodie Flowers, professor of mechanical engineering and teacher of a famous class in project design. "But information transfer cannot be the core benefit of the educational process. The high-gain area is informed creative thought, focused reflection. We rush over our

ideas without stopping to fondle them. Most of my creative ideas come at odd times."

In a larger sense, the rush over ideas is part of the rush of our society as a whole. And, just as in the Lewis and Hoffman reports, we must now respond to forces far beyond MIT. Historically, the speed of communication and information transfer has always helped regulate the pace of business and of life. In 1881, in an article titled "Modern Civilization and American Nervousness," the physician and medical writer George Beard noted that, "Before the days of Morse [the telegraph] and his rivals, merchants were far less worried than now, and less business was transacted in a given time." One can estimate that in 1880 a typical business establishment, such as a law office, transferred information at the rate of a few hundred words per hour per employed person. With the FAX machine and electronic mail, imagine the comparable rate, and its consequences, today.

Today's high-speed information technologies, with their undeniable

benefits and efficiencies, have helped create an urgency that pervades modern life. It is no longer uncommon to see people doing business on cellular phones as they dine out in restaurants, or others carrying FAXes and modems to their vacation homes on the beach, or others dashing off e-mail messages that read "Please disregard my last message." An attorney recently wrote to me that her mental capacity to receive, synthesize, and complete a legal document has been "outpaced by technology." With the advent of the FAX machine, overnight mail, and electronic mail, her clients want immediate turnaround, even on complex matters. She has consented, to please her customers, and the practice of law has, in her words, "forever changed from a reasoning profession to a marathon."

Education cannot be part of that marathon. We must slow down to see who we are and where we are going. We, and our students, must have time to listen to our own thoughts, to reflect, to invent.♣

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M.I.T. Numbers

Minority Enrollment 1996-97

	<u>Undergraduate</u>	<u>Graduate</u>
Native American	33	8
Asian American	1,253	473
African American	286	136
Hispanic American	425	139
Total	1,997*	756**

***45% of total undergraduate enrollment**

****14% of total graduate enrollment**

Source: MIT Facts 1997

Lotte Bailyn New Faculty Chair

Continued from Page 1

Americans toward Europe, the experience of foreign exchange students in the United States, the career paths of English women University graduates. All of these dealt with the effect on people's lives of the environments in which they live, a question that still shapes her major professional concern: the careers of technical professionals, their education, work and work environment, personal lives, and above all, in recent years, the complicated relationship between their private lives and their public, occupational careers, not in general terms but in terms of the technical work they actually do.

She arrived at MIT in 1969 as a research associate on a project tracing the careers of MIT alumni, a study which resulted in her first book *Living With Technology: Issues at Mid-Career* (MIT Press, 1980). She joined the faculty ranks in 1972, and enjoys rocking in her MIT chair, courtesy of the Quarter Century Club. Her latest book, *Breaking the Mold: Women, Men, and Time in the New Corporate World* (Free Press, 1993) focuses on the central point of her recent work, the difficulty of forming integrated lives within the divisive pressures of a work system that assumes all that matters is total devotion

to work and an emotional, personal world that goes begging for involvement that it can never properly get.

During the last few years, she and her research team have tackled this problem by means of an action research project. With support from the Ford Foundation they have analyzed the conditions of work in several major corporations that make it difficult for employees to integrate their employment with their personal lives, and then have tried to change those conditions in constructive ways. The experimental changes they introduced in the structure of everyday work practices not only helped employees personally but also allowed the organizations to achieve their own strategic goals more effectively. These experiments support the counterintuitive proposition that work and personal life are not trade-offs, but under the right work structures can actually be complementary. Late at night, she occasionally wonders: would this be possible at MIT?

Bailyn's first encounter with faculty committees was as a member of the Policy Committee of the now defunct Division for Study and Research in Education, an eye-opening experience into the workings of MIT at that time.

This was followed by two separate terms on the Committee on the Humanities, Arts and Social Science Requirement and membership on the Ad Hoc Committee on Family and Work and the Family and Work Council. She also served on the old Committee on Educational Policy, the Committee on Undergraduate Admissions and Financial Aid, the Committee on the Use of Humans as Experimental Subjects, and the Corporation Joint Advisory Committee on Institute-Wide Affairs.

Bailyn, who lives in Belmont, is surrounded by academics. Her mother and father were academics, her husband is an academic, her two sons are academics. One of these, an astronomer at Yale, was recently followed up a mountain in Chile by PBS for their series on Mysteries of Deep Space. The other, a linguist at SUNY/Stony Brook, is currently on sabbatical in St. Petersburg, Russia, where he is giving some lectures, in Russian, on generative grammar to a group of dutiful but utterly disbelieving members of the linguistics faculty of St. Petersburg State University.✚

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M.I.T. Numbers

Enrollment Facts

- Women have attended MIT since 1871. In 1996-97, there are 1,749 women enrolled as undergraduate students (39%) and 1,336 enrolled as graduate students (24%).
- MIT students come from all 50 states and the District of Columbia, as well as three territories. One hundred fifty-five foreign countries are represented, with an international student population of 347 undergraduate students (8%) and 1,797 graduate students (33%).

Source: MIT Facts 1997

Answers To Tree Quiz [P. 7]:

1B , 2A , 3D , 4C;

Plane tree, sycamore, buttonwood

M.I.T. Numbers

Enrollment 1996-97

Undergraduate Enrollment (Total: 4429)

First-year*	1,074
Undeclared Second-year*	31
Third-year Special Students	16
Architecture and Planning	74
Engineering	2,049
Humanities and Social Science	152
Management	151
Science	882

*MIT students do not enroll in an academic department until the start of their sophomore year, and may defer decision on a course of study until the end of that year.

Graduate Enrollment (Total: 5518)

	<u>Master</u>	<u>Doctoral</u>	<u>Special</u>
Architecture and Planning	352	163	27
Engineering	1,265	1,072	82
Humanities and Social Sciences	17	328	4
Management	774	121	18
Science	24	969	8
Whitaker College	12	281*	1

*This number includes 164 students working on Harvard degrees.

Source: *MIT Facts 1997*