



OFFICE OF THE PRESIDENT

To Members of the Community:

As the Institute embarks on its 25th annual contribution to the Massachusetts Red Cross Blood Program, I am doubly pleased. Members of the Institute community have donated 30,650 pints since our first peace-time campaign in 1948. Furthermore, for the past few years, MIT has consistently broken its own record as the largest donor in a single drive on the East Coast.

There is every reason to hope we can do it again this year. The goal of 2,500 pints is well within the percentage rise we have been able to achieve during the past few years.

The blood drive is scheduled for nine days, March 7-17, in the Sala de Puerto Rico. Solicitors are now canvassing the campus inviting donors to sign up.

I join Professor John Ross of Chemistry this year's faculty chairman, and the student chairmen, Jay Anderson, Gary Raymond and Peter Welling in urging you to consider donating. Giving blood is one of the greatest charities most of us can bestow.

Community to Advise Medical Department

A new Medical Advisory Committee with members representing all segments of the MIT community has been formed to act as a liaison between the Medical Department and the community.

"During the past year or so we have become increasingly aware of the lack of communication between the Medical Department and the rest of the community," explained Samuel D. Clark, Associate medical director and principal organizer of the committee.

"Many MIT people simply are not aware of standard services that we offer, and so do not take advantage of them. Others, particularly undergraduates, are critical of the Department because they are unfamiliar with our own problems and the problems of medical service in general.

"Our aim with the Medical Advisory Committee is to establish a dialogue between the Department and the community. We hope that the committee will not only air criticisms about medical services at MIT but also collect and disseminate information on available services and possible new ones."

How information will be distributed has not yet been decided, Dr. Clark said, but possible forms include pamphlets or a newsletter.

Although the Medical Department has provided the major impetus for forming the committee, Dr. Clark said that it would separate itself as soon as possible. "What we want is a sort of consumer group representing the community."

Members of the new committee are: Professor Kent Hansen and John B. Southard, representing the faculty, Nancy Powell, Technology Dames, Donald Stevenson, DSR staff, Jan Jefferson, office and clerical workers, Tom Lynch, hourly workers, Stephen Phister and Sue Stopek, undergraduates, and Neal Portnoff and James Garvin, graduate students.

The committee held its first meeting on February 1 to discuss organizational matters and planning. A second meeting is planned for the first week in March.

The KLH Child Development Center has an immediate full opening for one child of any employee, faculty member, staff member or student of the Institute community. Cost for the service is determined using a sliding scale depending on the income of the parents. Those interested should call Judy Rosenbaum, Planning Office, Ext. 5831.

Morison Returns to MIT As Killian 1926 Professor

The noted historian, Elting Elmore Morison, whose writings on the social, political, intellectual and industrial history of the US have commanded wide attention for nearly a quarter of a century, will return to MIT on July 1 as the Elizabeth and James Killian 1926 Professor in the School of Humanities and Social Science.

Announcement of the appointment of Professor Morison to be the first Killian 1926 Professor on a permanent basis was made by President Jerome B. Wiesner.

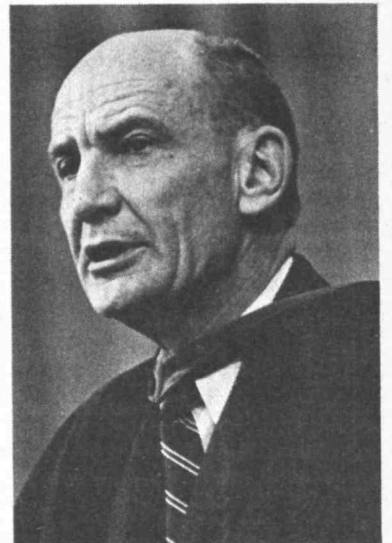
Professor Morison, who served on the MIT faculty for 20 years, first in the Department of Humanities and later in the Sloan School of Management, has been Master of Timothy Dwight College, professor of history, and director of the Scholars of the House program at Yale University since 1967. At the time he left MIT, Dr. Morison was Sloan Fellows Professor at the Sloan School. As Killian 1926 Professor, Professor Morison's appointment will be in the School of Humanities and Social Science without specific departmental designation.

"MIT is honored to have a scholar of Professor Morison's

distinction return to its faculty and it is particularly fitting that, in doing so, he should become our first occupant of a chair established in honor of one of America's leading science statesmen, Dr. James Rhyne Killian, Jr.," President Wiesner said.

Dr. Killian, now Honorary Chairman of the Corporation, was president of MIT from 1949 to 1959, and Chairman of the Corporation from 1959 to 1971 and science advisor to President Dwight D. Eisenhower in the late 1950s when many of the nation's major policies in scientific research, space exploration and industrial and military technology were formed. A 1926 graduate of MIT, Dr. Killian retired as Chairman of the Corporation last June, and was named Honorary Chairman. He continues to serve as Chairman of the Corporation's Development Committee.

In 1966, on the occasion of the 40th anniversary of the graduation of the Class of 1926, Dr. Killian's classmates established, under the Chairmanship of I. Austin Kelly III of New York City, the Killian 1926 Professorship in the History of Science honoring Dr. Killian and his wife, Elizabeth, for their long



Professor Morison.

years of service to the Institute, and for Dr. Killian's extraordinary role in advancing the humanistic and scientific interests of the nation.

Since it was established, two distinguished visiting scholars have been brought to the Institute under auspices of the Killian 1926 Professorship. Jay D. Frierman, chief curator and head of the Museum and Laboratories of Ethnic Arts and Technology at the University of California at Los Angeles, was at MIT in 1970-71 while Dr. Brooke Hindle, professor and chairman of the department of history at New York University, is

(Continued on page 6)

Dresselhaus to Be Associate EE Head

Professor Mildred S. Dresselhaus has been appointed Associate Head of the Department of Electrical Engineering for Electrical Science and Engineering.

Professor Louis D. Smullin, head of the department, announced the appointment in a letter to members of the electrical engineering faculty. In his letter Professor Smullin said:

"I am pleased to announce that Professor Mildred S. Dresselhaus has agreed to become Associate Department Head for Electrical Science and Engineering, joining Professor Robert M. Fano who is Associate Department Head for Computer Science and Engineering. She replaces Professor Wilbur B. Davenport, who has resigned his post to become Director of the Center for Advanced Engineering Study.

"Professor Dresselhaus is a solid state physicist with broad research interests in the solid state field. She plans to continue her research and teaching activities in these fields.

"The positions of associate department heads, newly created last fall, have become especially important in providing better communication links between the faculty and staff and the Department Headquarters. With our activities as widespread as they are—intellectually and geographically—the need for effective communications mechanisms is great. I am confident that Professor



Professor Dresselhaus.

Dresselhaus will continue the general type of operation that Professor Davenport brought to the office."

Professor Dresselhaus said she viewed her new post as a challenge, "one I hope to respond to with initiative and imagination. Professor Davenport made a great contribution during the short time he held the post."

Professor Dresselhaus came to MIT in 1967 as the Abby Rockefeller Mauze Visiting Professor and was appointed professor of electrical engineering in 1968. The Mauze Professorship was established to bring to MIT distinguished women scholars who

(Continued on page 7)

Faculty to Meet

A regular meeting of the faculty will be held today (February 16) at 3:15pm in Room 10-250.

The faculty will first hear reports of recommendations for advanced and bachelor's degrees from the Committees on Graduate School Policy and Academic Performance. This portion of the meeting will be closed to non-faculty members.

Other items on the agenda include reports by the Committee on Curricula and the Committee on Nominations, action on the change in the names of the graduate degrees in the Department of Architecture, and recommendations by the Committee on Educational Policy for faculty action on the report of the Special Task Force on Education.

The last item on the agenda is the Report to the Faculty on the Four Year Trial of Freshman Pass/Fail Grading, which is included as an insert in this week's *Tech Talk*. Please bring a copy of the report to the meeting.

Following the recommendations of candidates for degrees, the doors will be opened to admit non-faculty members to the meeting. All members of the MIT community are welcome. The seating areas for faculty members and others will be clearly marked.

Past Present

We went looking for the past the other day and it was harder to find than we had expected. The recently formed Committee for Institute Memorabilia is located, we had been told, on the second floor of the Epsco Building (N52), but when we asked after it we were told by a dubious resident that as far as he knew there wasn't anything on the second floor at all. He was almost right.

As we were proceeding down an empty corridor lined by what appeared to be storerooms, we were hailed by a figure at the other end. It turned out to be Warren Seamans, administrative officer of the Humanities Department, who told us he'd been keeping an eye out for us. "We're almost as hard to find as the things we're looking for ourselves," he said shaking our hand. "I'll show you what I mean." We turned a corner and Seamans unlocked a musty door that gave no clue to its content.

Inside were stacks of ancient files and piles of old furniture. Mr. Seamans gestured at an absolutely undistinguished wooden desk and we peered at the small tarnished brass plate adorning its forward right-hand corner. There was just enough light filtering through the grimy window to let us read: "Desk used by Dr. Norbert Wiener at MIT, 1919-1964." Seamans told us that the desk had been in the old mathematics building, had subsequently vanished and reappeared and was now being stored until a proper place for it could be found.

Seamans led us back through a storage area piled high with chairs and cartons until we came at last to two large uncluttered rooms, the walls of which were lined with paintings hung from floor to ceiling on heavy chicken wire. Here we found Walt Taylor, the memorabilia curator, and Don Frio, a Northeastern history student on a work-study project, who is lending a hand gathering the past hereabouts. Frio was vacuuming as we came in.

"We're doing a lot of vacuuming these days," Taylor said after greeting us. "We're only just beginning to get out from under the dust in the three weeks we've been going." We wondered if there was a special implement for vacuuming paintings. "Oh, Dan hasn't gotten down to the surface yet," Taylor remarked, "so there's no question of damaging them. We just take off the worst accumulation and eventually will send them to a professional restorer."

The committee's mission, so to speak, is search and preserve. It began, Taylor told us, when those responsible for organizing the "MIT Retrospect" for President Wiesner's inauguration couldn't find a particular painting of William Barton Rogers. "It eventually turned up right here," Seamans interjected. "In that big storeroom just outside the office. As a matter of fact, that was our first big find. Not only Rogers, but portraits of six of MIT's first seven presidents were stacked in there."

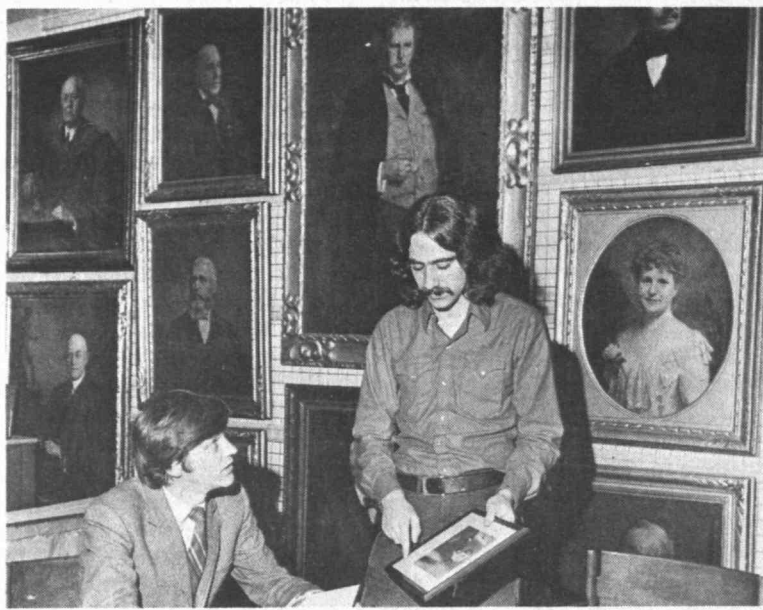
"Then Mrs. Wells Bosworth, wife of the architect of the original MIT buildings, sent along two of the original renderings of the main campus from Paris," Taylor resumed. "And it wasn't long before the committee was established. I understand, incidentally, that Bosworth built a tiny replica of MIT in France to live in."

Memorabilia, it turns out, turns up almost anywhere, and the committee's first concern is simply finding items known to

exist but momentarily lost to view. The presidential portrait hardest to run to earth, Seamans told us, was that of James Mason Crafts, who presided over the Institute for a brief spell from 1897 to 1900. The Crafts portrait had been hanging for years, not illogically, in the Crafts lounge of Ashdown House. Later it appeared in Bexley Hall, with the legend "Lord Bexley" under the figure. Then it disappeared altogether and was found a year or so later in Random Hall. "Come take a look," said Mr. Seamans leading us into the other room. We gazed at a portrait of a distinguished gent sporting mutton-chop whiskers and stooped over to look at the brass legend beneath him. It read "J. Arthur

was written in the artist's hand "Birthplace of William Tell, Lake Lucerne, Switzerland, 1872." We thought it something less than inspired and said so. "Horrible," Taylor agreed amicably, "but there's no equating taste with value. It's worth a great deal. Not all of the paintings, watercolors and sketches--we have some sketches by John Singer Sargent by the way--are of MIT subjects by any means. Many were given by alumni or came to MIT through an estate. It's a big job sorting them out. We hope eventually to compile a complete catalogue, with documentation. Art objects aren't the only things we have."

Taylor directed our attention to a display case in which a flock of



Walt Taylor (seated) and Don Frio with Institute memorabilia. Portrait to left of Frio is an unidentified woman, probably an MIT co-ed, painted in 1888 by C. Eksergian, known to have been a portraitist of the period. Above Frio is portrait of Theodore Vail, member of the MIT Corporation from 1913 to 1920, painted by the well known painter Alexander James. Just above Taylor's head is a painting that hung for years in the second floor corridor of Building 10 identified as Thomas Hunt, professor of geology from 1872 to 1878. In fact, as the memorabilia committee discovered when the painting's backing was removed, it is John M. Ordway, professor of chemistry from 1869 to 1884.

-Photo by Bob Lyon

Random, Founder." "We know it's Crafts," Seamans said, "not only from photographs but from various documentation of the painting."

We asked if he had a favorite painting. He and Taylor were unanimous in their choice. "Robert Richards," Taylor said, pointing to a humane visage whose piquant eyes all but winked at the viewer. "He was a member of MIT's first class, the Class of '68," Taylor went on fondly returning Richards' gaze, "and later joined the MIT faculty and married MIT's first co-ed, Ellen Swallow Richards."

The collection's value is by no means only sentimental, Taylor told us when we asked him about it. "We are just now getting an appraisal made," he said, "and I think MIT may well be staggered when it finds out just how valuable all this really is." It was a practice, he remarked, for MIT presidents and eminent faculty members to have their portraits done by leading painters of the day. The collection includes works by such American artists as Daniel Chester French, who did the Lincoln Memorial in Washington, D.C., Chester Harding, who was a student and contemporary of Stuart in Boston, and Henry Pratt, one of whose paintings recently sold, said Taylor with satisfaction, for \$25,000.

"We have a bust by R.S. Greenough, brother of Horatio, who did that semi-naked statue of Washington which caused such a stir in the Smithsonian," Taylor went on. "And we have a landscape done by George Brown, whose work is much sought after these days." He produced a battered and muddy painting much in need of restoration, on the back of which

memorabilia was housed. "There's a death mask of president Maclaurin, for example," he told us. "We have two Nazi flags, for some reason we haven't yet been able to discover. We know the whereabouts of a mock-up of the first radar. Those two large portraits of the Van Dyke school over there used to be in the Duke of Somerset's collection. There exists a design on canvas called 'Beacon of Progress' which was done as an entry for the Paris Exposition by Desiré Despradelle, who was Rotch Professor of Architecture at MIT. I even know where it is. It's up on the fourth floor in this very building in a long canister under a pile of other stuff. But it's so well-buried, I haven't been able to get it out yet."

To find a permanent home for these and other objects the committee hopes to uncover in nooks and crannies about the Institute, negotiations for a suitable place on the main campus are now afoot, Seamans told us. "We also need money badly for restoration and the like, and if we get a place where the public can see these things, as they ought to be able to, we can also qualify for federal aid as a small museum," Taylor pointed out. "In fact that is what we really are. The word 'memorabilia' puts one in mind of watch-fobs and the like. But some experts we've asked to look at the paintings tell me that our collection is already a better one than many small museums have."

"Tell everybody to let us know when they find an interesting memento stashed away in the back room," said Seamans as we got up to say good-bye. "And tell them to send money," Taylor added.

Model Library Gets Additional Funding

The Council on Library Resources of Washington, D.C., has made a grant of \$71,000 in continued support of the MIT Model Library Program.

The grant is in addition to the original \$150,000 grant for the program made by the Council in October 1969. The Model Library Program is part of Project Intrex, an experimental computer-based catalog and text access system under the direction of Professor Carl F.J. Overhage.

The Model Library is located in the Barker Engineering Library, which serves both as a traditional engineering library and as the experimental model library for Project Intrex. Until recently, the Model Library has been under the direction of Charles H. Stevens, now staff director of the National Commission on Libraries and Information Services. Jeffrey J. Gardner is the newly appointed director of the project.

Since October 1969 the Model Library has worked to develop new library services for "transitional libraries," in which services based on the new technology are provided

PBK Names 2 Scholars

Two MIT professors are among ten Visiting Scholars appointed by Phi Beta Kappa for 1972-73. Professors Lucian W. Pye of political science and Huston Smith of philosophy will travel throughout the country during the coming year visiting colleges and universities that have Phi Beta Kappa chapters. At each institution they will lecture and lead informal discussions.

Since 1956 Phi Beta Kappa has annually selected noted scholars in diverse disciplines who are also outstanding teachers to interact with undergraduates. MIT is the only school this year with two representatives among the Visiting Scholars.

Consciousness Is Lecture Topic

Dr. Robert Keith Wallace, a postdoctoral researcher at the Harvard Medical School, will present a lecture entitled "The Physiology of Consciousness" on Wednesday, February 16 at 8pm in Room 6-120.

Dr. Wallace and his colleague, Dr. Herbert Benson also of Harvard Medical School, have studied the physiological correlates of transcendental meditation using volunteer subjects in the United States. A report of their findings appears in the February issue of *Scientific American*.

According to their study, the meditative state is accompanied by several physiological changes--reductions in the rate and volume of respiration; a slowing of the heartbeat; a considerable increase in electrical resistance of the skin; and intensification of brain alpha waves. Such changes produce a state of deep relaxation and mental alertness, as distinct from waking, dreaming or sleeping.

Drs. Wallace and Benson concluded their report by saying: "The hypometabolic state, representing quiescence rather than hyperactivation of the sympathetic nervous system, may indicate a guidepost to better health. It should be well worthwhile to investigate the possibilities for clinical application of this state of wakeful rest and relaxation."

concurrently with traditional ones. These new services include Library Pathfinders, single sheet guides to published information in specific subject areas, which were developed by the Model Library to lead library users through complex traditional information systems. Although originally designed for use in the Barker Engineering Library, they have proven to be an effective tool in other institutions and are now used in research libraries in the US and abroad.

The Model Library's new audiovisual programs, developed to instruct library users in a variety of reference sources, are now in use in research libraries in the US, Canada and Europe as well as in the Barker Engineering Library. Since libraries of the future will depend increasingly on text in microform, the Model Library program has also been measuring users' preferences between hard copy and microfiche copy of various library materials.

The new grant will permit the Model Library to advance these existing programs while beginning new ones.

New programs planned for completion this year include a study of electronic calculators within a research engineering library. Electronic calculators will be installed in the Barker Engineering Library and user reaction monitored to define the need for such equipment. Results will be reported to the library community.

The Model Library also hopes to develop means of providing increased user access to non-print media by designing a special area to house easy-to-use individualized projection and listening equipment. Substantial research information in the form of sound-films, cartridge loop film and videotapes will form the nucleus of this area's collection.

Traditional library orientation methods--classroom lectures and library tours--require large amounts of staff time and have often failed to provide information to library users at the time they actually need it. A new program designed for on-demand use will respond to these problems, as an adjunct to Pathfinders and audiovisual point-of-use programs, by providing a good generalized introduction to research libraries.

TECH TALK

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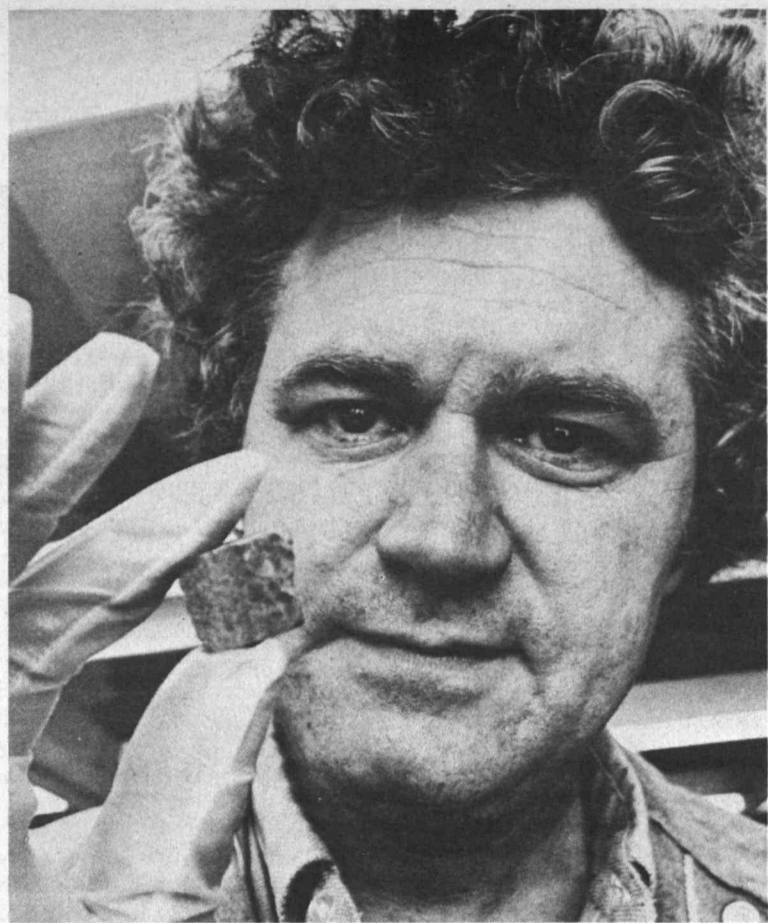
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Please address all news and comment to the editorial office, Room 5-111, Ext. 3277.



Dr. Gene Simmons, one of the nation's leading lunar scientists and professor of earth and planetary sciences, holds a moon rock returned to earth by the Apollo 14 mission. Dr. Simmons is the author of *On the Moon with Apollo 16*, a guidebook to the Apollo 16 mission published Tuesday, February 15, by the Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Texas. Dr. Simmons wrote a similar guidebook for the Apollo 15 mission, for which he served as Chief Scientist at the Manned Spacecraft Center. Launch date for the Apollo 16 mission is now scheduled for April 16. Dr. Simmons is also Principal Investigator for the Surface Electrical Properties experiment which will be conducted on the lunar surface by Apollo 17 astronauts next winter.

Quarter Century Club Tours Prove Popular

"It was a great trip, lots of fun, and I'd love to go again."

That's what Sarah Fitzgerald, a secretary in the Sloan School, said about the Quarter Century Club's January trip to Hawaii. Sarah and about 35 other members of the Institute community took advantage of the Club's charter flight to Honolulu and spent eight days and seven nights vacationing in the island sun.

Staying at the new Hawaiian Regent Hotel, the vacationers enjoyed swimming in the surf at Waikiki Beach, browsing through colorful shops, feasting at a Hawaiian luau and dining in exotic restaurants. Optional tours were also available including day trips to the outer islands and a night club tour.

Sarah says, "The lack of regimentation was wonderful. We could go on guided tours or just wander around and see what we wanted to see. I did both--on the night club tour we watched Polynesian dancers with their flaming torches and went to a performance by Don Ho. I also rented a car and drove out to some of the more remote beaches. The surf was incredible and we even saw two whales sunning themselves offshore."

After eight days of fun and sunshine, a plane filled with tanned-or sunburned-vacationers returned to the winter snows of Boston. Sarah says, "All in all, we had a wonderful time. The trip was well planned and definitely worth the money. I'd really like to go on another trip with the Club."

For Sarah and those of us who didn't go to Hawaii, the Quarter Century Club is sponsoring two more vacation trips this year. On April 9 a plane will leave Boston heading for London. Windsor Castle, Piccadilly, Westminster Abbey, as well as trips to Stonehenge, Stratford on Avon, and Woburn Abbey are just a few of the many features on the

itinerary.

On November 11 the Club's charter flight will take off for Athens, Greece. In addition to deluxe hotel accommodations and gourmet dinners, the trip will include tours of the Acropolis and the Athens Museum. Exciting optional tours will be available as well.

All of the Club's trips are open to the entire MIT community and their immediate families. Arrangements are made through reputable travel agencies and generally the tours are less expensive than normal commercial travel. Brochures describing the London trip are in the mail now to everyone in the community, and information on the Athens vacation will be mailed a few months before the trip.

Reading Course Offered at ERC

The Education Research Center will offer a special course on "The Techniques of Efficient Reading" to members of the MIT community starting Monday, February 28.

The course will emphasize specific practice methods and techniques to develop reading as a skill. Reading comprehension, speed and the setting and meeting of goals will be stressed. Much of the work will be done with the students' own reading material, and books will be furnished for class use.

The course will meet on Mondays and Wednesdays through April 28. Classes will meet from 4 to 5 pm, and one hour practice sessions will be held on Tuesdays and Thursdays during the same time period.

The course will accept the first 40 applicants paying the \$25 registration fee. The fee is payable by check only at ERC Headquarters, Room 20C-228. For more information, call David Burmaster, Ext. 4849.

New Magnetic Techniques Investigate Brain Waves

MIT Scientists have succeeded in recording directly the faint magnetic fields that arise from electrical activity within the brain.

The technique, known as magnetoencephalography (MEG), could become a tool in the study of the brain's complicated and little understood neural circuitry. In addition, MEG in combination with conventional electroencephalography (EEG) one day might help in diagnosis of brain disorders.

Dr. David Cohen, a physicist at the Francis Bitter National Magnet Laboratory, reported the MEG development in the current issue of the scientific journal, *Science*.

MEG employs a highly sensitive superconducting magnetometer placed an inch or so from the head of a subject who is seated inside a magnetically shielded chamber. The chamber is constructed to shield against extraneous magnetic fields--including the earth's magnetic field--that would otherwise drown out the weak magnetic field of the brain.

The MEG technique takes advantage of the fundamental fact that all electric current flow, no matter how small, has associated with it a proportional magnetic field. Thus, magnetic field readings can be used as a measure of the current flow that produces them.

This can be extraordinarily important in the case of the brain. There are in the brain something on the order of 10 billion nerve cells which respond to and transmit electric impulses.

The conventional electroencephalogram (EEG) is obtained from electrodes attached to the scalp and EEG tracings are summations, by electrical laws of voltage addition, of the gross activity of many of these brain cells taken together. Because of the laws of voltage addition, the EEG is limited in the information it can extract from the brain.

The magnetic field of the brain as measured just outside the skull, on the other hand, sums the electrical activity of the brain cells by the laws of current addition which are different than the laws of voltage addition. Thus, Dr. Cohen said, the study of MEG and EEG readings together could help brain researchers understand brain function better than the EEG alone.

The MEG record is produced on a strip chart with an ink stylus in the same familiar manner as an EEG tracing. This means MEGs and EEGs can be taken simultaneously and compared for response to the same electrical events in the brain.

Dr. Cohen said he has so far made repeated MEG recordings, often simultaneously with EEGs, using four normal subjects and one patient suffering from psychomotor epilepsy, one of the few brain disorders that produces an abnormal brain wave pattern on the EEG which is relatively easy to recognize.

Close correlations between MEG and EEG readings do occur, he said. For example, when normal subjects are asked to open and close their eyes, the presence and absence of alpha brain waves which come and go when the eyes are open or shut are clearly evident in both MEGs and EEGs.

There are occasions, however, when the MEG appears quite different from the EEG. It is this difference, Dr. Cohen said, that suggests the value of MEG

recordings in better understanding electrical activity in the brain.

Dr. Cohen for some time has been working on magnetic fields produced by the human body. At the University of Illinois before coming to MIT he obtained some evidence, often indirect, of magnetic fields produced by various "electrical" organs such as the heart and the brain.

The major problem at that time was the far stronger magnetic fields that are always present in the environment. These include the ever-present earth magnetic field, the force that causes compasses to point north. These extraneous fields are so strong when compared to the magnetic fields produced by the body that they obscure these weak fields and render them undetectable. The earth's field, for example, is approximately half a gauss (the unit of measure used for magnetic force) while magnetic fields from humans are usually far less than one-millionth of a gauss.

At Illinois, even though he used an early shielded chamber, Dr. Cohen also needed to employ the computer-based techniques of "noise averaging" to obtain indirect measurements of magnetic fields around the brain. Noise averaging originally was developed primarily by communications scientists and biophysicists at MIT to detect faint electronic signals buried in noise, or static.

Dr. Cohen joined the Bitter Laboratory three years ago where he designed and built the magnetically shielded chamber now in use. Its walls are built up from three layers of a highly-

magnetic nickel-iron alloy and two layers of pure aluminum. The shape is roughly a sphere. The shape together with the alloy have the effect of repelling external magnetic fields.

In addition to the chamber, Dr. Cohen obtained one of the first versions of a new superconducting magnetometer (called SQUID for superconducting quantum interference device) developed by Dr. James Zimmerman, now at the National Bureau of Standards, Boulder, Colorado. The SQUID--made from a shaped niobium element--is mounted in the narrow end of a special thermos jar filled with liquid helium which, because of its extreme low temperature, keeps the niobium-superconducting. The SQUID, in the presence of weak magnetic fields, emits proportional electric signals which are amplified to drive the recording equipment.

Support for the research has been provided by the National Science Foundation, the American Heart Association, the Damon Runyon Memorial Fund for Cancer Research and the American Cancer Society. Dr. Cohen's work with the heart led to his appointment as an Established Investigator of the AHA.

Collaborators with Dr. Cohen in various aspects of the brain research include Dr. John Hughes, professor of neurology at the Northwestern University Medical School in Chicago, Dr. Chaim Mayman, head of neurology at Boston's Beth Israel Hospital, and Dr. Frank Duffy of Boston's Children's Hospital Medical Center.

Spacks' 2nd Poetry Collection Published

A new book of poems by Professor Barry Spacks of humanities is out this week. The collection, entitled *Something Human*, consists of fifty poems on a variety of subjects ranging from "Shaving," to "Students in a Sanctuary." Several of the poems are reflective of MIT, including "The Cells," which Professor Spacks wrote for the inauguration of the Institute's Phi Beta Kappa

chapter last June.

Something Human was published by Harper's Magazine Press, which will also publish Professor Spacks' second novel *Orphans*. His earlier works include a collection of poems "The Company of Children" and the novel, *The Sophomore*.

The new volume includes this poem.

THE ABSTRACT NOTION OF BOSTON GATHERING DUST

Somewhere, among the scrimshaw and the bric-a-brac,
in the head of an old sailor, or in the thought
of a spinster tart as rust
lies the Abstract Notion of Boston, gathering dust.

I wasn't born to know this notion, but there must
still be a beanpot in it, and a ban on lust,
and Henry James and William James and Alice James
saying sentences to each other;

and one cold pot of harbor brewing
revolutionary tea;
and lawyers four abreast up Tremont
out for lunch, or equity,

footing it, doing it bostonly,
with hard coin reading in God we trust,
and a hint of antique musketry
in the flintlock chins of the upper crust.

O primly vulgar, practical city,
where lovers sail in a nutty swanboat
pair behind pair on a proper pond
and coo in a spinsterish, sailoresque accent;

O city of which all aunts are fond:
peace troops marching on the Common;
leafsmoke scent in the Public Garden;
endless sound of Henry... William...

THE INSTITUTE CALENDAR

February 16
through
February 25

Events of Special Interest

Organizational Meeting for People Interested in Growing Plants*
Discussion concerning formation of a plant club and plant related activities at MIT. Wednesday, February 16, 7:30pm, Student Center Rm 491.

The Physiology of Consciousness*
Dr. Robert Keith Wallace, postdoctoral researcher at Harvard Medical School. Lecture on the physiological effects of transcendental meditation. Wednesday, February 16, 8pm, Rm 6-120.

RAIN, the MIT Literary Magazine**
Spring organizational meeting. Desperately needs new blood: managers, artists, staff. . . Thursday, February 17, 8pm, Student Center Rm 451.

Nationalism and World Peace*
Karl Deutsch, Stanfield Professor of International Peace at the Harvard School of Government. Thursday, February 24, 8pm, Little Theatre.

ABCD Dance*
The Tech Dames are sponsoring an evening of "Appetizers, Beer, Couples, Dancing." Saturday, February 26, 8:30pm, Campus Rm, Ashdown. Admission \$2.50/couple, tickets available at the door.

Seminars and Lectures

Wednesday, February 16

The Computer That Looks Through A Microscope*
Prof. I. T. Young, electrical engineering. CIPG Seminar. 12n-1pm, Rm 20B-224.

Endotoxin, Complement and Tissue Damage
Dr. Stephan E. Mergenhagen, chief, Lab of Microbiology and Immunology, National Institute of Dental Research. Oral Science Seminar. 3-5pm, Rm E18-301.

A Functional Analysis Approach to the Design of Self-Optimizing Dynamic Systems*
Prof. Phillip Sarachik, New York University. Decision and Control Sciences Group Seminar. 4pm, Rm 37-212.

Thursday, February 17

Women's Forum
Subcommittee for women on bi-weekly payroll and administrative staff. Mr. James Culliton will discuss MIT's Affirmative Action Program. 12n-1pm, Rm 10-105.

The On-Line Shared Cataloging System of the Ohio College Library Center*
Frederick G. Kilgour, director, Ohio College Library Center. Project Intrex seminar. 3:30pm, Rm 37-252. Coffee, 3pm.

Atmospheric Science Applies to the AEC
Dr. R. Engelmann, program director for the Fallout Studies Branch, Division of Biology and Health, AEC. Meteorology Seminar. 4pm, Rm 54-1311. Tea at 3:30pm, Rm 54-923.

Theoretical and Experimental Studies of Helicopter Noise Due to Black-Vortex Interaction*
Prof. Sheila E. Widnall, aeronautics and astronautics. Interdepartmental Acoustics Seminar. 4pm, Rm 5-134. Coffee, 3:30pm, Rm 1-114.

Time-Sharing Characteristics and User Utility*
Jerold Grochow, graduate student, management. Operations Research Center Seminar. 4pm, Rm 24-307. Refreshments following in Rm 24-219.

Orientation Lecture for Sophomores Interested in Entering Course VI's Cooperative Education Program
Students on the Program and faculty advisors will be available for discussion. 4pm, Rm 10-105

Symmetries in Quantum Mechanics*
Prof. Harry J. Lipkin, Weizmann Institute of Science, Rehovoth, Israel. Physics Colloquium. 4:30pm, Rm 26-100. Tea, 4pm, Rm 26-110.

The Mechanical Properties of Methylmethacrylate*
Dr. J. Wagner, assistant professor of orthopedic surgery at University of Brussels, assistant director of Biomechanics Laboratory of Hospital Brugmann. Mechanical Engineering Seminar. 4:30pm, Rm 1-114.

Friday, February 18

Women's Forum
Subcommittee on faculty, research staff and others in academic roles, 1-2pm, Rm 3-310.

Interactive Lectures*
Stewart Wilson, senior scientist, Polaroid Corporation. ERC Colloquium. 12n, Rm 10-105.

An Infrared Study of the Chemisorption and Oxidation of Carbon Monoxide on a Platinum Catalyst*
H. Cochran, graduate student, chemical engineering. 2pm, Rm 10-105.

Diffusion with Reversible Chemical Reaction in Heterogeneous Media*
P. Stroeve, graduate student, chemical engineering. 3pm, Rm 10-105.

Nuclear Induction of Bulk Metals by Means of Electromagnetically Generated and Detected Sound Waves*
Dr. T. Kushida, Ford Motor Scientific Lab. Center for Materials Science and Engineering Colloquium. 4pm, Rm 9-150. Refreshments, 3:30pm.

Kink and Tearing Instabilities in a Tokamak
Dr. P. H. Rutherford, Princeton Plasma Physics Laboratory. Plasma Dynamics Seminar. 4pm, Rm 26-214.

Wednesday, February 23

Reconstruction of Pictures from Their Projections: Survey of the Work Done at the University of Buffalo*
Professor Gabor Herman, Computer Science Department, University of Buffalo. CIPG Seminar. 12n-1pm, Rm 20B-224.

Biochemistry of the Mammary Gland
Dr. Russell Hilf, Department of Biochemistry, University of Rochester School of Medicine and Dentistry. Oral Science Seminar, 3-5pm, Rm E18-301.

Current and Future Applications of Satellite Remote Sensing*
Paul Sherr with David Spiegler, Norman Gaut, and James Barnes, Environmental Research and Technology, Inc. AMS and Meteorology Seminar. 8pm, Rm 54-100.

Thursday, February 24

Applied Operations Research in a Job-Shop*
John Rudy, manager, Operations Research, Raytheon. Operations Research Center Seminar. 4pm, Rm 24-307. Refreshments following seminar.

The Dynamic Aspects of Muonic Atoms
Prof. Chien-Shung Wu, Columbia University. Physics Colloquium. 4:30pm, Rm 26-100. Tea at 4pm, Rm 26-110.

Day Care Seminar**
MIT Family Day Care Program. 7:30-9:30pm, Student Center West Lounge.

Friday, February 25

New Approaches to Dealing with Juvenile Offenders*
Arnold Schuchter, planning director, Massachusetts Department of Youth Services. ERC Colloquium. 12n, Rm 10-105.

Nitric Oxide Formation in the Combustion of Nitrogen Containing Hydrocarbons
S. Slater, graduate student, chemical engineering, 2pm, Rm 10-105.

Liquid Phase Oxidation of Alcohol Catalyzed by Transition Metal Complexes*
H. Klee, graduate student, chemical engineering, 3pm, Rm 10-105.

Dismal Energy Situation in the United States
John J. McKetta, Professor of Chemical Engineering, University of Texas. Mechanical Engineering Seminar. 3pm, Rm 3-270. Coffee 4pm, Rm 1-114.

Survey of Plasma Physics Research at FOM Jutphaas, Netherlands
Dr. L. T. M. Ornstein, FOM-MIT Collaboration. Plasma Dynamics Seminar, 4pm, Rm 26-214.

A Gas-Liquid Transition for Excitons*
Dr. W. F. Brinkman, Bell Telephone Laboratories. Center for Materials Science and Engineering Colloquium. 4pm, Rm 9-150. Refreshments 3:30pm, Rm 9-150.

Student Meetings

Student Information Processing Board Meeting
Every Monday, 7:30pm, Rm 39-200.

Thursday Staff Meeting**
Every Thursday, 8pm, 2nd floor, Walker.

Technique Staff Meeting
Every Saturday, 11am, Student Center Rm 457.

ERGO Staff Meeting
Every Sunday, 6pm, Student Center Rm 443.

MIT Club Notes

Book of the Week*
Informal discussion over dinner of *Synetics* by William J. J. Gordon. Wednesday, February 16, 5:15-7:15pm, Ashdown Dining Hall (table near door). James Snell, 523-1198.

Alpha Phi Omega†
Open meeting for new members. Wednesday, February 16, 7:30pm, Student Center West Lounge.

Chess Club***
Chess Club Championship. Saturday and Sunday, February 19 and 20 beginning at 10am, Student Center Rm 407.

Alpha Phi Omega
Chapter meeting Wednesday, February 23, 7:30pm, Student Center, Rm 407. Freshmen encouraged to attend.

Scuba Club*
Scuba Club Film Night, Wednesday, February 23, 8pm, Rm 20E-017.

Baker House SPAZ Jogging Club**
Daily, 10:45pm, Baker 2nd Floor West.

Hobby Shop**
Open weekdays, 10am-4:30pm, duPont Gym basement. Fee: students, \$6/term or \$10/year; community, \$15/year. Call X4343.

MIT/DL Duplicate Bridge Club**
Every Sunday, 2:30pm, Walker Blue Rm. Every Tuesday, 6pm, Lobdell.

Tech Catholic Community Bible Study Program*
Weekly series of informal Bible discussions. Every Monday, 7:30pm, Student Center Rm 441.

Tiddlywinks Association*
Every Monday, 8-11:15pm, Student Center Rm 491.

Soaring Association**
First and third Mondays every month. 7:30pm, Student Center Rm 473.

Judo Club**
Every Monday, Wednesday, Friday, 5pm; every Saturday, 1pm, duPont Gym Exercise Rm. Beginners welcome.

Outing Club*
Every Monday, Thursday, 5pm, Student Center Rm 473.

Fencing Club**
Every Tuesday, 6-9pm, duPont Fencing Rm.

Glee Club**
Every Tuesday, Wednesday, Thursday, 5-6:30pm, Kresge. New members, especially tenors, welcome. Call Cyril Draffin, 247-8691.

Classical Guitar Society**
Classical guitar classes, group or private. Every Tuesday and Thursday, 5-8pm, Rms 1-132, 1-134, 1-136.

Table Tennis Club**
Practice session, every Wednesday, 7:30-10:30pm, T-Club Lounge, duPont.

Society of Sigma Xi**
Informal coffee hour. Every Thursday, 4-5pm, Student Center Rm 407.

Science Fiction Society*
Every Friday, 5pm, Rm 1-236.

Student Homophile League*
Meeting and mixer. Every Friday, 7:30pm, Mission Church, 33 Bowdoin St, Boston.

Chess Club**
Every Saturday and Sunday, 1:30-5:30pm, Student Center Rm 491.

Mixers

Pi Lambda Phi Mixer*
Friday, February 25, 8pm, Sala de Puerto Rico. Admission 75 cents for all college students.

Muddy Charles Pub**
Join your friends at the Muddy Charles Pub, 110 Walker, daily 10:30am-7:30pm. Call X2158.

Friday Afternoon Club**
Music, conversation and all the cold draft Budweiser you can drink. Featuring folk singer Rich Holloway. Every Friday, 5:30pm, Ashdown basement Games Rm. Admission: men \$1, women free. Must be over 21.

Movies

Gertrud*
By Carl L. Dreyer. Wednesday, February 16, 7:30pm, Rm 10-250.

The Plow that Broke the Plains
Department of Humanities Film Series. Friday, February 18, 10am, Rm 14N-0615.

Butch Cassidy and the Sundance Kid**
LSC. Friday, February 18, 7 & 10pm, Rm 26-100. Tickets 50 cents.

Report to the Faculty on the Four Year Trial of Freshman Pass/Fail Grading

Massachusetts Institute of Technology
February 11, 1972

Committee on Evaluation of Freshman Performance

Peter Büttner

Sandra Cohen

Merton C. Flemings

Stephen A. Jordan

Arthur D. Kaledin

Paul F. Levy

Arthur P. Mattuck

Jeffrey Steinfeld

Felix M. Villars

Everett E. Hagen, Chairman

Introduction

In April, 1968, the faculty adopted for a four-year trial period beginning in September of that year the practice of recording grades of only Pass or Fail for freshmen in all subjects taken by them. Associated was to be an evaluation procedure which it was hoped would give a richer picture of each student's performance and experience in each subject than does one dimensional letter-grading. The action by the faculty called for a report and recommendation to the faculty during the 1971-72 academic year.

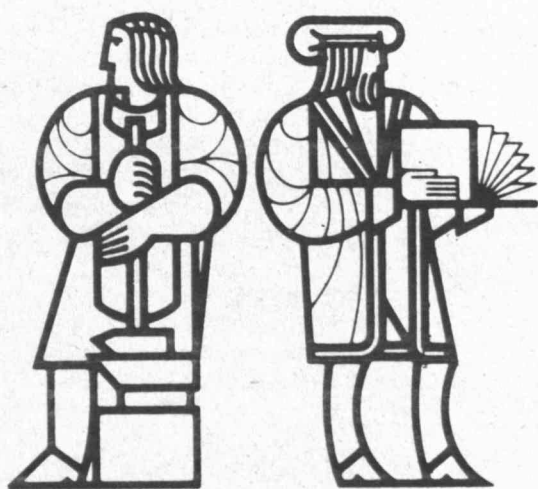
The turmoil in the university environment during the academic years 1968-71 obviously affected student life. Yet we believe that certain findings stand out so clearly in our research that we can be sure of their validity.

The Purpose of Freshman Pass/Fail

When Freshman Pass/ Fail was adopted in 1968, it was a mail-order bride. However, certain hopes and fears were clearly stated.

One of the major purposes was to relieve the anxiety and sense of pressure felt by incoming MIT students during the year of their transition from secondary school to work in a university of high quality and high expectation. It was also hoped to develop in each student a more mature motivation for his university education and a more active, expressive involvement in his studies; and to give him a sense of freedom to make a wider choice of subjects and a wider choice in the allocation of his time among his subjects when a topic within any one of them especially excited him. These attitudes, it was felt, might persist throughout the upperclass years.

Additional purposes were to give incoming students a year in which to compensate for differences in their secondary school preparation; to improve the instructor-student relationship by removing the corrupting doubt that a student



approaching an instructor might be attempting to influence his grade; to enrich the evaluation of student performance and experience in each subject; to change the image of MIT as a school that grinds out students mechanically, a school that only "tools" would find congenial; and lastly, to lessen the (fairly small) loss of creative students during the freshman year.

It was recognized that the Pass/ Fail procedure might have unwanted results also, among them that students might neglect their studies, being content only to "get by;" that their preparation for upperclass subjects might thereby suffer; that the absence of information about how well they were doing, relative to other students or absolutely, might create anxiety for some students; and that the absence of letter grades in freshman subjects might cause some difficulty in the placement of students in graduate schools, professional schools, or jobs.

The Structure of the Experiment

The motion adopted by the faculty provided for the creation of a Committee on the Evaluation of Freshman Performance (hereafter referred to as (CEFP)), which was to monitor the experiment and report to the faculty during the 1971-72 academic year. At the completion of faculty action on its report, the tenure of the committee ends.

Though labelled an "experiment," Pass/ Fail was not set up with a control group. It would have been useful to have had such a group, but ethically it was not possible. What the CEP proposed and the faculty accepted should, more accurately, have been described as a "trial." Thus our evaluation must be based on a more subjective analysis than we might like.

The CEFP initially made two decisions which may appropriately be mentioned here. First, we approved an evaluation form to be used by students and their instructors at the middle and end of each term. Some students and some instructors have failed to fill out these forms. We considered this at length (on several different occasions during the first three years) and decided not to make the filling out of forms compulsory, since this would tend to degrade both the process and the evaluations themselves, and with so much individual variation in people and modes of instruction, we were not sure that such evaluation forms were universally useful.

The second decision dealt with the number of units which a freshman might take. During the first term of the experiment a freshman was forbidden to take more than 54 units except by petition to the Freshman Advisory Council. At mid-year, this limit was raised to 57, and at the end of the first semester of 1969-70 the limit was removed. Both issues are further discussed in later sections.

Although the final grades were limited to Pass or Fail, no constraints were imposed on the nature or extent of feedback during the term. Instructors were free to grade homework, papers and quizzes as they had previously, if they chose to. In many subjects the written evaluation forms became a supplement to other, more frequent, forms of feedback.

To arrive at its recommendations the CEFP (among other actions) held open meetings with freshmen in 1968 and 1969; held other meetings; studied reports on grading systems with a single passing grade at other schools; obtained data concerning trends at MIT in student loads, grades, lecture attendance in freshman subjects, and other matters; obtained reports from the four departments doing the bulk of freshman teaching; obtained responses to questionnaires from 147 faculty members who were instructors of freshmen and sophomores during the second semester of 1971; and considered letters received (mainly in response to an invitation sent to all faculty members) from some twenty faculty members. Individual members of the committee interviewed a number of other individuals whose positions cause them to be directly concerned with freshman teaching. The committee commissioned certain studies and had the benefit of studies done for other groups. Among the latter were an analysis of the content of evaluation forms, and a series of sample surveys of freshmen conducted by the Freshman Advisory Council. One individual (Ingrid Sommerkorn) conducting research on behalf of the CEFP held lengthy interviews with twenty-three faculty members of the Physics and Political Science departments and with twenty-seven of their students; and another (Charles Stannard) administered and analyzed a rather elaborate questionnaire to which 687 students from the four undergraduate classes responded.

Recommendations for Faculty Action

Freshman Pass/ Fail has not done everything that was hoped when it was instituted; perhaps some of those hopes now appear a bit naive. It is popular with students and at least widely acceptable to faculty. There have been both anticipated and unanticipated benefits, and some disadvantages. Balancing the many discernible effects, we conclude that it should be regarded as a definite improvement to the freshman year. We believe, therefore, that as a minimum, it should be continued. We also make an additional recommendation.

Our two primary recommendations are:

1. That Freshman Pass/ Fail be continued indefinitely;
2. That for a two-year trial period a Pass/ No Record system be substituted for Pass/ Fail grades; and that the President appoint a committee to be charged with reporting to the faculty during the fourth semester of the trial.

While we have come to view these two recommendations as of a piece, the second actually strengthening the concept of a single passing grade, we recognize that to others No Record may represent a new idea and as such deserves separate consideration. Therefore, in the next section, we will first present the evidence which leads us to recommend retention of a single passing grade for freshmen, and then we will discuss our proposal for Pass/ No Record. We will conclude with the balance of our recommendations.

Summary and Discussion of Findings

A. Overall Student and Faculty Opinion

Freshman Pass/ Fail has gained wide acceptance throughout the MIT community. Specific data are in Table 1 below.

Group Polled	Positive	Negative	Undecided
Students, spring term, 1971	81%	9%	10%
Freshman instructors, spring term, 1971	57%	23%	20%
Advisors, '68	55%	15%	30%
Advisors, '69	59%	11%	30%
Advisors, '70	65%	11%	24%

It is of interest to note the other qualities associated with differing attitudes toward Freshman Pass/ Fail. Some students believe that they took a larger number of subjects and more difficult subjects because of Pass/ Fail. Others believe that they did less work: completed fewer homework problems and attended fewer lectures and recitations. The percentages of these two groups favoring continuation of Pass/ Fail were equal. On the other hand, students who believed that they explored more fields, concentrated on personally interesting subjects, or bunched up work more than otherwise because of Pass/ Fail favor its continuance by a larger percentage than do those who believe they did less work.

When instructors' responses are broken down by Schools, alternatively by "core" subjects vs. electives, and by freshman vs. upperclass subjects, in every sub-group the number favorable to Freshman Pass/ Fail was considerably greater than the number opposed. With a single exception, the ratio was between 2 and 4 (usually between 2 and 2.5) to 1; in the School of Engineering, the ratio was 1.5 to 1.

Although this acceptance by both faculty and students is necessary for our recommending continuance of the system, we cannot base our recommendation on popularity alone.

- B. Has Pass-Fail diminished anxiety and competition for grades in the first year? Has it eased the transition for students not quite so well prepared for MIT as the majority of their classmates?

In many respects it is impossible to compare the student reaction to Pass/ Fail grading with that to

ABCDF grading, since no freshman has experienced both. We have had to rely in part on students' own judgments as to whether they behaved or felt differently under Pass/ Fail than they would have under ABCDF grading.

One such aspect is students' feelings of anxiety or pressure. In the Stannard questionnaire survey, as might be expected, many fewer freshmen than upperclassmen said that they felt "a lot of competition" for grades, but, surprisingly, 45 percent of freshmen said that they did. Almost as large a percentage of freshmen as of upperclassmen reported feeling a great deal of pressure or a sense of anxiety in one or more courses. Table 2 presents the data. However, the facts cited in Section C (below) suggest that students actually do feel under less pressure to perform on demand. Also, large numbers of advisors and instructors mentioned a reduction in competitive pressure among students as a positive effect of Freshman Pass/ Fail.

	Freshman (183)	Sophomore (162)	Junior (186)	Senior (151)
Percent reporting a lot of competition for grades in one or more subjects	45%	70%	72%	64%
Percent feeling under a great deal of pressure in one or more subjects	74%	78%	82%	74%
Percent feeling anxious about how well they were doing in one or more subjects	74%	80%	78%	73%

It should be noted that the percentages of all subjects in which freshmen or other students felt these tensions is much smaller. For example, freshmen report a sense of competition for grades in 22% of their subjects, upperclassmen in 32%.

With respect to whether or not Pass/ Fail eased the transition to MIT for some students, a frequent comment on questionnaires was that Pass/ Fail allowed those students with weaker high school backgrounds time to catch up and adjust to the demands of MIT without fear of punishment (in the form of poor grades) for not achieving "instant success." Furthermore, without grades and overall class rankings one negative impact of moving into the Institute's highly competitive environment has been eliminated: the typical freshman, who was in the top 10% of his high school class, doesn't have to worry about the chance of ending up, officially, in the bottom-half of his class after only one term.

- C. Has Pass/ Fail encouraged more mature attitudes toward learning on the part of students?

Though many freshmen report a sense of pressure, anxiety, or even competition for grades, many of them also report actions consistent with a reduced sense of each. Stannard reports that 51% of the freshmen said they explored more fields and took a more diversified set of subjects under Pass/ Fail than they would have under letter grading. More importantly, 50% reported that because of Pass/ Fail they concentrated more than they otherwise would have on subjects that were personally interesting. Comments from the instructors indicate that faculty are aware of this change in learning attitude. Additionally, 28% of freshmen reported that they took harder subjects than they would have under letter grades, and half said that they "bunched up their work" in subjects, meaning that they pursued in depth an interesting topic, temporarily neglecting other work. This indicates to us a reduction in a sense of pressure and progress towards self-direction and concern with the subject content rather than with academic rewards.

Fifty-one percent of sophomores and juniors polled in the Stannard survey think that because of their experience with Pass/ Fail as freshmen they are less dependent on grades as an index of their progress.

- D. Are students learning less? Are they less well prepared for sequel subjects?

Students may or may not be studying less as a result of Pass/ Fail. Thirty-eight percent of fresh-

men reported that they studied less, 33% that they did fewer homework problems, 25% that they attended fewer classes than they would have under letter grades. Yet a survey of lecture attendance in required freshmen subjects over a series of years shows no smaller attendance under Freshman Pass/ Fail than previously. The downward trend in hours of homework, reported on Freshman Advisory Council questionnaires, was much slower from 1966/ 67 to 1969/ 70 (encompassing the onset of Pass/ Fail) than from 1964/ 65 to 1966/ 67 (a decrease of 0.7 hours/ week/ year versus 1.4 hours/ week/ year).

However, we recognize that a minority of students do abuse the freedom by studying only enough to "get by." But we recognize also that students who study primarily in order to get good grades, and not because of intrinsic interest in the subject matter, often slough off learning when the semester's work is completed and the grade is received. We therefore do not know how many even of this minority who study less than under letter grades learn less, and develop less intellectually, under Pass/ Fail.

The facts we have obtained indicate that not many students are less well prepared for later subjects because of Pass/ Fail in their freshman year. Thirteen percent of sophomores and juniors polled stated that they felt less well prepared, 75% that they did not. Eleven percent were uncertain. The continuing trend of rising term and cumulative averages for upperclassmen, which has existed over the past two decades, was not interrupted by the introduction of Pass/ Fail. The Mathematics, Physics, Chemistry, and Humanities departments report that Freshman Pass/ Fail does not in general or in any great number of cases seem to have weakened the preparation of freshmen for upperclass subjects. Moreover, instructors of mixed freshman-sophomore subjects report that, on the average, freshmen perform at least as well as the sophomores.

Although the percentage of F's in individual freshman subjects fluctuated from term to term, ranging from zero to nine percent, the overall percentage of F's received by freshmen remained under three percent, as it had prior to Pass/ Fail. An inspection of individual subjects both before and during Pass/ Fail suggests no significant changes in the percentage of F's.

E. Has Pass/ Fail improved student-faculty communication?

A secondary effect of Freshman Pass/ Fail has been some change in student-faculty communication. The evaluation forms are a more versatile and more personalized instructor/ student feedback method than are simple grade reports. Although the forms are not being used to their best possible advantage by everyone, questionnaire responses by students, instructors, and advisors, analysis of the evaluation forms, and personal interviews all indicate that the mechanism is more beneficial than letter grades for those who make active use of it. Based on her small sample, Sommerkorn concluded that the amount of verbal contact between students and instructors seems to have decreased from its pre-Pass/ Fail frequency, but in general that contacts have changed from arguments over grades to discussion of subject matter.

The loss of formal grades as a means of feedback to students does leave students less sure of their standing in relation to their peers, and, especially, leaves them without formal evidence of their ranking. This loss is felt by some despite the fact that many instructors have continued to grade homework, papers and quizzes with the same precision as they did when there were final letter grades. A small fraction of students and an occasional faculty member have expressed a preference for formal recognition for superior work; some faculty would prefer to formally delineate marginal passes. However, we believe that formal, extrinsic rewards and the derivative information about "standing" hinder the best educational motivation. Constructive feedback and encouragement can become (and in many class situations have become) the predominant focus in the absence of letter grades.

We are dissatisfied with the use made of the evaluation forms during the trial period. But the inadequacies of the process itself can be overstated. In 1968, 1969 and 1970, freshman advisors judged that about two thirds of instructors' comments on the evaluation forms were somewhat more useful or substantially more useful than letter grades. However, from 10 to 20% of freshmen failed to fill out the forms in two or more of their subjects. Moreover, instructors' comments on about one third of the forms were judged no more useful than letter grades. Yet, there is no reason to believe that

instructors would know their students better under a letter grading system. Perhaps until resources and the will exist to move the entire educational system in the direction of greater individual contact, the present lack of such contact will continue. However this may be, we note that the evaluation system is working only imperfectly. We hope that earnest, diligent and continuing effort to enlist the cooperation of all instructors may improve its functioning.

F. What role, if any, has Pass/ Fail played with respect to changes in curriculum content and instructional modes?

Pass/ Fail has provided an opportunity for the emergence of greater flexibility in the educational system. The new modular structure of freshman Physics and Calculus is evidence of specific innovation. Instructors in other subjects report a new freedom in teaching their classes; they can spend more time covering a topic in which students show an interest, and less reviewing old material.

G. How has Pass/ Fail affected, or how is it likely to affect, MIT students as they seek admission to graduate and professional schools?

The class of 1972 is the first that is applying from MIT to graduate schools with all first year grades recorded as Pass/ Fail. We have had to rely on scattered and inconclusive information about the impact of various non-traditional grading systems on graduate school admissions: letters from three schools with some years of experience with Pass/ Fail grading, plus two partial surveys made by other schools. Graduate and professional school attitudes about Pass/ Fail vary widely. Few graduate schools seem greatly concerned about freshman grades, since they stress letters of recommendation and grades in advanced subjects in the field in which the student proposes to do graduate work.

Students who apply for admission to certain medical schools are most likely to be disadvantaged. Almost 200 MIT students (of whom less than 100 were seniors, and some were graduate students and alumni) applied for admission to medical schools this year, and, judging by present expressions of intent, it is believed that the number will rise to over 200 per year. Some medical schools, burdened with extremely high numbers of applicants, insist on receiving letter grades or close equivalents for certain subjects commonly taken by MIT students in the freshman year. Other medical schools may discriminate against applicants who do not present letter grades. Under Corollary Recommendations we present a recommendation concerning this policy.

Our best judgment at this time is that Freshman Pass/ Fail will only in a few instances create difficulty for MIT students as they apply to graduate and professional schools. There is more likely to be difficulty if a substantial number of the student's upperclass grades are non-traditional. Caltech reports that their students have had no difficulty due to Freshman Pass/ Fail grades. Furthermore, in all categories of undergraduate schools there is a trend toward greater use of single passing grades, so we assume that, increasingly, graduate schools will come to accept such grades, particularly at the freshman level, and will use other means of evaluating applicants.

H. Does Freshman Pass/ Fail increase the attractiveness of MIT to especially creative individuals, or decrease withdrawals of such students?

We have not been able to acquire systematic evidence concerning either part of this question.

The 'No Record' Proposal

Under a Pass/ No Record system, only those subjects for which there was a grade of Pass or one of the temporary grades (I, O, OX, J) would appear on grade reports or transcripts. At the end of a term a subject for which the instructor indicates "no record" would thereafter not appear on any permanent records (except perhaps on the grade summary sheets, to avoid confusion with missing grades and recording errors).

We believe that there are several important benefits to such a system. At the same time we recognize several possible pitfalls. We think the pitfalls can be effectively guarded against by other positive steps which have value in and of themselves.

The basic reason for instituting Pass/ Fail was the recognition that the problems of transition

made the first year an especially difficult one, and freshmen therefore deserve some special consideration.

A major difficulty with Pass/ Fail as it now stands is the sharp discontinuity between Pass and Fail. Between the freshman who passes and the one who fails there may be only a small difference, yet the one who fails is penalized twice—he gets no credit, and he gets the F on his permanent record. This has bothered some faculty members teaching freshmen (particularly in electives), leading some to pass those students whom they really would rather have failed and others to propose a new grade of "Low Pass" to bridge the Pass/ Fail gap.

We feel that No Record is the best solution to this problem. It softens the penalty for failure; the student only loses the credit and doesn't get the F on his record. With the stigma of F removed, the freshman can make more rational decisions about how he will spend his time and intellectual energy—particularly toward the end of the term. All this is a logical extension of the special consideration we are giving to the freshman year.

In another way, it represents a toughening-up of the freshman year. The faculty under No Record—particularly those teaching electives—get more freedom to "fail" marginal students, since the penalties for failure are less severe. And yet the single-passing-grade concept is preserved. Note too that a freshman who fails a required subject will have to repeat it in a later year, under letter-grading, so he does not escape judgment.

Contrary to what one might initially suppose, No Record need not affect the decision-making about marginal students now done by the Freshman Advisory Council and Committee on Academic Performance. The criteria evolved over the past three and one-half years focus on the amount, nature and quality of work fully or partially completed and include an assessment of the student by his advisor. Since the fall of 1969 no official notice has been taken of recorded failure.

Finally we would point out that *de facto* No Record is for many students already a part of the grading system. The drop date has been set at more or less two weeks before the end of term for several years now. The student who is either cautious or a good guesser can keep his record relatively free—often totally free—of F's by dropping questionable subjects by the drop date, adding them back before the last day of class if conditions improve. Only the honest martyr, the negligent risk-taker, and the upperclassman whose advisor who won't play the game (substantial numbers are reportedly quite willing to) end up with F's. No Record would end this hypocrisy, at least for the freshmen (a statement we offer as fact and not as a necessarily valid argument for No Record).

Some Objections and Possible Pitfalls

The major objection to No Record, though not often spoken, is, we would guess, the feeling that "we're making it too easy for the freshmen, we're not teaching them to live up to their commitments." As we have indicated above, however, we believe the F grade is unfair in a Pass/ Fail setting. We hope it is clear why No Record is not as soft as it sounds at first. And the freshman year is still a "special" one, which should be entitled to its own rules.

Most of the other objections to Pass/ No Record stem from the fact that students will no longer be compelled to drop subjects—it will be done automatically for them. It has been argued that (particularly in electives):

1. Instructors will not know who is seriously in their subjects and who has psychologically dropped them;
2. Advisors will not see their advisees, since they will not have to come around to drop subjects.

The solution to both problems should not rest on administrative procedures: roll cards, drop dates, and the like, but rather in establishing a commitment between teacher and student (and among students, in some cases), and between advisor and student. If they wish, teachers are free to require some visible evidence of the student's commitment at certain points in the semester, in order that he qualify for a Pass. Even compulsory attendance has been used. Advisors can identify at mid-semester which students are hanging on marginally in one or more of their subjects, and set a time for a subsequent meeting at which the student will definitely decide what to drop.

We recognize the advantages of having administrative records reflect reality as nearly as possible and feel that the present procedures of dropping subjects (exclusive of the present time limit and processing charge) should be continued,

at least initially. To the extent that the reasons are defensible and clearly communicated we believe most students will tend to keep their records up to date.

Some have suggested that faculty will abuse Pass/ No Record by over-reacting and setting much too high standards for a Pass. This is unlikely for the required freshman subjects; note that math and physics already set absolute standards by the self-paced exams. Some mixed freshman-sophomore subjects require different standards for freshmen and sophomores, but this difference has so far not been great and the problem is easily monitored. This leaves the freshman electives and seminars; these represent at most one-fourth of the freshman's time, and while standards here are the faculty member's prerogative, if he is unreasonable it is not likely the subject will survive.

Stated more generally, we believe that the fundamental questions concerning standards and their implementation can be handled relatively independently of most grading systems. In addition to the examples cited above, we observe that other self-paced subjects have effectively raised the passing standards for all students without, to our knowledge, significantly penalizing any students. We conclude that there are probably many reasonable ways to maintain or raise standards which ask no more of a student than the time for which he receives credit, which are communicated early and unambiguously to the student, and which are administered fairly by the faculty.

One of the possible pitfalls for a freshman is that he may tend to carry along one or more subjects at a minimal level of effort, in hopes of passing, when it would be better for him to concentrate more on his other work. Aside from the fact that the "right" decision in such cases is often not obvious in advance, we believe that beyond encouraging the student to seek advice and make considered judgments, the best practice for decision-making is actual decision making, even (sometimes especially) when it results in poor decisions.

Ultimately there is no way in advance to judge how serious these problems will be. One has to try, and see what works. Many changes in the instructional pattern that have affected Pass/ Fail (or been affected by it) were unforeseen when it was started, and the same will doubtlessly be true of Pass/ No Record as well.

Thoughts on Evaluating No Record

As has been the case with Pass/ Fail, we believe that the committee designated to evaluate No Record will have to reach its own conclusions about relevant criteria and the weight to be attached to various types of evidence. However, we suggest that the following might be worth considering:

1. How do initial registration figures, drop patterns, and number of "failures" compare with pre-No Record data?
2. Do faculty report different standards and practices with respect to passing work? In what ways are students affected?
3. Do advisors report changes in advisee contact? Have they changed their own efforts in any way?
4. How do instructors feel about student commitment to their subjects? Does non-mandatory dropping appear to have an effect? Have they attempted to increase commitment by other means? With what effect?
5. Have end-of-term CAP decisions been affected in any way?

Corollary Recommendations

We conclude with the following recommendations for consideration by appropriate faculty committees:

A. That the use of evaluation forms relating to freshman performance in subjects should be continued, and in general as at present. That the filling out of these forms shall not be made compulsory. That in view of the rapid turnover of section instructors in freshman subjects, great care be taken to inform instructors fully at the beginning of each semester of the evaluation system and its importance.

At present, not all students and not all instructors fill out the forms. (Data obtained from several surveys indicate that mid-term evaluation forms for all or all but one subject are obtained from between 80 and 90% of students, and that few students fill in no forms at mid-term. The end of term record is poorer.) We recommend, nevertheless, that to fill out the forms should not be compulsory. As discussed earlier we continue to

believe that compulsion at mid-term is not practical, that compulsion might reduce the quality of evaluations now made voluntarily, and that evaluations not made voluntarily would probably not be illuminating.

With respect to students' needs for supportive information at the time of transfer to another school or later application for a job or to graduate school, we recommend that it be made as clear as possible to the freshmen that it is in their own best interest first to initiate detailed and thoughtful evaluations, second to ask for more feedback from instructors whose comments are not illuminating, and third to keep a personal file of all written feedback.

B. We call the attention of the faculty to the fact that the transmission of unofficial grades to anyone for any purpose is contrary to the intention and spirit of the Pass/ Fail system.

We recognize that at the request of students some faculty members are now reporting to medical schools letter grades for certain subjects taken by the students as freshmen. The requests have related mostly but not exclusively to subjects in Biology and Chemistry.

We believe that even this limited assignment and use of letter grades corrupts the Pass/ Fail or Pass/ No Record system for all students who are not certain when they are freshmen that they will not later apply to medical school. This use of letter grades is inconsistent with the purposes of the Pass/ Fail system. The resulting impairment of the system may well affect other freshmen also.

At this time we do not have sufficient information to know how broad or how serious the medical school problem is. We recommend that a committee be appointed by the President, charged (i) to inform itself concerning the admissions procedures and requirements of American medical schools and (ii) concerning the problems of other schools having Pass/ Fail systems with respect to applications to medical schools, and the practices they have adopted, (iii) to discuss with medical schools possible amelioration of this problem, and (iv) to make a recommendation to the M.I.T. faculty before the end of the present academic year.

C. That the present notation for pass, N, be changed to P, and that a more suitable explanation than presently exists appear on grade reports and other official records.

We are aware of frequent confusion surrounding the present symbol and explanation.

D. That the Rules and Regulations of the Faculty be modified to reflect not only these specific recommendations but also the principal underlying assumptions and expectations of the faculty. Suggested wording is included as Appendix A.

E. That no limit be established, even with a provision for exception by petition, on the maximum number of units which a freshman may take.

We make the recommendation for two reasons. One is that it is the emotional and mental style of some students to take exceptionally heavy loads. It is appropriate that they do so. The other is that we know of no satisfactory way of discriminating *a priori* between these students and those who abuse the privilege. Some students no doubt abuse the privilege, but to set limits would abuse some students.

Some faculty members may have an exaggerated impression of the problem. Forty-one percent of the freshmen responding to the Stannard questionnaire reported that they took a larger number of units under Pass/ Fail than they would otherwise have taken. However, some of them may be mistaken. Certainly few of them took a much larger number of units. For student loads and the dispersion with respect to them were increasing before the Freshman Pass/ Fail experiment, and while that trend accelerated somewhat under Pass/ Fail there was no discontinuity. During the first semester of 1964-65, typical freshman loads were 42-48 units; in 1967-68, 43-52 units; in 1969-70, 45-55 units. (The ranges indicated are approximately one standard deviation each side of the mean). For second term freshmen, there is a similar increase, though one less regular over time. First and second term sophomores now average about 47 units in both terms, but the dispersion both above and below is greater than for freshmen.

F. That it may be time for the entire grading system to be re-evaluated. New modes of instruction are appearing throughout the curriculum, in upperclass as well as freshman

subjects, such as "modular" or "self-pace" 18.01, 18.02, 8.01, and optional sections of other Physics courses; and "unified" programs such as USSP, ESG, Concourse, and Industrial Dynamics. In many of these subjects, instructors have already been forced to abandon, often on an *ad hoc* basis, the canonical ABCDF grading system on a fixed number of units. Alternative methods of evaluation and the granting of a variable number of credit units may be more appropriate for some situations.

At the same time, we do not feel that our recommendations should be tied to any consideration of the upperclass years, nor should freshman Pass/ No Record be viewed as a "pilot project" for the upperclass years. It is a proposal specifically for the freshman year, directed at resolving some of the specific difficulties of the freshman year and of Pass/ Fail.

Appendix A

Proposed Change in the Wording of Rules and Regulations of the Faculty

For the first full paragraph at the top of page 16, substitute the following three paragraphs:

The only grades recorded by the Registrar for freshman students shall be P, subject passed; F, subject failed; or the temporary grades of I, incomplete; O, absent; or OX, absence satisfactorily explained, as described above.

Beginning in the first term 1972-1973, and continuing for a trial period of four semesters, the instructor in charge of any subject shall report to the Registrar "No Record" rather than F for any freshman whose work does not merit a grade of P and who is not receiving one of the temporary grades described above. The permanent record maintained by the Registrar shall exclude any reference to subjects for which the instructor has reported "No Record."

It is the responsibility of each instructor to provide each freshman student with meaningful evaluation of his or her work. This should not be regarded as limited to the written comments on evaluation forms.

Appendix B

Acknowledgments

The not fully complete summary of sources of information presented in the first section of this report indicates the large number of members of the administration, faculty, and student body of M.I.T. to whom the CEFP is deeply indebted. In addition, we would like to express our especial indebtedness to Ingrid Sommerkorn and Charles Stannard. That their serving jointly their own research interests and our purposes were of great value to us is indicated by the references to them at numerous points in our report.

The faculty members of CEFP wish also to express their gratitude for the diligent and thoughtful work and the significant contributions to the analysis and report of the committee made by the student members of the committee; and to Peter Büttner, whose work on CEFP and the materials he obtained and analyzed as executive officer of the Freshman Advisory Council contributed greatly to the committee's work.

Appendix C

Membership of the Committee to Evaluate Freshman Performance

	Spring 1968	1968-69	1969-70	1970-71	1971-72
Hale Bradt			x	x	x
Peter Büttner	x	x	x	x	x
Sandra Cohen			x	x	x
Merton Flemings	x	x	x	x	x
Paul Gray	x	x			
Everett Hagen	x	x	x	x	x
Peter Harris		x			
Stephen Jordan				x	x
Arthur Kaledin	x	x	x	x	x
George Katsiaficas	x	x			
Paul Levy		x	x	x	x
Arthur Mattuck	x	x	x	x	x
Hal Moorman		x	x	x	
Gian-Carlo Rota	x	x			
Jeffrey Steinfeld	x	x	x	x	x
Felix Villars	x	x	x	x	x

King Off**
S.C. Saturday, February 19, 7 & 9:30pm, Rm 26-100.
Tickets 50 cents.

Mapama*
KAGAM film series. Sunday, February 20, 3:30pm, Rm
100. Tickets \$1.50.

and Mike
Department of Humanities Film Series. Wednesday,
February 23, 6pm, Rm 10-250.

**fundamentals of Boundary Layers and Boundary Layer
Control**
and Mechanics Films Series, Thursday and Monday,
February 24 and 28, 4-5pm, Rm 3-270.

the River
Department of Humanities Film Series. Friday, February
24, 10am, Rm 14N-0615.

Music

Chamber Music Series*
Pitstone Leslie Guinn and pianist John Buttrick perform
Schone Mullerin by Franz Schubert. Wednesday,
February 16, 8:30pm, Kresge. Reserved seats, \$3; general
admission, \$2.

Thursday Noonhour Concert*
Classical guitarist Vo-Ta-Han. Thursday, February 17,
1:10pm, Chapel.

Chamber Music Series*
Pianist Ernst Haefliger and pianist Franz Rupp perform Die
Interreise by Franz Schubert with lyrics by Wilhelm
Muller. Wednesday, February 23, 8:30pm, Kresge. Reserved
seats, \$3; general admission, \$2.

Theater and Shows

Arms and the Man*
Dramashop presentation of Shaw's popular comedy,
directed by Prof. Joseph D. Everingham. February 18, 19,
20pm, Kresge Little Theatre. Tickets: \$2.25. Reservations
made at X4720.

ACT Community Players
Ten-week course in beginning and intermediate acting will
begin Tuesday, February 29. There is a \$20 fee for the
course. For further information call Jane Howard, X2217.

Dance

folk Dance Practice*
Irish Students Club. Every Sunday, 4-7pm, Student
Center Rm 407.

folk Dance Club*
International folk dancing. Every Sunday, 7:30-11pm, Sala
Puerto Rico.

Modern Dance Technique Class**
Elementary/Intermediate. Every Monday, Wednesday,
Friday, 5:15pm. Every Sunday, 1pm. McCormick Gym.

Chess Squares*
Every Tuesday, 8-11pm, Rm 10-105. Call dorm X0888 or
X25453.

folk Dance Club*
Folk dancing. Every Tuesday, 7:30-11pm, Student Center
Rm 407.

folk Dance Club*
Israeli folk dancing. Every Thursday, 7:30-10pm, duPont
Club T-Club Lounge.

Exhibitions

Sol LeWitt
Work in Process. Artist Sol LeWitt, assisted by four Boston
artists, will produce walldrawings on the Hayden Gallery
walls.

Multimedia Works*
Designed by Frank Martinelli. Displayed at the Creative
Photography Gallery, 120 Mass. Ave, 3rd floor, beginning
February 11. Gallery is open daily from 12n to 7pm.

Other Colors of Greece and Cape Cod by Karen Vournakis
Exhibited at Faculty Club through February.

Student Art Exhibit*
Student art works produced during IAP including photo-
graphs, graphics and drawings. Through February 17.
Hayden Corridor Gallery.

Art of Rigging and Buoy System for Air-Sea Studies*
Nautical Museum, Bldg 5, 1st floor.

Hayden Corridor Exhibitions*
Presented by students and departments. Bldgs 7, 3, 4, 8.

Athletics

Men's Squash*
Thayer Academy. Wednesday, February 16, 4:30pm,
duPont Squash Courts.

Varsity Indoor Track*
Thayer Dummer Academy. Wednesday, February 16,
6pm, Rockwell.

JV/F Hockey*
Thayer Academy. Wednesday, February 16, 4pm, Skating
Rink.

Varsity Swimming*
Brown University. Wednesday, February 16, 6:30pm,
Alumni Pool.

Varsity Basketball*
Tufts University. Wednesday, February 16, 8:15pm,
Rockwell.

Rifle*
Northeastern. Friday, February 18, 6pm, duPont Rifle
Range.

Varsity Indoor Track*
Colby. Saturday, February 19, 12:30pm, Rockwell.

Gymnastics*
Dartmouth. Saturday, February 19, 2pm, duPont Gym.

Varsity Wrestling*
Tufts. Saturday, February 19, 2pm, duPont Wrestling Rm.

Varsity Hockey*
Assumption. Saturday, February 19, 7pm, Skating Rink.

Freshman Squash*
Harvard. Monday, February 21, 2pm, duPont Squash
Courts.

Hockey*
Alumni Game. Monday, February 21, 5pm, Skating Rink.

Varsity "B" Basketball*
Harvard. Monday, February 21, 7:30pm, Rockwell.

Varsity Basketball*
University of Rochester, Tuesday, February 22, 8:15pm,
Rockwell.

Wrestling*
Coast Guard. Wednesday, February 23, JV/F at 6pm,
varsity at 7:30pm, duPont Gym.

Varsity Swimming*
Springfield College. Wednesday, February 23, 6:30pm,
Alumni Pool.

Religious Services and Activities

The Chapel is open for private meditation from 7am to
11pm every day.

Ash Wednesday Roman Catholic Services*
Wednesday, February 16, masses at 8am, 12:05pm and
5:05pm in the Chapel. Ashes distributed before and after
each mass.

Roman Catholic Mass*
Every Sunday, 9:15am, 12:15pm, 5:15pm, Chapel.

Christian Worship Service*
Every Sunday, 11am, Chapel.

Christian Discussion Group*
Bible study and discussion of Christianity today. Every
Sunday, 9:30-11am, McCormick Seminar Rm A. Call Ron
Gamble, X6712 or 547-4279.

Hillel Religious Services*
Monday-Friday, 8am, Rm 7-102; Fridays, 7:30pm, Chapel;
Saturdays, 9:30am, Chapel.

Christian Science Organization*
Meeting includes testimony of healings. Every Tuesday,
7:15pm, Rm 8-314.

Latter Day Saints Student Association**
Religious seminars. Every Tuesday, 8pm, Student Center
Rm 473.

Christian Bible Discussion Groups*
Every Wednesday, 12:30pm, Rm 4-343; every Thursday,
12:30pm, Rm 20B-222. Call Prof. Schimmel, X6739 or
Ralph Burgess, X2415.

Christians for Dinner*
United Christian Fellowship. Every Thursday, 6-7pm,
Walker Dining Hall (under sign of the fish).

Praying, Singing, Sharing Meeting*
United Christian Fellowship. Every Thursday, 7-8pm, East
Campus Lounge.

Islamic Society Prayers*
Every Friday, 1pm, Kresge Rehearsal Rm B.

Vedanta Services*
Every Friday, 5:15pm, Chapel; discussion hour, 6pm,
Ashdown Dining Hall.

Free Draft Counselling*
Hillel, 312 Memorial Drive, X2982. Call or visit 10am-5pm.

Announcements

All Tech Sing
Annual singing competition will take place on Saturday
March 11. Living groups interested in participating are
urged to begin rehearsing as soon as possible. For addi-
tional information call X6294 or 868-0731.

Summer Internships
Undergraduate summer internships in Washington available
for juniors in political science. For more information, call
Chris Schaefer, X5276.

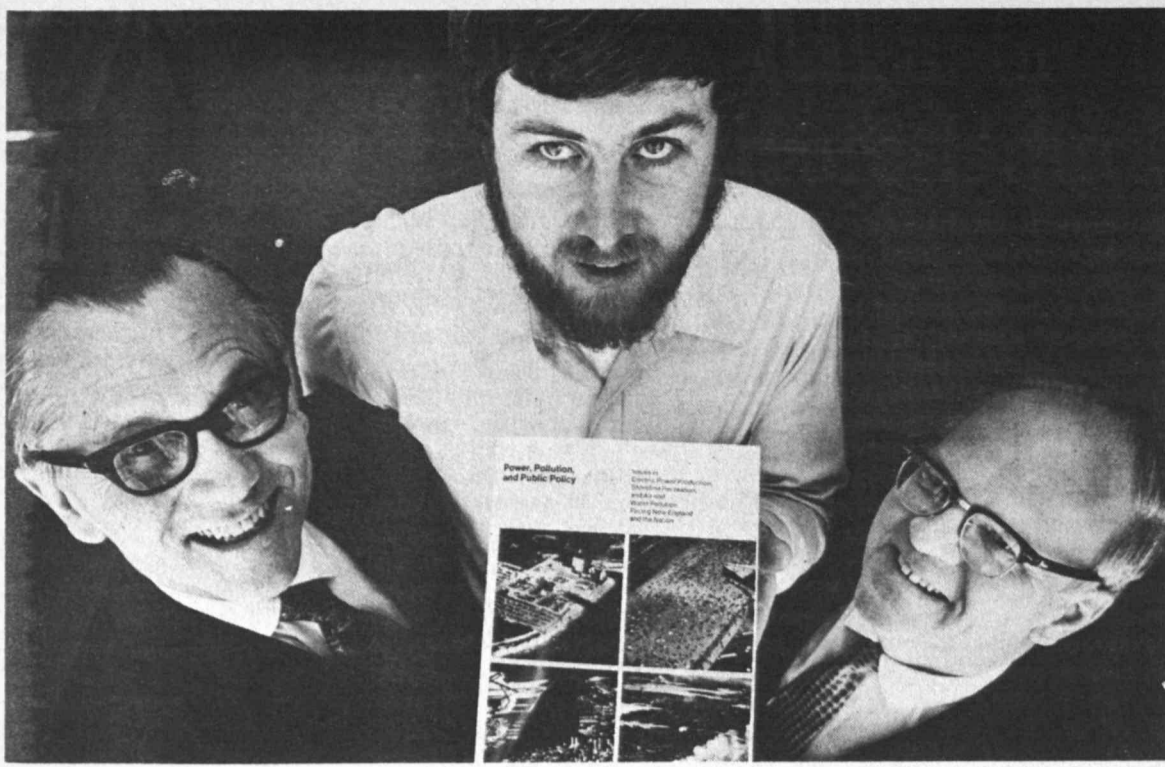
The Eastgate Grocery Store is now open on Sundays from
10am to 3pm.

*Open to the Public
**Open to the MIT Community Only
***Open to Members Only
†Freshmen encouraged to attend

Send notices for February 23 through March 3 to the
Calendar Editor, Room 5-111, Ext. 3279, by noon Friday,
February 18.



Phillip Bertoni, '72, and Deborah Tompkins in a scene from the
Dramashop production of Shaw's "Arms and the Man," which opened in
the Little Theatre last week. Performances will continue on Friday and
Saturday, February 18 and 19, and an additional performance has been
scheduled for Sunday, February 20 at 8:30pm.



Right to left: Alfred A.H. Keil, Dean of the School of Engineering and head of the MIT Sea Grant Program; Dennis W. Ducsik, editor of *Power, Pollution and Public Policy*, a just published book

growing out of an MIT course in systems engineering and William W. Seifert, professor of electrical engineering and professor of engineering in Civil Engineering, who teaches the course.

Super Conducting Generator Being Built in ME Cryo Lab

Researchers at the Institute are constructing an electric power generator using superconducting components operating only a few degrees above absolute zero which could revolutionize the construction of large power station generators.

Parts of the new generator, which are superconducting when extremely cold, will operate at a temperature of minus 452 degrees Fahrenheit - only eight degrees above absolute zero - in order to sidestep problems that have been blocking the construction of ever-larger generators.

The research, which is described in this month's issue of *Technology Review*, is being conducted in the Cryogenics Engineering Laboratory of the Department of Mechanical Engineering by Professors Joseph L. Smith, and Philip Thullen of the Laboratory, and Professors Gerald L. Wilson, Charles Kingsley, and James L. Kirtley of the Electric Power Systems Engineering Laboratory, Department of Electric Engineering, and Professor Herbert H. Woodson, now of the University of Texas, Austin. The project is funded by a grant from The Edison Electric Institute.

Generators work on a very simple principle. When a magnet and a wire move past each other, the magnet produces an electric current in the wire. In the type of generator in wide use today, an electromagnet (called the rotor) spins at 3600 revolutions per minute inside stationary coils of wire (the stator). The rotor consists of wire wound around an iron core.

The more power a generator can produce, the less per unit power it costs to buy and run. However, conventional methods of generator construction limit the size of generators to a range of about 1000 to 1500 megawatts, or about half the peak power consumption of Manhattan. This limit is imposed by the intensity of the rotor's magnetic field, which just cannot be made more intense using conventional approaches. To overcome this size hurdle, the MIT engineers are constructing the rotor with wires of a niobium and titanium alloy that is superconducting at profoundly cold (cryogenic) temperatures. A superconducting wire offers no resistance to a current passing

through it. Therefore, an extremely high current can be passed through superconducting wires to produce a more intense magnetic field than is practical using conventional technology.

Based on their experience so far, the MIT researchers have concluded that it should be possible to eventually construct a practical cryogenic generator capable of producing 10,000 megawatts of electric power.

To see if the alloy could maintain its superconductivity while spinning at 3600 revolutions per minute, the MIT engineers first constructed a small cryogenic generator of about 40 thousand watts. In 1970, they wired the generator into the Cambridge power system and it worked satisfactorily.

With that encouraging result, a new and larger model was designed and is now under construction. When finished, it will produce about two million watts of electric power which could drive a 2,700 horsepower motor. The new generator should be operating in the spring.

The major problems presented by a cryogenic generator are that the rotor must be constantly bathed in the coolant, liquid helium, and the superconductor must be protected from magnetic fluctuations. A superconductor quickly loses its superconducting properties when exposed to a fluctuating magnetic field.

Magnetic stability is provided by surrounding the rotor with a copper sleeve. The entire rotor operates in a vacuum, to maintain the cold temperature.

But, the advantages of a cryogenic generator far outweigh any problems it may present. One major advantage is that the cryogenic generator can be constructed free of iron. The rotor of a conventional generator requires an iron core to produce its magnetic field.

Because of the huge current passing through the superconducting coils, the cryogenic generator needs no iron core. This leaves even more space for windings, which further increases the power output of the generator.

The stator of the generator under construction is not superconducting. Unlike a conventional generator, however, its stator winding has no iron core,

eliminating the need to insulate the core from each of the wires. This will allow the output of the cryogenic generator to be about 300 to 400 thousand volts or about ten times the voltage possible with a conventional, iron-core generator.

Historian Morison Returns to Institute

(Continued from page 1)

spending the 1971-72 academic year at the Institute as Visiting Killian Professor.

Professor Morison, however, will be the first permanent appointee to the Killian chair.

Professor Morison came to MIT in 1946 as assistant professor of English and became associate professor in 1949. In 1953, he moved to the Sloan School as professor of history and director of a study program designed to reveal the significant sweep of technological change, including the history of science, technology and industrial development.

At the Sloan School faculty, Professor Morison devoted much of his teaching time to a course analyzing the major historical ideas affecting American industrial philosophy and processes to students in the Sloan Fellowship Program. This program, first of its kind in the country, was started at the Institute in 1931 and provides a year of intensive study in industrial management for promising young executives. Professor Morison was appointed to the Sloan Fellows Chair, endowed by graduates of the program, in 1964. In announcing his appointment the Dean of the School, Howard W. Johnson, later President of MIT and now Chairman of the Corporation, cited Professor Morison as "an eloquent spokesman for the use of history as a guide to present attitudes and thought."

In addition to his own research and teaching, Professor Morison was for many years a consultant to Educational Services, Inc., where he helped develop new social studies curricula for primary and secondary schools directed toward a clear understanding of the cause and effect relationship in history.

Professor Morison was born in 1909 in Milwaukee, Wisconsin, and studied at Harvard, where he received the A.B. degree in 1932

Killian Award Terms Announced to Faculty

As a permanent tribute to James R. Killian, Fr., tenth President of MIT (1948-1959), and Chairman of the Corporation from 1959 to 1971, the Faculty of the Institute established last spring The James R. Killian, Jr. Faculty Achievement Award. The Award, which is to recognize extraordinary professional accomplishment of members of the Faculty, was created as a reflection of Dr. Killian's consistent encouragement and support of professional excellence at the Institute, and as a token of affection and esteem for his long and brilliant service to MIT.

The terms of the Award are:

Purpose: To recognize extraordinary professional accomplishments by full-time members of the MIT faculty; to provide a means for the communication of these accomplishments to the faculty, students, other members of the MIT community and to the general public, and by so doing to honor the contributions made by Dr. Killian to the intellectual life of the Institute.

Tenure and Duties: The recipient of the Killian Award will hold the title of Killian Award Lecturer for a single academic year. During the course of this year he will be invited to present one or more lectures to the MIT community on his own professional activities. These lectures are intended to be at a level which will make them under-

standable to a majority of the faculty and students at MIT, not just to those in the lecturer's own department.

Selection: A special Selection Committee will choose one member of the MIT faculty to be the Killian Award Lecturer for the following academic year. The Selection Committee for the first (1972-73) recipient will consist of ten faculty members to be elected February 16, 1972 by a vote of the MIT faculty from a slate prepared by the Nominations Committee. The Selection Committee will develop its own procedures, but it is expected that it will consult with those outside as well as inside the Institute in the process. The Selection Committee will also prepare a statement to be circulated to the MIT community, describing in general terms the nature and importance of the accomplishments for which the lecturer is honored.

Honorarium: The Killian Award Lecturer will receive an honorarium of \$5,000 drawn from the income from a special endowment fund established in honor of Dr. James R. Killian, Jr. MIT faculty and friends of Dr. Killian, are contributing to this fund. While gifts and pledges are still being received, a generous special gift of \$5,000 has been pledged to make this first Award possible at this time.

Chairman: The Killian Award Lectures will be introduced by the Chairman of the Faculty.

New Photo Show Open

"Multiple Image Show," a collection of photographic works containing more than a single image, is now on display at MIT's Creative Photography Gallery.

The show consists of approximately 50 works by more than 30 photographers, collected by Frank Martinelli, a photographic assistant at the University of Rhode Island. Martinelli has selected works displaying a wide variety of techniques, including photomontages, gum-bichromates, composite prints and photo silkscreens.

The Creative Photography Gallery, located at 120 Massachusetts Avenue, Cambridge, is open daily from noon to 7pm. The show will continue through February 29.

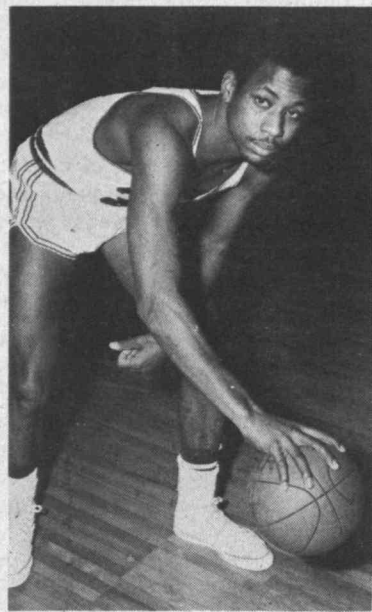
NASA Calls for Faculty Applications

The National Aeronautics and Space Administration has compiled a list of resident research opportunities at the Manned Spacecraft Center in Houston, Texas.

The list includes projects in all areas of aeronautic and space research, and grants are available to assistant, associate and full professors who submit the best proposals. The duration of the projects will depend upon the nature and complexity of the work, but will normally be eight to twelve months. Stipends will be comparable with present salaries, and will include a reasonable moving allowance.

Copies of the list of research opportunities are available in the Information Center, Room 7-111. The deadline for proposals is March 6, with the first projects scheduled to begin in June.

Brown Nears Scoring Mark Despite Three Team Losses



Harold Brown, '72.

Tech's high scoring senior forward, Harold Brown took a giant step toward MIT basketball immortality last week, pouring in 65 points in three games. The 6-3 co-captain scored 22 in a losing effort against Amherst, 72-65, 18 in loss to WPI, 76-70, and 25 in a loss to Bowdoin, 76-66. Brown has scored 388 points (20.4 average) in 19 games and has a career total of 1367.90 points shy of record holder Dave Jansson's ('68) 1457 points. With four games remaining on the slate, Brown will have to average better than 22 points a game to gain the all-time number one spot.

Two weeks ago, Brown's 66 points and 22 rebounds in leading MIT to three straight victories, earned Harold a starting forward spot on the weekly ECAC Division II Hoop Squad. The honor marks the third time Brown has been named to the All Star Team during his varsity career.

The start of Brown's varsity career as a sophomore in 1969-70 season, established the course of things to come. In twenty-five games, Harold scored 514 points (20.6 average), the highest sophomore total in Tech history. The following year, as a junior, Brown increased his scoring average to 22.1 points per game while totaling 465 points in twenty-one games. His two year total of 970 also established a new Tech record.

Despite Brown's heroics, Tech's hoop team record fell to 10-9 with the last week's triple losses. The rest of the way promises to be rough sledding. The engineers have two more games this week, home against Tufts tonight and at Middlebury on Saturday.

Squash

The squash team (1-9) dropped two more last week, 9-0, to Princeton and a hard fought, 5-4 loss to Franklin and Marshall. Against Franklin and Marshall, MIT won at number one, and two but dropped a heartbreaker at three, when Phil Navate lost in five games.

Fencing

Tech's fencing team (7-4) got strong support from their sabre team for the second straight week while rolling over two New England opponents, WPI, 17-10 and Holy Cross, 15-12. Against WPI Coach Eric Sollee was given the opportunity to use his subs earlier than usual, as the Tech sabremen scored an 8-1 victory over their Worcester counterparts. Juniors,

John Tsang, Mike Wong and freshman Doug Park have been MIT's top trio of sabremen all year and should be contenders in next month's New England and Inter Collegiate Fencing Association Championships. Against Holy Cross, the threesome paced the engineers 7-2, scoring the only team weapon victory, as the Crusaders scored 5-4 triumphs in the epee and foil.

Gymnastics

MIT's gymnasts (5-1) powered their way by Plymouth State, 121.60-87.30 last Saturday, as the engineers took first place honors in all six events. Leading the winners parade were senior captain, Dave Beck 8.05 in the floor exercise, Paul Bayer 6.75 in the pommel horse, Jarvis Middleton 7.70 in the rings, Al Razak 8.30 in the vaulting horse, Larry Bell 7.20 in the parallel bars and John Austin 6.85 in the high bar. The engineers host Dartmouth on Saturday in their last home tuneup before the New England Championships.

Marksmanship

Tech's pistol team (5-2) suffered a double beating at the hands and eyes of Army last Saturday. The engineers lost 3360-3307 on the conventional target and 1009-1000 on the international. The losses were MIT's first of the year.

The rifle team (6-2) fared better as MIT topped Harvard 1328-1224 but lost a four man team 1083-1054 decision to Coast Guard. In the Harvard match, freshman Ned Forrester fired a career high of 266. Against Coast Guard, junior Jack Breen fired his personal high of 274.

Cross Country Ski

Tech's cross country ski team fared the best for MIT in last weekend's Norwich Carnival, Eastern Intercollegiate Skiing Association Division II Qualifying Meet, placing fourth of eleven teams entered. Sophomore Scott Weigle placed ninth individually, followed by Bob Collier in twelfth position. The best individual effort, however, came from junior Steve Nadler who placed third in the slalom, followed by teammate John Nabelek in seventh. In the overall four event team scoring, MIT placed sixth of eleven teams entered.

Hockey

The Tech hockey team (2-11) ran over Tufts, 9-0, on Wednesday for the second time this season, but were run over by Trinity, 7-1, last Saturday night. Junior goalie, Mike Schulman turned in his second shutout against Tufts, turning back nine shots on nets. Senior wing Jerry Horten led the Tech attack with two goals and an assist. Against Trinity, Horten scored Tech's only goal, giving him ten on the season.

Track

The Tech track team (6-2) squeaked by New Hampshire, 57-52, last Saturday as they were paced by what is getting to be the same old story -- Brian Moore wins 35 pound weight and shot, Dave Wilson wins the pole vault.

Tech's premiere weightman, junior Brian Moore double triumph

gives the reigning Greater Boston 35 pound weight champ an impressive 11-1 dual-triangular weight and shot record. Vaulter, Dave Wilson's season and career record is even more impressive. Wilson is 6-0 in regular season competition and has been beaten only once in twenty-two dual/triangular meets in his three years of varsity competition.

The engineer cindermen host Colby College on Saturday.

Swimming

Tech's swimmers (5-4) split two meets last week, losing to Amherst, 63-50, but beating Trinity 79-32. Against Amherst, MIT could manage only two individual first's, senior diver, Ed Rich and freshman backstroker, Dave Deacon. Against Trinity it was a different story. The engineer merman scored eight individual first places, led by junior Ed Kavazanjian's Trinity pool record breaking 1000 yard freestyle mark of 11:14.9.

The engineers host Brown tonight and the second annual Greater Boston Championships, Monday and Tuesday, February 21 and 22. MIT is the defending champion.

Wrestling

The Tech wrestlers (6-6) split decisions last week, dropping a 22-16 match against surprisingly strong Boston University team, but topping Williams 33-12. Senior co-captain Paul Mitchell still smarting from his first loss of the season, a 5-4 decision against Hofstra two weeks ago, romped over his BU 177 pound opponent, 7-1 and decisioned the William's man, 3-0. Mitchell is now 11-1 on the season. Tech's co-captain, Bill Gahl wrestling at 150 pounds won his event by forfeit against Williams and decisioned his BU counterpart 3-1. Gahl's record to date is 8-3. The engineer grapplers hosted Connecticut yesterday and Tufts and Bowdoin will be here on Saturday.

IIE Sponsors Summer Study

Summer abroad programs in Yugoslavia, Africa and Britain are being offered by the Institute on International Education for 1972.

The Yugoslav Seminar, a six-week, six credit program open to graduate students and undergraduates who have completed their sophomore year, will study the history and development of contemporary Yugoslavian culture. It begins June 18.

The African Seminar, also for six credits, is open to teachers and graduate students. The program is designed to provide an historical perspective of the major political forces in West Africa as well as covering traditional and contemporary literature, art, drama, music and folklore. It will run from July 8 to August 18.

The British program, "Environmental and Social Planning in Britain," is designed for graduate students and professionals. It will feature lectures on British society, seminars and extensive field trips. It is also for six credits and will run from June 28 to July 28.

For more information, call the Foreign Study Office, Room 10-303, Ext. 5243.

Golay Appointed First A.D. Little Professor

Michael W. Golay, assistant professor of nuclear engineering has been appointed to the Arthur D. Little Professorship of Environmental Sciences and Engineering at MIT for a term of two academic years.

Announcement of the appointment was made by Provost Walter A. Rosenblith, who is serving as chairman of the Institute's Interdisciplinary Environmental Council.

This is the first award of the recently announced term professorship, funded by the Arthur D. Little Foundation of Cambridge, to encourage and support younger MIT faculty members in environmental studies of an interdisciplinary nature.

As the holder of the Arthur D. Little Professorship of Environmental Sciences and Engineering, Dr. Golay will play a key role in an intensive interdepartmental study

just beginning in the Environmental Laboratory on the total environmental impact of electrical power generation. The project will involve comparisons of the various environmental effects produced by the alternative generation and transmission technologies which are expected to make significant contributions to supplying society's growing demands for electricity in the next twenty years.

Dr. Golay studied mechanical engineering as an undergraduate at the University of Florida, receiving the B.M.E. degree in 1964, and nuclear engineering as a graduate student at Cornell, receiving the Ph.D. in 1969. He joined the MIT faculty in 1971. His teaching here has been in the area of engineering of power plants involving power conversion cycles, heat transfer, fluid flow, and environmental aspects.

Dresselhaus Becomes Associate Head of EE

(Continued from page 1)

would inspire women students in addition to enriching their professional education. During her year as Mauze Professor, Professor Dresselhaus conducted a seminar focusing on women in science and engineering for women students.

More recently, Professor Dresselhaus, together with Professor Emily Wick, organized the MIT Women's Forum for the January Independent Activities Period. The Forum was aimed at exploring the roles of all women at the Institute and is continuing through the spring semester.

From 1960 until she came to the Institute, Professor Dresselhaus was a solid state physicist at Lincoln Laboratory where she made outstanding contributions in the areas of energy band structure of solids and electronic and magneto-optical properties of solids.

Pistol Class to Be Offered

The MIT Pistol and Rifle Club will offer a course in basic pistol marksmanship for five consecutive Thursday evenings beginning February 24. Classes will meet from 6:30 to 8:30pm in the pistol range in duPont Gymnasium.

The Course is limited to the first 20 adult members of the MIT community who apply. There is a \$10 fee to cover the cost of pistols, ammunition and targets. Interested persons should call Herald Sulahian on Ext. 3989.

Institute Gets DuPont Grant

The DuPont Company of Wilmington, Delaware, has announced grants totaling \$80,000 to MIT to support teaching and research in science and engineering.

The grants include \$15,000 for chemical engineering, \$30,000 for chemistry, \$5,000 for physics and \$30,000 for mechanical engineering. The latter grant includes \$20,000 for support of young faculty.

The MIT grants are among \$2.5 million in educational aid the company has announced for 1972 for 149 colleges and universities.

A native of Brooklyn, New York, Professor Dresselhaus received the A.B. degree from Hunter College in 1951. She spent the following year at Cambridge University in England as a Fulbright Fellow. She received the A.M. degree from Radcliffe in 1953 and was a Bell Fellow at the University of Chicago from 1956-57. From 1958 to 1960 Professor Dresselhaus was a National Science Foundation Fellow at Cornell University.

In 1958 she married Dr. Gene F. Dresselhaus, a well known theoretical physicist who was involved in developing the first theory of cyclotron resonance and who is a staff member at Lincoln Laboratory. The Dresselhauses have four children and reside in Arlington.

A representative from the Peace Corps and Vista will be on campus to recruit students next Thursday and Friday, February 24-25. Booths will be set up in the lobby of Building 10 and on the fourth floor of the Sloan School from 9am to 4:30pm. Both volunteer organizations will accept and process all male applicants, regardless of draft status.

First Meeting of Orientation Group Planned

The 1972 Freshman Orientation Program will be launched on Tuesday, February 29 with an organizational meeting for prospective workers.

The Freshman Orientation Program is an effort by the Freshman Advisory Council to prepare incoming freshmen for life at MIT. The program includes extensive summer mailings as well as the planning and regulation of Rush/Orientation Week in September.

"We haven't yet made specific plans," said William DeCampi, '73, director of the program, "but we hope to enlist more faculty members in the preparation of a better academic orientation."

The February 29 meeting is scheduled for 5pm in Room 10-250.

