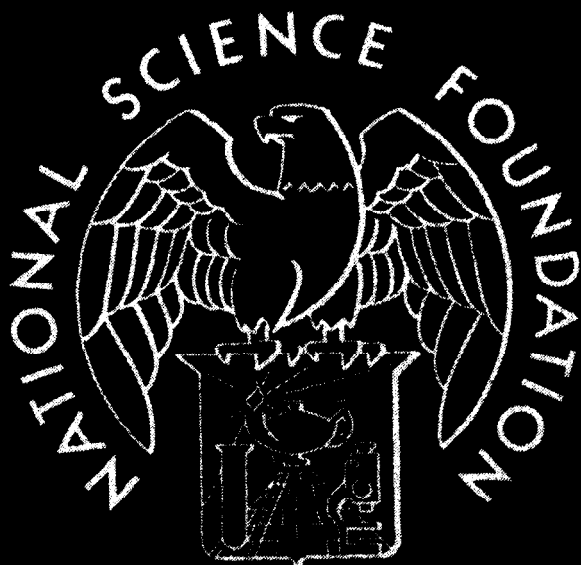


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NATIONAL SCIENCE FOUNDATION

Fifth Annual Report, Fiscal Year 1955

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NATIONAL SCIENCE FOUNDATION

Fifth Annual Report, Fiscal Year 1955



UNITED STATES GOVERNMENT PRINTING OFFICE

WASHINGTON, D. C.

Letter of Transmittal

WASHINGTON 25, D. C.

November 1, 1955

MY DEAR MR. PRESIDENT:

I have the honor to transmit herewith the Annual Report for Fiscal Year 1955 of the National Science Foundation for submission to the Congress as required by the National Science Foundation Act of 1950.

Respectfully,

ALAN T. WATERMAN,

Director, National Science Foundation

The Honorable

The President of the United States.

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Foreword

The following Fifth Annual Report of the National Science Foundation presents the major accomplishments of the Foundation, not only for the year ending June 30, 1955, but for the 5-year period. Of equal importance it describes the nature of many of the important problems with which the Foundation is concerned and what has been accomplished with respect to them, and what is in process toward the solution of some of them.

During the 5-year period it is evident that the public has become more and more aware of the importance of the development of science for national defense; for the general welfare; and for international cooperation. Indeed, during recent months it has been made quite evident in many ways that the promotion of science is not merely important but an urgent national problem requiring the cooperation of many private, educational and industrial institutions, and in many respects support and leadership by State and Federal Governments. It seems quite clear that the urgency will increase with the growth of scientific knowledge and its application through technology, with increasing specialization and complexity. One can hardly read this report without being impressed with the difficulty and complexity of an adequate solution of the tasks before us.

It seems much clearer now than it did when the National Science Foundation was established that the Federal Government must play an indispensable role in what must be a great and determined national effort. This role is only partly financial and only partly related to national security. It will be evident in the following pages that leadership by the central government will be necessary with respect to many phases of the work, particularly in the securing of factual knowledge about what is going on in science and technology, about who are carrying on scientific work, about the availability of future workers and about the resources available and needed for the continuation of scientific effort. The emphasis surely must be placed upon the development of both the competence and the interest of individuals. This has heretofore been nearly exclusively the function of the colleges and universities and of private foundations. Thus far, the support for the development of indi-

viduals by the Federal Government has undoubtedly been small compared with that given by the educational institutions, the private foundations and private individuals. That given through the National Science Foundation, through fellowships and grants for research, though increasing each year, has been relatively small.

It seems clear that the magnitude of the problem is such that the aid of the Federal Government will become increasingly indispensable in the development of an adequate cadre of scientific personnel. Moreover, in the last 15 years a revolution has occurred in scientific work in that much of it now calls for exceedingly expensive structures and equipment for accelerators, observatories, high pressure apparatus, ships, electronic computers, etc., which already have outrun the financial capacity of private resources, and this will increasingly be the case. Only the Federal Government, that is, all the people, will be able to meet the deficiency after all possible private resources have been utilized. Both the needs of national security and the promotion of the general welfare justify this support, although it must be asserted that the limiting factor should be the availability of men rather than of dollars. It seems probable that the maximum funds that can be effectively utilized for the promotion of science will be relatively small in proportion to the national budget, simply because the number of individuals competent and willing to be scientists will always be limited.

The situation we now confront was envisaged by Congress in the establishment of the National Science Foundation. Its mission is to promote science and the development of scientists in this country. Other agencies of the Government are, of course, involved and interested in this effort and to some extent will necessarily endeavor to support pure science research in fields related to their missions. Only the National Science Foundation, however, has as its exclusive function and reason for existence, leadership for the Government in the promotion of science and the channeling of Government support therefor without any other functions to color its ability to act and to give authoritative advice to the Government and other agencies with respect to governmental policies relating to science. These functions are those of leadership rather than direction. The increasing need for coordination can be accomplished almost spontaneously by the development of facts regarding the aspects of the scientific situation and much more can be accomplished by facilitating communication between scientists and scientific institutions. A number of instances of this is given in the following report.

The stimulation of increased collaboration is one of the means by which the National Science Foundation discharges its task. This

view of the functions of the Foundation is really embodied in its organization as prescribed by the National Science Foundation Act. It provides for a Director appointed by the President, supported by a permanent and part-time staff, and this part of the organization is quite analogous to that of any other Government agency. The other part, however, consists of the National Science Board. Its members, appointed by the President with the approval of the Senate, though technically officers of the Government, are not in any ordinary sense employees of the Government. They are, on the contrary, representatives of communities. They are required to be selected from the community of scientists, educators, and of general affairs. They are not paid salaries but are given small fees for the attendance of meetings. They are not, however, a mere advisory body.

In addition to the fact that awards in support of basic scientific research and for fellowships must be approved by the Board, the Board formulates, considers or endorses appropriate answers to questions of policy. It therefore functions for the Federal Government in the field of science promotion in the way somewhat analogous to that of many public school boards who control distribution of public funds as a voluntary service without remuneration. During the 5 years of its work this peculiar organization, depending upon cooperation between the Board and the Director, has worked exceedingly well. Enough time has now elapsed so that it is appropriate to record that the Board has been well pleased with the results obtained by the staff under conditions frequently difficult. The expression "well pleased" does not, however, mean that the job is satisfactorily behind us. On the contrary, the magnitude of the task is now much clearer and the extent of "unfinished business" now seems to be really large.

CHESTER I. BARNARD,
Chairman, National Science Board.

PART I

Current Aspects

of American

Science

The Year in Review

All the people of the United States are stakeholders in the success of basic scientific research. From this Fifth Annual Report of the National Science Foundation comes clear evidence of the affirmative manner in which the resources of these stakeholders are being used selectively to seed promising scientific ground throughout the several States.

However modest the total amount, the nearly \$8,000,000 disbursed by the Foundation across the Nation represents a timely endowment of the work of principal investigators and their research assistants and associates. To the lay reader, the following examples of the kind of grant approved by the Foundation may signify little—University of California (Berkeley), Otto Struve, *The Composition of the Stars*; University of Utah, Henry Eyring, *Theory of Reaction Rates*; Columbia University, P. Kusch, *Energy Levels and Hyperfine Structure of Helium Three and Four*; University of North Dakota, Donald E. Severson, *Mass Transfer Rates under Forced Convection*; Long Island Biological Association, Cold Spring Harbor, New York, M. Demerec, *Equipment for Virus and Bacterial Genetics Research*. But to the scientist, these grants and more than 500 others have a reassuring meaning—a chance to precipitate the known from the unknown for a better understanding of nature and man and in order that his discoveries in basic research can help his associates in applied and developmental science to produce finer electronic instruments, better vaccines, more disease resistant crops. Even today our socio-economic structure is built solidly on foundations embedded deeply in basic scientific research—breakthroughs ground out of the obstinate unknown in the recent and distant past. The objective of the National Science Foundation is to help keep the grindstone turning by a discriminate selection of men and facilities found most deserving of Federal support in order that the breakthroughs of today will sustain the Nation tomorrow.

As expressed in more detail in the section on *Support of Basic Research in Science* (page 45), such Federal support was extended through 588 grants in the biological, medical, physical, mathematical and engineering sciences to 184 institutions in 47 States, the District of Columbia, Hawaii, Puerto Rico, England, and Italy. The average research

grant for fiscal year 1955 was \$13,400 to run for 2.7 years, or about \$5,000 per year.

In the same selective manner, the Foundation has acted with respect to the inadequate total supply of scientists. Of those graduating from colleges each year, too many are being drained off into applied and developmental research to support the particular missions of industry and agencies of Government. Inducements to work in these latter fields are too enticing to disregard—although the compensations of accomplishment are tremendous in basic research, the work is not highly remunerative.

Although modest, the \$1,850,000 representing Foundation support for graduate fellowships during the academic year 1955–56, assured about 800 pre- and post-doctoral fellows an opportunity to continue their full-time work in basic scientific research. Average annual costs for a pre-doctoral fellow are about \$2,500; and for postdoctorals, \$4,180.

To these two programs—*Support of Basic Research in Science and Training of Scientists and Engineers*—the Foundation dedicated last year nearly \$10,000,000, or (exclusive of the International Geophysical Year) about 80 percent of the total appropriation made to it by the Congress. These figures compare with a total national expenditure for research and development during fiscal year 1954 which reached a record high estimated at over \$5 billion, of which nearly one-half was contributed by the Federal Government. From this total over two-thirds represented research and development undertaken by industry, but over a third of this amount, in turn, was financed by the Federal Government. National Science Foundation surveys show that of the total 1954 industrial research and development effort only 4 percent went into basic research.

Other programs called for major attention by the Foundation during fiscal year 1955. One in particular, the International Geophysical Year, promises to capture the imagination of all peoples as it approaches a climax in 1957 and 1958. Although lay interest will be centered on the drama surrounding launching of earthbound satellites and expeditions to Antarctica, scientific interest will focus on measurable results which will come from the worldwide cooperative efforts of scientists in 40 nations who will collect and coordinate geophysical data. The National Academy of Sciences, responsible for planning and executing the United States program, has established a special United States National Committee for the International Geophysical Year to carry out actual operations of the program. Administration of overall Federal participation is entrusted to the National Science Foundation. (Page 21.)

Unsatisfactory communications among scientists challenge efforts to help establish an efficient system for exchange of scientific information. Published material in the sciences is fast reaching overwhelming proportion. Coincidentally, costs of published material are constantly climbing. Investigators in a particular field must have access to the research of their associates in the same field before unimpeded progress can be made in basic research. Modern machine methods may provide some relief. The Foundation allocated to the solution of this problem a small share of its resources during fiscal 1955. (Page 80).

The loyalty of investigators seeking Foundation grants in support of unclassified basic research received careful consideration. The Foundation enunciated a principle widely endorsed by responsible groups of scientists. The Foundation will not knowingly support anyone who is, by admission or conviction, disloyal to the United States. In the interest of science, however, the Foundation will not pass judgment on the loyalty of an individual on the basis of unsupported charges but will make grants upon the judgment of outstanding scientists in his field and persons in intimate contact with him as to his competence and integrity. (Page 18).

Incident to the direct costs of scientific research using support from the Federal Government are certain indirect costs reflected in such items as administration, plant operation and maintenance, use and depreciation of buildings and equipment, and the like. At the request of the Bureau of the Budget, the Foundation last year gave special attention to the problem and recommended a uniform Federal policy for allowing the indirect costs in Government-sponsored research. (Page 28).

In order to provide forums for the exchange of ideas among scientists working in special areas, the Foundation helped underwrite 21 conferences during fiscal 1955—largely in instances where adequate support was not available from industrial or other institutional sources. Frequently attended by scientists of other nations, these conferences served as an effective clearinghouse for the interchange of concepts relating to new or incompletely explored fields. Some of the conferences brought together scientists of inter-related disciplines, resulting in a healthy cross fertilization of ideas. (Page 35).

Meanwhile, at home and abroad, science continued to assert itself. The first International Conference on the Peaceful Uses of Atomic Energy, held at Geneva, Switzerland, in July, was the outstanding scientific event of the year for citizens of all nations. The conference, called by the United Nations, was a direct outgrowth of President Eisen-

hower's "Atoms for Peace" proposals made last year. Scientists from 74 countries participated in the presentation and discussion of hundreds of scientific papers on the physics, chemistry, metallurgy, medicine, and biology involved in the fuller exploitation of atomic energy. Observers in great numbers, including industrialists, bankers, and public officials, attended sessions and exhibits and talked informally with delegates to learn when and how the promise of atomic energy for peace would become actuality. Over 2,000 journalists sent day-by-day accounts of the meetings to millions of readers and listeners in their respective homelands.

A vast quantity of unpublished scientific information was revealed for the first time at the Geneva sessions. Although experimental methods and techniques varied from country to country, it was clear to all that the world's scientists working behind walls of national security had common aims and had achieved strikingly similar results. A leading American theorist noting this fact remarked that "it is gratifying to learn that nature is the same on both sides of the Iron Curtain!" Announcement by several nations, including the United States, of current studies on the possibility of controlled energy release by thermonuclear or fusion reactions was a highlight of the meetings.

During the year bilateral agreements were made between the United States and 28 other nations for the exchange of information, technical assistance, and in some cases, materials for the construction and operation of research reactors. This program also was inaugurated as part of the Atoms-for-Peace plan.

During the year the Food and Agricultural Organization at Rome issued a 10-year summary of world agricultural developments since World War II. The report showed great improvement in some areas of the world in the ability of nations to meet minimum requirements for food and agricultural raw materials. This in large part was attributable to scientific agriculture, but there was no cause for complacency among scientists. In many areas it was clear that growing populations continue to outpace agricultural progress.

Throughout the United States research laboratories continued to report significant findings in all fields of science. Some led almost immediately to practical developments. In most cases, however, the results were less susceptible of immediate application serving more as bricks and mortar to buttress and strengthen the structure of science.

The nationwide program of antipolio vaccination proceeded vigorously, despite problems incident to getting into large-scale vaccine production.

At the Langley Aeronautical Laboratory, research scientists reported the aerodynamic principles that led to the design of the low-drag, pinch-waisted fuselage for aircraft at supersonic speeds. This development, supported by the National Advisory Committee for Aeronautics, has been described as "the most significant military scientific breakthrough since the atomic bomb" and "the kind of breakthrough that makes fundamental research so important."

Scientists and engineers at many other Federal laboratories reported discoveries of significance in a variety of fields. Among these were research in the kinetics and dynamics of metabolic processes at Brookhaven National Laboratory and the pioneering research of the Bureau of Standards on the reflecting layers of the upper atmosphere.

Basic research received encouraging emphasis in the Nation's industrial laboratories. Among scientific developments originating in industrial laboratories were the announcements of diamond synthesis at the General Electric Research Laboratories and the synthesis of natural rubber by scientists at research centers of the Goodrich-Gulf, Firestone, and Good-year corporations.

The biological and genetic implications of radioactive fall-out engaged the attention of biologists and medical scientists. Both in this country and abroad extensive research was under way on the prevention and control of air pollution, a by-product of the age of machines and in certain localities one of the most critical current problems in human ecology. The Department of Health, Education, and Welfare undertook a modest program of research looking toward ultimate solution of the air pollution problem.

The Commission on Organization of the Executive Branch of the Government (Hoover Commission) in its report on research and development in the Government made a strong plea for greater emphasis upon basic research. The report stated in part that "the foundation of the greatest sector of human advancement in modern times is basic research into nature's laws and materials. It is from these sources that come the raw materials of applied science. We owe to basic research the fabulous improvement in the health of the Nation; the greatest industrial productivity known to man; the weapons of defense which have protected our independence; and our knowledge of the laws which govern the Universe."

During the year more and more voices expressed concern at the existing, and even more critical future, shortages in the supply of trained scientific manpower. Leaders in education, industry, and Government

were increasingly alarmed at the social and cultural waste of manpower resources resulting from the failure of fully half of our most talented youth to continue their education beyond secondary school. Lack of finances was seen to be only part of the problem. Lack of adequate motivation to seek advanced training and a possible decline in public acceptance of the importance of higher education seemed to be of at least equal importance.

The National Science Foundation and Science Policy

A Four-Year Review

At the heart of the determination of national science policy is the role of the Federal Government in the encouragement and support of science. The Congress of the United States, in the National Science Foundation Act, directed the Foundation to support basic research in science, and in the area of policy forming it directed the Foundation to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences. The National Science Foundation took the position that it could be an effective policy-forming agency only after it had matured with a body of experience in operating science research programs.

While its act gave the Foundation great flexibility in the manner of research support, many advantages were found in support procedures successfully used by other agencies since the war, namely, by furnishing funds in response to applications or proposals from qualified scientists on problems of their own choice. The research support program of the Foundation was built on this basis. Typically, a grant is made by the Foundation to an institution for a specified amount and time on behalf of an individual research scientist or small group of scientists. The funds enable the scientists to continue or initiate a specified piece of scientific research for which his institution has made application.

Research can be supported by aiding departments or institutions without specification as to the precise nature of the scientific work to be done. However, the Foundation believes that at present it can best aid progress in science and the development of a concerted scientific effort throughout the country by selecting for support those problems in science adjudged most meritorious in the eyes of the country's leading experts in the respective fields.

Initiation of its research support program was a long step forward for the Foundation. Individual reviewers of research proposals, advisory panels for broad evaluations of special fields, and general committees such as the statutory divisional committees helped guide policy in operations, and laid a solid foundation on which this phase of policy might be

based. After careful deliberation the Foundation reached a series of decisions for research administration on such matters as indirect costs, reimbursement of institutions for salaries, summer employment, and similar considerations. Policy decisions directed toward the resolution of immediate operating problems of the Foundation affect, as well, relationships among scientists, universities and agencies of the Federal Government.

Support by the Federal Government affects scientific progress in three important aspects, namely, science itself, institutions concerned with science, and individuals engaged in scientific activities. Foundation support programs are directed toward removing road blocks to progress in all three of these areas. Now, out of considerable experience, policy guide lines have been drawn with respect to—

- (a) the paramount necessity for increased support of basic research in the sciences;
- (b) considerations of loyalty in connection with grants for nonclassified basic research;
- (c) the training of scientists;
- (d) the stimulation of improvement in science teaching; and
- (e) the provision of facilities and equipment for the support of research.

In all its efforts "to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences" the Foundation has cooperated formally and informally with other Federal agencies whose programs include science. In many ways this sharing of experience is akin to the unwritten considerations which underlie the universally recognized methods by which scientists achieve progress in their own research.

Following passage of the National Science Foundation Act, certain basic decisions were reached with respect to its grant program which still stand today as the administrative frame within which the Foundation operates.

- (a) Grants in support of basic research, declared meritorious following review by scientists in that scientific field, would be awarded to institutions on behalf of the principal investigator.
- (b) Grants would be made for the period of time required by the research project, up to a maximum of 5 years.
- (c) Grants would include a reasonable amount for indirect costs. As an interim policy, the Foundation determined that this amount may be up to 15 percent of the total direct costs in the grant

request. Now being revised, Foundation policy with respect to indirect costs is described in detail in the section of this report beginning at page 28.

- (d) Grants could include, as well, allowance for publication costs anticipated, including purchase of reprints.
- (e) Grants, under normal circumstances, would permit title to equipment purchased or constructed with grant funds to be vested in the grantee institution.

The Foundation soon discovered deficiencies in precise knowledge as to the state of scientific activities as a whole, and in the nature and amount of national resources expended in scientific pursuits. The Foundation concentrated its efforts primarily therefore on systematically surveying ways to remove these deficiencies. One of the most effective ways in which knowledge can be acquired in pure science lies in an approach through the disciplines or fields of science, following closely the opinions and advice of panels or committees of experts. By the same approach, knowledge can be obtained of the Federal role in the support of basic science. Close collaboration exists between Federal agencies engaged in basic research, and by tapping into this reservoir of knowledge the Foundation soon acquired an understanding of the science content of Federal agency programs on the part of all agencies similarly engaged.

Status of Science Studies

Although organized science faces many problems, each field—and often subfield—of a scientific discipline is in a unique position in terms of its particular development and current status. Long-range studies of the development and progress of fields of science are necessary underpinnings for the development of broader policy. Such studies, to be most useful, must stimulate the interest and active cooperation of working scientists. Four have been supported by the Foundation to date.

Physiology. The survey of physiological science by the American Physiological Society is under the general direction of a committee representative of the several subdisciplines of physiology. Information has been gathered and analyzed on approximately 3,500 American physiologists. As a result, definitive data are now available on the profession of physiology—the educational, social, economic and geographic backgrounds of physiologists; what activities physiologists engage in and how they divide their time among research, teaching and administration. Such personal and motivational factors as why persons enter and leave

the field and the problems encountered in practicing it have also been studied. Other areas under analysis, for which results are not yet available, include studies of the function of scientific literature in physiological science, of college course offerings in physiology and a special evaluation of the presentation of physiological science to the lay public.

Psychology. The development and status of psychology in the United States is being studied by the American Psychological Association under contract with the National Science Foundation. This study is divided into two major parts, one concerned with an evaluation of the status of psychological knowledge, the other with an analysis of occupations in psychology. This part of the study is nearing completion and will be published in book form in the spring of 1956. Preliminary data reveal important differences in values and activities between productive research psychologists and those whose research contributions are negligible.

Mathematics. As a result of a pilot study of applied mathematics, sponsored by the Foundation, a special committee of mathematicians under the auspices of the American Mathematical Society is concerned with surveying research potential and training in the field as a whole. This major study has been recently organized and preliminary planning has been concerned with methods of obtaining information relevant to the problems of increasing our national resources in mathematics.

Demography. The fourth study under way is an evaluation of the status of demography—the statistical study of populations—as a science. This survey will not touch upon the characteristics of demographers but will concentrate instead upon substantive problems. A basic objective is to determine gaps and deficiencies in the fund of knowledge of demography, its theory and methodology, and also in its resources and facilities for research and training. The basic evaluative materials will be obtained from individual scholars whose contribution to the literature indicate special competence in the areas surveyed. The staff of the Population Research and Training Center of the University of Chicago, with Foundation aid, will edit the papers for publication and prepare summarizing statements emphasizing frontiers for research in demography.

Although none is finally completed, all these studies have aroused much interest and ferment in their respective disciplines. Meetings of professional societies have been organized around study plans and preliminary results. These surveys promise to be a stimulating force in the field as well as an important guide to National Science Foundation planning. They become most meaningful as a method of developing science policy

when considered in conjunction with the Foundation-supported science conferences (page 35) convened throughout the year to bring together scientists representative of one or more disciplines in order that they may be provided workshop forums for exchanging ideas.

Fact-Finding Studies

The Foundation has made another major effort to uncover the basic information needed before certain policy decisions can be reached—the series of studies presenting data on the total national effort in science. In contrast to the surveys-of-science described above, this series has concentrated, not on the status of a particular discipline, but rather on the total picture of scientific activities in the United States.

The ascending role of the Federal Government has provided one of the focal points of study. Prior to World War II, organized scientific research received little support from the Federal Government apart from limited activity in the Government's own laboratories and installations and the program in support of agricultural research at the land-grant colleges. The demands of World War II necessitated the beginnings of contract research performed for the Government by scientists in universities, independent laboratories and industrial concerns. An assessment of the extent and impact of Federal activity in science has been long overdue.

The initiation of a basic series of reports entitled *Federal Funds for Science* has been the first step in providing detailed information on the extent of Government activity. Gross figures for all scientific expenditures, both intramural and extramural, have now been compiled for fiscal years 1952 through 1955. By establishing this series on a yearly basis, important trends in the level and direction of Federal expenditures for science may be analyzed. A historical study of Federal Government activities in science from 1789 to 1940, being done for the Foundation by the American Academy of Arts and Sciences, will add perspective and depth to current analyses. This study is in the final stages.

In addition to background-trend data, the breadth and scope of current Government operations affecting science is an important factor in establishing sound national policy. In the life sciences, psychology, and the social sciences, semiannual and annual listings have been made for the extramural unclassified research programs of all Federal agencies. These reports are valuable both to Federal officials responsible for program planning and to research workers in the field.

On a broader front, encompassing all disciplines, a large-scale review has been undertaken of current Federal research programs. This study will provide detailed data for fiscal years 1953 and 1954 on the funds spent for research, the types of research programs involved, and the scientific manpower resources of Government. A report on the organization of the Federal Government for scientific activities will be available early in 1956 showing the structure of Federal units and functions performed in science. The overall picture of Federal Government activities in science will be completed in companion reports on funds and personnel.

A large part of total scientific research is performed with the financial support of the Government by scientists working in private organizations—nonprofit research institutes, commercial laboratories, trade associations, labor unions, industry, and universities. The research and development activities of each of these organizational units have been surveyed with particular emphasis upon areas of mutual concern to Government and to the institution or organization.

A crucial area for the future of science, particularly basic research, involves Government-university relations. Educational institutions traditionally have been the home of basic research. The Federal Government has in the last few years, however, entered the campus in a major way through its sponsorship of specific research and its support of more generalized research. To inquire into the problems raised by these new relationships as they affect the universities the National Science Board appointed an Advisory Committee on Government-University Relationships.

At the same time, the Foundation staff is analyzing sources of support for research at universities and colleges, the nature of such research, and the effect of research upon the teaching programs of the institutions. The highlights of a survey of graduate-student enrollment were released in 1955. This study covered approximately 152,000 resident graduate students in the United States in 1951. (The U. S. Office of Education estimated the total number of graduate students in all fields at 223,832 during the academic year 1953-54.) Roughly one-third were enrolled in the natural and engineering sciences—31,000 in the natural, 14,250 in engineering sciences. Graduate students receiving financial assistance in the form of (1) teaching assistantships and (2) research assistantships and (3) fellowships represented about 25 percent of the 152,000 total studied. Almost two-thirds of the graduate students receiving support were paid from funds provided by academic institutions; the remaining one-third received assistance from noninstitutional sources. Over one-half of the latter group were supported from Federal sources.

State universities are a special case since they receive, in most instances, funds from both Federal and State government sources. A pilot study of six State governments and the State universities concerned indicates that the States vary widely in allotments of funds for scientific research and development. Research is done primarily by State universities and by in-service State units, concentrating for the most part on agricultural problems.

A survey of industrial research and development is obtaining estimates on a nationwide basis of the amounts spent for the conduct of research by size of companies and by industry groups; of the source of these funds by major economic sectors; and of the amount spent by companies to purchase research conducted elsewhere, as in universities and research institutes. In designing the study special attention was focused on problems of scientific and technical personnel in industry.

Private foundations are generally assumed to be a source of substantial support for scientific research. A study made for the Foundation by the Russell Sage Foundation indicates that within recent years basic scientific research has received less and less support from the 77 largest private foundations. This study covered the years 1939, 1946, and 1953. Medical sciences and social sciences were the fields of greatest interest to private foundations.

The continuing concern of the National Science Foundation with problems of scientific and technical manpower has resulted in many background studies. This information has been compiled and published in "Scientific Personnel Resources."

Special Policy Reports

When the role of the National Science Foundation in science policy was first deliberated, two types of studies were decided upon. The first was of long-range studies for the development of knowledge about the national research effort in science. This is the type of study discussed in the two sections above.

In addition to long-range studies the Foundation decided that special studies of an urgent nature should be undertaken. "These should be on topics of interest from the standpoint of the present emergency, the general welfare or significance to science itself, and should be defined within limits sufficiently narrow to permit completion without undue delay. The aim of such studies would be to determine the extent of research at present being conducted, the degree of Federal support, and the basic research needed to make maximum progress in the special area considered."

Since that decision, the Foundation has engaged in several special studies. The Secretary of Health, Education, and Welfare, requested that the Foundation undertake a review and evaluation of the medical research programs of that department. A special committee of leading scientists in the medical research area was appointed to undertake the study and make recommendations by the close of 1955.

Upon recommendation of the Rubber Producing Facilities Disposal Commission, the Foundation was asked to undertake the administration of the basic rubber research program that had been supported by the Federal Facilities Corporation at universities and institutes. As an integral part of this responsibility the Foundation appointed a Special Commission for Rubber Research to make recommendations on the future role of the Federal Government in synthetic rubber research.

The Bureau of the Budget requested the Foundation to recommend a uniform policy for indirect costs of research supported by the Federal Government at universities and colleges. Careful attention was given this problem by the staff of the Foundation and the Advisory Committee on Government-University Relationships. The National Science Board endorsed the final recommendations transmitted by the Director.

Other policy areas which have been of special concern to the National Science Foundation are minerals research—a concern arising from recommendations of the President's Materials Policy Commission; the support of research by medical students, and the role of the Foundation with respect to social science research. On the latter point, the Board approved, in August 1954, a limited program of support of selected social science areas.

A relatively new and major activity has been the systematic study of the national need for scientific installations and facilities. In this evaluation the Foundation has been assisted by various advisory bodies composed of specialists in the disciplines concerned. Acting on their recommendations the Foundation has recommended, as a national policy, the desirability of Government support of large-scale basic scientific facilities when the need is clear and it is in the national interest and when funds are not readily available from other sources. The Foundation has emphasized, however, that it regards as a primary responsibility the broad development of science through support of individual investigators. Examples of recommended installations are: a national astronomical observatory, a major radio astronomy facility, research installations of computers, accelerators and reactors, and specialized biological field-stations. The Foundation is now devoting attention to means of putting these recommendations into effect.

Summary

Stemming from its legislative and executive directives, the National Science Foundation has been concerned from its inception with problems of national science policy. It found a void in the basic data essential to sound planning. The first step toward policy formulation is necessarily the painstaking task of accumulating relevant data concerning the national effort in scientific research and development. The several studies noted above are efforts in that direction. Larger issues have been approached through study of scientific research, study of special problem areas, and lastly, through operations of the National Science Foundation itself. Although each aspect of the total program of surveys will achieve only limited impact on the resolution of national science policy, the Foundation is confident that together the individual parts will add up to a sound basis for planning long-range policies affecting the Nation's scientific efforts.

Loyalty and Security Considerations in Making Grants for Nonclassified Scientific Research

Loyalty as a consideration in Federal support of nonclassified basic scientific research has its origin in measures developed to protect the national security during and since World War II. Balancing the need for widespread research and dissemination of scientific information with the need for imposing restrictions to protect the security of the United States has posed difficult problems.

The increasing significance of science and scientific research in the defense and economic strength of the United States makes it most important that relations between the Federal Government and American scientists remain healthy and therefore conducive to maximum scientific progress. It is vital that this partnership of science and Government be strengthened in every way possible, and that elements tending to create conflict and distrust be eliminated.

As an outgrowth of World War II efforts to maintain the national security, increasing attention was paid to the reliability of individuals working on scientific or other matters involving classified information. Considerations of security and loyalty were rightly applied to the employment and performance of personnel engaged in such work. Later the applicability of similar criteria to those engaged in nonclassified basic scientific research became a matter for consideration. However, no current provisions of law or of any executive order require the withholding or termination of a Federal grant or contract in support of unclassified research on the basis of the existence of derogatory information regarding the loyalty of anyone connected with such research. Furthermore, where research does not involve classified information, no consideration of national security can be relevant. When national security is not involved, inquiry into the political thoughts and beliefs of individuals has traditionally been contrary to American principles.

National Science Foundation grants or contracts for nonclassified research are normally made to institutions intimately acquainted with the scientist directing the proposed research project. Before an award is made, the scientific competence and integrity of the scientist involved are carefully considered by panels of outside scientists who know his qualifi-

cations. In such cases, loyalty or security-type investigations are clearly undesirable and unlikely to serve any useful purpose. Present investigative facilities would be taxed beyond capacity if character inquiries were required on the many scientists currently working on unclassified research projects. A substantial proportion of the funds available for research would be drained off into costs of investigation.

Unclassified basic scientific research, whether or not supported by Federal grant or contract, poses no security problem. In supporting such research by grant or contract it is hoped that it will lead to results which will be published and disseminated as broadly as possible. There is no danger of unauthorized release of classified security information. The only reason, therefore, that the loyalty of an individual scientist working on a federally sponsored project would appear to be involved is on the principle that it would appear to be against the national interest thus to give aid and comfort to a person disloyal to the United States. The national welfare, on the other hand, requires the greatest possible encouragement to the participation of competent scientists in basic research which can contribute so much to our scientific progress, to our defense and to our well-being. While realizing, therefore, that there is no place for the disloyal person in Government-sponsored science, our policy and procedures must, at all times, take into consideration the aims we seek to attain, while supporting our basic traditions of justice and freedom.

Bearing in mind the considerations mentioned above, the policy of the National Science Foundation in processing proposals for grants in support of unclassified research, not involving considerations of security, is to assure that in appraising the merit of a proposal for unclassified research submitted by or on behalf of a scientist, his experience, competence and integrity are always taken carefully into account by scientists having a working knowledge of his qualifications. However, the Foundation does not knowingly give nor continue a grant in support of research for one who is:

1. An avowed Communist or anyone established as being a Communist by a judicial proceeding, or by an unappealed determination by the Attorney General or the Subversive Activities Control Board pursuant to the Subversive Activities Control Act of 1950, or anyone who avowedly advocates change in the U. S. Government by other than constitutional means, or

2. An individual who has been convicted of sabotage, espionage, sedition, subversive activity under the Smith Act, or a similar crime involving the Nation's security.

Furthermore, if substantial information indicates that a potential or actual researcher might be guilty of violating any law or regulation, the information would be forwarded to the Department of Justice for appropriate action.

The Foundation, therefore, will not knowingly support anyone who is, by admission or conviction, disloyal to this country. In the interest of science, however, it will not pass judgment on the loyalty of an individual on the basis of unsupported charges but will rely upon the judgment of those who best know the individual and his qualifications. This position of the Foundation has been endorsed by the American Association for the Advancement of Science in a resolution passed at its annual meeting in Berkeley last winter. We believe it to be in the best interests of the Nation.

International Geophysical Year

The International Geophysical Year (IGY) is a world-wide program of special observations of various earth sciences phenomena planned for the period July 1, 1957, through December 31, 1958. Under the auspices of the International Council of Scientific Unions 40 nations are planning a vast, joint effort to collect coordinated geophysical data on a world-wide basis in such fields as meteorology, upper atmosphere physics, including the ionosphere, aurora, geomagnetism, oceanography, glaciology, seismology and as a special additional program, redetermination of latitudes.

The planning and technical direction of the United States program is in the hands of the United States National Committee for the International Geophysical Year. The committee exists under the aegis of the National Academy of Sciences-National Research Council. Members of the committee and its technical panels include many prominent scientists in geophysics and related fields in the United States.

The National Science Foundation, at the request of the United States National Committee sought and obtained appropriations from the Congress for the United States program in the International Geophysical Year. The Foundation is responsible for administering certain aspects of the Federal program, including coordination of Government interests in the undertaking. Federal appropriations to the Foundation for support of the United States program may be made available by grant or transfer of funds to other Government agencies and private institutions engaged in the work.

The basic scientific program for the International Geophysical Year was described in Appendix VII (pp. 123-134) of the *Fourth Annual Report* of the National Science Foundation.

The Rome Meeting, September 1955

The second full meeting of the Special Committee for the International Geophysical Year of the International Council of Scientific Unions was

held in Rome, September 30 to October 4, 1954. Over a hundred delegates from some 30-odd nations were present. At this meeting a thorough review was made of all national programs for the International Geophysical Year. During the course of the meeting four principles were enunciated which had up to that time tacitly applied to the process of selecting suitable projects for the International Geophysical Year. They are as follows:

(1) Problems requiring concurrent synoptic observations at many places on the globe, involving coordinated effort by many nations;

(2) Problems, the solution of which will be aided by the availability of the results of synoptic or other concentrated geophysical work undertaken during the International Geophysical Year;

(3) Problems which can take advantage of the occupation of stations in regions of the earth at which comparatively little geophysical effort has been devoted in the past (these would include, in addition to synoptic programs, such fields as gravity and seismology);

(4) Observations of geodetic and other slowly varying geophysical phenomena for purposes of comparison with similar observations in future epochs.

During the technical review of International Geophysical Year programs, it was apparent that very few changes were required in the United States program to conform with the recommendations of the special committee as they then existed.

Earth Satellite Program

The most dramatic of the resolutions passed by the special committee at the Rome meeting was a recommendation urging that participating nations consider the feasibility of constructing small, unmanned, earth-circling satellite vehicles to be used for basic observations of extra-terrestrial phenomena.

The atmosphere of the earth acts as a huge shield against many of the types of radiation and objects that are found in outer space. It protects the earth from things which are known to be or might be harmful to human life, such as excessive ultra-violet radiation, cosmic rays, and those solid particles known as meteorites. At the same time, however, it deprives man of the opportunity to observe many of the things that could contribute to a better understanding of the universe. In order to acquire data that are presently unobtainable, it is most important that scientists be able to place instruments outside the earth's atmosphere in

such a way that they can make continuing records of the various properties about which information is desired.

Vertical rocket flights to extreme altitudes have provided some of the desired information, but such flights are limited to very short periods of time. Only by the use of a satellite can sustained observations in both space and time be achieved. Such observations will also indicate the conditions that would have to be met and the difficulties that would have to be overcome, if the day comes when man goes beyond the earth's atmosphere in his travels.

For several months following the Rome meeting the United States National Committee investigated the possibility of this country's participation in a satellite program. The feasibility of the project was discussed at length with representatives of the Foundation and the Department of Defense. In July the President announced that the United States would include the attempted launching of scientific satellites as part of its national program for the International Geophysical Year. Technical advice and assistance in the program were to be provided by scientists of the Department of Defense, who for many years had been engaged in research on the upper atmosphere. The Department of Defense will also provide the required equipment and facilities for launching the satellite.

Description of Satellite

Under the proposal the satellite itself will be the final stage of a multi-stage rocket launching vehicle. The development work, designated by the Department of Defense as Project Vanguard, will be carried on by a number of industrial groups, under the general direction of the Glen L. Martin Co., prime contractor and builders of the Viking rocket for the United States Navy.

Although the exact shape and size of the small scientific satellite have not been firmly established, it will be large enough to contain scientific measuring instruments and to be tracked from the ground by optical and radio telemetering devices.

As presently contemplated, the Vanguard, the first man-made satellite, will consist of three rocket stages plus the satellite itself. The first rocket will start the entire assembly vertically on the first part of its flight. When its fuel is exhausted, the first stage will drop off, and the second rocket, deflected from the vertical, will thrust the satellite upward. The third rocket carrying the satellite proper, will accelerate it to a top speed of about 18,000 miles an hour, which will establish the satellite in its

orbit, where it will continue under its own momentum. This high velocity is required to balance the centrifugal force of the satellite against the earth's gravitational pull.

The satellite's orbit will be elliptical rather than circular, ranging from 800 miles away at its farthest point from the earth to approximately 200 miles distant at its nearest point. The satellite will continue to circle the earth for several days, making the round trip in from 60 to 120 minutes. The cumulative effect of the drag of the earth's atmosphere, thin though it is at altitudes of 200 miles or more, will be sufficient to alter the course of the satellite and make it gradually spiral in closer to the earth. The friction of the air as the satellite enters the denser atmosphere will cause it finally to disintegrate in much the fashion of a "shooting star."

Subsequent to the announcement of the United States regarding plans for the launching of a scientific satellite, the Soviet Union made a similar announcement indicating that it also intends to launch a satellite in line with the recommendations of the Rome meeting.

Other Program Activities

One of the outstanding results of the Rome meeting was the recognition that participating countries are now willing to extend their planned programs well beyond first estimates. This involved both the filling in of geographical gaps in station networks and the addition of basic programs in seismology and gravity in certain regions. Gap stations were of particular importance in the Antarctic. Here a number of additional station sites were recommended in order to achieve a station network which would provide comprehensive observational coverage of many geophysical phenomena in this region. Principal additional sites recommended on the Antarctic Continent included a location at the head of the Weddell Sea, one on the Astrid Coast, and one on the Knox Coast. Certain additional outlying island locations also were urged.

Seismic and gravity programs were recommended in areas where few observations have been made in the past, and which will be occupied during the International Geophysical Year. These include the Antarctic, subantarctic areas, and equatorial regions of the Atlantic and Pacific.

The seismic program in the Antarctic has two objectives: (1) Better control of the location of epicenters in the southern latitudes; and (2) measurements of ice thickness by seismic methods. Gravity observations, particularly those in the Antarctic where little data have been available,

will improve our knowledge of the figure of the earth in these regions and will thus improve the accuracy of maps.

The Rome meeting resulted in the initiation of a supplemental program on the part of the United States National Committee. This supplemental program deals primarily with those new projects and the additional stations in the Antarctic which had been suggested at Rome. Thus programs of gravity measurements and seismic studies are planned for the Antarctic and in certain mid-Atlantic and Pacific areas. Additional rocketry was also recommended, particularly in the Arctic and Antarctic regions. The high-altitude ceiling of weather-sounding balloons will be increased. Finally, the program includes plans for additional stations in the Antarctic to be located at gap locations on the continent.

Appropriations

Results of the Rome meeting were not available in time to be reflected in the 1956 appropriation, which amounted to \$10 million. Since \$2 million had been appropriated in 1955, total funds now available for the International Geophysical Year are \$12 million. If the programs recommended by the United States National Committee on the basis of resolutions adopted at the Rome meeting are to be added to the United States effort, additional funds will be required.

An Office for the International Geophysical Year was established within the National Science Foundation in April, and on April 19th J. W. Joyce joined the staff of the Foundation to head this office.

Eighteen grants totaling \$1,914,975 were made during fiscal year 1955 for services and equipment for the International Geophysical Year. They are listed in Appendix V, p. 155.

Synthetic Rubber Research and Development

On July 1, 1955, the National Science Foundation assumed responsibility from the Federal Facilities Corporation for administering the Federal program for basic research on synthetic rubber. This action involved transfer of title to certain government-owned buildings and facilities at Akron, Ohio, which had been used for rubber research and development. The Foundation continued for the time being the administration of basic research contracts with eight universities, the Burke Research Co., the Mellon Institute for Industrial Research, and the National Bureau of Standards. The Foundation also continued to contract with the University of Akron for the operation of the Government Laboratories in that city.

Our Government recognized at the beginning of the Federal synthetic rubber program that research would be a continuing and necessary part of the successful development of a synthetic rubber industry. The broad objective of such research, of course, was to make the United States potentially independent of natural rubber, most of which is produced in the eastern hemisphere. Although important economically, an independent source of rubber is even more important to national defense. Synthetic rubbers now being produced are for most uses equal or superior to natural rubber. However, a few uses remain for which satisfactory synthetics have not yet been developed. Results of the research program carried on over the past few years improved the quality of various types of synthetic rubber, widely extended the uses to which synthetics can be adapted and introduced many process improvements and production economies.

Many large private manufacturers of rubber and rubber products have established their own research and development programs. However, some of the specialized types of rubber designed for defense needs will be required in such small quantities that there is little profit incentive for research. This applies particularly to certain types of rubber needed by the Department of Defense for operations under extreme weather conditions of heat and cold. Research in such cases will undoubtedly continue under sponsorship by the Federal Government.

The Federal research and development program for synthetic rubber was originally established under the direction of the Office of Synthetic Rubber, a subsidiary agency of the Reconstruction Finance Corporation. When the RFC dissolved, the rubber program and facilities were transferred to the Federal Facilities Corporation, the receiver agency of the RFC. Under Public Law 205, 83d Congress, a Rubber Disposal Commission was established to make recommendations concerning the disposal of production plants and continuation of the research and development program. The Commission recommended that basic research related to synthetic rubber at universities, research institutes, and the operation of the Akron laboratory be continued at substantially its current level of operation for at least fiscal year 1956. It further recommended that the National Science Foundation undertake supervision and control of the continuing research program.

After preliminary review and evaluation of the research program, the National Science Foundation concluded that the basic research program in rubber fell within its general legislative directives in support of research. The Foundation also concluded that continuation of the work of the Akron laboratory, pending a full evaluation of its activities, was not inconsistent with the Foundation's charter. During fiscal year 1956, the Foundation plans a full evaluation of current basic research activities by a Special Commission directed to make recommendations regarding the future scale and scope of a Federal research program for synthetic rubber. The membership of the Special Commission for Rubber Research is given in Appendix I, p. 96.

During the 5-year period ending June 30, 1955, the average expenditure for contract rubber research at universities and other institutions was about \$1,118,000 per year. Over this same period the average expenditure for the program at the Government laboratory at Akron was \$1,094,000 per year. During fiscal 1956 the program, which will be supported by transfer of funds from the Federal Facilities Corporation to the Foundation, will be continued at a slightly reduced level. A list of current contracts carried on as part of the rubber research program is given in Appendix II, p. 125.

Indirect Costs of Research Supported by Federal Grant or Contract at Educational Institutions

The pattern of Federal support of scientific research at educational institutions, started on a large scale during World War II, seems destined to continue. Long range development of the Nation's scientific strength will depend, however, not only upon the availability of Federal funds for research but upon the success with which these funds can be administered without destroying the independence of participating institutions. The maintenance of an environment in which our colleges and universities may continue to flourish, free from undesirable controls and influences, is a matter of national concern.

Universities traditionally have carried on scientific research as a necessary part of their educational programs. In World War II, with its unprecedented national requirements for research, the Government found at these institutions the research facilities and manpower ready for immediate scientific mobilization, at relatively low cost—although cost was not a ruling consideration—and with minimal administrative problems. The colleges and universities for their part welcomed the opportunity to participate fully in the Nation's war effort.

During the post-war period the clear advantages of this cooperation between the Government and educational institutions have led to its retention. As might be expected, however, the change from a temporary to a permanent basis has led to a reappraisal of the long range implications of this arrangement by both the Government and the institutions. The Federal agencies supporting research for the successful accomplishment of their missions have been interested for the most part in the end product or results. The institutions have been interested in Federal research support as a means to pursue their function of investigating natural phenomena and to improve the extent and quality of their scientific teaching. In many cases the performance of research for the Government is viewed by the institutions as a public service.

Before the war universities undertook only that research in which members of the faculty were interested. To a large extent the project research supported by Federal agencies immediately after World War II did not seriously modify this pattern. For this reason, many university

administrators felt that to the extent they were able, institutions should participate in the cost of such research. The university contribution was made in a variety of ways—through payment of salaries of the tenured staff members working on the projects or through partial payment of normal service and overhead costs.

As the amount of Federally sponsored research has grown, however, the ability of most colleges and universities to share in its support has steadily diminished. In many institutions the point has been reached where further increase in the amount of research accepted on a participating basis will adversely affect the overall activities and programs of the institutions. It is in this context that Federal policies regarding payment or nonpayment of indirect costs become significant.

Indirect Costs

Indirect costs normally involve the following types of institutional expense: General administration and general expense, plant operations and maintenance, use and depreciation of buildings, use and depreciation of equipment, library costs, social security taxes, and in some cases retirement costs. That portion of the total expense of the institution in these areas which is considered as applying equally to instruction and research is then divided by the total salaries and wages paid for instruction and research. The resulting percentage, when applied to the salaries involved in a particular research project, allocates to that research its equitable share of the institution's indirect expenses.

Plant operation and maintenance usually represent the largest part of an institution's total indirect costs, followed by general administration and general expense. Usually these two items account for 65 to 75 percent of the total.

Experience has shown that indirect cost rates vary widely from institution to institution. To some extent this results from differences in accounting systems, but also to differing institutional policies as to salary scales paid, the extent of services rendered to students, faculty, and outside agencies. The size and nature of the physical plant, and similar factors, may also have a marked effect on the amount of indirect costs.

How Indirect Costs Have Been Met

During the war the Office of Scientific Research and Development and later the newly established Office of Naval Research attempted to negotiate indirect cost rates on individual projects with individual universities. As the Office of Naval Research program expanded this pro-

cedure proved unsatisfactory because of the endless amount of time consumed in negotiation and the problems of administering a variety of rates, often at the same institution. The Department of the Navy and the War Department solved the problem after a 2 years' study by establishing a formula whereby a single indirect cost rate could be determined for each institution. The principles and definitions of allowable costs, known as the "Blue Book," have been incorporated in summary form into section 15 of the Armed Services Procurement Regulations. At present they serve as the basis for determining direct and indirect costs on research and development contracts with colleges and universities by the three military services.

Since 1949, the Atomic Energy Commission has used similar methods for determining costs of research at institutions, although the Atomic Energy Commission does not reimburse the institution for all the costs connected with certain of its research contracts. The normal practice of the United States Public Health Service in awarding grants has been to include an allowance for indirect costs of up to 8 percent of the total amount of the grant. Recently the upper limit was raised to 15 percent. Other agencies arrived at indirect cost allowances by various methods depending upon the size of their programs and their authorizing legislation.

The question does not arise with the Department of Agriculture's statutory grants program since research funds are distributed by statute in proportion to the rural populations of the various States. The allowance for indirect costs in research contracts made by the Bureau of Standards, the Weather Bureau, the National Advisory Committee for Aeronautics, and certain other agencies is determined by negotiation.

Indirect Cost Studies by the National Science Foundation

Since its organization in 1951 the National Science Foundation has given careful study to the question of indirect costs for research supported at universities and colleges. As an interim measure the Foundation adopted the policy of paying up to 15 percent of total direct costs as an allowance toward indirect costs.

In September 1954, the Director of the Bureau of the Budget asked the Foundation to be prepared to make recommendations for a uniform Federal policy by the end of the fiscal year, June 1955. In arriving at recommendations the Foundation had the help of its Advisory Committee on Government-University Relationships, which included among its members scientists and research administrators from educational institutions, private foundations, and industry.

In presenting its recommendations, the Foundation pointed out that indirect costs for Government supported research cannot be expected to solve the critical financial problems now facing many of the Nation's institutions of higher education. On the other hand, the Foundation believes that the indirect cost policy adopted by the Government should not further complicate nor magnify such problems. It is to this end that the recommendation is addressed.

In view of these considerations the Foundation has made the following recommendation:

The National Science Foundation recommends that in supporting research conducted in institutions of higher learning, agencies of the Federal Government, if requested, reimburse these institutions for those indirect costs of research supported.

There are, of course, many methods by which this policy might be implemented. After consideration of various alternatives, the Foundation suggested that the following recommendation might offer the most satisfactory and equitable way of policy implementation.

It recommended that:

(1) Each institution (a) request the determination of a rate in accordance with "Blue Book" principles or other equivalent methods, or (b) elect a flat rate not to exceed a maximum limit of 25 percent of salaries. Whichever option is chosen by the institution, all Federal agencies would be prepared to pay the same rate, if requested, for all research supported at the institution.

(2) At any time, an institution may request a rate determined in accordance with "Blue Book" principles to replace the flat rate, or vice versa. In the latter case, the flat rate may not exceed 25 percent of salaries or the rate determined in accordance with "Blue Book" principles.

(3) At all times the Government, to protect the public interest, reserves the right to determine a rate in accordance with "Blue Book" principles, where it becomes apparent that such a rate would be significantly lower than the flat rate.

(4) Exceptions to the general policy of a single institutional rate be made in special instances such as facility management, large scale construction, or similar enterprises. In such instances, a special rate for the specific enterprise involved may be appropriate and desirable.

The above recommendations presuppose an acceptance of the principles of cost determination set forth in the "Blue Book". Since it is generally agreed that these principles provide the best available method for determining the costs of research, both direct and indirect, at educational institutions the Foundation believes that the acceptance of these

principles offers the most practical means for implementing the recommended policy in the immediate future.

The recommended policy is not intended to preclude the possibility of cost-sharing on the part of the institution, nor the right of agencies to seek such an arrangement where deemed appropriate. It is expected that it would continue to occur in the manner and for the types of research suggested by the "Blue Book." The policy would, however, avoid mandatory participation in one particular type of cost as a feature of some Federal programs.

The financial impact of the recommended policy on the agencies is difficult to assess. Five agencies account for more than 98 percent of all funds expended on research and development contracts or grants at educational institutions. These are the Department of Defense, the Atomic Energy Commission, the United States Public Health Service, the Department of Agriculture, and the National Science Foundation. Of these, only the United States Public Health Service and the National Science Foundation would find that the proposed recommendation would add significantly to their payments for indirect costs. Estimates based on fiscal 1956 appropriations for research and development indicate that uniform adoption of the proposed policy would increase research costs of Federal agencies by no more than \$8 million. This amount would represent about 2.3 percent of the total now spent by Federal agencies for research in educational institutions.

PART II

Program Activities

of the

National Science Foundation

Conferences in Support of Science

The National Science Foundation helped underwrite 21 conferences convened to examine special areas of science during the year ending June 30, 1955—largely in instances where adequate support was not available from industrial or other institutional sources. These conferences served as an effective clearinghouse for exchange of thought among scientists working in new or incompletely explored fields. One or more private or public agencies, including universities and scientific societies, shared sponsorship of the conferences with the Foundation.

The list of conferences (below) shows a widely diversified subject matter, over many areas of physical and biological science with related fields of the social sciences. In many cases the conferences attracted leading foreign scientists who shared their knowledge with associates in the United States working in the same disciplines. Some of the most significant conferences impinged on two or more areas of interest, resulting in a healthy cross fertilization of ideas.

To insure wide distribution of conference subject matter, proceedings and papers are frequently published by the sponsors. Normally, the request for support of conferences originates with the scientists working in the field under review. Brief notes on the conferences are given below.

Scientific Conferences Supported by the National Science Foundation in Year Ending June 30, 1955

<i>Subject</i>	<i>Sponsoring Organizations</i>	<i>Chairman</i>
✓ Nuclear Emulsion Research in Colleges.	DePauw University.	Marcel Schein, Co-Chairman; Malcolm Correll, Co-Chairman.
International Arid Lands Symposium and Conference.	American Association for the Advancement of Science. United Nations Educational, Scientific and Cultural Organization. University of New Mexico.	George W. Beadle.
✓ The Crust of the Earth. . . .	Columbia University.	Paul F. Kerr.
✓ Anomalous Magnetization of Rocks.	University of California, Los Angeles.	Louis B. Slichter.

*Scientific Conferences Supported by the National Science
Foundation in Year Ending June 30, 1955—Continued*

<i>Subject</i>	<i>Sponsoring Organizations</i>	<i>Chairman</i>
Man's Role in Changing the Face of the Earth.	Wenner-Gren Foundation for Anthropological Research, Inc.	William L. Thomas, Jr.
✓ Cosmic Distance Scale.	University of Virginia	H. L. Alden, Local Chairman. J. J. Nassau, Chairman F. L. Singer.
✓ Mechanics in Engineering Education.	American Society for Engineering Education. New York University.	William C. Young.
Genetic, Psychological, and Hormonal Factors in the Regulation of Patterns of Sexual Behavior in Mammals.	University of Kansas	Philip M. Morse.
✓ Mathematical Tables.	Massachusetts Institute of Technology.	W. George Parks.
✓ Gordon Research Conferences.	American Association for the Advancement of Science.	L. P. Eisenhart.
✓ Research in the History, Philosophy, and Sociology of Science.	American Philosophical Society.	M. A. Mason.
✓ Mechanics of Sediment Transport.	American Society of Civil Engineers. University of Tennessee.	Frederick Johnson.
✓ Radiocarbon Dating.	Robert S. Peabody Foundation for Archaeology; National Research Council.	Anne Roe.
Evolution of Behavior.	American Psychological Assn. and the Society for the Study of Evolution.	H. F. Bohnenblust. Jerzy Neyman.
✓ The Theory of Numbers.	California Inst. of Technology- University of California	M. Demerec.
✓ Mathematical Statistics and Probability.	Long Island Biological Assn.; the Carnegie Corp.; the Atomic Energy Commission.	E. F. Barker.
✓ Quantitative Biology.	University of Michigan	V. C. Twitty.
✓ Problems of Nuclear Structure.	The Society for the Study of Development and Growth.	F. A. Matsen.
✓ Fourteenth Growth Symposium.	University of Texas	R. E. Marshak.
✓ Molecular Quantum Mechanics.	University of Rochester	
✓ High Energy Nuclear Physics.		

Nuclear Emulsion Research in Colleges

An interesting type of cooperative research project involving physicists in colleges and those in large research centers was critically evaluated

in a conference held March 31, 1955 at DePauw University. These research projects are concerned with nuclear processes as recorded in photographic emulsions where the emulsion is exposed either at large accelerations or during cosmic ray balloon flights. Typical investigations using nuclear emulsion techniques are those in which the distribution of cosmic ray stars is sought, the energy and momentum balance for nuclear events is studied or the event-history for unstable elementary particles is analyzed. Both groups of participants, namely the research-physicists and the teaching-physicists, endorsed these cooperative projects as effective instruments for producing good research, for indirectly improving undergraduate teaching and for making it easier to staff physics departments in small colleges and universities. Discussions brought out the unique ways in which nuclear emulsion research projects can encourage significant research and can improve the teaching in research-isolated institutions with only modest demands on space and funds. The conferees recommended that meritorious projects continue to be encouraged through grants and that summer research institutes be established to assist those interested in initiating a program of this kind. The conferees also requested that the steering committee for the conference be established as a liaison body during this period of intense interest in nuclear emulsion cooperative projects.

International Arid Lands Symposium

Top-ranking meteorologists, climatologists, geologists, hydrologists, geographers, botanists, biologists, and zoologists of the United States and other nations convened in the spring of 1955 to consider on an international basis problems relating to arid lands. Government and university scientists presented papers on such problems as the predictability of precipitation in arid regions, drought cycles, ground water resources, usage, and reusage. The group considered as well the plant and animal ecology of arid areas and possible changes which would favorably affect plant and animal populations and revegetation. The National Science Foundation sponsored the conference jointly with the American Association for the Advancement of Science, the United Nations Educational, Scientific and Cultural Organization, and the University of New Mexico.

The Crust of the Earth

What is the nature and behavior of the earth's crust? Attempts to find answers were made by geologists of international standing at a confer-

ence held at Columbia University, New York City, in October 1954, sponsored jointly by the National Science Foundation and Columbia University. The program coincided with the Bicentennial Celebration of the founding of Columbia. Agenda for the meeting centered around: (1) the nature and constitution of the earth's crust; (2) recent deformation and sedimentation; (3) petrogenesis and structural synthesis; and (4) historical (geological time) development of the crust. Papers were read by scientists of this and other countries and arrangements were made for their publication with the Geological Society of America.

Anomalous Magnetization of Rocks

The National Science Foundation sponsored a conference held August 7-8-9, 1954, on the "Anomalous Magnetization of Rocks", at the Institute of Geophysics, University of California, Los Angeles, California. Interest focused on certain rock formations which have a magnetic polarization that does not conform to present day magnetic field flux. Participants included a number of outstanding American scientists as well as experts from England, Canada, Japan, and France. Discussions emphasized the differences of opinion in this important field of study between the physicists and the geologists. Much additional study is needed in order to work out details of the anomalous magnetization problem.

Man's Role in Changing the Face of the Earth

Keyed to the central theme of man-nature relationship, a conference was held in June 1955, at Princeton, New Jersey, jointly sponsored by the Wenner-Gren Foundation for Anthropological Research, Inc., of New York, and the National Science Foundation. Attracted to the conference were scientists from the United States and abroad working in interrelated disciplines, including anthropology, geography, mathematics, geochemistry, botany, zoology, demography, anatomy, microbiology, culture history, limnology, climatology, and sociology.

The conference explored the dynamic effects, present resources and future prospects of: (1) the earth's resources; (2) the relation of population to these resources; and (3) man's differing cultures, or ways of life. Represented at the conference were scientists from many disciplines who, for the first time, attacked as a unified whole problems which heretofore had been touched upon only in "piece-meal" fashion by individual disciplines.

Cosmic Distance Scale

Sponsored jointly by the University of Virginia and the National Science Foundation, a conference was held in Charlottesville, Virginia, in April 1955, on the cosmic distance scale. Cosmic distances are basic data in almost any astronomical study. Recent advances in astronomical knowledge have revealed the complexities and difficulties in some of our concepts on which cosmic distances have traditionally been based. The present state of uncertainty of the distance scale of galaxies is but one outstanding example.

Some thirty astronomers met at Charlottesville to attempt to throw new light into this difficult area. Particular items on their agenda were: (1) current problems with regard to distance scale, ranging from nearby trigonometric to distant photometric distances; (2) determination of cosmic distances and technical difficulties encountered; and (3) a review of the problems whose solutions depend on a knowledge of distances.

Mechanics in Engineering Education

Engineers, physicists and mathematicians convened in January 1955 to review the desirability of modifying present engineering courses to keep them in stride with rapidly advancing science. Of particular concern to the conference were: (1) items that can be eliminated from an elementary physics course; (2) the rearrangement of subject matter for a modernized physics course; and (3) the re-orientation of the mechanics courses in relation to the engineering curriculum, together with a rearrangement of topics in the mathematics sequence, that would permit the rearrangements of course topics to be taught effectively. Jointly sponsored by the American Society for Engineering Education, New York University and the National Science Foundation, the conference brought together outstanding scientists and engineers for a 3-day discussion at the Gould House, Ardsley, N. Y.

Genetic, Psychological and Hormonal Factors in the Regulation of Patterns of Sexual Behavior in Mammals

Contributions to our knowledge of the physiology of reproductive behavior and to an understanding of the bases for different patterns displayed are being made by anatomists, anthropologists, biochemists, endocrinologists, physiologists, psychiatrists, psychologists, and zoologists. In order to bring together scientists representative of these several disciplines, the National Science Foundation underwrote a conference

which was held at Northampton, Mass., in December 1954. The conference served to facilitate an exchange of information with respect to latest research in the several fields of reproductive behavior and helped, as well, in systematizing new research approaches.

Mathematical Tables

Government and industry alike have benefited materially by the comparatively recent development of high-speed data processing equipment. In order to canvas, from the point of view of both users and producers, new ways of making mathematical tables and new forms of storing tabulated material, the National Science Foundation sponsored jointly with the Massachusetts Institute of Technology a 1954 summer conference in the Hayden Library of the Institute. The conference attracted both producer and consumer representatives from academic, industrial and Government sources—mathematicians, computers, and scientists actively interested in tables of functions. This workshop group sought answers to such immediate questions as how tables are made, functions needed to be tabulated, form the tables should take, and what the United States should do about producing tables.

Gordon Research Conferences

The Gordon Research Conferences are among the most significant scientific meetings called each year in the United States. They were first organized in 1931. They have been continued annually under the auspices of the American Association for the Advancement of Science, and have drawn not only leading American scientists, but eminent foreign scientists in the disciplines covered. During the past year the Rockefeller Foundation supported conferences in the fields of food and nutrition, medicinal chemistry, cancer, steroids and other subjects related to biology and medicine. The grant provided by the National Science Foundation assisted in the support of conferences in the physical sciences in such subjects as analytical chemistry, catalysis, chemistry and physics of metals, chemistry at interfaces, elastomers, ion exchange, and solid state reactions. The Foundation support enabled 137 scientists from the United States and abroad to attend these conferences during the year.

History, Philosophy, and Sociology of Science

A conference to discuss research in the history, philosophy, and sociology of science was held in February 1955 in Philadelphia under the

joint sponsorship of the American Philosophical Society and the National Science Foundation. Studies in the history and philosophy of science have contributed greatly to a better understanding of science as a logical and empirical system. They have served to clarify the factors, both external and internal, which promote progress in the sciences. It has been increasingly clear, however, that the sociology of science is of equivalent significance in our civilization, which depends so largely upon scientific and technological progress. Participants in the conference were drawn from all three areas, and the discussion centered largely on a review of recent developments in these fields, the inter-relation among the fields, and the selection of promising fields for future research.

Mechanics of Sediment Transport

Problems relating to sedimentation are encountered on a grand scale in such projects as river and flood control and the silting of large dams, and on a smaller scale in such problems as the treatment of sewage. There is wide current interest in the fate of radioactive sediments that arise in the operation of nuclear reactors.

A conference on Mechanics of Sediment Transport was sponsored jointly by the American Society of Civil Engineers, the University of Tennessee, and the National Science Foundation at Fontana Village, N. C., in October 1954. Participants discussed the physical factors which pertain to such processes as deposition, erosion, and transport of various types of sedimentary material in a fluid environment.

Radiocarbon Dating

The use of radiocarbon techniques for dating human and other biological remains over the past 30,000 years has been one of the most exciting interdisciplinary developments in science during the past decade. At the present time many laboratories have installed the necessary equipment to carry out dating measurements on a fairly routine basis. Experience of these laboratories has brought to light, however, a number of problems involving both theory and practice, which have led to confused, and in some cases, contradictory results. In order to resolve some of these difficulties, the R. S. Peabody Foundation for Archaeology, the National Research Council, and the National Science Foundation jointly sponsored a conference on radiocarbon dating, which was held at Andover, Mass., during October 1954. The conference enabled physicists,

chemists, archeologists, geologists, paleontologists, and soil scientists to review the technical problems involved in the application of radiocarbon dating to archaeological sites, geological deposits, and soil genesis.

Evolution of Behavior

The study of the evolution of behavior is fundamental for an understanding of both functional biology and psychology. A conference on the evolution of behavior was held in April 1955 at Arden House, Columbia University, under the joint sponsorship of the American Psychological Association, the Society for the Study of Evolution, and the National Science Foundation. The meeting enabled scientists from several disciplines to exchange ideas regarding the evolution of behavior. Participants discussed such topics as genetic and developmental behavior and the place of behavior in the study of evolution. Of particular interest were the sessions devoted to fairly well-defined aspects of behavior, such as learning, food-getting, locomotion and defense, reproductive behavior, and social behavior. An important session of the conference considered the relationship between biological and cultural evolution.

Theory of Numbers

For the past three centuries investigation of the mathematical theory of numbers has inspired some of the most significant developments in mathematics. Mathematicians are agreed, moreover, that this well has not run dry, and that such studies will continue to provide impetus to further development in a wide range of mathematical fields. In June 1955 a conference on the theory of numbers sponsored jointly by the California Institute of Technology and the National Science Foundation was held at Pasadena, Calif. About 30 specialists in number theory from all parts of the United States assembled to review recent advances and discuss unsolved problems. One of the most interesting sessions dealt with the use of modern high-speed computing machines in number theory.

Mathematical Statistics and Probability

In December 1954 and August 1955 the Third Berkeley Conference on Mathematical Statistics and Probability was sponsored jointly by the University of California and the National Science Foundation. The symposium was held in two sections to permit the attendance of a substantial number of scholars attending the Christmas meeting of the

American Association for the Advancement of Science. Three American societies immediately concerned with statistics also met in Berkeley at the same time. These were the American Statistical Association, the Institute of Mathematical Statistics and the Biometric Society.

The Berkeley symposia have been noted for the appearance of a number of substantial technical papers in rapidly developing areas of statistics and probability. These have served to sort out and combine fruitful recent ideas in the field, establish relations among them, and outline new problems that still await satisfactory solution. The proceedings of the symposium, which total some 700 pages, are being edited for publication.

Quantitative Biology

The Twentieth Cold Spring Harbor Symposium held in June 1955 at Cold Spring Harbor, Long Island, was devoted to the subject of quantitative biology with particular emphasis upon population genetics. These annual meetings have, over the past two decades, brought together some of the outstanding biological scientists in the United States and abroad and have proved extraordinarily fertile as a source of new ideas in both theory and experiment. The Twentieth Symposium was sponsored jointly by the Long Island Biological Association, Carnegie Corporation, the Atomic Energy Commission, and the National Science Foundation.

Nuclear Structure

During the summer of 1955 a conference was held on problems of nuclear structure at Ann Arbor, Mich., under the joint sponsorship of the University of Michigan and the National Science Foundation. The past 3 or 4 years have seen many improvements for techniques in measuring nuclear properties, and this experimental work has resulted in the development of improved concepts of shell structure of the nucleus. Several other types of models have also been proposed to explain or describe various nuclear reactions. The conference was particularly notable in that it was attended by numerous young scientists currently engaged on problems relating to nuclear structure.

The Fourteenth Growth Symposium

In 1955 for the third year in a row the National Science Foundation provided support for the Growth Symposium sponsored by the Society

for the Study of Development and Growth. This annual symposium enabled students of growth in such varied fields as genetics, pathology, biochemistry, botanical sciences, and embryology, who normally do not meet together, to exchange information and ideas on recent development in their respective fields. An outstanding contribution of the symposia has been publication of the presented papers. The major topics discussed in 1955 were differentiation of cells and tissues in plants and animals, acquired tolerance to tissue transplants, and the cytochemistry of nucleic acids.

Molecular Quantum Mechanics

Quantum theory is finding extensive application in molecular physics and chemistry. The techniques of quantum mechanics have been effectively used in giving theoretical knowledge on the physical and chemical behavior of molecules. In order that scientists in the area might be brought together to review the status of research, the Foundation jointly sponsored a 3-day conference with the University of Texas at Austin, Tex., in December 1954. Agenda for the conference centered around these chief considerations: (1) application of present-day theory to the calculation of the physical properties of molecules; (2) quantum interpretation of chemical valence concepts; (3) forces between molecules; (4) configurative interaction and correlation energy; (5) mathematical developments; and (6) evaluation of integrals.

High Energy Nuclear Physics

The year 1954 was important for furthering knowledge in high energy nuclear physics. The National Science Foundation had aided in University of Rochester in holding two previous conferences in this area, and the conference held in Rochester, N. Y., in late January and early February 1955, was co-sponsored by the Foundation and the International Union of Pure and Applied Physics. Subjects of particular interest to participants, among whom were included several scientists from other nations as well as American scientists, were nucleon-nucleon scattering, nucleon polarization, pion scattering, photomesic production, electron scattering by mesic atoms, field theories, elementary particles and nuclear forces theories. The conference served as a forum for experimental and theoretical physicists to exchange ideas and reports of progress in fields of high energy elementary particles and high energy nuclear physics.

Support of Basic Research in the Sciences

During the year ending June 30, 1955, 588 grants totalling \$7,857,395 were made by the Foundation for the support of basic research in the natural sciences. These funds were distributed in the biological, medical, mathematical, physical, and engineering sciences to 184 institutions in 47 States, the District of Columbia, Hawaii, Puerto Rico, England, and Italy. The average research grant for fiscal year 1955 was \$13,400, to run for 2.7 years, or about \$5,000 per year.

The table below summarizes the research support program by broad

National Science Foundation Research Grants by Fields of Science

Field	Fiscal year 1954		Fiscal year 1955	
	Number	Amount	Number	Amount
Biological and Medical Sciences:				
Anthropological.....	0	0	5	\$51,700
Developmental.....	13	\$110,520	21	156,400
Environmental.....	7	43,200	25	212,200
Genetic.....	13	156,900	20	254,800
Molecular.....	32	458,000	50	819,850
Psychobiology.....	27	293,450	41	568,500
Regulatory.....	41	464,800	62	947,895
Systematic.....	32	238,500	44	357,500
General.....	12	164,100	7	173,650
	177	1,929,470	275	3,542,495
Mathematical, Physical and Engineering Sciences:				
Astronomy.....	19	147,900	19	363,800
Chemistry.....	47	477,400	82	1,091,600
Earth Sciences.....	27	282,800	29	438,400
Engineering.....	42	390,900	64	724,200
Mathematics.....	21	173,950	48	562,400
Physics.....	41	485,800	67	1,083,800
General.....	0	0	4	50,700
	197	1,958,750	313	4,314,900
Total Research Grants.....	374	3,888,220	588	7,857,395

subject categories. A detailed list of the grants, showing institution, principal scientists, title of project, duration, and amount is given in Appendix II.

Four-Year Summary

The National Science Foundation has had a total of 4 years experience in administering research support. During this period, fiscal years 1952 through 1955, a total of 1,232 grants amounting to \$14,316,140 have been made for support of basic research in the natural sciences. During the same period a total of 3,561 proposals for research have been submitted to the Foundation requesting \$66,591,413. After careful review and evaluation by the scientific advisory panels and staff program directors, approximately 75 percent of the proposals were considered to be meritorious, that is, they were considered of sufficient merit to be worthy of support. The dollar value of grants actually approved and made was about 21 percent of the total of submitted proposals and 28 percent of the total of meritorious proposals.

The capacity of an educational institution to undertake research depends upon a number of factors. The primary factor is undoubtedly the relative emphasis placed by the institution upon teaching and research. Research activities enter into the curriculum most naturally during the course of graduate study. In certain instances and on particular types of research the Foundation has been able to support research activities in undergraduate departments. These are exceptional cases, however, and a useful index of institutional research capacity continues to be the number of graduate students in training.

The desires and aptitudes of the individual faculty members have much to do with the capacity of institutions to conduct research. While teaching ability may in many individuals be associated with excellence in research, this is by no means invariably true. As a result, many excellent teaching departments have carried on little or no research activities in the past, and there is no reason to expect a change in the near future.

The nature of the teaching program of the institution also governs or limits the extent to which that institution will participate in research. Obviously, agricultural research will be concentrated largely in the agricultural colleges and research in the physical sciences is prominent in the engineering schools.

The geographical distribution of Foundation grants and research funds over the 4-year period is illustrated in the map shown in figure 1 and its accompanying tables. As might be expected, there is a definite relationship between the graduate student population and distribution of grants.

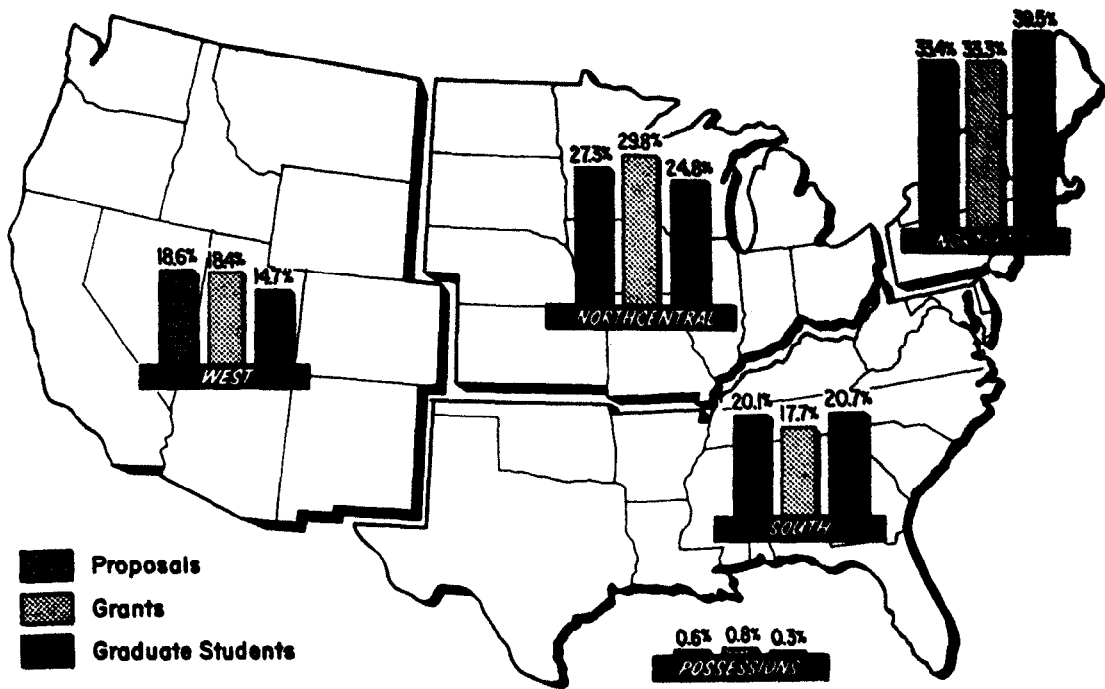


FIGURE 1. Regional comparison of proposals received (dollars), grants awarded (dollars), and graduate student population, fiscal years 1952 through 1955, expressed in percent of total of each index.

Regional Distribution of Proposals Received, Grants Awarded Graduate Students, and Total Population

Region	Fiscal years 1952-1955				Academic year 1952-53. Graduate students		1950 Census. Total population (100,000's)	
	Proposals received		Grants awarded		Number	Percent	Number	Percent
		Percent		Percent				
Northeast	\$22,267,980	33.4	\$4,771,945	33.3	88,417	39.5	395	26.2
South	13,360,208	20.1	2,537,060	17.7	46,280	20.7	443	29.3
North Central	18,205,167	27.3	4,261,935	29.8	55,425	24.8	471	31.2
West	12,368,994	18.6	2,628,400	18.4	32,987	14.7	197	13.0
Possessions	389,064	0.6	116,800	0.8	723	0.3	5	0.3
Totals	66,591,413	100.0	14,316,140	100.0	223,832	100.0	1,511	100.0

Preliminary analyses have been made of the final fiscal reports submitted by institutions for completed grants. Conclusions, illustrated in the chart and its accompanying table in figure 2, follow from a sampling of 149 completed grants and show a very tight relationship between estimated and actual expenditures for the average research grant. In short, grantees are spending Foundation funds strictly in line with, and for the purposes expressed in, their applications—almost to the dollar.

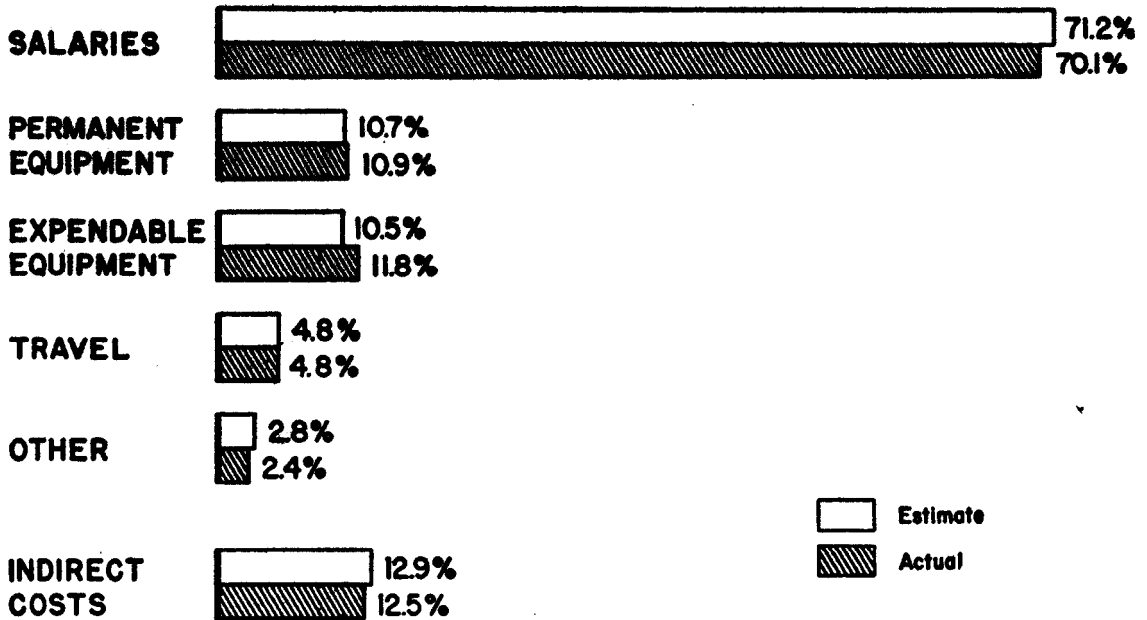


FIGURE 2. Estimated compared with actual expenditures for the average National Science Foundation research grant, expressed in percent of total direct costs.

Estimated vs. Actual Expenditures for the Average Research Grant ¹

(Expressed in % of total direct costs)

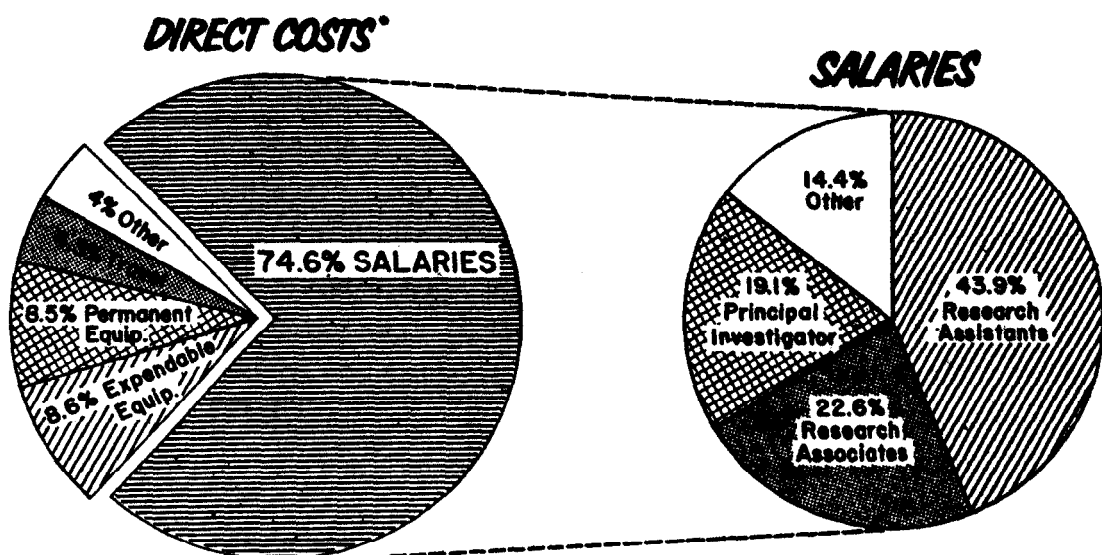
Object	Actual ²		Estimated ³	
		Percent		Percent
Salaries.....	\$4, 513	70. 1	\$4, 810	71. 2
Permanent Equipment.....	705	10. 9	724	10. 7
Expendable Equipment.....	763	11. 8	712	10. 5
Travel.....	307	4. 8	321	4. 8
Other.....	154	2. 4	186	2. 8
Total Direct.....	6, 436	100. 0	6, 753	100. 0
Indirect.....	809	12. 5	877	12. 9
Total.....	7, 245	7, 630

¹ Based on Analysis of 149 completed grants.

² Based on data obtained from fiscal reports.

³ Based on budget estimates at time of Board approval.

Figure 3 and its accompanying table show that nearly three-fourths of the total funds distributed have gone for personal services, primarily for support of research assistants and associates and laboratory and other skilled labor. About 17 percent of the total direct costs were spent for equipment. The allowance for indirect costs averaged 13 percent of direct costs.



* Indirect Costs - Approximately 13% of Total Direct Costs

FIGURE 3. Analysis of the average National Science Foundation research grant by type of expenditure (estimated).

Analysis of Salaries Paid from Average Research Grant ¹

	Average grant fiscal year 1954	Percent of salaries
Principal Investigator (total).....	\$1, 325	19. 1
Summer.....	(872)	(12. 5)
Sabbatical.....	(29)	(. 4)
Academic.....	(424)	(6. 2)
Research Associate ²	1, 573	22. 6
Research Assistant ³	3, 042	43. 9
Other ⁴	1, 000	14. 4
Total.....	6, 940	100. 0

¹ Based on budget estimates at the time of Board approval.

² Includes post-Ph. D. scientific personnel normally spending full time on research and usually not occupying tenure positions at the institution when they are doing the research.

³ Includes graduate assistants enrolled at the grantee institution and working towards a master's degree or a doctorate.

⁴ Includes laboratory technicians and assistants, undergraduate assistance, miscellaneous direct labor charges and retirement charges where the grantee's accounting system treats these as a direct charge.

Source: Commission on Human Resources and Advanced Training.

In the paragraphs following mention is made of specific parts of the Foundation's research support program of special current interest. It should be noted that these are selected examples and do not purport to represent the broad overall program for research support in all areas of the natural sciences.

Cooperative Nuclear Emulsion Research

In 1953 the National Science Foundation supported a conference at Amherst College to consider the advisability of sponsoring physics research programs in colleges. After a thorough discussion of its advantages and disadvantages the conference recommended the establishment of more research programs, pointing out that these research programs lead to more stimulated teaching, make it easier to get good men to take on college teaching jobs and help preserve the lifeline of graduate material that flows from the colleges to the graduate schools. A more detailed report on this conference was given in the Foundation's Fourth Annual Report.

Not all research lends itself to adoption by colleges and those universities that have not previously had strong research programs. One field of research that was mentioned at the Amherst Conference as having great promise was research in which nuclear data contained within special photographic emulsions are studied. The facilities required for this research are recognized as being small and the research field is one of great interest to physicists today.

To investigate further the potentialities of research programs using nuclear emulsions a second conference was held under the sponsorship of the Foundation at DePauw University on March 30, 1955. (See p. 36.) This conference concerned itself with cooperative programs in which the research would be jointly carried out by physicists on college staffs and those in universities or other laboratories. Cooperation of this type greatly strengthens the college research program and gives it a certain amount of assurance that it will be kept abreast of the advances being made in the field throughout the world.

At the DePauw Conference the discussions centered on questions dealing with the advantages, disadvantages, and difficulties associated with cooperative nuclear research projects in colleges. To furnish background material for these discussions expository surveys were first given on current nuclear emulsion research in the fields of classical nuclear physics, cosmic ray physics and high energy elementary particle physics. Methods for preparing, processing and measuring nuclear emulsions were also reviewed.

The Foundation has supported several research programs in this area. Dr. K. E. Davis of Reed College has received a grant to study cosmic ray stars in cooperation with the University of Rochester and other laboratories. Dr. A. G. Barkow of Marquette University and Dr. J. J. Lord of Washington University have grants to carry out a study on

elementary particles under the guidance of Dr. Marcel Schein of the University of Chicago. At Principia College Dr. S. L. Leonard is using nuclear emulsion material obtained from Stanford University and the University of California at Berkeley. Dr. Nora Mohler of Smith College is starting to work on a similar project in cooperation with the Massachusetts Institute of Technology and Brookhaven National Laboratory.

At the DePauw Conference it was recognized that it is frequently difficult for a college teacher to undertake a research program in the field of nuclear emulsions without first learning about special instruction on the experimental techniques and the recent theoretical advances that have occurred in the field. Many of these teachers have been trained in other fields which require facilities that are not available on college campuses. These theoretical advances referred to include developments in elementary particle theory, nuclear theory and field theory. The experimental techniques include methods of obtaining scattering data, recognition of cosmic ray events, grain counting, techniques for minimizing distortions, etc.

To facilitate the starting of programs by college staffs the DePauw Conference recommended that one or more summer institutes be held at institutions having active programs in this field. The Foundation plans to carry out this recommendation during the coming year.

Solid State Research

Scientists have been interested in solids from two points of view. First, they have been concerned with the mechanical properties of solids and the puzzling question of what holds the atoms together in a solid. The second interest centers on the electrical and magnetic properties of solids. Grants made by the Foundation have promoted significant research in both areas.

B. M. Warren of the Massachusetts Institute of Technology has successfully measured the atomic force constants in crystals of zinc and copper with methods that leave the sample undisturbed during the measurement. Dr. Warren and his students first made careful measurements of X-ray scattering by the crystals from which the thermal vibration states of the atoms could be calculated. These measurements do not subject the samples to stress or to high temperatures during the test. From the thermal vibration knowledge Dr. Warren next was able to calculate the atomic force constants. Full understanding of atomic behavior in simple crystals under normal conditions is necessary before attempting to describe the more complex characteristics of solids such as tensile strength.

During the past 10 years physicists have learned that imperfections and impurities play a very important part in the properties of solids. Imperfections affect the strength of materials, as well as the electrical and optical properties of many solids. R. L. Sproull at Cornell University has been investigating imperfections in alkali halide crystals by means of heat-conducting waves. He found that at liquid helium temperatures the heat waves are scattered by the submicroscopic imperfections, and simple heat conduction measurements gave precise information on the number and distribution of imperfections in the crystals. The further utilization of this method for investigating imperfections in solids may lead to better understanding of the almost catalyticlike effect that small imperfections seem to set up in many of the new materials that are now being introduced into our current technology.

C. Kittel at the University of California, Berkeley, has been investigating electron conduction in metallic solids. The study of magnetic resonance effects in atomic nuclei has been a favorite method by which physicists learn more about the electrical and magnetic properties of solids. Dr. Kittel first worked out a theoretical study of the interaction between the measurable nuclear resonance effects and electron conduction. His work showed that the conduction electrons should contribute to the broadening of nuclear resonance lines, and the theory was verified experimentally through resonance measurements made on metallic silver.

At Northwestern University J. A. Marcus has been investigating the magnetic properties of single crystals. The study was carried out at liquid helium temperatures using single crystals of bismuth. Dr. Marcus found that certain magnetic properties of the crystals change with the temperature in an oscillatory manner. This result suggested many possible configurations in the magnetic structure of crystals, which will now have to be studied one by one until a satisfactory interpretation of these unusual magnetic effects is arrived at.

F. C. Brown at Reed College investigated the mobility of electrons through single crystals. The study was made on silver-chloride crystals at various temperatures. The series of measurements on the electron mobility coefficients indicated that drift electrons are slowed down by interacting with the acoustic vibrations of the crystal lattice. Many factors can contribute to this effect and the investigators are collecting further mobility data under carefully controlled conditions in an attempt to clarify the matter.

At Carnegie Institute of Technology S. DeBenedetti and his co-workers are investigating the properties of electrons in metals by the use of short-lived positrons emitted by radioactive materials. Gamma rays

are created by the collision and annihilation of the positrons with electrons in the solid. By measuring the gamma radiation the scientists have been able to calculate the momenta and other characteristics of the electrons in the solid at the time of the reaction. They found that positrons are annihilated when at rest, that they usually react with loosely bound or free electrons, and that local lattice effects seem to play little part in the process.

High-Speed Computation

Recent experimental advances in the physical and engineering sciences have rendered useless many linear mathematical models that were formerly adequate concepts. In other cases where linear analysis still remains relevant, the size of the linear system employed has increased enormously. The use of mathematical models in biological and sociological research has induced consequences similar to those in the physical sciences. For example, Professor W. Leontieff of Harvard University has stated that even a highly condensed picture of the United States economy may be described only in terms of a system of at least 100 equations with as many variables.

It is a historically remarkable coincidence that with the development of these difficulties, a means of dealing with them has been found in the art of high-speed computation. The successes achieved by its use have led many scientists to the conviction that further progress in their fields will depend to a large extent on their access to the techniques and facilities of computation. The need for adequate computer facilities for basic research problems must be considered primarily from an interdisciplinary point of view. In addition to the obvious interdependency of computation and research in mathematics and physics, other mathematical, physical, and engineering sciences are using computational methods at an increasing rate.

The need for high-speed computers is most dramatically evident in meteorology. The greatest barrier in the development of the science of meteorology is the inability of research workers to perform large-scale experiments. The meteorologist has to extract information from observation of nature in a vast three-dimensional envelope where weather events occurring in any one portion are interdependent with other, often remote, events. The nature of atmospheric behavior is so complex that progress in understanding its fundamental nature has been slow and discouragingly tedious.

Meteorologists have dreamed for generations of something akin to a laboratory with capabilities reasonably approximating the atmosphere.

This dream now appears to be coming to fruition with completion of the first successful machine-produced predictions of large-scale atmospheric motions. The utilization of high-speed computing machines obliterates the boundary between dynamic and synoptic meteorology by making it possible to test suggested models simulating the atmosphere and also to evaluate quantitatively the effects of varying parameters believed important in influencing weather.

In astronomy, problems in celestial mechanics have been greatly aided by computer availability for the calculation of the orbits of planets, satellites and comets. Astrophysical problems are highly complex, raising, for example, such questions as turbulence, magnetohydrodynamics, and the relative abundances of chemical elements in the internal constitution of stars. Similarly, the evolutionary development of a star is traced by a series of numerical models representing the time-sequence of configurations of the primeval gas sphere. Such models require elaborate computation.

The fundamental theories such as those of quantum and statistical mechanics, thermodynamics, and kinetic theory, are tools with which to understand the complex problems of modern chemistry. Machine calculations are already being used in the fields of high-temperature and high-pressure phenomena, flame propagation and shock waves, transport phenomena, and the theory of liquids. The information resulting from such computation permits the prediction of probable chemical reactions and thereby increases the selectivity factor in the design of experiments.

The effect on industrial life will, apparently, be no less significant. At a Conference on Training in Applied Mathematics held at Columbia in October, 1953, an industrial producer of high-speed computers asserted that, on the basis of current leases and orders, 1500 mathematicians were needed at that time for their effective use. A Conference on Training Personnel for the Computing Machine Field at Wayne University in June, 1954, indicated a large, but unspecified, demand for people highly skilled in computation not only in the engineering but also in the managerial aspects of industry and government.

In order to meet this need, it will not only be necessary to have adequate computers available but it will be necessary to develop an adequate training program at all scientific levels for the mathematical formulation of the scientific problems. Even with existing machines, efficient as they are, effective utilization requires much more research in numerical analysis. At the same time, in order to solve existing problems that are beyond the capacities of the present computers, investigation into the theory and engineering of the computing machines themselves is essen-

tial. Continual interplay of all these factors is necessary for scientific progress.

The high cost of maintaining a modern computation laboratory is often met by having the facility "earn its keep" on a fee basis, a practice which affects the character of its scientific program. But it seems clear that few universities will be able to support large computing facilities without continuing Federal support. The Department of Defense and the Atomic Energy Commission have supported a considerable number of computer installations for their purposes. However, these facilities often operate under necessarily heavy security regulations.

In 1953 the National Science Foundation entered into an agreement with the Applied Mathematics Laboratories of the National Bureau of Standards for advice on the methods of numerical analysis and the choice of machines for specific computation involved in requests to the National Science Foundation for research support. To date, several grants have been made involving computational work, e. g., to Marshall Hall of Ohio State University, H. S. Vandiver of the University of Texas, J. Neyman of University of California, and A. H. Taub of the University of Illinois.

In May 1954, a conference on "The Significance and Possibilities of High-Speed Computing in Meteorology" was cosponsored by the National Science Foundation and the University of California (Los Angeles).

In order to provide the Foundation with informed advice as to the computer needs of modern science, and its possible role in assisting universities to meet these needs, an ad hoc Advisory Panel on University Computing Facilities was appointed in February 1955.

The panel recommended that the Foundation establish a limited program to provide computing equipment and partial support for appropriate staff in order to carry on research and training in high-speed computation. It also noted that research in the advanced design of computing machines should be recognized as of basic importance. As an example of areas for research the panel stated that it is desirable that the speed of computing machines be increased by a factor of at least 50 and that their capacity be substantially increased.

Geochemistry

The President's Materials Policy Commission in 1952 recommended that a full-scale basic research program be undertaken in the fields of

mineral exploration and processing. Partly as a result of this recommendation the National Science Foundation established a Committee on Minerals Research. The committee in turn appointed a number of specialized subcommittees which from time to time have reported to the Foundation on areas of basic research which should be supported in the national interest.

During the past year the Subcommittee on Geochemistry proposed that the highest priority be given to basic research into the characteristics of low-viscosity fluids and aqueous solutions in rocks during such geologic processes as burial, metamorphism, intrusion, and vein formation. Such knowledge will have great practical importance in developing better methods for detecting ore deposits.

The subcommittee pointed out that no concerted attempt has been made to apply modern techniques to the study of ore formation. By taking advantage of recent developments in the use of isotopes, in high pressure and high temperature techniques, in precise microchemical methods, and by applying modern chemical and physical principles, an extremely useful increase in our present knowledge of these processes would result. Geologists have a reasonably good understanding of the source and origin of the mineral assemblages in rocks. On the other hand, very little is known about the origin of the accompanying fluids. The subcommittee proposed five principal areas for basic research into the nature of low-viscosity fluids. These are described below.

1. **STUDY OF FLUIDS IN SEDIMENTARY AND VOLCANIC ROCKS.** The residual fluids from crystallizing magma are thought to be the source of most sulfide ore deposits. Geologists are uncertain, however, as to whether such fluids were originally contained in the sedimentary and volcanic rocks from which magma was derived or from emanations from lower levels in the earth's crust. An answer to this question would have great theoretical importance, but also practical importance, since it would indicate to what extent ore deposits could be expected in areas where no magmatic rock is present.

2. **TEMPERATURE-PRESSURE STUDIES OF SOLUTIONS IN IGNEOUS ROCKS.** It is proposed that solutions contained in igneous rocks, such as natural glasses, be studied in the ranges of concentrations, temperatures, and pressures that appear to be geologically probable. Such studies would have been impossible until recently because of the lack of suitable laboratory equipment. The results would be expected to give useful information on the types of magmatic rock that were likely to

have given off ore depositing solutions and to indicate what types are barren.

3. **ENVIRONMENT OF DEPOSITION OF ORE.** These studies would be similar in technique to those described in the previous paragraph. The aim, however, would be to obtain information on the mechanisms and conditions of pressure, temperature, and composition involved in ore transport and deposition. One approach would be to study the natural occurrences for evidence of the values of these variables, and then to set up similar laboratory conditions to see if experimental results fit the field evidence.

4. **ISOTOPIC STUDIES RELATED TO ORE DEPOSITION.** In order to search for ore deposits on a broad scale it is necessary to define when the deposits were formed. For example, age studies of uranium-bearing minerals of the Colorado Plateau have been of the utmost value to uranium prospectors. Geologic time is told by a variety of radioactive clocks, such as uranium-lead, uranium-helium, and potassium-argon. In these examples the ratio of the amount of radioactive material to the amount of nonradioactive daughter product indicates age. The uranium-lead method has been studied in sufficient detail to be immediately applicable. In the other two cases additional basic research in methodology is essential. The study of natural variation in isotopes will also help define the source of materials and whether or not more than one source has been involved. The use of radioactive tracer elements makes it possible to study very slow reactions in the laboratory equivalent to millions of years of geologic time.

5. **DETAILED STUDY OF INTRUSIONS AND RELATED ORE DEPOSITS.** Basic studies of conditions of formation and the environment of ore deposits are important. It should be possible eventually to work out specific systems. At present, however, the subcommittee suggests that a detailed empirical study of igneous intrusion with its related ore deposits and of a similar intrusion without ore deposits be made. Such a detailed study might yield broad principles and valuable data that could be applied directly to exploration and prospecting.

Biological Field Stations and Research Facilities

A biological field station has been defined as any institution which offers field instruction or research in one or more of the biological sciences and is a separate administrative unit located in the field. Some stations have emphasized a program of field instruction, others have concentrated

on research activities, but most biological stations have tried to combine instruction and research in such relations that each would contribute most to the same end—the advancement of biological science.

About one-half of the biological field stations in the world are marine stations. The rest are about evenly divided for work in fresh-water biology or in terrestrial biology. There are very few biological stations south of the equator. In 1945 R. W. Hiatt listed 145 hydrobiological laboratories in the United States of which 80 were located inland and 65 were on the coast.

The typical biological station of the 20th century has been organized to encourage research and instruction in one or more kinds of environments. The uniqueness of field stations lies in their locations, and in the opportunities they offer students and investigators to study biological forms at close range in their natural environment. Stations are usually located on sites near or within a unique biological environment or else in an area where an abundance and variety of biological forms are easily accessible.

Many proposals for assistance to field stations have been received by the Foundation within the past two years. The greatest demand has been for funds to be administered and distributed by the stations as stipends to students and investigators for assistance in summer research and training activities. Grants were made for this purpose during the past year to the following stations:

- Mountain Lake Biological Station
- Itasca Biological Station
- Bermuda Biological Station
- Duke University Marine Laboratory
- University of Michigan Biological Station

Probably the next greatest need by field stations has been for funds for construction and the procurement of new equipment. Construction requests have included such items as building of laboratories, housing, electrical and water systems, roads, and renovation of buildings. Major equipment needs include large or expensive pieces of scientific equipment, vehicles, boats, new salt water systems, and, in one or two cases, standard equipment for new laboratories. Modest grants for equipment or facilities have been approved for the White Mountain High Altitude Laboratory, Mt. Desert Laboratory, and Rocky Mountain Biological Laboratory.

Several proposals have included requests for “housekeeping” and administrative expenses. A grant of this type was made to the unique

Barro Colorado Island station in Panama. A grant was also provided the Marine Biological Laboratory (Woods Hole) for repair of hurricane damage.

Research in the Social Sciences

The interrelations of the natural sciences and social sciences have intrigued scientists, philosophers, and logicians for over a century. Auguste Comte, sociology's godfather, effectively set the stage for discussion with his hierarchy of the abstract sciences. Mathematical, physical, biological, social, and even psychological and ethical sciences (*la morale*) were viewed as integral parts of a unitary scheme. From Comte's day on, it has been well nigh impossible for sociologists, psychologists, anthropologists, and other students of human social behavior to avoid such questions as how "scientific" the social sciences are, whether free will or something else makes it impossible to apply scientific method to human behavior, or whether there is a fundamental incompatibility between the natural sciences and social knowledge. Such problems still command central consideration by sociological theorists.

In a practical way, this issue has also been faced by administrative officers of colleges, universities and foundations in resolving the problems of organizational structure within their institutions. In which faculty, school, or division, does anthropology or psychology belong? Should physics, genetics, economics, and sociology be grouped together? More recently similar questions have commanded the attention of administrators of governmental scientific research programs in both military and civilian agencies.

Insofar as research support and scholarships and graduate fellowships in the social sciences are concerned, the Congress essentially accepted the "permissive but not mandatory" position put forth by Dr. Vannevar Bush in the House hearings during the 80th Congress. Dr. Bush stated:

"The Federal Government already does a great deal of work in the social sciences of a research nature. Research in the social sciences is very important indeed. We could well do more. * * * I think it would be a mistake for the Foundation to plunge into work in the social sciences without very careful consideration on what parts it would like to cover, what parts it feels can appropriately be handled under Federal auspices in view of their nature. * * * In other words, the legislation should be permissive but not mandatory, so that the Foundation will not be barred from

entering into the field but on the other hand will not be forced into it until it has given it the study that the subject deserves.”

Thus, the science support functions of the Foundation may be summed up in the statement that the Foundation's responsibilities are mandatory with respect to the sciences specifically enumerated (mathematical, physical, medical, biological, engineering) but are permissive with respect to the social sciences. Enumeration of the sciences in the National Science Foundation Act includes the phrase “and other sciences”. The legislative history of the Act indicates that this phrase was clearly intended to enable the Foundation to support social science research and award scholarships and graduate fellowships in the social sciences when and if it was deemed desirable to do so.

The legislative history of the National Science Foundation Act and the act itself have been in part responsible for the interest the Foundation has taken in the social sciences. Other factors involved were: (1) cognizance of the relatively large sums of money going into support of social science research by Federal agencies; (2) policy discussions of the role of the Federal Government relative to the social sciences; and (3) inquiries from other Government agencies regarding current research in the social science fields.

As a result of these considerations, the National Science Foundation undertook, in March 1953, a systematic and continuing study of the present scientific status of the social sciences and of the role of the Foundation with respect to social science research. As part of this study, the Foundation has been compiling for the past 2 years a report of extramural, unclassified research projects sponsored or supported by Federal agencies in the social sciences and related interdisciplinary fields. The eighth quarterly report of this series appeared in May 1955.

As a result of this intensive study the Foundation approved a limited program of support of the social sciences in August 1954. This limited program is being developed on an exploratory basis within a framework of four criteria. These are:

- (1) the criterion of science, that is, the identification, within the social disciplines, of those areas characterized by the application of the methods and logic of science;
- (2) the criterion of national interest, namely, the assignment of highest priority to social science activities directly related to the responsibilities of the Federal Government with respect to national welfare and national defense;
- (3) the criterion of convergence of the natural sciences and the social sciences; and
- (4) the criterion of basic research.

The program is being administered within the framework of the Foundation's three scientific divisions.

The program in the Biological and Medical Sciences Division is called Anthropological and Related Sciences. It includes support of basic research of an interdisciplinary nature involving the convergence of the biological and social sciences. The disciplines tentatively defined as falling within this program include anthropology, functional archaeology, human ecology, demography, psycholinguistics, and experimental and quantitative social psychology. The program receives guidance and assistance in evaluation of specific proposals from an advisory panel of specialists in the areas covered.

In the Mathematical, Physical, and Engineering Sciences Division, there has been established a program in Socio-Physical Sciences, which includes support of basic research of an interdisciplinary nature in such areas as mathematical social science, human geography, economic engineering, and statistical design. The socio-physical sciences program also embraces support of fundamental research in the history, philosophy, and sociology of science.

A limited extension of the fellowship program for academic year 1956-57 has allowed support for both predoctoral and postdoctoral fellowships in such areas of natural science-social science convergence as the history, philosophy, and sociology of science.

The study of the role of the Foundation, and of the Federal Government generally, with respect to social science research is continuing. In pursuing its responsibilities with respect to national science policy, scientific and technical manpower, assessment of the status of science, study of the impact of science on social welfare, promotion of international relations in science and the improvement of the exchange of scientific information, the Foundation has necessarily had to exploit the techniques, methods and concepts of the social sciences.

In addition to the staff surveys conducted, effective utilization is being made of the facilities and technical skills of such organizations at Battelle Memorial Institute, Maxwell Research Center of Syracuse University, The Institute for Research in Social Science of the University of North Carolina, Roger Williams Technical and Economic Services, Inc., and the American Academy of Arts and Sciences, and such Government agencies as the Bureau of Labor Statistics and Bureau of the Census. It is not surprising, therefore, although it is little realized, that the National Science Foundation, is, among Federal agencies, one of the major supporters of extramural social science research.

A research economic group within the Foundation has been given the responsibility to undertake directly, or to arrange for the support of, research dealing with the economic consequences of scientific research, particularly in terms of the contributions of science to the national economy and gross national product.

Research by Medical Students

An informal survey of 21 of the 80 medical schools in the United States conducted by the staff of the Foundation's Division of the Biological and Medical Sciences indicates that most medical schools try to provide some type of research training for medical students. The magnitude and manner of operation of such programs are quite varied. In some cases the institution provides funds from its own sources although limited funds are sometimes available from industry and other sources. Students are encouraged to undertake research, voluntarily and frequently without compensation, both during the academic year and summer vacation. Stipends vary from nothing at all to several hundred dollars per month, but in most schools available funds are spread so thinly that inadequate stipends are paid in order to provide for as many students as possible.

Estimates of the total numbers of medical students engaged in research each year vary from as few as two or three in some institutions to as many as 80 in the largest schools.

For the most part, deans of the medical schools express the belief that student research should be conducted in preclinical disciplines, although some deans felt that a few carefully selected clinical projects might also be suitable for student research. Students are normally associated with a senior investigator in the conduct of research projects, but the deans agreed unanimously that medical students doing research should not be used solely as technicians or in other routine capacities.

The success of a program of research by medical students ultimately depends on two factors—the quality and interest of the student himself and the confidence, maturity and dedication of the senior staff member under whom he works. Selection of students and of staff members therefore have paramount importance.

During the past 2 years the National Science Foundation has made grants for medical student research programs to the medical schools at Washington University at St. Louis, the University of Minnesota, the University of Wisconsin, and the State University of New York. In these cases the schools selected their own candidates for student stipends.

The success of these grants encouraged the Foundation to establish a continuing program for providing funds to medical schools for the payment of research stipends to medical students. Normally the limiting factor in the amount of funds to be made available is the number of qualified, mature investigators in basic sciences who are interested in guiding the research of one, or at most, two medical students. A secondary factor, of course, is the number of medical students who show the necessary aptitude for such a program. In administering this program, the Foundation has established a special advisory committee to review and evaluate requests for grants.

Training of Scientists and Engineers

Graduate Fellowship Program

On March 15 the Foundation announced the award of 715 predoctoral graduate fellowships and 70 postdoctoral fellowships for advanced study in the natural sciences for the academic year 1955-56. This was the fourth year in which such awards were made. The distribution of fellowship awards by field of study and comparative figures for the previous programs are summarized in figure 4. A table giving the number of applicants and awards by State and region, a complete list of fellowship holders, and a list of institutions attended by the fellowship holders as undergraduates and graduate students is given in Appendix IV, p. 133.

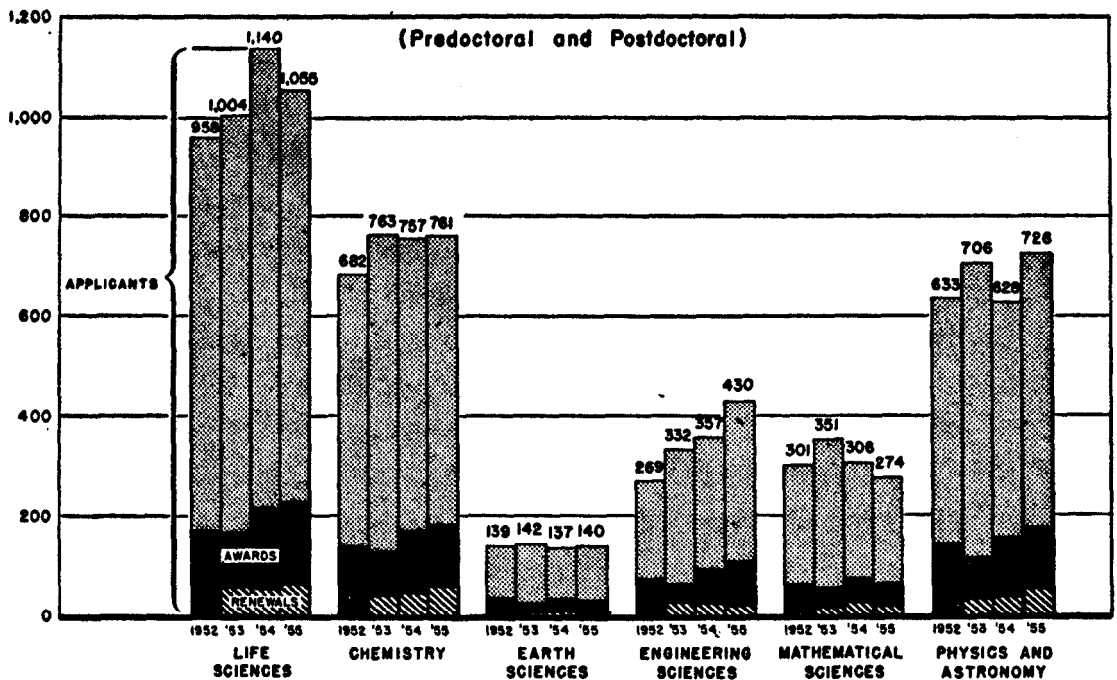


FIGURE 4. Pre- and postdoctoral fellowships awarded by the National Science Foundation by field of science, 1952-55, illustrating the disparity between number of applications and awards made.

Research on Fellowship Selection Techniques

Over the past 3 years the National Science Foundation has supported a research program on fellowship selection techniques under the direc-

tion of the Office of Scientific Personnel, National Research Council. This work has resulted in a number of interesting technical studies and two conferences which have led to modifications and simplifications of the methods for selecting Foundation fellows.

All personnel selection procedures involve the prediction of on-the-job effectiveness. The objective of research in this field is to establish the relationship between two sets of measurements:

1. The predictors or criteria on which selections were made.
2. The criteria of on-the-job effectiveness.

In attempting to tackle the research problems related to fellowship selection, the Research Advisory Committee to the National Research Council's Office of Scientific Personnel proposed three lines of study:

1. The development of short range and long range measures of success in science.
2. The isolation and definition of the ability and personality factors that are actually being measured with present selection techniques.
3. A follow-up study of fellowship applicants from previous years to determine which persons have most nearly shown the type of progress in science for which the particular fellowship program was established.

Measurement of Scientific Achievement

The successful pursuit of scientific activities requires a variety of specific abilities. Scientific creativity like artistic creativity, involves a large measure of originality and capacity to synthesize fresh, new ideas from a tangle of seemingly unrelated facts. But creativity is not necessarily the outstanding attribute of a great science teacher or science administrator. The observational powers of a skilled experimentalist must be of unusually high order, and he must have the critical judgment to recognize the point at issue and the ingenuity to design his experiment to test that point without ambiguity. In many areas scientific success depends upon more modest abilities, such as manual dexterity, persistence, and endurance. Study of the lives of the outstanding scientists reveals an unquenchable curiosity and an enormous drive or emotional identification with their work.

At the conferences supported by the Foundation relating to fellowship selection it was clear that scientists disagree among themselves as to suitable criteria for measuring on-the-job effectiveness in scientific fields. Certain obvious symbols of success exist, such as the Nobel prizes or

election to National Academies of Sciences. Ratings by peers may prove to be valuable and the quantity of publication, while not infallible if used alone, may also be a useful index of scientific productivity. Much raw data of this type have been accumulated on American psychologists as part of the American Psychological Association study supported by the Foundation on the development and current status of psychology in the United States. This information is being subject to rigorous statistical analysis to uncover the relationships and degree of consistency among various measures of productivity.

The psychological study and similar surveys in physiology, mathematics, and demography will undoubtedly provide a fertile source of information on the characteristics and social and educational backgrounds of scientists. It remains to be seen whether such information will be helpful in designing more adequate selection techniques.

Fellowship Selection Procedures

The selection procedure used by the Foundation includes the rating of applicants into quality groups. This part of the program is conducted for the Foundation by the National Research Council. Rating panels are chosen from leading American scientists in each of the fields for which awards are made. Each panel evaluates the records of candidates in its respective field. Each candidate's record consists of three parts:

1. Tests scores on verbal ability, quantitative ability, and scientific aptitude in the scientific field.
2. Previous scholastic record.
3. Confidential reports and evaluations obtained from the applicant's faculty advisors.

Another line of research undertaken by the research group on fellowship selection techniques involved intensive statistical studies of the types of ratings obtainable from the applicants' records. The factor analysis technique was used in an attempt to determine what characteristics are now actually being measured or evaluated in the selection process. In this connection psychologists versed in testing procedures have found that one rating scale frequently measures two or more specific abilities while several ratings often have the same or similar discriminating power among abilities. Seldom does a single rating device measure a single ability.

The first study of this type, undertaken at the University of Utah, was an investigation of seven rating scales taken from the confidential

report forms in the files of National Science Foundation fellowship applicants for the year 1952.

A similar, but much expanded study, was carried out on the records obtained on the 1953 fellowship applicants. In that year the Confidential Report Form requested ratings on 19 items as compared with 7 for the year before. The study also included the grades on four ability tests taken by each applicant, his age, three ratings based on previous academic grades, and the final quality group rating established by the panel. Thus, a total of 28 different measurements or ratings were available for each applicant. For the statistical analysis sets of ratings were obtained for a random sample of 175 first year fellowship applicants.

The analysis indicated that five identifiable factors or specific abilities were probably being measured by the 28 ratings used in the 1953 selection procedure. It is interesting to note that only three of the five were apparently being considered by the rating panels in making their quality group determinations. Three additional factors appeared to be statistically significant, but the study group was unable to identify them. The five factors identified are:

FACTOR A was tentatively described as a research ability factor, or more specifically as "the knowledge of and ability to use the basic research techniques in his field." This factor was common to all confidential report ratings, was significantly present in the academic grade ratings, and entered strongly into the quality group judgment of the panel.

FACTOR B was described as a personal soundness factor reflecting emotional stability and maturity. It appeared in most of the confidential report ratings with the exception of those having to do with research methodology. It figured most prominently in the personal soundness evaluation ratings on the confidential report. It apparently had little effect on the quality group judgment.

FACTOR C was described as an ability to evaluate critically and to organize the scientific literature in the applicant's field of interest. It was prominent in the previous academic grade averages and in the critical-mindedness and background preparation scales on the confidential report. It was contained significantly in the quality group judgment.

FACTOR D was tentatively described as an ability involving fertile imagination and originality. It was found primarily in the "new idea" ratings on the confidential report. Although it had no apparent effect on the quality group judgment, it may be of consider-

able importance in selection of young scientists and in the judgment of the study group should be investigated further.

FACTOR E was described crudely as an ability to perform well in the usual aptitude and achievement test situations. It was found in the aptitude test scores and also figured prominently in the quality group judgment.

While the study was highly tentative, it was also highly suggestive and indicated that further research in this direction might prove desirable. On the basis of the study the confidential report form for the 1954 fellowship program was revised in an effort to reduce the "halo effect" of Factor A and to bring out Factors B and D more sharply.

Role of Physics in Engineering Education

The Fourth Annual Report of the National Science Foundation reported that two conferences had been held with Foundation support to discuss the place of nuclear physics and solid state physics in engineering education. During the past year three similar conferences dealing with mechanics at New York University, thermodynamics at Pennsylvania State University, and electricity and magnetism at Lehigh University were held under the joint sponsorship of the American Society for Engineering Education and the Foundation.

In addition to the conferences, the American Institute of Physics was given a grant to establish a committee to review the recommendations and results of the several conferences and to evaluate the teaching of physics in engineering education. This group also agreed on a series of recommendations for enabling physics teachers to contribute a larger share in the development of better engineers.

Members of the committee visited 26 colleges offering engineering programs and discussed the problems of introducing physics courses into these programs with members of both the engineering and physics departments.

In its report the study group noted that the role of physics in engineering education is not static. Rather, it changes continually with the momentous changes that are taking place in both engineering and physics. In earlier times engineering was practiced essentially as an art, but more and more this conception of engineering is giving way to a modern science and technology. Since the beginning of the present century, the advance in physics has been enormous. To the committee, however, the increase in subject matter is not the most significant factor

in introducing physics instruction in engineering education. On the contrary, the committee believes that the cardinal aim should be that of imparting to the student a point-of-view or an attitude and capacity to deal with the principles and methods of analysis of contemporary physics. In its opinion, without training and experience in these new modes of thought neither physicists nor engineers will prove competent to deal with the emerging problems of science and technology.

The recommendations of the committee reflect interest in creating this attitude on the part of the student with respect to basic principles and methods of approach. They include:

1. Improved communication between engineers and physicists at the institutional level to discuss objectives and determine mutual needs.
2. Early contact of engineering undergraduates with physics.
3. Increased participation of research-minded professors in undergraduate teaching.
4. Introduction of more challenging experiments in laboratory instruction.
5. Greater emphasis, particularly in textbooks of general physics, on ideas, principles and methods.
6. More appropriate use of mathematics in general physics teaching.
7. Greater encouragement of experimentation in teaching.

Need for Science Teacher Training

Several years ago the Foundation learned through exploratory studies that a most critical and immediate limiting factor in developing latent science talent in the youth of the United States was the dwindling supply of adequately trained science teachers. In each succeeding year the proportion of college graduates qualified for high school science teaching has declined. Because of the unavailability of science teachers, many schools today have a limited science program or none at all. In other schools science teaching is on an emergency basis and many teachers have less than the minimum training required for certification.

As this trend continues, the introduction of science to our potential young scientists becomes more and more inadequate and distorted. A poorly trained science teacher is unable to capture the imagination of his students, to formulate and teach them up-to-date and vigorous courses, and to guide their scientific development according to their abilities.

In accord with these findings, the Foundation for the past 3 years has conducted a series of experimental programs to strengthen science teaching at the high school level.

Summer Institutes and Visiting Lecturers

For 3 years the National Science Foundation has sponsored a series of summer institutes attended by science teachers at both the high school and college level. The institutes normally ran for several weeks and the teachers attending them were given an opportunity to review recent developments in their respective fields of science under the guidance of leading scientists. The table below summarizes information on all institutes that have been held during this period.

NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTES

<i>Host Institution</i>	<i>Science Area</i>	<i>Participants</i>
<i>1953</i>		
University of Colorado	Mathematics	College Teachers.
University of Minnesota	Physics	College Teachers.
<i>1954</i>		
University of Wyoming	Chemistry	College Teachers.
University of North Carolina	Mathematics	College Teachers.
University of Oregon	Mathematics	College Teachers.
University of Washington	Mathematics	High School Teachers.
<i>1955</i>		
University of Wyoming	Biology	College Teachers.
University of Minnesota	Chemistry	College Teachers.
Syracuse University	Chemistry	College Teachers.
Syracuse University	Chemistry	High School Teachers.
Oklahoma A & M College	Mathematics	College Teachers.
Oklahoma A & M College	Mathematics	High School Teachers.
Stanford University	Mathematics	College Teachers.
University of Wisconsin	Mathematics	High School and College Teachers.
Oak Ridge Institute of Nuclear Studies.	Physical Sciences	High School Teachers.
Pennsylvania State University	Physical Sciences	High School Teachers.
University of New Mexico	Physics	High School and College Teachers.

The response of the teachers attending the institutes has been enthusiastic and the Foundation plans to continue this experimental program. During the past year, however, a grant has been awarded to the Bureau of Social Science Research, American University, to attempt to

evaluate the effectiveness of summer institutes as a device for improving high school and college teaching of science.

The Foundation has also provided several grants on an experimental basis to enable outstanding scientists to visit groups of colleges and lecture on recent research developments.

Failure of Talented Youth to Continue Education

Fully half of the young people in the United States having the intellectual capacity to continue their education beyond high school do not do so. (Figure 5.) Many of these people undoubtedly have the potential ability to become leaders in industry, government, and the professions. Their lack of training prevents them at the outset from embarking upon careers consistent with their native ability. Whatever this may mean to the individual himself in terms of personal satisfaction and fulfillment, it certainly means an appalling loss to the Nation. Within recent years leaders in education, industry, and government have sought ways and means to salvage a higher proportion of this waste in human resources.

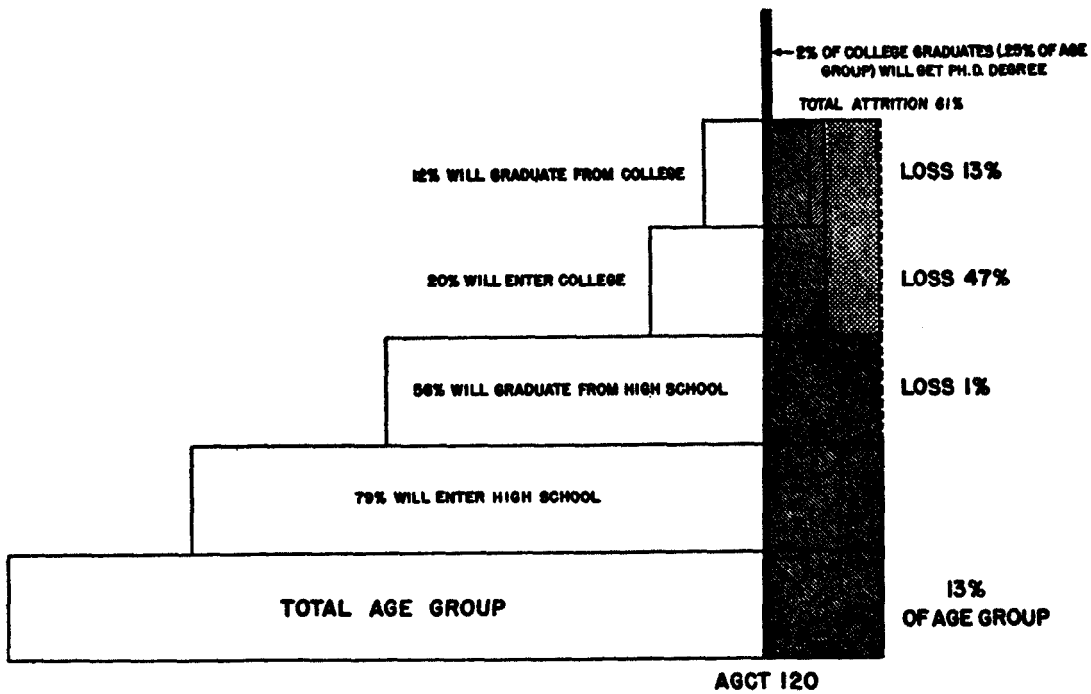


FIGURE 5. Of all the members of an age-group with intelligence and scholastic ability equal to that of the average college graduate (I. Q. or AGCT 120), more than 60% failed to complete college. Only 2% of the college graduates, and .25% of the entire age-group will obtain a Doctor's degree.

During the past year a cabinet level interdepartmental committee of the Federal Government, under the chairmanship of the director of the Office of Defense Mobilization, has attempted to gather available

information on the problem and to make recommendations for possible action. Clearly, the problem is not one that can be solved solely by action of the Federal Government. Education in the United States is almost entirely the responsibility of State and local governments and private groups and the social pressure required to improve or modify the educational system is generated in the citizenry itself.

The committee found that lack of finances was only in part responsible for the failure of many talented young people to continue their education. Lack of motivation was certainly a major factor. Many well-paying jobs were open to seniors graduating from high school. The value of additional education from a dollars and cents point-of-view was not immediately obvious to the graduate. In many localities a college education does not necessarily confer additional prestige upon its holder. On the contrary it tends to isolate the individual from his family and friends without at the same time providing him with ready access to other social groups.

Answers such as the above are plausible but nevertheless largely conjectural. There has been very little fact upon which to base either careful analyses of the problem or a sound program for encouraging a larger proportion of high ability young people to continue their education into college and beyond.

National Survey of High School Students

What factors are responsible for kindling a desire in high school graduates to enter or not to enter college? In order to get more information on this question the National Science Foundation entered into a contract with the Educational Testing Service, Princeton, New Jersey, to undertake a survey of the educational and vocational attitudes of 1955 high school seniors. The survey was designed to provide definitive information on a national scale of the post-high school interests of seniors, financial barriers to continued education, and the parental and other social factors which might be related to college going.

The 1955 graduating high school seniors from 5 percent of all public high schools in the United States were questioned. Each Senior student in the selected schools was asked to fill out a 30-minute questionnaire on his background and plans and interests relative to college, as well as to take a 15-minute test of academic aptitude. Fact sheets prefaced by the principals of the schools in the sample gave pertinent supplementary information about the school and community. In addition, comparative data were obtained for a smaller sample of high school

sophomores to see how attitudes change during the last 2 years of school.

The results reported below are based upon replies from 478 schools, with a total of 32,750 twelfth-year students. Since the scientific population of the future will be drawn largely from the high ability boys and girls, the responses of the high-scoring group were of particular interest to the Foundation. The top 30 percent of the students, known as "high-scoring," were assumed to have sufficient ability to do college work successfully.

Educational and Vocational Plans

Two questions dealt with post-high school plans of seniors and sophomores. The first asked: "What would you *really like* to do when you finish high school?" The second asked: "What do you think you *will* do when you finish high school?"

About half of the high scoring seniors, both boys and girls, would like to attend college immediately, while 79 percent of the boys and 69 percent of the girls express definite interest in college, now or later. The proportion of sophomores indicating similar interests is significantly lower. Part of the difference may result from drop-outs during the last 2 years, but there seems to be no doubt that interest in college increases from the tenth to the twelfth year in school.

The difference between the responses to the two questions suggests how finances may affect college going. Of the high scoring senior boys 47 percent state they will attend college immediately compared with 53 percent who would like to do so. Comparable figures for girls are 42 percent as against 50 percent. It will be noted that the higher the score on the ability test the larger the percentage of seniors planning to attend college.

Inquiries were made as to why students want to attend college. Seniors put greater emphasis upon vocational reasons than do sophomores. However, fewer sophomores answered the question, suggesting greater uncertainty as to the reason for a college education. Similar findings appear in comparison of what seniors and sophomores indicate they would like to study in college. Here again, many sophomores gave no response suggesting that many of them had not made up their minds.

The reasons given by high scoring seniors for not attending college defy simple analysis. About one out of eight definitely states that lack of adequate finances is the principal obstacle. Many other answers were given, however, some of them having economic implications, so that it is difficult to isolate the financial from the motivational factors.

Scholarship Assistance

A number of questions were asked concerning scholarship assistance to attend college. Students were asked: "Suppose that you would get a scholarship to go to college if you agreed to study a particular subject. The scholarship would be large enough to make it possible for you to attend a good college and you would have no need to worry about earning any part of your expenses. *But to get the scholarship you would have to agree to major in (or emphasize) some particular subject.*"

A surprisingly high proportion of those previously expressing no interest in college would apparently accept scholarships under the conditions stated. Logically, if there were no interest in college in these people, they would not be expected to accept a scholarship.

This inconsistency suggests several possibilities. Perhaps, the expressed lack of interest in college was a facade adopted to protect the respondents from admitting that they are not likely to be able to go to college. Perhaps, the offer of a "free ride" was too attractive to turn down. On the other hand, the fact that half of the high scoring boys expressing no interest in college stated that they would accept scholarships to study engineering and one quarter to study in the physical sciences suggests that lack of motivation for college might be replaced by positive interest if scholarship assistance were available.

It is also interesting to compare the response to the scholarship question with those previously given regarding subject of greatest interest. By contrasting what seniors say they would like to do with what they say they would do with the aid of scholarships, it is possible to assess to some extent the effect of financial pressure in diverting students from one field to another.

The responses indicate that if scholarships in the physical sciences were offered to high ability boys, they would attract 35 percent of those primarily interested in the social sciences, 27 percent of those primarily interested in business, and 26 percent of those interested in education. Scholarships in engineering would siphon off 72 percent of those interested in the physical sciences, 30 percent of those interested in the biological sciences, 46 percent of those interested in fine arts, and 34 percent of those interested in education. Scholarships in education, however, would attract only 18 percent of those primarily interested in physical science, 19 percent of those interested in engineering, and 34 percent of those interested in business.

High-scoring girls indicate less willingness to shift from nonscientific to scientific fields. It is worth noting, however, that one-third of the

high ability girls expressing interest in social science state they would leave that field to major in mathematics if a scholarship were available.

These figures must be interpreted with caution. What an adolescent says he will do and what he eventually does are often strikingly different. Undoubtedly, some respondents may have concluded that they would accept a scholarship to study in an area other than that of their primary interest and still devote most of their time to the field they like best. Moreover, many students might not have the ability or aptitude to obtain and keep a scholarship in a field outside their primary interest, despite their apparent willingness to accept it.

With due allowance for these precautions, however, it still appears that the offering of scholarships restricted to particular fields creates motivational forces of unequal intensity that tend to change the existing distribution of interest among secondary school graduates. The figures also indicate that commitment to some fields comes earlier than to others. More information on this point should be obtained in view of its implications in connection with recruitment for science and engineering at the high school level.

Social Factors

The survey gave more precise data than heretofore available on the relationship between parental occupation, income, and other social factors and college plans of talented high school seniors. About 95 percent of the children of professional parents expect to get to college sooner or later. For the business and technical groups the fraction drops to about 85 percent, falling to 65 percent for farm and labor groups.

Lack of motivation to attend college is much more evident among children whose fathers had little schooling than among those whose fathers graduated from college. The proportion of those planning to attend college immediately is higher among those who have friends also expecting to go to college than among those having few friends heading in that direction.

The size of school is also related to the plans for college attendance among high-scoring seniors. For schools having enrollments of from 1,000 to 1,499 students about 56 percent of the boys plan to attend college immediately. This is true of only 37 percent of the high-scoring boys from the smallest schools with enrollments of 99 students or less and of only 43 percent in the largest schools having enrollments of 1,500 students or more.

These findings may be related in part to the amount of vocational guidance available to the student, since the employment of professional guidance personnel is geared to size of school. It is noteworthy that more than one-fourth of the largest schools in the sample had no full-time guidance person, and over half of all schools reported no professional counselor on the staff, even on a part-time basis.

Conclusions

The survey permits estimates to be made of the number of youth of high ability in the United States who plan to go to college, who would like to go but will be prevented from doing so, and who have no motivation toward higher education. The United States Office of Education estimated a total of 1,265,000 seniors in public secondary schools in 1954-55. On the basis of the survey it would appear that about 6 percent of the high-scoring group, or 21,000 seniors, would really like to go to college but do not think they will be able to continue their education. Another 23,000 would like to go to college immediately but will have to defer college, for the time being, principally to go to work. About 6,000 plan to work full-time and will attempt to go to college at night.

On the basis of previous follow-up studies, it seems safe to say that at least 5,000 and at most 40,000 of those planning to go to college will not realize their plans.

Approximately 10 percent of the total secondary school population attend nonpublic schools. If it is assumed that similar proportions of talented students will be found in this group, it would appear that a total of from 60,000 to 100,000 seniors have the ability and the desire to go to college but will not do so. Presumably, if financial support were available, many of this group could be salvaged for higher education.

Finally, the survey indicates that about 50,000 high ability seniors in the United States have no interest in continuing their education. An additional 36,000 could not be classified because of failure to respond or because of the nature of the reply, but they are apparently not motivated toward college. If an allowance for nonpublic schools is added, there appear to be approximately 100,000 high ability seniors whose intellectual resources cannot be salvaged for higher education by simply offering scholarships.

Exchange of Scientific Information

The problem of managing the large volume of scientific information resulting from research becomes more acute each year. The Second Annual Report of the National Science Foundation for fiscal year 1952 gave as an example of the rapidly growing volume of scientific literature the increase in size of the *Physical Review* from about 2,000 pages annually during World War II to about 5,000 pages in 1951. This journal has continued to grow at the rate of about 700 pages a year so that in 1954 it contained almost 7,000 pages. It is so large now that the American Physical Society is considering the advisability of splitting the journal into two separate publications.

Another indication of the growth in the volume of scientific material is the rapid expansion of abstracting services that attempt to cover their fields comprehensively. For example, *Chemical Abstracts*, which attempts to cover all papers containing new knowledge in the field of chemistry, has about doubled in size since 1948. In that year, it contained abstracts of 43,000 papers and in 1954, 79,000 abstracts. In 1955, the number will undoubtedly go well over 80,000.

The scientific information problem has three major facets:

1. The form in which the literature originally appears.
2. The improvement of our bibliographic services and tools, and
3. The possibility that mechanization of our methods for searching the literature will eventually be required.

And in addition there is need to make more effective dissemination and use of foreign scientific information. Improved bibliographic services and the provision of translations of significant papers and reviews of foreign science will help to accomplish this objective.

Form in Which the Literature Appears

The form in which the literature appears is influenced by cost, by content, by the reading habits of users, and by the appearance of new methods of reproduction and processing. For more than 200 years,

the scientific journal has served as the principal channel of communication among scientists. Rising publication costs have caused the scientific societies to raise dues and subscriptions and occasionally to appeal to industry, research foundations, or government for help in meeting their publication deficits. The National Science Foundation for several years supported scientific publications on an emergency basis in order to tide them over difficult periods while they took steps to increase revenues and become self-supporting if at all possible.

Scientific publication, however, presents more than a financial problem. The sheer volume of many scientific journals is causing concern—although the journals are growing larger and larger the individual scientist does not have any more time for reading. It is necessary to study how to publish less without loss to science.

The Foundation will continue to consider requests from journals for emergency support, but in addition it is urging societies, and groups of societies in the same field, to look for some more permanent solution of their publishing difficulties and to undertake studies that will lead to greater understanding of the actual facts and the problems of scientific publication. Many societies have devoted a great deal of thought in the last few years to their publication problems, and some of them are planning studies and experiments with different forms of publication or distribution of information.

In order to provide reliable information about current scientific journals, the Science Division of the Library of Congress, with funds provided by the Foundation, prepared and published comprehensive lists of United States and Russian scientific serial publications and also a list of the world's biological serial publications. Each list contained about 3,000 entries giving complete bibliographical data about the publications and brief descriptions of their contents.

The Government has contributed in no small measure to the scientific information problem by issuing many thousands of scientific and technical reports annually. As a rule these reports are not covered by the widely used bibliographical tools of science; that is to say, they are outside the established channels of communication and may not come to the attention of many scientists who could make use of the information. In order to know whether a significant amount of important information remains permanently in the form of technical reports, the Foundation has supported a study in the Technical Information Division of the Library of Congress to determine to what extent information that appears first in the form of unclassified governments reports is subsequently published in the open literature. The questionnaires sent to

authors of some 1,500 reports have now been returned and the replies are being analyzed. A final report on this study should be available early in 1956.

Improvement of Bibliographic Tools

Many of the scientific abstracting and indexing publications have given good service to scientists for decades but even the best of them are now having difficulty keeping up with the tremendous volume of material. The publishers of *Chemical Abstracts* used to be very proud of the fact that they were able to issue an annual index to the journal within two or three months after the end of a year. Now the index does not appear until fall. This delay undoubtedly causes a great deal of additional work and inconvenience to chemists and librarians the world over. The American Chemical Society is fully aware of this problem and has a special committee studying methods of producing indexes promptly.

The indexes for *Biological Abstracts* some years ago were almost three years behind because of insufficient funds and reluctance to decrease coverage of the literature. Because the utility of an abstract journal is greatly impaired by lack of an index, the Foundation, in cooperation with the Office of Naval Research, the Atomic Energy Commission and the National Institutes of Health, has provided funds for up-dating the indexes for *Biological Abstracts*.

In addition, the Foundation has supported a thorough study of biological abstracting under the direction of Bentley Glass of Johns Hopkins University. The study had two parts: (1) A survey of the opinions and abstracting needs of biologists; and (2) a series of objective studies of the coverage of *Biological Abstracts* compared with the coverage of other services covering some of the same specialized fields of comprehensive subject bibliographies covering specific topics. The findings of this study and the resulting recommendations for increasing the effectiveness of *Biological Abstracts* may be helpful also to abstracting services in other fields of science. The results of the comparative studies of coverage clearly indicate the need for greater coordination of abstracting services.

Except for efforts to improve the coverage and the promptness of abstracting and indexes services and to coordinate their efforts in order to avoid undesirable duplication, it is difficult to know exactly what is needed in the way of improved bibliographic services because relatively little factual knowledge is available about the way in which scientists seek information and work with the literature. For this reason, the Foundation is supporting a study at the Department of Agriculture

of the uses made of information sources and bibliographic tools by laboratory scientists. The pilot study, directed by Ralph Shaw of Rutgers University, is being made in the Forest Products Laboratory at Madison, Wis., and is expected to produce information that will serve as a guide in designing more extensive studies of this type. When more precise knowledge is available about the way in which scientists work with the literature and the effectiveness and shortcomings of existing bibliographic tools and services, a sound basis will have been built on which to plan improved services.

Mechanization of Information Searching

Although many persons are convinced that machines can be used to advantage in searching our recorded knowledge and locating information on specific topics, as yet relatively little progress has been made toward this end. Dr. Vannevar Bush, who for many years has drawn attention to the need for the better use of information, said this about the problem in a recent address: ¹

The progress of our civilization in peace time depends, and has always depended, not only on our current thoughts and findings, but on the skill and facility with which we create, store, interchange, consult, and utilize the whole record of our collective past experiences. We are making enormous strides in the development of methods for creating a record of what we learn—in printed words, by photography, or on a magnetic tape. We are also making strides in developing means for the transmission of ideas from one to another or from a central point to great audiences. But in one exceedingly important phase of the whole problem we are making little progress indeed. This is the phase of finding in the record the information that we need.

It seems reasonable to look forward to the day when machines will take much of the drudgery out of literature searching and help locate the more obscure items of information that may now escape notice. It must be borne in mind, however, that the task of organizing and coding material and entering it into a machine system is likely to be very expensive. This is not to say that such a system or systems if well designed might not save money in the long run by helping to avoid duplication in laboratory and library research. But it is absolutely essential that effective systems for organizing and retrieving information be developed. Probably no one would dispute the fact that at present

¹ "Communications—Where Do We Go from Here?" Founding Anniversary Meeting of the American Society of Mechanical Engineers, February 16, 1955, New York, New York.

our machine technology is far in advance of our ability to organize information for machine manipulation. Some fundamental research on methods of organizing information is called for and the Foundation is endeavoring to encourage and promote such research.

Language Studies

Fundamental research on language will produce knowledge that may be helpful in devising systems for mechanized information searching. Willard Gibbs noted many years ago that "Mathematics is a language." Its great advantage, of course, over other languages lies in the precision, uniformity and lack of ambiguity with which it symbolizes that portion of reality with which it is concerned. While the ordinary language of speech or literature is also a code or symbolization for reality it is by no means as precise, uniform, and unambiguous.

At the present time, lack of understanding of the basic nature of language and our inability to achieve linguistic precision may be the central problem in the exchange of information. During the past 2 or 3 years the Foundation has provided support for some preliminary studies related to this problem. Rudolph Carnap, University of Chicago, has been attempting to develop a statistical theory of language. This research is supported as research in mathematics, but it also has important implications in the field of scientific information.

L. Brillouin, Columbia University, is attempting to establish the concepts and theories of modern physics on the basis of the formal information theory developed during the past decade by Norbert Wiener, Claude Shannon, and others. The successful outcome of these studies may suggest how statistical information theory might serve as a foundation for other areas where the need for a firm theoretical foundation is far greater than in the case of physics.

Victor H. Yngve, of the Research Laboratory of Electronics, Massachusetts Institute of Technology, has received Foundation support for studies into the feasibility of translation of languages by machine. While the immediate goal of Dr. Yngve's work is of great current interest, the long-range goal might have still greater significance. His studies may have even greater significance as a contribution to basic linguistic theory.

Foreign Science Information

Because so few scientists in the United States can read Russian and also because many Russian scientific publications are not widely dis-

tributed in this country, there is a specific and acute need for translations of Russian scientific papers. The Foundation is supporting a project, administered by the American Institute of Physics, for the translation and publication of an English edition of the Russian *Journal of Experimental and Theoretical Physics*. The publication has begun with the first issue of 1955. The English edition will be issued bi-monthly and will be sold on a subscription basis. The Foundation has also made a grant to the American Mathematical Society for the continuation of its program of translating significant Russian papers on mathematics, a program which was begun several years ago with the support of the Office of Naval Research. Under the Foundation grant, the translations will be published in three volumes per year and sold by the society.

The extension of translating activities to other languages has begun with a grant to the Missouri Botanical Garden for an English translation of a Japanese reference work entitled *The Flora of Japan*.

Continuing support is being given to the Library of Congress for the operation of a Scientific Translations Center, which collects, records, and duplicates translations of Russian scientific papers from many different sources: Government agencies, scientific societies, universities, and industrial laboratories. The center publishes a monthly Bibliography of Translations from Russian Scientific and Technical Literature, which lists all the translations deposited with the center and also translations available from other sources such as commercial translating services.

In order to provide authoritative review articles on current developments in Russia in selected fields of science, the Foundation has made a grant to Annual Reviews, Inc., for the preparation and publication of review articles on nuclear science, physical chemistry, microbiology, plant physiology, and biochemistry. The reviews will be published as chapters in the annual review volumes covering these fields.

Support for Attendance at International Scientific Meetings

Direct personal communication among outstanding scientists of different countries stimulates thinking and promotes the exchange of scientific ideas and information in a way which cannot be done by any other means of communication. In order to encourage such personal contact, the Foundation has provided grants for partial payment of travel expenses to enable American scientists to participate in selected international and scientific meetings.

During the year, 132 scientists were given grants permitting them to attend 29 different international scientific meetings, such as the 14th

International Congress of Pure and Applied Chemistry at Zurich, the 9th General Assembly of the International Astronomical Union at Dublin, the 10th International Union of Geodesy and Geophysics at Rome, the International Symposium of the Biometrical Society at Campinas, Brazil, the International Symposium of Molecular Spectroscopy at Oxford, and the Symposium on Radiation Chemistry of Liquids at Paris. The grants have averaged about \$580. This small figure indicates that the recipients must make substantial personal contributions in order to attend the meetings. In order to insure the maximum benefit to science and to the Nation, the international meetings to be supported by travel grants are carefully selected. The individual scientists who receive the grants are also carefully selected with the assistance of panels of consultants, scientific societies or the appropriate committees of the National Academy of Sciences—National Research Council.

APPENDIX I

NATIONAL SCIENCE BOARD, STAFF, DIVISIONAL COMMITTEES AND ADVISORY PANELS

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- ALLAN H. BROWN, Department of Botany, University of Minnesota, Minneapolis, Minn.
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- JOHN T. EDSALL, Biological Laboratories, Harvard University, Cambridge, Mass.
- FRANK H. JOHNSON, Department of Biology, Princeton University, Princeton, N. J.
- HENRY A. LARDY, Enzyme Institute, University of Wisconsin, Madison, Wis.
- HOWARD K. SCHACHMAN, Virus Laboratory, University of California, Berkeley, Calif.
- DAVID SHEMIN, Department of Biochemistry, Columbia University, New York, N. Y.
- BIRGIT VENNESLAND, Department of Biochemistry, University of Chicago, Chicago, Ill.

Advisory Panel for National Astronomical Observatory

- IRA SPRAGUE BOWEN, Mt. Wilson and Palomar Observatories, California Institute of Technology, Pasadena, Calif.
- LEO GOLDBERG, Department of Astronomy, University of Michigan, Ann Arbor, Mich.
- ROBERT R. McMATH, McMath-Hulbert Observatory, University of Michigan, Pontiac, Mich.
- BENGT STROMGREN, Director, Yerkes & McDonald Observatories, University of Chicago, Williams Bay, Wis.

OTTO STRUVE, Berkeley Astronomical Department, University of California, Berkeley, Calif.

ALBERT E. WHITFORD, Director, Washburn Observatory, University of Wisconsin, Madison, Wis.

Advisory Panel for Physics

SAMUEL K. ALLISON, Department of Physics, University of Chicago, Chicago, Ill.

ROBERT B. BRODE, Department of Physics, University of California, Berkeley, Calif.

GAYLORD P. HARNWELL, Department of Physics, University of Pennsylvania, Philadelphia, Pa.

KARL F. HERZFELD, Department of Physics, Catholic University of America, Washington, D. C.

CECIL T. LANE, Department of Physics, Yale University, New Haven, Conn.

R. E. MARSHAK, University of Rochester, Rochester, N. Y.

W. K. H. PANOFSKY, Department of Physics, Stanford University, Stanford, Calif.

JOHN C. SLATER, Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

EUGENE P. WIGNER, Department of Physics, Princeton University, Princeton, N. J.

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FRANK A. BEACH, Department of Psychology, Yale University, New Haven, Conn.

CARL I. HOVLAND, Department of Psychology, Yale University, New Haven, Conn.

LYLE H. LANIER, Department of Psychology, University of Illinois, Urbana, Ill.

QUINN McNEMAR, Department of Psychology, Stanford University, Stanford, Calif.

W. D. NEFF, Department of Psychology, University of Chicago, Chicago, Ill.

BENTON J. UNDERWOOD, Department of Psychology, Northwestern University, Evanston, Ill.

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JESSE L. GREENSTEIN, California Institute of Technology, Pasadena, Calif.

JOHN PETER HAGEN, Naval Research Laboratory, Washington, D. C.

JOHN D. KRAUS, Ohio State University, Columbus, Ohio.

RUDOLPH L. B. MINKOWSKI, Mt. Wilson and Palomar Observatories, Pasadena, Calif.

EDWARD M. PURCELL, Harvard University, Cambridge, Mass.

MERELE A. TUVE, Carnegie Institution of Washington, Washington, D. C.

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RICHARD H. BARNES, Director, Biochemical Research, Sharp and Dohme, West Point, Pa.

R. H. BURRIS, Department of Agricultural Biochemistry, University of Wisconsin, Madison, Wis.

IRWIN C. GUNSALUS, Department of Bacteriology, University of Illinois, Urbana, Ill.

PAUL J. KRAMER, Department of Botany, Duke University, Durham, N. C.

FRITZ A. LIPMANN, Department of Biological Chemistry, Harvard Medical School, Massachusetts General Hospital, Boston, Mass.

C. N. H. LONG, Department of Physiology, Yale University School of Medicine, New Haven, Conn.

ALWIN M. PAPPENHEIMER, JR., Department of Microbiology, New York University College of Medicine, New York, N. Y.

FOLKE K. SKOOG, Department of Botany, University of Wisconsin, Madison, Wis.

ELMER H. STOTZ, Department of Biochemistry, University of Rochester School of Medicine, Rochester, N. Y.

EDWARD L. TATUM, Department of Biology, Stanford University, Palo Alto, Calif.

ALFRED E. WILHELMI, Department of Biochemistry, Emory University, Emory, Ga.

CARROLL M. WILLIAMS, Biological Laboratories Harvard University, Cambridge, Mass.

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VERNER W. CLAPP, Chief Assistant Librarian, Library of Congress, Washington, D. C.

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- JAMES W. COLE, Jr., Department of Chemistry, University of Virginia, Charlottesville, Va.
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- JAMES C. O'BRIEN, Director of Personnel, Department of Health, Education, and Welfare, Washington, D. C.
- PHILIP N. POWERS, Executive Administrator, Atomic Electric Project, Monsanto Chemical Co., St. Louis, Mo.
- MERRIAM H. TRYTTEN, Director, Office of Scientific Personnel, National Research Council, Washington, D. C.
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- GERALD M. CLEMENCE, Director, Nautical Almanac, U. S. Naval Observatory, Washington, D. C.
- JOSEPH O. HIRSCHFELDER, Department of Chemistry, University of Wisconsin, Madison, Wis.

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J. BARKLEY ROSSER, Department of Mathematics, Cornell University, Ithaca, N. Y.

MARTIN SCHWAZSCHILD, Department of Astronomy, Princeton University, Princeton, N. J.

EDWARD TELLER, Department of Physics, University of California, Livermore, Calif.

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APPENDIX II

RESEARCH SUPPORT PROGRAM

BASIC RESEARCH GRANTS AWARDED IN FISCAL YEAR 1955

Anthropological and Related Sciences

- HARVARD UNIVERSITY, Cambridge, Mass.; Gordon R. Willey, Peabody Museum; *Prehistoric Settlement Patterns in the Maya Area*; 1 year; \$11,500.
- SOUTHERN ILLINOIS UNIVERSITY, Carbondale, Ill.; J. Charles Kelly, Department of Anthropology and Director of the Museum; *An Archaeological and Ecological Study of Pre-Agricultural Human Occupations of the Eastern United States*; 1 year; \$8,000.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; William L. Straus, Jr., Laboratory of Physical Anthropology; *Studies on Primate Evolution*; 1 year; \$10,000.
- UNIVERSITY OF OREGON, Eugene, Oreg.; Luther S. Cressman, Department of Anthropology; *A Study in Oregon Coast Prehistory*; 2 years; \$11,100.
- UNIVERSITY OF OREGON, Eugene, Oreg.; J. Arnold Shotwell, Museum of Natural History; *Effects of Environmental Change on Community Organization over Long Periods of Time*; 2 years; \$11,100.

Astronomy

- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Samuel Herrick, Department of Astronomy; *The Orbits of Icarus and other Astronomical Objects*; 3 years; \$5,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Otto Struve, Department of Astronomy; *The Composition of the Stars*; 2 years; \$21,000.
- CASE INSTITUTE OF TECHNOLOGY, Cleveland, Ohio; J. J. Nassau, Department of Astronomy; *Carbon Stars near the Galactic Equator*; 2 years; \$13,500.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; A. B. Meinel and W. W. Morgan, Department of Astronomy; *Microschmidt Reddened B-Star Survey*; 18 months; \$13,000.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Harold Urey, Institute for Nuclear Studies; *Chemical Reactions in Interstellar Matter*; 1 year; \$7,500.
- COLUMBIA UNIVERSITY, New York, N. Y.; Jan Schilt, Department of Astronomy; *Trigonometric Parallaxes of Stars*; 1 year; \$2,400.
- HARVARD UNIVERSITY, Cambridge, Mass.; Bart J. Bok and Harold I. Ewen, Harvard College Observatory; *Radio Astronomy in the Microwave Regions*; 15 months; \$132,000.
- INDIANA UNIVERSITY, Bloomington, Ind.; Halton C. Arp, Department of Astronomy; *Photometric Study of the Small Magellanic Cloud*; 2 years; \$18,600.
- INDIANA UNIVERSITY, Bloomington, Ind.; John B. Irwin, Department of Astronomy; *Photoelastic Observations of Southern Cepheids*; 1 year; \$5,800.
- INDIANA UNIVERSITY, Bloomington, Ind.; M. H. Wrubel, Department of Astronomy; *Evolutionary Sequences of Stellar Models*; 1 year; \$2,900.
- UNIVERSITY OF KANSAS, Lawrence, Kans.; H. G. Horak, Department of Physics and Astronomy; *Solar System Photometry*; 2 years; \$7,500.
- LOWELL OBSERVATORY, Flagstaff, Ariz.; E. C. Slipher and A. G. Wilson, Secretaries, Mars Committee; *Photographic Patrol of Mars*; 4 months; \$2,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Willem J. Luyten, Department of Astronomy; *Proper Motions of Faint Stars*; 3 years; \$17,800.

RANDOLPH-MACON WOMAN'S COLLEGE, Lynchburg, Va.; A. Marguerite Risley, Department of Mathematics; *Motions of Long Period Variable Stars*; 2 years; \$2,000.

UNIVERSITY OF VIRGINIA, Charlottesville, Va.; A. N. Vyssotsky, Department of Astronomy; *Spectra of Faint Stars*; 1 year; \$4,800.

UNIVERSITY OF VIRGINIA, Charlottesville, Va.; Harold L. Alden, Department of Astronomy; *Astrometric Study of Selected Stars*; 2 years; \$10,000.

WESLEYAN UNIVERSITY, Middletown, Conn.; Charles E. Gasteyer, Department of Astronomy, Yale University; *Photographic Observations of Double Stars*; 3 years; \$3,000.

UNIVERSITY OF WISCONSIN, Madison, Wis.; A. E. Whitford, Department of Astronomy; *Absolute Spectrophotometry of Stars*; 2 years; \$10,000.

Chemistry

UNIVERSITY OF ARKANSAS, Fayetteville, Ark.; Samuel Siegel, Department of Chemistry; *Substituent Effect in the Reactions of a Group Attached to the Cyclohexane Ring*; 2 years; \$9,700.

UNIVERSITY OF ARKANSAS, Fayetteville, Ark.; E. S. Amis, Department of Chemistry; *Influence of Charge and Field on Chemical Processes*; 2 years; \$15,000.

BARNARD COLLEGE, Morningside Heights, New York, N. Y.; Emma Dietz Stecher, Department of Chemistry; *Benzylidenepyruvic Acid Studies*; 2 years; \$17,500.

BRIGHAM YOUNG UNIVERSITY, Provo, Utah; J. Rex Goates, Department of Chemistry; *Mechanism of Adsorption of Ions by Silicate Minerals*; 1 year; \$5,100.

UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Lawrence J. Andrews and Raymond M. Keefer, Department of Chemistry, Davis, Calif.; *Molecular Addition Compounds*; 2 years; \$7,500.

UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; W. F. Giauque, Department of Chemistry; *Thermodynamic and Magnetic Properties of Matter at Low Temperatures*; 1 year; \$30,000.

UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; William G. Young, Department of Chemistry; *Displacement Reactions Involving Allylic Systems*; 2 years; \$11,500.

CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; Robert G. Parr and Frank O. Ellison, Department of Chemistry; *Electronic Structure of Molecules*; 2 years; \$21,500.

UNIVERSITY OF CHICAGO, Chicago, Ill.; W. F. Libby, Institute for Nuclear Studies; *Radiocarbon Dating*; 2 years; \$20,200.

UNIVERSITY OF CHICAGO, Chicago, Ill.; Earl A. Long, Institute for the Study of Metals; *Properties of Matter at Low Temperatures*; 2 years; \$16,000.

UNIVERSITY OF CINCINNATI, Cincinnati, Ohio; Hans H. Jaffe, Department of Chemistry; *Carbon Metal Bond Energies*; 3 years; \$17,200.

CLARK UNIVERSITY, Worcester, Mass.; Thomas T. Sugihara, Department of Chemistry; *Yields of Long-Lived Products in the Deuteron-Induced Fission of U238*; 2 years; \$10,500.

UNIVERSITY OF COLORADO, Boulder, Colo.; Stanley J. Cristol, Department of Chemistry; *Mechanism of Elimination Reactions*; 3 years; \$13,000.

CORNELL UNIVERSITY, Ithaca, N. Y.; Jerrold Meinwald, Department of Chemistry; *1, 3 Shift in Molecular Rearrangements*; 2 years; \$11,000.

DRAKE UNIVERSITY, Des Moines, Iowa; William H. Coppock, Department of Chemistry; *The Reaction of Aryl Esters of Chloroformic Acid with Aromatic Hydrocarbons*; 1 year; \$2,700.

DUKE UNIVERSITY, Durham, N. C.; Charles Hauser, Department of Chemistry; *Rearrangements, Eliminations, Displacements and Condensations*; 3 years; \$20,100.

- DUQUESNE UNIVERSITY, Pittsburgh, Pa.; Kurt C. Schreiber, Department of Chemistry; *Nucleophilic Substitution in the Naphthalene System*; 3 years; \$10,500.
- FLORIDA STATE UNIVERSITY, Tallahassee, Fla.; Ernest Grunwald, Department of Chemistry; *Ion Solvation and Ion Association in Various Solvents*; 3 years; \$25,800.
- FLORIDA STATE UNIVERSITY, Tallahassee, Fla.; Werner Herz, Department of Chemistry; *The Toxic Constituents of Lantana Species*; 2 years; \$13,600.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; J. H. Simons and E. E. Muschlitz, Jr., Department of Chemistry; *Molecular Collisions at Low Pressures*; 2 years; \$15,400.
- HARVARD UNIVERSITY, Cambridge, Mass.; Paul D. Bartlett, Department of Chemistry; *Mechanisms of Organic Reactions*; 3 years; \$30,500.
- HARVARD UNIVERSITY, Cambridge, Mass.; G. B. Kistiakowsky, Department of Chemistry; *Unstable Intermediates in Gas Reactions*; 2 years; \$25,400.
- HARVARD UNIVERSITY, Cambridge, Mass.; William Moffitt, Department of Chemistry; *Molecular Properties in Quantum Theory*; 3 years; \$19,000.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; John C. Bailar, Jr., Department of Chemistry; *Metal Complexes in the Resolution of Optically Active Organic Substances*; 2 years; \$13,000.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Elias J. Corey, Department of Chemistry; *Alpha- and Beta-Amyrin Triterpenes*; 1 Year; \$6,200.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; B. Roger Ray, Department of Chemistry; *Transference Numbers of Salts in Non-Aqueous Solvents*; 6 months; \$3,400.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; F. T. Wall, Department of Chemistry; *Dimensions of Coiling Type Polymer Molecules*; 3 years; \$24,300.
- INDIANA UNIVERSITY, Bloomington, Ind.; Walter J. Moore, Department of Chemistry; *Chemical Reactions of Ionic Beams*; 2 years; \$16,700.
- INDIANA UNIVERSITY, Bloomington, Ind.; V. J. Shiner, Jr., Department of Chemistry; *Effect of Deuterium Substitution on the Rates of Organic Reactions*; 2 years; \$10,800.
- IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, Ames, Iowa; George S. Hammond, Department of Chemistry; *Primary Products of Thermal Decomposition Reactions in Solution*; 2 years; \$12,900.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Alsoph H. Corwin, Department of Chemistry; *Synthetic Studies on Chlorophyll*; 2 years; \$13,900.
- UNIVERSITY OF KANSAS, Lawrence, Kans.; William E. McEwen, Department of Chemistry; *Relative Rates of Migration of Aryl Groups in the Schmidt Reaction*; 2 years; \$6,900.
- LAFAYETTE COLLEGE, Easton, Pa.; Joseph A. Dixon, Department of Chemistry; *Preparation and Study of n-Hexane-d14 and 2,2,4-Trimethylpentane-d18*; 1 year; \$5,000.
- LOYOLA UNIVERSITY, Chicago, Ill.; John L. Houston, Department of Chemistry; *Isotopic Exchange Reactions in Non-Aqueous Ionizing Solvents*; 2 years; \$8,500.
- LOYOLA UNIVERSITY, New Orleans, La.; H. R. Jolley, Department of Chemistry; *Chromatographic Separation of Racemic Mixtures*; 1 year; \$5,000.
- UNIVERSITY OF MAINE, Orono, Maine; Robert Dunlap, Department of Chemistry; *Liquid-Vapor Equilibrium for Binary Solutions of Fluorocarbons and Hydrocarbons and Volume Changes on Mixing*; 2 years; \$9,500.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Arthur C. Cope, Department of Chemistry; *Transannular Reactions of Cyclic Olefins and Related Reactions of Open-Chain Olefins*; 3 years; \$19,000.
- MELLON INSTITUTE OF INDUSTRIAL RESEARCH, Pittsburgh, Pa.; Foil A. Miller, Department of Research in Chemical Physics; *Relative Energies of Polar and Equatorial Derivatives of Cyclohexane*; 2 years; \$6,200.

- JAMES MILLIKIN UNIVERSITY, Decatur, Ill.; Carl Weatherbee, Department of Chemistry; *Mannich Type Reactions*; 1 year; \$1,600.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; I. M. Kolthoff, Department of Chemistry; *The Convection Mercury Electrode in the Electrolysis of Inorganic and Organic Compounds*; 1 year; \$7,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Robert Livingston, Department of Chemistry; *Flash Photolysis Studies of Labile Intermediates*; 3 years; \$23,100.
- UNIVERSITY OF NEBRASKA, Lincoln, Nebr.; H. E. Baumgarten, Department of Chemistry; *Chemistry of Simple Heterocyclic Systems*; 2 years; \$12,400.
- UNIVERSITY OF NEBRASKA, Lincoln, Nebr.; Norman H. Cromwell, Department of Chemistry; *Stereochemistry and Hyperconjugation of Three-Ring Compounds*; 2 years; \$15,000.
- STATE UNIVERSITY OF NEW YORK, Albany, N. Y.; Michael Szwarc, Department of Chemistry, College of Forestry, Syracuse, N. Y.; *Chemistry of Free Radicals*; 3 years; \$45,000.
- UNIVERSITY OF NORTH DAKOTA, Grand Forks, N. Dak.; Roland G. Severson, Department of Chemistry; *Heterocyclic Derivatives of Silicon*; 1 year; \$3,500.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Malcolm Dole, Department of Chemistry; *Stable Isotopes of Oxygen*; 2 years; \$21,800.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Arthur A. Frost, Department of Chemistry; *Molecular Potential Energies*; 2 years; \$10,000.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Ralph G. Pearson, Department of Chemistry; *A Relaxation Method for Fast Reactions*; 2 years; \$11,000.
- OHIO STATE UNIVERSITY, Columbus, Ohio; Melvin S. Newman, Department of Chemistry; *Synthesis of Highly Strained Hydrocarbons*; 2 years; \$11,700.
- OREGON STATE COLLEGE, Corvallis, Oreg.; W. H. Slabaugh, Department of Chemistry; *Preparation and Reactions of Graphite Oxide*; 3 years; \$9,000.
- PENNSYLVANIA STATE UNIVERSITY, University Park, Pa.; J. G. Aston, Julian Eisenstein, and J. J. Fritz, Department of Physics; *Paramagnetism in Crystalline Salts and in Free Radicals*; 2 Years; \$20,500.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; John G. Miller, Department of Chemistry; *Compressibility of Gaseous Mixtures*; 2 years; \$21,500.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; Jerome L. Rosenberg, Department of Chemistry; *Chemiluminescence of Photosensitizing Organic Dyes in Condensed Systems*; 3 years; \$10,700.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; W. E. Wallace and R. S. Craig, Department of Chemistry; *Electronic Specific Heats and the Metallic Bond in Alloys*; 2 years; \$22,000.
- POLYTECHNIC INSTITUTE OF BROOKLYN, Brooklyn, N. Y.; C. G. Overberger, Department of Chemistry; *Free Radicals Derived from Azo Compounds*; 3 years; \$22,700.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; Henry S. Frank and Leo S. Mason, Department of Chemistry; *Relation of Structures to Properties in Liquid Solutions*; 2 years; \$20,900.
- PRINCETON UNIVERSITY, Princeton, N. J.; Edward C. Taylor, Jr., Department of Chemistry; *Pyridinopyrimidines*; 1 year; \$3,000.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; Robert A. Benkeser, Department of Chemistry; *Organic Compounds of Silicon, Germanium and Tin*; 2 years; \$12,900.
- PURDUE UNIVERSITY, Lafayette, Ind.; Herbert C. Brown, Department of Chemistry; *Effect of Molecular Shape on Chemical Behavior*; 2 years; \$17,000.
- REED COLLEGE, Portland, Oreg.; Marshall W. Cronyn, Department of Chemistry; *Chemistry of Thiolacids and Thioesters*; 2 years; \$5,700.

- RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y.; George J. Janz, Department of Chemistry; *Reactions of Cyanogen with Unsaturated Organic Compounds at Moderately High Temperatures*; 2 years; \$13,800.
- RIPON COLLEGE, Ripon, Wis.; Dwight F. Mowery, Jr., Department of Chemistry; *Isomer Distribution in Fisher Glycoside Formation*; 2 years; \$3,500.
- UNIVERSITY OF ROCHESTER, Rochester, N. Y.; Winston D. Walters, Department of Chemistry; *Kinetics and Mechanism of Thermal Reactions*; 3 years; \$16,000.
- SAN DIEGO STATE COLLEGE, San Diego, Calif.; Robert W. Isensee and Harold Walba, Department of Chemistry; *Acid-Base Equilibria in Aqueous Solutions of Aromatic Cyclic Amidines*; 1 year; \$4,200.
- SMITH COLLEGE, Northampton, Mass.; Milton D. Soffer, Department of Chemistry; *Synthetic and Structural Investigations in the Sesquiterpene Series*; 2 years; \$9,000.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; Arthur W. Adamson, Department of Chemistry; *Kinetics of Ligand Exchange with Complex Ions in Non-Aqueous Media*; 1 year; \$5,000.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; Ronald F. Brown, Department of Chemistry; *Ring Closure of Substituted Open Chain Compounds*; 2 years; \$7,000.
- TEXAS SOUTHERN UNIVERSITY, Houston, Tex.; Ray Floyd Wilson, Department of Chemistry; *Spectrographic and Polarographic Study of Certain Rare Earth and Transitional Elements*; 2 years; \$2,800.
- TULANE UNIVERSITY, New Orleans, La.; Joseph H. Boyer, Department of Chemistry; *Preparation and Properties of Aliphatic Diazo Compounds*; 2 years; \$6,600.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; Henry Eyring, Department of Chemistry; *Theory of Reaction Rates*; 2 years; \$22,800.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; W. J. Horton, Department of Chemistry; *Seven-Membered Ring Compounds*; 2 years; \$12,500.
- UNIVERSITY OF VERMONT AND STATE AGRICULTURAL COLLEGE, Burlington, Vt.; Richard G. Inskeep, Department of Chemistry; *Hydrogen Bond Association Energies*; 3 years; \$17,500.
- WASHINGTON AND LEE UNIVERSITY, Lexington, Va.; James K. Shillington, Department of Chemistry; *Resolution of Optically Active Compounds through the Carbonyl Group*; 2 years; \$6,000.
- STATE COLLEGE OF WASHINGTON, Pullman, Wash.; Gardner W. Stacy, Department of Chemistry; *Additions to Schiff Base Systems*; 2 years; \$8,000.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; David F. Eggers, Jr., Department of Chemistry; *Molecular Structure and Molecular Spectra*; 3 years; \$17,300.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; Kenneth B. Wiberg, Department of Chemistry; *Mechanisms of Oxidation Reactions*; 3 years; \$17,000.
- WAYNE UNIVERSITY, Detroit, Mich.; Carl Djerassi, Department of Chemistry; *Alpha-Amyrin Chemistry*; 2 years; \$16,000.
- WELLESLEY COLLEGE, Wellesley, Mass.; Margaret K. Seikel, Department of Chemistry; *Flavanoid Plant Pigments*; 3 years; \$8,200.
- WEST VIRGINIA UNIVERSITY, Morgantown, W. Va.; Chester W. Muth, Department of Chemistry; *Intramolecular Cyclization Involving a Nitro Group*; 2 years; \$7,500.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Charles F. Curtiss, Department of Chemistry; *Theoretical Extensions of the Kinetic Theory of Gases*; 2 years; \$14,500.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Eugene E. Van Tamelen, Department of Chemistry; *Synthesis of Alkaloids*; 2 years; \$9,000.

Developmental Biology

- BROWN UNIVERSITY, Providence, R. I.; Paul B. Weisz, Department of Biology; *Morphogenesis and Growth in Stentor, Rana, and Mus*; 1 year; \$5,000.

- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Curt Stern, Department of Zoology; *Structure and Function of the Posterior Processes of the Brain Nephthys*; 1 year; \$6,900.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Thomas Park, Department of Zoology; *The Effort of Irradiation on Laboratory Populations*; 1 year; \$3,800.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Sherwood L. Washburn, Department of Anthropology; *Comparative and Experimental Analysis of Skull Form*; 1 year; \$7,500.
- DUKE UNIVERSITY, Durham, N. C.; C. G. Bookhout, Director, Duke University Marine Laboratory; *Reproduction, Life Histories, and Metamorphosis of Shrimp*; 1 year; \$3,500.
- FORDHAM UNIVERSITY, New York, N. Y.; Charles A. Berger, Department of Biology; *Changes in Chromosome Number During Development*; 1 year; \$2,900.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Norman D. Levine, Department of Veterinary Pathology and Hygiene; *Cultivation of Parasitic Nematodes*; 2 years; \$9,500.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Norman E. Kemp, Department of Zoology; *Utilization of Yolk in Amphibian Oogenesis*; 2 years; \$8,100.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Ray L. Watterson, Department of Biology; *Effect of Mitotic Inhibitors on Feather Patterns*; 2 years; \$8,000.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; Wesley G. Hutchinson, Department of Botany; *L Forms in Proteus*; 2 years; \$11,200.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; Charles E. Wilde, Jr., Department of Pathology, School of Dentistry; *Casual Relations between Particular Metabolites and Specific Cellular Differentiations*; 3 years; \$17,000.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; John B. Field and Herman M. Harvey, Department of Medicine and Psychology; *Effects of Psychological Stress on Tumor Development in Rats and Mice*; 1 year; \$10,500.
- ST. AMBROSE COLLEGE, Davenport, Iowa; William F. Lynch, Department of Biology; *Factors Affecting Metamorphosis of Bugula Larvae*; 1 year; \$500.
- UNIVERSITY OF TENNESSEE, Knoxville, Tenn.; Ronald C. Fraser, Department of Zoology; *Physiological and Biochemical Problems in Chick Embryogeny*; 2 years; \$3,500.
- TRINITY COLLEGE, Hartford, Conn.; James M. Van Stone, Department of Biology; *Nerve-Tissue Relationships in Anuran Hind Limb Regeneration*; 3 years; \$6,500.
- WABASH COLLEGE, Crawfordsville, Ind.; Louis E. DeLaney, Department of Biology; *Causative Factors in Development of the Amphibian Spleen*; 2 years; \$3,800.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; Richard J. Blandau, Department of Anatomy; *Periovarial Sac and Tubal Sac Fluids*; 3 years; \$21,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; H. W. Mossman, Department of Anatomy; *Uterine Vascular System*; 2 years; \$11,000.
- UNIVERSITY OF WYOMING, Laramie, Wyo.; Charles S. Thornton, Jackson Hole Biological Research Station; *Role of Nerves in Limb Regeneration*; 3 years; \$2,800.
- YALE UNIVERSITY, New Haven, Conn.; John Phillip Trinkaus, Osborn Zoological Laboratory; *Cell and Tissue Transformation*; 3 years; \$12,800.
- YESHIVA UNIVERSITY, New York, N. Y.; Richard N. Stearns, Department of Physiology, Albert Einstein College of Medicine; *Enzyme Synthesis in Dissociated Embryonic Cells*; 1 year; \$600.

Earth Sciences

- UNIVERSITY OF ARIZONA, Tucson, Ariz.; Roscoe H. Braham, Jr., Institute of Atmospheric Physics; *Physical Properties of Clouds*; 2 years; \$50,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; R. E. Holzer, Institute of Geophysics; *Origin of Low Frequency Geomagnetic Fluctuation*; 1 year; \$9,400.

- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; George C. Kennedy, Institute of Geophysics; *Silicate Systems*; 2 years; \$15,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Francis J. Turner, Department of Geology; *Fabric of Experimentally Deformed Ionic Crystals and Rocks*; 2 years; \$13,100.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Hans Ramberg, Department of Geology; *Thermodynamic Study of Minerals*; 3 years; \$27,000.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Harold C. Urey, Institute for Nuclear Studies; *Isotopic Abundances Relating to Geochemical Research*; 1 year; \$21,400.
- COLUMBIA UNIVERSITY, New York, N. Y.; Maurice Ewing and Frank Press, Lamont Geological Observatory; *Experimental and Theoretical Study of Short Period Surface Waves*; 1 year; \$12,800.
- COLUMBIA UNIVERSITY, New York, N. Y.; J. Laurence Kulp, Department of Geology; *Carbon 14 Dating of Archeological and Anthropological Specimens*; 1 year; \$10,000.
- COLUMBIA UNIVERSITY, New York, N. Y.; Arie Poldervaart, Department of Geology; *Structure and Petrogenesis of Part of the Beartooth Mountains*; 1 year; \$6,000.
- DARTMOUTH COLLEGE, Hanover, N. H.; J. B. Lyons, Department of Geology; *Systematic Compositional Variation in Metamorphic Minerals*; 2 years; \$7,200.
- EARLHAM COLLEGE, Richmond, Ind.; Ansel M. Gooding, Department of Geology and Soil Science; *Pleistocene Terraces of the Upper Whitewater Drainage Basin*; 2 years; \$6,000.
- FRANKLIN AND MARSHALL COLLEGE, Lancaster, Pa.; Richard M. Foose, Department of Geology; *Structural Patterns Around the Perimeter of the Beartooth Block in Southwestern Montana*; 2 years; \$10,000.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; R. B. Montgomery, Department of Oceanography; *Analysis of Serial Oceanographic Observations*; 2 years; \$9,000.
- THE KENTUCKY RESEARCH FOUNDATION, Lexington, Ky.; William A. Seay, Department of Agronomy; *Effect of Exchangeable Calcium and Magnesium on the Fixation of Phosphorous by Clay Fractions of Soils*; 2 years; \$11,500.
- LEHIGH UNIVERSITY, Bethlehem, Pa.; H. R. Gault, Department of Geology; *Studies of Carbonate Rocks*; 2 years; \$6,800.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; William H. Dennen and Ely Mencher, Department of Geology and Geophysics; *Geochemical Investigations of Sedimentary Rocks*; 1 year; \$10,300.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; M. J. Buerger, Department of Geology and Geophysics; *Crystal Structures of Minerals*; 2 years; \$24,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Frederick M. Swain, Department of Geology; *Stratigraphy of Bituminous Deposits*; 2 years; \$15,000.
- UNIVERSITY OF NORTH CAROLINA, Chapel Hill, N. C.; Stanley B. McCaleb, Department of Agronomy; *Studies of North Carolina Soils*; 2 years; \$9,400.
- UNIVERSITY OF NOTRE DAME, Notre Dame, Ind.; Raymond C. Gutschick, Department of Geology; *The Mississippian Sedimentary Basin in Northern Arizona*; 2 years; \$1,500.
- OBERLIN COLLEGE, Oberlin, Ohio; Kathryn H. Clisby and Fred Foreman, Department of Geology and Geography; *Pleistocene Stratigraphy and Chronology*; 2 years; \$22,000.
- PALEONTOLOGICAL RESEARCH FOUNDATION, Ithaca, N. Y.; Katherine V. W. Palmer, Paleontological Research Institute; *Molluscan Fauna of the Ocala Limestone (Upper Eocene) of Westcentral Florida*; 2 years; \$11,900.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; G. W. Brindley, School of Mineral Industries; *The Structural Mineralogy of the Serpentine Group of Minerals*; 1 year; \$10,000.

- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; Charles L. Hosler, College of Mineral Industries; *Aggregation of Ice Crystals to Form Snow*; 2 years; \$10,000. ✓
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; Rustrum Roy, Department of Earth Sciences; *The Phase Rule and Polymorphism*; 3 years; \$30,000.
- PRINCETON UNIVERSITY, Princeton, N. J.; W. T. Thom, Jr., Department of Geological Engineering; *Crustal Deformation in Portions of the Great Plains and Cordilleran Regions*; 2 years; \$14,000.
- SAINT LOUIS UNIVERSITY, St. Louis, Mo.; Ross R. Heinrich, Department of Geophysics and Geophysical Engineering; *Atmospheric Micro-Oscillations and Short-Period Microseisms*; 3 years; \$36,000. ✓
- TEXAS A. & M. RESEARCH FOUNDATION, College Station, Tex.; Donald W. Wood, Department of Oceanography; *Calcium Carbonate Solubility Equilibrium in Sea Water*; 3 years; \$20,000.
- U. S. COAST AND GEODETIC SURVEY, Washington 25, D. C.; Dean S. Carder, Seismology Branch; *Seismology: Travel-Time Studies and Development of Improved Travel-Time Curves for Pacific Ocean Region*; 2 years; \$15,000.
- YALE UNIVERSITY, New Haven, Conn.; Chester R. Longwell, Department of Geology; *Tectonic History of the Region Around Lake Mead, Nevada-Arizona*; 1 year; \$3,500.

Engineering Sciences

- UNIVERSITY OF ALABAMA, University, Ala.; W. D. Jordan, Department of Engineering Mechanics; *Inelastic Behavior of Eccentrically Loaded Columns of Strain-Hardening Materials*; 2 years; \$11,000.
- BUREAU OF RECLAMATION, Department of the Interior, Washington, D. C.; Richard C. Mielenz, Design and Construction Division, Denver, Colo.; *Hydration of Portland Pozzolan Cement*; 1 year; \$10,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; C. B. Milikan and H. W. Liepmann, Department of Aeronautics; *Stability of Fluid Flow*; 2 years; \$23,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Vito A. Vanoni, Division of Engineering; *Mechanics of Sub-Aqueous Dunes*; 1 year; \$12,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; A. M. Hopkin, Department of Electrical Engineering; *Nonlinear Control Systems*; 3 years; \$29,900.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; A. D. K. Laird, Department of Mechanical Engineering; *Movement of Gas over Waves*; 2 years; \$17,500.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; S. F. Ravitz and E. R. Parker, Department of Metallurgy; *Slag-Metal Interactions During Arc Welding*; 2 years; \$21,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; E. G. Thomsen, Department of Mechanical Engineering; *Mechanics of Plastic Deformation of Metals*; 2 years; \$12,000.
- CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; H. W. Paxton, Department of Metallurgical Engineering; *Interdependence of Thermodynamics and Kinetics in Reactions in Solids*; 2 years; \$20,000.
- CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; Herbert L. Toor, Department of Chemical Engineering; *Transfer of Matter Across Gas-Liquid Interfaces*; 2 years; \$13,500.
- COLUMBIA UNIVERSITY, New York, N. Y.; Ernest J. Henley, Department of Chemical Engineering; *Ionization Patterns in Condensed Systems*; 18 months; \$7,000.
- CORNELL UNIVERSITY, Ithaca, N. Y.; H. G. Booker and B. Nichols, Department of Electrical Engineering; *Cause of Motion in the Aurora*; 2 years; \$13,300. ✓
- UNIVERSITY OF DETROIT, Detroit, Mich.; Leon S. Kowalczyk, Department of Chemical Engineering; *Thermal Conductivity of Mesomorphic Liquids*; 1 year; \$3,500.

- DUKE UNIVERSITY, Durham, N. C.; C. D. Fulton, Jr., Department of Mechanical Engineering; *Heat Switches and Cyclic Magnetic Cooling*; 2 years; \$19,000.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; William A. Nash, Department of Engineering Mechanics; *Analysis of Buckling Phenomena*; 1 year; \$7,900.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; F. E. Richart, Jr., Department of Civil Engineering; *Stress Transfer in Granular Elastic Media*; 2 years; \$12,600.
- GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Ga.; M. R. Carstens, School of Civil Engineering; *Unsteady Flow in Smooth Pipes*; 2 years; \$13,800.
- GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Ga.; Robert S. Ingols, Engineering Experiment Station; *Protein Changes with Chlorine*; 1 year; \$7,100.
- UNIVERSITY OF HOUSTON, Houston, Tex.; A. E. Dukler, Department of Chemical Engineering; *Entrainment in Two Phase, Gas-Liquid Flow*; 2 years; \$13,900.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; M. E. Clark & O. M. Sidebottom, Department of Theoretical and Applied Mechanics; *Inelastic Behavior of Columns*; 1 year; \$8,600.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Clyde E. Kesler, Department of Theoretical and Applied Mechanics; *Fatigue of Concrete*; 2 years; \$20,000.
- STATE UNIVERSITY OF IOWA, Iowa City, Iowa; Karl Kammermeyer, Department of Chemical Engineering; *Electrical Conductivity of Thin Conductive Films on Non-Metallic Surfaces*; 1 year; \$7,500.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Stanley Corrsin, Department of Aeronautics, School of Engineering; *Dispersion of Solid Spheres in Isotropic Turbulence*; 2 years; \$16,500.
- KANSAS STATE COLLEGE, Manhattan, Kans.; Raymond C. Hall, Department of Chemical Engineering; *Effect of Sonic Vibration on the Rates of Mass Transfer*; 2 years; \$12,000.
- UNIVERSITY OF MAINE, Orono, Maine; Hamilton Gray, Department of Civil Engineering; *Moisture Content and Density of Granular Soils*; 3 years; \$7,900.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; P. L. de Bruyn, Department of Metallurgy; *Three-Phase Flotation Systems*; 2 years; \$20,000.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Rolf Eliassen, Department of Civil and Sanitary Engineering; *Mechanism of Corrosion Inhibition by Sodium Metaphosphate and Other Chemicals*; 2 years; \$14,000.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Warren M. Rohsenow, Department of Mechanical Engineering; *Effect of Surface Conditions on Nucleate Boiling*; 18 months; \$10,500.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Thomas K. Sherwood, Department of Chemical Engineering; *Mechanism of Mass Transfer with Chemical Reaction*; 1 year; \$2,900.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; John G. Trump, Department of Electrical Engineering; *Fundamental Processes in High Voltage Discharges in Vacuum*; 2 years; \$18,700.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Stuart W. Churchill, Department of Chemical Engineering; *Chemical Reaction Rates for Gases Passing Through Shock Waves*; 2 years; \$13,200.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Cedomir M. Sliepcevic, Department of Chemical and Metallurgical Engineering; *Light Scattering Properties of Aerosols*; 1 year; \$5,100.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Arthur J. Madden, Jr., Department of Chemical Engineering; *Rates of Mass and Heat Transfer to Gases in Free Convection*; 2 years; \$13,600.
- UNIVERSITY OF MISSISSIPPI, University, Miss.; F. H. Kellogg, Department of Civil Engineering; *Drainage of Sands under Artesian Conditions*; 2 years; \$7,000.

- NEW YORK UNIVERSITY, New York, N. Y.; John Happel, Department of Chemical Engineering; *Fluid-Solid Dynamics in Bounded Media*; 18 months; \$9,200.
- NEW YORK UNIVERSITY, New York, N. Y.; Maria Telkes, Research Division; *Solar Energy Collectors*; 1 year; \$7,000.
- NORTH CAROLINA STATE COLLEGE, Raleigh, N. C.; Nelson L. Nemerow, Department of Civil Engineering; *Mechanism of Biochemical Oxidation of Organic Matter*; 1 year; \$7,000.
- UNIVERSITY OF NORTH CAROLINA, Chapel Hill, N. C.; Marvin L. Granstrom, Department of Sanitary Engineering; *Kinetics and Mechanism of Reactions Involving Chlorine Dioxide*; 2 years; \$11,000.
- UNIVERSITY OF NORTH CAROLINA, Chapel Hill, N. C.; Hans H. Stadelmaier, Department of Engineering Research; *Disorder-Order Transformation in Fe Ni₃ and the Permalloy Problem*; 1 year; \$4,000.
- UNIVERSITY OF NORTH DAKOTA, Grand Forks, N. Dak.; Donald E. Severson, Department of Chemical Engineering; *Mass Transfer Rates under Forced Convection*; 2 years; \$5,400.
- UNIVERSITY OF NOTRE DAME, Notre Dame, Ind.; Murlin T. Howerton, Department of Chemical Engineering; *Catalytic Polymerization of Isobutene*; 2 years; \$10,900.
- OHIO STATE UNIVERSITY, Columbus, Ohio; John D. Kraus, Department of Electrical Engineering; *Radio Mapping and Design of a Prototype Telescope*; 1 year; \$23,000.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; J. Norton Brennan, Department of Engineering Mechanics; *Solid State Structures in Single Crystal Metals*; 3 years; \$20,000.
- PENNSYLVANIA STATE UNIVERSITY, University Park, Pa.; P. Mange, Department of Engineering Research; *Physical Structure of the High Atmosphere*; 2 years; \$7,400.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; William E. Ranz, Department of Engineering Research; *Disintegration and Dispersion of a Liquid into Droplets*; 18 months; \$6,300.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; A. H. Waynick, Department of Electrical Engineering; *Ionosphere Observations by Long Wave Radio Methods*; 1 year; \$10,000.
- POLYTECHNIC INSTITUTE OF BROOKLYN, Brooklyn, N. Y.; Ernst Weber, Director, Microwave Research Institute; *Electromagnetic Networks and Information-Handling Circuits*; 1 year; \$10,000.
- PRINCETON UNIVERSITY, Princeton, N. J.; A. E. Sorenson, Department of Mechanical Engineering, V. Olgyay and A. Olgyay, Department of Architecture; *Thermal Behavior of Buildings Through Model Structures*; 2 years; \$19,100.
- PURDUE RESEARCH FOUNDATION, Fafayette, Ind.; R. Schuhman, Jr., Department of Metallurgical Engineering; *Thermodynamic Properties of Titanium Alloys*; 2 years; \$17,000.
- PURDUE UNIVERSITY, Lafayette, Ind.; J. R. Burnett, Department of Electrical Engineering; *Nonlinear Servomechanisms*; 1 year; \$10,000.
- RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y.; Joel O. Hougen, Department of Chemical Engineering; *Process Dynamics and Control*; 3 months; \$1,700.
- ROSE POLYTECHNIC INSTITUTE, Terre Haute, Ind.; S. G. Bankoff, Department of Chemical Engineering; *Equilibrium Bubble Contact Angles as Related to Pool Boiling Heat Transfer*; 18 months; \$7,600.
- RUTGERS UNIVERSITY, New Brunswick, N. J.; Rudolf K. Bernhard, Department of Engineering Mechanics; *Dynamic Soil Characteristics: Response Curves and Critical Frequencies*; 2 years; \$16,000.
- STANFORD UNIVERSITY, Stanford, Calif.; James M. Gere, Department of Civil Engineering; *Coupled Vibrations of Thin Walled Bars of Open Cross Section*; 1 year; \$4,300.

- STANFORD UNIVERSITY, Stanford, Calif.; Karl Klotter, Department of Mechanical Engineering; *Non-Linear Oscillations*; 1 year; \$9,000.
- STANFORD UNIVERSITY, Stanford, Calif.; C. W. Richards, Department of Civil Engineering; *Effect of Specimen Size and Stress Distribution on Yielding in Mild Steel*; 1 year; \$6,700.
- SWARTHMORE COLLEGE, Swarthmore, Pa.; Carl Barus, Department of Electrical Engineering; *Electronic Instrumentation for Neurophysiology*; 1 year; \$7,300.
- UNIVERSITY OF TEXAS, Austin, Tex.; Matthew Van Winkle, Department of Chemical Engineering; *Viscosity and Surface Tension of Homogeneous Liquid Mixtures at Their Boiling Points*; 2 years; \$10,000.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; E. B. Christiansen and N. W. Ryan, Department of Chemical Engineering; *Non-Isothermal Flow of and Heat Transfer to Non-Newtonian Fluids*; 2 years; \$7,400.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; S. S. Kistler and E. B. Christiansen, Department of Chemical Engineering; *High Temperature Glass*; 1 year; \$5,100.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; N. W. Ryan, Department of Chemical Engineering; *Turbulent Flow of Non-Newtonian Fluids*; 1 year; \$3,300.
- VIRGINIA POLYTECHNIC INSTITUTE, Blacksburg, Va.; Michael V. Nevitt, Department of Metallurgy; *Sigma Phase in the Ternary Systems Cr-Co-Cu and Cr-Mn-Cu*; 1 year; \$8,000.
- WASHINGTON UNIVERSITY, St. Louis, Mo.; Gustav Mesmer, Department of Applied Mechanics; *Stresses in Pin-Loaded Eye-Shaped Bars*; 1 year; \$5,900.
- WEST VIRGINIA UNIVERSITY, Morgantown, W. Va.; H. V. Fairbanks, Department of Chemical Engineering; *Effect of Ultrasonics Upon Dispersion Hardening of Metals*; 2 years; \$9,100.

Environmental Biology

- THE AMERICAN MUSEUM OF NATURAL HISTORY, Central Park West at 79th Street, New York, N. Y.; C. M. Breder, Jr., Department of Fishes and Aquatic Biology; *Interaction of Endocrine System*; 1 year; \$6,800.
- BALDWIN-WALLACE COLLEGE, Berea, Ohio; E. Bennette Henson, Department of Biology; *Bottom Fauna of Northern Lake Huron*; 1 year; \$500.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Brian P. Boden, Scripps Institute of Oceanography, La Jolla, California; *Diurnal Vertical Migration of Sonic Scattering Layers in the Sea*; 1 year; \$1,200.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Carl L. Hubbs, Scripps Institution of Oceanography, La Jolla, California; *Ecological Conditions Associated with Eruptions of Human Populations*; 3 years; \$25,200.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Elmer R. Noble, Santa Barbara College, Santa Barbara, California; *Protozoan Parasites of Marine Fishes*; 1 year; \$4,500.
- CARLETON COLLEGE, Northfield, Minn.; J. Bruce Guyselmann, Department of Zoology; *Rhythms of Locomotor Activity in Crustaceans*; 1 year; \$3,400.
- DUKE UNIVERSITY, Durham, N. C.; Henry J. Oosting, Department of Botany; *Ecology of the Venus Fly-Trap (*Dionaea Muscipula*)*; 2 years; \$5,900.
- DUKE UNIVERSITY, Durham, N. C.; Paul J. Kramer, Department of Botany; *Physiological Processes of Forest Tree Species*; 3 years; \$18,900.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; Archie Carr, Department of Biology; *Ecology, Migration, and Population Levels of *Chelonia M. Mydas* in the Atlantic and Caribbean*; 3 years; \$18,000.
- INDIANA UNIVERSITY, Bloomington, Ind.; David G. Frey, Department of Zoology; *Ontogeny of North America and European Lakes*; 2 years; \$10,000.

- INDIANA UNIVERSITY, Bloomington, Ind.; Shelby D. Gerking, Department of Zoology; *Efficiency of Food Utilization by a Fish Population*; 2 years, \$10,000.
- STATE UNIVERSITY OF IOWA, Iowa City, Iowa; G. Edgar Folk, Jr., Department of Physiology; *Influence of Lowered Metabolism on Life Span of Rodents*; 2 years; \$8,000.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Dayton E. Carritt, Chesapeake Bay Institute, Annapolis, Md.; *Trace Metals in the Ecology of Chesapeake Bay*; 2 years; \$11,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; David C. Chandler, Department of Zoology; *Limnology of Northern Lake Huron*; 2 years; \$13,400.
- UNIVERSITY OF NEW HAMPSHIRE, Durham, N. H.; Emery Swan, Department of Zoology; *Environmental Effects on Growth Rate and Patterns in Sea Urchins*; 2 years; \$5,000.
- NORTH DAKOTA AGRICULTURAL COLLEGE, Fargo, N. Dak.; Gabriel W. Comita, Department of Zoology and Physiology; *Life Cycle Studies of a Calanoid Copepod*; 2 years; \$5,700.
- UNIVERSITY OF OREGON, Eugene, Oreg.; Bonita J. Miller, Department of Biology; *An Isolated Remnant of Forest in the Tillamook Burn Area*; 2 years; \$4,500.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; Richard T. Hartman, Department of Biological Sciences; *Antagonistic Effects between Algal Species*; 1 year; \$3,200.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; Alton A. Lindsey, Department of Biological Sciences; *Plant Communities of Indiana Floodplains*; 3 years; \$9,300.
- QUINCY COLLEGE, Quincy, Ill.; Troy C. Dorris, Department of Biological Sciences; *Bottom Fauna in the Middle Mississippi River*; 2 years; \$4,400.
- ROCKY MOUNTAIN BIOLOGICAL LABORATORY, Crested Butte, Colo.; Colin S. Pittendrigh, Department of Biology, Princeton University; *Physiological and Behavioral Aspects of Adaptation in Related Insects*; 2 years; \$6,400.
- STANFORD UNIVERSITY, Stanford, Calif.; Donald P. Abbott and Rolf L. Bolin; Hopkins Marine Station; *Fluctuations in Populations of Marine Organisms Correlated with Fluctuations in Hydrographic Factors*; 1 year; \$8,400.
- STANFORD UNIVERSITY, Stanford, Calif.; W. C. Brown, Natural History Museum; *Herpetofaunas of the Philippines*; 1 year; \$2,300.
- WOODS HOLE OCEANOGRAPHIC INSTITUTION, Woods Hole, Mass.; George L. Clark, Marine Biologist; *Measurement of Light in the Sea and Photic Reactions of Aquatic Organisms*; 2 years; \$14,500.
- WOODS HOLE OCEANOGRAPHIC INSTITUTION, Woods Hole, Mass.; Bostwick H. Ketchum; *Nitrification in Sea Water*; 2 years; \$11,700.

Genetic Biology

- ALLEGHENY COLLEGE, Meadville, Pa.; G. E. McClearn, Department of Psychology; *Genetic Influence on Exploratory Behavior of Mice*; 1 year; \$4,800.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Ray D. Owens, Department of Biology; *Serology of Tetrahymena*; 2 years; \$16,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Frits W. Went, Department of Biology; *Physiological Differences Among Races and Varieties of Higher Plants*; 3 years; \$30,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Carl Epling, Department of Botany; *Adaptive Mechanisms in Selected Wild Populations of Drosophila Pseudoobscura*; 3 years; \$20,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Taylor Hinton, Department of Zoology; *The Role of Genes in the Metabolism of Nucleic Acid and other Compounds*; 2 years; \$12,000.

- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Anton Lang and Sam G. Wildman, Department of Botany; *The Mode of Synthesis and Inheritance of Proteins in Plants*; 3 years; \$21,000.
- EMORY UNIVERSITY, Emory, Ga.; Charles Ray, Department of Biology; *Cytogenetic Studies of Tetrahymena Pyriformis*; 1 year; \$3,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; John R. Raper, Department of Biology; *Genetics and Physiology of Tetrapolarity in the Higher Fungi*; 2 years; \$13,000.
- LONG ISLAND BIOLOGICAL ASSOCIATION, Cold Spring Harbor, N. Y.; M. Demerec, Director; *Equipment for Virus and Bacterial Genetics Research*; 3 years; \$15,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; David L. Nanney, Department of Zoology; *Studies of Protozoan Genetics*; 3 years; \$21,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Joseph G. Gall, Department of Zoology; *Submicroscopic Morphology of the Animal Cell Nucleus*; 1 year; \$6,000.
- UNIVERSITY OF MISSOURI, Columbia, Mo.; E. R. Sears, A. C. Faberge and E. Novitski, Departments of Field Crops, Botany and Zoology; *Chromosome Structure and Behavior*; 2 years; \$28,500.
- REED COLLEGE, Portland, Oreg.; Richard W. Siegel, Department of Biology; *Duration of Immaturity in Paramecium Aurelia*; 3 years; \$9,000.
- THE ROCKY MOUNT BIOLOGICAL LABORATORY, Edinboro, Pa.; E. Novitski; *Chromosome Rearrangements of Phylogenetic Significance*; 2 years; \$6,500.
- SOUTH DAKOTA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, College Station, S. Dak.; James G. Ross, Department of Agronomy; *Colchicine-Induced Homozygous Diploid Mutants in Sorghum*; 2 years; \$4,000.
- UNIVERSITY OF NOTRE DAME, Notre Dame, Ind.; Albert L. Delisle, Department of Biology; *Cytogenetical Studies on the Asters*; 2 years; \$5,000.
- UNION COLLEGE, Schenectady, N. Y.; Henry M. Butzel, Department of Biology, William B. Martin, Jr., Department of Chemistry; *Mating Type Development and Determination in Paramecium*; 2 years; \$8,000.
- WESTERN RESERVE UNIVERSITY, Cleveland, Ohio; Charles Yanofsky, Department of Microbiology; *Gene Action in Neurospora*; 2 years; \$13,000.
- YALE UNIVERSITY, New Haven, Conn.; Henry P. Treffers, Department of Microbiology; *Mechanisms of Gene Action and Drug Resistance*; 2 years; \$13,500.
- YALE UNIVERSITY, New Haven, Conn.; Haig P. Papazian, Department of Plant Science; *Genetic Studies on Incompatibility Factors in Coprinus*; 2 years; \$5,500.

Mathematical Sciences

- AMERICAN MATHEMATICAL SOCIETY, Providence, R. I.; R. H. Bing, Chairman; *Study of Set Theoretic Topology*; summer of 1955; \$30,500.
- ANTIOCH COLLEGE, Yellow Springs, Ohio; Gustave Rabson, Department of Mathematics; *Fourier Series and Group Algebras*; 3 months; \$1,450.
- BROWN UNIVERSITY, Providence, R. I.; H. Federer and W. S. Massey, Department of Mathematics; *Topology and Measure Theory*; 30 months; \$36,500.
- CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; Alfred Schild, Department of Mathematics; *Relativistic Particle Mechanics*; 2 years; \$8,500.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Jerzy Neyman, Department of Mathematics; *The Distribution of Galaxies*; 2 years; \$21,800.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Alfred Tarski, Department of Mathematics; *Theory of Models*; 2 years; \$19,800.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Saunders MacLane and S. S. Chern, Department of Mathematics; *Algebraic Topology*; 3 years; \$31,000.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Andre Weil, Department of Mathematics; *Abelian Varieties and their Application*; 1 year; \$6,500.

- UNIVERSITY OF COLORADO, Boulder, Colo.; Sarvadaman Chowla, Department of Mathematics; *The Extended Riemann Hypothesis*; 1 year; \$9,000.
- COLUMBIA UNIVERSITY, New York, N. Y.; Walter Strodtt, Department of Mathematics; *Principal Solutions of Differential Equations*; 6 months; \$2,650.
- UNIVERSITY OF CONNECTICUT, Storrs, Conn.; Richard D. Schafer, Department of Mathematics; *Non-Associative Algebras*; 2 years; \$10,000.
- DARTMOUTH COLLEGE, Hanover, N. H.; J. G. Kemeny, Department of Mathematics; *Mathematical Methods in the Behavioral Sciences*; 1 year; \$10,000.
- UNIVERSITY OF DELAWARE, Newark, Del.; John H. Barrett, Department of Mathematics; *Solutions of Differential Equations in the Neighborhood of Infinity*; 2 years; \$6,000.
- UNIVERSITY OF GEORGIA, Athens, Ga.; M. K. Fort, Jr., Department of Mathematics; *Functional Equations*; 1 year; \$6,500.
- HARVARD UNIVERSITY, Cambridge, Mass.; Richard Brauer, Department of Mathematics; *The Structure of Groups of Finite Order*; 1 year; \$3,800.
- HARVARD UNIVERSITY, Cambridge, Mass.; Oscar Zariski, Department of Mathematics; *Local Uniformization on Algebraic Varieties over Modular Ground Fields*; 1 year; \$5,900.
- ILLINOIS INSTITUTE OF TECHNOLOGY, Chicago, Ill.; Gerald Berman, Department of Mathematics; *Finite Projective Geometries*; 1 year; \$6,100.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Chung-Tao Yang, Department of Mathematics; *Mappings from Spheres to Euclidean Spaces*; 1 year; \$6,200.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; A. H. Taub, Department of Mathematics; *Analytical Program for Digital Computer*; 1 year; \$14,500.
- INSTITUTE FOR ADVANCED STUDY, Princeton, N. J.; Leon Ehrenpreis; *The Theory of Distributions*; 2 years; \$11,900.
- THE INSTITUTE OF MATHEMATICAL STATISTICS, University of California, Berkeley, Calif.; David Blackwell, President-Elect; *Statistical Inference in Stochastic Processes*; 6 Weeks; \$7,700.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Wei-Liang Chow, School of Mathematics; *Abelian Varieties over Abstract Fields*; 1 year; \$5,400.
- UNIVERSITY OF KANSAS, Lawrence, Kans.; G. Baley Price, Department of Mathematics; *Geometry of Function Space*; 1 year; \$19,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; E. E. Moise, Department of Mathematics; *Topology of Manifolds*; 30 months; \$13,600.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Maxwell O. Reade, Department of Mathematics; *Subharmonic, Harmonic and Analytic Functions*; 2 years; \$12,600.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Charles J. Titus, Department of Mathematics; *Linear Vector Spaces of Elliptic Mappings*; 1 year; \$5,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Leonard Tornheim, Department of Mathematics; *Geometry of Numbers*; 1 year; \$6,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Hidehike Yamabe, Department of Mathematics; *Structure of Manifolds*; 2 years; \$11,100.
- MORGAN STATE COLLEGE, Baltimore, Md.; Luna I. Mishoe, Department of Mathematics; *Eigen-Function Series for a Non-Self Adjoint System*; 1 year; \$4,600.
- UNIVERSITY OF NEW HAMPSHIRE, Durham, N. H.; Henry G. Rice, Department of Mathematics; *Recursion Theory*; 2 years; \$8,700.
- NEW YORK UNIVERSITY, New York, N. Y.; Avron Dougliis; *Hadamard's Conjecture and Related Problems in the Theory of Wave Propagation*; 1 year; \$7,500.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; D. Zelinsky and A. Rosenberg, Department of Mathematics; *Galois Theory of Rings*; 1 year; \$11,000.
- UNIVERSITY OF NOTRE DAME, Notre Dame, Ind.; Paul Erdos, Department of Mathematics; *Probability and Related Problems*; 1 year; \$10,000.

- OBERLIN COLLEGE, Oberlin, Ohio; John D. Baum, Department of Mathematics; *Topological Dynamics*; 1 year; \$3,600.
- OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, Stillwater, Okla.; Edwin W. Titt, Department of Mathematics; *A New Approach to Partial Differential Equations*; 2 years; \$26,000.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; R. D. Anderson, Department of Mathematics; *Higher Dimensional Manifolds*; 3 years; \$23,700.
- PURDUE UNIVERSITY, Lafayette, Ind.; Leonard Gillman, Melvin Henriksen and Myer Jerison, Department of Mathematics; *Function Space Algebras*; 2 years; \$21,700.
- SMITH COLLEGE, Northampton, Mass.; Richard E. Johnson, Department of Mathematics; *Rings With Atomic Algebras of Ideals*; 1 year; \$3,700.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; Herbert Busemann, Department of Mathematics; *Geometry With Non-Symmetric Distances*; 2 years; \$6,600.
- SYRACUSE UNIVERSITY, Syracuse, N. Y.; Albert Edrei, Department of Mathematics; *Zeros of the Derivatives of Analytic Functions*; 1 year; \$7,000.
- UNIVERSITY OF TENNESSEE, Knoxville, Tenn.; Wallace Givens, Department of Mathematics; *Continuous Geometry*; 18 months; \$13,300.
- UNIVERSITY OF TEXAS, Austin, Tex.; H. S. Vandiver, Department of Mathematics; *Class Fields and Fermat's Last Theorem*; 1 year; \$10,600.
- UNIVERSITY OF VIRGINIA, Charlottesville, Va.; G. T. Whyburn and E. J. McShane, School of Mathematics; *Topological Methods in Analysis*; 3 years; \$34,400.
- WAYNE UNIVERSITY, Detroit, Mich.; George Lorentz, Department of Mathematics; *Summability Methods and Function Spaces*; 1 year; \$8,900.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; R. H. Bing, Department of Mathematics; *Imbedding Sets in Manifolds*; 2 years; \$17,000.
- YALE UNIVERSITY, New Haven, Conn.; Nathan Jacobson, Department of Mathematics; *Jordan Algebras*; 1 year; \$8,800.

Molecular Biology

- BOSTON DISPENSARY, Boston, Mass.; Gerhart Schmidt, Thannhauser Laboratory; *Biosynthesis of Proteins and Nucleic Acids in Yeast*; 3 years; \$16,500.
- BOSTON UNIVERSITY, Boston 15, Mass.; William G. Boyd, Department of Biochemistry; *Antibody-Antigen Reactions and Antibody Specificity*; 3 years; \$20,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Henry Borsook and Richard S. Sweet, Division of Biology; *Metabolism of Lysine*; 2 years; \$9,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Robert B. Corey, Department of Chemistry; *X-Ray Diffraction Studies of Crystalline Proteins*; 3 years; \$36,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; M. Delbruck, Division of Biology; *Phototropic Responses of Sporangiohores*; 2 years; \$15,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; H. K. Mitchell, Division of Biology; *The Biosynthesis of Pterins and Flavins*; 2 years; \$9,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Linus Pauling, Department of Chemistry; *Configurations of Polypeptide Chains in Proteins*; 3 years; \$30,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Daniel E. Atkinson, Department of Chemistry; *Autotrophism in Hydrogenomonas*; 3 years; \$14,500.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Arthur L. Black, School of Veterinary Medicine, Davis, Calif.; *Biosynthesis of Amino Acids in Dairy Cows from Carbon-14 Labeled Precursors*; 2 years; \$14,500.

- UNIVERSITY OF CHICAGO, Chicago, Ill.; Birgit Vennesland, Department of Biochemistry; *Enzyme Reaction Mechanism*; 3 years; \$24,000.
- COLUMBIA UNIVERSITY, New York, N. Y.; Elvin A. Kabat, Department of Neurology; *Immunochemical Studies on Polysaccharides*; 3 years; \$60,000.
- COLUMBIA UNIVERSITY, New York, N. Y.; Seymour Lieberman, Department of Obstetrics and Gynecology; *Steroid Hormone Biosynthesis by Perfused Human Placenta*; 3 years; \$25,000.
- DUKE UNIVERSITY, Durham, N. C.; George W. Schwert, Department of Biochemistry; *Properties of Chymotrypsinogen and of Chymotrypsin*; 3 years; \$19,000.
- FLORIDA STATE UNIVERSITY, Tallahassee, Fla.; Earl Frieden, Department of Chemistry; *The Properties of Ascorbic Acid Oxidase*; 2 years; \$7,400.
- HARVARD UNIVERSITY, Cambridge, Mass.; Wonrad Bloch, Department of Biochemistry; *Enzymatic Synthesis of Glutathione*; 3 years; \$20,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; Barbara W. Low, University Laboratory of Physical Chemistry; *X-Ray Crystal Structure of Proteins and Peptides*; 18 months; \$10,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; Barbara W. Low, Department of Biophysical Chemistry; *X-Ray Crystal Structure Studies of Proteins and Peptides—A Study of the Insulin Structure*; 1 year; \$10,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; J. M. Watson, Department of Biology; *Structure and Ribonucleic Acid Component of Tobacco Mosaic Virus*; 1 year; \$8,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; F. H. Westheimer, Department of Chemistry; *Chemical Models for Enzyme Systems*; 3 years; \$24,000.
- HAVERFORD COLLEGE, Haverford, Pa.; Ariel G. Loewy, Department of Biology; *Cytoplasmic Proteins*; 2 years; \$10,000.
- HUNTER COLLEGE, New York, N. Y.; H. W. Hoyer, Department of Chemistry; *Electrophoretic Mobility of Micelles*; 1 year; \$4,000.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Elliot Juni, Department of Bacteriology; *Mode of Action of Diphosphothiamine in Carbohydrate Metabolism*; 2 years; \$11,000.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Joseph Larner, Department of Chemistry; *Carbohydrate Absorption; Synthesis and Degradation of Polysaccharides*; 3 years; \$16,000.
- IOWA STATE COLLEGE OF AGRICULTURE, AND MECHANICAL ARTS, Ames, Iowa; S. Aronoff, Department of Botany; *Biosynthesis of Chlorophyll*; 3 years; \$12,000.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Vincent G. Dethier, Department of Biology; *Insect Chemoreception and Mechanism of Action of Attractants and Repellents*; 3 years; \$30,000.
- UNIVERSITY OF KENTUCKY, Louisville, Ky.; Richard L. Hardin and Peter R. Moore, Department of Biochemistry, School of Medicine; *Enzymes Concerned with Phosphorylation of Glycerol*; 2 years; \$5,500.
- UNIVERSITY COLLEGE LONDON, London, England; C. K. Ingold, Department of Chemistry; *Kinetics of Enzyme Reactions*; 1 year; \$2,900.
- UNIVERSITY OF LOUISVILLE, Louisville, Ky.; John F. Taylor and Duncan Dallam, Department of Biochemistry; *Enzymes Associated with Lipoproteins*; 2 years; \$16,000.
- LOYOLA UNIVERSITY, Chicago, Ill.; Norten C. Melchoir, Department of Biochemistry; *Molecular Structure and the Intensity of the Absorption of Light*; 3 years; \$12,000.
- MICHIGAN STATE COLLEGE, East Lansing, Mich.; Robert S. Bandurski, Department of Botany and Plant Pathology; *Biochemistry of Sulfate Reduction*; 2 years; \$12,000.

- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; P. D. Boyer, Department of Physiological Chemistry; *Mechanism and Control of Certain Metabolic Enzymes*; 3 years; \$18,000.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; Rufus Lumry, Department of Chemistry; *Reversible Structural Changes in Proteins*; 3 years; \$15,000.
- NATIONAL INSTITUTES OF HEALTH, Bethesda, Md.; Dr. Leah Bloch-Frankenthal; *Epsilon-Acylase in Animal Organs and Tissues*; 1 year; \$2,000.
- NEW YORK UNIVERSITY, New York, N. Y.; Werner K. Maas, Department of Pharmacology, College of Medicine; *Enzyme Synthesis in Temperature-Sensitive Mutants of Bacteria*; 2 years; \$8,500.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; John W. Hastings, Department of Biological Sciences; *Role of Flavins in Bioluminescence*; 2 years; \$10,000.
- UNIVERSITY OF OREGON, Eugene, Oreg.; Howard S. Mason, Department of Biochemistry, Medical School; *Biochemistry of Natural Melanins*; 3 years; \$27,000.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; B. Chance, Johnson Foundation for Medical Physics; *Dynamics of Intracellular Enzyme Systems*; 5 years; \$63,000.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; Ray Pepinsky, Department of Physics; *Nucleic and Desoxynucleic Acid Fragments*; 2 years; \$20,000.
- PRINCETON UNIVERSITY, Princeton, N. J.; A. M. Chase, Department of Biology; *Mechanism of Enzyme Action: Luciferase*; 3 years; \$9,500.
- UNIVERSITY OF PUERTO RICO, Mayaguez, Puerto Rico; Fred V. Soltero, Department of Chemistry; *Mechanism of Penicillin Biosynthesis*; 2 years; \$10,000.
- PURDUE UNIVERSITY, Lafayette, Ind.; Herschel Hunt, Department of Chemistry; *Heats of Combustion of Amino Acids and Proteins*; 3 years; \$25,000.
- REED COLLEGE, Portland, Oreg.; Helen A. Stafford, Department of Biology; *Pyridine Nucleotide Dehydrogenases in Higher Plants*; 3 years; \$9,500.
- RUTGERS UNIVERSITY, New Brunswick, N. J.; Walter J. Nickerson and Joseph R. Merkel, Department of Microbiology; *Metal Regulated Reactions of Flavin Systems*; 2 years; \$15,000.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; Paul D. Saltman, Department of Biochemistry, School of Medicine; *Enzymatic Mechanism of CO₂ Fixation in the Succulents*; 2 years; \$10,000.
- TUFTS COLLEGE, Medford, Mass.; Erich Heinz, Department of Biochemistry; *Chemical and Physico-Chemical Basis of Active Transport*; 2 years; \$10,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Robert A. Alberty, Department of Chemistry; *Physical Chemical Studies of Fumarase*; 2 years; \$22,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Helmut Beinert, Institute for Enzyme Research; *Isolation and Characterization of a New Flavoprotein*; 2 years; \$10,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Philip P. Cohen, Department of Physiological Chemistry; *Enzymatic Peroxidative Breakdown of Uric Acid*; 3 years; \$24,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Henry A. Lardy, Institute for Enzyme Research; *Apparatus for Enzyme Research*; 2 years; \$7,500.
- THE GEORGE WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, Washington, D. C.; Dr. Ira R. Telford; *Application of Densitometric Measurements in the Study of Basophilia of Nerve Cells*; 1 year; \$550.

Physics

- AMHERST COLLEGE, Amherst, Mass.; T. Soller, Department of Physics; *Metals and Paramagnetic Salts Below One-Tenth Degree Absolute*; 2 years; \$19,500.
- BROWN UNIVERSITY, Providence, R. I.; H. E. Farnsworth, Department of Physics; *Catalytic Action of Crystal Faces*; 2 years; \$12,400.

- BROWN UNIVERSITY, Providence, R. I.; Leonard Maximon, Department of Physics; *Evaluation of the Integral Cross Section for Bremsstrahlung*; 2 years; \$9,500.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; J. R. Pellam, Department of Physics; *Cryogenic Research*; 3 years; \$34,500.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Francis A. Jenkins, Department of Physics; *Nuclear Moments from Observations on Hyperfine Structure in the Optical Region*; 2 years; \$18,300.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; D. S. Saxon, Department of Physics; *Theoretical Nuclear and Atomic Physics*; 2 years; \$21,100.
- CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; Sergio DeBenedetti, Department of Physics; *Slow Positrons in Solids*; 2 years; \$20,600.
- CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa.; S. A. Friedberg, Department of Physics; *Investigations in Low Temperature Physics*; 2 years; \$14,700.
- CLEMSON AGRICULTURAL COLLEGE, Clemson, S. C.; J. E. Miller, Department of Physics; *A Study of Sulphur*; 1 year; \$5,700.
- COLUMBIA UNIVERSITY, New York, N. Y.; Henry A. Boorse, Department of Physics; *Research in Low Temperature Physics*; 2 years; \$15,700.
- COLUMBIA UNIVERSITY, New York, N. Y.; Leon Brillouin, Department of Physics; *Physics and Information Theory*; 1 year; \$12,600.
- COLUMBIA UNIVERSITY, New York, N. Y.; Gerard G. Harris, Department of Physics; *Emulsion Study of High Energy Nuclear Interactions*; 2 years; \$10,400.
- COLUMBIA UNIVERSITY, New York, N. Y.; P. Kusch, Department of Physics; *Energy Levels and Hyperfine Structure of Helium Three and Four*; 2 years; \$24,300.
- UNIVERSITY OF DENVER, Denver, Colo.; Mario Iona, Department of Physics; *Asymmetry of Extensive Air Showers*; 2 years; \$12,600.
- DEPAUW UNIVERSITY, Greencastle, Ind.; Malcolm Correll, Department of Physics; *Characteristics of Active Region Prominences of the Sun*; 2 years; \$4,200.
- DUKE UNIVERSITY, Durham, N. C.; H. Sponer, Department of Physics; *Electronic Structure of Molecules*; 2 years; \$14,200.
- GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Ga.; L. D. Wyly, Department of Physics; *Angular Correlations Between Nuclear Radiations*; 2 years; \$15,000.
- ILLINOIS INSTITUTE OF TECHNOLOGY, Chicago, Ill.; W. E. Bennett, Department of Physics; *Nuclear Reactions with Alpha-Particles of Low Energy*; 2 years; \$11,300.
- ILLINOIS INSTITUTE OF TECHNOLOGY, Chicago, Ill.; Forrest F. Cleveland, Department of Physics; *Spectroscopic Determination of Molecular Thermodynamic Properties*; 2 years; \$13,500.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; J. S. Koehler and F. Seitz, Department of Physics; *Plastic Deformation*; 2 years; \$18,100.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Robert Maurer, Department of Physics; *Low Temperature Research on Polar Crystals*; 2 years; \$14,300.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Frederick Seitz, Department of Physics; *Imperfections in Crystalline Materials*; 2 years; \$12,500.
- INDIANA UNIVERSITY, Bloomington, Ind.; K. A. Brueckner, Department of Physics; *Theory and Interpretation of Elementary Particle*; 2 years; \$32,200.
- INDIANA UNIVERSITY, Bloomington, Ind.; R. W. Thompson, Department of Physics; *Construction of a Double Cloud Chamber for Research on Fundamental Particles*; 2 years; \$78,900.
- STATE UNIVERSITY OF IOWA, Iowa City, Iowa; J. M. Jauch, Department of Physics; *The Scattering Matrix*; 2 years; \$16,100.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; G. H. Dicke, Department of Physics; *Spectroscopy of Rare Earths at Low Temperatures*; 1 year; \$4,700.
- UNIVERSITY OF KANSAS, Lawrence, Kans.; L. Worth Seagondollar, Department of Physics; *Nuclear Reactions with 3 MEV Protons*; 2 years; \$17,800.

- KENT STATE UNIVERSITY, Kent, Ohio; A. A. Silvidi, Department of Physics; *Continuous Cloud Chamber*; 2 years; \$3,100.
- UNIVERSITY OF MAINE, Orono, Maine; G. C. Krueger, Department of Physics; *Phase Contrast Analysis of Non-Homogeneous Transient Phenomena*; 2 years; \$6,600.
- UNIVERSITY OF MARYLAND, College Park, Md.; John S. Toll, Department of Physics; *Particle Theory and Foundations of Field Theory*; 2 years; \$22,800.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Hans Mueller, Department of Physics; *Optics of Partially Polarized Light*; 3 years; \$15,600.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Bruno B. Rossi, Department of Physics; *Cosmic Ray Research*; 1 year; \$9,300.
- MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, UNIVERSITY OF ILLINOIS, Urbana, Ill.; D. W. Kerst, University of Illinois; *High-Energy Accelerator Problems*; 9 months; \$69,400.
- MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, Urbana, Ill.; D. W. Kerst, University of Illinois; *High-Energy Accelerator Problems*; 3 months; \$83,100.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; W. B. Cheston, Department of Physics; *Medium Energy Nucleon-Nucleus Scattering*; 2 years; \$5,000.
- NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY, Campus Station Socorro, N. Mex.; Dr. E. J. Workman, President; *Geochemical Effects of Freezing of Terrestrial Waters*; 2 years; \$16,100.
- OHIO STATE UNIVERSITY, Columbus, Ohio; Jan Korringa, Department of Physics; *Energy Levels and Relaxation Mechanisms of Paramagnetic Ions*; 2 years; \$8,500.
- UNIVERSITY OF OKLAHOMA, Norman, Okla.; R. G. Fowler, Department of Physics; *Conductivity Coefficients in Highly Ionized Media*; 2 years; \$11,000.
- UNIVERSITY OF OREGON, Eugene, Oreg.; Bernd Crasemann, Department of Physics; *Decay Schemes of Long Lived Positron Emitters*; 2 years; \$7,700.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; K. R. Atkins, Department of Physics; *Superfluidity of Liquid Helium*; 2 years; \$22,200.
- PENNSYLVANIA STATE UNIVERSITY, University Park, Pa.; Edwin R. Fitzgerald, Department of Physics; *Dynamic Properties of Polymers*; 2 years, \$8,300.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; W. E. Stephens, Department of Physics; *Photonuclear and Transmutation Processes*; 2 years; \$24,700.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; C. Dean and G. A. Jeffrey, Department of Physics; *Nuclear Quadrupole Coupling and X-Ray Diffraction Data*; 2 years; \$11,500.
- UNIVERSITY OF PITTSBURGH, Pittsburgh, Pa.; T. M. Donahue, Department of Physics; *Sodium and Oxygen Air-Glow*; 2 years; \$9,900.
- PRINCIPIA COLLEGE, Elsau, Ill.; S. L. Leonard, Department of Physics; *Direct Pair Production by Electrons of 200-500 MEV Energy*; 2 years; \$4,200.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; Suraj N. Gupta, Department of Physics; *Quantum Theory of Fields*; 2 years; \$8,500.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; K. W. Meissner, Department of Physics; *An Atomic Beam Source for Wavelength Standard*; 1 year; \$9,100.
- RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y.; J. M. Greenberg, Department of Physics; *Approximations in the Theory of Scattering*; 2 years; \$9,100.
- RICE INSTITUTE, Houston, Tex.; C. F. Squire, Department of Physics; *Studies in Solid State Physics*; 2 years; \$22,300.
- UNIVERSITY OF ROCHESTER, Rochester, N. Y.; M. P. Givens, Institute of Optics; *A Study of Solids with Soft X-Rays*; 2 years; \$14,200.
- SMITH COLLEGE, Northampton, Mass.; Irving L. Kofsky, Department of Physics; *Structure and Development of Air Showers*; 2 years; \$2,700.
- SMITH COLLEGE, Northampton, Mass.; Nora M. Mohler, Department of Physics; *Studies with Nuclear Plates*; 15 months; \$7,800.

- SMITH COLLEGE, Northampton, Mass.; William T. Scott, Department of Physics; *Nuclear Scattering of Mesons*; 2 years; \$2,300.
- STANFORD UNIVERSITY, Stanford, Calif.; G. E. Pake, Department of Physics; *Hyper-fine Structure of Paramagnetic Resonance*; 1 year; \$6,900.
- STANFORD UNIVERSITY, Stanford, Calif.; W. K. H. Panofsky, Department of Physics; *Design Study for High-Energy Magnetic Spectrometers*; 1 year; \$15,600.
- SYRACUSE UNIVERSITY, Syracuse, N. Y.; Peter Fong, Department of Physics; *Theory of Nuclear Fission*; 2 years; \$5,500.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; J. W. Keuffel, Department of Physics; *Quantum Theory of Gravitation*; 2 years; \$19,200.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; Grant R. Fowles, Department of Physics; *Isotope Shifts in the Spectra*; 2 years; \$10,300.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; J. W. Keuffel, Department of Physics; *A Scintillation Counter Study of Unstable Cosmic Ray Particles*; 3 years; \$24,600.
- VANDERBILT UNIVERSITY, Nashville, Tenn.; Ingram Bloch, Department of Physics; *Normal Modes of Vibration of Nuclei*; 1 year; \$9,300.
- UNIVERSITY OF VERMONT AND STATE AGRICULTURAL COLLEGE, Burlington, Vt.; Adam S. Skapski, Department of Physics; *The Influence of Thickness on the Melting Point of Tin Lamellae*; 2 years; \$10,300.
- UNIVERSITY OF VIRGINIA, Charlottesville, Va.; Nicolas Cabrera, Department of Physics; *Dislocations in Crystal Growth and Plastic Deformation*; 2 years; \$6,100.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; J. H. Manley, Department of Physics; *Nuclear Emulsion Studies of Pion-Proton Scattering*; 3 years; \$9,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Kenneth M. Watson, Department of Physics; *High Energy Nuclear Reactions*; 2 years; \$10,300.
- UNIVERSITY OF WYOMING, Laramie, Wyo.; F. J. Bueche, Department of Physics; *Mechanical Properties of High Polymers*; 1 year; \$4,300.
- YALE UNIVERSITY, New Haven, Conn.; V. W. Hughes, Department of Physics; *Atomic Beam Magnetic Resonance Investigations*; 2 years; \$26,300.
- YALE UNIVERSITY, New Haven, Conn.; C. T. Lane, Department of Physics; *Low Temperature Physics*; 3 years; \$26,400.

Psychobiology

- THE AMERICAN MUSEUM OF NATURAL HISTORY, New York, N. Y.; T. C. Schneirla, Department of Animal Behavior; *Army Ant Behavior and Its Biological Basis*; 2 years; \$4,800.
- BROWN UNIVERSITY, Providence, R. I.; Carl Pfaffmann, Department of Psychology; *Behavioral Study of Odor Discrimination*; 1 year; \$4,800.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Roger W. Sperry, Division of Biology; *Neural Mechanisms of Behavior*; 2 years; \$31,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; David Krech, Department of Psychology; *Brain Chemistry and Behavior*; 1 year; \$11,600.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Mark R. Rosenzweig, Department of Psychology; *Physiological Mechanisms of Binaural Perception*; 1 year; \$3,200.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; John P. Seward, Department of Psychology, Los Angeles, Calif.; *Research on Drive-Reward Interaction*; 2 years; \$9,300.
- CORNELL UNIVERSITY, Ithaca, N. Y.; Eleanor J. Gibson, Richard D. Walk, Department of Psychology; *Development of Visual Perception*; 2 years; \$13,000.
- FLORIDA STATE UNIVERSITY, Tallahassee, Fla.; W. N. Kellogg, Oceanographic Institute; *Echolocation in the Dolphin*; 1 year; \$5,600.
- FLORIDA STATE UNIVERSITY, Tallahassee, Fla.; Daniel R. Kenshalo, Department of Psychology; *An Analysis of Tactile Stimuli*; 1 year; \$4,800.

- GRINNELL COLLEGE, Grinnell, Iowa; Irving Y. Fishman, Department of Biology; *Research on Chemoreceptors*; 2 years; \$6,800.
- HARVARD UNIVERSITY, Cambridge, Mass.; Eric G. Heinemann, Department of Psychology; *Simultaneous Contrast in Human Vision*; 18 months; \$7,600.
- HARVARD UNIVERSITY, Cambridge, Mass.; B. F. Skinner, Department of Psychology; *Research on Reinforcement Schedules*; 2 years; \$32,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; Philip Teitelbaum, Department of Psychology; *Effect of Hypothalamic Lesions on Behavior*; 1 year; \$5,000.
- HOWARD UNIVERSITY, Washington, D. C.; Max Meenes, Department of Psychology; *Research and Training in Experimental Psychology*; 2 years; \$12,100.
- INDIANA UNIVERSITY, Bloomington, Ind.; W. K. Estes and C. J. Burke, Department of Psychology; *Mathematical Models for Behavior Data*; 2 years; \$8,200.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; James Deese, Department of Psychology; *Analyses of Sources of Responses in Verbal Recall*; 2 years; \$13,100.
- LEHIGH UNIVERSITY, Bethlehem, Pa.; Natha B. Gross, Department of Psychology; *Neurophysiological Processes in the Auditory Cortices*; 2 years; \$9,600.
- LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE, Baton Rouge, La.; C. E. Noble, Department of Psychology; *Analysis of Trial and Error Learning*; 2 years; \$14,700.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; John E. Bardach, Department of Fisheries; *Behavior of Reef Fishes*; 2 years; \$14,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Russell A. Clark, Department of Psychology; *Factors Related to Motivation*; 1 year; \$5,400.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Edward L. Walker, Department of Psychology; *Comparison of Conditioning Techniques*; 1 year; \$7,000.
- MONTANA STATE COLLEGE, Bozeman, Mont.; Jack E. Conklin, Department of Psychology; *Studies of Apparent Movement*; 2 years; \$7,300.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Carl P. Duncan and Donald J. Lewis, Department of Psychology; *Persistence of Unrewarded Responses in Human Adults*; 3 years; \$17,600.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; D. J. Lewis and J. W. Cotton, Department of Psychology; *Research on Learning and Retention*; 2 years; \$10,200.
- PENNSYLVANIA STATE UNIVERSITY, State College Pa.; John F. Corso, Department of Psychology; *Neural Quantum Theory of Hearing*; 1 year; \$7,100.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; Eliot Stellar, Institute of Neurological Sciences; *Physiological Mechanisms Regulating Motivated Behavior*; 2 years; \$13,300.
- PRINCETON UNIVERSITY, Princeton, N. J.; William M. Smith, Department of Psychology; *Temporal Characteristics of Visual Processes*; 2 years; \$10,000.
- SARAH LAWRENCE COLLEGE, Bronxville, N. Y.; Mary E. Collins and Ruth C. Wylie, Department of Psychology; *Research and Training in Experimental Psychology*; 2 years; \$7,000.
- STANFORD UNIVERSITY, Stanford, Calif.; Calvin P. Stone, Department of Psychology; *Behavior of Hypophysectomized Rats*; 2 years; \$9,100.
- SWARTHMORE COLLEGE, Swarthmore, Pa.; Wolfgang Kohler, Department of Psychology; *Problems in Gestalt Psychology*; 3 years; \$26,600.
- SWARTHMORE COLLEGE, Swarthmore, Pa.; W. C. H. Prentice, Department of Psychology; *Psychological Research in the Department of Psychology*; 5 years; \$27,600.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; James L. Morey, Department of Psychology; *Research on Latent Learning*; 1 year; \$5,300.
- UNIVERSITY OF VIRGINIA, Charlottesville, Va.; Frank W. Finger and L. Starling Reid, Department of Psychology; *Research on Induced Drive States*; 3 years; \$15,500.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; Moncrieff H. Smith, Jr., Department of Psychology; *Aspects of Biological Motivation*; 2 years; \$8,900.

- WESTERN RESERVE UNIVERSITY, Cleveland, Ohio; Jan H. Bruell and George W. Albee, Department of Psychology; *Influence of Motor Events on Visual Perception*; 2 years; \$14,600.
- UNIVERSITY OF WICHITA, Wichita, Kans.; N. H. Pronko, Department of Psychology; *Research and Training in Experimental Psychology*; 2 years; \$10,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; E. James Archer, Department of Psychology; *Information Transmission and the Identification of Concepts*; 2 years; \$7,800.
- UNIVERSITY OF WYOMING, Laramie, Wyo.; Margaret Altmann; *Behavior Patterns in Ungulates*; 3 years; \$4,100.
- YALE UNIVERSITY, New Haven, Conn.; Frank A. Logan, Department of Psychology; *Conditions of Reinforcement*; 2 years \$15,500.
- YALE UNIVERSITY, New Haven, Conn.; Paul D. MacLean, Department of Psychiatry; *Effects of Hippocampal Seizures on Conditioned Behavior*; 1 year; \$7,500.
- THE YERKES LABORATORY OF PRIMATE BIOLOGY, INC., Orange Park, Fla.; Henry W. Nissen and Karl H. Pribram; *The Basic Research Program of the Yerkes Laboratories of Primate Biology*; 3 years; \$120,000.

Regulatory Biology

- BARNARD COLLEGE, New York, N. Y.; Aubrey Gorbman, Department of Zoology; *Comparative Physiology of Thyroidal Function*; 2 years; \$13,300.
- BOSTON UNIVERSITY SCHOOL OF MEDICINE, Boston, Mass.; John D. Ifft, Department of Anatomy; *Gonadotrophic Activities of the Adenohypophysis*; 3 years; \$13,800.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; James Bonner, Department of Biology; *Hormonal Control of Plant Responses*; 3 years; \$27,800.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Arthur W. Galston, Department of Biology; *Light-Controlled Growth Reactions*; 3 years; \$22,400.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Edward A. Adelberg, Department of Bacteriology; *Enzymatic Changes in Genetic Adaptation*; 4 years; \$26,100.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Clarence M. Agress, Department of Medicine; *Distribution and Nature of the Sensory Coronary Arterial Innervation*; 2 years; \$12,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Michael Doudoroff, Department of Bacteriology; *Mechanisms of Utilization of Carbohydrates by Microorganisms*; 4 years; \$26,700.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Robert Burr Livingston, Department of Anatomy; *Neurophysiological Mechanisms in Movement and Perception*; 2 years; \$20,400.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Donald M. Reynolds, Department of Bacteriology, Davis, Calif.; *Microbiological and Biochemical Aspects of Chitin Decomposition*; 2 years; \$6,200.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Sidney Roberts, Department of Physiological Chemistry; *Hypothalamic Regulation of Pituitary Function*; 3 years; \$24,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; Leonard Machlis, Department of Botany; *Metabolic Pathways in the Filamentous Fungus, Allomyces*; 3 years; \$15,400.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; E. S. Guzman Barron, Department of Medicine; *Pathways of Glucose Oxidation in Molds*; 1 year; \$3,450.
- COLUMBIA UNIVERSITY, New York, N. Y.; Edwin Chargaff, Department of Biochemistry, College of Physicians and Surgeons; *Role of Phosphorolytic and Phosphorylating Enzymes in Nucleic Acid Metabolism*; 3 years; \$28,600.

- COLUMBIA UNIVERSITY, New York, N. Y.; Philip Feigelson, Department of Biochemistry, College of Physicians and Surgeons; *Adaptive Enzyme Formation in Mammals*; 6 months; \$2,070.
- COLUMBIA UNIVERSITY, New York, N. Y.; Philip Feigelson, Department of Biochemistry, College of Physicians and Surgeons; *Adaptive Enzyme Formation in Mammals*; 2 years; \$9,600.
- CORNELL UNIVERSITY, Ithaca, N. Y.; Donald B. Melville, Medical College; *Biochemistry of Ergothioneine*; 3 years; \$30,000.
- UNIVERSITY OF DELAWARE, Newark, Del.; Bruce M. Pollock, Department of Biological Sciences; *Physiological and Biochemical Mechanisms of the Rest Period in Seeds*; 3 years; \$13,350.
- HAHNEMANN MEDICAL COLLEGE AND HOSPITAL, Philadelphia, Pa.; Albert G. Moat, Department of Bacteriology and Immunology; *Role of Biotin in Carbohydrate Metabolism*; 2 years; \$8,200.
- HARVARD UNIVERSITY, Cambridge, Mass.; Frederick L. Hisaw, Department of Biology; *Reproduction in Elasmobranch Fishes and Ascidians*; 2 years; \$6,000.
- HARVARD UNIVERSITY, Cambridge, Mass.; Boris Magasanik, Department of Immunology and Bacteriology; *Degradation of Histidine and Biosynthesis of Purines in Aerobacter Aerogenes*; 3 years; \$15,500.
- HARVARD UNIVERSITY, Cambridge, Mass.; Paul L. Munson, Harvard School of Dental Medicine; *Mechanism of Stimulation of ACTH Secretion*; 2 years; \$15,200.
- UNIVERSITY OF ILLINOIS, Urbana, Ill.; Robert Emerson, Department of Botany; *Efficiency of Photosynthesis*; 3 years; \$24,800.
- INDIANA UNIVERSITY, Bloomington, Ind.; Felix Haurowitz, Department of Chemistry; *Biosynthesis of Proteins and Antibodies*; 3 years; \$18,000.
- INDIANA UNIVERSITY, Bloomington, Ind.; Eugene D. Weinberg, Department of Bacteriology; *Mutual Effects of Metallic Ions and Antibiotics*; 2 years; \$6,500.
- THE INSTITUTE FOR CANCER RESEARCH AND THE LANKENAU HOSPITAL RESEARCH INSTITUTE, Philadelphia, Pa.; Sidney Weinhouse, Department of Metabolic Chemistry; *Biosynthesis of Valine and Isoleucine*; 3 years; \$16,500.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Andre T. Jagendorf, McCollum-Pratt Institute; *Tuber Initiation in the Potato Plant*; 2 years; \$13,500.
- JOHNS HOPKINS UNIVERSITY, Baltimore, Md.; Manfred M. Mayer, School of Hygiene and Public Health; *Cytotoxic Reactions Mediated by Antibody and Complement*; 5 years; \$50,000.
- KANSAS STATE COLLEGE, Manhattan, Kans.; Byron S. Miller and John A. Johnson, Department of Flour and Feed Milling Industries; *Biochemical Factors in The Resistance of The Wheat Plant to The Hessian Fly*; 2 years; \$6,800.
- MARINE BIOLOGICAL LABORATORY, Woods Hole, Mass.; Lewis H. Kleinholz, Department of Biology, Reed College; *Osmoregulation and Excretion of Tunicates*; 2 years; \$4,625.
- UNIVERSITY OF MARYLAND, College Park, Md.; Samuel P. Bessman, Department of Pediatrics, School of Medicine; *Low Energy Transacylation in Animal Tissues*; 1 year; \$8,500.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Gene M. Brown, Department of Biology; *Enzyme Systems Involved in The Metabolism of Pantothenic Acid*; 3 years; \$13,350.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; Warren S. McCulloch, Research Laboratory of Electronics; *Transmission of Signals Across the Central Nervous System*; 2 years; \$25,600.
- UNIVERSITY OF MIAMI, Coral Gables, Fla.; M. Michael Sigel, Department of Bacteriology, School of Medicine; *Cellular Resistance to Virus Infections*; 2 years; \$21,750.

- NEW ENGLAND DEACONESS HOSPITAL, Boston, Mass.; Nancy Nichols, Baker Clinic Research Laboratory; *Hepatic Glycogenesis and Potassium Distribution*; 1 year; \$3,500.
- NEW YORK MEDICAL COLLEGE, New York, N. Y.; Carl Neuberg, Department of Biochemistry; *Mechanism of Action of Certain Synthetic Hydrazine Derivatives*; 2 years; \$15,500.
- NEW YORK UNIVERSITY, New York, N. Y.; Bernard D. Davis, Department of Pharmacology; *Bacterial Growth Factors Derived from Catechol*; 1 year; \$5,200.
- NEW YORK UNIVERSITY, New York, N. Y.; Albert S. Gordon, Department of Biology, Washington Square College of Arts and Sciences; *Mechanisms Underlying Cell Formation With Emphasis Upon Erythropoiesis*; 2 years; \$15,250.
- NEW YORK UNIVERSITY, New York, N. Y.; Alwin Pappenheimer, Jr., Department of Microbiology; *A Study of SIII Depolymerase*; 3 years; \$12,100.
- NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING, Raleigh, N. C.; Clayton McAuliffe, Department of Agronomy; *Absorption and Metabolism of Nitrogen Compounds by the Tobacco Plant*; 2 years; \$10,000.
- UNIVERSITY OF NORTH CAROLINA, Chapel Hill, N. C.; T. Z. Csaky, Department of Pharmacology; *Relationship Between Cellular Permeability and Carbohydrate Metabolism*; 2 years; \$10,200.
- OREGON STATE COLLEGE, Corvallis, Oreg.; Vernon H. Cheldelin, Department of Chemistry, Science Research Institute; *Nutrition and Metabolism of Insects*; 2 years; \$24,000.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; David P. Earle, Department of Medicine, The Medical School; *Serum Complement Inhibition*; 2 years; \$11,500.
- NORTHWESTERN UNIVERSITY, Evanston, Ill.; Robert W. Hull, Department of Biological Sciences; *Feeding Mechanisms of Suctorian Protozoa*; 2 years; \$7,100.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; John R. Brobeck, Department of Physiology, School of Medicine; *Regulation by the Central Nervous System of Food Intake*; 5 years; \$35,500.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; Harry Beevers, Department of Biological Sciences; *Oxidations and Phosphorylations Induced by Enzymes and Plants*; 3 years; \$9,800.
- THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH; Dr. D. W. Wooley, Department of Microbiology; *Role of Folic Acid in Purine Biosynthesis*; 6 months; \$500.
- RUTGERS UNIVERSITY, New Brunswick, N. J.; Arthur F. Hopper, Department of Zoology; *Role of Thyroid Gland in Fish*; 2 years; \$4,000.
- UNIVERSITY OF SOUTHERN CALIFORNIA, Los Angeles, Calif.; Sydney C. Rittenberg, Department of Bacteriology; *Metabolism of Malonate by Pseudomonas Fluorescens*; 3 years; \$24,000.
- STANFORD UNIVERSITY, Stanford, Calif.; Arthur C. Giese, Department of Biological Sciences; *Comparative Physiology of Nutrition and Reproduction of Marine Invertebrates*; 2 years; \$7,600.
- STANFORD UNIVERSITY, Stanford, Calif.; O. H. Robertson, Department of Biology; *Experimental Acceleration of Gonad Development in Trout and Salmon*; 2 years; \$3,450.
- TEXAS AGRICULTURAL EXPERIMENT STATION, College Station, Tex.; James A. Liverman, Department of Biochemistry and Nutrition; *Biochemistry of the Photo-periodic Response*; 2 years; \$12,000.
- UNIVERSITY OF TEXAS, Austin, Tex.; J. Allen Scott and Etta Mae Macdonald, Medical Branch; *Nature of Racial or Species Immunity*; 2 years; \$12,000.
- TUFTS COLLEGE, Medford, Mass.; K. D. Roeder, Department of Biology; *Insect Neurophysiology, Neuropharmacology and Behavior*; 3 years; \$42,300.

- VANDERBILT UNIVERSITY, Nashville, Tenn.; Jane H. Park, Department of Physiology; *Relation of Thyroxine to Oxidative Phosphorylation*; 2 years; \$10,000.
- WASHINGTON UNIVERSITY, St. Louis, Mo.; Oliver H. Lowry, Department of Pharmacology, School of Medicine; *Riboflavin Enzymes*; 3 years; \$26,050.
- WASHINGTON UNIVERSITY, St. Louis, Mo.; Roy R. Peterson, Department of Anatomy, School of Medicine; *Cytology and Secretory Mechanisms in The Adenohypophysis*; 2 years; \$8,400.
- WASHINGTON UNIVERSITY, St. Louis, Mo.; Theodor Rosebury, Department of Bacteriology; *Interactions of Microorganisms Indigeneous to Man*; 2 years; \$15,250.
- WEST VIRGINIA UNIVERSITY, Morgantown, W. Va.; H. L. Barnett and V. G. Lilly, Department of Plant Pathology, Bacteriology and Entomology; *Parasitism of *Piptoccephalis Freseniana* on Other Fungi*; 2 years; \$9,400.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Eldon H. Newcomb, Department of Botany; *Metabolic Changes Underlying Cell Enlargement in Plants*; 3 years; \$14,100.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Harold R. Wolfe, Department of Zoology; *Antibody Response of an Animal as Correlated With Its Age*; 2 years; \$14,000.
- THE WORCESTER FOUNDATION FOR EXPERIMENTAL BIOLOGY, Shrewsbury, Mass.; Ralph I. Dorfman, Associate Director of Laboratories; *Mechanisms of Hormone Action*; 3 years; \$23,600.
- YALE UNIVERSITY, New Haven, Conn.; Gifford B. Pinchot, Department of Microbiology; *Phosphorylation in Cell-Free Bacterial Extracts*; 2 years; \$11,600.

Systematic Biology

- ALLEGHENY COLLEGE, Meadville, Pa.; Robert E. Bugbee, Department of Biology; *Taxonomy and Life Histories of Eurytomidae*; 2 years; \$2,000.
- ALLEGHENY COLLEGE, Meadville, Pa.; D. J. Rogers, Department of Biology; *Variation in *Manihot Utilissima**; 1 year; \$2,500.
- CALIFORNIA ACADEMY OF SCIENCES, San Francisco, Calif.; Elwood C. Zimmerman; *Insects of Hawaii*; 2 years; \$24,600.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; John N. Belkin, Department of Entomology, Los Angeles, Calif.; *Mosquitoes of the South Pacific*; 2 years; \$7,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; T. E. Rawlins, Department of Plant Pathology; *Investigations in Cystematic Plant Virology*; 3 years; \$10,000.
- COLORADO AGRICULTURAL AND MECHANICAL COLLEGE, Fort Collins, Colo.; Tyler A. Woolley, Department of Zoology; *Investigation of Colorado Oribatei*; 1 year; \$1,400.
- DUKE UNIVERSITY, Durham, N. C.; R. M. Schuster, Department of Botany; *Hepaticae of Eastern North America*; 1 year; \$5,000.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; Benjamin B. Leavitt, Department of Biology; *Analysis of Plankton from the Deep Scattering Layer*; 1 year; \$1,300.
- HARVARD UNIVERSITY, Cambridge, Mass.; Alfred S. Romer, Department of Zoology; *Collection, Preparation and Study of Carboniferous Tetrapods*; 2 years; \$11,500.
- UNIVERSITY OF HAWAII, Honolulu, Hawaii; Albert H. Banner, Department of Zoology; *Zoogeography of the Alpheidae in the Central Pacific*; 2 years; \$8,000.
- UNIVERSITY OF IDAHO, Moscow, Idaho; Malcolm T. Jollie, Department of Zoology; *Phylogeny of the Falconiformes*; 2 years; \$3,600.
- INDIANA UNIVERSITY, Bloomington, Ind.; James E. Canright, Department of Botany; *Floral Morphology and Anatomy of the Annonaceae*; 2 years; \$5,200.
- UNIVERSITY OF KANSAS, Lawrence, Kans.; E. Raymond Hall, Department of Zoology; *Speciation of North American Mammals*; 3 years; \$15,200.

- LOYOLA UNIVERSITY, New Orleans, La.; Walter G. Moore, Department of Biology; *Variation in Natural and Experimental Populations of Anostraca*; 2 years; \$5,000.
- MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION, Solomons, Md.; Romeo Mansueti, Chesapeake Biological Laboratory; *Fish Eggs and Larvae of Chesapeake Bay*; 2 years; \$9,000.
- UNIVERSITY OF MIAMI, Coral Gables, Fla.; Lauren C. Gilman, Department of Zoology; *Morphological and Physiological Differences among Varieties of Paramecium*; 2 years; \$7,100.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Frederick K. Sparrow, Department of Botany; *The Fungus Genus Physoderma (Phycomycetes)*; 3 years; \$9,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Pierre Danscreau, Department of Botany; *Phytosociological Studies in the Canary Islands*; 1 year; \$3,500.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Pierre Danscreau, Department of Botany; *Phytosociological Studies in the Canary Islands*; 1 year; \$1,700.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; Alexander H. Smith, Department of Botany; *Manual of Fleshy Basidiomycetes of Western U. S.*; 3 years; \$12,400.
- MISSOURI BOTANICAL GARDEN, St. Louis, Mo.; Rolla M. Tryon, Jr., Assistant Curator of the Herbarium; *A Manual of the Fern Flora of Peru*; 3 years; \$12,100.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; Preston E. Cloud, Jr.; *Marine Mollusks of Reefs of the Pacific Ocean*; 1 year; \$1,950.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; Tracy I. Storer, Department of Zoology, University of California, Davis, California; *Biology and Ecology of Rats on Pacific Islands*; 2 years; \$25,000.
- NEW YORK ZOOLOGICAL SOCIETY, New York, N. Y.; Jocelyn Crane, Department of Tropical Research; *A Comparative Study of Ocypodid Crabs (Decapoda) of the World*; 5 years; \$18,000.
- UNIVERSITY OF OKLAHOMA, Norman, Okla.; Norman H. Boke, Department of Plant Sciences; *Developmental Anatomy of Vascular Plants*; 3 years; \$10,800.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; George B. Cummins, Department of Botany and Plant Pathology; *Identity, Distribution, and Life Cycles of Grass Rusts*; 3 years; \$5,000.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; Dorothy M. Powelson, Department of Biological Sciences; *Ecology of Myxobacteria*; 2 years; \$5,000.
- THE ROCKY MOUNTAIN BIOLOGICAL LABORATORY, Crested Butte, Colo.; Charles L. Remington; *Genetic and Ecological Adaptation in Natural Populations of Mountain Lepidoptera*; 2 years; \$5,000.
- SMITHSONIAN INSTITUTION, Washington, D. C.; Floyd A. McClure; *Taxonomy of the Bamboos*; 3 years; \$17,250.
- UNIVERSITY OF SOUTH CAROLINA, Columbia, S. C.; Harry W. Freeman, Department of Biology; *A Study of Fish in the Wateree River System*; 2 years; \$6,300.
- SOUTH DAKOTA STATE COLLEGE, College Station, S. Dak.; Thomas B. Thorson, Entomology-Zoology Department; *Fluid Compartments of Fishes*; 2 years; \$4,000.
- STANFORD UNIVERSITY, Stanford, Calif.; Victor C. Twitty, Department of Biological Sciences; *Developmental Anatomy of Vascular Plants*; 3 years; \$10,800.
- SWARTHMORE COLLEGE, Swarthmore, Pa.; Robert K. Enders, Department of Biology; *Mammals of Western Panama*; 3 years; \$5,000.
- UNIVERSITY OF TENNESSEE, Knoxville, Tenn.; L. R. Hesler, Department of Botany; *Agaricales of the Southeastern United States*; 2 years; \$6,000.
- UNIVERSITY OF TENNESSEE, Knoxville, Tenn.; A. J. Sharp, Department of Botany; *Vascular Plants of Tennessee*; 3 years; \$9,000.
- UNIVERSITY OF TEXAS, Austin, Tex.; Wilson S. Stone and Marshall R. Wheeler, Department of Zoology; *Drosophilidae of the Caribbean Region*; 3 years; \$34,500.
- TULANE UNIVERSITY, New Orleans, La.; E. Peter Volpe, Department of Zoology; *Classification of the Genus Bufo*; 2 years; \$6,000.

- TUSCULUM COLLEGE, Greeneville, Tenn.; Arnold Van Pelt, Department of Biology; *Altitudinal Distribution of Ants in the Southern Blue Ridge Province*; 1 year; \$2,000.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; Stephen D. Durrant, Department of Zoology; *Mammals of the Mountains of Southern Utah*; 1 year; \$2,700.
- UNIVERSITY OF UTAH, Salt Lake City, Utah; Robert K. Vickery, Jr., Department of Genetics; *Physiological Variability in Mimulus*; 2 years; \$8,000.
- STATE COLLEGE OF WASHINGTON, Pullman, Wash.; Kenneth E. Frick, Irrigation Experiment Station; *Nearctic Species in the Family Agromyzidae*; 2 years; \$3,000.
- UNIVERSITY OF WASHINGTON, Seattle, Wash.; Arthur R. Kruckeberg, Department of Botany; *Biosystematic Studies of Silene*; 3 years; \$5,000.
- YALE UNIVERSITY, New Haven, Conn.; Nicholas Polunin, Osborn Zoological Laboratory; *Arctic Bontany*; 2 years; \$4,000.
- YALE UNIVERSITY, New Haven, Conn.; John R. Reeder, Department of Plant Science; *Grass Embryo in Relation to Taxonomy and Phylogeny*; 2 years; \$5,400.

General

- AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass.; Philipp G. Frank; *The Acceptance of Scientific Theories*; 2 years; \$22,000.
- AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES, Washington, D. C.; Dr. Bentley Glass, President; *Expenses of Organization and Operation*; 10 months; \$17,600.
- ASSOCIATED UNIVERSITIES, INC., New York, N. Y.; Richard M. Emberson; *Studies of a Radio Astronomy Facility*; 1 year; \$85,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; S. F. Cook, Department of Physiology; *Support of Basic Facilities for Conducting Scientific Investigations at White Mountain Research Station*; 3 years; \$50,000.
- CARNEGIE INSTITUTION OF WASHINGTON, Washington, D. C.; *Preliminary Studies of a Committee on Radio Astronomy*; \$6,800.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; *Preliminary Studies of the National Astronomical Observatory Panel*; \$9,700.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; A. A. Albert, Chairman of the Survey Committee; *Survey of Research Potential and Training in the Mathematical Sciences*; 18 months; \$39,900.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; Cyril Stanley Smith, Institute for the Study of Metals; *A Study of the History of Metallurgy*; 1 year; \$11,100.
- COLUMBIA UNIVERSITY, New York, N. Y.; *Support of Studies by a Committee on Minerals Research*; 1 year; \$12,700.
- HIGHLANDS BIOLOGICAL STATION, INC., Highlands, N. C.; Dr. Lewis E. Anderson, President; *Summer Research at the Highlands Biological Station*; 3 years; \$17,250.
- UNIVERSITY OF COLORADO, Boulder, Colo.; Burton W. Jones, Department of Mathematics; *To Assist in an Exchange Professorship in Mathematics at the University of London*; \$1,000.
- LEHIGH UNIVERSITY, Bethlehem, Pa.; Adolph Grunbaum, Department of Philosophy; *A Critical Study in Philosophy of Science Bearing on Fundamental Physical Theory*; 2 years; \$6,100.
- MARINE BIOLOGICAL LABORATORY, Woods Hole, Mass.; Philip B. Armstrong, Director; *Provision of Funds for Scientific Equipment and Facilities for Biological Research*; 1 year; \$50,000.
- THE MOUNT DESERT ISLAND BIOLOGICAL LABORATORY, Salisbury Cove, Maine; Dr. Warner F. Sheldon; *Provision of Basic Research Equipment and Facilities*; 1 year; \$11,400.

- NAPLES ZOOLOGICAL STATION, Naples, Italy; R. Dohrn, Director; *Two American Tables at the Naples Zoological Station*; 5 years; \$10,000.
- THE ROCKY MOUNTAIN BIOLOGICAL LABORATORY, Crested Butte, Colo.; Colin S. Pittendrigh, Department of Biology; *Utilities for Basic Research at the Rocky Mountain Biological Laboratory*; 1 year; \$6,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; *Research and Training at the University of Michigan Biological Station*; 1 year; \$6,900.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; *Biological Research at the Itasca Forestry and Biological Station*; 2 years; \$9,400.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; *Summer Research by Medical Students*; 3 years; \$10,350.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; *Summer Research by Medical Students*; 3 years; \$10,350.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *The Committee on Nuclear Sciences under the direction of the Division of Physical Sciences, National Research Council*; \$18,000.
- SMITHSONIAN INSTITUTION, Washington, D. C.; *The Barro Colorado Biological Laboratory, Barro Colorado Island, Gatun Lake, Panama Canal Zone*; 2 years; \$29,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; Marshall Clagett, Department of the History of Science; *Medieval Antecedents to Early Modern Mathematics and Physics*; 1 year; \$11,500.

Basic Research in Synthetic Rubber

University of Akron.....	\$50, 000
Burke Research Company.....	150, 000
Case Institute of Technology.....	70, 000
University of Chicago.....	55, 000
Cornell University (2).....	20, 000
	68, 000
University of Illinois.....	135, 000
Massachusetts Institute of Technology.....	105, 000
Mellon Institute of Industrial Research.....	109, 000
University of Minnesota.....	80, 000
National Bureau of Standards.....	194, 000
	<hr/>
Total.....	1, 036, 000

Operation and Management of Government Laboratories, Akron, Ohio

University of Akron.....	\$950, 000
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APPENDIX III

CONTRACTS AND GRANTS OTHER THAN RESEARCH AWARDED IN FISCAL YEAR 1955

Conferences in Support of Science

- AMERICAN ACADEMY OF ARTS AND SCIENCES, Boston, Mass., *International Optical Congress*; \$10,700.
- AMERICAN ANTHROPOLOGICAL ASSOCIATION, Peabody Museum, Cambridge, Mass.; *Fifth International Congress of Anthropology and Ethnology*; \$10,000.
- AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Washington, D. C.; *Gordon Research Conferences*; \$10,000.
- AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Washington, D. C.; *International Arid Lands Symposium and Conference*; \$10,000.
- AMERICAN PHILOSOPHICAL SOCIETY, Philadelphia, Pa.; *Research in the History, Philosophy and Sociology of Science*; \$5,000.
- AMERICAN PSYCHOLOGICAL ASSOCIATION, Washington, D. C.; *Conference on Evolution of Behavior*; \$8,600.
- UNIVERSITY OF ARIZONA, TUCSON, ARIZ.; *World Symposium on Applied Solar Energy*; \$6,000.
- DARTMOUTH COLLEGE, Hanover, N. H.; *Conference on Tissue Elasticity*; \$4,900.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif., *Conference on the Theory of Numbers*; \$5,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; *Third Berkeley Symposium on Mathematical Statistics and Probability*; \$10,000.
- DEPAUW UNIVERSITY, Greencastle, Ind.; *Conference on Nuclear Emulsion Research in Colleges*; \$4,700.
- LONG ISLAND BIOLOGICAL ASSOCIATION, Cold Spring Harbor, Long Island, N. Y.; *Twentieth Cold Spring Harbor Symposium on Quantitative Biology*; \$6,500.
- LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE, Baton Rouge, La.; *Conference on Low Temperature Research*; \$3,000.
- UNIVERSITY OF MICHIGAN, Ann Arbor, Mich.; *Problems of Nuclear Structure*; \$5,000.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *International Conference of Marine Biological Laboratory Directors*; \$4,000.
- NEW YORK UNIVERSITY, New York, N. Y.; *Conference on Mechanics in Engineering Education*; \$5,000.
- OHIO STATE UNIVERSITY, Columbus, Ohio; *Conference on Spectroscopy*; \$6,000.
- UNIVERSITY OF OREGON, Eugene, Oreg.; *Conference on Recent Advances in Invertebrate Physiology*; \$10,000.
- ROBERT S. PEABODY FOUNDATION FOR ARCHAEOLOGY, Phillips Academy, Andover, Andover, Mass.; *Conference on Radiocarbon Dating*; \$5,500.
- PENNSYLVANIA STATE UNIVERSITY, University Park, Pa.; *Fourth National Clay Conference*; \$3,000.
- UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa.; *International Congress on Catalysis*; \$5,000.
- UNIVERSITY OF ROCHESTER, Rochester, N. Y.; *Fifth Annual Conference on High Energy Nuclear Physics*; \$4,500.
- UNIVERSITY OF ROCHESTER, Rochester, N. Y.; *Sixth Annual Conference on High Energy Nuclear Physics*; \$10,000.
- SOCIETY FOR THE STUDY OF DEVELOPMENT AND GROWTH, Stanford University, Stanford, Calif.; *Fourteenth Growth Symposium*; \$4,500.

- UNIVERSITY OF TENNESSEE, Knoxville, Tenn.; *Conference on Mechanics of Sediment Transport*; \$5,800.
- UNIVERSITY OF TEXAS, Austin, Tex.; *Conference on Molecular Quantum Mechanics*; \$5,000.
- TULANE UNIVERSITY, New Orleans, La.; *Conference on Biophysics*; \$6,000.
- UNIVERSITY OF VIRGINIA, Charlottesville, Va.; *Conference on the Cosmic Distance Scale*; \$6,000.
- WENNER-GREN FOUNDATION FOR ANTHROPOLOGICAL RESEARCH, INC., New York, N. Y.; *Conference on Man's Role in Changing the Face of the Earth*; \$12,000.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; *Conference on Metabolic Aspects of Transport Across Cell Membranes*; \$4,600.
- LEHIGH UNIVERSITY, Bethlehem, Pa.; *Conference on Electricity and Magnetism in Engineering Education*; 3 days, \$5,000.
- PURDUE RESEARCH FOUNDATION, Lafayette, Ind.; *Conference on Thermodynamics in Engineering Education*; 3 days; \$7,000.

Education in the Sciences

- AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Washington, D. C.; *Traveling Science Libraries for Small High Schools*; 1 year; \$23,250.
- AMERICAN INSTITUTE OF PHYSICS, New York, N. Y.; *Study of Physics in Engineering Education*; 1 year; \$13,600.
- AMERICAN PHYSIOLOGICAL SOCIETY, Washington, D. C.; *Workshop on the Teaching of Physiology in Undergraduate Colleges*; 2 weeks; \$6,400.
- UNIVERSITY OF CHICAGO, Chicago, Ill.; *Conference on Summer Institutes for Science Teachers*; 2 days; \$4,000.
- MATHEMATICAL ASSOCIATION OF AMERICA, University of Buffalo, Buffalo, N. Y.; *Visiting Mathematicians*; 18 months; \$20,500.
- UNIVERSITY OF MINNESOTA, Minneapolis, Minn.; *Summer Institute for Chemistry Teachers in the Liberal Arts Colleges*; 5 weeks; \$11,850.
- NATIONAL ASSOCIATION OF BIOLOGY TEACHERS, St. Mary's College, Winona, Minn.; *Great Lakes Biology Conference*; 10 days; \$15,000.
- UNIVERSITY OF NEW MEXICO, Albuquerque, N. Mex., *Summer Institute for Physics Teachers*; 4 weeks; \$18,500.
- OAK RIDGE INSTITUTE OF NUCLEAR STUDIES, INC., Oak Ridge, Tenn.; *Summer Institute for High School Science Teachers*; 4 weeks; \$10,400.
- OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, Stillwater, Okla.; *Summer Institute on Collegiate Mathematics*; 6 weeks; \$15,000.
- OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, Stillwater, Okla.; *Summer Institute for High School Teachers of Mathematics*; 6 weeks; \$12,500.
- PENNSYLVANIA STATE UNIVERSITY, State College, Pa.; *Summer Institute for High School Science Teachers*; 6 weeks; \$12,500.
- SCIENCE SERVICE, INC., Washington, D. C.; *Science Clubs of America*; 1 year; \$10,000.
- STANFORD UNIVERSITY, Stanford, Calif.; *Summer Institute for Teachers of Collegiate Mathematics*; 8 weeks; \$15,000.
- SYRACUSE UNIVERSITY, SYRACUSE 10, N. Y., *Summer Institute for High School Teachers of Chemistry*; 6 weeks; \$6,600.
- SYRACUSE UNIVERSITY, Syracuse, N. Y.; *Summer Institute for Teachers of Collegiate Chemistry*; 6 weeks; \$13,500.
- UNIVERSITY OF WISCONSIN, Madison, Wis.; *Summer Institute for Mathematics Teachers*; 4 weeks; \$16,500.
- UNIVERSITY OF WYOMING, Laramie, Wyo.; *Summer Institute for Biology Teachers in Liberal Arts Colleges*; 5 weeks; \$15,000.

Studies in Science

UNIVERSITY OF CHICAGO, Chicago, Ill.; *Status of Demography as a Science*; 18 months; \$32,700.

Scientific Manpower

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES, Washington, D. C.; *Maintaining Register of Scientific Personnel in Biology*; 18 months; \$26,400.

AMERICAN INSTITUTE OF PHYSICS, New York, N. Y.; *Maintaining Register of Scientific Personnel in Physics*; 15 months; \$14,500.

AMERICAN PSYCHOLOGICAL ASSOCIATION, Washington, D. C.; *Maintaining the National Register of Scientific and Technical Personnel in Psychology*; 1 year; \$7,500.

AMERICAN MATHEMATICAL SOCIETY, Providence, R. I.; *Maintaining a Register of Scientific and Technical Personnel in the Field of the Mathematical Sciences*; 2 years; \$19,850.

AMERICAN METEOROLOGICAL SOCIETY, Boston, Mass.; *Maintaining the National Register of Scientific and Technical Personnel in Meteorology*; 18 months; \$11,500.

FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY, Washington, D. C.; *Maintaining the National Register of Scientific and Technical Personnel in the Field of Biology*; 18 months; \$15,750.

COLUMBIA UNIVERSITY, New York, N. Y.; *Estimating Supply of Professional and Technical Manpower as of 1965*; 1 year; \$10,000.

NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *Maintaining National Register of Scientific and Technical Personnel in the Earth Sciences*; 18 months; \$21,500.

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES, Washington, D. C.; *Register of Scientific and Technical Personnel in the Field of Biology*; \$17,000.

NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *Studies on Doctoral Degrees in Science*; \$15,000.

POPULATION ASSOCIATION OF AMERICA, Washington, D. C.; *Register of Scientists in the Field of Demography*; 1 year; \$1,000.

Attendance at International Meetings

Conference on Astrometry and British Royal Astronomical Society, Brussels, Belgium and London, England.—D. BROUWER, Yale University Observatory, Yale Station, New Haven, Conn.

Conference on Selection, Training, and Support of Medical Research Workers, London, England.—E. ALLEN, National Institutes of Health, Bethesda, Md.; R. K. CANNAN, National Research Council, Washington, D. C.; H. B. STEINBACH, University of Minnesota, Minneapolis, Minn.

Conseil de Physique Solvay, Brussels, Belgium.—L. ONSAGER, Yale University, New Haven, Conn.

The Faraday Society General Discussion on Microwave and Radio Frequency Spectroscopy, Cambridge, England.—

B. P. DAILEY, Columbia University, New York, N. Y.

W. GORDY, Duke University, Durham, N. C.

H. S. GUTOWSKY, University of Illinois, Urbana, Ill.

R. A. OGG, Jr., Stanford University, Stanford, Calif.

G. E. PAKE, Washington University, St. Louis, Mo.

J. G. KIRKWOOD, Yale University, New Haven, Conn.

K. J. LAIDLER, Catholic University of America, Washington, D. C.

E. L. SMITH, University of Utah, Salt Lake City, Utah.

Fifth Congress on Coastal Engineering, Grenoble, France.—T. SAVILLE, New York University, New York, N. Y.

Fourteenth International Union of Pure and Applied Chemistry, Zurich, Switzerland.—

M. L. BENDER, Illinois Institute of Technology, Chicago, Ill.

W. G. BROWN, University of Chicago, Chicago, Ill.

M. CARMACK, Indiana University, Bloomington, Ind.

E. J. COREY, University of Illinois, Urbana, Ill.

W. G. DAUBEN, University of California, Berkeley, Calif.

C. DJERASSI, Wayne University, Detroit, Mich.

M. R. EHRENSTEIN, University of Pennsylvania, Philadelphia, Pa.

E. L. ELIEL, University of Notre Dame, Notre Dame, Ind.

G. I. FUJIMOTO, University of Utah, Salt Lake City, Utah.

M. GATES, University of Rochester, Rochester, N. Y.

S. M. GOODWIN, National Institutes of Health, Bethesda, Md.

C. D. GUTSCHE, Washington University, St. Louis, Mo.

I. M. KOLTHOFF, University of Minnesota, Minneapolis, Minn.

S. M. KUPCHAN, Harvard University, Cambridge, Mass.

N. J. LEONARD, University of Illinois, Urbana, Ill.

J. M. LUCK, Stanford University, Stanford, Calif.

S. P. MASSIE, Fisk University, Nashville, Tenn.

M. S. NEWMAN, Ohio State University, Columbus, Ohio.

A. W. SCHRECKER, National Institutes of Health, Bethesda, Md.

A. SILVERMAN, University of Pittsburgh, Pittsburgh, Pa.

C. L. STEVENS, Wayne University, Detroit, Mich.

G. STORK, Columbia University, New York, N. Y.

R. B. TURNER, Rice Institute, Houston, Tex.

E. WICHERS, National Bureau of Standards, Washington, D. C.

R. H. WILEY, University of Louisville, Louisville, Ky.

B. WITKOP, National Institutes of Health, Bethesda, Md.

FOURTEENTH JAPANESE MEDICAL CONGRESS, Kyoto, Japan.—O. HAYAISHI, National Institutes of Health, Bethesda, Md.

INTERIM COUNCIL OF THE INTERNATIONAL UNION OF BIOCHEMISTRY, London, England.—

S. OCHOA, New York University College of Medicine, New York, N. Y.

E. STOTZ, University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.

INTERNATIONAL CONGRESS OF MATHEMATICIANS, Amsterdam, The Netherlands.—

K. KODAIRA, Princeton University, Princeton, N. J.

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS, Executive Committee Meeting of the Abstracting Board, Zurich, Switzerland.—E. HUTCHISSON, Case Institute of Technology, Cleveland, Ohio.

INTERNATIONAL SYMPOSIUM OF THE BIOMETRIC SOCIETY, Campinas, Brazil.—

C. A. BICKING, Silver Spring, Md.

C. ITTNER, Bliss, New Haven, Conn.

W. G. COCHRAN, Johns Hopkins University, Baltimore, Md.

E. R. DEMPSTER, University of California, Berkeley, Calif.

P. G. HOMEYER, Iowa State College, Ames, Iowa.

INTERNATIONAL SYMPOSIUM ON ELECTRICAL DISCHARGES IN GASES, Delft, Netherlands.—L. H. FISHER, College of Engineering, New York University, New York, N. Y.

INTERNATIONAL SYMPOSIUM ON MOLECULAR SPECTROSCOPY, Oxford, England.—R. C. LORD, Massachusetts Institute of Technology, Cambridge, Mass.

- INTERNATIONAL UNION OF CHEMISTRY, Munster, Germany.**—H. H. ANDERSON, Drexel Institute of Technology, Philadelphia, Pa.
- LECTURES AND SEMINARS ON PHOTOSYNTHETIC RESEARCH, Tokyo, Japan.**—A. H. BROWN, University of Minnesota, Minneapolis, Minn.
- Ninth General Assembly of the International Astronomical Union, Dublin, Ireland.**—
- A. BLAAUW, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - V. M. BLANCO, Case Institute of Technology, Warner and Swasey Observatory, East Cleveland, Ohio.
 - B. J. BOK, Harvard Observatory, Cambridge, Mass.
 - J. W. CHAMBERLAIN, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - HELEN W. DODSON, McMath-Hulbert Observatory, Lake Angelus, Pontiac, Mich.
 - L. GOLDBERG, The Observatory, University of Michigan, Ann Arbor, Mich.
 - G. H. HERBIG, Lick Observatory, University of California, Mt. Hamilton, Calif.
 - P. HERGET, Cincinnati Observatory, University of Cincinnati, Cincinnati, Ohio.
 - W. A. HILTNER, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - G. KELLER, Perkins Observatory, Ohio State University, Delaware, Ohio.
 - D. LAYZER, Harvard College Observatory, Cambridge, Mass.
 - E. LILLEY, Naval Research Laboratory, Washington, D. C.
 - W. J. LUYTEN, University of Minnesota, Minneapolis, Minn.
 - A. B. MEINEL, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - W. W. MORGAN, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - G. MUNCH, California Institute of Technology, Pasadena, Calif.
 - W. O. ROBERTS, High Altitude Observatory, University of Colorado, Boulder, Colo.
 - NANCY G. ROMAN, Yerkes Observatory, University of Chicago, Williams Bay, Wis.
 - M. SCHWARZSCHILD, Princeton University, Princeton, N. J.
 - CHARLOTTE M. SITTERLY, National Bureau of Standards, Washington, D. C.
 - K. A. STRAND, Dearborn University, Evanston, Ill.
 - F. L. WHIPPLE, Harvard College Observatory, Cambridge, Mass.
 - A. E. WHITFORD, Washburn Observatory, University of Wisconsin, Madison, Wis.
 - A. G. WILSON, Lowell Observatory, Flagstaff, Ariz.
 - F. B. WOOD, University of Pennsylvania, Philadelphia, Pa.
 - M. H. WRUBEL, Indiana University, Bloomington, Ind.
- Pisa Conference on Elementary Particles, Pisa Italy.**—M. SCHEIN, University of Chicago, Chicago, Ill.
- Second Inter-American Congress of Psychology, University City, Mexico.**—American Psychological Association, Washington, D. C.
- Symposium on Radiation Chemistry of Liquids, Paris, France.**—J. L. MAGEE, University of Notre Dame, Notre Dame, Ind.
- Tenth General Assembly of the International Union of Geodesy and Geophysics, Rome, Italy.**—P. E. CHURCH, University of Washington, Seattle, Wash.
- Third International Congress of Biochemistry, Brussels, Belgium.**—
- R. O. BRADY, National Institutes of Health, Bethesda, Md.
 - P. L. DAY, University of Arkansas, Little Rock, Ark.
 - A. L. DOUNCE, University of Rochester, Rochester, N. Y.
 - H. EDELHOCH, University of Kansas Medical Center, Kansas City, Kans.
 - M. R. EHRENSTEIN, University of Pennsylvania, Philadelphia, Pa.
 - S. W. FOX, Iowa State College, Ames, Iowa.
 - P. HANDLER, Duke University School of Medicine, Durham, N. C.

- F. L. HOCH, Harvard Medical School and Peter Bent Brigham Hospital, Boston, Mass.
- MARY ELLEN JONES, Harvard Medical School, Massachusetts General Hospital, Boston, Mass.
- PATRICIA J. KELLER, University of Washington, Seattle, Wash.
- L. M. KOZLOFF, Chicago, Ill.
- H. R. MAHLER, University of Wisconsin, Madison, Wis.
- M. F. MALLETT, Pennsylvania State University, University Park, Pa.
- J. L. ONGLEY, Boston, Mass.
- L. J. REED, University of Texas, Austin, Tex.
- S. ROBERTS, University of California, Los Angeles, Calif.
- W. C. SCHNEIDER, Department of Health, Education and Welfare, Bethesda, Md.
- DeW. STETTEN, Jr., National Institutes of Health, Bethesda, Md.
- VIRGINIA R. WILLIAMS, Louisiana State University, Baton Rouge, La.
- J. L. WOOD, University of Tennessee, Memphis, Tenn.
- W. A. WOOD, University of Illinois, Urbana, Ill.
- Third Pan-African Congress on Prehistory, Northern Rhodesia, South Africa.—
W. W. Howells, Peabody Museum, Harvard University, Cambridge, Mass.
- Twenty-ninth International Statistical Institute, Rio de Janeiro, Brazil.—
C. A. BICKING, Silver Spring, Md.
- W. E. DEMING, New York University, New York, N. Y.
- W. LEONTIEF, Harvard University, Cambridge, Mass.
- W. F. OGBURN, University of Chicago, Chicago, Ill.

Scientific Information Exchange

- AMERICAN GEOPHYSICAL UNION, Washington, D. C.; *For Partial Support of "Transactions of the American Geophysical Union"*; 1 year; \$4,000.
- AMERICAN INSTITUTE OF PHYSICS, New York, N. Y.; *English Edition of Journal for Experimental and Theoretical Physics (Russian)*; 1 year; \$40,000.
- AMERICAN MATHEMATICAL SOCIETY, Providence, R. I.; *Partial Support of the Transactions of the American Mathematical Society*; \$3,500.
- AMERICAN MATHEMATICAL SOCIETY, Providence, R. I.; *Preparing and Distributing Selected Translations of Russian Mathematics Articles*; 1 year; \$14,490.
- THE AMERICAN MUSEUM OF NATURAL HISTORY, New York, N. Y.; *The International Journal, Insectes Sociaux*; \$920.
- AMERICAN PHYSIOLOGICAL SOCIETY, Washington, D. C.; *Electrolytes in Biological Systems*; 3 years; \$3,500.
- AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York, N. Y.; *For Partial Support of the Publication of "Applied Mechanics Reviews"*; 1 year \$10,000.
- BERNICE P. BISHOP MUSEUM, Honolulu, Hawaii; *Partial Support of Secretariat of the Pacific Science Association*; \$12,000.
- UNIVERSITY OF CALIFORNIA, Berkeley, Calif.; *World Bibliography of Fossil Vertebrates*; 3 years; \$3,500.
- UNIVERSITY OF FLORIDA, Gainesville, Fla.; *Rainforests of Golfo Dulce*; 4 years; \$2,500.
- FREE UNIVERSITY OF BRUSSELS, Brussels, Belgium; *Publication of Tables of Physico-Chemical Constants of Concentrated Solutions*; \$12,000.
- INDIANA UNIVERSITY, Bloomington, Ind.; *Study on the History of Psychology as a Natural Science*; \$2,300.
- INSTITUTE FOR ADVANCED STUDY, Princeton, N. J.; *Survey of the Mathematical Foundations of Quantum Mechanics*; \$3,300.

- INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS, National Academy of Sciences, Washington, D. C.; *Partial Support of Meeting of the Bureau of the International Council of Scientific Unions*; \$3,700.
- ROSCOE B. JACKSON MEMORIAL LABORATORY, Bar Harbor, Maine; *Subject-Strain Bibliography of Mice*; 1 year; \$4,500.
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, Mass.; V. H. Yngve; *Methods of Translating Languages by Machine*; \$18,700.
- MISSOURI BOTANICAL GARDEN, St. Louis, Mo.; *Flora of Japan*; 1 year; \$1,500.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *Committee on International Scientific Unions, Office of International Relations*; \$7,500.
- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *Luigi Meschieri's visits to psychological laboratories and research facilities*; 1 month; \$575.
- OREGON STATE COLLEGE, Corvallis, Oreg.; *Manual of Vascular Plants of the Lower Yangtze Valley, China*; 3 years; \$2,550.
- SMITHSONIAN INSTITUTION, Washington, D. C.; *Biological Sciences Information Exchange*; \$22,000.
- SMITHSONIAN INSTITUTION, Washington, D. C.; *Publication of an Annotated Bibliography of Termites*; \$3,600.
- SOCIETY OF AMERICAN FORESTERS, Washington, D. C.; *Journal of Forest Science*; 3 years; \$5,000.
- CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, Calif.; Dr. Roger W. Sperry, Division of Biology, *Lectures on Visual Perception*; 1 year; \$725.
- U. S. AGRICULTURAL RESEARCH CENTER, Beltsville, Md.; Dr. Satyu Yamaguti, *Preparation of Two of Three Volume Publication entitled "Systems Helminthum"*; 1 year; \$3,500.
- NATIONAL ACADEMY OF SCIENCES, National Research Council, Washington, D. C.; *Preparation of a Monograph on the Training of Scientists and Engineers in Russia*; 1 year; \$4,050.

International Geophysical Year

- NATIONAL ACADEMY OF SCIENCES, Washington, D. C.; *Support of the U. S. National Committee for the International Geophysical Year 1957-58*; \$100,000.

APPENDIX IV

GRADUATE FELLOWSHIP PROGRAM

*Distribution of NSF Fellowships by State of Residence for the Academic Year
1955-56*

<i>Region and State</i>	<i>Applications Received</i>	<i>Awards Made</i>	<i>Region and State</i>	<i>Applications Received</i>	<i>Awards Made</i>
NORTHEAST			NORTH CENTRAL		
Connecticut.....	69	18	Illinois.....	253	55
Maine.....	15	4	Indiana.....	74	22
Massachusetts.....	194	38	Iowa.....	53	13
New Hampshire.....	12	3	Kansas.....	44	10
New Jersey.....	155	32	Michigan.....	109	28
New York.....	603	110	Minnesota.....	72	19
Pennsylvania.....	262	54	Missouri.....	73	19
Rhode Island.....	20	4	Nebraska.....	22	8
Vermont.....	7	2	North Dakota.....	9	4
			Ohio.....	113	39
			South Dakota.....	10	2
			Wisconsin.....	80	24
SOUTH			WEST		
Alabama.....	29	5	Arizona.....	19	5
Arkansas.....	13	5	California.....	293	82
Delaware.....	9	3	Colorado.....	39	8
District of Columbia.....	33	3	Idaho.....	7	1
Florida.....	59	11	Montana.....	11	0
Georgia.....	29	4	Nevada.....	2	0
Kentucky.....	23	7	New Mexico.....	14	4
Louisiana.....	28	9	Oregon.....	37	9
Maryland.....	64	15	Utah.....	40	9
Mississippi.....	34	8	Washington.....	65	21
North Carolina.....	48	10	Wyoming.....	7	2
Oklahoma.....	44	12			
South Carolina.....	18	3	POSSESSIONS		
Tennessee.....	25	9	Alaska.....	1	0
Texas.....	78	16	Hawaii.....	7	2
Virginia.....	53	13	Puerto Rico.....	1	0
West Virginia.....	10	1			

Distribution of NSF Fellowships by Year of Study and Field for the Academic Year 1955-56

Field	First year	Predoc- toral inter- mediate	Terminal year	Post- doctoral	Total
Life sciences	46	93	60	26	225
Chemistry	54	69	45	15	183
Engineering	55	31	20	2	108
Earth sciences	8	14	8	1	31
Mathematics	22	21	9	11	63
Physics and astronomy	70	63	27	15	175
Total	255	291	169	70	785

Names, Residences and Fields of Study of Individuals Awarded National Science Foundation Graduate Fellowships for Fiscal Year 1955

ALABAMA

PREDOCTORAL

GILMORE, ALVAN R., Auburn, Agriculture.
 KNIGHT, JAMES M., Mobile, Physics.
 RHODES, WILLIAM C., Anniston, Bio-
 chemistry.
 STEINBERG, CHARLES M., Montgomery,
 Biophysics.
 TOULMIN, PRIESTLEY, III, Birmingham,
 Earth Sciences.

ARIZONA

POSTDOCTORAL

ANDERSON, ROGER Y., Tucson, Earth
 Sciences.
 BRYANT, ROBERT C., Tucson, Earth
 Sciences.
 CARTER, MELVIN W., Glendale, Agricul-
 ture.
 JUSTICE, KEITH E., Tucson, Zoology.
 PETTUS, DAVID, Tempe, Zoology.

ARKANSAS

POSTDOCTORAL

ASKEY, RICHARD A., Little Rock, Mathe-
 matics.

ELLIS, WALTON P., Mammoth Spring,
 Chemistry.

GUSTAFSON, JOHN W., El Dorado,
 Physics.

PRICKETT, ROBERT JOE, Pine Bluff, Engi-
 neering.

WILLIS, WILLIAM JAY, Fort Smith, Phy-
 sics.

CALIFORNIA

POSTDOCTORAL

ALLINGER, NORMAN L., Santa Monica,
 Chemistry.

BLANCHFIELD, RICHARD C.,² South Pasa-
 dena, Mathematics.

CHAMBERS, KENTON LEE, Atascadero,
 Botany.

COMPTON, ROBERT R., Palo Alto, Earth
 Sciences.

DELLENBACK, ROBERT J.,¹ Long Beach,
 Zoology.

GLUSKER, DONALD L., Santa Monica,
 Chemistry.

HIRSCH, JEROME E., Berkeley, Psychology.

HOFFMANN, ROBERT S.,¹ Albany, Zool-
 ogy.

¹ Declined.
² Deceased.

SISTROM, WILLIAM R.,¹ Berkeley, Microbiological.

SMITH RONALD DEAN, Oakland, Chemistry.

TANNENBAUM, EILEEN, Berkeley, Chemistry.

PREDOCTORAL

ABRAHAMSON, GEORGE R., Wilmington, Engineering.

ANDELIN, JOHN P., JR., Los Angeles, Physics.

APPLEQUIST, JON B., Berkeley, Chemistry.

APPLEWHITE, THOMAS H., El Monte, Chemistry.

BACON, LYLE C., Pasadena, Engineering.

BARR, DONALD W., Berkeley, Chemistry.

BASS, HYMAN, Los Angeles, Mathematics.

BELKNAP, MARTHA JANE, Burbank, Microbiology.

BJORKLUND, IVAN S., Los Angeles, Engineering.

BONNER, BRUCE A., JR., Berkeley, Botany.

BOTTINI, ALBERT T., Petaluma, Chemistry.

BREDON, GLEN E., Sanger, Mathematics.

BROKAW, CHARLES J., El Segundo, Zoology.

BROSEMER, RONALD W.,¹ Oakland, Biochemistry.

CARLQUIST, SHERWIN J., San Marino, Botany.

CHER, MARK, Los Angeles, Chemistry.

CHINN, JAMES, Berkeley, Engineering.

CIMA, RICHARD M., Orosi, Engineering.

CONRAD, DAVID A., Palo Alto, Engineering.

CRANSTON, MARGARET B., Altadena, Zoology.

DE NEVERS, NOEL H., San Francisco, Engineering.

DOHERTY, LOWELL R., San Diego, Astronomy.

DRESSLER, ROBERT L., Inglewood, Botany.

EHLIG, PERRY L., Tarzana, Earth Sciences.

ELLIOTT, SHELDON D., JR., Independence, Physics.

FONG, PAUL, San Francisco, Mathematics.

FULLER, MARTIN E., II, Hawthorne, Chemistry.

HAITHCOCK, LINDA LEE, La Jolla, Zoology.

HARRIS, BRUNO, Arcadia, Mathematics.

HARRIS, ROBERT E., Ontario, Chemistry.

HERSCHBACH, DUDLEY R., Saratoga, Chemistry.

HONSAKER, JOHN L.,¹ Pasadena, Physics.

HOUSTON, MARY E., San Francisco, Zoology.

HUANG, LUC, Oakland, Chemistry.

HULTGREN, NEILEN WOOD, Berkeley, Chemistry.

LA TOURRETTE, JAMES T., Los Angeles, Physics.

LEVIN, ROBERT E., Santa Ana, Engineering.

LITTLE, JOHN CLAYTON, Stockton, Chemistry.

MATHEWS, JON, Sierra Madre, Physics.

MATHIS, JOHN S., Pasadena, Astronomy.

MAYFIELD, IVAN JEANNE, Chino, General Biology.

MESELSON, MATTHEW S., Los Angeles, Chemistry.

MILLIKAN, ROGER C., Berkeley, Chemistry.

MITCHELL, ALBERT H., Berkeley, Physics.

MITCHELL, JERRY C., Van Nuys, Chemistry.

MJOLSNESS, RAYMOND C., Mill Valley, Physics.

MORRISSETT, LLOYD N., JR., Los Angeles, Psychology.

NILSSON, NILS J., Glendale, Engineering.

NOONAN, THOMAS W., Los Angeles, Physics.

ORVILLE, PHILIP M., Santa Monica, Earth Sciences.

PAULING, PETER J., Pasadena, Biophysics.

PICCOLINI, RICHARD J., Crestline, Chemistry.

RAY, W. BARCLAY,¹ Saratoga, Earth Sciences.

REEVES, RICHARD A., Los Angeles, Chemistry.

REEVES, ROBERT B., Whittier, Medical Sciences.

REGIER, FRANK A.,¹ Oakland, Engineering.

RUNQUIST, WILLARD N., Green Valley Lake, Psychology.

SEDERHOLM, CHARLES H. Pleasant Hill, Chemistry.

¹ Declined.

¹ Declined.

SHREVE, RONALD L., Bishop, Earth Sciences.

SINCLAIR, H. KING, Los Angeles, Chemistry.

SNOW, SIDNEY R., North Hollywood, Genetics.

STRINGER, LORAN W., Sacramento Engineering.

STROMBOTNE, RICHARD L., Claremont, Physics.

SUTTON, DONALD D., Davis, Microbiology.

THOMAS, JOHN B.¹ Stanford, Engineering.

THOMASIAN, ARAM J., Berkeley, Mathematics.

THORSON, WALTER R., Los Angeles, Chemistry.

WAITE, HAL R., Covina, Chemistry.

WALSH, WALTER M., JR., Los Angeles, Physics.

WEITZNER, HAROLD, San Francisco, Physics.

WOODS, WILLIAM G., Los Angeles, Chemistry.

COLORADO

POSTDOCTORAL

GUNNING, ROBERT C., Longmont, Mathematics.

PREDOCTORAL

BENSON, ARNOLD, Boulder, Zoology.

BLANPIED, WILLIAM A., Denver, Physics.

JOHNSON, ALBERT W., Boulder, Botany.

KNORR, OWEN A., Boulder, Zoology.

NAZY, JOHN R., Denver, Chemistry.

REYNOLDS, LEWIS T., Denver, Chemistry.

STORKE, FREDERICK P. Jr., Boulder, Engineering.

CONNECTICUT

POSTDOCTORAL

AUSLANDER, LOUIS, Hamden, Mathematics.

FURSPAN, EDWIN J., Hartford, Zoology.

MAZO, ROBERT M., New Haven, Chemistry.

PREDOCTORAL

DRANOFF, JOSHUA S.¹ Bridgeport, Engineering.

GILBERT, WALTER, Westport, Physics.

¹ Declined.

KNIPMEYER, HUBERT E., New Milford, Chemistry.

KOHN, ALAN J., Hamden, Zoology.

LUNDGREN, LAWRENCE W., New Haven, Earth Sciences.

McKEE, ELLIOTT B., Jr., New Haven, Earth Sciences.

MEIGS, ROBERT A., Newington, Biochemistry.

NICHOLS, WILLIAM B., New Haven, Chemistry.

PECK, HARRY D., Jr., Middletown, Microbiology.

SEIWATZ, HENRY, New Haven, Biophysics.

SEIWATZ, RUTH F.¹ New Haven, Biophysics.

SINGER, MAXINE F., New Haven, Biochemistry.

TABOR, WILLIAM J., Rockfall, Chemistry.

TABORSKY, GEORGE¹ New Haven, Biochemistry.

TIFFT, WILLIAM G., Seymour, Astronomy.

DELAWARE

POSTDOCTORAL

GLOVER, ROLFE E., III, Wilmington, Physics.

PREDOCTORAL

FRY, KEELIN T., Jr., Wilmington, Chemistry.

LONDON, SHELDON A., Newark, Microbiology.

DISTRICT OF COLUMBIA

POSTDOCTORAL

SHAPPIRO, DAVID G., Washington, Zoology.

PREDOCTORAL

CRAIG, NORMAN C., Washington, Chemistry.

SEARS, RICHARD L., Washington, Astronomy.

FLORIDA

PREDOCTORAL

BARNES, ROBERT L., Gainesville, Agriculture.

BENTLEY, F. EDWARD, Jacksonville, Chemistry.

BROWN, MORTON, Palm Beach, Chemistry.
 CURL, HERBERT C., Jr., Tallahassee, General Biology.
 ELLIS, WALTER H., Tallahassee, Medical Science.
 KIEM, IRIS M., South Miami, Microbiology.
 LILLY, DOUGLAS K.,¹ Tallahassee, Earth Sciences.
 MCWILLIAMS, RALPH D., Fort Myers, Mathematics.
 MOSER, WALLACE A., Bradenton, Physics.
 PIPPIN, JOHN E.,¹ Panama City, Engineering.
 RAY, WILLIAM J., Jr., Bradenton, Chemistry.

GEORGIA

PREDOCTORAL

CHAMBLISS, DAVIS J.,¹ Atlanta, Psychology.
 FRYE, BILLY E., Clarkesville, Zoology.
 GOODFRIEND, PAUL L., Atlanta, Chemistry.
 MCDANIEL, EDGAR L., Jr., Augusta, Chemistry.

IDAHO

PREDOCTORAL

COWGILL, GEORGE L., Grangeville, Anthropology.

ILLINOIS

POSTDOCTORAL

DORHAN, VERNON R., Evanston, Anthropology.
 LEDERBERG, SEYMOUR,¹ Champaign, Microbiology.
 LICHTEN, WILLIAM L., Chicago, Physics.
 METZENBERG, ROBERT L., Jr.,¹ Highland Park, Biochemistry.
 PETERSON, FRANKLIN P., Naperville, Mathematics.

PREDOCTORAL

AAGAARD, JAMES S., Chicago, Engineering.
 APPELMAN, EVAN H., Chicago, Chemistry.
 AYARS, JAMES STERLING, Jr., Urbana, Mathematics.

¹ Declined.

BARON, ROBERT E., Chicago, Physics.
 BLOUNT, EUGENE I., Chicago, Physics.
 BREESE, ROBERT FINLEY, Chicago, Chemistry.
 CUMMISFORD, PATRICIA D., Arlington Heights, Medical Science.
 DERWENT, JOHN E., Chicago, Mathematics.
 DEWEY, RAY S., Chicago, Chemistry.
 DICKERSON, RICHARD E., Charleston, Chemistry.
 DRAKE, FRANK D., Chicago, Astronomy.
 DUBROVIN, KENNETH P., Chicago, Agriculture.
 EATHERLY, WALTER P., Decatur, Physics.
 ESHLEMAN, DEAN B., Sterling, Engineering.
 ETTINGER, RAY, Chicago, Chemistry.
 EVERETT, ALLEN E., Wilmette, Physics.
 EZEKIEL, DAVID H., Urbana, Microbiology.
 FINHOLT, JAMES E., Oak Park, Chemistry.
 FOX, JOHN D., Urbana, Physics.
 GELLER, DAVID M., Oak Park, Biochemistry.
 GINSBERG, DONALD M., Chicago, Physics.
 GOODMAN, GORDON L., Riverside, Chemistry.
 GOSSELINK, JAMES G., Chicago, Agriculture.
 HALFORD, DONALD W., Metamora, Chemistry.
 HARDER, ROBERT J., Gibson City, Chemistry.
 HARRIS, SAMUEL M., Chicago, Physics.
 HARTZLER, HARRIS D., Downers Grove, Chemistry.
 HELLER, ALFRED, Chicago, Medical Sciences.
 HERMAN, RICHARD N., Chicago, Engineering.
 HUFFMAN, JOHN W., Evanston, Chemistry.
 HULLAND, BURTON L.,¹ Villa Park, Engineering.
 JAMES, PHILIP N., Urbana, Chemistry.
 JOHNSON, JOSEPH E., Rock Island, Biochemistry.
 JOSEPH, DAVID W., Wheaton, Physics.
 LANE, N. GARY,¹ Sidell, Earth Sciences.
 LAW, JOHN H., Park Forest, Biochemistry.

¹ Declined.

LE NOBLE, WILLIAM J., Chicago, Chemistry.

LUSHBOUGH, CHANNING H., Chicago, Medical Sciences.

MATTESON, DONALD S., Champaign, Chemistry.

REBHUN, LIONEL I.,¹ Chicago, Biochemistry.

REINMUTH, WILLIAM H., Chicago, Chemistry.

RESING HENRY A., Chicago, Chemistry.

ROMANO, RICHARD C., Chicago, Engineering.

SEARING, JOAN A., Lincolnwood, Chemistry.

SHIPLETT, CARROLL M., Abingdon, Mathematics.

STEJSKAL, EDWARD O., Berwyn, Chemistry.

STOEVER, EDWARD C., Jr., Elmhurst, Earth Sciences.

VANDERWATER, ROBERT G., Pekin, Engineering.

WALLMAN, EDWIN J., Jr., Chicago, Engineering.

WHITESIDE, ARLISS E., Joliet, Engineering.

INDIANA

POSTDOCTORAL

FORD, KENNETH W.,¹ Bloomington, Physics.

RADAVICH, JOHN F., West Lafayette, Engineering.

PREDOCTORAL

BE MILLER, JAMES N., Evansville, Biochemistry.

BROSHAR, WAYNE C., Crawfordsville, Physics.

CARLSON, ELOF A., Bloomington, Genetics.

CHESICK, JOHN P., New Castle, Chemistry.

DAVIS, ROBERT E., VALPARAISO, Chemistry.

FALLER, JAMES E., Mishawaka, Physics.

FRAZER, WILLIAM R., Indianapolis, Physics.

GERKIN, ROGER E., South Bend, Chemistry.

¹ Declined.

HARRISON, JACK L., Granger, Earth Sciences.

HIATT, MARGARET M., Indianapolis, Microbiology.

LONG, LEON E., Gary, Chemistry.

LORDAN, WILLIAM C., Gary, Mathematics.

MASON, DONALD J., Cutler, Microbiology.

MURRAY, ROGER A.,¹ Hagerstown, Engineering.

RAY, CLAYTON E., Indianapolis, Earth Sciences.

ROONEY, LAWRENCE F., Bloomington, Earth Sciences.

SENKO, MICHAEL E., Crown Point, Chemistry.

SHONLE, JOHN I., Indianapolis, Physics.

STILLER, MARY L., Connersville, Botany.

TALLAN, IRWIN, Bloomington, Genetics.

IOWA

PREDOCTORAL

ANDERSON, HUGH R., Iowa City, Physics.

ENGLER, JEAN A., Mason City, Psychology.

GEORGE, BOYD W., Burlington, Zoology.

GESKE, DAVID H., Iowa City, Chemistry.

GRANT, GORDON S., Cedar Falls, Astronomy.

PETERSON, CONRAD L., Boone, Biochemistry.

ROTH, LAURA M., Waterloo, Physics.

ROZEBOOM, WILLIAM W., Ottumwa, Psychology.

SASS, RONALD L., Davenport, Chemistry.

WALLACE, DUANE C., Knoxville, Physics.

WILBOIS, ANNETTE D., Des Moines, Genetics.

WILCOX, RONALD E., Des Moines, Earth Sciences.

WYMORE, C. ELMER, Oskaloosa, Chemistry.

KANSAS

POSTDOCTORAL

SCOTT, WILLIAM R., Lawrence, Mathematics.

PREDOCTORAL

BURGER, W. LESLIE, Lawrence, Zoology.

CARPENTER, RAYMON T.,¹ Yates Center, Physics.

CLARKE, ROBERT F., Emporia, Zoology.

¹ Declined.

DALY, HOWELL V., JR., Lawrence, Zoology.

GRABER, JEAN W., El Dorado, Zoology.

HALL, BENJAMIN DOWNS, Lawrence, Chemistry.

LUNDEEN, ALLAN J., Fowler, Chemistry.

McMURRAY, LOREN R., Topeka, Mathematics.

STANER, BARBARA J., Wichita, Psychology.

KENTUCKY

PREDOCTORAL

DE MUMBRUM, LAWRENCE E., JR., Stiles, Agriculture.

DIXON, JOE B.,¹ Lexington, Agriculture.

GILBERT, J. FREEMAN, JR., Lawrenceburg, Earth Sciences.

HUNT, WILLIAM W., JR., Franklin, Chemistry.

RAGLAND, JOHN L., Beaver Dam, Agriculture.

VANDENBOSCH, ROBERT, Lexington, Chemistry.

WEINBERG, ALFRED, Louisville, Physics.

LOUISIANA

PREDOCTORAL

BEAVER, PAULA J., New Orleans, Zoology.

BLAKEWOOD, CHARLES H., Baton Rouge, Physics.

BURLESON, GEORGE R., Baton Rouge, Physics.

FUTRELL, JEAN H., Dry Prong, Chemistry.

LEMMON, WILLIAM W., New Orleans, Engineering.

PEGUES, BETTY E., Shreveport, Chemistry.

RICHARDSON, ROGER WOLCOTT, JR., Baton Rouge, Mathematics.

SIMON, ARTHUR B., New Orleans, Mathematics.

TINKLE, DONALD W., New Orleans, Zoology.

MAINE

PREDOCTORAL

BERKELMAN, KARL,¹ Lewiston, Physics.

COMMERFORD, SPENCER L., Belfast, Biochemistry.

LE BEL, NORMAN A.,¹ Brunswick, Chemistry.

SHIRLEY, DAVID A., Orono, Chemistry.

MARYLAND

POSTDOCTORAL

HOROWICZ, PAUL, Baltimore, Biophysics.

PROCK, ALFRED, Baltimore, Chemistry.

PREDOCTORAL

BERMAN, ALVIN L., Baltimore, Medical Science.

EVANS, DAVID R., Baltimore, Zoology.

FLETCHER, JOHN G., Chevy Chase, Physics.

GATES, OLCOTT, Ruxton, Earth Sciences.

HOPFIELD, JOHN J., Bethesda, Physics.

KANE, ROBERT E., Baltimore, Zoology.

MANDELBERG, HIRSCH ISRAEL, Baltimore, Physics.

MARTIN, MARY HELEN, College Park, Zoology.

NILSON, EDGAR, Middletown, Microbiology.

REESE, WILLIAM D., Owings Mills, Botany.

RODBERG, LEONARD S., Baltimore, Physics.

THOMAS, T. DARRAH, Chevy Chase, Chemistry.

WHITAKER, STEPHEN, Elkton, Engineering.

MASSACHUSETTS

POSTDOCTORAL

KENDALL, HENRY W., Sharon, Physics.

KODIS, RALPH D., Cambridge, Engineering.

MARK, HANS M., Brookline, Physics.

MARTIN, PAUL C., Cambridge, Physics.

NEISSER, ULRIC, Boston, Psychology.

RAY, PETER M., Cambridge, Botany.

RICE, STUART A., Cambridge, Chemistry.

WHITNEY, CHARLES A., Medford, Astronomy.

PREDOCTORAL

ACKLEY, JOHN N., Newton, Engineering.

BARR, R. MAC DONALD, Cambridge, Engineering.

BROOKS, DAVID B., North Easton, Earth Sciences.

BRYAN, MARGARET S., Cambridge, General Biology.

CHEN, HELEN D., South Lancaster, Medical Science.

¹ Declined.

CULVAHOUSE, JACKIE W., Cambridge, Physics.
 DAVIS, JOHN L., Rockland, Physics.
 DICKINSON, ALLAN W., Springfield, Mathematics.
 EIGNER, JOSEPH, Swampscott, Chemistry.
 HOWARD, WEBSTER E., Jr., Winthrop, Physics.
 JOYNER, WILLIAM BISH, Cambridge, Earth Sciences.
 KASETA, FRANCIS W., Norwood, Physics.
 KENNEDY, DONALD, Cambridge, Zoology.
 KENNEY, FRANCIS T., Springfield, Biochemistry.
 KOPP, JOSHUA K., Dorchester, Physics.
 LACY, ANN M., Newton Center, Microbiology.
 LINDQUIST, RICHARD W., Worcester, Physics.
 MILKMAN, ROGER D., Cambridge, Genetics.
 MUCKENHOUP, BENJAMIN, Newton Highlands, Mathematics.
 PALAIS, RICHARD S., Cambridge, Mathematics.
 PANAGOS, SYLVIA S., Lynn, Medical Sciences.
 POSKANZER, ARTHUR M., Cambridge, Chemistry.
 POTTER, DAVID D., Amherst, Zoology.
 RAUP, DAVID M., Petersham, Earth Sciences.
 SCHELL, ALLAN C., South Dartmouth, Engineering.
 SHEPARD, SUSAN C., West Falmouth, Earth Sciences.
 TUDEN, ARTHUR,¹ Boston, Anthropology.
 WHITE, ROBERT W., Somerville, Chemistry.
 WILLISTON, ANNE C., Northampton, Chemistry.
 ZABUSKY, NORMAN J.,¹ Cambridge, Engineering.

MICHIGAN

POSTDOCTORAL

BATTLE, EDWIN H.,¹ Port Huron, Microbiology.
 HELLWARTH, ROBERT W.,² Detroit, Physics.
 WEISS, EDWIN, Ann Arbor, Mathematics.

¹ Declined.
² Withdrew.

PREDOCTORAL

ALBRECHT, JAMES W.,¹ Detroit, Physics.
 ALLERTON, SAMUEL E., Kalamazoo, Chemistry.
 AXELROD, EUGENE H., Detroit, Chemistry.
 BRINEY, ROBERT E., Muskegon, Mathematics.
 CURTIS, THEODORE T., Ann Arbor, Psychology.
 DAWSON, MARY R., Ferndale, Earth Sciences.
 GARY, JOHN M., Kalamazoo, Mathematics.
 GOAD, ROBERT J., Detroit, Engineering.
 HAZARD, EVAN B.,¹ Ann Arbor, Zoology.
 HEFNER, ROBERT A., JR., Ann Arbor, Psychology.
 HOMMEL, LEONARD S., Detroit, Psychology.
 HORGER, LEWIS M., Adrian, Zoology.
 IVERSON, GRACE B., Ann Arbor, Botany.
 MEYER, WALTER L., Ann Arbor, Chemistry.
 MOHR, CHARLES M., South Haven, Engineering.
 MORENCY, ALFRED JAMES, Coldwater, Physics.
 MORROW, DUANE F., Detroit, Chemistry.
 NICHOLS, WILLIAM H., Detroit, Physics.
 PEHLKE, ROBERT D., Ferndale, Engineering.
 PLACEWAY, CARLTON, Imlay City, Chemistry.
 ROOD, JOHN W., East Lansing, Mathematics.
 SMITH, HARRY A., Grand Rapids, Chemistry.
 TOCCO, PHYLIS G., Detroit, Chemistry.
 VAN PUTTEN, JAMES D., JR., Holland, Physics.
 WATERS, THOMAS F., East Lansing, Zoology.

MINNESOTA

POSTDOCTORAL

WILLIAMS, STEPHAN, Minneapolis, Anthropology.

PREDOCTORAL

DANIELSON, ROBERT E., Deer River, Physics.

¹ Declined.

DICKELMAN, THEODORE E., Minneapolis, Chemistry.
 ELIASON, MORTON A., Moorhead, Chemistry.
 FAWCETT, MARK S., Winona, Chemistry.
 FREDERICK, EDWARD C., Eagle Lake, Agriculture.
 FREDERICKSON, ARNOLD GERHARD, Wamamingo, Engineering.
 GIESE, CLAYTON F., Minneapolis, Physics.
 HANSON, ROLAND C., Barnum, Physics.
 HOLMES, JOHN C., South St. Paul, Zoology.
 LARSON, DAVID C., Cloquet, Physics.
 LAURANCE, NEAL L., Winsted, Physics.
 MARCUS, ERICH, Minneapolis, Chemistry.
 MIZUNO, NOBUKO S., St. Paul, Biochemistry.
 NELSON, RODNEY A., Minneapolis, Engineering.
 PIERCE, RICHARD LEROY, Minneapolis, Botany.
 RICE, DAVID E., Northfield, Chemistry.
 SPERLING, SALLY E., Minneapolis, Psychology.
 WADE, WARREN F., Minneapolis, Engineering.

MISSISSIPPI

PREDOCTORAL

BLACKWELL, NOAH E., III, Plantersville, Engineering.
 CARPENTER, WILL D., Moorhead, Botany.
 CORLEY, KELLY O., Clinton, Chemistry.
 ELLARD, JAMES A., Pittsboro, Chemistry.
 FLAUTT, THOMAS J., JR., Sidon, Chemistry.
 GARST, JOHN F., Vicksburg, Chemistry.
 SMYLIE, JOHN W., Brookhaven, Engineering.
 ZACHRY, JAMES B., Lena, Chemistry.

MISSOURI

POSTDOCTORAL

BRADLEY, S. GAYLEN, Springfield, Microbiology.

PREDOCTORAL

CANTWELL, R. MURRAY, St. Louis, Physics.
 COHEN, GERALD ALLEN, University City, Engineering.

DOWNES, WILLIAM L., JR., Shewsbury, Zoology.
 DREITLEIN, JOSEPH F., Ferguson, Physics.
 GRUEN, LISE, Kansas City, Chemistry.
 HAAS, PAUL A.,¹ Rolla, Engineering.
 HALLOF, PHILIP G., Kirkwood, Earth Sciences.
 HIGDON, DONALD T., Kansas City, Engineering.
 KREBS, JAMES J., Kirkwood, Physics.
 LOWE, IRVING J., St. Louis, Physics.
 MEAD, C. ALDEN, Webster Groves, Chemistry.
 O'CONNOR, RODNEY J., Jackson, Chemistry.
 OEN, ORDEAN S., Columbia, Physics.
 SCHANUEL, STEPHEN H., Kirkwood, Mathematics.
 SHORT, NICHOLAS M., University City, Earth Sciences.
 STOUT, GEORGE H.,¹ St. Louis, Chemistry.
 THOMPSON, JOHN G., Jefferson City, Mathematics.
 WIESMEYER, HERBERT, St. Louis, Microbiology.

NEBRASKA

PREDOCTORAL

DAVIS, ROBERT J., Omaha, Astronomy.
 DOMINGO, JOHN J.,¹ Weeping Water, Physics.
 EICHER, DON L., Lincoln, Earth Sciences.
 HAGSTROM, STANLEY A., Omaha, Chemistry.
 JOHNSTON, RALPH C., Fremont, Engineering.
 SCHELKOPF, RUSSELL L., Geneva, Zoology.
 WEINBERG, GERALD M., Omaha, Physics.
 YOS, JERROLD M., Lincoln, Physics.

NEW HAMPSHIRE

PREDOCTORAL

AYER, DONALD E., Bradford, Chemistry.
 FITTS, DONALD D., Keene, Chemistry.
 JOHNSON, FREDERIC A., Concord, Chemistry.

¹ Declined.

NEW JERSEY

POSTDOCTORAL

BRESLOW, RONALD C. D.,¹ Rahway, Chemistry.

FULTON, THOMAS, Princeton, Physics.

GRIFFITH, WAYLAND C., Princeton, Physics.

PREDOCTORAL

ANDERSEN, KENNETH K., Fords, Chemistry.

ARTIN, MICHAEL, Princeton, Mathematics.

BROWER, LINCOLN P., Madison, Zoology.

CIECIUCH, RONALD F. W., Jersey City, Chemistry.

CLARK, ALVIN J., Morristown, Chemistry.

EHRlich, PAUL R., Maplewood, Zoology.

FEDERBUSH, PAUL G., Newark, Physics.

FLORANCE, EDWIN T., Summit, Physics.

GREENBERG, OSCAR W.,¹ Newark, Physics.

HARRIS, NELLIE R., Port Norris, Medical Science.

KNOX, ROBERT S., Newton, Physics.

LEMAL, DAVID M., Fanwood, Chemistry.

MACKEY, JOHN H., JR., Gloucester, Physics.

PARE', VICTOR K., Woodbury, Physics.

PARSONS, THOMAS S., Ridgewood, Zoology.

PURDY, ROBERT H., Summit, Medical Sciences.

REINKEN, DONALD L., Plainfield, Mathematics.

ROSEN, GERALD H., Teaneck, Physics.

RUSCH, WILLARD V., Lambertville, Engineering.

SAGAN, CARL E., Rahway, Physics.

SCHNITZER, HOWARD J., Newark, Physics.

SIBILIA, JOHN T., Newark, Physics.

STEINBERG, MALCOLM S., Highland Park, Zoology.

SWAN, RICHARD G., Boonton, Mathematics.

VAN BLERKOM, RICHARD, Westfield, Physics.

WARTER, PETER J., JR., Trenton, Engineering.

WILLIAMS, FORMAN A.,¹ Milltown, Engineering.

¹ Declined.

WOJTOWICZ, PETER J., Linden, Chemistry.

ZANET, PAUL M., Clifton, Chemistry.

NEW MEXICO

PREDOCTORAL

AGNEW, LEWIS E., JR., Portales, Physics.

KANE, WALTER R., Los Alamos, Physics.

PHILLIPS, JAMES C.,¹ Albuquerque, Physics.

SIEGMAN, ANTHONY E., Wagon Mound, Engineering.

NEW YORK

POSTDOCTORAL

BEARMAN, RICHARD J., New York, Chemistry.

BRODISH, ALVIN, Flushing, Zoology.

DESER, STANLEY, Brooklyn, Physics.

FELSENFELD, GARY, New York, Chemistry.

HERMAN, ROBERT, Brooklyn, Mathematics.

STEIN, ELIAS M., New York, Mathematics.

ZEMACH, ARIEL C., New York, Physics.

PREDOCTORAL

ABRAMSON, LEE R., New York, Mathematics.

BACH, MICHAEL K., Flushing, Biochemistry.

BARREKETTE, EUVAL S.,¹ Brooklyn, Engineering.

BAUM, LEONARD E., Brooklyn, Mathematics.

BEARD, ROBERT G., Oswego, Zoology.

BEEBE, PHYLLIS W., Kenmore, Genetics.

BENSON, ARNOLD M., New York, Engineering.

BLOCK, CLIFFORD H.,¹ Kenmore, Psychology.

BRILLIANT, MARTIN B., Brooklyn, Engineering.

CIOFFI, FRANK S.,¹ New York, Psychology.

COHEN, PAUL J., Brooklyn, Mathematics.

COHEN, WILLIAM C., Brooklyn, Engineering.

CONDON, PAUL E., Corning, Physics.

CONTI, JAMES J., Brooklyn, Engineering.

- DELLA TORRE, EDWARD, Bronx, Engineering.
- DETENBECK, ROBERT W., Kenmore, Physics.
- DEWEY, WADE G., Ithaca, Agriculture.
- DINSMORE, GEORGE H., Jr., Ridgewood, Mathematics.
- DRACHMAN, RICHARD J., Brooklyn, Physics.
- DROUILHET, PAUL R., Jr.,¹ Poughkeepsie, Engineering.
- ENNIS, HERBERT L., Brooklyn, Microbiology.
- ERNST, FREDERICK J., Jr., Ardsley, Physics.
- ESTRIN, JOSEPH, Brooklyn, Engineering.
- EVENS, LEONARD,¹ Brooklyn, Mathematics.
- FEINBERG, GERALD, New York, Physics.
- FILLENBAUM, SAMUEL, Brooklyn, Psychology.
- FLEISCHMAN, JULIAN B., New York, Biochemistry.
- FRIEDMAN, SHEILA, Amityville, Microbiology.
- FURSTENBERG, HARRY, New York, Mathematics.
- GARDNER, WILLIAM CECIL, Niagara Falls, Chemistry.
- GERSHENSON, HILLEL H., New York, Chemistry.
- GLASHOW, SHELDON L., New York, Physics.
- GOLDBERG, ABRAHAM, Staten Island, Physics.
- GOLDFINE, HOWARD,¹ Brooklyn, Biochemistry.
- GOLDSTEIN, MELVIN J., New York, Chemistry.
- GORDON, MALCOLM S., Brooklyn, Zoology.
- GREENBERGER, MARTIN H., Staten Island, Engineering.
- HARRIS, MORTON E., Brooklyn, Mathematics.
- HELFAND, EUGENE, Brooklyn, Chemistry.
- HELLER, PETER, New York, Physics.
- HOROWITZ, SAMUEL B., New York, Zoology.
- HORSTEIN, MICHAEL, Brooklyn, Engineering.
- KATZ, MYRON, Jamaica, Engineering.
- KAYE, GORDON I., Brooklyn, Zoology.
- KITTIVER, LAWRENCE I.,¹ Brooklyn, Engineering.
- KLEE, WERNER A.,¹ New York, Biochemistry.
- KLOTZ, TILLA S., New York, Mathematics.
- KNETTLES, MARY E., Terrytown, Microbiology.
- KOHLs, CARL W., Rochester, Mathematics.
- KOHN, JOSEPH J., New York, Mathematics.
- KOLENKOW, ROBERT J.,¹ Niagara Falls, Physics.
- KRISHER, LAWRENCE C., Livonia, Chemistry.
- LACKS, SANFORD A.,¹ Albany, Zoology.
- LANSBURY, PETER T., New York, Chemistry.
- LEW, JOHN S., Larchmont, Physics.
- LITTAU, VIRGINIA C., New York, Biochemistry.
- LOEBENSTEIN, ELI S., New York, Mathematics.
- LUBKIN, ELIHU, Brooklyn, Physics.
- LYNCH, EUGENE J. M., LaFayette, Physics.
- MARCUS, DANIEL H., New York, Engineering.
- MCCLURE, JAMES D.,¹ Glen Cove, Chemistry.
- MCCUMBER, DEAN E., Rochester, Engineering.
- METZNER, JOHN J., Flushing, Engineering.
- MIX, THOMAS W., New York, Engineering.
- ORNSTEIN, DONALD S., Harrison, Mathematics.
- PALEY, HIRAM, Rochester, Mathematics.
- PEARLMAN, ROBERT, Long Beach, Mathematics.
- PEDERSEN, CHARLES R., Brooklyn, Engineering.
- RAUSCHER, HERBERT E., Troy, Chemistry.
- REITMAN, WALTER R., New York, Psychology.
- RICHTER, ALAN,¹ Brooklyn, Genetics.

¹ Declined.
² Withdrew.

¹ Declined.

RICHTER, DONALD L., Brooklyn, Mathematics.
ROCKMORE, RONALD M., Brooklyn, Physics.
RODRIGUEZ, DAVID A., New Rochelle, Engineering.
ROSEN, STANLEY S., Bronx, Engineering.
ROSNER, LAWRENCE, Brooklyn, Physics.
ROTHMAN, DAVID, Bronx, Mathematics.
RUBIN, ISRAEL E., Brooklyn, Engineering.
SAGE, MARTIN LEE, New York, Chemistry.
SANTORO, ANGELO V., Brooklyn, Chemistry.
SCHAFFER, BERTRAM J., Brooklyn, Physics.
SCHRIER, ALLAN M., New York, Psychology.
SCHWARTZ, MELVIN, New York, Physics.
SHAKIN, CARL,¹ New York, Physics.
SHAW, RICHARD P., Queens Village, Engineering.
SICK, WILSON W., JR.,¹ Hornell, Engineering.
SILVER, MARC S., New Rochelle, Chemistry.
SIMPSON, ROBERT E., Kenmore, Physics.
SINGER, ESTELLE S., New York, Psychology.
SOMMERFIELD, CHARLES M., Brooklyn, Physics.
SPIEGEL, EDWARD A., New York, Astronomy.
STARK, GEORGE R., New York, Biochemistry.
STEIN, NORMAN B., Laurelton, Mathematics.
STEIN, SIDNEY, New York, Engineering.
STILLINGER, FRANK H., Scarsdale, Chemistry.
TAUSNER, MENASHA J., Bronx, Physics.
VICTOR, URSULA V., Pleasantville, Genetics.
WACHTEL, ALLEN W., Irvington, Biochemistry.
WASSERMAN, EDEL, Brooklyn, Chemistry.
WEINBERG, STEVEN, New York, Physics.
WEINGRAM, STEPHEN, New York, Mathematics.
WEISBACH, JERRY A., Brooklyn, Chemistry.
WELLS, WALLACE P., Batavia, Psychology.

NORTH CAROLINA

PREDOCTORAL

BRANTLY, EUGENE P., Raleigh, Engineering.
CARTERETTE, EDWARD C., Tabor City, Psychology.
COGGINS, CHARLES W., JR., Crouse, Botany.
DAVIS, GEORGE T., High Point, Chemistry.
FISHER, WILLIAM D.,¹ Roxboro, Zoology.
HEATH, ROBERT W., Chapel Hill, Mathematics.
LEWIS, DONALD E., Gastonia, Biochemistry.
SUMNER, THOMAS H., Asheville, Mathematics.
WALTERS, GEOFFREY K., Durham, Physics.
YOW, FRANCIS W., Asheville, Zoology.

NORTH DAKOTA

PREDOCTORAL

ADLER, JULIUS, Grand Forks, Biochemistry.
BAUMANN, DWIGHT M., Ashley, Engineering.
BUELOW, FREDERICK H.,¹ Drake, Engineering.
PARKER, DAVID J., Fargo, Chemistry.

OHIO

POSTDOCTORAL

SCARPELLI, DANTE G., Columbus, Medical Science.

PREDOCTORAL

BAPTIST, JAMES N., Olmsted Falls, Biochemistry.
BROWN, HENRY T., Cincinnati, Engineering.
BURFORD, ARTHUR E., Lakewood, Earth Sciences.
BUTLER, JAMES NEWTON, Lakewood, Chemistry.
CLARK, THOMAS J., St. Marys, Chemistry.
CRUM, RALPH G., Youngstown, Engineering.
DANIELS, EDWARD G., Lorain, Chemistry.
DEUTSCH, THOMAS F., Shaker Heights, Engineering.

¹ Declined.

EHRENFELD, JOHN R., Cincinnati, Engineering.
 FARRAND, WILLIAM R.,¹ Columbus, Earth Sciences.
 FEIL, JOSEPH N., Cuyahoga Falls, Engineering.
 FIFE, WILMER K., Dellroy, Chemistry.
 FLANAGAN, PAT W. K., Dayton, Chemistry.
 GARWIN, EDWARD L., Cleveland, Physics.
 GORDON, JOHN E., Columbus, Chemistry.
 HARNEY, DONALD J., Wright-Patterson AFB, Engineering.
 HARRISON, WALTER A., Toledo, Physics.
 HOLDEN, ELLSWORTH J., JR., Cleveland, Physics.
 HUFF, ROBERT W., Canton, Physics.
 KASNER, WILLIAM H., Killbuck, Physics.
 KING, MONIQUE V., Cleveland, Chemistry.
 LAWRENCE, LOIS C., Cincinnati, Psychology.
 LENHERT, P. GALEN, Arcanum, Chemistry.
 LONGMIRE, MARTIN S., Glendale, Chemistry.
 LOWENSTEIN, CARL D., Kent, Physics.
 MUSKAT, JOSEPH B., Marietta, Mathematics.
 PRANGE, RICHARD E., Berea, Physics.
 RAINEY, BYRON P.,¹ Georgetown, Physics.
 REBKA, GLEN A., JR., Cincinnati, Physics.
 REED, NANCY L., Middletown, Chemistry.
 RILLING, HANS CHRISTOPHER, Findlay, Chemistry.
 ROHNER, SR. MARY CHRISTOPHER, Cleveland, Zoology.
 ROSENSWEIG, RONALD E., Cincinnati, Engineering.
 RYEBURN, DAVID, Goshen, Mathematics.
 SAUER, KENNETH H., East Cleveland, Chemistry.
 SILVERMAN, ROBERT, Columbus, Mathematics.
 WICHNER, ROBERT P.,¹ Cincinnati, Engineering.
 YOUNG, ANDREW T., Massillon, Astronomy.

OKLAHOMA

PREDOCTORAL

ARNOLD, GAIL, Fairfax, Zoology.
 BARRETT, HAROLD E., JR., Tulsa, Biochemistry.

¹ Declined.

BRADFORD, REAGAN H., Lawton, Biochemistry.
 BROOKS, MARGARET H., Stillwater, Genetics.
 BRUNER, LEON J., Ponca City, Physics.
 DABNEY, JOE M., Oklahoma City, Medical Science.
 ESSLINGER, JACK H., Oklahoma City, Zoology.
 HAMILTON, PAT B., Haskell, Microbiology.
 HEDGES, FRANK, Stillwater, Engineering.
 LANE, CHARLES A., Oklahoma City, Biochemistry.
 MCCUNE, JAMES E., Tulsa, Engineering.
 SOULE, MALCOLM S., Oklahoma City, Engineering.

OREGON

PREDOCTORAL

BUDDENHAGEN, IVAN W., Corvallis, Botany.
 DICK, BERTRAM G., JR., Portland, Physics.
 KIND, PHYLLIS D., Portland, Microbiology.
 MCNEIL, WILLIAM JOHN,¹ Corvallis, Zoology.
 NYBERG, DAVID D., Corvallis, Chemistry.
 OHLSEN, GERALD G., Springfield, Physics.
 SKIENS, WILLIAM E., Burns, Chemistry.
 SKINNER, RICHARD E., Milwaukie, Physics.
 WHEELER, NICHOLAS A., The Dalles, Mathematics.

PENNSYLVANIA

POSTDOCTORAL

COTTON, FRANK A.,¹ Philadelphia, Chemistry.
 FELDMAN, JACOB, Philadelphia, Mathematics.
 KREEVOY, MAURICE M., State College, Chemistry.
 MUDD, STUART HARVEY, Haverford, Biochemistry.
 TEUTSCH, WERNER B., Philadelphia, Physics.

PREDOCTORAL

ALEXEFF, IGOR, Pittsburgh, Physics.
 ATLAS, HENRY, Philadelphia, Physics.
 BRIDGES, JOANNE M., McKees Rocks, Chemistry.

¹ Declined.

- CLARK, HAROLD B.,¹ Huntingdon, Engineering.
- CURTIS, RICHARD B., Ardmore, Physics.
- DAVIS, EDWARD D., Philadelphia, Physics.
- DAVIS, EDWARD M., JR.,¹ Pittsburgh, Engineering.
- DESSY, RAYMOND E., Blawnox, Chemistry.
- DI MARZIO, EDMUND A., Philadelphia, Physics.
- DUGAN, GENEVIEVE E., Bethlehem, Psychology.
- EUWEMA, ROBERT N., State College, Physics.
- FELBECK, GEORGE T., JR., Wernersville, Agriculture.
- FOLK, ROBERT T., Allentown, Physics.
- GLARUM, SIVERT H., Wyncote, Chemistry.
- GOLLUB, LEWIS R., Philadelphia, Psychology.
- GOUTERMAN, MARTIN P., Philadelphia, Biophysics.
- GREEN, PAUL B.,¹ Bala-Cynwyd, Botany.
- GREENER, ALAN E., Erie, Physics.
- JOHNSON, LEON J., State College, Agriculture.
- JOHNSON, NEIL R., McKeesport, Engineering.
- KAUFFMAN, MARVIN E., Lancaster, Earth Sciences.
- LANG, L. GEORGE, Pittsburgh, Physics.
- LANGER, JAMES S.,¹ Pittsburgh, Physics.
- LOUX, HARVEY M., Sellersville, Chemistry.
- LOVE, WILLIAM A., Pittsburgh, Physics.
- LUKENS, LEWIS N., Philadelphia, Biochemistry.
- MCILVRIED, HOWARD G., III, Pittsburgh, Engineering.
- MILEY, GEORGE H., II, Petrolia, Engineering.
- MISNER, CHARLES W., Pittsburgh, Physics.
- MORRIS, ROBERT L., Philadelphia, Engineering.
- MULLHAUPT, JOSEPH T., Warren, Chemistry.
- MUNSON, RONALD A., Lancaster, Chemistry.
- NEIDHARDT, FREDERICK C., Bucks County, Microbiology.
- NEWELL, WILLIAM E., Sharon, Engineering.
- NORTON, RICHARD E., Philadelphia, Physics.
- O'LEARY, WILLIAM M., Pittsburgh, Microbiology.
- OLENICZAK, ALBERT T., Philadelphia, Engineering.
- OLSON, JOHN M., Philadelphia, Biophysics.
- REIBEL, KURT, Philadelphia, Physics.
- ROMBERGER, JOHN A., Hershey, Botany.
- SHAPIRO, GILBERT, Philadelphia, Physics.
- SIMMONS, VIOLET E., Philadelphia, Chemistry.
- SOLO, ALAN J., Philadelphia, Chemistry.
- SORENSEN, RAYMOND A., Pittsburgh, Physics.
- SWIFT, MICHAEL R., Swarthmore, Mathematics.
- TEMIN, HOWARD M., Philadelphia, Genetics.
- WAITE, THOMAS R., Pittsburgh, Chemistry.
- WOLL, JOHN WILLIAM, JR., Newtown, Mathematics.
- ZENER, JOHN R., Pittsburgh, Physics.

RHODE ISLAND

PREDOCTORAL

- EKSTROM, LINCOLN, Providence, Chemistry.
- MARTINS, GEORGE F., East Providence, Chemistry.
- MURPHY, EDWARD L., Cranston, Physics.
- PALMIERI, JOSEPH N., Providence, Physics.

SOUTH CAROLINA

PREDOCTORAL

- GEORGE, RHETT T., JR., Anderson, Engineering.
- LAURIE, VICTOR W., Columbia, Chemistry.
- SAGE, ANDREW P., JR., Charleston, Engineering.

SOUTH DAKOTA

PREDOCTORAL

- COLLINS, PAUL E., Brookings, Agriculture.
- HYDE, RICHARD M., Pierre, Microbiology.

¹ Declined.

TENNESSEE

PREDOCTORAL

- CHADWELL, ANDREW J., JR., Knoxville, Chemistry.
 COX, JAMES R. JR., Nashville, Chemistry.
 DUPREE, THOMAS H., Knoxville, Physics.
 DURAND, LOYAL, III, Knoxville, Physics.
 GROSS, BENJAMIN H., Chattanooga, Chemistry.
 JENSEN, DONALD R.,¹ Goodlettsville, Agriculture.
 MARTIN, MICHAEL M., Nashville, Chemistry.
 SCOTT, DAN W., Oak Ridge, Physics.
 STOCKELL, ANNE, Nashville, Biochemistry.

TEXAS

POSTDOCTORAL

- HUMMEL, JAMES A., Houston, Mathematics.
 MARION, JERRY B., Houston, Physics.

PREDOCTORAL

- AGOSTA, WILLIAM C., Dallas, Chemistry.
 AUTREY, ROBERT L., Houston, Chemistry.
 CURL, ROBERT F., JR., San Antonio, Chemistry.
 GIBBONS, JAMES F.,¹ Texarkana, Engineering.
 HAM, RICHARD GEORGE, Austin, Biochemistry.
 HILLIARD, JOHN R., JR., San Antonio, Zoology.
 JOLLEY, RUSSELL L., JR., Houston, Biochemistry.
 LE BLANC, OLIVER H., JR., Beaumont, Chemistry.
 MAGEE, ELLINGTON M., San Augustine, Chemistry.
 MIMS, JONNIE E., Falfurrias, Biochemistry.
 MITCHELL, BERNARD L., Beaumont, Engineering.
 PARKER, HARRY W., Tulia, Engineering.
 PONDROM, LEE G., Dallas, Physics.
 YOUNG, ROBERT C.,¹ San Antonio, Physics.

UTAH

POSTDOCTORAL

- CANNELL, LAWRENCE G., Smithfield, Chemistry.
 SELANDER, ROBERT K.,¹ Salt Lake City, Zoology.

PREDOCTORAL

- ANDERSON, CLAIR KEITH, Ogden, Earth Sciences.
 GRANT, DAVID M., Salt Lake City, Chemistry.
 HARRISON, BERTRAND K., Spanish Fork, Physics.
 SAGERS, RICHARD D., Tooele, Microbiology.
 SNOW, RICHARD L., Salt Lake City, Chemistry.
 SORENSON, JOHN L., Provo, Anthropology.
 WALKER, LEROY H., Midvale, Engineering.

VERMONT

PREDOCTORAL

- FRIGERIA, NORMAN A., Lyndonville, Biochemistry.
 WOODWORTH, ROBERT C., Bennington, Chemistry.

VIRGINIA

PREDOCTORAL

- BARKER, JOHN G., Radford, Zoology.
 BARRON, ROGER L., Springfield, Engineering.
 BENTLEY, S. BAYNE, Urbanna, Physics.
 BOYDEN, JAMES H., Wytheville, Physics.
 DARNELL, WALTER T., Harrisonburg, Engineering.
 DUFORT, ROBERT H., Richmond, Psychology.
 EVERETT, HUGH, III, Alexandria, Physics.
 HEATWOLE, HAROLD F., Waynesboro, Zoology.
 JENKINS, W. TERRY, Yorktown, Biochemistry.
 LYON, RICHARD K., Arlington, Chemistry.
 PUBOLS, BENJAMIN H., JR., Arlington, Psychology.
 SNIDER, PHILIP J., JR., Richmond, Botany.
 ZUCHELLI, A. JOSEPH, JR., Charlottesville, Physics.

WASHINGTON

POSTDOCTORAL

- CAMPBELL, BYRON, Seattle, Psychology.
 HAWTHORNE, DONALD C., Olympia, Microbiology.
 HUGHES, DANIEL R., Bothell, Mathematics.

¹ Declined.

KRAFT, ROBERT P., Edmonds, Astronomy.
LAWRENCE, DOUGLAS H., Everett, Psychology.

PREDOCTORAL

ANDERSON, LOWELL L., Spokane, Biophysics.
ANEX, BASIL G., Seattle, Chemistry.
FAHEY, DENNIS M., Walla Walla, Chemistry.
FERNEA, ROBERT A., Vancouver, Anthropology.
FREEMAN, MARK P., Seattle, Chemistry.
FUJIOKA, GEORGE S., Seattle, Chemistry.
HAWTHORN, ROBERT D., Seattle, Engineering.
KEPPLER, BELVA H., Garfield, Earth Sciences.
KING, JAMES R., Pullman, Zoology.
KLUKSDAHL, HARRIS E., Stanwood, Chemistry.
MANWELL, CLYDE P., Seattle, Zoology.
MINTON, ROBERT G., Ellensburg, Chemistry.
MORRISON, CHARLES F., JR., Zillah, Chemistry.
REHFUSS, DONALD E., North Bonneville, Physics.
WARE, JUDITH C., Vancouver, Chemistry.
WILSON, LAURENCE E., Seattle, Chemistry.

WEST VIRGINIA

PREDOCTORAL

CAZIN, JOHN, JR., Follansbee, Microbiology.

WISCONSIN

POSTDOCTORAL

BATTIG, WILLIAM F., Wauwatosa, Psychology.
DAHLER, JOHN S., Madison, Chemistry.
MORTON, NEWTON, E.,¹ Madison, Genetics.
SILVERSMITH, ERNEST F., Madison, Chemistry.
TOSTESON, DANIEL C.,¹ Wauwatosa, Medical Sciences.

¹ Declined.

PREDOCTORAL

ANDERSON, NORMAN H., Madison, Psychology.
BLATNER, ROBERT J., Milwaukee, Mathematics.
BOWMAN, ROBERT E., Madison, Psychology.
BROWN, FREDERICK G., Madison, Psychology.
DARLING, STEPHEN D., Appleton, Chemistry.
FRAUTSCHI, STEVEN C., Madison, Physics.
HORGAN, JAMES D., Wauwatosa, Engineering.
HUMBERT, JOHN W.,¹ Kohler, Engineering.
JOHNSRUD, ALAN E., Manitowoc, Physics.
KADLEC, JOHN A.,¹ Racine, Zoology.
KALBUS, BARBARA H., Manitowoc, Botany.
MCKIBBINS, SAMUEL W., West Allis, Engineering.
NELSON, CANDEN R., Evansville, Engineering.
RIESE, JEROME W., Kaukauna, Physics.
SALISBURY, STANLEY R., Milwaukee, Physics.
SCHROTH, STANLEY E., Appleton, Psychology.
SILBERT, MYRON G., Milwaukee, Physics.
SOBOTKA, STANLEY E., Ellsworth, Physics.
WALECKA, JOHN DIRK, Wauwatosa, Chemistry.

WYOMING

PREDOCTORAL

KLEINDIENST, MAXINE R., Superior, Anthropology.
TALBERT, WILLARD L., Jr., Casper, Physics.

HAWAII

PREDOCTORAL

HU, ALFRED S. L., Honolulu, Zoology.
MURASHIGE, TOSHIO, Hilo, Botany.

Institutions attended by National Science Foundation Fellows as Undergraduates and Graduate Students

<i>Institution and Location</i>	<i>Number of fellows attending As under- graduates</i>	<i>Number of fellows attending As graduate students</i>	<i>Institution and Location</i>	<i>Number of fellows attending As under- graduates</i>	<i>Number of fellows attending As graduate students</i>
Abilene Christian College, Abilene, Tex	1	1	Capital University, Columbus, Ohio	1	1
Amherst College, Amherst, Mass	5	5	Carleton College, Northfield, Minn	3	3
Antioch College, Yellow Springs, Ohio	1	1	Carnegie Institute of Technology, Pittsburgh, Pa	13	10
Arizona State College, Tempe, Ariz	2	1	Case Institute of Technology, Cleveland, Ohio	6	1
Asheville-Biltmore College, Asheville, N. C	1	1	Catholic University, Washington, D. C	1	1
Atlantic Union College, South Lancaster, Mass	1	1	Central College, Pella, Iowa	2	2
Augsburg College, Minneapolis, Minn	1	1	Central Washington College of Education, Ellens- burg, Wash	1	1
Augustana College, Rock Island, Ill	1	1	Citadel, Charleston, S. C	1	1
Bakersfield College, Bakersfield, Calif	1	1	City College of New York, New York, N. Y	9	9
Baldwin-Wallace College, Berea, Ohio	1	1	Clarke Memorial College, Newton, Miss	1	1
Balliol College, Oxford, England	2	2	Colby College, Waterville, Maine	1	1
Barnard College, New York, N. Y	1	1	College of Puget Sound, Tacoma, Wash	1	1
Beloit College, Beloit, Wis	1	1	College of the Sequoias, Visalia, Calif	1	1
Bemidji State Teachers College, Bemidji, Minn	1	1	College of William and Mary, Williamsburg, Va	2	2
Bethany-Peniel College, Bethany, Okla	1	1	College of Wooster, Wooster, Ohio	2	2
Bob Jones University, Greenville, S. C	1	1	Colorado Agricultural and Mechanical College, Fort Collins, Colo	4	4
Boston College, Chestnut Hill, Mass	1	1	Colorado College, Colorado Springs, Colo	1	1
Boston University, Boston, Mass	3	3	Columbia University, New York, N. Y	12	30
Bowdoin College, Brunswick, Maine	1	1	Compton College, Compton, Calif	1	1
Bradford Durfee Technical Institute, Fall River Mass	1	1	Concord College, Athens, West Va	1	1
Brigham Young University, Provo, Utah	3	3	Concordia College, Moorhead, Minn	2	2
Brooklyn College, Brooklyn, N. Y	7	7	Cooper Union, School of Engineering, New York, N. Y	3	3
Brown University, Providence, R. I	6	2	Cornell University, Ithaca, N. Y	21	14
Bryn Mawr College, Bryn Mawr, Pa	1	1	Dartmouth College, Hanover, N. H	1	1
California Institute of Technology, Pasadena, Calif	18	32	Delft Technical University, Delft, Netherlands	1	1
Calvin College, Grand Rapids, Mich	1	1			
Cameron State Agricultural College, Lawton, Okla	1	1			

<i>Institutions attended by National Science Foundation Fellows as Undergraduates and Graduate Students—Continued</i>		<i>Institution and Location</i>		<i>Number of fellows attending</i>		<i>Number of fellows attending</i>	
<i>As under-</i>	<i>As graduate</i>	<i>As under-</i>	<i>As graduate</i>	<i>As under-</i>	<i>As graduate</i>	<i>As under-</i>	<i>As graduate</i>
<i>graduates</i>	<i>students</i>	<i>graduates</i>	<i>students</i>	<i>graduates</i>	<i>students</i>	<i>graduates</i>	<i>students</i>
1	1	Illinois Institute of Technology, Chicago, Ill.	3	1			
1	1	DePaul University, Greencastle, Ind.					
2	2	Drake University, Des Moines, Iowa					
3	3	Drexel Institute of Technology, Philadelphia, Pa.					
4	6	Duke University, Durham, N. C.					
1	1	East Stroudsburg State Teacher's College, Stroudsburg, Pa.					
1	1	El Camino College, El Camino College, Calif.					
	2	Emory University, Emory University, Ga.	7	12			
1	1	Fisk University, Nashville, Tenn.	1	1			
1	3	Florida State University, Tallahassee, Fla.					
	1	Fordham University, New York, N. Y.					
2	2	Franklin and Marshall College, Lancaster, Pa.					
3	3	George Washington University, Washington, D. C.					
	1	Georgia Institute of Technology, Atlanta, Ga.					
	1	Gettysburg College, Gettysburg, Pa.					
	1	Goshen College, Goshen, Ind.					
1	1	Gustavus Adolphus College, St. Peter, Minn.					
1	1	Hamline University, St. Paul, Minn.					
1	1	Hanover College, Hanover, Ind.					
47	112	Harvard University, Cambridge, Mass.					
2	2	Haverford College, Haverford, Pa.					
1	1	Hershey Junior College, Hershey, Pa.					
1	1	Herzel Junior College, Chicago, Ill.					
1	1	Hofstra College, Hempstead, N. Y.					
1	1	Hope College, Holland, Mich.					
1	1	Howard College, Birmingham, Ala.					
2	2	Hunter College, New York, N. Y.					
		Indiana University, Bloomington, Ind.	3	1			
		Institute for Advanced Study, Princeton, N. J.					
		Institute for Theoretical Physics, Copenhagen, Denmark.					
		Instituto de Matematicas, Mexico City, Mexico*					
		Iowa State College, Ames, Iowa					
		Jersey City Junior College, Jersey City, N. J.					
		John Carroll University, Cleveland, Ohio*					
		Johns Hopkins University, Baltimore, Md.					
		John Muir College, Pasadena, Calif.					
		Joliet Junior College, Joliet, Ill.					
		Kalamazoo College, Kalamazoo, Mich.					
		Kansas State Teachers College, Emporia, Kans.					
		Kent State University, Kent, Ohio					
		Kentucky Wesleyan College, Winchester, Ky.					
		Kenyon College, Gambier, Ohio					
		Knox College, Galesburg, Ill.					
		Lafayette College, Easton, Pa.					
		Lamar State College of Technology, Beaumont, Tex.					
		Landbouwhogeschool, Wageningen, Holland					
		LaSalle College, Philadelphia, Pa.					
		Lehigh University, Bethlehem, Pa.					
		Los Angeles City College, Los Angeles, Calif.					
		Louisiana Polytechnic Institute, Ruston, La.					

Louisiana State University, Baton Rouge, La.	5	2	Newark College of Engineering, Newark, N. J.	1
Loyola University, Chicago, Ill.	1	---	New Jersey State Teachers College, Montclair, N. J.	1
Magdalene College, Cambridge, England	1	---	New York University, New York, N. Y.	7
Manhattan College, New York, N. Y.	2	---	North Carolina State College of Agriculture and Engineering, Raleigh, N. C.	3
Mankato State Teachers College, Mankato, Minn.	1	---	North Dakota Agricultural College, State College, N. Dak.	2
Marietta College, Marietta, Ohio	1	---	Northeastern State College, Tahlequah, Okla.	1
Marine Biological Laboratory, Woods Hole, Mass. *	---	4	Northeastern University, Boston, Mass.	2
Marquette University, Milwaukee, Wis.	4	3	Northern Oklahoma Junior College, Tonkawa, Okla.	1
Mars Hill College, Mars Hill, N. C.	1	---	Northwest Nazarene College, Nampa, Idaho	1
Massachusetts General Hospital, Boston, Mass.	---	---	Northwestern University, Evanston, Ill.	15
Massachusetts Institute of Technology, Cambridge, Mass.	30	61	Notre Dame College, Cleveland, Ohio	1
Mesa Junior College, Grand Junction, Colo.	1	---	Oberlin College, Oberlin, Ohio	7
Messiah College, Grantham, Pa.	1	---	Ohio State University, Columbus, Ohio	6
Miami University, Oxford, Ohio	3	---	Ohio University, Athens, Ohio	1
Michigan College of Mining and Technology, Houghton, Mich.	3	---	Ohio Wesleyan University, Delaware, Ohio	1
Michigan State College, East Lansing, Mich.	3	2	Oklahoma Agricultural and Mechanical College, Stillwater, Okla.	4
Middlebury College, Middlebury, Vt.	2	---	Oregon State College, Carvallis, Oreg.	5
Mississippi College, Clinton, Miss.	2	---	Oxford University, Oxford, England	1
*Summer session only.	---	---	Park College, Parkville, Mo.	1
Mississippi State College, State College, Miss.	4	---	Pasadena City College, Pasadena, Calif.	2
Missouri School of Mines, Rolla, Mo.	2	---	Pembroke College, Cambridge, England	1
Montana State University, Missoula, Mont.	2	1	Pennsylvania College for Women, Pittsburgh, Pa.	1
Morton Junior College, Cicero, Ill.	1	---	Pennsylvania State University, State College, Pa.	2
Mount Holyoke College, South Hadley, Mass.	3	1	Piedmont College, Demorest, Ga.	1
Mount Wilson Observatory, Carnegie Institution of Washington, Pasadena, Calif.	---	1	Polytechnic Institute of Brooklyn, Brooklyn, N. Y.	5
Naval Medical Research Institute, Bethesda, Md.	---	1	Pomona College, Claremont, Calif.	6
Nebraska Wesleyan University, Lincoln, Nebr.	1	---	Pratt Institute, Brooklyn, N. Y.	1

*Summer session only.

<i>Institutions attended by National Science Foundation Fellows as Undergraduates and Graduate Students—Continued</i>		<i>Institution and Location</i>		<i>Number of fellows attending</i>	
<i>As under-</i>	<i>As graduate</i>	<i>As under-</i>	<i>As graduate</i>	<i>As under-</i>	<i>As graduate</i>
<i>graduates</i>	<i>students</i>	<i>graduates</i>	<i>students</i>	<i>graduates</i>	<i>students</i>
	16	37	Princeton University, Princeton, N. J.		1
	1		Providence College, Providence, R. I.		1
	11	9	Purdue University, Lafayette, Ind.		1
	2		Queens College, Flushing, N. Y.		1
	1	6	Radcliffe College, Cambridge, Mass.		2
	1		Randolph-Macon College, Ashland, Va.		3
	9		Reed College, Portland, Ore.		2
	1		Regis College, Denver, Colo.		1
	3		Rensselaer Polytechnic Institute, Troy, N. Y.		1
	5	6	Rice Institute, Houston, Tex.		15
			Rijks-Universiteit te Groningen, Groningen, Netherlands		34
		1	Roosevelt College, Chicago, Ill.		2
	6	1	Rutgers University, New Brunswick, N. J.		7
	2		Sacramento Junior College, Sacramento, Calif.		4
	1		Sacramento State College, Sacramento, Calif.		1
		1	St. John's College, Oxford, England		1
	1		St. Joseph's College, Philadelphia, Pa.		1
	5	1	St. Louis University, St. Louis, Mo.		1
	1		St. Mary's College, Notre Dame, Ind.		2
	1		St. Michael's College, Winooksi Park, Vt.		1
	1		St. Norbert College, West De Pere, Wis.		1
	3		St. Olaf College, Northfield, Minn.		1
	1		Sampson College (closed July, 1949), N. Y.		1
			San Bernardino Valley College, San Bernardino, Calif.		2
	1		San Jose State College, San Jose, Calif.		1
	1		San Mateo Junior College, San Mateo, Calif.		1
			Santa Ana College, Santa Ana, Calif.		1
			Santa Rosa Junior College, Santa Rosa, Calif.		1
			Shenandoah College, Dayton, Va.		1
			Simpson College, Indianola, Iowa		1
			Smith College, Northampton, Mass.		2
			Southern Methodist University, Dallas, Tex.		3
			Southwest Missouri State College, Springfield, Mo.		2
			Southwestern College, Winfield, Kans.		1
			Spring Hill College, Spring Hill, Ala.		1
			Stanford University, Stanford, Calif.		15
			State University of Iowa, Iowa City, Iowa		2
			State College of Washington, Pullman, Wash.		2
			Sunflower Junior College, Moorhead, Miss.		1
			Swarthmore College, Swarthmore, Pa.		11
			Syracuse University, Syracuse, N. Y.		1
			Technische Hochschule, Karlsruhe, Germany		2
			Technische Hochschule, Munich, Germany		1
			Temple University, Philadelphia, Pa.		1
			Texas Agricultural and Mechanical College, College Station, Tex.		2
			Texas Technological College, Lubbock, Tex.		1
			Trinity University, San Antonio, Tex.		1
			Truett-McConnell Junior College, Cleveland, Ga.		1
			Tufts College, Medford, Mass.		1
			Tulane University, New Orleans, La.		2
			Tyler Junior College, Tyler, Tex.		1
			United States Air Force Institute of Technology, Dayton, Ohio		1

United States Naval Academy, Annapolis, Md	1	1	University of Maine, Orono, Maine	1
Universität Göttingen, Göttingen, Germany		2	University of Maryland, College Park, Md	3
Université de Liege, Liege, Belgium		1	University of Massachusetts, Amherst, Mass	2
University College, London, England		2	University of Miami, Miami, Fla	1
University of Amsterdam, Amsterdam, Netherlands		2	University of Michigan, Ann Arbor, Mich	10
University of Arizona, Tucson, Ariz	2	2	University of Michigan Biological Station,* Douglas Lake, Mich	23
University of Besancon, Besancon, France		1		
University of California, Berkeley, Calif	23	40	University of Minnesota, Minneapolis, Minn	9
University of California, Davis, Calif		3	University of Mississippi, University, Miss	1
University of California, Los Angeles, Calif	8	11	University of Missouri, Columbia, Mo	1
University of California, Scripps Institute of Oceanography, La Jolla, Calif			University of Montana Biological Station*	1
University of Cambridge, Cambridge, England		1	University of Nebraska, Lincoln, Nebr	4
University of Chattanooga, Chattanooga, Tenn	1	8	University of New Hampshire, Durham, N. H.	2
University of Chicago, Chicago, Ill	19	50	University of New Mexico, Albuquerque, N. Mex	1
University of Cincinnati, Cincinnati, Ohio	3		University of North Carolina, Chapel Hill, N. C.	6
University of Colorado, Boulder, Colo	6		University of North Dakota, Grand Forks, N. Dak	1
University of Connecticut, Storrs, Conn	2	8	University of Notre Dame, Notre Dame, Ind	1
University of Copenhagen, Copenhagen, Denmark		1	University of Oklahoma, Norman, Okla	4
University of Delaware, Newark, Del	1	3	University of Oklahoma Biological Station	4
University of Detroit, Detroit, Mich	2	5	University of Oklahoma City, Oklahoma City, Okla	1
University of Edinburgh, Edinburgh, Scotland			University of Omaha, Omaha, Nebr	2
University of Florida, Gainesville, Fla	1	1	University of Oregon, Eugene, Oreg	1
University of Hawaii, Honolulu, T. H.	2	2	University of Paris, Paris, France	2
University of Heidelberg, Heidelberg, Germany		1	University of Pennsylvania, Philadelphia, Pa	10
University of Idaho, Moscow, Idaho	10	31	University of Pittsburgh, Pittsburgh, Pa	5
University of Illinois, Urbana, Ill	2	6	University of Redlands, Redlands, Calif	1
University of Kansas, Lawrence, Kans	1		University of Rhode Island, Providence, R. I.	1
University of Kansas City, Kansas City, Mo	2		University of Richmond, Richmond, Va	2
University of Kentucky, Lexington, Ky	2	3	University of Rochester, Rochester, N. Y.	7
			University of San Francisco, San Francisco, Calif	1

*Summer session only.

<i>Institutions attended by National Science Foundation Fellows as Undergraduates and Graduate Students—Continued</i>		<i>Institution and Location</i>		<i>Number of fellows attending</i>		<i>Number of fellows attending</i>	
<i>Institution and Location</i>	<i>As under-graduates</i>	<i>As graduate students</i>	<i>Institution and Location</i>	<i>As under-graduates</i>	<i>As graduate students</i>	<i>Institution and Location</i>	<i>As under-graduates</i>
University of South Carolina, Columbia, S. C.	1	1	Wayne University, Detroit, Mich.		3		
University of South Dakota, Vermillion, S. Dak.	1	1	Weber College, Ogden, Utah		1		
University of Southern California, Los Angeles, Calif	3	2	Wellesley College, Wellesley, Mass.		1		1
University of Tennessee, Knoxville, Tenn.	2	4	Wesleyan University, Middletown, Conn.		5		2
University of Texas, Austin, Tex.	3	9	Western Carolina College, Cullowhee, N. C.		1		
University of Tulsa, Tulsa, Okla.		1	Western Kentucky State College, Bowling Green, Ky.		1		
University of Utah, Salt Lake City, Utah.	7	6					
University of Vermont, Burlington, Vt.	1	1	Western Michigan College, Kalamazoo, Mich.		1		
University of Virginia, Charlottesville, Va.	6	2	Western Reserve University, Cleveland, Ohio		1		
University of Washington, Seattle, Wash.	9	12	Western Washington College, Bellingham, Wash.		2		2
University of Washington, Friday Harbor, Wash.*		1	Westminster College, New Wilmington, Pa.		2		
University of Wichita, Wichita, Kans.	2	1	West Virginia University, Morgantown, W. Va.		1		
University of Wisconsin, Madison, Wis.	12	36	Wheaton College, Wheaton, Ill.		1		
University of Wyoming, Laramie, Wyo.	1	1	Whitman College, Walla Walla, Wash.		1		
University of Zurich, Switzerland.			Whittier College, Whittier, Calif.		1		
Utah State Agricultural College, Logan, Utah.	3	1	Whitworth College, Spokane, Wash.		1		
Vanderbilt University, Nashville, Tenn.	5	3	Wittenberg College, Springfield, Ohio		1		
Virginia Polytechnic Institute, Blacksburg, Va.	1	1	Worcester Polytechnic Institute, Worcester, Mass.		1		
Wabash College, Crawfordsville, Ind.	1	1	Worcester Junior College, Worcester, Mass.		1		
Wagner College, Staten Island, N. Y.	1	1	Wright Junior College, Chicago, Ill.		1		
Wartburg College, Waverly, Iowa.	1	1	Xavier University, Cincinnati, Ohio		1		
Washburn Municipal College, Topeka, Kans.	2	2	Yale University, New Haven, Conn.		15		35
Washington and Jefferson College, Washington, Pa.	1	1	Yeshiva University, New York, N. Y.		2		
Washington University, St. Louis, Mo.	2	5	Youngstown College, Youngstown, Ohio		1		

*Summer session only.

APPENDIX V

GRANTS FOR THE INTERNATIONAL GEOPHYSICAL YEAR PROGRAM MADE DURING FISCAL YEAR 1955

<i>National Bureau of Standards</i>	
Procurement of Ionospheric and Auroral Equipment for the International Geophysical Year.....	\$400, 000
Procurement of scanning photometers for the aurora and airglow program of the International Geophysical Year.....	42, 000
Procurement of ionospheric equipment for the Antarctic program of the International Geophysical Year.....	22, 000
<i>U. S. Coast and Geodetic Survey</i>	
Construction of special equipment for the geomagnetism program of the International Geophysical Year.....	15, 000
<i>Office of Naval Research (Naval Research Laboratory)</i>	
Procurement of rockets and auxiliary equipment for the International Geophysical Year.....	755, 000
Procurement of rockets and auxiliary equipment for the International Geophysical Year.....	417, 000
<i>U. S. Weather Bureau</i>	
Establishment of Antarctic planning staff for the International Geophysical Year.....	28, 000
<i>University of Alaska</i>	
Design and construction of auroral radar-type instrumentation for the International Geophysical Year.....	8, 000
<i>American Geographical Society</i>	
Construction of base map of the Antarctic region for the International Geophysical Year.....	4, 000
<i>University of Chicago</i>	
Design and pilot construction of an automatic patrol spectrograph for the International Geophysical Year.....	11, 000
<i>Columbia University</i>	
Procurement of a portable seismograph for the Antarctic program of the International Geophysical Year.....	18, 975
<i>Dartmouth College</i>	
Investigation of latitude dependence and occurrence at conjugate geomagnetic locations of whistlers.....	11, 000
<i>High Altitude Observatory</i>	
Program of instrumentation for the solar activity program of the International Geophysical Year.....	32, 000
<i>State University of Iowa</i>	
Engineering study of comparative suitability of small rockets for the International Geophysical Year.....	2, 000
Preparation and testing of prototype instrumentations for the rocket program of the International Geophysical Year.....	15, 000
<i>National Academy of Sciences</i>	
Support of the United States National Committee for the International Geophysical Year.....	100, 000
Support of the United States National Committee for the International Geophysical Year.....	27, 000
<i>Stanford University</i>	
Investigation of latitude dependence and occurrence at conjugate geomagnetic locations of whistlers.....	7, 000
Total (gross amounts).....	<hr style="width: 100%;"/> \$1, 914, 975
	155

APPENDIX VI

FINANCIAL REPORT FOR FISCAL YEAR 1955

APPROPRIATED FUNDS

STATUS OF APPROPRIATIONS FROM THE CONGRESS TO THE NATIONAL SCIENCE
FOUNDATION AS OF JUNE 30, 1955

SALARIES AND EXPENSES APPROPRIATION (Basic Appropriation for the NSF)

Receipts

Appropriation for fiscal year 1955.....	\$12, 250, 000	
Unobligated balance from fiscal year 1954.....	407, 722	
Total.....		\$12, 657, 722

Obligations

National science policy studies.....	\$901, 278	
Support of science:		
Grants for support of research:		
Biological and medical sciences.....	3, 611, 562	
Mathematical, physical, and engineering sci- ences	4, 397, 907	
Grants for training of scientific manpower:		
Graduate fellowships.....	1, 783, 706	
Education in the sciences.....	315, 790	
Review of research and training programs.....	677, 551	
Subtotal.....		10, 786, 516
Scientific information exchange:		
Dissemination of scientific information.....	326, 285	
Attendance at international meetings.....	77, 054	
Subtotal.....		403, 339
Executive direction and management.....	395, 130	
Total obligations.....		12, 486, 263
Unobligated balance carried forward to 1956.....		171, 459
		12, 657, 722

INTERNATIONAL GEOPHYSICAL YEAR APPROPRIATION

Receipts

Appropriation for fiscal year 1955.....		\$2, 000, 000
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Obligations

Geophysical research related to the earth's atmosphere...	\$466, 724	
Geophysical research related to the planet earth.....	32, 965	
Related scientific support activities.....	1, 203, 096	
Scientific direction and administration.....	133, 757	
Total obligations.....		1, 836, 542
Unobligated balance carried forward to 1956.....		163, 458

TRUST FUND

STATUS OF FUNDS DONATED FROM PRIVATE SOURCES TO THE NATIONAL SCIENCE
FOUNDATION AS OF JUNE 30, 1955

Receipts

Received from donations.....	\$50	
Unobligated balance from fiscal year 1954.....	1,356	
		<hr/>
Total.....		\$1,406

Obligations

Unobligated balance carried forward to 1956.....	1,406
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APPENDIX VII

PUBLICATIONS OF THE NATIONAL SCIENCE FOUNDATION

ANNUAL REPORTS

In January of each year the National Science Foundation issues an annual report of activities covering the previous fiscal year ending on June 30. The annual reports are made available to the public through the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at nominal prices.

FEDERAL FUNDS FOR SCIENCE SERIES

These reports contain information on the Federal research and development budget. Such information is compiled on a current basis by the National Science Foundation with the cooperation of other Federal agencies having research and development programs. The most recent report in the series may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

IV. The Federal Research and Development Budget, Fiscal Years 1954, 1955, and 1956. 30 cents.

SCIENTIFIC MANPOWER SERIES

The Scientific Manpower Series consists of reports on the supply and characteristics of scientific and technological manpower in various fields of science. The reports were based originally upon data developed through the registration program of the National Scientific Register, which functioned under the policy and fiscal direction of the National Science Foundation and was operated by the Federal Security Agency, Office of Education. Following the transfer of registration operations to the Foundation the reports were continued in cooperation with the United States Department of Labor, Bureau of Labor Statistics. These reports may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Research and Development Personnel in Industrial Laboratories 1950. 15 cents.

The Composition of the Sanitary Engineering Profession. 15 cents.

Manpower Resources in Physics 1951. 20 cents.

Manpower Resources in Chemistry and Chemical Engineering. 50 cents.

Manpower Resources in Mathematics. 20 cents.

Manpower Resources in the Earth Sciences. 45 cents.

Manpower Resources in the Biological Sciences. 40 cents.

Education and Employment Specialization in 1952 of June 1951 College Graduates. 35 cents.

SCIENTIFIC MANPOWER BULLETINS

This series of four-page leaflets was also established as a means for releasing scientific manpower information gathered in connection with the scientific registration program. Copies of *Bulletins* still in print may be obtained upon request from the Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C.

Manpower Resources in Chemistry, 1951.

Manpower Resources in Physics, 1951.

Manpower Resources in Chemical Engineering, 1951.

Military Status and Selective Service Classification of June 1951 College Graduates.

Manpower Resources in Geology, 1951.

Manpower Resources in Psychology, 1951.

Manpower Resources in Mathematics, 1951.

Highlights of a Survey of June 1951 College Graduates.

Manpower Resources in the Geophysical Sciences.

Manpower Resources in Meteorology, 1951.

Highlights of a Survey of Graduate Student Enrollments, Fellowships and Assistantships, 1954.

Shortages of Scientists and Engineers in Industrial Research.

PROCEEDINGS OF CONFERENCES ON SCIENTIFIC MANPOWER

Since December 1951, the National Science Foundation has sponsored an annual conference on scientific manpower in conjunction with the annual meetings of the American Association for the Advancement of Science. In view of the widespread interest in these meetings a limited number of processed copies of the *Proceedings* have been issued. Copies of *Proceedings* still in print may be obtained upon request from the Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C.

I. Philadelphia, December 1951.

II. St. Louis, December 1952.

III. Boston, December 1953.

IV. Berkeley, December 1954.

SCIENCE INFORMATION EXCHANGE

In connection with its program for exchange of scientific information the National Science Foundation has published or sponsored the publication of material of interest to American scientists and scientific librarians.

List of International and Foreign Scientific and Technical Meetings. Quarterly. May be ordered from Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription price: 75 cents per year, domestic; \$1 per year, foreign. Single copy price: 20 cents.

Bibliography of Translations from Russian Scientific and Technical Literature. Monthly. May be ordered from the Card Division, Library of Congress, Washington 25, D. C. Subscription price: \$3 per year. Single copy price: 25 cents.

Scientific and Technical Serial Publications. United States, 1950-53. Compiled by Library of Congress. May be ordered from Superintendent of Documents, Government Printing Office, Washington 25, D. C. \$1.25.

Scientific and Technical Serial Publications. Soviet Union, 1945-1953. Compiled by Library of Congress. May be ordered from Superintendent of Documents, Government Printing Office, Washington 25, D. C. 60 cents.

Soviet Science. A symposium presented on December 27, 1951, at the Philadelphia meeting of the American Association for the Advancement of Science. May be ordered from American Association for the Advancement of Science, 1515 Massachusetts Avenue NW., Washington 5, D. C. \$1.

GRANTS FOR SCIENTIFIC RESEARCH

A guide for the submission of research proposals and the administration of National Science Foundation research grants.

FELLOWSHIP ANNOUNCEMENT

Annual fall announcement of the National Science Foundation fellowships with instructions for applying.