

Alfred P. Sloan Foundation

ANNUAL REPORTS

Alfred P. Sloan Foundation

Founded in 1934 by Alfred P. Sloan, Jr. (1875-1966)

REPORT for 1970



15

Contents

Trustees, Officers, and Staff	vi
President's Statement	1
General Program	7
Science and Technology	9
Education	17
Economics and Management	27
Related Problems of Society	30
Particular Programs	33
Neuroscience	35
Expanding Professional Opportunities	39
Foundation Operations	46
Financial Review	49
Index	70

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President's Statement

President's Statement



NINETEEN-SEVENTY was a year in which important new developments affected the foundation world. It was the first full year during which the new Tax Reform Act was in effect. It was also a year in which the critical financial problems faced by the major beneficiaries of foundation support, colleges and universities, came clearly to the fore.

These circumstances have served to underscore the special opportunities and obligations foundations face in our democratic society. Small though their total assets are in relation to the needs of society, they possess in their flexibility, their concern for innovation, and their willingness to support efforts of uncertain outcome, characteristics which attach to few enterprises, private or governmental. On the other hand, foundations can easily fall into the habit of being only passive, limited to responding to other people's ideas and sorting out the most promising of them. While a defensible method of grant making can follow from such an approach, the full leadership potential of a foundation is more likely to be realized when it assumes some initiative itself, identifying by its own efforts important problem areas and uncovering the individuals and the institutions most likely to be successful in contributing to the resolution of these problems.

On the basis of the conviction that an active and not a passive role would result in the best investment of the Foundation's resources, the Sloan Foundation adopted two years ago a new operating concept. It is described in some detail in the 1969 Annual Report of the Foundation. Its appropriateness in response to the developments of the year nineteen-seventy

has found ample confirmation and is documented in later sections of this Report.

The new operating concept involves the development of *particular programs*, two or three in number at any time to which approximately forty percent of the Foundation's grants are allocated. Each *particular program* is centered on a problem or an opportunity wherein a series of related grants over a three- to seven-year period would seem to have promise of producing discernible results. Two *particular programs* are now fully established, one concerned with neuroscience and one with increasing the access of minority group members to the professions of medicine and management.

A third *particular program* was approved by the Foundation's Board of Trustees late in 1970 and will begin to operate in a very limited way in 1971. The focus of this program will be on the uses of technology in education, especially in higher education. It extends the Foundation's traditional interests in science, technology and management.

"Educational technology" is a term that evokes disenchantment as often as it does enthusiasm. The rapid growth of the so-called knowledge industry in the 1960's and its equally rapid retrenchment have prompted some to conclude that technology offers little promise for the advancement of education. They may be right, but we believe that a good chance now exists for the development of a genuine Technology of Education: hard lessons have been learned by all parties; a number of experiments have been conducted with apparent but isolated success; and the general state of the art is sufficiently advanced to suggest that the time has arrived for a systematic, rigorous effort to bring technology and education together. We do not propose to finance that effort ourselves, for it is a large one, but we hope to encourage it and have a part in it.

Inauguration of our third *particular program* reflects, not an interest in technology for its own sake, but a concern for both the financial stability of American institutions of higher education and for the quality of instruction in them. Many colleges and universities, including many high-prestige institutions, are in financial straits. More than a few of them are headed for a crisis of serious proportions. It is clear that ways have to be found of reducing the costs of higher education or of meeting the costs in new ways. The limited resources of the Sloan Foundation obviously militate against unrestricted institutional support and against grants to reduce the operating deficits of colleges and universities. What the Foundation can do is provide seed money for institutions and groups striving to find answers to the problem.

4 Through our third *particular program*, the question of whether technology, broadly defined, can help control and even reduce the costs of

education can be explored. The program will not be large. It will have to be highly selective. It will provide experimental funds for institutions and groups who want to test the proposition that education can become more efficient and productive.

Educational costs, however, are only one of our concerns in this *particular program*. We are equally concerned with the quality of instruction and whether technology can do anything to improve the educational process. How much technology can do to raise educational quality is a question for which only primitive answers are available. It has been asserted that technology can free the student for the first time from the tyranny or the simple inefficiency of group instruction, allowing him to pace himself according to his particular interests and abilities. At the same time the teacher, the most expensive element in the educational system, is freed for work that *cannot* be done with technological devices. Unfortunately, the evidence for such claims is scattered and difficult to evaluate, and is often confused with the claims themselves.

Even so, we are inclined to share the view of those persons who feel that the promise of technology in education is great. The failures need no extended discussion here. They only underscore the need for more systematic, more rigorous, and perhaps more disinterested experimental work.

A foundation may be able to play a special role in the present circumstances. It can be to seek out the strategic rather than the grandiose project. The Foundation cannot support large-scale experiments using expensive equipment; nor can it finance nationwide dissemination projects. Neither can it finance the construction of facilities for technological experiments. Important as such projects may be, the Foundation's role must be that of a highly discriminating explorer, interpreter, and energizer.

To reduce the costs of education and simultaneously improve quality—the twofold hope of this program—may seem unrealistic or even naive. It may turn out that only one purpose can be served, and that at the expense of the other. It would be indefensible to suggest that technology can provide a ready answer to problems that educators have struggled with a long time. At best technology is likely to prove to be but one answer among many to the problems of cost and quality. The potentialities of technology in education are a diffuse and complex subject. For these reasons the program will begin slowly in 1971 with a modest budget and a small number of grants. We hope that our initial efforts will encourage and justify the further development of the program in future years.

W. G. Wassell

THE FOUNDATION, under a policy adopted in 1969, divides its efforts and resources between a General Program and a limited number of relatively short-term, sharply focused Particular Programs, which are discussed on Pages 33 to 45 of this Report. The General Program carries forward the Foundation's traditional interests in science and technology, in economics and in management, in higher education, and in problems of society bearing a relationship to these interests. Within these broad areas the Foundation functions as a grant-making, nonoperating philanthropic foundation. Proposals are received and acted upon with reference to established priorities and available resources. On occasion the Foundation may invite proposals in an area of special interest, as in the engineering design program described in later pages. It is also possible under the General Program to establish and support special study groups such as the Sloan Commission on Cable Communications. Thus the General Program preserves for the Foundation the flexibility to respond selectively to needs within broadly defined program areas.

Science and Technology



THE advancement of science and technology has been one of the Foundation's long-established interests, and that interest continued in 1970.

The Foundation's largest continuing program in this area, the Program for Basic Research in the Physical Sciences, has disbursed since its founding in 1955 some \$17.8 million in basic research fellowships for young faculty scientists in the United States and Canada. By this means some 821 scientists, chosen on evidence of their exceptional potential for creative contributions to fundamental knowledge, have been helped to advance their research in chemistry, physics, mathematics, and certain interdisciplinary fields such as geochemistry and astrophysics.

During 1970 the Foundation began active grant-making in the new field of neuroscience (see Pages 35-38), in which postdoctoral training is a particularly urgent need at this time. Trustees of the Foundation approved the inclusion within the present Program for Basic Research of a limited number of fellowships for basic research in neuroscience. Thus 10 per cent or so of the approximately 75 fellowships annually awarded will be allocated for the support of promising young neuroscientists in the 1972-73 academic year. The Program Committee of distinguished scientists which

*Fundamental
Study Retains
High Priority*

reviews nominations and makes recommendations for support will be expanded to include two neuroscientists.*

In keeping with this limited extension of the Program into the life sciences, its name has been changed to the Sloan Fellowships for Basic Research. The annual appropriation for the Program continues at \$1.4 million.

Early Support for Younger Scientists

During 1970, seventy-six new two-year fellowships were awarded to scientists on the faculties of 42 colleges and universities. Of these awards, 33 were for scientists in chemistry, 15 in mathematics, and 28 in physics.

Scientists selected for Sloan fellowships are under 30 on the average and often are in their first faculty appointments. It is in this early stage of a career that federal and other conventional forms of research support are hardest to come by, because the young scientist has not yet built a body of work which can be judged by conventional standards. The Foundation, with the aid of the Program Committee, reviews some 500 nominations for fellowships annually.

The support made available through Sloan Research Fellowships is largely unrestricted. The Foundation's grant, made through the Fellow's institution, permits him (or her) to pursue that line of research which is of greatest interest to him. To this end he may engage technical and scientific assistance, obtain computer time, purchase needed equipment and supplies, support himself through the summer, take time off for study or professional travel, and in general do whatever is needed to advance his own growth as a scientist. Fellowship grants average \$17,500 over a two-year period, although individual amounts vary widely depending on the Fellow's field in science. The nominee for a fellowship does not submit a research proposal or project to the Foundation, nor is he precluded from changing the direction of his research once a fellowship is awarded. He is, however, expected to report to the Foundation, either explicitly or through published articles, on the research accomplished with the assistance of the Sloan grant.

Scientists who received new Sloan Research Fellowships in 1970 are listed below by their institutions and fields of science:

AMHERST COLLEGE Chemistry: Richard D. Fink	CALIFORNIA INSTITUTE OF TECHNOLOGY Chemistry: Robert G. Bergman
UNIVERSITY OF BRITISH COLUMBIA Chemistry: Anthony J. Merer, Edward Piets	UNIVERSITY OF CALIFORNIA, Berkeley Chemistry: Charles B. Harris, Ronald R. Herm, William H. Miller. <i>Mathe</i>

* Members of the Program Committee during 1970 were Franklin A. Long, Cornell University, chairman; Lipman Bers, Columbia University; R. H. Bing, University of Wisconsin; E. J. Corey, Harvard University; Robert E. Marshak, City College of New York; and Alfred O. C. Nier, University of Minnesota.

matics: Hung-hsi Wu, H. Blaine Lawson, Jr., Jack H. Silver. *Physics*: John Clarke

UNIVERSITY OF CALIFORNIA,
Los Angeles

Mathematics: Yiannis N. Moschovakis.
Physics: Chun Wa Wong

UNIVERSITY OF CALIFORNIA, Riverside
Physics: Nai Li Huang

UNIVERSITY OF CALIFORNIA, San Diego
Chemistry: Kent R. Wilson

UNIVERSITY OF CALIFORNIA,
Santa Barbara

Physics: James B. Hartle

UNIVERSITY OF CALIFORNIA, Santa Cruz
Physics: George D. Gaspari

CARNEGIE-MELLON UNIVERSITY
Chemistry: Robert F. Stewart

UNIVERSITY OF CHICAGO

Atmospheric Science: Richard S. Lindzen. *Mathematics*: Charles L. Fefferman. *Radio Astronomy*: Patrick P. Palmer

COLUMBIA UNIVERSITY

Astrophysics: J. Roger P. Angel. *Chemistry*: Philip Pechukas. *Physics*: Riley Newman

CORNELL UNIVERSITY

Chemistry: James M. Burlitch. *Physics*: John Peoples, Jr.

FLORIDA STATE UNIVERSITY

Mathematics: R. Christopher Lacher

UNIVERSITY OF FLORIDA

Chemistry: William R. Dolbier, Jr.

HARVARD UNIVERSITY

Mathematics: Robert C. Hartshorne, John N. Mather

UNIVERSITY OF HAWAII

Chemistry: Robert S. H. Liu

UNIVERSITY OF IDAHO

Chemistry: Jean'ne M. Shreeve

UNIVERSITY OF ILLINOIS

Chemistry: William H. Pirkle. *Physics*: Christopher J. Pethick, Myron B. Salamon

IOWA STATE UNIVERSITY

Chemistry: Robert J. Angelici, Walter S. Trahanovsky

UNIVERSITY OF KANSAS

Chemistry: Robert G. Carlson

McMASTER UNIVERSITY

Physics: Malcolm F. Collins

UNIVERSITY OF MARYLAND

Physics: Ronald C. Davidson

MASSACHUSETTS INSTITUTE OF
TECHNOLOGY

Applied Mathematics: Steven A. Orszag. *Biophysical Chemistry*: Paul R. Schimmel. *Physics*: Eric R. Cosman, Marlan O. Scully

UNIVERSITY OF MINNESOTA

Chemistry: Richard F. Borch

STATE UNIVERSITY OF NEW YORK AT
STONY BROOK

Astronomy: Stephen E. Strom. *Mathematics*: Jeff Cheeger, Hershel M. Farkas. *Physics*: Janos Kirz

UNIVERSITY OF NORTH CAROLINA

Chemistry: David G. Whitten

OHIO STATE UNIVERSITY

Chemistry: Raphael D. Levine

UNIVERSITY OF OREGON

Chemistry: Michael R. Philpott. *Physics*: Paul L. Csonka

UNIVERSITY OF PENNSYLVANIA

Physics: Paul Soven

UNIVERSITY OF PITTSBURGH

Chemistry: Paul Dowd

PRINCETON UNIVERSITY

Astrophysics: Jeremiah P. Ostriker. *Mathematics*: William K. Allard, Nicholas M. Katz. *Physics*: David J. Gross

PURDUE UNIVERSITY

Mathematics: Richard A. Hunt

RICE UNIVERSITY

Astrophysics: W. David Arnett. *Chemistry*: Philip R. Brooks

UNIVERSITY OF ROCHESTER

Astrophysics: J. G. M. Duthie. *Chemistry*: Keiji Morokuma, Richard H. Schlessinger. *Physics*: Thomas Ferbel

RUTGERS UNIVERSITY

Chemistry: Gerald S. Manning

UNIVERSITÉ DE SHEBBROOKE

Chemistry: Pierre Deslongchamps

UNIVERSITY OF SOUTHERN CALIFORNIA

Chemistry: Gerald A. Segal, Lawrence A. Singer

STANFORD UNIVERSITY
Chemistry: Frank A. Weinhold. Physics: Jerome L. Finkelstein

WASHINGTON UNIVERSITY
Mathematics: Ronald R. Coifman. Physics: Martin H. Israel

YALE UNIVERSITY
Chemistry: John W. Faller, Jr.

The search for fundamental new knowledge at the highest intellectual levels occupies the 150 professors and members who make up the Institute for Advanced Study at Princeton, N.J. Founded in 1930, the Institute consists of Schools of Historical Studies, Mathematics, and Natural Sciences, and a new School of Social Sciences. Each School has a small core of permanent professors who conduct their own research while providing intellectual stimulation and guidance to a larger number of visiting members, ranging from postdoctoral fellows to senior investigators, who come to the Institute from all over the world to work for a time there. From this changing community of scholars there have emerged insights of basic importance in mathematics, theoretical physics, and other fields of learning.

The Institute, directed since 1966 by the economist Carl Kaysen, recently has adopted two major new interests. One is the study of social change through the application of the techniques and perspectives of the social sciences to history. The other, for which Sloan Foundation support was requested, is the study of human and social information processing with emphasis on computer simulation of the systems being studied.

The information-processing study attacks a problem of central importance in modern scientific inquiry. Working conceptually rather than experimentally, it seeks to develop models of the operations which take place in the central nervous system when new information impinges on an organism. It is possible to measure the response of the organism when it receives new information through one or more of its senses; this is the domain of the experimental psychologist. It is possible to study chemical and physical changes in an organism's nervous system as information is fed to it. But what does the nervous system actually *do* with the information? It is evident that some kind of intricate processing operation is occurring whereby the central nervous system compares the new information with information previously stored in the organism, determines its significance, and signals a response for which, in some instances, there may have been no precedent in the organism's previous experience. How is this possible?

The willingness of the Institute to undertake a study of such complexity and significance, and its ability to recruit such outstanding researchers in the field as Dr. George Miller and Dr. Duncan Luce, brought about a Sloan Foundation grant of \$300,000, payable over two years.

Information
Processing
in Organisms

12

During 1970 the Institute for Advanced Study also initiated a program to strengthen another branch of science, the fundamental discipline of theoretical physics. The Princeton University Department of Physics and the Institute are bringing together for an "Axiomatic Year" some of the world's leading researchers in quantum field theory and statistical mechanics. In these two disciplines, which share some concepts and techniques, the progress made in recent years suggests that a year's collaboration by scientists from both fields could lead to some fundamental new understanding of the laws of nature. Both senior scientists and younger men from several nations are spending the year working and exchanging ideas with Institute and Princeton University scientists.

The "Axiomatic Year" signifies a renewed emphasis by the Institute on the "axiomatic" approach to physics, which in recent years has been overshadowed by the "phenomenological" approach. The phenomenologist concentrates on detailed analysis of experimental data, building theories piecemeal by finding mathematical models to fit the observed results of particular experiments. The axiomatist aims at a deeper understanding of concepts such as space, time, symmetry, and causality upon which all theoretical models are based; he attempts to describe the properties of the natural world in terms of a general mathematical framework which is logically precise, representing the qualitative behavior of things correctly and ignoring quantitative details. Both approaches are necessary, and it is through their collaboration that some important advances in theoretical physics have occurred—and may occur again. The Foundation granted \$72,000 for the Institute's participation in this effort.

The development of statistics as a separate discipline at Princeton University reached a point in 1970 at which additional support became a crucial need. Since the founding of an independent Department of Statistics in 1967, curricular goals have been defined, undergraduate and graduate student involvement is rising, and the Department has been housed together with the Department of Mathematics in a new building. Dr. John W. Tukey, who was succeeded as chairman during the year by Dr. G. S. Watson but who remains a professor in the Department, viewed the immediate need as the ability to invite visiting professors who would add greater depth and diversity to the programs offered by the small regular faculty. It seemed clear to the Foundation that with this added stimulus the Department would develop rapidly into one of the leaders in its field. Accordingly, \$50,000 was granted for the support of five to seven visiting professors over the next five years.

Strengthening
Theoretical
Physics

13

In the life sciences, the Foundation's support under its General Program in 1970 was designed to assure the continuity of certain existing programs. One of these, the work of the Committee on Mathematical Biology at the University of Chicago, is characterized by increasing rigor in the analysis of diverse biological phenomena. The Committee, soon to become a department of the University, applies mathematical analysis to certain areas of biology—principally neurobiology, developmental biology, and population biology—in an effort to develop quantitative theory which will encompass a broad range of biological events. Its chairman, Prof. Jack D. Cowan, has assembled a faculty of 13 members, eight of whom hold joint appointments in such other departments as physics, mathematics, physiology, and information science.

The Committee on Mathematical Biology has been assisted during the past two years by a \$400,000 grant from the Sloan Foundation, as well as by University and government funds. Over the next three years Professor Cowan hopes to add four full-time faculty members, to continue to bring in distinguished visitors, to support increased numbers of graduate students and postdoctoral fellows, and to strengthen computer, library, and research facilities. The Foundation, after a review of progress during the past two years, agreed to contribute to the support of these further developments by a grant of \$350,000, payable in decreasing amounts through 1972.

At the Massachusetts Institute of Technology a multidisciplinary group of scientists and engineers is attacking a problem of immediate general concern: how to increase the world protein supply by means of a nonagricultural technology. The group, supported in part since 1968 by a Sloan grant of \$400,000, seeks to learn to produce edible protein in commercial amounts by growing single-celled organisms upon a hydrocarbon or carbohydrate base. The resulting "single cell protein," when and if perfected, could make a major contribution to alleviating the prevailing shortage of protein in many nations of the world.

The present line of attack is to identify or develop microorganisms whose use seems economically feasible, to find the best ways of processing them and extracting protein from them, and to eliminate unwanted effects of ingestion of the protein by humans. In this effort, MIT's Department of Nutrition and Food Science has brought together a team of engineers, microbiologists, biochemists, food technologists, toxicologists, and clinicians, to study at basic levels the problems which thus far have inhibited the widespread production and use of single cell protein. Graduate students are being trained to carry on the work. The Foundation, after a review of the program in 1970, agreed to provide continuing core support of \$200,000 for a third year, and to provide up to \$100,000, subject to matching requirements, for a fourth year.

Single Cell
Protein Study
Continues

The largest and broadest, as well as the oldest, of the programs in the life sciences assisted by the Foundation is that of the Sloan-Kettering Institute for Cancer Research, which seeks through fundamental research to define and ultimately to control those biological phenomena which go by the name of cancer. As the complexity of the disease, rooted in the very nature of life itself, has become recognized, the search for its cause has enlisted the interest of scientists in an ever-widening variety of disciplines. Currently the Institute seeks greater understanding of the disorder through the use of clinical investigations and drugs, and through studies in immunology, biophysics, biochemistry, oncogenesis, virology, cell biology, cytology, genetics, endocrinology, and biomathematics. Along with its research programs the Institute trains new researchers at both the predoctoral and postdoctoral levels.

For the second consecutive year, rising costs of research coupled with a leveling off of Federal research support placed the Sloan-Kettering Institute in a serious deficit position. Through curtailment and outright discontinuance of some of its research activities the Institute managed to reduce its projected 1970 operating deficit to \$1.2 million, somewhat less than the deficit of \$1.6 million in 1969. Under a prior agreement with the Institute the Foundation granted a request for \$600,000, or half the projected 1970 deficit. Together with the Foundation's regular annual support of \$400,000, this brought Foundation support of the Institute to \$1 million in 1970.

The Foundation's support of the Sloan-Kettering Institute continues to be provided from the General Motors Dealers Appreciation Fund for Cancer and Medical Research. The Fund was established in 1948 by gifts totaling \$1,525,000 from the dealer organization of General Motors, in appreciation of Mr. Sloan's contributions as chief executive officer of General Motors Corporation. Grants may be made from both the income and the principal of the Fund.

Another specific focus of the Foundation's scientific interests has been the investigation of disorders of hearing. Over the past decade the Foundation has granted some \$931,000 to the Deafness Research Foundation, which sponsors research on hearing disorders, assists young scientists in entering this field, and conducts an educational program to stimulate awareness of the seriousness of the problem. It is estimated that one in ten Americans suffers from some degree of hearing loss or ear disorder, but until the Deafness Research Foundation was organized in 1958 this was a relatively neglected area of research. Since then the Deafness Research Foundation has directed more the \$3 million into ear research and related objectives, and has helped to stimulate support from other private and governmental sources. As a result, basic knowledge of the structure, func-

Research
on Cancer . . .

. . . and on
Deafness

tions, and dysfunctions of the ear has greatly increased over the past few years. In part this has been due to a Temporal Bone Banks Program, initiated by the Deafness Research Foundation and the American Academy of Ophthalmology and Otolaryngology, through which persons having hearing disorders are encouraged to bequeath their inner-ear structures for use in otological research.

As was noted in the Sloan Foundation's Report for 1968, Trustees of the Foundation agreed in that year, while approving a \$316,250 grant to the Deafness Research Foundation, to consider a suitable terminal arrangement for this support in 1970. This decision was reaffirmed in 1970 by the award of a final grant of \$263,000. These funds will help to sustain the work of the Deafness Research Foundation while it seeks funds from other sources to replace Sloan support. This grant brought the Foundation's over-all commitments for ear research through the Deafness Research Foundation to slightly more than \$1,194,000.

These other grants for the advancement of science and technology were awarded in 1970:

ASPEN CENTER FOR PHYSICS, Aspen, Colo.: For terminal support of the operating expenses of the Center (formerly the Physics Division of the Aspen Institute for Humanistic Studies) \$20,000

CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.: For support of Dr. Aron Kuppermann's research in electron scattering spectroscopy . . . \$10,000

UNIVERSITY OF CALIFORNIA, Berkeley, Calif.: For partial support of the first step in adapting a mass spectrometer to the sensing of minute particles in air and breath, under the direction of Prof. Kenneth Street, Jr., at the Lawrence Radiation Laboratory \$20,000

UNIVERSITY OF CAMBRIDGE, Cambridge, England: In partial support of the research of Dr. Derek T. Whiteside on the mathematical thought of Sir Isaac Newton \$20,000

UNIVERSITY OF CHICAGO, Chicago, Ill., two grants:
In partial support of a "Special Year" to encourage interaction between the fields of applied mathematics and analysis \$15,000

Toward support of the 1971 meeting on statistical mechanics of the International Union of Pure and Applied Physics, to be held at the University of Chicago \$ 5,000

YALE UNIVERSITY, New Haven, Conn.: To help support the Second American Peptide Symposium, held in Cleveland in August of 1970 . . . \$ 750

Education



MAJOR new grants in education during 1970 were closely related to the Foundation's interests in science and technology. A group of grants will assist ten institutions in educating design-oriented engineers, and another award will enable Tufts University to inaugurate a new and flexible program of study in engineering and science.

Engineering education has occupied a substantial share of the Foundation's attention for more than a decade. In 1961 and 1962, grants of \$1,000,000 each were made to six universities (Brown, Dartmouth, Johns Hopkins, Notre Dame, Princeton, and Rochester) to strengthen the basic-science component of engineering education; Yale University received a similar grant in 1966. In these and other ways the Foundation sought to increase the competence of engineers in the physical sciences upon which engineering is so largely based.

In more recent years, as the nation's urban, environmental, and social problems have grown, it has become apparent that more and more of the problems facing engineers demand a sophistication and a sensitivity to economic, social, and other factors which earlier models of engineering education did not emphasize. Among the first to recognize this fact was Dartmouth College's Thayer School of Engineering which, with the aid of its 1962 Sloan grant, began to reorient its curriculum around the concept of creative design. The Foundation made an additional grant of \$1.5 million to Dartmouth in 1967 to facilitate this "pilot" development in engineering education. Grants of \$600,000 each to Harvey Mudd College and Rensselaer Polytechnic Institute in 1969 also were intended partly to strengthen design-centered education at those schools.

*New Demands
on the Skills
of Engineers*

Design concepts are enriching engineering education at a number of institutions including Clarkson College of Technology, right. Professors and students discuss computer output from an interdisciplinary project on regional planning.



A Lehigh University design team of students from three engineering departments studies a solid-waste-disposal problem, above. At Northwestern University, right, a faculty design project involves a car-following device which would avert collisions.



"Design centers" at Polytechnic Institute of Brooklyn encourage undergraduate students to explore creative engineering ideas. The students above designed and built this experimental helicopter as part of their undergraduate work.



Computer-assisted design demonstration at the University of Pittsburgh, left, introduces students to a powerful engineering tool. At the University of Santa Clara, above, students and a professor check out a hybrid electric vehicle designed and built by undergraduates.



By 1970 the need for new approaches to the design of educational, health-care, and municipal systems was apparent to all, and it was evident that the application of purely technical criteria to such problems would not yield the proper solutions. The demand for a "new breed" of engineer in society and the eagerness of many students to grapple with "real world" problems while still undergraduates have stimulated a movement toward design-oriented education in many of the nation's engineering schools. The Sloan Foundation endeavored to encourage this movement by the award of ten grants totaling \$2 million in 1970.

Design education implies no diminution in the role of the basic sciences in engineering education; institutions which received these grants are characterized by strong departments of mathematics, physics, and chemistry. In addition they are, of course, committed to an emphasis on creative design in the education of undergraduates in at least one engineering department. Their programs include large elements of humanities and social sciences, to insure that the impact of the engineer's work on the rest of society will be clear to the student engineer. The institutions' programs are guided by strong faculty and administrative leadership, and frequently by the participation of design-experienced engineers from government and industry.

Amounts awarded range from \$100,000 to \$300,000, payable at the rate of \$100,000 a year. The recipient institutions, together with brief descriptions of their programs, are as follows:

CASE WESTERN RESERVE UNIVERSITY, \$300,000. This institution will expand a program in its School of Engineering whereby senior students in electrical engineering and other divisions develop design projects, often in collaboration with a local Cleveland firm, and present the results to a jury of faculty and industry engineers. It will revise and expand its offerings in computer-assisted mechanical and structural design. It plans to expand its capability for teaching the computer-assisted design of complex systems in cooperation with industry and to develop detailed examples of such systems for experimental study by students in the laboratory.

CLARKSON COLLEGE OF TECHNOLOGY, \$200,000. Clarkson plans a Creative Engineering Design Program beginning with the freshman year and extending through all four years in all engineering departments. Freshmen will be introduced to computer science, graphics, engineering design, and the systems approach to problems of society, and will be encouraged to undertake simple projects. Through seminars, independent study, team design projects, and close student contact with faculty and external lecturers, Clarkson expects to maintain an emphasis on systems design throughout the student's education. Problems of economic development in northern New York State will be used as a focus for some design studies.

UNIVERSITY OF DETROIT, \$200,000. This University plans to experiment further with the formation of design "companies" made up of graduate and undergraduate students, possibly including freshmen. The companies would work on problems of authentic social significance, such as the design of a mobile multiphasic health screening unit or the development of a product which could be manufactured in inner-city areas, to provide jobs where they are needed. After the experimental

program has been adjusted and repeated on an expanding scale, the University of Detroit plans to issue a report on the experiment and to hold a summer Design Institute to share its experience with engineering educators from other schools.

DREXEL UNIVERSITY, \$100,000. By establishing a continuum of undergraduate design courses in its Department of Mechanical Engineering, Drexel (formerly Drexel Institute of Technology) expects to create a model of design education which will be implemented in time throughout its College of Engineering. New freshman and junior-year courses will be developed, and the existing senior design projects course will be substantially enriched. Efforts will be made to increase the design experience of students during the time they spend with industry and government under Drexel's cooperative education program.

LEHIGH UNIVERSITY, \$100,000. Through an Interdisciplinary Engineering Design Program, Lehigh will initiate year-long projects in the design of large and complex systems involving as many as 50 undergraduates from diverse engineering disciplines in collaborative efforts. An example of such a project would be the design of a saline-water-conversion and chemical-recovery power plant, requiring attention to power plant design, fresh water production, brine processing, and environmental and economic considerations. Community, governmental, and industrial organizations are expected to assist in identifying suitable problems for study and in consulting on the design projects.

NORTHWESTERN UNIVERSITY, \$300,000. Building upon a substantial existing design program in the Design and Development Center of its Technological Institute, Northwestern plans to increase the interdisciplinary design experience of its students in three principal ways. Large numbers of undergraduates will be assembled into small design teams, each working on some facet of a major and complex design problem; final recommendations will be presented formally to a panel of faculty and outside engineers for evaluation. Faculty members will be encouraged to undertake real design projects in such areas as urban systems, involving students in various phases of the projects as the work progresses. A research seminar of faculty and advanced graduate students will seek to develop new design methodologies, techniques, and teaching approaches.

UNIVERSITY OF PITTSBURGH, \$200,000. Pittsburgh's School of Engineering will link an intensified effort in design education to its new Environmental and Urban Studies program. New design problems relevant to societal needs will be developed for an existing freshman course, a new junior-year course, and a senior design project. At the junior level, students will be working on problems drawn from the industrial and governmental sectors of the Pittsburgh area, and will have an opportunity to see their solutions tested. At the senior level, "specialists" from various departments will collaborate on still more complex designs, working much as they would after graduation.

POLYTECHNIC INSTITUTE OF BROOKLYN, \$300,000. The Institute plans several innovations in its Engineering Division which will add a greater interdisciplinary dimension to its education in design, now primarily a departmental function. New undergraduate courses and course materials will offer an early introduction to the philosophy and methods of design. Summer internships after three years of study will involve students in real design problems in government, industry, and hospitals. The use of the computer as a design tool will be taught more extensively. Design project centers, in which senior students undertake their most complex undergraduate design efforts, are to be expanded and further developed. As at several other

institutions, a design-experienced faculty committee will guide the improvements in design education.

UNIVERSITY OF SANTA CLARA, \$100,000. Santa Clara plans a new four-year undergraduate program oriented toward systems engineering, with emphasis on ecological problems as exemplified by pollution. A new freshman course in physical-biological ecology will replace the present freshman chemistry course. The second year will include a sequence on human ecology, and during the third and fourth years, in applied ecology, the student will be engaged in the design of large systems of increasing complexity, such as power-distribution and transportation systems. During the third and fourth years the student will be involved in practical work with an industry or agency in the San Francisco Bay area, and in the summer between those years he will serve an internship with that industry or agency. Santa Clara also plans to bring visiting scholars and industrialists to the campus, and to work with professional societies to enhance the systems orientation of employed engineers.

WORCESTER POLYTECHNIC INSTITUTE, \$200,000. An Environmental Systems Study Program, which is to be an interdisciplinary effort based on the project approach to education, will be initiated. It will focus on the solution of environmental problems using systems methods of analysis and design. A key element in the program will be the assignment of students to work off-campus on problems facing industrial and governmental organizations. Other member schools of the Worcester Consortium for Higher Education will be invited to participate in such areas as sociology, psychology, public health, ecology, and meteorology, to help insure the necessary breadth of the program.

Like most of the institutions which received Sloan grants for engineering design education in 1970, Tufts University has been concerned about the desire of many students to devise for themselves programs of study which they perceive as relevant to serious problems of society. In the Tufts College of Engineering, a limited number of freshman students and faculty members took part in 1969-70 in a Unified Science Study Program in cooperation with the Massachusetts Institute of Technology. A Sloan grant of \$10,000 assisted Tufts in this participation.

Tufts then proposed to establish a Unified Science Study Program independently on its own campus, and to increase the number of freshman and sophomore students enrolled in it to about 40. The program permits students, under faculty supervision, far greater latitude than the usual highly structured engineering curriculum. Students are encouraged to develop projects of interest to them, to read widely, and to choose their own courses, or to ignore formal course work and carry out their own supervised programs. They work at their own pace, which may be faster than usual for gifted students or slower than usual for those who are less well prepared. The objective is to offer an alternate means of entry into engineering and science for selected and highly motivated students. Students would enter the regular curriculum after one or two years in the Unified Science Study Program.



Unified Science Study Program at Tufts University encourages individualized and self-directed study by selected freshman and sophomore students. Dr. John Sununu, left, associate dean of engineering, directs the program which involves about 40 students.

The Tufts program is distinctly experimental, and its potential value as a model for similarly innovative programs in other schools made it appear to warrant encouragement. The Foundation approved a grant of \$273,000 in support of the first three years of the Tufts Unified Science Study Program.

An earlier group of Foundation grants to strengthen the teaching of science in 20 private liberal arts colleges led to a conference at Williams College in 1970 of representatives of the 20 colleges and other educators. Topics for discussion included new science programs initiated by the 20 colleges and prospects for sustaining them after expiration of the five-year Foundation grants, which totaled \$7.5 million, in 1972. The conference was supported by a grant of \$15,000 to Williams College. (A discussion of the Foundation's College Science Program appears in the Report for 1966, pp. 10-14.)

In its more generalized support of undergraduate education, the Foundation has operated principally through a program of scholarships at 45

*A Concern
for Science
in Colleges*

colleges and universities in the United States. The Alfred P. Sloan National Scholarship Program, which began on a small scale in 1953, awarded its final four-year scholarships to 146 freshmen who entered college in September of 1970. Since its inception the Program has assisted more than 2,000 students at a total outlay of \$15 million. The final appropriation of \$1.2 million for the Program was made in 1969.

Programs to strengthen certain predominantly black colleges and in other ways to expand higher-educational opportunities for minorities have received Foundation support for a decade or longer. Currently the bulk of this effort is concentrated in a Particular Program to expand opportunities for minorities in the two professions of management and medicine (see "Expanding Professional Opportunities," pp. 39-45).

An earlier project to help certain black institutions strengthen themselves is known as the Cooperative College Development Program. By 1970 thirty member colleges in this Program had raised a total of \$9,190,142 from private sources over a two-year period, matching several times over a Foundation offer of a collective \$900,000 extended in 1967. Four member institutions, chosen by the Program's advisory council, received additional awards of \$25,000 each for exceptional achievements in development. The four were:

Tuskegee Institute, Tuskegee Institute, Ala., for the best-coordinated and most effective development effort of any institution in the Program;	Meharry Medical College, Nashville, Tenn., for the largest year-to-year increase in contributions from private sources within its state, and
Hampton Institute, Hampton, Va., for the greatest year-to-year increase in alumni giving;	Lincoln University, Lincoln University, Pa., for the greatest total of alumni and in-state giving in 1968 and 1969.

The Foundation's four-year operational support of the Cooperative College Development Program, provided through the Phelps-Stokes Fund, ended in 1969 but the Program is continuing in modified form with other support.

An internally operated project to strengthen admissions and financial aid procedures at the 34 member colleges of the United Negro College Fund continued in 1970. The project is directed by Robert K. Hage, director of financial aid at Dartmouth College, who has been serving as a consultant to the Foundation. Mr. Hage has conducted evaluations of financial aid operations at 23 of the colleges, and more evaluations are scheduled. Twenty-seven of the colleges were represented at a four-day seminar on admissions practices held at Knoxville College in July.

Other grants for educational purposes reflected the Foundation's continuing interest in opportunities for minorities, and in science education, public understanding of science, and related areas of education:

Black Schools
Counseled
on Admissions

AUTOMOTIVE SAFETY FOUNDATION, Washington, D.C.: For terminal support of Alfred P. Sloan Awards for efforts to promote highway and pedestrian safety through the mass media, a program now sponsored by the Highway Users Federation for Safety and Mobility	\$ 9,250
A BETTER CHANCE, New York, N.Y.: For a study of the effectiveness of the A Better Chance program in preparing disadvantaged students for college careers through private preparatory schools	\$20,000
COLUMBIA UNIVERSITY, New York, N.Y.: For support of a 1970 summer program in the physical and life sciences for disadvantaged students, principally from the Harlem area	\$15,000
COMMITTEE FOR ENVIRONMENTAL INFORMATION, St. Louis, Mo.: For terminal support of <i>Environment</i> magazine	\$15,000
COUNCIL ON FOUNDATIONS, New York, N.Y.: For general support of educational efforts in the foundation field	\$10,000
FIVE COLLEGES, INC., Amherst, Mass.: To assist the Five College Astronomy Department (a joint enterprise of Amherst, Hampshire, Mount Holyoke, and Smith colleges and the University of Massachusetts) in developing a new radio astronomy observatory	\$20,000
THE HAHNEMANN MEDICAL COLLEGE AND HOSPITAL OF PHILADELPHIA: For a planning and feasibility study by the Philadelphia Center for Health Careers of a contingent repayment loan program to assist in financing the education of 2,000 students in six Philadelphia medical schools	\$14,000
KNOX COLLEGE, Galesburg, Ill.: To study and disseminate the results of an experimental program in computer-augmented instruction in accounting	\$ 9,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: To assemble a conference of leading educators to discuss the organization and functions of a proposed National Institute of Education, as authorized by the Congress	\$ 5,000
MOREHOUSE COLLEGE, Atlanta, Ga.: In support of a conference on Teaching of Physics in the Black Colleges, held in May of 1970	\$ 9,850
NATIONAL AFFAIRS, INC., New York, N.Y.: In support of a conference on the issuance of vouchers as a means of financing education	\$14,050
NEW YORK PUBLIC LIBRARY, New York, N.Y.: For general support of the Library's central research collection	\$ 5,000
THE PALACE OF ARTS AND SCIENCE FOUNDATION, San Francisco, Calif.: For planning the development of a participatory exhibit and display material based on elucidation of the mechanisms of human visual perception	\$15,000
PYTZER COLLEGE, Claremont, Calif.: In partial support of a Minority Student Administrative Intern Program, in cooperation with the Human Resources Institute of the Claremont Colleges and with other institutions and agencies in the Claremont area	\$15,000

RESEARCH FOUNDATION OF THE CITY UNIVERSITY OF NEW YORK,
New York, N.Y.: To establish a new method of teaching first-year college
mathematics through the use of individualized and technologically assisted
instruction at Hunter College of the City University of New York . . . \$18,375

STANFORD UNIVERSITY, Stanford, Calif.: For a study of the feasibility
of establishing an educational opportunity bank for students in certain
Stanford professional schools . . . \$20,000

YALE UNIVERSITY, New Haven, Conn.: To support planning of a con-
tingent repayment loan program for the assistance of students in Yale
professional schools . . . \$20,000

Economics and Management



THE behavior of the economy in 1970 under-
scored the need for research leading to a better understanding of economic
developments, and for the training of administrators and policy makers
equipped to deal with the shifting array of forces involved in contemporary
economic, governmental, and social problems.

For some time it has been evident that there exists a need for a process
of continuous monitoring and reporting on the economy and its various
segments which goes beyond both the time-consuming studies of economic
specialists and the "fire fighting" activities of governmental bodies which
necessarily must function at the front line of economic developments. The
Brookings Institution, a private research organization in Washington, D.C.,
proposed to create just such a process through the establishment of a
Brookings Panel on Economic Activity. The Sloan Foundation granted
\$300,000 in major support of the Panel over a three-year period.

The Panel, made up of senior economists and younger persons in the
field, meets thrice yearly with the support of Brookings staff and of senior
advisers. Papers on salient issues, such as housing prospects and price
behavior, are presented and are later published by Brookings along with
summaries of the ensuing discussions. The publications are intended to be
both timely and intellectually rigorous, and at the same time comprehensible

*A Panel
on Economic
Activity*

to non-specialists who require an understanding of economic developments. The first two issues of Brookings Papers on Economic Activity were published in 1970.

Members of the 1970 Brookings Panel on Economic Activity and their affiliations are:

- Charles Bischoff, Yale University.
- Barry Bosworth, Harvard University.
- William H. Branson, Princeton University.
- Robert J. Gordon, University of Chicago.
- Robert E. Hall, University of California (Berkeley).
- Saul H. Hymans, University of Michigan.
- John H. Kareken, University of Minnesota.
- Lawrence B. Krause, Brookings Institution.
- Arthur M. Okun, Brookings Institution.
- George L. Perry, Brookings Institution.
- William Poole, Federal Reserve Board.
- Craig Swan, University of Minnesota.
- Nancy H. Teeters, Brookings Institution.

A Public Policy Program at Harvard

The increasing urgency and complexity of public problems has led to a concern by the Sloan Foundation and others for the education of persons qualified to participate in policy formulation and management in government and other enterprises outside the "for-profit" sector. A new program in the John Fitzgerald Kennedy School of Government of Harvard University addresses itself to this concern. The Kennedy School, in cooperation with other professional schools of Harvard, has instituted a Public Policy Program which will enable a graduate student to obtain both a degree in law, medicine, or management, and the degree of Master in Public Policy or a Ph.D. in public policy. The student is expected to acquire the intellectual skills needed for the analysis of policy and administrative problems in government concurrently with the knowledge required in his most specialized profession. The goal is to develop a new genre of professionally competent and broadly aware public administrators. Toward that end the Foundation granted \$600,000 in partial support of the Public Policy Program at Harvard for three years.

A program focused specifically on the training of urban managers is under development in the Graduate School of Business at Stanford University. The analytical and quantitative techniques successfully employed in business management can be applied to the management of cities, Stanford believes, but it is first necessary to sort out the differences and similarities in these two discrete constellations of management problems. An obvious difference is that decisions on urban management and policy must be made within the context of demands from a wide variety of divergent and competing interest groups.

In order to gain insights into such problems, and before launching its formal new educational program, the Stanford Business School under Dean Arjay Miller plans to devote significant faculty time in the present academic year to establishing closer ties with practicing urban managers. Urban executives, past and present, are being brought to the Stanford campus for varying lengths of time to consult with faculty, and faculty members are being given time to delve into problems of cities at first hand. From this initial phase there should emerge courses and materials designed for students who wish to make careers in urban management, as well as suggestions for research which will deepen understanding of urban problems. The Foundation granted \$75,000 for this planning phase of the Stanford program in urban management.

Several other projects received support on the basis of the Foundation's interest in management:

- LEAGUE OF WOMEN VOTERS EDUCATION FUND, Washington, D.C.: For a study on improving the structure and management of the League and its associated funds \$12,500
- PLANNED PARENTHOOD/WORLD POPULATION, New York, N.Y.: In partial support of a project to develop measures of program effectiveness as a guide to resource allocation \$10,000
- THE URBAN INSTITUTE, Washington, D.C.: To support partially the preparation of a monograph on "Managing New York City" by Frederick O.R. Hayes, former Director of the Budget for New York City \$13,000

Training Urban Managers

Related Problems of Society



THE Foundation in 1970 took the unusual step for it, of setting up a formal study commission, the Sloan Commission on Cable Communications, to investigate ways in which the burgeoning technology of broad-band communications (also described as "cable television") might serve to meet public needs and opportunities, especially in densely settled urban areas.

The Potential of Cable in Cities

Announcing the Commission's formation in June, President Wessel explained: "It is inevitable that within a few years, many or most city dwellers in the United States will be linked by cable television systems that will constitute the most powerful communications system ever conceived. Much of that system will be devoted, as indeed it should be, to entertainment and to news. But there will remain a channel capacity beyond that ever previously put in place, capable of providing a host of urban services for which there has been heretofore no conception."

A key characteristic of the coaxial communications system now coming into being is the sheer volume of communications capacity which it will make available, probably to a majority of American homes. Even now millions of homes are wired for a capacity of 20 to 25 communications channels, and the capacity is moving upward to the range of 40 channels; fore-

seeable developments in the technology make a capacity of 80 to 100 channels likely in the near future.

The central questions are whether this powerful new technology will be developed with due regard for its multiple impacts on the human and social environment, and whether sufficient forethought will take place to insure that the new medium's potential for meeting a number of pressing needs of society will be exploited to the fullest.

It is easy to visualize new opportunities in education, employment and social services, merchandising, community development, library services, and a host of other activities which will be made possible by the new communications capacity. Only slightly less obvious are facsimile services, access to data-processing equipment, and alarm systems—all in addition to the signals now transmitted over the air by the existing television system.

But the broader implications of the new system—and the reason why it requires serious study at this time—involve the very nature of the institutional arrangements which govern the present conduct of the communications enterprise, public and private. The new system's impact on present communications practices cannot fail to be considerable, and its development without full prior consideration of alternatives would, in the Foundation's view, be unfortunate.

To head the Sloan Commission on Cable Communications as its chairman, the Foundation obtained the services of Professor Edward S. Mason, former dean of the Graduate School of Public Administration of Harvard University. The Commission's staff director is Paul L. Laskin, an attorney and consultant to numerous governmental and nonprofit agencies. The Commission has headquarters at 105 Madison Avenue in New York City. It is intended to deliberate until late in 1971, and to issue a public report. The Foundation's Trustees appropriated \$500,000 for the work of the Commission. (A Foundation occasional paper, *Issues for Study in Cable Communications*, by Arthur L. Singer, Jr., is available upon request from the Foundation or the Commission.)

Other members of the Sloan Commission on Cable Communications are:

- Ivan Allen, Jr., former Mayor of Atlanta.
- John F. Collins, former Mayor of Boston.
- Lloyd C. Elam, president, Meharry Medical College.
- Kenneth Gordon, president, the Brookings Institution.
- William Gorham, president, the Urban Institute.
- Morton L. Janklow, New York attorney.
- Carl Kaysen, director, Institute for Advanced Study.
- Edward H. Levi, president, University of Chicago.
- Emanuel R. Piore, vice president, International Business Machines Corporation.
- Henry S. Rowen, president, Rand Corporation.
- Frederick Seitz, president, Rockefeller University.

A Study to Anticipate the Impact

Franklin A. Thomas, president, Bedford-Stuyvesant Restoration Corporation.
 Patricia M. Wald, Washington attorney.
 James Q. Wilson, professor of government, Harvard University.

On a closely related subject, the Foundation granted \$15,200 to the Vera Institute of Justice for a study of the options open to New York City in franchising cable television operations. It is believed that decisions reached in New York will be watched with interest by officials of other cities who face similar decisions on the future shape and structure of cable communications in their communities.

For partial support of a related study of national communications technology and policy, which may provide important inputs to the Sloan Commission's study, the Foundation granted \$20,000 to the Massachusetts Institute of Technology.

Through these other grants the Foundation supported several activities dealing with problems related to the Foundation's General Program interests:

HENRY STREET SETTLEMENT, New York, N.Y.: To develop the program of an Urban Training Center which would familiarize business executives, social-work students, and others with the needs of minority populations in inner-city areas \$20,000

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: two grants:
 For a conference on The Role of University-Based Urban Centers, convened by the Harvard-MIT Joint Center for Urban Studies \$13,300
 Toward a Summer Study on Critical Environmental Problems, held in July of 1970 \$10,000

NAACP LEGAL DEFENSE AND EDUCATIONAL FUND, INC., New York, N.Y.: For renewed support of a project of the Fund to train lawyers to render legal advice in the field of business \$20,000

NAACP SPECIAL CONTRIBUTION FUND, New York, N.Y.: For continued general support of educational activities assisted by the Fund \$20,000

NATIONAL INFORMATION BUREAU, New York, N.Y.: Toward support over a five-year period of the Bureau's services in providing information on charitable organizations \$ 5,000

NEW YORK CITY HEALTH AND HOSPITALS CORP., New York, N.Y.: For emergency support of the School for Medical Laboratory Assistants at Harlem Hospital Center \$20,000

STATE COMMUNITIES AID ASSOCIATION, New York, N.Y.: In partial support of the Governor's Conference on Medical Care and Facilities, held in May of 1970 \$15,000

Particular Programs

THE FOUNDATION'S policy providing for the designation of a limited number of Particular Programs, adopted in 1969, represents an effort to concentrate specified resources over a limited period of time on problems which may be amenable to sharply focused and relatively short-term approaches. A Particular Program may involve the expenditure of from \$10 million to \$15 million over a period of from three to as long as seven years. Continuing internal studies will generate new Particular Programs as existing ones reach their terminal points. The intent is to maintain three Particular Programs in being at any given time.

Currently two Particular Programs are active. One is concerned with development of the new discipline of neuroscience, through which expanded basic research may lead to a fuller understanding of the functioning of the nervous system. The other supports efforts to increase the access of minorities to the professions of medicine and management, largely through educational programs leading to the professional degree. A third Particular Program, adopted at the close of the year and announced in the President's Statement in this Report, will seek to discover ways in which technology may contribute directly or indirectly to increased efficiency in higher education.

It will be clear that these three Particular Programs, while distinct from the Foundation's General Program in method and approach, are grounded in the same general array of interests. Together, they embody those elements of social concern, support of basic research, and applications of technology which have animated the Foundation since its establishment in 1934 by Alfred P. Sloan, Jr.

Neuroscience



THE Foundation's Particular Program in neuroscience, which existed largely in conceptual form at the close of 1969, underwent further definition in 1970 and led to the award of four major grants for research and training.

Neuroscience cannot yet be called a single discipline, but it has the potential, drawing upon other disciplines ranging from neurochemistry to experimental psychology, of coalescing into a powerful new intellectual force capable of breaching the scientific frontier at which patterns of action and behavior become understandable in terms of molecular events in the nervous system. The analytical and conceptual tools are becoming available; what is needed is the establishment of appropriate institutional settings for their use, and the training of more neuroscientists to use them. In time it is hoped that there will emerge those unifying principles which define a discipline and which galvanize thought and energy in ways heretofore unforeseen, just as atomic particle theory and molecular biology revolutionized the thought of earlier generations of scientists.

Basic to progress in this field is the support of those activities which will lead to the establishment of neuroscience as a unified and coherent scientific discipline. Of first priority is the strengthening of the few existing centers of excellence in the field and the development of new centers, together with provisions for training young neuroscientists and for retraining those established scientists from other disciplines who wish to become active in neuroscience. The support of individual, and seminal, neuroscience research projects in a later phase of the program is also a possibility.

Assisting
a Discipline
in the Making

Thus while the Foundation can devote only limited resources and time to the furtherance of neuroscience as a new discipline, it hopes to set the stage for developments which in time will delineate the internal mechanisms through which an organism is able to function in the world around it. Such new knowledge may have extensive implications for man and society, but for the present, further basic research seems to rank first in order of priority.

To advise the Foundation on the evolving shape and direction of the Neuroscience program, a Neuroscience Advisory Committee was appointed, consisting of the following members:

Dr. Max Tishler, Professor of Chemistry, Wesleyan University, Chairman.

Dr. George W. Beadle, President Emeritus and William E. Wrather Professor of Biology, University of Chicago.

Dr. Paul M. Doty, Professor of Chemistry, Harvard University.

Dr. Caryl P. Haskins, President, Carnegie Institution of Washington.

Dr. John L. Kennedy, Visiting Professor of Industrial Management, University of Southern California.

Dr. William Kessen, Professor of Psychology, Yale University.

Dr. Patrick Suppes, Institute for Mathematical Studies in the Social Sciences, Stanford University.

A description of grants approved in 1970 will indicate further how the Particular Program in neuroscience is being implemented:

Cold Spring Harbor Laboratory at Cold Spring Harbor, Long Island, N.Y., has been for the past 25 years a world center for advanced teaching in molecular genetics. Along with its year-round research programs it offers summer training programs which draw upon distinguished faculty from around the world to introduce younger scientists to the laboratory techniques and biological knowledge needed to expand their research interests into new areas.

Recently, under the leadership of Dr. James D. Watson, the Laboratory has begun to broaden its interests into other regions of biology, including neuroscience. The established summer-training format will be adapted to the further education of young postdoctoral students, as well as older scientists, who wish to apply their specialized knowledge of chemistry, physics, mathematics, or other areas of biology to the study of the functions of the nervous system. The result should be an increasing flow of talented scientists into the new discipline. To this end, the Foundation granted to Cold Spring Harbor Laboratory \$450,000, of which \$200,000 is contingent upon its being matched from other sources by the end of 1972. The grant will provide support over a five-year period.

Massachusetts Institute of Technology has an outstanding program in neuroscience. A particular strength of the MIT neuroscience work, directed by Dr. Hans-Lukas Teuber, is its ability to draw upon scientists from the diverse disciplines which can contribute to the advance of neuroscience. The disciplinary boundaries which are at some institutions a chief imped-



Neuroscience research at Massachusetts Institute of Technology draws upon varied disciplines in seeking knowledge of the nervous system. Here a scientist is preparing brain sections for study by light and electron microscopy.

ment to the flowering of neuroscience are being breached at MIT and the result is a group effort applying physical, chemical, and mathematical techniques in gaining an understanding of some of the underlying biological mechanisms of behavior.

MIT, moreover, alone among institutions interested in neuroscience, is projecting an undergraduate curriculum in neuroscience. College students will be exposed to the stimulation of this new field at a time when many of them are making career decisions and may become the neuroscientists of the future.

The Foundation granted \$480,000 for support of MIT's work in neuroscience.

At the Rutgers Institute of Animal Behavior in Newark, N.J., Dr. Daniel S. Lehrman heads a research group which is making strong advances

in relating aspects of animal behavior to chemical and physical events in the brains of the animals being studied. The Rutgers group's contribution to neuroscience lies in its ability, drawing upon the skills of zoologists, psychologists, and anatomists, to study those elemental bits of animal behavior which are associated with the older, simpler parts of the brain. From this work, and from the Institute's training program for graduate students in neuroscience, there will emerge a stronger capacity for interpreting brain-and-behavior phenomena.

As with most neuroscience groups, the Institute of Animal Behavior desires to strengthen its capability in certain areas which can contribute to a fuller range of expertise in its study of the nervous system. The Foundation granted \$240,000 to Rutgers University in support of the Institute of Animal Behavior over a five-year period.

The Salk Institute, a young institution which already has achieved eminence in molecular and cell biology, has decided recently to undertake a concerted study of the nervous system, focusing initially on the functioning of individual nerve cells and the nervous systems of simple organisms. With a core of distinguished resident and non-resident fellows, and with active and projected programs in closely related areas of biology, the Institute offers an environment in which the interdisciplinary work of neuroscience research should be able to flourish.

To implement its new interest in neuroscience, the Salk Institute plans to appoint as senior fellows neuroscientists of established reputation and to provide them with supporting staff and equipment. An expenditure of several million dollars for this purpose over the next five years is envisioned. The Sloan Foundation granted \$600,000 in support of initial appointments over the first two years of Salk's effort to create a new center of strength in neuroscience.

The Foundation made these other grants toward the advancement of neuroscience in 1970:

CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.: In partial support of a conference on The Biological Bases of Human Behavior, held in March of 1970	\$12,500
UNIVERSITY OF MIAMI, Coral Gables, Fla.: For support of a conference on Physical Principles of Neuronal and Organismic Behavior, held at the Center for Theoretical Studies of the University of Miami	\$15,000
UNIVERSITY OF NEW MEXICO, Albuquerque, N.M.: In support of a conference on development of a neuroscience research program, utilizing a chimpanzee colony being discontinued at Holloman Air Force Base	\$ 1,134

Expanding Professional Opportunities



ADDITIONAL grants were made in 1970 to implement the Particular Program in improving the access of blacks and other minorities to the professions of management and medicine. As the Foundation foresaw in 1969 when it selected this pair of problems for a concentrated effort, measures to stimulate the flow of minority students along the long and arduous educational pathway which leads to the M.D. required a longer period of planning and preparation than did analagous measures to increase the numbers of minority M.B.A.'s. Thus grants in 1969 were principally on the managerial side of this Particular Program; in 1970 they began to reflect priority needs which had been identified on the medical side.

It is becoming a matter of wide concern that blacks comprise only 2.2 per cent of American physicians and 3.8 per cent of medical students as contrasted with their 11 or 12 per cent of the population. For other minorities (Puerto Ricans, Mexican Americans, American Indians) complete data are lacking but available figures indicate an even lower representation. The effects on the general health levels of these minority populations are visible in medical statistics such as those on infant mortality.

Any program which seeks to correct this imbalance must take into

*A Shortage
of Physicians
for Minorities*



Meharry Medical College plans to triple its enrollment of future physicians and other health personnel over the next decade. These students are at work in the Master of Medical Science Laboratory.

account the central importance of Meharry Medical College, the only private, predominantly Negro medical school in the country. Since its founding in 1876 Meharry has educated about half the nation's black physicians. While other medical schools are increasing their efforts to enroll minority students, Meharry nevertheless awarded about one-fourth of the M.D. degrees granted to Negroes in 1969.

Meharry Raises Its Sights

For most of its lifetime Meharry has been underfinanced, understaffed, and underequipped. Fortunately this condition is changing. A new president, Dr. Lloyd C. Elam, has been appointed and the board of trustees has been broadened. A comprehensive improvement program, capitalizing on the College's unusual strength in community medicine and health-care delivery, has been developed, and a tripling of the student body has been projected over the next ten years. To underwrite this improvement and expansion, and to achieve a measure of financial stability, Meharry has launched a campaign to raise \$88 million and has made impressive progress toward that goal.

A key element in Meharry's planned development is the strengthening of instruction in the basic medical sciences, which provide the intellectual foundation for the practice of medicine. To accomplish this, along with the projected expansion in number of students, the College expects to add 35 new faculty members over the next five years. Toward this planned enlargement of faculty in basic and applied science, the Foundation contributed \$1 million.

Important as it is to strengthen a pivotal institution like Meharry, it is unrealistic to expect any large increase in the number of minority students seeking medical careers unless they can look forward to financial aid sufficient to see them through their medical studies. Over the past several years, while the quality and quantity of health care available to minorities has been emerging as a major social concern, aid to medical students under Federal and some private programs actually has decreased. Various special programs, both precollegiate and undergraduate, have encouraged minority students to prepare and apply for admission to medical schools; but many schools find themselves in such financial straits that they are hard-pressed to maintain even their present enrollments and programs, let alone provide the financial aid which their increasing numbers of minority students require. Thus many potential physicians, and especially black physicians, are lost to a society which sorely needs them.

This emergency situation (for it is that) throws into sharp relief the role which National Medical Fellowships, Inc., has to play at this time. National Medical Fellowships (NMF), which has provided scholarships for Negro medical students since 1946 (and with partial Sloan Foundation support since 1959), has set out to expand greatly its activities and its base of support for assisting Negro and other minority students in medicine. Established in Chicago by Dr. Franklin C. McLean and now headed by Dr. Robert C. Stepto as president, NMF has had long experience in appraising both the need and the potential of minority students applying for admission to medical schools. Now, with an augmented staff, with a New York office, and with expanding contacts among funding sources and in the medical-education community, it expects to play increasingly a central role in stimulating the flow of blacks and other minorities into the medical profession.

NMF's financial projections are geared to the sharply rising number of minority medical-school entrants which will be necessary if these groups are ever to achieve adequate representation in the profession. Its own experience suggests the trend: in 1968, NMF assisted 134 students; in 1969 this number doubled to 270, and for 1970 it more than doubled again to 598. The total amount of the 1970 awards was \$920,000. Even so, NMF had to reject a significant number of qualified applicants, and its average

The Problem of Financing More Students

A Doubling and Redoubling in Numbers



A junior-college graduate continues his premedical studies under a Sloan-assisted program at the University of Miami.

stipend of around \$1,500 was so minimal in terms of the high cost of medical education that students whom it assisted also required substantial help from the schools they attended.

The Foundation in 1970 granted \$345,000 to National Medical Fellowships, of which \$45,000 went toward NMF's increased operating expenses. Of the remainder, \$100,000 was for renewals of fellowships which the Foundation underwrote on an emergency basis in 1969, and \$200,000, matched from other sources, was allocated for new fellowships. It is clear that NMF will have to expand greatly its base of support if the challenge of equalizing opportunity in medicine is to be met. The Foundation also granted \$15,000 to NMF during 1970 to enable it to obtain consulting services for the design and development of a comprehensive fund-raising program.

A third element in the Foundation's efforts to expand opportunities for minorities in medicine was the support of programs designed to expand the pool of qualified minority aspirants to careers in the health professions. Projects to enhance the motivation and academic qualifications of students from the secondary through the collegiate level were supported at various institutions.

42 Harvard Medical School received \$75,000 in partial support of the 1970 session of its Health Careers Summer Program. The program brought

to Harvard some 100 minority college students, half of them returning from the previous year's summer program, for eight weeks. Their studies consisted of regular Summer School course work in medicine-related subjects; academic-tutorial work in groups of three or four with one tutor; and clinical-tutorial work with Medical School faculty at Harvard-affiliated hospitals. Counseling helped students define career goals. Harvard encourages other medical and dental schools to recruit these students for their entering classes, and enrolls some in its own medical school.

The University of Miami received \$75,000 for a novel program to recruit ten graduates of paramedical courses at Miami-Dade Junior College into premedical undergraduate studies. These carefully selected students, having demonstrated an interest in medicine, will be assisted by means of individually designed courses of study, tutoring, counseling, and necessary financial aid to complete their junior and senior years of college in preparation for admission to medical school.

Williams College received \$60,000 to conduct a Summer Premedical Program in 1970 and 1971 for high-school graduates interested in careers in medicine or related sciences. The students, 20 each summer, take special courses in mathematics and chemistry designed to equip them better for the pressures of college work. They hear discussions of careers in medicine by guest speakers, often black physicians, and visit neighboring medical schools to inspect facilities and talk with faculty members. Most of them subsequently enroll as freshmen at Williams, which regularly sends about 15 per cent of its graduates to medical schools; some go to other colleges to prepare for medical studies.

In the continuing effort to achieve equality of opportunity in medicine and equal access to medical care, a fully articulated plan for the attainment of specific goals has been needed for some time. Such a plan now exists in the report of a Task Force of the Association of American Medical Colleges which was issued in April of 1970. The report maps the educational pathway from secondary school to the M.D. degree and identifies critical points at which special efforts must be made to retain minority students in the premedical and medical stream. Greatly expanded financial aid, more and better counseling, and expanded medical-school class sizes are recommended as a means of increasing the proportion of minority medical students to 12 per cent by 1975. A Sloan grant of \$20,000 in 1969 supported the work of the task force and the preparation of the report under the direction of Dr. Bernard W. Nelson, dean of student affairs at the Stanford University School of Medicine. The report was accepted by an Inter-Association Committee made up of representatives of the American Medical Association, the National Medical Association, the American Hospital Association, and the Association of American Medical Colleges.

Motivation
for Careers
in Medicine

Expanding
the Pool
of Aspirants

43

Implementation of the AAMC Task Force recommendations now rest with the health professions, medical schools, government, foundations, health-related industries, and all other groups which might contribute to the solution of the problem. The Foundation granted an additional \$20,000 to the AAMC in 1970 to enable it to monitor progress toward the goals set forth in the report.

Additional grants having similar objectives were made as indicated:

CASE WESTERN RESERVE UNIVERSITY, Cleveland, Ohio: For partial support of an enrichment program to motivate and prepare minority students for admission to medical school \$12,500

MEDICAL CARE AND EDUCATION FOUNDATION, INC., Boston, Mass.: For a series of planning conferences among New England medical schools and major colleges on increasing the number of minority students in medicine \$15,000

RESEARCH FOUNDATION OF THE STATE UNIVERSITY OF NEW YORK, New York, N.Y.: For a summer health science program designed to recruit undergraduates and high-school students into premedical training, conducted by the Downstate Medical Center of the State University of New York \$10,000

In the sphere of management and business, as in medicine, special efforts are needed to ensure that the minority person will have the opportunity to make his full contribution to an important aspect of American life. A consortium of ten leading graduate management schools,* the Council for Opportunity in Graduate Management Education, was designed specifically for this purpose and received initial support from the Foundation late in 1969. In 1970 it became operational and engaged as its executive director Hughie E. Mills, on leave as assistant director of admissions and student affairs at Columbia University, where the Council is based.

The Council and its constituent schools work across the spectrum of activities required to increase the flow of minority students through graduate management programs and into positions of responsibility in the administration of corporate, nonprofit, and public institutions. A first step is to make information about careers in management available to minority students who often are unaware of such opportunities. Through counseling, financial aid, the provision of course work relevant to the student's goals, and

* The Council for Opportunity in Graduate Management Education is made up of the graduate management schools of the University of California-Berkeley, Carnegie-Mellon University, University of Chicago, Columbia University, Cornell University, Dartmouth College, Harvard University, Massachusetts Institute of Technology, University of Pennsylvania, and Stanford University.

professional placement services, the student is enabled to attain the Master of Business Administration degree and to make use of his training in productive ways. The Council awarded its first graduate fellowships to 159 students entering the ten schools in the fall of 1970.

Additional grants sought by various means to contribute to expanding opportunities for minorities in the management profession:

ATLANTA UNIVERSITY, Atlanta, Ga.: For a cooperative planning study by the Atlanta University School of Business Administration and the Northwestern University Graduate School of Management on ways to develop and strengthen joint programs of the two schools \$19,000

CENTER FOR POLICY RESEARCH, New York, N.Y.: For a study of the black executive in large companies \$20,000

WASHINGTON UNIVERSITY, St. Louis, Mo.: For a planning study by the Consortium for Graduate Study in Business for Blacks to identify the recruitment, financial, and curricular requirements of a program of management education for the public and nonprofit sectors \$20,000

Foundation Operations



THE areas of interest within which the Alfred P. Sloan Foundation is prepared to entertain proposals are indicated in preceding sections of this Report. To recapitulate, they are science and technology, with emphasis on basic research; education, especially higher education in science and engineering; economic research and the education of managers for both public and private enterprises; and problems of society amenable to scientific, technological, and educational approaches. Through its Particular Programs the Foundation expresses more specialized interests in expanding minority opportunities in management and medicine, in the emerging discipline of neuroscience, and in the use of technology in higher education.

Proposals within these areas of interest are welcome, and need not conform to any specific format so long as enough information is presented to make possible a reasoned judgment concerning the proposal's merits and its degree of priority among the many proposals which are always before the Foundation. It will be understood that not all meritorious requests can be accorded an affirmative response, because of limitations on the Foundation's resources.

46 Necessary policy restrictions mean that proposals in certain areas can not be considered for support. These areas include the creative and performing

arts, religion, and the humanities. Medical research is supported only through the Sloan-Kettering Institute for Cancer Research. The Foundation does not provide funds for endowment, for general support of institutions, or for buildings. No grants are made directly to individuals.

Many proposals originate in informal discussions or letters of inquiry to the Foundation. If a formal proposal is received, and if the officers and staff conclude after study that it warrants support, an appropriate recommendation is made to the Trustees for decision. Once a grant has been approved, a schedule of reporting on its progress is established to meet the requirements of good philanthropic practice and the applicable laws.

The Trustees, officers, and staff responsible for this operation are listed in the front matter of this Report. The Foundation gained three new Trustees in 1970 and lost one to the obligations of public service. The new Trustees are:

—Franklin A. Long, Henry Luce Professor of Science and Society and director of the Program on Science, Technology and Society at Cornell University.

—Albert L. Williams, chairman of the executive committee of International Business Machines Corporation.

—R. Manning Brown, Jr., president and chief administrative officer of New York Life Insurance Company.

Arthur K. Watson, vice chairman of the board of International Business Machines Corporation, resigned from the Foundation's Board in May after his nomination and confirmation as United States Ambassador to France.

These changes in staff occurred:

Stephen White, who became a Program Officer of the Foundation in September of 1969, was elected a Vice President of the Foundation by the Board at its meeting in December of 1970.

James D. Koerner, an author and consultant in the field of education, joined the Foundation as a Program Officer in September of 1970. Previously he was senior research fellow at Education Development Center. Dr. Koerner has served as executive director and president of the Council for Basic Education, and has taught at Kansas State University and Massachusetts Institute of Technology.

Robert M. Ogden was succeeded in mid-year as Secretary and Treasurer by Joseph W. Brinkley, who resigned at the end of the year and was succeeded by William B. Mebane. Mr. Mebane has been associated with the treasurer's office of General Motors Corporation since 1954. He is a native of Texas who holds degrees from Texas A&M University and the Harvard Graduate School of Business Administration.

Larkin H. Farinholt, formerly Vice President of the Foundation,

reached mandatory retirement age during 1970 and became a full-time consultant to the Foundation on October 1. Arnold J. Zurcher retired as a consultant on October 31. Robert K. Hage, who had been on leave as director of financial aid at Dartmouth College for the past two years to serve as a consultant to the Foundation, became a part-time consultant in July.

* * *

DURING 1969 the officers and staff devoted considerable effort to formulating a policy for the Foundation with respect to evaluation of its grant-making activities. Their conclusion was that the Foundation should seek to go beyond the usual evaluative procedures, which were intended to assure that the purposes of a grant were carried out and the funds responsibly expended; in addition, the Foundation should look upon the evaluative process as a means of improving its own grant-making procedures and of rendering more effective its own operations. A proposal to this effect was presented to the Trustees and approved in December, 1969. Two such evaluations of major Foundation activities were undertaken and completed during 1970.

Information received by the Foundation in the course of evaluations is confidential. The Foundation regards this condition as essential to preservation of the integrity of the evaluative process.

A description of the Foundation's rationale on this subject has been published as an occasional paper entitled *Evaluation of Foundation Activities*, by Stephen White, and is available from the Foundation.

Financial Review

Financial Review



THE financial statements of the Foundation, which have been audited by Haskins & Sells, independent certified public accountants, appear on pages 55 to 67. They include the balance sheet, the statement of income and funds, the schedule of marketable securities and the summary and schedule of grants and appropriations.

Investment and other income in 1970 amounted to \$12,378,391, after provision for Federal excise tax of \$512,000. This compared with total income of \$14,524,314 in 1969. The decrease of \$2,145,923 was due principally to lower investment income of \$1,391,320 in dividends and interest received and to the Federal excise tax of \$512,000 applicable to 1970 income. Income in 1969 also included income of \$246,651 received as residuary legatee from the Estate of Alfred P. Sloan, Jr.

The total of grants and appropriations authorized and administration expenses during 1970 amounted to \$12,401,029, or slightly in excess of investment and other income of \$12,378,391. Grants and appropriations totalled \$11,341,225 while administration expenses amounted to \$1,059,804. Over the Foundation's thirty-six year history, the cumulative excess of grants and expenses over income has amounted to \$43,145,324.

The total of grant and appropriation payments in 1970 was \$15,819,235, compared with \$15,807,734 in 1969. Together with administration expenses, the total of cash expenditures in 1970 was \$16,879,039, compared with \$16,868,734 in 1969.

A disposition of funds summary showing the sources of funds and their application is presented below:

SOURCE OF FUNDS:

Investment and other income—net	\$12,378,391	
Net profit on disposal of securities	<u>570,122</u>	\$12,948,513
Federal excise tax accrued but not payable until 1971		<u>512,000</u>
		13,460,513

APPLICATION OF FUNDS:

Grant and appropriation payments	15,742,831	
Special projects	<u>76,404</u>	
	15,819,235	
Administration expenses	<u>1,059,804</u>	16,879,039

DECREASE IN FUNDS CONSISTING OF:

Decrease in ledger value of investments	3,081,670	
Decrease in cash balances	<u>336,856</u>	\$ 3,418,526

A comparative summary of the Foundation's assets at quoted market values at December 31, 1970 and December 31, 1969 follows:

	DECEMBER 31, 1970		DECEMBER 31, 1969	
	AMOUNT	PERCENT OF TOTAL INVESTMENTS	AMOUNT	PERCENT OF TOTAL INVESTMENTS
Fixed Income Securities:				
U.S. Government and agency obligations	\$ 33,077,323	10.4%	\$ 33,343,217	11.0%
Other bonds and notes	23,898,920	7.5	22,363,290	7.5
Total fixed income	<u>56,976,243</u>	<u>17.9</u>	<u>55,706,507</u>	<u>18.5</u>
Common Stocks:				
General Motors	124,023,613	38.9	106,498,537	35.2
All other	137,476,417	43.2	139,941,829	46.3
Total common stocks	<u>261,500,030</u>	<u>82.1</u>	<u>246,440,366</u>	<u>81.5</u>
Total investments	<u>318,476,273</u>	<u>100.0%</u>	<u>302,146,873</u>	<u>100.0%</u>
Cash	<u>380,531</u>		<u>717,387</u>	
Total assets at quoted market values	<u>\$318,856,804</u>		<u>\$302,864,260</u>	

A summary of grants by major classifications followed by a listing of grants made during 1970 will be found on pages 62-67. Grants and

appropriations authorized and payments for the year ended December 31, 1970 are summarized in the following table:

Grants and appropriations unpaid	
January 1, 1970	\$20,454,514
Authorized during 1970	<u>11,341,225</u>
	31,795,739
Payments during 1970	<u>15,819,235</u>
Total grants and appropriations authorized but not due at December 31, 1970	<u>\$15,976,504</u>

Income from investments credited to the General Motors Dealers Appreciation Fund during 1970, after provision for Federal excise tax, amounted to \$418,329. Grants authorized and applied against this Fund totalled \$1,000,000, representing grants to the Sloan-Kettering Institute for Cancer Research, as set forth on page 15. Grant payments from this Fund during the year 1970 amounted to \$2,056,250, which resulted in grants outstanding and unpaid at the end of 1970 of \$3,500,000, compared with \$4,556,250 a year ago.

After taking account of the foregoing, the net worth of the Foundation at December 31, 1970, based on quoted market values, was divided as follows:

	TOTAL ASSETS AT MARKET VALUE	GRANTS AND APPROPRIATIONS AUTHORIZED BUT NOT DUE FOR PAYMENT	PROVISION FOR FEDERAL EXCISE TAX UNPAID	FUND BALANCES AT MARKET VALUE
General Fund	\$309,542,492	\$12,476,504	\$495,000	\$296,570,988
General Motors Dealers Appreciation Fund	<u>9,314,312</u>	<u>3,500,000</u>	<u>17,000</u>	<u>5,797,312</u>
Total	<u>\$318,856,804</u>	<u>\$15,976,504</u>	<u>\$512,000</u>	<u>\$302,368,300</u>

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

TWO BROADWAY
NEW YORK 10004

ACCOUNTANTS' OPINION

Alfred P. Sloan Foundation:

We have examined the balance sheet of Alfred P. Sloan Foundation as of December 31, 1970 and the related statement of income and funds for the year then ended, and the supplemental schedules of marketable securities and grants and appropriations. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, such financial statements and supplemental schedules present fairly the financial position of the Foundation at December 31, 1970 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Haskins & Sells

February 1, 1971

Balance Sheet

December 31, 1970 and December 31, 1969

	<u>1970</u>	<u>1969</u>
<u>ASSETS</u>		
MARKETABLE SECURITIES (at cost or quoted market at date of gift or receipt):		
Fixed income securities:		
U.S. Government and agency obligations	\$ 33,421,407	\$ 36,185,832
Other bonds and notes	24,585,740	25,810,002
Total fixed income	<u>58,007,147</u>	<u>61,995,834</u>
Common stocks	<u>149,063,158</u>	<u>148,156,141</u>
Total marketable securities (quoted market: 1970—\$318,476,273; 1969—\$302,146,873)	207,070,305	210,151,975
Cash	380,531	717,387
TOTAL	<u>\$207,450,836</u>	<u>\$210,869,362</u>

OBLIGATIONS AND FUNDS

GRANTS AND APPROPRIATIONS AUTHORIZED BUT		
NOT DUE FOR PAYMENT	\$ 15,976,504	\$ 20,454,514
ACCRUED FEDERAL EXCISE TAX	512,000	—
FUND BALANCES	<u>190,962,332</u>	<u>190,414,848</u>
TOTAL	<u>\$207,450,836</u>	<u>\$210,869,362</u>

Statement of Income and Funds

For the years ended December 31, 1970 and 1969

INCOME	1970	1969
Investment income (recorded on cash basis):		
Dividends	\$ 9,477,527	\$ 10,750,652
Interest	3,404,361	3,522,556
Income received as residuary legatee under will of Alfred P. Sloan, Jr.	—	246,651
Other	8,503	4,455
	<u>12,890,391</u>	<u>14,524,314</u>
Less provision for Federal excise tax	512,000	—
Investment and other income—net	<u>12,378,391</u>	<u>14,524,314</u>
Grants and expenses:		
Grants and appropriations authorized	11,341,225	17,019,340
Cost of special projects	—	100,000
Administration, including investment counsel and custodian fee	1,059,804	1,061,000
Total	<u>12,401,029</u>	<u>18,180,340</u>
Excess of grants and expenses over income for the year	(22,638)	(3,656,026)
Cumulative excess of grants and expenses over income from inception to:		
Beginning of year	(43,122,686)	(39,466,660)
End of year	<u>(43,145,324)</u>	<u>(43,122,686)</u>
PRINCIPAL		
Balance at beginning of year	233,537,534	230,939,258
Assets received as residuary legatee under will of Alfred P. Sloan, Jr.	—	1,270,741
Net profit on disposals of securities	570,122	1,327,555
Balance at end of year	<u>234,107,656</u>	<u>233,537,534</u>
FUND BALANCES AT END OF YEAR	<u>\$190,962,332</u>	<u>\$190,414,848</u>

Schedule of Marketable Securities

December 31, 1970

	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
FIXED INCOME			
U.S. Government and Agency Obligations:			
Treasury Bonds:			
4% —August 15, 1973	\$ 5,921,000	\$ 5,863,617	\$ 5,669,358
Treasury Notes:			
5.375%—February 15, 1971	2,500,000	2,496,063	2,507,800
5.75% —November 15, 1974	3,000,000	3,002,812	2,983,110
6% —May 15, 1975	2,000,000	2,003,750	2,006,240
6.50% —May 15, 1976	2,000,000	1,997,945	2,042,500
Federal Home Loan Banks			
Consolidated Bonds:			
7.75% —February 25, 1980	1,300,000	1,301,219	1,358,500
Twelve Federal Land Banks Con- solidated Federal Farm Loan Bonds:			
5.125%—April 20, 1978	500,000	416,250	458,750
Federal National Mortgage Association Debentures:			
6% —March 11, 1971	2,000,000	1,998,750	2,001,240
6.30% —April 8, 1971	2,500,000	2,500,000	2,501,550
5.75% —June 23, 1971	300,000	301,500	299,625
5.125%—February 10, 1972	2,350,000	2,358,813	2,326,500
5.50% —April 1, 1972	1,640,000	1,637,438	1,627,700
4.70% —December 1, 1972	1,000,000	955,000	975,000
4.50% —July 1, 1973	2,790,000	2,580,750	2,664,450
5.20% —January 19, 1977	3,000,000	3,011,250	2,775,000
6.05% —February 1, 1988	1,000,000	996,250	880,000
Total U.S. Government and agency obligations		<u>33,421,407</u>	<u>33,077,323</u>
Other Bonds and Notes:			
Westinghouse Electric Corp. Undi- vided Interest in Demand Note	1,220,000	1,220,000	1,220,000
General Motors Acceptance Corporation Debentures:			
5.75% —May 1, 1971	1,000,000	973,260	990,000
3.625%—September 1, 1975	1,000,000	810,600	862,500
5% —September 1, 1980	1,300,000	1,300,000	1,087,125
5% —March 15, 1981	1,500,000	1,492,500	1,245,000

Schedule of Marketable Securities

December 31, 1970

(continued)

FIXED INCOME	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
Norfolk and Western Railway Company 7.25% Conditional Sale Contracts:			
August 1, 1971	\$ 430,000	\$ 430,000	\$ 426,775
August 1, 1972	430,000	430,000	420,325
August 1, 1973	430,000	430,000	414,950
Florida Power & Light Company First Mortgage Bonds			
3.50% —January 1, 1974	1,000,000	862,520	912,500
National Dairy Products Corporation Debentures			
3.125%—June 1, 1976	200,000	158,664	163,000
Household Finance Corporation Sinking Fund Debentures			
4.625%—January 15, 1977	1,015,000	870,118	852,600
Public Service Electric and Gas Company Debenture Bonds			
4.625%—March 1, 1977	1,223,000	1,096,630	1,057,895
American Telephone and Telegraph Company Debentures:			
4.375%—April 1, 1985	1,500,000	1,518,210	1,125,000
8.75% —May 15, 2000	2,000,000	1,945,938	2,132,500
Burlington Industries, Inc. Convertible Subordinated Debentures			
5% —September 15, 1991	2,000,000	2,047,500	2,400,000
Aluminum Company of Canada, Limited Sinking Fund Debentures			
9.5% —March 1, 1995	1,000,000	1,012,500	1,045,000
International Paper Company Sinking Fund Debentures			
8.85% —March 15, 1995	1,000,000	1,000,000	1,062,500

Schedule of Marketable Securities

December 31, 1970

(continued)

FIXED INCOME	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
Standard Oil Company (New Jersey) Debentures			
6% —November 1, 1997	\$5,000,000	\$ 5,000,000	\$ 4,531,250
Standard Oil Company (Indiana) Debentures			
6% —January 15, 1998	1,000,000	990,000	880,000
Dow Chemical Company, The Debentures			
8.875%—May 1, 2000	1,000,000	997,300	1,070,000
Total other bonds and notes		24,585,740	23,898,920
Total fixed income securities		\$58,007,147	\$56,976,243

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
American Can Company	15,000	\$ 748,426	\$ 596,250
American Metal Climax, Inc.	60,000	1,305,194	2,017,500
American Telephone and Telegraph Company	120,000	4,926,836	5,865,000
Avon Products, Inc.	26,200	822,375	2,318,700
Babcock & Wilcox Company, The	30,000	679,983	678,750
Baxter Laboratories, Inc.	15,000	398,564	386,250
Caterpillar Tractor Co.	80,000	1,448,479	3,420,000
Central and South West Corporation	25,000	653,569	1,212,500
Cerox Company, The	50,000	409,294	1,812,500
Coca-Cola Company, The	12,000	946,463	1,017,000
Corning Glass Works	9,598	1,030,430	1,696,447
Cutler-Hammer, Inc.	27,500	1,192,936	800,938
Digital Equipment Corporation	7,000	454,468	400,750
Walt Disney Productions	4,080	376,022	588,344
Dun & Bradstreet, Inc.	15,000	794,653	785,625

Schedule of Marketable Securities

December 31, 1970

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
E. I. du Pont de Nemours & Company	12,000	\$ 1,916,128	\$ 1,600,500
Eastman Kodak Company	103,954	2,499,064	7,861,521
First Chicago Corporation	18,114	753,105	1,086,840
First National Bank of Boston, The	22,500	851,683	1,473,750
General Electric Company	39,810	2,741,464	3,737,164
General Foods Corporation	25,000	2,186,566	2,187,500
General Motors Corporation	1,540,666	70,384,314	124,023,613
Gillette Company, The	25,000	1,230,998	1,231,250
Gulf Oil Corporation	56,768	578,073	1,837,864
Household Finance Corporation	40,000	737,671	1,715,000
International Business Machines Corporation	68,000	5,251,600	21,607,000
International Nickel Company of Canada, Limited, The	96,500	1,971,791	4,378,688
International Paper Company	75,000	2,505,785	2,643,750
Johnson & Johnson	9,000	422,053	513,000
Kennecott Copper Corporation	60,000	2,519,809	2,362,500
Merck & Co., Inc.	24,400	256,742	2,415,600
Middle South Utilities, Inc.	60,600	1,022,692	1,613,475
Minnesota Mining and Manufacturing Company	12,000	1,331,058	1,188,000
Mobil Oil Corporation	74,000	2,047,176	4,255,000
J. P. Morgan & Co. Incorporated	53,636	1,800,027	3,613,726
National Cash Register Company, The	34,000	2,216,501	1,334,500
Northern Natural Gas Company	40,000	2,251,137	2,055,000
Northwest Bancorporation	42,000	615,477	1,512,000
Owens-Corning Fiberglas Corporation	43,600	1,778,408	1,891,150
Phelps Dodge Corporation	27,300	1,186,853	1,078,350
Polaroid Corporation	18,000	1,612,392	1,386,000
Procter & Gamble Company, The	50,180	650,493	2,910,440
Public Service Electric and Gas Company	68,000	1,451,313	1,904,000
Royal Dutch Petroleum Company	102,300	2,362,854	4,577,925
Schlumberger Limited	10,000	817,645	875,000
Scott Paper Company	60,000	1,750,058	1,440,000

Schedule of Marketable Securities

December 31, 1970

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Leas. Roebuck and Co.	78,605	\$ 1,689,531	\$ 5,993,631
Shell Oil Company	59,986	2,402,589	2,841,837
Southeast Bancorporation, Inc.	20,000	1,139,144	1,345,000
Southern Company, The	52,000	950,596	1,365,000
Standard Oil Company (New Jersey)	53,967	2,622,317	3,959,829
TIW Inc.	30,000	360,717	1,023,750
Texaco Inc.	118,652	1,839,222	4,137,989
Virginia Electric and Power Company	49,844	823,638	1,171,334
Wachovia Corporation, The	20,000	1,130,759	1,160,000
Went Corporation	30,000	216,023	2,595,000
Total common stocks		149,063,158	261,500,030
Total fixed income securities		58,007,147	56,976,243
Total marketable securities		\$207,070,305	\$318,476,273

Summary of Grants Appropriations

GRANTS	AUTHORIZED BUT NOT DUE DECEMBER 31, 1969	CHANGES DURING 1970		AUTHORIZED BUT NOT DUE DECEMBER 31, 1970
		AUTHORIZED	PAYMENTS	
College Science Program (20 colleges and universities)	\$ 3,000,000	—	\$ 1,500,000	\$ 1,500,000
Sloan National Scholarship Program (602 students in 45 colleges and universities)	3,179,090	\$ 182,338*	1,198,708	1,798,044
Sloan Fellowships for Basic Research (152 fellowships in 60 colleges and universities)	2,073,076	1,400,974	1,354,853	2,119,197
Cooperative College Development Program (30 colleges and universities)	149,282	—	149,282	—
Major Grants to colleges and universities	4,573,500	5,578,000	6,554,000	3,597,500
Other Major Grants:				
American Council on Education	\$ 200,000	—	\$ 120,000	\$ 80,000
Brookings Institution, The	—	\$ 300,000	100,000	200,000
Cold Spring Harbor Laboratory	—	450,000	250,000	200,000
Deafness Research Foundation, The	—	263,000	131,500	131,500
Harper Hospital	210,000	—	70,000	140,000
Institute for Advanced Study, The	—	372,000	172,000	200,000
Institute for Educational Management, The	210,000	—	105,000	105,000
Memorial Sloan-Kettering Cancer Center	2,500,000	—	1,000,000	1,500,000
National Academy of Sciences	250,000	—	250,000	—
National Bureau of Economic Research, Inc.	500,000	—	—	500,000
National Medical Fellowships, Inc.	107,500	345,000	415,000	37,500
National Urban League	150,000	—	150,000	—
Salk Institute, The	—	600,000	—	600,000
Sloan-Kettering Institute for Cancer Research	2,000,000	1,000,000	1,000,000	2,000,000
TOTAL OTHER MAJOR GRANTS	6,127,500	3,330,000	3,763,500	5,694,000
Opportunity Awards (10 colleges and universities)	157,000	—	104,400	52,600
Staff Grants available for grants in ensuing year	750,000	705,339	705,339	750,000
Other Grants (none over \$100,000 in 1970)	333,469	9,250	275,052	67,667
TOTAL GRANTS	20,342,917	10,841,225	15,605,134	15,579,008
APPROPRIATIONS				
Sloan Commission on Cable Communications Special projects	111,597	500,000	137,697 76,404	362,303 35,193
TOTAL GRANTS AND APPROPRIATIONS	<u>\$20,454,514</u>	<u>\$11,341,225</u>	<u>\$15,819,235</u>	<u>\$15,976,504</u>

*Cancellation of prior year authorizations.

Schedule of Grants Appropriations

GRANTS	AUTHORIZED	CHANGES DURING 1970		AUTHORIZED
	BUT NOT DUE DEC. 31, 1969	AUTHORIZED	PAYMENTS	BUT NOT DUE DEC. 31, 1970
A BETTER CHANCE—Independent Schools Talent Search		\$ 20,000	\$ 20,000	
Administration and Management Research Association of New York City, Inc.	\$ 94,552		94,552	
Albion College	46,499	4,275*	16,890	\$ 25,334
American Council on Education	200,000		120,000	80,000
Amherst College	81,099	10,325	37,070	54,354
Antioch College	184,174		89,670	94,504
Aspen Center for Physics		20,000	20,000	
Association of American Medical Colleges		20,000	20,000	
Atlanta University		19,000	19,000	
Automotive Safety Foundation		9,250	9,250	
Bethune-Cookman College	14,850		9,900	4,950
Bishop College	16,650		11,100	5,550
Bowdoin College	53,600	600*	21,200	31,800
British Columbia, University of		31,690	15,590	16,100
Brookings Institution, The		300,000	100,000	200,000
Brown University	101,050	200*	51,470	49,380
California Institute of Technology	306,520	27,525	233,225	100,820
California, University of	122,709	259,404	240,653	141,460
Cambridge, University of		20,000	20,000	
Canisius College	13,750		13,750	
Carleton College	252,700	4,800*	119,160	128,740
Carnegie Mellon University	164,249	7,375	77,900	93,724
Case Western Reserve University	99,974	311,100	151,930	259,144
Catholic University of America, The	9,400		9,400	
Center for Policy Research		20,000	20,000	
Chicago, The University of	27,500	429,500	273,250	183,750
Clarkson College of Technology		200,000	100,000	100,000
Colby College	25,100		10,040	15,060
Cold Spring Harbor Laboratory		450,000	250,000	200,000
Colgate University	247,674	10,950*	110,690	126,034
Columbia University	1,110,303	76,580	1,111,726	75,157
Committee for Environmental Information		15,000	15,000	
Cornell College	150,000		75,000	75,000
Cornell University	606,749	10,305*	257,060	339,394
Council on Foundations, Inc.		10,000	10,000	
Dartmouth College	806,850	25,450*	653,060	128,340
Davidson College	120,924		58,370	62,554
Deafness Research Foundation, The		263,000	131,500	131,500
Detroit, University of		200,000	100,000	100,000
Dillard University	14,850		9,900	4,950
Drexel University		100,000	100,000	
Fisk University	17,850		11,700	6,150
Five Colleges, Incorporated		20,000	20,000	
Florida State University, The		16,100	3,680	12,420
Florida, University of		16,128	8,676	7,452
Georgia Institute of Technology, The	15,000		6,000	9,000

GRANTS (continued)	AUTHORIZED	CHANGES DURING 1970		AUTHORIZED
	BUT NOT DUE DEC. 31, 1969	AUTHORIZED	PAYMENTS	BUT NOT DUE DEC. 31, 1970
Georgia, University of	\$ 8,050		\$ 8,050	
Ginnell College	187,300	\$ 2,000*	90,120	\$ 95,180
Hahnemann Medical College and Hospital of Philadelphia, The		14,000	14,000	
Hamilton College	28,950	2,900*	10,420	15,630
Hampton Institute	15,750		10,500	5,250
Harper Hospital	210,000		70,000	140,000
Harvard University	139,849	712,750	454,885	397,714
Harvey Mudd College	350,000		200,000	150,000
Haverford College	160,000		80,000	80,000
Hawaii, University of		18,210	10,160	8,050
Hazy Street Settlement		20,000	20,000	
Hope College	150,000		75,000	75,000
IaHo, University of		18,745	7,935	10,810
Illinois, University of	30,550	42,835	30,965	42,420
Indiana University	9,165		9,165	
Institute for Advanced Study, The		372,000	172,000	200,000
Institute for Educational Development	92,667		55,000	37,667
Institute for Educational Management, The	210,000		105,000	105,000
Iowa State University		33,840	17,280	16,560
John Hopkins University, The	114,274	6,800*	61,440	46,034
Kalamazoo College	160,000		80,000	80,000
Kansas, The University of		16,100	8,050	8,050
Kean College	139,775	5,025	74,320	70,480
Knoxville College	14,850		9,900	4,950
League of Women Voters Education Fund		12,500	12,500	
Lehigh University	53,350	97,800	120,460	30,690
Lincoln University	16,450		6,580	9,870
McMaster University		23,000	11,500	11,500
Marland, University of	21,275	16,100	29,095	8,280
Massachusetts Institute of Technology	1,138,675	897,991	1,136,136	900,530
Massachusetts, University of	17,250	6,498	23,748	
Medical Care and Education Foundation, Inc.		15,000	15,000	
Meharry Medical College		1,000,000	500,000	500,000
Memorial Sloan-Kettering Cancer Center	2,500,000		1,000,000	1,500,000
Miami, University of		90,000	65,000	25,000
Michigan, The University of	29,860		16,360	13,500
Middlebury College	160,000		80,000	80,000
Minnesota, University of	32,820	30,984	42,254	21,550
Morehouse College	155,874	9,850	89,800	75,924
Mount Holyoke College	150,000		75,000	75,000
NAACP Legal Defense and Educational Fund, Inc.		20,000	20,000	
NAACP Special Contribution Fund		20,000	20,000	
National Academy of Sciences	250,000		250,000	
National Affairs, Inc.		14,050	14,050	

*Cancellation of prior year authorizations.

Schedule of Grants Appropriations

GRANTS (continued)	AUTHORIZED BUY NOT DUE DEC. 31, 1969	CHANGES DURING 1970		AUTHORIZED BUY NOT DUE DEC. 31, 1970
		AUTHORIZED	PAYMENTS	
National Bureau of Economic Research, Inc.	\$ 500,000			\$ 500,000
National Information Bureau, Inc.		\$ 5,000	\$ 5,000	
National Medical Fellowships, Inc.	107,500	360,000	430,000	37,500
National Urban League	150,000		150,000	
New Mexico, The University of		1,314	1,314	
New York City Health and Hospitals Corp.		20,000	20,000	
New York Public Library, The		5,000	5,000	
New York University	251,250	11,635	152,885	110,000
North Carolina, The University of	6,900	16,100	14,950	8,050
Northwestern University	8,750	300,000	108,750	200,000
Notre Dame, University of	71,150		28,460	42,690
Oberlin College	275,324		130,130	145,194
Occidental College	184,174		89,670	94,504
Ohio State University, The	22,500	16,100	17,050	21,550
Oregon State University	8,027		8,027	
Oregon, University of		32,200	16,100	16,300
Palace of Arts & Science Foundation, The		15,000	15,000	
Pennsylvania State University, The	8,050	8,050*		
Pennsylvania, University of	120,000	17,625	127,250	10,375
Phelps-Stokes Fund, The		10,000	10,000	
Pittsburgh, University of		218,860	109,430	109,430
Pitzer College		15,000	15,000	
Planned Parenthood World Population		10,000	10,000	
Polytechnic Institute of Brooklyn		300,000	100,000	200,000
Pomona College	24,299	575*	9,490	14,234
Princeton University	107,400	136,718	120,578	123,540
Purdue University	22,500	23,637	22,862	23,275
Reed College	150,000		75,000	75,000
Rensselaer Polytechnic Institute	400,000		200,000	200,000
Research Foundation of The City University of New York		18,375	18,375	
Research Foundation of State University of New York, The	8,625	105,018	69,943	43,700
Rice University	8,750	35,000	26,250	17,500
Rochester, University of	274,000	87,125	317,375	43,750
Rockefeller University, The	13,000		13,000	
Rutgers University	8,050	257,480	256,790	8,740
Salk Institute, The		600,000		600,000
Santa Clara, University of		100,000	100,000	
Scientists' Institute for Public Information	90,000		60,000	30,000
Sherbrooke, Université de		18,400	9,200	9,200
Sloan-Kettering Institute for Cancer Research	2,000,000	1,000,000	1,000,000	2,000,000
Smith College	100,000		50,000	50,000
Southern California, University of	8,750	35,000	26,250	17,500
Southern Research Institute	56,250		56,250	

GRANTS (continued)	AUTHORIZED BUY NOT DUE DEC. 31, 1969	CHANGES DURING 1970		AUTHORIZED BUY NOT DUE DEC. 31, 1970
		AUTHORIZED	PAYMENTS	
Stanford University	\$ 193,470	\$ 124,380	\$ 192,640	\$ 125,210
State Communities Aid Association		15,000	15,000	
Swarthmore College	150,000		75,000	75,000
Taladega College	9,900		6,600	3,300
Tennessee, The University of	2,070		2,070	
Texas, The University of	8,878		8,878	
Toronto, University of		18,400	9,200	9,200
Tougaloo College	10,300		6,800	3,500
Tufts University		283,000	110,500	172,500
Tulane University	45,574		18,230	27,344
Tuskegee Institute	35,424		19,770	15,654
Urban Institute, The		13,000	13,000	
Utah, University of	11,500		11,500	
Vanderbilt University	320,960	3,710*	276,900	40,350
Venue Institute of Justice		15,200	15,200	
Virginia, University of	18,400		18,400	
Wabash College	45,574		18,230	27,344
Washington and Lee University	100,000		50,000	50,000
Washington University		57,512	41,812	15,700
Wesleyan University	56,000		56,000	
Whitman College	20,000		8,000	12,000
Williams College	281,824	69,900	175,690	176,034
Wisconsin, University of	41,552		28,052	13,500
Worcester Polytechnic Institute		200,000	100,000	100,000
Yale University	255,650	38,250	186,610	107,290
Cooperative College Development Program	149,282		149,282	
Shaw Fellowships for Basic Research to be granted in ensuing year	1,400,000			1,400,000
Staff Grants available for grants in ensuing year	750,000			750,000
	20,342,917	10,903,869	15,667,778	15,579,008
		62,644	62,644	
Reduction for Grant Transfers				
TOTAL GRANTS	20,342,917	10,841,225	15,605,134	15,579,008
APPROPRIATIONS				
Sloan Commission on Cable Communications		500,000	137,697	362,303
Special projects	111,597		76,404	35,193
TOTAL GRANTS AND APPROPRIATIONS	\$20,454,514	\$11,341,225	\$15,819,235	\$15,976,504

*Cancellation of prior year authorizations.

INDEX

Index

A Better Chance—Independent Schools Talent Search, 25, 64

Administration and Management Research Association of New York City, Inc., 64

Albion College, 64

American Council on Education, 62, 64

Amherst College, 10, 64

Antioch College, 64

Aspen Center for Physics, 16, 64

Association of American Medical Colleges, 43-44, 64

Atlanta University, 45, 64

Automotive Safety Foundation, 25, 64

Bethune-Cookman College, 64

Bishop College, 64

Bowdoin College, 64

British Columbia, University of, 10, 64

Brookings Institution, The, 27-28, 31, 62, 64

Brown University, 17, 64

California, University of, 11, 16, 28, 44, 64

California Institute of Technology, 10, 16, 38, 64

Cambridge, University of, 16, 64

Canisius College, 64

Carleton College, 64

Carnegie-Mellon University, 11, 44, 64

Case Western Reserve University, 20, 44, 64

Catholic University of America, The, 64

Center for Policy Research, 45, 64

Chicago, The University of, 11, 14, 16, 28, 31, 36, 44, 64

Clarkson College of Technology, 18, 20, 64

Colby College, 64

Cold Spring Harbor Laboratory, 36, 62, 64

Colgate University, 64

College Science Program, 23, 62

Columbia University, 11, 44, 64

Committee for Environmental Information, 25, 64

Cooperative College Development Program, 24, 62, 67

Cornell College, 64

Cornell University, 11, 44, 47, 64

Council for Opportunity in Graduate Management Education, 44-45

Council on Foundations, Inc., 25, 64

Dartmouth College, 17, 24, 44, 64

Davidson College, 64

Deafness Research Foundation, The, 15-16, 62, 64

Detroit, University of, 21, 64

Dillard University, 64

Drexel University, 20, 64

Fisk University, 64

Five Colleges, Incorporated, 25, 64

Florida State University, The, 11, 64

Florida, University of, 11, 64

Georgia Institute of Technology, The, 64

Georgia, University of, 65

Grimm College, 65

Hahnemann Medical College and Hospital of Philadelphia, The, 25, 65

Hamilton College, 65

Hampton Institute, 24, 65

Harper Hospital, 62, 65

Harvard University, 11, 28, 31, 32, 36, 42-43, 44, 47, 65

Harvey Mudd College, 17, 65

Haverford College, 65

Hawaii, University of, 11, 65

Henry Street Settlement, 32, 65

Hope College, 65

Idaho, University of, 11, 65

Illinois, University of, 11, 65

Indiana University, 65

Institute for Advanced Study, The, 12-13, 31, 62, 65

Institute for Educational Development, 65

Institute for Educational

Management, The, 65

Iowa State University, 11, 65

Johns Hopkins University, The, 17, 65

Kalamazoo College, 65

Kansas, The University of, 11, 65

Knox College, 25, 65

Knoxville College, 24, 65

League of Women Voters Education Fund, 29, 65

Lehigh University, 18, 21, 65

Lincoln University, 24, 65

McMaster University, 11, 65

Maryland, University of, 11, 65

Massachusetts Institute of Technology, 11, 14, 25, 32, 36-37, 44, 47, 65

Massachusetts, University of, 65

Medical Care and Education

Foundation, Inc., 44, 65

Meharry Medical College, 24, 31, 40-41, 65

Memorial Sloan-Kettering Cancer Center, 62, 65

Miami, University of, 38, 43, 65

Michigan, The University of, 28, 65

Middlebury College, 65

Minnesota, University of, 11, 28, 65

Monmouth College, 25, 65

Mount Holyoke College, 65

NAACP Legal Defense and Educational Fund, Inc., 32, 65

NAACP Special Contribution Fund, 32, 65

National Academy of Sciences, 62, 65

National Affairs, Inc., 25, 65

National Bureau of Economic

Research, Inc., 62, 66

National Information Bureau, Inc., 32, 66

National Medical Fellowships, Inc., 41-42, 62, 66

National Urban League, 62, 66

Neuroscience, 9-10, 35-38

New Mexico, The University of, 38, 66

New York City Health and

Hospitals Corp., 32, 66

New York Public Library, The, 25, 66

New York University, 66

North Carolina, The University of, 11, 66

Northwestern University, 18, 21, 66

Notre Dame, University of, 17, 66

Oberlin College, 66

Oberlin College, 66

Ohio State University, The, 11, 66

Opportunity Awards, Alfred P. Sloan, 62

Oregon State University, 66

Oregon, University of, 11, 66

Palace of Arts & Science Foundation, The, 25, 66

Pennsylvania State University, The, 66

Pennsylvania, University of, 11, 44, 66

Phelps-Stokes Fund, The, 66

Pittsburgh, University of, 11, 19, 21, 66

Pitzer College, 25, 66

Planned Parenthood World Population, 29, 66

Polytechnic Institute of Brooklyn, 19, 21, 66

Purdue College, 66

Purdue University, 11, 13, 17, 28, 66

Purdue University, 11, 66

Rad College, 66

Rensselaer Polytechnic Institute, 17, 66

Research Foundation of The City University of New York, 26, 66

Research Foundation of State University of New York, The, 11, 44, 66

Rice University, 11, 66

Rochester, University of, 11, 17, 66

Rockefeller University, The, 31, 66

Rutgers University, 11, 37-38, 66

Salk Institute, The, 38, 62, 66

Santa Clara, University of, 19, 22, 66

Scientists' Institute for Public Information, 66

Sherbrooke, Université de, 11, 66

Sloan Commission on Cable Communications, 8, 30-32, 62, 67

Sloan Fellowships for Basic Research, 9-12, 62, 67

Sloan, Alfred P., National Scholarship Program, 23-24, 62

Sloan-Kettering Institute for Cancer

Research, 15, 53, 62, 66

Smith College, 66

Southern California, University of, 11, 36, 66

Southern Research Institute, 66

Stanford University, 12, 26, 28, 36, 43, 44, 67

State Communities Aid Association, 32, 67

Swarthmore College, 67

Talladega College, 67

Tennessee, The University of, 67

Texas, The University of, 67

Toronto, University of, 12, 67

Tougaloo College, 67

Tufts University, 22-23, 67

Tulane University, 67

Tuskegee Institute, 24, 67

Urban Institute, The, 29, 31, 67

Utah, University of, 67

Vanderbilt University, 67

Vera Institute of Justice, 32, 67

Virginia, University of, 67

Wabash College, 67

Washington and Lee University, 67

Washington University, 12, 45, 67

Wesleyan University, 36, 67

Whitman College, 67

Williams College, 23, 43, 67

Wisconsin, University of, 67

Worcester Polytechnic Institute, 22, 67

Yale University, 12, 16, 17, 26, 28, 36, 67

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Alfred P. Sloan Foundation

Founded in 1934 by Alfred P. Sloan, Jr. (1875-1966)

REPORT for 1971



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New York, New York 10020

Contents

Trustees, Officers, and Staff	vi
President's Statement	1
General Program	7
Science and Technology	9
Economics and Management	16
Education	20
Related Problems of Society	26
Particular Programs	31
Neuroscience	33
Expanding Professional Opportunities	37
Technology in Education	42
Other Grants	45
Foundation Operations	47
Financial Review	49
Index	69

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President's Statement

President's Statement



IN its Annual Report for 1970, the Sloan Foundation announced its intention to address itself over the next few years to the exploration of the uses of technology in the processes of higher education. It was our purpose to devote perhaps ten per cent of our disposable income, for a period of approximately five years, to a set of coherent grants within that area—a modest enough sum in light of all the current needs of higher education and yet adequate, we believe, to offer some hope that a very useful contribution might be made.

A program in *Technology in Education* thus became the third of the particular programs which together are intended to command about 40 per cent of the Foundation's annual grant allocations. Earlier reports have asserted the rationale which underlies the concept of "particular programs," and I need not restate it here. Earlier reports, too, have stated the purposes and the progress of the first two such programs, in *Neuroscience* and in *Expanding Minority Opportunities*.

As the body of this Annual Report for 1971 makes clear, the two older particular programs have continued to flourish during the year just past. Neuroscience is slowly coming into being as a discipline in its own right, and research in neuroscience is both more extensive and more coherent than it had earlier been. More minority students are embarked upon educational careers that will lead them directly into the professions of medicine and management. We believe that the involvement of the Sloan Foundation in each of those program areas has made a substantial difference.

The program in *Technology in Education* is getting under way more slowly. Grants under the program in 1971 came to only \$134,500, much

of which was directed toward assisting us in our own planning. This is not surprising. In the two earlier particular programs, the Foundation entered fields in which considerable momentum already existed. The remarkable successes of molecular biology were leading inexorably to the study of the molecular and cellular bases of behavior, and it was inevitable that neuroscience should begin to emerge, like molecular biology, as its own coherent scientific discipline. For decades minority groups within American society were beginning to find their way, or force their way, into the main stream of American life.

There had appeared to be, some years back, similar momentum in the application of technology to education, most of it stimulated by the postwar development of computer and communications technology. In the late 1950's and into the 1960's industries based on both those technologies turned their attention to the educational market and in many instances made sizable investments with that market in mind. The results were not entirely negligible. Computer technology has made a promising beginning in the teaching of the sciences, engineering and mathematics—disciplines which themselves are most closely wedded to technology. There has been some use of television in the early grades. But beyond those limited successes, technology has made little mark upon education. In particular, the arts, letters and humanities have been almost unaffected, except in some limited areas of remedial education. Much of the educational hardware developed now gathers dust.

Outside those disciplines in higher education where technology may be said to "come natural" there is little forward motion. Yet, we have discovered nothing that would lead us to abandon our purposes. Institutions of higher education continue to be in deep financial trouble, and cannot hope to escape that trouble by pursuing their old courses in their old ways. We find it still a reasonable article of faith that technology offers some promise of relief from the financial dilemma.

On the basis of a year's endeavor, we believe we can identify more narrowly the problems that the program confronts, and the nature of the opportunities we must seek:

1. We must be careful not to permit ourselves, or to encourage others, to be guided by too strict a definition of "technology." The word is too readily taken to signify the computer and the television installation. We extend it to include the entire technology of the printed word, the whole range of classroom tools, and even the concepts of the learning module, self-paced instruction and the reordering of the presentation of learning materials, whether or not these are associated (as indeed often they are) with such more clearly technological devices as video cassettes and computer-assisted instruction.

2. Programs in educational technology can be designed around the hardware, the institution, or the discipline. In the first instance, one asks, "How can I use e.g. the computer in the educational process?" In the second instance, one asks, "How should I reorganize my institution to take advantage of educational technology?" In the third, one asks, "What technological instruments can be used to render more efficient the communication to students of a specific discipline?"

We have come to the conclusion that for the immediate future the disciplinary approach is likely to be the most fruitful, as indeed it has already been fruitful in the sciences, engineering and mathematics. We must identify the professor, discontented with the manner in which the educational process is now carried out, and desirous of developing the use of more sophisticated teaching and learning tools than he now possesses.

3. There are suggestions of a role for technology in education which goes beyond questions of economics. There has been, in higher education, a loosening of the constraints with respect to time and place. The growing emphasis on openness and flexibility is accompanied by a renewed interest in lifelong education and the promise that the growth of leisure will give the consumer of education considerable choice as to when and what and how he studies. The whole development seems to provide opportunities for the use of technology, or even to depend upon technology for its full realization.

We intend during the year ahead to pursue the Third Particular Program along those lines. It will not be at any time a program that can be easily carried through. But we think the effort worth while—we consider it to be precisely the kind of effort that a foundation should be willing to make, even against the odds—and we do not believe that this one is truly against the odds.

As is implied in this discussion of the Foundation's particular programs, the bulk of grants made will be directed to our General Program which is best described as a continuation of the Foundation's recent past interests in science, technology, economics, management, and certain restricted fields in medical research. Within our General Program interest in technology we are addressing ourselves to a development in engineering education which we believe deserves strong encouragement. That development is represented by the realization by engineering educators and practicing engineers that traditional courses in engineering specialties must be supplemented by or integrated with courses which are designed to assist the engineer to achieve an understanding of the social implications of the technology he practices.

Under its General Program the Foundation will also continue an interest in undergraduate science education. During 1972 we will undertake a thorough evaluation of the five year program of support of undergraduate science programs now coming to a close and will determine what direction continuing support of such programs should take over the next few years.

The other concerns of the Foundation under General Program are documented in this annual report as well as in preceding annual reports. The interested reader should receive from these publications an understanding of the Foundation's basic interests as well as of the modifications of these interests which occur because of changing times.

his G. Wassell

General Program

THE FOUNDATION, under a policy adopted in 1969, divides its efforts and resources between a General Program and a limited number of relatively short-term, sharply focused Particular Programs, which are discussed later in this Report. The General Program carries forward the Foundation's traditional interests in science and technology, in economics and management and in the problems of society bearing a relationship to these interests. Within these broad areas the Foundation functions as a grant-making, non-operating philanthropic foundation. Proposals are received and acted upon with reference to established priorities and available resources. On occasion the Foundation may invite proposals in an area of special interest. It is also possible under the General Program to establish and support special study groups such as the Sloan Commission on Cable Communications. Thus the General Program preserves for the Foundation the flexibility to respond selectively to needs within broadly defined program areas.

Science and Technology



EXPERIMENTS in engineering education occupied a central place among the Foundation's grants for support of science and technology in 1971. In a time of social and economic upheaval, some engineers are finding their skills too narrow to enable them to deal with changing demands, while growing numbers of students are finding the field too restricted in scope to engage their interests. Yet society's need for enlightened solutions to its technological problems has seldom been greater.

Carnegie-Mellon University, recognizing the need for changes to develop more broadly educated engineers, will mount a new undergraduate Program in Engineering and Public Affairs with the aid of a four-year, \$442,000 Sloan grant. Its goal is to develop practitioners equipped to deal with the social, economic, and political as well as the technological aspects of the problems they will confront.

In this interdisciplinary effort, Carnegie-Mellon will draw upon faculty from its engineering school, its School of Urban and Public Affairs, and its Graduate School of Industrial Administration. A new four-year curriculum will combine a physical sciences background with a major option in one of the engineering disciplines, a major concentration in the analysis of political and social systems, and interdisciplinary projects and elective courses. The

*More Breadth
in Engineering
Education*



The University of Bridgeport received \$204,800 for a cooperative work-study program which will help make it possible for inner-city youths to become engineers. Dr. Richard L. Price, center, gives two students extra help with a mathematics problem.

*Meeting
the Cost
of Engineering
Education*

program will lead to the degree of bachelor of science in engineering and public affairs.

Grants to two schools address themselves to the problem of underrepresentation of minorities in the engineering profession. Both institutions, the University of Bridgeport and Pratt Institute, will make use of cooperative work-study programs to make engineering education more accessible to inner-city disadvantaged youth.

The University of Bridgeport, in Connecticut, will recruit from its own inner-city area such students who show an aptitude for engineering. After a special summer remedial program they will take a full freshman year in Bridgeport's College of Engineering; thereafter they will enter a work-study program which will enable them to earn sufficient money to pay their tuition during the remaining years of study. The project is expected to graduate about 30 students after five years of study and work.

10 The Sloan Foundation granted \$204,800 over three years, principally to pay part of the cost of tuition and academic reinforcement during each

student's freshman year. Earlier, it granted \$20,000 toward the expense of summer remedial work for the first students in the program.

Pratt Institute, in central Brooklyn, is surrounded by a large minority population from which it draws some 10 per cent of its student body. Its School of Engineering and Science operates a work-study program through which a sizeable number of students of limited income have been able to complete engineering degrees. Pratt now plans to increase the number of such students by making it possible for them to borrow part or all of their expenses during their first year, when they have no earnings from work-study. Through a variable payback feature, students will repay all or part of their loans during their working periods. It is also hoped that their employers will contribute to the loan fund.

The Sloan Foundation agreed to provide \$180,000 over a three-year period to help initiate on an experimental basis Pratt's revolving loan fund for disadvantaged students.

In the training of young scientists, as distinct from engineers, the Foundation's principal program since 1955 has been the Sloan Fellowships for Basic Research. Through this program the Foundation makes grants to universities and colleges in the United States, and to a limited extent in Canada, to help support fundamental research by promising young scientists in physics, chemistry, mathematics, neuroscience, and certain interdisciplinary fields such as astrophysics and geochemistry.

During 1971, seventy-seven new Sloan Research Fellows were appointed, of whom 34 are in chemistry, 27 in physics, and 16 in mathematics. (Award of fellowships in neuroscience will begin in 1972.) In addition, 76 Fellows selected in 1970 continued on the second year of their fellowships. Thus there are 153 Fellows now in the program, holding appointments at 62 universities. Their average age is 30.

The Foundation annually allocates \$1.4 million for the Sloan Fellowships for Basic Research. Nominations for the 1972 Fellowships were reviewed and final selections were made by a Program Committee consisting of the following:

- | | |
|---|--|
| Dr. LIEMAN BERS (Mathematics)
Columbia University, Chairman | Dr. ROBERT E. MARSHAK (Physics)
The City College of The City University of New York |
| Dr. RICHARD B. BERNSTEIN (Chemistry)
University of Wisconsin | Dr. CARL PFAFFMANN (Neuroscience)
Rockefeller University |
| Dr. E. J. COREY (Chemistry)
Harvard University | Dr. ARTHUR L. SCHAWLOW (Physics)
Stanford University |
| Dr. MARK KAC (Mathematics)
Rockefeller University | Dr. FRANCIS O. SCHMITT (Neuroscience)
Massachusetts Institute of Technology |

More than 600 nominees were under consideration in 1971 for fellowships to be awarded for the period beginning in September of 1972. Candi-

*Fellowships
to Advance
Basic Science*

dates for fellowships do not apply for an award, but are nominated by a senior colleague. In the physical sciences and mathematics they must be members of the regular faculty at a recognized college or university in the United States or Canada. In neuroscience, postdoctoral fellows as well as junior faculty members are considered.

Scientists who received new Sloan Research Fellowships in 1971 are listed below by institution and field of research:

- | | |
|---|---|
| UNIVERSITY OF ARIZONA
Physics: Richard A. Young | UNIVERSITY OF ILLINOIS
Chemistry: James K. Beattie, Robert M. Coates. Mathematics: Phillip A. Griffith |
| UNIVERSITY OF BRITISH COLUMBIA
Chemistry: Laurance D. Hall | INDIANA UNIVERSITY
Chemistry: Joseph J. Gajewski. Physics: Lloyd L. Chase |
| POLYTECHNIC INSTITUTE OF BROOKLYN
Chemistry: Avigdor M. Ronn | JOHNS HOPKINS UNIVERSITY
Astrophysics: Richard C. Henry |
| CALIFORNIA INSTITUTE OF TECHNOLOGY
Physics: Edward C. Stone, Jr., Thomas A. Tombrello, Jr. | UNIVERSITY OF KANSAS
Chemistry: Ralph E. Christoffersen |
| UNIVERSITY OF CALIFORNIA, Berkeley
Mathematics: George M. Bergman, Alan D. Weinstein. Computer Science: Manuel Blum. Chemistry: Kenneth N. Raymond | MARQUETTE UNIVERSITY
Chemistry: Sheldon E. Cremer |
| UNIVERSITY OF CALIFORNIA, Davis
Mathematics: David W. Baidette | UNIVERSITY OF MARYLAND
Physics: Victor Kotchman |
| UNIVERSITY OF CALIFORNIA, Los Angeles
Chemistry: John P. McTague | MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Physics: Thomas J. Greytak, Vytenis M. Vasyliunas |
| UNIVERSITY OF CALIFORNIA, San Diego
Physics: Shang-keng Ma, Thomas M. O'Neil | UNIVERSITY OF MINNESOTA
Mathematics: Jonathan Brezin. Physics: Jonathan L. Rosner |
| UNIVERSITY OF CALIFORNIA, Santa Cruz
Chemistry: Claude F. Bernasconi. Geophysics: Robert S. Coe | MONTANA STATE UNIVERSITY
Physics: Kenneth L. Nordtvedt, Jr. |
| CARNEGIE-MELLON UNIVERSITY
Chemistry: William L. Mock | UNIVERSITY OF NEW MEXICO
Chemistry: Douglas C. Neckers |
| CORNELL UNIVERSITY
Physics: Donald L. Hartill. Astrophysics: James R. Houck | STATE UNIVERSITY OF NEW YORK AT STONY BROOK
Mathematics: Michael Fried. Physics: Andrew D. Jackson |
| DREXEL UNIVERSITY
Chemistry: William A. Guillory | UNIVERSITY OF NORTH CAROLINA
Chemistry: Thomas L. Isenbort |
| FLORIDA STATE UNIVERSITY
Chemistry: Jack Saltiel | NORTHEASTERN UNIVERSITY
Chemistry: Barry L. Karger |
| UNIVERSITY OF FLORIDA
Chemical Physics: David A. Micha | NORTHWESTERN UNIVERSITY
Chemistry: Sigbert F. Fischer, Brian M. Hoffman. Physics: Chia-Wei Woo |
| HARVARD UNIVERSITY
Chemistry: Brian D. Sykes. Physics: Paul Horowitz, Robert B. Meyer | OHIO STATE UNIVERSITY
Chemistry: John S. Swenton |
| HAVERFORD COLLEGE
Astrophysics: R. Bruce Partridge | UNIVERSITY OF OREGON
Crystallography: Brian W. Matthews |

- PRINCETON UNIVERSITY
Geophysics: Francis A. Dahlen. Mathematics: Sylvain Cappell. Mathematical Physics: Barry M. Simon
- QUEENS COLLEGE OF THE CITY UNIVERSITY OF NEW YORK
Chemistry: Jerome M. Schulman
- RICE UNIVERSITY
Chemistry: Edward F. Hayes. Mathematics: William A. Veech
- ROCKEFELLER UNIVERSITY
Mathematics: Donald A. Martin
- RUTGERS UNIVERSITY
Chemistry: Robert A. Moss, Joseph A. Poesza. Mathematics: Julius L. Shanon, Nolan R. Wallach. Physics: William I. Glaberson
- STANFORD UNIVERSITY
Chemistry: Lawrence J. Altman. Mathematics: Gregory W. Brumfiel. Physics: William A. Bardeen

- UNIVERSITY OF UTAH
Chemistry: Josef Michl
- UNIVERSITY OF VIRGINIA
Chemistry: Carl Trindle. Physics: Julian V. Noble
- UNIVERSITY OF WASHINGTON
Physics: Samuel C. Fain, Jr., Henry J. Lubatti
- UNIVERSITY OF WISCONSIN
Chemistry: Edwin Vedejs, John P. Walters. Mathematics: James W. Cannon, I. Martin Isaacs
- WORCESTER POLYTECHNIC INSTITUTE
Chemistry: C. Hackett Bushweller
- YALE UNIVERSITY
Chemistry: J. Michael McBride. Mathematics: Yum-Tong Siu
- YESHIVA UNIVERSITY
Chemistry: Martin Pomerantz

The Foundation continued its support of another major scientific program, that of the Sloan-Kettering Institute for Cancer Research, at a rate of \$400,000 a year. The Institute, established in 1945 with a major grant from the Foundation, is the research wing of Memorial Sloan-Kettering Cancer Center. In 1970 it reported research was under way in anti-cancer drugs, clinical methods, immunology, biophysics, biochemistry, cell biology, virology, cytology, genetics, endocrinology, and biomathematics. The Foundation's support of the Sloan-Kettering Institute continues to be provided from the General Motors Dealers Appreciation Fund for Cancer and Medical Research. The Fund was established in 1948 by gifts totaling \$1,525,000 from the dealer organization of General Motors, in appreciation of Mr. Sloan's contributions as chief executive officer of General Motors Corporation.

Research in the biological and other sciences has been greatly facilitated in the past few years by the introduction of the scanning electron microscope, which can produce three-dimensional images of minute structures at resolutions intermediate between those of conventional electron microscopes and light microscopes. Cellular surfaces and numerous physical materials are visible in new detail in the light of the scanning microscope's electron beam.

Dr. A. V. Crewe, a noted experimental physicist and a pioneer in developing the scanning microscope, has shown experimentally that the resolu-

Technology
May Improve
Health Care

tion of the scanning instrument can be improved to a point almost comparable to the resolution of the conventional electron microscope. Dr. Crewe, who is Dean of the Physical Sciences Division at the University of Chicago, proposes to continue this development of scanning technology, and to establish at the University a scanning microscope service facility for use by scientists in a variety of disciplines. He also plans to train young scientists for further research in scanning technology and skilled operators who would assist scientists who bring their research problems to the instrument.

The Sloan Foundation granted \$429,000 to the University of Chicago, payable over three years, for these purposes.

The over-all cost of medical services in the United States has reached a point where even small gains in efficiency can result in savings on the order of tens of millions of dollars. Increasing applications of technology may be one means by which such savings can be effected. A group of physicians and engineers in the Boston area has formed a Health Services Technology Program to explore ways in which new technologies might make a greater contribution to the provision of medical care. The program involves the seven teaching hospitals of Harvard Medical School and is centered at one of them, Beth Israel Hospital. Engineers at the Lincoln Laboratory of Massachusetts Institute of Technology also are directly involved.

The ultimate outcome of the Boston group's work may be the creation of one or more Health Services Technology Laboratories, to engage in continuing research and development in applications of technology to health care. Before that can happen, however, it is necessary to identify a group of worthwhile R & D programs, to determine the "market" for such developments if they are successful, to engage teams of physicians and engineers to develop and evaluate R & D programs, and to establish financing mechanisms for a Health Services Technology Laboratory.

Protocols already in experimental use at some Boston hospitals enable high-school graduates under computer guidance to determine whether diabetic, hypertensive, and prenatal patients need to revisit their physicians and if so how urgent the need is; if not, an alternate course of action is indicated. Protocols for the management of several other conditions are under development. Marked for possible future study and development are automated procedures in ambulatory care; consultative advice to physicians seeing patients with certain disorders; parameters of in-hospital and emergency services, and radiological services.

14 The Foundation granted \$250,000 to Harvard in partial support of the Health Services Technology Program. Earlier, Beth Israel Hospital received \$20,000 for a series of seminars which led to the formulation of the program.

These other grants for the advancement of science and technology were awarded in 1971:

AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass.:	
For interim support of planning and development costs of the International Centre of Insect Physiology and Ecology	\$20,000
In partial support of a research project on insect hormones and pheromones at the International Centre of Insect Physiology and Ecology	\$14,000
AMERICAN PHYSICAL SOCIETY, New York, N.Y.: To support a committee to study the status of women physicists and make a report with recommendations to the Council of the American Physical Society	
	\$10,000
ATLANTA UNIVERSITY CENTER CORPORATION, Atlanta, Ga.: In partial support of the Dual Degree Program of the Atlanta University Center and the School of Engineering of the Georgia Institute of Technology	
	\$15,850
UNIVERSITY OF CALIFORNIA, Davis, Calif.: In support of a conference in September 1972 on "The Problem of Reduction in Biology"	
	\$17,000
ENGINEERS JOINT COUNCIL, New York, N.Y.: To help process and publish data on engineering and technical enrollments and degrees for 1970 and 1971	
	\$10,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: In partial support of the 1971 Summer Study of Man's Impact on Climate	
	\$10,000
SOUTHERN METHODIST UNIVERSITY, Dallas, Texas: For development of a remote time-sharing hybrid computer terminal system to allow off-campus students to engage in computer simulation work in engineering	
	\$9,800

Economics and Management



SUPPORT for the application of modern management skills in a variety of business and non-business situations and a renewed effort to increase economic understanding constituted the Foundation's principal initiatives in economics and management during 1971. The Foundation's effort to increase the number of blacks and other minorities in managerial positions is discussed in a section on "Expanding Professional Opportunities" beginning on Page 37.

The training of students for careers in urban management is beginning at Stanford University's Graduate School of Business with the help of a \$550,000, three-year grant from the Sloan Foundation. The Stanford program puts into practice, in the words of Dean Arjay Miller, "our belief that the skills used so successfully in modern business management can be applied with equal effectiveness in attacking complex problems of the cities."

Students in Stanford's urban management program will be enrolled in new urban-oriented courses in addition to the basic studies through which Stanford's two-year master of business administration (MBA) program develops analytical and problem-solving skills. Courses will emphasize the pervasive role of political processes in urban affairs and the specifically urban aspects of subjects like economics, finance, and managerial decision-making. Between their first and second years of graduate study, students will serve as salaried interns in city governments, and in the second year a

New Careers
in Urban
Management

16

year-long workshop will tie together their course work and internship experiences and make possible the study of specific problems in depth.

The urban management program enrolled its first 19 students in the fall of 1971. Its graduates will be prepared to follow management careers in government and other nonprofit enterprises, and in urban-related work in business. A 1970 Sloan grant of \$75,000 supported curriculum planning.

A successful model of mid-career training for corporate and other executives, developed at Massachusetts Institute of Technology and later at Stanford, was exported to the United Kingdom with the aid of a Sloan grant to the London Graduate School of Business Studies in 1966. Since that time the London-Sloan Fellowship Program has begun to occupy a significant place in the six-year-old London Business School and in the British and European management scene.

The London-Sloan Fellowship Program, established with the advice and assistance of MIT's Alfred P. Sloan School of Management, annually provides a year of advanced management study to some 16 selected young

*Fellowships
for Managers
in Britain*

Stanford Business School's program in urban management gets under way with a course in urban political processes. Sitting in, at far right of first, second, and third rows respectively, are Professors Eugene J. Webb, George L. Bach, and Richard T. Johnson.





Her Majesty Queen Elizabeth II pays a visit to a class of London Sloan Fellows in the Fall of 1970. At extreme left is Dr. Arthur F. Earle, principal of the London Business School.

executives nominated by their organizations in the United Kingdom, the Commonwealth, and in some instances Continental Europe. Field trips to the United States and Eastern Europe augment course work and expose the participants to management practices in divergent economic settings. Expenses of the program are borne by the School, sponsoring organizations, and other donors including the Sloan Foundation. The program is now in its third year.

Dr. Arthur F. Earle, principal of the London Business School, is of the opinion that by the end of another three years the London-Sloan Program will be firmly rooted and able to sustain itself through British and European funding. Concurring with this view, the Sloan Foundation granted an additional \$350,000 for partial support over the next three years.

The complex economic events of 1971 and the sharpening of public issues having major economic components underscored the need for a better understanding of economic principles in all segments of society. Since 1948 the Joint Council on Economic Education has been working in a variety of ways to bring about that understanding. Through one of its projects, a net-

work of Centers for Economic Education on 70 college and university campuses, the Joint Council has reached the conclusion that introductory college courses in economics are in need of major improvements. Few students take them, and even those who do often show little gain in knowledge. Future public-school teachers in particular often have no preparation, or inadequate preparation, in economics.

Under the Joint Council's sponsorship and coordination, therefore, teams of economists at seven institutions, ranging from a small state college to large private institutions, are working on new approaches to the teaching of introductory economics. Improved teaching strategies and special attention to the preparation of future teachers are emphasized in the new courses being developed with the advice and assistance of the Joint Council.

The participating institutions are to spend three years developing, testing, revising, and refining their courses. The Sloan Foundation granted to the Joint Council \$80,200 for one-third of its cost of this part of the project. In a later phase a series of regional conferences will be held at which the various courses will be compared, criticized, and appraised in terms of their effectiveness. The Joint Council will then undertake to see that the successful courses are made widely available, especially to teacher-training institutions.

Support for fundamental and applied research in economics continued through grants approved in prior years to the National Bureau of Economic Research and the Brookings Institution. There were no new major commitments in this area during 1971, but in November the terms of a \$1 million matching grant awarded the National Bureau in 1968 were amended to allow the Bureau until mid-1974 to claim \$500,000 it had not yet matched.

These other grants in the areas of economics and management were approved in 1971:

HARVARD UNIVERSITY, Cambridge, Mass.: For a market survey to determine the need for a program of in-service management training for school administrators	\$20,000
NATIONAL BANKERS ASSOCIATION, INC., Washington, D.C.: In partial support of a training program in banking for blacks and other minority groups	\$20,000
NEW COLLEGE, Sarasota, Fla.: For planning and conducting a conference on entrepreneurial training	\$15,000
RUTGERS UNIVERSITY GRADUATE SCHOOL OF BUSINESS ADMINISTRATION, Newark, N.J.: In support of a Symposium on Methodology in Finance-Investments held in May of 1971	\$9,000
THE URBAN INSTITUTE, Washington, D.C.: For additional support of the preparation of a book, <i>Managing New York City</i> , by Frederick O'R. Hayes	\$7,000

Education



OTHER projects in education were concerned principally with curriculum development in areas of interest to the Foundation, with efforts to improve the management of higher education, and with public understanding of science. An experiment in educational method using task forces made up of students from varied disciplines to analyze a specific problem also received support.

Computers now have long been a part of the college and university scene, and yet surprisingly few students have any real contact with them. At Yale University the Department of Computer Science has set out to make the computer an integral part of students' learning and thinking processes.

In order for many or most undergraduate students to have regular face-to-face experience with a computer, a system that is both interactive and inexpensive is necessary. Yale has made a start in this direction through the use of remote satellite "mini-computers" which remove the editing load from its central PDP-10 computer. A clustering of terminals around each mini-computer makes for further efficiencies. By this means the cost of an hour's session on one of the terminals has been reduced substantially, and Yale believes that further reductions are possible. The next stage of development calls for additional mini-computer stations around the campus, and a link to two other large computers—Yale's IBM 360/67 and New York University's CDC 6600. When this system is fully operational the computers will automatically allocate functions among themselves and the student will have the benefit of the specialized capacities of all of them.

While the initial benefits will be to Yale students discovering how the



Wesleyan University is continuing development of a course on science for non-science students with the aid of a Sloan grant. Here two students use audio-tutorial stations to supplement class work.

computer can extend their intellectual reach, Yale expects that benefits also will flow in time to smaller colleges which will tie into such low-cost, interactive and responsive systems. The Sloan Foundation granted \$535,000 for the first year of a five-year development program in computer education.

Science 103-104 is the name of a two-semester course which has been attracting interest among undergraduates at Wesleyan University and in wider educational circles as well. In it, students who do not plan to become scientists learn something of what science is about through exposure to the relationships of two seemingly disparate disciplines, biology and mathematics. Wesleyan has been developing and refining the course since 1968, assisted by a two-year Sloan grant of \$106,000 in 1969. Original course materials have been developed, including technological aids such as audio-tutorial stations where individual students can fill in gaps in needed background knowledge.

Wesleyan now feels that Science 103-104, while still needing further refinement, is ready for limited export to a group of neighboring Connecti-



The San Francisco Exploratorium plays host to a growing number of visitors attracted by its unusual ways of presenting science to laymen. A Sloan grant will help strengthen educational exhibits.

cut colleges and universities having a more diverse student population. Accordingly, over the next two years, Wesleyan and five other institutions will cooperate in establishing the course on the various other campuses. Wesleyan also expects to introduce high-school science teachers to the course through a summer program. The Sloan Foundation granted \$98,000 to Wesleyan for this effort.

A different way of communicating the interest and excitement of science is being developed by Dr. Frank Oppenheimer at the San Francisco Exploratorium, operated by the Palace of Arts and Science Foundation. Taking as his focus the science and technology of human sensory perception, Dr. Oppenheimer, a physicist, is assembling a series of displays through which the viewer becomes a participant in demonstrating some facet of the perceptual process. Rising attendance at the Exploratorium, and the interest of other science museums in adopting some of Dr. Oppenheimer's devices for their own audiences, testify to the Exploratorium's impact in stimulating a broader understanding of science among laymen.

The Foundation granted \$100,000 for the development of more prototype exhibits, and \$25,000 for the Exploratorium's "Explainer" program. In this program high-school students, trained by the museum, are employed to answer questions stimulated in visitors by the exhibits; this affords the students both a learning and a teaching experience, and contributes to the effectiveness of the Exploratorium's educational program.

The cry for "relevance" continued to be heard among students in 1971, and the search for new structural models of education which would provide it continued. At Harvard's Kennedy School of Government, recipient of a 1970 Sloan grant for a master's degree program in public policy, one possible model emerged. Adapting that model to other campuses, in the Fall semester of 1971 task forces of senior and graduate students from diverse disciplines at eight universities were learning how to pool their intellectual resources in the study and analysis of a major and concrete problem in public policy. The problem selected by the students, following the Harvard experience of 1970, was that of heroin usage in major cities.

These Interdisciplinary Student Task Forces consist of 15 to 20 students, working for credit under supervision of a faculty member, gathering data on the heroin situation in their cities and engaging in analysis, projections, and the formulation of recommendations. Students may come from the fields of law, medicine, science, social science, and other areas. Their work is designed to lead to a meeting at which student and faculty representatives of each school will present their findings to a national panel of experts which will question the students about their methods and conclusions. The panel will then assemble a summary report.

The Student Task Forces project is focused initially on the heroin problem because of the obvious concern of students and the community at large about it; its methodology is believed to be transferable, however, to other issues of public policy. Harry Weiner, assistant dean of the Kennedy School of Government, is coordinating the project for the Foundation; at each participating university a specific school or division has assumed responsibility for the project on that campus. From Foundation appropriations totaling \$135,000, grants were made to participating institutions in the following amounts: Harvard University (Kennedy School of Government), \$9,250; Southern Methodist University (Department of Political Science), \$11,850; University of California, Berkeley (Graduate School of Public Policy), \$13,500; University of Pennsylvania (Fels Center of Government), \$10,000; University of Southern California (School of Public Administration), \$14,190; Washington University (The Social Science Institute), \$11,832. In addition, the American University is participating in the project with support from other sources.

*Explaining
Science
to Laymen*

*Students
Collaborate
on a Problem*

The danger of high-quality private institutions' pricing themselves out of the higher-education market remained unabated in 1971, and a number of institutions received support, singly and in groups, for efforts to come to grips with the problems of maintaining both heterogeneity in their student bodies and quality in their academic programs.

A cooperative undertaking to define the true cost factors in quality undergraduate education and explore ways to deal with them is being undertaken by nine private colleges and universities in the Northeast. A policy committee made up of the institutions' presidents or their deputies, aided by a staff and a consulting firm, will seek to develop new data to determine the actual cost of an undergraduate education at each of the nine institutions: instructional expense, housing, dining, student services, support facilities, books, and personal expenses all will enter into such a determination. The ability and willingness of students' families to pay a share of the costs will be analyzed, as will the capacity of students to assume a share of the expense by borrowing against future earnings. The institutions will examine various alternate plans for the collection of fees and the provision of financial aid. They foresee that the study may "ultimately make possible a multi-institutional program to meet the problem of financing undergraduate college education."

The colleges and universities involved in the study are Amherst College, Brown University, Dartmouth College, Harvard University, Massachusetts Institute of Technology, Mount Holyoke College, Princeton University, Wellesley College, and Wesleyan University. The study is supported by a Sloan grant of \$310,000 administered by Dartmouth College. Participants have agreed to make available to other institutions both the results of the study and the techniques developed for conducting it.

Another facet of the same problem is being studied by Princeton University with the aid of a \$16,000 grant. As part of a larger investigation into the future of the undergraduate college, Princeton is surveying and analyzing the relationship between rising tuitions, the number and kind of students applying to private universities, and enrollment decisions by students and their families.

Duke University, one of the first to implement the much-discussed deferred-tuition plan, which gears loan repayments to future earnings, received \$18,880 for an informational program to explain the plan to students and for gathering and analyzing data on the plan's effectiveness. United Student Aid Funds was granted \$6,500 for a feasibility study which led to a low-interest guaranteed loan program for students in independent secondary schools.

In the Midwest, presidents of a dozen or more smaller colleges are planning a conference to discuss possible cooperative means of survival. A \$7,000 grant to Heidelberg College supports the planning phase.

Two small grants were made to encourage minority students to enter upon careers in science. Columbia University received \$15,000 for a summer program, conducted principally by Columbia students, in physical and life sciences for minority high-school youths. Temple University received \$14,000 for its Bio-Sciences Career Program, which offers summer work in introductory biochemistry and scientific writing for minority students preparing for medical school or other graduate studies.

Other grants for the advancement of education:

AMERICAN ASSOCIATION FOR HIGHER EDUCATION, Washington, D.C.: In support of meetings to plan an Association of Professors of Higher Education	\$2,500
JOHN CARROLL UNIVERSITY, Cleveland, Ohio: To support a study by the Associated Colleges of Cleveland of the feasibility of establishing joint computing services for member colleges	\$4,800
COUNCIL FOR BASIC EDUCATION, Washington, D.C.: For a symposium on open admissions	\$8,500
DETROIT INSTITUTE OF TECHNOLOGY, Detroit, Mich.: To explore the establishment of a cooperative association with Massachusetts Institute of Technology	\$20,000
EDUCATIONAL CHANGE, INC., New Rochelle, N.Y.: For the preparation for Change magazine of a series of journalistic essays, and later a book, on the experience of blacks in American colleges and universities	\$13,000
EDUCATIONAL FOUNDATION FOR NUCLEAR SCIENCE, Chicago, Ill.: To train an apprentice journalist in researching and reporting topics in science and public affairs for the <i>Bulletin of the Atomic Scientists</i>	\$15,000
FLORIDA INSTITUTE OF TECHNOLOGY, Melbourne, Fla.: For supplementary support of students in the oceanographic technology program of the Hydrospace Technical Institute	\$20,000
POMONA COLLEGE, Claremont, Calif.: For an experiment in teaching computer science	\$10,000
SAIN'T ANN'S EPISCOPAL SCHOOL, Brooklyn Heights, N.Y.: For a graduate intern program in science teaching	\$14,000
SYRACUSE UNIVERSITY, SYRACUSE, N.Y.: In partial support of a study of the relationships of Federal government departments with colleges and universities	\$7,500

Related Problems of Society



THE uses of technology and the problems of technological change have been among the Foundation's major interests for many years, and more recently the Foundation has shared in the growing interest in the complex and difficult process of technological assessment. Because of such interests and concerns the Sloan Commission on Cable Communications was established in June of 1970 to investigate ways in which the spread of wired broad-band communications across the nation might yield the maximum public benefit. Its report* was issued in December of 1971.

The Commission, through eighteen months of deliberations, arrived at a total of thirty conclusions and recommendations for the development of cable television in the public interest. Central to its findings was the con-

*How Cable
Can Benefit
the Public*

26

**On the Cable: The Television of Abundance*. Report of the Sloan Commission on Cable Communications. McGraw-Hill Book Company. 256 pp. \$7.95 hard cover, \$2.95 paperback.

clusion that to encourage the growth of cable television is in the public interest, because of the broad range of diversified voices and services which cable technology makes possible. Regulation of cable at the federal, state, and local levels, the Commission concluded, should be structured so as to protect the public interest in the new system of electronic communications, but not to stifle its development.

Given such regulation, and resolution by Congress of the problem of access to copyright program material, the Commission foresaw that by 1980 the nation could have an interconnected cable system serving 40 to 60 per cent of all homes with twenty to forty broad-band communications channels, or more, and having a limited capacity for the sending of signals back from the receiver to the point of transmission. In a typical twenty-channel system, perhaps six channels would carry existing network and local broadcast stations; two would be for service uses of a governmental or quasi-governmental nature; one would be reserved for public access, and one for experimental educational uses. Of the remaining ten channels, the system operator would be permitted to program two himself and would be required to lease eight to other operators. In a forty-channel system, allocations would be proportionately higher. Thus the present "television of scarcity," confined by limited space in the broadcast spectrum to programming mainly of mass-audience appeal, may be augmented by a "television of abundance" capable of serving a variety of smaller and more specialized audiences as well.

The Commission's report considers the potential impact of cable on entertainment, news and opinion, public services, politics, community needs, and the existing over-the-air television industry.

The future of wired broad-band communications, as exemplified by cable television, is of course subject to numerous influences, not all of them predictable. Even as the Sloan Commission's report was being published, government and industry negotiators were attempting to define a future structure for cable television which presumably would be embodied in federal regulations and legislation. The Foundation, believing that many problems of urban areas and of society generally may be ameliorated through improved communications, sought through the Commission to obtain an assessment of this new technology, its problems and prospects, before it became firmly locked in place.

The Commission's chairman was Dr. Edward S. Mason, dean emeritus of the Graduate School of Public Administration at Harvard University. Its staff director was Paul L. Laskin and its associate director was Prof. Monroe E. Price of the Law School of the University of California at Los Angeles. Commission members in addition to Professor Mason were:

Ivan Allen, Jr., former Mayor of Atlanta
John F. Collins, former Mayor of Boston

*The Prospect
of Abundant
Communications*

*Technology
in the Service
of Society*

27

Lloyd C. Elam, president, Meharry Medical College
 Kermit Gordon, president, the Brookings Institution
 William Gorham, president, the Urban Institute
 Morton L. Janklow, New York attorney
 Carl Kaysen, director, Institute for Advanced Study
 Edward H. Levi, president, University of Chicago
 Emanuel R. Piore, vice president, International Business Machines Corporation
 Henry S. Rowen, president, Rand Corporation
 Frederick Seitz, president, Rockefeller University
 Franklin A. Thomas, president, Bedford-Stuyvesant Restoration Corporation
 Patricia M. Wald, Washington attorney
 Jerome B. Wiesner, president, Massachusetts Institute of Technology
 James Q. Wilson, professor of government, Harvard University

For a number of years the Foundation had made small annual sustaining grants to two leading organizations in the field of equal rights, the National Association for the Advancement of Colored People and the formerly related NAACP Legal Defense and Educational Fund. Together, the two organizations have been responsible for much of the peaceful and constructive social change which has occurred over the past several decades. The pace of that change, of course, has not been as rapid as it might have been had groups like the NAACP and the Legal Defense Fund been adequately staffed and financed to respond to all the challenges and opportunities that confronted them.

To better equip themselves for continuing leadership in the struggle for racial justice, both the NAACP and the Legal Defense Fund have projected and sought to finance five-year budgets which would enable them to engage in longer-range planning and to avoid annual financial crises. Major foundations have contributed substantially to these two efforts, and the organizations are seeking additional funding from all sources. Over the five-year period they hope to develop new sources of support which would reduce their dependence on traditional sources.

The Legal Defense Fund, independent of the NAACP since 1939, has been the spearhead of legal actions to overcome patterns of segregation through litigation. Its Earl Warren Legal Training Program, which seeks to double the number of black lawyers over a seven-year period, awarded more than 300 law scholarships in the current academic year. Spurred by recent favorable court rulings, the Legal Defense Fund foresees accelerated activity and progress toward racial equality in employment, administration of justice, housing, and education. The Foundation contributed \$250,000, payable over five years, for the legal training program.

The NAACP, a grass-roots membership organization coordinated from its New York headquarters, is the largest rights organization and one of the most effective in dealing with problems as they are identified at the local

*Organizing
 the Struggle
 for Justice*

and state levels. To help the NAACP establish a firm base under its core activities over the next five years, the Sloan Foundation granted \$125,000 to the NAACP's Special Contribution Fund.

Other grants for related problems of society:

- BEDFORD-STUYVESANT RESTORATION CORPORATION, Brooklyn, N.Y.: In partial support of an engineering survey to determine the feasibility of the Corporation's acquiring a cable television franchise \$20,000
- BETH ISRAEL HOSPITAL, Brookline, Mass.: To support a study by a physician in the field of drug abuse treatment and education \$18,250
- HENRY STREET SETTLEMENT, New York, N.Y.: For renewed and terminal support of the Settlement's Urban Training Center \$17,000
- LOS ANGELES TECHNICAL SERVICES CORPORATION, Los Angeles, Calif.: For a planning program on urban analysis to be presented to federal agencies \$14,000
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.: For an inquiry into the applications of urban analysis to urban problem solving \$12,000
- UNION SETTLEMENT ASSOCIATION, New York, N.Y.: In support of a Fiscal Management Service to serve a number of organizations in East Harlem \$18,000
- YALE UNIVERSITY, New Haven, Conn.: For a study of the use of federal procurement to expand job and management opportunities for minorities and the poor \$10,714

Particular Programs

THE FOUNDATION'S policy providing for a limited number of Particular Programs, adopted in 1969, represents an effort to concentrate specified resources over a limited period of time on problems which may be amenable to sharply focused and relatively short-term approaches. A Particular Program may involve the expenditure of from \$10 million to \$15 million over a period of from three to as long as seven years. Continuing internal studies will generate new Particular Programs as existing ones reach their terminal points. The intent is to maintain three Particular Programs in being at any given time.

Currently two Particular Programs are active, and a third has been identified and is being developed. Of the two programs in being, one is concerned with development of the new discipline of neuroscience, through which expanded basic research may lead to a fuller understanding of the functioning of the nervous system. Another supports efforts to increase the access of minorities to the professions of medicine and management, largely through educational programs leading to the professional degree. The third Particular Program will seek to develop ways in which technology may contribute directly or indirectly to increased efficiency and quality in higher education.

Neuroscience



RESEARCH and training in neuroscience, the study of the brain and its relationship to behavior, gained impetus with the award of Sloan grants totaling more than \$2.5 million in 1971. As in the preceding year, the bulk of this support was directed toward catalyzing the formation of interdisciplinary centers of excellence at institutions already possessing considerable strength in many of the disciplines which contribute to neuroscience. The beginnings of a planned shift in emphasis, however, were evident in smaller grants for research projects focused on specific problems. Such grants are intended not only to fill in important gaps in knowledge, but also to stimulate neuroscience activity at a larger number of institutions and to provide support for younger scientists in the field. Seven younger neuroscientists also will receive support, beginning in 1972, through the Sloan Fellowships for Basic Research (Page 11).

The University of California at San Diego, which established the first Department of Neurosciences in the nation, is recognized as a leader in creating unified approaches to the study of the nervous system. Beginning with a small core of distinguished neuroscientists, the Department has enlisted the enthusiasm of talented investigators from other parts of the science-oriented San Diego campus and is now a firmly established entity with a marked potential for growth. The UCSD program in neuroscience is a particularly broad one, embracing work ranging from molecular biology to behavioral studies. Its research aims at understanding the development and maintenance of connections among nerve cells and of integrated systems

*Understanding
the Integration
of Nerve Cells*

of nerve cells, these being the basis for the most important aspects of brain function.

In projecting the future growth of neuroscience work on its campus, UCSD has drawn up plans for shared core facilities for research and training along with broadened training programs and the addition of scientists who will add strength to the over-all program in key areas of research. The Foundation granted \$840,000 for partial support of the first two years of this five-year program.

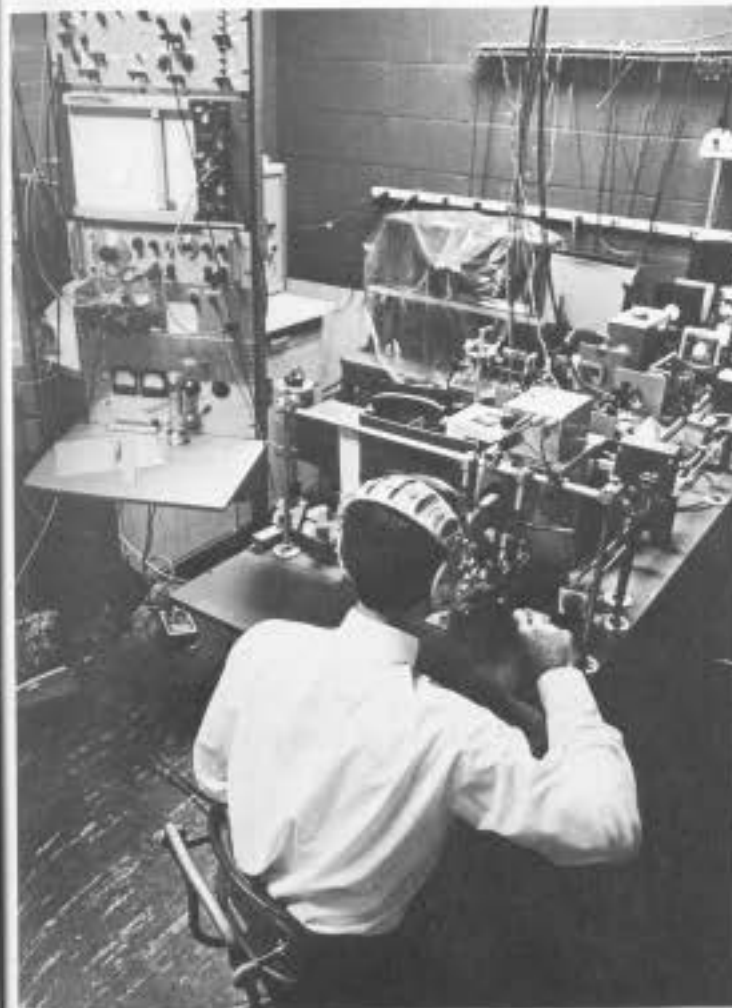
Extending Research at Caltech

Another center of strength in neuroscience exists at the California Institute of Technology, where both senior scientists and a number of promising young investigators are attacking fundamental problems at basic levels. Caltech's depth of experience in molecular biology and biochemistry provides intellectual support for a program in neuroscience which is attracting the interest of scientists from diverse fields of inquiry.

The Sloan Foundation granted \$610,000 to enable Caltech to extend its neuroscience research over a four-year period. With this assistance Caltech researchers will endeavor to analyze the molecular properties which underlie chemical signals between nerve cells. They will seek to determine how genes control patterns of connections among nerve cells, and they will study the events in brain cells which are related to certain periodic variations in behavior such as sleep and wakefulness or sexual activity. And they will undertake mathematical analyses of brain activity recorded simultaneously from a large number of points on the human scalp. These studies may open new scientific approaches to the biological processes underlying many important aspects of human behavior.

The development of complex nervous systems from the single cell of the fertilized egg—developmental neurobiology—is of particular interest to neuroscientists at the Albert Einstein College of Medicine of Yeshiva University in New York. New techniques for growing brain cells in laboratory vessels enable Albert Einstein scientists to gain insights into how clusters of rapidly differentiating cells organize themselves for specific functions. Chemical and electrical characteristics of different kinds of brain cells and the functions of brains at early stages of development also are investigated in the Einstein laboratories. For expansion of this kind of research and related training over a two-year period, the Foundation granted \$440,000 to Yeshiva University.

Neuroscience research under the coordination of Dr. Hans-Lukas Teuber at Massachusetts Institute of Technology began to expand substantially in breadth and depth with the help of a Sloan grant awarded in 1970. New interdisciplinary research projects arose, existing ones sharpened their focus, and related training opportunities increased. MIT scientists approach the central problem of neuroscience—the relation between brain



In neuroscience research at MIT, Dr. Whitman Richards moves his eyes in time to audible clicks while an optical system "watches" his eyes and records data. One objective is to learn whether the brain "switches off" the sensory channel momentarily just before the eyes move.

Characteristics and Functions of Brain Cells

34

function and organism activity—from a number of directions. Chemicals that transmit signals between brain cells are studied; changes in brain cell transmission and in organism behavior as a result of specific brain lesions are analyzed. One project whose practical consequences are immediately evident studies the effects of protein deficiency in newborn animals on their brain chemistry and subsequent performance.

MIT also reported encouraging experience with its undergraduate courses in neuroscience, which attracted some 870 students in the first year of Sloan support. Student interest in intermediate-level courses was correspondingly high. The Foundation in 1971 granted an additional \$480,000 to MIT to assist the second year of development of its neuroscience program.

Within institutions which do not yet have broad-based programs in neuroscience, there may be found small groups of scientists ready to collaborate on a particular neuroscience problem which requires inputs from several disciplines. Northwestern University, for example, received \$70,800 for a project by a psychologist, a biochemist, and an electron microscopist to study the structural and chemical basis for memory. Their multidisciplinary

Research Projects Gain Support

35

approach may lead to significant findings on a basic problem whose solution thus far has largely eluded more narrowly conceived studies.

Another promising area of research is the nervous systems of amphibians. The brains of frogs and toads are more complex than those of invertebrates, yet simpler and easier to study than the highly elaborate brains of mammals. The behavior patterns displayed by amphibians are relatively limited and clear-cut, thus simplifying the possible relationships between brain function and activity. These relationships provide sharper insights into analogous relationships in higher animals and man. Research in this area by several laboratories is being coordinated by Dr. David Ingle of Harvard University and McLean Hospital under a Sloan grant of \$50,000 to Massachusetts General Hospital.

Other grants for neuroscience approved in 1971:

MARINE BIOLOGICAL LABORATORY, Woods Hole, Mass.: For a 1971 Summer Neurobiology Training Program	\$9,779
In partial support of a 1972 summer training program in excitable membranes	\$12,500
NEUROSCIENCES RESEARCH FOUNDATION, INC., Brookline, Mass.: For support of resident scientist activities of the Neurosciences Research Program	\$15,000

Expanding Professional Opportunities



THE Particular Program to expand opportunities for minorities in the professions of medicine and management completed its second full year of operation in 1971. Grants approved by Foundation Trustees for this Program during 1971 reached a level of \$3 million.

Grants to increase access for minorities to medical careers focused largely in 1971 on problems of student financial support, educational preparation for medical studies, and retention of students once they have entered medical schools. Problems of initial recruitment of students and of their entry into the profession after completion of studies, both important considerations in increasing the minority representation in medicine, are receiving continuing attention as the Particular Program evolves.

Concerted efforts stimulated to some degree by this Particular Program make it seem likely that by 1975 the number of minority students entering United States medical schools will be about 1,800, or roughly 12 per cent of all freshman medical students enrolling in that year. The number entering in 1971 was about 1,000, or 7.5 per cent; this compared with about 300 only three years earlier.

One of the significant contributors to this past and projected increase is National Medical Fellowships, Inc., which currently helps to support about

*The Problems
for Minorities
in Medicine*

60 per cent of first-year minority medical students. Organized in 1946, NMF is the only private, nationwide organization devoted to increasing the number of minority medical students by helping to finance their educations. As the number of such students has multiplied dramatically in recent years, NMF has strengthened its organization and broadened its fund-raising appeals to attempt to keep pace with their financial needs. It has, in fact, helped to stimulate interest among minority students in entering medicine, and by providing financial support it has helped to encourage medical schools to accept them. (NMF support, however, does not meet the schools' full cost of training physicians.)

For 1971, NMF projected a budget of \$2.2 million, more than double its 1970 income of about \$1 million, and redoubled its efforts with corporations, foundations, and other private donors to meet that goal. The Sloan Foundation granted \$805,000 (compared with \$345,000 in 1970). Of the 1971 grant, \$450,000 was allocated for first-year fellowships, \$250,000 for fellowship renewals, and \$105,000 for operating expenses. NMF is now emphasizing support of students in their first and second years of medical school, in the belief that third- and fourth-year students will be more inclined and better able to borrow to complete their medical educations.

A grant to strengthen a major institution training minority physicians and to support an experiment in reducing the length of a medical education was made to the Howard University College of Medicine. Until recently Howard and Meharry Medical College trained nearly all of the nation's black physicians; Howard still has the largest black medical enrollment. Faced with increasing competition from other medical schools for the most able students, Howard has begun to upgrade its programs and to seek the financial support to enable it to do so.

One innovation being introduced by the Howard College of Medicine is its Accelerated Medical Education Program, through which twenty selected students enter directly into medical studies at the end of their sophomore undergraduate year. Reorganization and acceleration of the medical curriculum and improved methods of instruction may enable them to complete in six years or less the course to the M.D. degree that now requires eight years. Such a program, if successful and if more widely adopted, could materially reduce the cost of expanding the number of minority and other physicians.

In a three-year grant, Howard received \$350,000 for the Accelerated Medical Education Program and \$100,000 for the establishment of a development office for the College of Medicine. Although Howard is partially supported by Federal appropriations, it must seek other funds to elevate standards and to develop innovative programs in the College of Medicine. The new development office will be instrumental in this effort.

A program to prepare and motivate minority college students to enter medical schools received a second year of partial support through a \$75,000 grant to Harvard University. The Health Careers Summer Program of Harvard Medical School provides eight weeks of academic course work, tutorial work in academic subjects, and clinical-tutorial work in Harvard-affiliated hospitals. Evaluation of the 1970 sessions indicated that this experience was effective in stimulating a high percentage of eligible students to apply and gain admission at medical schools.

The Pre-Medical Research and Education Program (PREP) of the New York University School of Medicine reaches down to the pre-college level to recruit talented minority students into pre-medical studies. During the school year they attend laboratory-oriented Saturday courses at the School of Medicine; during summers they work full time in research laboratories and community health projects; and after high-school graduation they receive intensive pre-college preparation in science, mathematics, and English. Begun in 1969, PREP has shown encouraging results thus far. The Foundation granted \$50,000 in partial support of the 1971 program.

Management careers for blacks and other minorities are becoming more accessible partly because of the efforts of two separate consortia embracing fifteen graduate management schools. Both groups received substantial Sloan support in 1971.

The Council for Opportunity in Graduate Management Education (COGME), made up of management schools at ten leading universities*, first became active in 1970 with financing from a \$1 million grant awarded by the Sloan Foundation late in 1969. In its first year it helped to raise the enrollment at member schools of minority candidates for the Master of Business Administration degree from 257 to 435. This was accomplished through the provision of fellowship support, together with accelerated recruiting activities. Some schools instituted new preparatory and tutorial programs to insure success of their minority MBA candidates, with support from COGME.

For 1971 COGME sought renewed support of its programs by the Sloan Foundation while organizing itself to raise funds from other foundations, corporations, and private and government sources. The Foundation approved a grant of \$820,000, designated initially for Columbia University and later transferred to Harvard University when COGME's headquarters moved

*University of California-Berkeley, Carnegie-Mellon University, University of Chicago, Columbia University, Cornell University, Dartmouth College, Harvard University, Massachusetts Institute of Technology, University of Pennsylvania, and Stanford University.

*Managers
for Nonprofit
Organizations*

there. The grant provides \$450,000 for 120 first-year fellowships, \$270,000 for second-year fellowships, and \$100,000 for administrative expenses.

The Consortium for Graduate Study in Management, a group of five management schools* having much the same objectives as COGME, has added a new dimension to its program with the help of a \$500,000 Sloan grant to Washington University. The new program will seek to meet some of the need for more business-trained minority talent in public and private not-for-profit organizations. The Sloan support will meet initial costs of a five-year, \$1.1 million program which is intended to graduate a total of 175 managers for the nonprofit sector of society.

To prepare students for careers in varied nonprofit settings, the participating management schools have secured the collaboration of such other professional schools in their universities as medicine, hospital administration, fine arts, education, and social work. The Consortium foresees opportunities for these minority MBA graduates in the administration of hospitals, public and private educational systems and institutions, governmental agencies and corporations, health care delivery agencies, social welfare agencies, community service organizations, and museums, art centers, and other cultural enterprises.

A principal source of trained minority managers is the Atlanta University School of Business Administration, which has awarded about 400 MBA degrees since 1946. The University, founded in 1869, is the graduate institution of an Atlanta complex which also includes five traditionally black undergraduate colleges. Its graduate management program is the oldest among predominantly black schools. Thus it has borne historically a major responsibility for the training of minority managers at the graduate level.

Recently the Atlanta business school has begun to raise its sights in terms of both the number of students it enrolls and the quality and efficiency of its instruction. It has formed a cooperative relationship with Northwestern University's Graduate School of Management through which both schools seek to increase their enrollment of minority students and to develop programs appropriate to their needs and interests. It is seeking to expand its faculty and resources initially to the point where it will qualify for accreditation.

To support these efforts the Foundation in 1971 granted \$300,000 to Atlanta University, to be used over three years principally for expanding faculty, increasing student financial support, and strengthening administration.

*Indiana University, University of Rochester, University of Southern California, Washington University, and University of Wisconsin.

Other grants for expanding opportunities in medicine and management:

AMERICAN MEDICAL ASSOCIATION EDUCATION AND RESEARCH FOUNDATION, Chicago, Ill.: To subsidize interest for one year on loans to third- and fourth-year M.D. candidates in California medical schools	\$12,000
UNIVERSITY OF CALIFORNIA, San Diego, Calif.: For a summer laboratory program for Mexican-American undergraduate students	\$10,400
GEORGETOWN UNIVERSITY, Washington, D.C.: For support of academic reinforcement programs for minority medical students	\$20,000
HOWARD UNIVERSITY, Washington, D.C.: For a reading improvement program for students in the Howard University College of Medicine	\$10,000
UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.: For support of planning activities to implement a cooperative loan program for students in the five Philadelphia medical schools	\$6,000
NORTHWESTERN UNIVERSITY, Evanston, Ill.: For regional conferences organized by the Committee on Institutional Cooperation to explore joint efforts for improving access for minority students to Midwestern medical schools	\$15,000
TEXAS SOUTHERN UNIVERSITY, Houston, Texas: For planning activities to expand opportunities for minorities in the University's graduate business program	\$19,200
UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.: For a summer academic enrichment program for entering and enrolled minority students in the University's School of Medicine	\$9,800

*Raising Quality
and Quantity
at Atlanta*

Technology in Education



THE Foundation's third and newest Particular Program, announced at the beginning of 1971, will explore ways in which technology, broadly defined, can contribute to controlling the cost and enhancing the quality of education. It is clear that the rapid cost increases of the 1960s cannot continue; but at the same time, the accelerated influx of lower-income students at many institutions is exerting new pressures on both financial structures and academic standards.

For reasons such as these it seems timely to take a second look at the possibilities of technology for improving educational productivity, avoiding if possible the excesses of enthusiasm and consequent disappointments that characterized the educational technology boom of the previous decade.

To guide this Particular Program a Steering Committee has been assembled, consisting of the following:

William G. Bowen, Provost and President-elect, Princeton University
John B. Coleman, President, Haverford College
Charles Eames, Designer and Film-maker
Andrew Gleason, Professor of Mathematics, Harvard University
Wayne H. Holtzman, Hogg Foundation for Mental Health
Frank Oppenheimer, Director, San Francisco Exploratorium
Jerome B. Wiesner, President, Massachusetts Institute of Technology

The Steering Committee, over the course of its meetings in 1971, reached the conclusion that modest and limited exploratory undertakings will be a necessary prerequisite to more ambitious developmental projects. It counseled a disciplinary approach, seeking to learn how technology can strengthen teaching in specific subjects and devising appropriate software for that purpose—not the creation of more hardware with only vague purposes in mind. In this approach the crucial elements will be individual scholars and teachers dedicated to improving the pedagogy of their subjects, and inventive enough to discern in technology a set of instruments they can convert to their own purposes.

One further step taken by the Foundation in 1971 was the convening of a one-day Conference on the Wired Campus, attended by representatives of thirteen colleges and universities interested in the prospects of broad-band communications for increasing the scope of educational activity in their institutions, and possibly in their surrounding communities as well. The complexities of such an undertaking are numerous, and have only begun to be explored. The initial in-depth exploration is occurring at Stanford University with the aid of a \$57,500 Sloan grant.

The Stanford study brings together scholars from five different schools of the University (Business, Education, Engineering, Law, and Humanities and Sciences) under the coordination of the Institute for Communication Research. They are spending twelve months investigating the ramifications—financial, technical, managerial, pedagogical, legal, and behavioral—of a system providing cable television and associated services to Stanford's classrooms, laboratories, libraries, and residences, and possibly to the adjacent community of Palo Alto, Calif., which is planning its own cable system. From the Stanford study there may emerge the first comprehensive design for a prototype broad-band campus system, adaptable to similar institutions elsewhere.

The Steering Committee identified two areas in which the development of better technological software might serve to accelerate learning and reduce the per-student cost of higher education. Freshman mathematics and English in many institutions are essentially remedial courses in which large numbers of students of varying degrees of preparation attempt to become qualified for more advanced courses. It is in these "mass" subjects, the Committee suggested, that economies of scale through expanded use of technology may be realized. Moreover, an interactive and self-paced mode of instruction would permit both well-prepared and poorly prepared students to proceed at their own speed.

This hypothesis is being tested by Prof. Louis J. Nachman with support from a grant of \$58,500 to Oakland University. Professor Nachman is developing materials for a course designed to teach students the essentials

*Emphasis
on Individual
Scholars*

*Economies
of Scale
in Mathematics*

of mathematics which are prerequisite to the study of calculus. The course is divided into four "mini-courses," each of which the student must pass before moving on to the next one. The student learns by means of programmed texts, video cassettes (which he can replay as needed), and individual tutoring by a professor, graduate students, and undergraduate education majors when he needs help. He is not bound to the pace of a class; some students may complete the full course in less than one semester, while others may take as long as two semesters. Thus, in theory, the most efficient use is made of teachers, and the student learns through a desirable combination of self-instruction, lectures (on videotape), and individual tutoring.

Status Reports
on English
and Libraries

In two other areas of possible technological application, the Foundation is underwriting surveys to determine what is now known and what is being done. Prof. Irving Gersten of Florissant Valley Community College is studying the present uses of technology in the teaching of English composition under a grant of \$14,000 to the Junior College District of St. Louis. At the University of Chicago, Prof. Herman H. Fussler of the Graduate Library School is surveying the state of the art in library technology under a \$4,500 grant.

The program on Technology in Education thus remains in an embryonic stage at this writing. Hopefully the explorations now in progress will point the way to development of a full-fledged Particular Program in the application of the most advanced technical knowledge to some of the pressing problems now facing education.

Other Grants



GRANTS not mentioned in preceding sections of this Report are listed and briefly described here. These grants are civic and support grants, made in recognition of obligations by the Foundation toward its geographical and professional communities, and *ad hoc* grants for activities of unusual interest for which no continuing commitment is implied.

AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass.: In partial support of a Symposium on the Future of the Submarine-Based Nuclear Deterrent	\$7,500
THE UNIVERSITY OF CHICAGO, Chicago, Ill.: To assist in disseminating <i>Foundations, Private Giving, and Public Policy</i> , the report of the Peterson Commission on Foundations and Private Philanthropy	\$2,500
DEPARTMENT OF COMMERCE GIFTS AND BEQUESTS ACCOUNT, Washington, D.C.: To support the printing of pre-conference materials for the White House Conference on the Industrial World Ahead	\$20,000
MUSEUM OF FINE ARTS, Boston, Mass.: For partial support of publication of papers presented at a 1970 symposium on applications of science in the examination of works of art	\$9,000
NEW YORK PUBLIC LIBRARY, New York, N.Y.: In partial support of the Library's Science and Technology Division	\$2,100

NEW YORK URBAN COALITION INC., New York, N.Y.: To provide tuition for a member of the Coalition staff to attend the Alfred P. Sloan Fellowship Program in management training at Massachusetts Institute of Technology \$6,900

TOUGALOO COLLEGE, Tougaloo, Miss.: Emergency supplement to a major 1969 grant for the College's building fund \$20,000

UNITED STUDENT AID FUNDS, INC., New York, N.Y.: For partial support during 1972 of the Advisory Council of United Student Aid Funds . . . \$7,500

WOODBOW WILSON NATIONAL FELLOWSHIP FOUNDATION, Princeton, N.J.: In partial support of the 1971 National Congress of Martin Luther King Fellows \$10,000

Foundation Operations



THE Foundation's areas of interest, as earlier sections of this Report have indicated, are research and education in basic science and technology; economics; the education of managers for both public and private enterprises; and problems of society amenable to scientific, technological, and educational approaches. Through its Particular Programs the Foundation pursues more specialized interests in expanding minority opportunities in management and medicine; in neuroscience, the study of the brain and its relationship to behavior; and in the use of technology in higher education.

The Foundation welcomes proposals within these areas of interest. No application forms are supplied and there are no deadlines for applications except in special programs such as the Sloan Fellowships for Basic Research. Many proposals originate in informal discussions with Foundation officers or in letters of inquiry to the Foundation. Often such a letter will be helpful in determining whether it would be worth while to prepare a comprehensive proposal.

In this Foundation, as in any other, many proposals must be declined. Most often this is because they fall in areas in which the Foundation is not currently active, such as the creative and performing arts, religion, and the humanities. The Foundation also does not make grants for medical research, for endowment, for general support of institutions, or for direct support of individuals. Even beyond these restrictions, limitations on the Foundation's

resources make necessary the declination of numerous proposals which are within program and are clearly meritorious.

If a grant request, after suitable investigation, receives the staff's recommendation and the Trustees' approval, a schedule of reporting on its progress is established to meet the requirements of good philanthropic practice and the applicable laws.

The Board of Trustees gained one member and lost one during 1971. Herbert E. Longenecker, president of Tulane University, was elected a Trustee of the Foundation on April 7. Dr. Longenecker, trained as a biochemist, has served on numerous private and public bodies concerned with science, government, and higher education. Joseph C. Wilson, chairman of the board of Xerox Corporation, died November 22. Mr. Wilson was a principal benefactor of his alma mater, the University of Rochester, of his home city of Rochester, New York, and in a larger sense of his nation and his world. The Trustees in a special resolution took note of his passing with profound regret.

There were no changes in the professional staff during the year.

Financial Review

Financial Review



THE financial statements of the Foundation, which have been audited by Haskins & Sells, independent certified public accountants, appear on pages 55 to 67. They include the balance sheet, the statement of income and funds, the schedule of marketable securities and the summary and schedule of grants and appropriations.

Total investment and other income in 1971 amounted to \$12,720,227, compared with \$12,890,391 in 1970. The decrease of \$170,164 reflected slightly lower dividend and interest income in 1971. Investment expenses in 1971 totalled \$154,302, of which \$111,862 were investment counsel and custodian fees. Provision for Federal excise tax amounted to \$490,000 in 1971. These deductions from income totalled \$644,302 in 1971, compared with \$637,243 in 1970.

Net investment income was \$12,075,925 in 1971, or slightly less than net investment income of \$12,253,148 in 1970.

The total of grants and appropriations authorized and administration expenses during 1971 amounted to \$12,340,348, or \$264,423 in excess of net investment income of \$12,075,925. Grants and appropriations totalled \$11,293,842 while administration expenses amounted to \$1,046,506. Over the Foundation's thirty-seven year history, the cumulative excess of grants and expenses over income has amounted to \$43,409,747.

The total of grant and appropriation payments in 1971 was \$13,542,346, compared with \$15,819,235 in 1970. Together with 1971 administration expenses, investment expenses and Federal excise taxes paid, the total of cash expenditures in 1971 was \$15,248,655, compared with \$16,879,039 in 1970.

A disposition of funds summary showing the sources of funds and their application is presented below:

SOURCE OF FUNDS:		
Investment and other income	\$12,720,227	
Net profit on disposals of securities	<u>90,732</u>	\$12,810,959

APPLICATION OF FUNDS:		
Grant and appropriation payments	13,542,346	
Administration expenses	1,046,506	
Investment expenses	154,302	
Federal excise taxes paid	<u>505,501</u>	<u>15,248,655</u>

DECREASE IN FUNDS		
CONSISTING OF:		
Decrease in ledger value of investments	2,839,310	
Less increase in cash balances	<u>401,614</u>	<u>\$ 2,437,696</u>

A comparative summary of the Foundation's assets at quoted market values at December 31, 1971 and December 31, 1970 follows:

	DECEMBER 31, 1971		DECEMBER 31, 1970	
	AMOUNT	PERCENT OF TOTAL INVESTMENTS	AMOUNT	PERCENT OF TOTAL INVESTMENTS
Fixed Income Securities:				
U.S. Government and agency obligations	\$ 29,272,495	8.9%	\$ 33,077,323	10.4%
Other bonds and notes	26,847,503	8.2	23,898,920	7.5
Total fixed income	<u>56,119,998</u>	<u>17.1</u>	<u>56,976,243</u>	<u>17.9</u>
Common Stocks:				
General Motors	115,973,613	35.3	124,023,613	38.9
All other	156,219,790	47.6	137,476,417	43.2
Total common stocks	<u>272,193,403</u>	<u>82.9</u>	<u>261,500,030</u>	<u>82.1</u>
Total investments	<u>328,313,401</u>	<u>100.0%</u>	<u>318,476,273</u>	<u>100.0%</u>
Cash	782,145		380,531	
Total assets at quoted market values	<u>\$329,095,546</u>		<u>\$318,856,804</u>	

A summary of grants by major classifications followed by a listing of grants made during 1971 will be found on pages 62-67. Grants and appro-

priations authorized and payments for the year ended December 31, 1971 are summarized in the following table:

Grants and appropriations unpaid	
January 1, 1971	\$15,976,504
Authorized during 1971	11,293,842
	<u>27,270,346</u>
Payments during 1971	13,542,346
Total grants and appropriations authorized but not due at December 31, 1971	<u>\$13,728,000</u>

Income from investments credited to the General Motors Dealers Appreciation Fund during 1971, after provision for Federal excise tax, amounted to \$338,796. Grants authorized and applied against this Fund totalled \$400,000, representing support of the Sloan-Kettering Institute for Cancer Research, as set forth on page 13. Grant payments from this Fund during the year 1971 amounted to \$1,400,000, which resulted in grants outstanding and unpaid at the end of 1971 of \$2,500,000, compared with \$3,500,000 a year ago.

After taking account of the foregoing, the net worth of the Foundation at December 31, 1971, based on quoted market values, was divided as follows:

	TOTAL ASSETS AT MARKET VALUE	GRANTS AND APPROPRIATIONS AUTHORIZED BUT NOT DUE FOR PAYMENT	ACCRUED FEDERAL EXCISE TAX	FUND BALANCES AT MARKET VALUE
General Fund	\$320,476,309	\$11,228,000	\$482,699	\$308,765,610
General Motors Dealers Appreciation Fund	8,619,237	2,500,000	13,800	6,105,437
Total	<u>\$329,095,546</u>	<u>\$13,728,000</u>	<u>\$496,499</u>	<u>\$314,871,047</u>

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

TWO BROADWAY
NEW YORK 10004

ACCOUNTANTS' OPINION

Alfred P. Sloan Foundation:

We have examined the balance sheet of Alfred P. Sloan Foundation as of December 31, 1971 and the related statement of income and funds for the year then ended, and the supplemental schedules of marketable securities and grants and appropriations. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, such financial statements and supplemental schedules present fairly the financial position of the Foundation at December 31, 1971 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Haskins & Sells

February 1, 1972

Balance Sheet

December 31, 1971 and December 31, 1970

	<u>1971</u>	<u>1970</u>
<u>ASSETS</u>		
MARKETABLE SECURITIES (at cost or quoted market at date of gift or receipt):		
Fixed income securities:		
U.S. Government and agency obligations	\$ 28,932,516	\$ 33,421,407
Other bonds and notes	27,330,480	24,585,740
Total fixed income	56,262,996	58,007,147
Common stocks	147,967,999	149,063,158
Total marketable securities (quoted market: 1971—\$328,313,401; 1970—\$318,476,273)	204,230,995	207,070,305
CASH	782,145	380,531
TOTAL	<u>\$205,013,140</u>	<u>\$207,450,836</u>

OBLIGATIONS AND FUNDS

GRANTS AND APPROPRIATIONS AUTHORIZED BUT NOT DUE FOR PAYMENT	\$ 13,728,000	\$ 15,976,504
ACCRUED FEDERAL EXCISE TAX	496,499	512,000
FUND BALANCES	190,788,641	190,962,332
TOTAL	<u>\$205,013,140</u>	<u>\$207,450,836</u>

Statement of Income and Funds

For the years ended December 31, 1971 and 1970

INCOME	1971	1970
Investment income (recorded on cash basis):		
Dividends	\$ 9,318,805	\$ 9,477,527
Interest	3,368,469	3,404,361
Other	32,953	8,503
	<u>12,720,227</u>	<u>12,890,391</u>
Less:		
Investment expenses	154,302	125,243
Provision for Federal excise tax	490,000	512,000
Net investment income	<u>12,075,925</u>	<u>12,253,148</u>
Grants and expenses:		
Grants and appropriations authorized	11,293,842	11,341,225
Administration expenses	1,046,506	934,561
Total	<u>12,340,348</u>	<u>12,275,786</u>
Excess of grants and expenses over income for the year	(264,423)	(22,638)
Cumulative excess of grants and expenses over income from inception to:		
Beginning of year	(43,145,324)	(43,122,686)
End of year	<u>(43,409,747)</u>	<u>(43,145,324)</u>
PRINCIPAL		
Balance at beginning of year	234,107,656	233,537,534
Net profit on disposals of securities	90,732	570,122
Balance at end of year	<u>234,198,388</u>	<u>234,107,656</u>
FUND BALANCES AT END OF YEAR	<u>\$190,788,641</u>	<u>\$190,962,332</u>

Schedule of Marketable Securities

December 31, 1971

FIXED INCOME	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
U.S. Government and Agency Obligations:			
Treasury Bonds:			
4% —August 15, 1973	\$ 5,921,000	\$ 5,863,617	\$ 5,846,988
Treasury Notes:			
5.75% —November 15, 1974	3,000,000	3,002,812	3,048,750
6% —May 15, 1975	2,000,000	2,003,750	2,052,500
6.50% —May 15, 1976	2,000,000	1,997,945	2,090,000
6.25% —February 15, 1978	2,500,000	2,509,766	2,550,000
Federal Home Loan Banks			
Consolidated Bonds:			
7.75% —February 25, 1980	1,300,000	1,301,219	1,386,125
Twelve Federal Land Banks Con- solidated Federal Farm Loan Bonds:			
5.125%—April 20, 1978	500,000	416,250	467,500
Federal National Mortgage Association Debentures:			
5.125%—February 10, 1972	2,350,000	2,358,813	2,351,457
5.50% —April 1, 1972	1,640,000	1,637,438	1,642,050
4.70% —December 1, 1972	1,000,000	955,000	995,000
4.50% —July 1, 1973	2,790,000	2,580,750	2,755,125
5.20% —January 19, 1977	3,000,000	3,011,250	2,861,250
7.25% —June 10, 1981	300,000	297,656	308,250
6.05% —February 1, 1988	1,000,000	996,250	917,500
Total U.S. Government and agency obligations		<u>28,932,516</u>	<u>29,272,495</u>
Other Bonds and Notes:			
General Electric Company Undivided			
Interest in Demand Note	1,713,000	1,713,000	1,713,000
Norfolk and Western Railway Company			
7.25% Conditional Sale Contracts:			
August 1, 1972	430,000	430,000	428,925
August 1, 1973	430,000	430,000	426,775
Florida Power & Light Company			
First Mortgage Bonds			
3.50% —January 1, 1974	1,000,000	862,520	954,000

Schedule of Marketable Securities

December 31, 1971

(continued)

FIXED INCOME	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
General Motors Acceptance Corporation Debentures:			
3.625%—September 1, 1975	\$ 1,000,000	\$ 810,600	\$ 918,750
5% —September 1, 1980	1,300,000	1,300,000	1,134,250
5% —March 15, 1981	1,500,000	1,492,500	1,310,625
National Dairy Products Corporation Debentures			
3.125%—June 1, 1976	200,000	158,664	175,200
Household Finance Corporation Sinking Fund Debentures			
4.625%—January 15, 1977	1,015,000	870,118	916,038
Public Service Electric and Gas Company Debenture Bonds			
4.625%—March 1, 1977	1,223,000	1,096,630	1,106,815
Morgan Guaranty Trust Company of New York Capital Notes			
6.375%—April 1, 1978	1,000,000	1,000,000	980,000
Bankers Trust New York Corporation Debentures			
6.375%—September 1, 1978	1,000,000	997,500	970,000
American Telephone and Telegraph Company Debentures:			
4.375%—April 1, 1985	1,500,000	1,518,210	1,181,250
8.75% —May 15, 2000	2,500,000	2,502,188	2,796,875
Burlington Industries, Inc. Convertible Subordinated Debentures			
5% —September 15, 1991	2,000,000	2,047,500	1,940,000
Aluminum Company of Canada, Limited Sinking Fund Debentures			
9.50% —March 1, 1995	1,000,000	1,012,500	1,110,000

Schedule of Marketable Securities

December 31, 1971

(continued)

FIXED INCOME	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
International Paper Company Sinking Fund Debentures			
8.85% —March 15, 1995	\$ 1,500,000	\$ 1,553,750	\$ 1,657,500
Standard Oil Company (New Jersey) Debentures			
6% —November 1, 1997	5,000,000	5,000,000	4,568,750
Standard Oil Company (Indiana) Debentures			
6% —January 15, 1998	1,000,000	990,000	912,500
Dow Chemical Company Debentures			
8.875%—May 1, 2000	1,500,000	1,544,800	1,646,250
Total other bonds and notes		27,330,480	26,847,503
Total fixed income securities		\$56,262,996	\$56,119,998

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
American Home Products Corporation	4,000	\$ 308,919	\$ 357,500
American Metal Climax, Inc.	60,000	1,305,194	1,695,000
American Telephone and Telegraph Company	120,000	4,888,398	5,370,000
Avon Products, Inc.	27,100	907,927	2,720,163
Baxter Laboratories, Inc.	25,500	740,179	911,625
Caterpillar Tractor Co.	85,400	1,716,154	4,035,150
Central and South West Corporation	25,000	653,569	1,225,000
Clorox Company	50,000	409,294	2,987,500
Coca-Cola Company	12,000	946,463	1,464,000
Corning Glass Works	9,598	1,030,430	1,780,429
Cutler-Hammer, Inc.	27,500	1,192,936	1,117,188
Digital Equipment Corporation	15,100	993,805	1,162,700

Schedule of Marketable Securities

December 31, 1971

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Walt Disney Productions	12,022	\$ 766,622	\$ 1,686,086
Dun & Bradstreet, Inc.	18,000	968,933	1,224,000
E. I. du Pont de Nemours and Company	12,200	1,945,788	1,769,000
Eastman Kodak Company	103,954	2,499,064	10,109,527
First Chicago Corporation	36,228	753,105	1,403,835
First National Boston Corporation	22,500	851,683	1,518,750
General Electric Company	87,700	3,229,466	5,492,213
General Foods Corporation	50,000	2,186,566	1,793,750
General Motors Corporation	1,440,666	62,878,064	115,973,613
Gillette Company	25,000	1,230,998	1,000,000
Gulf Oil Corporation	56,768	578,073	1,639,176
Household Finance Corporation	40,000	737,671	2,075,000
International Business Machines Corporation	70,500	6,046,293	23,723,250
International Nickel Company of Canada, Limited	100,000	2,081,782	3,212,500
International Paper Company	76,000	2,543,803	2,660,000
Johnson & Johnson	13,600	839,209	1,339,600
Kennecott Copper Corporation	65,000	2,673,547	1,584,375
Eli Lilly and Company	21,900	1,245,861	1,245,563
Louisiana Land and Exploration Company	7,100	300,802	362,988
Lubrizol Corporation	8,800	378,153	474,100
Masonite Corporation	7,600	439,494	478,800
Merck & Co., Inc.	25,900	414,231	3,211,600
Middle South Utilities, Inc.	68,000	1,219,354	1,683,000
Minnesota Mining and Manufacturing Company	12,000	1,331,058	1,620,000
Mobil Oil Corporation	77,000	2,211,644	4,206,125
J. P. Morgan & Co. Incorporated	53,636	1,800,027	4,015,996
Northern Natural Gas Company	40,000	2,244,987	1,820,000
Northwest Bancorporation	42,000	615,477	1,611,750

Schedule of Marketable Securities

December 31, 1971

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Owens-Corning Fiberglas Corporation	43,600	\$ 1,778,408	\$ 2,299,900
J. C. Penney Company, Inc.	13,500	876,772	985,500
Phelps Dodge Corporation	33,300	1,421,951	1,252,913
Pinkerton's, Inc. Class B	5,800	449,980	420,500
Polaroid Corporation	23,400	2,124,772	2,082,600
Procter & Gamble Company	51,180	711,947	4,017,630
Public Service Electric and Gas Company	68,000	1,451,313	1,870,000
Royal Dutch Petroleum Company	102,300	2,362,854	3,554,925
Schlumberger Limited	11,700	992,179	1,810,575
Scott Paper Company	60,000	1,750,058	960,000
Sears, Roebuck and Co.	78,605	1,689,531	8,057,013
Shell Oil Company	59,986	2,402,589	2,834,339
Southeast Banking Corporation	22,000	1,139,144	1,215,500
Southern Company	52,000	950,596	1,144,000
Squibb Corporation	8,000	595,780	700,000
Standard Oil Company (New Jersey)	53,967	2,622,317	3,980,066
TRW Inc.	30,000	360,717	911,250
Texaco Inc.	118,652	1,839,222	4,078,663
Virginia Electric and Power Company	49,844	823,638	1,021,802
Wachovia Corporation	20,000	1,130,759	1,290,000
Xerox Corporation	31,500	388,449	3,945,375
Total common stocks		147,967,999	272,193,403
Total fixed income securities		56,262,996	56,119,998
Total marketable securities		\$204,230,995	\$328,313,401

Summary of Grand Appropriations

	AUTHORIZED BUT NOT DUE DECEMBER 31, 1970	CHANGES DURING 1971		AUTHORIZED BUT NOT DUE DECEMBER 31, 1971
		AUTHORIZED	PAYMENTS	
Sloan Fellowships for Basic Research (153 fellowships in 62 colleges and universities)	\$ 2,119,197	\$ 1,402,556	\$ 1,424,319	\$ 2,097,434
College Science Program	1,500,000	—	1,500,000	—
Sloan National Scholarship Program	1,798,044	—	899,022	899,022
Major Grants to colleges and universities	3,597,500	7,825,222	5,463,022	5,959,700
Other Major Grants:				
Brookings Institution	\$ 200,000	—	\$ 100,000	\$ 100,000
Cold Spring Harbor Laboratory	200,000	—	—	200,000
Deafness Research Foundation	131,500	—	131,500	—
Harper Hospital	140,000	—	70,000	70,000
Institute for Advanced Study	200,000	—	100,000	100,000
Institute for Educational Management	105,000	—	105,000	—
Memorial Sloan-Kettering Cancer Center	1,500,000	—	1,000,000	500,000
NAACP Legal Defense and Educational Fund, Inc.	—	\$ 250,000	—	250,000
NAACP Special Contribution Fund	—	125,000	25,000	100,000
National Bureau of Economic Research, Inc.	500,000	—	—	500,000
National Medical Fellowships, Inc.	37,500	805,000	842,500	—
Palace of Arts and Science Foundation	—	125,000	75,000	50,000
Salk Institute	600,000	600,000*	—	—
Sloan-Kettering Institute for Cancer Research	2,000,000	400,000	400,000	2,000,000
TOTAL OTHER MAJOR GRANTS	5,614,000	1,105,000	2,849,000	3,870,000
Opportunity Awards	52,600	—	52,600	—
Staff Grants available for grants in ensuing year	750,000	749,973	749,973	750,000
Other Grants (none over \$100,000 in 1971)	147,667	130,200	184,667	93,200
Interdisciplinary Student Task Forces in Higher Education	—	64,378	10,553	53,825
Sloan Commission on Cable Communications	362,303	50,000	407,484	4,819
Special projects	35,193	33,487*	1,706	—
TOTAL GRANTS AND APPROPRIATIONS	<u>\$15,976,504</u>	<u>\$11,293,842</u>	<u>\$13,542,346</u>	<u>\$13,728,000</u>

* Cancellation of prior year authorizations.

INDEX

Index

- Albion College, 64
American Academy of Arts and Sciences, 15, 45, 64
American Association for Higher Education, 25, 64
American Council on Education, 64
American Medical Association
Education and Research Foundation, 41, 64
American Physical Society, 15, 64
American University, 23
Amherst College, 24, 64
Antioch College, 64
Arizona, University of, 12, 64
Atlanta University, 15, 40, 64
- Bedford-Stuyvesant Restoration Corporation, 29, 64
Beth Israel Hospital, 14, 29, 64
Bethune-Cookman College, 64
Bishop College, 64
Bowdoin College, 64
Bridgeport, University of, 10, 64
British Columbia, University of, 12, 64
Brookings Institution, 19, 64
Brown University, 24, 64
- California, University of, 12, 15, 23, 33, 39, 41, 64
California Institute of Technology, 12, 34, 64
Carleton College, 64
Carnegie-Mellon University, 9, 12, 23, 39, 64
Case Western Reserve University, 64
Chicago, University of, 14, 39, 45, 64
City University of New York, 13, 66
Clarkson College of Technology, 64
Colby College, 64
Cold Spring Harbor Laboratory, 64
Colgate University, 64
Columbia University, 25, 39, 64
Consortium for Graduate Study in Management, 40
Cornell College, 64
Cornell University, 12, 39, 64
Council for Basic Education, 25, 64
Council for Opportunity in Graduate Management Education, 39
- Dartmouth College, 24, 39, 64
Davidson College, 64
Deafness Research Foundation, 64
Department of Commerce Gifts and Bequests Account, 45, 64
Detroit, University of, 64
Detroit Institute of Technology, 25, 64
Dillard University, 64
Drexel University, 12, 64
Duke University, 24, 64
- Educational Change, Inc., 25, 64
Educational Foundation for Nuclear Science, 25, 64
Engineers Joint Council, 15, 64
- Fisk University, 64
Florida Institute of Technology, 25, 64
Florida, University of, 12, 64
Florida State University, 12, 64
- Georgetown University, 41, 65
Georgia Institute of Technology, 65
Grinnell College, 65
- Hamilton College, 65
Hampton Institute, 65
Harper Hospital, 65
Harvard University, 12, 14, 19, 23, 24, 39, 65
Harvey Mudd College, 65
Haverford College, 12, 65
Hawaii, University of, 65
Heidelberg College, 25, 65
Henry Street Settlement, 29, 65
Hope College, 65
Howard University, 38, 41, 65
- Idaho, University of, 65
Illinois, University of, 12, 65
Indiana University, 12, 40, 65
Institute for Advanced Study, 65
Institute for Educational Development, 65
Institute for Educational Management, 65
Iowa State University, 65
- John Carroll University, 25, 65
Johns Hopkins University, 12, 65
Joint Council on Economic Education, 18, 65
Junior College District of St. Louis, 44, 65
- Kalamazoo College, 65
Kansas, University of, 12, 65
Knox College, 65
Knoxville College, 65
- Lehigh University, 65
Lincoln University, 65
London Graduate School of Business Studies, 17, 65
Los Angeles Technical Services Corporation, 29, 65
- Marine Biological Laboratory, 36, 65
Marquette University, 12, 65
Maryland, University of, 12, 65
Massachusetts General Hospital, 36, 65
Massachusetts Institute of Technology, 12, 14, 15, 17, 24, 34, 39, 65
McMaster University, 65
Meharry Medical College, 38, 65
Memorial Sloan-Kettering Cancer Center, 13, 65
Miami, University of, 65
Michigan, University of, 65
Michigan State University, 65
Middlebury College, 65
Minnesota, University of, 12, 65
Montana State University, 12, 65
Morehouse College, 65
Mount Holyoke College, 24, 65
Museum of Fine Arts, 45, 65
- NAACP Legal Defense and Educational Fund, Inc., 28, 66
NAACP Special Contribution Fund, 28, 66
National Bankers Association, Inc., 19, 66
National Bureau of Economic Research, Inc., 19, 66
National Medical Fellowships, Inc., 37, 66
Neurosciences Research Foundation, 36, 66
New College, 19, 66
New Mexico, University of, 12, 66
New York Public Library, 45, 66
New York University, 20, 39, 66
New York Urban Coalition Inc., 46, 66
North Carolina, University of, 12, 66
Northeastern University, 12, 66
Northwestern University, 12, 35, 41, 66
Notre Dame, University of, 66
- Oakland University, 43, 66
Oberlin College, 66
Occidental College, 66
Ohio State University, 12, 66
Oregon, University of, 12, 66
- Palace of Arts and Science Foundation, 22, 66
Pennsylvania, University of, 23, 29, 39, 41, 66
Pittsburgh, University of, 66
Polytechnic Institute of Brooklyn, 12, 66
Pomona College, 25, 66
Pratt Institute, 10-11, 66
Princeton University, 13, 24, 66
Purdue University, 66
- Reid College, 66
Rensselaer Polytechnic Institute, 66
- Rice University, 13, 66
Rochester, University of, 40, 66
Rockefeller University, 13, 66
Rutgers University, 13, 19, 66
- Saint Ann's Episcopal School, 25, 66
Salk Institute, 66
Scientists' Institute for Public Information, 66
Sherbrooke, Université de, 66
Sloan Commission on Cable Communications, 26
Sloan-Kettering Institute for Cancer Research, 13, 66
Smith College, 66
Southern California, University of, 23, 40, 41, 66
Southern Methodist University, 15, 23, 66
Stanford University, 13, 16, 39, 43, 67
State University of New York, 12, 66
Swarthmore College, 67
Syracuse University, 25, 67
- Talladega College, 67
Temple University, 25, 67
Texas Southern University, 41, 67
Texas, University of, 67
Toronto, University of, 67
Tougaloo College, 46, 67
Tufts University, 67
Tulane University, 67
Tuskegee Institute, 67
- Union Settlement Association, 29, 67
United Student Aid Funds, 24, 46, 67
Urban Institute, 19, 67
Utah, University of, 13, 67
- Vanderbilt University, 67
Virginia, University of, 13, 67
- Wabash College, 67
Washington and Lee University, 67
Washington, University of, 13, 67
Washington University, 23, 40, 67
Wellesley College, 24
Wesleyan University, 21, 24, 67
Whitman College, 67
Williams College, 67
Woodrow Wilson National Fellowship Foundation, 46, 67
Wisconsin, University of, 13, 40, 67
Worcester Polytechnic Institute, 13, 67
- Yale University, 13, 20, 29, 67
Yeshiva University, 13, 34, 67

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Founded in 1934 by Alfred P. Sloan, Jr. (1875-1966)

REPORT for 1972



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Contents

Trustees, Officers, and Staff	vi
President's Statement	1
Particular Programs	7
Technology in Education	9
Expanding Professional Opportunities	15
Neuroscience	23
General Program	29
Science and Technology	31
Economics and Management	42
Education	45
Related Problems of Society	50
Policies and Procedures	52
Financial Review	55
Index	75

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President's Statement

President's Statement



LESS than a decade ago presumably authoritative groups were predicting a serious shortage of engineers, and exhorting the federal government to adopt all reasonable measures that might increase their number in the period immediately ahead. Few predictions and few recommendations have been so quickly and so decisively proved false. By the beginning of the 1970's thousands of engineers were in search of jobs. College enrollments in engineering shrank and have yet to return to previous levels. Federal support of research and development—the cutting edge of engineering practice—has been whittled away by reduced appropriations, or by the effects of inflation in those instances where the appropriations have appeared to remain more or less constant. The economy may be showing signs of marked improvement, but for the engineering professions the times remain hard.

Under such circumstances it might appear prudent for the Alfred P. Sloan Foundation, with its long interest in the education of engineers, to wait for more propitious circumstances to develop further programs of support in engineering. The substantial withdrawal of government support cannot be made good by the resources of this or of any other private foundation. In the absence of a healthy job market, it might even be irresponsible for a foundation to attempt to stimulate engineering enrollment. In a period of widespread discontent with the consequences, real or fancied, of technology, the easiest course might be to let engineering

wait while the Foundation busied itself with other matters.

Despite all this, it is the view of the Sloan Foundation that the decade ahead is one in which the arts of the engineer are likely to be in pressing demand, and that in the craft of the engineer lie important contributions to the solution of many of the problems which face American society. A new kind of engineer may well be required, prepared by his education to meet a wholly new set of responsibilities.

There was a time, not long past, when one could assert a real distinction between the accumulation of new knowledge and the application of that knowledge to material affairs. It was the scientist primarily who was charged with extending knowledge, the inventor who was charged with ferreting out its technological significance, the engineer who converted that significance into process and product. While the scientist often turned engineer, and the engineer commonly was also inventor, the three distinct forms of enterprise could be readily identified, and most of those who dealt in technological matters could be found in one category or another.

It was a division of labor that worked well, and appeared to work expeditiously, but under the goad of World War II it did not appear to be adequate. Out of a sense of urgency there was created a new pattern in which the scientist became part engineer, the engineer became part scientist, and between them the two took over most of the responsibility of the inventor. The "state of the art" ceased to be an inert entity but became something that could alter almost moment by moment as the engineer and scientist combined their different skills. This new intimacy of two disciplines resulted in the burgeoning of a new kind of industrial enterprise based upon "research and development"—R & D—which by its very name signaled the association of scientific and engineering talents.

Engineering institutions found themselves obliged to modify curriculum, adjust faculty, respond to altered space and equipment requirements, and preside over a period of transition. The awareness of these developments on the part of the Alfred P. Sloan Foundation is reflected in its report for 1961-62 which refers to "The growing interdependence of engineering and science, the almost exponential rate of increase of industrial and governmental research and development programs, and the ever-increasing reliance of our entire economy upon the art of the engineer," and in a major series of grants in 1961. A steady succession of grants followed, almost all of them designed to increase and improve the presentation of science within engineering curricula.

4 The scientist and the engineer, working together, have made it possible over the last generation to produce material wealth on a scale previously unimaginable. A dream has been largely realized, but in being realized suddenly appears a good deal less significant than it once appeared to be

The paradox lies in the nature of a substantial part of that new capacity.

There has been generated over the past thirty years an enormous new capability in the fields of communications and data-processing, the consequence of which is already immense, and yet is only at its earliest stage of development. The computer and vastly expanded communications technologies have enabled us to perceive the interconnectedness of our diverse activities, and at the same time have offered some hope that society can make appropriate responses to that interconnectedness. The notion of the embracing "system" is growing, a concept not new to the engineer. What have changed are the scope and breadth of the activities that are now seen to constitute parts of a single, immensely complicated system and the capacity to deal with that complication.

The new technology has further made it impossible to restrict an awareness of this new capability to the elite which manages it. The very same communications capacity serves to spread an awareness of the interrelationships.

Finally, material wealth has brought about a change in values, a remarkable and an unintended consequence of high technology; simply because we are able to produce so much material goods, the cleanliness of the air is becoming far more highly valued than certain economic considerations.

All this, taken together, constitutes a challenge and promise for the engineer. As society's values change, the mission of the engineer changes. For example, it is no longer sufficient that the engineering graduate be able to design and to bring into production the most efficient electrical generating plant that science and technology can devise. Rather, he and his fellows will be expected to examine the larger system of which that plant is intended to be a part and to determine whether a new generating plant is the most effective method of serving the purposes of that system. He will be expected to understand the impact of a new generating plant upon those it is intended to serve, the narrow community in which they live, the broader community of which they are also a part, the patterns of employment and family life, and all the other considerations that flow from the perturbation of a complex system.

If these are to be the obligations of the engineer, he must become acquainted with a whole new range of academic disciplines; with economics, political science, certain aspects of sociology and psychology, and with social analysis. Furthermore the interaction between engineering and social science, like the earlier interaction between engineering and the natural sciences, must be at the highest conceptual and methodological

level: the engineer must not only learn to benefit from the social sciences, but must in some degree learn to contribute to them.

It is fortunate, and in some sense rounds out the circle, that in effectuating this new interaction with the social sciences one of the major products of the new technology, the computer, may turn out to be of great significance. The social sciences have been the "soft sciences," producing data which often have been difficult to measure or count. The prodigious capacity of the computer means that heretofore unmanageable data suddenly become manageable. The great power of mathematical and statistical analysis can be called to the assistance of the economist, the political scientist, the social analyst. Consequently, to some degree the natural scientist, the engineer and the social scientist begin to have a language, or at least part of a language, in common.

The engineer in collaboration with the social scientist can begin, in this last quarter of the twentieth century, to serve the new values that are emerging out of the society at large, and can do so without failing in his services to the values that preceded them and that still retain their validity. The locus of that effort is likely to be the academic institutions out of which both engineers and social scientists come.

During 1972, the Sloan Foundation embarked upon a major effort to assist a number of institutions in so broadening their engineering curricula. This effort will continue in 1973, and possibly beyond.

As in the past, the Foundation plans to pursue this course in terms of engineering education. Its own interest has been in engineering rather than in the social sciences broadly construed, and its own experience lies in that field. The Foundation does not deprecate the value of the parallel effort, broadening the technological sophistication of the social scientist, but limited resources impose upon any foundation limited objectives, and the Sloan Foundation is best advised to do what it can where it is accustomed to labor.

What the Foundation can do, of course, is only a small fraction of what must be done within the field of engineering education during the next decade. Other private and governmental institutions are also moving in this direction. Moreover, the Foundation has other concerns of high priority: in science, management, economics, and medicine, for example. It can only hope that its efforts in behalf of the present-day needs of engineering education will effect the same catalytic result achieved by its earlier and equally timely responses to changing demands made upon the engineer.

W. G. Wassell

Particular Programs

THE FOUNDATION functions under an operating policy which divides its resources between a General Program and three or more discrete and sharply focused Particular Programs. A Particular Program is intended to concentrate limited but adequate resources for a specified time on a problem which can be encompassed within such an approach. The three current Particular Programs, which are described in the pages that follow, involve expenditures of from \$10 million to \$15 million over a period of roughly five years. The programs in Expanding Professional Opportunities and in Neuroscience are entering their fourth year; the program in Technology in Education is somewhat younger. Studies by the Foundation staff during 1973 will identify a suitable subject for a fourth Particular Program, to be phased in as one of the original three programs terminates.

Technology in Education



FOR the Sloan Foundation, given its long-standing interests in technology and in education, a program on Technology in Education can be viewed as a natural outgrowth of traditional commitments. There is nothing inevitable about the beneficial penetration of technology into the educational process, and indeed there appear to have been more disappointments than successes in recent years. If technology is ever to be truly tested as an aid to education, which has its pressing problems of cost and productiveness, it is clear that a sustained effort in research and development will be required.

The Foundation's undertakings in Technology in Education are meant to be a modest contribution to that effort. No panaceas are expected, but given the mounting concern over both the expense and the quality of education, it seems only sensible to ask whether technology, which has accomplished so much in other enterprises that are based on communications, can contribute appreciably to education.

With this in mind, the Foundation has embarked on a five-year Particular Program in Technology in Education which is intended to rise to a level of \$2 million annually at its peak. Grants made in furtherance of this Particular Program reached a level of about \$1 million in 1972, with a moderate increase projected for 1973. A continuing effort by the Steering Committee for this Particular Program* and by the Foundation's

*William G. Bowen, President, Princeton University; John R. Coleman, President, Haverford College; Charles Eames, Los Angeles film maker and designer; Andrew Gleason, Professor of Mathematics, Harvard University; Wayne H. Holtzman, Hogg Foundation for Mental Health; Frank Oppenheimer, Director, San Francisco Exploratorium, and Jerome Wiesner, President, Massachusetts Institute of Technology.

staff is being made to explore the broad issues of the field of educational technology and to define the Foundation's place in this field.

Special attention was given to the question of whether a conventional series of grants to individual institutions, however worthy the separate projects might be, could produce any significant advancement in a field as diffuse and undeveloped as educational technology, with needs that are so great in both hardware and software. The state of the art may not yet permit the design of a coherent program of grants that will have a substantial influence on the field. One of the principal contributions, therefore, that the Foundation can make to this field may lie in helping, through a series of special inquiries, to define the issues and locate the main pressure points. The Foundation may thereby be able not only to improve its own grant making in this area but to help shape public policy and the direction of public investment in educational technology.

While such matters were under examination, grant making in 1972 proceeded within three categories which may be subject to change as experience accumulates. One category was *faculty education*. It is obvious that new technologies will not take hold at the higher levels of education unless more faculty members become strongly interested in pedagogy and become aware of how technology may strengthen teaching. Some grants were therefore made for projects to expose teachers to the possibilities of instructional technology, and to provide them with expert technical help to develop courses employing educational technologies.

Software development projects also were selected for attention. In the past fifteen years the technological means of delivering educational materials has outstripped development of the materials to be so delivered. Elaborate hardware often is under-used for lack of effective software. Broad-based efforts in software development were therefore emphasized in several projects which received support in 1972.

Finally, under a third category called *special projects*, several small grants were made dealing with new communications technologies or other activities of particular promise.

The College of Engineering of the University of Texas at Austin is one of many institutions experimenting with the so-called Keller Plan of instruction, whereby a course is divided into small and coherent modules which the student masters one at a time, more or less on his own but with frequent testing and with tutoring by more advanced students. This system seems to work well for many students in many subjects, but it has yet to undergo a large-scale demonstration and evaluation. That is what the College of Engineering will be doing over the next two years with the aid of a \$340,000 Sloan grant.

Texas will seek to demonstrate, through a controlled experiment, that

Defining Issues
and Helping
Shape Policy

Modular Plan
to be Tested
at Texas

10



Students at Harvey Mudd College conduct an experiment in material analysis with step-by-step guidance from tape-slide equipment at left. The technology frees a professor to supervise several experiments at once and permits more flexible scheduling.

Keller Plan modular courses, combined with such instructional technologies as television, videotape, computer-assisted instruction, audio-tutorial units, and programmed texts, are more effective than conventional instruction in engineering and possibly in other subjects. To this end it will make more systematic its present work in this individualized system of instruction, develop twelve new Keller Plan courses, mostly in basic engineering subjects, and test and refine them. The University's Measurement and Evaluation Center will appraise the new courses against regular instruction in terms of costs and effectiveness, retention of learning, and student attitudes.

A further dimension of the Texas project will be the involvement of scholars from other institutions who are working with modular instruction, and who will form a Board of Advisors for the project. Thus the effects of the experiment should reach beyond the Austin campus.

The Foundation's support, to be used for faculty released time, summer workshops, the Board of Advisors, and associated activities, will be payable \$240,000 in 1973 and \$100,000 in 1974.

Harvey Mudd College, a relatively new and small institution known for the quality of its instruction in science and engineering, is expanding its capacities in educational technology with Sloan support. While individual faculty members have pursued their own projects in this area in the past, Harvey Mudd now will organize and systematize this work into an

Harvey Mudd's
New Emphasis
on Technology

11

institution-wide, team-based research and demonstration effort which ultimately may change the way many courses are presented at Harvey Mudd and at other institutions as well. The College is young enough (15 years) and small enough (enrollment is 400) that productive innovations can be effectively disseminated throughout the institution, and it has access to the resources and students of neighboring colleges in its Claremont, California, group.

While it is too early to say precisely which directions the Harvey Mudd project will take, some of the developments it will be considering include new techniques in computer simulation in chemistry and other subjects; an automated, self-paced learning laboratory for use with a variety of subjects; problem-oriented computer languages in science and mathematics; and a variety of interdisciplinary experiments in technology-based learning. As the work progresses, methods will be devised to evaluate the relative effectiveness of alternate methods of instruction.

The grant of \$331,000 to Harvey Mudd, payable over three years, will be used to release faculty for software development projects, to purchase equipment, and to engage a project director and an electronic systems technician.

The Southern Medical School Consortium has mounted an ambitious Self-Instructional Materials Project through which the 29 participating schools develop, test, refine, and share modular packages which will help students to master independently many parts of the voluminous medical curriculum. The project has a director and a small technical staff at the University of North Carolina School of Medicine, and each participating medical school contributes to the project's support and has its own in-house coordinator for it. To the Foundation's knowledge, this is the only multi-institutional development program of such scope in educational technology.

The Southern Medical School project expects to produce instructional materials which will be usable interchangeably among its member schools, and which probably will be exportable to other schools of medicine. In large part these materials will make use of low technology—programmed texts, inexpensive slides linked to small audio devices, and pencil and paper exercises—perhaps demonstrating that excellent work can often be done without high-cost computers and television systems.

While the Self-Instructional Materials Project is already a going concern, it needs to be able, if it is to realize its potential, to underwrite more time for faculty members to learn to construct instructional modules, and then to produce such modules. For this purpose the Foundation made a one-year grant of \$79,000 to the University of North Carolina.

The above three grants are responsive principally to the need for more and better software in educational technology, although it may be assumed

that they will also encourage a good deal of faculty education about the potentialities of technology in education. A grant focused specifically on the training of *future* educators who will be competent and interested in educational technologies was made to the University of Illinois at Chicago Circle. There, an "Alternate Ph.D." program will seek to create a supply of college teachers whose first interest is in teaching and who are thoroughly familiar with the various technologies of teaching. Preparation for the alternate degree will be fully as rigorous as that for the conventional Ph.D., and candidates will be as carefully selected; but the emphasis will be on pedagogy, and the dissertation may take the form of an original project in educational technology, such as a computer program in an academic subject, rather than a piece of scholarly research.

The UICC's Alternate Ph.D. will be offered initially in four subjects—chemistry, biology, mathematics, and German—and candidates will be under the supervision of those departments. But they will also spend much of their time at UICC's media center, which is fully equipped and generously staffed to assist them in learning to develop educational programs employing various technologies. A Sloan grant of \$150,000 over three years will provide graduate stipends for a selected number of candidates and will help meet the cost of developing new courses for them and of producing the programs and materials which they develop.

One of the curious aspects of educational technology is the under-usage of television in formal programs of instruction. Education is largely a communications process, and television has proven to be a remarkably effective instrument of communication in other areas. Moreover, the physical plant for instructional use of television is largely in place: more than 200 public television stations are operating and are connected in networks, and most large colleges and universities have closed-circuit television facilities or could acquire them rather easily. Yet the impact of instructional television after twenty years has been so minor that, were it to disappear suddenly, it would hardly be missed.

It is difficult to concede that television, which has had a revolutionary impact in entertainment, journalism, and advertising, has so little to contribute to education. A few outstanding examples of success like the Children's Television Workshop serve to emphasize the undeveloped potential. Quite possibly the hard work of focusing the powers of the television technology on broader areas of education has not yet been properly done. It may be necessary to ask, not just how television can be added to existing curricula, but precisely what it is that one wishes to achieve in teaching science, for example, and how the available teaching tools (including television) and curricula might be reordered to reach newly defined goals.

The Sloan Foundation proposes to undertake, through its Particular

*Educating
the Educators
in Technology*

*Instructional
Television's
Unrealized
Potential*

*Schools Share
'Packages'
in Medicine*

Program in Technology in Education, an inquiry into instructional television. Initially there will be a series of seminars and intensive short meetings early in 1973 with scholars, educators, and experts in television production. This is expected to lead to the definition of a course of action for the balance of 1973 and for 1974. No television production is contemplated. The intention is to define for the Foundation a catalytic role in stimulating efforts to realize the potential of instructional television.

These other grants were approved in 1972 for projects involving educational technology:

AMERICAN ASSOCIATION OF COMMUNITY AND JUNIOR COLLEGES, Washington, D.C.: For a study of the current use of educational technology in selected community and junior colleges	\$20,000
BELOIT COLLEGE, Beloit, Wisc.: To support the development of DRILL, a computer-based instructional program for use in the study of humanistic subjects	\$19,800
CASE WESTERN RESERVE UNIVERSITY, Cleveland, Ohio: For a study of the use of laser links in an on-campus broadband communications system	\$20,000
KNOX COLLEGE, Galesburg, Ill.: In partial support of an experimental project employing the combined use of the computer and audio-visual-tutorial laboratories in the teaching of accounting, especially aimed at improving the learning process for disadvantaged students	\$16,150
RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK, Albany, N.Y.: For a 1972 summer study project at the State University of New York at Stony Brook in collaboration with three public junior colleges to develop a program for redesigning four courses in basic engineering with an emphasis on educational technology	\$16,000
SAINT OLAF COLLEGE, Northfield, Minn.: To assist the development of an interdisciplinary self-instructional science laboratory for non-science students	\$5,000
UNIVERSITY OF SOUTH CAROLINA, Columbia, S.C.: For a study of the cost effectiveness of the University's television-based, part-time Master of Business Administration program	\$15,000
SYRACUSE UNIVERSITY, Syracuse, N.Y.: For development and testing of several modules for a new Master of Business Administration degree in Syracuse's School of Management	\$20,000

Expanding Professional Opportunities



AS the Foundation's first Particular Program enters its fourth year, it has governed the investment of some \$8 million in expanding opportunities for minority Americans in the professions of medicine and management. About \$2.3 million of that investment was made in 1972, and a similar amount is contemplated for 1973.

While the benefits of this program in 1972 continued to flow for the most part to members of the large Black minority, grants also were awarded to make professional degrees more accessible to Mexican-Americans and American Indians.

The Foundation's efforts to stimulate the flow of Blacks and other minorities into the medical profession date in a small way to 1959, when modest support of National Medical Fellowships, Inc., began. With the announcement of the first Particular Program in 1969 a more systematic effort began, and one of the first steps was the underwriting of a task force representing the principal health professions to define problems and establish goals. The task force decided that it was both feasible and desirable to increase minority representation in M.D. degree programs to 12 per cent by 1975. During the period of the task force's work, 1969 and 1970, the comparable percentage was only 3.1. But the task force spelled out how

the 12 per cent level might be achieved by 1975, and the Foundation and others adopted that goal.

By the fall of 1972, about the midway point in the effort, minority medical enrollment was up to 3,102 students or 6.7 per cent of the total, compared to 1,178 and 3.1 per cent in 1969. More encouragingly, first-year minority students numbered 1,172 or 8.7 per cent, compared with 501 and 4.8 per cent in 1969.* Less encouragingly, the increase in first-year minority students slowed markedly in 1972, because of a falling-off in numbers of qualified minority students seeking entry into medical schools. It appeared that stepped-up efforts in recruiting and retaining minority medical students would be needed to sustain the momentum of recent years. Several new grants were made for those purposes, and for educational and financial assistance to minority medical students, in 1972.

The major source of financial aid to minorities seeking medical education continues to be National Medical Fellowships, Inc., which currently is assisting 1,518 students in 104 medical schools. This number represents a tenfold increase since 1968 and includes awards to 772 freshmen—66 per cent of all first-year minority medical students. NMF support is concentrated in the first two years of medical school, when the need is greatest, and even in those two years it is necessarily partial. Thus a sizeable share of the financial burden of educating minority physicians falls on the medical schools themselves.

While a large majority of the latest NMF awards went to American Blacks, there were also 161 to Mexican-Americans, 25 to American Indians, and 47 to mainland Puerto Ricans. Minority women received 368 awards or 24 per cent of the total.

The Sloan Foundation continues to be the largest single source of NMF's support, but it is encouraging to see that NMF is developing other sources which ultimately will free it of dependence on Sloan funds. For 1972 the Foundation's grant totaling \$1 million made up something less than half of NMF's budget. Of the Sloan grant, \$200,000 was contingent on NMF's raising an additional \$1.4 million elsewhere.

While NMF addresses itself to the financial problems of educating minority physicians, a number of other useful programs are concerned with seeking to interest minority students in medical education, and to assure their academic success once they are in medical schools. One such program is operated by the United Negro College Fund for promising students from member colleges. The students, some 120 of them in 1972, spend post-freshman and post-sophomore summer sessions at Fisk University in special studies designed to strengthen their preparation for medical school. Junior

*Data from Association of American Medical Colleges.



Georgetown University medical students conduct a series of seminars for Washington, D.C., high-school students to acquaint them with opportunities in medicine and allied health fields. This group is learning about the musculo-skeletal system.

and senior faculty are recruited from UNCF colleges, and the cooperation of nearby Meharry Medical College adds to the medical content of the program. The program appears to be succeeding in its purpose of expanding the pool of interested and able minority students who will apply for admission to medical schools. Sloan and other foundations joined in supporting the program after an initial summer was financed by the W. K. Kellogg Foundation. The Sloan contribution amounts to \$137,500 over two years.

At Georgetown University, the rapidly growing School of Medicine has demonstrated a commitment to expanding its minority enrollment and to dealing with the problems which are inherent in the admission of sizeable numbers of students whose preparation is less than ideal. An experimental 1971 summer remedial program enabled several first-year students who had been doing failing work to continue in medical school. Georgetown then proposed to continue and expand this program, aiming it at about 25 minority students during the summer *before* they enter medical school, and emphasizing the development of study skills and remedial work in basic medical sciences. In addition, Georgetown sought support for a sum-

1,518 Students
Receiving Help
from NMF

Commitment
to Minorities
at Georgetown

mer fellowship program in which ten sophomore and junior premedical students, mostly from Black colleges, work as research assistants to Georgetown medical faculty members. A third aspect of the Georgetown program is a series of yearly seminars for students in the heavily Black schools of Washington, D.C., to inform them of career opportunities in the medical and paramedical fields. To help meet the cost of this ambitious minority health careers program, the Foundation granted \$105,000 over three years.

Early recruitment, at the pre-college level, is the purpose of the Pre-Medical Research and Education Program (PREP) of the New York University School of Medicine. Academically talented students in New York City's secondary schools attend Saturday laboratory courses at the School of Medicine during the academic year and do summer work in community health centers. They receive intensive counseling and guidance in selecting and gaining admission to a suitable college, and after high-school graduation they receive additional preparation for college-level work. During the current year 125 students are participating; in 1972 there were 58 graduates of the program, all of whom were accepted, with financial assistance, at leading colleges and universities. The Foundation extended its support of PREP for one year at \$50,000; comparable support is provided by the Ernest and Mary Hayward Weir Foundation.

The problems of recruiting Mexican-Americans or Chicanos into medicine are if anything more acute than those involving Blacks, and the University of California at Santa Cruz has undertaken to do something about them. Drawing on the large Chicano population in surrounding counties, it will seek to graduate ultimately ten students a year from this group who are qualified to enter medical school. The students will receive special tutoring and supervision to make up for any deficiencies they have in science and other required subjects; they will receive financial support, and summer jobs will be found for them in health-related areas. They will be enrolled in science-oriented Crown College, one of six colleges that make up the University. The Foundation granted \$76,000 in support of this program for three years.

At the University of Michigan a successful approach to the problem of retaining underprepared students in the School of Medicine has been developed, using the study techniques devised by Professor Laia Hanau at the University of Kentucky. The techniques, designed to improve note-taking, the use of textbooks, the organization of material, and preparation for examination, have helped the Michigan school to graduate a sizeable number of minority medical students each year. This record aroused the interest of medical schools, and in consequence Michigan and Professor Hanau in the summer of 1972 conducted a training course for counselors from nearly a score of Midwest medical schools. The course involved both



Participants in a premedical program for minority students practice techniques in a chemistry laboratory at the University of California, Santa Cruz. The program in the University's Crown College prepares students, mainly Chicanos, for later medical studies.

classroom study and supervised tutoring of students at the Michigan School of Medicine. The counselors are now back at their own institutions, helping minority and other disadvantaged students to improve their study skills. The Foundation partially supported the summer program by a grant of \$57,600 to the University of Michigan.

The parallel effort to expand opportunities in graduate management education was broadened somewhat in 1972 to attempt to reach two minority groups previously underserved by Master of Business Administration degree programs. One of these groups is made up of "older" minority persons, often Blacks, who were graduated from college ten to fifteen years ago, before present opportunities for professional and educational advancement were available to minorities. The possibility exists that

Recruiting
Talent
by PREP

A Special
Program
for Chicanos

there are a number of such earlier graduates who now find themselves in work which does not make full use of their preparation and abilities. Given additional training, some of them might qualify for higher-level managerial positions. A number of graduate management schools have expressed interest to the Foundation in devising programs through which such people could attain the MBA degree through part-time study. Foundation Trustees agreed to allocate \$100,000 for feasibility and planning studies toward this end at a selected number of universities, and the first two grants of \$15,000 each were made to Northeastern University and Pace College.

The other group hitherto underserved or not served at all by an MBA program adapted to its needs is comprised of native American Indians. As Indian communities come into more contact with the larger economy, as they seek increasingly to manage their own affairs, and as more of their members enter the larger culture, the need for persons having both managerial skills and an understanding of Indian cultural values is magnified. The University of New Mexico, which already had several special programs for Indians, has established an MBA program geared to Indian needs and interests in its School of Business and Administrative Sciences. Its director is a Navajo Indian, Donald A. McCabe. The program enrolls fifteen students each year, mostly Indians from the Southwest, and provides them with financial aid during the two-year course of study. Principal major support for the program during its first two years comes from a Sloan grant of \$225,000.

At the University of New Mexico a new program geared to the needs and interests of American Indians leads to the degree of Master of Business Administration. At left is a typical seminar; at right Donald A. McCabe, director of the program, tutors a student.

*MBA Training
for American
Indians*



A major effort in training numbers of minority MBA's continued to come from the ten graduate management schools* which in 1970 formed the Council for Opportunity in Graduate Management Education, with Sloan Foundation support. Beginning with 257 minority students in 1969-70, the ten schools currently enroll more than 600, of whom 210 are receiving COGME fellowship support. The enrolled fellows come from all regions of the United States and from 104 undergraduate colleges. All racial minorities are represented, and 16 per cent are women. Fellowship amounts currently average about \$3,000 for first-year fellows and \$2,700 for second-year fellows.

Besides providing financial support for students, COGME assists the member schools in recruiting students and sponsors collaborative efforts among the schools to maximize benefits to minority students in management. Sloan support in COGME's third year, 1972, came to \$500,000 of which \$400,000 was for fellowships and \$100,000 for administrative costs. For purposes of administration the grant was made to Harvard University. COGME was able to raise from government and private sources an amount almost equal to the Sloan grant for the current year, and expects to make further progress in diversifying its support next year.

A similar consortium of management schools†, the Consortium for Graduate Study in Management, continued a program, initiated in 1971 with Sloan support, to train minority managers for careers in public and private not-for-profit organizations. The program involves cooperation by management and other professional schools to educate managers for educational, health-care, governmental, community, and cultural organizations.

Other grants for expanding opportunities in medicine and management:

UNIVERSITY OF CALIFORNIA, San Diego, Calif.: For renewed support of a summer research program for Mexican-American undergraduates interested in careers in science and medicine \$12,720

CONNECTICUT COLLEGE, New London, Conn.: In partial support of a post-baccalaureate (fifth year) program to prepare minority students for medical or dental school \$15,000

UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.: For renewed support of the USC School of Medicine's summer tutorial program for entering medical students \$20,000

* University of California-Berkeley, Carnegie-Mellon University, University of Chicago, Columbia University, Cornell University, Dartmouth College, Harvard University, Massachusetts Institute of Technology, University of Pennsylvania, and Stanford University.

† Indiana University, University of North Carolina-Chapel Hill, University of Rochester, University of Southern California, Washington University, and University of Wisconsin.

*Continuing
Efforts by
Two Consortia*

STUDENT NATIONAL MEDICAL ASSOCIATION, Washington, D.C.: In partial support of an analysis of data on recruitment and progress of minority medical students \$20,000

TULANE UNIVERSITY, New Orleans, La.:
In partial support of the Tulane School of Medicine's summer academic reinforcement program for minority students \$13,000

To expand opportunities for minorities in the MBA program of the Tulane Graduate School of Business Administration \$20,000

WILLIAMS COLLEGE, Williamstown, Mass.: For renewed support of Williams' summer science institute for minority high-school graduates interested in medicine \$20,000

WOODROW WILSON NATIONAL FELLOWSHIP FOUNDATION, Princeton, N.J.: For support of graduate management students in the Martin Luther King Fellowship Program \$20,000

Neuroscience



THE Particular Program in Neuroscience, now entering its fourth year, seeks to expand knowledge of how organisms receive, process, and store information, relate new information to previously stored data, and respond in an organized manner. In this search for the biological bases of behavior, formerly discrete disciplines are coming together in new institutional settings, new mechanisms of communication are evolving, and training of the needed scientists who are at home in more than one discipline is proceeding. The Sloan Foundation has committed to this program thus far about \$6 million, including \$2.3 million in 1972 for nine major grants and several smaller ones. Also, seven young neuroscientists received support through the Sloan Fellowships for Basic Research, discussed on Pages 36 to 38. Commitments for 1973 are projected at roughly the same level as in 1972.

One approach of the Sloan neuroscience program has been to assist the development of a number of centers of excellence in neuroscience research and training. These centers have the breadth and depth to tackle neuroscience problems on a broad front, and to train new scientists in nearly all of the relevant disciplines. During 1972 the University of North Carolina was identified as such a center and the Foundation awarded a grant of \$350,000, payable over two years, to help strengthen the program there. Previous support for "centers of excellence" in neuroscience has been granted to the Massachusetts Institute of Technology, the University of California-San Diego, the Albert Einstein College of Medicine of Yeshiva

*Developing
Centers
of Excellence*

University, Rutgers University, and the California Institute of Technology. The University of Virginia (see below) also received support on this basis in 1972.

The University of North Carolina's Neurobiology Program, established in 1966, involves faculty members from eleven departments, ranging literally from anatomy to zoology, and is administered by an executive committee made up of representatives of those departments. Its function is to facilitate communication and collaborative research by neuroscientists in diverse departments, and to train younger scientists to deal with broad interdisciplinary problems. The Ph.D. in Neurobiology is awarded by the University's Graduate School. North Carolina neuroscientists have produced some of the most compelling evidence of changes in certain large molecules of brain cells associated with learning, and are studying some broader aspects of brain function such as how complex actions of animals are regulated by hormones.

The Sloan support is being used by North Carolina to add four junior neuroscience faculty members, to support trainees, to cover certain administrative costs, and to expand computer facilities.

The evolution of the nervous system from primitive species to the most complex ones is under study at the University of Virginia, as is the increasingly layered structure of parts of the more highly developed brains. This approach to brain function through concepts of comparative neurology and laminar organization is an unusually complex and multi-disciplinary one which very few laboratories have the capacity to undertake. The Virginia research in structure and function of nervous systems ranges from simple invertebrates to the most complex mammals including man. This ability to compare and relate the brain-and-behavior patterns of numerous species is yielding some unusually interesting insights.

The University of Virginia has made rapid progress in building research teams in this and other fields of neuroscience, and in establishing communication and interaction among the various research groups. It still lacked certain key scientists in specialties essential to further progress, and these were provided for by a two-year Sloan grant of \$300,000. Post-doctoral research associates and certain administrative costs also are supported by the grant.

The Foundation also has helped to support research at "growing points" where fundamental advances in specific areas of neuroscience appear to be imminent. One of these is at New York University, where Drs. W. Alden Spencer and Eric Kandel are studying the structure of certain nerve cells whose functions have been identified. Dr. Spencer is working with mammalian brain cells associated with recognition of certain patterns of stimulation of the skin. Dr. Kandel's research concerns cells in the sea

snail which change when a simple form of learning takes place. A successful effort to describe the relationship between structure and function of these cells could open up important new areas of neuroscience research.

The Foundation granted \$214,000, payable over three years, to stimulate these promising lines of research. The funds will pay for supporting scientific and technical personnel, and for electron microscopy which is essential to these studies of cellular structure.

Scientists in Harvard University's Department of Neurobiology under the leadership of Dr. Stephen Kuffler have contributed important knowledge about the growth of nerve cells in tissue culture, the chemical transmission of information from one nerve cell to another, and the mechanisms of vision in mammalian brains. They emphasize the need for combining several disciplines in the study of a single problem, frequently through importing for a limited time a scientist who can provide special expertise at a crucial stage of the research. Thus, in the study of how nerve cells develop and form connections with specific other cells, for example, a particular electron microscopist and a cellular immunologist could make important contributions to advancing the research. In other areas as well, the Harvard group plans to invite certain scientists to spend periods from a few weeks to as long as a year working in the laboratories of Harvard neuroscientists, contributing to the interchange of ideas and expertise on which neuroscience depends.

The Foundation granted \$100,000 in support of such visits by scientists from the United States and abroad to Harvard during a three-year period.

Membranes which cover nerve cells are the site of numerous chemical reactions which regulate the biological processes of those cells and ultimately influence the behavior of the whole organism. Membrane biophysics has thus become an important part of neuroscience because of the fundamental role of membranes in brain function. Much remains to be discovered about the molecular structure of membranes and about the dozens of proteins and enzymes which interact at the membrane to mediate such processes as the cellular power supply, oxidation, vision, transfer of material between cells and regulatory activities.

A group at Columbia University headed by Dr. David Nachmansohn has long been concerned with the excitable membrane which surrounds nerve and muscle fibers. This membrane exhibits unusually high metabolic activity and other characteristics which make it of special interest to neuroscientists. Columbia proposes to bring to its laboratories a number of distinguished scientists, many from abroad, who will engage in research and workshops on the special properties of excitable membranes. The Sloan Foundation made a two-year grant of \$50,600 for this purpose.

Scientists at the Salk Institute have identified a group of cell lines

North Carolina
Adds Breadth
and Depth

Comparing
Patterns
in Species

24

Visiting
Scientists
at Harvard

Understanding
the Role
of Membranes

25

which, when removed from rat brain and grown in isolation, appear to retain their original properties. Because the isolated cells are much easier to study than intact brains, the scientists believe that further study of these cell lines will answer some important questions in neuroscience. They believe, for example, that they can determine the molecular components of nerve cells' membranes with the help of an additional scientist trained in the recording of electrical signals from nerve cells. The Foundation granted \$80,000 to support this additional expertise for the Salk research over a two-year period.

The "center of excellence" in neuroscience at the Massachusetts Institute of Technology received in 1972 a final Sloan grant of \$600,000 which is intended to see it through the next three years. Earlier grants to MIT for this purpose totaled \$960,000. The MIT program represents a unique experiment, combining under one roof laboratories in neuromorphology, neurochemistry, neurophysiology, and experimental psychology. MIT's neuroscience research is unusually broad in scope, ranging from the fine structure of connections between brain cells to the brain's processing of visual and auditory stimuli and its regulation of body movements in response to those and other stimuli. Training activities are similarly broad, embracing a large undergraduate program, a new five-year program which awards both Bachelor's and Master's degrees in neuroscience, and an active program in which postdoctoral fellows enjoy a rich environment created by specialized faculty seminars, visits by scientists from other areas of the Institute and from abroad, and association with outstanding MIT neuroscientists.

Systematic undergraduate exposure to neuroscience has been sparse up to now, but it would seem to be essential if students are to begin early on the multi-disciplinary track which leads to competence in neuroscience. The Foundation therefore welcomed the initiative of a leading liberal-arts college, Amherst College, in establishing an interdisciplinary neuroscience program for its students. Building upon its successful biophysics program, Amherst proposed to develop new courses, co-ordinate existing courses, and cooperate with neighboring institutions (Hampshire, Mount Holyoke, and Smith colleges and the University of Massachusetts) to prepare students for careers in neuroscience. A \$400,000 Sloan grant will assist Amherst in augmenting its faculty, laboratories, and other facilities for neuroscience education and research over a three-year period.

In a field embracing as many subdisciplines as does neuroscience, effective communication is imperative. Thus it is not surprising that neuroscience has spawned its own unique communications center, the Neurosciences Research Program, founded in the mid-1960s by the MIT molecular biologist, Dr. Francis O. Schmitt. NRP conducts frequent

workshops at which world leaders in the many neuroscience disciplines discuss their differing approaches to problems of mutual interest; it then distributes proceedings of these meetings rapidly to the world-wide neuroscience community. Every three years, summer study programs pull together the current state of knowledge in the field. Resident scientists gain new perspectives on the field by working for a time at the NRP headquarters in Brookline, Massachusetts. Since NRP's goals are so closely analogous to those of the Sloan Foundation in neuroscience, the Foundation granted \$200,000 for NRP's support over a four-year period.

These other grants were made through the Particular Program in Neuroscience in 1972:

UNIVERSITY OF BRITISH COLUMBIA, Vancouver, B.C., Canada: To initiate a research program applying new chemical techniques to the analysis of brain structure	\$18,500
UNIVERSITY OF IOWA, Iowa City, Iowa: In partial support of a symposium on the application of Procion and related dyes to neurobiological problems	\$6,336
MANFRED SAKEL INSTITUTE, New York, N.Y.: To initiate an experimental collaborative research program among selected neuroscience laboratories	\$20,000
RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK, Albany, N.Y.: In support of a workshop on the anuran visual system, held at the Downstate Medical Center	\$9,000

A Center
of Information
for Scientists

Continuing
Excellence
at MIT

Undergraduate
Neuroscience
at Amherst

General Program

THE GENERAL PROGRAM of the Alfred P. Sloan Foundation, which is distinct from the three Particular Programs, carries forward the Foundation's interests in science and technology, in economics and management, and in education and the problems of society related to those interests. Within these areas the Foundation supports promising research efforts and innovative educational programs, and occasionally convenes groups of experts for discussion and advice on matters of general concern. General Program grants often result from the initiatives of proponents; in other instances the Foundation identifies a significant problem area and invites proposed solutions.

Science and Technology



IN a society that has been radically transformed by the nation's vast scientific-technological enterprise, science and technology find themselves in an anomalous position. The postwar period of ever-expanding resources for scientific research appears to be over. Basic research is under new pressure to justify its claim to public funds and the best young minds. Technology has seen some of its highest aspirations reduced in scope (the space program) or rejected (the supersonic transport). And problems attributed to technology seem to resist present efforts at solution while numbers of trained engineers are unemployed and fewer young people set out to be engineers. Science and technology have changed the world, and the milieu in which they themselves function has likewise changed.

In this changed world there appear to be new ground rules for the technologist. These rules are not always clear, but there is growing evidence that projects developed without consideration of their social consequences will not be accepted. Today's engineer must function within a context of social and political constraints unknown to his predecessors of even a decade or two ago. Once it was enough for the engineer to know how things work; now he still must know that, and in addition he must know how society and its institutions work.

Thus engineering education, which only recently has absorbed powerful infusions of knowledge and technique from the basic natural sciences,

*New Context
for the Work
of Engineers*

*A Concern
for the Needs
of Society*

now finds itself in need of the expertise which the social and behavioral sciences can provide in equipping engineers to deal with today's vastly more complex problems. This ferment in the engineering schools—among faculties and students alike—has become strongly evident to the Sloan Foundation, which has taken a major interest in engineering education since 1961. The Foundation in 1972 invited a number of institutions to propose solutions and selected eight of the most promising proposals for support. A ninth program received support late in the year.

The first eight grants, announced in May, were explicitly designed to strengthen the social-science component of engineering education by various means. They totaled \$2,492,000 in amount and all are for two years. The recipient institutions and brief descriptions of their programs:

UNIVERSITY OF CALIFORNIA, Berkeley, \$295,000. The College of Engineering at Berkeley is initiating a new two-year Master of Engineering program which combines advanced work in engineering with study in other disciplines such as the social sciences, law, public health, social welfare, business administration, environmental design, and public policy. Students may earn joint degrees in engineering and another professional discipline. The goal is a new breed of engineer who is not only machine-oriented but also human-oriented, "able not only to analyze a complex large-scale system involving both humans and machines, but also assess the consequences of various decision strategies in economic, political, and human terms."

COLUMBIA UNIVERSITY, \$330,000. Columbia's School of Engineering and Applied Science sees the need for "a new kind of professional education, a kind of socio-technical education which develops individuals capable of understanding problems in their entirety, not just in their parts." It is instituting a program spanning the senior undergraduate and master's degree levels which is centered on tangible problems in which technical elements are dominant but where possible solutions are strongly constrained by social factors. Students, in addition to this project work, will take appropriate courses in engineering and social sciences and will participate in seminars designed to tie together their technical and social-science studies and the realities of the project work.

DUKE UNIVERSITY, \$330,000. Duke's School of Engineering, in cooperation with its Institute of Policy Sciences and Public Affairs, plans to educate engineers who are prepared for policy-making positions in federal, state, and local governments, which are heavily staffed at the upper levels by persons trained as engineers. New undergraduate courses will be developed for this purpose, and will make possible a bachelor of engineering degree with a second major in public policy. At the graduate level, a new master's degree program in engineering and policy science is expected to admit students in the Fall of 1973.

HOWARD UNIVERSITY, \$330,000. At Howard the School of Engineering is developing a two-year program leading to the degree of Master of Urban Systems Engineering. The program seeks to apply analytic and quantitative skills, along with social-science expertise, to the problems of inner cities. It will work with Howard's existing Urban Systems Program which involves faculty, students, and local residents in research, seminars, institutes, and evening courses dealing with urban problems.



Rice University engineering students use a computer simulation of global forces to test the broad implications of technical decisions. Rice was one of several universities receiving Sloan support for programs to increase engineers' social awareness.



At Columbia University's School of Engineering and Applied Science, a new kind of "socio-technical" education is being developed. The program includes this project which uses computer graphics to devise new housing and site-use concepts for Welfare Island in New York City.



In the University of Michigan's Program for Engineering in Public Systems, a visiting lecturer is videotaped, to make his presentation available for other classes. Michigan has established a two-year graduate program to prepare engineers for careers in public service.

UNIVERSITY OF ILLINOIS, \$319,000. The College of Engineering seeks to infuse its instruction with an awareness of human and social considerations through a series of seminars at which senior engineering and social-science faculty members will take up a social-technical problem while junior faculty members observe and learn. Insights gained from this exercise will be introduced into teaching and the results reported back to the continuing, rotating seminar. By this means Illinois expects that over two years some 50 faculty members will be exposed to these broader dimensions of engineering and in turn will expose their students to them.

UNIVERSITY OF MICHIGAN, \$313,000. At Michigan, the College of Engineering and the Institute of Public Policy Studies are cooperating to establish a two-year graduate program to prepare engineers for careers in public service. Students having bachelor's degrees in science, mathematics, or engineering will be able to study for the degree of Master of Science in Engineering or Master of Public Policy. The academic program will combine advanced engineering courses with studies in public policy subjects and a summer internship dealing with real problems in the public sector. Faculty and graduate students will develop research projects dealing with public technical problems.

RICE UNIVERSITY, \$250,000. Rice University will seek to impress on engineering and other students the far-reaching impact of technical decisions by establishing on its computer a macro-simulation of global forces such as population, capital investment, pollution, food production, and natural resources. Aspects of the simulation will be taught by instructors from various disciplines, and students will be able to experiment with the variables to gain appreciation of the global effects of local decisions. In addition, new courses will be developed, some of them being in the nature of case studies of technical operations which have broad sociological implications.



A seminar in Stanford University's Values, Technology, and Society program holds an evening session in the home of Professor Robert E. McGinn, seated in front of the fireplace. Students are from all four undergraduate classes as well as graduate schools, and from a wide variety of disciplines.

STANFORD UNIVERSITY, \$325,000. Stanford's School of Engineering will use Sloan funds for four discrete but related programs: A Values, Technology, and Society program seeks to integrate technology, social science, and human values through a seminar in which faculty and students from all three areas participate, and through other new types of courses and teaching methods. A program on Energy and Society brings together faculty and graduate students from all relevant disciplines to prepare a syllabus which will guide teaching and research in this area. A workshop on National Growth Policy for postdoctoral fellows and advanced graduate students seeks to synthesize aspects of systems analysis and social science in the study of policy decisions affecting population and economic growth. Finally, a program designated Engineering-Economic Planning, which emphasizes the social responsibilities of civil engineering, will benefit from an opportunity for two professors to organize and publish teaching and study materials on this subject.

Princeton University, recipient of a \$1 million Sloan grant in 1962 to strengthen the basic science component of engineering education, has recognized that engineers and social scientists increasingly possess shared interests in certain topical areas. It therefore has established "topical programs" of study in four areas: environmental studies, transportation systems and technology, energy conversion and resources, and bioengineering. Programs are planned in computer sciences and urban engineering. These studies are open to students from all engineering departments as well as to students in economics, political science, and other social sciences. The faculty is similarly varied for any given program. This kind of interaction

*Disciplines
Converge
on a 'Topic'*

is intended to produce engineers who are "still highly skilled and creative technically, but now better poised both professionally and personally to guide society toward superior technological solutions to its problems."

Princeton's topical programs have led to noticeably increased interest in engineering among graduate students, and the 1972 freshman class in engineering is the largest in a decade. To help the School of Engineering and Applied Science extend and consolidate these gains, the Foundation made a grant of \$592,000, payable over four years. The funds will enable the School to recruit and train a nucleus of junior faculty who are already oriented toward interdisciplinary approaches, and to support their research in the topical program areas. Princeton also will use a small portion of the grant to move its Department of Aerospace and Mechanical Sciences from a remote location to the main campus.

Since 1955 some 977 young scientists have been encouraged to pursue basic research by grants totaling \$20.6 million through the Sloan Fellowships for Basic Research. The funding for this program, currently \$1.4 million a year, is small in terms of the need but about 10 per cent of the Foundation's income, and it may be of increasing significance as other sources of research support, especially within the federal government, become scarcer.

Until 1972 the Sloan Fellowships were confined to faculty scientists in physics, chemistry, mathematics, and interdisciplinary fields involving physical science. With the establishment of the Foundation's Particular Program in Neuroscience, the study of the brain and its relationship to behavior, a decision was reached to open the Fellowships to promising young neuroscientists, and seven neuroscientists were included among the 79 recipients of Sloan Fellowships in 1972. Because neuroscience is not yet a well-established discipline, postdoctoral fellows as well as junior faculty from that field are considered for Sloan Fellowships.

The fellowship program seeks to create the optimum conditions for the most creative basic research, that is, the greatest possible freedom for the investigator. Recipients, selected from more than 500 nominations considered annually, are not asked to submit a research proposal and the grant funds may be used for a broad variety of purposes, subject to the policies of the Fellow's institution. The average two-year fellowship amounts to \$18,000, and the average age of the fellows when selected is 30.

The task of selection, given the large number of nominations and the relative youth of the nominees, is necessarily a laborious one, but it is vital to such success as the program has enjoyed. This responsibility the Founda-

tion entrusts to a distinguished Program Committee of senior scientists, which at present consists of the following:

- | | |
|---|--|
| DR. RICHARD B. BERNSTEIN (Chemistry)
University of Wisconsin | DR. CARL PFAFFMANN (Neuroscience)
Rockefeller University |
| DR. E. J. COREY (Chemistry)
Harvard University | DR. ARTHUR L. SCHAWLOW (Physics)
Stanford University |
| DR. MARK KAC (Mathematics)
Rockefeller University | DR. FRANCIS O. SCHMITT (Neuroscience)
Massachusetts Institute of Technology |
| DR. ROBERT E. MARSHAK (Physics)
The City College of The City
University of New York | DR. I. M. SINGER (Mathematics)
Massachusetts Institute of Technology |

For fellowships beginning in the Fall of 1972 the Program Committee recommended 25 physicists, 32 chemists, 15 mathematicians, and seven neuroscientists. These 79, together with 77 Fellows now in the second year of their fellowships, bring to 156 the number of Fellows now holding appointments at 66 universities and colleges.

Fellows selected in 1972, their institutions, and their fields of research are:

- | | |
|--|--|
| UNIVERSITY OF ARIZONA
Physics: Bruce R. Barrett | UNIVERSITY OF CALIFORNIA, Santa Cruz
Mathematics: Michael Shub |
| BOSTON UNIVERSITY
Chemistry: Richard H. Clarke. Bio-
organic Chemistry: Richard A. Laursen | UNIVERSITY OF CHICAGO
Mathematical Physics: Robert P. Ge-
roch. Physics: James E. Pilcher |
| BRANDEIS UNIVERSITY
Mathematics: David I. Lieberman | COLORADO STATE UNIVERSITY
Chemistry: Larry L. Miller |
| UNIVERSITY OF BRITISH COLUMBIA
Physics: Irving Ozier | UNIVERSITY OF COLORADO
Chemistry: William C. Lineberger |
| BROWN UNIVERSITY
Chemistry: Richard Eisenberg. Physics:
See-Chen Ying | COLUMBIA UNIVERSITY
Physics: William C. Carithers, Jr.,
Robert W. Guernsey, Jr. Mathematics:
Jonathan L. Gross |
| CALIFORNIA INSTITUTE OF TECHNOLOGY
Astrophysics: James E. Gunn | DUKE UNIVERSITY
Neuropsychology: James W. Kalat |
| UNIVERSITY OF CALIFORNIA, Berkeley
Applied Mathematics: Alexandre J.
Chozin. Mathematics: Arnold Kas,
Tsit-yuen Lam, Ralph N. McKenzie. | HARVARD UNIVERSITY
Mathematics: George R. Kempf. Chem-
istry: John A. Osborn, William P. Rein-
hardt. Neurobiology: Melitta Schachner |
| Chemistry: Henry F. Schaefer III. As-
trophysics: Joseph I. Silk | UNIVERSITY OF HOUSTON
Chemistry: Donald J. Kouri |
| UNIVERSITY OF CALIFORNIA, Davis
Chemistry: Gerd N. LaMar | UNIVERSITY OF ILLINOIS
Chemistry: David Chandler, James T.
Yardley III. Physics: Shau-jin Chang. |
| UNIVERSITY OF CALIFORNIA, Irvine
Astrophysics: Virginia L. Trimble | Mathematics: Robert P. Kaufman.
Neurochemistry: William O. McClure |
| UNIVERSITY OF CALIFORNIA, Los Angeles
Chemistry: David A. Evans. Physics:
Seth J. Putterman, Biochemistry: David
S. Sigman | UNIVERSITY OF IOWA
Chemistry: Dimitri N. Coucouvanis,
William C. Stwalley |
| UNIVERSITY OF CALIFORNIA, San Diego
Chemistry: Robert L. Vold, John C.
Wheeler | JOHNS HOPKINS UNIVERSITY
Chemistry: Douglas C. Poland |

McGILL UNIVERSITY

Chemistry: Byung Chan Eu

UNIVERSITY OF MARYLAND

Neurochemistry: Sandor Kerpel-Fronius. Radio Astronomy: Benjamin M. Zuckerman

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Applied Mathematics, Theoretical Physics: Carl M. Bender. Physics: John W. Negele

UNIVERSITY OF MASSACHUSETTS

Physics: Robert B. Hallock

MICHIGAN STATE UNIVERSITY

Nuclear Chemistry: William C. McHarris

UNIVERSITY OF MICHIGAN

Chemistry: Arthur J. Ashe III. Crystallography: Billy Joe Evans

STATE UNIVERSITY OF NEW YORK AT STONY BROOK

Chemistry: David M. Hanson. Mathematics: Stanley J. Osher. Astrophysics: Frank H. Shu. Biochemistry: Sanford R. Simon. Physics: Gene D. Sprouse

UNIVERSITY OF NORTH CAROLINA

Chemistry: Paul J. Kropp

NORTHEASTERN UNIVERSITY

Physics: David A. Garelick

UNIVERSITY OF OREGON

Chemistry: John F. W. Keana

PRINCETON UNIVERSITY

Physics: Frank P. Calaprice

PURDUE UNIVERSITY

Mathematics: Allen Weitsman

RICE UNIVERSITY

Mathematics: F. Reese Harvey

ROCKEFELLER UNIVERSITY

Neurochemistry: Richard E. Zigmond

STANFORD UNIVERSITY

Chemistry: Hans C. Andersen. Mathematics: C. Denson Hill. Geophysics: Amos M. Nur. Astrophysics: Vabe Petrosian

TEMPLE UNIVERSITY

Physics: Ted W. Mihalisin

UNIVERSITY OF TEXAS AT AUSTIN

Nuclear Astrophysics: Cary N. Davids

UNIVERSITY OF WASHINGTON

Physics: Eric G. Adelberger. Chemistry: Niels H. Andersen. Neurophysiology: Eberhard Fetz

WAYNE STATE UNIVERSITY

Chemistry: Morton Raban

WESLEYAN UNIVERSITY

Astrophysics: James E. Faller

UNIVERSITY OF WESTERN ONTARIO

Chemistry: Donald R. Arnold

UNIVERSITY OF WISCONSIN

Chemistry: Marion H. O'Leary. Molecular Neurobiology: A. O. W. Stretton

YALE UNIVERSITY

Mathematics: Lawrence Corwin

Academy proposed to establish a fellowship program whereby six to ten persons each year would be afforded this experience for periods of six to ten months. The fellows, from five to ten years past their doctor's degrees and already in positions of some responsibility in their institutions, are to be chosen by a committee in part external to the Academy. They will be assigned to work with the boards and committees of the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the National Research Council, and will be given an opportunity to expand their knowledge of how government agencies and the Congress go about forming public policy on science and technology. The Sloan Foundation made a three-year grant of \$250,000 to help the Academy initiate this program.

Most of the basic biological research supported by the Sloan Foundation has taken place at the Sloan-Kettering Institute for Cancer Research, established in 1945 with major support from the Foundation. The Foundation has made annual supporting grants, and an occasional major grant for construction and renovation, to the Institute since 1945. Today the Institute, as the research wing of Memorial Sloan-Kettering Cancer Center, stands as a principal resource in the struggle against cancer, a struggle which was recently designated a matter of national priority by the federal administration. While this national commitment augurs well for the Institute's future, in the year under review the Institute continued to feel the effects of earlier cutbacks, resulting in an operating deficit. In response to this special need, the Foundation made a supplementary grant of \$700,000 in addition to its regular annual supporting grant of \$400,000. These grants are paid from the General Motors Dealers Appreciation Fund for Cancer and Medical Research, established in 1948 by gifts from General Motors dealers in appreciation of the contributions of Alfred P. Sloan, Jr. to the corporation and its dealer organization.

The Sloan-Kettering Institute during 1972 reported progress toward the control of certain leukemias with anti-cancer drugs and toward harnessing the body's immune mechanisms for the rejection of cancerous tissue.

Dr. Robert A. Good, Regents' Professor of Pediatrics and Microbiology and head of the Department of Pathology at the University of Minnesota, was appointed president and director of the Institute, succeeding the late Dr. Frank L. Horsfall.

In the field of applied mathematics one of the leading centers of teaching and research is New York University's Courant Institute of Mathematical Sciences, which has received Sloan support of more than \$3.7 million since 1961. In the application of mathematics to problems in the physical and other sciences (in contrast to the more detached development of pure mathematics), the Courant Institute has had few peers. Recently

Continuing the Attack on Cancer

Sustaining Leadership in Mathematics

Where Government Meets Science

If the capabilities of science and technology are to play a part in shaping enlightened public policies, it is necessary that there be scientists and engineers who are familiar with the workings of government. The National Academy of Sciences and its related agencies occupy a unique position at the science-government interface in Washington, D.C. A private, congressionally chartered organization, the Academy is an official adviser to the Federal Government in matters of science and technology. In drawing up recommendations for agencies of government, the Academy and its affiliates rely on more than 400 boards and committees recruited from academia, industry, and elsewhere.

Such a setting offers an opportunity for younger scientists and engineers to observe and participate in the day-to-day processes through which science and technology interact with government in the formulation of policy. The

its leadership in the field has been threatened, however, by a number of developments, including a slower growth of federal research funds, declining undergraduate mathematics enrollment, and a serious financial crisis in the parent university.

Through a series of stringent measures the Courant Institute expects to bring its budget into balance, or near balance, by 1977. The immediate problem is to maintain the scientific integrity of the Institute during the intervening period, while the necessary adjustments are being worked out and implemented. The Sloan Foundation agreed to provide \$300,000, payable in 1973, to help ease this period of transition.

The human mind as an information-processing device is the subject of a study that has been under way with Sloan support since 1970 at the Institute for Advanced Study. The study, initially headed by Drs. Duncan Luce and George Miller, seeks to discover the formal rules by which the mind encodes, stores, retrieves, and decodes information. Through the use of computer simulation, processes such as perception and learning and use of language are studied from a psychological and logical point of view. The result may be an understanding of mental operations which will complement the knowledge of brain physiology being gained in neuroscience. This project will continue under the supervision of Dr. Miller with renewed support of \$150,000 over two years from the Sloan Foundation.

Other grants for science and technology in 1972:

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Washington, D.C.: In partial support of the 1973 AAAS meeting in Mexico City	\$10,000
UNIVERSITY OF CHICAGO, Chicago, Ill.: To assist in the development of a high-resolution scanning proton microscope	\$15,000
GENETICS SOCIETY OF AMERICA: For partial support of the XIII International Congress of Genetics	\$10,000
INSTITUTE OF INTERNATIONAL EDUCATION, New York, N.Y.: For a revised and updated edition of the pamphlet "Engineering Education in the United States," principally for the guidance of foreign students	\$7,500
MARLBORO COLLEGE, Marlboro, Vt.: In support of research on a mathematical theory of evolution	\$8,350
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: For partial support of an international conference and publication on single cell protein as a food source	\$10,000
40 To support the transfer of the Science and Public Policy Studies Group (SPPSG) Newsletter to The MIT Press	\$15,000

M.I.T. Development Foundation, Inc., Cambridge, Mass.: In support of the grantee's efforts, for the benefit of the Massachusetts Institute of Technology, to stimulate the transfer of technology from the laboratory stage to market applications	\$20,000
NATIONAL ACADEMY OF SCIENCES, Washington, D.C.: For preparation of a volume of essays as part of the celebration in 1973 of the quinquennial of the birth of Nicolaus Copernicus	\$7,595
SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS, Philadelphia, Pa.: To help support a conference on the application of mathematics to the solution of societal problems	\$9,650
STUDENT COMPETITIONS ON RELEVANT ENGINEERING, INC., Medford, Mass.: To assist SCORE in expanding into new areas its programs of student competitions related to engineering education	\$15,000
UNIVERSITIES RESEARCH ASSOCIATION, INC., Washington, D.C.: To support participation by three minority graduate physics students in the 1972 summer program of the European Organization for Nuclear Research (CERN)	\$5,000

Economics and Management



SUBSTANTIVE research in economics and a broad new undertaking to improve the teaching of economics received Sloan support in 1972. Major grants for management education were confined to the Particular Program on Expanding Professional Opportunities for minorities, discussed in the section beginning on Page 15.

The quality of economics teaching at the undergraduate level has long been a matter of concern, and recent developments have sharpened that concern. The financial squeeze in higher education has placed a new premium on effective and productive teaching; there is a surplus of Ph.D. teachers in economics as in some other fields, and many economics departments now realize that their products must have better teaching skills than in the past if they are to find jobs. And the junior and community colleges—the fastest growing segment of higher education—are reluctant to hire Ph.D.'s who have not proven their ability to teach.

These conditions are not peculiar to the discipline of economics. What is unusual is the determination of a large number of leaders in economics to face up to the situation, and the presence of an established entity in the field, the Joint Council on Economic Education, to spearhead the effort.

The Joint Council on Economic Education has received Sloan support for a number of projects, including a current seven-school program to develop an improved introductory college course in economics (see the

*Improving
the Teaching
of Economics*

42

Report for 1971, Pages 18 and 19). The new and broader enterprise aims to improve the quality of undergraduate economics teaching generally by a concerted effort to teach prospective Ph.D.'s in economics how to teach. No fewer than ten major departments of economics will join in the effort, which also enjoys the cooperation of the Committee on Economic Education of the American Economic Association.

The project will extend over five years. At the outset a teacher-training model and curriculum will be developed by leading economics teachers and tested at a summer workshop. Further development, as presently envisioned, will result in a teacher-training manual and other materials such as videotapes. These will be introduced at selected universities for further testing and refinement. At a later stage the completed training manual and model will receive a full-scale demonstration and evaluation in at least ten universities. If this phase is successful, the new model for teacher training will be disseminated to the economics teaching profession generally. It may, in fact, influence the ways in which other disciplines prepare their doctoral candidates for teaching.

The Foundation's support of this project takes the form of a grant of \$230,000 for the first three years of the venture, with payment beginning in 1973. The Joint Council, which represents an effort by both industry and the educational community to advance economic understanding, has committed itself to obtaining other support for the remaining two years. A separate Sloan grant of \$15,000 supported the planning phase of the project.

Among the emerging economic issues of 1972, perhaps the most far-reaching one concerned the rapid development of foreign investments by corporations. U.S. firms alone have foreign direct investments of more than \$80 billion at book value. One-fourth of their after-tax profits derive from foreign investment. One-fourth of U.S. exports move between parent firms and their foreign subsidiaries. At least 15 per cent of total new U.S. corporate investment goes into foreign plant and equipment. And foreign corporations are expanding their investments in other countries, including the United States, even more rapidly.

What is the effect of all this on jobs, wages, competition, prices, the balance of payments and the stability of national currencies, the future of developing nations, and the international political balance? Does a factory built overseas by a U.S. firm mean that jobs have been exported, or does it stimulate domestic employment by bringing more earnings home? There are at present no generally accepted answers to such questions, and the result has been mounting controversy plus shifting and uncertain national policies: some nations restrict foreign investment by domestic firms, some promote it, and some (including our own) do both at the same time. The

*Collaboration
by 10 Schools
in Training*

*A Study
of Foreign
Investments*

43

controversy lately has reached the front pages and the Congress.

The Brookings Institution proposed a scholarly study which would consider all aspects of the question and attempt to integrate them into recommendations for a coherent U.S. policy toward foreign direct investment. The study will be directed by Dr. C. Fred Bergsten, senior fellow in the Foreign Policy Studies program at Brookings. He is the author of important works on international economics and international politics; for two years until May 1971 he was the White House official responsible for coordinating U.S. foreign economic policy, and previously he was the State Department's chief staff economist on international monetary problems. The Sloan Foundation made a three-year grant of \$350,000 for this research.

Brookings continued to publish, with partial support from a 1970 Sloan grant, the Brookings Papers on Economic Activity. The papers, developed through periodic meetings of the Brookings Panel on Economic Activity, deal in a timely and comprehensible way with issues having immediate implications for policy and operations. They have found a receptive audience among scholars and business and government economists, and occasionally they reach a wider audience through quotation in the mass media.

Other grants for economics and management:

AMERICAN ECONOMIC ASSOCIATION, Nashville, Tenn.: In partial support of a summer program to increase educational opportunities for minority students in economics	\$20,000
CREIGHTON UNIVERSITY, Omaha, Nebr.: To assist in obtaining a computer time-sharing service as a pilot project in the College of Business Administration	\$3,780
UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.: For support of research on the economic development of a colonial frontier	\$1,500

Education



TWO principal problems of higher education—how to make it of greater benefit to its consumers, the students, and how to pay for it—are receiving attention with the aid of Sloan grants approved in 1972 and in previous years.

The rigid pattern of courses and requirements that prevails in many institutions has been a source of discouragement to many students, not yet committed to a single academic discipline, in their early undergraduate years. At the University of Pennsylvania an intensive study of undergraduate programs has led to a number of changes, including the establishment of several "thematic colleges" wherein small groups of students and faculty concentrate full-time for a semester or a year on specific study areas involving several disciplines. Thematic colleges typically are made up of 25 to 75 freshmen and sophomores and eight to ten faculty members who share seminars, small-group research projects, visiting lecturers, and sometimes communal meals. Many of the faculty members are drawn from graduate and professional schools, thus affording lower-division students early contact with leading scholars which they otherwise would not be likely to have.

The University proposed to add to its first three thematic colleges, all in humanistic subjects, four more colleges which would focus on topics

*Organizing
Education
on a Theme*

in business and technology. The subjects chosen were energy management, transportation, systems-coordinated problem solving, and the culture of industry and business. Students from all schools are eligible to enter these "colleges," and the faculty will be enlisted from the full range of the University's intellectual resources—the Schools of Engineering, the Wharton School, the Fels Center of Government, the Graduate School of Education, and departments of economics, anthropology, history, law, city planning, operations research, and physical sciences.

The University of Pennsylvania expects to continue its experimental thematic colleges for at least three years, to test its hypothesis that these coherent programs developed around groups of students and their interests will prove superior to traditional undergraduate instruction in motivating students to discover and pursue their own academic interests. The low student-faculty ratios and the time needed for curriculum development will impose additional costs, which the Sloan Foundation will partially meet through a grant of \$356,000 over two years for the second group of four colleges. If the thematic colleges are successful, the University foresees that they could be expanded into the junior and senior years, and that a significant part of undergraduate work in business and engineering could take place in such colleges in the future.

A Foundation-sponsored experiment in interdisciplinary education is entering a second phase. The Interdisciplinary Student Task Forces project in its first phase involved groups of from five to more than 20 students at seven universities, most of them at the graduate level, who investigated the problem of heroin usage in their urban areas and developed policy recommendations for dealing with the problem. Assisted by a faculty advisor, each group was able to reach into the relevant disciplines—economics, statistics, sociology, social psychology, law, political science, pharmacology, epidemiology, and others—to describe the current extent of the problem and efforts to correct it, and to suggest possibly more effective ways of controlling heroin usage in cities. The one-semester project culminated in a meeting of faculty advisors and representatives of each task force with a panel of experts at which the recommendations of each group and the methods used in arriving at them were subjected to critical scrutiny. Harry Weiner, assistant dean of the John F. Kennedy School of Government at Harvard University, coordinated the project for the Foundation and wrote a paper* describing this exercise in demonstrating the usefulness of knowledge from many disciplines in dealing with important questions of public policy.

*Basing Studies
on Interests
of Students*

*Groups Study
How to Make
Public Policy*

* *Student Task Forces: an Experiment in Interdisciplinary Education*, by Harry Weiner. An Occasional Paper from the Alfred P. Sloan Foundation. May 1972.

The educational innovation of the Student Task Forces aroused in many of the participating universities and in others a desire for its continuation. Trustees of the Foundation accordingly approved an appropriation of \$100,000 for a second round of Student Task Forces on another subject: the problems of the elderly in the United States. Grants were made to eight institutions in the amounts indicated: University of California, Berkeley (Graduate School of Public Policy), \$15,000; The University of Chicago (School of Special Service Administration), \$13,800; Cornell University (New York State College of Agriculture), \$10,500; Duke University (Center for the Study of Aging and Human Development), \$12,500; Harvard University (Kennedy School of Government), \$11,000; State University of New York at Stony Brook (Program for Urban and Policy Sciences), \$15,000; University of Pennsylvania (Fels Center of Government), \$15,000; The University of Texas at Austin (Lyndon B. Johnson School of Public Affairs), \$11,000.

During 1972 the Foundation undertook a review of progress achieved in undergraduate science instruction at 20 liberal arts colleges which were recipients of five-year grants totaling \$7.5 million through the Foundation's College Science Program. (See the Report for 1966, pp. 10-14.) Roughly three-fourths of these colleges succeeded in strengthening and enriching their programs in science for undergraduates. Especially beneficial were the stimulation of research activities on campus and the addition, temporary or longer-term, of young postdoctoral scientists to faculty. Improvements in curriculum also were frequent, although radical curriculum reform showed a high rate of failure. To this extent the objectives of the College Science Program were met and the investment was worthwhile.

A further objective—sustaining these improvements after the expiration of Sloan support in 1972—cannot be wholly met in most cases, for reasons which few could have foreseen during the development of this program in 1966. The reasons are quite simply the severe financial straits in which most private, liberal arts colleges find themselves today, the general drift of today's undergraduate students away from natural science, and the concomitant decline, in real dollars, of federal support for science. Thus most of the colleges which lifted themselves, with Foundation encouragement, to new levels of activity in science in the years following 1966 face the unhappy prospect of reverting to lower levels now that the original College Science Program is expiring.

Foundation Trustees determined that the most promising developments stimulated by the College Science Program should not be lost and should be supported for another two years. Grants for this purpose in the range of \$50,000 to \$100,000 will be made during 1973 from an appropriation of \$1 million approved in 1972.

*The Status
of Science
in Colleges
After 5 Years*

The Foundation has shared the growing concern for the financial health of higher education, and through a number of grants over the past few years it has supported planning, research, and experimentation in alternative means of meeting or controlling the rapidly rising costs of private colleges and universities. It is supporting a major cooperative study by nine private institutions in the Northeast to determine their true costs of education and how much of this cost burden students and their families can and will shoulder through various means of payment which might be devised.

Many other studies and experiments in the financing of higher education are of course being conducted under other auspices. During 1973 a group of college and university presidents, economists, and administrators will be meeting under Sloan Foundation sponsorship to consider these and other topics in the economics of higher education. By bringing together the best obtainable expertise in a series of seminars, the Foundation hopes to create a body of information which will serve as a guide to future activities concerned with student financing of higher education.

One of the functions of this working seminar will be to consider a major new venture in student self-financing at Yale University. Among the various suggestions which have been put forward for helping students to meet the cost of their college and university studies, the deferred tuition plan or tuition postponement option remains a lively contender. In general it enables the student to borrow all or part of tuition and repay it over a period of years after graduation on a sliding scale adjusted to income. The concept itself is controversial; the means of implementing it are diverse and are the subject of continuing study and debate. But many feel that if some such plan can be proved out, as Yale is attempting to do, and if significant federal funds can then be obtained for its implementation on a large scale, the financial problems of higher education will be ameliorated.

Yale has established a Tuition Postponement Option with start-up funds from private lenders and its own resources. Repayment can be made over 35 years at a rate of .004 of annual income for each \$1,000 of tuition postponed. Repayment ceases earlier whenever the graduate has repaid the full amount postponed plus the costs of financing and administration, or when a repayment group (all individuals who begin payments in the same year) has repaid its total tuition postponements and costs.

In the early years of this experiment at Yale, a research and evaluation team will be analyzing and reporting the data which the program develops. Thus it may become possible to draw some firm conclusions about the workings of deferred tuition as it affects students, alumni, and institutions. Other institutions should be able to profit from Yale's experience. For this

research aspect of the Yale program the Foundation made a two-year grant of \$200,000.

Another financing plan which has received some testing in primary and secondary education, but not yet in higher education, is the voucher system. Students or their families are issued tuition vouchers from public funds, for use at any educational institution which will admit them. Such a plan, if widely used, would have widespread ramifications for both public and private institutions. California is organizing a panel to study the voucher system as it might be applied to the state's large system of higher education; the Foundation contributed \$4,000, through the University of Santa Clara, for the planning phase of this study. The University of Oregon received \$11,500 to help extend a pioneering study of vouchers for higher education by Dr. John Wish of the College of Business Administration. Collaboration between the California and Oregon investigators should enhance the usefulness of their findings on this much-discussed subject.

Other grants for the support of education in 1972:

BARNARD COLLEGE, New York, N.Y.: For partial support of the 1972 Summer Institute of the Barnard-Columbia History of Physics Laboratory . . . \$9,160

COLLEGE AND UNIVERSITY SYSTEMS EXCHANGE, Boulder, Colo.: To support the program of CAUSE for providing member institutions with expert advice and service in the area of administrative data processing . . . \$20,000

COUNCIL FOR THE ADVANCEMENT OF SMALL COLLEGES, Washington, D.C.: In partial support of the completion and publication of a cost-analysis study of 60 of the Council's member institutions . . . \$10,000

GEORGE WASHINGTON UNIVERSITY, Washington, D.C.: For follow-up to a two-year University management study . . . \$19,600

HARVARD UNIVERSITY, Cambridge, Mass.: For the development of an interdisciplinary course in the sociology of science for science students . . . \$19,700

HENRY STREET SETTLEMENT, New York, N.Y.: To help meet the costs of the first year of operation of the Henry Street Children's School . . . \$20,000

IOWA WESLEYAN COLLEGE, Mount Pleasant, Iowa: To support development of an interdisciplinary physical science course for non-science students . . . \$9,750

NEWARK COLLEGE OF ENGINEERING, Newark, N.J.: To design an integrated college-level mathematics-physics course for senior high-school students of Newark's experimental School Within a School . . . \$15,300

PALACE OF ARTS AND SCIENCE FOUNDATION, San Francisco, Calif.: In support of the Explainer program of the San Francisco Exploratorium . . . \$17,500

Related Problems of Society



ACCESS to information of specific kinds, both for specialists and for the public generally, has become a necessity in the kind of society that has evolved in the latter half of the twentieth century. The Foundation made several grants in 1972 to preserve and enhance the availability of information in areas of interest to it.

The Science and Technology Division of the New York Public Library is the repository of many almost irreplaceable periodicals, largely in the physical sciences, which at an over-all rate of some 300 usages a day are deteriorating. The Library has had the facilities, but not the operating funds, to preserve in microfilm those historical materials in its possession which are not available elsewhere. A two-year Sloan grant of \$60,000 will enable the Library to begin placing on film those materials which are of greatest significance to the history of science, and which are in greatest need of preservation.

Information about the Sloan Foundation's own field, which is professional philanthropy, is assembled and made available to the public by the Foundation Center, established in 1956. The Center operates programs of research and publications, and maintains reference libraries in New York and Washington which are used by some 12,000 visitors annually, as well as eight regional depository libraries. The Center shares new quarters and some board members with the Council on Foundations, a membership organization of more than 500 foundations of many kinds and sizes. The Council provides advice and consultation on the increasingly complex

Preserving
a Collection
on Science

50

administrative and program concerns affecting foundations, publishes the journal *Foundation News*, and on occasion represents the foundation field at public hearings and the like.

Recently both the Foundation Center and the Council on Foundations have acquired new chief executives and have undertaken expanded programs of activity. The Center has increased its capacity for the reproduction and dissemination of foundations' official information returns and annual reports, and has installed new data-processing systems to improve the storage and retrieval of information. The Council has enlarged its staff to plan additional regional meetings of foundations and to expand services to its members, and has embarked on an extensive Public Affairs and Education Program to create wider understanding of foundation philanthropy.

The Center and the Council turned to foundations for support of these augmented activities to strengthen philanthropy and, indirectly, its beneficiaries and society. The Sloan Foundation made three-year grants of \$120,000 to the Foundation Center and \$60,000 to the Council on Foundations for its Public Affairs and Education Program, in addition to a grant for Council membership dues of \$10,000.

Other grants in 1972 for related problems of society:

CHARLES F. KETTERING FOUNDATION, Dayton, Ohio: In partial support of production of the film "Survival of Spaceship Earth" for use at the United Nations Conference on Problems of the Human Environment, held in Stockholm in June of 1972	\$15,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: For the second stage of a Cable Planning Workshop, held in the summer of 1972	\$15,000
NATIONAL AFFAIRS, INC., New York, N.Y.: To strengthen the editorial content of <i>The Public Interest</i> in areas of interest of the Sloan Foundation	\$15,000
NATIONAL CENTER FOR STATE COURTS, Washington, D.C.: For support of the Center's program to improve the administration of justice in state court systems	\$7,500
NATIONAL CENTER FOR VOLUNTARY ACTION, Washington, D.C.: In partial support of the first phase of a research program on the status of voluntary action	\$19,500
NATIONAL COMMITTEE OF UNITED STATES-CHINA RELATIONS, INC., New York, N.Y.: For general support of the Committee's activities	\$10,000
NEW YORK STATE WELFARE CONFERENCE, Albany, N.Y.: Contribution to the Conference's Stabilization Fund	\$1,000

Information
About
Foundations

51

Policies and Procedures



THE Alfred P. Sloan Foundation is a nonprofit philanthropic foundation established in 1934 by Alfred P. Sloan, Jr., who was then and for many years thereafter the chief executive officer of General Motors Corporation. It makes grants for research and education in science and technology, economics and management, and problems of society in which scientific, technological, and educational approaches may be useful. Particular Programs of the Foundation currently focus on expanding professional opportunities for minorities in management and medicine; on neuroscience, the study of the brain and its relationship to behavior; and on the use of technology in education.

The Foundation makes grants to tax-exempt institutions and organizations. No grants are made directly to individuals. Except in Particular Programs, grants are confined to support of activities within the United States. While the Foundation recognizes the value of the creative and performing arts, religion, and the humanities, it does not make grants in

those areas. Medical research is supported only at the Memorial Sloan-Kettering Cancer Center. The Foundation does not normally make grants for endowment, general support, or buildings, and grants for equipment are made only when equipment is essential to the progress of a program being supported by the Foundation.

The Foundation welcomes proposals within the above guidelines. Application usually is made in the form of a letter to the President of the Foundation. There are no special forms and no deadlines except in special programs such as the Sloan Fellowships for Basic Research. In a letter of application the Foundation hopes to find statements of: (1) the nature of the problem which led to the application; (2) the procedure to be used in attacking the problem; (3) the name and qualifications of the person or persons to be responsible for the project; and (4) the expected cost and duration of the project. Often a preliminary letter of inquiry will save time for both the applicant and the Foundation. Because the Foundation's resources are limited, many proposals of great merit must be declined.

If a grant is approved, a schedule of both substantive and financial reporting on it is established to meet the requirements of good philanthropic practice and the applicable laws.

Final authority for grants rests with a Board of Trustees which consists of 18 members representative of the educational, scientific, and business communities. During 1972 Clifton C. Garvin, Jr., president, Exxon Corporation, and Charles J. Scanlon, vice president, General Motors Corporation, were elected to the Board. Albert Bradley, a longtime associate of the founder, Mr. Sloan, retired as Honorary Chairman and a member of the Board.

The Board of Trustees is assisted by a professional staff headed by Nils Y. Wessell, President. Staff members are engaged full-time in the investigation of proposals and the formulation of recommendations to the Board, and in evaluative, planning, and administrative duties. Lucius P. Gregg resigned from the staff in 1972 to direct a student loan program of the First National Bank of Chicago. There were no other staff changes in 1972.

Financial Review

Financial Review



THE financial statements of the Foundation, which have been audited by Haskins & Sells, independent certified public accountants, appear on pages 59 to 73. They include the balance sheet, the statement of income and funds, the statement of changes in financial position, the summary of administration and investment expenses, the schedule of marketable securities, and the summary and schedule of grants and appropriations.

Investment and other income in 1972 amounted to \$13,580,299, compared with \$12,720,227 in 1971. The increase of \$860,072 reflected somewhat higher dividend income in 1972. Investment expenses in 1972 totalled \$254,466, of which \$207,972 represented investment counsel fees. Provision for Federal excise tax amounted to \$531,000 in 1972. These deductions from income totalled \$785,466 in 1972, compared with \$644,302 in 1971.

Net investment income was \$12,794,833 in 1972, compared with net investment income of \$12,075,925 in 1971.

The total of grants and appropriations authorized and administration expenses during 1972 amounted to \$16,091,072, or \$3,296,239 in excess of net investment income of \$12,794,833. Grants and appropriations totalled \$15,069,592 while administration expenses amounted to \$1,021,480. Over the Foundation's thirty-eight year history, the cumulative excess of grants and expenses over income has amounted to \$46,705,986.

The total of grant and appropriation payments in 1972 was \$13,917,776, compared with \$13,542,346 in 1971. Together with 1972 administration

expenses, investment expenses and Federal excise taxes paid, the total of cash expenditures in 1972 was \$15,689,181, compared with \$15,248,655 in 1971.

A summary of the Foundation's marketable securities at ledger and quoted market value at December 31, 1972 appears on page 63. The market value of these investment assets of \$367,274,081 at December 31, 1972 was a record high for the end of any year.

A summary of grants by major classifications followed by a listing of grants made during 1972 will be found on pages 68 to 73. Grants and appropriations authorized and payments during the year ended December 31, 1972 are summarized in the following table:

Grants and appropriations unpaid	
January 1, 1972	\$13,728,000
Authorized during 1972	15,069,592
	<u>28,797,592</u>
Payments during 1972	13,917,776
Total grants and appropriations authorized but not due at December 31, 1972	<u>\$14,879,816</u>

Income from investments credited to the General Motors Dealers Appreciation Fund during 1972, after provision for Federal excise tax, amounted to \$332,022. Grants authorized and applied against this Fund totalled \$1,100,000, representing grants to the Sloan-Kettering Institute for Cancer Research, as set forth on page 39. Grant payments from this Fund during the year 1972 amounted to \$900,000, resulting in grants outstanding and unpaid at the end of 1972 of \$2,700,000.

The net worth of the Foundation at December 31, 1972, based on quoted market values, was divided as follows:

	TOTAL ASSETS* AT MARKET VALUE	GRANTS AND APPROPRIA- TIONS AUTHO- RIZED BUT NOT DUE FOR PAYMENT	ACCRUED FEDERAL EXCISE TAX	FUND BALANCES AT MARKET VALUE
General Fund	\$358,614,393	\$12,179,816	\$518,487	\$345,916,090
General Motors Dealers Appreciation Fund	8,993,543	2,700,000	13,553	6,279,990
Total	<u>\$367,607,936</u>	<u>\$14,879,816</u>	<u>\$532,040</u>	<u>\$352,196,080</u>

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

TWO BROADWAY
NEW YORK 10004

ACCOUNTANTS' OPINION

Alfred P. Sloan Foundation:

We have examined the balance sheet of Alfred P. Sloan Foundation as of December 31, 1972 and the related statements of income and funds and changes in financial position for the year then ended, and the supplemental schedules of administration and investment expenses, marketable securities, and grants and appropriations. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, such financial statements and supplemental schedules present fairly the financial position of the Foundation at December 31, 1972 and the results of its operations and the changes in its financial position for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Haskins & Sells

February 1, 1973

Balance Sheet

December 31, 1972 and December 31, 1971

	<u>1972</u>	<u>1971</u>
<u>ASSETS</u>		
MARKETABLE SECURITIES (at cost or quoted market at date of gift or receipt):		
Fixed income securities:		
U.S. Government and agency obligations	\$ 26,782,990	\$ 28,932,516
Other bonds and notes	28,770,480	27,330,480
Total fixed income securities	<u>55,553,470</u>	<u>56,262,996</u>
Common stocks	153,292,986	147,967,999
Total marketable securities (quoted market: 1972—\$367,274,081; 1971—\$328,313,401)	208,846,456	204,230,995
CASH	333,855	782,145
TOTAL	<u>\$209,180,311</u>	<u>\$205,013,140</u>

OBLIGATIONS AND FUNDS

GRANTS AND APPROPRIATIONS AUTHORIZED BUT NOT DUE FOR PAYMENT	\$ 14,879,816	\$ 13,728,000
ACCUMULATED FEDERAL EXCISE TAX	532,040	496,499
FUND BALANCES	<u>193,768,455</u>	<u>190,788,641</u>
TOTAL	<u>\$209,180,311</u>	<u>\$205,013,140</u>

Statement of Income and Funds

For the years ended December 31, 1972 and 1971

INCOME:	1972	1971
Investment income (recorded on cash basis):		
Dividends	\$ 10,263,190	\$ 9,318,805
Interest	3,304,212	3,368,469
Other	12,897	32,953
	<u>13,580,299</u>	<u>12,720,227</u>
Less:		
Investment expenses	(254,466)	(154,302)
Provision for Federal excise tax	(531,000)	(490,000)
Net investment income	<u>12,794,833</u>	<u>12,075,925</u>
Grants and expenses:		
Grants and appropriations authorized	15,069,592	11,293,842
Administration expenses	1,021,480	1,046,506
Total	<u>16,091,072</u>	<u>12,340,348</u>
Excess of grants and expenses over income for the year	(3,296,239)	(264,423)
Cumulative excess of grants and expenses over income from inception to:		
Beginning of year	(43,409,747)	(43,145,324)
End of year	<u>(46,705,986)</u>	<u>(43,409,747)</u>
PRINCIPAL:		
Balance at beginning of year	234,198,388	234,107,656
Assets received from Gladys P. Wilde Trust under Will of Irene Jackson Sloan	346,566	—
Net profit on disposals of securities	5,929,487	90,732
Balance at end of year	<u>240,474,441</u>	<u>234,198,388</u>
FUND BALANCES AT END OF YEAR	<u>\$193,768,455</u>	<u>\$190,788,641</u>

Statement of Changes in Financial Position

For the years ended December 31, 1972 and 1971

SOURCE OF FUNDS:	1972	1971
Investment and other income	\$13,580,299	\$12,720,227
Assets received from Gladys P. Wilde Trust under Will of Irene Jackson Sloan	346,566	—
Net profit on disposals of securities	5,929,487	90,732
	<u>19,856,352</u>	<u>12,810,959</u>
APPLICATION OF FUNDS:		
Grant and appropriation payments	13,917,776	13,542,346
Administration expenses	1,021,480	1,046,506
Investment expenses	254,466	154,302
Federal excise taxes paid	495,459	505,501
	<u>15,689,181</u>	<u>15,248,655</u>
INCREASE (DECREASE) IN FUNDS CONSISTING OF:		
Change in ledger value of investments	4,615,461	(2,839,310)
Change in cash balances	(448,290)	401,614
	<u>\$ 4,167,171</u>	<u>(\$ 2,437,696)</u>

Summary of Administration and Investment Expenses

For the years ended December 31, 1972 and 1971

	1972	1971
ADMINISTRATION EXPENSES:		
Salaries and employee benefits	\$ 677,421	\$ 676,988
Rent	147,058	122,597
Program expenses	102,001	118,074
Office expenses and services	84,214	114,299
Professional fees (including investment counsel fees)	239,211	143,414
Reports and publications	26,041	25,436
Total administration expenses	1,275,946	1,200,808
Less: Expenses applicable to investments	254,466	154,302
Balance of administration expenses applicable to grant making	\$1,021,480	\$1,046,506
 INVESTMENT EXPENSES:		
Investment counsel fees	\$ 207,972	\$ 111,862
Administration expenses applicable to investments	46,494	42,440
Total investment expenses	\$ 254,466	\$ 154,302

Schedule of Marketable Securities

December 31, 1972

	LEDGER AMOUNT	QUOTED MARKET VALUE AMOUNT	PERCENT OF TOTAL INVESTMENT
SUMMARY			
Fixed Income Securities:			
U.S. Government and agency obligations	\$ 26,782,990	\$ 26,845,592	7.3%
Other bonds and notes	28,770,480	28,580,273	7.8
Total fixed income securities	55,553,470	55,425,865	15.1
Common Stocks:			
General Motors	62,878,064	116,874,029	31.8
All other	90,414,922	194,974,187	53.1
Total common stocks	153,292,986	311,848,216	84.9
Total marketable securities	\$208,846,456	\$367,274,081	100.0%

	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
FIXED INCOME SECURITIES			
U.S. Government and Agency Obligations:			
Treasury Bills:			
—January 4, 1973	\$ 1,805,000	\$ 1,799,224	\$ 1,803,520
Treasury Bonds:			
4% —August 15, 1973	5,921,000	5,863,618	5,867,297
Treasury Notes:			
5.75% —November 15, 1974	3,000,000	3,002,812	2,988,750
6% —May 15, 1975	2,000,000	2,003,750	1,997,500
6.50% —May 15, 1976	2,000,000	1,997,945	2,022,500
6.25% —February 15, 1978	2,500,000	2,509,766	2,495,300
Federal Home Loan Banks			
Consolidated Bonds:			
7.75% —February 25, 1980	1,300,000	1,301,219	1,374,750
Twelve Federal Land Banks Con- solidated Federal Farm Loan Bonds:			
5.125%—April 20, 1978	500,000	416,250	466,875

Schedule of Marketable Securities

December 31, 1972

(continued)

FIXED INCOME SECURITIES	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
Federal National Mortgage Association Debentures:			
4.50% —July 1, 1973	\$ 2,790,000	\$ 2,580,750	\$ 2,762,100
5.20% —January 19, 1977	3,000,000	3,011,250	2,861,250
7.25% —June 10, 1981	300,000	297,656	308,250
6.65% —June 10, 1982	1,000,000	1,002,500	992,500
6.05% —February 1, 1988	1,000,000	996,250	905,000
Total U.S. Government and agency obligations		<u>26,782,990</u>	<u>26,845,592</u>
Other Bonds and Notes:			
Undivided Interest in Demand Notes:			
Atlantic Richfield Company	754,000	754,000	754,000
General Electric Company	834,000	834,000	834,000
Norfolk and Western Railway Company			
Conditional Sale Contracts			
7.25% —August 1, 1973	430,000	430,000	430,000
Florida Power & Light Company			
First Mortgage Bonds			
3.50% —January 1, 1974	1,000,000	862,520	975,000
General Motors Acceptance Corporation Debentures:			
3.625% —September 1, 1975	1,000,000	810,600	932,500
5% —September 1, 1980	1,300,000	1,300,000	1,147,250
5% —March 15, 1981	1,500,000	1,492,500	1,320,000
National Dairy Products Corporation Debentures			
3.125% —June 1, 1976	200,000	158,664	180,750
Household Finance Corporation Sinking Fund Debentures			
4.625% —January 15, 1977	1,015,000	870,118	945,219
Public Service Electric and Gas Company Debenture Bonds			
4.625% —March 1, 1977	1,223,000	1,096,630	1,132,804

Schedule of Marketable Securities

December 31, 1972

(continued)

FIXED INCOME SECURITIES	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
Morgan Guaranty Trust Company of New York Capital Notes			
6.375% —April 1, 1978	\$ 1,000,000	\$ 1,000,000	\$ 987,500
Bankers Trust New York Corporation Debentures			
6.375% —September 1, 1978	1,000,000	997,500	990,000
General Electric Credit Corporation Notes			
7% —February 15, 1979	2,000,000	1,995,000	2,030,000
American Telephone and Telegraph Company Debentures:			
4.375% —April 1, 1985	1,500,000	1,518,210	1,175,625
8.75% —May 15, 2000	2,500,000	2,502,188	2,800,000
Burlington Industries, Inc. Convertible Subordinated Debentures			
5% —September 15, 1991	2,000,000	2,047,500	2,050,000
Aluminum Company of Canada, Limited Sinking Fund Debentures			
9.50% —March 1, 1995	1,000,000	1,012,500	1,125,000
International Paper Company Sinking Fund Debentures			
8.85% —March 15, 1995	1,500,000	1,553,750	1,700,625
Exxon Corporation Debentures			
6% —November 1, 1997	5,000,000	5,000,000	4,500,000
Standard Oil Company (Indiana) Debentures			
6% —January 15, 1998	1,000,000	990,000	890,000
Dow Chemical Company Debentures			
8.875% —May 1, 2000	1,500,000	1,544,800	1,680,000
Total other bonds and notes		<u>28,770,480</u>	<u>28,580,273</u>
Total fixed income securities		<u>\$55,553,470</u>	<u>\$55,425,865</u>

Schedule of Marketable Securities

December 31, 1972

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Alcon Laboratories, Inc.	35,000	\$ 1,186,311	\$ 1,295,000
American Home Products Corporation	13,400	1,289,570	1,634,800
American Telephone and Telegraph Company	60,000	3,252,240	3,165,000
Avon Products, Inc.	31,000	1,382,511	4,239,250
BankAmerica Corporation	12,000	578,625	576,000
Baxter Laboratories, Inc.	31,000	1,009,749	1,728,250
Black and Decker Manufacturing Company	6,720	595,694	725,760
Caterpillar Tractor Co.	88,900	1,889,550	5,911,850
Central and South West Corporation	25,000	653,569	1,275,000
Clorox Company	100,000	409,294	4,637,500
Coca-Cola Company	13,000	1,088,253	1,930,500
Corning Glass Works	3,298	537,439	899,530
Digital Equipment Corporation	15,100	993,805	1,385,425
Walt Disney Productions	12,262	766,594	2,903,029
Dun & Bradstreet, Inc.	23,000	1,334,924	1,753,750
E. I. du Pont de Nemours & Company	12,200	1,945,788	2,165,500
Eastman Kodak Company	104,154	2,522,077	15,453,850
Exxon Corporation	54,167	2,636,955	4,739,613
First Chicago Corporation	36,228	753,105	2,200,851
First National Boston Corporation	45,000	851,683	2,058,750
First National City Corporation	16,000	1,024,998	1,224,000
General Electric Company	92,000	3,498,015	6,704,500
General Motors Corporation	1,440,666	62,878,064	116,874,029
General Reinsurance Corporation	2,500	1,051,550	1,182,500
Halliburton Company	30,000	2,462,318	4,207,500
Household Finance Corporation	60,000	737,671	2,107,500
Howard Johnson Company	50,000	1,393,671	1,662,500
International Business Machines Corporation	70,624	6,092,917	28,390,848
International Flavors & Fragrances Inc.	5,000	356,997	449,770
International Nickel Company of Canada, Limited	100,000	2,081,782	3,187,500
International Paper Company	76,000	2,543,803	3,182,500
Johnson & Johnson	16,000	1,115,167	2,088,000
Kennecott Copper Corporation	65,000	2,673,547	1,543,750

Schedule of Marketable Securities

December 31, 1972

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
S. S. Kresge Company	12,000	\$ 513,384	\$ 586,500
Eli Lilly and Company	43,000	2,636,167	3,423,875
Louisiana Land and Exploration Company	31,000	1,410,872	1,340,750
Lowe's Companies, Inc.	22,000	1,234,375	1,430,000
Lubrizol Corporation	55,000	2,421,029	2,475,000
Masonite Corporation	10,000	590,022	650,000
MassMutual Mortgage and Realty Investors	42,000	1,198,453	1,176,000
Merck & Co., Inc.	53,000	518,429	4,723,625
Middle South Utilities, Inc.	68,000	1,219,354	1,819,000
Minnesota Mining and Manufacturing Company	24,000	1,331,058	2,055,000
Mobil Oil Corporation	77,000	2,211,643	5,698,000
J. P. Morgan & Co. Incorporated	53,636	1,800,027	5,631,780
Northwest Bancorporation	42,000	615,477	2,572,500
Northwestern Mutual Life Mortgage and Realty Investors	65,000	1,546,423	1,738,750
Owens-Corning Fiberglas Corporation	43,600	1,778,408	2,392,550
J. C. Penney Company, Inc.	20,000	1,371,310	1,807,500
Phelps Dodge Corporation	33,300	1,421,951	1,311,188
Pinkerton's, Inc. Class B	5,800	449,980	372,650
Polaroid Corporation	28,500	2,720,342	3,594,563
Procter & Gamble Company	53,000	889,253	5,909,500
Research-Cottrell, Inc.	16,000	1,228,969	1,092,000
Schlumberger Limited	45,600	1,544,154	4,126,800
Sears, Roebuck and Co.	78,805	1,711,618	9,141,380
Skaggs Companies, Inc.	34,000	924,665	722,500
Southeast Banking Corporation	44,000	1,139,144	1,628,000
Squibb Corporation	20,000	1,706,450	2,120,000
Superior Oil Company	1,000	332,175	346,500
Texaco Inc.	118,652	1,839,222	4,449,450
Wachovia Corporation	40,000	1,130,759	1,790,000
Xerox Corporation	15,000	269,637	2,238,750
Total common stocks		153,292,986	311,848,216
Total fixed income securities		55,553,470	55,425,865
Total marketable securities		\$208,846,456	\$367,274,081

Summary of Grand Appropriations

	AUTHORIZED BUT NOT DUE DECEMBER 31, 1971	CHANGES DURING 1972		AUTHORIZED BUT NOT DUE DECEMBER 31, 1972
		AUTHORIZED	PAYMENTS	
Sloan Fellowships for Basic Research (156 fellowships in 66 colleges and universities)	\$ 2,097,434	\$ 1,415,051	\$ 1,431,844	\$ 2,080,641
Sloan National Scholarship Program	899,022	—	599,354	299,668
College Science Program	—	1,000,000	—	1,000,000
Major Grants to colleges and universities	5,959,700	8,002,000	7,884,800	6,076,900
Other Major Grants:				
Brookings Institution	\$ 100,000	350,000	\$ 200,000	\$ 250,000
Cold Spring Harbor Laboratory	200,000	—	200,000	—
Foundation Center	—	120,000	40,000	80,000
Institute for Advanced Study	100,000	150,000	175,000	75,000
Joint Council on Economic Education	53,200	230,000	27,000	256,200
Memorial Sloan-Kettering Cancer Center	500,000	—	500,000	—
NAACP Legal Defense and Educational Fund, Inc.	250,000	—	80,000	170,000
NAACP Special Contribution Fund	100,000	—	25,000	75,000
National Academy of Sciences	—	250,000	134,000	116,000
National Bureau of Economic Research, Inc.	500,000	—	250,000	250,000
National Medical Fellowships, Inc.	—	1,000,000	800,000	200,000
Neurosciences Research Foundation, Incorporated	—	200,000	50,000	150,000
Sloan-Kettering Institute for Cancer Research	2,000,000	1,100,000	400,000	2,700,000
United Negro College Fund, Inc.	—	137,500	55,000	82,500
TOTAL OTHER MAJOR GRANTS	3,803,200	3,537,500	2,936,000	4,404,700
Staff Grant appropriation for grants in ensuing year	750,000	749,391	749,391	750,000
Other Grants and Appropriations (none over \$100,000 in 1972)	218,644	365,650	316,387	267,907
TOTAL GRANTS AND APPROPRIATIONS	<u>\$13,728,000</u>	<u>\$15,069,592</u>	<u>\$13,917,776</u>	<u>\$14,879,816</u>

Schedule of Grants and Appropriations

(continued)

	AUTHORIZED	CHANGES DURING 1972		AUTHORIZED
	BUT NOT DUE DEC. 31, 1971	AUTHORIZED	PAYMENTS	BUT NOT DUE DEC. 31, 1972
National Bureau of Economic Research, Inc.	\$ 500,000		\$ 250,000	\$ 250,000
National Center for State Courts		\$ 7,500	7,500	
National Center for Voluntary Action		19,500	19,500	
National Committee on United States-China Relations, Inc.		10,000	10,000	
National Medical Fellowships, Inc.		1,000,000	800,000	200,000
Neurosciences Research Foundation, Incorporated		200,000	50,000	150,000
New Mexico, University of	8,740	225,000	133,740	100,000
New York Public Library		60,000	30,000	30,000
New York State Welfare Conference Inc.		1,000	1,000	
New York University	30,000	564,000	218,000	376,000
Newark College of Engineering		15,300	15,300	
North Carolina, University of	7,130	445,100	324,180	128,050
Northeastern University	7,250	35,700	32,600	10,350
Northwestern University	157,000		157,000	
Notre Dame, University of	21,345		14,230	7,115
Oberlin College	22,597		15,065	7,532
Occidental College	7,252		4,835	2,417
Ohio State University	6,750		4,500	2,250
Ohio State University Research Foundation	7,245		7,245	
Oregon, University of	8,119	17,060	17,129	8,050
Oregon Development Fund, University of		11,500	11,500	
Pace College		15,000	15,000	
Palace of Arts and Science Foundation	50,000	17,500	67,500	
Pennsylvania, University of		371,000	178,000	193,000
Polytechnic Institute of Brooklyn	108,750		108,750	
Pomona College	7,117		4,745	2,372
Pratt Institute	120,000		60,000	60,000
Princeton University	59,395	615,060	63,210	611,245
Purdue University	6,750	16,675	14,275	9,150
Research Foundation of The City University of New York	8,500		8,500	
Research Foundation of State University of New York	25,875	127,555	121,115	32,315
Rice University	19,750	269,780	158,720	130,810
Rockefeller University	10,625	23,000	22,125	11,500
Rutgers University	42,550		42,550	
Saint Olaf College		5,000	5,000	
Salk Institute		80,000	80,000	
Santa Clara, University of		4,000	4,000	
Sloan-Kettering Institute for Cancer Research	2,000,000	1,100,000	400,000	2,700,000
Society for Industrial and Applied Mathematics		9,650	9,650	
South Carolina, University of		15,000	15,000	

	AUTHORIZED	CHANGES DURING 1972		AUTHORIZED
	BUT NOT DUE DEC. 31, 1971	AUTHORIZED	PAYMENTS	BUT NOT DUE DEC. 31, 1972
Southern California, University of		\$ 20,000	\$ 20,000	
Stanford University	\$ 479,480	388,365	661,455	\$ 206,390
Stony Brook Foundation, Inc.		15,000		15,000
Student Competitions on Relevant Engineering, Inc.		15,000	15,000	
Student National Medical Association, Inc.		20,000	20,000	
Syracuse University		20,000	20,000	
Temple University		18,900	11,450	7,450
Texas, University of		369,400	11,615	357,785
Tufts University	88,100		88,100	
Tulane University	13,672	33,000	42,115	4,557
Tuskegee Institute	4,327		2,885	1,442
United Negro College Fund, Inc.		137,500	55,000	82,500
Universities Research Association, Inc.		5,000	5,000	
Utah, University of	6,900		6,900	
Vanderbilt University	20,175		13,450	6,725
Virginia, University of	15,075	300,000	15,075	300,000
Wabash College	13,672		9,115	4,557
Washington, University of	24,495	55,710	48,895	31,310
Washington University	400,000	400,000*		
Wayne State University		16,100	8,050	8,050
Wesleyan University	48,000	16,100	56,050	8,050
Western Ontario, University of		14,880	8,440	6,440
Whitman College	6,000		4,000	2,000
Williams College	23,017	20,000	35,345	7,672
Wisconsin, University of	28,140	38,725	45,065	21,800
Woodrow Wilson National Fellowship Foundation		20,000	20,000	
Worcester Polytechnic Institute	8,750		8,750	
Yale University	574,895	216,100	574,855	216,140
Yeshiva University	208,750		208,750	
Sloan Fellowships for Basic Research to be granted in ensuing year	1,400,000			1,400,000
Staff Grant appropriation for grants in ensuing year	750,000			750,000
College Science Program		1,000,000		1,000,000
Instructional television		100,000		100,000
Part-time MBA program		70,000		70,000
Other appropriations for grants and related expenses	58,644	25,913	56,650	27,907
	13,728,000	15,174,423	14,022,607	14,879,816
Reduction for Grant Transfers		104,831	104,831	
TOTAL GRANTS AND APPROPRIATIONS	\$13,728,000	\$15,069,592	\$13,917,776	\$14,879,816

* Transfer of grant to Consortium for Graduate Study in Management from Washington University.

INDEX

Index

- Albion College, 70
American Association for the
 Advancement of Science, 40, 70
American Association of
 Community and Junior Colleges, 14, 70
American Council on Education, 70
American Economic Association, 43, 44, 70
Amherst College, 26, 70
Antioch College, 70
Arizona, University of, 37, 70
Atlanta University, 70
- Barnard College, 49, 70
Beloit College, 14, 70
Boston University, 37, 70
Bowdoin College, 70
Brandeis University, 37, 70
Bridgeport, University of, 70
British Columbia, University of, 27, 37, 70
Brookings Institution, 44, 68, 70
Brown University, 37, 70
- California, University of, 18, 19, 21, 23, 32,
 37, 47, 70
California Institute of Technology, 23, 37, 70
Carleton College, 70
Carnegie-Mellon University, 21, 70
Case Western Reserve University, 14, 70
Chicago, University of, 21, 37, 40, 47, 70
Colby College, 70
Cold Spring Harbor Laboratory, 68, 70
Colgate University, 70
College Science Program, 47, 68, 73
College and University Systems
 Exchange Corporation, 49, 70
Colorado, University of, 37, 70
Colorado State University, 37, 70
Columbia University, 21, 25, 32, 33, 37, 70
Connecticut College, 21, 70
Consortium for Graduate Study
 in Management, 21, 70, 73
Cornell University, 21, 47, 70
Council on Foundations, Inc., 50-51, 70
Council for the Advancement
 of Small Colleges, 49, 70
Council for Opportunity in
 Graduate Management Education, 21
Creighton University, 44, 70
- Dartmouth College, 21, 70
Davidson College, 70
- Drexel University, 70
Duke University, 32, 37, 47, 70
- Fisk University, 16
Florida, University of, 70
Florida State University, 70
Foundation Center, 50-51, 68, 71
- Genetics Society of America, Inc., 40, 71
George Washington University, 49, 71
Georgetown University, 17-18, 71
Georgia Institute of Technology, 71
Grinnell College, 71
- Hamilton College, 71
Harper Hospital, 71
Harvard University, 9, 21, 25, 37, 46, 47, 49, 71
Harvey Mudd College, 11-12, 71
Haverford College, 9, 71
Henry Street Settlement, 49, 71
Houston, University of, 37, 71
Howard University, 32, 71
- Illinois, University of, 13, 34, 37, 71
Indiana University, 21, 71
Institute for Advanced Study, 40, 68, 71
Institute of International Education, 40, 71
Interdisciplinary Student Task Forces, 46-47
Iowa, University of, 27, 37, 71
Iowa Wesleyan College, 49, 71
- Johns Hopkins University, 37, 71
Joint Council on Economic
 Education, 42-43, 68, 71
- Kansas, University of, 71
Kettering Foundation, Charles F., 51, 71
Knox College, 14, 71
- Lehigh University, 71
Lincoln University, 71
London Graduate School of
 Business Studies, 71
- Manfred Sakel Institute, Inc., 27, 71
Marlboro College, 40, 71
Marquette University, 71
Maryland, University of, 38, 71
Massachusetts, University of, 38, 71
- Massachusetts Institute of
 Technology, 9, 21, 23, 26, 37, 38, 40, 51, 71
McGill University, 38, 71
Meharry Medical College, 17
Memorial Sloan-Kettering Cancer Center, 53, 68, 71
Michigan, University of, 18-19, 34, 38, 44, 71
Michigan State University, 38, 71
Minnesota, University of, 39, 71
M.L.T. Development Foundation, Inc., 14, 71
Montana State University, 71
Morehouse College, 71
- NAACP Legal Defense and Educational
 Fund, Inc., 68, 71
NAACP Special Contribution Fund, 68, 71
National Affairs, Inc., 15, 71
National Academy of Sciences, 38-39, 41, 68, 71
National Bureau of Economic Research, Inc., 68, 72
National Center for State Courts, 51, 72
National Center for Voluntary Action, 51, 72
National Committee on United
 States-China Relations, Inc., 51, 72
National Medical Fellowships, Inc., 15-16, 68, 72
Neurosciences Research Foundation, Incorporated
 (Neurosciences Research Program), 26-27, 68, 72
New Mexico, University of, 20, 72
New York, City University of, 37
New York Public Library, 50, 72
New York, State University of,
 at Stony Brook, 14, 38, 47
New York State Welfare Conference, Inc., 51, 72
New York University, 18, 24-25, 39-40, 72
Newark College of Engineering, 49, 72
North Carolina, University of, 12, 21, 23-24, 38, 72
Northeastern University, 20, 38, 72
Northwestern University, 72
Notre Dame, University of, 72
- Oberlin College, 72
Occidental College, 72
Ohio State University, 72
Ohio State University Research Foundation, 72
Oregon, University of, 38, 49, 72
Oregon Development Fund, University of, 72
- Pace College, 20, 72
Palace of Arts and Science Foundation
 (San Francisco Exploratorium), 9, 49, 72
Pennsylvania, University of, 21, 45-46, 47, 72
Polytechnic Institute of Brooklyn, 72
Pomona College, 72
Pratt Institute, 72
Princeton University, 9, 35-36, 38, 72
Purdue University, 38, 72
- Research Foundation of The City
 University of New York, 72
- Research Foundation of State
 University of New York, 14, 27, 72
Rice University, 33, 34, 38, 72
Rochester, University of, 21
Rockefeller University, 37, 38, 72
Rutgers University, 23, 72
- Saint Olaf College, 14, 72
Salk Institute, 25-26, 72
Santa Clara, University of, 49, 72
Sloan Fellowships for Basic
 Research, 23, 36-38, 53, 68, 73
Sloan-Kettering Institute for
 Cancer Research, 39, 57, 68, 72
Sloan National Scholarship Program, 68
Society for Industrial and
 Applied Mathematics, 41, 72
South Carolina, University of, 14, 72
Southern California, University of, 21, 73
Southern Medical School Consortium, 12
Stanford University, 21, 35, 37, 38, 73
Stony Brook Foundation, Inc. (State University
 of New York at Stony Brook), 47, 73
Student Competitions on Relevant
 Engineering, Inc., 41, 73
Student National Medical Association, Inc., 22, 73
Syracuse University, 14, 73
- Temple University, 38, 73
Texas University of, 10, 38, 47, 73
Tufts University, 73
Tulane University, 22, 73
Tuskegee Institute, 73
- United Negro College Fund, Inc., 16-17, 68, 73
Universities Research Association, Inc., 41, 73
Utah, University of, 73
- Vanderbilt University, 73
Virginia, University of, 24, 73
- Wabash College, 73
Washington, University of, 38, 73
Washington University, 21, 73
Wayne State University, 38, 73
Wesleyan University, 38, 73
Western Ontario, University of, 38, 73
Whitman College, 73
Williams College, 22, 73
Wisconsin, University of, 21, 37, 38, 73
Woodrow Wilson National Fellowship
 Foundation, 22, 73
Worcester Polytechnic Institute, 73
- Yale University, 38, 48-49, 73
Yeshiva University, 23, 73

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Alfred P. Sloan Foundation

Founded in 1934 by Alfred P. Sloan, Jr. (1875-1966)

REPORT for 1973



Contents

Trustees, Officers, and Staff	vi
President's Statement	1
Particular Programs	9
Technology in Education	11
Neuroscience	19
Expanding Professional Opportunities	24
Minority Engineering Education	31
General Program	35
Science and Technology	37
Economics and Management	50
Related Problems of Society	54
Policies and Procedures	57
Financial Review	59
Index	78

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President's Statement

President's Statement



IN 1969, the Alfred P. Sloan Foundation introduced into its operations the concept of the particular program, which along with the general program of the Foundation was intended to determine the manner in which resources were deployed. In the new mode, the general program remained largely unchanged; it continues to provide broad support for science and engineering, economics and management, and related higher education; it represents the major part of the Foundation's activities. But it was proposed that a significant portion of the Foundation's income be dedicated to a new kind of program, in which a carefully defined, sharply focused problem would be addressed with substantial resources over a period of time that would be relatively short, and yet adequate for some real progress to be achieved. The intention was to select three such problems and to deal with each over a period of five to seven years with approximately \$2 million annually devoted to each; as each particular program approached termination a new one would be found to take its place. Over time, it was expected that some 60 per cent of the Foundation's income would be devoted to its general program, and 40 per cent to its *particular programs*.

The first two *particular programs* were selected and in operation during that year. One of them was intended to enhance minority opportunities in the professions of medicine and management, the other to stimulate growth of the emerging discipline of Neuroscience. In 1970 a third program, to

encourage the uses of technology in higher education, was initiated. Since 1969, almost exactly 40 per cent of the dollar value of Foundation grants has gone as planned to those three programs.

Five years later, it appears appropriate to examine the manner in which the concept of the *particular program* has contributed to the operations of the Foundation. There will be during 1974 four such programs in operation as one program phases out and a new one phases in; in 1975 there will again be three. The program in minority medicine and management will make its last grants in the coming year; any residual activities thereafter will be encompassed in the general program. The program in Neuroscience will continue at much the level of previous years, to be completed in 1976. The program in technology in education, slow to get under way, should begin to operate at peak level. A new program, modeled after the program in minority medicine and management, will begin its first full year of activities intended to enhance minority opportunities in the profession of engineering.

Medicine and Management

If raw numbers are to be given any significance, the program in minority medicine and management has been an unqualified success. During the academic year 1968-1969, there were approximately 850 minority students engaged in the pursuit of the degree of M.D., almost all at two predominantly Black institutions, Howard University and Meharry Medical College. By 1972-1973 the number had risen to 3,100, and all the growth had taken place at predominantly white institutions. First-year enrollments, which were of the order of a minority of 3 per cent in 1968-1969, have now risen beyond 9 per cent and continue to grow toward the target of 12 per cent by the conclusion of the Foundation program or shortly thereafter.

For education toward the degree of MBA, representing a profession less highly organized than medicine, national figures are harder to come by. The estimate has been made that more minority students are now enrolled for that degree than were graduated during the entire period before the program began. The Foundation's activities have been largely channeled through two consortia of the country's leading graduate schools of management. The members of the first of those consortia, national in scope, enrolled 140 minority students in 1968-1969; by 1973-1974 the number had risen to 575. The second consortium, in the Midwest, shows a minority enrollment of 25 in 1968-1969 and 140 in 1972-1973. In addition, there are now two predominantly Black universities about to be accredited to give the MBA degree where there was formerly none.

4 How much this growth can be attributed to the part played by the Alfred P. Sloan Foundation is problematical. When the Foundation

entered the field, there were already powerful forces in being that were inevitably destined to have an effect upon minority education. But in five years of activity the Foundation can point to support of a wide range of activities in medical education, most of it intended to support the transition between college and medical school but including as well support at the levels of both the secondary school and the medical school; the Foundation has in that period helped increase by ten-fold the activities of the principal grant-making institution in the field of minority medical education and has put substantial Foundation funds into medical fellowship grants between 1968 and 1973. In management, the Foundation stimulated the creation of a major consortium and made available substantial support for a second consortium; it has supported remedial education and curriculum revision; as in medicine it has contributed major sums to fellowships for minority management students; and it has played a large part in assuring the accreditation of the two predominantly Black schools of graduate management education. It is difficult to resist the conclusion that the program has made a difference.

Neuroscience

The problem in Neuroscience was not merely one of numbers. Until quite recently, the investigation of the central nervous system was the domain not of a single scientific discipline but of a wide range of disciplines. By 1969 it was becoming clear that the study of the central nervous system, in all its aspects, was likely to prove one of the most fruitful scientific areas of the last third of the century. To fulfill its promise, the field would have to assume a disciplinary character of its own, generating its own domain of concept, methodology and theoretical structure. By adopting this field as one of its *particular programs*, the Foundation hoped to accelerate the development of that disciplinary identity.

In the intervening years the Foundation has assisted in the creation of six strong centers of Neuroscientific research, has funded more than thirty projects in Neuroscience, has assisted directly and indirectly in the training of a new generation of scientists who think of themselves as Neuroscientists, and has begun to contribute toward support of the development of a theory of Neuroscience. A great deal of substantial work has been done and many institutional arrangements have been made from which further substantial work may be expected.

Whether indeed a new discipline is in the process of formation, and whether the efforts of the Foundation will prove to be of major significance in that process, can not yet be known nor will it be fully known when the Foundation's program is completed in 1976. The most that can be said is that those directly engaged in the enterprise of Neuroscience testify that the

thrust provided by the Foundation has been important, and that if the great breakthroughs come in the next decade or two—as indeed many Neuroscientists now expect them to come—the Foundation will have played some central part in bringing about the circumstances that led to their achievement.

Technology in Education

The particular program on the uses of technology in education was based on a premise rather than an existing state of affairs. It was apparent that education in general is a process of communication, and it was evident that revolutionary activities were taking place in communication, led by rapid development of computer technology and telecommunications technology. Yet the first of these had made only limited impact upon education, and little of that in higher education; telecommunications and all its various technologies had made virtually no impact beyond the pre-school and early school years. The consequent premise was that there were opportunities in that general area, and the Foundation set out to exploit them.

But those opportunities had first to be identified, and it has not proved easy to do so. The conditions that existed in the two earlier *particular programs* were in this instance absent: there were no major institutions awaiting the stimulus of Foundation support, and no clearly delineated lines of action that the Foundation could pursue. The impact of the two earlier programs has not yet been reproduced in the third.

Over the three years of its existence, 38 projects employing technology in education have been supported; it is still too early to calculate one by one their measures of success. But they are in any case disjoint undertakings, engaging first-rate persons in first-rate institutions, it is true, but not providing for each other the kind of mutual reinforcement that will be necessary before any real advance becomes possible. They constitute interesting singularities, but by no means the beginnings of a systematic attack upon the major problems that are inherent in any educational innovation.

During the last months of 1973, at a variety of institutions, interest began to awaken in the possibility of large-scale, institution-wide activity in which would be joined technologists, scholars and students. The first large grant in the program was made to Dartmouth College and it is most likely that subsequent grants on that scale will be made in 1974 and 1975, to accompany the smaller project grants that still represent most of the activity in the field.

6 The ultimate outcome of the program is by no means yet assured. But it is our hope that the patient investment of effort and resources during the first three or four years of the program will begin to show substantial returns during the years that remain until its conclusion.

Minority Engineering

In September, 1973, the Board of Trustees approved a fourth *particular program*, intended to stimulate minority opportunities in the profession of engineering. Like the program in medicine upon which it is modeled, the program is designed for a lifetime of five to seven years, during which it is hoped that minority enrollment in schools of engineering will increase fivefold.

Firm figures concerning minority representation in engineering are in most instances two to three years old and subject to considerable uncertainty. The best estimates are that as of 1971 there were 1.1 million trained engineers, of whom approximately 8,000, or well under 1 per cent, were Black; other disadvantaged minorities are virtually unrepresented. Considering the Black population alone, a proportionate representation would be in the neighborhood of 120,000.

It will not be a simple matter to duplicate in engineering the success of the program in medicine. The sheer numbers of students who must be involved is larger by an order of magnitude: in medicine the Foundation dealt in hundreds, in engineering it must deal in thousands. The attractiveness of a career in medicine is enormous, for disadvantaged students as for all students, and medical education has taken and will continue to attract many disadvantaged students who have an affinity for scientific and mathematical endeavor. The role-models which have stimulated disadvantaged students to seek a career in medicine are not so readily found in engineering. The engineering program must in some degree create the disposition to seek an engineering education and in most instances create that disposition while the potential engineer is still engaged in pre-college education, uncertain about a career and perhaps unaware that the first steps toward an engineering career must be taken in secondary school or even earlier. It is already clear that in terms of the total task the dollar contributions of the Alfred P. Sloan Foundation can at best be modest but the Foundation can hope to help organize and lead. There is moreover good reason to believe that the major contribution that must be made by industry, if the program is to have any likelihood of success, will be forthcoming.

In General

After five years' experience with *particular programs*, it appears to us that they constitute an effective and a prudent manner of making explicit what has often been largely implicit. At the outset of any such program, the Foundation is obliged to make clear exactly what it is that it hopes to achieve, how long it proposes to go about the task, and how much of its resources it will make available. Since the Foundation itself is not likely to

be an operating mechanism, its announcement of a *particular program* constitutes a call for assistance from all those who share the goals that the Foundation has asserted, and who believe themselves capable of contributing to the achievement of those goals.

The cycle of *particular programs* imposes a salutary discipline upon the Foundation. We have become aware that we must know precisely what we are about before we move into a new program. That awareness served us well when we set about considering candidates for the fourth program. Knowing as we do that a fifth program must be launched some time in 1975 or 1976, we now know also that we must begin at once to make plans for it. On the basis of the experience that is reported here we are persuaded that the mode of operation adopted in 1969 by this Foundation has contributed substantially to the Foundation's exercise of its responsibilities.

The Foundation's Board of Trustees lost two members and gained two in 1973. Carl E. Allen retired in April as Chairman of the Investment Committee and a Trustee. W. Sam Carpenter, 3rd, died on November 30. The Trustees in a special resolution paid tribute to Mr. Carpenter's valuable service during his more than seven years as a member of the Board.

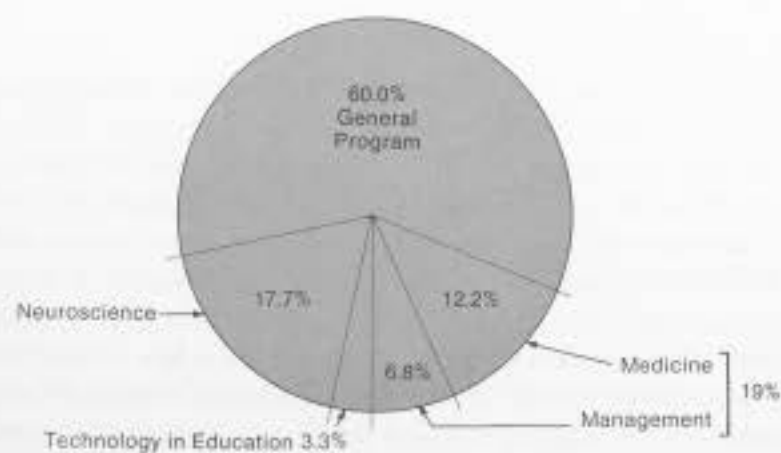
Arthur K. Watson, who had been a Trustee from 1963 to 1970, rejoined the Board in April after a period during which he was Ambassador to France. He is a director and a member of the executive committee of International Business Machines Corporation. William G. Bowen, president of Princeton University, was elected to the Sloan Board of Trustees in September.

Dr. Percy A. Pierre, Dean of Engineering at Howard University, joined the Foundation staff as a consultant in July and was appointed a Program Officer in September; he continues to serve as dean at Howard while directing the Particular Program on Minority Engineering Education for the Foundation. Dr. Larkin H. Farinholt, formerly a Vice President and Trustee of the Foundation, retired as a consultant as of October 1.

his Y. Wassell

Particular Programs

DISTRIBUTION OF GRANTS BY PROGRAM, 1970-1972



Particular Programs accounted for 40 per cent of 1970-1972 grants.

THE FOUNDATION divides its resources between its General Program and three or more discrete and sharply focused Particular Programs. A Particular Program concentrates finite resources, from \$10 million to \$15 million over a period of roughly five years, on a closely defined problem area where an effort on this scale appears to have substantial opportunity to make a constructive difference. During 1974 there will be four Particular Programs in existence. Those in Expanding Professional Opportunities and Neuroscience will be approaching the end of their span, while the program on Technology in Education continues and the program on Minority Engineering Education moves into full operation.

Technology in Education



THE Foundation's Particular Program on Technology in Education, in its second full year of operation in 1973, committed more than \$2 million for experiments to improve instruction and productivity in higher education through the use of technology. This was nearly twice the amount committed for this purpose in 1972.

In a year of escalating costs for nearly all institutions and of academic retrenchment for some, the search for ways of making higher education more efficient without sacrifice of quality became increasingly urgent. This Particular Program assumes that continued development and refinement of various educational technologies may contribute to the solution of some of the problems of higher education.

The program has proceeded largely through support of promising individual disciplinary projects conducted by dedicated teachers and scholars, sometimes in small groups, simply because most of the activity is to be found in such settings. It has long been evident, however, that there is need for one or more large-scale, well-financed, broadly based centers for research and development in educational technology. Dartmouth College proposed to create such a center.

Dartmouth is perhaps uniquely situated to undertake such a development. It has had ten years' experience with educational technologies including its large and sophisticated computer system. Some forty faculty members, broadly distributed across disciplines, are ready to participate. The top administration is fully committed. The College therefore intends to spend nine years on intensive institutional development of instructional

*A Possible
Way to Help
Education*

*Developing
New Modes
at Dartmouth*

technologies. The Foundation granted \$600,000 for partial support of the first three years.

Dartmouth's Office of Instructional Services, advised by a faculty council, provides over-all guidance, encouragement, assistance, and evaluation to faculty members and departments who wish to develop new modes of instruction. A two-way cable communications system will provide access at seven instructional resource centers to a central store of slide, audio, and video materials, and will make possible central recording of lectures and demonstrations from remote stations. Existing computer facilities will be augmented for use with the cable system.

Dartmouth has selected for initial development technology-based instructional projects in four departments: mathematics, music, languages, and art. Interactive computer programs, video tapes, multi-media materials, and a digital music synthesizer will be used where appropriate in these efforts to enhance individualized learning. Projects in other subjects will be added as the institution-wide effort progresses. The successful ones, of course, will become part of Dartmouth's regular instruction.

Basic engineering, economics, history, genetics, freshman biology—a broad range of subject matter is being explored by educational technologists at other institutions with Sloan support.

An experiment with basic engineering courses will take place on Long Island, where there are close links between the College of Engineering of the State University of New York at Stony Brook and three two-year colleges (State University Agricultural and Technical College at Farmingdale, Nassau Community College, and Suffolk County Community College). Stony Brook accepts graduates of the two-year colleges as juniors, and the four institutions have largely coordinated their first two years of engineering instruction.

Eastern Long Island is an area of rapid population growth underserved by institutions of higher education, so the existing institutions have projected rapid increases in enrollment. It is therefore an attractive idea to them to place more emphasis on educational technology to accommodate the growing numbers. To this end, the four engineering faculties will design new introductory courses employing the full range of educational technologies in the subjects of computers, engineering and society, mechanics, and electronics. The progress of students taking these courses will be compared with those in control groups receiving conventional instruction, and the new courses will be thoroughly evaluated.

12 Involving as it does institutions, faculties, and students to some degree dissimilar, the Stony Brook project may shed light on the effectiveness of



University of Notre Dame faculty members check work of students in a computer-assisted sophomore course in Principles of Economics. Computer also is being used in a freshman history course.

such inter-institutional curriculum development. It also may produce some courses which other institutions will want to adopt. The Foundation made a three-year grant of \$490,000 to the State University of New York at Stony Brook for partial support of the project. A grant of \$16,000 to the same recipient in 1972 supported project planning.

Large-enrollment introductory courses appear to offer opportunities for economies of scale through the use of various educational technologies. At the University of Notre Dame, computer software programs are being developed with Sloan assistance for a freshman history course in Western Civilization and a sophomore course in Principles of Economics. Students in the history course use the computer in a tutorial mode to review material previously covered in lectures and discussions. In the interpretation mode the computer tests the student's ability to analyze a given historical situation and form a hypothesis, as a working historian does. In economics the computer can demonstrate various economic models and principles, simulate "real world" situations and show the effects of policy decisions, and conduct reviews.

A two-year Sloan grant of \$220,000 is helping Notre Dame to accelerate its development of this program. The resulting software packages will, as usual, be evaluated by means of control groups as to their costs and effectiveness.

*The Computer
as a Tutor
in Big Courses*



The University of California, Davis, is developing a course in which students learn introductory genetics through a combination of television and auto-tutorial techniques. Here some of them confer with an instructor about their progress.

Television Helps Teach Genetics

The University of California, Davis, is developing an unusual combination of television with auto-tutorial techniques for teaching an introductory genetics course. The course is divided into 26 modules which may be viewed, as often as necessary, at the student's convenience. The videotape modules incorporate live material and laboratory demonstrations, as well as animation to convey concepts, and are accompanied by a printed syllabus and textbook reading assignments. Classes meet once a week for a quiz or a guest lecture.

Experience at Davis with a previous course taught in this way has demonstrated that it provides flexible pacing for students from varying backgrounds, and permits teachers to spend more time helping individual students. A study of the effectiveness of the new course will be conducted in collaboration with the Stanford Research Institute. A Sloan grant of \$165,000 over two years to the Davis institution will support course development and the study of teaching effectiveness.

14 Computer-managed audio-tutorial instruction is being developed for an introductory biology course at the University of Maine, Orono. The audio-



The University of Maine at Orono will use a computer to monitor students' progress in a botany-zoology course in which they use slides, tapes, and laboratory equipment. Dr. Julian Haynes, zoology chairman, helps a student at a study carrel.

tutorial technique, using color slides along with laboratory experiments and printed study materials, has been used successfully in a freshman botany course, and computer management was developed for an introductory zoology course. The project at Orono first will design a new biology course which includes material that is common to both botany and zoology. Part-way through the course, students may "branch" into either botany or zoology, or remain in general biology. The computer will be used to monitor students' progress through this highly individualized system of instruction. It will generate and administer examinations (potentially a different examination for each student), direct students to needed study materials, keep records of grades, and assign final grades in the course.

The University of Maine at Orono expects to offer the new course on a pilot basis to 250 students in the spring of 1975; it believes the system eventually will be able to handle 1,300 students at once. A two-year Sloan grant of \$90,000 is supporting course development.

A project that may have an impact on the high cost of medical education received renewed support in 1973. The Self-Instructional Materials Project of the Southern Medical School Consortium, which received Sloan support of \$79,000 in 1972, is designed to enable students to learn on their own, at their own pace, certain basic medical subjects. Faculty members at participating schools are producing low-cost, low-technology "packages" that use programmed texts in combination with color slides and audio tapes. The project assumes that, when use of such packages becomes widespread,

Cutting Costs in Medical Education

15

faculty time will be saved, the student's work schedule will be made more flexible, and the student's mastery of material will be greater than in conventional lectures.

Thus far some 50 of these packages have been produced and are being tested in Consortium schools. A growing number of faculty members are gaining experience in preparing packages, and medical schools in other sections of the country are expressing interest in using them. Student response has been enthusiastic. In the light of these favorable developments, the Foundation granted an additional \$253,000 over two years to the University of North Carolina School of Medicine, which administers the project for the Consortium.

At Beloit College, Dr. Francis Wheeler, who holds degrees in both classics and electrical engineering, is developing an instructional use of the computer which departs significantly from conventional computer-assisted instruction. Instead of being led along a predetermined course by the computer, the humanities student in Beloit's LEARN system creates his own file of information which he can review, modify, augment, and compare with the files of other students and the instructor. The system is designed to stimulate active involvement by the student in his own learning, and to promote an independent intellectual approach to the subject being studied. It is based on a small, inexpensive, stand-alone computer, the PDP-8, which is a computer widely used in higher education.

The Sloan Foundation, by a grant of \$19,800 in 1972, supported development of the first phase of the LEARN system. For completion of the last two phases and dissemination of the completed system the Foundation made a two-year terminal grant of \$74,800 in 1973.

Fisk University, partly because of the diversity of preparation in its student population, is looking into the feasibility of computer-assisted instruction (CAI) for its students with the aid of a \$32,000 Sloan grant. Fisk envisions that the computer could be particularly effective as a teacher in subjects involving repetitive drill such as mathematics and languages, including English. The grant provides time for certain faculty members to become familiar with computer programming, to study CAI programs at other institutions, and to determine the kind of facilities which would be most advantageous to Fisk and its students.

The Foundation's interest in instructional television, announced in the Report for 1972, resulted in three smaller grants during 1973. The University of California at Berkeley received \$25,000 for experimental work on an introductory biology course for non-science majors, using color television and other technologies. The same institution received \$18,300 for another project in teaching science through television, administered by the Lawrence Hall of Science. Education Development Center was awarded \$20,000 in

Growing Use
of Medical
"Packages"

Exploring
CAI
at Fisk

partial support of a summer study for a proposed new course in elementary mathematics using television and manipulable materials, and drawing upon examples in science, technology, and the arts.

These other grants were made during 1973 for developments in educational technology:

CALIFORNIA STATE UNIVERSITY AND COLLEGES, Los Angeles, Calif.: For partial support of the first phase of a plan to establish a center for research and development in educational technology \$16,000

UNIVERSITY OF CALIFORNIA, Santa Cruz: For partial support of an experiment in computer-assisted instruction in chemistry \$ 9,000

UNIVERSITY OF CHICAGO, Chicago, Ill.: For the revision, publication, and distribution of a report on library technology by Dr. Herman H. Fussler of the University's Graduate Library School \$ 5,000

CORNELL UNIVERSITY, Ithaca, N.Y.:
For the continued development and controlled evaluation of an audio-tutorial course in engineering physics \$16,000

For partial support of development of an interactive, time-shared, computer-assisted instruction system in gaming and simulation for urban studies \$14,600

DREXEL UNIVERSITY, Philadelphia, Pa.: For partial support of development of a program for interinstitutional cooperation between Drexel University and other colleges, with emphasis on educational technology \$18,000

EDUCATIONAL PRODUCTS INFORMATION EXCHANGE INSTITUTE, New York, N.Y.: For start-up costs of the EPIE Laboratory for Educational Technology, in particular, the initial costs of a system for collecting field data in educational technology \$20,000

HARVARD UNIVERSITY, Cambridge, Mass.:
To support development by the Laboratory for Computer Graphics and Spatial Analysis, Graduate School of Design, of a system of videotapes and computer terminals for instruction in computer-based mapping and graphics \$15,400

For development of a computer-based modular French course \$18,060

UNIVERSITY OF ILLINOIS, Urbana, Ill.: To support development of a computer-assisted instruction program in introductory computer science for use on the University's PLATO IV system \$14,900

OKLAHOMA CHRISTIAN COLLEGE, Oklahoma City, Okla.: To support a demonstration project in the use of multi-media modules as a means of instruction for faculty members in educational technology \$16,900

OKLAHOMA CITY UNIVERSITY, Oklahoma City, Okla.: For partial planning support for a program to individualize the University's degree structure and provide a variety of learning modes	\$20,000
THE SPENCE SCHOOL, New York, N.Y.: To support a planning study for a comprehensive program of computer-assisted instruction	\$14,000
UNIVERSITY OF VERMONT, Burlington, Vt.: For development of a system of microfiche displays linked to the computer-based, problem-oriented medical records system in the University's Medical School	\$20,000
UNIVERSITY OF WISCONSIN, Milwaukee, Wis.: For planning and development of a systems laboratory for the application of technology to the problems of remediation, especially in reading and writing	\$17,000

Neuroscience



THE science of the brain and its intricate involvement with overt behavior continues to enlist some of the most creative investigators. The Foundation's Particular Program in Neuroscience, initiated in 1969, granted some \$1.9 million for research and related training in 1973.

The Particular Program in Neuroscience is concerned with basic research—with expanding the base of knowledge upon which future advances in understanding the physiological basis of behavior may be made. Clinical applications of such knowledge, while undeniably important, are not within the scope of the program.

The program also concerns itself with facilitating communication within this broadly interdisciplinary field, and with catalyzing the formation of centers of unusual strength in the emerging discipline of neuroscience. The training of young and future neuroscientists also is essential to progress in the discipline: undergraduate programs in neuroscience at Amherst College and the Massachusetts Institute of Technology received continuing support in 1973 through grants approved in earlier years. Young neuroscientists are eligible for support through the Sloan Fellowships for Basic Research (Pages 43 to 45) and eight of them were awarded two-year Sloan fellowships in 1973.

A project at Rockefeller University illustrates one approach to understanding how the brain functions. Four young investigators—two physiological psychologists, a pharmacologist, and a molecular biologist—are studying the interrelation of certain hormones, brain function, and behavior in laboratory rats. The animals, subjected to stress, appear to secrete a hormone which affects brain metabolism and in turn their behavior. The precise chemical mechanisms by which these phenomena occur are the

*Training,
Building,
Communicating*

subject of this research, which is receiving Sloan support of \$145,000 over two years.

The known ability of viruses to alter the functioning of cells may provide a powerful new research tool in neuroscience. With the aid of a two-year, \$100,000 Sloan grant, scientists at the University of Minnesota, Duluth, are using viruses to infect specific brain cells in laboratory animals and, by means of electrical recordings, to chart the resulting changes in cell function. By this means it may ultimately prove possible to sort out the contributions which specific kinds of cells make to the over-all functioning of the central nervous system.

Technicians at the University of Minnesota, Duluth, School of Medicine prepare solutions for work with viruses and brain cells in an effort to develop a new neuroscience research tool.



While such promising laboratory experiments go forward, another group of scientists is attempting to develop the unifying concepts and coherent theory which will "make sense" of scattered experimental findings. One of their tools is computer modeling of the central nervous system, based on what is now known about it. As a means of bringing together experimentalists and theorists in neuroscience, the University of Massachusetts at Amherst is establishing a Center for Systems Neuroscience with the help of a \$300,000, three-year grant from the Sloan Foundation. The Center, staffed by scholars in the computer and information sciences, will invite as Fellows scientists who have been active mainly in experimental work. The experimentalists will be introduced to techniques of computer simulation and mathematical modeling of the nervous system which, it is hoped, will enrich their subsequent research. At the same time, the experimental concerns which the Fellows will bring with them are expected to open up new avenues of research for the theoretical neuroscientists at the University of Massachusetts. The Sloan contribution will support fellowships, a coordinator for the new Center, and certain expenses for equipment and services.

Neuroscience remains in the early stages of its development as a coherent discipline, and during this phase effective communication among scientists pursuing different paths toward essentially the same goal is crucial. Neuroscientists at the University of Pennsylvania and Duke University have developed close working relationships with their counterparts at four institutions in Europe (University of Birmingham, England; University College, London; The Nencki Institute, Warsaw, Poland, and the University of Pisa, Italy). Through visits and collaborative research projects they have explored such subjects as how organisms find meaning in sound; differences between nerve cells involved in reflexes and those involved in learning; how physical movement is controlled, and how various areas of the brain are involved in eye movements and vision.

Duke and the University of Pennsylvania believe it is essential to continue this kind of transatlantic cooperation, through visits of shorter or longer duration by junior and senior scientists at the six institutions. In partial support of this activity for two years, the Foundation granted \$100,000 to the University of Pennsylvania.

Much information about brain function has come from the tiny electrical signals transmitted through micro-electrodes implanted near active individual brain cells. Systems currently in use can record from one cell at a time; it seems desirable to be able to monitor a number of cells at once, and to attempt to analyze the interrelationship of their activity. A group at the University of Pittsburgh, headed by a neurophysiologist and an electronics engineer, proposes to employ space-age technology to develop

*The Search
for Unifying
Theory*

*Transatlantic
Collaboration
in Research*



Tracing signals from multiple brain cells is the goal of University of Pittsburgh neuroscientists. Dr. Gerhard Werner adjusts an oscilloscope used in the research.

a system capable of recording from as many as several hundred cells simultaneously. Initially, a pilot sixteen-cell system will be attempted with Sloan support of \$75,000.

The first formal department of neurosciences was established at the University of California, San Diego, which received substantial Sloan support in 1971. Since that time the program at San Diego has developed into a major center of training and research, broadly distributed across departments of biology, psychology, chemistry, and others in addition to the neuroscience department. Core facilities including a computer and electron microscope have been established, faculty members added, and new laboratories opened. The 1971 Sloan grant has helped to support 48 predoctoral and postdoctoral fellows from eight departments. The focus of research interests is on the general questions of how connections among brain cells are formed and how these connections are modified by the experience of the organism.

UCSD particularly wishes to insure the continued training of young investigators possessed of even broader interdisciplinary perspectives than their mentors. For this and related purposes the Sloan Foundation agreed to provide renewed and terminal support of \$630,000 over three years.

*A Center
of Strength
at UCSD*

At the Albert Einstein College of Medicine of Yeshiva University another major center of neuroscience research and training has developed around a multidisciplinary group of investigators. Members of the group hold faculty appointments in seven different departments—anatomy, biochemistry, physiology, neurology, neurosurgery, molecular biology, and neuropathology. Thus a great diversity of approaches is employed in investigating the central question of how the nervous system develops. In its training aspect, the Einstein program accommodates about 40 post-doctoral students each year.

The Albert Einstein neuroscience group first received Sloan support in 1971. In 1973 a second and final two-year grant of \$440,000 was awarded.

Renewed support also was granted, in the amount of \$35,000, to a team of scientists at Northwestern University who are investigating the structural and chemical basis of memory. Thus far they have been able to link specific brain regions with certain memory processes, and have identified a class of complex molecules which appear to play a role in memory formation.

These other activities in neuroscience received support in 1973:

THE HEBREW UNIVERSITY OF JERUSALEM, Israel: For a research project on Somatosensory Mechanisms in Normal and Abnormal Nervous Systems . . . \$19,675

INTERNATIONAL BRAIN RESEARCH ORGANIZATION, Montreal, Que.: For partial support of development of a program of international cooperation in neuroscience, to be administered by an independent secretariat . . . \$10,000

MASSACHUSETTS GENERAL HOSPITAL, Boston, Mass.: For renewed support of research at McLean Hospital on visual mechanisms in anuran amphibians . . . \$20,000

UNIVERSITY OF MINNESOTA, Minneapolis, Minn.: For partial support of a summer institute on the evolution and development of behavior at the University's Institute of Child Development . . . \$20,000

UNIVERSITY OF VERMONT, Burlington, Vt.: For a feasibility study of a thermoacoustic sensing technique for use in neuroscience research . . . \$19,839

*A Diversity
of Approaches
at Einstein*

Expanding Professional Opportunities



THE Particular Program in Medicine and Management completed its fourth year in 1973. Over the four years it has committed about \$10.6 million to facilitating the flow of minorities into the professions of medicine and management. Some \$2.3 million of those commitments were made in 1973.

*New Levels
of Activity
in 1973*

During 1974 the Foundation expects to terminate its support of this program, in a manner designed to assure continued progress toward the goals originally set for it. This is in keeping with the operating policy under which Particular Programs were established in 1969. While a final assessment would be premature at this time, it may be appropriate to note that two organizations which rose to prominence during the term of the program, the Council for Opportunity in Graduate Management Education and National Medical Fellowships, Inc., achieved new levels of activity in 1973 and were making plans to sustain and if possible increase their activities in the future.

A new Particular Program to increase the representation of minorities in engineering (Pages 31 to 34) is being activated as the Particular Program in Medicine and Management runs its course.

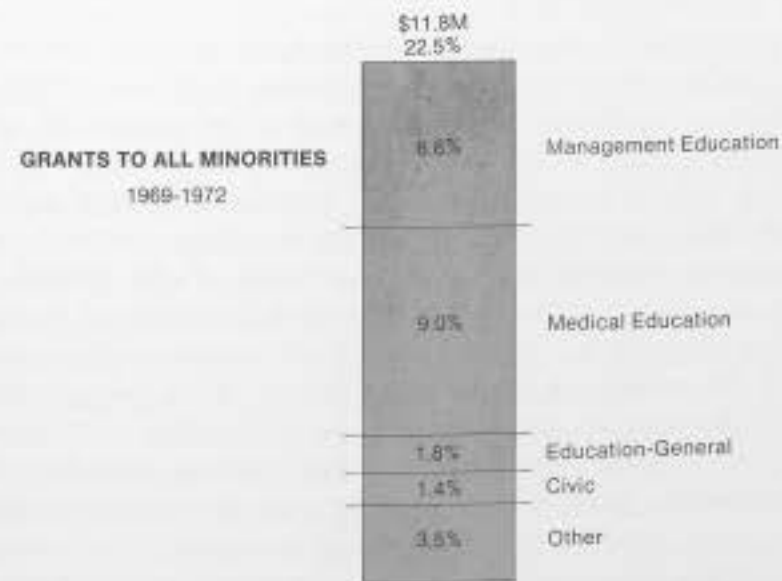
On the management side of this Particular Program, a principal thrust in 1973 was toward the strengthening of management programs at three predominantly Black institutions. Texas Southern University has one of the two graduate management programs in such institutions; the other, at Atlanta University, received Sloan support in 1971. Texas Southern,

a state institution in Houston, was the first predominantly Black institution to obtain accreditation for its undergraduate business program. Assisted by an earlier Sloan grant for planning, it has now mapped out a plan for gaining accreditation of its graduate program leading to the Master of Business Administration (MBA), which has more than 140 students enrolled. The principal needs are for additional faculty and for strengthening the business library and supporting services. For these purposes the Sloan Foundation approved a two-year grant of \$193,000.

At Xavier University of Louisiana, a traditionally Black private institution in New Orleans, the Department of Business Administration and Economics has become the largest department in the University and provides an ample pool of able minority graduates for further training. This complements the plans of Tulane University's Graduate School of Business, which has been seeking to increase its enrollment of minority candidates for the MBA degree. The two universities, therefore, have agreed to establish a joint degree program in which seven or eight Xavier students a year will take courses in both universities in their senior year and then will move into the full MBA program at Tulane. For some, this will make possible an MBA degree in a total of five years instead of the usual six. A summer workshop will be conducted by Tulane for Xavier post-juniors to help prepare them for the MBA program at Tulane.

At the same time, Xavier will be strengthening its Department of Business Administration and Economics with Tulane's assistance. Xavier

*Strengthening
Education
for the MBA*



22.5 per cent of all 1969-1972 grants went for minority purposes.

plans to add one faculty member, develop new courses, enable present faculty to do further graduate study, and acquire much-needed equipment. Tulane's recent experience with individualizing and modularizing business courses will help Xavier in modernizing its curriculum, and the institutions expect to benefit from cooperative efforts in other areas as well.

A grant to Xavier of \$162,600, and a similar amount from the Olin Corporation and the Olin Corporation Charitable Trust, will support these developments for three years. The funds will provide fellowships for 21 students, faculty and curriculum enrichment as described above, and administrative expenses.

Florida Agricultural and Mechanical University in Tallahassee has emerged in recent years as the leading source of Black Certified Public Accountants. Major national accounting firms recruit its graduates and have underwritten scholarships and professorships there. As the accounting profession seeks to increase its minority representation—perhaps the lowest in any major profession—Florida A. & M.'s Department of Business and Economics increasingly has assumed a role of leadership in this field.

Student response to opportunities in accounting has produced a rapid increase in enrollment to a level of some 350 accounting majors—nearly a tenth of the University's total enrollment. This has placed a severe strain on the department and created a need for additional faculty. Florida A. & M. therefore asked the Foundation for funds to support five new faculty positions over the next two years, after which it is hoped that additional state support will be forthcoming. The Foundation approved a two-year grant of \$190,000.

A consortium of ten leading graduate management schools*, the Council for Opportunity in Graduate Management Education (COGME), has become a significant factor in increasing the number of minority students in Master of Business Administration programs. COGME, established with Sloan support in 1970, provides fellowship support for minority MBA students and supplements recruiting efforts of member schools among minority groups in all sections of the United States. Minority enrollment in the ten member schools has increased from 257 in 1969-70 to 575 in 1973-74 and now stands at 8 per cent of total enrollment. COGME has awarded two-year fellowships to 570 of these students.

COGME also has made progress in establishing an independent financial base to assure that its activities will continue for as long as they may be needed. Support from industry and government programs is

*University of California-Berkeley, Carnegie-Mellon University, University of Chicago, Columbia University, Cornell University, Dartmouth College, Harvard University, Massachusetts Institute of Technology, University of Pennsylvania, and Stanford University.

expected to exceed Sloan support in the current academic year. The current Sloan grant of \$400,000, approved in 1973, brings total Sloan support of this program to \$2,720,000. (For administrative purposes the Sloan grant was paid to Harvard University.)

Advancement in management for the minority person, male or female, may require something more than the normal preparation available in most schools of management. The Association for the Integration of Management, founded in 1970 by a group of Black business executives, believes that this is so, and it is developing a broad program which includes special services for minority management students at graduate and undergraduate levels. AIM conducts Conference-Workshops on Career Opportunities in the Private Business Sector for as many as 1,000 minority business students annually. At these sessions, students are informed of specific career opportunities and of what they must do to take advantage of them. Specialized seminars focus on opportunities in particular industries. Other workshops focus on career preparation and attempt to instill the insights and attitudes which will make for success by minority persons in their first professional assignments. AIM also plans a bi-monthly newsletter to provide general and specific information about career opportunities in particular industries, companies, and geographic locations.

For the above activities the Foundation made a two-year grant of \$100,000 to AIM. Support is being received in increasing amounts from industry for other activities, such as a successful series of Career Development Workshops for practicing minority managers.

The minority person who was graduated from college ten or fifteen years ago faces a different problem. The opportunities available now were not available then, and as a consequence, many of these "older" minority graduates have ended up in jobs which do not make full use of their training and abilities. The Foundation in 1972 invited a number of institutions to investigate whether this situation existed in their areas, and if it did, to devise programs of part-time graduate business study for such persons to enable them to qualify for more responsible positions in business, government, and other institutions. These feasibility and planning studies would necessarily involve surveys of the number of potential candidates for advanced management training, and of the readiness of local employers to support their studies and to recognize their enhanced abilities through professional advancement. For such feasibility studies the Foundation made two grants in 1972 and five more in 1973, to Atlanta University (\$9,800), the University of California at Los Angeles (\$18,300), the University of Houston (\$15,000), Long Island University (\$15,000), and the University of Pittsburgh (\$6,500).

The first university to propose a graduate management program for

AIM Identifies Opportunities in Management

What to do for the "Older" Graduate

*Northeastern's
Part-time
MBA Program*

"older" minority college graduates was Northeastern University. Northeastern has determined, with the aid of a 1972 feasibility grant, that there are probably enough such persons in the Boston area to warrant a specially designed, experimental program enrolling about 20 persons a year in part-time studies toward the Master of Business Administration degree. They would retain their jobs while engaging in part-time studies, and some of their employers would help pay their tuition costs, the Northeastern study indicates. Northeastern expects to mount an active effort to search out suitable candidates among businesses and institutions in its area. The Foundation granted \$105,000 for the first two years of this program.

American Indians are receiving graduate management training at the University of New Mexico in a program initiated with a 1972 Sloan grant. The program, designed to impart understanding of the Indian cultural value system as well as managerial skills, is administered by an all-Indian staff. In its first year, 1972, it enrolled thirteen students from twelve tribes in five states. Eleven of these continued into a second year, and ten more were admitted in 1973. The University requested additional support for the 1974-75 academic year, principally for student stipends and dependency allowances. A grant of \$140,000, payable in 1974, was approved.

The Foundation also granted renewed support of \$20,000 for graduate management students in the Martin Luther King Fellowship Program for minority veterans of the military, administered by the Woodrow Wilson National Fellowship Foundation.

Minority enrollment in schools of medicine resumed its upward trend in 1973, reaching a level of 9.2 per cent of first-year students and 7.4 per cent of all medical students. (Adjusted comparable percentages for the previous year were 8.6 and 6.6.) Thus it appeared that the goal of 12 per cent minority representation by 1975 in M.D. degree programs, established by a Sloan-sponsored task force in 1970, was a realistic goal, at least as regards first-year students.

In the penultimate year of a concerted effort to increase the number of minority physicians, the Sloan Foundation in 1973 concentrated its support on minority students in their early medical training, and on a number of pre-medical programs designed to motivate and prepare minority students to enter into medical education.

National Medical Fellowships, Inc. (NMF) currently provides partial support for about 70 per cent of all medical students from underrepresented groups—American Blacks, mainland Puerto Ricans, American Indians, and Mexican-Americans—pursuing studies toward the M.D. degree. NMF in 1973 awarded fellowships aggregating \$2,476,500 to some 1,800 minority

*Focusing
on Early
M.D. Studies*

28



One of 1800 minority medical students currently being assisted by National Medical Fellowships, Inc., questions a faculty member at the Howard University School of Medicine. NMF awarded \$2,476,500 in fellowships for the 1973-74 academic year.

medical students in their first and second years of study. Only three years earlier, NMF was assisting about 600 students.

Thus NMF has become a major force in the drive to increase the number of minority physicians. This development has been due in part to major Sloan support beginning in 1969, and including a \$750,000 grant in 1973. But NMF also now attracts substantial grants from other foundations, including the Robert Wood Johnson Foundation, the James Irvine Foundation, the Commonwealth Fund, and the Grant Foundation, in addition to lesser but continuing support from corporations. Medical schools also contribute substantially to support of the NMF fellows whom they enroll. For the future, NMF expects to expand its administrative and fund-raising capabilities in order to sustain its vital role in the education of minority physicians.

Data from 1972 indicated an apparent leveling-off of interest among minority students in medical careers. The Foundation therefore accelerated efforts in 1973 to increase the number of minority applicants to medical schools, beginning at the high-school level.

*Foundations,
Others Join
in Support*

29

One of the most successful regional programs in this field has been the Pre-Medical Research and Education Program (PREP) of the New York University School of Medicine. PREP recruits talented students from New York City high schools and endeavors to motivate them toward college and, later, medical studies. The year-round program involves students in Saturday laboratory courses at the School of Medicine, in work in hospitals and community health centers, and, after high-school graduation, in an intensive six-week summer program to help prepare them for college work. Currently about 125 students are participating; previous graduates of PREP are all in college, most of them in pre-medical studies. The Sloan Foundation in 1973 granted renewed support of \$66,000 for PREP, bringing total contributions since 1969 to \$177,000. The Ernest and Mary Hayward Weir Foundation shares in support of the program.

*Williams
Encourages
Future M.D.'s*

Much the same purpose is served by a Summer Science Institute conducted since 1969 by Williams College. Each year, twenty college-bound high-school seniors are brought to the Williams campus for intensive six-week courses in chemistry and mathematics. Most of them ultimately enroll at Williams, which is known for its undergraduate preparation of future medical students; the rest go to other colleges. As the program has matured, upperclass students who have passed through it now provide tutoring and counseling for their younger successors entering Williams. The Foundation in 1973 granted renewed support of \$60,000 for the Summer Science Institute, bringing total Sloan grants for this program to \$140,000.

A number of other institutions conduct summer programs intended to elevate the interest and ability of potential minority medical students. Target groups range from high-school students to those who are about to enter medical school. For such programs the Foundation in 1973 made grants to Baylor College of Medicine (\$10,000), Johns Hopkins University School of Medicine (\$20,000), University of Kentucky Medical Center (\$17,600), University of Mississippi School of Medicine (\$6,200), and Stanford University (\$20,000).

For a program of special efforts to retain minority students enrolled in Harvard Medical School, the Foundation granted \$10,000.

Minority Engineering Education



THE Foundation's fourth Particular Program is concerned with increasing the representation of minorities in the profession of engineering. The Foundation is prepared to allocate from \$12 million to \$15 million for this purpose over the next five to seven years.

This program grows naturally out of the Foundation's historic interest in engineering, and seems a logical successor to the Particular Program for minorities in medicine and management, which will begin to terminate in 1974. It also responds to societal needs, in two ways: Blacks and other minorities, according to the best available data, make up well under 1 per cent of the approximately 1.1 million trained engineers in the United States; and total engineering enrollments have declined to the point where serious shortages of engineers in many fields are foreseeable for the near future.

*The Shortage
of Minorities
in Engineering*

Why Choose Engineering as a Career?

Both the opportunity and the need, then, are fairly clear. Space exists in schools of engineering for more students than are presently attending them; and minority students, by and large, have not availed themselves of existing opportunities for careers in engineering, probably because they were not aware of them. Moreover, preparation for the professional engineering degree usually takes only four years of undergraduate study, and starting salaries are relatively high. Job security is good, notwithstanding widely publicized instances of unemployment in such engineering specialties as aerospace.

What is needed, then, is a means of bringing able minority students together with the available opportunities. It seems reasonable to believe that a fivefold increase in minority engineering enrollment is possible over the next several years. Others are even more optimistic: the National Academy of Engineering speaks of a tenfold increase over the next decade. Whatever the ultimate goal, the Foundation hopes to play a stimulating and catalyzing role in achieving it.

Future directions of the program on Minority Engineering Education will depend to a significant degree on the recommendations of a special task force organized by Prof. Louis Padulo of Stanford University at the Foundation's request to study the critical factors limiting the enrollment and retention of minority engineering students, and to propose solutions. The task force includes representatives of universities and schools, minority organizations, industry, government, and the professional engineering societies. Stanford received a grant of \$20,000 for initial support of the task force, which is scheduled to report in the spring of 1974.

Pending the task force report, there is an immediate opportunity to increase minority engineering enrollment in the six predominantly Black colleges of engineering, which currently graduate nearly 50 per cent of all Black engineers. Each of them has both the physical capacity and the staff capacity to increase enrollment substantially, and each is located in an area of large minority population. They are accustomed to dealing with minority students, and they recruit actively among high schools in their areas.

In December of 1973, two-year grants of \$100,000 each were approved for three predominantly Black engineering institutions:

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY, which has been graduating about 30 engineering students a year, hopes to double that number in a few years by two principal means: expansion of a pre-freshman summer program to 100 students studying mathematics and other engineering subjects on a correspondence basis, followed by a visit to the campus; and a co-operative work-study program in which students work at the Naval Weapons Laboratory in Dahlgren, Virginia, while preparing at a nearby junior college to enter the North Carolina

A. & T. engineering school. For the latter group, the work-study arrangement will resume after one semester in the engineering school. The Sloan grant was requested primarily for staff support and student aid.

PRAIRIE VIEW A. & M. UNIVERSITY, the largest single source of Black engineers (with 67 graduates in 1972 and 55 in 1973), hopes to increase freshman enrollment by 40 per cent a year through an intensive and diversified recruiting program in five states of the Southwest, and through a Summer Engineering Concepts Institute for 100 students. To reduce attrition, an Intercept Program will assign upper-division students as tutor-counselors to lower-division students. Staff support and some student summer stipends are to be the principal uses of the Sloan funds.

TUSKEGEE INSTITUTE hopes to double the number of students in its summer Pre-Engineering Program from 30 to 60 by strengthening its recruiting efforts, and to increase the number who enroll and remain at Tuskegee through a student tutoring program and increased financial aid. Tuskegee currently graduates approximately 35 students each year, and awards approximately 18 Master of Science degrees annually in electrical, mechanical, and nuclear engineering.

The predominantly Black engineering schools obviously cannot by themselves overcome the scarcity of minorities in engineering. But they can have a substantial early impact on the problem, because of the numbers they enroll, and their experiences in accelerated recruitment and increased efforts at retention should be of value to the whole body of engineering schools.

A national program to stimulate minority enrollment in engineering education has been functioning on a relatively small scale for about a year. The Minority Engineering Education Effort (ME³) Task Force is conducted by the Engineers' Council for Professional Development (ECPD) with corporate support and an executive secretary on leave from industry (A.T.&T.). During the spring of 1973 this Task Force, with the cooperation of national testing and scholarship organizations, collected the names of 10,000 minority high-school and junior-college seniors who might qualify for entry into engineering schools. These students were encouraged to apply to the engineering schools of their choice, and the schools were provided the students' names and academic records.

Initially 115 institutions expressed interest in this service; now 190 have. The Task Force hopes to expand this activity, and is also initiating a program of providing, for all interested institutions, brochures and publications as well as audio-visual materials designed to arouse interest in engineering among minority students at the junior-high-school, high-school, and junior-college levels.

These activities being clearly in consonance with the goals of the Foundation's Particular Program, the Foundation approved a three-year grant of

Stimulating Interest in Engineering

\$225,000 to ECPD to sustain and expand them, and to strengthen the headquarters support of the Minority Engineering Education Effort Task Force.

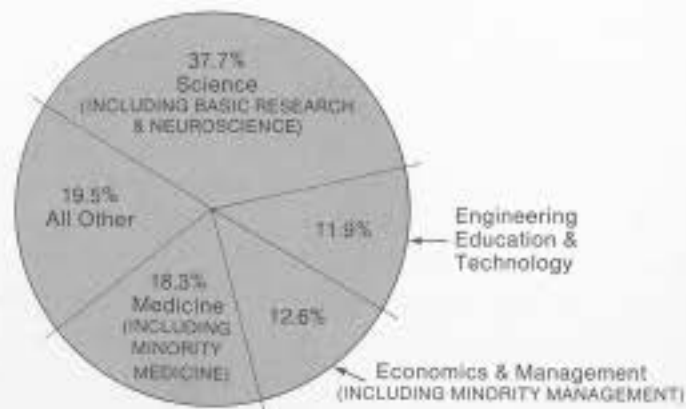
Several other organizations have been active in aspects of the minorities-in-engineering effort. The National Academy of Engineering, as a result of a symposium on the subject in May of 1973, is planning to coordinate a national effort to increase the number of minorities in the engineering profession. The symposium was supported partially by a Sloan grant of \$10,000 to the National Academy of Sciences.

The American Society for Engineering Education, which was instrumental in directing the Foundation's attention to the Black engineering colleges, received a grant of \$20,000 for its Black Engineering Colleges Development Committee.

The Engineers Joint Council received \$10,000 to complete the gathering of data on minority enrollment in some 280 engineering schools and technical institutes during the 1973-74 academic year.

General Program

DISTRIBUTION OF GRANTS BY AREAS OF INTEREST, 1965-1972



Science and engineering received half of all grant funds over an eight-year period.

THE GENERAL PROGRAM of the Alfred P. Sloan Foundation, which is distinct from the three Particular Programs, carries forward the Foundation's interests in science and technology, in economics and management, and in education and the problems of society related to those interests. Within these areas the Foundation supports promising research efforts and innovative educational programs, and occasionally convenes groups of experts for discussion and advice on matters of general concern. General Program grants often result from the initiatives of proponents; in other instances the Foundation identifies a significant problem area and invites proposed solutions.

Science and Technology



AS our seeming abundance turned suddenly into scarcity in 1973 it became obvious, if it was not before, that a wiser use of technology is not only desirable but imperative. Somewhat less obvious, but equally real, was the fact that a society which skimps on basic scientific research cannot expect to reap the continued benefits of the serendipitous discoveries which have helped to enrich the more prosperous nations thus far.

The impact which one private foundation can make on such global problems is limited. But at least the directions which its effort in science and technology ought to take are now clearly visible. A more humane use of technology is clearly called for, as is continuing support of basic research, especially at a time when the latter may be somewhat out of fashion with government granting agencies.

The chief practitioner of the technological arts and skills, the engineer, has seen his role sharply altered in the past decade or so. Technological problems no longer can be resolved in a social vacuum; a broad range of other considerations now enters into decisions about where and how to build a new power plant, a new highway, or indeed a new city. The contemporary engineer must be at ease with not only the traditional science and mathematics of his discipline, but also with social, economic, and political considerations which increasingly influence engineering decisions. It is thus essential that future engineers receive some training in the social sciences,

*New Demands
in Engineering
and Research*

and that teachers of both engineering and social science begin to communicate and cooperate in the task of educating young persons who will be making technological decisions in the future.

Fortunately, engineering faculties and students in many institutions are eager to enter into such interaction with their social-science counterparts, and the Sloan Foundation has sought to encourage this trend. By the end of 1973 the Foundation had made grants to 21 institutions aggregating \$6,867,200 for this purpose. Grants totaling \$3,341,200 to eleven institutions occurred in calendar 1973. Most of these inevitably were to large public universities which graduate large numbers of engineers. But two grants also went to smaller private colleges, Lafayette and Swarthmore, which have significant engineering programs.

In general, the 1973 Sloan grants are being used for development of new courses which bring social concerns to bear on engineering problems. The recipient institutions are pursuing the basic objective in a variety of ways, as the following brief summaries will indicate:

CITY COLLEGE OF THE CITY UNIVERSITY OF NEW YORK, with a \$309,000 grant, will develop a two-year Master's degree program in urban engineering. Its graduates are expected to acquire a broadened understanding and competence in the use of technological, social, managerial, and behavioral sciences. They will thus be equipped to make substantial contributions in improving the quality of urban life.

GEORGIA INSTITUTE OF TECHNOLOGY, which received \$305,000, plans a new undergraduate elective sequence of courses emphasizing both external and internal factors influencing the rate of technological innovation and utilization, and technological forecasting and assessment. Several new faculty members will be added in these areas.

LAFAYETTE COLLEGE received a three-year grant of \$151,300 for a plan which will expand the perspectives of tenured faculty while developing new courses in the economic and social aspects of technological change. Each year two faculty members from the social sciences and engineering will be granted leave to study at another institution in subjects outside their principal fields. The following summer they will develop a new course on a socio-technical subject, and in the fall they will teach it together.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY received a two-year grant of \$800,000 for a new Master's degree program which will concentrate on the application of technology to public systems, and for support of its Center for Policy Alternatives. The Center, directed by Dr. J. Herbert Hollomon, will engage in and stimulate research on societal change with particular reference to the role of science and technology in such change. Its work can be seen as complementary to the Public Policy Program in Harvard University's John F. Kennedy School of Government, which also is receiving Sloan support.

THE UNIVERSITY OF MINNESOTA, with a \$280,000 grant, will introduce four innovations in its Institute of Technology: (1) an integrated series of courses for lower-



City College of the City University of New York was one of eleven institutions receiving Sloan grants in 1973 to strengthen the social-science component of engineering education. Here Dr. Egon Brenner, acting provost, second from right, discusses with faculty members the curriculum for a new Master's program in urban engineering.

division engineering students, including introductory social science courses; (2) an upper-division program in social science which will utilize the mathematical skills of engineers and will provide them the experience of working with social scientists; (3) an upper-division sequence called Engineering for New Priorities, which will emphasize the practice of engineering in a changing environment; and (4) a joint graduate degree program between the Institute of Technology and the School of Public Affairs, enabling science and engineering students to earn a minor in public affairs.

OHIO STATE UNIVERSITY will use a \$230,900 grant for a project called Developing an Interface Between Engineering and the Social Sciences. A faculty team of engineers, psychologists, and political scientists is developing a two-quarter course designed to bring to engineering students an understanding, through a case-study and systems-design approach, of the contributions which the social sciences can make to the solution of engineering problems.

PURDUE UNIVERSITY, with a \$315,000 grant, will begin offering a new "Man Series" of courses in the spring of 1974. The courses, dealing with the relationship of human values to various technical problems, will be team-taught by professors from several disciplines and will be open to both engineering and non-engineering students.

THE UNIVERSITY OF SOUTHERN CALIFORNIA, which received \$242,000, is restructuring its engineering curriculum, initially on a pilot basis, through the addition of core faculty, some of them non-engineers, who will teach future engineers such



Purdue University is developing a new series of courses for engineering and other students relating technical problems to human values. Here Prof. Richard E. Grace, head of the Division of Interdisciplinary Engineering Studies (standing at rear), leads an informal planning discussion by faculty and students.

courses as technology and society, fine arts, political science, psychology, and technology and law, in addition to the usual engineering subjects.

SWARTHMORE COLLEGE will use a three-year, \$75,000 grant to release faculty in its engineering department and social science departments to develop new courses stressing the societal aspects of engineering. Swarthmore believes that in the setting of a small, liberal arts college the necessary interaction between disciplines should be facilitated. Moreover, its non-engineering students take some present engineering courses and should benefit from the new ones.

THE UNIVERSITY OF WASHINGTON College of Engineering will apply a \$321,000 grant to its broadly multidisciplinary program on Social Management of Technology. Additions to faculty, new courses to help graduate and undergraduate students deal with the social implications of technology, and increased interaction between engineering and social science faculties are envisaged.

THE UNIVERSITY OF WISCONSIN-MADISON will use a \$312,000 grant for two activities in its College of Engineering: a graduate-level program which will bring engineering and social-science faculty together on joint research projects, leading to graduate seminars and ultimately to a new Master's degree program in socio-engineering; and development of new undergraduate curriculum options in engineering and social science for both engineering and non-engineering students.



Fourteen private, liberal arts colleges in 1973 received renewed support of efforts to maintain excellence in science. A Haverford College professor and student analyze astronomy data.

Science as an essential part of liberal education has been strengthened at most of the twenty private colleges which received grants totaling \$7.5 million through the Foundation's College Science Program, initiated in 1966. An evaluation of this program in 1972 (see the Report for 1972, Page 47) found that while substantial progress had been made in upgrading science departments, most of these institutions were finding it difficult to sustain these gains. Government and other support for science was harder to get, the job market for science majors was slackening, and students generally were less interested in some areas of science.

The Foundation determined therefore that some modest renewed support of developments it had helped to start was warranted. From an appro-



A College Science grant helps support Prof. Russell Sutton's chemistry teaching in this laboratory at Knox College.



Geology students at Oberlin College examine aerial photographs, another activity supported partially by a College Science grant.

priation of \$1 million approved in 1972, fourteen grants totaling \$937,000 were made in 1973. It was hoped that by the end of the two-year terms of these grants, the colleges might be better able to sustain their levels of activity in science through their own funds or through new sources of support.

The fourteen colleges were invited to describe how they could use grants at about half their previous annual level to maintain and improve their science offerings, within certain guidelines. The Foundation suggested, based upon its evaluation, that promising areas of activity might include student research, faculty research, and new young teaching assistants. Most of the recipient institutions will apply their Sloan funds to such purposes; some also will add teaching equipment, particularly peripheral computer equipment.

Institutions which received College Science grants in 1973 are:

42	CARLETON COLLEGE	\$85,000	Haverford College	\$80,000
	COLGATE UNIVERSITY	\$75,000	KNOX COLLEGE	\$55,000
	CORNELL COLLEGE	\$20,000	MIDDLEBURY COLLEGE	\$80,000
	GRINNELL COLLEGE	\$70,000	MOUNT HOLYOKE COLLEGE	\$70,000

OBERLIN COLLEGE	\$50,000	WASHINGTON AND LEE UNIVERSITY	\$40,000
OCCIDENTAL COLLEGE	\$70,000	WILLIAMS COLLEGE	\$90,000
REED COLLEGE	\$90,000		
SMITH COLLEGE	\$62,000		

Since 1955 the Foundation has awarded Sloan Research Fellowships to 1,056 young research scientists in the fields of physics, chemistry, mathematics, and neuroscience. This program has accounted for about \$22 million of Foundation funds. Some 550 to 600 nominations are reviewed annually by the staff and an advisory committee. Currently the program is funded at a rate of \$1.4 million a year, which amounts to about 10 per cent of the Foundation's annual grants.

In any program which has gone on for 18 years, the question naturally arises whether it continues to serve a useful purpose and, in particular, whether it still represents the best possible use of the funds committed to it. The Foundation set out to answer those questions through a staff evaluation in 1973. Interviews were conducted at twenty universities with past Sloan Fellows, department heads, other scholars in chemistry, physics, and mathematics, and with persons who were nominated for fellowships but did not receive them. (The neuroscience aspect of the program, now in only its second year, was not included in the evaluation.) An effort was made to probe into such matters as: Did the Sloan Fellowship advance the recipient's career? Was the money itself of special value? Was the fellowship important in non-monetary ways? Is the selection process satisfactory? How might the program be changed? And—does the program constitute the optimum use of Foundation funds?

Those consulted had nothing further to gain from the program, so it may be assumed that self-interest was not an important factor in their replies. Their responses constituted a unanimous endorsement of the program as it is now operated, even though critical assessments were expressly invited. The prestige attached to the fellowships was if anything greater than the Foundation had expected. Sloan fellows do advance rapidly in their professions (four have won Nobel Prizes), and they attribute this in part to the early impetus of the fellowship. The confidence expressed in the program is of considerable satisfaction to the Foundation.

A feature of the program which drew particular praise was the great flexibility in use of the grant funds. One after another of these young faculty members mentioned the value of being able to make a timely commitment to a junior colleague, to acquire a key piece of equipment without delay, or to obtain computer time and support for professional travel not otherwise available. The fellow is not required to complete a specific

Sloan Research Fellowships: an Evaluation

Result: a Unanimous Endorsement

research project; he is asked through his institution only to account annually for the use made of the money. If he moves to another institution, he may with the Foundation's approval take with him what remains of the grant.

*Suggestions:
Broaden
and Expand It*

The only substantive suggestions were that the fellowship program be expanded and broadened in its coverage both as regards the age of recipients and the number of disciplines it supports. At present the average age of recipients when selected is 31. All are regular faculty members in the United States and Canada, except some of the neuroscientists, who may be postdoctoral fellows. The fellowships run for two years at an average rate of \$8,750 a year.

Foundation Trustees voted another appropriation of \$1.4 million for fellows to be selected in 1974. During 1973 fellowships were awarded to 79 young scientists, eight of them neuroscientists, in 49 universities and colleges.

Nominations are reviewed and selections recommended by a Program Committee consisting of the following:

DR. MARK KAC, Professor of Mathematics, Rockefeller University (Chairman of Program Committee)
DR. RICHARD B. BERNSTEIN, Professor of Chemistry, University of Texas
DR. T. D. LEE, Professor of Physics, Columbia University
DR. CARL PFAFFMANN, neuroscientist, Professor and Vice President of Rockefeller University

DR. ARTHUR L. SCHAWLOW, Professor of Physics, Stanford University
DR. FRANCIS O. SCHMITT, Chairman, Neurosciences Research Program, Massachusetts Institute of Technology
DR. I. M. SINGER, Professor of Mathematics, Massachusetts Institute of Technology
DR. GILBERT STORK, Professor of Chemistry, Columbia University

Scientists who received Sloan Research Fellowships in 1973 are listed below, by their institutions and fields of science:

ARIZONA STATE UNIVERSITY
Chemistry: Alexandra Navrotsky
BRANDEIS UNIVERSITY
Mathematics: David Eisenbud
UNIVERSITY OF BRITISH COLUMBIA
Physics: Walter N. Hardy
BROWN UNIVERSITY
Neurophysiology: James T. McIlwain.
Chemistry: Langley A. Spurlock. *Geophysics:* Terry E. Tullis
CALIFORNIA INSTITUTE OF TECHNOLOGY
Mathematics: Michael Aschbacher.
Chemistry: Robert W. Vaughan. *Astrophysics:* Michael W. Werner
UNIVERSITY OF CALIFORNIA, Berkeley
Radio Astronomy: Carl E. Heiles. *Bio-physical Chemistry:* Wayne L. Hubbell

UNIVERSITY OF CALIFORNIA, Irvine
Chemistry: Robert T. McIver, Jr.
UNIVERSITY OF CALIFORNIA, Los Angeles
Mathematics: Thomas M. Liggett.
Bruce L. Rothschild. *Chemistry:* Malcolm F. Nicol
UNIVERSITY OF CALIFORNIA, San Diego
Mathematics: Carl H. FitzGerald
UNIVERSITY OF CALIFORNIA, Santa Barbara
Physics: David S. Cannell
CASE WESTERN RESERVE UNIVERSITY
Chemistry: Robert C. Dunbar. *Molecular Neuroanatomy:* Raymond J. Lasek
UNIVERSITY OF CHICAGO
Physics: Robert D. Carlitz. *Bio-organic Chemistry:* Ronald H. Kluger. *Crystal-*

lography, Geochemistry: Paul B. Moore. *Developmental Neurobiology:* Anthony D. J. Robertson
UNIVERSITY OF COLORADO
Chemistry: Arlan D. Norman
COLUMBIA UNIVERSITY
Mathematics: C. Herbert Clemens.
Geophysics: Paul G. Richards
CORNELL UNIVERSITY
Neurochemistry: Stuart J. Edelstein.
Chemistry: Martin F. Semmelhack
DUKE UNIVERSITY
Neurobehavior: Thomas T. Norton
HARVARD UNIVERSITY
Neurochemistry: John G. Hildebrand.
Chemistry: Bryan E. Kohler
UNIVERSITY OF ILLINOIS
Mathematics: E. Graham Evans, Jr.
Chemistry: J. Douglas McDonald
IOWA STATE UNIVERSITY
Chemistry: Jon C. Clardy
JOHNS HOPKINS UNIVERSITY
Mathematics: Bernard Shiffman
UNIVERSITY OF KENTUCKY
Mathematics: Thomas A. Chapman
UNIVERSITY OF MARYLAND
Physics: David D. Brayshaw
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Physics: Carleton DeTar, Michael S. Feld, Jeffrey E. Mandula. *Mathematics:* Norberto Kerzman. *Chemistry:* K. Barry Sharpless
MICHIGAN STATE UNIVERSITY
Chemistry: Stanley R. Crouch. *Mathematics:* Richard T. Miller
UNIVERSITY OF MICHIGAN
Chemistry: Hans H. Brintzinger
UNIVERSITY OF MINNESOTA
Physics: Ernest Coleman. *Chemistry:* Donald G. Truhlar
NEW YORK UNIVERSITY
Chemistry: Mark A. Ratner
UNIVERSITY OF NORTH CAROLINA
Chemistry: Reuben D. Rieke
NORTHWESTERN UNIVERSITY
Mathematics: George Gasper, Jr.

UNIVERSITY OF PITTSBURGH
Physics: David Jasnow, Ralph Z. Roskies
PRINCETON UNIVERSITY
Astrophysics: Edward J. Groth, III.
Physics: Anthony Zee
QUEEN'S UNIVERSITY
Physics: Ian P. Johnstone
REED COLLEGE
Neurobiology: Stephen W. Arch
RICE UNIVERSITY
Chemistry: W. Edward Billups
UNIVERSITY OF ROCHESTER
Physics: Stephen L. Olsen
SOUTHERN ILLINOIS UNIVERSITY
Chemistry: Conrad C. Hinckley
STANFORD UNIVERSITY
Physics: Theodor W. Hansch. *Mathematics:* John H. Coates
STATE UNIVERSITY OF NEW YORK AT STONY BROOK
Physics: Philip B. Allen, Barry M. McCoy
UNIVERSITY OF TEXAS AT AUSTIN
Physics: Kenneth W. Gentle, Jack B. Swift. *Chemistry:* Robert E. Wyatt
UNIVERSITY OF UTAH
Chemistry: John P. Simons, Chin-Hsien Wang
VANDERBILT UNIVERSITY
Chemistry: William B. Peatman
UNIVERSITY OF VIRGINIA
Chemistry: W. Lester S. Andrews
WASHINGTON UNIVERSITY
Chemistry: Alfred G. Hortmann
UNIVERSITY OF WASHINGTON
Atmospheric Science: John M. Wallace
UNIVERSITY OF WATERLOO
Chemistry: F. R. McCourt
WEST VIRGINIA UNIVERSITY
Physics: Mohindar S. Seehra
UNIVERSITY OF WINDSOR
Physics: Gordon W. F. Drake
UNIVERSITY OF WISCONSIN
Molecular Neurobiology: Gerald L. Hazelbauer. *Physics:* Max G. Lagally.
Chemistry: John L. Schrag
YALE UNIVERSITY
Mathematics: Ronnie Lee

A long-standing relationship between the Foundation and the Sloan-Kettering Institute for Cancer Research was reaffirmed through extension of an agreement whereby the Foundation annually provides operating support of \$400,000 to the Institute. The Institute, which has been studying the problem of cancer over a broad scientific front since 1945, emphasized two particular areas of progress in its most recent published report. One is the increasingly sophisticated use of chemotherapy, the application of several different drugs at specific times and in specific doses determined through new knowledge of cell kinetics. The other area is immunology, through which the body's built-in immunity system may be mobilized to destroy cancer cells; the ultimate goal of this research is development of a vaccine to provide immunity against cancer-causing virus.

*Reorganizing
Research
at SKI*

A reorganization of the Sloan-Kettering Institute's entire research effort was going forward in 1973 under the direction of the Institute's new president and director, Dr. Robert A. Good. The intention is to create more flexibility and to encourage greater interaction among investigators working in different disciplines. The Institute's relationship with its largest source of support, the National Cancer Institute of the National Institutes of Health, was restructured to provide continuing core support along with more flexible support for separate project areas.

Grants to the Sloan-Kettering Institute are paid from the General Motors Dealers Appreciation Fund for Cancer and Medical Research, established in 1949 by gifts from General Motors dealers in appreciation of the contributions of Alfred P. Sloan, Jr. to the corporation and its dealer organization.

The Sloan Foundation has had a special interest in mathematics for many years. It has been concerned with the balanced development of applied and practical mathematics along with pure and abstract mathematics, and with improved teaching of mathematics. Adelphi University on Long Island has an unusual opportunity to further this development. Many of its mathematics students are teachers in two- and four-year colleges on Long Island, and it has a strong faculty including several graduates of New York University's Courant Institute of Mathematical Sciences. Adelphi proposed to create a new Doctor of Arts degree program designed to train persons interested primarily in teaching mathematics in colleges rather than in becoming research specialists. The D.A. program will replace the traditional Ph.D. requirement of a foreign language with a computer language requirement. The graduate of the program will be expected to be soundly versed in the history of mathematical ideas, able to understand research results and explain their significance to students. He or she will have had

seminars in teaching and experience in curriculum preparation, and will have produced a thesis which may be a discussion of the development of mathematical ideas in some specialized area.

Adelphi plans to follow up graduates of the program three years after they receive the D.A. to obtain an evaluation of the program. The teacher's own classroom effectiveness is to be assessed by one of his or her superiors. The Foundation granted \$138,500 in partial support of the Adelphi D.A. program for three years. The funds will be used principally to release faculty time for curriculum development, and for student support.

Another unusual approach to science education is taking place at Clark University, where an interdisciplinary undergraduate program entitled Technology and Man is being established. The program is designed to appeal to students who have had adequate science and mathematics preparation in high school but who do not plan to become scientists. Rather, they will be equipped to deal with public policy questions involving the use and misuse of technology. While the program enjoys broad support among several departments at Clark, its emphasis will be on natural science and it will be based in the department of physics. It will require nine to eleven semesters of natural science, with at least six semesters in a single discipline; four semesters of social science, and three or more semesters of problem-oriented courses on specific issues.

Clark has added a faculty member in physics who devotes his time exclusively to the Technology and Man program. Principally for this purpose, and for an additional graduate teaching assistant, the Foundation made a two-year grant of \$55,000.

A Program on Science, Technology and Society was established at Cornell University in 1969 with a five-year Sloan grant of \$300,000. Directed originally by Dr. Franklin A. Long, the Cornell program concerns itself with such subjects as the relationships of science and technology to the environment, to peace and war, and to human values and processes of socialization. It addresses issues of public policy in the development of science and technology, the legal and moral implications of modern biology, and a host of other topics. A core faculty of eight scholars from eight disciplines forms a nucleus around which interdisciplinary teaching and research are conducted by faculty members from many departments of the University. The program has developed a score of new courses, all sponsored jointly with other units of the University, and has provided graduate assistantships for interdisciplinary research as well as seed money for special projects ranging from a film on exobiology to studies in arms control.

As the Cornell program enters its sixth year it is receiving increasing support from government, other foundations, and the University itself. Student and faculty interest remains high, and the program's present direc-

*Effectiveness
of D.A. Degree
to be Studied*

*How Science
and Society
Interact*

tor, Dr. Raymond Bowers, hopes over the next five years to consolidate past gains and to continue development and refinement of courses, research on technological assessment, and experiments with multi-disciplinary teaching techniques. Dr. Bowers also expects to develop a system for evaluating the program's activities and a plan for making available to other institutions the knowledge, experience, and materials developed by the program. For continued core support of such activities, the Foundation made a second and final five-year grant of \$300,000.

*New Degrees
in Technology
at Detroit*

In 1969 the Foundation became interested in the possibility of preparing disadvantaged inner-city youth for technical jobs which do not require a full engineering degree, and a number of relatively small exploratory grants were made. By 1973 Detroit Institute of Technology, a recipient of one of the 1969 grants, was well along in refurbishing both its physical plant and its curriculum, and had enlisted the aid of the Education Research Center at MIT in tailoring its courses more closely to the needs of inner-city students. It is now ready to mount a new Associate Degree Program in Basic Engineering with the help of a 1973 Sloan grant of \$135,000, payable over three years. The program will offer studies in manufacturing, construction/surveying, and computers/electronics. A student may leave after one year of study with some technical skill and a certificate; he may study for a second year on a cooperative work-study basis, gaining experience in a Detroit industry and an Associate degree after two years; and he then may move into DIT's regular Bachelor's degree program, or continue for a Bachelor's degree in his specialty. The two-year program is so structured that transfer to a four-year program may be made without loss of credits. Thus a new avenue of education is created for Detroit youth, and a new source of technical manpower for Detroit industry is developing.

Two recipients of 1969 grants for technical training for minorities received additional support in 1973. Wentworth Institute, for renewed support of a summer technical internship program, received \$15,000. Princeton University received \$14,200 for a program in which minority high-school youths do laboratory work at Princeton during the summer and receive counseling toward para-technical studies during the academic year.

Other grants related to science and technology in 1973:

AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass.: To provide financial consulting services for the International Centre of Insect Physiology and Ecology	\$10,000
In partial support of a special issue of DAEDALUS on the energy crisis to be published in the fall of 1974	\$20,000

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Washing- ton, D.C.: To help meet the costs of a one-day program on international science to be held at the Association's annual meeting in February 1974 . . .	\$ 2,000
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UNIVERSITY OF CHICAGO, Chicago, Ill.: For renewed and terminal assis- tance in the development of a high-resolution scanning proton microscope . .	\$15,000
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CONFERENCE BOARD OF THE MATHEMATICAL SCIENCES, Washington, D.C.: To help initiate a cooperative arrangement among various mathemati- cal organizations to produce a comprehensive reviewing/abstracting service for the mathematical sciences	\$ 6,000
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HALL OF SCIENCE OF THE CITY OF NEW YORK, INC., Flushing, New York: Toward the expenses of reopening the Hall of Science	\$10,000
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MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: To support a three-day Workshop on Women in Science and Technology	\$20,000
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For partial support of a historical study of the Office of Naval Research	\$ 4,025
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For partial support of an international workshop on alternative strategies for North America, Europe, and Japan in the field of energy	\$20,000
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NATIONAL ACADEMY OF SCIENCES, Washington, D.C.: Partial support for the Academy's efforts to initiate a series of public forums in science and its relevance to public policy	\$20,000
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To support the participation of two Academy staff members in the AAAS meeting on "Science and Man in the Americas," held in Mexico City, June 20-July 4, 1973	\$ 1,269
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RUTGERS—THE STATE UNIVERSITY, New Brunswick, New Jersey: In partial financial support for the magazine <i>Adventures in Experimental Physics</i>	\$15,000
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SMITHSONIAN INSTITUTION, Washington, D.C.: To permit a selected group of Sloan Research Fellows to participate in the Smithsonian sympo- sium, "The Nature of Scientific Discovery," held April 22-26, 1973	\$190
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SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS, Philadelphia, Pa.: Partial support for the SIAM Program in Societal Problems	\$18,500
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SOUTHERN METHODIST UNIVERSITY, Dallas, Texas: To support the development of a zero base budgeting system for the SMU Institute of Technology	\$17,500
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TECHNICAL EDUCATION RESEARCH CENTER, Cambridge, Mass.: For general support of <i>Technical Education Reporter</i>	\$15,000
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UNITED PRODUCTIONS LIMITED, Sherman Oaks, Calif.: Supplementary grant for environmental film: "Survival of Spaceship Earth"	\$ 1,275
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Economics and Management



THE need for better management—in public, corporate, and nonprofit sectors—and for more effective use of economic knowledge and theory was evident in 1973 as never before, and the need promised to become still more pressing in the years ahead. Institutions of government, business, and education apparently will require all the economic and managerial skill they can muster if serious damage is to be avoided.

*Illuminating
the Issues
at Brookings*

As economic understanding becomes ever more crucial to an enlightened conduct of affairs, the significance of the Brookings Papers on Economic Activity has increased. Published three times a year by the Brookings Institution in Washington, D.C., the Papers deal on a timely but rigorous basis with current economic issues—inflation, unemployment, fiscal policy, monetary policy, international economic issues, and individual demand sectors, to name a few. The Papers were created in 1970 with Sloan support of \$300,000 to close a conspicuous gap in economic research, midway between the quick, journalistic analysis and the long-term depth study which often is dated by the time it appears. The Brookings Papers endeavor to provide the maker of public policy and the business executive with analyses of economic issues while they are still “live,” and also to report in sufficient depth to be of use to the academic specialist.

50 The effectiveness of the Brookings Papers on Economic Activity is attested to in part by their more than 4,000 subscribers in academia, govern-

ment, and business, and by the enthusiasm of both senior and younger economists for serving on the thrice-yearly panels which develop the Papers under the direction of Brookings senior fellows Arthur Okun and George Perry. Brookings is finding increasing support for this project from other foundations, and believes that by 1975 it can be operated without further Sloan assistance. The Foundation approved a final two-year grant of \$150,000.

A separate Brookings project, concerned with research on the effects of foreign direct investments by corporations, entered its second year in 1973. This research, being conducted by Dr. C. Fred Bergsten, senior fellow at Brookings, is being supported by a three-year Sloan grant of \$350,000, approved in 1972.

*Also: a Study
of Foreign
Investments*

Since so many persons from the learned professions, such as law and medicine, end up in policy making positions in government, it is wise for them to have some preparation in the new methods of policy analysis and decision theory which will help to equip them for such roles. The John F. Kennedy School of Government at Harvard University in 1970 undertook a Public Policy Program to train students from other Harvard professional schools to participate in the making of public policy. A dual degree program enables students to earn both their regular professional degree and a Master of Public Policy degree from the Kennedy School, in less time than it would take to earn the two degrees separately. Such arrangements have been developed with schools of law and medicine, and are now under discussion with engineering and other professional disciplines. A three-year Sloan grant of \$600,000 in 1970 supported some of these developments.

In 1973 Harvard proposed a second phase in which the Public Policy Program would develop a new curriculum dealing with managerial problems in the governmental sector. Other professional schools, particularly the Harvard Business School, will collaborate with the Kennedy School in designing new courses, teaching materials, and research programs relating managerial insights to problems in government and public policy. Business School professors will work in the Kennedy School for set periods of time to help review the demands for public-management courses in other professional areas, and to translate these demands into new teaching and research programs. The Sloan Foundation made a three-year terminal grant of \$450,000 to support this effort.

*Policy Issues
in Management
of Government*

Many Black and other developing colleges, in their struggle to maintain institutional viability, are handicapped by a lack of professional administrative services. To help meet this problem the Woodrow Wilson National Fellowship Foundation in 1967 initiated an Administrative Internship Program. The program recruits recent graduates of leading graduate schools of business to work for two years or more in the administrations of develop-

51



Administrative Interns assigned to the University of Alabama, Huntsville; Fisk University, and Spelman College get together at a seminar to compare experiences. The program to aid developing colleges is conducted by the Woodrow Wilson National Fellowship Foundation.

Benefits to Colleges and Interns

ing colleges, helping to install new record-keeping procedures, sophisticated computer planning systems, and the like. The interns commonly serve as assistants to presidents, to business managers, and to development officers. Some of them have been particularly successful in increasing the amount of federal and state funds for their institutions; others have brought about improved financial aid and purchasing practices. Less tangibly, many have influenced the attitudes of college administrations toward modern financial and management procedures. The benefits run both ways; many of the interns find the experience so rewarding that they decide to remain in academic administration.

In recent years the demand for interns has increased beyond the Woodrow Wilson Foundation's capacity to meet it. (The foundation pays expenses of recruiting, orientation, and relocation for the interns, and part of their salaries.) A moderate expansion of the program was therefore projected, from 20 positions in 1972-73 to 35 two years later. Support for the expansion was obtained from a number of foundations and corporations,

including the Sloan Foundation which early in 1973 granted \$135,000 over three academic years. In the current year, 25 interns are in service.

A uniquely valuable resource of the international economic community is the British Library of Political and Economic Science. It is used by scholars and advanced students from all over the world, especially from the United States, including those who come to study at the London School of Economics and Political Science. In recent years the Library's collection has grown so large that only a part of it can be effectively used. A solution to this problem arose when an adjacent building became available at a favorable price. The additional space would make possible not only adequate housing for the Library's books and documents, but also a major reorganization and extension of the activities of the London School of Economics. The Sloan Foundation joined in an international effort among governmental, corporate, and philanthropic sources to make these developments possible. The Sloan contribution, payable to the London School of Economics, was \$75,000. In this instance, because of the direct bearing on a Foundation program interest, the Foundation's usual constraints against support of international activities were waived.

These other grants in the area of economics and management were awarded in 1973:

EDUCATION DEVELOPMENT CENTER, Newton, Mass.: To provide partial support for the start-up costs of a special center for the training of public school administrators	\$17,000
HARVARD UNIVERSITY, Cambridge, Mass.: Start-up funds for support of Project Bolivar, of the University's Seminar on Science, Technology, and Public Policy	\$15,000
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.: Support for research in the Department of Economics	\$18,620

Enhancing a Collection in Economics

Related Problems of Society



A concern for education, especially higher and professional education, characterizes most of the Foundation's programs, both General and Particular. The ultimate intention is to educate individuals who will be able to strengthen society in areas where it needs strengthening.

To this end the Foundation has been supporting for the past two years a series of Interdisciplinary Student Task Forces aimed at helping university students bring their theoretical knowledge to bear on practical problems of public policy. Each task force, drawn from various departments and graduate and professional schools in its university, works with the help of a faculty adviser to evaluate current public policies toward a particular problem and to produce a report suggesting new policies where needed. The students are encouraged to employ knowledge and methods from all disciplines relevant to the problem, thus acquiring, it is hoped, a facility in working as part of an interdisciplinary group.

In the academic year 1971-72 student task forces from seven universities studied the problem of heroin addiction in cities. In 1972-73 the subject for eight task forces was the problem of the elderly in the United States.

This exercise does not end with the preparation of a report. Representative students from each group present and defend their recommendations before a national panel of experts in the field under study; the experts question the students on their premises, methods, and findings. Thus the students know in advance that they will be held accountable for their

recommendations, and they prepare them with care. They receive academic credit for their work on the task forces.

For 1973-74, a third group of ten task forces is at work, on the problems of financing higher education. The question of precisely who should pay how much for higher education is of concern to policy makers at every level of government, and of course to the students themselves; it has been the subject of numerous recent pronouncements and studies, including a Foundation-supported study by nine private institutions in the Northeast (Report for 1971, Page 24), soon to be completed. Thus the student task forces should find ample material for study.

For the current group of Interdisciplinary Student Task Forces, grants of \$10,000 each were made to:

CARNEGIE-MELLON UNIVERSITY, School of Urban and Public Affairs
DUKE UNIVERSITY
HARVARD UNIVERSITY, John F. Kennedy School of Government
INDIANA UNIVERSITY, School of Public and Environmental Affairs
UNIVERSITY OF MICHIGAN, Institute of Public Policy Studies
UNIVERSITY OF MINNESOTA, School of Public Affairs

PRINCETON UNIVERSITY, Woodrow Wilson School of Public and International Affairs
STANFORD UNIVERSITY, School of Education
STATE UNIVERSITY OF NEW YORK AT STONY BROOK, Program for Urban and Policy Sciences
UNIVERSITY OF WISCONSIN

Nearly all of our nation's cultural institutions are plagued by chronic and persistent operating deficits. Lincoln Center for the Performing Arts, in New York City, is no exception. As one possible solution to its problems, Lincoln Center is looking to technology, specifically to the telecasting of live performances of symphony, ballet, opera, drama, and chamber music for a fee over cable or pay television. The technological problems of doing this are considerable, to say nothing of the marketing and labor problems, but Lincoln Center proposed to make a start on them through a Media Development Program.

As part of this effort, Lincoln Center will study all the available technologies of telecasting and, probably, initiate development of new or modified equipment capable of transmitting from a concert hall or theater at a suitably high level of quality. The project is expected to culminate in actual videotaping of selected live performances, for comparative study of results of the different techniques and equipment employed. It is purely a research and development undertaking; no actual telecasts will be made, hence no performance fees are involved.

While the Sloan Foundation does not have a program interest in the arts, its interest in communications technologies, especially for educational

purposes, led to a grant of \$250,000 for the Media Development Program. Of that amount, \$150,000 is to be matched two-for-one from other sources.

Other grants in 1973 for related problems of society:

AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass.: In support of background meetings and a conference on Nuclear Deterrence in the 1980's and Determinants of Arms Policies \$18,000

COLLEGE ENTRANCE EXAMINATION BOARD, New York, N.Y.: For a College Scholarship Service conference on the self-supporting or "emancipated" student and subsequent publication and distribution of the proceedings . . . \$18,500

COUNCIL ON FOUNDATIONS, INC., New York, N.Y.: For general support . . . \$10,000

FEDERALISM SEVENTY-SIX, Washington, D.C.: For planning the development of programs in conjunction with the Bicentennial Celebration, aimed at enlarging citizen interest in and understanding of the American system of government \$10,000

HENRY STREET SETTLEMENT, New York, N. Y.: To provide partial support for the Henry Street School during the 1973-74 academic year . . . \$10,000

UNIVERSITY OF MAINE, Bangor, Maine: To support the establishment of a consortium of public institutions of higher education to develop a system of gathering and exchanging comparable information on financial and related matters \$19,900

PUBLIC EDUCATION ASSOCIATION, New York, N. Y.: For general support \$20,000

THE ST. VINCENT HOSPITAL, Worcester, Mass.: For a planning program to establish permanently the hospital's Medical Index Project, an annotated medical bibliography, together with formation of a consortium of medical schools \$16,500

UNION SETTLEMENT ASSOCIATION, New York, N. Y.: In support of an evaluative survey and report on the Settlement's College Readiness Program \$12,000

Policies and Procedures



THE Alfred P. Sloan Foundation was established in 1934 as a general-purpose philanthropic foundation by Alfred P. Sloan, Jr., for many years the chief executive officer of General Motors Corporation. Mr. Sloan was active in the Foundation's affairs until his death in 1966.

The basic interests of the Foundation are in science and technology, economics and management, and in education and the problems of society related to those interests. From these interests have arisen the Foundation's Particular Programs, currently focusing on the uses of technology in education; on neuroscience, the study of the brain and its relationship to behavior; on expanding opportunities for minorities in medicine and management, and on minority engineering education.

Excluded from the Foundation's interests are the creative and performing arts; religion, the humanities, and medical research except for that conducted at the Sloan-Kettering Institute for Cancer Research. International projects are not supported, with rare exceptions, and the Foundation does not normally make grants for endowment, general support, or buildings, or for equipment not part of a Foundation-supported program. No grants are made directly to individuals.

Proposals falling within the above guidelines may be submitted at any time, usually to the President of the Foundation. A letter of application should state: (1) the specific nature of the proposed activity or study; (2)

the procedure to be employed; (3) the name and qualifications of the person or persons to be responsible for the project, and (4) the expected cost and duration of the project. Often a preliminary letter of inquiry will be useful in determining whether a formal proposal would be warranted.

A grant application should be accompanied by documents indicating the applicant's tax-exempt status and its classification as either a private foundation or a publicly supported organization.

The Foundation is governed by a 19-member Board of Trustees assisted by a professional staff. Final disposition of all proposals is the responsibility of members of the Board.

Financial Review

Financial Review



THE financial statements of the Foundation, which have been audited by Haskins & Sells, independent certified public accountants, appear on pages 63 to 77. They include the balance sheet, the statement of income and funds, the statement of changes in financial position, the summary of administration and investment expenses, the schedule of marketable securities, and the summary and schedule of grants and appropriations.

Investment and other income in 1973 amounted to \$14,012,864, compared with \$13,580,299 in 1972. The increase of \$432,565 reflected higher dividend and interest income in 1973. Investment expenses in 1973 totalled \$316,982, of which \$271,465 represented investment counsel fees. Provision for Federal excise tax amounted to \$546,000 in 1973. These deductions from income totalled \$862,982 in 1973, compared with \$785,466 in 1972.

Net investment income was \$13,149,882 in 1973, compared with net investment income of \$12,794,833 in 1972.

The total of grants and appropriations authorized and administration expenses during 1973 amounted to \$15,305,333, or \$2,155,451 in excess of net investment income of \$13,149,882. Grants and appropriations totalled \$14,255,369 while administration expenses amounted to \$1,049,964. Over the Foundation's thirty-nine year history, the cumulative excess of grants and expenses over income has amounted to \$48,861,437.

The total of grant and appropriation payments in 1973 was \$14,135,492, compared with \$13,917,776 in 1972. Together with 1973 administration expenses, investment expenses and Federal excise taxes paid, the total of cash expenditures in 1973 was \$16,031,758, compared with \$15,689,181 in 1972.

A summary of the Foundation's marketable securities at ledger and quoted market value at December 31, 1973 appears on page 67. The market value of these investment assets of \$283,783,324 at December 31, 1973 compared with \$367,274,081 at December 31, 1972.

A summary of grants by major classifications followed by a listing of

grants made during 1973 will be found on pages 72 to 77. Grants and appropriations authorized and payments during the year ended December 31, 1973 are summarized in the following table:

Grants and appropriations authorized but not due at January 1, 1973	\$14,879,816
Authorized during 1973	<u>14,255,369</u>
	29,135,185
Payments during 1973	<u>14,135,492</u>
Grants and appropriations authorized but not due at December 31, 1973	<u>\$14,999,693</u>

The Foundation has a contributory retirement plan covering substantially all employees under arrangements with Teachers Insurance and Annuity Association of America and College Retirement Equities Fund which provides for purchase of annuities for employees. Retirement plan expense was \$87,435 and \$88,972 for 1973 and 1972, respectively.

The Internal Revenue Code, as amended by the Tax Reform Act of 1969, imposes an excise tax at the rate of 4% on the net investment income of private foundations. The accompanying financial statements include provision for this tax. No Federal excise tax has been allocated to net profit on disposals of securities added to principal fund, since the basis for determining gain or loss on disposals of securities under the Act resulted in a small net loss for excise tax purposes.

Income from investments credited to the General Motors Dealers Appreciation Fund during 1973, after provision for Federal excise tax, amounted to \$299,884. A grant of \$400,000 to the Sloan-Kettering Institute for Cancer Research was authorized and applied against this Fund, as set forth on page 46. Grant payments from this Fund during the year 1973 amounted to \$1,100,000, resulting in grants outstanding and unpaid at the end of 1973 of \$2,000,000.

The net worth of the Foundation at December 31, 1973, based on quoted market values, was divided as follows:

	TOTAL ASSETS AT MARKET VALUE	GRANTS AND APPROPRIA- TIONS AUTHO- RIZED BUT NOT DUE FOR PAYMENT	ACCRUED FEDERAL EXCISE TAX	FUND BALANCES AT MARKET VALUE
General Fund	\$278,030,426	\$12,999,693	\$536,470	\$264,494,263
General Motors Dealers Appreciation Fund	6,297,822	2,000,000	12,250	4,285,572
Total	<u>\$284,328,248</u>	<u>\$14,999,693</u>	<u>\$548,720</u>	<u>\$268,779,835</u>

HASKINS & SELLS

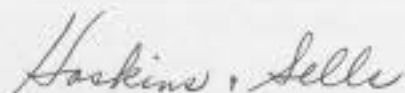
CERTIFIED PUBLIC ACCOUNTANTS

TWO BROADWAY
NEW YORK, NEW YORK 10004ACCOUNTANTS' OPINION

Alfred P. Sloan Foundation:

We have examined the balance sheet of Alfred P. Sloan Foundation as of December 31, 1973 and the related statements of income and funds and changes in financial position for the year then ended, and the supplemental schedules of administration and investment expenses, marketable securities, and grants and appropriations. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, such financial statements and supplemental schedules present fairly the financial position of the Foundation at December 31, 1973 and the results of its operations and the changes in its financial position for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.



February 1, 1974

Balance Sheet

December 31, 1973 and 1972

	<u>1973</u>	<u>1972</u>
<u>ASSETS</u>		
MARKETABLE SECURITIES:		
Fixed income securities:		
U.S. Government and agency obligations	\$ 38,169,364	\$ 26,782,990
Other bonds and notes	19,675,980	28,770,480
Total fixed income securities	<u>57,845,344</u>	<u>55,553,470</u>
Common stocks	153,406,901	153,292,986
Total marketable securities (quoted market: 1973—\$283,783,324; 1972—\$367,274,081)	211,252,245	208,846,456
CASH	544,924	333,855
TOTAL	<u>\$211,797,169</u>	<u>\$209,180,311</u>

OBLIGATIONS AND FUNDS

GRANTS AND APPROPRIATIONS AUTHORIZED		
BUT NOT DUE FOR PAYMENT	\$ 14,999,693	\$ 14,879,816
ACCRUED FEDERAL EXCISE TAX	548,720	532,040
FUND BALANCES	<u>196,248,756</u>	<u>193,768,455</u>
TOTAL	<u>\$211,797,169</u>	<u>\$209,180,311</u>

SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES:

The Foundation maintains its accounts on a modified cash basis, which in effect is not materially different from the accrual basis of accounting.

Marketable securities purchased are carried at cost; those received by gift or bequest are carried at quoted market value at date of gift or bequest. Gain or loss on disposal of securities is determined generally on the basis of first-in, first-out cost, but in certain instances the identified certificate basis is used. Net gain or loss on disposals is applied to the principal fund.

Dividend and interest income, and investment expense are recorded on a cash basis. The unrecorded amount of interest and dividends receivable, and investment expense payable is not material in relation to net assets or fund balances.

Grant appropriations are accrued at the time authorized by the Trustees and the Federal excise tax is accrued in the year to which it relates. There were no significant unpaid administration expenses at either year-end.

Statement of Income and Funds

For the years ended December 31, 1973 and 1972

INCOME:	<u>1973</u>	<u>1972</u>
Investment income:		
Dividends	\$ 10,532,075	\$ 10,263,190
Interest	3,455,964	3,304,212
Other	24,825	12,897
	<u>14,012,864</u>	<u>13,580,299</u>
Less:		
Investment expenses	(316,982)	(254,466)
Provision for Federal excise tax	(546,000)	(531,000)
Net investment income	<u>13,149,882</u>	<u>12,794,833</u>
Grants and expenses:		
Grants and appropriations authorized	14,255,369	15,069,592
Administration expenses	1,049,964	1,021,480
Total	<u>15,305,333</u>	<u>16,091,072</u>
Excess of grants and expenses over income for the year	(2,155,451)	(3,296,239)
Cumulative excess of grants and expenses over income from inception to:		
Beginning of year	(46,705,986)	(43,409,747)
End of year	<u>(48,861,437)</u>	<u>(46,705,986)</u>
PRINCIPAL:		
Balance at beginning of year	240,474,441	234,198,388
Assets received as remainderman of trusts	27,873	346,566
Net profit on disposals of securities	4,607,879	5,929,487
Balance at end of year	<u>245,110,193</u>	<u>240,474,441</u>
FUND BALANCES AT END OF YEAR	<u>\$196,248,756</u>	<u>\$193,768,455</u>

Statement of Changes in Financial Position

For the years ended December 31, 1973 and 1972

SOURCE OF FUNDS:	<u>1973</u>	<u>1972</u>
Investment and other income	\$14,012,864	\$13,580,299
Assets received as remainderman of trusts	27,873	346,566
Net profit on disposals of securities	4,607,879	5,929,487
	<u>18,648,616</u>	<u>19,856,352</u>
APPLICATION OF FUNDS:		
Grant and appropriation payments	14,135,492	13,917,776
Administration expenses	1,049,964	1,021,480
Investment expenses	316,982	254,466
Federal excise taxes paid	529,320	495,459
	<u>16,031,758</u>	<u>15,689,181</u>
INCREASE (DECREASE) IN FUNDS CONSISTING OF:		
Change in ledger value of investments	2,405,789	4,615,461
Change in cash balances	211,069	(448,290)
	<u>\$ 2,616,858</u>	<u>\$ 4,167,171</u>

Summary of Administration and Investment Expenses

For the years ended December 31, 1973 and 1972

	<u>1973</u>	<u>1972</u>
ADMINISTRATION EXPENSES:		
Salaries and employee benefits:		
Salaries	\$ 529,044	\$ 542,414
Employees' retirement plan and other benefits	140,108	135,007
	<u>669,152</u>	<u>677,421</u>
Rent*	184,567	147,058
Program expenses	114,649	102,001
Office expenses and services	75,407	84,214
Professional fees	27,896	31,239
Reports and publications	23,810	26,041
Total administration expenses	1,095,481	1,067,974
Less: Allocation of administration expenses applicable to investments	45,517	46,494
Balance of administration expenses applicable to grant making	<u>\$1,049,964</u>	<u>\$1,021,480</u>
INVESTMENT EXPENSES:		
Investment counsel fees	\$ 271,465	\$ 207,972
Allocation of administration expenses applicable to investments	45,517	46,494
Total investment expenses	<u>\$ 316,982</u>	<u>\$ 254,466</u>

*The Foundation occupies office facilities under a lease which expires April 30, 1985 and provides for annual rental payments (including real estate taxes) of approximately \$200,000 a year.

Schedule of Marketable Securities

December 31, 1973

SUMMARY	LEDGER AMOUNT	QUOTED MARKET VALUE	
		AMOUNT	PERCENT OF TOTAL INVESTMENT
Fixed Income Securities:			
U.S. Government and agency obligations	\$ 38,169,364	\$ 37,690,825	13.3%
Other bonds and notes	19,675,980	19,430,729	6.8
Total fixed income securities	<u>57,845,344</u>	<u>57,121,554</u>	<u>20.1</u>
Common Stocks:			
General Motors	47,865,564	57,225,719	20.2
All other	105,541,337	169,436,051	59.7
Total common stocks	<u>153,406,901</u>	<u>226,661,770</u>	<u>79.9</u>
Total marketable securities	<u>\$211,252,245</u>	<u>\$283,783,324</u>	<u>100.0%</u>

	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
FIXED INCOME SECURITIES			
U.S. Government and Agency Obligations:			
Treasury Bills:			
—January 17, 1974	\$ 6,035,000	\$ 5,983,954	\$ 6,015,386
—June 4, 1974	3,105,000	2,893,026	3,005,361
Treasury Notes:			
5.625%—August 15, 1974	3,000,000	2,902,500	2,961,540
5.75% —November 15, 1974	3,000,000	3,002,812	2,958,750
6% —May 15, 1975	2,000,000	2,003,750	1,970,000
6.50% —May 15, 1976	2,000,000	1,997,945	1,985,000
6.25% —February 15, 1978	2,500,000	2,509,766	2,448,425
Federal Home Loan Banks			
Consolidated Bonds:			
7.95% —August 25, 1975	680,000	682,341	684,250
7.20% —May 25, 1976	1,000,000	1,002,031	995,000
7.75% —February 25, 1980	1,300,000	1,301,219	1,324,375

Schedule of Marketable Securities

December 31, 1973

(continued)

	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
FIXED INCOME SECURITIES			
Twelve Federal Land Banks Con- solidated Federal Farm Loan Bonds:			
5.70% —July 21, 1975	\$ 2,055,000	\$ 2,053,990	\$ 1,998,488
5.125%—April 20, 1978	500,000	416,250	460,625
7.30% —October 20, 1982	1,000,000	1,007,500	997,500
Federal National Mortgage Association Debentures:			
5.20% —January 19, 1977	3,000,000	3,011,250	2,827,500
7.25% —June 10, 1981	300,000	297,656	297,375
6.65% —June 10, 1982	1,000,000	1,002,500	952,500
6.05% —February 1, 1988	1,000,000	996,250	860,000
7% —March 10, 1992	5,350,000	<u>5,104,624</u>	<u>4,948,750</u>
Total U.S. Government and agency obligations		<u>38,169,364</u>	<u>37,690,825</u>
Other Bonds and Notes:			
Undivided Interest in Demand Notes:			
Atlantic Richfield Company	6,000	6,000	6,000
General Electric Company	955,000	955,000	955,000
Florida Power & Light Company			
First Mortgage Bonds			
3.50% —January 1, 1974	1,000,000	862,520	993,750
General Motors Acceptance Corporation Debentures:			
3.625%—September 1, 1975	1,000,000	810,600	932,500
5% —September 1, 1980	1,300,000	1,300,000	1,124,500
5% —March 15, 1981	1,500,000	1,492,500	1,276,875
National Dairy Products Corporation Debentures			
3.125%—June 1, 1976	200,000	158,664	177,000

Schedule of Marketable Securities

December 31, 1973

(continued)

	PRINCIPAL AMOUNT	LEDGER AMOUNT	QUOTED MARKET VALUE
FIXED INCOME SECURITIES			
Household Finance Corporation Sinking Fund Debentures			
4.625%—January 15, 1977	\$ 1,015,000	\$ 870,118	\$ 913,500
Public Service Electric and Gas Company Debenture Bonds			
4.625%—March 1, 1977	1,223,000	1,096,630	1,102,229
Morgan Guaranty Trust Company of New York Capital Notes			
6.375%—April 1, 1978	1,000,000	1,000,000	955,000
Bankers Trust New York Corporation Debentures			
6.375%—September 1, 1978	1,000,000	997,500	937,500
General Electric Credit Corporation Notes			
7% —February 15, 1979	2,000,000	1,995,000	1,970,000
American Telephone and Telegraph Company Debentures:			
4.375%—April 1, 1985	1,500,000	1,518,210	1,123,125
8.75% —May 15, 2000	2,500,000	2,502,188	2,700,000
Aluminum Company of Canada, Limited Sinking Fund Debentures			
9.50% —March 1, 1995	1,000,000	1,012,500	1,061,250
International Paper Company Sinking Fund Debentures			
8.85% —March 15, 1995	1,500,000	1,553,750	1,627,500
Dow Chemical Company Debentures			
8.875%—May 1, 2000	1,500,000	<u>1,544,800</u>	<u>1,575,000</u>
Total other bonds and notes		<u>19,675,980</u>	<u>19,430,729</u>
Total fixed income securities		<u>\$57,845,344</u>	<u>\$57,121,554</u>

Schedule of Marketable Securities

December 31, 1973

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Alcon Laboratories, Inc.	51,000	\$ 1,811,451	\$ 1,504,500
American Home Products Corporation	60,000	2,164,861	2,407,500
American Telephone and Telegraph Company	30,000	1,595,517	1,503,750
Avon Products, Inc.	31,000	1,382,511	1,976,250
BankAmerica Corporation	36,100	1,633,425	1,683,163
Baxter Laboratories, Inc.	31,000	1,009,749	1,491,875
Black and Decker Manufacturing Company	13,820	1,400,135	1,382,000
Caterpillar Tractor Co.	50,000	1,489,726	3,350,000
Central and South West Corporation	50,000	653,569	837,500
Clorox Company	100,000	409,294	1,362,500
Coca-Cola Company	17,000	1,669,683	2,150,500
Walt Disney Productions	24,524	766,594	1,181,934
Dow Chemical Company	29,000	1,530,517	1,667,500
Dun & Bradstreet Companies, Inc.	48,000	1,412,906	1,548,000
Eastman Kodak Company	104,154	2,522,077	12,081,864
Exxon Corporation	54,167	2,636,955	5,098,469
First Bank System, Inc.	20,000	1,230,500	1,155,000
First Chicago Corporation	36,228	753,105	2,549,546
First National Boston Corporation	45,000	851,683	1,839,375
First National City Corporation	46,000	1,524,025	2,104,500
General Electric Company	50,000	2,287,451	3,150,000
General Motors Corporation	1,240,666	47,865,564	57,225,719
General Reinsurance Corporation	9,000	1,893,850	1,836,000
Government Employees Life Insurance Company	28,800	1,941,621	1,584,000
Halliburton Company	30,000	2,462,318	5,797,500
Household Finance Corporation	60,000	737,671	1,177,500
Howard Johnson Company	86,800	2,300,836	1,009,050
International Business Machines Corporation	88,280	6,092,917	21,783,090
International Flavors & Fragrances Inc.	19,000	1,682,536	1,517,625
Johnson & Johnson	20,000	1,590,413	2,255,000
S. S. Kresge Company	58,000	2,397,230	1,899,500
Eli Lilly and Company	43,000	2,636,167	3,187,375
Louisiana Land and Exploration Company	52,000	2,208,855	2,665,000

Schedule of Marketable Securities

December 31, 1973

(continued)

COMMON STOCKS	NUMBER OF SHARES	LEDGER AMOUNT	QUOTED MARKET VALUE
Lowe's Companies, Inc.	39,600	\$ 2,301,650	\$ 1,504,800
Lubrizol Corporation	73,000	3,134,412	2,719,250
MassMutual Mortgage and Realty Investors	80,000	2,014,187	1,130,000
Merck & Co., Inc.	53,000	518,429	4,279,750
Middle South Utilities, Inc.	68,000	1,219,354	1,147,500
Minnesota Mining and Manufacturing Company	24,000	1,331,058	1,872,000
Mobil Oil Corporation	77,000	2,211,643	4,081,000
J. P. Morgan & Co. Incorporated	107,272	1,800,027	7,401,768
Northwest Bancorporation	42,000	615,477	2,530,500
Northwestern Mutual Life Mortgage and Realty Investors	86,700	2,037,151	1,929,075
J. C. Penney Company, Inc.	24,400	1,775,864	1,750,700
Philip Morris Incorporated	15,000	1,862,933	1,721,250
Polaroid Corporation	30,300	2,932,922	2,117,213
Procter & Gamble Company	53,000	889,253	4,876,000
Ralston Purina Company	26,000	1,067,762	1,079,000
Research-Cottrell, Inc.	40,000	2,535,616	1,550,000
Schering Plough Corporation	18,000	1,345,800	1,278,000
Jos. Schlitz Brewing Company	20,000	1,239,442	1,120,000
Schlumberger Limited	45,600	1,544,154	6,013,500
Sears, Roebuck and Co.	78,805	1,711,618	6,324,101
Skaggs Companies, Inc.	110,000	2,612,838	1,333,750
Southeast Banking Corporation	44,000	1,139,144	1,342,000
Squibb Corporation	25,500	2,305,438	2,059,125
Standard Oil Company of California	60,000	2,261,234	2,100,000
Superior Oil Company	5,900	1,770,789	1,740,500
Texaco Inc.	118,652	1,839,222	3,485,403
Upjohn Company	10,000	952,296	717,500
Wachovia Corporation	52,500	1,621,839	1,653,750
Xerox Corporation	15,000	269,637	1,841,250
Total common stocks		153,406,901	226,661,770
Total fixed income securities		57,845,344	57,121,554
Total marketable securities		\$211,252,245	\$283,783,324

Summary of Grants and Appropriations

	AUTHORIZED BUT NOT DUE DECEMBER 31, 1972	CHANGES DURING 1973		AUTHORIZED BUT NOT DUE DECEMBER 31, 1973
		AUTHORIZED	PAYMENTS	
Sloan Fellowships for Basic Research (158 fellowships in 66 colleges and universities)	\$ 2,080,641	\$ 1,404,016	\$ 1,417,512	\$ 2,067,145
Sloan National Scholarship Program	299,668	—	299,668	—
College Science Program (14 colleges and universities)	1,000,000	63,000†	427,500	509,500
Major Grants to colleges and universities	6,076,900	10,069,000	7,876,000	8,269,900
Other Major Grants:				
Association for the Integration of Management, Inc.	\$ —	\$ 100,000	\$ 50,000	\$ 50,000
Brookings Institution	250,000	150,000	200,000	200,000
Engineers' Council for Professional Development, Inc.	—	225,000	—	225,000
Joint Council on Economic Education	256,200	—	141,200	115,000
Lincoln Center for the Performing Arts, Inc.	—	250,000	150,000	100,000
NAACP Legal Defense and Educational Fund, Inc.	170,000	—	60,000	110,000
National Academy of Sciences	116,000	—	67,000	49,000
National Bureau of Economic Research, Inc.	250,000	—	35,614	214,386
National Medical Fellowships, Inc.	200,000	750,000	950,000	—
Neurosciences Research Foundation, Incorporated	150,000	—	50,000	100,000
Sloan-Kettering Institute for Cancer Research	2,700,000	400,000	1,100,000	2,000,000
Woodrow Wilson National Fellowship Foundation	—	135,000	100,000	35,000
TOTAL OTHER MAJOR GRANTS	4,092,200	2,010,000	2,903,814	3,198,386
Staff Grant appropriation for grants in ensuing year	750,000	898,653	898,653	750,000
Other Grants and Appropriations (none over \$100,000 in 1973)	580,407	63,300	312,345	204,762
TOTAL GRANTS AND APPROPRIATIONS	<u>\$14,879,816</u>	<u>\$14,255,369</u>	<u>\$14,135,492</u>	<u>\$14,999,693</u>

† Cancellation of prior year authorization.

Schedule of Grants and Appropriations

	AUTHORIZED	CHANGES DURING 1973		AUTHORIZED
	BUT NOT DUE	AUTHORIZED	PAYMENTS	BUT NOT DUE
	DEC. 31, 1972			DEC. 31, 1973
A&T University Foundation, Inc.		\$ 100,000		\$ 100,000
Adelphi University		138,500	\$ 46,500	92,000
Albion College	\$ 4,222		4,222	
American Academy of Arts and Sciences		48,000	48,000	
American Association for the Advancement of Science		2,000	2,000	
American Society for Engineering Education		20,000	20,000	
Amherst College	157,392		82,392	75,000
Antioch College	2,417		2,417	
Arizona, University of	7,475		7,475	
Arizona State University		16,100	8,050	8,050
Association for the Integration of Management, Inc.		100,000	50,000	50,000
Atlanta University	100,000	9,800	109,800	
Baylor College of Medicine		10,000	10,000	
Beloit College		74,800		74,800
Boston University	16,100		16,100	
Bowdoin College	5,300		5,300	
Bowling Green State University		9,746	9,746	
Brandeis University	9,775	23,000	16,675	16,100
Bridgeport, University of	64,800		64,800	
British Columbia, University of	10,350	23,000	21,850	11,500
Brookings Institution	250,000	150,000	200,000	200,000
Brown University	27,205	43,680	47,095	23,790
California, University of	349,120	1,009,037	579,050	779,107
California Institute of Technology	436,545	50,586	212,481	274,650
California State University and Colleges Foundation		16,000	16,000	
Carleton College	4,790	85,000	47,290	42,500
Carnegie-Mellon University	258,787	10,000	148,787	120,000
Case Western Reserve University	9,857	35,259	27,498	17,618
Chicago, University of	96,300	86,135	151,730	30,705
Clark University		55,000	27,500	27,500
Colby College	2,510		2,510	
Colgate University	7,672	75,000	45,172	37,500
College Entrance Examination Board		18,500	18,500	
Colorado, University of	3,450	16,100	12,420	7,130
Colorado State University	8,050		8,050	
Columbia University	222,097	40,601	241,423	21,275
Conference Board of the Mathematical Sciences		6,000	6,000	
Consortium for Graduate Study in Management	200,000		200,000	
Cornell College		20,000		20,000
Cornell University	94,772	365,864	138,027	322,609
Council on Foundations, Inc.	40,000	10,000	30,000	20,000
Dartmouth College	21,390	600,000	21,390	600,000
Davidson College	2,092		2,092	
Detroit Institute of Technology		135,000	55,000	80,000
Drexel University		18,000	18,000	
Duke University	179,290	25,804	200,379	4,715
Education Development Center, Inc.		37,000	37,000	

	AUTHORIZED	CHANGES DURING 1973		AUTHORIZED
	BUT NOT DUE	AUTHORIZED	PAYMENTS	BUT NOT DUE
	DEC. 31, 1972			DEC. 31, 1973
Educational Products Information Exchange Institute		\$ 20,000	\$ 20,000	
Engineers' Council for Professional Development, Inc.		225,000		\$ 225,000
Engineers Joint Council, Inc.		10,000	10,000	
Federalism Seventy-Six		10,000	10,000	
Fisk University		32,000	32,000	
Florida Agricultural and Mechanical University		190,000	100,000	90,000
Foundation Center	\$ 80,000		40,000	40,000
Georgetown University	70,000		35,000	35,000
Georgia Institute of Technology	1,500	305,000	156,500	150,000
Grinnell College	2,530	70,000	37,530	35,000
Hall of Science of the City of New York, Inc.		10,000	10,000	
Hamilton College	2,605		2,605	
Harvard University	126,667	952,915	784,777	294,805
Harvey Mudd College	181,000		126,000	55,000
Haverford College		80,000	40,000	40,000
Hebrew University of Jerusalem		19,675	19,675	
Henry Street Settlement		10,000	10,000	
Houston, University of	3,680	15,000	18,680	
Howard University	310,000		310,000	
Illinois, University of	298,525	49,285	271,935	75,875
Indiana University Foundation		10,000	10,000	
Institute for Advanced Study	75,000		75,000	
International Brain Research Organization		10,000	10,000	
Iowa, University of	11,735		11,735	
Iowa State University		18,400	9,200	9,200
Johns Hopkins University	15,492	38,400	43,542	10,350
Joint Council on Economic Education	256,200		141,200	115,000
Kentucky, University of		33,240	27,950	5,290
Knox College	2,580	55,000	30,080	27,500
Lafayette College		151,300	50,000	101,300
Lehigh University	5,115		5,115	
Lincoln Center for the Performing Arts, Inc.		250,000	150,000	100,000
Lincoln University	1,645		1,645	
London Graduate School of Business Studies	105,000		105,000	
London School of Economics and Political Science		75,000	75,000	
Long Island University		15,000	15,000	
Maine, University of		109,900	64,900	45,000
Maryland, University of	19,550	18,975	21,965	16,560
Massachusetts, University of	10,350	300,000	10,350	300,000
Massachusetts General Hospital		20,000	20,000	
Massachusetts Institute of Technology	501,805	954,185	500,100	955,890
McGill University	8,050		8,050	
Michigan, University of	168,311	26,100	186,361	8,050
Michigan State University	8,050	31,150	23,250	15,950
Middlebury College		80,000	40,000	40,000
Minnesota, University of	2,250	446,905	240,295	208,860

Schedule of Grants and Appropriations

	AUTHORIZED BUT NOT DUE		CHANGES DURING 1973		AUTHORIZED BUT NOT DUE	
	DEC. 31, 1972		AUTHORIZED	PAYMENTS	DEC. 31, 1973	
	\$		\$	\$	\$	
Mississippi, University of						
Morehouse College	\$ 1,487		\$ 6,200	\$ 6,200		
Mount Holyoke College			70,000	35,000	\$ 35,000	
NAACP Legal Defense and Educational Fund, Inc.		170,000		60,000	110,000	
NAACP Special Contribution Fund		75,000		25,000	50,000	
National Academy of Sciences		116,000	31,269	98,269	49,000	
National Bureau of Economic Research, Inc.		250,000		35,614	214,386	
National Medical Fellowships, Inc.		200,000	750,000	950,000		
Neurosciences Research Foundation, Incorporated		150,000		50,000	100,000	
New Mexico, University of		100,000	140,000	100,000	140,000	
New York Public Library		30,000		30,000		
New York University		376,000	82,100	417,050	41,050	
North Carolina, University of		128,050	274,510	144,960	257,600	
Northeastern University		10,350	105,000	10,350	105,000	
Northwestern University			51,100	43,050	8,050	
Notre Dame, University of		7,115	220,000	127,115	100,000	
Oberlin College		7,532	50,000	32,532	25,000	
Occidental College		2,417	70,000	37,417	35,000	
Ohio State University		2,250	230,900	122,250	110,900	
Oklahoma Christian College			16,900	16,900		
Oklahoma City University			20,000	20,000		
Oregon, University of		8,050		8,050		
Oregon State University			4,903	4,903		
Pennsylvania, University of		193,000	100,000	193,000	100,000	
Pittsburgh, University of			102,765	16,155	86,610	
Pomona College		2,372		2,372		
Prairie View A&M University			100,000		100,000	
Pratt Institute		60,000		60,000		
Princeton University		611,245	60,355	216,200	455,400	
Public Education Association			20,000	20,000		
Purdue University		9,150	315,000	166,650	157,500	
Queen's University			15,295	7,475	7,820	
Reed College			107,974	54,137	53,837	
Research Foundation of The City University of New York			315,686	106,686	209,000	
Research Foundation of State University of New York		32,315	543,470	234,750	341,035	
Rice University		130,810	16,100	138,860	8,050	
Rochester, University of			57,492	45,992	11,500	
Rockefeller University		11,500	145,000	31,500	125,000	
Rutgers—The State University			15,000	15,000		
Sloan-Kettering Institute for Cancer Research		2,700,000	400,000	1,100,000	2,000,000	
Smith College			62,000		62,000	
Smithsonian Institution			190	190		
Society for Industrial and Applied Mathematics			18,500	18,500		
Southern California, University of			242,000	121,000	121,000	
Southern Illinois University			16,100	4,830	11,270	
Southern Methodist University			17,500	17,500		
Spence School			14,000	14,000		
St. Vincent Hospital			16,500	16,500		

(continued)

	AUTHORIZED BUT NOT DUE		CHANGES DURING 1973		AUTHORIZED BUT NOT DUE	
	DEC. 31, 1972		AUTHORIZED	PAYMENTS	DEC. 31, 1973	
	\$		\$	\$	\$	
Stanford University	\$ 206,390		\$ 87,729	\$ 265,875	\$ 28,244	
Stony Brook Foundation, Inc.	15,000		10,000	25,000		
Swarthmore College			75,000	25,000	50,000	
Technical Education Research Center, Inc.			15,000	15,000		
Temple University	7,450			7,450		
Texas, University of	357,785		54,280	288,950	123,115	
Texas Southern University			193,000	96,500	96,500	
Tulane University	4,557			4,557		
Tuskegee Institute	1,442		100,000	1,442	100,000	
Union Settlement Association			12,000	12,000		
United Negro College Fund, Inc.	82,500			82,500		
United Productions Limited			1,275	1,275		
Utah, University of			32,775	16,330	16,445	
Vanderbilt University	6,725		15,200	17,325	4,600	
Vermont, University of			39,839	39,839		
Virginia, University of	300,000		19,595	160,970	158,625	
Wabash College	4,557			4,557		
Washington, University of	31,310		322,150	192,885	160,575	
Washington and Lee University			40,000	20,000	20,000	
Washington University			16,100	8,050	8,050	
Waterloo, University of			15,985	8,395	7,590	
Wayne State University	8,050			8,050		
Wentworth Institute			15,000	15,000		
Wesleyan University	8,050			8,050		
West Virginia University			22,790	11,280	11,510	
Western Ontario, University of	6,440			6,440		
Whitman College	2,000			2,000		
Williams College	7,672		150,000	82,672	75,000	
Windsoe, University of			21,620	10,695	10,925	
Wisconsin, University of	21,800		66,680	67,090	21,390	
Wisconsin Foundation, University of			322,000	200,000	122,000	
Woodrow Wilson National Fellowship Foundation			155,000	120,000	35,000	
Xavier University of Louisiana			162,600	54,200	108,400	
Yale University	216,140		19,550	125,915	109,775	
Yeshiva University			440,000	240,000	200,000	
Sloan Fellowships for Basic Research to be granted in ensuing year	1,400,000				1,400,000	
Staff Grant appropriation for grants in ensuing year	750,000				750,000	
College Science Program	1,000,000		937,000*			
Instructional Television	100,000		63,000†			
Part-time MBA program	70,000		63,300*	670	36,030	
Other appropriations for grants and related expenses	27,907		64,600*			
	14,879,816		78,622	47,797	58,732	
Reduction for Grant Transfers			14,320,241	14,200,364	14,999,693	
			64,872	64,872		
TOTAL GRANTS AND APPROPRIATIONS	\$14,879,816		\$14,255,369	\$14,135,492	\$14,999,693	

* Transfer of appropriation to grants authorized.

† Cancellation of prior year authorization.

Index

A&T University Foundation, Inc. (North Carolina A&T State University), 32, 74
Adelphi University, 46-47, 74
Albion College, 74
American Academy of Arts and Sciences, 48, 56, 74
American Association for the Advancement of Science, 48, 74
American Society for Engineering Education, 34, 74
Amherst College, 19, 74
Antioch College, 74
Arizona, University of, 74
Arizona State University, 44, 74
Association for the Integration of Management, Inc., 27, 72, 74
Atlanta University, 24, 27, 74
Baylor College of Medicine, 30, 74
Beloit College, 16, 74
Boston University, 74
Bowdoin College, 74
Bowling Green State University, 74
Brandeis University, 44, 74
Bridgeport, University of, 74
British Columbia, University of, 44, 74
Brookings Institution, 50-51, 72, 74
Brown University, 44, 74
California, University of, 14, 16, 17, 22, 26, 27, 44, 74
California Institute of Technology, 44, 74
California State University and Colleges Foundation, 17, 74
Carleton College, 42, 74
Carnegie-Mellon University, 26, 55, 74
Case Western Reserve University, 44, 74
Chicago, University of, 17, 26, 44, 49, 74
City University of New York, 38, 39
Clark University, 47, 74
Colby College, 74
Colgate University, 42, 74
College Entrance Examination Board, 56, 74
College Science Program, 41-43, 72, 77
Colorado, University of, 45, 74
Colorado State University, 74
Columbia University, 26, 44, 45, 74
Conference Board of the Mathematical Sciences, 49, 74
Consortium for Graduate Study in Management, 74
Cornell College, 42, 74
Cornell University, 17, 26, 45, 47, 74
Council for Opportunity in Graduate Management Education, 24, 26
Council on Foundations, Inc., 56, 74
Dartmouth College, 6, 11-12, 26, 74
Davidson College, 74

Detroit Institute of Technology, 48, 74
Drexel University, 17, 74
Duke University, 21, 45, 55, 74
Education Development Center, Inc., 16, 53, 74
Educational Products Information Exchange Institute, 17, 75
Engineers' Council for Professional Development, Inc., 33-34, 72, 75
Engineers Joint Council, Inc., 34, 75
Federalism Seventy-Six, 56, 75
Fisk University, 16, 75
Florida Agricultural and Mechanical University, 26, 75
Foundation Center, 75
Georgetown University, 75
Georgia Institute of Technology, 38, 75
Grinnell College, 42, 75
Hall of Science of the City of New York, Inc., 49, 75
Hamilton College, 75
Harvard University, 17, 26, 27, 30, 45, 51, 53, 55, 75
Harvey Mudd College, 75
Haverford College, 41, 42, 75
Hebrew University of Jerusalem, 23, 75
Henry Street Settlement, 56, 75
Houston, University of, 27, 75
Howard University, 4, 29, 75
Illinois, University of, 17, 45, 75
Indiana University Foundation, 55, 75
Institute for Advanced Study, 75
International Brain Research Organization, 23, 75
Iowa, University of, 75
Iowa State University, 45, 75
Johns Hopkins University, 30, 45, 75
Joint Council on Economic Education, 72, 75
Kentucky, University of, 30, 45, 75
Knox College, 41, 42, 75
Lafayette College, 38, 75
Lehigh University, 75
Lincoln Center for the Performing Arts, Inc., 55-56, 72, 75
Lincoln University, 75
London Graduate School of Business Studies, 75
London School of Economics and Political Science, 53, 75
Long Island University, 27, 75
Maine, University of, 13-14, 56, 75
Maryland, University of, 45, 75
Massachusetts, University of, 21, 75
Massachusetts General Hospital, 23, 75

Massachusetts Institute of Technology, 19, 26, 38, 44, 45, 48, 49, 53, 75
McGill University, 75
Meharry Medical College, 4
Michigan, University of, 45, 55, 75
Michigan State University, 45, 75
Middlebury College, 42, 75
Minnesota, University of, 20, 23, 38, 45, 55, 75
Mississippi, University of, 30, 76
Morehouse College, 76
Mount Holyoke College, 42, 76
NAACP Legal Defense and Educational Fund, Inc., 72, 76
NAACP Special Contribution Fund, 76
Nassau Community College, 12
National Academy of Sciences, 34, 49, 72, 76
National Bureau of Economic Research, Inc., 72, 76
National Medical Fellowships, Inc., 24, 28-29, 72, 76
Neurosciences Research Foundation, Incorporated, 72, 76
New Mexico, University of, 28, 76
New York Public Library, 76
New York University, 30, 45, 46, 76
North Carolina Agricultural and Technical State University, 32
North Carolina, University of, 16, 45, 76
Northeastern University, 28, 76
Northwestern University, 23, 45, 76
Notre Dame, University of, 13, 76
Oberlin College, 43, 76
Occidental College, 43, 76
Ohio State University, 39, 76
Oklahoma Christian College, 17, 76
Oklahoma City University, 18, 76
Oregon, University of, 76
Oregon State University, 76
Pennsylvania, University of, 21, 26, 76
Pittsburgh, University of, 21, 27, 45, 76
Pomona College, 76
Prairie View A&M University, 33, 76
Pratt Institute, 76
Princeton University, 8, 45, 48, 55, 76
Public Education Association, 56, 76
Purdue University, 39, 40, 76
Queen's University, 45, 76
Reed College, 43, 45, 76
Research Foundation of The City University of New York, 38, 76
Research Foundation of State University of New York, 12-13, 45, 76
Rice University, 45, 76
Rochester, University of, 45, 76
Rockefeller University, 19, 44, 76
Rutgers—The State University, 49, 76

Sloan Fellowships for Basic Research, 19, 43-45, 72, 77
Sloan-Kettering Institute for Cancer Research, 46, 57, 72, 76
Smith College, 43, 76
Smithsonian Institution, 49, 76
Society for Industrial and Applied Mathematics, 49, 76
Southern California, University of, 39, 76
Southern Illinois University, 45, 76
Southern Medical School Consortium, 12
Southern Methodist University, 49, 76
Spence School, 18, 76
St. Vincent Hospital, 56, 76
Stanford University, 26, 32, 44, 45, 55, 77
State University Agricultural and Technical College at Farmingdale, 12
Stony Brook Foundation, Inc. (State University of New York at Stony Brook), 55, 77
Suffolk County Community College, 12
Swarthmore College, 38, 40, 77
Technical Education Research Center, Inc., 49, 77
Temple University, 77
Texas, University of, 44, 45, 77
Texas Southern University 24-25, 77
Tulane University, 25-26, 77
Tuskegee Institute, 33, 77
Union Settlement Association, 56, 77
United Negro College Fund, Inc., 77
United Productions Limited, 49, 77
Utah, University of, 45, 77
Vanderbilt University, 45, 77
Vermont, University of, 18, 23, 77
Virginia, University of, 45, 77
Wabash College, 77
Washington, University of, 40, 45, 77
Washington and Lee University, 43, 77
Washington University, 45, 77
Waterloo, University of, 45, 77
Wayne State University, 77
Wentworth Institute, 48, 77
Wesleyan University, 77
West Virginia University, 45, 77
Western Ontario, University of, 77
Whitman College, 77
Williams College, 30, 43, 77
Windsor, University of, 45, 77
Wisconsin, University of, 18, 40, 45, 55, 77
Wisconsin Foundation, University of, 77
Woodrow Wilson National Fellowship Foundation, 51-53, 72, 77
Xavier University of Louisiana, 25-26, 77
Yale University, 45, 77
Yeshiva University, 23, 77

CREDITS

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