

**THE COVER:** During the Centennial Year we honor William Barton Rogers for his devoted and perceptive leadership in the founding of this institution. With remarkable foresight into the twentieth century as well as the nineteenth, M.I.T.'s founder wrote in his plan for the Institute just one hundred years ago, "*We believe that the most truly practical education, even in an industrial point of view, is one founded on a thorough knowledge of scientific laws and principles, and which unites with habits of close observation and exact reasoning a large general cultivation.*"

When ill health forced Dr. Rogers to resign as President of M.I.T. ten years later, he told the Corporation that "*the Institute will always be as now the first object of my affection and my efforts.*"

# The President's Report 1960



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# Report of the President

TO THE CORPORATION      **O**n the twenty-fourth of May, radio and newspapers carried the formal announcement of a Second Century Program for M.I.T.

This Program, with a goal of \$66 million, ranks among the boldest yet undertaken by any university. For the future development of the Institute, it will be comparable in significance to the move that brought us in 1916 across the Charles from Copley Square to Cambridge.

No institution enters lightly upon such an undertaking. No college should consider itself alone in its appeal to the public for support. The sum total of current solicitations on behalf of private schools in the United States — not to speak of hospitals, museums, art centers, and the like — is a formidable figure. The public may wonder whether there is to be any end to these appeals for financial aid. Yet clearly there cannot be, as long as we as Americans value the contribution of private, independent institutions to our way of life. The very existence of independent schools and colleges is a distinctive mark of our free society. But private schools cannot expect support as a birthright; by their excellence they must constantly earn it. The first need, the primary condition for generous financial aid, is a breadth and depth of understanding, throughout the country, of the crucial role played by these institutions in the achievement of our highest national aims.

What, then, in this context of a strong America, justifies a program for M.I.T. of such magnitude?

One must begin, I believe, by taking full account of the stupendous changes that are being wrought by the contemporary revolution in science and engineering. I need hardly dwell upon the character of an advance that has become the most significant movement of our age, that affects every aspect of human affairs: our moral and physical health, our domestic economy, our relations with foreign powers, our intellectual concepts of the universe in which we live. No longer may engineering and science be dealt with as a technical domain apart; they are bound up with the essential fabric of our society.

For a century past, M.I.T. has endeavored to set standards of excellence for the education of architects, engineers, and scientists. Throughout these hundred years, our graduates have contributed vastly to the growing industrial might of the United States. Our numerous foreign students have exerted a constructive influence abroad. The imperative need to maintain this flow of men and women trained at the highest level of professional competence is clear. But M.I.T. must now do more. It must move vigorously in the vanguard of swift advances in every field of science and engineering. As a national institution, it must respond to obligations for national service. And above all else, it must fulfill its commitment to the teaching of students with a dedication and care commensurate with the tremendous responsibilities that will fall to our graduates in coming years.

One hears frequently of late the statement that M.I.T., in its historical development, has passed from the limited stage of an institute of technology to that of a modern university centered in science. I believe this to be true; or more accurately, that M.I.T. is — and for some time has been — in transition, moving towards a

larger view of its responsibilities and opportunities. The formal designation is rather immaterial. Our own name as an institute, after all, has been distinguished by a hundred years of service and achievement; we shall preserve it and honor it. But the *idea* of a university is significant.

A university in essence is dedicated to three purposes. First, it undertakes to broaden and strengthen the general culture of the individual so that he may take his proper place among educated men and women in every walk of life. Second, it imparts to the student the foundations and the specialized training of his profession. And finally, a university is committed to the advancement of learning — to research — as well as to preserving and interpreting the accumulated knowledge of the past. These three purposes are indissolubly united; separation of any one from the others destroys the spirit and the substance of the whole.

In its structure and its aims, M.I.T. has been shaping its course upon such an idea. Historically, the Institute has derived much of its strength from the definiteness of its objectives and the unity of its faculty. This is a strength that we should and can preserve. While M.I.T. has experienced an almost incredible expansion in the range of its intellectual interests over the past quarter century, nonetheless science — science in its larger meaning — remains the central guiding theme. We are concerned with the advancement of pure science and with the education of mathematicians, chemists, physicists, biologists, and geologists. Through the profession of engineering, we prepare our graduates to apply the results of scientific discovery to immediately useful purposes. And increasingly, M.I.T. is concerned with the implications of engineering and science for contemporary society — with their impact upon industry and labor and government. From this has followed the growing support extended to the School of Industrial Management, to architecture

and planning, to economics, psychology, and political science.

Though our horizons have widened, we delimit the domain of our efforts and are able to direct the forces of growth. Within its own province and attuned to the urgent needs of our age, M.I.T. aspires to the highest ideals of a great institution of learning.

The Second Century Program has been undertaken with just this end in view. Its objectives are the product of a searching inquiry on the part of the faculty, administration, and Corporation that has extended over a period of more than two years. These objectives constitute the hard, irreducible core of our future strength. They are the sinews and muscles of M.I.T. for the task ahead.

In simplest terms, we propose to enhance the quality and character of professional education; to develop the physical environment of our campus so that it may contribute more effectively to the cultural and spiritual life of the student; and to create new facilities for furthering the advancement of scientific knowledge.



“It is significant that a technical school reputedly devoted only to practical science and engineering maintained from the earliest days studies in literature, philosophy, and modern languages; required all students to take subjects in this area in all four years; and from the outset offered one or more complete curricula that combined general science with the humanities.” Samuel C. Prescott, *When M.I.T. Was “Boston Tech”*





In reporting briefly upon the progress of the year, I am faced immediately by the dilemma of what to choose from an impressive array of significant events. There is a great temptation to talk at length about the more spectacular happenings: plans for new buildings, new research facilities, and outstanding advances on the frontiers of engineering and science.

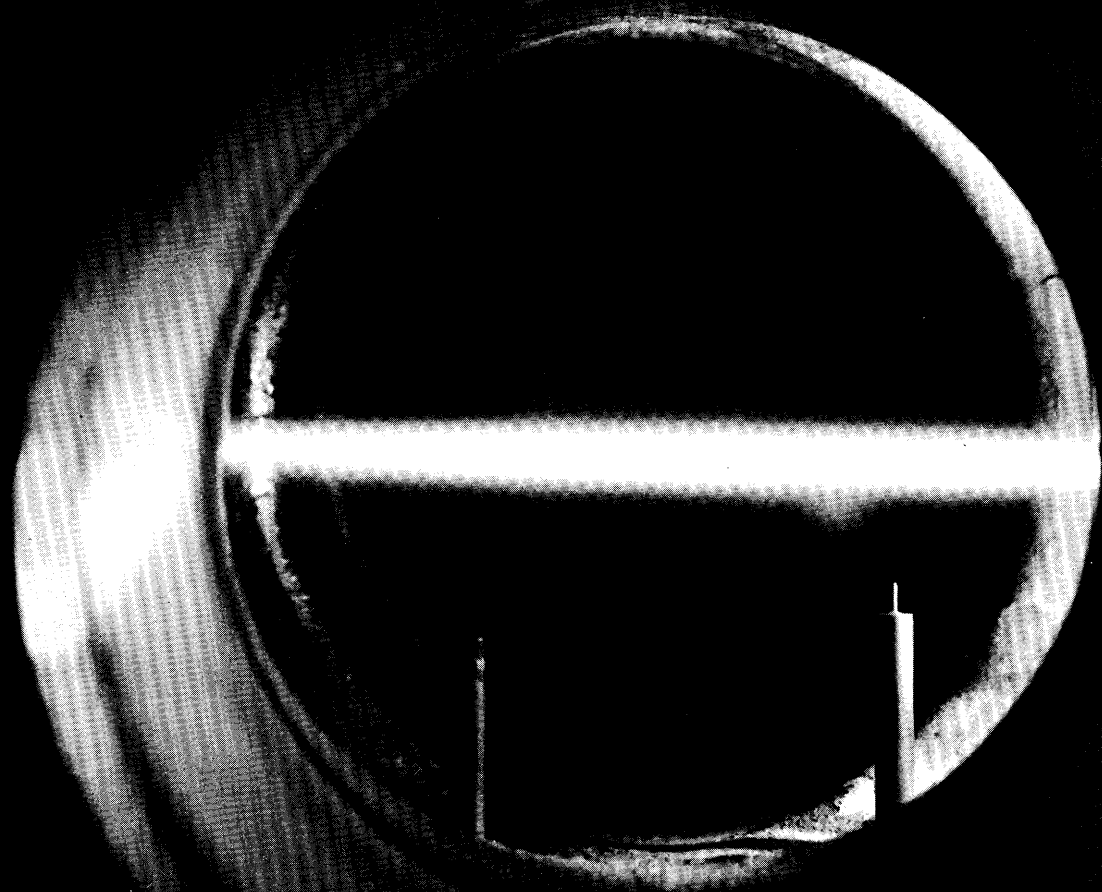
For example, I should like to discuss in detail the record of our research reactor's first year of full operation and its versatility in supporting a wide variety of investigations in science, in medicine, and in engineering.

I am tempted to recount also the role M.I.T. is playing over a broad spectrum of activities relating to space science and engineering, from the design of satellites to the development of some of the country's most effective systems for space navigation.

Moreover, M.I.T. has been engaged in pioneering research in a variety of newly emerging fields of great promise and challenge. Of these, one of the most significant from a scientific, engineering, and industrial point of view deals with the direct conversion of heat energy to electricity. If this can be accomplished in an efficient manner by means of thermionic converters, fuel cells, or magnetohydrodynamic (MHD) generators, it will be possible to eliminate the turbogenerator cycles of conventional power production. Students and faculty of the Departments of Electrical, Mechanical, and Chemical Engineering are engrossed in ramifications of this problem.

In a closely related field, the Nuclear Engineering, Mechanical Engineering, Electrical Engineering, and Physics Departments are all involved in studies of the properties of electrical plasmas and of their application to MHD generators and cesium plasma converters. This entire domain of plasma dynamics, with all its implications for fusion power, for space engineering, and even for

Inside this vacuum chamber is highly ionized gas — plasma — produced in a uniquely inexpensive way for new research on wave propagation, electrical noise, and oscillations.



our understanding of the constitution of the stars, is one of rapidly growing importance at the Institute.

The last two examples — the problem of energy conversion and our work in plasmas — illustrate three highly significant aspects of education at M.I.T. to which I shall refer later:

1. The tight interlocking of science and engineering.
2. The breaking down of sharply defined departmental boundaries.
3. The intimate relation of teaching and research.

I might report at length on other investigations of equal interest. But to dwell upon the research activities of M.I.T., however important, would be to overshadow another primary concern: the teaching of students. These two taken together, teaching and research — or one might better say teaching and learning — are complementary parts of an educational whole. They cannot be divorced from one another in an institution such as M.I.T.; but they must also be kept in balance, and the influence of one upon the other must be constantly appraised.

The simple fact is that progress in science and engineering has “gone critical” in almost every field. So rapid is the rate of advance that the magnitude of change in industrial processes as well as the progress of academic research is difficult to grasp. These discoveries and innovations in turn claim a place in already crowded curricula. What was once a steady flow of knowledge has become a flood threatening to engulf teacher and student alike.

Nowhere has this crisis in education become more acute than in the field of engineering. I have commented in earlier reports upon some of the issues involved, but in the light of developments this past year and of their great relevance to the future course of the Institute, I think it well to continue the discussion even at the risk of some repetition.

Let me begin by remarking that the problems in question are national in scope. Although one looks normally to the academic institutions to provide the innovating forces of education, in this instance industry has clearly shown the way. But neither in industry nor within the schools of engineering has there been full agreement on the most urgent needs of the profession, nor consequently any unanimity of opinion as to how and to what extent our curricula should be revised.

The grounds for this division of judgment are easy to discover. The great bulk of American industry still draws upon well-established, relatively stable technologies. Steel, oil, motors, construction, to name but a few, are the backbone of our national economy. And in these industries, the effectiveness of each method or process has been tested by experience. Because of the inherent nature of the operations involved, research has influenced rather slowly the character and volume of production.

To this basic industrial core we must now add the extraordinary and expanding array of new enterprises whose very lifeblood is research and development. Their field of operation lies along the furthest frontiers of scientific discovery. Their business is to exploit the advances of science, to translate them rapidly and economically into useful products and services. Relatively few of these new names appear as yet on *Fortune's* list of the 500 largest American industrial corporations. But their role in the current technological revolution, their significance for our country's economic strength in the face of rising international competition, is wholly out of proportion to their individual size.

As we go about the task of preparing our students to meet the engineering responsibilities of *their own generation*, we must consider in fair perspective the whole range of future needs and opportunities. Since the middle of the nineteenth century, American

engineers, educated in schools such as M.I.T., have had a leading part in the prodigious growth and achievements of our basic industries. Any alteration in the present plan of education must be designed to increase the prospects of further contributions on the part of our graduates.

No institution, however, can effectively accommodate its efforts to every interest and aptitude. Much of the practical training of the engineer — the special knowledge of contemporary equipment, the acute sense of economy and service — inevitably must be acquired through direct experience with industrial operations. We believe it now to be our principal responsibility to prepare the student to cope with — and ultimately, indeed, to lead — a technological revolution that is proceeding with gathering momentum. No experienced observer of the contemporary industrial scene can easily escape the conclusion that research and development *are in fact* powerful agents for growth and change. The impact of this innovating force of research bears increasingly upon every segment of our industrial activity — upon our basic industries as well as upon our more novel enterprises. Popular interest in the spectacular success of electronic devices or the prospects of “exotic power packages” should not obscure the significance of far-reaching advances on many other fronts. Recent applications of solid-state physics to materials — both metals and non-metals — and progress in the chemistry and thermodynamics of combustion, in the theory of communications and control, in biochemistry, in the mechanics of fluid flow, to suggest only a few, will in due course affect the operations, the competitive position, and the profits of industry of every size and category.

Industry in the decades ahead will exploit increasingly the progress of basic science. The time lag between scientific discovery and practical application will diminish, and the boundary

between pure and applied will often be confused. But the achievements of industry, the reduction of ideas and principles to useful products, will remain the work of the engineer. One of the important responsibilities falling upon institutions such as M.I.T. is that of conveying to students a clear understanding of the character of the engineering profession, a sense of the challenge and excitement of its opportunities.

The pace of technological change is accelerating. We cannot possibly foresee the progress or discoveries of tomorrow. We ought, therefore, to concentrate our efforts in imparting to prospective engineers a thoroughly fundamental technical competence, together with intellectual and moral self-reliance.

This means a greater emphasis on basic science — and every conference on engineering education in recent years has concurred in the need for a higher level of achievement in mathematics, physics, and chemistry. Yet while it is quite clear that the bonds between engineering and science are growing tighter, we could make no more disastrous error than to attempt to recreate the engineer in the image of a scientist. The engineer is concerned with means as well as with use and purpose, with ideas of design, cost, and reliability that are largely alien to the scientist. So much has been made recently of the need for more mathematics and physics that we are in danger of losing sight of the problem that remains in fact the most difficult in engineering education: how to balance theory with experiment, how to couple purpose and action with theoretical competence, and how to develop an appreciation of the empirical judgments that so often determine design.

In an earlier time — and here I speak of all engineering schools — this objective was accomplished at least in part by introducing into the curriculum a relatively large amount of practical work in shops, drafting rooms, and machine laboratories. Step by

step these subjects have been eliminated, partly to make room for more fundamental material and partly because they no longer fulfilled their original purpose. Our task now is to devise their equivalent in a more modern setting.

One of the extremely important steps taken lately at M.I.T. has been the development of teaching laboratories, new both in equipment and concept, which will supplement the new or revised courses in theory. There is no means other than the laboratory for imparting to the student that indispensable feeling for measurement, for scale, for quantitative orders of magnitude. The recent Ford Foundation grant to M.I.T., upon which I shall comment shortly, is proving enormously beneficial in accelerating the renewal and development of such teaching facilities. Moreover, the broad problem of instruction in engineering design is a subject of most active study and discussion on the part of numerous members of our faculty.

Our greatest potential resource, however, in providing the desired balance and fullness of experience to the professional education of the engineer lies in our interdepartmental laboratories and centers. In my report to the Corporation a year ago, I described several of these at some length and discussed their structure and purpose. The development of a group of these centers is one of the major goals of the Second Century Program. Such facilities on the M.I.T. campus afford an unparalleled opportunity for education. We must encourage the greatest possible participation by students in the work of these large laboratories and extend their influence to the undergraduate as well as the graduate.

This desired intermingling of teachers and students in research does take place on the M.I.T. campus. The record of the Research Laboratory of Electronics furnishes one example. During

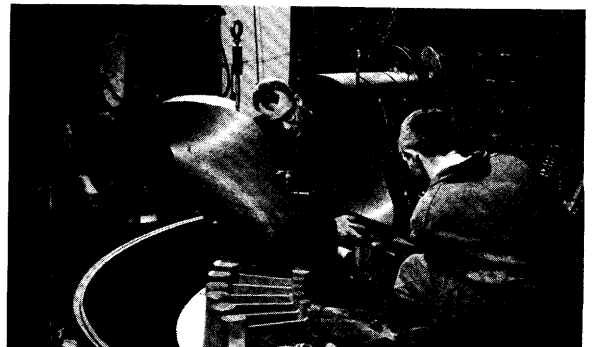
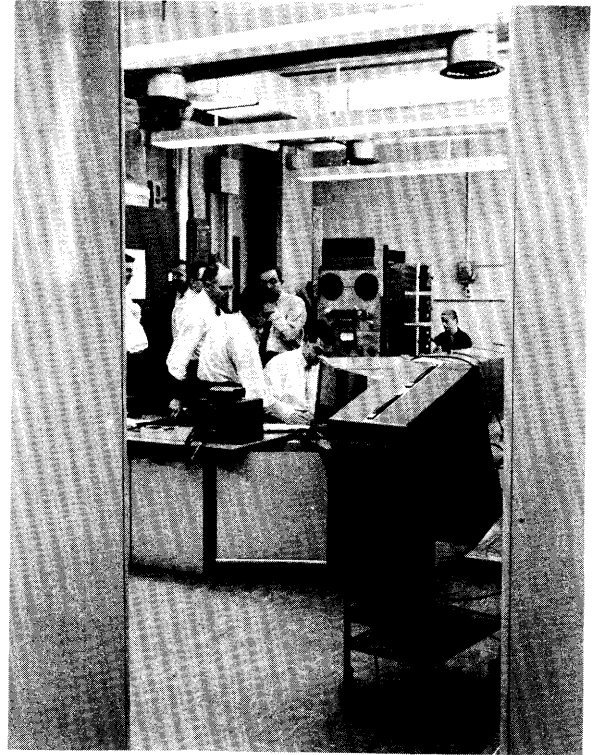
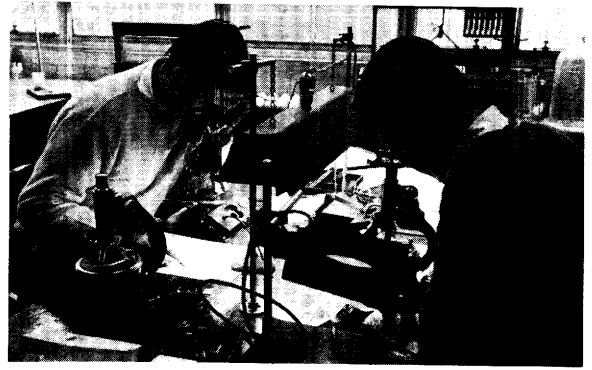
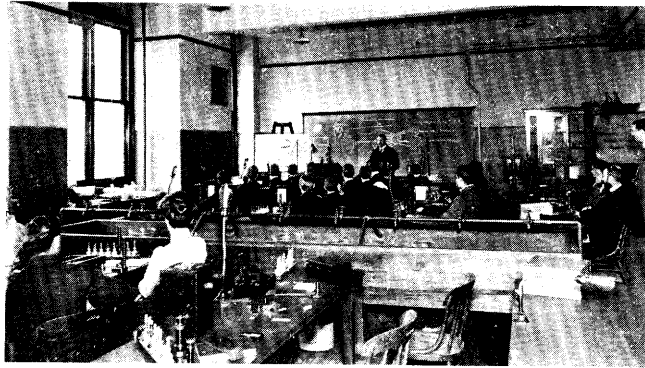
the past year students working in R.L.E. completed 16 theses for the doctor's degree, 8 for the engineer's degree, 35 for the master's degree, and 65 for the bachelor's degree. It is interesting, moreover, to record that of the 81 members of the faculty associated with the Laboratory, only 35 came from the Department of Electrical Engineering. There was representation also from the Departments of Physics, Mathematics, Biology, Modern Languages, Chemistry, Chemical Engineering, Nuclear Engineering, Economics, Mechanical Engineering, and Aeronautics and Astronautics, all sharing the facilities of the Laboratory and drawn together by interests in a common group of problems.

Few academic questions have been more widely debated in recent years than the impact of large programs of sponsored research upon major American universities. The case for the support of basic research in science is relatively easy to defend. There has been far less clarity on the subject of sponsored programs in schools of engineering. There is, nevertheless, one sound justification — and perhaps apart from special defense projects, only one — for the major support of engineering research. When such programs are intimately incorporated into the total academic plan, they can make a unique and indispensable contribution to the education of the engineering student. At M.I.T., we have learned a great deal over the past ten years or so about the management and role of such programs as integral parts of an educational institution. I am confident that we have gone far to meet these desirable aims.



In 1861 Dr. Rogers proposed laboratory exercises to “*cultivate the habits of observation and exact thought.*” One hundred years later we know that “there is no means other than the laboratory for imparting to the student that indispensable feeling for measurement, for scale, for quantitative orders of magnitude.”









I return now to comment more specifically on progress and notable developments of the year.

SCHOOL OF ENGINEERING **F**irst, I am most happy to report that in October of last year the Trustees of the Ford Foundation voted a grant of \$9,275,000 in support of engineering education at the Institute. This program was initially formulated by a faculty committee under the chairmanship of Dean C. Richard Soderberg and since his retirement has been carried forward with the leadership of Dean Gordon S. Brown. It is the largest grant ever made to M.I.T. for purposes directly related to the advancement of teaching, and the future implications for the Institute are tremendous. In brief, the program comprises these parts:

1. For the revision of engineering curricula and the preparation of teaching materials, including new texts, \$3,000,000.
2. For the development of instructional laboratories to be integrated closely with classroom theory, \$1,500,000.
3. For the endowment of seven additional professorships to represent newly emerging fields of engineering, \$3,500,000.
4. For the establishment of postdoctoral teaching internships and research fellowships to encourage young men to enter the field of engineering education, \$1,000,000.
5. For fellowships and loans to graduate students anticipating careers in teaching, \$150,000.
6. For faculty exchanges with industry and other colleges, and for conferences on educational matters as the program develops, \$125,000.

Although the attainment of the goals made possible by the Ford grant will take a number of years and will make great demands on

our wisdom and energy, the engineering faculty is already responding magnificently to the opportunities and responsibilities which the grant has given us. None of us underestimates the task of developing new curricula and creating new laboratory equipment and teaching methods to meet the needs I discussed earlier. But I am pleased to report that these objectives have been advanced in a number of significant ways over the past year.<sup>1</sup>

With assistance from the Carnegie Corporation, a committee of our faculty spent four weeks last summer in day-long discussions with leading designers from industry and in the examination of our teaching practices. One major conclusion of this study emphasized anew, and in the strongest terms, the importance of the laboratory and of the engineering project in the education of engineers.

Currently, throughout the School, departments are either enlarging the role of the laboratory in the curriculum or revising their laboratory work to stress fundamental concepts rather than conventional machines. The use of big commercial equipment suitable only for stereotyped experiments is yielding to more imaginative approaches in which students are given an opportunity to undertake projects of their choice and to benefit by a kind of internship under the guidance of a faculty member.

A major part of our immediate and visible efforts in initiating new laboratory programs has been concerned with changes in space and facilities. For example, we have given up the student wind tunnel in Building 33 and remodeled it to provide a student projects laboratory for the Department of Aeronautics and Astronautics. The Department of Mechanical Engineering has removed the majority of its materials testing machines in Building 1 and some of its metal cutting tools in Building 35 to reclaim space for more up-to-date study in materials and to expand laboratory work in pro-

<sup>1</sup> In this summary, and in the others which follow, I draw largely on separate reports by the deans of the schools.

pulsion and related activities in energy conversion and control. Through these and similar projects in other departments, we hope to inject the purposefulness and reality of engineering into engineering education.

Equally important has been the growth of interdepartmental planning and teaching of subjects. Characteristic of what is beginning to emerge is a new junior subject in materials engineering, which is open to all students and taught by a faculty drawn from six departments. Similar developments are forming in electrical science and engineering, in dynamics, and in energy processing systems. The Departments of Electrical and Mechanical Engineering, for example, are collaborating on the development of new subjects in energy conversion that will encompass graduate as well as undergraduate teaching and research. These interdisciplinary movements are examples of the trends and opportunities cited earlier in this report.

The tempo of our recent vigorous efforts to strengthen and advance our engineering education has quickened materially under the impetus of the Ford grant. Every department in the School is now directing its program of studies toward new goals.

The Department of Civil Engineering has struck out in a basically new direction far more strongly influenced by science and mathematics than before. In brief, the new undergraduate program comprises:

1. A strong core in science and engineering science.
2. New subjects in materials engineering and electrical engineering.
3. New subjects in the engineering of geology and soils, biological factors in engineering, and social and political factors in engineering.
4. Additional advanced mathematics to prepare students to handle sophisticated analysis and synthesis problems and to exploit the capability of modern computers.

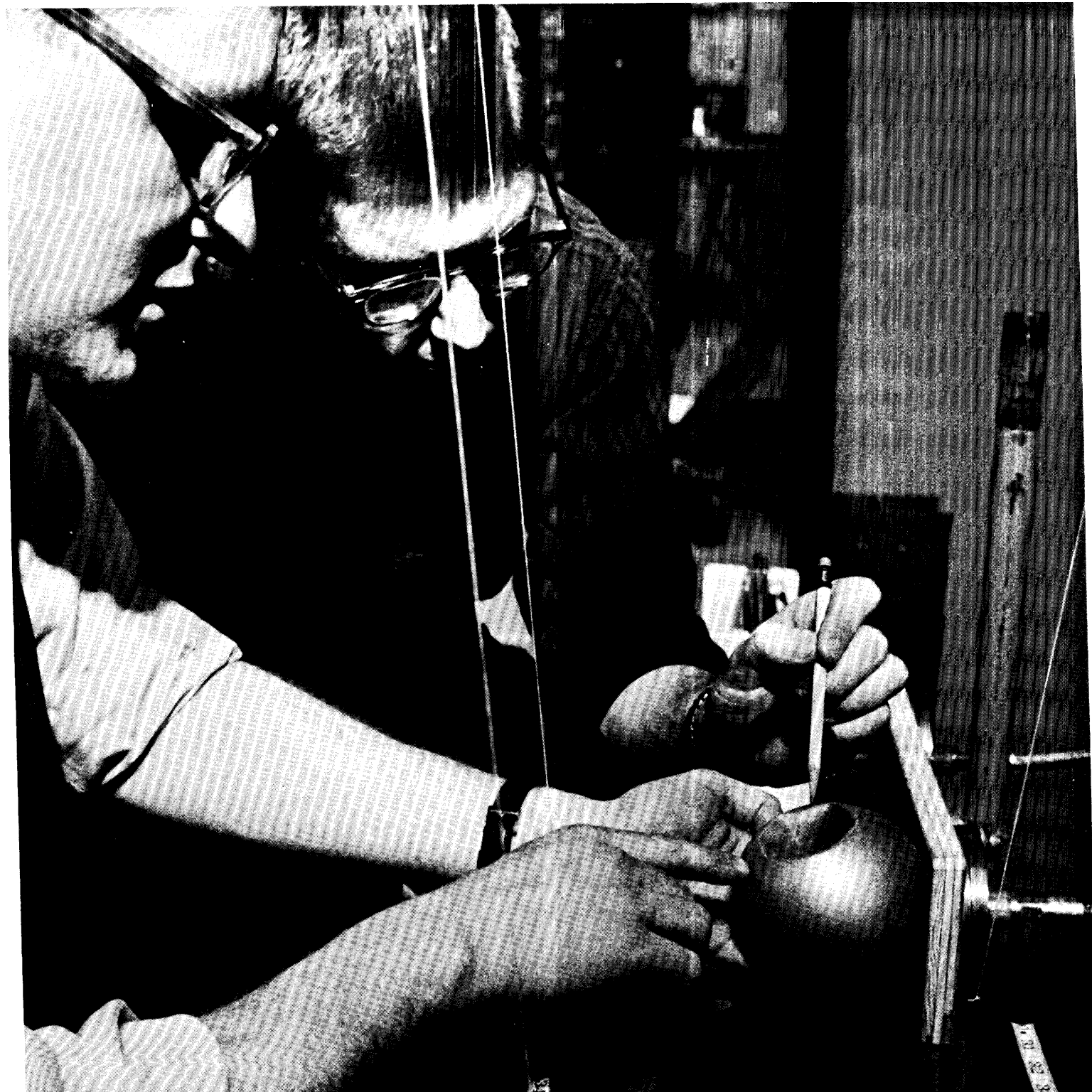
5. A two-term sequence of subjects treating civil engineering projects.
6. A program of senior electives, either in such areas as structures, transportation, construction materials, hydraulic engineering, city planning, and industrial management or in more science-based subjects, in preparation for graduate study.

The Department of Aeronautics and Astronautics has revised radically the substance and organization of its curriculum to accommodate new material associated with astronautics and to meet new requirements in aeronautics. The undergraduate program during the junior and senior years has been divided into two general plans of study: an Engineering Curriculum and an Engineering Science Curriculum.

The Engineering Curriculum will provide a substantial foundation for the engineering of all types of flight vehicles. Emphasis will be placed on a thorough grounding in five specialized fields (structures, fluid dynamics, propulsion, control, and guidance) and on developing those patterns of thought necessary to practical and purposeful design. The Engineering Science Curriculum will stress more depth in the areas of physics, mathematics, fluid dynamics, and solid mechanics and is particularly suited to preparing undergraduates for careers in research. Here, too, much attention will be devoted to experimental work to give balance and direction to theory. It is expected that most students electing this option will continue into graduate work.

Thus a comprehensive educational pattern in science, applied science, and engineering is emerging with a broad core of fundamentals and with the flexibility to match the changes of this rapidly developing technology. As aeronautics, and now astronautics, have developed at M.I.T. over the past years, we have made notable additions to our staff and facilities to cover the complete spectrum

Can meteorites destroy space vehicles? To help answer the question, M.I.T. graduate students in aeronautics and astronautics are firing projectiles at tiny spheres.





of flight vehicles from helicopters to space craft. But future requirements will soon outpace us unless we move quickly to sustain our leadership. To meet the challenges now on the horizon in these fields, we are seeking support, as you know, for a new Center for Aeronautics and Astronautics as an integral part of the Second Century Fund.

The Department of Metallurgy will offer this fall a new option in Materials Science, encompassing the structure, properties, and behavior of materials of all kinds, but emphasizing especially those engineering materials which are useful in structures, machines, or devices. The need for such a curriculum stems from the growing importance of non-metallic materials in manufacturing operations and from the recognition that methods of study and investigation which have been applied to metals can provide important points of departure for study and research in non-metallic materials. This new option is but one example of a broadening basic interest throughout the Institute in the entire field of materials and the critical role it plays in modern technology.

The Department of Chemical Engineering took initial steps during the spring term toward a major refocusing of its educational goals by assigning three of its faculty — Professors Edwin R. Gilliland, Harold S. Mickley, and Raymond F. Baddour — to serve as a full-time team to re-examine the objectives and content of its undergraduate program and of its relationship to other areas of engineering. While it would be premature to anticipate their conclusions, it is already evident that fresh viewpoints have emerged, that new relationships with other disciplines will be strong and numerous, and that in all probability the classical course of chemical engineering will be redirected along promising new lines.

Although these are the most sweeping revisions in process or in being, all departments in the School have made important advances in their curricula and methods during the year. Moreover,

the intensive re-examination of the substance and method of our teaching being carried out in the School of Engineering has its counterparts in other schools of the Institute.

SCHOOL OF SCIENCE **I** wish to mention particularly the strengthening of the undergraduate curricula in physics, especially in the first two years, since these subjects are required for all M.I.T. students. A study has been initiated to see how much of the physics traditionally taught in the upper years can be effectively integrated into the first- and second-year basic physics curricula. Because of the continuous and rapid growth of the body of physical knowledge, adherence to the traditional pattern of providing a solid base almost exclusively in classical physics brings with it an increasing and uncomfortable length of time before a student is brought face to face with the boundaries of knowledge. One of the major purposes in studying the content of the first two years of physics is to bring the student into contact with these boundaries as soon as possible without weakening his depth of understanding of classical fundamentals.

To support these important developments, we have established a Science Education Center under the direction of Professor Francis L. Friedman. The principal aim of this Center will be to provide the facilities, freedom, and means for members of our faculty to embark on experimental programs in education. This includes the creation of new laboratory and demonstration experiments; the generation of new experimental patterns of teaching physics; the teaching of these new experimental versions to limited numbers of students; and the exploration of methods of making available to students a greater degree of personal experimental experience with physical phenomena, including an attempt to provide the means of assigning them experimental homework. The use of movies and other modern

teaching aids will also be fully explored. While the initial phase of this operation will center around physics, we hope that this research into the communication of knowledge will grow to include other departments in the School of Science.

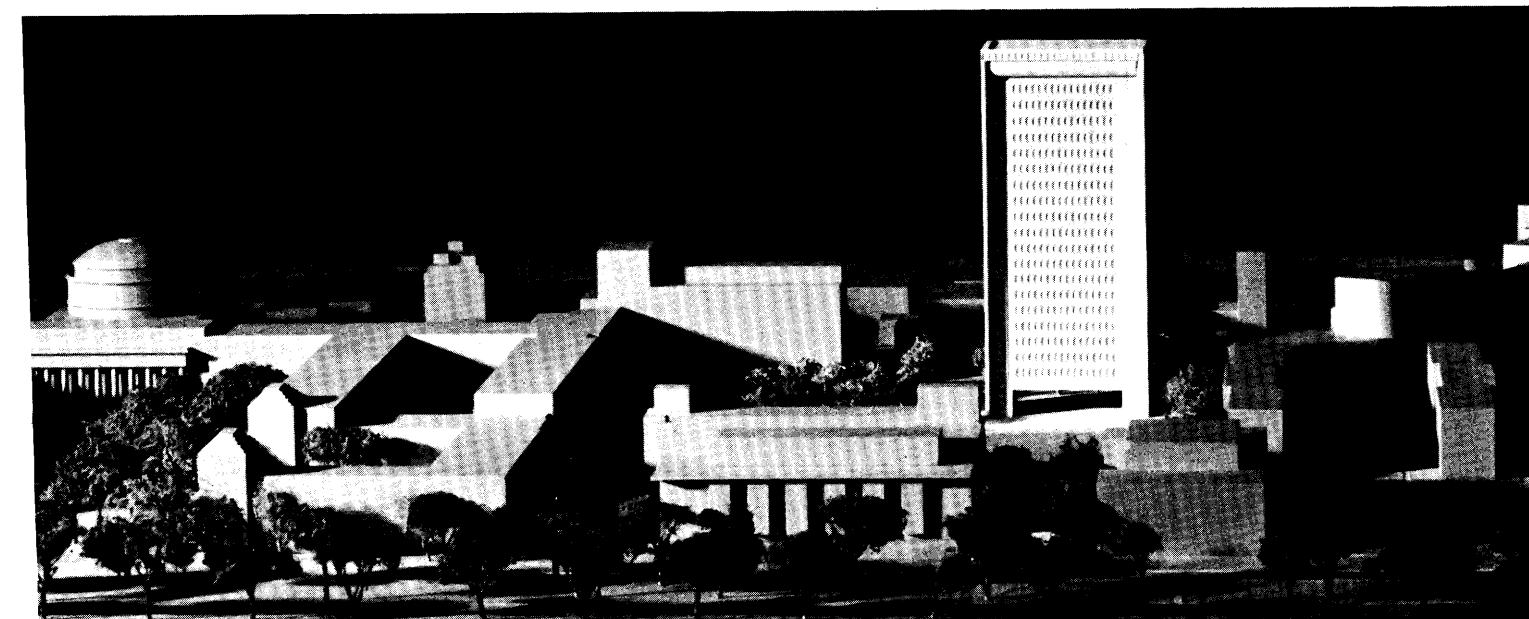
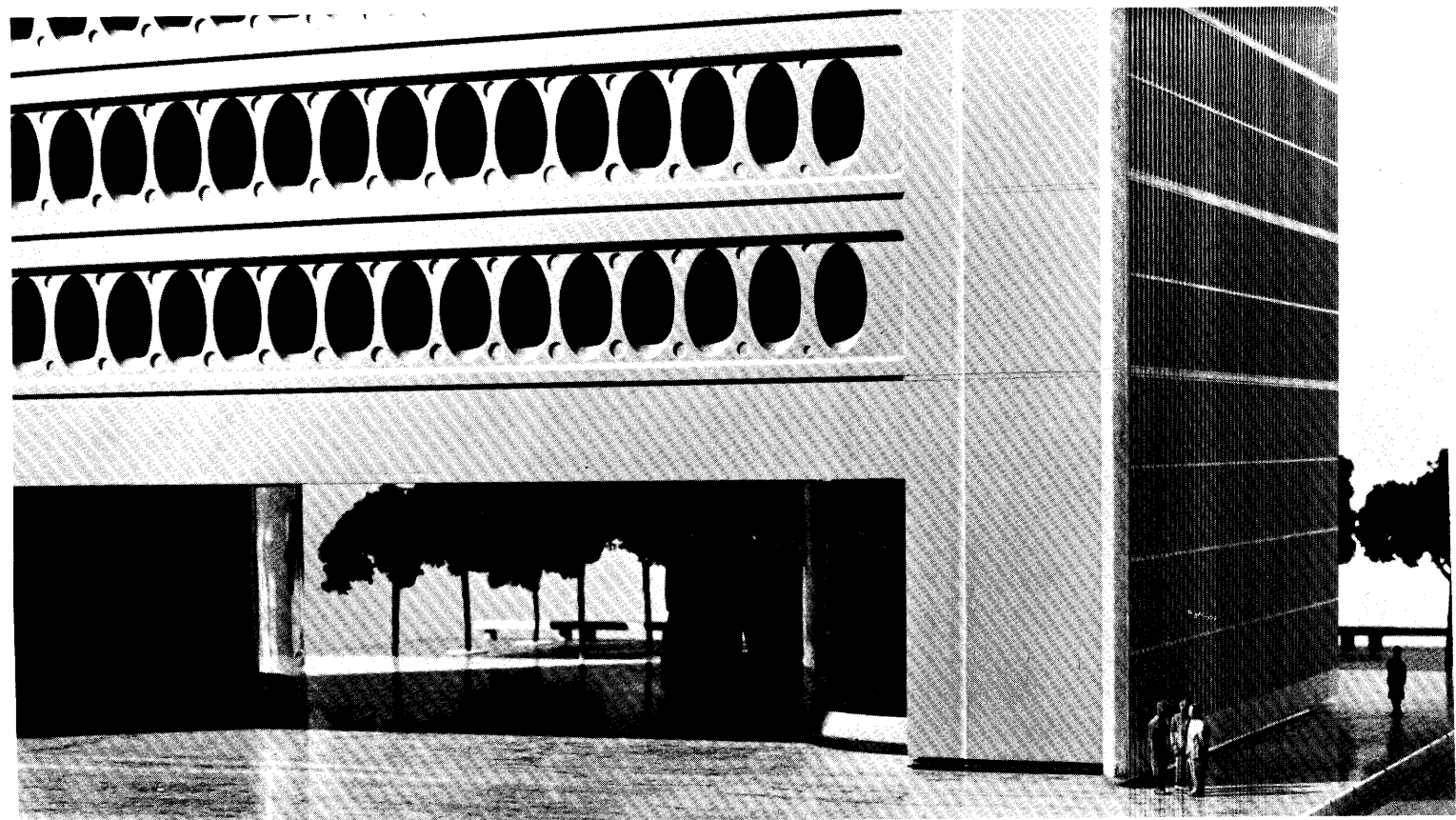
During the year, the School of Science has also accelerated the integration and expansion of the earth sciences and begun similar moves in the life sciences. These undoubtedly are the most significant advances of the year in this School.

In the past, M.I.T. has offered an undergraduate curriculum in each branch of science and sometimes several in the different options of a single department. This pattern is changing. This year, for example, we established a single undergraduate curriculum for all the earth sciences. Any undergraduate student now planning to become a geologist, a geophysicist, a geochemist, an oceanographer, or a meteorologist will be enrolled in this common core curriculum. Specialization will come through the selection of electives in the upper years. In this way we can broaden the undergraduate base and leave the bulk of the specialization to the graduate years. It is expected that this change will also stimulate much closer integration of the efforts of our faculty members working in the various earth sciences.

Planning has gone forward rapidly for the new Center for the Earth Sciences made possible by the gift of Dr. Cecil H. Green '23 and Mrs. Green. It is expected that the new building will be a twenty-story structure which will provide space for all of the instructional and research activities of the Departments of Geology and Geophysics and of Meteorology and for our new program in oceanography. Present plans anticipate that we will break ground for this Center before the end of 1960.

We are grateful to Mr. and Mrs. Eugene McDermott of Dallas, Texas, for their gift of \$1,250,000 for undergraduate

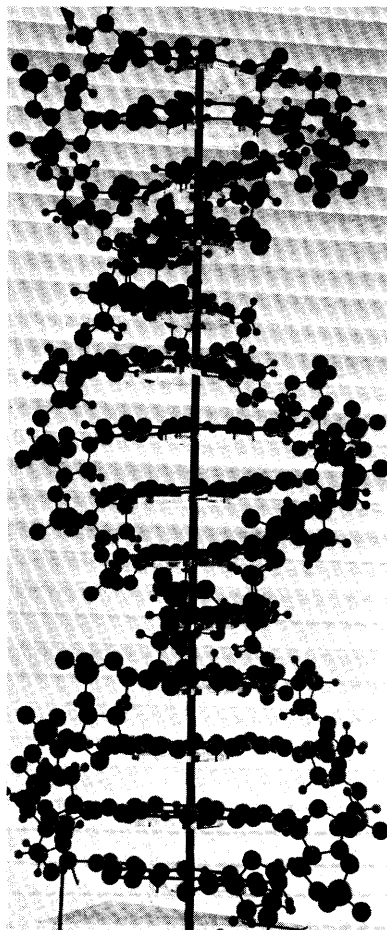
Architect Ieoh M. Pei's plans for the twenty-story Center for Earth Sciences result from new concepts of campus development and of building construction.

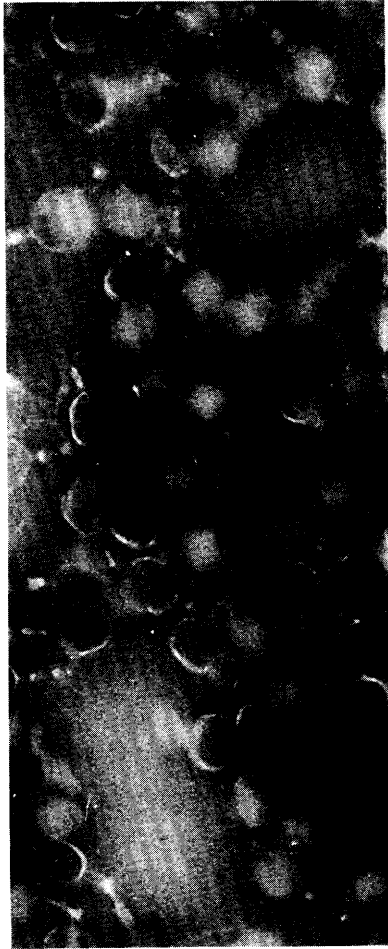


scholarships. Preference will be given to students from Texas and the Southwest who intend to follow careers in the earth sciences or allied fields. The Ford Foundation also has made a substantial grant for the establishment of a program of predoctoral fellowships in the atmospheric sciences and in oceanography.

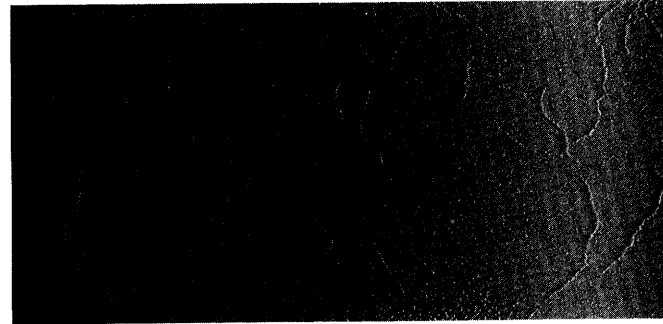
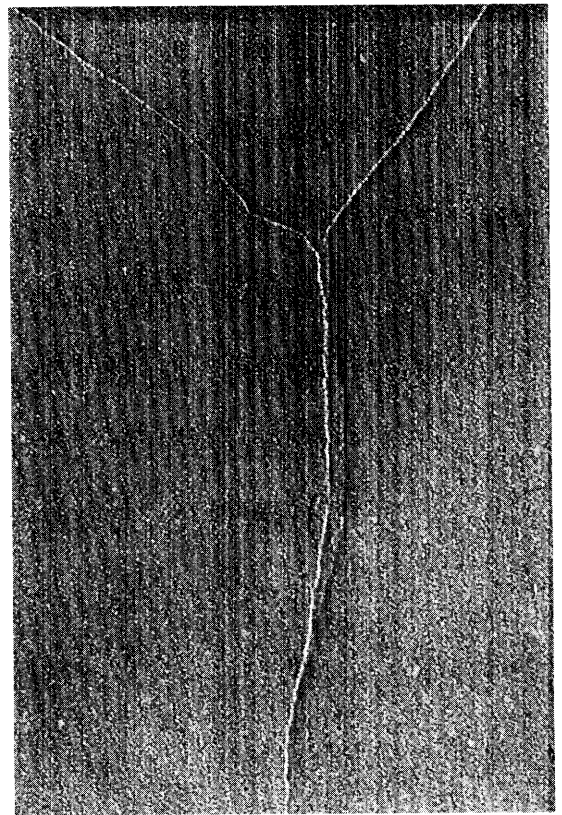
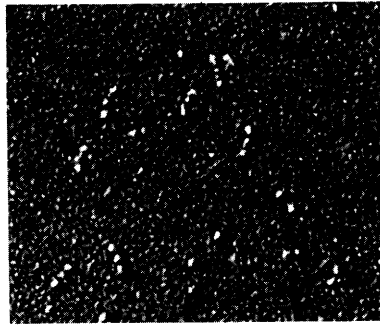
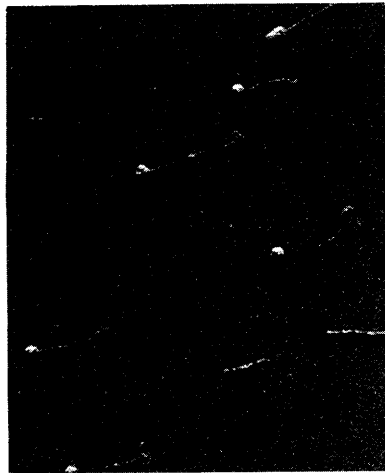
Programs of integration and expansion comparable to those in the earth sciences are also being undertaken in the life sciences, which include biology and food technology. We are now dropping specialized undergraduate curricula in these departments in favor of a single broad and fundamental Course in the life sciences. This core curriculum will be followed by all undergraduates planning to go into biology, biophysics, biochemistry, microbiology, physiology, medicine, nutrition, food science, food technology, or biochemical engineering. Here again the beginnings of specialization will occur in the junior and senior years, through elective subjects which can lead into a particular specialty in graduate work. The Biology Department will be responsible for the supervision of this new undergraduate program.

The Department of Food Technology is now being reconstituted, its name having been changed to the Department of Nutrition, Food Science and Technology. This new development represents an expansion and broadening of our work in food technology, with new emphasis on the basic aspects of food science and an increase in our activities in the area of nutrition. Dr. Nevin S. Scrimshaw, Director of the Institute of Nutrition of Central America and Panama, has accepted the headship of the Department and will come to M.I.T. in the summer of 1961. Dr. Alfred E. Harper of the University of Wisconsin has been appointed Professor of Nutritional Biochemistry, while Dr. Donald M. Watkin of the National Institutes of Health has been named Associate Professor of Clinical Nutrition. These additions to the Department, coupled with the





These electron micrographs from the M.I.T. Biology Department literally show the shape and size of life itself — the virus containing genetic material (DNA) which can duplicate itself by infecting a cell; genetic material forced out of its virus head; the material itself, in a great chain of molecules depicted in the model on the opposite page; the short chains of enzyme which join together to form the strength of clotted blood; and the long, tough molecules of collagen — skin.



impressive progress of the Biology Department over the past few years, will give M.I.T. unprecedented strength in fields covering the phenomena of life at the molecular and cellular levels.

SCHOOL OF INDUSTRIAL MANAGEMENT **T**he primary function of the School of Industrial Management centers around a teaching program designed to produce first-rate men for managerial responsibilities and a research program for the improvement of managerial effectiveness. The forward movement of the School during the year just past may be reported in the context of these highlights:

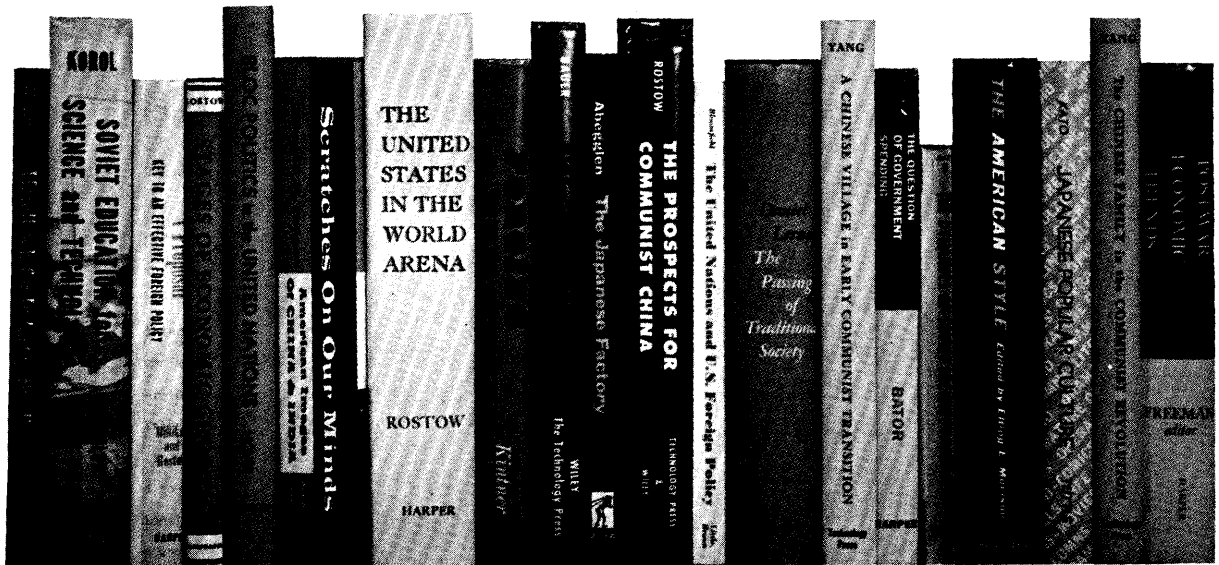
1. The establishment of a management minor for engineering undergraduates at M.I.T., better to meet our obligation to train at a high level of competence the young engineer who will also have management responsibilities.
2. The initiation of a "Quantitative Option" in the two-year master's program for a small number of students concentrating in mathematics and computer applications to management problems. These students tend not to become managers in our traditional sense, but rather operations analysis and synthesis specialists.
3. The development of a Ph.D. program in industrial management which will be inaugurated in 1960 and which promises to add strength and depth to the School's graduate program and research efforts and to produce in time a vital number of teacher-researchers for the management field.
4. The successful expansion of the Sloan Fellowship Program to three groups of young executives, 45 men in all, who spent twelve months in intensive graduate study at

psychology, and economic history. There are at hand many opportunities for fruitful cooperation between these social sciences and science and engineering. These are fields also in which mathematical and statistical techniques are playing increasingly important roles.

The committee gave special attention to psychology. It argued that M.I.T. offers research possibilities in psychology that are unique and may well be of central importance for the advance of the entire discipline. The prospect of collaborative work with the Research Laboratory of Electronics, the Center for Communication Sciences, the Center for International Studies, and the School of Industrial Management adds weight to the argument. Moreover, psychology courses have proved extremely attractive to our undergraduates.

Accordingly, we are now determined to strengthen our work in this field. As an important first step we have appointed Dr. Hans-Lukas Teuber to be Professor of Psychology and Chairman of

These books are among the recent contributions from research in the Center for International Studies.





the Institute. The continuing confidence of industry in the character and quality of this program is gratifying and encouraging.

5. The development of two international management efforts, both financed by the Ford Foundation: a senior management program for leaders of Indian industry to be held in Kashmir for three years beginning in the summer of 1960; and an African Fellowship Program in which eight men who completed work for the master's degree this June were assigned to industrial posts in some of the new countries of mid-Africa for a two-year period. These opportunities for service both to India and to African countries reflect our growing stake in effective management development beyond our shores.

Throughout the School there was wide-ranging experimentation in teaching methods. The marketing group, for example, devoted substantial time to the development of a computerized marketing game for use in the marketing subjects at both the undergraduate and graduate levels. This is the most ambitious approach to simulating live decision situations yet attempted by the School. Other examples of successful teaching tactics range from a venture in tutorials in industrial history and the business environment to further work in tape-recorded studies in the labor field.

SCHOOL OF HUMANITIES **I**n the School of Humanities and Social Science, a faculty committee under the chairmanship of Professor Max F. Millikan spent the past year surveying the needs of the Institute for staffing, teaching, and research in the social sciences. This committee strongly recommends that M.I.T. press forward with particular vigor in the fields of economics, political science,

an expanded interdepartmental Psychology Section. Dr. Teuber, who is currently on the staff at New York University and at the N.Y.U.-Bellevue Medical Center, is a specialist of great distinction in physiological and neurological psychology. This appointment marks the serious entry of psychology as a behavioral science at the Institute.

It is appropriate to comment here also on the progress of our Political Science Section. In the past four years political science at the Institute has evolved from a modest offering in general education to a full-fledged program at both undergraduate and graduate levels, including doctoral studies. Much of the strength of the Political Science Section continues to stem from activities of the Center for International Studies, particularly in political communication, international affairs, and the politics of underdeveloped areas. In similar fashion the Section's work on urban problems draws in substantial measure on the research in progress at the Harvard-M.I.T. Joint Center for Urban Studies. The Political Science Section's major educational effort in the future must be in advancing and enlarging its work in these and related areas where M.I.T. has special strength, such as defense studies and the interrelationship of science and government.

**I** conclude this part of my review of the year with a report of action taken by the faculty relating to freedom and choice in the M.I.T. curricula. We have felt for some time that many of our students have not been able to make a realistic selection of a professional major by the end of the freshman year. Some freshmen have interests in several areas and are not ready to make a final selection. Others are quite unfamiliar with some of the professional opportunities offered by the Institute. There has also been increasing recog-

dition among our students of the importance of gaining a strong basic preparation in both the freshman and sophomore years.

A significant step to meet these needs was taken this spring when the faculty unanimously voted that no student need commit himself to a departmental major until the end of his sophomore year, although any student may make such a choice at the end of his freshman year if he so desires. The system of freshman counseling by faculty members will now be available through the sophomore year. All subjects taken as sophomore electives will also be accepted for degree credit in all departments.

This action by the faculty clearly gives students a greater opportunity to appraise their interests and aptitudes more thoroughly before committing themselves to a specific major. It also provides the faculty with more flexibility in the development of new patterns of undergraduate education. At the same time this liberalization of our requirements by no means represents a shift to a freely elective system. We still require a student to focus his interests at a reasonably early stage of his career. And we can still satisfy the desires of the highly motivated student who knows what he wants. I am convinced that with this change we have achieved a better balance between freedom and direction in our evolving curriculum.

M.I.T. COMMUNITY LIFE **A**nd now may I stress the profound importance that I attach to the development of a strong residential campus with its inherent benefits to the character and manner of student life.

We must recognize that the educational experience afforded by a great university comprises more than the basic material of classrooms, lectures, and laboratories. We have no choice but to be deeply involved with the development of qualities which in simple,



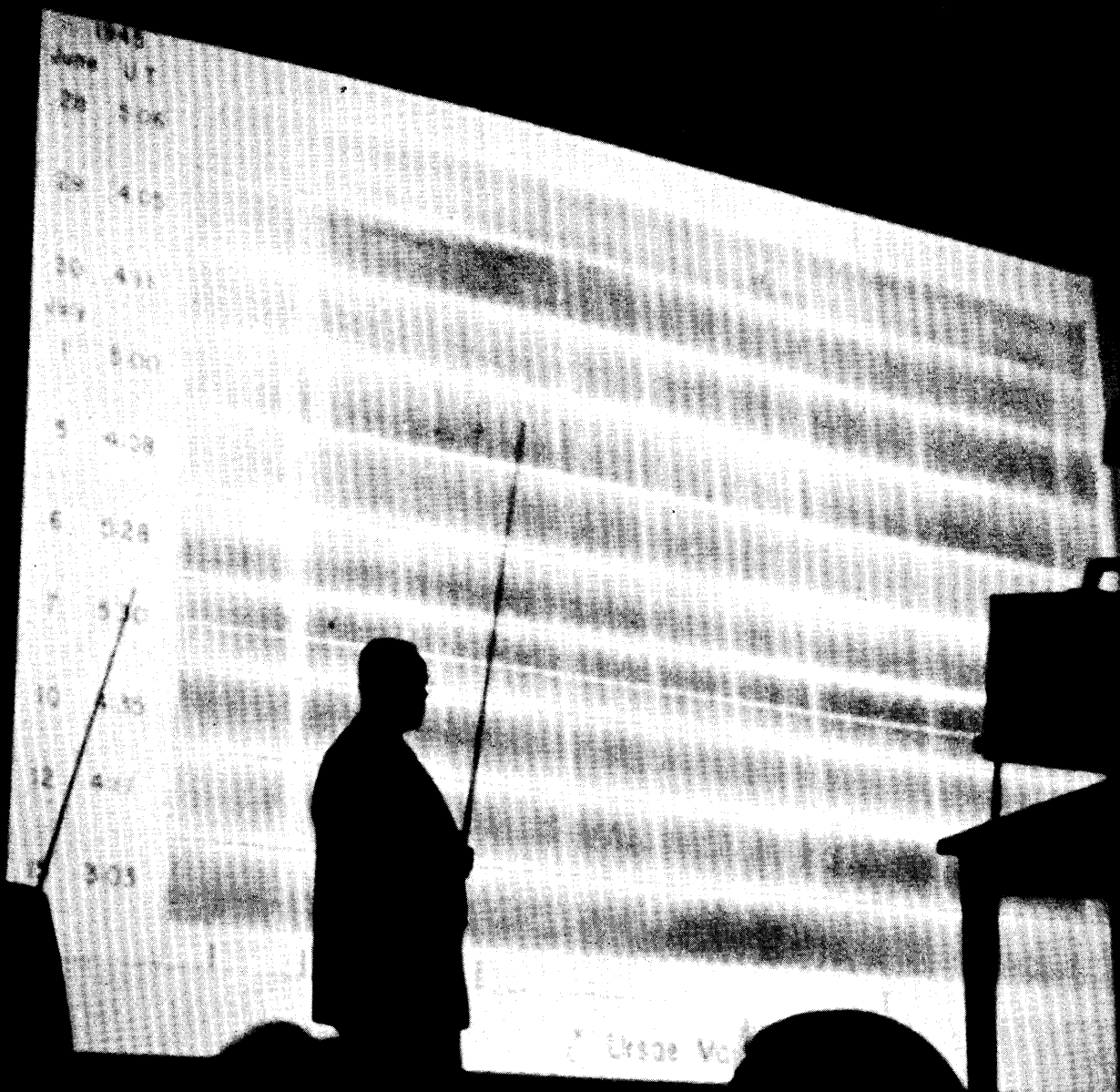
Among our distinguished 1959–60 visitors: Compton Lecturer Dr. André Lwoff of the Institut Pasteur, Paris; Dr. George W. Beadle, Nobel laureate geneticist who visited as Arthur D. Little Lecturer; and Dr. Otto Struve, director of the National Radio Astronomy Observatory (next page), second Compton Lecturer.



old-fashioned terms we call character. I am talking about such qualities as judgment, fortitude, integrity — the virtues that mark men as civilized — and I include, too, the sensitivity and understanding that come from close relations with other students and with the faculty. I think it imperative that we provide rich opportunities for this side of life in our campus environment. Consequently, everything we are doing to improve our dormitories, our campus, and our playing fields is focused on this objective. It is not that we seek more comfort, or more leisure, or big-time athletics; it is simply that we do recognize the need for an environment in which the wholeness of education can thrive.

The basic purpose of a university residential system was summed up by President Karl T. Compton on the opening of the Institute's Graduate House in October, 1933. The House, he declared, was expected "to provide those social contacts which are important in broad cultural development. Through it men of widely divergent professional interests but of equivalent intellectual outlook will be brought together in one group." For more than a quarter of a century this House has contributed with distinction to graduate education at the Institute. It has fostered the exchange of ideas, stimulated contact with leading thinkers and doers in many fields, and instilled a sense of identity and responsibility in its members. Indeed, the principal drawback of the Graduate House today is that it is far too small to accommodate all who would like to live there.

Substantially similar are the goals of the undergraduate residential system at the Institute, the full development of which is a primary concern of the Office of the Dean of Students. Undergraduate residence, to do its full share in the education of students, must be planned and operated in such fashion as to ensure its being both constructive and creative. If constructive, it provides the student with a comfortable establishment in which to live, where his energies



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are set as free as possible for the work of education which brought him to the Institute. If creative, undergraduate residence gives the student an environment and associations which will evoke greater effort and better thinking on his part. It provides him with stimulating new ideas and points of view, it calls on him to accept responsibility for his and others' conduct, and it sustains him with a sense of continuity and stability.

It is toward goals of this sort that we have been striving. They are not easily nor quickly attained. Yet distinct progress has been made toward them during the decade since, with the opening of Baker House and Burton House, the Institute began to house the majority of undergraduates on the campus and thus became a residential university. The opportunities for further progress are many.

A RESIDENCE FOR WOMEN STUDENTS **O**ne of the most notable gifts for the development of our residential program was the pledge this year of \$1,500,000 from an anonymous benefactor for the construction of a residence for M.I.T.'s women students. To be built on the West Campus, overlooking Memorial Drive and the Charles River, this new House will give M.I.T. women for the first time gracious living quarters and a social and recreational center of their own. Between 120 and 150 residents will be housed here. This will permit doubling the number of women undergraduates at the Institute, for the enrollment of freshman girls has been limited by the accommodations available under our direct supervision. Dining facilities, main lounges and smaller floor lounges, a House library, seminar and typewriting rooms, suitable laundry and storage areas, music rooms, and recreation rooms are all planned for the building, which should be ready in the autumn of 1962.

This significant pledge now affords us an unprecedented opportunity to advance the professional development of our women

students. Women have made substantial contributions to scientific and technical progress in the past, and today there are more opportunities for girls in the scientific professions than ever before. Woman's potential for achievement in these fields represents one of the great latent resources of the country.

**DORMITORIES**      **W**e are pleased to have completed this year a thorough rehabilitation of the three dormitories on the East Campus, where some 600 undergraduates are in residence. The project began in the summer of 1958, when the "East Parallel" — Walcott, Bemis, and Goodale of the Alumni Houses — was completely renovated and refurnished at an expenditure of about \$150,000. Similar work is being done on the West Parallel and the Faculty Houses — the latter having come this year to be officially known as the Senior House. This remodeling will be completed, at a cost of \$250,000, in time for the opening of the academic year.

Beyond this, as a separate project, a gatehouse is being constructed at the Ames Street end of the Senior House. This addition will contain the House desk and mailboxes and will make the Senior House a self-contained unit. Along Amherst Street an ornamental wall and fence is being built to enclose the House and increase the sense of privacy and unity. This construction includes bicycle shelters and patio areas at the Amherst Street entrances.

All these improvements on the East Campus were planned in collaboration with the students in residence there, through the House Committees and specially appointed subcommittees. Their suggestions were discussed in detail with the architects and others concerned with the planning, especially with Dr. John B. Goodenough, Master of the Senior House, and Professor F. Albert Cotton, Faculty Resident of the East Campus Houses.





On the West Campus we broke ground this spring for a dining room and supporting facilities for Burton House. Residents of the House reviewed the plans and, in cooperation with Professor Howard R. Bartlett, Master of the House, offered valuable comments for the architects. This addition to the House, overlooking Briggs Field, is designed to serve with versatility as a dining hall, an attractive scene for dances and other social functions, and a study hall in the evening.

Also on the West Campus, a good start has been made on the seriously needed renovation and rehabilitation of the Graduate House. As a first step, the corridors are being repainted and equipped with improved lighting fixtures and new carpeting. Ultimately the individual rooms must be repainted and refurnished, as has been done in the East Campus Houses.

THE HOUSEMASTER PLAN **I** have referred to the way in which resident students contributed to the planning of the improvements which have been made in the Houses. They made positive and practical suggestions. In this they were assisted by the guidance and judgment of House Masters and Faculty Residents. The Housemaster Plan completed its second year of operation in June, Professor Howard Bartlett having served as Master in Burton House since the beginning of the academic year 1958-59. It is a matter of great satisfaction that he will continue in that post. Dr. Goodenough, after launching the Housemaster Plan in the Senior House with notable effectiveness, has relinquished the post in order to give greater time to study and research. Professor Samuel J. Mason of the Department of Electrical Engineering, already experienced through Faculty Residency in Baker House from 1953 to 1955, becomes Master of the Senior House in the fall.

Student acceptance, both individually and as members of student government, of greater responsibility for the conduct of affairs in the Houses owes much to these men, whose counsel has been invaluable. No better measure of the value of the Housemaster Plan is to be found than the growth in maturity and responsibility which it develops in the students in residence. The work of Masters, Senior Tutors, and Tutors is direct and perceptible in the improved academic performance of their student groups.

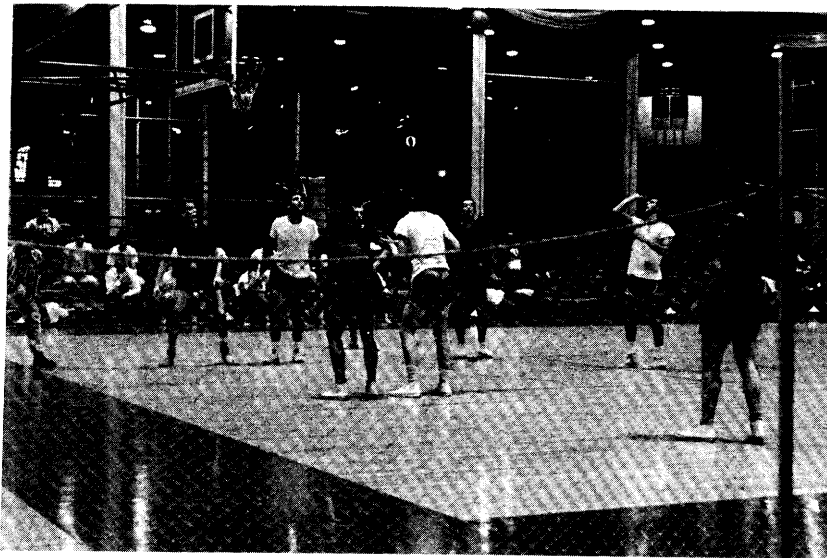
ACTIVITIES **T**hanks largely to the superb facilities provided by Kresge Auditorium, an impressive list of cultural programs was enjoyed during the last twelve months, ranging from performances by the Don Cossack Chorus and the New York City Center Ballet to lectures by such distinguished visitors as Pierre Mendes-France, the former Premier of France, and Sir John Gielgud's presentation of "The Ages of Man." The Little Theater, the large auditorium, and the musical rehearsal rooms are in constant use, bearing testimony to the vigor of the various Institute groups interested in the arts.

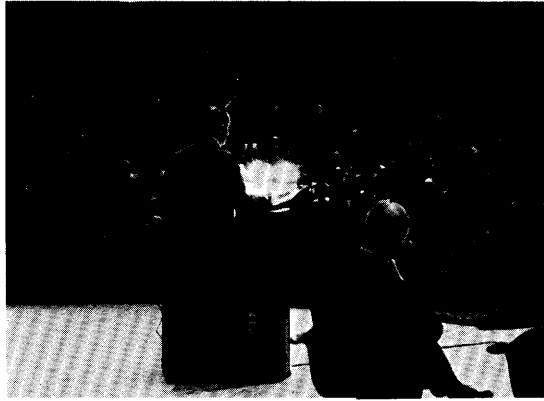
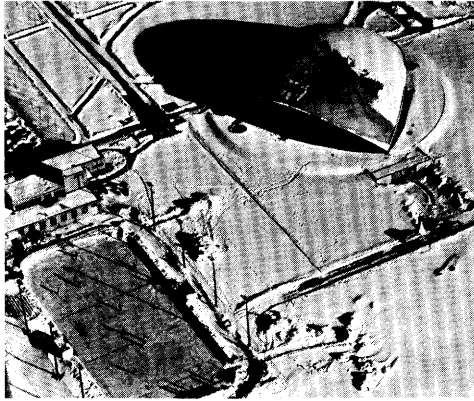
The several campus religious organizations have maintained strong programs of counseling and have extended their influence during the year. It is impossible to give an account here of the magnitude of these programs, but they clearly benefit our students in countless significant ways. The M.I.T. Chapel was the setting for 589 religious services last year and, in addition, was used frequently by students for private meditation. This beautiful and unique religious structure also continues to attract visitors in substantial numbers.

The concept I mentioned earlier — that learning extends beyond the classroom walls to extracurricular activities — is a basic belief of the Institute. We are very proud of the full program of such activities, managed with great independence by the students them-

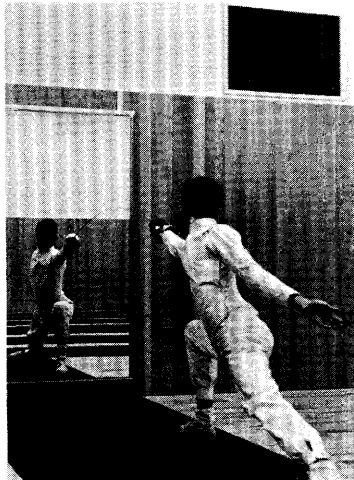
selves under the general aegis of student government, with only minimal direction from the Dean of Students. Particular interest is being shown in the relationship of alumni advisory boards to the various activities. I am delighted that this interest has come from the students themselves.

It is inevitable, as the Institute grows and adapts itself to meet new demands, that we will have to make many space changes. For example, during the past year several activity offices in Walker Memorial have been relocated to meet changing student needs. Yet there remains a major need for a new Undergraduate Student Center to serve as a focal point for extracurricular activities and student government and to accommodate commuters. It would also contain dining facilities and certain essential shops for books, clothing, tailor, barber, and the like.





The fine facilities of the David Flett du Pont Athletic Center, the Kresge Auditorium (above, Pierre Mendes-France and Tech Show 1960), our skating rink, and our student houses contribute to an environment "in which the wholeness of education can thrive."





ATHLETICS     **T**he dedication of the David Flett du Pont Athletic Center on October 5, 1959, was a landmark in the development of our athletic program. This new Center unites Rockwell Cage, Briggs Field House, the Armory, and a new building containing staff and student offices and a variety of athletic facilities in an integrated complex. In planning the Du Pont Center, special emphasis was placed on supporting a program of teaching and enhancing recreational skills that may be carried over to later life.

This does not mean, of course, that intercollegiate athletics are being neglected. During the year some 850 individuals participated in 17 intercollegiate sports. At the same time there were approximately 3,000 students in physical education classes, and 3,625 took part in intramural contests on 459 different teams. This year for the first time we also provided formal physical education classes for women students, who have their own facilities in the Du Pont building.

Despite the gratifying growth of our athletic program, there are needs that must still be met. We must renovate and improve the Armory, and we should cover the skating rink. In addition, the Metropolitan District Commission's plan for the relocation of Memorial Drive makes imperative a new boathouse for M.I.T. crews. Our planning includes provisions for these additions and improvements.

ADMISSIONS     **M**.I.T., like other major educational institutions today, attracts many more applicants than it can admit. For the freshman class entering M.I.T. this fall, 3,512 completed applications were received. Of this number, 1,584 were granted admission, with the expectation that approximately 900 students would eventually register.

This past year, for the first time in the history of the Institute, more members of the freshman class expressed an interest

in majoring in some branch of science than in engineering. We have some reason to believe that the image of engineering held by secondary school students is causing a steady decline in the total number and perhaps also in the quality of the applicants for admission to engineering schools throughout the country. Certainly our own Admissions Office has observed a trend over the past few years indicating that those applicants for admission who prefer to major in science score higher on College Entrance Board Examinations than those with preferences for engineering.

Our changing enrollment pattern is shown in this table, giving Course preferences of entering freshmen in 1955 through 1959.

**COURSE  
PREFERENCES  
OF ENTERING  
FRESHMEN**

SCHOOL OF ENGINEERING	1955-56	1956-57	1957-58	1958-59	1959-60
AERONAUTICS AND ASTRONAUTICS	60	82	65	64	61
CHEMICAL ENGINEERING	141	135	112	91	82
CIVIL ENGINEERING	40	37	18	32	19
ELECTRICAL ENGINEERING	239	229	233	217	211
MECHANICAL ENGINEERING	113	74	78	72	37
METALLURGY	13	9	10	11	15
NAVAL ARCHITECTURE AND MARINE ENGINEERING	6	6	5	4	6
	612	572	521	491	431

SCHOOL OF SCIENCE	1955-56	1956-57	1957-58	1958-59	1959-60
BIOLOGY	9	4	8	11	9
CHEMISTRY	43	29	56	37	56
FOOD TECHNOLOGY	0	0	1	1	3
GEOLOGY AND GEOPHYSICS	6	2	3	6	5
MATHEMATICS	15	28	45	76	98
PHYSICS	178	223	222	268	283
	251	286	335	399	454

The table reveals several interesting trends. Physics in 1959 drew very nearly 30 per cent of all entering freshmen, a significantly greater number than any other professional Course. Electrical Engineering was second, while Mathematics in third place shows an increase of over 500 per cent in five years. Equally significant is the decline of interest in some engineering disciplines, notably in Mechanical and Civil Engineering.

Because enrollment trends such as these ultimately affect all departments of the Institute, I think it essential to reaffirm the wisdom of our policy to admit students first because they have top-flight minds and first-rate characters and only secondly because they show an interest in a particular field. But this does not mean that we view the decline in our engineering enrollments without concern. We have an obligation to the country and to ourselves to maintain a strong undergraduate engineering school. And this School must have its share of the most able students. Moreover, I am confident that many of the developments discussed earlier in this report will achieve this end.

STUDENT AID **L**ike other privately supported colleges and universities, M.I.T. has been forced over the years to make successive increases in tuition in an attempt to keep pace with the constantly mounting costs of operation. Tuition is now at \$1,500 per academic year, one of the highest fees in the country.

In setting its tuition the Institute must be mindful of several limiting factors. It must not "price itself out of the market" nor exclude nor discourage those highly qualified applicants who want an M.I.T. education but have limited financial resources.

Today the Institute's resources for student aid are being



taxed to the utmost; nevertheless, it is gratifying to note that financial aid to students during the past year amounted to slightly more than \$3,250,000. The very considerable size of our student aid — although still inadequate — can be seen when it is compared with the Institute's total tuition income of \$7,889,000. In other words the financial aid given to M.I.T. students last year was slightly more than 40 per cent of the tuition received.

Financial aid to undergraduates this year amounted to \$2,241,830, a modest increase (3 per cent) over the previous fiscal year. Specifically, \$1,056,379 was granted in scholarships and \$505,451 in loans, and \$680,000 was earned in part-time employment on the campus.

Financial support of graduate students amounted to \$1,048,899. This included 246 industrial fellowships, totaling \$502,598, and 89 M.I.T. fellowships and scholarships valued at \$145,520. Loans to 222 graduate students totaled \$139,693, a decrease in both number and amount from last year. Staff awards for teaching and research helped 434 students, granting them \$261,088.

At the close of the fiscal year, June 30, 1960, the capital of the undergraduate scholarship endowment stood at more than \$7,500,000. This is an increase of more than 30 per cent for the year, thanks in large part to the gift of \$1,250,000 from Mr. and Mrs. McDermott previously mentioned in this Report and to a \$250,000 gift by the Trustees of the Charles Hayden Foundation to augment the permanent Charles Hayden Memorial Scholarship Fund. Generous gifts were also received from Thomas C. Desmond '09, John L. Turner '31, Mrs. Frederick T. Moses, and Mrs. Eleanor Haebler Skove.

It should be noted that this year 30 per cent of our undergraduates (1,075 individuals) received scholarship aid totaling slightly over \$1 million. Of this sum, more than 70 per cent

was generously furnished by 130 contributors, including industrial organizations, foundations, fraternal groups, the M.I.T. Alumni Fund, M.I.T. clubs, individual alumni, and other friends of the Institute. We are grateful for this substantial subsidy that enables hundreds of students to enter M.I.T. Now we urgently need to increase the scholarship funds under our own control to augment this generous outside assistance.

Of prime importance to our total student aid program and also a source of pride is the Technology Loan Fund, which during the past year made 976 loans totaling \$656,144 to undergraduate and graduate students. Twenty-one per cent of our undergraduates were assisted by our loan fund. This was the first year that such assistance was extended to entering freshmen, and more than 18 per cent of the Class of 1963 matriculated with loans amounting to \$73,245 for the first year. The general acceptance of loan assistance by students and parents marks a profound change in the public attitude toward this form of support. With the availability of loans to entering freshmen, it has now become possible to initiate a realignment in the Institute's program of aid to undergraduates. We now can meet an entering student's demonstrated need with grants from both scholarship and loan funds rather than by scholarship solely, as has been the previous practice. This dual grant makes for a more effective distribution of gift aid. In addition, part-time work on campus jobs still continues to be available to all interested students.

The Technology Loan Fund was started thirty years ago with a subscription of \$1,451,469. During the past three decades of operation it has clearly been the bulwark of our student aid program. Records at the end of the fiscal year show that 6,284 individuals have borrowed \$5,917,696; and of this number, 3,533 have fully repaid their obligations. A total of \$3,059,174 has been collected on the principal, and there remains \$2,840,548 in out-

standing notes — almost double the original subscription. Over the years the total accumulated “past due” stands at slightly in excess of \$50,000. Clearly, this is a remarkable record and one of which all of us are justly proud.

The terms of borrowing from the Technology Loan Fund are today more advantageous than those granted by the federal program. During the coming academic year, total loans may well approach the \$800,000 mark. As the tuition rises, demands on the Fund are beginning to exhaust its principal, and we must now seek additional capital funds.

At the beginning of the current academic year, the Institute initiated a new credit plan whereby any student could receive an extension of credit on tuition in excess of \$1,000. Repayments, at 5 per cent interest, are scheduled so that the obligation will be completed within six years after graduation. During the year, 54 requests were approved, totaling \$14,400. It is expected that there will be increased use of this type of credit in the future, but it is too early to judge the effectiveness of this credit-extension experiment.

These data seem to me to show quite clearly that we have been assiduous in efforts to help needy students to meet the heavy financial burdens placed upon them. I should add that in this period of rising costs students have also been commendably busy helping themselves. Last year a total of 1,423 undergraduates earned \$680,000 for services performed on campus, clearly an impressive amount. Perhaps even more impressive are the amounts contributed by the many student wives who are working to help their husbands earn degrees.

REGISTRATION **I**n 1959-60 the student body numbered 6,270, as compared with 6,259 in 1958-59. We estimate that enrollment this fall will be about 6,300. Veterans numbered about 3 per cent of the total enrollment, as compared with 5 per cent the year before. In 1958-59, 21 per cent of our students were married, 1 per cent less than the previous year. One hundred and fifty-five women were enrolled, 87 of whom were graduate students.

Enrollment in the Graduate School was 2,690. There were 159 officers from the United States armed services enrolled for advanced degrees.

Students enrolled at M.I.T. last year held degrees from 503 other colleges and universities, 295 American and 208 foreign. The foreign student population was 739, representing some 12 per cent of the total student body. These students were citizens of 71 different countries.

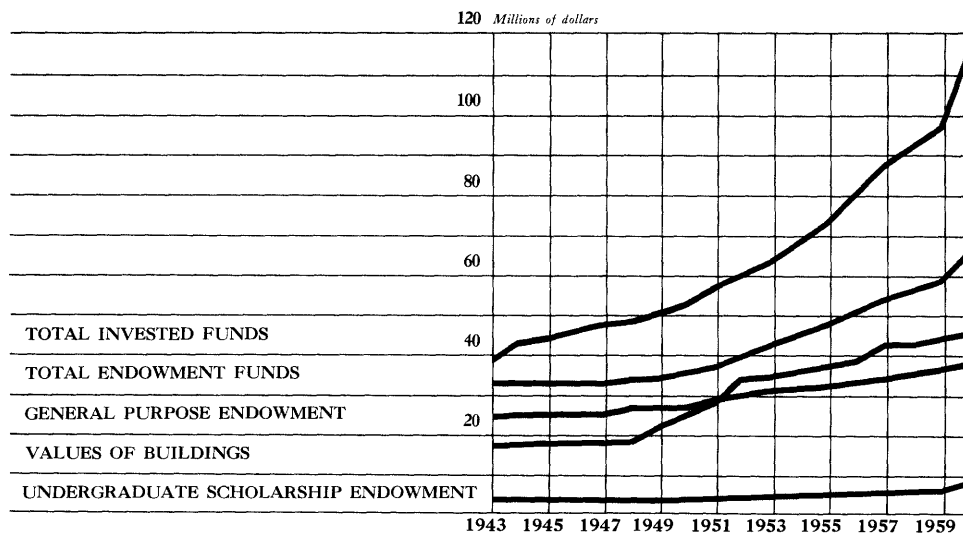
FINANCES **D**uring the year 1959-60, the Institute's academic expenses, not including funds expended on sponsored research, amounted to \$25,468,000, approximately 10 per cent more than the preceding year. This increase resulted primarily from salary and wage adjustments for faculty and other employees of the Institute, along with new or expanded departmental programs. A special distribution of investment income and a greater use of gifts and other receipts financed a part of the higher expenses. Sponsored research, on the other hand, decreased from last year's all-time high of \$67,277,000 to \$66,550,000. The great majority of this work is carried on in the Lincoln and Instrumentation Laboratories under sponsorship of the Department of Defense and the armed services.

The Institute's investments at the end of the fiscal year had a total book value of \$113,043,000 and a market value of

\$173,574,000. At market value, the proportion of the general investments in common stocks decreased from 57 per cent a year ago to 54.3 per cent on June 30, 1960. Educational plant assets now stand at \$44,814,000.

The rate of income earned last year on the funds sharing in the general investments was 6.36 per cent on the average book value, compared to 6.22 per cent last year. The total income on the general and special investments was \$5,346,000, compared to \$4,767,000 in 1958-59.

## THE GROWTH OF M.I.T.'S FUNDS AND PLANT



**G**IFTS Gifts during the past year amounted to \$17,355,000, as contrasted to slightly more than \$10,000,000 the preceding year. This is the largest sum received in any year by the Institute.

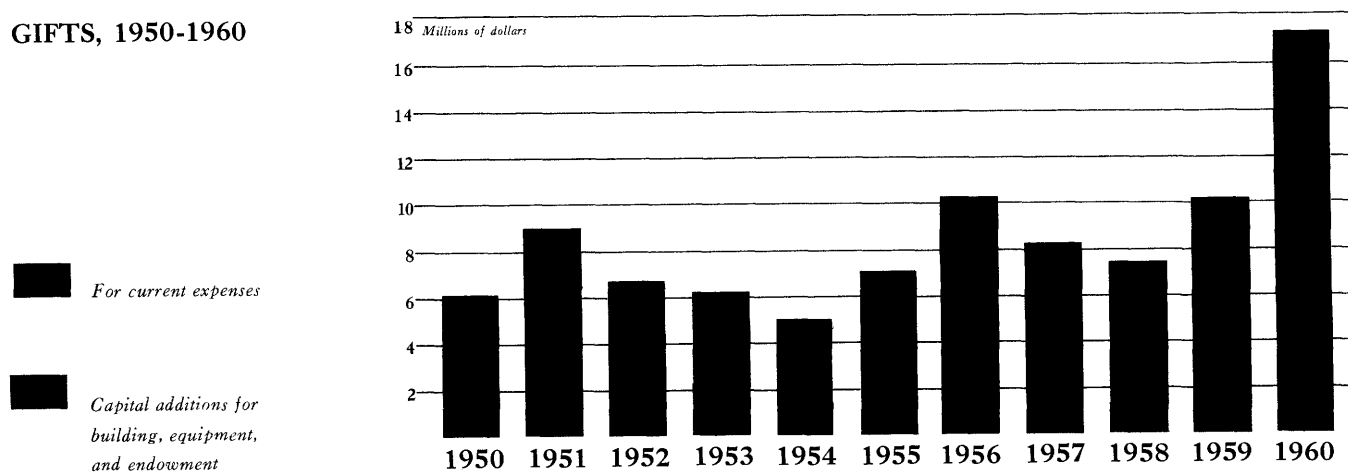
This splendid record includes gifts from the Ford Foundation for the program of improving engineering education, from Mr. and Mrs. McDermott for endowed scholarships, and from Dr.

and Mrs. Green for the Center for the Earth Sciences. We are very grateful to the Alumni Fund, through which 15,682 alumni contributed \$626,000 for current use by the Institute. This sum is the largest annual total ever given during the entire history of the Fund, and it represents as well the greatest number of individual contributors.

Corporate support of the Industrial Liaison Program totaled \$1,312,500 given by 94 different companies. This sum, an all-time high, represents an increase of 11 per cent over a year ago. It is most encouraging to receive such generous support, reflecting industry's confidence in M.I.T. as a center of basic research and teaching in science, engineering, and management.

I would like to make special mention of a grant of \$5,000,000 made last spring to the Institute by the Alfred P. Sloan Foundation for support of basic research in the physical sciences. The fund is to be used, in accordance with the wishes of Mr. Sloan, for "people as distinguished from projects." The grant will enable us to move forward on a widened front to meet the nation's critical need for greater creativity and strength in science and engineering.

## GIFTS, 1950-1960



IN CONCLUSION **I**n presenting this report, I speak not only for myself but also for the many men and women who form the common enterprise that is M.I.T. It is their efforts and achievements that have made this so notable a year.

We are embarking on our second century with high aims and with entire confidence in success. For behind us there stands a record of loyalty and dedicated service of our alumni, of our faculty, and of our countless friends, a testimony of faith in the principles of our institution.

J. A. STRATTON

# Personnel Changes to July 1, 1960

## CORPORATION

### TERM EXPIRATIONS

ROBERT A. LOVETT  
*Special Term Member*

HUGH S. FERGUSON  
*Alumni Term Member*

FRED C. KOCH  
*Alumni Term Member*

MAX L. WATERMAN  
*Alumni Term Member*

EDWARD J. HANLEY  
*President of the Alumni Association*

### ELECTIONS

GEORGE P. EDMONDS  
*Special Term Member*

LAURANCE S. ROCKEFELLER  
*Special Term Member*

BENNETT ARCHAMBAULT  
*Alumni Term Member*

SEMON E. KNUDSEN  
*Alumni Term Member*

ROBERT H. WINTERS  
*Alumni Term Member*

CLARENCE L. A. WYND  
*President of the Alumni Association*

### CHANGES

WALTER HUMPHREYS  
*to Emeritus Life Member and  
Honorary Secretary of the Corporation*

JOHN J. WILSON  
*to Secretary of the Corporation*

### DEATHS

WILLIAM C. FORBES  
*Emeritus Life Member*

LOUIS C. CATES  
*Emeritus Life Member*

## FACULTY

### DEATHS

BERNARD E. PROCTOR  
*Professor and Head of the  
Department of Food Technology*

JAMES A. MURRAY  
*Associate Professor in Civil Engineering*

GERALD PUTNAM  
*Assistant Professor in Mechanical Engineering*

WARREN J. MEAD  
*Professor Emeritus in Geology*

ARCHER T. ROBINSON  
*Professor Emeritus in Humanities*

WILLIAM H. TIMBIE  
*Professor Emeritus in Electrical Engineering*

ARTHUR R. DAVIS  
*Associate Professor Emeritus in Chemistry*

GERHARD DIETRICHSON  
*Associate Professor Emeritus in Chemistry*

ROY G. BURNHAM  
*Assistant Professor Emeritus  
in Mechanical Engineering*

### RETIREMENTS

RAYMOND D. DOUGLASS  
*Professor in Mathematics\**

RALPH E. FREEMAN  
*Professor in Economics\**

DIRK J. STRUIK  
*Professor in Mathematics*

C. FAYETTE TAYLOR  
*Professor in Mechanical Engineering\**

LAURENS TROOST  
*Professor and Head of the Department of  
Naval Architecture and Marine Engineering*

HAROLD C. WEBER  
*Professor in Chemical Engineering\**

C. RICHARD SODERBERG  
*Institute Professor\**

NORBERT WIENER  
*Institute Professor\**

SAMUEL D. ZELDIN  
*Associate Professor in Mathematics\**

\*Will continue as Lecturers or on part-time service.



## RESIGNATIONS

*Professors*

EUGENE W. BOEHNE  
*Electrical Engineering*

GORDON R. WILLIAMS  
*Civil Engineering*

ERNST LEVY  
*Visiting Professor in Humanities*

*Associate Professors*

EWAN W. FLETCHER  
*Electrical Engineering (to Research Associate)*

BURNHAM KELLY  
*City Planning*

ROSS E. MCKINNEY  
*Civil Engineering*

OSMAN K. MAWARDI  
*Mechanical Engineering*

JURGEN MOSER  
*Mathematics*

ROBERT J. VAN DE GRAAFF  
*Physics*

THOMSON M. WHITIN  
*Industrial Management*

ROBERT W. WILLIAMS  
*Physics*

*Assistant Professors*

JOSEPH R. APPLGATE  
*Modern Languages*

GEORGE E. BACKUS  
*Mathematics*

IRVING H. BARTLETT  
*Humanities*

PAUL J. BERENSON  
*Mechanical Engineering*

LEE C. BRADLEY III  
*Physics (to Research Associate)*

PIERRE J. BROSENS  
*Mechanical Engineering*

WALTER F. CANNON  
*Humanities*

WALTER R. DAVIS  
*Humanities*

ROBERT G. DEAN  
*Civil Engineering*

RICHARD R. DOELL  
*Geology*

ROBERT L. FLEISCHER  
*Metallurgy*

GEORGE J. FULD  
*Food Technology*

BRISON D. GOOCH  
*Humanities*

CHARLES M. GRAY  
*Humanities*

GEORGE F. HADLEY  
*Industrial Management*

ALLAN S. HOFFMAN  
*Chemical Engineering*

RICHARD C. JEFFREY  
*Electrical Engineering*

DAVID H. KLIPSTEIN  
*Chemical Engineering*

CHARLES H. KRUGER, JR.  
*Mechanical Engineering*

THEODORE D. LOCKWOOD  
*Humanities*

LEONARD M. MARSAK  
*Humanities*

ROWLAND L. MITCHELL, JR.  
*Humanities*

THOMAS W. MIX  
*Chemical Engineering*

WILLIAM G. MOFFATT  
*Metallurgy (to Research Associate)*

SAUL NAMYET  
*Civil Engineering*

NORMAN A. NELSON  
*Chemistry*

ROGER W. PROUTY  
*Humanities*

JAMES E. ROBERTS  
*Civil Engineering*

THOMAS P. RONA  
*Mechanical Engineering*

ROBERT A. SCHLUTER  
*Physics*

YASUTOSHI SENOO  
*Mechanical Engineering*

WILLIAM D. STAHLMAN  
*Humanities*

ALAN H. STENNING  
*Nuclear Engineering*

JOHN A. WELSH  
*Mechanical Engineering*

ROBERT M. WHITELAW  
*Athletics*

## PROMOTIONS

PETER ELIAS  
*to Professor and Head of the Department  
of Electrical Engineering*

SAMUEL A. GOLDBLITH  
*to Professor and Acting Head of the  
Department of Nutrition, Food  
Science and Technology*

ERNST A. GUILLEMIN  
*to Edwin S. Webster Professor  
in Electrical Engineering*

*To Professor*

HOLT ASHLEY  
*Aeronautics and Astronautics*

BENJAMIN L. AVERBACH  
*Metallurgy*

WILLIAM F. BOTTIGLIA  
*Modern Languages*

JOHN F. ELLIOTT		EDWARD W. MERRILL	
TRUMAN S. GRAY	<i>Metallurgy</i>	ROBERT E. OGLIVIE	<i>Chemical Engineering</i>
YUK-WING LEE	<i>Electrical Engineering</i>	HENRY M. PAYNTER	<i>Metallurgy</i>
LUCIAN W. PYE	<i>Electrical Engineering</i>	WILLIAM H. PINSON, JR.	<i>Mechanical Engineering</i>
DAVID J. ROSE	<i>Economics</i>	DANIEL B. RAY	<i>Geology</i>
DAVID P. SHOEMAKER	<i>Nuclear Engineering</i>	HARALD A. T. O. REICHE	<i>Mathematics</i>
LOUIS D. SMULLIN	<i>Chemistry</i>	EDGAR H. SCHEIN	<i>Humanities</i>
MALCOM W. P. STRANDBERG	<i>Electrical Engineering</i>	CAMPBELL L. SEARLE	<i>Industrial Management</i>
CARL L. SVENSON	<i>Physics</i>	JOHN A. SWETS	<i>Electrical Engineering</i>
GEORGE B. THOMAS, JR.	<i>Mechanical Engineering</i>	JOHN M. WOZENCRAFT	<i>Economics</i>
LASZLO TISZA	<i>Mathematics</i>		<i>Electrical Engineering</i>
FELIX M. H. VILLARS	<i>Physics</i>		
	<i>Physics</i>		
		<i>To Assistant Professor</i>	
<i>To Associate Professor</i>		RUDOLF W. BAUER	<i>Physics</i>
DEAN N. ARDEN	<i>Electrical Engineering</i>	DWIGHT M. B. BAUMANN	<i>Mechanical Engineering</i>
FRANCIS M. BATOR	<i>Economics</i>	DAVID J. BENNEY	<i>Mathematics</i>
ARTHUR J. BOUCOT	<i>Geology</i>	PAUL J. BERENSON	<i>Mechanical Engineering</i>
GEORGE W. CLARK	<i>Physics</i>	WILLIAM BERTOZZI	<i>Physics</i>
F. ALBERT COTTON	<i>Chemistry</i>	JOHN BLAIR	<i>Electrical Engineering</i>
MARCY EAGER	<i>Electrical Engineering</i>	EUSTRATIOS N. CARABATEAS	<i>Mechanical Engineering</i>
LEONARD A. GOULD	<i>Electrical Engineering</i>	JEROME CATZ	<i>Mechanical Engineering</i>
PETER GRIFFITH	<i>Mechanical Engineering</i>	PAUL G. FEDERBUSH	<i>Physics</i>
DAVIS H. HOWES, 3RD	<i>Economics</i>	JAMES G. GOTTLING	<i>Electrical Engineering</i>
STANLEY M. JACKS	<i>Industrial Management</i>	PAUL E. GRAY	<i>Electrical Engineering</i>
ARTHUR K. KERMAN	<i>Physics</i>	JUSTIN E. KERWIN	<i>Naval Architecture</i>
GEORGE F. KOSTER	<i>Physics</i>	CHARLES H. KRUGER, JR.	<i>Mechanical Engineering</i>
FREDERICK J. MCGARRY	<i>Civil Engineering</i>	THOMAS J. LAMBIE	<i>Civil Engineering</i>
HENRY P. MCKEAN, JR.	<i>Mathematics</i>	WILLIAM F. MASSY	<i>Industrial Management</i>
ROBERT E. MACMASTER	<i>Humanities</i>	JOHN E. MAYER, JR.	<i>Mechanical Engineering</i>
ALAN L. MCWHORTER	<i>Electrical Engineering</i>	RAPHAEL MOISSIS	<i>Mechanical Engineering</i>

WILLIAM T. PEAKE	<i>Electrical Engineering</i>	STEPHEN J. GENDZIER	<i>Modern Languages</i>
PAUL L. PENFIELD, JR.	<i>Electrical Engineering</i>	JAMES G. GLIMM	<i>Mathematics</i>
JAMES B. STONE	<i>Humanities</i>	KENT F. HANSEN	<i>Nuclear Engineering</i>
MARTIN WOHL	<i>Civil Engineering</i>	JOHN HOWER	<i>Geology</i>
GEORGE J. WOLGA	<i>Physics</i>	EMMET J. LARKIN	<i>Humanities</i>
<b>APPOINTMENTS</b>			
<i>Professors</i>			
WILBUR B. DAVENPORT, JR.	<i>Electrical Engineering</i>	JAMES A. LARRIMORE	<i>Chemical Engineering</i>
ALFRED E. HARPER	<i>Nutrition, Food Science and Technology</i>	SANFORD A. MILLER	<i>Nutrition, Food Science and Technology</i>
BORIS MAGASANIK	<i>Biology</i>	HENRY A. MILLON	<i>Architecture</i>
JOHN B. RAWLS	<i>Humanities</i>	FREDERIC R. MORGENTHAUER	<i>Electrical Engineering</i>
NEVIN S. SCRIMSHAW (August, 1961)	<i>Head of the Department of Nutrition, Food Science and Technology</i>	JAMES R. MUNKRES	<i>Mathematics</i>
IRVING E. SEGAL	<i>Mathematics</i>	PAUL O. ROBERTS	<i>Civil Engineering</i>
HANS-LUKAS TEUBER	<i>Economics</i>	LAWRENCE A. SHEPARD	<i>Metallurgy</i>
<i>Visiting Professors</i>			
<i>Associate Professors</i>		FRED W. BILLMEYER, JR.	<i>Chemical Engineering</i>
GEORGE T. BRYANT	<i>Civil Engineering</i>	JOSEPH B. S. BRAVERMAN	<i>Nutrition, Food Science and Technology</i>
DAYTON E. CARRIT	<i>Geology</i>	AMOS DE-SHALIT	<i>Physics</i>
MURRAY EDEN	<i>Electrical Engineering</i>	KARL W. DEUTSCH	<i>Economics</i>
HARVEY P. GREENSPAN	<i>Mathematics</i>	JANE B. DREW	<i>Architecture</i>
DONALD M. WATKIN	<i>Nutrition, Food Science and Technology</i>	STEPHEN FREEMAN, JR.	<i>Electrical Engineering</i>
EMMETT A. WITMER	<i>Aeronautics and Astronautics</i>	MARGARET HALL	<i>Economics</i>
<i>Assistant Professors</i>			
GOFFREY R. BELTON	<i>Metallurgy</i>	ALDOUS HUXLEY	<i>Humanities</i>
HARRIS J. BIXLER	<i>Chemical Engineering</i>	W. PRICHARD JONES	<i>Aeronautics and Astronautics</i>
THOMAS CANTWELL	<i>Geology</i>	MAYNARD A. JOSLYN	<i>Nutrition, Food Science and Technology</i>
HENRI FENECH	<i>Nuclear Engineering</i>	GEORGE KATONA	<i>Industrial Management</i>
FRANKLIN M. FISHER	<i>Economics</i>	HAROLD D. LASSWELL	<i>Economics</i>
FREDERICK W. FREY	<i>Economics</i>	FRANCO MODIGLIANI	<i>Economics</i>
JEROME I. FRIEDMAN	<i>Physics</i>	PAUL D. NELSON	<i>Architecture</i>
		MICHAEL M. POSTAN	<i>Economics</i>

JOHN P. ROCHE  
 DUDLEY B. SPALDING  
 ZDENKO STRIZIC  
 KENZO TANGE  
 CHARLES R. WILKE  
 NORMAN WILLIAMS, JR.  
 CARROLL L. WILSON  
 Visiting Associate Professors  
 DEREK G. ASHWELL  
 MICHAEL P. BARNETT  
 ROWLAND S. BENSON  
 THOMAS G. BRIDGWOOD  
 JOHN R. S. FINCHAM  
 J. ARTHUR SHERCLIFF  
 CHARLES L. WRIGHT, JR.  
 Visiting Assistant Professors  
 SUKHAMOY CHAKRAVARTY  
 JACK LEWIS  
 AMARTYA K. SEN  
 SENOL UTKU

*Economics*  
*Chemical Engineering and  
 Mechanical Engineering*  
*Architecture*  
*Architecture*  
*Chemical Engineering*  
*City Planning*  
*Industrial Management*  
  
*Mathematics*  
*Physics*  
*Mechanical Engineering*  
*Electrical Engineering*  
*Biology*  
*Mechanical Engineering*  
*Naval Architecture*  
  
*Economics*  
*Chemistry*  
*Economics*  
*Civil Engineering*

## CHANGES IN AIR, MILITARY, AND NAVAL SCIENCE

### RESIGNATIONS

COL. GILBERT G. BRINCKERHOFF, JR.  
*Professor and Head of the  
 Department of Military Science*  
 MAJOR OSBORNE S. COX  
*Associate Professor in Military Science*  
 COMDR. ALFRED C. EDWARDS  
*Associate Professor in Naval Science*  
 CAPT. JOHN M. MAYS  
*Associate Professor in Military Science*  
 LT. COL. TRACY E. MULLIGAN, JR.  
*Associate Professor in Military Science*  
 CAPT. EDWARD P. STEFANIK  
*Associate Professor in Military Science*  
 CAPT. RICHARD T. REMERS  
*Assistant Professor in Air Science*  
 CAPT. ROBERT N. STRICKLAND  
*Assistant Professor in Air Science*  
 CAPT. WILLIAM W. TAYLOR, JR.  
*Assistant Professor in Military Science*

### APPOINTMENTS

COL. IRVING W. FINBERG  
*Professor and Head of the  
 Department of Military Science*  
 MAJ. ALBERT E. ANDREWS  
*Associate Professor in Military Science*  
 COMDR. ROBERT B. GIBLIN  
*Associate Professor in Naval Science*  
 CAPT. JAMES NORTON  
*Associate Professor in Military Science*  
 CAPT. MAX B. SCHEIDER  
*Associate Professor in Military Science*  
 CAPT. LEO BRACHTENBACH  
*Assistant Professor in Air Science*  
 CAPT. DAVID A. SENA  
*Assistant Professor in Air Science*

**ADMINISTRATION****DEATHS**

EDWARD L. COCHRANE  
*Emeritus Vice President for Industrial  
 and Governmental Relations; Special  
 Adviser to the President*

WILLIAM N. SEAVER  
*Emeritus Librarian*

**RESIGNATIONS**

KENDALL B. RANDOLPH  
*Industrial Liaison Officer*

RUTH L. BEAN  
*Assistant Dean of Students*

WILLIAM MACKINTOSH  
*Assistant to the Treasurer*

**APPOINTMENTS**

NATHANIEL McL. SAGE, JR.  
*Associate Director of the Division  
 of Sponsored Research*

GARY L. BENTON  
*Industrial Liaison Officer*

JAMES E. DONAHUE  
*Industrial Liaison Officer*

RICHARD B. FINN, JR.  
*Industrial Liaison Officer*

JOHN F. MAXWELL, JR.  
*Industrial Liaison Officer*

**PROMOTIONS AND CHANGES**

PROFESSOR FRANCIS BITTER  
*to Professor of Geophysics and Chairman  
 of the Policy Committee of the  
 Magnet Laboratory*

BENJAMIN LAX  
*to Director of the Magnet Laboratory*

DONALD T. STEVENSON  
*to Assistant Director of the  
 Magnet Laboratory*

JAMES M. WEST  
*to Assistant Director of the  
 Magnet Laboratory*

PROFESSOR PHILIP M. MORSE  
*to Director of the  
 Operations Research Center*

JOHN P. DONAHUE  
*to Associate Director of the  
 Division of Sponsored Research*

FERNANDO J. CORBATO  
*to Associate Director of the  
 Computation Center*

HERBERT P. GALLIHER, JR.  
*to Associate Director of the  
 Operations Research Center*

WILLIAM W. SEIFERT  
*to Assistant to the  
 Dean of Engineering*

VINCENT A. FULMER  
*to Executive Assistant to the Chairman of the  
 Corporation (on leave from the  
 Industrial Liaison Office)*

WINSTON R. HINDLE  
*to Acting Director of the  
 Industrial Liaison Office*

H. STANLEY PALMER  
*to Assistant Superintendent  
 of Power and Utilities*

EUGENE R. CHAMBERLAIN  
*to Associate Director of Admissions*

M. BRYCE LEGGETT  
*to Associate Director of Admissions*

WILLARD W. DICKERSON, JR.  
*to Assistant Director of Admissions*

JAMES H. EACKER  
*to Assistant Director of Admissions and  
 Executive Secretary of the  
 Educational Council*

ROBERT K. WEATHERALL  
*to Assistant Director of Admissions*

DR. JAMES M. FAULKNER  
*to Consultant in Medicine and  
 Adviser to Premedical Students*

DR. ALBERT O. SEELE  
*to Medical Director*

D. HUGH DARDEN  
*to Special Assistant in the  
 Development Office*

LAMAR WASHINGTON  
*to Special Assistant in the  
 Development Office*

THIS REPORT. The design is by James H. Casper, the Office of Publications. The title page reproduces an eighteenth century volume of *Life and Letters of William Hamilton* based on a photograph taken in 1882. The historical maps which have been prepared with the assistance of Claude L. Barber of the M.I.T. Library. Other photographs are by J. Ralph Adams and Robert Lyon of the M.I.T. Photographic Service. George Corwin (page 25), Professor Cecil E. Hall (page 26), Professor Karas (pages 43-5 and 54-5), Marjorie Lowry (page 44-5), and Charles D. Walter (page 44-5). Typeset in Linotype Caslon by the Mische Lithographic Company. Printed and bound by American Writing Paper Corporation, 100 Gray Text, by the Lowry Printing Company. October, 1960.

3 9 NOV 1960

PROFESSOR GEORGE G HARVEY

ROOM 6-113