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Annual Report, 1958

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[2] Resigned February 26, 1958.

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To the

Trustees of The Rockefeller Foundation

Gentlemen:

I have the honor to transmit herewith a general review of the work of The Rockefeller Foundation for the year 1958, together with detailed reports of the Treasurer of the Foundation and of the Directors for Medical Education and Public Health, Biological and Medical Research, Agriculture, the Social Sciences, and the Humanities for the period January 1, 1958 to December 31, 1958.

Respectfully yours,

Dean Rusk
President

A Quarter Century in the Natural Sciences

by WARREN WEAVER

WITH AN INTRODUCTION
BY DEAN RUSK

INTRODUCTION

In January, 1932, Dr. Warren Weaver, then Chairman of the Department of Mathematics of the University of Wisconsin, was elected Director for the Natural Sciences of The Rockefeller Foundation. On July 31, 1959, he reached statutory retirement as the Foundation's Vice-President for the Natural and Medical Sciences. He was invited to reflect upon his extraordinary experience for the benefit of readers of this President's Review; his qualities as a humane citizen scientist and the vantage point of his responsible post suggested that his views would be of lively interest both to professional scientists and to informed citizens. It is a privilege to present Dr. Weaver's "A Quarter Century in the Natural Sciences" in the pages which follow.

Warren Weaver became the Foundation's principal officer in the natural sciences at a crucial moment in its history. In 1929 The Rockefeller Foundation and the Laura Spelman Rockefeller Memorial had been merged; the review of the several Rockefeller boards that led to the merger also resulted in an understanding between the Foundation and the General Education Board that the Foundation would accept responsibility for the support of the natural sciences. It was at this time that the Trustees of the Foundation decided to move beyond their earlier preoccupation with medicine and health and to make significant resources available to the natural sciences, the social sciences, and the humanities.

Shortly thereafter, in 1932-1933, The Rockefeller Foundation elected to center its major scientific effort in the sciences concerned with living things. As a personal participant in the studies and discussions which led to this decision, and as the principal architect of the program which gave it effect, Warren Weaver is peculiarly fitted to tell why it was made and what was done about it. The major emphasis upon the life sciences, which continues to characterize the Foundation's science program, rested upon four considerations. First, these could be expected to add significantly to a better understanding of man himself, whose well-being is a basic charter concern of the Foundation. Second, the life sciences were intimately linked with medicine and public health, the central interests of the Foundation in its opening decades. Third, in the early 1930's the several sciences concerned with living things seemed to be poised for an historical surge forward, with exciting possibilities opening up in all directions. Finally, it seemed at the time that the life sciences were not receiving the public interest and financial support which were warranted by their intellectual promise and by their potential capacity to contribute brilliantly to man's practical needs. The decisions gave The Rockefeller Foundation a modest share in a great adventure which is continuing to unfold.

Warren Weaver is an answer to the fear that a foundation officer is tempted to withdraw into an ivory tower. His duties took him on frequent travels to every continent where his search for Foundation opportunities gave him an extensive and perceptive acquaintance with men and institutions. These duties did not prevent a full share of public service in war and in peace. He has been a President of the American Association for the Advancement of Science, a Director of the National Science Foundation, a Trustee of the Alfred P. Sloan Foundation, chairman of a study panel of the National Academy of Sciences which considered the effect of radiation on human genetics—to name a few of many national and community services. This breadth of interest and experience helps to explain his success in weaving the following account into the broader context of science and society.

Dr. Weaver's manuscript, with characteristic generosity, acknowledged by name the assistance he has had over the years from a great many colleagues, both inside and outside The Rockefeller Foundation. This portion has been omitted, in the confidence that his colleagues would get full satisfaction from his personal review of their joint efforts.

DEAN RUSK

Model showing tentative arrangement of atoms in a molecule of deoxyribonucleic acid (DNA). Since this model was made, it has been found necessary to make certain adjustments in this structure in order to conform with later experimental evidence. (Photograph courtesy Sloan-Kettering Institute for Cancer Research.)

Photograph Excised Here

I. Science and Complexity[1]

The program of The Rockefeller Foundation in the natural sciences, here to be discussed, has been guided by principles which the Trustees approved and adopted in 1933; and there may be some value in reviewing the lines of thinking which led to these principles and the extent to which the developing history of science has indicated that these principles have been justified. In part, however, the program has evolved in response to opportunity, rather than by previous design. It should also be emphasized that the Trustees have never imposed any rigid or self-limiting program, always encouraging the officers to be alert to outstanding opportunities of unusual character.

Before reviewing these principles—which have been periodically evaluated but which have not been importantly altered since 1933—it is desirable to fill in some of the historical background. Therefore the first section of this report will describe, and in part explain, what was the general state of advance of science in 1932.

PROBLEMS OF SIMPLICITY

Speaking roughly, one may say that the seventeenth, eighteenth, and nineteenth centuries formed the period in which physical science learned how to analyze two-variable problems. During that three hundred years, science developed the experimental and analytical techniques for handling problems in which one quantity—say, a gas pressure—depends primarily upon a second quantity—say, the volume of the gas.

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[1] This summary report makes use of a number of statements written previously. Most of these were internal Rockefeller Foundation documents. Section I is a modified form of a paper which formed Chapter I of *The Scientists Speak* (published by Boni & Gaer in 1947), and which, in an abbreviated form, was published in *American Scientist*, Vol. 36, No. 4, Autumn Issue, 1948, p. 536.

The essential character of these problems rests in the fact that, at least under a significant range of circumstances, the first quantity depends wholly upon the second quantity, and not upon a large number of other factors. Or in any event, and to be somewhat more precise, the behavior of the first quantity can be described with a useful degree of accuracy by taking into account only its dependence upon the second quantity, and by neglecting the minor influence of other factors.

These two-variable problems are essentially simple in structure, this simplicity resulting largely from the fact that the theories or the experiments need deal with only two quantities, changes in one of which cause changes in the other. The restriction to two variables, and in most cases to simple relations between the variables and their first and second derivatives, kept the theoretical system well within the then analytical and computational capacity of mathematics. Correspondingly, there could be simplicity in the experimental basis; and simplicity was a necessary condition for progress at that stage of development of science.

It turned out, moreover, that vast progress could be made in the physical sciences by theories and experiments of this essentially simple character. The physicists of this period could analyze how the intensity of light varies with the distance from the source; how the strength of a beam depends upon its dimensions or upon the physical properties of its material; how electric current is related to voltage or resistance, how gravitational attraction depends upon distance; how steam pressure is related to steam temperature; and hundreds of other such things. The resulting knowledge made possible great advances in our understanding and control of nature, great practical advances in technology. It was this kind of two-variable science which laid, over the period up to 1900, the foundations for our theories of light, of sound, of heat, and of electricity. It was this kind of two-variable science—or minor extensions of it to handle three or four variables—which brought us the telephone and the radio, the automobile and the airplane, the phonograph and the moving pictures, the turbine and the Diesel engine and the modern hydroelectric power plant.

The concurrent progress in biology and medicine was also impressive, but was of a different character. The significant problems of living organisms are seldom those in which one can rigidly maintain constant all but two variables. Living things are more likely to present situations in which a half-dozen, or even several dozen, quantities are all varying simultaneously and in subtly interconnected ways. And often they present situations in which some of the essentially important quantities are either non-quantitative, or have at any rate eluded identification or measurement up to the moment. Thus these biological and medical problems often involve the consideration of a most complicatedly organized whole.

Between the living world and the physical world, moreover, there is a critical distinction as regards dissectability. A watch spring can be taken out of a watch and its properties usefully studied apart from its normal setting. But if a heart be taken out of a live animal, then there is a great limitation on the range of useful studies which can be made.

It is not surprising that up to 1900 the life sciences were largely concerned with the necessary preliminary stages in the application of the scientific method—preliminary stages which involve collection, description, classification, and the observation of concurrent and apparently correlated effects. They had only made the brave beginnings of quantitative theories, and hardly even begun detailed explanations of the physical and chemical mechanisms underlying or making up biological events.

To sum up, physical science before 1900 was largely concerned with two-variable *problems of simplicity;* while the life sciences, in which these problems of simplicity are not so often significant, had not yet become highly quantitative or analytical in character.

PROBLEMS OF DISORGANIZED COMPLEXITY

Subsequent to 1900—and actually earlier, if we remember heroic pioneers such as Josiah Willard Gibbs—the physical sciences developed an attack on nature of an essentially and dramatically new kind. Rather than study problems which involved two variables or at most three or four, some imaginative minds went to the other extreme, and said: "Let us develop analytical methods which can deal with two billion variables." That is to say, the physical scientists (with the mathematicians often in the vanguard) developed powerful techniques of probability theory and of statistical mechanics which can deal with what we may call problems of *disorganized complexity.*

This last phrase calls for explanation. Consider first a simple illustration in order to get the flavor of the idea. The classical dynamics of the nineteenth century was well suited for analyzing and predicting the motion of a single ivory ball as it moves about on a billiard table. In fact, the relationship between positions of the ball and the times at which it reaches these positions forms a typical nineteenth-century problem of simplicity. One can, but with a surprising increase in difficulty, analyze the motion of two or even of three balls on a billiard table. There has been, in fact, considerable study of the mechanics of the standard game of billiards. But as soon as one tries to analyze the motion of ten or fifteen balls on the table at once, as in pool, the problem becomes unmanageable, not because there is any theoretical difficulty, but just because the actual labor of dealing in specific detail with so many variables turns out to be impracticable.

Imagine, however, a large billiard table with millions of balls flying about on its surface, colliding with one another and with the side rails. The great surprise is that the problem now becomes easier: the methods of statistical mechanics are now applicable. One cannot trace the detailed history of one special ball, to be sure; but there can be answered with useful precision such important questions as: On the average how many balls per second hit a given stretch of rail? On the average how far does a ball move before it is hit by some other ball? On the average how many impacts per second does a ball experience?

Two paragraphs back it was stated that the new statistical methods were applicable to problems of disorganized complexity. How does the word "disorganized" apply to the large billiard table with the many balls? It applies because the balls are distributed, in their positions and motions, in a helter-skelter—that is to say, a disorganized—way. For example, the statistical methods would not apply if someone were to arrange the balls in a row parallel to one side rail of the table, and then start them all moving in precisely parallel paths perpendicular to the row in which they stand. Then the balls would never collide with each other nor with the end rails; and one would not have a situation of disorganized complexity.

We can see, from this illustration, what is meant by a problem of disorganized complexity. It is a problem in which the number of variables is very large, and one in which each of the many variables has a behavior which is individually erratic, and may be totally unknown. But in spite of this helter-skelter or unknown behavior of all the individual variables, the system as a whole possesses certain orderly and analyzable average properties.

A wide range of experience comes under this label of disorganized complexity. The method applies with increasing precision when the number of variables increases. It applies with entirely useful precision to the experience of a large telephone exchange, predicting the average frequency of calls, the probability of overlapping calls of the same number, etc. It makes possible the financial stability of a life insurance company. Although the company can have no knowledge whatsoever concerning the approaching death of any one individual, it has dependable knowledge of the average frequency with which deaths will occur.

This last point is interesting and important. Statistical techniques are not restricted to situations where the scientific theory of the individual events is very well known—as in the billiard example where there is a beautifully precise theory for the impact of one ball on another. This technique can also be applied to situations—like the insurance example—where the individual event is as shrouded in mystery as is the chain of complicated and unpredictable events which leads to the accidental death of a healthy man.

The examples of the telephone and insurance companies will suggest a whole array of practical applications of such statistical techniques. But they are in a sense unfortunate examples, for they tend to draw attention away from the more fundamental use which science makes of these new techniques. The motions of the atoms which form all matter, as well as the motions of the stars which form the universe, all come under the range of these new techniques. The fundamental laws of heredity are analyzed by them. The laws of thermodynamics, which describe basic and inevitable tendencies of all physical systems, are derived from statistical considerations. The whole structure of modern physics, our present concept of the nature of the physical universe and of the accessible experimental facts concerning it, rests on these statistical concepts. Indeed, the whole question of evidence, and the way in which knowledge can be inferred from evidence, is now recognized to depend on these same ideas. During the last years we have also come to realize that communication theory and information theory are similarly based upon statistical ideas. One is thus bound to say that probability notions are essential to any theory of knowledge itself.

PROBLEMS OF ORGANIZED COMPLEXITY

And yet this statistical method of dealing with disorganized complexity, so powerful an advance over the earlier two-variable methods, leaves a great field untouched. One is tempted to oversimplify and say that scientific methodology went from one extreme to the other—from two variables to an astronomical number—and left untouched a great middle region. The importance of this middle region, moreover, does not depend primarily on the fact that the number of variables involved is moderate—large compared to two, but small compared to the number of atoms in a pinch of salt. The problems in this middle region will, in fact, often involve a considerable number of variables; but much more important than the mere number of variables is the fact that these variables are all interrelated. That is to say, the really important characteristic of the problems of this middle region which science has as yet little explored or conquered lies in the fact that these problems, as contrasted with the disorganized situations with which statistics can cope, *show the essential feature of organization.* We will therefore refer to this group of problems as those of *organized complexity.*

What makes an evening primrose open when it does? Why does salt water fail to satisfy thirst? Why is one chemical substance a poison when another, whose molecules have just the same atoms but assembled into a mirror-image pattern, is completely nontoxic? Why does the amount of manganese in the diet affect the maternal instinct of an animal? What is the description of aging in biochemical terms? What meaning is to be assigned to the question: Is a virus a living organism? What is a gene, and how does the original genetic constitution of a living organism express itself in the developed characteristics of the adult? What happens when previously normal cells suddenly start the uncontrolled growth we call cancer? Why can a salamander regenerate an amputated limb, whereas a man cannot? How does the DNA molecule reproduce itself, and just how does it store genetic information?

All these are certainly complex problems. But they are not problems of disorganized complexity, to which statistical methods hold the key. They are all problems which involve dealing simultaneously with a *sizeable number of factors which are interrelated into an organic whole*. They are all, in the language here proposed, problems of organized complexity.

On what does the price of wheat depend? This too is a problem of organized complexity. A very substantial number of relevant variables is involved here, and they are all interrelated in complicated but nevertheless not in helter-skelter fashion.

How can we compare the social costs and the social gains to be expected from the continuation of atomic weapon testing? What are the total biological dangers involved in man's exposure to all sorts of radiations?

How can currency be wisely and effectively stabilized? To what extent is it safe to depend on the free interplay of such economic forces as supply and demand? Or to what extent must we employ systems of economic control to prevent the wide swings from prosperity to depression? These are also obviously complex problems, and they too involve analyzing systems which are organic wholes, with their parts all in close interrelation.

How can we explain the behavior pattern of an organized group of persons such as a labor union, or a group of manufacturers, or a racial minority? There are clearly many factors involved here, but it is equally obvious that here also we need something more than the mathematics of averages. Indeed if we only could, in the biological field, begin to learn how to deal with problems of organized complexity, then there might be opportunities to extend these new techniques, if only by helpful analogy, into vast areas of the behavioral and social sciences.

By the early thirties it was clear that science had generally effective tools and techniques for dealing with problems of simplicity, and problems of disorganized complexity. Advances falling under these broad categories continued to be highly important and highly desirable; but there was every basis for expecting that these advances would occur without the stimulation of special or additional financial support. Speaking in very broad terms, this meant that man's conquest of physical nature—so large a part of which comes under the two categories just stated—was certain to move forward and in fact with increasing momentum. But was the time ripe for stimulating advances in the more complex, more difficult, and in many ways more critical areas which, although involving many dissectable problems of the two simpler sorts, essentially involved problems of organized complexity? Was the time ripe for an accelerated and deeper attack upon the life sciences?

II. The 1933 Decision

BACKGROUND

Part I has sketched in very general terms the longer-range background for the situation in which science found itself a quarter of a century ago. But in addition to these external influences there was, within the structure of the various Rockefeller boards, an internal history of interest and activity which also affected the decisions which were made concerning the program of The Rockefeller Foundation in science.

Three Rockefeller philanthropic agencies[1] have been closely associated in the financial support of science—the General Education Board, the International Education Board, and The Rockefeller Foundation. Although these three agencies were legally distinct, each with its own financing, there has been heavy overlapping of major officer personnel. Thus Dr. Wickliffe Rose was President of both the General Education Board and the International Education Board from 1923 to 1928; since 1929 the President of The Rockefeller Foundation has regularly also been the President of the General Education Board; and for several years after 1932, all of the other principal officers of The Rockefeller Foundation had corresponding appointments in the General Education Board. Thus an evaluation of the situation requires an examination of all three of these closely related Boards.

The earliest of the Rockefeller fund-granting agencies was the General Education Board, founded in 1903. Free to involve itself in essentially any aspect of education or re-

[1] The Rockefeller Institute, organized in 1901 as the Rockefeller Institute for Medical Research, is an entirely separate organization, with its own endowment, and with no overlapping at the scientific officer level with the fund-granting Rockefeller Boards.

search, it was geographically restricted to grants within the United States; and, as a matter of policy, it placed primary emphasis upon educational advances, in both Negro and white schools, colleges, and universities, in the historic "south," i.e., the southeastern portion of the United States.

When The Rockefeller Foundation was organized in 1913, it was to a considerable extent an outgrowth of the Rockefeller Sanitary Commission which had been started four years earlier; and as a result of this initial orientation, the activities of The Rockefeller Foundation were, for many years thereafter, largely concentrated in the fields of public health and medicine.

The International Education Board, founded in 1923, was to a large extent the intellectual creation of Dr. Wickliffe Rose. When in 1923, he was made President of the General Education Board, it seemed to him natural to plead for the creation of a similar agency which would be free to work anywhere in the world.

There are thus three organizations which, in their activities prior to 1932, formed the background of Rockefeller philanthropic board experience in the natural sciences, these three being, in order of their founding, the General Education Board, The Rockefeller Foundation, and the International Education Board. The natural science history, up to 1932, of each of these will now be very briefly summarized.

THE NATURAL SCIENCES IN THE GENERAL EDUCATION BOARD

The General Education Board, from its founding in 1902 through the year 1956 (by which time this Board, although still in existence, was in a relatively inactive terminal phase), appropriated a grand total of nearly 280 million dollars for various aspects of education in the United States, nearly 60 million of this going to Negro institutions.

This Board further appropriated nearly 26 million for projects or activities aimed at advancing the science and art of education; and appropriated nearly 6 million dollars for other projects, including a southern fellowship-scholarship program, agricultural extension work, etc.

The numerous large general grants to institutions, often made for buildings or endowment, involved a very considerable amount of educational aid to science. Beginning in 1924, however, the General Education Board began to recognize a more explicit interest in the support of research in scientific fields. The October, 1924, meeting of the Board of Trustees of the General Education Board, for example, contained the statement:

> Convinced that on the whole the progress of civilization coincides with the increase of accurate knowledge and the spread of the objective and dispassionate spirit of scientific inquiry, the Board is now definitely undertaking to co-operate in the improvement in the United States of conditions favorable to the development of the physical and biological sciences.

And in the Annual Report of the General Education Board for 1925-1926 it was stated that:

> The increase of knowledge upon which human welfare depends comes largely from the laboratories dealing in the most fundamental fashion with the physical and biological sciences. In cultivating these, universities make therefore a notable contribution not only to knowledge, as such, but to the art of living.

Thus, the period during which the General Education Board was actively and explicitly concerned with the natural sciences was from 1924 to 1929; for at the latter of these two dates, and in connection with the general reorganization, the science interests of the General Education Board were transferred to The Rockefeller Foundation.

Fig. 1

NATURAL SCIENCE APPROPRIATIONS OF THE GENERAL EDUCATION BOARD – 1924-1929

Total — $12,158,500

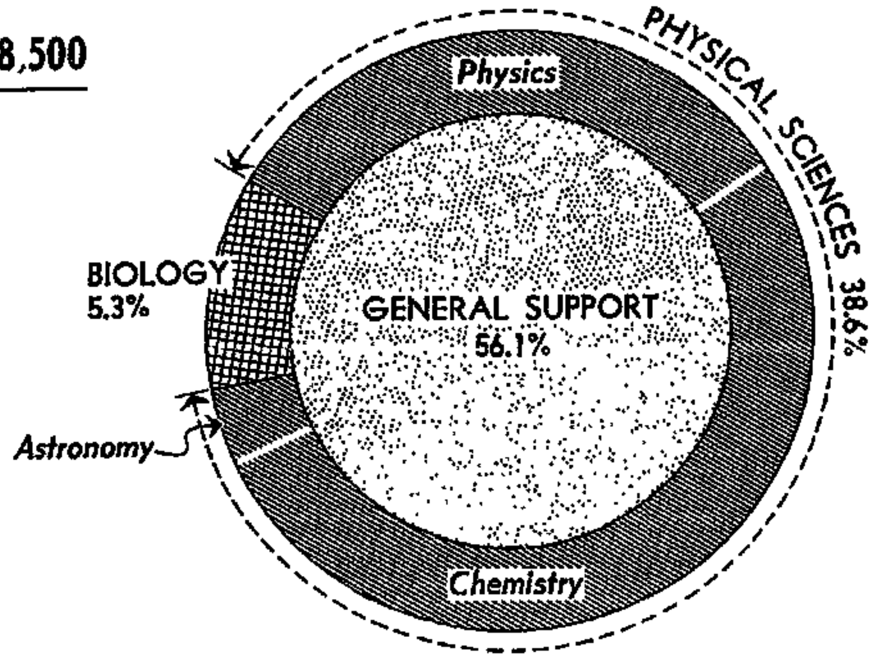


Figure 1 summarizes the natural science appropriations of the General Education Board over this 1924-1929 period. This chart by no means indicates the total contribution of the General Education Board to science *education*; and it should be remembered that the General Education Board gave very large support, totaling nearly 100 million dollars, to medical science and medical education. But the chart does at least approximately show the contributions explicitly in support of scientific research in the natural sciences.

PRE-1932 NATURAL SCIENCE IN THE ROCKEFELLER FOUNDATION

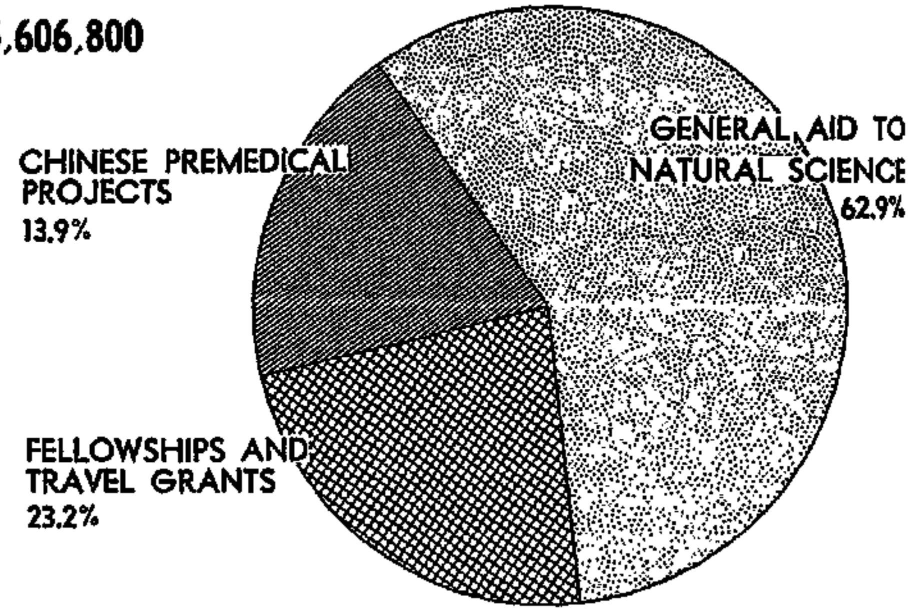
Turning now to the pre-1932 record of The Rockefeller Foundation in the natural sciences, the financial facts are roughly summarized in Figure 2.

The item "Chinese Premedical Projects" deserves a word of explanation. In connection with the plan for the development of a great medical school in the Far East—the

Fig. 2

NATURAL SCIENCE APPROPRIATIONS OF THE ROCKEFELLER FOUNDATION — 1913-1932

Total — $15,606,800



Peking Union Medical College—it was early realized that this institution would be greatly handicapped unless steps were taken to improve the facilities for the premedical training of Chinese students in the natural science departments of their own universities and colleges. Accordingly a series of grants was made for this purpose.

Over half of the large item labeled "General" in Figure 2 represents funds to institutions for the constructing and equipping of science laboratories, and for maintenance or endowment of scientific research. A large part was unassigned as to specific scientific fields; but marine biology and oceanography received over three million dollars.

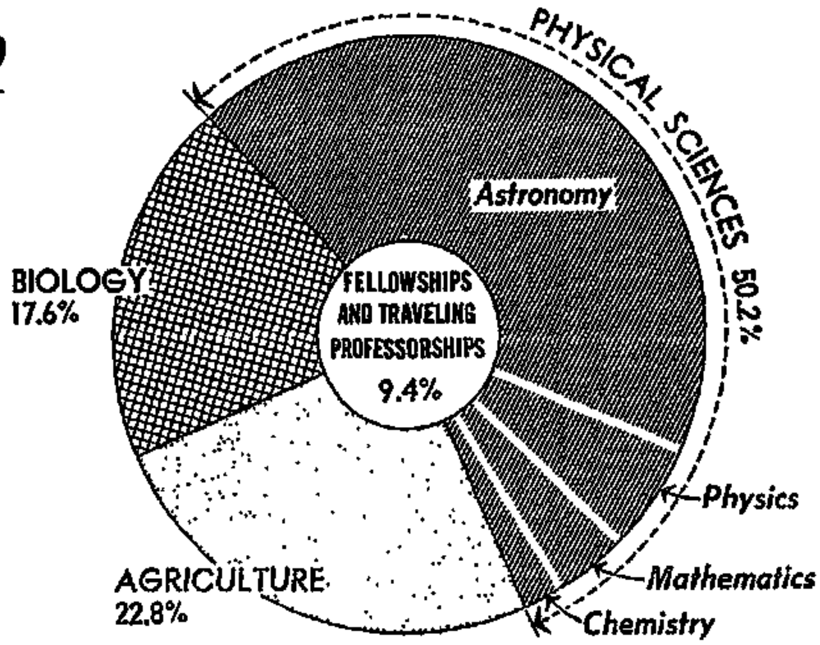
THE NATURAL SCIENCES IN THE INTERNATIONAL EDUCATION BOARD

The International Education Board was founded by Mr. John D. Rockefeller, Jr., and appropriated, during its active period, a total of nearly 28 million dollars, of which

Fig. 3

NATURAL SCIENCE APPROPRIATIONS OF THE INTERNATIONAL EDUCATION BOARD

Total — $16,050,059



over 16 million was devoted to natural science and agriculture. The distribution is indicated in Figure 3.

These grants were made, with trivial exceptions, in Europe and North America. The large items were six million dollars to the California Institute of Technology for the 200-inch telescope; nearly three million to Cambridge University toward the cost of laboratories of agriculture, botany, physiology, and zoology; and two million to Harvard for a biology building.

SUMMARY: NATURAL SCIENCES IN ROCKEFELLER BOARDS PRIOR TO 1932

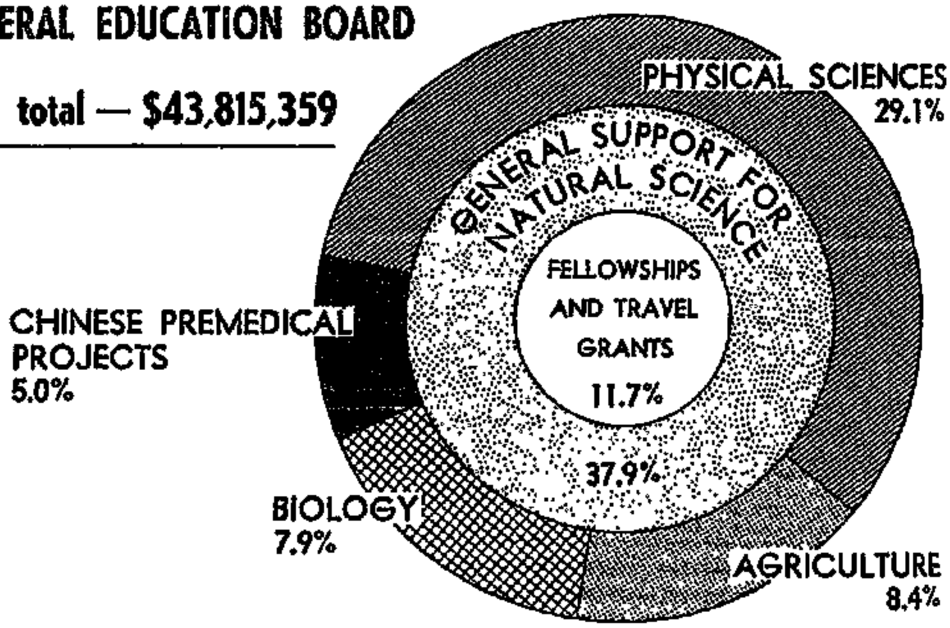
By combining the three figures, it is possible to indicate in crude terms[1] the financial character and amount of sup-

[1] The major error is the artificial emphasis here on "natural science" to the exclusion of the very great support given by these agencies to the medical sciences, and the fact that this latter support involved large aid to the preclinical sciences.

Fig. 4

DISTRIBUTION OF TOTAL APPROPRIATIONS FOR THE NATURAL SCIENCES GRANTED PRIOR TO 1932 BY THE ROCKEFELLER FOUNDATION, THE INTERNATIONAL EDUCATION BOARD, AND THE GENERAL EDUCATION BOARD

Combined total — $43,815,359



port for the natural sciences which the various Rockefeller philanthropic boards had given prior to the adoption in 1933 of the then new program in experimental biology. This over-all summary is given in Figure 4.

The over-all summary of the total aid to the natural sciences, prior to 1932, given by The Rockefeller Foundation and its two close associates, the General Education Board and the International Education Board, indicates several basic points:

All during this period substantial emphasis was placed upon broadening and deepening the training and experience of individual scientists through fellowships and grants for travel. This segment of program is placed, in the charts, at the center; for this type of aid has always been viewed by The Rockefeller Foundation as an essential core of program.

Prior to 1932 a substantial proportion—nearly 40 per cent—of the aid to the natural sciences was broad in character. This was often for buildings or general endowment for science.

A substantial amount of aid was closely related to the development of medical education in the Far East.

Of the aid which was specified as to field, the physical sciences received nearly four times the amount given for the biological sciences.

It may be interesting to note that of this total support of nearly 44 million dollars for the natural sciences, just about 70 per cent was spent within the United States, and the remaining 30 per cent outside the United States, primarily in western Europe and China.

REORGANIZATION, AND THE 1933 PROGRAM

As these summaries indicate, the various Rockefeller philanthropic boards, set up to meet rather specific problems, had developed somewhat complex and partly overlapping interrelationships; and in 1928 it was decided to consolidate and unify. For formal legal reasons it was not feasible to concentrate into a single organization; the result was a pair of philanthropic agencies, one of which, the General Education Board, continued its traditional emphasis on education in the southeastern part of the United States, whereas the other, The Rockefeller Foundation, was geographically unlimited in scope and was internally formed of five Divisions. One of these, the International Health Division, did occasionally make grants to other organizations, but it was primarily an operating agency with an extensive scientific staff of its own, which carried on in various parts of the world the traditional activities, which originated in 1909 with the Rockefeller Sanitary Commission, of research and field programs in such widespread diseases as hookworm, malaria, yellow fever, typhus, influenza, tuberculosis, rabies, etc. The other four Divisions, which were granting agencies rather than operating agencies, were the Divisions of Humanities, of Social Sciences, of Medical Sciences, and of Natural Sciences. This latter name referred broadly to anything that was "science" and was not "medicine." It potentially included the main classical fields of physics, chemistry, biology, and mathematics, as well as such disciplines as astronomy, meteorology, geology, biochemistry, and many others.

Thus after the consolidation of 1928 the newly created Division of Natural Sciences was faced with the problem of deciding how "the well-being of mankind throughout the world" could most effectively be served through support for science. The amount then available annually for the science division—roughly two million dollars a year—was substantial; but it was so small compared to the world-wide opportunities in all fields that it was clearly necessary to decide upon choices of emphasis and limitations as to types of support.

The central decision was closely connected with—indeed really rested upon—the view concerning the general progress of scientific development which is stated in Part I above. For reasons which this description should make clear, the basic point was, to quote from a memorandum which the Trustees considered early in 1933, that "our understanding and control of inanimate forces has outrun our understanding and control of animate forces." This indicated the desirability of placing major emphasis upon research directed toward living nature rather than toward physical nature.

But what was proposed was not at all a disregard of the physical sciences, and did not mean a restricted emphasis upon classical biology. Rather was it proposed that the Foundation's resources be used to encourage the application of the whole range of scientific tools and techniques, and specially those which had been so superbly developed in the physical sciences, to the problems of living matter.

Indeed, in an attempt to make clear that much more than traditional biology was to be involved, this was originally designated as a program in "Vital Processes." But since this name proved to be confusing rather than helpful, the program was later referred to as "Experimental Biology," although this latter name is itself misleading unless very broadly interpreted.

Throughout this report the phrase "Experimental Biology Program" will be used to designate the entire program, in the natural sciences, which was adopted in 1933 and has been followed ever since. This Experimental Biology Program, in addition to the primary emphasis on biological problems, also includes a certain amount of general support for science, support for certain exceptional items, and eventually support for agriculture. The phrase "experimental biology" will uniformly be used in this report to refer to that specific part of the total natural sciences program which places primary emphasis on biological problems.

The new interest in experimental biology involved, of course, such standard disciplines as physiology, genetics, embryology, developmental mechanics, cellular biology, ecology, experimental histology, etc. It involved heavy emphasis on all aspects of biochemistry and the various activities subsumed under the more vague term biophysics. There was a substantial interest in the organic chemistry of natural products, and in the physical chemistry of the macromolecules of biological importance. It also involved the stimulation of the interest of physicists and mathematicians in basic problems of biology, and specially involved application of the powerful and precise instrumentation, largely arising in the physical sciences, to the exploration of the phenomena of living systems.

This is not an appropriate place for details, but the character of the science program adopted in 1933 would be misjudged if it were not here stated that, in addition to the major emphasis just described, a broader base was provided by a moderate amount of assistance for general assistance to science departments and even to the science research programs of entire institutions; by a substantial amount of general fellowship support; and by a continuing readiness to consider very exceptional opportunities, regardless of their formal relationship to program.

There is perhaps some interest, in looking back over the eventful intervening years, in considering certain of the statements of general principles which formed part of the program statement of 1933:

> A highly selective procedure is necessary if the available funds are not to lose significance through scattering. In the past, this selection has consisted chiefly of a choice of scientific leaders, among both men and institutions, although there has always been some selection on the basis of fields of interest. It is proposed, for the future program, that interest in the fields play the dominant role in the selection process. Within the fields of interest, selection will continue to be made of leading men and institutions.
>
> In general, this narrowing of purpose in the specialized program should result in greater emphasis on the biological and related fields, and especially in greater emphasis on the study of man himself.

However, there was no intent to insist upon rigid and exclusive emphasis on one aspect of science, however broad:

> No person or group of persons is sufficiently wise to specify, even for a short time, all desirable features of a program. A small provision should be made in the budget of the program to care for unpredictable but unquestionable opportunities.
>
> The program should always be kept flexible, so that it can be continuously modified to best serve the welfare of mankind.
>
> The immediate and underlying values in science justify a continuation of general support to the development of science.

There was some anticipation at that time of certain of the problems which have so clearly faced us in the post-World War II period:

> The basic development of science in relatively backward regions such as China, southeastern Europe, and possibly South America, is a necessary factor in intellectual emancipation and in social, political, and economic progress.

These quotations are all taken from program memoranda written in 1932. Some years after that, the following restatement was made of the objectives of the program:

> The century of biology upon which we are now well embarked is no matter of trivialities. It is a movement of really heroic dimensions, one of the great episodes in man's intellectual history. The scientists who are carrying the movement forward talk in terms of nucleoproteins, of ultracentrifuges, of biochemical genetics, of electrophoresis, of the electron microscope, of molecular morphology, of radioactive isotopes. But do not be misled by these horrendous terms, and above all do not be fooled into thinking this is mere gadgetry. This is the dependable way to seek a solution of the cancer and polio problems, the problems of rheumatism and of the heart. This is the knowledge on which we must base our solution of the population and food problems. This is the understanding of life.

III. The Financial Record

FINANCIAL SUMMARY: 1932 to 1959

This report is primarily intended as a summary of The Rockefeller Foundation activities, since 1932, in the Program in Experimental Biology. But this statement is also, at least to a minor extent, a more personal document which includes all of the activities, wherever in The Rockefeller Foundation, for which the writer has had administrative responsibility.

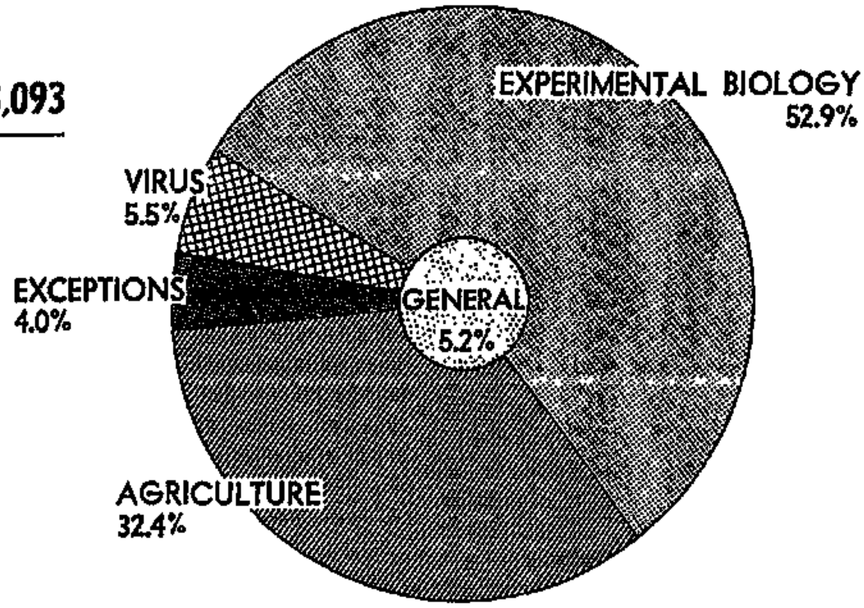
A report of this sort necessarily is handicapped by the universal difficulties of classification. Where does—where can—one draw a useful line between research in biology and research in the preclinical medical subjects, or for that matter, clinical research and field activities in public health? The answer, of course, is that such distinctions are arbitrary and misleading.

Over the period covered here, The Rockefeller Foundation appropriated over 134 million dollars in the general area of medical research, medical education, and public health. A substantial part of the activity represented by this large sum is related—and often closely related—to the general area of experimental biology which is the subject of this report. Much of this medical effort contributed a background of knowledge, of physical resource, and of personnel which was essential for the advances in the more specifically "biological" areas. Of the total sum just mentioned, nearly 17 million dollars have been appropriated during recent years in response to recommendations made by a part of our total organization which, as a formal matter, reports to the author of this report. These "medical" appropriations, however, are not included within or covered by this report, since this would involve including here a small,

Fig. 5

APPROPRIATIONS IN THE EXPERIMENTAL BIOLOGY PROGRAM — 1932-1959

Total — $88,348,093



and except for the time period involved, an arbitrary portion of the total Rockefeller Foundation effort in public health and medical education, and would arbitrarily assign that portion to the Experimental Biology Program.

The financial facts of the Experimental Biology Program—which constitute a necessary skeleton but which by no means form the really important features—can usefully be summarized in three sets of terms: to what scientific fields did the money apply; in what geographic areas was it spent; and specifically how was the money used (for fellowships, research grants, buildings, endowment, field operations, etc.)?

With respect to the first of these three aspects of distribution, the twenty-seven year totals, January 1, 1932, to January 1, 1959, are indicated by Figure 5.

It must be remembered that agriculture has been an active interest for only the last seventeen of the twenty-seven years covered by the chart; and the operating program in virus research for only four of the twenty-seven years. Thus Figure 5 does not reflect the present emphasis on those fields. The present emphasis is better indicated by the fact that for the year 1957 the total appropriations in Biological and Medical Research and Agriculture were distributed about as follows:

TABLE I

Present Relative Emphasis, in Biological and Medical Research, and in Agriculture, on Field Operations as compared with other major activities.

Biological and Medical Research	
Field Operations in Virus Program	26%
Research Grants	26
Fellowships and Grants in Aid	19
General	29
	100%
Agriculture	
Field Operations in Agriculture	38%
Research Grants	41
Fellowships and Grants in Aid	18
General	3
	100%

The classifications used in Figure 5 overlap, so that it should not be interpreted too precisely. For example, a substantial amount of the money classified as devoted to "Agriculture" and to "Virus" supported work which is certainly modern "Experimental Biology." To illustrate other puzzling problems of classification, if a grant was made in support of mathematical journals in the United States, this has been listed as an *exception to program*. But grants made to the Royal Society in England to assist in the publication of a wide variety of scientific journals have been classified as *general*. These decisions are by no means automatic, and if all of the hundreds of individual actions were reclassified by someone else, this would undoubtedly shift several or even many items; but the general impressions of relative emphasis would not be substantially changed.

As to the major sum of $48,947,152 which was devoted within the Experimental Biology Program to experimental biology itself, the distribution among the various disciplines is indicated in Figure 6.

This chart gives a breakdown of the Experimental Biology sector of the previous Figure 5 and thus does not include any of the projects classified under Agriculture and Virus Research.

The chart clearly indicates the heavy emphasis on the interrelationships of biology and chemistry; and the emphasis, within the more classical divisions of biology, on genetics and physiology. Sector 6, Microbiology, would of course be very much larger were grants made in the virus program included in the figure.

The distribution of the grants relative to mechanisms of use is indicated in Figure 7.

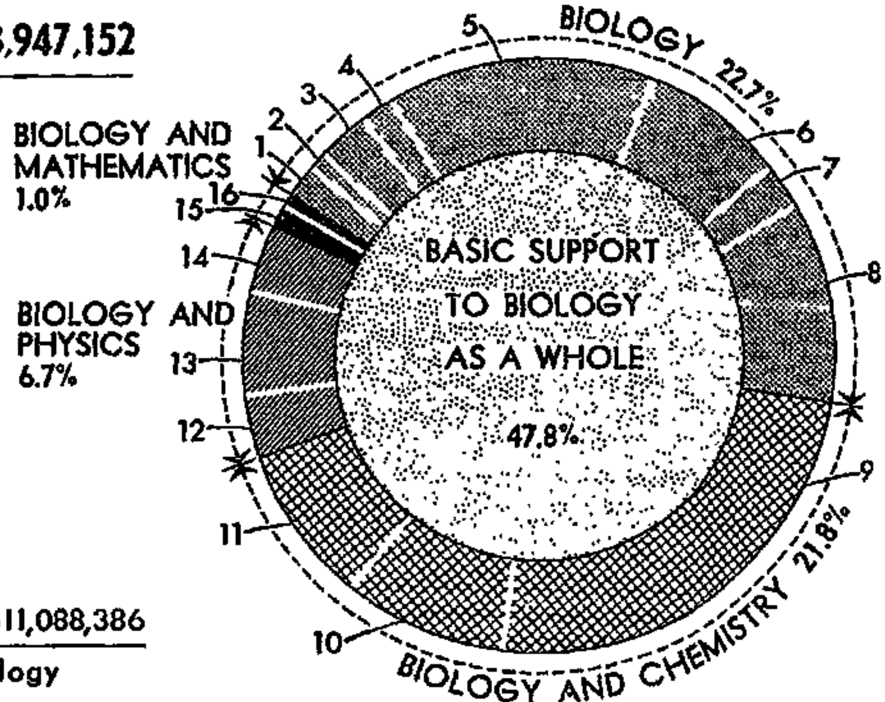
As the chart indicates, a great proportion of the support (62.5 per cent) was devoted directly to aiding the research of scientists in the university and other laboratories of the world; over 13.5 per cent was used for the training of personnel; 16.4 per cent was used in the field operations carried out by the Foundation's own staff in agriculture and virus research; and relatively small proportions (4 per cent and 3.6 per cent) went for endowment or buildings.

Fig. 6

SUPPORT FOR VARIOUS FIELDS OF BIOLOGY

EXPERIMENTAL BIOLOGY PROGRAM – 1932-1959

Total — $48,947,152



BIOLOGY $11,088,386

1 Cytology
2 Ecology
3 Embryology
4 Histology
5 Genetics
6 Microbiology
7 Molecular biology
8 Physiology

BIOLOGY AND CHEMISTRY $10,677,195

9 Biochemistry
10 Organic chemistry
11 Physical chemistry

BIOLOGY AND PHYSICS $3,260,595

12 Radiation biology
13 Structure studies
14 Instrumentation

BIOLOGY AND MATHEMATICS $485,650

15 Mathematical biophysics
16 Statistics

BASIC SUPPORT $23,435,326

The geographical distribution of the grants is indicated in Figure 8, where the category of "International" is used for grants, such as fellowships, travel grants, support of internationally available scientific literature, support for international meetings, etc., to which a specific geographical location cannot be sensibly assigned.

Fig. 7

MECHANISMS OF USE OF THE APPROPRIATIONS IN THE EXPERIMENTAL BIOLOGY PROGRAM - 1932-1959

Total — $88,348,093

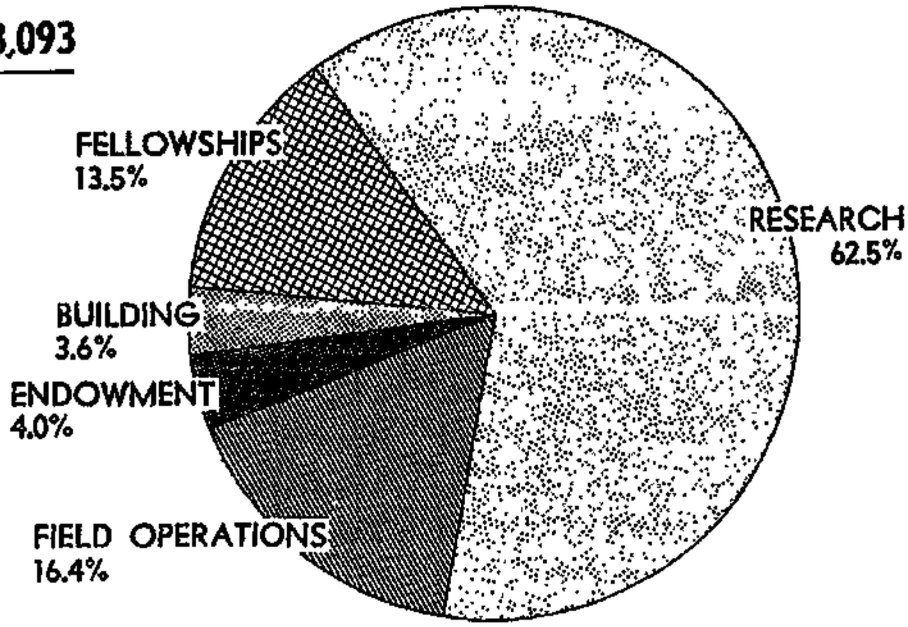
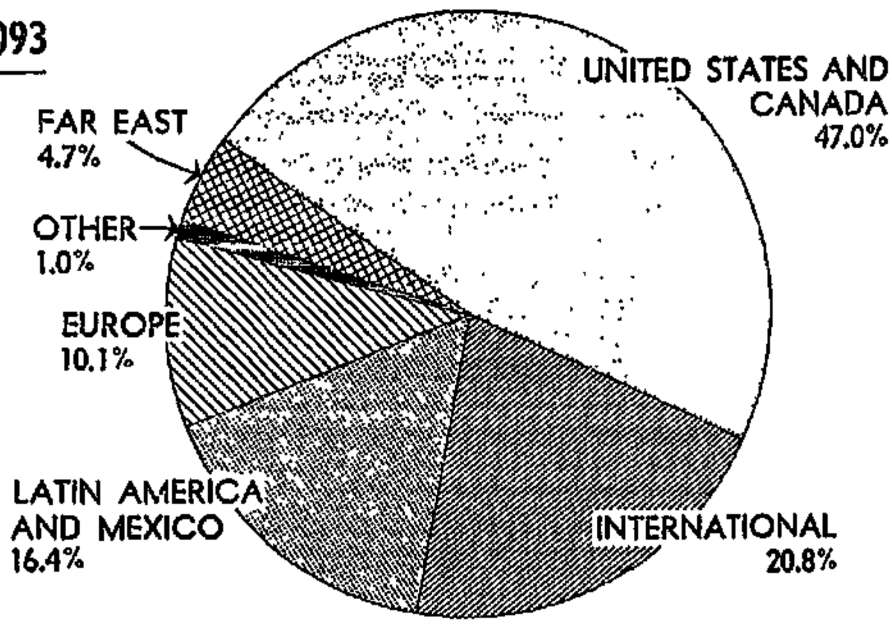


Fig. 8

GEOGRAPHICAL DISTRIBUTION OF THE APPROPRIATIONS IN THE EXPERIMENTAL BIOLOGY PROGRAM 1932-1959

Total — $88,348,093



In connection with the geographical distribution shown in Figure 8 several points should be noted. The expenditures in Latin America and Mexico did not effectively begin until about 1942, while the figure gives the average distribution over a period which begins ten years earlier. Hence the present emphasis on that region is larger than the chart indicates.

The expenditures in the Far East were relatively heavy from 1932 to 1937, reflecting earlier Foundation interest in developing medical education in China. Expenditures in that area were then very low until about 1950 when activities were renewed, particularly in Japan, in biological and medical research and in agriculture. The proportion of expenditure in the United States is, at the present time, less than the figure indicates as the average over the period 1932-1959. Since the close of World War II large sums of money have become available for research in the United States. Although the emphasis, due largely to the interest in nuclear physics and to defense considerations, continues to favor the physical sciences, nevertheless large aid for biology has become available from the National Institutes of Health, the National Science Foundation, the Atomic Energy Commission, the research organizations of the armed services, and the various agencies concerned with major diseases. Thus The Rockefeller Foundation has, during the recent years, curtailed certain aspects of its biology program in the United States.

IV. Progress in Biology

THREE DISCLAIMERS

What has been accomplished with this money? Did science advance, because of this aid, in a way otherwise not possible? Has this contributed to the "well-being of mankind throughout the world"?

These questions are, in every strict sense, unanswerable. Each grant to aid research is an experiment without a control, in that one can never know what would have happened if the grant had not been made. Furthermore the money given by a foundation to scientists in other institutions is, in practically all circumstances, only a part, and often a small part, of the total support necessary. Most important of all, this money is brought to useful life by the brains and energy of the scientists themselves.

A substantial part of the total sum involved, as Figure 7 indicates, was expended for operations, in agriculture and in virus research, by members of The Rockefeller Foundation's own staff. For this activity we must accept a greater share of the full responsibility, but even in this work a large part of whatever success has been achieved is due to the enthusiastic and able collaboration of the local scientists and officials of the various countries in which these field operations have occurred.

Thus any attempt to measure in a formal or quantitative way what this support has accomplished is foolish, and indeed is improper to attempt. We will, later, look at a few specific aspects of The Rockefeller Foundation activities over the period under review; but before that is done it may be illuminating to describe certain characteristic movements which have taken place, chiefly over the past two decades, in modern quantitative biology. For the most that we can hope is that we have been some useful part of a general movement, and that this movement itself is a significant one.

If The Rockefeller Foundation disclaims any credit for scientific progress with which it has been associated in a very modest and partial way, still more is it true that credit—if any be in fact due—for the administrative management of this Foundation program must be given to a large group of persons. One of the great assets of The Rockefeller Foundation is that its policies and procedures, and particularly the trustee-officer relationships, make it possible to attract good individuals to its own staff. The science activities over the period here under review have been served by a total of 36 officers, plus staff scientists numbering 78 who have been involved in the operating programs, widely spread over the world, in agriculture and virus research. These are the persons who have really "run" the program.

Recognition is also richly due to the very numerous other individuals—indispensable secretaries, members of service departments, clerical help of all kinds—who make the whole operation possible. In some cases, notably the whole natural science program in Latin America, the entire agricultural program, and the total natural science activity in Europe since World War II, it has been one single individual who, because of devoted, long-continued, and efficient service, deserves a very large share of whatever credit is due.

Still another disclaimer is in order. The author of this report was trained in the physical sciences. A little biology must have rubbed off onto him during the contacts of all the years here being reported; but the fact remains that he never had the experience of doing biological work himself, of sensing through firsthand experimental experience the nature of biological material. This is a real handicap, and he would not want to appear to claim that he had overcome it.

This prejudice of authorship produces, almost surely, an overenthusiasm for those aspects of biological research that yield especially well to quantitative and precise measurement and to strict analysis. This makes it hard to be very excited over, say, systematics, even though one realizes the necessity for the collection and ordering of all these items of fact about nature. To the extent that these items of fact are fitted into a great conceptual scheme—such as evolution—then to that extent any scientist, of whatever background, must applaud and bow.

The author recognizes the lack of true balance in the topics about to receive treatment in this section. There is too little of the sense of the mystery, the beauty, and the grandeur of living nature which one experiences so richly in reading the wonderful book[1] which George Gaylord Simpson and two colleagues have recently written. There may well be too much emphasis on chemistry and physics and mathematics, and too little recognition of what George Wald has called the deep truths of biology. In a superb article on "Innovation in Biology,"[2] this scientist has emphasized that a true biologist always must ask three questions about any phenomenon in living organisms: How does it work (mechanism); what does it do for the organism (adaptation); how did it come about (evolution)? The emphasis of the present report seems to rest heavily on the first of these three and that is a weakness. Professor Wald closes his article with the words, "Indeed many of them [i.e. biologists] hold that the task of biology is to 'reduce' its phenomena to the level of chemistry and physics. . . . We can afford to wait; though I am sure that no amount

[1] *Life—An Introduction to Biology*, by George Gaylord Simpson, Colin S. Pittendrigh, and Lewis F. Tiffany, Harcourt Brace and Company, New York, 1957.

[2] *Scientific American*, Vol. 199, No. 3, September, 1958, p. 100.

of waiting will 'reduce' the most characteristic problems of biology to present-day chemistry and physics. If biology ever is 'reduced' to chemistry and physics, it will be only because the latter have grown up to biology. At that point it will be hard to say which is which."

Professor Wald, in the combination of the exquisite precision of his biochemical research on vision and of the philosophical sweep and artistic force of his biological ideas, proves that we are in fact approaching the day when "it will be hard to say which is which." The presentation of the present report, in spite of the emphasis on chemistry and physics, and in spite of the emphasis on accurate quantitative measurement, is not based upon any arrogant assumption that the physical sciences are superior, or upon any shallow assumption that the physical sciences will ultimately absorb all of biology. The viewpoint here is simply that problems of organized complexity are at once so difficult and so important that we must use all our resources if we expect to make progress.

THE LIVING WORLD

As man looks about him and observes the living world, the first great impression must be that of almost incredible diversity. Trees, flowers, birds, insects, fishes, mammals from the tiny shrew to the greatest whale—a truly overwhelming array of forms of life. No one can say, with any precision, just how vast this variety is. In the plant kingdom it has been estimated that there have been identified 65,000 kinds of fungi, 20,000 of algae, 12,000 of mosses, 4,000 of liverworts, 4,400 of ferns, 600 club mosses, 25 of primitive types such as the horsetail, 500 gymnosperms such as the conifers, and 175,000 flowering seed plants—a total of over 281,000 identified species. With such profusion it is perhaps not too surprising that, to choose a very special example, within the State of New Mexico there are 13 species of wild roses.

There are some 30,000 known species of protozoa, and 10,000 nematodes. There are 25,000 crustaceans, 80,000 mollusks, 20,000 fishes, and over a million insects of various sorts. Whereas Linnaeus listed 4,235 species of animals, it is now known that in the Old World alone there are more than 560 species and subspecies of rats of the genus *Rattus*.

Facing this confusion, the student of living nature must begin by observing and describing, so that he can start to sort out the kinds—first, as by Linnaeus, on the basis of form and an assumption of stability of form, and later, after Darwin, on a dynamic basis that recognizes evolutionary change and that deals with populations rather than individuals.

When one directs his attention to any one special part of the living world, certain great central problems arise. How does the creature in question adapt itself to its physical surroundings, and to all the forms of life about it, including its own kind? How does this creature reproduce itself? To what extent and how are the characteristics of the ancestors passed on to new generations? How does it obtain energy from its environment, and how does it utilize that energy to serve its needs? In particular, what are the metabolic processes whereby this creature ingests food, breaks these complicated chemical mixtures down into component parts, discards unwanted parts, and utilizes others to enable it to grow, repair injury, move about, maintain a suitable temperature, etc.? What are the internal transport systems which distribute, within the body of the creature, the substances necessary for the various parts, including as the ultimate case, the individual cells? As the original fertilized egg cell divides, eventually to produce the myriads of cells that compose the whole organism—a total of the order of a hundred million million cells, for example, in the case of man—what controls and directs the processes of differentiation that lead these cells to follow separate lines of development and form all the specialized parts of the body? What controls the processes of growth, maturation, decay, and eventual death? How does the creature maintain the integrity of its composition and structure, remaining a highly individual organism with mechanisms for resisting invasion by foreign material? To what extent is it possible to explain the behavior of this creature—the presumably inherited patterns of action together with the learned behavior and the learning process itself?

These problems, together with their pathological aspects which lead to disease or other disaster, have been major concerns of the biologist for many, many years. They continue to be central concerns, and there is every reason to suppose they will so continue for long years ahead. But the attitude toward these problems, the methods of study which seem most promising, have been substantially altered over the last century, this change having been particularly accelerated over the last quarter century.

The newer attitude has been made possible by one set of circumstances, and has been deeply motivated by a second. The motivation depends upon man's idea as to what constitutes a satisfying and useful explanation of any phenomenon. It is interesting, for example, to know the superficial facts about migration of birds. It is, indeed, fascinating to trace the accurate itinerary and the careful timing of the golden plover that breeds in northern Canada and, after an almost incredible nonstop flight over water, winters in the Hawaiian Islands. A knowledge of these external facts, however, does not constitute an "explanation." When one realizes that migrating animals are those which do not possess good temperature-adjusting mechanism, and when one notices a relation between time of departure and the night-day light cycle, then he feels that he is beginning to "understand" a little better. But not until this—or any other vital phenomenon—is analyzed in much more fundamental and much more universal terms is the scientist ready to say that he "understands."

There is an elusive element of paradox involved here. To illustrate from the physical sciences, an almost perfect case of complete and satisfying understanding is furnished by the motion of the planets about the sun. These motions can be precisely described and precisely predicted on the basis of Newton's laws of motion and his law of gravitation. Through these few laws, essentially simple and completely universal, all the apparent complexity of motion is brought into poetic harmony and simplicity. But of course no one, in any serious sense whatsoever, "understands" the law of gravitation. This law is, at least at the present stage of science, an ultimate simplicity which we just accept.

We feel satisfied about the "explanation" of planetary motion in spite of the fact that it is explained in terms of the unexplained and the unexplainable. We feel satisfied because of the compactness, simplicity, and universality of the laws which effect the explanation; we feel satisfied because we have the intellectual tool for predicting the future as well as understanding the past; and we feel satisfied because we know just what would have to be changed, and how it would have to be changed, to alter the phenomena into some new pattern. That is, we have the intellectual tool necessary to obtain control of the phenomena. The fact that this control is a practical impossibility in the case of planetary motions is an irrelevant accident of this particular illustration. If, instead of planets, we choose man-made satellites, then it is all too clear that the available scientific knowledge permits man to control.

It is, parenthetically, interesting to note the distinction between an ordinary or popular type of "explanation" and a scientific "explanation." For everyday purposes, understanding is normally achieved by restating the new and unfamiliar in terms of old and familiar ideas. It is not at all necessary that the old and familiar ideas be themselves understood: it is only necessary that they be so familiar that curiosity concerning them no longer exists. Using this technique, one explains to a non-physicist the concept of electrical voltage by saying that it is similar to the water pressure in a pipe. The more pressure, the greater the flow of water in the pipe; the more voltage, the greater the flow of electricity in the wire.

It is curious that the value of this explanation is not in the least impaired by the fact that no one knows, in any really detailed sense, how water does flow in a pipe, or by the fact that pressure is a crude microscopic concept which collapses when, on closer examination, one studies the molecular and ionic structure of the water, the motions of the ultimate particles, and the essentially mysterious electrical actions involved.

The scientist, on the other hand, does not explain the unfamiliar in terms of the familiar. Indeed he normally reverses the order, as when he "explains" a chair or table in terms of electrons and protons. The scientist is quite willing to accept explanations in very abstract terms; but he insists that the explanation be given in as universal and as compact terms as possible.

Thus it is quite clear that a special, "one-at-a-time" description of the objects and events of the natural phenomena of the living world cannot be accepted as satisfying. The scientist feels the constant urge to reduce the terms of his explanation to a more basic level, to analyze in more and more general, even if in more and more abstract, concepts. For it is on this level of explanation that he achieves prediction and control.

This very basic intellectual urge could not, in fact, express itself effectively in the life sciences so long as biology had to content itself with fairly large-scale techniques of analysis. Animals and plants, seen by the human eye at distances of a foot or more, inevitably present a complexity and variety which resist the unification and simplification which constitute a satisfying explanation. Subject these organisms to the scalpel and the microscope, and wider interrelationships begin to emerge. But—and this is of course the critical point—only when the tools are at hand to get down past the biological universality of the cell to the total universality of the molecule and the atom can one expect to achieve explanation at the ultimate level of simplicity, universality, and power.

It is for this reason that, especially over the last quarter century, new precision tools of exploration, description, and measurement have been of such tremendous importance to biology. It is for this reason that the following pages will devote so much attention to those new tools and techniques which are now permitting the analysis of biological phenomena at a molecular level.

MODERN EXPERIMENTAL BIOLOGY

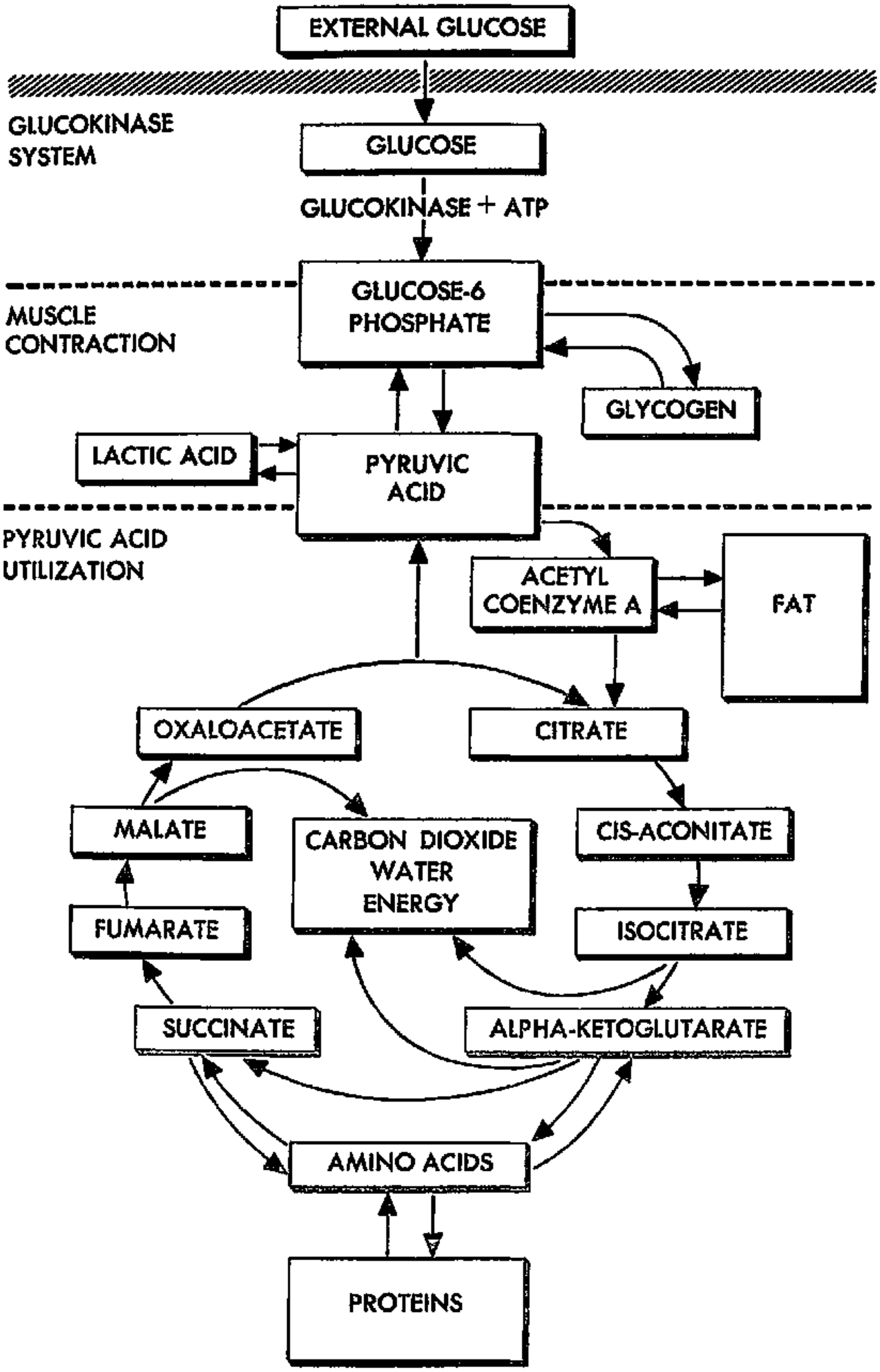
The solid progress made by science always consists, *au fond,* in highly technical details. Just what do we now know that we did not know a quarter century ago about the detailed structural pattern of deoxyribonucleic acid; what do we know about the genetic behavior of bacterial viruses; about the antigens, such as cytolipin H, which may furnish early immunological clues to cancer cells; about the exact role of rhodopsin in vision; about the specific catalysts which split the water molecule in photosynthesis; about the real source of infectivity in ribonucleic acid preparations, as to whether it is the ribonucleic acid itself, or contaminating virus particles; about the way in which the tetrapyrrole ring is built into the molecules of chlorophyll, hemoglobin, and various enzymes; about the nervous circuits which link the cerebrum, the thalamus, the cerebellum, and the spinal cord; about the citric acid cycle, mediated by mitochondria, which uses fats and carbohydrates as fuels, and produces the adenosine triphosphate which is the primary source of energy in all cells and organisms which depend upon oxygen; about the role of the microsomes in the biosynthesis of proteins —and so on, and so on?

These are, of course, only a small sample of the sort of modern biological questions which are asked today. The questions themselves give some hint of what has happened in the last quarter century. For generally speaking, so little was known in 1932 about such matters that these questions would not at that time have been sensible or even possible.

The progress in modern experimental biology during the past quarter century has been so vast, so penetrating, and so exciting that it would require a battery of experts and a set of books to do it justice. As a single example, is it not a striking fact that only for a very few years has science realized the sexual nature of the reproduction process in bacteria and the interchange of genetic material between virus strains? We can here look at only three or four interconnected and rather general topics; and if these depart widely from the classical fields of biology, that of itself is not without significance.

When the Nobel laureate Szent-Györgyi came to the United States in 1947, to pursue his researches here, he was asked where he hoped or expected to go, and on what he

Fig. 9 (opposite)
This chart gives an indication of the detail with which modern biochemistry deals with organized complexity. It shows how glucose, a sugar, enters a cell through the cell membrane (the hatched layer at the top), and then combines with adenosine triphosphate (ATP) to form a glucose phosphate compound. This, in turn, breaks down into pyruvic and acetic acids: these furnish both the raw material and the energy for a wide range of essential products, such as fats and proteins. (Reproduced by permission of *Scientific American.*)


EXTERNAL GLUCOSE
GLUCOKINASE SYSTEM
GLUCOSE
GLUCOKINASE + ATP
GLUCOSE-6 PHOSPHATE
MUSCLE CONTRACTION
GLYCOGEN
LACTIC ACID
PYRUVIC ACID
PYRUVIC ACID UTILIZATION
ACETYL COENZYME A
FAT
OXALOACETATE
CITRATE
MALATE
CARBON DIOXIDE WATER ENERGY
CIS-ACONITATE
FUMARATE
ISOCITRATE
SUCCINATE
ALPHA-KETOGLUTARATE
AMINO ACIDS
PROTEINS

wanted to work. He prefaced his answer by saying: "Well, if I can't have the modern instrumental means to learn the *facts,* and have just to use my *imagination,* then I think I would rather write poetry."

Access to the facts of biology has, to be sure, been greatly aided by developments in instrumentation. Biologists have themselves made notable contributions to instrumental procedures. As we will see presently, it was the botanist Tswett who originally developed column chromatography, and one recalls that W. Pfeffer, a nineteenth century plant physiologist, significantly advanced our knowledge of osmotic pressure. Much more recently we have seen great technical advances made by biologists in the development of methods of bioassay, in application of the various and subtle immunological reactions, and in connection with genetic recombination. Furthermore, many of the developments of physical or chemical techniques have occurred largely as a response to biological demand—the newer types of chromatography and microscopy being examples.

It has nevertheless been the physical sciences which have, to a large extent at least, produced the great modern armament of biological and medical research equipment. The opening section of this report should make it clear why this was bound to be the case. For as science moves forward through an array of problems of increasing complexity, the physical sciences, dealing as they have for so long a time with problems of simplicity, have quite naturally had the great early successes, and have in this process produced many tools of thought and experiment which can now be used to drive deeper into biological complexity.

Furthermore the trend of modern biology, as was discussed in the previous section, is toward an ever finer scale of dimension. The classical morphologist or systematist used his eyes—the bacteriologist, the ordinary optical microscope. But modern biology is deeply concerned with structure and events on a much more refined scale. This push into an ever-smaller world of analysis and explanation can be symbolized by the statement that there is very likely no more basic or central problem of modern biology than that of the detailed arrangement of the millions of individual atoms within the DNA of chromosomes.

The physical sciences have also been engaging in a drive toward smallness, and for reasons which we now recognize as obvious, they are ahead of the biologist. Whereas the latter is, so to speak, inside the cell and in extreme cases inside huge macromolecules of protein, the physicist is inside the nucleus, some ten orders of magnitude smaller than a cell. It is therefore not surprising that the physical sciences have developed a whole range of devices and experimental procedures which are now becoming a normal and accustomed part of biological experimentation.

Many of these devices and procedures can be classified under two headings—new and more powerful ways of *separating,* and new and more powerful ways of *seeing.* Here both of the words *separating* and *seeing* are used in a rather extended sense. *Seeing,* for example, means any procedure which reveals structure so that the experimenter can end up by *drawing a picture,* just as though he had really seen with his eyes.

SEPARATING AND IDENTIFYING

If biology presents, for the most part, problems of organized complexity, then one must expect any piece of living matter to contain a vast number of individual substances, all tangled together in an intimate interrelation. But this kind of complexity remains a mystery until one can, in some way, untangle the mess, separate out parts that are themselves homogeneous, and find out what these separate parts are. So *separation* is a basic procedure in attacking biological problems.

Separation is relatively easy for the construction engineer who wishes sand rather than gravel, or for the electronic engineer who designs an automatic device to identify and discard, in a production line, the units which are underweight, or discolored, but procedures of great delicacy and precision are needed to tease out the evidence from a living cell.

That wise applied biologist, the gardener, preparing his potting soil, puts it through a screen to separate out the pebbles and the weed roots. Screening—or its finer form, filtration—has been useful to the sanitary engineer, and to the biologist also. But it illuminates the character of recent biological advances to remember that a quarter century ago the name "filterable virus" was used precisely to emphasize that one was dealing with an infective agent which would pass right through the filters which successfully screened out bacteria. At that time the virus particles remained unseen—now we take them apart and put them together again!

Thus first in our list of newer methods of separation we should note the improvements in the ancient procedure of screening. Modern science and technology now makes available cellulose ester filters of remarkable porosity (up to 80 or even 85 per cent) with a range of carefully controlled pore sizes. One can have pores of five, or three, or one, or one-half of a ten-thousandth of a centimeter, to use with bacteria; or even pores as small as a millionth of a centimeter to use with viruses; and in all of these the variation in pore size need be only about 10 per cent.

The centrifuge, familiar to the dairyman who separates the cream from the milk by utilizing their difference in density, has been developed over the period under review into a most powerful tool for separating out the various component particles, differing in density, which are suspended in or go to make up a liquid. Using rotating speeds up to a thousand revolutions each second, produced by an electrical drive and precisely maintained by automatic electronic controls, the analytical ultracentrifuge has now become a standard part of the equipment of the modern laboratory. In 1936 there were only two high-speed analytical centrifuges in the world, one in Svedberg's laboratory in Uppsala, where he had developed it, and a replica in the Lister Institute in London.

At that time a grant was made to the University of Wisconsin for the construction of a third; and a year later modest aid was given to Professor Jesse Beams,[1] at the University of Virginia, for the development of an electrical drive, rather than the turbine type of drive used in the Svedberg model. Just as this report is being written word has been received that the University of Wisconsin has discontinued use of the oil-driven Svedberg centrifuge, thus marking the end of that era.

Ultracentrifuges are now produced in several places in the world. The most advanced American model, not very much larger than an old-fashioned upright piano in size, is an instrument of great precision and delicacy, which has been engineered to dependability even when used by nonspecialized operators.

Although the technique of high-speed whirling is quite different, being produced by a combination of electrical and magnetic effects, the mass spectrometer is in reality a close relative of the ultracentrifuge, separating and identifying the various atoms of different weights in a mixture. It has been used in studies of respiration, and is invaluable in connection with biological tracer experiments which utilize stable, rather than radioactive, isotopes. "As recently as 1940," says Professor Alfred O. C. Nier, who has done a

[1] Professor Beams has recently rotated at speeds of more than a million turns per second, tiny steel balls suspended magnetically in a very high vacuum, and driven by a rotating magnetic field.

great deal to develop and utilize the mass spectroscope, "there were probably fewer than a dozen of such instruments in the world. Now there are many hundreds, and their use steadily grows." Thus once again, this is an instrumental technique of great power which has emerged into use during the period under review.

For two things to be separable from each other, they have to differ in some way, and this difference must be exploited as a sort of handle which permits the scientist to pick up the one and leave the other. *Size* is such a difference, and furnishes the handle for filtering methods. *Density* is such a difference, and furnishes the handle for centrifugation. But a difference which can be variously exploited, which is capable of very delicate discrimination, and which is related in a revealing way to the nature of the thing being separated, is furnished by *electrical properties* such as charge, distribution of electric charge, magnetic strength, etc.

One such method, useful both for identification and separating, is the modern procedure of electrophoresis. The basic principle is an old one, and is due to observations made in 1809 by the Russian physicist F. F. Reuss. But the modern development dates only from the mid-thirties, and is due very largely to the brilliant researches of the Swedish physical biochemist, Arne W. K. Tiselius.

If a conducting liquid, containing several or many kinds of permanently suspended colloidal particles, is located in a horizontal tube, and if an electrical potential difference is established between the two ends, then there is a voltage gradient at every point in the liquid that urges charged particles to drift in the liquid, the force being the larger the larger their charge. By taking a suitable type of photograph at a suitable time one observes the whole range of kinds of particles, separated out in bunches like the slower and faster horses at the finish of a race. It will of course be

Photograph Excised Here

Fig. 10

Electrophoretic diagram of human blood serum showing the whole range of blood proteins. Each peak on the diagram represents the boundary, and concentration, of a different blood protein: albumin, alpha-one globulin, alpha-two globulin, beta globulin, and gamma globulin. (Photograph made at The Rockefeller Institute and reproduced by permission of *Scientific American*.)

recognized that this is a very crude description. In the course of years of experience and of instrumental development, electrophoresis has come to be a method of very great power and usefulness.

An extraordinarily useful and interesting set of procedures which involve identification, although normally not separation, depends upon the obvious fact that tiny experimental creatures such as bacteria or fungi are available in large, willing, and rapidly replenished numbers, and upon the further not at all obvious fact that they have chemical skills which no human chemist possesses.

If, for example, one studies a large number of microorganisms (the red bread mold *Neurospora crassa* is a now classic example, although the method is only about twenty years old) some of these turn out to be *mutant* strains, this meaning that one of the creature's genes has become altered. According to the present view, certain genes are responsible for the possession by the organism of certain enzyme systems; and in some instances at least, one gene controls one enzyme. If this gene is altered, the mutant strain of the fungus would lack that particular enzyme.

Now this tiny and lowly creature, in order to live, carries out a great many chemical tasks. It can take a number of relatively simple chemical substances and link them together into some larger and more complex substance which it requires; or it can take large and complex material which is unusable in its complete form, and split it up into useful parts. Each one of these individual steps of joining or splitting is activated by one special enzyme. Whereas a human organic chemist can carry out multitudes of chemical reactions, an enzyme system (generally speaking) can carry out only one specific chemical operation. But it may be a job which *no* human chemist can do; and it is, moreover, easy to exploit the fact that each enzyme is such a specialist.

For suppose one has produced (by irradiating with X rays, for example) a lot of mutant strains of *Neurospora*. Suppose these have been sorted out, and a strain isolated which cannot live unless the food furnished to it contains a supply of, say, the B vitamin thiamine, whereas the normal strains do not require thiamine since they possess an enzyme which is a specialist at making thiamine from other material.

This thiamine-requiring mutant strain (which incidentally breeds true so that it can be maintained in the laboratory) is now ready to go to work for the scientist. If he has a sample of mixed-up material, and wants to know whether or not it contains thiamine, he merely introduces the sample into a thiamine-lacking food supply and offers it to the mutant strain. If the fungus prospers, then the mess contained thiamine; otherwise, not.

A single example of this sort is likely to sound like a *tour de force*; but actually there are numerous and highly useful ramifications of this general technique. The chemist has, for example, isolated and purified enzymes; and he can then himself use one of these to split some large and complex molecule, confident that the precise inanimate specialist he is using is carrying out the operation in just that one place, in the whole structure of the molecule, where it is known to be able to operate.

Or, to take one more example that involves living organisms, one may have a strain of bacteria which has mutated so as to become resistant to a certain drug. Now try out a new and relatively untested drug on this strain. If the bacterium is also resistant to this new substance, then the latter's mode of action (affecting some step in the synthesis of a metabolite or antimetabolite) is very probably similar to the known mode of the known drug. Such procedures are just becoming useful in connection with screening tests for substances which may show promise in the chemotherapy of cancer.

Another whole battery of identification procedures, also making use of the exquisitely precise and subtle chemistry employed by living things, is to be found in the various immunological reactions. When a foreign protein or protein-like substance is injected into, say, a mouse, its body elaborates and distributes in the blood counter-substances, called antibodies, which tend to fight off and give protection against the foreign invader. Thus if in one set of mice there is introduced a known virus A, into a second set a known virus B, and so on, then these various sets of mice constitute an expert panel to which can be submitted a sample of unknown virus. The first set will have developed some degree of immunity to Virus A, the second to Virus B, etc.; and by injecting the unknown virus one can, by the immune serological reactions observed or more crudely, simply by the survival rate, determine its type or even its exact character. Tests of this general character have been developed to the point of great usefulness.

Before closing this section on separating and identifying we must pay tribute to one of the most dramatic successes of this period—the development of chromatography. This is in fact a kind of screening procedure, so that in a very broad sense we return to the topic which started this section. But the screening, here, does not depend on size.

Just over fifty years ago a young Russian botanist, Michael Tswett, found a way of separating out the various pigments of a green leaf. He packed a fine white powder (usually calcium carbonate) into a vertical glass tube, poured into the top of the tube a petroleum ether extract obtained from mashed-up green leaves, and let this complex mixture seep down into and through the tube. The marvel was that various components of the pigmented mixture—components of different shades of yellow, orange, orange-green, etc.—separated out and produced, on the previously pure white column, a Roman stripe pattern of various shades and colors, each layer of the striped pattern having a sharp boundary. The whole core of the tube could then be pressed out and sliced up into the various layers, from which the separated-out fractions (in this case the various types of chlorophyll pigment) could be dissolved. Subsequent evaporation produces the material in crystalline form — the chemist's hallmark of purity.

This amazing discovery was used only a few times between 1906 and the beginning date of this review; but chromatography, in its present greatly improved forms, is now one of the most powerful tools in the hands of the chemically minded biologist. It promptly turned out that this method of separation, almost mysterious in its simplicity and its ability to deal with complex mixtures which defy ordinary chemical means, was not restricted to colored dyes, but could be used for a wide range of materials. It can be used not only for liquids or dissolved solids but also for gases, and this rather recent extension of the method has proved specially valuable. It is so gentle a procedure, chemically speaking, that it can handle very unstable and elusive substances, this being a great advantage to the biologist.

Extremely clever automatic devices have been developed to collect the various fractions of a complex mixture as they drip out, one after another, from the bottom of a Tswett column.

British workers, fourteen years ago, perfected a simplified method. A drop of the mixture to be separated is put on one corner of a vertically suspended sheet of special filter paper, and the adjoining horizontal edge of the paper is placed in contact with a suitable solute. As the solute spreads out, like moisture spreading in a sheet of blotting paper, the soluble fractions of the drop mixture move in the dampened paper (just as the fractions move in the dampened column of the original method), coming to rest in different places to form a vertical line of spots. The separation of the spots occurs because of the fact that the

Photograph Excised Here

Fig. 11
Automation in science. The older fractionator (*right*) automatically collected amino acids, drop by drop in individual test tubes, as the drops flowed from the Tswett column which separated them; this is the apparatus referred to in the text. It has now been superseded by equipment in which the stream from the column is monitored by photo cells and recorded (*lower left*) entirely automatically. (Photographs made at The Rockefeller Institute; left-hand picture reproduced by permission of *Federation Proceedings.*)

different fractions move with differing speeds. The sheet is then turned through 90 degrees, and the then horizontal edge next to the line of spots is brought into contact with a second solute. Again the solute spreads, and the soluble fractions of the mixture move, again at varying speeds, coming to rest in a pattern which now extends over the entire sheet of paper. The paper, after it is dried, is then sprayed with some chemical that makes visible (colored) the various spots, or the paper is viewed by ultraviolet light; and the net result is a two-dimensional set of colored spots which visually exhibits the recipe of the original mixture, telling just what constituents it contained.

In a brilliant modification, developed by Melvin Calvin, a complex mixture containing certain molecules labeled with radioactive atoms is separated by the two-dimensional paper method, and the dried chromatogram is then placed in contact with X-ray film, for two weeks or so. The radioactive spots affect the film, and, so to speak, "take their own picture."

The method can be used with as little as a fraction of a milligram of material, and tricks have been developed which make possible not only *separation* and *identification*, but also *measurement* of the amount of each constituent.

"It has been said by many, notably the eminent nineteenth century physiologist Claude Bernard," (This is a quotation from an article[1] by Drs. William H. Stein and Stanford Moore of The Rockefeller Institute, two scientists who have greatly advanced this technique and who have applied it to important problems) "that progress in science frequently depends upon the development of good methods. Chromatography furnishes a vivid example of the truth of this statement. It is doubtful that even the fertile imagination of Michael Tswett could have foreseen the great advances in scientific knowledge that have already come, and the greater ones that will surely come in the future, from the application of his chromatograms."

NEW WAYS TO SEE

Even more spectacular than the new ways to separate are the developments which give the biologist new ways of

[1] *Scientific American*, Vol. 184, No. 3, March, 1951, p. 41.

Fig. 12

Paper chromatograms demonstrate the difference between the amino acid content of a modern clam shell (*left*) and that of a fossil clam shell (*right*). Thirteen amino acids make up the protein of the modern clam shell, indicated here as: ALA (alanine), ASP (aspartic acid), GLU (glutamic acid), GLY (glycine), ILEU (isoleucine), LEU (leucine), LYS (lysine), PHE (phenylalanine), PRO (proline), SER (serine), THR (threonine), TYR (tyrosine), and VAL (valine). The fossil shell contains only seven amino acids. The amino acids are themselves colorless but are made colored and visible by spraying them with reagents. (Photographs courtesy the Carnegie Institution of Washington and reproduced here by permission of *Scientific American.*)

seeing; and among these the most obvious and also one of the most important is to be found in the modern improvements in microscopy. Nearly three hundred years ago the English experimental philosopher, Robert Hooke, using the single optical lens system which had been developed by Italian, Dutch, and other astronomers and instrument makers, saw and described cell structures, and thus made possible the advance from the eye-scale anatomy of the past to the more detailed histology and cytology of the future. But the primitive character of the then existing simple microscope permitted only a primitive view, as is illustrated by the fact that Hooke chose the word "cell," which literally means a small chamber or box; because what he thought he saw was "hollow boxes filled with air or water." It was a century and three quarters later before the evidence had become sufficiently extensive and definite for Schleiden and Schwann to recognize the fundamental role of these tiny "boxes," and to come forward with a comprehensive cell theory for all living things.

The optical microscope has, of course, been marvelously improved since those early days. But however precise and efficient its optical system, its mechanical control, its lighting, and the photographic techniques which furnish permanent records for study, the microscope which uses ordinary visible light is subject to an inherent and inescapable limitation: It cannot "see" anything whose dimensions are not somewhat larger than the half wave length of the light being used. In the case of ordinary white light, this means that an optical microscope cannot effectively discriminate details which are smaller than, say, a ten-thousandth of a centimeter. To be sure, this sounds very small. But remember that the ordinary cells of the human body measure roughly a thousandth of a centimeter and have in their interior a vast number of much smaller parts which must be observed if they are to be understood. If we consider the sequence of human blood cells, certain bacteria, animal virus, and plant virus, each of these living objects is only about one-tenth as big as its predecessor in the series. So clearly the optical microscope can deal only very roughly with the interior of a cell, can identify only the external form of the smaller bacteria, and is completely unable to reveal viruses. It is not surprising that a recent review in *Nature* of Dr. A. Frey-Wyssling's book, *Macromolecules in Cell Structure,* states concerning cytoplasm that it was "so optically empty no longer ago than the early thirties."

The limitation of the ordinary light microscope can be relieved somewhat by using ultraviolet light, since it has a wave length about half that of ordinary visible light. In the mid-thirties the uv microscope was being perfected, especially by Swedish workers, and it did reveal details about twice as fine as those which could be studied previously.

But the great advance in resolution—which is the technical term for the capacity of a seeing device to discriminate fine detail—came from the development of the electron microscope. Utilizing the fact that electrons behave like light of wave length less than one-thousandth that of ordinary light, instruments have been developed which can handle detail down to a ten-millionth of a centimeter. This whole instrumental development has occurred over the period here under review. Indeed as recently as 1941 The Rockefeller Foundation made grants for the study and improvement of the instrument, and then made grants to set up electron microscopy laboratories to serve whole universities. These latter grants seem curious, in retrospect, for they were based on the conservative idea that an electron microscope, while useful, was a costly tool unlikely to come into very general use. A university presumably needed *one,* available to everyone, in somewhat the same sense that a university ought to have one available copy in its library of a very expensive but not often used reference work.

Photograph Excised Here

Fig. 13

Top: Electron micrograph showing segments of two single molecules of deoxyribonucleic acid extracted from salmon sperm. Magnification X 170,000. (Reproduced by permission of *J. Biophys. and Biochem. Cytol.*) *Bottom:* Electron micrograph of ultrathin sections of a bacterium infected with a virus. (Photograph courtesy E. Kellenberger, University of Geneva, Switzerland.)

Since that time the "e. m." has become such a generally useful and standard device that it goes by this familiar nickname; and the present pattern of use is not a single instrument for a university, but often two or more for a department. Only a few years ago a resolution of 50 Å (an Ångstrom is one hundred-millionth of a centimeter) was considered excellent, and there was in the whole world only one manufacturer of electron microscopes. Now these devices are made not only in the United States but also in England, Holland, Germany, and Japan. It is understood that the Japanese instrument is now guaranteed to give a resolution of 10 Å, this being at the level of size which begins to deal directly with the largest molecules. This resolution is also achieved, under optimum circumstances, with other makes of instruments.

There are a variety of other devices which have improved the scientist's capacity to see. Several of these are modifications of the older optical microscope. Thus phase contrast microscopy, about twenty years old, has been specially useful in examining transparent biological material whose structure involves small differences in optical path, due either to differences in thickness or in the refractive index of the specimen. Interference microscopy, or micro-interferometry, goes a step further by putting phase contrast microscopy on a quantitative basis. Not only does the refractive index ordinarily vary from place to place in biological material; it also varies, at a fixed point, with respect to the direction of the light beam. This fact can be exploited by using a polarizing microscope. Although microscopy which utilized polarized light has been known for a long time, the effective use of this method to study biological ultrastructure is comparatively recent.

There are still further variants such as the reflecting microscope; fluorescent microscopy; the "flying-spot" microscope which can scan living material with ultraviolet light,

Fig. 14

Top: Electron micrograph of three frozen-dried particles of Tipula iridescent virus shadowed with gold-manganin. The insect virus exhibits three forms of shadows. The information from this and from other similar pictures, together with previously known facts, unambiguously show that frozen-dried particles of this virus are icosahedral in shape. (Reproduced by permission of *Biochim. Biophys. Acta.*) *Bottom:* Electron micrograph of a complete southern bean mosaic virus crystal. Shadowing shows up the molecular arrangement on several of its faces. Magnification X 30,000. (Reproduced by permission of *Nature.*)

pausing such a short time at any one place that the specimen is not killed; and the linking up of microscopy with the picture tube of television, so as to obtain a large image that can be seen by many persons at once. It is still an unrealized dream to produce a microscopic system which fully exploits X rays, although most hopeful advances have been made in the use of this very penetrating radiation.

In most of the techniques of microscopy just listed the scientist studies the biological specimen in ways that, aiding his own eyes, reasonably deserve the verb "to see." To be sure, he often has to be contented with looking at a thin section of dead material, and in the case of electron microscopy, the specimen has to be perfectly dry, exceedingly thin, and located in a high vacuum. Moreover, ways, such as the freeze-drying technique, have been found to avoid at least part of the distortions that used to be caused by dehydration, by sectioning, and by staining with colored chemicals that are differently absorbed and thus bring out contrasts that reveal structure.

In some of the cases mentioned, there is so much instrumental intervention between the thing being examined and the eyes of the scientist, that he "sees" the specimen only in a very generalized sense. For example, a most useful procedure of electron microscopy involves spraying the specimen at a glancing angle with atoms of a heavy metal. This spray is caught by irregularities in the surface of the specimen; and since the heavy metal is relatively opaque to the electron beam, visible shadows of otherwise unclear protruding irregularities are produced.

Since the angle of spraying with the vaporized metal is known, the lengths of the shadows can be measured and interpreted in terms of distances vertical to the plane of the specimen. This spraying method may sound like a very indirect procedure, of doubtful dependability; but actually it has been developed into a most useful tool, and by using it one "sees" things that would otherwise be quite inaccessible to the senses.

Still more indirect ways of "seeing" have been developed in recent years. One of these is the method of X-ray and electron diffraction. Suppose that every person who goes through the main concourse, upper level, of Grand Central Station in New York City carries a lighted candle; and suppose that a large camera, located in the ceiling and pointed toward the floor, records the path of each one of these spots of light but shows nothing else. If the exposure were kept up until many hundreds of persons—light tracks on the film—had passed through, then by studying this film one could deduce that in the center of this great concourse is a special impenetrable region, whose size and shape would become more and more definite as more and more light tracks were photographed. Certain light spots would go up to this region, and then start off in other directions. Other light spots would veer around this region; but none would go through this region. Gradually, as the evidence accumulated, a person who has never been in Grand Central Station, who has seen only these photographs of light tracks, would begin to "see" the size and shape of the Information Booth in the center of the concourse.

In a way which is only very roughly similar, a scientist can take an unknown structure built out of atoms, pass through this structure a very large number of light particles (X rays) or electrons, make a photograph which shows the pattern in which the light particles or electrons emerge, and then in a very complicated, very tedious, most ingenious way, he begins to get ideas about the details of the structure through which the light particles or electrons have passed. He has a much harder job than our camera man in Grand Central. He does not have a picture of the lights *going through* the structure, but only the pattern in which they emerge; and he is dealing with a three-dimensional structure which may easily contain thousands of atoms, each of which must be located. He cannot, by any rigorous and straightforward way, *calculate* what that structure is. He can only get hunches of what it might be; and then rigorously calculate what effect this assumed structure would have on a lot of light particles passing through. Only by an incredible miracle would the first hunch turn out right; so there must be months or even years of trial and error. The organic chemist, the biochemist, and the physical chemist help him a great deal, telling him how many of what kinds of atoms he is dealing with, discouraging certain guesses which they know to be unlikely, suggesting certain guesses which their chemical knowledge makes probable. And out of all of this, with skill and art and patience, with inspired guess and with laborious check calculations, using all the aid that can be furnished by modern computing devices, comes an eventual knowledge of the detailed arrangement of the atoms which make up the structure which has been under study.

The culmination of this is a three-dimensional drawing of the structure. The X-ray diffraction or the electron diffraction expert has succeeded in "seeing" the structure—but in how indirect and sophisticated a sense! Some of the triumphal successes of this method will be mentioned later in this report. The present emphasis is on this procedure as a wonderful new way of seeing.

Similar are the various spectroscopic methods which, in equally indirect but equally useful ways, enable one to "see" submicroscopic details of structure. Absorption spectroscopy is particularly useful in biological research; and in this procedure one passes radiant energy of various wave lengths through material, and determines what special wave lengths are relevant to the structure being investigated and are hence absorbed by it, and what wave lengths are irrelevant and hence pass on through uninfluenced. Here again it is very hard for one who has not worked in the field to realize that such a procedure can be developed into a tool of precision and power. But under such experts as Caspersson in Sweden, these methods of ultramicrospectrophotometry, using all the modern battery of electronic controls, can examine—can "see"—the chemical events in a very small portion of a single cell.

These remarks have by no means exhausted the ways, either unknown in 1932 or at least greatly refined since then, which enable the present-day scientist to "see" the revealing details, down to the molecular or even atomic scale, of the structures which are important to the biologists. The very recent methods of nuclear paramagnetic resonance and electron spin resonance are in essence spectroscopic procedures; but have the great advantage to the biologist that information can be obtained about the free radicals in wet biological material.

The labeling of compounds with radioactive isotopes enables the scientist to trace them as they move about in a biological system, sometimes actually by hearing them as they produce clicks in a counter, and sometimes by "seeing" them as they register their positions on a photographic film through autoradiography. In a somewhat similar way it is possible to stain antibodies with a chemical which fluoresces when ultraviolet light impinges, thus making the antibodies visible through photography. Seeing, incidentally, has been greatly improved by the development of photographic emulsions of great speed, finer grain, and sensitivities to various forms of energy which do not directly affect the human eye but which are made humanly visible by the photochemical reactions in the emulsion. The way in which light is scattered by particles of various sizes, shapes, and electrical properties has been most usefully exploited to enable us to "see" these sizes and shapes. And modern electronic techniques have been used to intensify weak optical images, such as might be produced in the X ray of a difficult region, to reveal otherwise invisible detail.

OTHER ADVANCES IN TECHNIQUES AND INSTRUMENTS

A great many of the newer tools of the biologist come under the headings we have already considered, of *separation, identification,* and *seeing*; but there are additional ways in which the chemist, the physicist, the engineer, and the mathematician are aiding in the exploration and analysis of living matter.

The more modern aspects of this service began less than forty years ago when Pregl developed methods for the microchemistry of organic compounds. These classical microchemical methods are able to accept a bit of matter only a millimeter in dimension and only a thousandth of a gram in weight, and determine the sorts and amounts of the individual chemical compounds it contains. But under the demands of present-day biology (and also through the work of the chemists who are associated with atomic and nuclear researches, and who also have to deal with very small amounts of material) it is possible to carry out limited chemical analyses of samples which measure not a millimeter, but a tenth or even a thousandth of a millimeter, and whose weight is not a thousandth of a gram, but a millionth of a gram. Indeed some sort of estimates of chemical composition can be made on samples even smaller than this.

The modern biologist has the great advantage, over his predecessors, that he can confidently ask for high precision measurements, carried out with dependable and convenient equipment, of a whole array of properties which are of importance to him—temperature, thermal energy, dielectric contents, conductivity, surface tension, viscosity, osmotic pressure, streaming birefringence, light scattering, and so on.

The modern biologist has at his disposal a wide variety of electronic techniques, for amplification, for automatic control, and especially for the "pick-up" of a mechanical, a thermal, or a chemical effect and its reliable transformation into an electrical effect which can then be conveniently measured and recorded.

The modern biologist uses heavy and radioactive isotopes in a very wide range of experimental procedures. The almost incredible possibility of being able to put a label on certain atoms or molecules so that they can be individually traced as they move about in the complex chemical traffic of a living organism has opened up problems for analysis that previously were simply unthinkable mysteries. The earliest inorganic experiments with isotopes preceded, by a few years at least, the period here under review; but the application to biological problems has entirely occurred over the last quarter century. Indeed it is interesting to note that in 1937, 1938, and 1939 The Rockefeller Foundation made grants at Copenhagen, at the University of Minnesota, at Paris, at Berkeley, at Rochester, at Columbia University for the group interested in intermediary metabolism, and at St. Louis, to assist in the installations of cyclotrons or other devices to produce isotopes for biological studies. In retrospect, one again recognizes this as a temporary phase. At the present time the use of isotopes is universal and of unquestioned importance; and the Atomic Energy Commission is the chief supplier. It is symptomatic that the April 1958 issue of *Reviews of Modern Physics,* which totals 319 pages, is devoted entirely to a listing in condensed form of the current information about the isotopes of the elements.

In the thirties there was great interest in the then new devices—micromanipulators—by means of which the experimenter could reduce the scale of movement of his fingers and could move, within the field of view of a microscope, tiny dissecting knives, tiny pipettes, etc., so that the human operator could effectively enter the microscopic world. These devices continue to be useful, and have been supplemented by other devices, particularly microelectrodes, which permit even more effective exploration of the small world in which biological affairs often take place.

The scientific knowledge and technological skill which has produced many of the familiar materials of the modern household has also been of great value to the biologist. The whole range of plastics, for example, gives the modern experimenter almost anything he can ask for in terms of flexibility, transparency, resistance to heat and chemicals, lightness, mechanical strength, and precision moulding.

There have been great advances in the freeze-drying, staining, and ultrathin sectioning techniques which produce the samples for microscopic study. Potentiometric methods, including pH measurements, have been improved. Ultrasonics, homogenization, and similar "blendor" techniques are at the disposal of the biologist at the turn of a switch. Mathematicians have become interested in constructing model theories for biological systems; and biostatistics and the broad analyses of the operations analysts are increasingly used in the life sciences.

All in all, the biologist has come a long way since the early days when his was an observational science, depending on his eyes and touch, aided by the simple microscope. He now has in his hand tools to enter the work of molecular biology.

STRUCTURE

The reader, more than once as he has read thus far, may well have wondered if modern biology no longer is concerned with the classical fields of anatomy, physiology, genetics, embryology, neurology, etc.; if it is now so preoccupied with tools and techniques that it is not interested in the conceptual aspects of the great problems of biology; if it no longer is mystified as to how differentiation, growth, decay, and death occur; if it no longer hopes to get fuller understanding of instinct, of learning, of behavior in general.

The reply, of course, is that these remain great central concerns of the biologist. What has changed is that these problems are now being approached not only from *above*, with the broad view of the natural philosopher who scans the whole living world, but also from *underneath*, by the quantitative analyst who measures the underlying facts. The migration of birds, for example, has for long been an almost poetic mystery in biology, and it is now beginning to be understandable in terms of hormones and polarized light.

The most biological of biologists should welcome this newer orientation, not as a replacement for a more naturalistic attitude, but as a supplement to it. For the fact is that biology, for all the richness of its collections of bits and pieces of information about nature, has been singularly weak in discovering great principles around which myriads of otherwise isolated facts can cluster in a meaningful and unifying way. In the case of the physical sciences one can write down a substantial number of "great laws," applicable universally, such as Newton's three laws of motion, the universal law of gravitation, the first and second laws of thermodynamics, Maxwell's laws of the electromagnetic field, the basic principles of relativity, the central rules of quantum theory, the conservation of mass-energy, etc. For biology, one starts off bravely with the concepts of evolution, the universality of the cell as a unit of life, and the central principles of genetics—and then rather lamely turns to discussion of individual problems rather than broad pronouncement. Some may wish to bring forward, as a further great biological generalization, the law that all life springs from life; but there is, one must agree, at least a small chance that spontaneous generation may presently be made respectable by science.

There is, however, real reason to expect that biology is now in the process of establishing the kind of base of analytical and often quantitative fact which can lead to and can sustain a much broader theoretical base than has as yet been available to the life sciences.

It is of the most characteristic significance, relative to the movements in modern biology, that in many instances the underlying facts are now being successfully explored at the submicroscopic scale of molecular and even atomic dimensions. Biological ultrastructure has become a recognized and rich field. For several years now a term has been used, seriously and in an operational sense, which in 1932 would have been used only with imagination and hope—*molecular biology.*

A great deal of the information about biological material at this new scale of smallness consists of knowledge about *structure.* This knowledge has to a great extent been made possible by the procedures and instruments which have been reviewed in the preceding sections. The organic chemists interested in natural products, the physical chemists interested in macromolecules, the specialists in X-ray and electron diffraction, the micro- and submicroanatomists, the molecular biologists, the ultramicroscopic cytologists, the physiologists and biophysicists concerned with life at the smallest scale, the electron microscopist, and many others have all played essential and often interlinked roles in developing the new knowledge about the ultrastructure of living material. But before we go further, we must question the meaning of the word "structure."

When one talks about the meaning of words, it has become traditional to recall Humpty Dumpty's remark that "When *I* use a word, it means just what I choose it to mean —neither more nor less." We repeat so often this characteristically charming bit of Lewis Carroll's nonsense, that we sometimes forget that it is also characteristically wise. What does a person mean when he says that he "understands" a statement or an object? He means that his individual relationship with the statement or the object is, so to speak, a comfortable one: he means that he knows how to deal with the question posed by the statement or the object. But understanding is thus, as Humpty Dumpty pointed out, an individual matter, not a universal or absolute one. A service technician "understands" a television set when he confidently faces one that won't work, finds out what is wrong with it, and successfully fixes it. But this service man does not really know what goes on inside a vacuum tube or a transistor, and he has probably never so much as heard of Maxwell's equations of the electromagnetic field. When an electronics engineer says that he "understands" a TV set, he does not at all mean what the service man meant; a theoretical physicist, in turn, would mean still another thing.

We can now come back to the word "structure." When an organic chemist says that he understands the structure of a molecule, he means that he knows, about that structure, the things which enable *him* to deal usefully with it. This means, in part, that he has it classified in relation to a lot of other compounds which he also understands; and that he therefore has a very good idea of how it will behave under a lot of chemical circumstances. It also means that he knows how to go about modifying the compound, and perhaps even knows how to synthesize it.

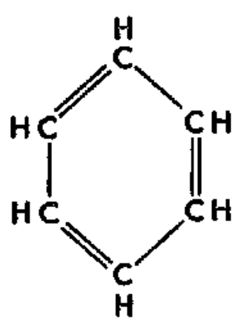
This, however, is not at all what the physicist, in particular the X-ray crystallographer, means when he says that *he* knows the structure of a molecule. Since the whole matter of structure is of such interest in modern biology, it is worth while to explore this topic a little further.

Let us for the moment take the chemist's point of view, and let us use insulin as the compound we are talking about. Given the purified substance (this very first step may involve great difficulty: insulin was first crystallized by Abel in 1926), the next step is to determine its *molecular weight*. For insulin the early estimates from light scattering and centrifugation indicated a rough figure of 36,000, which means that all the atoms in a molecule of insulin add up to about the equivalent of 36,000 hydrogen atoms: but it later turned out that this method dealt with groupings of twelve "insulin chains"; and with the present knowledge that there are two different kinds of insulin chains, and that a molecule can, under differing circumstances, consist of one of each kind of chain, or two of each kind, or even of six of each kind, the molecular weight of insulin is 6,000, or 12,000, or 36,000, depending on circumstances. Already things are getting complicated and the reader may wonder why a simpler example has not been chosen. But a simple example will not serve our purpose, for we are dealing with organized complexity.

A next stage often involves the determination of *constitution*—just what atoms, and how many of each, do its molecules contain? This stage is characterized by the writing down of the "molecular formulas" familiar from freshman chemistry. Thus the formula H_2O says that a molecule of water has two atoms of hydrogen and one of oxygen. The writing of such a formula for the insulin molecule with its 777 atoms and its various molecular forms, is in fact not too useful; but if one wishes to look at it, the formula, on present evidence, would be $C_{254}H_{377}N_{65}O_{75}S_6$. For such biological macromolecules, it is often more illuminating to consider how the molecule is built up, not out of individual atoms, but rather out of certain significant groups of atoms.

Thus an important stage in the progressive unraveling of structure is to know how many of what sorts of groups of atoms are involved. A polypeptide, as the name implies, is made up of several peptides, each of which, in turn, is composed of two or more amino acids; and one is interested to know just what amino acid residues, and how many of each, before he advances to know the exact order in which they are linked together. Thus insulin was found to consist of seventeen kinds of amino acid groups, and the relative amount of each group was determined.

In the case of rather simple molecules, a further stage is the ability to draw a two-dimensional map which depicts which atoms are linked, and in what way, to which other atoms. These are the familiar diagrams of the organic chemist. Benzene, which has the molecular formula C_6H_6, is the classical example whose cyclic or ring structure was suggested by Kekule in 1865, this being one of the most important events in the whole history of knowledge of chemical structure. It has the diagram

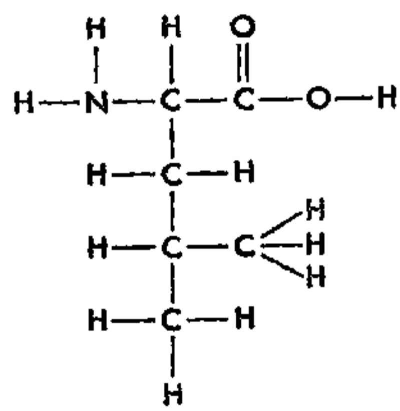


and this hexagonal benzene ring figure, with single and double bonds between the carbon atoms, tells the organic chemist much more than does the mere statement that the molecule contains six carbon and six hydrogen atoms. We are not displaying one of these two-dimensional maps of insulin for reasons that will be obvious in a moment.

In the case of the biologically all-important proteins (and insulin is a protein) one is often dealing with long chains, the units of which are the amino acids. In such cases, it is extremely useful to know just what is the order in which these amino acid units are linked together. Dr. Frederick Sanger of Cambridge University, who worked on the insulin molecule for ten years with a group of colleagues which included Hans Tuppy, L. F. Smith, and Ruth Kitai, determined for one of the types of polypeptide chains of insulin the amino acid sequence:

> Phenylalanyl-valyl-asparaginyl-glutaminyl-histidyl-leucyl-cysteyl-glycyl-seryl-histidyl-leucyl-valyl-glutamyl-alanyl-leucyl-tyrocyl-leucyl-valyl-cysteyl-glycyl-glutamyl-arginyl-glycyl-phenylalanyl-phenylalanyl-tyrosyl-threonyl-prolyl-lysyl-alanine

where, to illustrate with just one member of the sequence, leucine has the two-dimensional diagram



These mouth and eye filling details are not included to make a show, but to give the reader some sense of the complication—but the strictly organized complication—with which these experts have successfully dealt.

Perhaps at this point we may pause for a moment, before going further with remarks about the structure of insulin, to say what the organic chemist means by the word "structure." This is a suitable point for summarizing the chemist's usage of the word, for we have in fact just about reached, in the insulin example, the point at which it seems necessary to turn to the physicist for further information. Indeed, at least two groups of crystallographers are now working on insulin, and these efforts should lead rather soon to a knowledge of the actual three-dimensional position of many, at least, of the atoms of the molecule.

The two-dimensional, and actually very formalized, diagrams of classical organic chemistry, are of course not capable of giving full information about a three-dimensional structure. A builder who has the floor plans of the various levels of a building, but has them all superimposed on one sheet of paper, would have to be pretty skillful to build the structure from this collapsed two-dimensional drawing and without the various other architectural views—the front, side, and rear elevations. But if he knew that the building were to have a well-known and standardized style of architecture with which he was very familiar, then he could do a pretty good job. The skillful organic chemist, being so familiar with the various styles and traditions of molecular architecture, can often, or even usually, get along with the two-dimensional diagram. But there are important instances in which the formal two-dimensional structure is the same for two molecules whose actual *three-dimensional space* arrangements are different. For example, corresponding parts of the two atoms may be related, one to the other, as a right-hand glove is related to a left-hand glove. They have the same parts, but one is a mirror image of the other. Without going into further detail, one can sense that one of these molecules can be transformed into the other by various rotational interchanges of atoms or groups of atoms. Two such molecules (one of which the chemist would call the stereoisomer of the other) may, moreover, be vitally different to the biologist. One may be physiologically active, the other entirely inactive. Indeed one may be a deadly poison

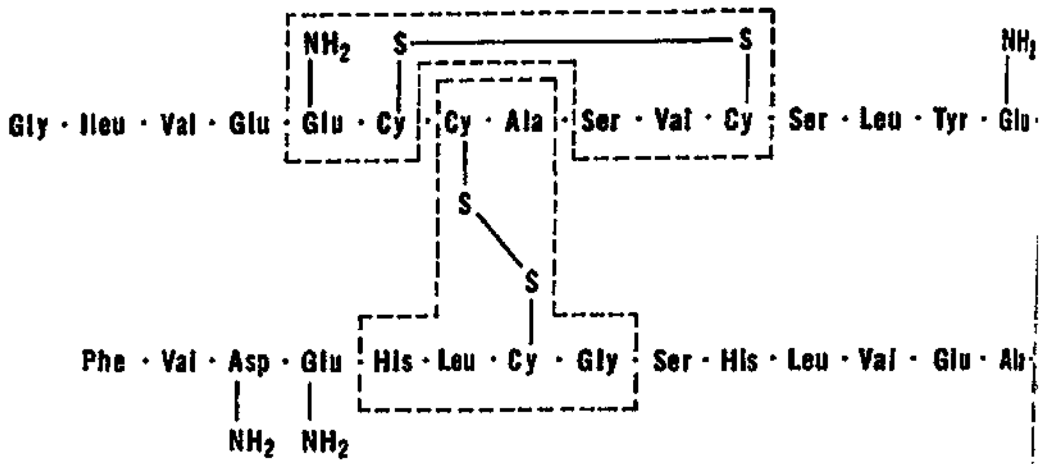
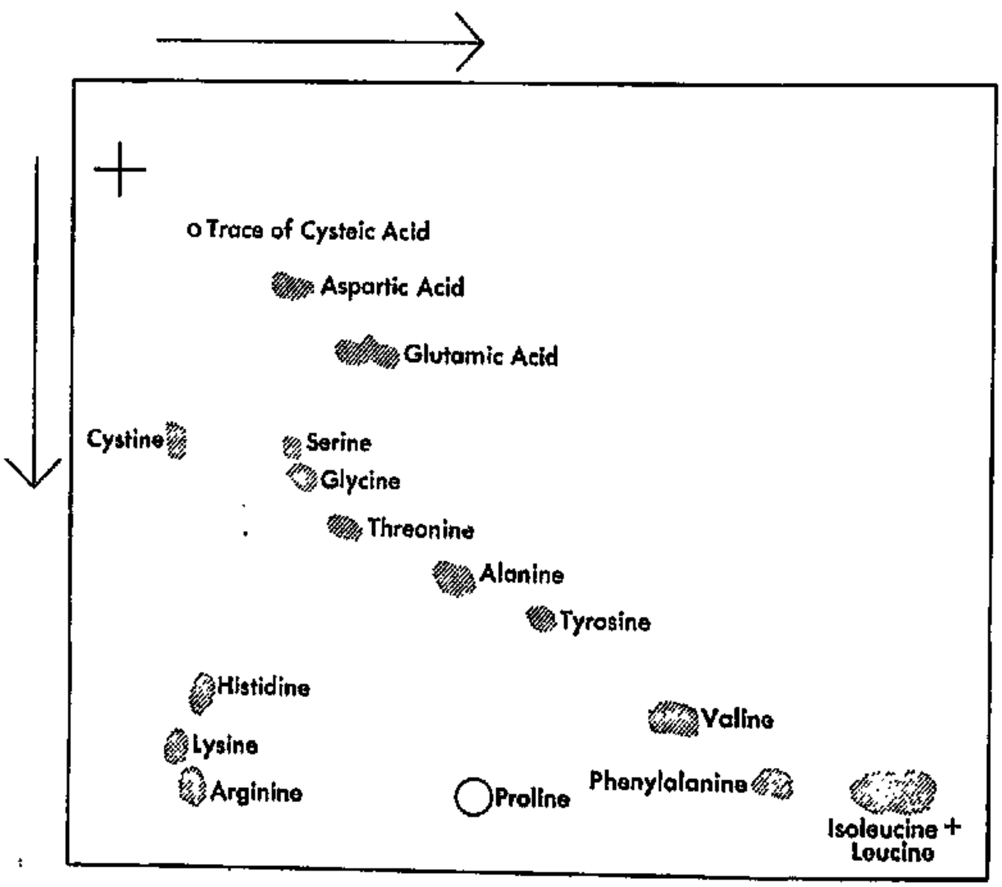
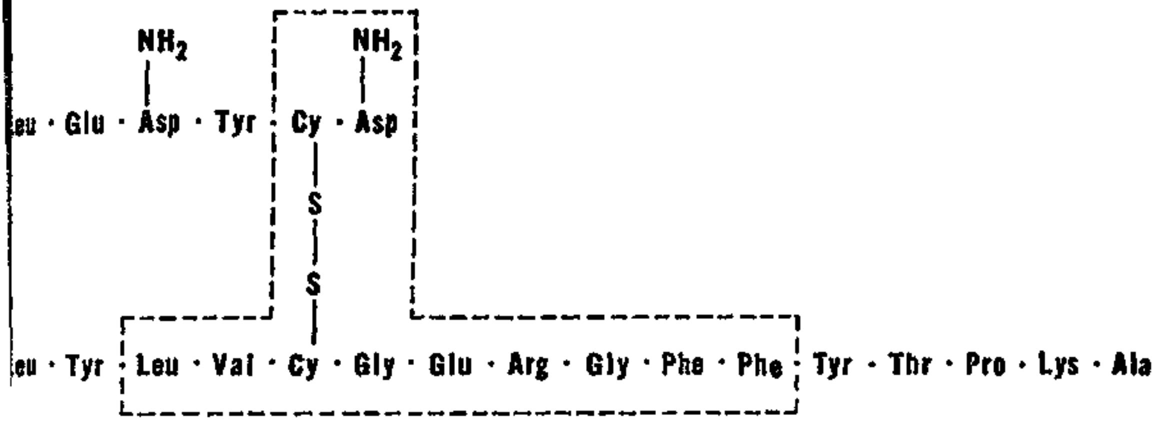


Fig. 15
Top: The structural formula of the insulin molecule given here is an example of the way in which chemists give organization to complication. *Bottom:* Chromatographic illustration of the separation of the amino acids of insulin. (Reproduced by permission of *Scientific American.*)





while the other is quite innocuous. More generally, such isomers are called "optically active," since the two have a different effect on polarized light.

We are now, at last, ready to state what the organic chemist means when he says, with various modifying words, that he "knows the structure."

An organic chemist says he knows the *full* or *complete structure* of a compound provided he can draw his sort of conventional two-dimensional picture of it, and provided that any ambiguity relative to groups where isomerism is possible, is ruled out by the rigidity of double bonds or by other aspects of the structure which induce rotational rigidity.

On the other hand, if the nature of the molecule does permit rotational interchanges, and if there is ambiguity concerning the position—or the reversed position—of certain groups, then the organic chemist, still working entirely within his own special field, can often carry out degradation studies, chemically reducing the molecule to a less complex one which will relate this molecule to optically active substances of known configuration. Having done this, the organic chemist says that he knows the *absolute configuration*, or the *full stereochemical structure.*

But the organic chemist uses these strong terms only because he now has answers to all the questions which *he* normally cares to ask. Knowing what he calls the absolute configuration, he still does not know, and except in limited phases of stereochemistry is not really interested in knowing, either the bond distances, in hundredths of an Ångstrom, between the various atoms, or the angular orientation of these bonds. It is when and only when these latter data are in hand, that one can draw, in various views as an architect would, the full three-dimensional space location of every atom of the molecule—and it is then and only then that the physicist says that he knows the full structure.

It was said, just above, that the organic chemist can often carry out purely chemical studies which give him what he calls the full stereochemical structure. But there are instances in which he finds it awkward or impossible to get this information by chemical means. He is then glad to accept the three-dimensional assistance of the X-ray crystallographer.

It should be no surprise that the X-ray crystallographer has not, as yet, been able to give by his methods the location of each of the hundreds of atoms in the insulin molecule. Crystallographic studies have been made of insulin—or more strictly, of two insulin derivations; and the point has now been reached at which the chemical studies and the crystallographic studies are progressing together, each aiding the other.

That sort of collaboration between the chemist and the crystallographer is very characteristic of the present state of structure studies. In the case of nucleic acid studies, for example, the organic chemist went as far as he could when he determined the precise nature of the individual nucleotide units and showed how they were joined together through the phosphate groups. He then had achieved his goal of chemical and stereochemical knowledge of the units and their mode of linkage. It remained for the X-ray crystallographer, basing his deductions on *physical measurements* but interpreting them, of course, in the light of all the chemical data, to deduce and prove the two-stranded helical structure of the DNA molecule (see color plate).

This is not the proper place for an extended survey of the structural determinations of particular importance to biology which have been accomplished over the period under review; but an impression, at least, of the magnitude of the progress in this field can be gained from a highly condensed and simplified account.

Of the smaller molecules, a very substantial amount of accurate and useful data, largely determined by Professor Robert B. Corey and his group at the California Institute of Technology, exists concerning nearly twenty amino acids or closely related compounds,[1] and concerning at least thirteen simple peptides.[2] These very basic data have provided evidence concerning hydrogen bond formation; and have been essential in obtaining accurate dimensions for the polypeptide chain from which, in turn, has been derived the α-helix and the pleated sheet structures which are now known to be of such fundamental importance in biological ultrastructure.

Crystallographic studies have been carried out, by various workers, on at least twenty-three nucleic acid derivatives and related compounds[3] (pyrimidine derivatives, purines,

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[1] Glycine; DL-alanine; D-isoleucine; DL-norleucine; DL-serine; L-threonine; DL-methionine; DL-glutamic acid HCl; L-glutamic acid; L-glutamine; Histidine $HCl \cdot H_2O$; Hydroxy-L-proline; L-cystine; Cu-proline dihydrate; α Amino-iso-butyric acid; β L-glutamic acid; di-glycine H Br and HCl; Zn, Co, Ni aspartate 3 H_2O.

[2] Diketopiperazine; β-Glycyl-glycine; N-acetylglycine; Cysteinyl glycine NaI; Glycyl-L-tyrosine HCl; Glycyl-L-asparagine; NN′diglycylcystine; Glycyl-L-tryptophan 2 H_2O; L-Leucyl-L-prolylglycine; Glutathione; β-Blycylglycine; Diglycylglycine ethyl ester HCl; Lysine Hydrochloride Dihydrate.

[3] 2-Amino-4-methyl-6-chloropyrimidine; 2-Amino-4,6-dichloropyrimidine; Adenine HCl $\cdot \frac{1}{2} H_2O$; 4-6-Dimethyl-2-hydroxypyrimidine 2 H_2O; 4-Amino-2,6-dichloropyrimidine; 5-Bromo-4,6-diaminopyrimidine; Cytidine; Guanine HCl; Nicotinic acid; 2′:3′ isopropylidene 3:5′ cycloadenosine iodide; Nicotinamide; Uracil; Isonicotinic acid hydrazide; 4,5-Diamino-2-chloropyrimidine; Dialuric acid (2,4,5,6-tetrahydroxypyrimidine H_2O); Pteridine; 5′ Bromo 5′ deoxythymidine; Theophylline; Caffeine; 2,5-Diamino-4-mercapto-6-methylpyrimidine; 2-Metanilamido-5-Br-pyrimidine; 2′3′-Isopropylidene, 3:5′-Cycloadenosine Iodide; Dibenzylphosphoric acid.

nucleosides, neucleotides, etc.). These studies furnished several pieces of information which were helpful in the derivation of the Watson-Crick model of DNA. A good deal of this work was done by the group of crystallographers at the University of Cambridge, and W. Cochran has made important and elegant contributions characterized by particularly high accuracy.

The two groups of results just mentioned are not as spectacular as the dramatic instances of the determination of structure of some larger and better known compounds; but the somewhat less glamorous results mentioned in the preceding two paragraphs are, to a significant extent, the solid base of wider knowledge on which various other triumphs rest.

There are a number of other structure determinations of smaller molecules which, for one or another reason, are particularly important. The absolute configuration of D-tartaric acid, achieved by J. M. Bijvoet and his group at Utrecht in the early 1950's, cleared up for a whole group of related compounds the "right glove-left glove" ambiguity. The determination during the war, by work under the direction of Dr. Dorothy Hodgkin of Oxford, of the structure of cholesteryl iodide was an outstanding achievement which clarified several of the structural problems of steroid chemistry.[1] The determination, in a series of papers between 1935 and 1940 by Professor J. M. Robertson and his colleagues in Glasgow, of the structure of phthalocyanine and its metal derivatives provided the dimensions and configuration of the porphyrin ring system which is the fundamental structural unit occurring in chlorophyll, hemoglobin, and all heme-related compounds. Around 1950 two almost simultaneous determinations—one by Bijvoet and the Utrecht group and

[1] From this same laboratory there subsequently came the structure of two other sterols, namely Calciferol-4-iodo-3-nitrobenzoate and Lumisterol-4-iodo-3-nitrobenzoate.

the other by C. A. Beevers and his colleagues at Edinburgh —were made of the structure of strychnine, these pioneer investigations of the alkaloids confirming the structure of the strychnine molecule most generally accepted by chemists at that time. An outstandingly brilliant example of a determination which quite outdistanced the chemists is the analysis of DL-isocryptopleurine methiodide by Dr. A. M. Mathieson of Melbourne, the detailed structure and dimensions of this molecule being completely worked out, starting with no chemical information other than the rough empirical formula.

Structure determinations by X-ray methods have been accomplished for at least seven sugars and related compounds, nine alkaloids, and seven isoprenes and terpenoids. The really great triumph in the small molecule field, however, is the monumental determination in 1949 of the structure of penicillin. A large team of workers, both chemists and crystallographers, was involved, the X-ray work being under the direction of Dr. Dorothy Crowfoot Hodgkin.

Turning now to large molecules, the case of Vitamin B-12 presents the most complex structure of biological interest so far to be essentially completely solved by X-ray methods. This molecule, whose structure was reported in 1957, has the molecular formula

$$C_{63}\,H_{88}\,O_{14}\,N_{14}\,P\,Co$$

and hence it contains 181 atoms. The diagrams showing the contours of electron density, as revealed by the X-ray studies, the conventional structural diagram, and the projection of its actual three-dimensional shape are all shown in Figure 16.

This structure was determined by workers at Oxford, Los Angeles, and Princeton, the group being headed by Dr. Dorothy Crowfoot Hodgkin. The inspired combination of science and art which produces a truly great achievement of this sort is accurately reflected by the fact that the article in *Nature,* which reports the work, states that "The molecule that appears is *very beautifully composed. . . .*"

When one moves on to still larger molecules, or other aggregates which play important biological roles, there are a number of fascinating examples. As a great pioneer in the general field of the fibrous proteins, W. T. Astbury, studying keratin fibers in the early thirties, distinguished an extended (β-keratin) and a folded (α-keratin) form of the interchain packing of polypeptide chains. "This early work," as Hans Neurath and Kenneth Bailey say,[1] "has provided the foundations for most subsequent stereochemical theories of protein structure." Based largely on the amino acid and simple peptide results of the Pasadena group, a general model has been proposed by R. B. Corey and J. Donohue for the fully extended polypeptide chain. Taking off from the early keratin studies and combining the powerful theoretical and the precise experimental resources of the Pasadena school, Linus Pauling and R. B. Corey have introduced several structural ideas, notably that of the so-called α-helix and several "pleated sheet" models, which are of the greatest importance for protein structure studies. Myosin, the principal protein constituent of muscle, exhibits the α and β patterns of Astbury, and the Pauling-Corey α-helix seems to conform to the known facts. Similar results have been obtained for the fibrous protein constituents in skin, the keratin from hair and feathers, and for silk fibroin. Both the α and the β forms are now becoming rather accurately known; and the general structure of collagen, the fibrous protein found in connective tissue, tendons, bones, etc., is now considered to be fairly clear.

Having referred to myosin, it should at least be mentioned that the whole interlocked structural and biochemical problem of muscle has been greatly illuminated by studies by Albert Szent-Györgyi, Francis Schmitt and his colleagues

[1] *The Proteins,* Academic Press, New York, 1953, Vol. 1, Part A, p. 239.

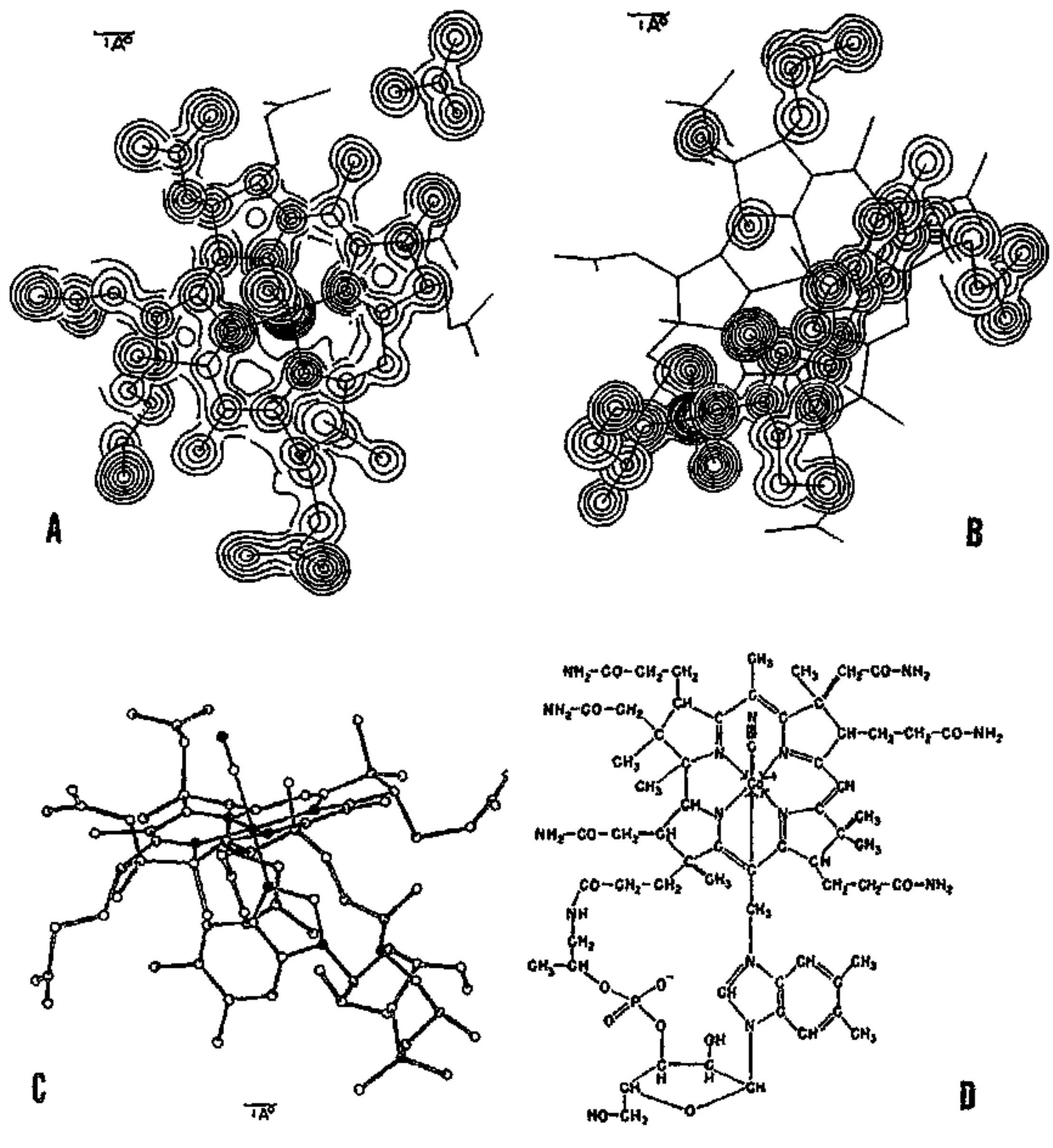

Fig. 16

The Vitamin B-12 molecule: (a) and (b) show contours of electron density determined from X-ray studies of the three-dimensional electron density distribution for wet B-12 crystals; (c) gives projection of the three-dimensional positioning of the atoms which make up the B-12 molecule; (d) gives conventional structural diagram for the molecule. (Reproduced by permission of *Nature*.)

at MIT, H. E. Huxley, and others. Much as has been learned, Szent-Györgyi says in the conclusion of a recent article,[1] "So we can sum up by saying that we still do not understand muscle. . . . It may be true not only that our outlook on biological action is too narrow, but also that our knowledge of muscle structure is too incomplete." But what progress we could make in muscular dystrophy, and in the disorders of that great muscle, the heart, if only we could gain a more complete understanding!

The most spectacular of the large molecule structure determinations, and surely the one of the most basic interest to biology, is that of deoxyribonucleic acid, better known by its short name, DNA. The great interest in this substance results from the fact that it is this long chain molecule which, on all present evidence, constitutes the naked genetic material in every cell. As one can see from the color plate, there are two intertwined helices, formed of alternating phosphate and pentose sugar groups, linked together with side groups, or bases. There are (at least[2]) four kinds of these bases, of which two, adenine and guanine, are purines, while the other two, cytosine and thymine, are pyrimidines. When guanine is attached to one helix at a certain point, it always pairs with cytosine on the other helix; and similarly adenine always pairs with thymine. Thus the sequence of bases on one helix determines the sequence on the other. But the over-all sequence of bases, as found on one molecule of DNA, is by no means the same as that to be found on another molecule, at least unless these two come out of the same living organism. For it is precisely the sequence of these bases which is, by the present view, supposed to contain—and at duplication to pass on—genetic information.

[1] *Science*, Vol. 128, No. 3326, September 26, 1958, p. 702.
[2] It has recently been shown that 6-methyl amino purine is present in some DNA's.

Thus it seems very likely that this beautiful helical molecule, whose long chain pieces inside cells have molecular weights in the millions, is the really critical link between chemistry and biology. It is a pure chemical; but there is strong reason to believe that it is the special chemical which possesses two capabilities necessary for life—the capability of causing itself to be duplicated, and the capability of storing and passing on, to the next generation, a vast amount of genetic information.

A single chromosome of a cell is now thought to consist of about ten million turns of DNA, and there is evidence that what we normally call a gene corresponds to only a few base-pairs along the double helix.

If indeed the genetic constitution of an organism depends fundamentally upon the order along one of the two DNA helices of the four bases A(adenine), G(guanine), C(cytosine), and T(thymine), then at a single base point the question is: which one of the letters A, G, C, or T is to be written down? This requires two simple either-or choices: that is, shall we pick a purine or a pyrimidine, and having settled that, shall we pick the first or the second of the kind? In the language of modern information theory, in which one "bit" of information corresponds to a single either-or or yes-no choice, one would say that it requires two bits of information to decide upon a single one of the chemical cross-links between the two DNA helices: and since there are roughly nine cross-links per turn, a chromosome has something of the order of one hundred million of these cross-links, each of which requires for its specification two bits of information.

We all know, from playing twenty questions, that it is usually possible to single one out of a vast array of possibilities by asking "Yes or no?" only twenty times. A chromosome is able, so to speak, to answer such a yes-or-no question some two hundred million times,[1] which corresponds roughly to the total information stored in about one thousand large textbooks.

How DNA, this master chemical of life, duplicates itself, how the genetic information is coded on to the sequence of bases, and how it is read off, are massive questions for the future.

A large part of the credit for this DNA structure story goes to J. D. Watson and F. H. Crick. But as they have been the first to emphasize, they utilized the superb X-ray diffraction data of M. H. F. Wilkins, Rosalind Franklin, and their co-workers at King's College London; the basic structural concept of the α-helix which owes so much to Pauling and Corey and to various other scientists back to the pioneer ideas of Astbury; and a mass of essential knowledge built up, step by patient step, by the various organic and biochemists who have worked on nucleic acids. This is a proud example of the fact that it is, after all, within the capabilities of men to deal successfully with organized complexity.

In this brief sketch we have by no means surveyed the entire range of structure studies. Much as we now know, it remains a startling challenge that it has as yet not been possible to determine the complete structure of a single protein. "The proteins, as the name implies, are of first importance in the structure of living matter. No living cell is without them, and any discussion of biological ultrastructure must inevitably start with a consideration of the structure of the proteins."[2] Much is now known, of course, about protein structure; several very able teams, chiefly in the United States and England, are hard at work. David Harker in New York City and J. D. Bernal and C. H. Carlisle in

[1] This estimate would be increased if there is an occasional base which differs from the four predominant ones.

[2] *Biological Ultrastructure*, by Arne Engström and J. B. Finean, Academic Press, New York, 1958, p. 101.

London, for example, are carrying out detailed studies of the protein ribonuclease.

A real advance in the prospects of elucidating protein structure occurred in 1953 when M. F. Perutz of Cambridge showed that it is possible with protein crystals, as well as with the simpler structures to which the method had previously been applied, to add to each protein crystal one single very heavy molecule, such as gold or mercury; and then to gain wonderful new knowledge by *comparing* the X-ray pictures given by the original and by the loaded protein.

This method was brilliantly applied by Perutz to hemoglobin, the protein which is the respiratory pigment in red blood cells. With a molecular weight of the order of 68,000, and with well over 2,000 atoms in its molecule, this substance is of obvious complexity and of equally obvious biological interest.

Perutz, by the method just mentioned, was able to obtain a two-dimensional projection of hemoglobin. But this projection, which "looked through" a depth of some forty atoms, involved so much overlapping of structural detail as to be most confusing. Later J. C. Kendrew applied the same procedure to myoglobin, which is one-quarter the size of hemoglobin; but in this case also the results were by no means clear.

Kendrew and an extended group of collaborators have, however, very recently[1] extended this method by loading the molecule (myoglobin in this case) with not one but four heavy atoms, and by obtaining projections in not one, but in all three spatial directions. This beautiful work, which presently represents the greatest advance in the elucidation of the three-dimensional structure of a protein, is most satisfying in that it does show up "rod-like features of just

[1] *Nature*, Vol. 182, No. 4638, September 20, 1958, p. 764.

the dimensions and density to be expected of polypeptide chains arranged in a helical configuration." But it is a challenging indication of how much hard work lies ahead that Kendrew, in the closing paragraph of his paper, says, "All in all, the model poses more questions than it answers. It gives us a first glimpse of the configuration of a protein molecule, but it is a tantalizing glimpse because the picture is so blurred. . . ."

V. Aspects of Program

FOREWORD

In the preceding Part there have been described some of those more recent aspects of biological research which are specially relevant to the interest and emphasis which have characterized The Rockefeller Foundation's program in modern experimental biology. These sections make no pretense of giving a balanced or full impression of the total picture of modern biological research; nor is there any implication of lack of interest and importance in many fields —systematics, gross morphology, ecology, for example— which have received little or no mention here.

Particularly should it be emphasized that these four preceding headings have sought to give a general account, which is not in the least intended as a record of accomplishment for which The Rockefeller Foundation deserves or wishes any recognition. If, as in fact is the case, we have had some formal association with essentially all of the developments mentioned, and long sustained and extensive association with many of them, that we simply view to be an honored privilege, the credit, as always, going to the scholars.

Since, however, this is a report of The Rockefeller Foundation, and since several aspects of the natural science activities over the past twenty-seven years are not involved in the preceding sections, these aspects will be briefly reviewed in the present Part.

MEN

Planning is necessary, and there is such a thing as a good plan or a bad plan. A stimulating and stable institutional setting is also important. But the really important thing is *men.*

The way to advance work in any field whatsoever is to seek out the well-trained men of capacity and character, men who are imaginative and energetic—and then back them. If one is giving broad and sustained support to an area, he must also be concerned to help create a future flow of such persons—that is, he must help create attractive circumstances for the recruitment and training of younger personnel.

There are variants to this principle, and the variants are not always obvious. One must not expect that backing men will always involve grants to individuals, or grants for salaries. Sometimes one is fortunate enough to find a considerable group which deserves support. But even in large groups it is the leadership which is the absolutely essential matter. And it is the combined quality of all of the personnel involved that, in the last analysis, justifies the support. Once in a while one finds a situation where the traditions are so high and so well maintained that support is justified even if it is support for future men not at the moment known and specified. But in all such variant cases there is—or should be—no real departure from the guiding principle that what counts is men.

Thus the seeking out and the liberating, through advanced training and broadened research experience, of individual young scientists of intelligence, dedication, and character has been one of the most active, and certainly one of the most basic and rewarding, segments of the whole program. From 1932 to the present time approximately 1,400 persons have held fellowships or scholarships in the natural sciences and in agriculture. In the great proportion of instances this involves training outside the country of origin. Money spent in a well-administered fellowship program, which uses all possible care in selection and in the initial arrangements of program and then gives the recipients freedom to develop, is probably the safest and best money a foundation can spend.

The list of the individuals aided over this period includes a considerable number whose names now bear high honorific titles, such as knighthoods or Nobel laureates.[1] This of itself is not very significant, for if titles are to be used as the criterion for grants, the World Almanac and a bright secretarial staff could replace foundation officers. What is rewarding is an association which long predates the honors. It is, of course, gratifying when an outstanding biochemist, receiving support from The Rockefeller Foundation, is given a Nobel Prize. It is still more gratifying that he received his first Rockefeller Foundation aid twenty-two years earlier, and that his researches had been aided over almost the whole of the intervening period.

EXCEPTIONS TO PROGRAM

Under this heading one must expect a heterogeneous assortment. For many years it has been considered that a proposal must satisfy two criteria if it is to qualify as an exception to the stated program: first, it must be of quite exceptional interest, importance, and quality; second, it must be essentially unique, so that approval of the one exception does not set a precedent which would then embarrass the orderly development of program.

An almost perfect illustration of this philosophy of exception is furnished by the 200-inch telescope of Mount Palomar. This great project is not a part of the history here being recorded, since its inception occurred under Dr. Wickliffe Rose in the International Education Board in 1928. But two supplementary grants to complete this project were made in 1946 and in 1948; and two or three further exceptional grants in astronomy were also made during the period of this report, one of these being aid for a radio telescope installation in Australia.

[1] Four men whose work has been referred to in this report received the Nobel Prize while the report was being written.

Before the advent of the now familiar electronic type of computer, grants were made to the Massachusetts Institute of Technology toward the design and construction of the more mechanical sort of differential analyser invented by Dr. Vannevar Bush; and this was followed, in 1946, by a grant for studying the potentialities of electronic computation.

A rather large grant was made in 1940 to assist in the construction, by Dr. Ernest Lawrence, of the first really large cyclotron. At that moment one thought that this 154-inch cyclotron might be the permanent giant, comparable in its field to the 200-inch telescope in its. Built just in time to play a critical role in connection with nuclear energy developments, this instrument was promptly overshadowed by larger devices of improved types. Grants were also made to improve the design of the Van de Graaff generator, another device for furnishing high energy particles.

For years before World War II it was clear that the development in this country in applied mathematics was unsatisfactorily weak. Grants were accordingly made, for periods of several years, to the development at Brown University under Professor Prager, and at New York University under Professor Courant. This was supplemented by aid to mathematical publication. It seems reasonable to suppose that this particular set of exceptional grants had a useful effect on the resources, in what has turned out to be so critical an area, with which the United States has subsequently faced the technical problems of defense.

Between 1932 and 1940 there were a number of rather modest exceptional grants in meteorology. This was a field which had not notably prospered in the United States, and it seemed clear that important advances were possible and were highly desirable for a variety of reasons, including military needs. If more substantial and longer continued aid had been given, this might have played a role somewhat like the aid to applied mathematics. But this must be written off as a much less successful venture, for the Director for Natural Sciences was not able to convince the Board of Trustees that a recognized, even though minor, program in this area would be a desirable thing.

Also in the general area of the physical sciences was some exceptional aid to world-wide studies of meteorites, and to high altitude studies, partly on the physical but also partly on the biological aspects.

As three final illustrations of exceptional projects, a substantial sum was given as endowment to the Woods Hole Oceanographic Institution, an Institute of Experimental Pathology was built in Iceland, and support was given for a period of years for human paleontological research related to Peking man.

GENERAL GRANTS

A few typical examples will illustrate the sort of broad aid to science as a whole which has always formed part of The Rockefeller Foundation program.

At this particular moment, when many nations are devoting millions of dollars, and newspapers dozens of pages, to the International Geophysical Year, it may be interesting to note that in 1932-33, when there occurred the Second International Polar Year (the first was held fifty years before that), there was so little public interest and correspondingly so little financial support that grants made in 1932 and 1934, exceedingly small as things go nowadays, were important in supplying standardized equipment to the smaller countries, and in helping to analyze and publish the data.

Some aid was given to studies of the history of science, chiefly under George A. L. Sarton and Otto Neugebauer.

When the position of many liberal, and particularly

Jewish, scientists became untenable in Germany and in some other parts of Europe, aid was given to rescue these scholars, to transport them to other parts of the world, and to pay their salaries until they could become re-established. Also related to World War II was emergency aid given in France, in Holland, in Norway, and in Italy, chiefly to obtain postwar equipment for laboratories which were then in desperate need.

In areas where science is not so highly developed as it is, for example, in the United States and in Western Europe, it is often neither feasible nor desirable to restrict aid sharply to definite program ends; and for that reason several general grants have been made for the broad research interests of whole faculties of certain of the universities of Latin America. Similarly, and before such aid was generally available in the United States as is now the case, general grant-in-aid funds were made available to a few universities of this country.

The Rockefeller Foundation has given aid, restricted as to the number of instances but substantial in total amount, to scientific publications, including the *Annual Table of Constants*, *Biological Abstracts*, research journals in both physics and mathematics, and postwar emergency aid to a wide range of British scientific journals.

As a final example of aid that has a strong "general" flavor, partly because the detailed decisions as to distribution were in hands other than our own and in many instances because the support was in fact unrestricted as to field, it should be noted that support of large total magnitude has been turned over to the National Research Council, both to finance a program of National Research Fellowships in essentially all aspects of science, and also in support of such NRC committees as that on Research in Problems of Sex, on the Effect of Radiations on Living Organisms, on Biophysics, on Developmental Biology, on Education Policies, and on Effects of Atomic Radiations.

OTHER COMMENTS ON PROGRAM ACTIVITIES

There remain unmentioned several aspects of the program in experimental biology. One of these, namely genetics, has in fact been a large interest as Figure 6 shows. The field has advanced notably, and certain of its more spectacular successes have been in connection with the structure studies of DNA, etc.; so that our account has in fact paid more attention to modern genetics than would explicitly appear. This is a field in which the United States has been in the forefront since the pioneer work of Thomas Hunt Morgan; and aid has been given for research in genetics at such leading centers as the California Institute of Technology, Indiana, Texas, Columbia, and Wisconsin. Considerable aid in this field was also extended in England, Brazil, and Sweden.

Grants intended not for any specified set of projects but rather intended to assist in the development of a considerable group of able scientists—often a whole department or division of biology—were given to the California Institute of Technology, Chicago, Hopkins, the Massachusetts Institute of Technology, and Stanford, with somewhat similar aid lesser in amount to Amherst and Dartmouth.

Grants specially aimed at sponsoring the collaboration of physicists and biologists were made in Holland (A. J. Kluyver and later J. M. Milatz), to W. T. Astbury and his group at Leeds, to the Bohr-Hevesy-Krogh-Rehberg group in Copenhagen (and Stockholm), to the Massachusetts Institute of Technology, and more recently to Professor J. T. Randall and his group at King's College London.

Assistance to marine biological stations was given through grants to the Scripps Institution of Oceanography, La Jolla; the Department of Marine Science of the University of Miami; the Naples Zoological Station; the Marine Biological Laboratory at Woods Hole; and the Marine Biological Association of the United Kingdom at Plymouth; with lesser support to stations in France and Latin America.

Substantial aid was given to various programs of research carried out with chimpanzee subjects in the laboratories, originally at Yale, and later moved to Orange Park, Florida, now named the Yerkes Laboratories in honor of the man who pioneered in this field.

As the level of project support for biological research in the United States was decreased, beginning about 1951 (see page 34), two compensating movements arose. The first was a temporary one. In something like a half dozen instances fairly large-sized "definitive final grants" were made, to groups of workers or to departments, or to all-university programs in certain instances, with which the Foundation had had a considerable association. In a larger number of instances, and as a continuing aspect of program, flexible and rather long-term (five or seven years) grants were made in support of the general program under certain really outstanding leaders. These grants were flexible in two regards. There was no specification of the detailed way in which the money was to be spent; and the maximum amount which could be drawn, in any one year, was set at about 50 per cent more than the average available for all the years. As was stated in an internal memorandum written in 1953, such a grant has the following advantages:

> It is flexible as to the use of the money. It permits a man to follow up unexpected leads and to handle unforeseeable desirabilities or emergencies. It does not tie an investigator up to some unhappy promise that he will try to solve some definite 'practical' problem.
>
> Money not used in one year does not revert to the RF, and hence there is none of the indecent temptation to spend money rather than lose it. On the contrary, the whole pressure, under such a grant, is

not to use it unless necessary. For this is the best money the researcher has; and he does not lose it by not spending it.

This kind of money, flexible as to purpose and rate, is of the greatest value in smoothing out the eccentricities in the receipt of specified and short-term grants. It makes this other money more important and useful, just as a relatively small amount of mortar can give stability to a large number of separate bricks, and can permit them to contribute to the formation of a meaningful structure.

This kind of money is frequently most useful when it is in fact not spent. For it permits an investigator to undertake an obligation (as, for example, for the next year's stipend for a young man offered a competing job). The obligation may actually be met from a short-term grant whose approval is secured several months after the decision must be made. But in the meantime, the program has stability and the investigator can sleep nights.

This kind of help obviously should be restricted to really first-class men, whose records are such as to justify this sort of confidence. But it is *the most needed element in the support of such men*. It represents, under present circumstances, one of the most important opportunities the RF has.

AGRICULTURE

The present agricultural program of The Rockefeller Foundation as it has evolved since 1941 involves three aspects:

a) Research and development projects carried out in various countries, namely Mexico, Colombia, Chile, and India, to list them in the chronological order of inception of the projects, there also being an activity in Central America which is closely tied in with both the Mexican and the Colombian projects, and also an extension of the Colombian project into Ecuador. All of these "operating" programs seek improvement of the food crops of major importance to the host country, and the development of local institutions and resources, particularly of indigenous personnel, which will enable the country in question to take over the work in due course. These operating programs depend upon a substantial core of scientists under stable appointment as field staff of The Rockefeller Foundation; and upon extensive physical facilities, funds, and personnel provided by the collaborating countries.

b) Fellowship and other training activities which in large part serve the operating projects just described, and which in lesser part train key agricultural personnel in other countries in which we do not have operating programs.

c) Grants to universities, agricultural colleges, research institutes, etc., in support of basic researches in agricultural science. These are typically researches in plant physiology, plant pathology, microbiology, plant biochemistry, genetics, etc., which are intended to add to that world stock of scientific knowledge which will make possible future advances in agriculture.

Of these three aspects of the agricultural program the second and third, granting the agricultural orientation, are entirely similar to the fellowship and grant programs carried on in other branches of The Rockefeller Foundation. Indeed many of the agricultural grants, especially those to universities, would perfectly properly be classified on the Foundation's lists as "experimental biology," were it not for the existence of the agricultural program. This report will give no special attention to the aspects b) and c) above of the agricultural program, but will concentrate on the operation aspect a).

The operating agricultural interests of The Rockefeller Foundation originated in 1941, when a team of specialists was sent to Mexico to study the agricultural situation there, and to report whether or not there were significant opportunities for aid which fell within the financial and other competence of The Rockefeller Foundation. Following this survey, extended discussions were held with officials of the Mexican government, the result being an invitation that a collaboration be arranged.

The search for key personnel required some time, and the program developed slowly, the annual costs over the first, second, and third years being only $10,000, $30,000, and $20,000, this however being followed the next year by nearly $200,000 and a series of steadily increasing annual budgets. Initially there was a single Foundation scientist and a single Mexican associate. At present the program in Mexico employs 18 Rockefeller Foundation staff members and approximately 104 Mexican associates, 33 of whom are regular staff members and 71 of whom are junior staff members. The program includes studies of corn, wheat, beans, potatoes, truck crops, sorghums, soybeans, forage legumes, grasses, poultry, and livestock. As this list indicates, the emphasis is upon the food crops of the people of Mexico.

"Work was begun," to quote from a report[1] by Dr. J. G. Harrar, who has led and directed the Foundation's agricultural program from the outset, "near Mexico City on the land of the National College of Agriculture at Chapingo and has gradually expanded into the states of Mexico most important to national food crop production. Chapingo is still the center of the research operation, where some two hundred and sixty acres of experimental farm land are in use, along with field laboratories, greenhouses, farm machinery, shops, and warehouses. The research in progress places primary emphasis on the genetic improvement of varieties of food crops best adapted to the various regions of the country, the control of pests and diseases, and the improvement of soils and management practices which tend to produce increased yields.

"Since the project was initiated in 1943, there has been close collaboration between the Mexican Ministry of Agriculture and the Foundation in an effort to insure increased food production. Land and the labor to work it were made

[1] *The Agricultural Program of The Rockefeller Foundation*, The Rockefeller Foundation, 1956.

available by the Government, and young Mexican agricultural graduates were officially assigned to the *Office of Special Studies* as commissioned personnel to receive in-service training in the program. As the work got under way, the Government and the Foundation joined in establishing the experiment station at Chapingo and in providing buildings and equipment. Later a direct appropriation was provided by the Government to supplement the funds provided by The Rockefeller Foundation. The location of Chapingo is ideal, close to Mexico City, and representative of much of the high plateau of Mexico. Most important of all is the direct association with the National School of Agriculture, where over four hundred young Mexicans are studying agricultural science. The agricultural experiment station serves as a demonstration area for classes, and provides opportunities for students to gain useful experience during vacation periods and for members of the faculty of the school to carry on investigations that are coordinated with the work at the station. As a result, the college and the station are mutually helpful and together comprise the main center for agricultural instruction and research in Mexico.

"As the program expanded other research centers were established by the Government and The Rockefeller Foundation in the subtropical State of Morelos, and the State of Guanajuato. The first of these greatly facilitated research on corn and beans, and the second, which is representative of the Bajío region of Mexico's high plateau, is especially suitable for work on wheat, barley, sorghum, forage crops and grasses. During 1955 two additional important centers for agricultural investigation were established by the Government of Mexico. One of these, because of its strategic location in the tropics in the State of Veracruz, will be of major significance in the development of tropical agriculture in Mexico and elsewhere. The second new station is in the State of Sonora, in the center of a promising, fertile area, which is rapidly becoming the principal source of wheat for Mexico, and which is also of increasing importance in the production of rice, flax, sorghum, and fiber crops.

"The operation in Mexico also includes cooperative research activities at state experiment stations in the States of Mexico, Hidalgo, Oaxaca, and Tamaulipas; at the Colleges of Agriculture at Monterrey and Saltillo; at federal experiment stations in the States of Jalisco, Sinaloa, Sonora, Chiapas, and Coahuila; and experimental plantings on a large number of private farms.

"As one significant indication of the benefits of the cooperative research program, corn production in Mexico has increased steadily since 1947. When the first improved varieties of corn became available, the National Corn Commission was established directly by the President of Mexico for the purpose of increasing and distributing seed of the new varieties so that they might be most promptly effective in aiding increased national yields. Not only has the country been able to meet the demands of increasing population since 1947 without resorting to the importation of this basic food from abroad; there is also evidence that additional quantities of corn will soon be available for animal husbandry and industry. This increase in the country's corn crop reflects the combined efforts of government officials, scientists and farmers as well as the potentialities of the improved varieties developed by the *Office of Special Studies*. These include six open-pollinated, twelve synthetic, and twenty-five hybrid varieties.

"As a second example, twelve years ago Mexico imported more than three hundred thousand tons of wheat annually; but in 1955 it was officially announced that imports of wheat would soon be unnecessary because of the great increase in national production. This was made possible by the efforts of the Mexican Government to stimulate wheat production through the utilization of improved rust-resistant varieties developed by the *Office of Special Studies;* by increasing supplies of inorganic fertilizers; and by expanding irrigation facilities. An office was established within the Ministry of Agriculture to distribute the growing volume of seed of the improved varieties of rust-resistant wheat, which for the first time permitted large-scale wheat production during the rainy season. To date over a dozen new rust-resistant hybrids have been developed and released by the Office, and it is estimated that these have now been planted to more than 95 per cent of the total wheat acreage in Mexico.

"The Mexican bean, or 'frijole,' is the major source of protein for the rural population of Mexico. It is grown widely and successfully although average yields are considerably lower than those which can be expected when improved seed is used in conjunction with careful management practices. In an effort to improve bean production in Mexico some two thousand collections of beans were made from Mexico, Central America, and North and South America. These were field tested, and several hundred selections were obtained from the test plots in various parts of the republic. These were further selected and those varieties which proved outstanding were purified and multiplied for distribution as a first step in increasing production. Simultaneously a breeding program was undertaken, and to date more than a dozen varieties have been developed which have superior qualities for yield and disease resistance. The use of improved varieties together with the control of pests and diseases has made it possible for farmers to obtain increasing average yields of this vital crop. From present evidence Mexico can expect to produce, economically, increased quantities of frijoles for internal consumption and export markets.

"The double-dwarfed combine type sorghums introduced and sponsored by the *Office of Special Studies* have proved of great value for those areas where low annual rainfall severely limits the production of corn. The area now planted to grain sorghum in Mexico is estimated at more than one hundred thousand acres, in contrast to a few hundred acres in 1945, and sorghum is becoming an increasingly important animal feed.

"It has been clearly shown that soybeans are useful in Mexico in soil improvement, as a forage crop, and as a source of important vegetable oils. Similarly, wide-scale testing by the *Office of Special Studies* of a considerable number of native and introduced forage legumes and grasses has revealed that many are of great potential importance as animal feeds, and selected types are being increased for wide distribution in support of improved animal production.

"The potato, which is an important food crop in Mexico, is susceptible to numerous fungus and virus diseases. Methods for controlling these diseases economically are now making it possible for Mexico to increase production and at the same time to develop its own seed potato industry rather than having to depend exclusively on imported seed.

"A series of experiments with a wide variety of vegetable crops has demonstrated that Mexico can produce essentially any desired vegetable comparable in quantity and quality to those grown elsewhere. Hence there are now projects to develop improved varieties especially adapted to local conditions and to produce seed locally in support of the growing vegetable industry."

There are other significant aspects of the operating agricultural program in Mexico. Extension activities are being emphasized, now that there is solid and useful material to extend; and from the very first, the training of Mexican personnel has received large attention. Over 450 Mexicans have received training through their association with the operation in Mexico during the past fifteen years. Most of these men have remained in agricultural development work and have now been elevated to positions of responsibility in administrative, research, or extension activities. Others have gone into special phases of government service, have become teachers or investigators in local colleges of agriculture, have accepted important positions in state agricultural development programs, or have engaged in local agricultural enterprises. Many have studied entirely in Mexico, but 83 have taken postgraduate training in the United States leading to the Master's degree, and 19 have completed or are now completing the requirements for the Ph.D. degree in some phase of agricultural science. Some 27 have had opportunity to travel and study in the United States or in other Latin American countries.

Of international significance is the fact that approximately 125 agricultural scientists from other Latin American countries and the United States have spent a year or more as interns in the Mexican program. At the end of this experience they have returned to their countries to apply their new knowledge to local problems. More than 300 distinguished agricultural scientists from all the Americas, as well as approximately 200 from other countries, have visited the program for periods of a few days to several months. This many-sided exchange of personnel has had multiple benefits. Not only have many of the visitors gained useful knowledge and skill, but all have contributed in some way and have made friendships which will ultimately aid in the future development of international agriculture.

The agricultural activity in Mexico has been emphasized here, because it was the initial, and remains the largest, activity of The Rockefeller Foundation in this field. However as agricultural graduates from other countries came to Mexico for training and took back home with them enthusiastic reports of the program, requests were made to The Rockefeller Foundation to initiate similar efforts elsewhere. Thus in 1950 a similar program was started in Colombia, and this has now become almost as large as the Mexican program. In 1955 a third such program was started in Chile. In 1954 a "Central American Corn Improvement Program" was initiated, involving Honduras, Nicaragua, El Salvador, Costa Rica, Panama, and Guatemala. The local countries provide land, labor, and local technicians. The program is coordinated by a Rockefeller Foundation staff member who, with a Latin American associate, operates from a tropical research center in Veracruz, Mexico, but who visits all the local programs frequently. This coordinator furnishes the genetic stocks developed in Mexico and Colombia, and in general makes available the knowledge developed in the larger programs. In addition a number of young Central American scientists have been given experience, under scholarships, with The Rockefeller Foundation corn improvement program in Mexico and Colombia.

Beginning in 1956 The Rockefeller Foundation undertook a collaboration in agriculture with the Government of India. This involves programs for the improvement of varieties, suitable for various regions of India, of corn, sorghum, and other cereal crops. It also involves close collaboration in the development of a postgraduate program of agricultural education and research at the Indian Agricultural Research Institute, the central institution supported by the federal government of India for agricultural research and development. This institution has, in the past, offered training up to the level of the Master's degree; and under the collaborative plan, which will be aided by the assignment of Rockefeller Foundation personnel, there will be brought into being the facilities for more advanced education, this being worked out in close relationship with the research projects of the operating program. The detailed plan for the development of this postgraduate educational scheme has now been approved by the relevant authorities of the Indian government.

The Foundation's agricultural program also involves a number of international activities, such as the collection and preservation of genetic stocks of the basic food crop plants, and the aiding of various international agricultural meetings.

Perhaps one of the interesting, and we hope useful, aspects of this whole adventure in international agriculture has been the gradual evolution of certain principles of procedure. To quote again from Dr. Harrar's report of 1956, these are:

"1. Cooperation is the key principle, and it starts with an invitation from the host country to The Rockefeller Foundation to collaborate in a program of food improvement and with the agreement of the Foundation's Trustees to undertake the joint effort.

"2. Operating programs are then organized as integral parts of the Ministry of Agriculture of the host country and are affiliated with its appropriate agricultural agencies.

"3. Staff scientists for these foreign assistance programs are selected by The Rockefeller Foundation on the basis of high personal and scientific quality; they and their families must be persons who welcome an opportunity to serve the aims of international agriculture on a career basis.

"4. Programs are designed to fit the economic and cultural framework in which they are set. They are intended to accelerate natural processes of evolution rather than to create agricultural revolutions.

"5. Emphasis is steadfastly on research, leading to the improvement of the quantity and quality of basic food crops in the country involved.

"6. Results of research are made available as rapidly as possible to agencies which are responsible for seed multiplication and distribution and for extension activities. Attempt is made to publish results promptly in technical bulletins, popular circulars, and through the medium of professional journals.

"7. The entire operation is carried out in close association with local scientists, who participate in every phase of the program—initially as junior associates and ultimately as research leaders. The educational phase includes in-service training, a scholarship and fellowship program, and the training of young agricultural scientists from other nations who will subsequently return to positions of greater responsibility in agricultural education and research in their own countries.

"8. International collaboration is promoted whenever compatible with the basic aims of the local programs.

"9. Terminal dates are not established at the beginning of collaboration; rather it is understood that the joint effort will continue to the point at which Foundation assistance is no longer necessary to its continuing success."

VIRUS RESEARCH[1]

Since the initiation of The Rockefeller Foundation's yellow fever program in 1916 and the establishment of the Laboratories of the former International Health Division in 1928, virus studies have been an important activity of The Rockefeller Foundation. This activity has, since 1955, been the responsibility of the group in charge of Biological and Medical Research. The program has two main branches, the first of which is a grants program, under which aid is furnished, in laboratories spread all over the world, to scientists or groups of scientists engaged in research on viruses. These grants range from the most basic type of study which investigates the biochemical, genetic, and structural nature of the ultimate virus particles, to studies on a more applied, often epidemiological, level. This grant aspect of the program seeks to build up to a still more effective level, the

[1] The description of this phase of program is largely based on reports written by Dr. Robert S. Morison, Director for Biological and Medical Research, who has the direct responsibility for the management of the virus program.

good laboratories now working in this field; and to develop and train more and better personnel. This activity is closely similar to the general grants program in Biological and Medical Research, being specially characterized only by the specific interest in viruses.

The other part of the program is the operating aspect. This operating program centers in The Rockefeller Foundation Virus Laboratories in New York City, where the personnel consists of persons on the Foundation staff, together with visiting scientists, fellows, etc., from other locations. This central laboratory is coordinated with a series of field stations in South America, Africa, and India. Two units are located in South America: one at Port-of-Spain, Trinidad, is maintained in collaboration with the Health Department of the Government of Trinidad and Tobago and the Colonial Research and Development Scheme; the other at Belém, Brazil, is operated in conjunction with the Special Service of Public Health of the Ministry of Health with professional and technical staff contributed by the Institute of Medical Microbiology of the University of Brazil.

In the Union of South Africa, at Johannesburg, a unit is maintained in cooperation with the South African Institute for Medical Research, the Council for Scientific and Industrial Research, and the Poliomyelitis Research Foundation of South Africa which provides laboratory space, services, and maintenance. In India a station at Poona is operated jointly with the Indian Medical Research Council. In Berkeley, California, a unit is working in cooperation with the State Department of Health.

In each of these locations The Rockefeller Foundation maintains scientists who are regular staff members; and in each field station there will also be found local personnel of various grades. The five field laboratories have all been organized since 1951. The home laboratory in New York City acts as a coordinating agency, as a training place where workers can learn new and special techniques, and as a research center concerned with the basic problems which are common to all the field groups.

Informal collaboration has been developed with similar laboratories maintained by other organizations: in Nigeria with the West African Research Council; in Uganda with the East Africa High Commission; in Singapore with the University of Malaya; and in Israel with the Virus Laboratory of the Ministry of Health. Close liaison is also maintained with the virus laboratories of the U. S. Army in Tokyo and in Kuala Lumpur, and with the various units of the U. S. Public Health Service. The investigation of viruses by the Foundation is primarily concerned with the insect-borne viruses (arthropod-borne viruses, and hence somewhat confusingly referred to as "arbor" viruses) which infect man. There is special emphasis on the identification of hitherto unknown viruses, and the clinical symptoms which they may cause. Closely related to this is the description of their distribution in various parts of the world, and in such sub-areas as may be identified by the ecological characteristics of rainfall, temperature, degree of urbanization, etc. Of great importance is the identification of insect species capable of carrying the virus, and of mammals and birds which may serve as reservoirs or more or less continuous sources of new human infection.

In this program there have been many interesting findings and new results. A new strain of dengue was discovered and immunologically characterized in Trinidad. An entirely new virus agent was isolated from an ill patient at the same laboratory. Several other apparently new agents have been isolated from men, monkeys, and mosquitoes in South Africa, in the Amazon Valley, and in Trinidad. When this program was first started in 1949 approximately 15 insect-borne viruses had been identified. At the present time the number is well over 100. A few of the original isolations have been made by other workers, but all of the new strains have been referred to the Foundation's New York laboratory for classification, and are now included in the reference collection there located. Of the greatest importance, also, have been the advances in the techniques for identification, as worked out in the New York laboratory.

It will be noticed that most of the laboratories mentioned are in tropical or semitropical locations. This is primarily because the insect-borne viruses are more continually active in these regions than they are in areas with marked seasonal variations. They thus may serve as reservoirs from which the viruses can periodically be carried, perhaps by migratory birds or bats, to cause outbreaks of severe diseases in the temperate zone. A classical example is the regular appearance of encephalitis in Japan. Closer to home are the annual outbreaks of western equine and St. Louis encephalitis in the irrigated valleys of California and the less regular incidence of eastern equine encephalitis in New England. One member of the staff is closely collaborating with the California Public Health Department in an extensive study of the two western diseases, and a former staff member, now at Yale, is studying the eastern outbreaks. One of the most important theoretical and practical objectives of the program is to find the explanation for the recurrence of these temperate zone outbreaks. Are they due to a seasonal reintroduction of the virus by migrating birds and bats; or is the virus continuously but latently present in resident species and reactivated by changes in the weather, the onset of reproductive activity, or some similar cyclical event? Suggestive evidence is available to support both hypotheses but much further work must be done before the factors at play in any particular instance can be satisfactorily understood.

The rapid accumulation of new viruses has led to serious problems of classification, and much work has been done on unraveling the interrelationships of the various agents uncovered so far. The discovery about five years ago that most of the insect-borne viruses produce an antigen which agglutinates red blood cells has provided the basis for a method of classifying the agents into two broad groups known as A and B. The year 1956 added the description of group C which so far is composed largely of strains isolated from animals and man in the Amazon Valley. Several other agents which fail to fit any of the three known groups have been roughly characterized, but it is too early to say whether or not they will ultimately fit into a single additional group D.

This work of classifying the viruses may at first sight appear as a somewhat pedestrian return to an earlier phase of biology. But, however much one may applaud the modern emphasis on process as opposed to the mere description of appearance, it remains true that the first and still most essential step in producing order out of any set of observations is to classify them in some way. In the present instance, a system of classification can be expected to help in forwarding our knowledge in any one of several ways. The labor of diagnosing an unknown virus is greatly eased, for example, when a simple serological test can rapidly identify the group of which it is a member. In epidemiological surveys, sample sera may initially be analyzed for their reaction to group antigens and the negative ones immediately eliminated from further consideration. Those giving positive reactions to one of the group antigens need only be analyzed for the presence of antibodies to members of that group rather than for the entire spectrum of possible agents. The demonstration of group antibodies has also raised the possibility that infection with one member of the group may confer a certain degree of protection against future infection with other members of the same group. Thus, infection with a mild disease, such as dengue, Ilhéus, or West Nile fever, might produce a relative immunity to more serious conditions such as yellow fever or Japanese B encephalitis. Confirmation of the hypothesis might help in explaining such curious epidemiological facts as the absence of yellow fever from the Middle or Far East. An even more interesting but still rather uncertain possibility is the development of a vaccination procedure to provide protection against a whole group of diseases rather than a single specific member. On a more theoretical level, a classification system provides an indication of the probable genetic or evolutionary relationships among viruses. Particular interest attaches to the arbor viruses in this connection since Sir Macfarlane Burnet has recently developed several arguments to support his suggestion that the arbor viruses are probably the most primitive viral agents affecting man and the lower animals.

A dramatic development of the year 1956 was the identification of what appears to be a new disease for India. During the month of March the staff of the Poona laboratory received reports that monkeys were dying in the forests of the State of Mysore. A visit by a Foundation officer revealed that villagers near the forests were suffering from a severe and unusual disease. Within three weeks virus strains had been isolated from both man and monkeys. The two isolates were shown to be identical, and recovered patients were shown to have developed antibodies to the isolated agent. Shortly thereafter the virus was isolated from a series of ticks and was identified as being closely similar to the virus of Russian spring-summer encephalitis and Omsk hemorrhagic fever.

Through the generous and effective cooperation of the Walter Reed Army Institute of Research in Washington, a vaccine was prepared using a strain of Russian spring-summer encephalitis virus; and Indian scientists have been enabled to study vaccine production techniques in the United States.

In the past there have been several instances in which knowledge of clinical diseases has antedated by many years the discovery of the causative viral agent. The sequence of events is now more or less reversed. A large number of viral agents, potential causes of disease, have been discovered before their recognition in terms of clinical symptoms. Under modern conditions of transport, an agent can move from a remote tropical spot to a heavily populated spot in less than twenty-four hours.

This program, as seen from the public health point of view, seeks the advance information which will cope with future outbreaks of disease. From the basic biological point of view, this program seeks to get more and more knowledge about the nature of viruses, the objects—sometimes inert crystalline chemicals, sometimes living and reproducing organisms—which stand just on the border line between the physical and the living world.

A LOOK AHEAD

It has been a major purpose of this report to make clear why, in 1932, it seemed advisable that The Rockefeller Foundation put the major emphasis in its support of science on studies of living things. This choice was made because of the pressing importance of biological problems, because of the conviction that the time was ripe for an accelerated advance, and because of the belief that there was an imbalance in our total scientific progress, knowledge of the physical world having outstripped our knowledge of the living world.

What would be the analogous judgment, if made today? Are there now less pressing, less challenging, less hopeful opportunities in biological research? Are we running out of problems, or are we faced by wholly baffling problems for which there are no sensible present modes of attack? Has the imbalance been corrected, and is biology now in the lead; and if so, what program conclusion should be drawn?

In the very year 1932, when The Rockefeller Foundation was motivated by the conviction that the physical sciences were ahead of the biological sciences, a discovery occurred which in its repercussions was to have a great influence on maintaining the physical science lead. For it was in that year that Chadwick discovered the neutron. Seven years later Hahn and Strassman discovered that when uranium, element 92, is exposed to slow neutrons, the resulting fission fragments are usually nuclei of barium and krypton, quite different elements which contain, respectively, 56 and 36 rather than 92 electrons: and that in this fission process, energy is released. With this literally world-shaking discovery, the modern nuclear age began. As the intervening years have passed, the physicists have retreated further and further from the world of the ordinary firsthand experience of man, and penetrated ever deeper into the ultrasubmicroscopic world of the interior of the nucleus, and at the other extreme of dimension, they have inaugurated the departure from this planet and the exploration of space. The race—in some of its applied aspects almost a mad race—to obtain greater control of the physical world has become ever more swift. The massive financial support that governments and industries have from choice or from necessity poured into research in the physical sciences,[1] and the magnificent but bewildering progress that has occurred since 1932 in the physical sciences, combine to make it obvious that the imbalance still exists.

[1] The National Science Foundation report "Federal Funds for Science" (NSF-58-30) indicates that for the federal fiscal year 1957 the total research and development obligation of the government for science was 917 million dollars, of which 602 million, or nearly 66 per cent, was devoted to the physical sciences. The life sciences received an allotment of 278 million, or a little more than 30 per cent; while the social sciences received 36 million, or about 4 per cent. Just about the same proportions held in the estimated totals for fiscal 1958 and 1959.

Indeed, nuclear power, and nuclear weapon testing, lead to the inevitable conclusion that man will in the future live in a physical environment in which some additional radiation will surely exist and in which major radiation hazards are possible. This emphasizes, with sometimes terrifying clarity, that the present disproportion between man's conquest of the atom and his understanding of the effects of radiation on living things may well be the major scientific imbalance of our time. As a threat to the future, it ranks only with the threat of major future imbalance between population and the world's resources, especially of food.

Brilliant as has been biological progress over the last quarter century, only a start has been made. Great problems have been opened up by this brave beginning; and the hope of progress is far greater now than it was in 1932; for we now have available vastly improved resources of trained men, of theory, of experimental procedure, and of instrumentation. At the same time, the imperative need for this biological knowledge is clearer now than it has ever been.

It is much safer to write about the past than it is to predict, even in general terms, the future. But there are certain directions in which it seems clear that great advances are probable, and would be of the greatest possible significance. Only a few major topics will be mentioned here, although one could easily extend the list.

It is less than a century ago that Mendel founded modern genetics; and about half that time since Thomas Hunt Morgan began the development that we see today. But it has been only a few years since genetics has had the concepts, the facts, and the tools for a really deep and satisfying attack on the problems of heredity. Modern biochemical genetics—recognized by the 1958 Nobel awards—is, for all of its present knowledge, just at its beginnings. Human genetics, of the greatest possible significance to medicine and an absolute necessity for the nuclear age, has hardly begun. Certainly in this particular area of biology the next quarter century will see tremendous, and tremendously significant and useful, advance.

A vast amount of the confusion, the suffering, and the economic burden of our society results from the various forms of mental illness. During the last decade we have for the first time seen a slowing down—in some cases even a reversal—of the rate of hospitalization of mental cases. This has been largely due to the so-called tranquilizing drugs. Useful as they are, the chief significance of these drugs is to be found not in their own effects, but rather in the demonstration they provide that mental disorders are not an unavoidable form of some mysterious curse, but rather result from disfunction which is analyzable, understandable, and thus controllable. The analysis and understanding has barely begun; but the biochemistry of the brain and of the central nervous system surely is a subject which is destined for great advance in the years ahead.

The border line between abnormal and normal behavior will always be a difficult one to draw; and there seems to be some reasonable basis for hoping that progress can be made, over the next quarter century, in the broader understanding of human behavior. It seems probable that this will be attained along the lines of physiological psychology and through carefully planned examinations of animal behavior, rather than in the apparently permanently debatable areas of the metaphysical types of psychological theory. It may not be too optimistic to hope that in another fifty years we will have learned something about storage in and retrieval from human memory,[1] about learning, and about the role of the subconscious. New knowledge of this sort could greatly im-

[1] It is interesting that there has been such emphasis recently on modern electronic computers that when one now uses the word "memory" he feels under some necessity to make clear, especially when one also uses the words "storage" and "retrieval," whether or not he is speaking of the memory organ of a machine.

prove present methods in our educational process, and particularly in the necessary accumulation of routine facts, thus freeing time and energy for dealing with the more significant mental effort of dealing with relationships between facts.

We are, at this moment, just on the threshold of what should be a quite new era in biology, in that we are just now gaining the first knowledge of the three-dimensional structure of a protein.

'All that association of phenomena which we term life is manifested only by matter made up to a very large extent of proteins, and is never exhibited in the absence of these substances.'[1] The wool, leather, and silk that clothe us are largely protein, as are the skin, hair, nails, hoof, horn, feathers, and scales which form a more intimate protection for so many living things. Proteins are the fundamental constituents of muscles, tendons, and connective tissue; they are a part of nearly every organ and enter into nearly every vital process. They form a principal component of the chromosomes that govern our heredity; they are basic building materials for the protoplasm of each cell of every living thing. Our immunity to many diseases depends upon the mysterious way in which serum globulin a protein in the blood stream, seems to form specific antibodies when foreign proteins are introduced. Several of the hormones, including insulin, are protein in nature. Special sensitivities to minute traces of certain proteins cause the unpleasant difficulties that we refer to the allergist. The invasions of certain huge protein molecules, otherwise known as viruses, give us the common cold, influenza, encephalitis, certain forms of pneumonia, and many other diseases. Enzymes—those strange chemical controllers of so many of the detailed processes of the body, those perfect executives which stimulate and organize all sorts of activities without using up any of their own substances or energy—are now believed to be protein in nature. Indeed, many diverse scientists, each with his own special enthusiasms, would be willing to agree that these proteins deserve their name of 'first substance.' . . .

Proteins play central and basic roles in practically every aspect of vital processes—reproduction, growth and development, health and

[1] *Fundamentals of Biochemistry,* by T. R. Parsons, W. Heffer & Sons, Cambridge, 1939, p. 1.

disease. The almost countless variety of the instances in which protein reactions are important, and the delicacy and precision with which proteins enter into these reactions, depend upon the fact that there are myriads of kinds of proteins, and that each individual kind is delicately fitted to its special purposes. Furthermore, this vast and accurate specialization of the protein molecules is describable and understandable only in terms of the accurate details of the three-dimensional spatial configuration of the atoms that compose the protein molecules. . . .

Proteins are, from the point of view of the student of life processes, the most ubiquitous of all substances. They are involved in all the myriad details of vital phenomena. They are involved in this way because they are complicated enough so that there can be a specialized protein for every conceivable special job, and they are unstable enough to make them suitable for the ever-changing business of life. Furthermore, suppose that someone asks, 'What do you need to know about proteins in order to understand the way they work, in order to be able to synthesize certain important ones, in order ultimately to bring certain undesirable aspects of their activities under control?' The answer, of course, is that you want to know everything about proteins. But recognizing what we already know, and appreciating what is vital to know next, the answer surely would be structure.

These last paragraphs are quoted from a paper[1] which the present author wrote some eight years ago. At the present time it seems most hopeful that we will, over the next decade or so, have deeper and much more extensive and explicit information about protein structure; and that this new information will open vast new opportunities for understanding human health and disease. This new knowledge should contribute in a most significant way to certain of the large medical problems which now confront our society, such as the degenerative diseases of later life, circulatory and cardiac disorders, mental abnormalities, as well as certain less acute but widespread and sometimes disabling handi-

[1] "Protein Structure Studies," *The Scientific Monthly,* Vol. LXXIII, No. 6, December, 1951, pp. 387-390.

caps such as allergies. Deeper knowledge of protein structure should permit an understanding of enzyme action, with all that this implies. It will open new vistas in genetics, both in the area of urgent human problems and in the universally important area of world-wide food production. In addition to these tangible benefits, moreover, such advances in a broader understanding of the living world would form, from every intellectual and aesthetic point of view, a worthy and satisfying response of man to the challenge of nature.

For centuries it has been considered that physical nature is orderly, that it is subject to discoverable laws, and that it may be brought under a considerable degree of control through the study of its problems of simplicity and its problems of disorganized complexity. But it has not only been recognized that the phenomena of life present problems of organized complexity; it has also been considered by many that these phenomena of life are, in some dark and foreboding way, irrational. Indeed, some have gone even further, and have believed that vital phenomena are not only inaccessible to scientific investigation, but are improper and impious objects of any such attempt. This is an old attitude, which centuries ago forced the Italian anatomists to steal corpses in order to carry out their studies.

Even during the magnificent progress made in the last century by the medical sciences, there continued the attitude that certain gross and relatively simple disorders of man were analyzable and curable; but that man as a conceiving, child-bearing, thinking, remembering, behaving, growing, and finally dying organism presented problems that were in large part outside the range of rational analysis. The last quarter century has seen a considerable reversal of this view.

We can be well satisfied if this Program in Experimental Biology of The Rockefeller Foundation has helped in a small way to demonstrate that the living world, in its most intimate details, exhibits discoverable rationality and orderly beauty; and that the tools of science are just as effective here as they have proved to be in the purely physical world. Indeed one no longer wishes to insist that man is alien to the universe in which he exists. It involves no belittlement of his higher self to recognize that his body is brother to the molecule and the star.

The

President's Review

1958

Financial Summary for 1958

The Rockefeller Foundation appropriated a total of $31,592,157 during 1958. This amount was distributed among the several programs as follows:

Agriculture	$6,274,205
Biological and Medical Research	6,201,225
Humanities	3,620,582
Medical Education and Public Health	4,239,160
Social Sciences	4,300,160
General Grants	3,690,250
Supporting Services	3,266,575

The reader is invited to consult the Annual Report for detailed information on each program. The total appropriations included funds for 279 Rockefeller Foundation Fellowships awarded in 51 countries for advanced study outside the recipient's own country; 301 additional Fellows pursued their work during 1958 through earlier awards. Rockefeller Foundation Fellows studied at 127 institutions in 25 countries during 1958.

The annual income of the Foundation was $22,692,469. On December 31, 1958, the market value of its uncommitted principal fund was $578,661,640.

The Revolution of Rising Expectations

Much has been said in recent years about the "revolution of rising expectations." It is an apposite if slightly dramatic term for a striking phenomenon of the postwar period—the surging demand for the means to meet more adequately the essential requirements of daily life. The most explosive impact of this revolutionary force is to be found, quite naturally, among the peoples of the so-called underdeveloped areas. For a variety of reasons these peoples had lagged behind in productivity and standards of living; disease, poverty, and illiteracy seemed to be inescapable features of their physical and social environment.

If there has been any fatalistic acceptance of the inevitable it has been shattered in mid-century. Before World War II improvements in such public services as education and public health had whetted appetites. Vigorous nationalist movements brought into being, during and after the war, a large number of independent nations in the underdeveloped areas; independence movements won strong popular support in part by identifying misery with the alleged exploitations of the colonial powers and by promising that independence would bring rapid social and economic improvement. Education, mass communications, and multiplying contacts with economically more advanced areas played their part in persuading hundreds of millions of peoples that poverty, disease, and ignorance are afflictions which men can do something about.

Nor have the economically more advanced countries been untouched by the upsurge of demand for improved conditions. War devastation and war-imposed austerity had interrupted economic growth in civilian goods and services and forced reductions and postponements in personal hopes and expectations. Even in highly productive economies relatively sheltered from the severest wounds of war, new vistas opened of unprecedented levels of material comfort at a diminishing cost in toil and effort. The revolution of rising expectations may reasonably be described as a universal phenomenon, varying in intensity and in the priorities assigned to different needs. No society has been untouched by it, whether large or small, complex or simple, capitalist, socialist, or communist, industrial or agricultural, stable or unstable.

The historian may find it curious and even significant that these explosive postwar demands for material improvement have not been translated politically into open demands for territorial expansion. In the 1930's the international scene was marked by belligerent insistence on the part of self-styled "have not" nations upon more living room and control over raw materials and markets. One may accurately characterize those particular expansionist demands as both fraudulent and cynical but still recall that they were stimulated in part by the economic distress of the 1920's and acknowledge that they helped to enlist popular support for military aggression.

In the postwar period it would be difficult to find a government, however threatening its policies might be, which pretends that it is compelled to take resources away from someone else to meet the essential needs of its own peoples. The underlying reasons are complex and go beyond the limits of this comment. But it seems worth noting that, although economic improvement is accorded high priority in most political systems, there seems to be general acceptance that the means to be used are increased productivity through the development of one's own resources, more efficient techniques, larger capital investment, popular education, improved health, and expanded trade and commerce.

One might add that rising expectations have nourished new and growing forms of international cooperation and may be drawing resources away from intense military rivalries. This is not to say that the risk of a destructive war is less—that remains to be seen—but it is just possible that the complex "causes of war" have been narrowed somewhat. Aggressive policies draw less support from alleged economic interest than once they did and are more clearly revealed as embedded in the mysterious, irrational, and dangerous realms of ambition, prestige, lust for power, ideological hostility, suspicion, and fear.

It would be imprudent to suppose that economic and social development will necessarily remain tied to peaceful processes. The revolution of rising expectations, especially among the newly independent nations, runs far ahead of the realistic possibilities of quick and substantial satisfaction. Gains will be disappointingly slow and expansive hopes can boomerang as disillusionment. Frustration might then prepare the way for political extremism and its attendant domestic and international tension. One may hope that responsible leaders will be able to draw upon the fresh energies unleashed by these new hopes and succeed in achieving results significant enough to sustain the orderliness of economic growth. The objective is one which engages directly the self-interest of the economically more advanced peoples and calls for their understanding and practical assistance. It would be difficult to exaggerate the stake which the international community has in the pursuit of social and economic development through peaceful processes rather than through violent means.

The Rockefeller Foundation, chartered "to promote the well-being of mankind throughout the world," has been involved in efforts to improve social and economic conditions since its founding in 1913. In its earliest decades it engaged in selected campaigns against such serious threats to public health as malaria, yellow fever, hookworm, yaws, and other widespread afflictions. As governments and international organizations assumed increasingly larger responsibilities for public health and as the necessary techniques became generally known, The Rockefeller Foundation withdrew from large field operations and concentrated more and more upon medical education and advanced medical research. Beginning in the 1940's, the Foundation undertook field operations in agriculture, in an effort to stimulate the production of basic foodstuffs for rapidly growing populations. These programs continue, with strong emphasis upon the essential combination of education, research, and extension. The experience gained in Mexico and Colombia is now providing the base for more extensive activities throughout the Western Hemisphere, especially with respect to corn, wheat, and potatoes. At the same time its agricultural operating program is being enlarged to include Asia, beginning in India with the Foundation's now traditional attention to basic food crops.

The enormous expansion of development programs which has occurred since the war as a response to the revolution of rising expectations has forced The Rockefeller Foundation, as a private organization with limited funds, to consider carefully where it can make its best contribution. Looking back over its own experience, it is impressed with the facts that significant social and economic advances are wholly dependent upon trained leadership and that large development programs will be severely limited by the lack of qualified people. What has been true in the West in this regard is an imperative in the developing non-West. One can say in sympathy rather than criticism that the needs for professional competence will be far greater than official development plans usually consider as possible goals. These shortages are felt in national efforts and wherever attempts are made to obtain or to provide assistance across national frontiers—by those who would give as well as by those who would receive.

A study of the Foundation's Annual Report for 1958 will reveal a strong emphasis upon individual competence at the more advanced levels—both in the United States and overseas. It cannot make large capital investments in support of general development; it cannot contribute significantly to the universal urge toward expanded and improved elementary and secondary education, although these are fundamental; it cannot justify the rapid liquidation of its resources through providing consumer goods and services to meet immediate emergencies. But it can assist in the preparation of competent men and women for roles of leadership. Here it can call upon a not inconsiderable experience. Relatively modest funds can yield a high return through the encouragement of individual excellence, and a substantial difference can be made at a crucial point in development programs.

Impressive advances in the natural and social sciences have accumulated a vast store of knowledge which is relevant to the problems of peoples reaching for rapid social and economic improvement. Surely enormous gains could be achieved by an effective application of what is already known to the practical needs of the underdeveloped countries. Even so, both basic and applied research have vital roles to play in long-range development. Nature confronts man with infinite variety and endless surprises. Answers which satisfy in one part of the world fall short in another environment. We may expect that as research grows in depth and intensity throughout the world, new light will be thrown upon knowledge now considered to be well established in the economically more advanced countries. Research into local variations among well-known diseases, relatively unknown pathogens and pests, unusual deficiencies in soils or in nutritional factors, and unfamiliar sociological factors, to cite a few examples, is a necessary part of the process of finding answers to questions which appear to stand in the way of practical accomplishment. The Foundation's program parallels its interest in professional competence with an emphasis upon fundamental research.

The Rockefeller Foundation continues to draw upon its capital funds for approximately $5,000,000 each year in order to do more in Latin America, Africa, the Middle East, and Asia than it otherwise could within the limitations of its annual income. The consequent reduction in the Foundation's future income is readily accepted because of the crucial importance of these present years for the peoples of these areas. The Annual Report shows the variety of techniques used to enlarge the supply of qualified talent and to stimulate the more significant research. These include:

(1) The Rockefeller Foundation Fellowship program, administered directly by the Foundation (the 279 awards made in 1958 bring the total to 8,117).

(2) Scholarships, training grants, and other directly administered training aids where the more formal Fellowships would not be appropriate.

(3) Funds to permit other organizations to award fellowships and training grants as a part of that organization's specialized interest and activity; an example during 1958 was a grant of $300,000 to the Population Council of New York for a three-year period.

(4) Funds to permit other agencies to award fellowships within the recipient's own country; an example in 1958 would be $58,000 to the Indian Council of Medical Research in support of fellowships for postgraduate study in India.

(5) Travel grants to permit visits which are highly relevant to the recipient's plans and professional advancement; approximately 250 such grants were made in 1958.

(6) Training within the Foundation's own operating programs in agriculture and virus research.

(7) Financial assistance to key institutions which can assume roles of national and regional significance in developing leadership; an example in 1958 was a $600,000 grant to the Paulista School of Medicine in São Paulo, Brazil.

(8) Assistance to libraries, both in books and in the improvement of library techniques; the Annual Report for 1958 shows, among such grants, aid to the University of Lucknow's Medical College ($34,000), to the Indian Agricultural Research Institute ($100,000), to the international activities of the American Library Association ($130,000), to the School of Library Science of the University of Antioquia, Colombia ($265,000), to Columbia University, New York, for training Indonesian librarians ($95,620), and toward the libraries of eleven foreign ministries ($5,000 each).

(9) A considerable variety of selected grants in support of research highly relevant to development programs; examples drawn from the dozens of such grants in 1958 are those to Cornell University for research on crop yields ($75,000), to Kyoto University for research on wheat ($39,500), to the University of Alaska for studies of grasses and legumes ($30,000), to the South Pacific Commission for investigations of the rhinoceros beetle ($22,175), to the National Research Council for research on protein-rich foods ($300,000), and to the Institute of Economic Research of the University of the Andes in Colombia ($36,000).

Intercultural Understanding

The 1956 Review called attention to The Rockefeller Foundation's long and lively interest in intercultural understanding—"understanding" defined as "knowledge, discernment, comprehension." In a world in which few far-off places remain and in which men of diverse cultures are in daily and rapidly multiplying contacts with each other, the discovery of common ideas and interests and the accurate and sympathetic comprehension of differences become urgent necessities. Studies that might once have been the hobby of a few curious amateurs and the preoccupation of a scattered handful of scholars have become an exigent need for entire societies and a heavy responsibility for their educational systems. Beyond necessity lies opportunity—for the enrichment of each culture by the best offerings of others and for fresh injections of diversity to counter the pressures of mass societies toward dull uniformity.

The Foundation's most direct contribution to intercultural understanding takes the form of assistance to relevant university work in the humanities and social sciences. The appropriations fall into four principal groups, the first of which includes aid for studies of non-Western cultures in the United States. That the United States has need of a deeper and more perceptive understanding of the cultural backgrounds of other peoples in this mid-twentieth century is obvious. That it has entered the modern period with serious deficiencies in this respect is equally apparent. For over a century the nation concentrated upon the occupation and development of its own large continental area. Successive waves of immigrants consciously abandoned much of their varied cultures in order to become "American" as rapidly as possible. There was no far-flung colonial empire to take large numbers of Americans into distant parts of the world and to require a working knowledge of the cultures and traditions of other peoples. The educational system concentrated upon the heritage of England and northwestern Europe, the cultural home of the dominant portion of the population.

Even as historical events projected the United States into a new role in world affairs, fortuitous circumstances seemed to decrease the urgency of giving more attention to other cultures. English spread rapidly as a lingua franca, with a minimum of conscious effort on the part of English-speaking peoples. Americans were thereby reasonably assured of a language of communication throughout the world and relieved of pressure to make other great languages their own. Further, the revolution of rising expectations stimulated economic development; the United States had earned general respect for its material achievements and was one of the few countries in a position to assist development elsewhere. In becoming the lender, teacher, giver, it tended to forget how much it had learned from others and to ignore the opportunities for its own enrichment through two-way cultural exchange.

Similarly, peoples receiving American aid have given little or no attention to their own capacity to enrich American life and culture and thereby to put the relationship upon a more satisfying and reciprocal basis.

Beginning with "area studies" in the 1930's, The Rockefeller Foundation has tried to encourage a steadily growing interest in non-Western cultures and has assisted universities in the development of trained leadership. A number of the grants made in 1958 illustrate this effort: $225,000 to the Harvard-Yenching Institute for Korean studies; $110,000 to Stanford University for Japanese studies; $60,000 to the University of California's work in Indian languages; $46,750 to the University of Wisconsin for Indian studies; and $39,000 to the University of California at Los Angeles for its Oriental music program. A considerable number of appropriations made in earlier years continue in active support of similar activities in other universities.

A second group of appropriations serves to stimulate American studies at selected centers abroad. Genuine understanding between peoples involves a measure of mutuality and reciprocity. One need not be chauvinistic to suggest that a comprehension of the United States and of the American scene is of some consequence to peoples in other parts of the world as well as to the people of the United States. The institutions and experiences of the Western Hemisphere have received little attention in the educational systems of Europe, the Middle East, and Asia. This aspect of the human story has been an offshoot of the main trunk of experience which is the natural concern of other societies. But misunderstanding is the inevitable consequence of this lack of systematic attention. Illustrations abound. The United States conducts its public business through a unique constitutional arrangement, with its written constitution applied as supreme law by a Supreme Court, with its division of powers between state and federal governments, with the formidable checks and balances which operate within the federal system, and with a party system which plays a significantly different role than those more familiar elsewhere. The operations and implications of this political system are largely unknown abroad, even in well-informed circles. Again, American capitalism is understood in some parts of the world as an amalgam of the East India Company, the "Robber Barons," and the portrait of capitalism painted by Karl Marx, with little regard for the striking changes that have occurred during the past fifty years in the ways in which America makes a living.

Perhaps each nation can make the point that it is badly understood abroad; the relevance here is that The Rockefeller Foundation believes that some part of its effort is properly made in support of more knowledge about the United States elsewhere. In 1958 grants were reported to the British Association of American Studies ($150,500), to the University of Munich's America Institute ($31,700), and to Kyoto and Doshisha Universities for American and social studies ($60,000 each).

Third, the Foundation has provided modest assistance for cross-cultural studies outside the United States in which the American scene is not directly involved. Creative and profound examinations of other cultures, past and present, are being made in many places to the general enrichment of the international community of scholarship. Grants in this category in 1958 included $106,850 to the University of Delhi for comparative music studies and £8,300 to the School of Oriental and African Studies of the University of London.

In the fourth group are grants to assist scholars in the study and interpretation of their own societies and cultures and thereby to strengthen the literature available to the international community. Typical grants in 1958 were $123,692 to the Colegio de México for its work in contemporary Mexican history under the leadership of Professor Daniel Cosío Villegas, $45,000 to the Academia Sinica in Taipei for research in Chinese history, and $22,000 to the Muslim University, Aligarh, India, for a history of the Sikhs.

Not unrelated are the considerable number of grants to individual scholars in the United States for periods of research and reflection in legal and political philosophy. The perceptive external observer has an important contribution to make: witness Alexis de Tocqueville and Lord Bryce. But so does the creative and articulate scholar whose interests are directed toward his own society and its institutions. Established societies are experiencing rapid change; newly independent nations are assuming new responsibilities and reaching out toward new aspirations. Old and new societies alike have a need to comprehend the roots of their past and new directions of growth and to understand these things about each other.

Grants falling into the four groupings described above represent conscious attention to intercultural problems on the part of the humanities and social sciences programs of The Rockefeller Foundation. This comment would be incomplete without some mention of the understanding which comes as a by-product of many other activities. Reference has already been made to the 580 fellowship awards and 250 travel grants which, in 1958, provided periods of professional experience outside the recipient's own country. Whatever the immediate task at hand, knowledge of other cultures is significantly increased. Further, the phenomena of the natural environment do not vary with the language, pigmentation, or religion of the observer. Science is a powerful unifying force among cultural diversities and provides its own high returns in human understanding as scientific colleagues join to know, control, or adapt to the physical environment in which man finds himself. The reader who scans the Foundation's Annual Report from the point of view of intercultural understanding will get at least a partial glimpse of the infinitely varied ways in which cultural barriers are being reduced or penetrated as men discover more and more of what they have in common and comprehend and cherish what is valuable in their differences.

Grants in the United States

During the period 1913-1958, The Rockefeller Foundation expended or committed approximately $637,000,000. Of this sum just less than 65 per cent was provided to institutions, organizations, and individual scientists and scholars in the United States. The rough proportion of the total is reflected with some consistency in the annual figures throughout the 46-year period. It might appear that the Foundation had in its early years come to a policy decision that, as an American philanthropy, it "owed" substantially more than half of its funds to its own society, but such was not the case. Nor is the proportion wholly explained by the natural tendency of a foundation to find many needs and opportunities near at hand, constantly before the eyes of its officers and Trustees in a familiar scene.

Traditionally, the American people have accepted as a serious responsibility the support through private contributions of a great many educational, charitable, and religious institutions and services. Private gifts for these purposes probably now exceed $7 billion per year. More than two thirds of this total comes from individual citizens, whose modest gifts combine to sustain and invigorate the national life through voluntary action. Business corporations contribute almost 7.5 per cent of the national total, a factor of increasing significance as business leadership accepts a larger share of responsibility for the urgent needs of higher education. New foundations, both large and small, continue to appear on the scene; approximately 11,000 foundations combined represent a bit more than 7 per cent of the total philanthropic effort. Something more than half of the $7 billion total is contributed for religious purposes; about a third goes to health and welfare services, and more than an eighth as private support for education.

The motives generating this very considerable expenditure of private funds for public purposes are undoubtedly mixed. In the American tradition are strong elements of piety and of the neighborly concern characteristic of a pioneer society. Alexis de Tocqueville found here and commented upon the pragmatic notion that if a problem exists, someone ought to do something about it. That "someone" has not necessarily meant government; initiatives have more frequently come through voluntary effort. Despite the enormous expansion of governmental activity in the present century, there persists the conviction that government should not be relied upon to meet every need, nor even be permitted to concern itself with some of them. In a pluralistic society strong attachments develop to one's community, school, college or other undertaking which enlists one's interest; these loyalties are expressed in part through financial support, in a process in which wholesome competition plays its part. Rising standards of living provide margins beyond necessity which permit personal giving and the personal satisfactions which accompany it. And, it must be added, there are social pressures in most communities, not always gentle, toward a reasonable amount of charitable giving. Finally, the encouragement of private giving is a fixed public policy, given most direct expression in tax laws framed to make it attractive. Tax deductions strongly reinforce other motives, although the record of charitable giving before taxes assumed their present significance suggests that it would be unfair to attach too much weight to that factor alone.

The scale of private giving results in great flexibility in the society; initiative and devotion have their chance; new ideas can be tested; peaks of excellence can rise out of the general mass, setting new standards and new aspirations for the rest. More important than the funds themselves is the mobilization of energies in support of worthwhile undertakings. Without delving into underlying political and economic philosophy, it is understandable that a foundation would find many stimulating opportunities in such an environment and that it might pause before adding small increments to national budgets where little or no effort is made to mobilize the vitality and practical support of the general public. It is encouraging to note the growing interest abroad in the American experience in this field. A number of countries have made tax adjustments to encourage private giving and others have the matter under close study.

Another circumstance throws light upon the interest of The Rockefeller Foundation in the American scene. The General Education Board was founded in 1903 to promote education within the United States; the Foundation was established in 1913. Their first decades coincided with a period of vigorous growth in American higher education, both public and private. A number of great universities reached full maturity. In the same period medical education in the United States moved out of chaos into a university responsibility with university standards. Before World War I, Americans had necessarily to look across the Atlantic to Britain and the Continent for advanced research and scholarship. By mid-century the relation was less one of tutelage than of a genuinely mutual and increasingly fruitful exchange. The two Rockefeller boards were strongly attracted to the prospects for a serious qualitative advance in American higher education and brought substantial resources to bear upon the task, taking full advantage of the ability of private funds to concentrate at key points.

Some of the funds invested by the Foundation in American institutions have been a direct result of its own activities and programs abroad. It has strengthened American institutions from which it has drawn its own staff and in which its Fellows might be trained for increased responsibility upon return to their own countries. It has contributed to basic research out of which might come the new knowledge which could open up new approaches to stubborn practical problems in, say, health or agriculture in distant countries. Thus it has tried to enlarge the two bottlenecks which experience has shown to be the severely limiting factors in working at "the well-being of mankind throughout the world"—trained personnel and more adequate knowledge.

To find the most effective role for a single endowed philanthropy in the current American scene is a task of considerable complexity. The explosive growth of needs and opportunities and the massive scale of other resources becoming available in fields of traditional foundation interest require a continuous reappraisal of one's own effort. Foundation policies necessarily stop short of attempting to meet a substantial portion of the urgent and deserving needs in even a single major field; this would be beyond its financial resources. The necessity for making difficult choices is multiplied, in the case of The Rockefeller Foundation, by its view that its charter responsibilities require it to think seriously about several fields which are highly relevant to the well-being of mankind. Its decisions must inevitably involve choices which will appear to many as quite arbitrary. Rigid programs and exact criteria, on the other hand, would fail to adapt flexibly to rapidly changing conditions. The comments which follow are not intended to provide a comprehensive description of the Foundation's "program" in the United States but to indicate certain trends in the way in which it thinks about how it can best use its resources.

ALONG THE GROWING EDGES

In his *The Story of The Rockefeller Foundation,* Raymond B. Fosdick commented, "In the first place, a foundation should be a pioneering institution rather than a regular source of support for tried and established activities. Its capital is venture capital, and it should be used adventurously. . . . A foundation fulfills its unique promise when it works on the frontiers of knowledge and experience, rather than in the more settled areas behind." Warren Weaver's account of The Rockefeller Foundation's interest in the biological sciences over the past quarter century vividly illustrates this sense of adventure along the frontiers.

The postwar phenomenal growth in the numbers of foundations and the increasing variety in the legitimate and worth-while purposes for which they are formed would now make it hazardous to generalize about foundations as a single group. Some were established specifically to support continuing community health and welfare services, to provide funds for a limited number of named institutions, or to work at a specific need which commended itself to one or another founder. Others have decided as a matter of policy to work "in the more settled areas" behind the frontiers. The forms of giving, especially where the more substantial gifts are concerned, may be shifting somewhat; resources which might once have gone into direct gifts for the solid support of going institutions may now appear in foundation form. It is just as well that many foundations concern themselves with "tried and established activities" and that all eleven thousand of them are not wholly preoccupied with pioneering.

The Rockefeller Foundation was founded in a spirit of great venture by a man who was confident in the possibilities of human progress if intelligence and imagination could be provided the financial sinews with which to work. Pioneering has been its dominant mood from its inception; it has been less interested in helping people or institutions to stand still more comfortably than in assisting those who are determined to move ahead at the cost of exacting and strenuous effort.

A review of recent Annual Reports would illustrate this sustained interest in the growing edges. Strong support for the Lincoln Center for the Performing Arts was not merely an expression of interest in the civic life of New York City; here was a concept genuinely unique, offering intriguing new possibilities by the intimate association of a great opera, a fine philharmonic orchestra, the ballet, drama, and advanced training for promising talent within a single center. Again, the advent of the nuclear age raises new questions in public health, calling for large and sustained efforts to understand the effects of radiation upon living organisms and means of protection against them; in 1958 the Foundation added to earlier grants elsewhere a half million dollars each to New York University and to the University of Chicago in this field. An interest in area studies, begun in the 30's with prophetic insight, calls for further stimulation as the great cultures come into intimate contact with each other. Another example of venture capital is to be found in the Foundation's comprehensive investigation of insect-borne viruses on a world-wide basis, a task too expensive for single universities or medical schools and one not yet accepted by governments whose resources are understandably directed to more damaging health problems. Grants in 1958 continued the quiet support provided for dozens of younger scholars interested in legal and political philosophy in the belief that the rate of social change requires keen attention to the basic ideas which shape and guide institutional arrangements.

Other 1958 grants which illustrate The Rockefeller Foundation's acceptance of the role described by Mr. Fosdick include $250,000 to the University of Wisconsin for studies in solar energy, $201,800 to the University of Arizona for arid lands research, $300,000 to the Population Council for fellowships, $300,000 to the National Research Council for research on protein-rich foods, $175,000 to Columbia University for studies of the potentialities of electronic music, $300,000 to Vanderbilt University for a graduate training program in economic development, and modest grants to Columbia University and to the Rand Corporation for examinations of the legal and political problems arising from the entry of man into outer space.

RESEARCH PROJECTS AND BROAD SUPPORT

In recent years The Rockefeller Foundation has moved somewhat away from the support of narrowly conceived research "projects" in the United States and has given more attention to broader and longer-term support for institutions, departments, and research programs. The sharpest reduction in grants for specific projects is evident in the field of science. Very large sums have become available from other sources—government, business corporations, voluntary health campaigns, and recently formed foundations. Taking these resources for project support into account, The Rockefeller Foundation now tends to look toward a type of support which is rising in importance and urgency, partly because of the large new sums available for projects. Income from short-term grants requires stabilization over time. Research workers need a degree of freedom from "saleable" project research if they are to follow their own inclinations and the most promising leads. Job security is difficult to achieve if too high a proportion of institutional or departmental income is on short commitment. Although longer-term and general support will necessarily mean that The Rockefeller Foundation can assist only in a few selected cases, it is believed that this type of giving is a responsible adjustment to changes brought about by what others are doing. A second factor is that broad support leaves decisions about specific research to those most closely concerned, a responsibility which Foundation staff would gladly relinquish.

BRICKS AND MORTAR

The general policy of The Rockefeller Foundation not to accept responsibility for physical plant is widely understood. Yet almost every quarterly or annual report shows Foundation grants involving assistance in the construction of facilities of one type or another. The explanation is not simply that a foundation must, in the interest of flexibility, reserve the right to make arbitrary exceptions to announced policies. It remains true that the Foundation cannot undertake to meet large and growing needs for buildings, whether in the United States or abroad. Were it to attempt to do so, its capital funds could be liquidated almost overnight without making a substantial dent upon the total need. On the other hand, there are occasional situations in which the Foundation would like to assist in a significant forward step where, upon examining all the factors involved, support for physical plant proves to be an essential aspect of the total venture. Obviously, one cannot think seriously about the Lincoln Center for the Performing Arts without acknowledging the crucial importance of its opera house, concert hall, etc. In some cases, other support is available for other features of the program one hopes to help; some assistance to building turns out to be the remaining obstacle. For example, support for the life sciences at Brown University ($560,000 in 1958) and for the biological and medical sciences at Dartmouth College ($1,500,000 in 1958) both involved substantial sums toward essential building needs. Willingness to consider "bricks and mortar" turns, therefore, on a great many factors other than the inadequacy of existing plant, the most crucial one being whether the Foundation sees an opportunity for an unusually significant advance under all the circumstances and a realistic assessment as to how the enterprise can best mobilize the necessary support.

NEW INTEREST IN THE OLD

From time to time The Rockefeller Foundation has decided to provide financial resources to fields in which it had not been previously involved. Such new programs are "new" only in the sense that they are new to the Foundation. A recent example is to be found in grants for the creative and performing arts. Here was a field in which the Foundation had had little experience; its Trustees were prepared to consider a measure of support. Its initial efforts have been largely experimental in character as the Foundation itself learns, seeks advice, and accepts the risks of trial and error in discovering an appropriate and fruitful role. The details of the Arts program have been discussed in the Review for 1956; additional grants during 1958 are listed in the Annual Report. The program is mentioned here in order to point out that grants in the United States sometimes represent a process of education for the Foundation itself before it ventures into less familiar areas.

FOREIGN RESPONSIBILITIES

If the United States as a nation has moved into a new period of responsibility in world affairs, so have its schools, colleges, and universities, its scientists and scholars. Its training facilities are crowded with students from other countries; the new knowledge which comes out of its laboratories and research departments is highly relevant to problems outside its own borders.

Rockefeller Foundation grants in the United States frequently support the international commitments of American institutions and organizations, whether for research which reinforces an effort abroad or for a considerable variety of direct services. Examples of such grants during 1958 would be one of $130,000 to the American Library Association for its international program and another to Columbia University ($95,620) for the training of Indonesian librarians. In a similar role was a grant of $66,000 to Stanford University for seminars on university administration conducted for the benefit of Japanese university administrators. Support for the English language program in the Philippines being conducted by the University of California at Los Angeles would be another. Grants to the

National Research Council for research on protein-rich foods and to the Population Council for fellowships, cited above, are cases in point. The prospect is that this type of role for American institutions is a growing one and that The Rockefeller Foundation will provide support on a selective basis.

Organizational Information

MEETINGS

The annual meeting of the corporation and a regular stated meeting of the Board of Trustees were held on April 2; a stated meeting of the Board of Trustees was held on December 2 and 3. Six regular meetings of the Executive Committee of the Trustees were held to take actions within the general policies approved by the Board.

TRUSTEES

The members of the corporation elected two new members and Trustees at their meeting on April 2. Mr. Barry Bingham, president and editor-in-chief of the Louisville, Kentucky, *Courier-Journal* and *Times,* was elected to succeed Mr. William H. Claflin, chairman of the board of the Soledad Sugar Company, who retired on June 30. Mr. Arthur Amory Houghton, Jr., president and director of Steuben Glass, Inc., was elected to succeed Dr. Thomas Parran, dean emeritus of the University of Pittsburgh Graduate School of Public Health, who also retired on June 30.

The Board of Trustees, at their meeting on December 2-3, accepted with regret the resignation of Mr. John J. McCloy, a Trustee of the Foundation since 1953. Mr. McCloy felt it necessary to reduce his commitments in order to accept the Chairmanship of the Board of Trustees of the Ford Foundation.

At their December meeting, the Board of Trustees authorized the appointment of Mr. Eli Whitney Debevoise as Counsel to the Foundation. This appointment became effective January 22, 1959. Mr. Debevoise, a partner in the firm of Debevoise, Plimpton, and McLean, will serve jointly with Mr. Chauncey Belknap.

OFFICERS AND STAFF

At its stated meeting of April 1, 1959, the Board of Trustees elected Dr. J. George Harrar a Vice-President of the Foundation, and approved certain administrative changes that recognize the growing interrelationships between the activities of the programs in Biological and Medical Research and in Medical Education and Public Health.

Dr. Harrar joined the Foundation's staff in 1942 as local director for the agricultural operating program in Mexico. In 1952 he was named Deputy Director and in 1955 Director for Agriculture.

A program in Medical and Natural Sciences now merges the medical, biological, and public health interests of the Foundation. Dr. Robert S. Morison, since 1955 Director for Biological and Medical Research, was elected Director of this program. The Associate and Assistant Directors for Medical Education and Public Health and Biological and Medical Research are assigned to the new program.

Dr. John C. Bugher, Director for Medical Education and Public Health since 1955, has been appointed Consultant on Nuclear Energy Affairs. As a principal officer Dr. Bugher will assist all program areas with respect to the impact of nuclear energy.

Dr. Albert H. Moseman, who joined the Foundation's staff in 1956 as Associate Director for Agriculture, has been appointed Deputy Director for Agricultural Sciences, the new designation of the program.

During 1958 several new appointments were made for the programs. Dr. Richmond K. Anderson, formerly an Assistant Director, was appointed Associate Director for Biological and Medical Research. Dr. Lucien A. Gregg joined the staff as Associate Director for Medical Education and Public Health. He is stationed in India as advisor to the All-India Institute of Medical Sciences. Mr. Boyd R. Compton and Mr. Richard H. Nolte joined the program in the Humanities as consultants in 1958 and in April, 1959, were appointed Assistant Directors.

There were several new appointments and reassignments in the Biological and Medical Research field staff during 1958. Dr. Robert E. Shope joined the staff of the New York Virus Laboratories, and Dr. C. Brooke Worth joined the virus staff in Johannesburg. Dr. Hubert E. Webb became a temporary staff member of the Virus Research Centre in Poona. In July Dr. Charles R. Anderson was transferred from the Regional Virus Laboratory in Trinidad to the Virus Centre in Poona, and in October Dr. Telford H. Work was reassigned from the Poona to the New York laboratories.

Several new staff members joined the program in Agriculture during 1958. Dr. D. Roy Casorso was named Animal Pathologist in Colombia; Dr. Donald E. Davis became Associate Animal Pathologist in Mexico; Dr. Elmer C. Johnson was appointed Associate Geneticist in Mexico; Dr. Ernest W. Sprague became Associate Geneticist in India; and Dr. H. David Thurston was appointed Associate Plant Pathologist in Colombia. Dr. Peter R. Jennings, formerly Assistant Geneticist in Mexico, was transferred to the program in Colombia. Dr. David H. Timothy, formerly Assistant Geneticist in Colombia, became Associate Geneticist. Mr. Jesse P. Perry, Jr., formerly Administrator of Experiment Station Operations in Mexico, was appointed Administrative Assistant to the Executive Vice-President and transferred to New York. Dr. Paul O. Ritcher was given a one-year appointment with the Indian Agricultural Program to assist with the educational phase of the work.

Four staff members were on loan to other organizations during the year: Dr. Marshall C. Balfour, Associate Director for Medical Education and Public Health, to The Population Council, New York City; Dr. John B. Grant, a member of the Medical Education and Public Health field staff, to the University of Puerto Rico; Dr. J. Austin Kerr, a member of the Biological and Medical Research field staff, to the Pan American Sanitary Bureau; and Mr. George E. Van Dyke, formerly Assistant Comptroller of the Foundation, to Robert College, Istanbul, Turkey.

Mr. H. Malcolm Gillette, Assistant to the President, who had been with the Foundation since 1919 and its Comptroller from 1953 to 1957, retired on June 30. Mr. Fred W. Knipe retired from the staff of the program in Medical Education and Public Health on June 30. Miss Katharine E. Oster retired as Assistant Secretary of the Foundation on June 30, but remained on the staff as Assistant to the Secretary. Dr. Robert L. Skiles, Associate Plant Pathologist with the Colombian Agricultural Program, resigned on October 15, and Dr. Donald L. Smith, Associate Geneticist with the Mexican Agricultural Program, resigned on February 26.

The sudden death, on April 25,1958, of Dr. Norman S. Buchanan was a tragic loss to the Foundation and to the world of scholarship. Dr. Buchanan first served with the Foundation as Assistant Director for Social Sciences in 1947-1948, and as Associate Director, 1948 to 1950. Professor of economics at the University of California from 1950 to 1955, he returned to the Foundation in April, 1955, as Director for Social Sciences.

Summary of Appropriations Account

FUNDS AVAILABLE

Balance from 1957	$ 6,464,162
Income for 1958	22,692,469
Amount transferred from Principal Fund as of December 31, 1958	7,000,000
Unused balances of appropriations allowed to lapse and refunds on prior year grants	1,226,943
	$37,383,574

FUNDS APPROPRIATED

Appropriations[1]	
Medical Education and Public Health	$4,239,160
Biological and Medical Research	6,201,225
Agriculture	6,274,205
Social Sciences	4,300,160
Humanities	3,620,582
General	3,690,250
Administration	3,266,575
	$31,592,157
Less appropriation for which funds were previously authorized	715,924
	$30,876,233
Balance available for appropriation in 1959	6,507,341
	$37,383,574

Principal Fund

Book value, December 31, 1957	$142,401,486
Additions during the year	193,230
	$142,594,716
Less amount transferred to Income Account	7,000,000
Book value, December 31, 1958 (Market value, $578,661,640)	$135,594,716

[1] These totals include appropriations for grant-in-aid, fellowship, and scholarship funds to be allocated in 1959, and $513,700 appropriated conditionally for later allocation and release.

Karamu House in Cleveland has been an interracial social and cultural center for over 40 years. Its productions of drama, music, and dance include new commissions and revivals of standard and experimental works, and are of a quality which has led to numerous invitations to present them at U. S. and foreign festivals. Shown is a scene from the Karamu House production of Truman Capote's play *The Grass Harp.*

Photograph Excised Here

Photograph Excised Here

Although it is only eight years old, the National Ballet Company of Canada has already achieved the status of a national institution. Despite its youth and comparatively small size, it has developed more than 30 productions, almost half of which are new works by Canadians. This picture shows the company in a scene from the second act of the classical ballet *Coppélia.*

THE ROCKEFELLER FOUNDATION 1913

THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

Photograph Excised Here

A research worker checks a water culture experiment on rice in progress at the Central Rice Research Institute in Cuttack, India. Established in 1946, the Cuttack center has become one of the important centers for production studies on the crop which feeds more people than any other in the world. The Indian government is constructing new laboratories for the center to improve its facilities for basic investigations.

The National Institute of Agricultural Sciences, a government organization, was formed when several major Japanese research institutions were consolidated in 1950. While its nine departments conduct applied studies, they also give time and facilities to basic research. This picture was taken during an investigation of problems of adequate water supply for rice fields, being conducted by the Department of Agricultural Engineering at the Hiratsuka field station.

Members of the Central American Corn Improvement Program examining a collection of indigenous varieties. Begun five years ago with the active participation of United States scientists, the program is carried on now almost entirely by local agronomists. Corn production in the participating countries—Costa Rica, Guatemala, Honduras, Nicaragua, Panama, and El Salvador—has benefited from improved methods and materials developed in the Foundation's agricultural programs in Mexico and Colombia and from the free exchange of varieties and information among the cooperating countries. The success of the Central American program led to the suggestion that a similar corn improvement project be started on a hemisphere-wide basis.

Photograph Excised Here

One recent outgrowth of a long-standing interest in oriental music at the University of California, Los Angeles, has been the organization there of two orchestras trained to perform it. In addition to the Indonesian-type gamelan orchestra shown here, the University has a group which plays gagaku, the music of the Japanese court. The Department of Music now plans to extend this work in Far Eastern music by increasing its library, bringing oriental musicians to California, and providing study in the Far East for more graduate students and staff members.

Photograph Excised Here

Surveys of immunity to arthropod-borne virus diseases undertaken in 1954 in South Africa showed that residents of the Lake Simbu region of Tongaland had a higher incidence of immunity to several viruses than was found elsewhere in the Union. This fact, coupled with the new economic importance of the area, led to the setting up at Ndumu of a permanent field station of the Arthropod-Borne Virus Research Unit centered at Johannesburg. Since 1956, work has been conducted at Ndumu for two-week periods during the months from January to June—the prime season for viral infections—and somewhat less frequently during the rest of the year.

The activities of the Ndumu station are varied. *Left,* a fever clinic is held at a native kraal (village). Investigators seek out cases of fevers of undetermined origin which might be caused by viral agents, and collect blood specimens from the patients. *Below,* mosquito trappers climb to a catching station high in a giant fig tree. Over 30 different species have been taken, many of which proved to be vectors of virus diseases. Other insects, especially flies, are also being studied by the researchers at Ndumu.

Below, both traditional and modern methods of transportation are employed by virologists of the Ndumu field station. *Right*, investigators about to take a blood sample from a vervet, or green monkey, caught in a trap deep in the jungle. While monkeys are the chief object of the field mammalogy studies, many other small mammals, especially rodents, are important hosts of the viruses of Tongaland. These viruses also infect birds, as well as domestic animals of great economic importance, such as sheep and cattle.

In recent years 12 different arthropod-borne viruses known or believed to be pathogenic for man have been isolated in South Africa. Five of them—Middelburg, Pongola, Simbu, Spondweni, and Wesselsbron—were unknown prior to the investigations in Tongaland. Theories about the maintenance of viral agents and the nature of the infection cycle are being explored at Ndumu, and new discoveries have been made there regarding the effects of altitude, temperature, and vegetation on the incubation and transmission of viruses.

One of the important centers for the study of the arthropod-borne viruses is the Department of Virology and Rickettsiology of the National Institute of Health, Tokyo. The investigators at this laboratory are especially interested in Japanese B encephalitis, a mosquito-borne virus disease which was first recognized in Japan and is now known to range from western United States to southern India. The clinical features of Japanese B are fairly well understood but its transmission and mode of survival in temperate zones remain puzzling. This picture shows a technician catching mosquitoes in a livestock pen for investigation as possible vectors of the virus.

The one opposite shows reindeer in Lapland being rounded up by workers of the Institute of Virology of the University of Helsinki, Finland, in a study of the tick-borne Kumlinge virus.

Of the arthropods which transmit virus diseases of human beings, mosquitoes are the characteristic vectors in warm climates and ticks in colder ones. The discovery of a tick-borne virus in semitropical southern India in 1957, and the serious epidemic caused by it, have stimulated renewed study of the whole tick-borne complex. The institute group, under the direction of Professor Nils Oker-Blom, have shown that Kumlinge virus is closely related to the tick-borne Russian spring-summer encephalitis virus, as is Kyasanur Forest disease virus, the one discovered in India.

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The Catholic University of Chile, in Santiago, is one of that country's two main centers for the development of drama of professional quality. Each summer its productions are sent on tour, to give the company year-round experience and to contribute to the cultural life of the nation. For the past two seasons, the Catholic University Rehearsal Theatre has emphasized the production of plays by young native authors. This picture was taken during a rehearsal of *Comedy for Murderers* by Camilo Perez de Arce.

The University of Bahia, Salvador, was the first university in Brazil to assume responsibility for professional training in the performing arts. Its School of Theatre offers three-year courses in acting, directing, playwriting, scene and costume design, and technical production, and is well known as an experimental center. The plans of the school for the future include the establishment of a documentary section for the use of the nation's theatrical profession. This picture shows a square in Salvador, where an open-air performance of a passion play by Henri Ghéon is in progress.

Photograph Excised Here

Many ancient artifacts of great cultural and historical importance collected in scientific investigations of the early 1930's and later, are now in the Institute of History of the Academia Sinica, at Taipei, Taiwan. Many of them are unrestored or were damaged during the war years. Shown, *above*, are bronzes from Anyang, the capital of the Shang Dynasty in the second millennium B.C., which are being reassembled and studied by members of the institute staff.

Left, as a first step toward the writing of a history of the Mexican Revolution, scholars at El Colegio de México are compiling a bibliography of source material, much of which was published in obscure provincial papers or lies uncatalogued in government archives. A portion of the bibliography already assembled is shown.

The Research Institute of Biological Sciences in Montevideo, Uruguay, conducts studies on a wide variety of subjects including neurobiology, experimental histology, biomicroscopy, cytogenetics and cytochemistry, and cell ultrastructure. This picture shows some of the equipment being used by the Department of Electrobiology in a program of electroencephalographic investigations related to conditioned reflexes.

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THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

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At the Center for International Studies of the Massachusetts Institute of Technology the techniques of analysis by analog computer are being applied to the study of economic variables in an underdeveloped economy. Economic models can be tested by the process of simulation on this computer, which is able to record time paths of many more variables and at much greater speed than has been possible by conventional methods. The group at the center has several models of various sectors of a national economy, and is now tying them together into a more complete economic system, in which the repercussions from any given change would be by no means intuitively obvious. This view, which includes only about a quarter of the computer, shows a researcher examining new results from a recording machine, while others consider previous findings.

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THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

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The Institute of Industrial Medicine of New York University—Bellevue Medical Center is collaborating with the Health and Safety Laboratory of the United States Atomic Energy Commission in a teaching and research program. Shown in this picture is the shield from a whole body radiation counter, in which the degree of radioactivity in human subjects is measured. It is constructed of iron five to six inches thick, to keep background radiation away from the sensitive detectors and to permit accurate measurement of the normal radioactivity of the body.

The teaching program of the Institute of Child Health is now affiliated with the University of Calcutta, which in 1957 recognized it as a center for the postgraduate training of students. In its work for the prevention of disease and the promotion of health among children, it emphasizes research and the training of personnel. The institute is much more than a teaching hospital; its general pattern is that of a community health center whose functions include the education of the public in child health. This picture, taken in the X-ray Department, shows a researcher examining a child with a fluoroscope.

Photograph Excised Here

Since its establishment in 1940 to give veterinary training to Peruvian army officers, the Faculty of Veterinary Medicine of the University of San Marcos in Lima has made substantial progress toward becoming an international center for advanced studies of diseases affecting the animals of the Andean highlands. A large-scale building program for the faculty, the plans for which are shown in the model below, is now in progress at the university.

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THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

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The Medical School of the University of Lovanium, Leopoldville, has recently begun its fifth year. During their eight years at the school, the students will follow a strong medical curriculum, and will, in addition, help to meet special regional health needs through work in the university hospital and in two nearby villages. This picture shows medical and other students at work in the library at Kimwenza, in the suburbs of Leopoldville. The university hopes to develop an independent medical library section in the near future.

THE ROCKEFELLER FOUNDATION 1913

THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

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An important and often tragic cause of food loss is damage or deterioration of crops in storage; this type of loss is especially important in technically less developed countries where total harvests are usually short of human need and loss during storage compounds an initial deficiency.

In Colombia, where the potato rivals corn as a basic food, plant breeders of The Rockefeller Foundation's cooperative agricultural program direct their work toward better storage quality as well as toward yield and resistance to disease. These hybrid potatoes, produced in the multiplication section of the national agricultural bank, will keep under ordinary conditions up to six or seven months without the use of sprout inhibitors.

The storage of corn is of major interest in the Foundation's agricultural program in Mexico. This open crib, built largely of local materials, is one of several types being studied. It has performed well in the tropics where many conventional insecticides and fungicides are ineffective. The study also includes storage problems of other grains in all the agriculturally important regions of Mexico.

Planting corn by the ancient dibble method, in which the seed is dropped by hand into holes made with a short pointed stick, at the Amberpet Experiment Station, Hyderabad, India. In the cooperative agricultural program of The Rockefeller Foundation in India, staff scientists are experimenting with traditional as well as with modern methods of tillage to arrive at procedures which can be realistically recommended for the use of average farmers.

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THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

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If every condition of soil fertility, sunshine, and moisture were highly favorable, to what bushels-per-acre figure could the yield of food crops be raised? Freak yields of astonishing magnitude are on record in many countries, exceeding average yields by factors of two, three, or higher. Though the influence of single factors such as fertility or moisture has been studied, only in a project of the Department of Agronomy of Cornell University has a systematic investigation of the varying influences and interrelations of all the factors governing yield been undertaken. The picture shows the effect of varying increments of fertility on the growth of corn.

THE ROCKEFELLER FOUNDATION 1913

THE WELLBEING OF MANKIND THROUGHOUT THE WORLD

Photograph Excised Here

The solar energy research project at the University of Wisconsin has already produced working models of a number of simple, low-cost devices such as refrigerators, engines, and cookers powered by the sun's rays, designed especially for use in underdeveloped areas where sunshine is the most plentiful energy source. The picture shows one of the solar cookers being demonstrated in Mexico. Before housewives and other users—in Mexico or elsewhere—will accept such a radically different type of heat source, however, the devices must meet many requirements besides those of engineering efficiency. The Wisconsin solar energy project has called on the university's department of anthropology for help in studying the social and human factors involved in the acceptance of the new devices.

The deserts which cover about one-third of the earth's land surface hem in some of the world's most heavily populated regions, as in the southwestern United States, northern Africa, and the Middle East. To use them for living room for expanding populations and for increased food production requires more knowledge about them. At the University of Arizona teams of archaeologists, biologists, and earth scientists work together to learn how man may live and cultivate crops in arid lands. The archaeologists shown are excavating a 3,000-year-old pit house in the Sonoran Desert. Their findings were used by the other members of the research group to discern patterns of sedimentary deposit and erosion.

Photograph Excised Here

The extraordinarily high protein content of algae (up to 56 per cent) makes these minute water-growing plants of great interest to nutritionists concerned with finding new and economical food sources. Algae are being intensively studied in a number of research centers. Dr. Hiroshi Tamiya's group at the Tokugawa Institute for Biological Research, Tokyo, have developed unique new apparatus for the mass production of algae and, with the Japan Nutrition Association, have experimented extensively with utilizing algae in acceptable foods for humans and animals. Shown are some of the culture ponds in which rotating arms stir the solution to promote the increase of the algal cells.

Two members of the staff of the Bermuda Biological Station prepare to lower a plankton net from the station's research vessel, *Panulirus*, in the course of an investigation of the productivity of the Sargasso Sea. Situated in a transitional biological zone between northern and tropical waters, the Bermuda station offers a number of advantages as a marine research center. One of them is that a short voyage from the laboratory takes the investigator to deep sea locations as well as to a variety of off-shore environments. Each summer a visiting staff of about thirty scientists comes to the station for periods of several months. Established in 1903, the Bermuda station has practically rebuilt its plant and reequipped its laboratories since World War II.

These photographs, made in the cytochemical research laboratories of the University of Brussels, show the action of the enzyme ribonuclease on living cells. *Above,* a normal amoeba; *below,* one to which the enzyme has been added. This research is under the joint direction of Professors Jean Brachet and Hubert Chantrenne.

Medical Education

and Public Health

MEDICAL EDUCATION AND PUBLIC HEALTH

Major Interests, 1958

Professional Education	$3,564,607
General	144,700
Field Service	363,260
Fellowship and Scholarship Fund	675,000

MEDICAL EDUCATION AND PUBLIC HEALTH

THE FOUNDATION's program in medical education and public health has continued to emphasize the incorporation of modern scientific advances into clinical and public health teaching and practice, and the adaptation of these educational developments to national and regional cultural patterns.

In assisting various countries in their attempts to improve the level of medical and health care, it has been clearly recognized that an adequate supply of medical manpower cannot be achieved solely by a program of training in the United States. Development of personnel on a broad scale must take place within the region itself, and also within the framework of its own educational resources and patterns. External assistance can be indispensable in encouraging the emergence of strong educational centers whose academically oriented graduates may in turn form the faculties of other medical schools. The development of these primary teaching and research centers has been the special concern of the Foundation in Latin America and India, and thus far, to a limited extent, in Africa. Certain institutions, outstanding because of their national and regional positions, which have undertaken to encourage a larger proportion than usual of their graduates to prepare for careers in teaching and research, have received broad support not only for the basic sciences but also for the departments devoted to clinical teaching and postgraduate activities.

Well established pedagogic principles have been encouraged, with the expectation that the student would develop an appreciation for the scientific basis of modern medicine and for the diffusion of the scientific approach at all levels in the preparation of the physician. In these institutions it is well recognized that the medical curriculum cannot result in the production of a finished physician, but that it can and should establish the general competence in medicine upon which further training leading to special capabilities may be based. Inevitably, such an approach also has its impact upon, and to some extent is limited by, the premedical educational system of the region concerned. Consequently, increasing attention must be paid to the quality and scope of premedical education.

In certain areas outside the United States, notably in Brazil and India, a special effort has been made to encourage the establishment of fellowships upon a national basis. Through these programs a young faculty member from one institution may enjoy one or two years of special training in a distinguished department in another university of his own country. The results up to the present appear to indicate that this method of making more effective utilization of a country's own intellectual resources is a highly significant one.

Closely related to any program of strengthening the faculty of a medical school is the development of its library. Special training for librarians, grants to increase the library's resources, and assistance in improving its operations are of broad benefit to the medical faculty as well as to the student body. Such support has been given to several institutions.

The effort to bring effective teaching to the bedside of the patient also serves to emphasize the importance of effective nursing services. The patterns of nursing education, like those of medicine, are substantially affected by the structure of the societies concerned. Nursing especially must be developed with reference to the social status and educational position of women, which may vary substantially from country to country. Adequate programs of nursing education require an accurate knowledge of both resources and trends, and special surveys are as essential to the development of a sound educational system in nursing as they are to clinical medicine.

Within the United States, the program in medical education and public health has followed two major lines: one is aid to the overseas institutional program in medical and nursing education through special departmental support in the United States and the exchange of academic personnel. The other is support for explorations into problems of medical education especially relevant to the United States itself. Toward this end assistance has been given to various faculty studies leading to the incorporation of new scientific developments into the medical curriculum, with special reference to the growing importance of radiobiology and human genetics. Special studies on the development of educational forms responsive to the changing patterns of disease and the social requirements of the next 20 years have been encouraged.

Of importance commensurate with the scientific developments of this period is concern with the effectiveness with which modern medical knowledge is brought to bear upon the health problems of individuals and communities. The organization of medical and health services will require increasingly intense examination in the light of the shifting patterns of disease within our population and the changing expectations in our society concerning standards of professional performance. The medical student must be adequately prepared now for his professional responsibilities of a decade hence. At the same time a continuing examination of the administrative structures by which the medical and health needs of the public are to be met is necessary.

Professional Education

NEW YORK UNIVERSITY–BELLEVUE MEDICAL CENTER

RADIATION HAZARDS

The rapid advances being made in the application of atomic energy to industrial research and development give urgency to the need for more extensive and precise information concerning the dangers inherent in the use of atomic power, and to the need for specialists equipped to safeguard public and industrial health. For some years New York University has been giving increasing attention to the health considerations arising in the atomic energy industry, and has already instituted courses for physicians, nurses, industrial hygiene engineers, and health officials on the problems of toxic dusts and chemicals and various other matters related to radiological safety. Now, through a cooperative arrangement between the university and the Atomic Energy Commission, the resources of the university's Institute of Industrial Medicine and the commission's Health and Safety Laboratory will be joined in a broad program focused on the dangers to the general population of radiation and on the special risks in industrial use of nuclear power.

In the new program, attention will be given to the ecological movement of radioactive materials through intermediate hosts to man, to human genetics, the epidemiology of radiation effects, and the physical and biological factors that determine radiation dosage and tissue response. A full graduate curriculum in health physics is being instituted under the program, and teaching and research in radiobiology, epidemiology, and population response are being extended. More advanced pre- and postdoctoral training than is available in the health physics courses is being provided for research workers.

To help the New York University–Bellevue Medical Center develop the cooperative teaching and research program on the industrial and public health aspects of radiation hazards over the ten-year period beginning January 1, 1958, The Rockefeller Foundation in 1958 made available $500,000 appropriated for this purpose in 1957. Other grants in the same amount were made in 1957 to Harvard University, the Johns Hopkins University, and the University of Pittsburgh for university-wide programs of training and research in the health problems associated with nuclear energy.

UNIVERSITY OF CHICAGO

SECTION OF NUCLEAR MEDICINE

The University of Chicago, where the first controlled release of atomic energy was achieved in 1942, is now establishing a Section of Nuclear Medicine which will serve as a combined clearinghouse and focal point for faculty members with special interest and competence in the broader aspects of nuclear energy's impact on public health. Functioning as a unit of the Department of Medicine of the university's Division of Biological Sciences, the section will be the center for study of the legal, psychological, and social implications for community development and industry of various problems arising from the use of nuclear energy. Among the general areas of concern to which attention will be given are the increase in natural background radiation resulting from the use of nuclear energy devices, and the probable genetic and physiological consequences to man and domestic animals of increased exposure to ionizing radiations.

Through participation in the program of many different units of the university, the section will contribute to the curricular content of relevant courses, particularly at the graduate level. Conferences and seminars will ensure that all interested groups at the university are made aware of important information and ideas formulated during the course of the work at the section.

Among the various university units that will cooperate with the Section of Nuclear Medicine are the regular departments of the Division of Biological Sciences, the Schools of Law and Business, the Enrico Fermi Institute for Nuclear Studies, the Institute for the Study of Metals, the Food Research Institute, the Public Administration Service, the National Opinion Research Center, the Weather Forecast Research Center, the Conference Center, the Downtown Center concerned with adult education, and the Argonne Cancer Research Hospital and National Laboratory.

To help the University of Chicago, Illinois, meet various expenses connected with the establishment and development of the Section of Nuclear Medicine, The Rockefeller Foundation has appropriated $500,000 for use over a ten-year period.

PAULISTA SCHOOL OF MEDICINE

GENERAL DEVELOPMENT

Established in 1933 as a private school and incorporated into the system of higher education of the Brazilian government in 1956, the Paulista School of Medicine, São Paulo, is today one of the country's outstanding medical training centers. The school serves the State of São Paulo principally, but its reputation has attracted students from the other Brazilian states and from other countries as well.

By the end of 1954, the Paulista School had graduated more than 1,300 physicians.

In 1954 the curriculum of the Paulista School of Medicine was completely reorganized, and the changes proposed effected in the following year. Plans were also made to develop the school's physical facilities, to provide advanced training for younger staff members, and to place faculty members, particularly in the clinical departments, on a full-time basis.

The school has made great progress in realizing its objectives. In 1956 the new building for the Departments of Biochemistry and Pharmacology was completed. Shortly thereafter the Department of Microbiology was expanded and installed in reconditioned and re-equipped quarters. The City of São Paulo has donated a new building for experimental surgery, and student and research laboratories, associated with the Department of Medicine and with the basic science departments, have been placed in service. Finally, extensive construction changes in the school's teaching hospital have permitted the institution of geographic full-time for eight members of the Department of Medicine.

The Paulista School is gradually increasing the number of clinical faculty on geographic full-time status, and will inaugurate complete full-time in the basic science departments as quickly as possible. The new arrangements for the clinical faculty have already made it possible for Paulista students to begin their clinical training in the teaching hospital a year earlier than is usual in most other Brazilian schools, and to participate more closely in ward rounds, in conferences on special cases and clinical pathology, and in clinical research programs.

Among the other plans which will be acted on in the next few years are the development of a training program for technical personnel in all departments, the reorganization of the library and the construction of a new building for it, the reconversion of existing space for the expansion of the departments associated with morphology, and the construction of a new building for the physiological sciences.

To help the Paulista School of Medicine continue its general development, and achieve full-time status for its faculty as rapidly as possible, The Rockefeller Foundation in 1958 appropriated $600,000 for use over a three- to five-year period.

LOVANIUM UNIVERSITY

MEDICAL SCHOOL, UNIVERSITY HOSPITAL, AND SCHOOL OF NURSING

One of Africa's newest universities, Lovanium University in Leopoldville, the Belgian Congo, began functioning in 1954 and was granted university status by the Belgian government in 1956. The new university is coeducational, and permits no racial, religious, or political discrimination. Its standards and curricula parallel those of its sponsor, the University of Louvain, and there is a growing interchange between the faculties of the two schools. The Government of the Congo, the Mining Union, and private sources are contributing generously to the funds needed for construction of university buildings and the development of its program. To help the university strengthen its activities in medicine and nursing, The Rockefeller Foundation appropriated a total of $305,000 during 1958.

When the medical school of Lovanium was opened in 1954, five students were enrolled. There are now 37 students in medicine, 15 of whom are in the first year of the course. During these formative years, the medical school is giving primary attention to the development of course work in the basic sciences and morphological studies. By the time the present students reach the clinical stage of medical training, the new university hospital is expected to be ready for use in the teaching program.

The university obtained the hospital at 20 per cent of its actual cost under an agreement to operate it for the medical needs of the region for which the government is responsible. When completed, the hospital will have a capacity of 1,000 beds and represent an investment of $4,000,000. Two wings, one for bed patients, are already in operation.

The university has also undertaken responsibility for public health activities in two nearby villages, Ndjili and Matete, with a combined population of 14,000. University medical students will participate in the medical and health services for the villages, and thus have direct practical experience with community problems as well as with inpatients in the university hospital.

To assist in the further development of the medical school and university hospital, The Rockefeller Foundation has appropriated 10,952,500 Belgian Congo francs (about $230,000) for use over a three-year period.

The school of nursing of Lovanium University, at present an adjunct of the university hospital, will eventually be developed into a faculty offering a complete professional nursing education program. Classes have already begun, and the first group of 21 students are in residence. The present teaching quarters are, however, urgently needed for hospital patients, and the students' residence will be needed next year for the planned expansion of other units of the university.

To help Lovanium University realize its present plans for the construction of a building for the nursing school and a residence for student nurses, The Rockefeller Foundation has granted $75,000, payable during a two-year period when the university has secured an equal amount from other sources. Other immediate requirements of the school of nursing—teaching equipment and supplies, and additional funds for faculty salaries and student stipends—are being met by the University of Louvain, the Belgian Congo government, and private sources.

UNIVERSITY OF NORTH CAROLINA

DEPARTMENT OF MEDICINE

Converted in 1952 from a two-year to a four-year institution, the Medical School of the University of North Carolina, Chapel Hill, has developed a strong and vigorous program of training and research. The work of its clinical departments is coordinated with that of the basic science departments, and close cooperation exists between the activities of the medical school and those of other university units concerned with health and medical matters. To provide the best possible physical facilities for the medical school, the university has constructed an interconnecting group of buildings which house, as well, the hospital and the Schools of Public Health, Pharmacy, Dentistry, and Nursing.

The program of the Department of Medicine is unusually comprehensive, extending into the preclinical sciences and including subspecialties, such as dermatology, neurology, cardiology, and hematology, which often constitute separate departments in medical schools. Instruction in medicine begins in the second year of the course, and continues throughout the remainder of the students' residence. In the clinic, students work with staff members from various disciplines and clinical specialties as they study a patient's illness in consultation with all the relevant clinical groups. Productive research is carried on in all phases of the department's work.

Recognizing its opportunity and responsibility for extending its services through cooperation with foreign medical institutions, the University of North Carolina has planned changes that will enable the Department of Medicine to add international activities to its work in the next few years. Faculty members of the department will accept visiting appointments in foreign medical schools where they can utilize their special competence in their fields of interest. At the same time, foreign scholars will be invited to Chapel Hill to participate fully in teaching and research in the Department of Medicine. To enable faculty members to serve overseas without disrupting the work of the department, a number of additional staff will be appointed.

To help the University of North Carolina develop and strengthen its Department of Medicine, and meet some of the expenses connected with the faculty exchange programs, The Rockefeller Foundation has appropriated $250,000 for use over a five-year period. The grant will also help support a number of activities at the Chapel Hill campus, including the activation of a metabolic ward, conferences on experimental approaches to postgraduate medical instruction, and continued research on such subjects as genetic disorders.

UNIVERSITY OF ANKARA

FACULTY OF MEDICINE

Inaugurating an educational system markedly different from the previous pattern, the Faculty of Medicine of the University of Ankara has lengthened its academic year from six to nine months, reduced the size of classes, and shifted the primary educational emphasis from theoretical instruction through lectures to laboratory and hospital training. Some of these changes, introduced in all the basic science and clinical departments by the fall of 1957, had been put into effect earlier in the Department of Child Health.

In the basic science courses the students now spend two-thirds of their time in the laboratory and one-third in the lecture room. In their clinical years they divide into small groups for clinical and theoretical training, and, under a "clinical clerkship" requirement, take medical histories, conduct physical examinations, assist at obstetrical deliveries, and perform other professional services under supervision.

The Ankara medical school trains students not only from Turkey but also from other countries in the area, such as Iran, Iraq, Syria, Lebanon, Jordan, Libya, Afghanistan, and Ethiopia. Under an unusual new arrangement, fees for the foreign group—about 25 out of each entering class—will be paid by the Turkish government.

The Turkish government, the local community, and organizations with an interest in promoting the teaching and medical care program of the university have contributed generously toward the costs of the equipment needed for the new laboratory and clerkship activities. To enable the faculty to purchase equipment and supplies outside Turkey, The Rockefeller Foundation has appropriated $170,000 to the University of Ankara for use over a two-year period. The Foundation previously, in 1956, made a $100,000 grant to the university in support of the pediatric program of the Department of Child Health.

ALL-INDIA INSTITUTE OF MEDICAL SCIENCES

PRECLINICAL AND CLINICAL DEPARTMENTS

The Indian government established the All-India Institute of Medical Sciences in June, 1956, with the long-range aim of strengthening medical education in India through the development of patterns of teaching in undergraduate and graduate medical education that would serve as a model to other medical colleges and allied institutions in India. It will have facilities of the highest order for training in every important branch of health activity and is expected to enable India to become self-sufficient in graduate medical education. The establishment of such an institute was envisaged by the Health Survey and Development (Bhore) Committee in 1946.

The government undertook construction of the new institute with the help of a grant of about £1,000,000 from New Zealand under the Colombo Plan. India provided the land, about 150 acres, and expects to spend the equivalent of $9,000,000 on the development of the center as part of the second five-year plan.

Though its plant has not yet been completed, the institute has been conducting undergraduate medical classes and a limited graduate program in orthopedic surgery since 1956, and has already progressed toward the goals conceived when it was founded. It is teaching along modern lines, with emphasis on seminars, practical work by students, and an integrated biochemical and physiological approach to medicine. It has selected faculty members of high caliber, and its students are making a very good showing.

When fully developed, the plant of the institute will include a main building with an attached modern hospital of 650 beds, a nursing college and a nurses' home, a dental college, and residential quarters for students and staff. Of these units, the College of Nursing and the nurses' home, dormitories for women students, and dormitories for graduate men students, interns, and residents have been built. For the present, the College of Nursing building is being used for medical classes.

If its preclinical and clinical departments are to continue growing as planned, the institute requires a certain amount of equipment from abroad. To provide foreign exchange to meet some of the more pressing needs, the Foundation has made a two-year grant of $100,000.

DEPARTMENTAL UNIVERSITY HOSPITAL

TEACHING AND SERVICE FACILITIES

When the Faculty of Medicine of the University of Valle, Cali, Colombia, was established in 1950, the community of the Cauca Valley donated a partially completed building for use as a teaching hospital by the faculty and the School of Nursing. Subsequently the people of the valley contributed 12,600,000 pesos (about $4,500,000 at the then current exchange rates) for the further development of the Departmental University Hospital.

The hospital now has facilities for 310 beds—230 for all services related to the Departments of Medicine and Surgery, and 80 for pediatric programs. An additional 80 beds and ancillary laboratories, financed wholly by the community, are planned for use by the Department of Obstetrics.

Classes in the eight-year-old medical school are now reaching full capacity. When the larger classes pass from preclinical to clinical training, and as instruction programs for nurses, interns, and residents expand, more beds and equipment will be required for teaching and service.

The Departmental University Hospital is planning to complete the teaching and service facilities of the medical and surgical wards with aid from a Foundation grant of $100,000 made in 1958. The new funds, available to December 31, 1960, are to be paid when 600,000 Colombian pesos have been secured from Colombian sources for the same purpose.

In previous years the Foundation appropriated approximately $792,000 to aid the University of Valle in the development of its schools of medicine and nursing. The grants were part of the Foundation's general program of assistance to modern centers of medical education in Latin America.

AMERICAN UNIVERSITY OF BEIRUT

MEDICAL SCHOOL

Established in 1867, the medical school of the American University of Beirut, Lebanon, has for years held a leading position in medical education in the Middle East. It has attracted many students from neighboring countries, and its faculty and graduates have made an important contribution to medical care and public health throughout the entire region.

The university embarked in 1953 on a major program designed to strengthen teaching and research throughout the medical school by creating additional full-time positions in each of eight preclinical and four clinical departments, by enlarging the school's physical facilities, and by establishing professorships in several clinical specialties. A Rockefeller Foundation grant, made in the same year, provided $500,000 to help the university realize the first step of the program, the appointment of additional faculty and the increase in the salary scale, during the period ending in February, 1958.

A new Foundation grant of $100,000, available, as was the earlier grant, on the basis of one dollar for every two the university secures from other sources for faculty development and certain teaching and research expenses, will continue Foundation support of the Beirut medical school through another year. It brings to well over $3,000,000 the amount appropriated by the Foundation since 1924 for medical and nursing education and research at the American University of Beirut.

AMERICAN COLLEGE OF RADIOLOGY

EDUCATIONAL PROGRAM

Since the publication of the report of the National Academy of Sciences on the hazards to the public from ionizing radiations, it has been generally recognized that most man-made exposure is connected with the diagnostic and therapeutic use of X rays and allied radiations.

The American College of Radiology in Chicago, Illinois, has undertaken the direction of an educational program on the safe use of X rays. As its first step the college published a booklet on the fundamental principles of protection from the dangers of radiation, with examples of their applications. This booklet has been distributed generally through the medical and dental professions and to specialists who employ X rays in connection with their professional duties.

The college has now embarked on the preparation of a motion picture film to expand the information contained in the booklet and to render it in a more effective fashion. The film deals with the techniques of minimizing radiation exposure to the doctor, technician, and patient. Enough copies of the film will be made to allow it to be shown within a reasonable amount of time to national, state, and local professional societies and to educational organizations.

To help defray the costs of the film, The Rockefeller Foundation granted $65,000 to the American College of Radiology.

ST. LOUIS UNIVERSITY

RADIOBIOLOGY

More than two years ago the School of Medicine of St. Louis University formed a faculty committee to determine how the school might best incorporate work in radiobiology into its general program. Recognizing that advances in knowledge and methods in radiobiology will ultimately have a profound effect in every area of medical science and practice, the committee reviewed the organization and subject content of every course and formulated plans concerning necessary changes in the curriculum.

A detailed program covering work in all aspects of radiobiology pertinent to medicine has now emerged from the committee's deliberations. It will be integrated into the teaching plan of the existing departments of the medical school and several departments of the university, and will give students knowledge of and practical competence in the applications of radiobiological technology to the diagnosis and treatment of disease.

To help St. Louis University School of Medicine, in Missouri, develop the new program over an initial five-year period, The Rockefeller Foundation appropriated $62,000 during 1958. The Atomic Energy Commission is assisting the school with grants for necessary equipment.

INDIAN COUNCIL OF MEDICAL RESEARCH

FELLOWSHIPS FOR POSTGRADUATE MEDICAL TRAINING

India has 47 medical schools today as contrasted with 13, plus a few without university affiliation, a decade ago. The schools are needed, but their development at this rate has put a severe strain on the available supply of teachers. Many faculty posts have had to be filled by incompletely trained staff.

The Indian Council of Medical Research, a government agency responsible for the support of medical research and the training of research workers, has been active in an effort to improve the qualifications of teachers in Indian medical schools. For four years, beginning in May, 1953, the council offered fellowships to teachers for postgraduate study at educational centers in India. During this period 97 fellowships were awarded, for training in various medical science disciplines, to candidates from 29 institutions. To date 67 candidates have completed their studies and returned to their parent institutions.

The objectives of the council were to train junior staff members of medical colleges in teaching and research methods; to aid in the development of certain departments of medical colleges as graduate training centers by providing regular support for young medical scientists in training; and to enhance the value of and the respect for Indian medical qualifications.

The council financed the expansion of its fellowship program in part through a grant of $121,000 from The Rockefeller Foundation. In 1958 the Foundation made a further grant of $58,000 to enable the council to renew the expanded program for an additional three years.

UNIVERSITY OF CEYLON

FACULTY OF MEDICINE

Since the end of the Second World War, the demand for doctors for Ceylon's medical and health services has increased steadily. The Faculty of Medicine of the University of Ceylon, established in 1942, has responded by gradually accepting more students, currently about 120 as contrasted with 50 or 60 early in the forties.

As the student body has grown, the faculty has expanded its facilities and made a number of other adjustments. A building completed in 1957 provides office space for administrative and clinical staff, as well as accommodations for a central medical library. The new library, for which plans have been developing since 1955, will incorporate the individual collections accumulated by the various departments. The Departments of Pharmacology, Physiology, and Biochemistry, formerly combined in one section, have been established as separate units, and the research programs of all three, and of the Department of Pediatrics, are being extended.

To help the University of Ceylon, Colombo, continue the growth of its Faculty of Medicine by providing funds for equipment and supplies needed by the Departments of Biochemistry, Pharmacology, Physiology, and Pediatrics, and for the further development of the central medical library, The Rockefeller Foundation made a three-year grant of $57,000 in 1958.

INSTITUTE OF CHILD HEALTH TRUST

BASIC SCIENCE DEPARTMENTS AND LIBRARY

The Institute of Child Health Trust, Calcutta, India, was established in 1953 as a private organization for teaching and research in pediatrics. It has been approved and encouraged by the state and central governments and is now affiliated with the University of Calcutta, which in 1957 recognized it as a postgraduate training center.

The institute was organized through the efforts of Dr. K. C. Chaudhuri, one of India's foremost pediatricians, and operates under his direction. Its general pattern is that of a community health center, with the promotion of health and the prevention of diseases of children the central objective, and education of the public in child health forming part of the design.

When fully developed, the institute will have a modern teaching and research program embracing the major types of pediatric activity. It now gives in-hospital and outpatient care. In the future it will extend beyond the hospital to give crèche, kindergarten, school, and domiciliary health services in an adjacent urban district. It also plans to undertake research in child health and development as an integral part of the teaching and study program.

The Foundation has appropriated $45,000 to the institute, to be available through June 30, 1960, for the purchase of equipment and supplies for the basic science departments and for the development of the library.

UNIVERSITY OF LUCKNOW

KING GEORGE'S MEDICAL COLLEGE

To continue the development of its central library, one of the best medical libraries in India, King George's Medical College of the University of Lucknow plans to enlarge its collection, open a rental library, add to its audio-visual equipment, and establish a documentation unit. The new documentation unit will enable the library to provide reference services for other institutions in India, while the expansion of the audio-visual unit will permit the college staff to display medical and paramedical films as a regular feature of the teaching program.

In India, where the cost of a single textbook may be as much as that for one month's board, students must depend almost exclusively on the library for the books and special publications they need in their medical work. The rental library will for the first time allow students at King George's Medical College to use library books in their own rooms.

A Rockefeller Foundation grant of $34,000 to the University of Lucknow will assist the continued development of the central library's services at King George's Medical College during the period ending June 30, 1961. The grant will be used chiefly for equipment and reconversion of the library building to provide the additional space needed for the new units.

CORNELL UNIVERSITY MEDICAL COLLEGE

GRADUATE CLINICAL ORIENTATION COURSE

To prepare foreign fellows for training in American hospitals and medical schools, Cornell University Medical College has for some years maintained a six-month graduate orientation course in the clinical fields. Often trained under systems totally different from that followed in the United States, the fellows participating in the course are given an introduction to the routines of a teaching service in an American hospital, as well as a review of the physiological sciences and clinical principles.

The course was started shortly after World War II to provide orientation for Kellogg Foundation fellows in medicine from Latin America. The Rockefeller Foundation has been placing students from Latin America and the Middle East in the course since 1955.

Cornell University Medical College will continue the course, now given at its Bellevue division, for a further three-year period with the help of a $30,000 grant from The Rockefeller Foundation.

ROYAL COLLEGE OF PHYSICIANS

ASSOCIATION FOR THE STUDY OF MEDICAL EDUCATION

The Association for the Study of Medical Education in Great Britain was organized in 1957, largely on the initiative of the Royal College of Physicians, to serve as a forum for persons interested in the problems of medical education. Its charter purposes are to exchange information in the field, organize meetings on relevant topics, maintain a bureau for the receipt, storage, and distribution of information on medical education, and encourage, promote, or conduct research on subjects concerned with medical education. To it now belong most of the licensing bodies and medical schools of Great Britain, as well as individual medical educators and physicians.

To help the association develop its activities during an initial five-year period, The Rockefeller Foundation in 1958 appropriated £10,000 (about $28,500) to the Royal College of Physicians, London.

NATIONAL RESEARCH COUNCIL

STUDY OF TROPICAL MEDICINE AND HYGIENE

Although within its own borders the United States is fortunately free from tropical diseases, it nevertheless has a vital stake in disease control and nutritional improvement in the tropics. As an important step in determining the country's opportunities and responsibilities in the field of tropical medicine and hygiene, the National Research Council is sponsoring a survey of present research and training programs in this field in the United States.

The study will also compile factual information on the status of economically important diseases affecting human beings and animals in the tropics, identify the most serious tropical diseases that are not yet subject to practical control, and analyze hygienic, climatic, and nutritional problems in the tropics. It will evaluate research in tropical medicine now in progress in the United States, and gather data relevant to American governmental, military, and private activities in the tropics.

A special staff appointed by the council will conduct the study and formulate recommendations under the guidance of a committee of prominent authorities in the several branches of tropical medicine. To supplement funds for their work provided by the National Institutes of Health and the Department of Defense, The Rockefeller Foundation has made a three-year grant of $26,000 to the National Research Council, Washington, D.C.

LAVAL UNIVERSITY

FACULTY OF MEDICINE

The medical school of Laval University, a private university which receives substantial support from the Provincial Government of Quebec, is the older of two medical schools serving the French-speaking segment of Canada. Laval began planning for the modernization of the school about five years ago, and has already taken steps in that direction. A new building for the preclinical science departments, constructed at a cost of $6,000,000, was opened in September of 1957, and important administrative and other changes have also been made. There are, however, further matters arising from the modernization program which the school wishes to examine.

The Faculty of Medicine will now undertake studies relating to a contemplated revision of its curriculum with the help of a Rockefeller Foundation grant of $25,000, available through June 30, 1960. The Faculty will use the grant to send observers to selected medical centers in Canada, the United States, and possibly elsewhere; study the colleges affiliated with Laval University, from which most of the medical students come; review admissions policies of the medical school; examine the clinical teaching program and facilities in Quebec; and assess the personnel and the facilities available for research and the possibility of increases in both.

CHRISTIAN MEDICAL COLLEGE

MEDICAL RECORD LIBRARY DEPARTMENT

Christian Medical College in Vellore, India, has made rapid progress in the past few years in developing its Medical Record Library Department. The contribution that adequate and complete data and reference material can make to the improvement of clinical teaching and research has become apparent. Because doctors from all parts of India come to Vellore for specialized training, it is expected that the well-run Medical Record Library Department at the Christian Medical College will serve as a demonstration and guide for other Indian institutions.

For the continued development of the department, potentially a center for the training of medical record librarians in India, The Rockefeller Foundation has appropriated $21,000 for use over a two-year period. In previous years the Foundation has aided the work of the medical record section and the training abroad of a medical record librarian.

OTHER GRANTS

United States

New England

Boston University, Massachusetts: a research project on the role of the professional nurse in the outpatient department, by the Human Relations Center; $9,000;

Dr. James Harriman Jandl, associate in medicine, Medical School, Harvard University, Boston, Massachusetts: to observe recent developments in the field of hematology in Great Britain and on the Continent; $2,000;

Massachusetts Institute of Technology, Cambridge: to calibrate the intensity and energy distribution of the neutron beam from the medical therapy facility of its nuclear reactor; $17,000;

Dr. William Ernest Bloomer, assistant professor of surgery, School of Medicine, Yale University, New Haven, Connecticut: to visit the Faculty of Medicine, University of Valle, Cali, and other medical schools in Colombia; $1,100;

Middle Atlantic

Columbia University, Teachers College, New York: preparatory work in connection with the establishment of a national citizens' fund to aid nursing education, by the Institute of Research and Service in Nursing Education; $6,000;

Medical Society of the County of Kings and Academy of Medicine of Brooklyn, New York: a survey to develop plans for a new library, including a Deposit Library; $10,000;

Dr. Katherine Eileen Hite, family internist, Division of Social Medicine, and associate attending physician, Pulmonary Division, Montefiore Hospital, New York: to observe teaching methods for family physicians in Great Britain; $1,800;

National Board of Medical Examiners, Philadelphia, Pennsylvania: toward costs of a study of the efficacy of National Board examinations in Spanish and English in the medical schools of the University of Valle, Cali, Colombia, and the University of Puerto Rico, San Juan; $6,000;

National Citizens' Committee for the World Health Organization, Inc., New York: expenses of post-assembly visits, with particular reference to Puerto Rico, by delegates to the Tenth Anniversary World Health Assembly held in Minneapolis, Minnesota; $7,500;

National League for Nursing, Inc., New York: toward support of a practical nurses leadership training program; $8,500;

New York Hospital – Cornell Medical Center, New York: a study of the public health nursing experience in the basic program of the School of Nursing; $9,524;

New York University, College of Medicine, New York: Dr. Milan Hasek, Czechoslovakian Academy of Sciences, Prague; to visit centers of medical research, particularly those concerned with tissue transplantation, in the United States; $2,090;

University of Pittsburgh, Pennsylvania:

Dr. Lucien A. Gregg, assistant to the chancellor for health affairs and professor of medicine, School of Medicine, and Mrs. Gregg; to visit medical centers in India, the Middle East, and Europe; $5,100;

Dr. Antonio Ciocco, professor and head, Department of Biostatistics, Graduate School of Public Health; to visit Brazil to assist in a preliminary survey concerning the availability of data on radiation health problems; $1,900;

Dr. Ching Chun Li, associate professor of biostatistics, Graduate School of Public Health; to visit Brazil to assist in a preliminary survey concerning the availability of data on radiation health problems; $1,900;

Dr. Thomas Parran, dean emeritus, Graduate School of Public Health; to visit Brazil to assist in a preliminary survey concerning the availability of data on radiation health problems; $1,900;

Dr. Niel Wald, associate research professor of radiation health and assistant professor of medicine, Graduate School of Public Health; to visit Brazil to assist in a preliminary survey concerning the availability of data on radiation health problems; $1,900;

Dr. William B. Kiesewetter, associate professor of surgery, and surgeon-in-chief, Children's Hospital, Pittsburgh; to observe developments in the field of pediatric urology in Sweden; $1,000;

Department of Health of Puerto Rico, San Juan:

Dr. Reinaldo A. Ferrer, regional coordinator and director of research; to visit hospitals and medical care centers in Europe; $3,100;

Dr. Guillermo Arbona, Secretary of Health; to visit Cali, Colombia, to observe the teaching of preventive medicine and public health and to study the relationship between the medical school and the health department; $600;

University of Puerto Rico, School of Medicine, San Juan:

To enable senior personnel of the School of Medicine and the Department of Health of Puerto Rico to observe comprehensive medical care and regionalization programs in the United States; $5,000;

Dr. Roger M. Reinecke, professor of physiology; to visit the Department of Physiology, University College of the West Indies, Mona, Jamaica; $250;

Dr. Douglas Edward Johnstone, instructor in radiation biology and pediatrics, and director, Pediatric Allergy Clinic, School of Medicine and Dentistry, University of Rochester, New York: to observe teaching and research in clinical and experimental allergy while in the Soviet Union; $780;

World Medical Association, New York: toward expenses of a second world conference on medical education; $10,000;

South

Institute of Religion, Texas Medical Center, Houston: to study and evaluate the relationship of the clergyman to the ill individual, and especially to the cancer and heart patient; $10,000;

University of North Carolina, Chapel Hill:

Dr. Charles H. Burnett, professor and head, Department of Medicine, School of Medicine, and Mrs. Burnett; to visit schools of medicine in Puerto Rico and South America; $4,200;

Dr. Henry Toole Clark, Jr., administrator, Division of Health Affairs; to observe medical care programs and medical center organization in Europe; $2,875;

Tulane University of Louisiana, New Orleans:

Dr. William B. Wendel, professor and chairman, Department of Biochemistry; to visit medical schools in Latin America to observe teaching and research in biochemistry; $2,550;

Dr. Ernest Carroll Faust, field coordinator, Tulane-Colombia Program in Medical Education, and visiting professor, Faculty of Medicine, University of Valle, Cali, Colombia; to observe recent developments in research in epidemiology and parasitology at European centers; $2,100;

Dr. Oscar Thorup, Jr., assistant dean, School of Medicine, University of Virginia, Charlottesville: to serve as visiting investigator in the hematology laboratory of Dr. R. G. Macfarlane, University of Oxford, England; $2,500;

Central West

Association of American Medical Colleges, Evanston, Illinois: to supply copies of the *Journal of Medical Education* to medical schools belonging to the Association for the Study of Medical Education in Great Britain for a one-year period; $1,500;

Dr. John J. Phair, professor of preventive medicine, College of Medicine, University of Cincinnati, Ohio: to visit centers of epidemiology and industrial health in Great Britain and on the Continent; $3,050;

University of Michigan, Ann Arbor:

Expenses of a faculty exchange program between the Medical School and the University of Antioquia, Medellín, Colombia; $9,000;

Dr. James V. Neel, chairman, Department of Human Genetics, Medical School; to serve as consultant to The Rockefeller Foundation in connection with a study of the genetic results of natural radiation in India; $2,050;

Dr. John Thomas Boyer, assistant resident in medicine, University Hospitals of Cleveland, Ohio: to accept a fellowship in medicine at the Royal Melbourne Hospital, Australia; $1,322;

Miss Florence Sherbon, associate professor of nursing, College of Nursing, Wayne State University, Detroit, Michigan: to observe nursing education programs in India; $5,400;

Dr. Thomas Hale Ham, professor of medicine and chairman, Committee on Medical Education, School of Medicine, Western Reserve University, Cleveland, Ohio, and Mrs. Ham: to visit medical schools in Great Britain and on the Continent; $4,500;

Dr. John Z. Bowers, dean, Medical School, University of Wisconsin, Madison: to address an initial meeting of the new Association for the Study of Medical Education (ASME) in London, England, and to visit medical schools in Manchester and Birmingham; $1,552;

West

University of California, Los Angeles: to provide the School of Nursing with an associate research sociologist and secretarial assistance to help with the development of a doctoral program in nursing; $10,000;

University of Utah, Salt Lake City:

To conduct a survey of selected surgical centers in connection with the reorganization of the Department of Surgery of the College of

Medicine and with the planning of a new research and graduate training program; $8,000;

Dr. Walter J. Burdette, professor and head, Department of Surgery, College of Medicine; to observe techniques, instruction, and research at medical centers in Czechoslovakia, Poland, and the Soviet Union; $1,330;

West Indies

University College of the West Indies, Faculty of Medicine, Mona, Jamaica:

Dr. Paul Pao-chun Feng, lecturer in pharmacology; to visit centers of pharmacological research in the United States; $2,200;

Dr. Eric Kennedy Cruickshank, professor of medicine; to observe clinical work, teaching, and research projects at medical schools in Colombia; $700;

Latin America

University of Buenos Aires, Argentina: training of personnel, and supplies and equipment for the Institute of Physiology, Faculty of Medical Sciences; $10,000;

Dr. Rodolfo Muratorio Posse, professor of clinical medicine, Faculty of Medicine, University of Cuyo, Mendoza, Argentina: to visit medical schools in South America, Mexico, the United States, and Puerto Rico; $3,500;

National University of La Plata, Faculty of Medicine, Argentina:

Equipment and supplies for the Institute of Physiology; $10,000;

Dr. Ricardo Rosendo Rodriguez, professor of physiology and director, Institute of Physiology; to observe modern teaching methods and research techniques in physiology at medical centers in Brazil, Colombia, and the United States; $3,000;

Dr. Carlos Cruz Lima, professor of propaedeutic medicine, Faculty of Medicine, University of Brazil, Rio de Janeiro: to visit medical schools in the United States to observe the teaching of internal medicine and the organization of residency and internship programs; $2,200;

University of Pará, Belém, Brazil: equipment and supplies for the Department of Parasitology, Faculty of Medicine; $10,000;

Paulista School of Medicine, São Paulo, Brazil:

Study of the program of medical education and administration of the Faculty of Medicine, University of Valle, Cali, Colombia, by five members of the faculty; $4,150;

Dr. Magid Iunes, head, metabolic and nutrition division, Department of Medicine; to visit departments of medicine in Colombia and the United States; $2,800;

University of São Paulo, Faculty of Medicine of Ribeirão Preto, Brazil:

Dr. Jose Venancio Pereira Leite, assistant professor of physiology; to study modern instrumentation in physiology at Baylor University, Waco, Texas, and to visit physiology centers in the United States; $2,625;

Dr. Mauricio Oscar da Rocha e Silva, professor and head, Department of Pharmacology; to visit departments of pharmacology at medical schools in the United States and Latin America; $2,550;

Dr. Fernando Huidobro Toro, professor of pharmacology and director, Medical School, Catholic University of Chile, Santiago: to observe the teaching of pharmacology and the organization of medical schools in Latin America; $2,700;

University of Chile, Santiago:

Local postgraduate training in Chile for selected recent graduates of the Faculties of Medicine of the University of Chile, the Catholic University of Chile, Santiago, and the University of Concepción; $10,000;

Dr. Osvaldo Cori, professor of biochemistry and associate professor of physiology, Medical School; to visit centers of research in biochemistry in the United States; $1,550;

Dr. Walter Sunkel, assistant, Department of Surgery, Faculty of Medicine; to visit centers of cardiac surgery while in the United States; $630;

Dr. Ricardo Katz, assistant in clinical medicine, Medical School; to visit departments of medicine while in the United States; $500;

University of Caldas, Faculty of Medicine, Manizales, Colombia:

Basic texts and reference sources for the medical library; $10,000;

An interchange program between the Faculty of Medicine and the Faculty of Medicine of the University of Valle, Cali, Colombia; $2,000;

Dr. Ferry Aranzazu, chairman, Department of Medicine; to obtain observational training at the School of Medicine, Tulane University of Louisiana, New Orleans; $1,850;

Dr. Hernando Orozco Ospina, chairman, Department of Physiology; to obtain observational training at the School of Medicine, Tulane University of Louisiana, New Orleans; $1,850;

University of Cartagena, Faculty of Medicine, Colombia:

Reference books, journals, and library materials in the medical and health sciences for the university library; $10,000;

Basic equipment for the teaching of biochemistry; $10,000;

University of Valle, Cali, Colombia:

Dr. Gabriel Velázquez Palau, dean, Faculty of Medicine, and Mrs. Velázquez; to observe the organization and teaching programs of medical centers in South America; $3,750;

An interchange program between the Faculty of Medicine and the Faculty of Medicine of the University of San Marcos, Lima, Peru; $3,000;

Dr. Hernan Zuleta Carrasquilla, director and instructor, Clinical Laboratory, Faculty of Medicine; to observe the organization and the techniques of clinical laboratories in the United States; $2,900;

Dr. Roberto Jaramillo H., director, Department of Radiology, Faculty of Medicine; to observe the teaching of radiology and radiotherapy in the United States; $2,650;

Dr. Juan Antonio Montoya Ochoa, vice-dean and professor of epidemiology, Faculty of Medicine; to observe programs of social medicine in Great Britain and the Netherlands; $2,300;

Dr. Carlos Restrepo, professor and head, Department of Pathology, Faculty of Medicine; to visit departments of pathology in Latin America to observe teaching and research and to develop plans for a seminar on pathology; $2,225;

Miss Elva Leonor Ortiz, general secretary; to observe records and administrative procedures at universities in the United States; $1,700;

Dr. Jorge Bustamante, chief, Obstetrics and Gynecology Service, Maternity Hospital, and assistant professor of obstetrics and gynecology, Faculty of Medicine, University of El Salvador, San Salvador: to visit departments of obstetrics and gynecology in the United States; $1,100;

University of Guanajuato, Mexico: equipment for the teaching program of the Department of Pathology, School of Medicine, León; $10,000;

Mexican Center for Scientific and Technical Documentation, Mexico City: equipment for the reproduction of scientific documents, and for visits to libraries in the United States by the director; $8,700;

University of San Luis Potosí, Faculty of Medicine, León, Mexico:

Equipment for the new teaching program in microbiology; $10,000;

Professor Edmundo Tellez Giron, professor of biochemistry; to take a course in radioisotope techniques at the Institute of Nuclear Studies, Oak Ridge, Tennessee; $1,350;

Equipment for the teaching and research programs of the Department of Physiology; $600;

National University of San Agustín, Faculty of Medicine, Arequipa, Peru:

Interchange of members of the medical faculty of the National University with faculty members of medical schools in Colombia and other Latin American countries; $6,000;

Dr. Jorge Chiriboga, dean; to visit medical schools in Colombia; $800;

Europe

University of Aarhus, Denmark: teaching equipment and materials for the Postgraduate School of Nursing; $10,000;

Dr. Basil C. Malamos, professor of clinical therapeutics, University of Athens, and member, Greek Atomic Energy Commission: to observe the uses of nuclear energy in biology and medicine at laboratories in the United States; $1,100;

University of Naples, Italy: support of the educational and research program of the Sanitary Engineering Laboratory, Institute of Hydraulics and Hydraulic Construction; $15,000 for a two-year period;

Dr. Jon Bjørnsson, deputy director general, Health Services of Norway, Oslo: to observe the organization of health and social services in Australia and New Zealand; $4,000;

Dr. Jozef Bogusz, director, First Surgical Clinic, and professor of surgery, Academy of Medicine, Cracow, Poland: to observe teaching methods in medical centers in the United States and Canada; $2,950;

Professor Marian Stefanowski, rector, Academy of Medicine, and head, First Surgical Clinic, Lodz, Poland: to observe developments in medical education at medical schools in the United States and Europe; $2,925;

Academy of Medicine, Poznan, Poland:

Professor Jan Roguski, director, II Clinic of Internal Medicine; to observe developments in medical education and internal medicine at medical schools in the United States and Europe; $2,975;

Dr. Wiktor Dega, head, Orthopedic Clinic; to observe current trends in medical education and rehabilitation at medical centers in the United States; $1,400;

Dr. Andrzej Biernacki, director, First Medical Clinic, Academy of Medicine, Warsaw, Poland: to observe recent developments in medical education at medical schools in the United States and Europe; $3,500;

Dr. Wiktor Bross, professor of surgery, Academy of Medicine, and director, Second Surgical Clinic, Wroclaw, Poland: to visit medical schools in the United States and Europe to observe developments in medical education and surgery; $3,050;

Dr. Zbigniew Apolinary Zawadzki, Institute of Hematology, Warsaw, Poland: to observe the organization of work and study at various blood research centers while in the United States; $400;

Professor Walenty Hartwig, director, First Medical Clinic, Postgraduate Medical Institute, Warsaw, Poland: to observe developments in postgraduate medical education and endocrinology at medical schools in the United States and Europe; $2,870;

Dr. Leon Manteuffel, head, Surgical Department, Wolski Hospital, Warsaw, Poland: to visit medical schools in the United States and Europe to observe developments in medical education; $3,000;

Technical School for Nurses, Lisbon, Portugal:

Miss Roselia Ribeiro Ramos, public health nursing teacher; to visit nursing schools and hospitals in Brazil and Costa Rica, and to attend an international workshop on nursing surveys in Brazil; $2,730;

Miss Crisanta Monteiro Regala, assistant director; to visit nursing schools and hospitals in Brazil and Costa Rica, and to attend an international workshop on nursing surveys in Brazil; $2,730;

Dr. Charles Ronald Lowe, senior lecturer in social medicine, University of Birmingham, England: to observe the teaching of public health and departments of preventive medicine at medical schools in the United States; $2,075;

Dr. Percy Cyril Claude Garnham, director, Department of Parasitology, London School of Hygiene and Tropical Medicine, England: to participate in the teaching and research program of the University of Valle, Cali, Colombia; $2,500;

Dr. George A. G. Mitchell, dean, Medical Faculty, and professor of anatomy, Victoria University of Manchester, England: to observe methods of medical education at medical schools in the United States and Canada; $2,245;

Dr. John Alexander Hugh Lee, Social Medicine Research Unit, Medical Research Council of Great Britain, London: to visit departments of preventive medicine and centers of epidemiological research in the United States and Canada; $3,525;

Miss Alice M. C. Thompson, librarian, Royal College of Nursing, London, England: to visit selected medical, nursing, and other libraries in the United States; $2,300;

Dr. Branko Kesic, professor of hygiene and social medicine, University of Zagreb, and director, Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb: to visit public health institutions in the United States and Puerto Rico; $3,060;

Africa

Dr. L. J. Charles, Specialist Malariologist, Ministry of Health, Accra, Ghana: to attend the annual meeting of the American Mosquito Control Association and to observe developments in aerial larvicidal control while in the United States; $950;

Dr. Harry Sutherland Gear, vice-president elect for medical research, Council for Scientific and Industrial Research, Johannesburg, Union of South Africa, and Mrs. Gear: to observe developments in medical education and research in the United States, Canada, and Europe; $6,800;

Middle East

Dr. Abdul Amir Allawi, professor of pediatrics, Royal College of Medicine, Baghdad, Iraq, and Mrs. Allawi: to observe integrated curricula and modern teaching methods at medical schools in the United States, Puerto Rico, and Colombia; $6,360;

University of Ankara, Turkey: expenses involved in attendance at international congresses by Turkish medical scientists and their visits to laboratories and scientific colleagues in other countries; $5,000;

Ministry of Health and Social Assistance, Ankara, Turkey: initial supplies to enable the School of Hygiene, Ankara, to inaugurate formal courses in 1958; $10,000;

South Asia

The Honorable Mrs. Vimala Wijewardene, Minister of Health, Colombo, Ceylon: to visit Puerto Rico while in the United States to observe developments in medical and health services; $700;

Dr. Edward M. Holmes, Jr., consultant and professor of preventive and social medicine, All-India Institute of Medical Sciences, New Delhi: to visit Puerto Rico to observe teaching programs in preventive and social medicine en route to India from the United States; $400;

Dr. Subodh Mitra, vice-president, University College of Medicine, and dean, Faculty of Medicine, University of Calcutta, India: to observe preclinical and clinical teaching at the postgraduate level in the United States; $3,900;

Miss Florence Taylor, dean and professor of nursing, School of Nursing, Christian Medical College, Vellore, India: to observe recent developments in nursing education in the United States and Canada; $1,750;

Dr. Keshavarao Krishnarao Datey, honorary physician, K. E. M. Hospital, and lecturer, Seth Gordhandas Sunderdas Medical College, Bombay, India: to observe methods of undergraduate and postgraduate teaching in cardiology in the United States and Europe; $4,000;

University of Lucknow, King George's Medical College, India:

Dr. Badri Narain Sinha, professor and head, Department of Orthopedic Surgery; to observe recent developments in orthopedic surgery, including the organization of intern training programs in this specialty, in the United States and Europe; $4,550;

Dr. Bir Bhan Bhatia, professor and head, Department of Medicine; to observe residency and intern training programs in the United States; $4,350;

To continue the appointment as head of the model teaching ward of Dr. Madan Mohan Singh; 7,200 rupees (about $1,570);

Dr. M. P. Joseph, chief radiologist and assistant professor, Medical College Hospital, Trivandrum, India: to observe recent developments in the field of radiobiology and cancer therapy in the United States and Canada; $4,225;

Miss Lakshmi Devi, general secretary, Trained Nurses' Association of India, Delhi: to observe the programs of schools of nursing and professional nursing organizations in the United States and England; $4,300;

Dr. Krishna Murari Lal, director, Medical and Health Services of Uttar Pradesh, Lucknow, India: additional expenses of visits to Europe and Japan to observe national health insurance and public health and rehabilitation programs; $239;

Dr. Charas Yamarat, associate professor of microbiology, Faculty of Public Health, Bangkok, Thailand: to observe methods of teaching microbiology and new techniques in virology in the United States and Japan; $4,400;

Far East

Dr. Kiyoshi Saito, director, Institute of Public Health, Tokyo, Japan: to observe postgraduate education and research activities in schools of public health in the United Kingdom and on the Continent; $1,600;

Dr. Eiichi Kimura, assistant professor, Department of Internal Medicine, Tohoku University, Sendai, Japan: to observe developments in medical education and particularly in the teaching of cardiology while in the United States; $925.

Field Service

Outside the United States, the Foundation implements its program in medical education and public health primarily by assisting a few institutions in a given country which seem particularly able to give their graduates interest and competence in academic careers. On joining the faculties of other schools in the country, these graduates can, in their turn, strengthen medical training and research. During 1958, for example, support was given the developing medical school of Lovanium University in Leopoldville, the Belgian Congo, and other medical schools in Brazil, Chile, Colombia, India, Lebanon, Japan, Turkey, and West Africa.

The Foundation seeks to advance medical education and public health within the United States by financing studies and experiments designed to improve the quality of medical education and care, and to hasten the solution of complex problems arising from social and technological developments. In the past few years, for example, encouragement has been given to the establishment of university-wide programs focusing on the problems inherent in the growing use of atomic energy.

Field offices for medical education and public health were maintained in 1958 in Santiago, Chile, Rio de Janeiro, Brazil, and New Delhi, India. Foundation representatives serve as advisors to medical institutions, and consultants on medical education and public health, in whatever ways seem indicated in the countries in which they are stationed. During 1958 two staff members had assignments to other organizations: one to the Population Council, New York, and the other to the School of Medicine of the University of Puerto Rico.

For the support of its field services in medical education and public health, the Foundation appropriated $336,260 in 1958. A separate grant of $27,000 was made for various expenses in New Delhi, where the office is shared by members of the Foundation's agricultural staff.

General

ROYAL SOCIETY OF MEDICINE

LIBRARY DEVELOPMENT

The Royal Society of Medicine, London, provides extensive services to its 10,000 members and fellows. It sponsors about 250 scientific meetings each year, and publishes a journal with a world-wide circulation of approximately 11,000 copies. The photographic unit, established with Rockefeller Foundation funds, has become an important center for medical photography, cinematography, and documentation for research workers and physicians in Great Britain and abroad. Finally, the society's library is one of the great medical libraries of the world.

The financial strains of the war and the postwar period have, however, greatly hampered the Royal Society in its efforts to keep pace with the increasing demand for its services, and the library particularly is seriously in need of better housing and enlarged facilities for cataloguing, preservation, and service functions. The society has been given some additional endowment funds for the library, but a larger permanent income is needed to maintain its activities at an optimum level. To provide general support for the library over a period of five or more years, while the society secures stable, long-term funds, The Rockefeller Foundation made an outright grant of £24,000 (about $68,400) in 1958.

WORLD HEALTH ORGANIZATION

GUIDE TO PROCEDURES AND PRACTICES

Since its establishment in 1945, the World Health Organization has developed many different procedures and practices to govern its programs, its internal administration, and its relationships with the governments of the United Nations. These will now be compiled in a book which will serve as a manual to the operations of WHO for use in its sections and regional offices, as a permanent record of the organization's procedures, and as a guide to health agencies throughout the world in formulating programs and policies relating to the organization. The "repertory of practice" will also include the historical aspects of the development of international health activities and of the establishment of the World Health Organization.

The document will be prepared during the next three years with the help of a grant of $25,000 from The Rockefeller Foundation.

PENNSYLVANIA STATE UNIVERSITY

RESEARCH ON INSECTICIDES

Although insecticides are widely used for the control of such insect-borne diseases as malaria and for the protection of crops and domestic animals, relatively little is known about their physical, chemical, and biological properties. These will now be intensively studied by the Departments of Agricultural and Biological Chemistry, Agricultural Engineering, and Zoology and Entomology of the Pennsylvania State University. The investigations will cover such questions as the influence of surface tensions and surface energy of liquids and solids on the activity of insecticides, wetting and spreading phenomena, adhesive forces between the spray deposits and the surface sprayed, and the effects on the spray deposit of natural forces under field conditions.

The cooperative researches on insecticides of the three departments will be partially supported by a one-year grant of $24,000 from the Foundation to Pennsylvania State University. As part of its general interest in increasing the effectiveness of insecticide use, the Department of Agricultural Engineering is also investigating the possible application of improved sprayer design to the power sprayers used in agriculture.

OTHER GRANTS

University of Pittsburgh, Pennsylvania: development, by the Graduate School of Public Health, of prototypes for use in a long-term study of congenital malformation; $10,000;

Health Insurance Plan of Greater New York, New York: completion of a study of hypertension; $5,000;

Johns Hopkins University, Baltimore, Maryland: completion of a book on international health administration, by Dr. Athol J. Patterson, assistant professor of public health administration, School of Hygiene and Public Health; $3,850;

Okayama University, Japan: radiation equipment for the use of the Medical School; $2,150;

Pan American Sanitary Bureau, Washington, D.C.: to continue the assignment of Miss Donna Geib, laboratory consultant, to Port-of-Spain, Trinidad; $1,300;

Fund for grants of amounts not exceeding $500 for allocation under the supervision of the Foundation's Director for Medical Education and Public Health; $5,000.

Biological and Medical Research

Major Interests, 1958

Experimental Medicine	$ 458,340
The Biological Basis of Behavior	143,435
General Biology	320,385
Genetics	304,465
Biochemistry	848,500
Biophysics	135,325
Virology, including the Foundation's Virus Research Program	1,309,766
Special Projects	2,232,525
Fellowship and Scholarship Fund	425,000

BIOLOGICAL AND MEDICAL RESEARCH

THE PRESENT STATE of the biological and medical sciences exhibits a curious paradox. As the activities of individual investigators become more and more specialized, the field as a whole becomes more and more interrelated and coherent. Thus the grants described below provided help for field workers studying the behavior of fruit fly populations in isolated parts of Brazil, for clinicians and psychologists appraising the physical and mental capacities of children of consanguineous marriages in Japan, for X-ray diffraction experts studying the structure of large protein molecules, for physical chemists separating cells into their particular constituents, and for biochemists who analyze such particles to determine the arrangement of their molecules and atoms. Each of these techniques requires years of preparation and makes varying demands on the skill, intelligence, and character of the investigator. The X-ray crystallographer, for example, must have a very considerable ability in mathematics and logical analysis plus an unusual sort of leaping intuition, but he need not possess the love of the outdoors, the resistance to personal discomfort, and the powers of detailed observation which characterize the field naturalist. Similar, more-or-less accurate character sketches could be drawn for each of the typical specialists who compose the complement of the modern biological ship. The point is that it is the techniques of biology which separate its specialties. Recent developments in the conceptual framework are drawing them ever closer together.

It is now beginning to be seen quite clearly that the characteristic life functions of reproduction, growth, development, and differentiation all form a continuous pattern. The population geneticist studying the adaptation of a new hybrid fruit fly on a Brazilian island and the physical chemist determining the structure of the large nucleoproteins that form the genes stand at two ends of a single coherent chain of events. The behavior of the Drosophila colony is the final logical expression of the major and minor premises laid down in the chemical code contained in the gene: how this code determines the enzymes which determine the cells which determine the tissues which determine the behavior of the adult organism—finally, how these organisms react with one another and with their environment to select a slightly different set of codes to get the next generation off to a different (and hopefully better) start, all this is the warp and woof of biology.

Concerning the details of the process, there is still much more that is unknown than is known. The nursery rhyme about the house that Jack built is pretty vague about the exact nature of the house—where its doors and windows were, what kind of furniture it had, the efficiency of its heating system, and so on. But we are left, nevertheless, with the feeling that it is one house and that it was put together in a very logical way. Similarly, biologists now know that they are all working on the same structure, that their particular bits of woodwork will shortly be fitted together with other bits, and that the whole thing will ultimately be painted, papered, and landscaped to make a harmonious unit.

In the following section of this report an attempt is made to classify the grants made during the year just past. The classifications adopted are more a matter of administrative convenience than a reflection of basic differences in purpose or method among the laboratories involved. Thus

"Experimental Medicine" includes those grants made primarily to strengthen research in medical schools. Some of the workers so assisted will probably have their sights set a little more closely on the study of human illness than will those included under other headings. But as medicine becomes ever more solidly based on general biology, the distinction between the two becomes ever more indistinct and inconsequential. Similarly, "Genetics," which was far removed from biochemistry when Gregor Mendel started to measure the sweet peas in his monastery garden, is moving steadily closer to it. Distinction is still quite easy sometimes, as in the case of the grant to the University of London which will be used largely for the study of the genetics of certain gross morphological abnormalities in mice. The work at Pavia, on the other hand, is in part involved with the specific enzymes controlled by specific gene loci in microorganisms and in part with alteration of genes by X-radiation and mutagenic chemicals.

The work of Brachet's laboratory in Brussels, listed under "Biochemistry" because of the predominantly chemical nature of its techniques, is primarily concerned with how the code laid down by the genes acts to determine the differentiation of cells into the specialized tissues that characterize the fully developed organism. It could equally well be classified as general biology, experimental embryology, or genetics. One of the grants listed under "Virology," that to the Australian National University at Canberra, may well have its most lasting impact on genetics rather than on classical microbiology, for it is concerned with genetic recombinations of viruses, the simplest system in which heredity has been found to operate.

One hears a great deal these days about the compartmentalization of science and the rigidity of interdisciplinary boundaries. It seems unlikely that such statements are true in any objective sense since otherwise there would have been less difficulty "compartmentalizing" the grants in the biological and medical sciences. The more serious problem is a subjective one: individual scientists tend to *feel* compartmentalized. They are constantly and often painfully aware of the Malthusian tendency of scientific knowledge to increase geometrically while their own grasp is constrained by an iron arithmetical law. The biologist of today ordinarily knows far more mathematics and organic chemistry than his predecessors did, but he probably knows far less of the total that is known. The resulting sense of isolation is real enough and poses severe personal problems to many of those who have dedicated their lives and fortunes to expanding man's knowledge of himself and his universe.

The problems remain personal, however, and do not seem to interfere with the progress of science. Scientific knowledge does continue to expand and the more it expands, the more closely its parts come in touch with one another. One can now pass without serious discontinuity from mathematical symbol to strange particle, to neutron, to atom, to molecule, to cell, to tissue, to nervous system, to total organism. Tomorrow we may bridge the gap which still exists between single organisms and society. Perhaps when that happens the scientist as well as his colleague, the organization man, will have found a way of restoring his sense of personal participation.

Experimental Medicine

MEDICAL RESEARCH COUNCIL OF GREAT BRITAIN

FELLOWSHIPS IN THE MEDICAL SCIENCES

The British Medical Research Council fellowship program under which a small but carefully chosen group of postgraduates has been sent abroad for advanced research experience in the medical sciences has, since 1923, been interrupted only during the war years. The standards of selection applied by the council, and the subsequent success of the fellows, have been notable. Of the 177 fellows who have held awards, 54 have been appointed to university professorships, and about 100 have held other academic or research appointments. One Nobel laureate, Sir Howard Florey, is numbered among the former fellows of the council.

The Rockefeller Foundation has supported the fellowship program of the Medical Research Council since its first year. A new grant of $150,000, continuing that support through the period ending August 31, 1964, brings the total of Foundation grants for the council's fellowship activities to $744,000.

UNIVERSITY OF CUYO

FACULTY OF MEDICINE

The University of Cuyo is located in Mendoza on the Andean slopes of western Argentina in a region important for its petroleum resources and wine production. Founded only in 1939, the university has received enthusiastic local and national support which has enabled it to plan its development and expansion. Recently a 155-acre park was donated by the federal government for a new University City which will be built to house the institution. The Faculty of Medicine has been provided with a large hospital building on the new campus, and in addition the federal government has allocated construction funds and building materials valued at almost $400,000 for use by the medical school.

The Faculty of Medicine, many of whose teaching staff are on a full-time basis, ensures limited enrolment and careful selection of students through rigid entrance requirements.

Increasing emphasis is now being placed on research in the basic sciences, and investigations are being conducted in physiology, histology and embryology, and biology.

To help strengthen teaching and research in the basic science departments of the Faculty of Medicine, The Rockefeller Foundation has made a two-year grant of $100,000 to the University of Cuyo for research and teaching equipment and supplies.

UNIVERSITY OF TURKU

BASIC SCIENCE INSTITUTES

A private, autonomous school established in 1920, the University of Turku, Finland, organized its medical school in 1943 to train doctors needed to replace those lost during the wars. In the years since, it has constructed new buildings for both clinical and preclinical departments, and built up an excellent faculty. Like most other private universities, however, the University of Turku has felt the effects of progressive postwar inflation, and has been unable, despite Finnish government help, to give salary increases commensurate with the cost of living. As a consequence, assistants—the equivalent of instructors or assistant professors—have had to supplement their incomes outside the university.

In the institutes devoted to anatomy, pathology, biochemistry, physiology, microbiology, and pharmacology, both research and teaching have been hampered by the half-time arrangement for assistants in the basic sciences, who are less able than their colleagues in clinical fields to find secondary positions related to their major interests. To enable each basic science institute to appoint one full-time assistant, The Rockefeller Foundation has appropriated 18,000,000 Finnish marks (about $61,200) for use by the University of Turku over a five-year period. The Finnish government will assume the extra costs of the full-time assistantships upon the expiration of Foundation aid.

UNIVERSITY OF HELSINKI

ANATOMY, PATHOLOGY, AND PHARMACOLOGY

In the Anatomical Institute of the University of Helsinki, Finland, Professor O. Eränkö is introducing a new emphasis on experimental research, and is continuing and extending his own histochemical studies of the biosynthesis and metabolism of adrenalin, noradrenalin, and similar substances. Research led by Dr. M. Paasonen on the pharmacology of serotonin, and its localization and significance in the nervous system, is one of the major projects in progress at the Pharmacological Institute. The Second Pathology Institute, established several years ago for Professor Harald Teir, maintains an extensive research program on various aspects of the biology of growth and regeneration.

To help these three basic science institutes acquire equipment for which foreign currency is needed, The Rockefeller Foundation has made a two-year grant of $47,000 to the University of Helsinki. The additional facilities will also be available to investigators from other university departments, including the university clinics, and from the state hospital services.

YUGOSLAV ACADEMY OF SCIENCES AND ARTS

INSTITUTE FOR MEDICAL RESEARCH

The Institute for Medical Research, Zagreb, Yugoslavia, has in recent years placed increasing emphasis on research in the basic biological sciences. Because the institute works closely with the University of Zagreb, where most of its senior staff teach, the shift in program has tended to strengthen the basic science departments at the university.

The institute now plans a further expansion of fundamental physiological and biochemical investigations, with an increase in scientific staff. To make this possible, it will transfer work in biochemistry to the School of Public Health of the University of Zagreb, where more extensive facilities will be available, and will continue the remaining portions of its program in larger quarters in its own building.

For the purchase of additional research equipment and supplies for the Institute for Medical Research and for the School of Public Health, the Foundation has made a three-year grant of $33,000 to the Yugoslav Academy of Sciences and Arts, Zagreb. The institute is one of the research units of the academy.

UNIVERSITY OF RIO GRANDE DO SUL

DEPARTMENT OF THERAPEUTICS

In addition to its undergraduate teaching responsibilities in clinical medicine, the Department of Therapeutics at the University of Rio Grande do Sul, Pôrto Alegre, Brazil, offers part-time internships principally in applied pharmacology, weekly lectures on therapy and electrocardiography, and postgraduate courses in clinical therapy which are attended by practicing physicians. The Brazilian organization CAPES (Campaign for the Improvement of Higher Education Personnel) recently selected the department as a center for postgraduate study in clinical medicine under its teacher-training program.

A laboratory for research, diagnosis, and therapy with radioactive isotopes, to serve the entire medical school, was organized as a section of the Department of Therapeutics in 1958. Staff are being trained at the Institute of Biophysics in Rio de Janeiro, Brazil, and at the Isotope Laboratory of the Faculty of Medicine and the Clinical Hospital at São Paulo, Brazil. To provide the department with additional teaching and research materials and with new equipment, especially for the Isotope Laboratory, The Rockefeller Foundation has made a two-year grant of $30,000 to the University of Rio Grande do Sul.

OTHER GRANTS

University of Sydney, Australia: equipment for research in the Department of Medicine, under the direction of Dr. C. R. B. Blackburn; £5,000 (about $14,250);

Dr. R. N. Chaudhuri, director, Calcutta School of Tropical Medicine, India: to visit research centers in Europe, Asia, and North America; $4,600;

Dr. Hideo Nishimura, Department of Anatomy, Faculty of Medicine, Kyoto University, Japan: to visit research laboratories in the United States, Canada, and Europe; $4,280;

Sir Harold Himsworth, secretary, Medical Research Council of Great Britain, London, and Lady Himsworth: to confer with scientific colleagues in the United States; $2,600;

Associate Professor Arno G. Motulsky, Department of Medicine, University of Washington, Seattle: to visit departments of bacteriology, genetics, and malariology in the Belgian Congo, Uganda, Kenya, Israel, and Sardinia; $2,500;

Dr. H. B. Stein, Department of Chemical Pathology, University of Witwatersrand, Johannesburg, Union of South Africa: to visit pathology centers in the United States and Canada; $2,200;

University of Zagreb, Yugoslavia: equipment for research in the Department of Medicine; $2,200;

University College of the West Indies, Mona, Jamaica:

Dr. John Edward MacIver, senior lecturer in hematology, Department of Pathology; to visit research centers in the United States; $1,600;

Dr. Harold Geoffrey Dixon, senior lecturer in obstetrics and gynecology, Faculty of Medicine; to visit the Medical School of the University of Puerto Rico, San Juan; $250;

Dr. Juan Itoiz, professor of biochemistry, Faculty of Medical Sciences, University of Cuyo, Mendoza, Argentina: to visit new medical school buildings in Chile, Peru, and Colombia; $1,000;

Dr. Yuzuru Justin Homma, associate professor, Institute of Infectious Diseases, Tokyo University, Japan: to visit centers of bacteriological research while in North America; $960;

Dr. Katsuo Takeda, dean, School of Medicine, Hokkaido University, Sapporo, Japan: to visit research centers and medical schools in the United States; $700.

The Biological Basis of Behavior

WELSH REGIONAL HOSPITAL BOARD

RESEARCH IN NEUROPSYCHIATRY

The Neuropsychiatric Research Centre, Whitchurch Hospital, Cardiff, Wales, directed by Dr. Derek Richter, has devoted its chief attention to the biochemistry of the central nervous system for almost 30 years. In 1957 it became one of the regular clinical research units of the British Medical Research Council under a new council program designed to further studies in fields related to mental illness.

A major part of the work of the center deals with the metabolism of phospholipids, the complex fatty compounds which constitute a large proportion of nervous system tissue. Using radioactive isotope techniques, Dr. Richter and his colleagues have estimated the rate at which some of the phospholipids break down and resynthesize in the brain and recently determined that chlorpromazine, one of the most widely used of the "tranquilizer" drugs, produces a marked decrease in phospholipid turnover. Other studies in progress at the center concern the protein metabolism of brain cells, changes in a variety of enzyme systems resulting from localized brain injury, and the glycolytic mechanism—one of the systems by which brain cells meet their energy requirements.

Toward the costs of research at the laboratory through the next five years, the Foundation has appropriated £10,000 and $5,000 (approximately $33,500) to the Welsh Regional Hospital Board.

OTHER GRANTS

University of Oxford, England: research in neurohistology in the Department of Human Anatomy, under the direction of Dr. Graham Weddell; £7,000 (about $19,950) for a five-year period;

University of Munich, Germany: studies in animal behavior, under the direction of Professor Karl von Frisch; $15,000 for a three-year period;

Chiba University, Japan: research in neuroanatomy and neurophysiology in the School of Medicine, under the direction of Dr. Toshio Kusama; $10,000;

Hokkaido University, Sapporo, Japan:

Research in the Departments of Physiology and Neuropsychiatry, School of Medicine, under the direction of Dr. Bunichi Fujimori and Dr. Nozomi Suwa; $10,000;

Research in endocrine physiology in the Department of Physiology, School of Medicine, under the direction of Dr. Shinji Itoh; $5,400;

McLean Hospital, Waverly, Massachusetts: toward the expenses of a group of American scientists invited to attend the Third International Neurochemical Symposium in Europe; $10,000;

University of Buenos Aires, Faculty of Medical Sciences, Argentina: research in clinical and experimental physiology at the Center of

Cardiological Investigations, under the direction of Dr. Alberto C. Taquini; $10,000;

Yamaguchi Prefectural Medical College, Ube, Japan: equipment for use in the Department of Physiology; $6,000;

University of Bahia, Salvador, Brazil: study and research in the United States by two staff members of the Department of Physiology, Faculty of Medicine; $4,700;

Dr. Mary A. B. Brazier, research associate, Medical School, Harvard University, Boston, and neurophysiologist, Massachusetts General Hospital, Boston: to visit centers of neurophysiological research in European countries, including Czechoslovakia, Poland, and the Soviet Union; $3,100;

Professor Theodore Gillman, Department of Physiology, Faculty of Medicine, University of Natal, Durban, Union of South Africa: to visit physiology centers and medical schools in the United States and Canada; $2,600;

Dr. Roman J. Wojtusiak, professor of zoopsychology and ethology, Jagiellonian University of Cracow, Poland: to visit biological laboratories in the United States; $2,500;

University of California, Los Angeles: research on the physiology of yoga in the Department of Psychology, under the direction of Dr. M. A. Wenger; $2,500;

Nagasaki University, Japan: research on neurophysiology in the School of Medicine, under the direction of Dr. Kensuke Sato; $2,500;

Dr. Peter O. Bishop, professor of physiology, University of Sydney, Australia: to participate in the International Union on Biological Sciences held in Paris during July, 1958, and to visit research centers in Europe, the United States, and Canada; 1,000 Australian pounds (about $2,260);

Dr. Masayoshi Goto, professor of physiology, Kagoshima University, Japan: to study at the Marine Biological Laboratory, Woods Hole, Massachusetts; $1,725;

Dr. Héctor Mazzella Elena, adjunct professor of physiology, Faculty of Medicine, University of the Republic, Montevideo, Uruguay: to accept a visiting professorship in physiology at the State University of New York; $1,000;

Dr. Gordon M. Schoepfle, Department of Physiology, School of Medicine, Washington University, St. Louis, Missouri: to attend an international symposium in Berlin, Germany; $700.

General Biology

BERMUDA BIOLOGICAL STATION

MARINE BIOLOGY

The Bermuda Biological Station, an important center for research in marine biology since 1903, suffered setbacks and interruptions during the war but has now made an excellent recovery. In recent years it has refitted its laboratories, assembled modern laboratory apparatus, and provided for the housing of equipment in dehumidified rooms. In addition it has obtained a 60-foot boat suitable for research in the deep sea, the *Panulirus*, on permanent loan from the Bermuda government. The station also has two smaller vessels for off-shore studies.

The center complements a mainland institution, the Marine Biological Laboratory at Woods Hole, Massachusetts, by offering opportunities for research in semitropical waters. Another advantage associated with the Bermuda location is that studies of the deep sea are possible in nearby areas.

Like the Woods Hole laboratory, the station functions in part as a base for visiting investigators. Every summer about 30 scientists from other institutions take part in its program for periods of several months. Toward the cost of additional housing for the visiting investigators, and for new research equipment, the Foundation has made a two-year grant of $52,000. Previous aid for the development of the center totaled $257,000.

UNIVERSITY OF ZURICH

RESEARCH IN EXPERIMENTAL BIOLOGY

Working in the borderline areas between experimental embryology and biochemical genetics, Professor Ernst Hadorn and his colleagues at the University of Zurich, Switzerland, are using the newer techniques of embryology and genetic analysis to restudy the problems of zoology and comparative anatomy. Research is being done on cell and tissue differentiation, the biochemical effects of varying gene patterns on development, the interaction of nuclear and cytoplasmic factors in the control of growth, and the sequence of developmental abnormalities that leads to the death of lethal mutant strains and incompatible hybrid crosses. Other members of the Institute of Zoology and Comparative Anatomy directed by Professor Hadorn are studying fertility and viability in insects, and the institute serves as one of the three European centers for the maintenance of Drosophila-type collections.

In 1957 the university made plans for the modernization and enlargement of the institute. New laboratories for biochemical and physiological research, rooms for work with isotopes, several new constant-temperature and culture rooms, additional space for about 15 investigators, and four extra laboratories for a second professor of experimental zoology have been planned, and construction of a number of the units has already begun.

The Canton of Zurich and the university are providing most of the funds needed for the expansion of the institute and The Rockefeller Foundation has contributed $50,000, available over a three-year period, to meet the costs of new equipment.

MINISTRY OF PUBLIC HEALTH, URUGUAY

RESEARCH IN THE BIOLOGICAL SCIENCES

For three decades the Research Institute of Biological Sciences of the Uruguayan Ministry of Public Health has pioneered in the development of modern biology in Uruguay. Its staff has done significant research, and has had a marked success in attracting young people, principally medical students, interested in training in experimental methods.

The institute started as a one-room laboratory, with a simple microscope as its only equipment. Later it became an agency of the Ministry of Public Health, which has supported it increasingly through the years. It is now housed in a fine modern building in Montevideo, and has five main departments and a number of specialized laboratories.

The Foundation, which in the past contributed more than $183,000 for the development of the institute, in 1958 renewed its support with a three-year appropriation of $35,000 to the Ministry of Public Health. The grant will provide dollar credits for scientific equipment and supplies which must be purchased abroad, and for various other research expenses.

LONG ISLAND BIOLOGICAL ASSOCIATION

SYMPOSIA ON QUANTITATIVE BIOLOGY

The consistently high quality of the symposia on quantitative biology held at the Cold Spring Harbor Laboratory has earned for the Long Island Biological Association an enviable world-wide reputation. Held annually since 1933 except for the war years, the conferences have been distinguished by the importance of the topics chosen for discussion, the discriminating selection of an international group of participants, and the effective organization of the meetings and of the publications that report them.

To provide fluid funds for use in the months of planning that precede each conference, the Foundation has appropriated $25,000 for a five-year period to the Long Island Biological Association. The grant will also enable the association to assist a greater number of foreign delegates who wish to prolong their stays in the United States beyond the period of the meetings for work at the Cold Spring Harbor Laboratory and visits to other research centers in the New York-New England area.

Rockefeller Foundation aid represented primary support of the symposia during their first decade.

OTHER GRANTS

Bombay Natural History Society, India: general support; $10,000;

University College of the West Indies, Mona, Jamaica:

Equipment and materials for studies in marine biology, under the direction of Professor D. M. Steven, Department of Zoology; $10,000;

Dr. George A. Stirling, lecturer in pathology; to visit research centers in the United States and Canada; $1,500;

Dr. L. N. Went, lecturer in pathology; to visit research centers in the United States and Canada; $1,500;

University of Texas, Austin: research in ecology at the Institute of Marine Science, under the direction of Dr. Howard T. Odum; $10,000;

University of Western Australia, Nedlands: research in ecology in the Department of Zoology, under the direction of Dr. H. Waring; $10,000;

University of San Marcos, Lima, Peru: studies in taxonomic botany and plant geography in the Department of Botany, Faculty of Sciences, under the direction of Professor Ramón Ferreyra; $9,200;

University of London, England:

Equipment for research in plant physiology and genetics in the Department of Botany, University College; $9,000;

Research on the embryology of primitive mammals in the Department of Zoology, University College; £1,000 (about $2,900);

University of Adelaide, Australia: research equipment for use in the Department of Zoology; $8,000;

Ministry of Health, Oswaldo Cruz Institute, Rio de Janeiro, Brazil: equipment and expenses for genetic and evolutionary studies of snails of the genus *Planorbis,* under the direction of Dr. Wladimir Lobato Paraense; $7,600;

Hokkaido University, Sapporo, Japan: research in cytology in the Department of Zoology, under the direction of Dr. Sajiro Makino; $6,500;

University of Recife, Brazil:

Expenses of visiting investigators conducting research at the Institute of Mycology under the direction of Professor Augusto Chaves Batista; $6,000;

Professor Augusto Chaves Batista, director, Institute of Mycology; to visit centers of research in mycology while in Europe; $480;

Rutgers, the State University, New Brunswick, New Jersey: Dr. Hubert A. Lechevalier, Institute of Microbiology; to visit microbiological centers in the Soviet Union and the Academy of Sciences in Moscow; $5,000;

Tokyo University, Japan: tissue culture studies in the Department of Anatomy, Faculty of Medicine, under the direction of Dr. Junnosuke Nakai; $5,000 for a three-year period;

Catholic University of Chile, Santiago: researches in histology and cytology in the Department of Anatomy, Faculty of Medicine, under the direction of Professor Juan de Dios Vial; $3,800;

Professor Jerzy Kaulbersz, Department of Physiology, Academy of Medicine, Cracow, Poland: to visit centers of research in physiology in the United States and Canada; $3,700;

Professor Henryk Szarski, rector and professor of zoology, Copernicus University, Torun, Poland: to visit zoological laboratories in the United States and Western Europe; $3,650;

Professor Stefan Slopek, director, Institute of Immunology and Experimental Therapy, Polish Academy of Sciences, Wroclaw, and professor of microbiology, Academy of Medicine, Wroclaw: to visit biological laboratories in the United States, Canada, and Western Europe; $3,600;

Jagiellonian University of Cracow, Poland:

Dr. Jerzy Kreiner, director, Department of Comparative Anatomy; to visit biological laboratories in the United States and England; $3,575;

Professor Zygmunt Grodzinski, director, Institute of Biology; to visit centers of research in embryology and cytology, primarily in the United States; $3,100;

Professor Bernard Zablocki, professor of microbiology and vice-rector, University of Lodz, Poland: to visit centers of research in microbiology in the United States; $3,300;

Dr. Hans Heugh Wandall, director, Institute of Experimental Surgical Research, University of Copenhagen, Denmark: to visit centers of surgical research in the United States; $2,600;

Serbian Academy of Science, Belgrade, Yugoslavia: research equipment for use in the Department of Occupational Medicine, Institute of Medical Research; $2,400;

University of Ljubljana, Yugoslavia: equipment and supplies for research in the Institute of Pathophysiology, under the direction of Professor A. O. Zupancic; $2,400;

Dr. Roberto E. Mancini, professor of histology and embryology, Faculty of Medicine, University of Buenos Aires, Argentina: to visit centers of research in histophysiology in Europe and the United States; $2,050;

University of Cambridge, England: an international symposium on ornithology, held early in 1959; $2,000;

Dr. Jacques S. Zaneveld, director, Caribbean Marine Biological Institute, Curaçao, Netherlands West Indies: to visit centers of research in marine biology and related sciences in the United States; $2,180;

Swedish Royal Academy of Sciences, Stockholm: Professor Lars Brundin, Department of Entomology, Swedish Museum of Natural History, Stockholm; to visit Chile to make limnological collections and investigations; $2,000;

Dr. Luigi Provasoli, research associate, Haskins Laboratories, New York: to participate in an international symposium in Galway, Ireland, and to visit centers of marine biology in Great Britain and on the Continent; $1,850;

Dr. Vincenzo Leone, Department of Zoology and Comparative Anatomy, University of Milan, Italy: to visit centers of electron microscopy and experimental zoology in France, Belgium, England, and Switzerland; $1,700;

Dr. Arpad Csapo, associate professor, The Rockefeller Institute, New York: to visit centers of physiology research in South America, principally in Brazil; $1,600;

Professor Paulo Sawaya, professor of general and animal physiology, University of São Paulo, Brazil: to visit marine biological stations and other research centers in Europe; $1,400;

Dr. Yositada Takenouti, chief oceanographer, Japan Meteorological Agency, Tokyo: to visit centers of oceanographic and related research in North America; $1,250;

Dr. Masami Suda, Department of Physiological Chemistry, Osaka University, Japan: to visit research centers in North America; $1,250;

Dr. Esko Orma, Second Medical Clinic, University of Helsinki, Finland: to visit research centers in the United States; $800;

Professor Roderic Alfred Gregory, professor of physiology, University of Liverpool, England: to visit physiological laboratories while in the United States; $500;

Fund for grants of amounts not exceeding $500 for allocation under the supervision of the Foundation's Director for Biological and Medical Research; $5,000.

Genetics

UNIVERSITY OF PAVIA

RESEARCH IN GENETICS

The Institute of Genetics of the University of Pavia, directed by Professor A. A. Buzzati-Traverso, has grown rapidly since its establishment in 1948. In 1953 it moved from guest space in the Institute of Zoology at Pavia to larger quarters, and acquired a considerable amount of new equipment. In 1957, through an agreement with the Italian National Committee for Nuclear Research, it became Italy's chief center for research on the genetic and other biological effects of ionizing radiations, and for advanced training in this field.

Since the 1957 agreement, the institute has broadened its field of study, enlarged its staff, and inaugurated a new training program. The training program, a two-year, limited enrolment course open to young scientists with doctorates in medicine, the natural sciences, or agriculture, is a bold attempt to provide Italy with specialists in radiation biology such as every country needs today. It has attracted an exceptionally able group of students.

In connection with the new teaching and research programs, the institute plans to add to its equipment, to expand its library facilities, and to bring to Pavia a number of visiting specialists in radiation biology and in plant and animal breeding. To help meet the expenses of these and related projects, the Foundation has made a three-year grant of $80,000 to the institute.

NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL

RESEARCH IN GENETICS

The major difficulty to be overcome in estimating the number of deleterious genes carried in any human population arises from the fact that most such genes are recessive, with effects which become apparent only when they are paired—in other words, inherited from both parents. The chance that this double inheritance will occur is much greater when the parents are closely related.

During the extensive study of the effects of radiation carried on by the Atomic Bomb Casualty Commission in Japan, 6,000 children were identified as being born of consanguineous marriages between parents exposed to varying levels of atomic radiation. These children, now from five to ten years old, constitute a unique group for the study of genetic inheritance, particularly the inheritance of deleterious genes, and of a wide variety of physical and mental characteristics.

To help finance a joint Japanese-American study, which will include careful physical and anthropometric examinations of the 6,000 children and statistical analysis of the data, The Rockefeller Foundation has made a grant of $50,000 to the National Academy of Sciences—National Research Council, Washington, D.C., for use during the period ending August 31, 1963.

UNIVERSITY OF LUND

RESEARCH IN GENETICS

Sweden's major school of genetics and an international advanced training center in the field, the Institute of Genetics of the University of Lund has achieved great distinction for researches of basic scientific importance in such areas as cytogenetics, human heredity, and plant genetics. One group of investigators is concentrating on the fundamental problems of chromosome behavior during mitosis and reduction division, the fine structure of chromosomes, and chromosome breakage by ionizing radiations and chemicals. Others concerned with a wide variety of issues in plant cytogenetics are cooperating with scientists at the Swedish Seed Association in Svalöf in the application of genetic theory to the selection and improvement of important food crops.

The incidence of consanguineous marriage in normal south Swedish population groups and the genetic consequences of these matings are the subjects of one of the institute's long-range research projects. The cytogenetics of tumors and malignant tissues are being studied under another long-term program with the objective, among others, of determining whether malignancy may not in part be the result of genetic adaptation or chromosome reshuffling.

A new grant of $40,000 to the University of Lund will continue Rockefeller Foundation support of the Institute of Genetics for a further three-year period.

UNIVERSITY COLLEGE, UNIVERSITY OF LONDON

RESEARCH IN GENETICS

The most widely recognized laboratory of mammalian genetics in Europe is that at University College of the University of London. Here for 20 years has been accumulated a rich store of data on the genetics of the mouse, with special emphasis on the effects of mutant genes.

The laboratory is now under the direction of Professor Hans Grüneberg, who came to the department when J. B. S. Haldane was there and who has devoted his research career to the genetics of congenital abnormalities and inherited diseases in the mouse.

The genetics of the mouse may prove to be an important link between present knowledge of genetic principles and their application to the study of human genetics.

The advent of nuclear power and the consequent increase in the exposure of large populations to fallout and radiation from industrial and other sources has sharply increased the urgency of the need for more information on the effects of radiation on human beings, including the genetic effects. Precise quantitative answers must be found to such questions as the current load of deleterious recessive genes, the normal rate of mutation, and the genetic aspects of radiation in humans.

Most of the present information about genetics has been gathered through work with plants, insects, and microorganisms. Though much of this information is directly applicable to problems of human inheritance, the extrapolation becomes more sure if it is first tested in lower mammals. Especially important for this reason are studies of the genetics of mice and other small laboratory animals whose anatomy and physiology show many close similarities to those of man.

The Rockefeller Foundation in 1958 appropriated $35,000 to be used by the Department of Eugenics, Biometry, and Genetics of the University College for research in mammalian genetics over a five-year period.

UNIVERSITY OF SÃO PAULO

RESEARCH ON DROSOPHILA GENETICS

Scientists from six Brazilian and five foreign universities are cooperating in a unique genetics research program sponsored by the University of São Paulo. For "laboratories" the investigators are using small, isolated, uninhabited islands off the coast of Brazil between Santos and Rio de Janeiro, where they are releasing marked fruit flies with identifiable mutations among natural fly populations. Thus the fate of the mutations and their effect on the heredity of successive generations can be observed under natural conditions.

The mutations in the marked flies (*Drosophila willistoni*) include some that arose naturally and others which were induced by exposure to X rays. The results are followed through periodic studies over a six-month period. In future experiments, additional lots of Drosophila will be subjected to gamma radiations of different intensities from a Cobalt 60 source and released on the islands.

To help meet the costs of the program, The Rockefeller Foundation has made a five-year grant of $30,000 to the University of São Paulo, Brazil.

OTHER GRANTS

University of Oslo, Norway: research in human genetics at the Laboratory of Human Genetics, under the direction of Dr. Jan Mohr; 76,000 Norwegian crowns (about $10,700) for a three-year period;

Government Hospital, Tel-Hashomer, Israel: genetic studies, under the direction of Dr. Chaim Sheba; $10,000;

University of Parma, Italy: research in human genetics, under the direction of Acting Professor L. L. Cavalli-Sforza; $10,000 for a two-year period;

University of Naples, Italy:

Research in human genetics; 4,000,000 Italian lire (about $6,600);

Professor Giuseppe Montalenti, Institute of Genetics; to visit genetics laboratories while in the United States; $600;

Dr. Marcello Siniscalco, Institute of Genetics; to visit genetics laboratories while in the United States; $600;

Genetics Society of America:

Toward expenses of a special group of foreign geneticists invited to participate in the Tenth International Congress of Genetics held in Canada during August, 1958; $5,000;

Expenses of visits to research centers in the United States and Canada by Latin American geneticists attending the Tenth International Congress of Genetics held in Canada during August, 1958; $4,000;

Harvard University, Cambridge, Massachusetts: statistical analysis of genetics data in the Department of Anthropology; $4,000;

Professor Waclaw Gajewski, head, Institute of Genetics, Polish Academy of Sciences, Warsaw, and professor, Department of Botany, University of Warsaw: to visit centers of research in plant cytogenetics and experimental plant taxonomy in Canada and the United States; $3,450;

Dr. A. G. Bearn, associate professor, The Rockefeller Institute, New York: to visit European centers of research in human genetics; $3,150;

Dr. H. Kikkawa, Department of Genetics, Faculty of Medicine, Osaka University, Japan: to visit centers of genetics research in the United States and Canada; $3,050;

Dr. Andrzej Bajer, senior lecturer, Botany Department, Jagiellonian University of Cracow, Poland: to visit biological research centers in the United States; $2,050;

Institute of Hematology, Blood Bank of the Prefecture of the Federal District, Rio de Janeiro, Brazil: research in human genetics, under the direction of Dr. Pedro Clovis Junqueira; $2,000;

Dr. Roy T. Simmons, consultant, Commonwealth Serum Laboratories, Commonwealth Department of Health, Melbourne, Australia: to visit hematology and anthropology centers in the United States; $2,000;

Professor Wladyslaw Kunicki-Goldfinger, professor of microbiology, University of Wroclaw, Poland: to visit genetics laboratories in the United States, Great Britain, and France; $1,400;

Dr. Tosihide H. Yosida, head, Laboratory of Animal Genetics, National Institute of Genetics, Misima, Japan: to visit research centers while in North America; $865.

Biochemistry

NATIONAL RESEARCH COUNCIL

RESEARCH ON PROTEIN-RICH FOODS

Because deficiency in dietary protein is the most serious nutritional problem in the underdeveloped areas of the world, the National Research Council in 1956 initiated studies of foods that are inexpensive, easily available in food-deficient countries, and of high protein content. Such protein-rich foods as fish flour, soy bean oil press cake, sesame seed, and peanuts, for example, are often available in large amounts in underdeveloped regions, but are now largely wasted or used for less essential purposes as animal feed or fertilizer. Not enough is known as yet about the suitability of these and similar items for human consumption.

The studies supported by the council have already shown that mixtures of locally grown foods can be made which will prevent or cure malnutrition in young children.

Some of these mixtures have a value rivaling that of milk, and can be obtained at a cost per child of as little as two cents a day. It has also been established that children accept and show a remarkable tolerance for some of these vegetable protein foods. Such protein foods as cottonseed flour, previously regarded as of doubtful utility for human consumption, and particularly for young children, have been shown to possess unexpectedly good protein values.

The research with children has confirmed, too, that foods inadequate individually may become adequate when mixed with other foods because of the complementary action of their protein constituents, and that vegetable protein insufficient at a low level may become adequate if the intake is raised.

With funds appropriated in 1956 by The Rockefeller Foundation, the National Research Council, Washington, D.C., is financing researches on protein foods by scientists in Mexico, Guatemala, French West Africa, Nigeria, the Belgian Congo, Uganda, South Africa, India, Japan, the United States, the United Kingdom, and France. A new grant of $300,000 will enable the council's special Committee on Protein Malnutrition of the Food and Nutrition Board to finance related investigations through the period ending December 31, 1961. The United Nations Children's Fund is also helping to support the National Research Council program.

NATIONAL INSTITUTE OF NUTRITION

RESEARCH IN BIOCHEMISTRY AND NUTRITION

In 1956 the Government of Mexico created a new, autonomous National Institute of Nutrition in Mexico City which will serve as the center for medical care, public health activities, and research and training in the field. One of the units of the new institute is the Hospital for Nutritional Diseases, established in the early 1940's, which has been responsible for important advances in nutrition research, medical training, and hospital care in Mexico. The Directorate of National Nutrition, which is responsible for the community and public health aspects of nutrition, will be another branch. With the support of the Mexican Department of Health and assistance from the World Health Organization, the United Nations Children's Fund, and the Food and Agriculture Organization, the directorate is currently undertaking studies of community nutrition.

The third unit of the National Institute of Nutrition is the Division of Research and Training, of which the main component is the Department of Biochemistry directed by Dr. Guillermo Soberón. A two-year course leading to the National University of Mexico's master's degree has already begun, and a doctoral program will later be developed. Initially, research in the Department of Biochemistry will focus on three main subjects—the development of better methods for determining nutritional status, the nutritional value of Mexican foods, and protein metabolism, including the utilization of proteins and amino acids in Mexican foods.

To help the National Institute of Nutrition develop its research programs in biochemistry and nutrition, The Rockefeller Foundation has appropriated $90,000 for use over a three-year period.

UNIVERSITY OF BRUSSELS

CHEMICAL EMBRYOLOGY AND BIOCHEMISTRY

Under the leadership of Professor Jean Brachet, the Laboratories of Animal Morphology at the University of Brussels have become a distinguished international center for study and research on the chemistry of development. Professor Brachet's principal research interest is in the physico-chemical explanations which would lead to better understanding of the complexities of cell behavior and of the development of the embryo from the fertilized egg. One of the first biologists to undertake extensive study of the distribution of nucleic acids in invertebrate eggs, Professor Brachet has become increasingly concerned with the comparative roles played by the nucleus and various cytoplasmic particles in regulating the activities of the cell, and has investigated the metabolism of plant and animal cells from which the nucleus has been removed or into which foreign nuclei have been implanted.

Professor Hubert Chantrenne, assistant to Professor Brachet until his appointment as professor of biochemistry several years ago, is primarily interested in the biosynthesis of proteins. He has continued to work closely with Professor Brachet in studies of ribosenucleic acid (RNA), in which special attention is being given the metabolism of RNA during the synthesis of specific proteins, the action of the enzyme ribonuclease on living cells, and the role of the nucleus in the synthesis of RNA and protein.

To provide the Belgian professors, both of whom are former Fellows of The Rockefeller Foundation, with more adequate facilities for their collaborative investigations and additional space for other researchers and advanced students, the University of Brussels is constructing a new laboratory building for biochemistry adjacent to those for animal morphology. A Foundation grant of $75,000 will be used for the purchase of equipment for the expanded laboratories during the next three years.

UNIVERSITY OF SÃO PAULO

ENZYME CHEMISTRY

Dr. Isaias Raw, of the University of São Paulo, Brazil, has spent some seven or eight years in studies of the enzymes and cofactors involved in the biological process known as oxidative phosphorylation. Oxidative phosphorylation occurs during biological oxidations and reductions, when the removal of hydrogen from the substrate undergoing oxidation results in the formation of adenosine triphosphate (ATP). Energy is stored in the phosphate bonds and is available for rapid release in the form of muscle contractions, nerve impulses, and secretory processes.

Dr. Raw's research has led to the isolation of a new enzyme and of a new flavoprotein from among the enzymes of pig liver. Now on a Rockefeller Foundation fellowship at the University of Indiana, Dr. Raw is working on the localization of these enzymes within the cell.

After he completes his fellowship, Dr. Raw will return to Brazil to direct further studies on the differences and similarities of heart and liver oxidizing systems, and on the mechanism of oxidative phosphorylation in brain tissues. In addition, he and his group plan to begin comparative enzyme studies of marine animals. To help with the costs of the program, the Foundation has appropriated $45,000 to the University of São Paulo, to be available through the end of 1963.

UNIVERSITY OF THE REPUBLIC

RESEARCH IN BIOCHEMISTRY

In recent years the Faculty of Medicine of the University of the Republic, Montevideo, Uruguay, has encouraged and assisted research activities in a number of the sciences basic to medicine. It has now invited an American scientist, Dr. John R. Totter of the Oak Ridge National Laboratory, to spend two years in Montevideo as visiting research professor to cooperate with its staff in developing research in biochemistry and in establishing a new Institute of Biochemistry. Dr. Totter will conduct his own investigations, and give advanced research guidance to trained biochemists and basic grounding to younger trainees.

The university has provided ample quarters for the new institute in the Clinical Hospital, and supplied the major equipment needed. To meet various expenses connected with the work in biochemistry, The Rockefeller Foundation has appropriated $27,500 for use during the period ending June 30, 1960.

UNIVERSITY OF TURKU

RESEARCH IN BIOCHEMISTRY

For a number of years Professor E. Kulonen of the University of Turku, Finland, has had as his principal research interest the biosynthesis of collagen, a biologically important protein which is the principal constituent of connective tissue, the supporting framework of the body. A number of diseases, such as rheumatoid arthritis, are associated with alterations, not yet well understood, in the structure and metabolism of collagen. Professor Kulonen has also found that alterations in mucopolysaccharides, large molecules with which collagen seems to be combined in the native state, probably also occur in rheumatoid arthritis.

In order to advance his research, Professor Kulonen needs an ultracentrifuge which will make possible the isolation of such complex substances as collagen and the mucopolysaccharides without disruption of the linkages that hold them together. A Rockefeller Foundation grant of $21,000 to the University of Turku, where Professor Kulonen holds the chair of medical chemistry, will supply the funds needed for the new equipment. The ultracentrifuge will also be available for the research programs of the Departments of Pharmacology, Microbiology, and Internal Medicine.

OTHER GRANTS

University of Oslo, Norway: equipment and supplies for research on the chemistry of proteins and carbohydrates in the Institute for Medical Biochemistry and Physiology, under the direction of Professor Otto Walaas; $18,500 for a two-year period;

Federal Technical Institute, Zurich, Switzerland: research on the chemistry of physiologically active compounds, under the direction of Professor Vlado Prelog; $15,000 for a three-year period;

University of Durham, King's College, Newcastle upon Tyne, England: equipment for research in the Department of Chemistry on the chemistry of biologically important compounds, under the direction of Professor James Baddiley; $15,000 for a two-year period;

University of Texas, Austin: research on the biochemistry and physiology of algae; $13,000 for a two-year period;

Bose Institute, Calcutta, India: research in biochemistry; $10,000;

Kanazawa University, Japan: research in the Department of Chemistry, Faculty of Science, under the direction of Dr. Ikuo Yamashina; $10,000;

Kyoto Prefectural Medical University, Japan: research in enzyme chemistry in the Department of Biochemistry, under the direction of Dr. Yoshitsugu Nose; $10,000;

National Institute of Nutrition, Mexico City, Mexico: research on biochemical and nutritional problems in the Department of Biochemistry, under the direction of Dr. Guillermo Soberón; $10,000;

Tokyo University, Japan:

Research in protein chemistry in the Department of Chemistry, College of General Education, under the direction of Dr. Kazutomo Imahori; $10,000;

Research in the Department of Chemistry, College of General Education, under the direction of Dr. Akira Yoshida; $5,000;

University of Illinois, Urbana: research in the Department of Chemistry, Division of Biochemistry, under the direction of Dr. I. C. Gunsalus; $10,000;

University of Madras, India: research in biological chemistry in the Department of Chemistry, under the direction of Dr. P. S. Sarma; $10,000;

University of Buenos Aires, Argentina:

Research in biochemistry, under the direction of Professor A. O. M. Stoppani, director, Institute of Biological Chemistry; $9,900;

Research on the organic chemistry of natural products in the Faculty of Exact and Natural Sciences, under the direction of Professor V. Deulofeu; $7,100;

University of Toronto, Canada: research on phosphatides in the Department of Synthetic Chemistry of the Charles H. Best Institute, under the direction of Dr. Erich Baer; $9,000;

University of Liverpool, England: equipment for use in the Department of Biochemistry; $8,500;

University of Naples, Italy: equipment for use in the Institute of General Pathology; $8,500;

University of Sheffield, England:

Equipment for use in the Department of Microbiology; $8,500;

Equipment for research on the physico-chemical behavior of proteins in the Department of Biochemistry, under the direction of Professor Q. H. Gibson; $8,000;

University of Ghent, Belgium: equipment for use in the Institute of Biochemistry; $7,000;

G. R. Medical College, Gwalior, India: research in pharmacology in the Department of Pharmacology, under the direction of Dr. S. L. Agarwal; $6,000;

University of Rochester, New York: expenses of delegates to the Fourth International Congress of Biochemistry held in Austria during the fall, 1958; $6,000;

University of São Paulo, Brazil:

Research in inorganic chemistry in the Department of Chemistry, by Dr. Ernesto Giesbrecht under the direction of Dr. H. Hauptmann; $5,150;

Research in biochemistry in the Department of Chemistry, by Dr. Giuseppe Cilento under the direction of Dr. H. Hauptmann; $4,905;

Dr. Jose Moura Gonçalves, professor of biochemistry, Faculty of Medicine at Ribeirão Preto; to conduct research in enzyme chemistry, principally at the Institute of Biochemistry, University of Munich, Germany; $600;

University of Turku, Finland: research equipment for the Pharmacological Institute; $5,000;

Dr. V. N. Patwardhan, director, Nutrition Research Laboratories, Coonoor, India: to visit biochemical and nutritional laboratories in Europe, the United States, Jamaica, and Latin America; $4,550;

Dr. A. Sreenivasan, professor of food technology, University of Bombay, India: to visit biochemical and nutritional laboratories in the United States; $4,400;

University of Bristol, England: research on the biochemistry of alkaloids in the Department of Organic Chemistry; $3,500;

Professor Zdzislaw Stolzmann, professor of physiological chemistry and dean, Academy of Medicine, Poznan, Poland: to visit biochemical laboratories in the United States and Europe; $3,400;

Dr. Erwin Chargaff, professor of biochemistry, College of Physicians and Surgeons, Columbia University, New York: to visit biochemical centers in Japan and India; $3,235;

Professor Wiktor Kemula, professor of chemistry, University of Warsaw, Poland: to visit chemical laboratories in the United States and Europe; $3,075;

Yokohama National University, Japan: research on the mechanism of catalysis in the Faculty of Engineering, under the direction of Dr. Kenzi Tamaru; $3,000;

Professor Jean Schwartz, Faculty of Medicine, University of Strasbourg, France: to visit laboratories engaged in research on steroids in the United States; $2,975;

Professor Janusz Supniewski, professor of pharmacology, Academy of Medicine, and director, Pharmacological Institute, Polish Academy of Sciences, Cracow: to visit departments of pharmacology, physiology, biochemistry, and organic chemistry in the United States and Europe; $2,900;

Dr. Derek Michael Phillips, Chester Beatty Institute, Royal Cancer Hospital, London, England: to visit centers of protein research in the United States; $2,900;

University of Sarajevo, Yugoslavia: equipment for research in the Institute of Pharmacology, under the direction of Professor Pavle Stern; $2,750;

Dr. Lorentz Eldjarn, director, Clinical and Biochemical Laboratories, Norwegian Radium Hospital and Norsk Hydro's Institute for Cancer Research, Oslo: to visit laboratories of clinical chemistry and pathophysiology in the United States; $2,500;

University of Valle, Cali, Colombia: supplementary support for a conference on nutritional deficiencies in the Americas, held under the auspices of the Faculty of Medicine during 1958; $2,400;

University of Cambridge, England:

Dr. Peter Sykes, University Chemical Laboratory; to visit undergraduate chemistry departments in representative North American universities; $2,350;

Dr. Vernon M. Ingram, Medical Research Council Unit for Molecular Biology; to serve as visiting associate professor of biochemistry at the Massachusetts Institute of Technology, Cambridge; $1,600;

Dr. William Joseph Whelan, Department of Biochemistry, Lister Institute of Preventive Medicine, London, England: to study methods of enzyme preparation at laboratories in the United States; $2,000;

Dr. Lars Ernster, docent in physiological chemistry, Wenner-Gren Institute, University of Stockholm, Sweden: to visit centers of research in biochemistry and cell physiology in the United States; $1,825;

Dr. Bo Gunnar Malmström, Biochemistry Institute, University of Uppsala, Sweden: to visit centers of enzyme research in the United States; $1,700;

Dr. Darab K. Dastur, assistant research officer, Neuropathology Unit, Indian Council of Medical Research, Bombay: to visit research centers in the United States, Canada, and Europe, $1,550;

Dr. Barbarin Arreguin Lozano, Institute of Chemistry, National University of Mexico, Mexico City: to visit centers of research in plant chemistry in Europe; $1,300;

Dr. Haruo Sato, professor of pathology, Fukushima Medical College, Japan: to visit scientific centers in Europe; $1,225;

Kyoto University, Japan:

Dr. Naofumi Koga, Department of Pharmacy, Faculty of Medicine; to visit research centers in North America; $1,225;

Dr. Osamu Hayaishi, professor and chairman, Department of Medical Chemistry, Faculty of Medicine; to visit centers of biochemical research in Europe; $1,200;

Dr. Shigeru Tanaka, Faculty of Medicine, Gunma University, Maebashi, Japan: to visit centers of endocrine research in North America; $1,200;

Dr. Kimishige Ishizaka, National Institute of Health, Tokyo, Japan: to visit immunochemistry centers while in the United States; $360;

Professor Armas Vihtori Vartiainen, professor of pharmacology, University of Helsinki, Finland: additional expenses of visits to departments of pharmacology and biochemistry in the United States; $225.

Biophysics

UNIVERSITY OF OXFORD

RESEARCH IN CRYSTALLOGRAPHY

With highly skilled crystallographic studies of the structure of penicillin, gramicidin, and vitamin B-12 completed, Dr. Dorothy Crowfoot Hodgkin of the University of Oxford, England, is returning to an earlier interest—the structure of insulin. Although much is already known about the chemistry of insulin and the important role it plays in the regulation of glucose metabolism, the exact structure of the insulin molecule has not yet been determined. Dr. Hodgkin, aided by the advances that have been made in understanding of insulin chemistry and in the techniques of crystallography, will resume her work on this problem with the collaboration of her own group at Oxford and other investigators concerned with the same subject.

Largely as a result of Dr. Hodgkin's leadership, the Laboratory of Chemical Crystallography at Oxford has become noted as one of the major centers for training and research in the field. The unusual degree of collaboration achieved at the laboratory among crystallographers at various stages of research experience has resulted in a series of distinguished studies of crystalline structure.

The Rockefeller Foundation, which has supported Dr. Hodgkin's work since 1940, has made a grant of £12,500 (about $35,625) to assist her new project during a five-year period.

UNIVERSITY OF BRUSSELS

ELECTRON MICROSCOPY

Within recent years the University of Brussels, Belgium, has been developing plans calling for a greater degree of interdisciplinary collaboration in and increased emphasis on studies of the cytochemical and ultrastructural aspects of biology. As a major step in this direction, the university is now creating in the Medical School a center for electron microscopy which will initially be shared by the Departments of Embryology, Anatomy, and Histology, but which will later be made available to investigators in other laboratories as well.

The university has already obtained from Belgian sources half of the amount required for the establishment of the microscopy center. A Rockefeller Foundation grant of $20,000, available during a two-year period, provides the balance of the funds needed.

OTHER GRANTS

University of Graz, Austria: research on the structure of biologically active compounds, under the direction of Professor Otto Kratky, Institute for Theoretical and Physical Chemistry; $15,000 for a two-year period;

University of Rome, Italy: research on the structure of biologically active compounds in the Institute of Pharmaceutical Chemistry and Toxicology, under the direction of Professor Giordano Giacomello; 9,000,000 Italian lire (about $15,000) for a three-year period;

University of Birmingham, England: equipment for use in structure analysis of biologically important compounds; $13,000 for a two-year period;

University of Melbourne, Australia: equipment for research in the Department of Anatomy; $12,000;

University of Durham, King's College, Newcastle upon Tyne, England: equipment for use in research in radiation chemistry, under the direction of Professor Joseph Weiss; $8,500;

University of Leeds, England: a replacement cobalt source of high-energy radiation for use in radiochemical and biomedical research in the Department of Chemistry; $7,000;

University of Bari, Italy: equipment for research in X-ray crystallography, under the direction of Professor Alfonso Liquori; $5,600;

University of Chile, Santiago: research on the fine structure of brain tissues in the Institute of Neurosurgery and Brain Research, Faculty of Medicine, by Dr. Alfonso Martinez; $1,800;

Dr. José Roberto Sotelo, head, Department of Cell Ultrastructure, Research Institute of Biological Sciences, Montevideo, Uruguay: to visit electron microscopy research centers in the United States; $1,000;

Dr. David J. E. Ingram, reader in electronics, University of Southampton, England: to undertake collaborative research in nuclear magnetic resonance with Professor Kai Siegbahn, University of Uppsala, Sweden; $800.

Virology

NATIONAL INSTITUTE OF HEALTH

RESEARCH IN VIROLOGY

The National Institute of Health, Tokyo, will expand its program of virus studies, including work with arthropod-borne viruses. One of the centers of attention in the new program will be the Japanese B encephalitis virus. Japanese B was discovered in Japan and is still a public health problem there. It also appears to be the dominant arbor virus in the geographical region reaching from Japan around Southeast Asia to India, with an extension into Australia.

Although the clinical features of Japanese B encephalitis as a disease are well recognized, much remains to be learned about the mosquitoes that transmit it, about how the virus maintains itself through the winter, and about the birds and subhuman mammals that may act as reservoirs of infection. Further information on these points will almost certainly throw additional light on various questions concerning the biology of arbor viruses in general.

Dr. Masami Kitaoka, who heads the virus section of the institute, is one of the foremost virologists in Japan. In work with arbor viruses he will be assisted by Dr. Akira Oya, a former Foundation Fellow who recently returned to Japan after a year in the Foundation's New York Virus Laboratories and field visits to other virus research facilities, including the Trinidad regional laboratories.

In partial support of the virus investigations projected by the scientists under Dr. Kitaoka's direction, the Foundation has made a three-year grant of $130,000 to the National Institute of Health. The funds will be used for the construction of laboratories, for additional equipment, and for various other research expenses, including enlargement of the field study program.

UNIVERSITY OF HELSINKI

RESEARCH IN VIROLOGY

Kumlinge disease, a viral encephalitis that closely resembles a type of Russian spring-summer encephalitis, was first observed in Finland in 1942. Mild cases in human beings have been reported only sporadically, although in all likelihood many were not recognized. Very little is yet known about the disease, but it is presumably similar to the tick-borne fever recently discovered in Austria, Yugoslavia, and at a few scattered points in Western Europe.

The laboratory of the University of Helsinki, Finland, is unusually well staffed and equipped for intensive field and laboratory studies of this widespread virus. The research program, directed by Dr. Nils Oker-Blom of the university's new Institute of Virology, is being partially supported during the next three years by a Rockefeller Foundation grant of $40,000.

AUSTRALIAN NATIONAL UNIVERSITY

RESEARCH IN VIROLOGY

The research program in virology led by Professor Frank Fenner at the Australian National University, Canberra, is unusually comprehensive in scope and in the variety of techniques employed. Professor Fenner himself has done distinguished research on virus-host adaptation in myxomatosis, a virus disease deliberately introduced into Australia to control the rabbit population, in which he has shown that there has been both a definite reduction in the virulence of the virus and an increase in the resistance of the rabbits since the first epidemic.

One group of researchers at the university is working on the genetics and recombination of various virus strains, including examples of three classes ranging from the very small to the large. Other investigators are concerned with biochemical studies on the multiplication of viruses in tissue culture.

To provide Professor Fenner's group with flexible funds for the purchase of research equipment and supplies outside Australia, The Rockefeller Foundation has appropriated $30,000, available over a five-year period.

UNIVERSITY OF ZAGREB

RESEARCH IN VIROLOGY

Since 1946 when a new type of meningo-encephalitis first appeared in Yugoslavia, the area in which the disease is endemic has steadily increased, and cases requiring hospitalization occur every year. Research led by Dr. Jelka Vesenjak at the University of Zagreb has revealed that the causative agent of the new disease is related to the virus causing Russian spring-summer encephalitis, but that a second neurotropic virus, still unidentified, is also present and responsible for some of the infections. During the next few years, Dr. Vesenjak will continue her efforts to identify the other neurotropic viruses believed to be present, study their transmission by insects, assess the relationship between the new virus and Russian spring-summer encephalitis virus, and determine the ecology of the new agent.

A two-year grant of $25,000 from The Rockefeller Foundation to the University of Zagreb will help provide equipment needed for Dr. Vesenjak's research on the meningo-encephalitis virus, as well as other investigations in virology.

THE VIRUS RESEARCH PROGRAM

The virus research program of The Rockefeller Foundation is concerned with study of the arthropod-borne virus infections of man and domestic animals throughout the world. The Foundation's Virus Laboratories in New York are concerned chiefly with basic research on the nature, physical, chemical, and biological, of viruses shown to be transmitted by arthropods. The work in New York is complemented by that of field stations in North and South America, Africa, and India, where Foundation staff are concentrating on the prevalence and importance of arthropod-borne viruses as a cause of human and animal disease.

Two field stations have been established in South America: the one at Port-of-Spain, Trinidad, is maintained in collaboration with the Health Department of the Government of Trinidad and Tobago and the Colonial Research and Development Scheme; the other at Belém, Brazil, is operated in conjunction with the Special Service of Public Health of the Ministry of Health.

In the Union of South Africa, a unit is maintained at Johannesburg in cooperation with the South African Institute for Medical Research, the Council for Scientific and

Industrial Research, and the Poliomyelitis Research Foundation of South Africa which provides laboratory space, services, and maintenance. The station at Poona, India, is operated by the Indian Medical Research Council with Foundation assistance. In Berkeley, California, a unit is working in cooperation with the State Department of Health.

During 1958 the Foundation appropriated a total of $1,058,400 for the support of the virus research program.

The great increase in knowledge concerning arthropod-borne (arbor) virus infections in recent years is clearly shown by a comparison of the first and third editions of the standard American textbook, *Viral and Rickettsial Infections of Man.* The first, edited by Dr. Thomas M. Rivers, appeared in 1948, before the present virus program of the Foundation was begun. In it such well known arbor virus infections as yellow fever, dengue, Colorado tick fever, and Phlebotomus fever were allotted individual chapters. Other known agents, including the three equine encephalitides, St. Louis, Japanese B, and Russian tick-borne viruses, and a variety of viruses then suspected of being transmitted by arthropods, were grouped together in one chapter entitled "Viral Encephalitides." In all, 21 agents now known to be arthropod-borne were mentioned in the book.

The third edition appeared early in 1959 under the joint editorship of Dr. Rivers and Dr. Frank L. Horsfall, Jr. In this, as in the first edition, yellow fever, dengue, Colorado tick fever, and Phlebotomus fever were treated in individual chapters. But in the decade since the appearance of the first edition so much more had been learned about the subject matter of "Viral Encephalitides" that four chapters were needed to cover it. No less than 44 distinct arbor viruses are discussed in the third edition, and most of the chapters dealing with these agents were contributed by staff members of The Rockefeller Foundation.

The striking advances achieved in classification of the arbor viruses determined the grouping of the agents in the various chapters. Immunologically related viruses are discussed together in one chapter, or, if their number is very large, in successive chapters. Although many of the arbor viruses mentioned in the book could be grouped in this way, a number of apparently distinct agents remained which were all discussed in a chapter entitled, "Miscellaneous Arthropod-borne Virus Infections of Man." Such agents as Bunyamwera, Wyeomyia, and the California encephalitis viruses, all discovered many years ago, are included in the chapter. Since its preparation, new observations have been made which indicate that these three viruses are not immunologically distinct entities but rather members of two newly established immunological groups that have been named the Bunyamwera and California groups of arbor viruses.

The Bunyamwera virus was originally isolated from mosquitoes in the Bwamba forest of Africa during investigations on jungle yellow fever. In recent years strains of the virus have been isolated in South Africa not only from mosquitoes but also from the blood of patients, and immunity surveys using neutralization tests in mice indicate that infection is probably very widespread in Africa south of the Sahara. In addition, antibodies capable of neutralizing Bunyamwera virus have been found in the blood of residents of Malaya, Borneo, and the Amazon Valley.

Recent investigations have shown that the Bunyamwera virus is related to agents isolated in North and South America. One of these, the Wyeomyia virus isolated in Colombia, was first discovered in 1944. Other virus strains belonging to the group have been found in Utah, in the United States, and in the Amazon Valley and Trinidad. It is apparent that this new immunological group has a wide geographic distribution, occurring in the Americas, Africa, and the Orient.

The other new immunological group so far includes only agents discovered in North and South America. The first of these, the California virus, was isolated in 1943 from wild-caught mosquitoes in California. Serological surveys indicated that infection of man must be quite prevalent. Further evidence suggested that a case of encephalitis in man had been caused by this agent.

Agents closely resembling the California virus were obtained from *Culex trivittatus* mosquitoes in North Dakota, and later proven to be closely related to but not identical with it. Other viruses belonging to the group have been discovered in Colombia, the Amazon Valley, and Trinidad. One of these, the Guaroa virus from Colombia, is of particular interest because it was isolated from the blood of six individuals who were apparently in good health at the time of bleeding. Immunity surveys indicated that human infections with this virus were quite common in the area. These observations once again demonstrate that infections with an arbor virus may be prevalent in a region without causing any obvious illness.

At a conservative estimate, there are at least 80 distinct arbor viruses known to be, or suspected of being, capable of infecting man and his domestic animals. As research progresses, this number will undoubtedly increase. Many recently isolated viruses are now under study in the laboratories associated with the Foundation's virus program, and probably many of them will prove to be new agents.

In the evolution of the study of infectious diseases, it was logical that those which caused severe symptoms or high mortality were the first to be investigated. Yellow fever, which caused devastating epidemics, was the first disease of man shown to be caused by a virus and to be transmitted by the bite of a mosquito. The latter finding suggested the use of appropriate anti-mosquito measures as a rational method of combating urban epidemics.

The arthropod-borne agents, such as St. Louis, Japanese B, and Russian tick-borne viruses, which occasionally produce severe clinical manifestations as a result of infection of the central nervous system, were also the subject of intensive investigation. It has become apparent, however, that in addition to the agents which sometimes cause severe disease, there are a great number of distinct infectious viruses which cause, as a rule, only mild symptoms. It is largely the systematic study of these with which the New York laboratories of the Foundation are now concerned.

The field laboratories contribute many of the strains which provide the material for systematic study in New York. New agents are being received in increasing numbers, however, from other groups of workers as interest in global virology mounts in various parts of the world and an expanding number of laboratories acquire the necessary skills.

Many of these new laboratories, as well as the field stations conducted by the Foundation in collaboration with local authorities, are primarily concerned with the arbor viruses which continue to be public health hazards in the areas in question. Thus, the Poona laboratory gives emphasis to Japanese B encephalitis and the recently discovered Kyasanur Forest disease. The laboratories in Belém and Trinidad continue to monitor the forest for the appearance of yellow fever and for the viruses which cause periodic outbreaks of encephalitis. Johannesburg gives attention to Rift Valley fever, and certain other agents which cause serious disease in animals and to a somewhat lesser degree in man.

In spite of the large amount of work done on the arbor viruses as a group, it remains unfortunately true that the complete ecological cycle of no one of them is as yet completely understood. Even yellow fever, which has been the subject of intensive study for over half a century, is still something of a mystery. That it can pass from man to man with the help of the mosquito, *Aedes aegypti,* and from monkey to monkey to man through several species of jungle mosquitoes, is well known. But the absence of clear evidence for other intermediate hosts makes it difficult to understand how the virus reappears in certain isolated tropical areas after absences of several years. The conventional explanation that it is constantly kept alive in bands of monkeys which circulate widely through the jungle becomes more and more difficult to hold as more evidence of isolated outbreaks accumulates. It is even harder to explain the recurrence in the temperate zone, either regularly every year or after longer intervals, of certain other diseases like Japanese B or western equine encephalitis. Promising clues, such as the ability of mosquitoes to carry the virus over the winter or of birds to reintroduce the agent during their annual migrations, have been intensively followed but have not yet led to convincing evidence.

In the classification of the large number of viruses discovered during the past few years, use has been made of their antigenic characteristics as revealed by the complement fixation test, hemagglutination inhibition test, and the ability of immune sera to protect mice from infection. The past year has brought considerable progress in the use of tissue culture methods as well. The principal members of groups A, B, and C have all been cultivated successfully in one cell line or another. Almost all produce visible changes in the cells. Others may be made to reveal themselves by the fact that the infected cultures cause a characteristic agglutination of added red cells. These developments open the way to the substitution of tissue culture protection tests which should be cheaper, more convenient, and less time consuming than the classical mouse tests.

The precipitin tests developed in Sweden by Ouchterlony have been adapted for use with arbor viruses and have proved helpful in differentiating the various agents causing the important tick-borne fevers related to Russian spring-summer encephalitis. Continued development of antibody absorption techniques has led to further insights into the complicated antigenic structure of several viruses, especially those in group B. Perhaps most interesting is the finding that strains of African yellow fever produce an antigen that is lacking in all the South American strains so far observed. Curiously, the "attenuated" 17D strain, that is widely used as a vaccine because of its lack of virulence for man, appears to possess a special antigen of its own which is present in neither the South American nor the African strains.

Work on the purification of Semliki virus reached the stage at which it proved possible to count individual particles with the help of the electron microscope. Quantitative studies of the same purified preparation showed that almost all such particles individually possess the ability to infect tissue cultures or to cause hemagglutination of red blood cells. This is a somewhat unexpected finding, since most of the viruses studied elsewhere (polio and tobacco mosaic viruses, for example) have exhibited a far lower "infectivity ratio." Incidentally, these studies provide a basis for calculating that the infectious dose for a baby mouse may contain as few as 3 virus particles and probably no more than 30.

The quantitative physical and chemical study of viruses is still in its infancy and its development is especially slow in the case of the arbor viruses because of special technical problems. In the long run such studies may lead to a more rational and orderly system. For some time to come, however, workers must rely principally upon the serological procedures which form the backbone of the Foundation's current program in virus classification and diagnosis.

OTHER GRANTS

Dr. M. G. P. Stoker, professor of virology, University of Glasgow, Scotland: to visit virus research centers in Canada, the United States, Australia, New Zealand, India, and on the Continent; $6,000;

Professor Feliks Przesmycki, director, State Institute of Hygiene, Warsaw, Poland: to visit laboratories of virus research in the United States and Western Europe; $2,900;

Dr. Akinyele Fabiyi, Lagos, Nigeria: to study at The Rockefeller Foundation Virus Laboratories in New York; $2,765;

Dr. Pravin N. Bhatt, research officer, Virus Research Centre, Poona, India: to attend the Congress of Tropical Medicine in Lisbon, Portugal, and to visit virus research centers in Europe and the Soviet Union; $2,640;

Dr. Richard M. Taylor, Department of Preventive Medicine, School of Medicine, Yale University, New Haven, Connecticut: to visit, on behalf of The Rockefeller Foundation, virus research laboratories in Trinidad and Brazil; $2,600;

Dr. Masahiko Kuroya, Department of Bacteriology, School of Medicine, Tohoku University, Sendai, Japan: to visit biological laboratories in the United States; $1,700;

Dr. Botha de Meillon, South African Institute for Medical Research, Johannesburg: to attend the International Congresses on Tropical Medicine and Malaria held in Lisbon, Portugal, during September, 1958; $1,550;

University of California, Berkeley:

Dr. William C. Reeves, professor of epidemiology, School of Public Health; to participate in the International Congresses on Tropical Medicine and Malaria in Lisbon, Portugal, and to visit research centers in Trinidad and Panama; $1,500;

Dr. C. A. Knight, research biochemist, Virus Laboratory; to visit centers of virus research in Europe and to attend the Virus Section of the Fourth International Congress of Biochemistry in Vienna; $1,000;

National University of Mexico, Mexico City: research on the role of bats in the transmission of rabies at the Institute of Biology, under the direction of Bernardo Villa R.; 18,000 Mexican pesos (about $1,460);

American Type Culture Collection, Washington, D.C.: to expand its Viral and Rickettsial Registry and Distribution Center; $1,000;

Dr. George Otto Gey, director, Division for Cellular Pathology, Department of Surgery, and assistant professor of surgery, the Johns Hopkins University, Baltimore, Maryland: to visit cytological and virological laboratories in Europe; $600;

Dr. Ambhan Dasaneyavaja, instructor in microbiology, Chulalongkorn Hospital, Bangkok, Thailand: additional expenses of visits to virus laboratories in India and Malaya; $564;

Dr. Henry Makower, Hirszfeld Institute of Immunology, Polish Academy of Sciences, Wroclaw: an addition to an earlier grant for expenses of visits to virus laboratories in the United States; $87.

Special Projects

DARTMOUTH COLLEGE

TEACHING AND RESEARCH IN THE SCIENCES

Long respected as one of the country's fine liberal arts colleges, Dartmouth College in Hanover, New Hampshire, has in recent years made particular efforts to strengthen its work in the biological and physical sciences. Starting with the Department of Mathematics, the college has developed its staff in the sciences, and stimulated scientific research by both faculty and students. The introduction into other departments and disciplines of mathematical concepts and methods, and the revitalization of work in the biological and chemical sciences, have enriched Dartmouth's curriculum with fresh approaches to the world of nature.

Dartmouth is now planning to introduce an integrated five-year course emphasizing all the basic sciences for future doctors, medical researchers, and scientists in closely related fields. When fully developed, the new course should provide so thorough a grounding in all the sciences that students completing it will be prepared to undertake doctoral study for teaching and research careers in the biological and medical sciences, or to transfer to other institutions to complete their training as physicians.

As important steps in the inauguration of the five-year course, Dartmouth will continue to strengthen its faculty in biochemistry, physiology, and the related biomedical sciences, and will construct a new building for the medical sciences, both to improve teaching and research facilities and to free space in existing structures for the expansion of work in the other sciences. To help the college develop teaching and research in the physical, biological, and medical sciences and in mathematics, The Rockefeller Foundation made an outright grant of $1,500,000 during 1958.

BROWN UNIVERSITY

DEPARTMENT OF BIOLOGY

The Department of Biology of Brown University, Providence, Rhode Island, is distinguished both for the researches of its staff and the training it gives developing scientists. Among the varied research interests of the department's faculty are cytology, the comparative histology and physiology of the skin, tissue differentiation and regeneration, nutrition and metabolism, cytogenetics, and microbial genetics. The quality of these and other investigations by department members commands generous support from a number of sources. The high positions in governmental, scientific, and academic institutions held by former members of the graduate group give evidence of the caliber of the department's training program.

The principal laboratory building used by Brown's Department of Biology was constructed in 1914, when the staff consisted of four professors and one instructor. Although the faculty now comprises ten professors, three associate professors, and two assistant professors, the physical facilities for research and teaching have been expanded only by the reconversion of a number of homes in the neighborhood. Space has now become so limited that the department is finding it increasingly difficult to continue the development of its research activities and to find room for the promising graduate students who wish to work under the supervision of its faculty members.

Professor J. Walter Wilson, head of the Department of Biology, has for several years been working with his colleagues in other science divisions of the university in drawing up plans for rehousing a number of Brown's scientific activities in a single group of buildings. The first unit to be constructed will accommodate a number of fields in biology—biochemistry, physiology, and microbial genetics—that will benefit from a close geographical relationship. The transfer of these sections to new quarters will also free space in the main laboratory building for the expansion of other parts of the department, and thus take care of the over-all needs for some time to come.

Of the $1,600,000 needed by Brown University for the construction of the new building, The Rockefeller Foundation in 1958 provided $560,000, payable on or before December 31, 1961, when Brown secures the balance from other sources.

OSAKA UNIVERSITY

LIBRARY FOR MEDICINE AND THE SCIENCES

Although the library collections of Osaka University, Japan, are comprehensive, they are scattered through the various faculties and departments and lack the organization necessary for efficient use by both staff and students. Realizing that consolidation would greatly facilitate study and research, members of the medical faculty began raising funds from staff, students, and alumni, and agreed to donate one per cent of their own limited salaries for the establishment of a medical library to serve the medical school and a number of associated research and teaching institutes. To the amount these groups have contributed, about $27,000, the Japanese Department of Education has added more than $29,000, and the university is now ready to plan construction of the new library building.

To avoid duplication and unnecessary expense, the medical and science libraries will be combined in the new building. Located near one another, the medical and science faculties cooperate closely in their research activities. Other institutions, including a number of medical, dental, and science colleges in Osaka, several universities in nearby cities, and medical societies and industrial laboratories in the area, which now use the scattered collections, will have access to the facilities of the new library.

To supplement the funds provided by Japanese groups for the establishment of the medical and science library, two Rockefeller-endowed philanthropies have appropriated a total of $150,000. The China Medical Board, at one time a unit of The Rockefeller Foundation, has given $50,000, primarily for furnishings and equipment. A Foundation grant of $100,000 will be used for construction during the next three years.

BRAZILIAN INSTITUTE OF EDUCATION, SCIENCE, AND CULTURE

SCIENCE DEVELOPMENT PROGRAM

Since its inception at the University of São Paulo in 1953, the objectives of the Science Development Program have been to bring about an improvement in science instruction at the secondary school level and to assist young students in developing their interest in science.

Cultus, the program's publication that furnishes a wide range of information on pedagogical methods, sources of material, and technical data, was first issued about ten years ago by Dr. Isaias Raw, now a member of the university's medical faculty. The Science Development Program is largely an outgrowth of the stimulus provided by this magazine. Among its services, the program supplies, at cost, science kits for biology, chemistry, and physics to interested students and also furnishes specially designed, simple demonstration equipment to institutions. Textbooks dealing with subjects inadequately treated in existing manuals are being written under the auspices of the program.

The amount of $50,000 was granted in 1958 to the Brazilian Institute of Education, Science, and Culture, sponsoring agency of the Science Development Program. This sum is to be used, over a five and one-half year period, for the purchase of equipment not obtainable in Brazil.

OTHER GRANTS

Indian Council of Medical Research, New Delhi: to initiate a program of research fellowships in India for Indian scientists now located in other countries; $10,000;

Dr. F. C. Courtice, professor of experimental pathology, John Curtin School of Medical Research, Australian National University, Canberra: to visit experimental pathology centers in the United States and Europe; $4,525;

Professor Luiz Pilla, director, Faculty of Philosophy, University of Rio Grande do Sul, Pôrto Alegre, Brazil: to visit universities and colleges in the United States, Canada, Mexico, and Peru; $3,550;

Professor Eremildo Luiz Vianna, director, Faculty of Philosophy, University of Brazil, Rio de Janeiro: to visit universities and colleges in the United States, Canada, Mexico, and Peru; $3,450;

University of Ceara, Fortaleza, Brazil: bibliographic and related materials for use in the teaching and research programs of the Institute of Mathematics, under the direction of Professor Francisco Silva Cavalcante; $1,000.

The Humanities

THE HUMANITIES

Major Interests, 1958

Intercultural Studies	$1,112,475
Humanistic Research	531,997
The Arts	768,225
Special Projects	924,005
Fellowship and Scholarship Fund	350,000

THE HUMANITIES

THROUGH ITS PROGRAM in the humanities, the Foundation assists efforts to advance intercultural understanding, to add to knowledge in history, philosophy, and linguistics, and to further the development of the arts. In addition, the Foundation attempts to meet some of the related special needs and opportunities that are, from time to time, brought to its attention.

For a number of years, grants made in the humanities program have been discussed, as they will be listed in the sections that follow, in terms of their relation to the major purposes cited above. They might equally well, however, be considered geographically. Although many aims and aspirations are universally shared, the different areas of the globe show wide variations in cultural values, in modes of artistic expression, and in present educational needs. The new nations, unindustrialized areas, and non-Western countries particularly have special concerns and interests today which must necessarily differ in nature, if not in ultimate aim, from those of Western Europe and North America.

EUROPE AND NORTH AMERICA

The grants made in any given year to institutions in the United States represent, more often than not, a sampling rather than a cross-section of continuing interests. In 1958 the Foundation's concern with the humanistic disciplines was expressed, for example, in grants for continued researches on genetic epistemology, and for a major historical study of the British Empire. Two other appropriations arose from a long-standing interest in significant ways of interpreting the American past.

Assistance was continued, during 1958, for the development in Europe of research on North America through grants to institutions in England and Germany. Long-established concern with the Slavic world led to grants in 1958 for the development of language courses in the professional uses of Russian—the latest in a series of grants which, it is hoped, has widened Americans' command of the language—and for a history of Russian-Polish relations between 1900 and 1917.

Democratic, industrialized society should provide opportunities for cultural and artistic growth that have never before been equaled. It gives its citizens sufficient income, leisure, and education to enable them to replace, if they choose, any ugliness, drabness, or uniformity in their lives or their surroundings with beauty and individuality. Although there will always be a place for more constructive government policies toward the arts, and for philanthropic encouragement, still the arts must depend, for their basic long-term support, on the interest of large numbers of individual citizens who freely commit both their energies and their resources. Only so can freedom and nonconformity in the arts be preserved.

Basing its activities in the arts on these premises, and mindful of its own limited resources, The Rockefeller Foundation has endeavored to assist a few undertakings which, by virtue of their high quality and their more than local importance, seem destined to command generous and continuing public support. A number of the projects in music, drama, and the dance for which grants were made during the year serve a second Foundation purpose,—the encouragement of new creative work in the arts.

A relatively new approach in the visual arts was supported, in 1958, by grants to four institutions that are experimenting with activities designed to foster greater use of the visual arts and, indirectly, more extensive purchasing by the public and better support for the artist. Their methods, if successful, may prove to have wider application elsewhere.

Efforts to enable artists to make use of some of the newer technological developments were assisted by grants for a program in electronic music, for work on new types of stage equipment, and for experimentation with new casting techniques for sculpture.

LATIN AMERICA

For a number of years a major Foundation interest in Latin America has been the support of training, research, and writing on nineteenth- and twentieth-century history. A 1958 grant is helping to finance the preparation of a comprehensive history of Mexico from 1910 to 1950 which will be the first major critical study of a fundamental twentieth-century revolution in Latin America. Related grants have supported work on the source materials needed for the history. Because the condition of governmental and other archives in many Latin American countries has hindered historical research on the colonial period and frequently made impossible work on the nineteenth and twentieth centuries, the Foundation has also assisted a number of efforts to improve archival administration.

The growing interest in the contemporary theatre in Latin America is most evident in Brazil, Chile, and Mexico. In Brazil and Chile, the professional theatre is distinguished by the fact that the responsibility for commercial production, as well as for the training of actors, directors, stage designers, and—to a lesser extent—playwrights, has been accepted by universities. This promising development has made it possible for the Foundation to reinforce its earlier interest in Latin American drama, expressed chiefly through fellowship awards, with institutional grants—in 1958 to the Catholic University of Chile and to the University of Bahia in Brazil.

The intellectual ferment of recent years has produced a distinctive body of imaginative and critical literature in Latin America. The Foundation has attempted, over a decade and particularly in Mexico, to increase the opportunities for promising young writers in Latin America. During the past year the Foundation initiated a new series of small grants designed to make more of this literature available to the English-speaking public, with the dual purpose of enlarging the market that supports Latin American authors and of introducing the United States public directly to contemporary Latin American thought and values.

MIDDLE EAST

In the Middle East, as in South Asia and the Far East, Foundation activities have two principal purposes. One is the support of humanistic scholarship and of work in the arts in the countries of the region; the other, the encouragement of understanding and appreciation of the area in the West.

Several sizeable grants were made to strengthen certain facets of education in the countries of the Middle East. In Turkey, Robert College and the American College for Girls are developing a general education program in the humanities with Foundation support. Egyptian Ministry of Education officials are continuing their advanced training in linguistics in the United States as part of a plan to improve English language instruction in the country.

Both Middle Eastern and Western scholars received funds during the year for a variety of research projects which promise to illuminate some of the important aspects of Middle Eastern life and thought, and to advance Western knowledge of the region's rich culture. Among the subjects of study are the Turkish revolution, contemporary Turkish life, nineteenth-century Turkish literature, Middle Eastern history, the Muslim approach to art, and Islam and modern political movements in Africa south of the Sahara.

The future development of the visual arts, music, drama, and literature in both the Middle East and the West might well be enriched by the new concepts that emerge from greater familiarity with the differing artistic traditions of the two areas. With this thought in mind, the Foundation made a number of small grants to enable Western scholars to visit the Middle East and Middle Eastern scholars to observe activities in their fields in the West.

SOUTH ASIA

Many of the projects in both the humanistic disciplines and the arts that the Foundation has assisted in South Asia in recent years have dealt with subjects widely considered to be of great present importance in the region. Substantial support has been given, for example, to studies of language problems, first in India and now in other countries of South Asia as well.

Institutions in the West are studying the languages of South Asia not to solve practical problems but to increase their knowledge and understanding of the literature and culture expressed in them. Several Foundation grants made in 1958 are being used for the development of programs on Indian languages and literature at American universities.

Interpretative studies by South Asian scholars of the meaning and significance today to their nations of recent historical events again received support in 1958. Among these is a history of the Sikhs that will reveal the distinctive qualities and influences of this religious and ethnic community in the subcontinent. Further support was also given projects, such as the proposed guide to the collections of manuscripts on South Asia in the British Isles, that will facilitate or strengthen Western scholarship on that region.

Of the arts, music and literature appear to have, in modern times, the widest appeal and the firmest grip on the people of India. A new music program at the University of Delhi, which will involve both comparative studies of Indian and Western music, and performance of Indian music, received support in 1958. A small grant will enable the secretary of India's National Academy of Letters to travel abroad and to arrange literary exchanges that will benefit both India and other countries.

FAR EAST

The interrelationship between the Foundation's interest in humanistic scholarship and the arts in the countries of the Far East and in Western understanding of the area can be seen in many of the grants made in 1958 to key educational institutions. Support is being given to institutions in the Far East for work in history, philosophy, and American studies in which scholars from other parts of the world will participate. Complementary grants are helping American institutions develop their programs in Japanese and Korean studies, in part with the help of visiting professors from those countries. Smaller grants are also encouraging international intellectual exchange by enabling scholars from both Western and Far Eastern countries to travel and study abroad.

Another series of awards relates more directly to some of the present requirements of a number of the Far East's important scholarly institutions. The administrative officers of Japan's privately supported universities, Japanese librarians, and a Philippine educational official, for example, have been enabled to study and observe American or European practices in dealing with the same problems in higher education.

A number of new appropriations reflect the Foundation's belief that increased contacts between Western and non-Western music might prove fruitful and constructive in their future development. Several programs in oriental music in Western institutions received support, and a number of Asian musicians were given travel grants so that they might observe musical activities in other countries.

Finally, a number of projects in literature and the arts that will contribute new knowledge in the West concerning the cultures of the Far East received assistance in 1958. Among these are studies of the arts of Fiji and Samoa, the translation of a Chinese treatise on literary theory, and the preparation of literary materials that can be used to present non-Western cultures in anthropology courses.

Intercultural Studies

HARVARD-YENCHING INSTITUTE

KOREAN STUDIES

Korea's role in international politics in recent years has stimulated Western interest in this small but culturally rich country. Nevertheless, few American universities have undertaken Korean studies.

The Harvard-Yenching Institute, Cambridge, Massachusetts, founded in 1928, conducts and promotes teaching and research on Northeast Asia, including Korea. As part of its program it has assembled one of the few strong library collections on Korea in this country, given aid for investigations at several institutions in Korea, and from time to time invited Korean scholars to visit Harvard.

The institute now plans to endow a chair of Korean studies at Harvard. The university will develop the new program in close association with others of longer standing on China, Japan, and Russia. Its previous work with the languages and histories of these nations, its large Asian library, and its exceptional facilities for instruction in the Asian languages are all expected to contribute to the success of the project.

Toward the support of Korean studies at Harvard, The Rockefeller Foundation has made an outright capital grant of $200,000 to the Harvard-Yenching Institute, to be released when an equal amount is raised from other sources, and an interim appropriation of $25,000.

VICTORIA UNIVERSITY OF MANCHESTER

AMERICAN STUDIES

In 1956 British teachers and scholars formed the British Association of American Studies to encourage and strengthen study of the United States at British institutions, and to serve as the center of a broader educational program for a larger public. The association now has about 125 members, three-fourths of whom are professors and lecturers responsible for teaching and research in such subjects as American history, literature, government, and law at British universities.

The association has already begun to hold annual professional meetings and biennial conferences, to publish a *Bulletin* which is chiefly bibliographical in character, and, with funds from the United States Information Agency, to make a survey of materials for research in American subjects located in the United Kingdom. As part of the general expansion of its program, the association plans to acquire microfilms needed for work on American subjects, institute an advisory and information service for British students and scholars who wish to study in the United States, and award study and research grants to British scholars and students who give promise of making important contributions to the field.

To help the British Association of American Studies continue the development of its program, The Rockefeller Foundation has made a five-year grant of $150,500 to the Victoria University of Manchester, which has for some years had a distinguished American Studies Department.

STANFORD UNIVERSITY

JAPANESE STUDIES

The first American university to establish a formal interest in Japanese studies, Stanford University in Palo Alto, California, has sponsored cooperative research and teaching on Japan by both Japanese and American scholars since the end of the Russo-Japanese war. In recent years, a Japanese scholar of Buddhism has worked with Stanford professors of oriental studies, philosophy, and anthropology on the interrelations between culture and patterns of language and thought. Another Japanese professor has spent a year at Stanford studying with American scholars various problems in the sociology of religion. A third has participated in cooperative experiments with American scholars to extend ideas of literary criticism by applying both Western and Japanese critical techniques to early Japanese poetry.

Increasingly, Stanford University has attempted to make Far Eastern studies an integral part of established disciplines rather than a special and isolated interest. To advance this goal, Stanford will undertake a wider range of reciprocal projects in such fields as art, philosophy, history, political thought, and Asiatic studies on the basis of plans to be worked out by an interdepartmental committee at Stanford and a cooperating committee at Tokyo University. The two universities have collaborated since the war in developing American studies at Tokyo, and gained experience which will be valuable in the formulation of the complementary program of Japanese studies at Stanford.

To help finance the new program at Stanford, particularly the expenses of visiting Japanese scholars, The Rockefeller Foundation has appropriated $110,000 for use during the next five years.

UNIVERSITY OF DELHI

COMPARATIVE MUSIC STUDIES

Music, the art enjoyed by the largest number of Indians and the one most closely touching their lives, has undergone a continuous evolution in India for more than 2,000 years. The rich literature of musical theory and the immense body of compositions that have developed in North and South India during these centuries will now be studied under a new program at the University of Delhi.

With support from the University Grants Commission, an agency of the Indian government, and the Sir Shanker Lal Charitable Trust Society, the university is establishing an institute of music which will function as a department within the university framework and which will offer undergraduate and advanced degree courses by 1960. The director of the institute will be assisted in formulating its program by an expert committee composed of leading scholars, performers, and patrons of music in India.

During its first two years, the institute will concentrate on performing and appraising, through lectures, study groups, and seminars, the music that will later be studied;

identifying the most gifted scholars and performers throughout India; recruiting a library staff; and acquiring essential books, scores, records, and other equipment.

The major research program will focus on the music of North and South India and of the West. Indian scholars will join with two visiting professors from Western countries in comparative studies of the three musical traditions, their interrelations, and their potentialities for growth.

The Rockefeller Foundation has contributed 192,000 rupees and $65,000 (about $106,850) to aid the University of Delhi in establishing and developing the new institute of music through the period ending June 30, 1964.

STANFORD UNIVERSITY

SEMINAR ON UNIVERSITY ADMINISTRATION

Like other institutions of higher learning throughout the world, the privately supported universities of Japan, which accommodate more than half of all university students in the country, have pressing needs to secure larger funds and to make the most efficient use of their financial and other resources. To enable a number of the officers and trustees of these universities, and others concerned with higher education, to learn how American schools meet their administrative and financial problems, Stanford University, Palo Alto, California, held a seminar in the summer of 1957 which included both discussions and observations of business procedures at Stanford and other institutions. Since their return home, the delegates to the seminar have published more than 20 articles or pamphlets on the subject, and stimulated thoughtful interest in the relations between a university and its community.

Stanford University will now hold another seminar for a slightly larger group of Japanese university business officers during which greater attention will be given to special problems. The delegates will spend several weeks at Palo Alto participating in seminar discussions with persons familiar with various aspects of university administration and finance, visit other institutions in the country, and attend an annual meeting for American college business managers. To support the seminar, The Rockefeller Foundation has appropriated $66,000, available for a two-year period. The first Stanford seminar was also supported by the Foundation.

UNIVERSITY OF CALIFORNIA

STUDIES OF INDIAN LANGUAGES

Within the past few years the University of California at Berkeley has become a leading center for studies of South Asia in which work on the modern languages of the area is closely related to research and teaching in such other fields as history, anthropology, sociology, and art. Now the university plans to initiate a number of new activities which will greatly strengthen its offering in Indian languages and which will culminate, within a four-year period, in the establishment on a permanent basis of a Department of Indian Languages and Literature.

The university will inaugurate an intensive summer seminar on Hindustani (Hindi and Urdu) and one other language for government officials, journalists, and business representatives as well as students specializing in South Asian languages. It will, at the same time, extend the faculty's research on Hindi and on materials in that and other Indian languages so as to prepare fully for adequate instruction at advanced as well as elementary levels. As part of the plan, an American scholar will visit India to collect books and other language materials that will be useful in the teaching program.

To help the University of California develop the work on Indian languages, The Rockefeller Foundation has appropriated $60,000, of which $15,000 is payable on request for initial expenses and $45,000 payable within the next four years as the university secures state, federal, or other support adequate to finance the total costs of the program.

DOSHISHA UNIVERSITY

AMERICAN STUDIES

A private school founded in 1875 by a Japanese scholar educated in the United States, Doshisha University in Kyoto has a traditional interest in American studies, and has long maintained courses in American history, literature, and government. Since the war its work in the field has been greatly strengthened by its collaboration with neighboring Kyoto University in a Foundation-aided American studies program under which American professors have taught at the schools and Japanese professors have visited the United States.

Both schools are now ready to integrate American studies more closely into their own regular curricula, and to this end intend to establish and develop separate courses in the relevant subjects. Doshisha University is being helped to realize its plans by a $60,000 grant for travel and study abroad by faculty members, and for the purchase of books relating to American studies or by American scholars.

Under its program in the social sciences, the Foundation made an equal grant to Kyoto University in 1958 for the support of its expanded activities in American studies.

UNIVERSITY OF WISCONSIN

INDIAN STUDIES

During the past six years, the University of Wisconsin, Madison, has become one of the major centers in the United States for studies of India. A course on Indian civilization was initiated in 1957 with the help of an Indian scholar as visiting professor, and other courses on Indian history will be introduced in the 1959-1960 academic year. When instruction on Indian literature and important Indian languages is inaugurated during the same year, undergraduate and graduate students at Wisconsin will be able to major in Indian studies with the balance of the work in related humanistic and social science disciplines.

In the new course emphasis will be given to the social, cultural, and political aspects of Indian literature and such major languages as Hindi. Several Indian scholars will be invited to Wisconsin to assist in teaching and research, and additional Indian language materials will be acquired for the library.

To help the University of Wisconsin develop the new studies in Indian languages and literature, The Rockefeller Foundation has appropriated $46,750 for use over a four-year period.

UNIVERSITY OF MUNICH

AMERICAN STUDIES

The American Institute of the University of Munich, Germany, one of the leading centers for American studies in Europe, is planning a new research program limited to fields where Germans or Europeans are in a position to make a particular contribution. The centers of interest under the program will be three: German-American and European-American relations and mutual influences; problems requiring for analysis an outside observer or one with European information; and the application of German or European methods to American materials or, vice versa, the application of American methods to German or European materials.

In addition to the director, Professor Helmut Kuhn, the staff of the institute includes an associate professor of political science, a professor of modern history, a lecturer in American social history and sociology, and, during the present year, a Fulbright visiting professor in American literature. This group is authorized to offer both general study in American civilization and advanced work leading to the doctorate. Currently 15 candidates are working toward the doctoral degree.

In support of the new research program the Foundation has appropriated $31,700 to the University of Munich. The funds will be available during the period ending June 30, 1961.

UNIVERSITY OF CALIFORNIA

HISTORY OF RUSSO-POLISH RELATIONS

Although he is primarily a literary historian, Professor Waclaw Lednicki of the University of California has long been interested in the history of Russo-Polish relations, both as a scholar and as a member of a family intimately involved in the events leading to the proclamation of Polish independence in 1917. Educated in Russia and Poland, Professor Lednicki taught at the University of Cracow before coming to the United States in 1940. He is the author of more than 150 books and articles, including *Russia, Poland and the West*, published in 1954.

When Professor Lednicki retires as professor of Slavic languages and chairman of the department at the University of California, he intends to begin a long-planned study of political cooperation between Russian and Polish liberal groups at the beginning of the twentieth century. He will review Russo-Polish conferences and congresses of the period, the efforts made during the First World War to achieve Polish independence, and the immediate background of the Russian Manifesto of 1917. A Rockefeller Foundation grant of $27,200 to the university will help finance his researches during a two-year period.

UNIVERSITY OF LONDON

SCHOOL OF ORIENTAL AND AFRICAN STUDIES

The documents on South and Southeast Asia which found their way into various collections in the British Isles during three centuries of British influence and rule in various parts of the area are unparalleled in richness and variety. The largest group of these documents is in the India Office Library and Archives, but others, which have been only partially listed in published bibliographies, are scattered in public and university libraries, county record offices, the headquarters of missionary societies and other associations, and private collections throughout the country.

To make the materials on South and Southeast Asia in British collections outside the India Office Library and Archives more readily accessible to scholars and students, the University of London's School of Oriental and African Studies has assumed responsibility for the preparation of a comprehensive guide. It will describe the main classes of materials and important individual documents, give reference to all published catalogues and listings, and include a complete name and subject index. A small committee composed of the head of the School of Oriental and African Studies and the librarians of the school and the India Office Library will supervise three research assistants, one of whom may be recruited from Asia, in the work.

A Rockefeller Foundation grant of £8,300 (about $23,650) will help finance the preparation of the guide over a two-year period.

MUSLIM UNIVERSITY

HISTORY OF THE SIKHS

Although the Sikhs, a group numbering over 6,000,000 members, have played an important role in Indian history for about 400 years, no adequate history of their development has yet appeared. A Sikh scholar, Khushwant Singh, will now undertake the preparation of a comprehensive two-volume study in which attention will be given to all aspects of Sikh history from 1469, when they emerged as a new religious and social community, up to the present. The first volume will cover the religious and political growth of the Sikhs, their early shift from pacificism to militarism, and their rise as a major military power in what is now West Pakistan and Kashmir. The second will discuss the wars between the Sikhs and the British, Sikh adjustment to British rule, the growth of Sikh national consciousness and economic enterprise, the role of the Sikhs in the partition of India and Pakistan, and developments during the past ten years.

The history will be written under the sponsorship of the Muslim University, Aligarh, India, with the help of a grant of 100,000 rupees (about $22,000) from The Rockefeller Foundation.

OTHER GRANTS

American Council of Learned Societies, Washington, D.C.: preparation of a revised edition of the *Encyclopedia of Islam,* under the auspices of the Royal Netherlands Academy of Sciences; $15,000 for a five-year period;

Stanford University, Palo Alto, California: studies of the history of the Turkish Revolution, principally at the Hoover Institution on War, Revolution, and Peace, by Professor Enver Ziya Karal, University of Ankara, Turkey, and Frederick P. Latimer, Jr., Princeton University, New Jersey; $15,000;

Harvard University, Cambridge, Massachusetts: translation of the Chinese treatise on literary theory, *Wen-hsin tiao-lung,* and related literary studies, by Achilles Fang, Harvard-Yenching Institute; $12,320 for a two-year period;

Cornell University, Ithaca, New York:

To invite A. G. Pringgodigdo, president, Airlangga University, Surabaja, Indonesia, and Mrs. Pringgodigdo to visit educational centers in the United States and Asia; $10,000;

Preparation of materials for use in anthropology courses to present non-Western cultures through their own literatures, under the direction of Professor Lauriston Sharp; $9,620;

Study of the role of the arts in Indonesia, by Mrs. Claire Holt; $3,000;

Professor Gordon H. Fairbanks, Division of Modern Languages; to review the possibilities for linguistic research in Ceylon and Pakistan; $1,000;

Middlebury College, Vermont: support of Russian language courses on science, technology, and other fields given in the summer Institute of Soviet Studies; $10,000;

University of Washington, Seattle: to enable a scholar in the humanities to conduct teaching and research at the National Taiwan University, Taipei, National Republic of China; $10,000;

Science Council of Japan, Tokyo: to invite three Islamic scholars to spend several months in Japan; $8,060;

McGill University, Montreal, Canada: study of Islam and of modern political movements in Africa south of the Sahara, by Thomas Hodgkin, research associate, Institute of Islamic Studies; $7,500;

University of Florida, Gainesville: development of the research library on the Caribbean; $7,500;

Honolulu Academy of Arts, Hawaii: to appoint George H. Kerr as advisor in Far Eastern cultural history; $7,200;

National Taiwan University, Taipei, National Republic of China:

Expenses of two experimental summer seminars to be led by American scholars in the social sciences or the humanities; $6,500;

Professor Hsia Tsi-an, professor of English literature; to conduct research and teaching in the United States, principally at the University of Washington, Seattle; $6,050;

Korea University, Seoul: to invite John Harvey, American graduate student, to serve with the Asiatic Research Center; $6,000;

Hebrew University, Jerusalem, Israel: studies of Middle Eastern history, by Dr. David Ayalon and Dr. Uriel Heyd; $5,000;

Waseda University, Tokyo, Japan:

Professor Naotaro Tatsunokuchi, professor of English language and literature; to study American literature in the United States; $5,000;

Toshio Kawatake, instructor, Department of Drama, Faculty of Literature; to study drama while in Europe; $600;

Professor Seizi Uyeda, professor of philosophy, and president, Japanese Association for the Study of American Philosophy; to visit university centers of philosophy while in the United States; $550;

Miss Ng Tung-king, assistant librarian in charge of the Fung Ping Shan Chinese section of the library, University of Hong Kong: to visit oriental libraries in the United States and Canada; $4,125;

University of Chicago, Illinois:

Research in Indian cultural history, by Dr. J. A. B. van Buitenen; $3,500;

Research on the languages and cultures of Sumatra, by Mr. and Mrs. Gerald E. Williams; $3,000;

Mirrit Boutros Ghali, writer, Cairo, Egypt: to visit universities and observe programs of agricultural and economic development in the United States, Canada, and Mexico; $3,400;

John Alden Williams, assistant director and fellow, American Center for Research in Egypt, Cairo: to observe Muslim art in Europe, North Africa, and Asia; $3,000;

Dr. Vahit Turhan, professor of English, Faculty of Letters, University of Istanbul, Turkey: to observe American studies programs at universities in Western Europe; $3,000;

Elmira College, New York: continuation in Turkey of studies of contemporary Turkish life, by Dr. Mack B. Swearingen; $2,850;

Dr. Anthony H. Johns, senior lecturer for Indonesian and Malayan studies, Canberra University College, Australia, and Mrs. Johns: to visit centers of Southeast Asian studies in the United States and Europe; $2,500;

University of Hawaii, Honolulu:

Edward A. Stasack, Department of Art; to study the arts of Fiji and Samoa; $2,500;

Development of teaching materials on oriental music, under the direction of Miss Barbara B. Smith, associate professor of music; $2,000;

Miss Barbara B. Smith, associate professor of music; to observe work in comparative music in Europe; $1,000;

University of London, England: an inquiry into the Muslim approach to art, by Professor D. S. Rice, reader in Islamic art and archaeology, School of Oriental and African Studies; £650 (about $1,860);

Professor N. V. M. Gonzalez, writer and teacher of literature, University of the Philippines, Manila: additional leave of absence for creative writing; 3,178 Philippine pesos (about $1,600);

Professor Robert E. Spiller, University of Pennsylvania, Philadelphia: to appraise in Europe the development of research on North America; $1,000;

Columbia University, New York: a seminar on language planning during the spring semester, 1958, under the direction of Dr. Uriel Weinreich; $830;

Dr. V. K. R. V. Rao, vice-chancellor, University of Delhi, India: to observe departments of music and other programs at universities while in the United States; $760.

Humanistic Research

UNIVERSITY OF GENEVA

RESEARCH IN GENETIC EPISTEMOLOGY

For the past ten years Professor Jean Piaget of the University of Geneva, long known for his studies of learning in children, has increasingly concentrated on genetic epistemology—the study of the ways fundamental concepts of knowledge develop. Professor Piaget believes that while it is patently impossible to study the origin of fundamental concepts in man's intellectual pre-history, some clues may be obtained through study of learning processes in children. For example, analysis of the child's construction of such a concept as number illuminates its nature in adult thought, just as, in biology, embryology illuminates adult anatomy and histology.

Professor Piaget's researches indicate that there is more continuity between the child's thought processes and the adult's than is generally supposed. He finds that mistaken ideas acquired in childhood persist into adult life, and that, as many emotional reactions in adults are determined in part by unconscious memories and infantile conflicts, so thought processes, scientific or unscientific, in adults are dominated by factors in their early mental development the importance of which is only now beginning to be understood.

Among the striking findings of Professor Piaget's studies is the fact that some of the fundamental methods and concepts of physics, mathematics, and logic are closely related to structures of thought inherent in the mental growth of children. Professor Piaget plans further exploration of this important phase of his research in collaboration with scholars in other disciplines. The group will continue the studies related to logic, on which much research has been done, and expand their studies of the development of thought processes related to mathematics and the sciences.

A new Rockefeller Foundation grant of 600,000 Swiss francs (about $141,000) to the University of Geneva will be used for Professor Piaget's researches during the next five years. A previous grant assisted the work from 1955 through 1958.

COLEGIO DE MÉXICO

CONTEMPORARY MEXICAN HISTORY

In 1948 the Colegio de México, in Mexico City, organized a seminar on contemporary Mexican history to undertake the critical and realistic appraisal of the Mexican Revolution essential to future research on twentieth-century Mexico and to realistic national planning and public understanding of political action. As a necessary preliminary to research on the Revolution, the group first undertook a thorough study of the regime of Porfirio Díaz which immediately preceded the Revolution. This has now been completed, and its findings incorporated in a multivolume work, the *Historia Moderna de México,* of which four volumes are in print, one in press, and a sixth in manuscript form.

The seminar group have now turned to their major interest, the Mexican Revolution, and have already begun to locate and evaluate the sources on Mexican history from 1910 to 1940, when the direction of the revolutionary movement was radically altered, and from 1940 through 1952. The history will be prepared by four teams of six scholars each, who will be responsible for searching and analyzing the sources, and drafting volumes on the political, economic, social, and cultural aspects of the Revolution. Professor Daniel Cosío Villegas, distinguished Mexican scholar and historian who has recently become head of the Colegio de México, will direct the work.

A grant of $123,692 will continue Foundation support of the seminar on contemporary Mexican history and meet some of the expenses connected with the preparation of the history of the Revolution during a five-year period. The new grant brings to $419,224 the amount appropriated by the Foundation for projects in history, literature, and linguistics at the Colegio de México.

THE HARRY S. TRUMAN LIBRARY INSTITUTE FOR NATIONAL AND INTERNATIONAL AFFAIRS

The Truman Library, in Independence, Missouri, is the repository of the personal papers of former President Truman, the White House files for 1945-1952, and personal papers of cabinet members and other officials of the Truman administration. The library, whose collection and resources are available to all scholars, is becoming an important center for the study of contemporary American history. Its accessibility to universities in Missouri, Kansas, Nebraska, Oklahoma, and Iowa has contributed to a growing interest in the region in the study of the office of the presidency and of the foreign relations of the United States since 1900.

To augment the value of its collection to scholars and graduate students, the Truman Library will acquire a working reference library. The new materials will include government documents, memoirs, studies, background matter on foreign affairs, United Nations and foreign government documents relating to American foreign policy, and a basic collection of works on the presidency as an institution.

Toward the cost of the reference materials The Rockefeller Foundation has made a three-year grant of $48,700 to The Harry S. Truman Library Institute for National and International Affairs, Independence, Missouri. The library is maintained and operated by the National Archives and Records Service.

ACADEMIA SINICA

RESEARCH IN CHINESE HISTORY

The Academia Sinica in Taipei, Formosa, is the national research organization of the National Republic of China and the custodian of a wealth of original materials for the study of Chinese civilization. Among its collections are the bulk of inscribed bones dating from about the middle of the second millenium B.C. excavated in and around Anyang, capital of the Shang Dynasty, and the largest single group of original written material from the Han Dynasty. Because of the disruptions of war, these materials were transported first to Western China and then to Formosa, and many reports and analyses, basic to understanding of various periods in Chinese history, have never been completed.

Selected senior and junior scholars in the academy's Institute of History and Philology will now be given appointments enabling them to spend up to three years in research on these important materials and other projects on Chinese history prior to the modern period. To allow the scholars to devote all their time to research, and to meet related research expenses, The Rockefeller Foundation has appropriated $45,000 to the Academia Sinica for use over a three-year period.

LEHIGH UNIVERSITY

HISTORY OF THE BRITISH EMPIRE

Professor Lawrence H. Gipson has won high praise for the published portions of his multivolume history, *The British Empire Before the American Revolution (1748-1775)*. The series was awarded the Laubat and Bancroft prizes for historical writing and has been described as "the most distinguished multivolume work by any living American historian." The author has been characterized as a Macaulay "with all the technical resources that Macaulay could not command."

Nine volumes of the history have been published to date. Three more are planned, two to complete the history and a third which will include an essay on the historiography of the subject, an extensive critical bibliography, and an index to the series as a whole. Currently Professor Gipson is writing Volume 10 and revising Volumes 1 to 3. These early volumes are out of print but are to be reissued as part of a definitive edition.

In 1958 the Foundation renewed its support of Professor Gipson's work, continuous since 1951, with a three-year grant of $36,000 to Lehigh University, Bethlehem, Pennsylvania.

AMERICAN UNIVERSITY

HISTORY OF WASHINGTON, D.C.

Dr. Constance Green began preparation of a history of Washington, D.C., in 1954, with the help of a $46,000 grant from The Rockefeller Foundation. In her history, now complete to about 1880, she hopes to bring the past into focus in such a way that it will become meaningful for today's thinking on the problems of the national capital.

Originally Dr. Green planned to deal only with the period since 1878, but following the recommendation of an advisory board of historians, she later decided to push her work back to the establishment of the District of Columbia. The change of plan has made it impossible for her to complete her project as scheduled.

To enable Dr. Green to continue her research and writing for a further two years, $26,000 has been appropriated to the American University, Washington, D.C.

OTHER GRANTS

University of Nebraska, Lincoln: preparation of a critical guide to periodical and newspaper sources on the Mexican Revolution, by Professor Stanley R. Ross; $14,500 for a two-year period;

University of Cambridge, England: expenses of publication of a Journal of African History, by the Cambridge University Press; £5,000 (about $14,250) for a five-year period;

Columbia University, New York:

Development of philosophical studies of the recent history of science, by Professor Ernest Nagel and Professor Sidney Morgenbesser with the cooperation of Professor Joseph Epstein, Amherst College, and other philosophers and scientists; $9,700;

Richard De Martino, graduate student; to study Zen Buddhism in Japan; $2,500;

Kyoto University, Japan: research on the characteristics of the modernization of Japan, under the direction of Dr. Masaaki Kosaka, dean, Faculty of Education; 3,074,000 yen (about $9,220);

Tokyo Union Theological Seminary, Japan: to strengthen the Department of Philosophy; $8,000;

American Philosophical Association, Western Division, Chicago, Illinois: studies in philosophy and the public interest, under the direction of Professor Wayne A. R. Leys; $7,950;

Professor Bisheshwar Prasad, head, History Department, University of Delhi, India: to visit Great Britain and the United States to study problems relating to the organization of source materials for the analysis of modern Indian history; $6,025;

Harvard University, Cambridge, Massachusetts:

Preparation of three additional volumes, covering the presidential years, of a biography of Franklin D. Roosevelt, by Professor Frank Freidel; $6,000;

Shigeru Nakayama, Japanese science historian now at the Harvard-Yenching Institute; to assemble data on the history of science in Japan; $1,200;

Princeton University, New Jersey: to invite Professor K. S. Murty, Philosophy Department, Andhra University, Waltair, India, to participate in studies of comparative religion at Princeton; $5,250;

Institute on Religion in an Age of Science, Boston, Massachusetts: general support of the 1958 summer conference on religion in an age of science; $5,000;

Hebrew Union College—Jewish Institute of Religion, Cincinnati, Ohio: a conference on the desirability and content of a program of advanced religious studies; $4,440;

Professor Abraham I. Katsh, chairman, Department of Hebrew Culture and Education, New York University, New York: to microfilm Hebraic and Judaic manuscripts in the Soviet Union and Eastern Europe; $4,000;

Professor William Lytle Schurz, American Institute for Foreign Trade, Phoenix, Arizona: to observe recent regional developments in Brazil in preparation of an interpretative study of Brazil; $3,900;

Dr. Peter Viereck, professor of history, Mount Holyoke College, South Hadley, Massachusetts: to visit Europe to study the recent cultural history of Germany; $3,000;

David Patterson, Cowley Lecturer in Post-Biblical Hebrew, University of Oxford, England: to undertake research on the life and thought of the late Joseph Hayyim Brenner, Hebrew novelist and journalist, in Israel; $2,700;

University College of the West Indies, Mona, Jamaica: expenses of a linguistic seminar on Creole dialects in the Caribbean; $2,300;

Philip D. Curtin, associate professor of history, University of Wisconsin, Madison: to visit centers of research in African history in Central and East Africa; $1,200;

Professor Karl Lowith, professor of philosophy, University of Heidelberg, Germany: toward a visit to Korea at the invitation of the Korean Philosophical Association; $470.

The Arts

COLUMBIA UNIVERSITY

PROGRAM IN ELECTRONIC MUSIC

In recent years the rapid development of electronic devices has opened up a new path in musical expression. Today an increasing number of composers are experimenting in the field of electronic music, using electronic devices which extend the range of musical expression beyond the performing ensembles, players, and instruments now available. Speed changes and other manipulations of a tape recorder playback mechanism, for example, allow composers to give unusual effects to usual musical materials through the preparation of "phono-montages" of instrumental sounds on tape, the addition of natural or electronic sounds, and the development of the resultant combinations by means of such techniques as mixing several signals or overlapping a sound on itself.

Although equipment has been available in Europe for experiment and composition for some years, American musicians interested in electronic music have been hindered by the fact that few electronic facilities are at their disposal in this country. To enable American composers to undertake experimentation and creative work in this new field on a scale commensurate with its potentialities, Columbia and Princeton Universities have joined together in establishing an electronic studio at Columbia. Both universities will arrange to free resident composers from some of their duties to devote time to the new program, and both will introduce graduate instruction in electronic music.

To help the two schools meet some of the initial expenses of the work in electronic music, particularly the costs of the equipment and its maintenance, The Rockefeller Foundation has made a five-year grant of $175,000 to Columbia University, New York.

AMERICAN SHAKESPEARE FESTIVAL THEATRE AND ACADEMY, INC.

The American Shakespeare Festival Theatre and Academy, Stratford, Connecticut, was founded for the purposes of producing Shakespeare's plays and training Shakespearean actors. During the 1957-1958 season the theatre's repertory company played for a total of 30 weeks, giving regular summer performances in Stratford and embarking on its first national tour of 15 cities across the United States. The academy functions primarily as a school for theatrical students and apprentices, and it has already trained promising young actors and production personnel for the company. The academy is adding in 1958 special classes for teachers of English.

So that the theatre and academy can be truly national in character, a new full-time executive director has been appointed to organize a national council and to seek country-wide support. With the inauguration of national tours, geographic representation on the Board of Trustees is also being broadened.

The American Shakespeare Festival Theatre and Academy will use a new two-year grant of $50,000 from

The Rockefeller Foundation to support this expansion of its activities. The 1958 appropriation brings the total of Foundation assistance to the organization to $350,000 since 1954.

AMERICAN SYMPHONY ORCHESTRA LEAGUE, INC.

TRAINING IN ORCHESTRAL DIRECTION

Since 1953 the American Symphony Orchestra League, Inc., has developed a three-part program for the training of United States and Canadian orchestra conductors. In the first phase of the program, the league gives selected conductors, mainly from the smaller community orchestras, the opportunity to attend summer workshops where they conduct an "assembled" orchestra—an orchestra of musicians who have not played together before. In the second phase, the league arranges winter workshops for those who have demonstrated exceptional ability in the summer. At the winter sessions, organized in cooperation with such major orchestras as those of Philadelphia, Pittsburgh, Cleveland, and Los Angeles, the trainees get a chance to observe the work of other conductors in rehearsal and at performances, and again to conduct.

The third, most recently inaugurated phase of the program provides intensive experience in conducting over a period of three or four years for a few conductors of conspicuous talent. In support of this third stage, the Foundation has appropriated $49,500 to the league, for use through the end of June, 1961. The grant will help the organization continue to experiment with methods of training conductors on an advanced level.

The Foundation has been giving assistance for the various projects of the American Symphony Orchestra League since 1954. Funds appropriated to the league now total more than $300,000.

CONNECTICUT COLLEGE

SUMMER SCHOOL AND FESTIVAL OF THE DANCE

The Connecticut College Summer School and Festival of the Dance, a leading center of instruction in modern dance, has played an important role in the development of the modern dance not only as a performing art but also as a part of physical education programs throughout the United States.

To assist Connecticut College, New London, in further strengthening its program in the modern dance during the next three years, The Rockefeller Foundation has made a new grant of $40,000. The college plans to present works by young choreographers, appoint musicians in residence, and expand the fellowship program. The archive of dance in film and notation will also be developed, and new works by established artists commissioned.

INTERNATIONAL GRAPHIC ARTS SOCIETY, INC.

ART LOAN PROGRAM

The International Graphic Arts Society, Inc., in 1956 began to experiment with an unusual technique for increasing the appreciation and use of pictorial art: the loan of original art, on a rental basis, to university students. Six American colleges and universities cooperated by accepting from the society loan collections of 50 etchings, wood blocks, lithographs, and other work in the graphic media. Each agreed to spend at least $150 annually from rentals or other income for the purchase of additional prints from any source.

Students responded enthusiastically at most of the participating schools, which included Syracuse University, Wellesley College, Indiana University, the University of Minnesota, Sarah Lawrence College, and Brown University.

Encouraged by the response so far, the IGAS now proposes to extend the plan to include 25 additional colleges and universities. When distribution of the collections has been completed and there has been time to judge their usefulness, the IGAS will prepare and publish a report on the methods, problems and results of the project, to encourage and facilitate the creation of other art-loan services in the United States.

To help the society meet the costs of expanding the program, and of publishing the final report, the Foundation has made a two-year grant of $39,400.

UNIVERSITY OF CALIFORNIA

ORIENTAL MUSIC PROGRAM

A sizeable group of Americans, including a number of composers and performers, has taken up the study of oriental music in recent years, but as yet few schools or departments of music have followed suit. An exception to the rule is the Department of Music of the University of California at Los Angeles, which has an extensive program in oriental music. As part of the program, advanced degree candidates have conducted research on the music of such areas as Japan, Thailand, Java, and Bali, and faculty members have organized two orchestras, one for the performance of Javanese music and another for Japanese court music or gagaku.

In response to the interest its oriental orchestras have aroused among students and the public, the department now wishes to extend its work in Indonesian and Japanese music by bringing oriental musicians to the California campus, enabling selected graduate students or staff members to study in the orient, acquiring additional oriental instruments, and increasing the library and musical archive resources of the university. In support of these projects, the Foundation has made a two-year grant of $39,000.

UNIVERSITY OF PENNSYLVANIA

SCHOOL OF FINE ARTS

Two years ago, aided by a Rockefeller Foundation grant, the School of Fine Arts of the University of Pennsylvania undertook a new study of the aesthetics of the urban environment. The object of the program was to find out more about what makes cities appealing, and to stimulate architects, city planners, and the public to take a greater interest in this important but somewhat neglected question.

One of the results of the program has been the development of an extensive file of technical information, graphic illustration, and critical commentary concerning various important phases of city design. Some of this material will be systematized and analyzed in book form in the next two years, when the school will invite two experts in city planning to use its files for the preparation of two monographs. In each case the author will be asked to discuss and criticize the trends and achievements of recent years, and to identify concepts which require creative development or exploration. The books will be written for the widest possible audience of architects, city planners, and informed laymen.

For work on the manuscripts, and for research on two additional aspects of city planning, the Foundation has appropriated $36,000 to the University of Pennsylvania. The university is one of three institutions where the Foundation has supported research on the aesthetics of urban and suburban planning in recent years.

CATHOLIC UNIVERSITY OF CHILE AND THE UNIVERSITY OF BAHIA

THEATRICAL PERFORMANCE AND TRAINING

The professional theatre has developed in Chile mainly through the efforts of the drama groups at the major universities. These groups train the actors, directors, and technicians of the professional stage in Chile, and to a certain degree also in other Latin American countries. They also provide Chile with some of its most effective stage performances.

Recently the *Teatro de Ensayo* (Rehearsal Theatre) of the Catholic University of Chile, Santiago, expanded its program. Beginning with the 1956-1957 season, it adopted a policy of producing plays by young Chilean playwrights, believing this a necessary step for the growth of a theatrical tradition in Chile. At the same time it began sending its productions on summer tour to the provincial cities of Chile, a practice which is winning new audiences for live drama.

A Foundation grant of $35,000 to the Catholic University, to be available through an 18-month period, will assist the *Teatro de Ensayo* with the costs of a new lighting system. The equipment will help the group stage new Chilean plays effectively, and achieve the special lighting effects essential for the production of many recent American and European plans. It will be constructed in such a way that it can be taken on tour and used outdoors if necessary.

The University of Bahia, Salvador, Brazil, was the first Brazilian university to inaugurate a program of professional training in the performing arts. Its Drama School, now three years old, has developed rapidly under the leadership of Martim Gonçalves, a professional director who previously founded one of Brazil's most successful drama groups. The school offers three-year courses in acting, directing, playwriting, scene and costume design, and technical production.

To further the growth of the new Brazilian school, the Foundation has made a two-year grant of $28,000 to the University of Bahia. More than half the appropriation will be used to purchase lighting equipment for a 500-seat theatre now under construction on the Bahia campus.

KARAMU HOUSE

MUSIC BUILDING

For more than 40 years Karamu House in Cleveland, Ohio, has served as a cultural and social center for both whites and Negroes. Among its many activities it has presented excellent programs in drama, music, and the dance, comprising revivals of the classics, experimental productions, and performances of new and commissioned works.

Although the participants of the Karamu House productions are amateurs, many go on to professional careers in theatre and music, and the high level of their artistic attainment is reflected in the invitations Karamu has received to perform at the Edinburgh Festival and the International Festival at Zurich, and to produce plays, musicals, and dances at the Old Vic in England and in a number of African countries. Many foreign visitors come to Karamu House under State Department auspices.

In 1954 The Rockefeller Foundation contributed $100,000 to the funds needed by Karamu House for a new music building. Because of a rise in construction costs in the few years intervening, the Foundation in 1958 made a second grant of $30,000, payable, as was the first, when Karamu House secures an equal amount from other sources for the same purpose.

AMERICAN INTERNATIONAL MUSIC FUND, INC.

CONTEMPORARY MUSIC

The American International Music Fund, New York, is the American affiliate of the International Music Fund founded in 1948 by the late Serge Koussevitzky to aid composers and to encourage the presentation of the compositions of living composers by leading orchestras.

In 1957 the American fund was able to negotiate an arrangement by which tape recordings could be made of performances of contemporary compositions with the understanding that the tapes would be deposited under suitable restrictions in the New York Public Library, the Library of Congress, and in libraries in Cincinnati, Los Angeles, Dallas, and Minneapolis. As part of the agreement the fund undertook to guarantee the issuance, under regular conditions, of discs of two of the works performed under the program. Part of the financing of the program came from a Foundation grant of $27,000.

Twenty-nine major orchestras in the United States and Canada participated in the program in its first year, and their performances of 53 works by 46 composers were put on tape. A jury of eminent musicians and critics selected two of these as winning compositions for commercial recording and release: Easley Blackwood's "Symphony No. 1" and Alexei Haieff's "Symphony No. 2," both of which were recorded by the Boston Symphony and RCA Victor.

To help finance the program during a second year, the Foundation made a new grant of $27,000, available through June, 1959.

NATIONAL BALLET GUILD OF CANADA AND THE SAN FRANCISCO BALLET GUILD

NEW PRODUCTIONS

Two distinguished ballet companies will be able to create a number of new ballet productions during the next five years with the help of grants totaling $51,250 made by the Foundation during 1958. The National Ballet Guild of Canada, Toronto, has received C$25,000 (about $26,250) for the use of the National Ballet Company of Canada, and the San Francisco Ballet Guild was granted $25,000 for the San Francisco Ballet Company.

Since its organization in 1951, the National Ballet Company of Canada has achieved status as a national artistic institution commanding the generous support of Canadian individuals, corporations, and foundations. During the 1957-1958 season it presented its repertory, which includes 16 new works by Canadians, in cross-country tours of Canada and the United States, and performed in Mexico at the invitation of the Mexican government. Of the new ballets to be created by the company, a high proportion will be by Canadians.

The San Francisco Ballet Company, organized in 1942, is particularly noted for its work in modern ballet. With the sponsorship of the American National Theatre and Academy and financial support from the State Department, the company toured the Far East in 1957, performing in Formosa, Malaya, Ceylon, India, West Pakistan, and Iran, and in 1958 gave performances in Latin America under the same auspices. The San Francisco Ballet Guild secures substantial support for the company from the people of the city.

OTHER GRANTS

San Francisco Art Association, California: toward establishment of an information center on current work by artists on the West Coast; $14,750 for a three-year period;

Massachusetts Institute of Technology, Cambridge: research on new processes of casting metal, by Alfred Duca, sculptor; $10,000;

New School for Social Research, New York: a study of the relation of function to design in large cities, by Mrs. Jane Jacobs; $10,000;

State Ceramic Institute, Faenza, Italy: equipment for research in ceramics; $10,000;

University of Pennsylvania, Institute for Urban Studies, Philadelphia: a conference to formulate guidelines for more adequate criticism of city planning and design; $10,000;

Walker Art Center, Minneapolis, Minnesota: an experimental program to stimulate the purchase and rental of works of art; $10,000;

University of Ankara, Faculty of Letters, Turkey: to invite Dr. Grant H. Redford, associate professor of English, University of Washington, Seattle, to assist in the development of the work of the Theatre Institute; $9,000;

Hofstra College, Hempstead, New York: completion of research on and development of a new mechanical system for handling scenery in the theatre; $8,750;

National Conservatory of Ankara, Turkey:

A. Adnan Saygun, composer, and Mrs. Saygun; to gain a direct acquaintance with music in the United States and Canada; $8,500;

Teaching materials on the theatre arts for use in the Drama Department; $750;

K. R. Kripalani, secretary, National Academy of Letters, New Delhi, India: to establish closer associations between the academy and literary academies and other cultural organizations in Asia, North America, and Europe; $7,550;

Library of Congress, Washington, D.C.:

Recording and cataloguing of Latin American poetry; $6,950;

Study of the folk and art music of Morocco, by Paul Bowles, writer and composer; $6,800;

San Francisco Museum of Art, California: to continue an art lending program in the elementary and secondary schools of San Francisco; $6,400 for a three-year period;

Professor Ahmed Hamdi Tanpinar, Faculty of Letters, University of Istanbul, Turkey: to study nineteenth-century Turkish literature in Western Europe; $6,100;

Juilliard School of Music, New York: Michel Saint Denis, former director, Ecole Supérieure, Centre Dramatique de l'Est, Strasbourg, France; to visit the United States and Canada for consultation on problems of the American theatre; $5,225;

New York Public Library, New York: to complete the arrangement and the microfilming of unpublished manuscripts, drafts of published poems, and personal papers of the late Gabriela Mistral, Chilean poet and Nobel laureate; $5,200;

Rutgers, the State University, New Brunswick, New Jersey: selection and translation of contemporary Latin American literature for publication in English; $4,500;

Brooklyn Museum, New York: an exploratory conference on the conservation of works of art; $4,400;

University of Arizona, Tucson: to arrange a joint exhibit and conference on contemporary Indian art in the southwestern United States; $4,000;

Lim Won-sik, conductor, Korean Broadcasting System Orchestra, Seoul: to participate in the conducting class at the Berkshire Music Center, Tanglewood, Lenox, Massachusetts; $3,150;

Donald M. Allen, co-editor, *Evergreen Review,* and associate editor, Grove Press, New York: to meet writers, editors, translators, and publishers in Latin America to improve the United States market for translations of contemporary Latin American literature; $2,850;

Board of Directors of the National Artistic and Historic Patrimony, Rio de Janeiro, Brazil: Edson Motta, technical director for conservation and restoration; to participate in conferences on art conservation in Boston and New York, and to visit scientific laboratories concerned with the fine arts in the United States; $2,750;

Boston Museum of Fine Arts, Massachusetts: to make available for distribution the results of a seminar on the "Application of Science to Examination of Works of Art," and to invite Dr. E. T. Hall, University of Oxford, England, to participate in the seminar; $2,150;

Dr. Lee Hye-Ku, music historian, Seoul National University, Korea: to visit centers of comparative music in the United States; $2,050;

American Shakespeare Festival Theatre and Academy, Inc., Stratford, Connecticut: preparation of a manuscript on dramatic education in three different dramatic schools, by Michel Saint Denis, former director, Ecole Supérieure de Centre Dramatique de l'Est, Strasbourg, France; $2,000;

University of Edinburgh, Scotland: study of the influence of science on the visual arts during the twentieth century, by Professor C. H. Waddington; $2,000;

Columbia University, New York: adaptation of traditional Chinese drama for music and dance production in the United States, by Chou Wen-chung; $1,500;

Donald Demarest, editor, Mexico City, Mexico: to visit the United States for consultation with American publishers concerning translations of contemporary Mexican authors; $750.

Special Projects

UNIVERSITY OF ANTIOQUIA

SCHOOL OF LIBRARY SCIENCE

A year ago the University of Antioquia, Medellín, Colombia, opened a new School of Library Science which offers a three-year course and is empowered to award a university degree. By establishing the school the university hoped to help alleviate the shortage of librarians in Latin America, and to demonstrate the advantages of specialized preparation at the university level for the practice of the library profession.

The school is an international project. Its curriculum was planned after study by an international committee, and its staff and student body are from a number of different countries. It enjoys major support in the form of scholarships from the Colombian *Fondo Universitario*, and cooperation from UNESCO and the Organization of American States.

Eventually the school expects to appoint some of its own graduates to its faculty. It will give selected graduates an opportunity for field work in various Latin American libraries and for a year of postgraduate academic study outside the University of Antioquia, with the expectation that these students will assume teaching posts on the completion of their special training, and finally will take over full responsibility for running the school.

In 1956 the Foundation appropriated $58,000 to the University of Antioquia toward the costs of starting the new School of Library Science. A 1958 grant of $265,000 will extend this support through the end of 1965.

AMERICAN LIBRARY ASSOCIATION

INTERNATIONAL ACTIVITIES

The American Library Association, in Chicago, Illinois, is the major organization in the United States concerned with the relations between libraries in this country and those abroad. To help the association support a number of activities designed to fulfill its charter purpose of "promoting library interests throughout the world," The Rockefeller Foundation made three grants totaling $185,950 during 1958. Since 1923 the Foundation and the former Laura Spelman Rockefeller Memorial have assisted the work of the association with appropriations totaling more than a million and one-half dollars.

The largest grant made in 1958, one of $130,000, will continue Foundation support of the association's Office of International Relations through the period ending September 30, 1962. Established several years ago, the office attempts to provide better professional education for foreign libraries, to enable librarians to study the library practices and resources of other countries, to improve international exchanges of information on library procedures, and to strengthen library collections in the United States and other countries. The office works closely with American and foreign universities, foundations, government agencies, and other organizations interested in its activities.

A new activity of the association, a field seminar in the United States for ten Japanese librarians, will be supported by a Foundation grant of $40,450. The Japanese participants, who will represent university, public, national, special, and general libraries, will spend approximately two weeks visiting various kinds of libraries in major cities in the country, and will then report and discuss their observations at a two-day seminar conducted by American librarians. Before they come to the United States, and again on their return to Japan, the librarians will participate with other Japanese librarians and officials of academic and governmental institutions in seminars designed to demonstrate the contribution which well organized library resources can make to scholarship.

The third grant of $15,500 will help the association arrange special training programs in the United States for two staff members of the Central Secretariat Library in Delhi, India. The library, itself a government unit, serves all the ministries and other governmental agencies located in Delhi, and receives large collections of official documents from foreign governments. To ensure that official material, both Indian and foreign, is easily available for reference, the Indian government is sending two of the librarians to the United States for nine-month programs of in-service training at libraries in Washington, New York, and elsewhere, where they will give particular attention to the acquisition, processing, storage, and servicing of official documents. The American Library Association will guide the programs of study of the Indian librarians.

COLUMBIA UNIVERSITY

TRAINING PROGRAM FOR INDONESIAN LIBRARIANS

The rapid spread of literacy in Indonesia and the creation of new schools at every academic level have led to an acute need for a more extensive library system. Through its Library Bureau, the Ministry of Education has given priority to the purchase of books and the provision of adequate housing for state public libraries in the provincial capitals which serve the general reading public and government staff as well as students. Eight of these are already in operation, and eight more will probably be established within the next three or four years. As part of the general effort to build up a larger library system for the entire country, the bureau is also setting up central libraries at the state universities and arranging to send librarians abroad for training.

Under a new program, Columbia University will assume responsibility for training nine Indonesian librarians during the next three to four years. The candidates, who will be selected by the Indonesian Ministry of Education, will be given training leading to the master's degree in library science at the Columbia University School of Library Service or other library schools selected by the university. Because of its experience with and special interest in the needs of many foreign students, Columbia is particularly well qualified to oversee the training of the Indonesians.

A Rockefeller Foundation grant of $95,620 to Columbia University, New York, will help finance the training program for Indonesian librarians during a four-year period.

ROBERT COLLEGE

GENERAL EDUCATION

The Turkish government has recently authorized Robert College, which is located in Istanbul, to extend its program beyond the lycée level to cover a four-year period. As a result of this government action, Robert College and its affiliate, the American College for Girls, are developing courses for the curriculum to cover the additional years.

The curriculum will include general education courses dealing with the interplay of Eastern and Western civilizations. All students will study the significant aspects of Eastern and Western cultures as they appear in literature, philosophy, and history. The major phases of the two worlds, oriental and occidental, will be covered up to the eighteenth century, as will the subsequent emergence of the modern era in both the East and the West.

A principal aim of this program is to approach these studies from the Turkish point of view, to see these periods through the eyes of the Turks and against a background of Turkish development.

The organization of these courses and the preparation of the necessary materials will be accomplished by a staff of Turkish and American faculty members from both Robert College and the American College for Girls.

In 1958, The Rockefeller Foundation granted $115,000 to the Trustees of Robert College to help develop the new program. The new grant, which is the third made to the college by the Foundation since 1956, is to be available during a five-year period.

CORNELL UNIVERSITY AND THE UNIVERSITY OF MICHIGAN

TRAINING IN LINGUISTICS

To strengthen the teaching of English, the second language in most Egyptian schools, the Ministry of Education in Cairo in 1956 formulated a program under which it is sending a number of Egyptian English teachers to the United States for training in linguistics leading to the doctoral degree. After the completion of their courses, the teachers will return home to important posts in the Ministry of Education or in teacher training schools where they can take the lead in improving English teaching methods adapted to the speech patterns of Egyptians.

The first group of three teachers is studying at the University of Michigan, where their work toward the doctorate is well advanced. The University of Texas is training the second group, which arrived in the United States during 1957. The third group has begun to study at Cornell University which, like the other two universities, has a well developed program in general linguistics and a special interest in the techniques of teaching English as a second language.

In 1958 the Foundation appropriated $66,000 to Cornell University, Ithaca, New York, to supplement funds made available by the Ministry of Education and the Department of State for three teachers' expenses during the period ending August 31, 1962, and $26,000 to the University of Michigan to enable the teachers studying there to complete the requirements for the doctoral degree. The two grants are part of a series through which the Foundation has sought to assist the Ministry in its program. The training of the three teachers at Texas is being partially supported by a 1957 grant to the university, and various small grants have been used for travel, equipment, and liaison with the Ministry of Education.

CONGRESS FOR CULTURAL FREEDOM

PHILHARMONIA HUNGARICA

Some of the musicians and other performing artists who fled Hungary in the 1956 rebellion resumed their careers in a new orchestra, the Philharmonia Hungarica, organized under the auspices of the Congress for Cultural Freedom, Paris, France. Antal Dorati, who is also conductor of the Minneapolis Symphony Orchestra, assumed artistic direction of the group in the fall of 1957. Subsequently, in the spring of 1958, the Philharmonic embarked on an extended tour of Italy, Holland, and France, at which time one critic described it as "already brilliant," and another expressed the opinion that it would "soon rank among the world's most reputed orchestras."

As a result of its success in its first year, the orchestra has a full concert schedule for the 1958-1959 season. It is booked for tours in Portugal, Spain, Italy, and West Germany, and in addition plans performances in the Austrian provinces. In the spring of 1959 it will participate in the International Music Festival in Vienna, and the following fall expects to tour the United States.

The Foundation has made an outright grant of $66,750 to the Congress for Cultural Freedom, bringing the total of its aid for the Hungarian Philharmonic to more than $176,000. The Ford Foundation made a similar appropriation. The assistance of the two American foundations, and of European agencies, together with its own earnings, will see the Philharmonic through another season, during which, it is hoped, it may find a permanent location and stable sources of income.

UNIVERSITY COLLEGE, NIGERIA

UNIVERSITY PRESS

Started several years ago to meet routine printing needs at the college, the University Press of the University College, Ibadan, Nigeria, has grown into a small but well-equipped unit whose functions now extend to the printing of scholarly publications. Its increasing volume of academic printing has included scholarly papers and journals, and last year, an anthology of West African verse. When Nigeria becomes independent in 1960, it will by dint of its size and location assume a position of great importance in the affairs of West Africa, and the continent as a whole. This imposes upon the University College an intellectual role which can be greatly facilitated by an effectual operating university press.

Since its establishment the University Press has been directed by the college librarian on a part-time basis. With the expansion both of the library and of the work of the press, this arrangement is no longer practical, and the college has made plans to invite an experienced manager to spend several years at Ibadan directing the press and training the Nigerians who will eventually succeed him. To help the University College meet his expenses during the next four years, The Rockefeller Foundation appropriated £12,000 (about $34,200) during 1958.

OTHER GRANTS

British Academy, London: a survey of research in the humanities and social sciences in Great Britain; £6,000 (about $17,100) for a two-year period;

Trustees of Robert College, Istanbul, Turkey: advanced study in the humanities, especially in literature, at Princeton University, New Jersey, by David Garwood, dean; $10,000;

University of the Ryukyus Foundation, Shuri City, Okinawa: to invite distinguished non-Japanese scholars and artists to the university; $8,400;

University of São Paulo, Brazil: equipment for the publication of studies in linguistics, the classics, and mathematics by Brazilian scholars, by the University Press; $6,600;

Mrs. Sadun Katipoglu, director, Turkish-American University Association, Istanbul: to observe the administration and activities of similar organizations in the United States and Europe; $4,200;

Dr. James H. Sledd, Department of English, University of California, Berkeley: to discuss the development of an improved English teaching program in Ceylon at the University of Ceylon and institutions in the United States; $3,685;

Professor Kenji Fujita, professor of philosophy, Ochanomizu University, Tokyo, Japan: to observe work in philosophy and general education in Europe and the United States; $3,200;

University of Pennsylvania, Philadelphia: experimental phonetics equipment for use in studies of factors affecting perception and learning of unfamiliar languages, by Dr. Leigh Lisker; $3,000;

Pan American Institute of Geography and History, Commission on History, Mexico City, Mexico: to invite four Latin American archivists to participate in the sessions on archival administration and training of the Committee on Archives, held in Cuenca, Ecuador, during January, 1959; $2,600;

Dr. Soichi Saito, president, YMCA Institute for Training and Research, Tokyo, and Trustee, International Christian University, Tokyo, Japan, and Mrs. Saito: to visit centers of religious studies in Europe; $2,600;

American Council for Emigrés in the Professions, Inc., New York: supplies and materials to be used by Jozsef Domjan, refugee Hungarian print maker; $1,500;

Yukichi Nakamura, director, Osaka Prefecture Library, Japan: to observe library practices while in the United States and Canada; $800;

Dr. Vitaliano Bernardino, deputy director of public schools, Department of Education, Manila, Philippines: to observe educational organization and drama programs while in the United States; $800;

Fund for grants of amounts not exceeding $500 for allocation under the supervision of the Foundation's Director for Humanities; $5,000.

The Social Sciences

Major Interests, 1958

The Social Sciences as Scientific Disciplines..	$1,806,860
The Quest for Economic Development	992,740
Problems of Contemporary Western Society.	621,550
Legal and Political Philosophy	183,890
Fellowship and Scholarship Fund	500,000

THE SOCIAL SCIENCES

DURING 1958, as in recent years, the Foundation continued to emphasize three principal lines of effort in its social sciences program: extension of fundamental knowledge in the basic social science disciplines; development of key centers of social science training and research in a number of countries in the main underdeveloped areas of the world; and study of certain major social science problems of wide and enduring importance in contemporary Western society.

Basic research in all fields of science, including the social sciences, is concerned with the extension and verification of organized bodies of theory. Although such work is rarely aimed directly at the solution of practical problems, its long-run usefulness can scarcely be overestimated. The enrichment of fundamental knowledge usually does not long fail to increase the effectiveness of applied research; research on practical problems is most likely to be ineffective, however, where basic science is impoverished.

In the social sciences, perhaps even more than in the older sciences, the advancement of fundamental knowledge depends on extraordinarily able people who are thoroughly trained, highly imaginative, and enabled to work on the problems they find important for the advancement of their disciplines. A number of the grants reported in the following pages reflect the Foundation's recognition of the facts which have just been stated.

At present, opportunities to support the growth of the social sciences as scientific disciplines are found almost entirely in North America and Western Europe. Many countries in other parts of the world are increasingly looking to social scientists, however, to undertake research or to offer advice on problems of economic development and related problems of social change or of government. It seems clear that at least the major ones of these countries must develop in one or more of their own universities graduate training and research in the social sciences equal to that in the leading Western universities. Only thus can these countries reasonably hope to get an adequate number of social scientists qualified both by training and by understanding of the country to provide competent research and consultation on problems of development. Only thus, also, can these countries make their proper contribution in the future to the world's body of fundamental knowledge in the social sciences.

Several of the grants described hereafter are designed to help develop or strengthen social science departments in selected universities in countries which have recognized the need and are making efforts to meet it. Some grants were also made to assist qualified social scientists from Western countries to undertake research on problems of development which it is hoped will yield knowledge applicable to a wide area or in some cases to several areas including the West.

The Foundation's greatest long-range contribution, in the future as in the past, is likely to be its support of the extension of fundamental knowledge in key fields of science and learning. Although the special capacities of social scientists to seek solutions to many of society's current problems are by no means unimportant, they are nevertheless quite limited in comparison with the complexity and stubbornness of these problems. While recognizing these facts, the Foundation, like other responsible institutions, is keenly aware of the gravity and urgency of certain of the world's contemporary problems and of the need for the best obtainable efforts to deal with them. Few would deny that the most urgent and persistent question confronting contemporary Western society is how world affairs can be conducted so as to preserve the possibility for human values and potentialities to continue to develop and approach fulfillment among men everywhere. The Foundation has made a few grants to enable leading scholars and men of wide experience in government and international affairs to undertake systematic study and discussion of several facets of this complex problem. In another attempt to make a useful contribution to constructive attacks on this problem, the Foundation is providing the libraries of various foreign ministries, mainly in countries which have assumed responsibility for the conduct of their foreign affairs comparatively recently, with small collections of basic publications in international relations. The ministries which received these gifts in 1958 are listed on pages 335 and 336.

The Foundation also continued during 1958 its special program of grants to enable individual scholars to devote uninterrupted periods to study and reflection on problems of legal and political philosophy. Awards made in 1958 with the approval of an advisory committee of distinguished specialists in the field are described in the last part of this section of the report.

The Social Sciences as Scientific Disciplines

SOCIAL SCIENCE RESEARCH COUNCIL

RESEARCH FELLOWSHIPS AND GRANTS IN AID

Since its establishment more than a third of a century ago, the Social Science Research Council, New York, has played a central role in the development of the social sciences in the United States. Under one major program, the council has stimulated and assisted research in particular fields or subjects which, by reason of neglect, importance, or unusual opportunity have seemed to warrant special emphasis for a period of time. The council's other principal activity has been its continuing program of fellowships and grants in aid through which it has supported research training and individual research projects on a nation-wide basis without restriction as to discipline or subject of interest within the social sciences. The council is the only agency in the United States which maintains a major research fellowship and grant-in-aid program in the social sciences which is not limited either by geographical location of study or by particular field of study.

The Social Science Research Council's awards give assistance to social scientists at a number of different stages in their careers, from late predoctoral or early postdoctoral through the middle and later years of scholarly activity. Fellowships enable advanced students to complete their dissertations and gain research training beyond that which is available in the normal doctoral program, and free young faculty members from some of their academic responsibilities so that they can carry on independent research. Small grants defray the basic costs of important research by mature scholars for which other funds are not available, while larger grants enable faculty members to take leaves of absence or use sabbatical years for the conduct of independent research. During 1957 the council made approximately 125 awards of these various types.

In 1958 The Rockefeller Foundation appropriated $600,000 to the Social Science Research Council to help finance research fellowships and grants in aid during the next three to four years. The new grant brings to approximately $12,300,000 the amount contributed since 1924 by the Foundation and by the former Laura Spelman Rockefeller Memorial for the support of the activities of the council.

YALE UNIVERSITY

COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

The Cowles Foundation for Research in Economics, since its move to Yale University in 1954, has been an integral part of the Department of Economics with particular responsibilities in the department's graduate training and faculty research programs. The staff members of the foundation all hold academic appointments from the university; graduate students participate in foundation investigations under faculty supervision, or prepare doctoral dissertations independently; and at a research seminar, members of the Cowles Foundation and visiting scholars submit their researches for discussion and critical analysis by the group.

The major activity of the investigators at the Cowles Foundation is the search for better tools of analysis, such as theoretical concepts and statistical methods, to apply to substantive economic problems. Currently under way are quantitative investigation of monetary institutions and capital markets, research on efficiency in production and allocation and on the roles of centralized and decentralized mechanisms, and a project designed to formulate improved analytical methods for the study of economic development. In the study of production and allocation, the Cowles group have already made important contributions to information concerning linear programming, inventory and production scheduling, and the theory of industrial location, and are now turning to various related problems in cost allocation and estimation and in production programming.

To help finance the program of the Cowles Foundation for Research in Economics during a five-year period, The Rockefeller Foundation has appropriated $310,000 to Yale

University, New Haven, Connecticut. The Foundation has assisted the Cowles Foundation since 1942 when, as the Cowles Commission, it was affiliated with the University of Chicago.

UNIVERSITY OF MICHIGAN

THEORY OF CONSUMER BEHAVIOR

Because the level of consumer buying is one of the crucial determinants of the level of national income, economists have in recent years given considerable attention to consumption expenditures and the changes that might be expected as a result of alterations in national income or shifts in consumers' attitudes toward the future. In the course of their studies, they have found that the total level of consumption behaves in an apparently unexpected way. One might assume, for example, that people would save a larger proportion of a higher income than of a lower, yet they do not appear to do so for a variety of reasons that might best be assessed through analysis of individual consumer behavior.

Two theories have been advanced to explain this perhaps surprising facet of consumer behavior—one, that relative community status is as influential in the decision to save or spend as the absolute size of income, and the other, that the decision to save or spend rests at least in part on whether the higher income is permanent or a "windfall." The Survey Research Center of the University of Michigan now proposes to examine these two hypotheses in the light of the information it has accumulated in many surveys on the long-term expectations of consumers and on their incomes, expenditures, and savings. The center staff will attempt to relate the consumption patterns of the individual not only to income, assets, and debts, but to economic motives, attitudes, and expectations as well.

A second phase of the Survey Research Center study will concern the methodological problems which arise from generalization to a total population of economic and psychological information obtained through the survey technique, and from the attempt to reconcile Bureau of the Census data with the center's cross-section data. Before embarking on their research, the group will consult with a number of theorists in the field of consumer behavior to clarify further a number of relevant issues.

To help finance the Survey Research Center's new project, The Rockefeller Foundation has made a four-year grant of $150,000 to the University of Michigan, Ann Arbor.

NUFFIELD COLLEGE, UNIVERSITY OF OXFORD

RESEARCH AND TRAINING IN THE SOCIAL SCIENCES

In the past ten or twelve years Nuffield College of the University of Oxford, England, has developed a distinguished program of research and training in the social sciences, including economic theory, applied economics, political theory, political science, public administration, and African studies. More recently, it has become an international graduate training center, and more than half of its graduate students during the past three years have come from other countries.

To strengthen and broaden its research and training programs, the college now plans to institute a program of visiting research fellowships under which scholars from other institutions in the United Kingdom and abroad will come to Oxford for periods varying from one to five years to study and conduct research on subjects related to the interests of the college's official fellows. An additional number of graduate students, both British and foreign, will also be selected for training and research at Nuffield College.

To help finance visiting research fellowships and graduate studentships, The Rockefeller Foundation appropriated £50,000 (about $142,500) in 1958. Part of the grant will meet related research expenses and the costs of library acquisitions in the social sciences. Since 1946 the Foundation has contributed over $275,000 for the development of work in the social sciences at Nuffield College.

UNIVERSITY OF MICHIGAN

STUDY OF LEGISLATIVE REPRESENTATION

The Survey Research Center of the University of Michigan has compiled an impressive amount of data on the political process at the point where the citizen's interest and participation are most widely and directly engaged. Studies of the 1948, 1952, and 1956 presidential elections have revealed the complexity of the factors which influence the decision of the individual voter, and have provided more accurate and precise information on such subjects as the political relevance of social class, the place of the "indifferent" citizen in representative government, the vote of women, and the relation between party membership and political participation.

The Survey Research Center has now begun a study of legislative representation with a view to determining the attributes of the political system, and the individual attitudes and perceptions of both representatives and constituents, that facilitate or inhibit representation. In order to gain better understanding of the interactive process between constituent and representative, the center interviewed Congressional candidates in the 1958 election to discover how they viewed the will of their constituencies and their responsibilities as representatives. Did they, for example, try to mirror the people's wishes, depend on their own judgment, or choose to reflect a minority opinion? Before beginning the survey, the data from which are now being assessed, the center staff consulted with political theorists who discussed and advised on the research design.

To help finance the Survey Research Center's study of legislative representation through February 28, 1960, The Rockefeller Foundation has appropriated $140,000 to the University of Michigan, Ann Arbor. Previous studies of voting behavior by the center have been assisted by Foundation grants.

STANFORD UNIVERSITY

APPLIED MATHEMATICS AND STATISTICS LABORATORY

Whether economists approach the study of economic decision-making from a normative point of view—assessing what the economic agent *should* do—or from the empirical one—determining what the agent will in fact do—they find that most economic choices are made in ways which are still imperfectly understood and which are, moreover, marked by uncertainty. A number of investigators in Stanford University's Applied Mathematics and Statistics Laboratory are attempting to shed light on the actual nature of the decision process in situations of uncertainty by testing the facts of experience against the results derived from theoretical mathematical models based on various recent hypotheses.

Professor Kenneth Arrow of the Stanford laboratory is concentrating on investment decisions, where the element of uncertainty as to the future result is particularly important, with the goal of illuminating the effect of a specialized market, such as the forward market in foreign exchange, on the relation of uncertainty to the degree of decentralization in decision-making. His experimental findings should also contribute information useful to examination of the optimal degree of decentralization of decision-making in an economy.

Professor Patrick Suppes is more concerned with the application of statistical learning theory to social situations, believing that decisions made under uncertainty in situations of social interaction are reducible to the conventional concepts of stimulus, response, and reinforcement. He proposes to explore the degree to which such indefinite concepts as "friendliness," "cohesiveness," and "group pressure" can be sharpened and even quantified under these headings.

To help support the researches on the ramifications and consequences of uncertainty factors in the decision process, The Rockefeller Foundation has made a three-year grant of $117,300 to Stanford University, Palo Alto, California.

UNIVERSITY OF VIENNA

INSTITUTE OF STATISTICS

The electronic computer has made possible the solution of problems containing many variables with unbelievable speed and economy of labor. In many problems in the social sciences, analytical and computational procedures involve large numbers of variables (fifty are often too few) which could not be easily manipulated until the advent of the electronic computer. Now, computers can solve in a few minutes problems which formerly took weeks of laborious arithmetical operations with standard desk calculators. For this reason there appears to be some justification for the recently expressed view that the electronic computer may prove as important to the social sciences as the microscope has been to the natural sciences.

An increasing number of social scientists are currently using computers in attempts to solve a variety of multidimensional problems. In the United States and a number of other countries, these scholars have been given access to electronic computers frequently because of arrangements made by manufacturers with various universities. To enable the University of Vienna to take advantage of an educational discount, The Rockefeller Foundation in 1958 appropriated $80,350, available over a three-year period, to help meet the costs of an electronic computer.

The computer will be installed in the University's Institute of Statistics, and will be used in teaching and research by the Universities of Vienna, Graz, and Innsbruck. All three schools, as well as the Austrian Ministries of Commerce and Education and two other Austrian groups, will share the expenses of purchase and maintenance.

PRINCETON UNIVERSITY

ECONOMETRIC RESEARCH PROGRAM

In 1957 Princeton University formalized the "Economics Research Project" which the Office of Naval Research had established nearly a decade earlier, renaming it the "Econometric Research Program" and incorporating it within the Princeton departmental structure. Professor Oskar Morgenstern, coauthor with the late John von Neumann of *The Theory of Games and Economic Behavior,* continues as director.

Professor Morgenstern and his colleagues are presently conducting research on the use of high-speed computers for the analysis of time series, on the construction of industry-wide production functions, and on certain problems of aggregation in economic analysis. They have also undertaken a comprehensive statistical study of the "acceleration principle"—the relation between changes in demand for final products and the induced demand for capital goods to make these products. Toward the costs of these and related investigations, The Rockefeller Foundation has made a five-year grant of $75,000 to Princeton University.

INSTITUTE FOR ADVANCED STUDY

RESEARCH IN THE SOCIAL SCIENCES

The Institute for Advanced Study, Princeton, New Jersey, is perhaps unique in the opportunity it offers scholars to combine intellectual association with other scholars with complete freedom from administrative and teaching duties. Its unusual arrangements draw visitors from all over the world, who find at the institute a singularly congenial atmosphere for their research.

Organized into two schools—the School of Mathematics and the School of Historical Studies—the institute invites scholars in a wide variety of fields in the social sciences, including legal, economic, and diplomatic history, theoretical psychology, economics, and politics to conduct advanced study and research at Princeton. These visitors come for periods ranging from a few months to several years, to work either individually or in association with the professors and members of the institute.

To help the institute plan more effectively for visiting scholars in the social sciences from the United States and other countries, The Rockefeller Foundation appropriated $60,000 in 1958. Since 1938 the Foundation has provided more than $350,000 for the support of work in the social sciences at the Institute for Advanced Study.

UNIVERSITY OF TURIN

INSTITUTE OF POLITICAL SCIENCE

The Institute of Political Science at the University of Turin, a center for research and advanced training founded in 1952, has been making a particularly important contribution in Italy through its empirical studies of contemporary problems. Recent examples include research on electioneering methods used in the 1958 general election in Italy, and a study of the municipal council of Turin from 1900 to the present designed to relate changing social class structure to political power.

The staff of the institute is interested not only in empirical analysis, but also in more theoretical work in jurisprudence, political philosophy, and the history of political thought. The University of Turin has a long and distinguished tradition of scholarship in these fields.

Currently the institute has several plans for strengthening its program. In the next six years, fellowships will be awarded to nine promising younger scholars, three in each alternate year, to enable them to come to Turin for two years of study and research. In the same period, the institute will invite a number of visiting scholars to Turin from other Italian and foreign universities. In support of these and related phases of the institute's training and research program, the Foundation has made a six-year grant of $45,000.

IFO-INSTITUTE FOR ECONOMIC RESEARCH

LONG-TERM ECONOMIC PROJECTION

The IFO-Institute for Economic Research, which developed a short-term business forecasting technique now in use in several countries, has begun work in the related area of long-term or growth forecasting. The institute will construct a model of the German economy using one of the three recognized methods for long-term economic projection, the simultaneous extrapolation of selected time series. The purpose of the program is to learn more about the method by applying it to new data, in a country where it has not been used before, and to test a number of theoretical innovations.

The Foundation, which helped to support the institute's research on short-term business forecasting, has made a two-year grant of 100,000 German marks (approximately $24,000) toward the costs of the new program.

OTHER GRANTS

University of Oxford, England: a comparative study in the Institute of Statistics of consumer behavior in Great Britain and the United States, under the joint direction of H. F. Lydall of the Institute of Statistics and Dr. J. B. Lansing of the Survey Research Center, University of Michigan, Ann Arbor; $14,080;

Harvard University, Cambridge, Massachusetts: further exploratory study of social structure in relation to community leadership in local communities, under the direction of Professor Samuel A. Stouffer; $10,000;

National Foundation of Political Sciences, Paris, France: a study of French political behavior during the recent constitutional referendum and general elections, under the direction of Dr. Georges Dupeux; $10,000;

University of Helsinki, Finland: research in the Institute of Sociology on the measurement of power relations, under the direction of Professor Erik Allardt and Antti Eskola; 1,816,000 Finnish marks (about $6,175);

University of Lund, Sweden: equipment for research in Swedish economic and demographic history; 24,225 Swedish crowns (about $4,700);

Professor Erich Schneider, Department of Economics, Christian Albrecht University, Kiel, Germany: to visit university centers of teaching and research in economics in the United States; $4,355;

Northwestern University, Evanston, Illinois: toward the costs of research on the life and works of Leon Walras, under the direction of Professor William Jaffe; $4,300;

Queen's University of Belfast, Northern Ireland: cataloguing of Irish economic pamphlets, under the direction of Dr. R. D. Collison Black, Department of Economics; £1,125 (about $3,200);

Professor Fred Alexander, University of Western Australia, Nedlands, and Mrs. Alexander: to visit universities in the United States en route from Canada to Australia; $900;

Fund for grants of amounts not exceeding $500, for allocation under the supervision of the Foundation's Director for Social Sciences; $5,000.

The Quest for Economic Development

VANDERBILT UNIVERSITY

GRADUATE TRAINING PROGRAM IN ECONOMIC DEVELOPMENT

For some years Vanderbilt University in Nashville, Tennessee, has been developing a broad training and research program on the problems of economic development. The Graduate Training Program in Economic Development, administered by the Department of Economics and Business Administration, has an annual enrolment of about 50 students, including about 25 scholars and government administrators from other countries many of whom are sponsored by the International Cooperation Administration, the Ford Foundation, and the Institute of International Education.

Through the joint efforts of the departments of economics and business administration, and of political science and sociology, the training program in economic development includes consideration of the important roles played by political and sociological factors. In their research on economic development in the South, the faculty at Vanderbilt have gained useful insight into the problem as a whole.

The university now plans to strengthen the foreign service phase of its program in economic development, both to enrich its offering to its own students and to assist foreign universities in building up courses in the social sciences. A number of additional social scientists will be appointed to the Vanderbilt faculty to allow staff members to accept visiting professorships in foreign universities without disrupting the teaching program. On their return to Nashville after service overseas, the faculty members will be given a further semester free of academic responsibilities during which they will incorporate the results of their experiences in research publications or teaching materials. Thus the entire group will be able to profit from the faculty's visits abroad.

To help Vanderbilt University expand its work in economic development, The Rockefeller Foundation has appropriated $300,000 for use over an eight-year period. The former Laura Spelman Rockefeller Memorial, the General Education Board, and the Foundation, all Rockefeller-endowed organizations, have provided almost a million and a half dollars for Vanderbilt's programs in the social sciences.

POPULATION COUNCIL, INC.

FELLOWSHIPS

Believing that vigorous efforts must be made to find solutions to the grave problems caused by the rapid growth of the world's population, a group of distinguished scientists and laymen established the Population Council, Inc., in 1952 to "stimulate, encourage, promote, conduct, and support significant activities in the broad field of population." The work of the council encompasses both the demographic and medical aspects of population, and is designed to increase knowledge and understanding of the many problems associated with population growth and to train the personnel needed to deal with them.

Under its demographic program, the council awards fellowships, assists in the establishment and support of research and training centers in non-Western countries, and makes grants for research on relevant subjects. Emphasis is given to the underdeveloped, and already often overcrowded countries, where dramatic declines in death rates, with no corresponding reduction in birth rates, have resulted in such rapid population growth that ambitious programs for economic development are threatened with ultimate frustration.

The demographic fellowships awarded by the council are providing for the training of personnel in the underdeveloped countries who can serve their governments and their peoples in their own languages and in terms of their own cultures. These specialists are increasingly needed to study and define population trends, and to analyze the implications of the trends for the economy, living standard, health, education, and social well-being of their people.

The council's medical program, carried on in its own laboratories and through grants to other investigators, is focused on the field of reproductive physiology, and has as its major goal the development of effective methods for the physiologic regulation of fertility. Medical fellowships have enabled foreign scientists to visit American departments of biochemistry, physiology, embryology, urology, and obstetrics for advanced research training in the field of reproduction.

To help finance fellowships to be awarded to candidates from Asia, Latin America, the Middle East, and Africa during the next three years, The Rockefeller Foundation in 1958 appropriated $300,000 to the Population Council, Inc., New York.

INDIAN SCHOOL OF INTERNATIONAL STUDIES

TRAINING IN INTERNATIONAL RELATIONS

In the years since independence, India has increasingly needed men and women in all walks of life who can participate knowledgeably in the interpretation of international developments and in the conduct of foreign affairs. Specialists are needed to analyze and evaluate contemporary events as an aid to public understanding of India's role in world affairs. At the governmental level, experts are needed to staff the agencies which formulate and execute the country's foreign policies.

In response to these needs, the Indian School of International Studies was established in 1955, in affiliation with the University of Delhi, to provide specialized training in international fields, both topical and regional, and to foster research. Its three-year course leads to the Ph.D. degree and its students enter with an M.A. degree in one of the basic social science disciplines. Dr. A. Appadorai is director of the school.

To build a permanent faculty as rapidly as possible, the school has inaugurated a staff training program under which candidates of promise may be given one to three years' advanced experience to equip them for appointment. In the meantime the school has filled certain posts by inviting foreign scholars on a temporary basis.

Approximately $150,000 is required for the staff training program over a seven-year period. The Rockefeller Foundation has appropriated half this amount, $75,000, to the school. The remainder will be secured from other sources.

KYOTO UNIVERSITY

AMERICAN AND SOCIAL STUDIES

Since the war Kyoto University has cooperated with Doshisha University, also in Kyoto, in an American studies program partially financed by The Rockefeller Foundation. Now both universities are ready to develop separate American studies courses within their own regular curricula, and Kyoto has begun its efforts in this direction by assigning a number of chairs to social sciences and humanities disciplines broadly related to American studies.

In the law faculty of Kyoto, one chair will be assigned to international politics and international relations and another to American law. In other faculties, chairs will be designated for American literature, economics, comparative education, and social anthropology. To enable the Japanese scholars appointed to the new posts to undertake advanced study in the United States, the Foundation has appropriated $60,000 for use during the period ending March 31, 1962. A small portion of the grant will finance the purchase of books for the library.

Under the Foundation's program in humanities, a second grant of $60,000 was made in 1958 to help Doshisha University in the development of its separate American studies program.

INSTITUTE OF APPLIED ECONOMICS

RESEARCH IN ECONOMICS

Since its establishment in 1944, the Institute of Applied Economics in Paris has become an important center for the analysis of French and international economic problems. Among its current interests are economic development, especially in Latin America, the Middle East, and the Belgian Congo, and the economies of the "peoples' democracies." Recent research included studies of the dangers of excess investment in the French inflation, of price rigidities in French agriculture, and of prospective profits in the French economy from 1957 to 1961.

The institute encourages intellectual exchange between French and foreign economists through a series of seminars which it sponsors in Paris and which scholars from different parts of the world attend. In addition it cooperates in an international research project on economic growth directed by Professor Simon Kuznets at Johns Hopkins University.

For further research by the institute, The Rockefeller Foundation in 1958 made a six-year grant of $50,000. Previous appropriations for this purpose totaled approximately $113,000.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CENTER FOR INTERNATIONAL STUDIES

The need to decide whether alleviation of a short-run difficulty will impede long-run progress, a problem in any economy, is of particular importance to those responsible for economic policy in underdeveloped economies. Will a policy adopted to combat inflation, for example, have the effect of pushing the economy back into a condition of stagnation? Or will a policy which achieves deflation eventually but at the expense of an initial increase in inflation have long-run benefits which warrant its use?

To analyze the behavior of economic factors crucial for self-sustaining growth in underdeveloped economies, Dr. Edward P. Holland of the Massachusetts Institute of Technology plans to investigate these and similar questions by means of an analog computer, a device which permits instantaneous and simultaneous observation and recording of the behavior of a few or many variables over periods of time. Dr. Holland will construct a model of an underdeveloped economy—one in which the time paths of such variables as income, capital accumulation, and profits, show no per capita increase—and then follow on the graph generated by the computer the behavior in time of all the variables when one, such as government investment in public works, is increased. If the conditions as originally set up show no economic growth, Dr. Holland and his co-workers will be able to make arbitrary adjustments in the model to establish the critical value of various parameters at which stagnation is overcome.

To help support Dr. Holland's research at the Center for International Studies through 1959, The Rockefeller Foundation has appropriated $38,680 to the Massachusetts Institute of Technology, Cambridge.

UNIVERSITY OF THE ANDES

INSTITUTE OF ECONOMIC RESEARCH

In the less than ten years since its founding, the University of the Andes, Bogotá, Colombia, has developed a high-caliber curriculum in economics. Having established its basic teaching program on a firm footing, it now plans to organize as part of the School of Economics an institute devoted to the investigation of fundamental, long-range economic problems in Colombia and neighboring countries, and to the training in research techniques of young economists from this region.

To date most economic research in Colombia has been sponsored by groups whose fields of inquiry have been more or less determined by their special functions, such as the Coffee Federation, the Agricultural Credit Bank, and the National Federation of Merchants. The program of the new institute should constitute a valuable supplement to the efforts of these other organizations.

To make possible the appointment of a full-time director for the new institute, the Foundation has appropriated $36,000 to the University of the Andes, for use through August 31, 1960.

OTHER GRANTS

University of Washington, Seattle:

Study of the national income and expenditure statistics of underdeveloped countries, under the direction of Dr. Harry T. Oshima; $11,400 for a two-year period;

Dr. W. Rhoads Murphey, associate professor of geography; to conduct an experimental summer seminar and research related to the development of American studies and the social sciences at the National Taiwan University, Taipei, National Republic of China; $5,370;

Al-Hikma University of Baghdad, Iraq: Dr. Walter H. Zukowski, associate professor of business administration, Colby College, Waterville, Maine; to serve as visiting professor of business administration; $10,000;

Saburo Okita, director, Planning Bureau, Economic Planning Agency of the Japanese government, Tokyo, and Mrs. Okita: to study the work of private and government centers of economic research and planning in several countries; $10,000;

Fund for the International Conference of Agricultural Economists, Inc., Urbana, Illinois: toward the expenses of agricultural economists from Latin America and the Caribbean islands invited to attend the conference's triennial meeting in India; $10,000;

University College of Rhodesia and Nyasaland, Salisbury:

A study by the Departments of Economics and of African Studies of the economic behavior of urban Africans; $10,000;

Social science library materials and research equipment; $2,230;

University of Helsinki, Finland: research in the Institute of Social Policy on social change in a rapidly developing far northern economy, under the direction of Professor Heikki Waris; $10,000;

University of São Paulo, Brazil: toward the costs of research on the economic history of São Paulo and of research training, under the direction of Professor Alice P. Canabrava; $9,250;

University of Brazil, Rio de Janeiro: an experimental program in the Faculty of Economic Sciences to test the feasibility of full-time instruction in the social sciences in Brazil; $9,000;

Professor Kameo Matusita, professor of statistical mathematics and head, First Division, Institute of Statistical Mathematics, Tokyo, Japan: to visit and study at corresponding institutions in the United States; $7,700;

Professor S. H. Frankel, Nuffield College, University of Oxford, England: research in Latin America and the United States in connection with a comparative study of economic development in multiracial countries; $4,100;

Dr. Eiji Kometani, professor of traffic engineering, Kyoto University, Japan: to study methods of operations research in the United States; $4,000;

Kyushu University, Fukuoka, Japan: books, journals, and equipment for the Institute of Mathematics; $4,000;

Massachusetts Institute of Technology, Cambridge: completion of a book on the Indian sugar industry as a case study in marketing the indigenous products of underdeveloped areas, by Leon Hirsch, research assistant, Center for International Studies; $3,500;

Rhodes-Livingstone Institute for Social Research, Lusaka, Rhodesia: expenses of African junior research assistants and of library acquisitions; $3,500;

University of Chicago, Illinois:

Professor Josip Roglic, chairman, Department of Geography, University of Zagreb, Yugoslavia; to visit the United States and the United Kingdom to consult with American and British geographers; $3,500;

Expenses of a meeting of specialists in Asian economic history held under the auspices of the Research Center in Economic Development and Cultural Change; $2,000;

Professor Hiroshi Saito, School of Sociology and Politics of São Paulo, Brazil: to visit Japan to continue studies of the acculturation of Japanese emigrants to Brazil; $3,200;

University College of East Africa, Kampala, Uganda: research and related travel in East Africa by faculty members in the social sciences; £1,000 (about $2,850);

Miss Tan Giok-lan, Indonesian sociologist: to study at Cornell University, Ithaca, New York, and other centers in the United States; $2,200;

Professor Horace Miner, professor of sociology and anthropology, University of Michigan, Ann Arbor: to continue study of cultural change in northern Nigeria; $1,800;

Fletcher School of Law and Diplomacy, Medford, Massachusetts: toward the costs of completion of graduate studies, by Miss K. Janaki K. Amma; $1,410;

University of Wisconsin, Madison: a study of civic cohesion in Bombay, India, under the direction of Dr. Henry C. Hart, professor of political science; $1,200;

Professor John M. Hunter, acting head, Department of Economics, Michigan State University, East Lansing: to visit Colombia to consult with the rector and members of the Faculty of Economics of the University of the Andes, Bogotá; $750;

National Chengchi University, Taipei, National Republic of China: additional costs of books and journals in the social sciences; $100.

Problems of Contemporary Western Society

COLUMBIA UNIVERSITY

SCHOOL OF INTERNATIONAL AFFAIRS

Over the years a number of distinguished scholars at Columbia University have produced a variety of valuable books and articles on international organization, recently including *The United Nations and the Maintenance of International Peace and Security; Korea: A Study of U.S. Policy in the United Nations; The International Problem of Governing Mankind;* and *Charter of the United Nations.* In addition, the group has encouraged research on international organization elsewhere in the country by bringing to Columbia, for each of the past two years, a promising young scholar in the field from a smaller university.

Columbia now plans a broader and more closely defined program. Most of the major aspects of international organization will be studied, and the results published in a series of monographs. The university will continue to bring to New York one young American scholar and will add to the program one or more young foreign scholars each year. More mature foreign scholars may also be invited for shorter periods of research.

In 1956 The Rockefeller Foundation appropriated $30,000 to Columbia University for use by the School of International Affairs in studies of international organization, and in 1958 an additional $125,000, to be available through August of 1964.

HARVARD UNIVERSITY

CENTER FOR INTERNATIONAL AFFAIRS

Harvard University is establishing a new Center for International Affairs to bring together scholars and diplomats for joint examination of foreign relations. Officials who deal daily with the practical problems of international affairs for United States and foreign governmental, military, and private agencies will be invited to spend several months or several years at the center working with academic experts from the United States and other countries. The collaboration will permit the practitioners of diplomacy to gain greater insight into the fundamental implications of the concrete situations with which they are confronted, and the scholars to submit their researches to review by men experienced in handling practical problems. All the research and writing projects, whether individual undertakings or cooperative enterprises, will be subjected to the informed criticism of members of the center.

Each year work at the center will be organized into four or five seminars on topics selected on the basis of the interests and special qualifications of faculty and participants. The special seminars will be related, however, to the five broad areas selected for continuing research and attention at the center—Europe and the Atlantic community, economic and political development, the role and control of force, international order, and Far Eastern problems. From time to time the group will undertake projects on other important subjects.

To help the center meet research expenses during its initial years, The Rockefeller Foundation has appropriated $120,000 to Harvard University, Cambridge, Massachusetts.

COLUMBIA UNIVERSITY, THE UNIVERSITY OF LONDON, AND THE RAND CORPORATION

RESEARCH ON THE LEGAL AND POLITICAL PROBLEMS OF OUTER SPACE

As scientific and technological developments bring closer man's conquest of outer space, the legal and political problems concerning administration and control become increasingly urgent. Man's success in launching satellites is still so recent, however, that even the many problems involved have not yet been clearly formulated, and still less have specific suggestions and proposals for their solution been advanced. It is hoped that some of the new conceptions needed for productive study in this critical field may emerge from the researches of a growing number of investigators.

A group at Columbia University, New York, is analyzing some of the aspects of international administration of outer space by assessing comparable proposals for the control of areas, such as Antarctica, in which conflicting claims to national sovereignty are absent or not generally accepted. Professor Philip C. Jessup is directing the research, which is being supported by a $20,000 grant from The Rockefeller Foundation.

Dr. Bin Cheng, lecturer in international law at the University College, University of London, will attempt to define some of the legal aspects of outer space problems by considering such subjects as the legal status of space vehicles, space law in time of war, and the problems of order in outer space. A $6,700 grant will finance his research. To help the Rand Corporation, Santa Monica, California, hold a three-day conference at which scientists and social scientists will discuss such topics as international law and outer space, space technology, and the space race and international politics, the Foundation has made $6,250 available.

The funds allocated for these projects are part of a $60,000 appropriation made by the Foundation in 1958 for the support of a variety of studies of the legal and political problems of outer space.

UNIVERSITY OF CAMBRIDGE

HISTORY OF ENGLISH CRIMINAL LAW

The first three volumes of the substantial *History of English Criminal Law and Its Administration from 1750* by Dr. Leon Radzinowicz have already been published: *The Movement for Reform; The Clash Between Private Initiative and Public Interest in the Enforcement of the Law;* and *Cross-Currents in the Movement for the Reform of the Police.* Succeeding volumes will deal with the maintenance of public order, the prevention of crime, the treatment of offenders, and the emergence of the modern machinery of justice.

Professor Radzinowicz, who is director of the Department of Criminal Science of the University of Cambridge, has made extensive use of original sources: for example, more than 400 volumes of manuscript documents preserved at the Public Record Office, another 7,000 documents relating to the Home Office, the Law Officers, the Treasury, and other departments, the records of New Scotland Yard, and various libraries. Similar source material will be used for the remainder of the *History.*

The Rockefeller Foundation is continuing aid begun in 1951 with a new grant for £15,000 (about $42,750) to the University of Cambridge, England, to help meet the expenses of completing the *History.*

SOUTHERN METHODIST UNIVERSITY

STUDIES IN INTERNATIONAL LAW

The Graduate School of American and Foreign Law of Southern Methodist University, Dallas, Texas, is a cooperative endeavor of the university's School of Law and the Southwestern Legal Foundation. An international center where legal scholars and attorneys can study the law, institutions, and diverse legal systems in effect in different nations, the graduate school has established four programs for advanced legal studies.

The Law Institute of the Americas was created so that lawyers trained in the Civil law of Latin America may study Anglo-American law, and North American attorneys trained in the common law may study the Civil law systems of Latin America and Continental Europe. The Academy of American Law offers courses in the theory and practice of American political and legal institutions and systems primarily for lawyers and scholars from outside the Western Hemisphere. A Foreign Specialist Program in international and comparative law is designed especially for American attorneys wishing to train for service abroad, and the General Graduate Studies Program offers graduate work in common law.

The school, which annually attracts up to 50 students —about half of its total enrolment—from the newer nations and underdeveloped areas, will use a $40,000 grant from The Rockefeller Foundation over a five-year period toward the costs of an additional professorship in international law.

OTHER GRANTS

University of London, England: a study of government and politics in Ghana since 1946, by Dennis G. Austin, Institute of Commonwealth Studies; *£5,610 (about $16,000) for a three-year period;*

Carnegie Endowment for International Peace, New York:

A study of the procedure and practices of the United Nations General Assembly; $14,600;

Toward the expenses of American participation in the conference of the Bilderberg Group held in England in September, 1958; $10,000;

Advanced training abroad for young Ceylonese in the field of foreign service, selected by the Ministry of Defence and External Affairs of Ceylon, Colombo; $10,000;

Harvard University, Cambridge, Massachusetts:

A preliminary study of the allocation and administration of resources for scientific research and development, by the Graduate School of Public Administration; $10,000;

Research on political parties and interest groups in Great Britain and their influence on Britain's national and foreign policies, by Professor Samuel H. Beer, chairman, Department of Government; $9,000;

The National Council of the Churches of Christ in the United States of America, Department of International Affairs, New York: preparation of basic research papers for its World Order Study Conference; $10,000;

New School for Social Research, New York: research on structural trends in Soviet society, under the direction of Professor Arvid Brodersen; $9,900;

Columbia University, New York:

Continued research on the procedures and techniques of United Nations semi-parliamentary diplomacy, by Dr. Alexander W. Rudzinski, School of International Affairs; $9,500;

Research on the wage-price spiral, under the auspices of the American Assembly; $8,500;

Columbia University Press; toward the publication costs of *American Trade Union Democracy,* by the late William M. Leiserson; $5,000;

University of Florida, Gainesville:

Research on legal problems arising from territorial claims in the Arctic and Antarctic regions, by Dr. Oscar Svarlien, professor of history and political science; $9,300;

Research on contemporary German foreign policy, by Dr. Frederick H. Hartmann, professor of political science; $8,500;

Johns Hopkins University, Baltimore, Maryland: School of Advanced International Studies, Washington Center of Foreign Policy Research; study of the role of Congress in foreign policy, by Dr. Roger Hilsman, Library of Congress, Washington, D.C.; $9,000;

Vanderbilt University, Nashville, Tennessee: studies from the legal standpoint of strategic, practical problems of economic and social development in the southern United States, by the Law School; $9,000;

Professor Robert C. Pratt, McGill University, Montreal, Canada: to study political change in British Africa at the Institute of Commonwealth Studies, University of Oxford, England; $6,000;

Massachusetts Institute of Technology, Cambridge: study of selected Anglo-American theories of international relations, relating the concepts of national interest and international community, by Professor

Laurence W. Martin, Department of Economics and Social Science; $5,500;

Stanford University, Palo Alto, California:

Professor Takeyoshi Kawashima, professor of the sociology of law, Tokyo University, Japan; to serve as visiting scholar; $5,000;

Dr. Boris C. Swerling, associate professor of economics, Food Research Institute; to study the legal aspects of international trade in agricultural commodities at the Stanford School of Law; $1,000;

University of Southern California, Los Angeles: study of the relation to judicial interests and values of selected decisions of the International Court of Justice, by Dr. Carl Q. Christol, associate professor of political science; $5,000;

A collection of basic books in international relations for the Foreign Office, Rangoon, Burma; $5,000;

A collection of basic books in international relations for the Ministry of Defence and External Affairs of Ceylon, Colombo; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Djakarta, Indonesia; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Teheran, Iran; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Baghdad, Iraq; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Rabat, Morocco; $5,000;

A collection of basic books in international relations for the External Affairs Branch, Prime Minister's Office, Lagos, Nigeria; $5,000;

A collection of basic books in international relations for the Department of Foreign Affairs, Manila, Philippines; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Khartoum, Sudan; $5,000;

A collection of basic books in international relations for the Ministry of Foreign Affairs, Bangkok, Thailand; $5,000;

A collection of basic books in international relations for the Department of Foreign Affairs, Saigon, Vietnam; $5,000;

Publications in international law and related fields for the library of the Permanent Secretariat, Asian-African Legal Consultative Committee, New Delhi, India; $2,500;

University of Notre Dame, South Bend, Indiana: a symposium on the role of the Supreme Court in the American constitutional system, under the auspices of the Law School; $2,500;

Dr. Chang Kuei-yung, research professor of diplomatic history, Institute of Modern History, Academia Sinica, Taipei, National Republic of China: to work on Sino-American collections in the United States; $1,800;

American Academy of Arts and Sciences, Boston, Massachusetts: a conference to complete plans for a proposed study of technical problems of arms limitation; $1,200.

Legal and Political Philosophy

PERMANENT COMMITTEE FOR THE OLIVER WENDELL HOLMES DEVISE

HISTORY OF THE SUPREME COURT

In a multivolume history of the Supreme Court being prepared under the auspices of the Permanent Committee for the Oliver Wendell Holmes Devise, a group of distinguished legal and historical scholars are tracing the vital growth and development of the Court over a period of more than a century and a half with the aim of portraying the Court as a living institution. They are viewing the Court as an expositor of constitutional doctrine, as an agency both shaping and reflecting the economic, social, and intellectual evolution of the country, and as an organ of collective decision-making.

The major expenses of the history are being paid by the Permanent Committee from funds bequeathed to the United States by Mr. Justice Holmes prior to World War II. The committee was appointed by the President of the United States from nominations made by the American Philosophical Society, the Association of American Universities, the American Historical Association, and the Association of American Law Schools.

A Rockefeller Foundation grant of $37,500 to the Permanent Committee, Washington, D.C., will be used to free a number of the authors from teaching and other academic commitments during certain periods to allow them to give undivided time to their work on the history of the Supreme Court.

OTHER GRANTS

University of Florida, Gainesville: a comparative study in experimental jurisprudence of the relationship between law in action and written law in France, Germany, and the United States, by Professor Walter O. Weyrauch, Law School; $10,000;

New School for Social Research, New York: study of the political philosophy implicit in the writings of Shakespeare, by Professor Howard B. White, Graduate Faculty; $9,000;

Vanderbilt University, Nashville, Tennessee: study of the conceptions of the source, nature, and ends of law in three contemporary approaches to jurisprudence, by Professor Samuel E. Stumpf, Department of Philosophy; $9,000;

Atlanta University, Georgia: analysis and criticism of seven main contemporary ethical justifications of democracy, by Professor Samuel DuBois Cook, chairman, Department of Political Science; $8,000;

Cornell University, Ithaca, New York:

Research on Moslem law and its interrelationship with Hindu law, by Professor Harrop Freeman, Law School; $8,000;

Study of the patterns of democratic government, by Dr. Howard Mark Roelofs, Department of Political Science; $3,000;

Harvard University, Cambridge, Massachusetts: comparative study of the political theories of the Western nations from 1750 to 1850, by Professor Louis Hartz, Department of Government; $8,000;

Pennsylvania State University, University Park: study of modern democratic theory, by Dr. Neal Riemer, associate professor of political science; $8,000;

University of Puerto Rico, Río Piedras: study of the philosophy of criminal justice, by Professor Helen Silving, Law School; $8,000;

Washington University, St. Louis, Missouri: a systematic study of the political thought of Karl Kautsky, by Dr. John H. Kautsky, assistant professor of political science; $8,000;

Wesleyan University, Middletown, Connecticut:

Study of the activities of organized interest groups in Supreme Court cases as affecting theories of justice and representation, by Dr. Clement E. Vose, associate professor of government; $8,000;

Continued research on theories of political organization in terms of American democratic concepts and institutions, by Professor Elmer E. Schattschneider, Public Affairs Center; $5,000;

University of Minnesota, Minneapolis: completion of an original study of political participation, affiliation, and political belief based on field research materials designed to test propositions by de Tocqueville, Hofer, and others, by Professor Herbert McClosky, Department of Political Science; $6,500;

University of Oklahoma, Norman: interpretation of the assumptions and conditions upon which contemporary constitutional government depends, by Professor Edwin Fogelman, Department of Government; $6,400;

Michigan State University, East Lansing:

Completion of an analysis of the political philosophy of Harold D. Lasswell, by Dr. Robert Horwitz, associate professor of political science; $6,000;

Completion of a volume on the theory of the public interest in governmental decision-making, by Dr. Glendon A. Schubert, Jr., associate professor of political science; $1,500;

University of Chicago, Illinois: study of the concept of public interest and its sources in politics and public administration in the decisions of public officials in Great Britain and the Scandinavian countries, by Dr. Edward C. Banfield, associate professor of political science; $5,500;

University of Georgia, Athens: research, under the supervision of Professor Lon Fuller at the Harvard University Law School, Cambridge, Massachusetts, on the political philosophies of modern legal movements, by Dr. George S. Parthemos, assistant professor of political science; $5,000;

Washington and Jefferson College, Washington, Pennsylvania: critical analysis of the political philosophy of Walter Lippman, by Dr. Benjamin Nimer, associate professor of political science; $5,000;

St. Olaf College, Northfield, Minnesota: study of the social-political thought of Kierkegaard with special reference to his views on the nature of man and of politics, by Professor Howard V. Hong, chairman, Department of Philosophy; $4,650;

St. Mary's College, California: research on the concept of the "common good" in political theory, by Dr. Victor C. Ferkiss, assistant professor of political science; $4,000;

University of San Francisco, California: study of the philosophic principles underlying certain fundamental decisions in American jurisprudence, by Father Richard A. Vachon, S.J., professor of law; $3,500;

Columbia University, New York: completion of a study of law and social change, by Professor Wolfgang Friedmann, Law School; $2,500;

Syracuse University, New York: comparative study of presidential leadership, with special emphasis on President James Monroe, by Professor Stuart Gerry Brown, Maxwell Graduate School of Citizenship and Public Affairs; $2,000;

Yale University, New Haven, Connecticut: investigation of the problem of the philosophical basis of judicial review, by Dr. Walter F. Berns, assistant professor of political science; $1,500;

Dr. Kan-ichi Fukuda, assistant professor of political science, Tokyo University, Japan: to continue research at the University of Oxford, England, on problems of democratic theory, particularly in the nineteenth century, and to participate in the Twelfth Congress of Philosophy in Vienna and the World Congress of Political Sciences in Rome; $340.

Agriculture

AGRICULTURE

Major Interests, 1958

Aid to Research and Teaching	$2,219,005
Grants with Long-Range Relation to World's Food Supply	569,800
Operating Programs	2,185,380
Fellowship and Scholarship Fund	800,000

AGRICULTURE

After 15 years of experience in developing a pattern for improving the quantity and quality of basic foods for the populations of certain of the less-developed nations, The Rockefeller Foundation is convinced of the useful potential of a program which comprises direct cooperation with selected countries, intensive training activities, and the support of critical research efforts designed to expand the frontiers of knowledge in agricultural science. It has now been demonstrated that cooperative international projects directed toward the solution of the production problems of basic food crops and animals can resolve many of them, with resulting nutritional and economic benefit. It has further been shown that carefully planned training programs collateral to the operating activities are effective in extending the research projects and their results over a wider geographic area, and in building the entire effort into indigenous patterns. Coincidentally, emphasis on continuing research helps to provide a flow of information and material which permits greater advances in each succeeding year.

During the first years of the Foundation's work in the field of agriculture, effort was concentrated in Latin America, which is still the principal base. The parent program in Mexico is flourishing, and materials and methods developed there jointly by Mexican scientists and Foundation field staff have been extremely useful in countries with comparable climatic and other conditions in many parts of the world.

The younger programs in Colombia and Chile are making rapid progress, and the recently established operation in India gives promise of making definite contributions to the further agricultural progress of that country.

The Foundation is currently attempting to utilize its accumulated experience and information to catalyze similar programs on a broader basis. Thus, special attention is being paid to the training of scientists from other countries who can initiate and develop crop and livestock improvement projects at home after returning from a training experience. Collateral support is provided for the aid of indigenous institutions of science and education as selected opportunities occur, and local programs directly related to crop and animal production are encouraged and supported when possible.

The specter which continues to haunt society is that of hunger, with all its unhappy and threatening implications. The demographic problem associated with human nutrition is, of course, enormous and one which must be taken into consideration in any rational approach to its solution. In its agricultural program, The Rockefeller Foundation believes that its primary responsibility concerns the economic development of available resources in ways that will gradually improve agricultural productivity and the nutrient quality of the product. It is believed that this can best be done by aiding local enterprise and initiative through support of national agencies and the growing body of individuals with special training and competence in the several disciplines related to agricultural science and economics.

The Foundation is currently analyzing its past experience and seeking to apply this somewhat more broadly in areas where needs and opportunities are apparent. Thus, while activities in Latin America are being intensified, at the same time a series of efforts have been initiated in several countries of Asia in addition to India. A most recent development has been a growing interest in various countries in Africa, and a modest beginning has been made in cooperation with selected institutions in a small but increasing number of the nations of that continent.

It is recognized that the areas which are of concern to the Foundation are vast and that their needs are beyond the resources of any single agency or group of institutions seeking to be of assistance. Thus, The Rockefeller Foundation takes the position that an exhaustive and continuous study is an essential preliminary to decisions concerning the wisest investment of time and available resources. The Foundation's role can be only a modest one, but its objective is to ensure that this role is an increasingly significant one with respect to the well-being of the peoples concerned.

Aid to Research and Teaching

BALWANT RAJPUT COLLEGE

AGRICULTURAL TEACHING AND RESEARCH

One of India's principal centers for agricultural teaching and research, Balwant Rajput College, Agra, India, has long been interested in the educational needs of India's rural population, and has been particularly successful in bridging the gap between agricultural theory and local practice. When the college's new center in Bichpuri is completed, and all agricultural activities transferred there, the college will have a full and integrated program of education, research, and extension to prepare students even more effectively for their future roles in India's agricultural economy.

Roads and irrigation facilities are being constructed and improved at the 436-acre farm in Bichpuri, and two dozen staff residences, three dormitories, a medical clinic, classroom building, and extension unit have already been constructed. Other main buildings are under way, and three science buildings, a library, and certain other facilities are included in future plans. The college has received funds from the Ford Foundation for extension training and an engineering workshop, and the International Cooperation Administration is assisting in research and training in soil management.

To help meet the costs of equipment and library facilities at the Bichpuri center, The Rockefeller Foundation in 1958 appropriated $200,000 to Balwant Rajput College, an affiliate of the University of Agra. In 1956 the Foundation made grants totaling $80,000 for related agricultural programs of the college.

UNIVERSITY OF SAN MARCOS

ANIMAL SCIENCE

Originally a military establishment that trained veterinarians for the army, the Faculty of Veterinary Medicine was incorporated in 1946 into the 400-year-old University of San Marcos, Lima, Peru. The college now offers broad professional education suited to the general needs of the country.

Stressed in the school's teaching and research program is the study of llamas, alpacas, and vicuñas—animals unique to the high Andean region and of considerable economic importance. Many animal disease and nutrition problems existing in Peru prevail throughout the Andean highlands, and as a result the research findings and methods taught at the faculty have application in the neighboring countries of Colombia, Ecuador, and Bolivia.

A completely new and greatly enlarged plant for the Faculty of Veterinary Medicine is now being built as part of the expansion program of the university. The new buildings will be located on a recently purchased tract outside Lima near the National School of Agriculture. They will include an administration, classroom, laboratory, and library unit; animal clinics; an auditorium; a student center; and dairy and poultry farms.

To help meet the costs of the new facilities, The Rockefeller Foundation has appropriated $175,000, to be released to the University of San Marcos in the next year: $25,000 for the library without conditions, and $150,000 for equipment and construction as matching funds are raised in Peru.

CENTRAL RICE RESEARCH INSTITUTE

RESEARCH ON RICE PRODUCTION

If Asia is to solve its food problems, most of its countries will need to increase their rice yields far beyond the present levels. The attainment of this objective will depend on the development, simultaneously, of higher yielding varieties, more efficient cultural and fertilizer practices, and more effective controls for diseases and pests.

The various factors that affect the productivity of rice are interrelated, and should be studied together. The Central Rice Research Institute, Cuttack, India, is well equipped for this purpose, having staff and facilities for research on all the important aspects of rice production. Since its establishment by the Indian government in 1946, the institute has become one of the leading rice research centers in the world.

At present the government is adding a new laboratory to the institute to make possible more extensive research in genetics and breeding, physiology, agronomy, disease and insect control, and on rice quality. One section of the laboratory has been built. The remaining sections are scheduled to be completed in the next several years.

Among the subjects to be studied in the new laboratory are the anatomy and embryology of rice; the cytological behavior of natural and induced mutants; rice quality as influenced by variety and cultural practices; the nature of varietal resistance to disease; the physiologic specialization and virulence of the pathogens responsible for important rice diseases; the biological control of rice insects; and the nitrogen nutrition of the rice plant.

For laboratory and field equipment and for library materials to be used in connection with the expanded program, the Foundation has appropriated $125,000 to the institute, to be available through the next three years.

INDIAN AGRICULTURAL RESEARCH INSTITUTE

LIBRARY DEVELOPMENT

India's present food production goals call for a five per cent increase every year, an increase which can be realized only if there are adequate numbers of agricultural scientists to take the lead in expanding educational programs, introducing more productive farming practices, breeding better crop varieties, and advising farmers. According to a 1957 Indian government survey, some 23,000 graduate and 4,500 postgraduate agricultural scientists will be needed in Indian agriculture during the period of the third five-year plan, 1961-1966.

The Indian Agricultural Research Institute in New Delhi, already one of India's major research centers in the field, is inaugurating a postgraduate course in order to meet its responsibilities for training many of the agricultural scientists needed by the country. The new program will cover all the major fields of agricultural science, and will be patterned after that followed in the leading agricultural universities in the United States. Significant features of the course will be the arrangements for major and minor subject matter training and research experience with practical problems the students will have to face in their future careers in education, research, or extension.

The Government of India is providing living accommodations for the students, housing for the faculty, classrooms, seminar rooms, and offices. New laboratories for the institute are now under construction. To defray the costs of a new wing for the library, already stocked to capacity, The Rockefeller Foundation has appropriated $100,000. The new wing will furnish additional space for the growing collection of books and periodicals, for reading rooms, and for microfilming and photostat services.

The Rockefeller Foundation, which in 1956 instituted an agricultural operating program in cooperation with the Indian government, is also aiding in the development of the institute's program by providing visiting consultants to work with Indian scientists in the formulation of course work in each of the divisions of the postgraduate school.

KASETSART UNIVERSITY

TRAINING AND RESEARCH IN AGRICULTURE

Thailand's Kasetsart University, which specializes in the agricultural sciences, is a leading center for agricultural training and research in Southeast Asia. The university, established in 1943, has a faculty that now numbers over 100 and a student body totaling over 1,000. The curriculum includes, in addition to the basic agricultural sciences, studies in forestry, cooperative science and economics, fisheries, veterinary medicine, and irrigation engineering; a Department of Home Economics was established recently with Foundation assistance.

With the support of the Thai government, the university's physical plant has continued to develop. The construction of twelve new buildings, the paving of new roads, and the improvement and modernization of the water supply and irrigation systems are among the physical changes that have been realized in the last five years.

Kasetsart University has a significant contribution to make in the training of agricultural personnel, not only in Thailand, but throughout all of Southeast Asia as well. The enrolment already includes students from Laos, Cambodia, and Vietnam, and there are indications that the student body will soon include representatives from the other neighboring countries. Of particular interest to students from these surrounding countries are the programs in poultry science and rice breeding.

Additional research and training facilities are needed to enable students at Kasetsart University to participate directly in laboratory and research work. In 1958 the Foundation granted $100,000 which will be used, with the balance remaining from a previous grant, for the purchase of foreign-made equipment and library materials over a three-year period.

UNIVERSITY OF MINNESOTA

RESEARCH ON PLANT INTERACTION

Interactions among plants are common and varied. Lower organisms, such as bacteria and fungi, may inhibit or stimulate the growth of other lower organisms, or of higher plants. Similarly, higher plants may inhibit or stimulate the growth of each other.

As an important part of the research that has been done on interaction, plant scientists at the University of Minnesota have studied the relationships between economic crop plants and weeds. Among the interesting discoveries they have made are the facts that quackgrass inhibits the germination and retards the growth of alfalfa, small grains, and peas, while stimulating plantains and dandelions; that leafy spurge is toxic to seedlings of peas and wheat; and that the wild onion is antibiotic to oats.

The Minnesota group now plans more extensive study of the interactions among plants, including not only inhibitory but also stimulatory effects. In the first phase of the project they will observe plants and weeds under a variety of field and greenhouse conditions in an effort to refine their understanding of the nature of observed interaction phenomena. Subsequently they will attempt to collect, purify, and identify the chemical compounds involved and to use them in a series of controlled experiments. The program will also include research on the relationships between different kinds of crop plants and between pathogens and the organisms antibiotic to them. Finally, on the level of fundamental research, the mechanisms concerned in the various phenomena will be explored.

The Institute of Agriculture will conduct the new program through the Department of Biochemistry and the section of plant physiology of the Department of Plant Pathology. To help support the work, the Foundation has made a five-year grant of $88,500 to the University of Minnesota.

NATIONAL INSTITUTE OF AGRICULTURAL SCIENCES

RESEARCH IN AGRICULTURE

Formed in 1950 through the consolidation of the National Agricultural Experiment Station, the Horticultural Research Station, the Livestock Experiment Station, and the Land Reclamation Research Institute, the National Institute of Agricultural Sciences is today Japan's foremost center for research in agriculture. Its programs combine research on many of the immediate problems of Japanese agriculture with fundamental studies in the various agricultural sciences.

The headquarters and principal laboratories of the National Institute are in Tokyo, where a new laboratory of nematology is being organized. Work in agricultural engineering, horticulture, and certain aspects of rice breeding are based at a branch station in Hiratsuka, and the animal science program is located at another branch station in Chiba. The institute now has a research staff of 290 persons.

To provide the National Institute of Agricultural Sciences with funds for the purchase of equipment needed in the research programs, The Rockefeller Foundation has appropriated $82,850, for use during a three-year period.

CORNELL UNIVERSITY

RESEARCH ON CROP YIELD

Since 1953 scientists in a number of departments of the New York State College of Agriculture have been studying the factors influencing crop yield in an effort to explain why crop yields vary markedly from country to country and why the maximum yields on record are so much larger than the highest average yield. The program involves study of the effects of heat, water, light, nutrient elements, nonpathogenic microorganisms, soils, pests, and diseases on a day-to-day basis under both natural and carefully controlled conditions.

A number of interesting facts have emerged from the research. It has been found that the yield of corn can be raised 8 to 16 per cent if three times the normal amount of fertilizer is applied, but as much as 35 per cent if this heavy fertilization is accompanied by irrigation. A soil temperature increase of only 5°C. reduced the yield of oats by one-third, and the nitrogen content of the plants was considerably higher. Not only did total nitrogen content increase, but nitrate nitrogen accumulated in the plants to an abnormal degree, an indication that a disturbance of the nitrogen metabolism accompanied the higher soil temperature.

The College of Agriculture scientists will continue their studies during a further five-year period with the help of a Rockefeller Foundation grant of $75,000 to Cornell University, Ithaca, New York. A previous grant of $80,000 helped support their work over the first five years.

CENTRAL LUZON AGRICULTURAL COLLEGE

AGRICULTURAL TEACHING AND RESEARCH

The Central Luzon Agricultural College, originally a vocational school, is now a four-year college authorized to offer the Bachelor of Science degree in agricultural engineering, home economics, and agricultural education, and the Master of Science degree in agricultural education. It is making a significant contribution to the Philippine national program for increasing local agricultural production through the training of much needed agricultural teachers, extension agents, experiment station workers, and private agriculturists.

Since 1950, when the college achieved its present academic rank, the faculty has developed a sound four-year curriculum combining theoretical and practical studies. Students are instructed in the basic and applied sciences and in addition are trained in crop cultivation, soil science, livestock care, and farm machinery operation. Those who expect to teach have practice facilities in the high school maintained by the college for this purpose.

The college began in 1907 as an institution designed to provide practical experience in agriculture and to train high school teachers of vocational agriculture. By the thirties it had become one of the best vocational schools of agriculture in Southeast Asia. During the Second World War the physical plant was almost completely destroyed but was rebuilt with funds from the United States–Philippine War Damage Commission.

To assist the college in Nueva Ecija in the acquisition of additional laboratory equipment and supplies, The Rockefeller Foundation has made a three-year grant of $75,000.

HARVARD UNIVERSITY

RESEARCH ON CORN

Because corn is the basic food plant of the Western Hemisphere and one of the twelve most important food plants in the world, knowledge of its biology is of immediate practical concern as well as theoretical interest. Significant contributions to understanding of corn and its improvement have been made by Dr. Paul C. Mangelsdorf, professor of economic botany at Harvard University, during his many years of research on this plant.

Dr. Mangelsdorf and his colleagues at Harvard are currently engaged in four principal lines of research: genetic and cytological studies of the origin and evolution of corn; cytogenetic investigations of corn's closest relatives, teosinte and *Tripsacum;* classification of the races of corn in the Western Hemisphere; and identification and description of prehistoric corns from archaeological sites. They have succeeded in extracting from Latin American corn varieties chromosomes which produce effects similar to those of teosinte and *Tripsacum,* and have been able to reconstruct what are apparently some of the ancestral forms involved in the evolution of the modern corn plant.

To help support Dr. Mangelsdorf's continued researches on corn during the five-year period beginning July 1, 1959, The Rockefeller Foundation has made a grant of $69,650 to Harvard University, Cambridge, Massachusetts.

NATIONAL UNIVERSITY OF COLOMBIA

AGRICULTURE AND VETERINARY MEDICINE

Since 1944, the Foundation has appropriated more than $319,000 to the National University of Colombia, Bogotá, in support of the Faculties of Agronomy in Palmira and Medellín and the Faculty of Veterinary Medicine. In 1958, the Foundation renewed its aid with three grants totaling $156,500. In each instance the funds will be available for three years.

Established in 1934, the Faculty of Agronomy at Palmira has acquired facilities and set standards which make it today one of the principal agricultural colleges in Colombia. It is situated in the Cauca Valley, the country's most productive agricultural region. Its location adjacent to the Palmira Experiment Station of the Ministry of Agriculture has led to the development of fruitful cooperation between the two institutions.

For the Faculty of Agronomy at Palmira, the Foundation appropriated $60,000 to the National University. The funds are for the purchase of laboratory supplies and equipment, for the reorganization and further development of the library, and for various related activities.

The Faculty of Agronomy at Medellín is the oldest agricultural college in Colombia and the one which trained the majority of the agronomists now serving in official capacities in Colombian agriculture. It has an excellent physical plant, one of the best libraries in any Latin American college of agriculture, and a predominantly full-time teaching staff.

The dean of the Medellín faculty and his colleagues are strengthening the basic science departments, undertaking additional extension activities, and expanding research on the agricultural problems of the small farmers who live in the region around Medellín. In all these projects they are receiving substantial support from the businessmen of Medellín and from the National University.

To help support teaching and research at the Medellín faculty, the Foundation appropriated $46,500 to the National University.

In the next several years the Faculty of Veterinary Medicine in Bogotá expects to modernize several of its present laboratories and to supply them with new equipment to facilitate teaching to an expanded student body. It also plans to add five young veterinarians to the staff of eleven full-time professors to serve as assistants in such fields as anatomy, physiology, and animal husbandry.

The improvements projected by the Faculty of Veterinary Medicine will considerably enhance the value of the school to Colombian agriculture. The livestock industry of Colombia is of great significance to the local economy but is in need of many more well trained veterinarians to meet the variety of animal health problems in the country.

The Foundation appropriated $50,000 for the Faculty of Veterinary Medicine, to help meet the costs of a mobile clinic, of laboratory equipment and supplies, and other teaching and research expenses.

UNIVERSITY OF SONORA

SCHOOL OF AGRICULTURE AND ANIMAL HUSBANDRY

The School of Agriculture and Animal Husbandry of the University of Sonora, Hermosillo, Mexico, was established in 1953 in response to the increased agricultural importance of northwestern Mexico. This area has changed rapidly in the last decade as the result of the completion of large federal irrigation projects. It is now unique in Mexico for its concentrated, mechanized, modern agriculture, and is producing a large percentage of the basic food crops for the country.

With strong support from the university and substantial state and federal backing, the new school has developed rapidly. It has been successful in attracting capable young agronomists as professors for its staff, in winning support from the farmers of the region, and in raising funds from Mexican organizations. Currently the school has further plans for expansion. New classrooms and laboratories will be constructed; the 500-acre experiment station near the city of Hermosillo will be improved; and the present teaching staff of 18 will be increased. To help meet the cost of these improvements, the Foundation in 1958 made a two-year grant of $60,000 to the University of Sonora.

NATIONAL SCHOOL OF AGRICULTURE

POSTGRADUATE EDUCATION

One of the major schools of agriculture in Mexico, the National School of Agriculture at Chapingo has for several years been developing plans for the inauguration of a postgraduate curriculum. With the enthusiastic support of National School of Agriculture alumni and of officials of the Mexican Ministry of Agriculture, the director of the school, Ing. Jesús Múñoz Vázquez, is organizing courses leading to the Master of Science degree in such fields as plant science, plant protection, soil science, agricultural economics, irrigation, forestry, and animal husbandry.

To help the National School introduce the first graduate courses in the spring, 1959, semester, The Rockefeller Foundation granted $50,000 for use through the end of 1959. Since 1943, when the Foundation's cooperative agricultural research and demonstration program in Mexico was organized, the Foundation has enjoyed close collaborative relationships with the National School, and has located its principal experiment station near the school at Chapingo.

MINISTRY OF AGRICULTURE, PERU

POTATO IMPROVEMENT PROGRAM

The Ministry of Agriculture of Peru, the region where the potato is believed to have originated, is inaugurating a broad potato improvement program through the Cooperative Program of Agricultural Experimentation, created several years ago to conduct national research projects on basic food crops and on livestock improvement. The research on the potato will include agronomic studies of rotation, fertilization, cultivation, storage, disease and insect control, and varietal improvement. A germ plasm bank of indigenous species of *Solanum* will be established in connection with the work. One of the leaders will be Ing. Carlos Ochoa, trained in potato pathology and genetics at the University of Minnesota, whose studies have attracted the attention of specialists in many other countries.

The new Peruvian program has broad international implications for the production of new and better varieties of potato. Close cooperation with the potato research activities of The Rockefeller Foundation Mexican and Colombian Agricultural Programs is expected to be of mutual benefit, and to contribute to understanding of the potato plant over its entire ecological range. To help finance the work over a five-year period, the Foundation has appropriated $40,000 to the Ministry of Agriculture in Lima.

KYOTO UNIVERSITY

RESEARCH ON WHEAT

Under the direction of Dr. Hitoshi Kihara, now head of Japan's National Institute of Genetics, scientists at Kyoto University in 1955 collected 970 different strains of cereal grains and related grasses from 495 locations in the Middle

East as part of a distinguished research program on the genetics and evolution of wheat. The geneticists, now led by Dr. Kosuke Yamashita, will in the next few years subject these strains, and others they plan to collect from the Eastern Mediterranean region, to thorough study with the main object of determining more specifically the origin of cultivated wheat.

The group will undertake revision of the classification system for the tribe *Hordeae,* a genome analysis of wheat based on morphological and cytological study of the materials collected, and thorough study of the morphological and cytogenetic characteristics of the genus *Aegilops.* Other researches will include physiological studies of the various species with particular reference to temperature and length-of-day response, and studies of disease resistance in various strains of cereal grains. The investigations at Kyoto are expected to yield information of practical value to the plant breeder working on the improvement of cultivated wheat.

To help support the researches at Kyoto University, The Rockefeller Foundation has appropriated $39,500 for use during a three-year period.

UNIVERSITY COLLEGE OF RHODESIA AND NYASALAND, MAKERERE COLLEGE, AND THE UNIVERSITY COLLEGE, NIGERIA

AGRICULTURAL TEACHING AND RESEARCH

To help three African colleges develop programs of teaching and research directed specifically toward the needs of African farmers and students training for professional roles in their countries' agricultural technology, The Rockefeller Foundation made grants totaling $105,700 during 1958. The three schools, the University College of Rhodesia and Nyasaland, Makerere College, and the University College of Nigeria, are associated with the University of

London, England, which awards the Bachelor of Science (Agriculture) degree to African students completing course work at the schools. The standards of the colleges and of the university are identical.

The British government, the Federal Government of Rhodesia and Nyasaland, and the city of Salisbury all contributed to the establishment in 1953 of the University College of Rhodesia and Nyasaland as an interracial and nondenominational school serving the three territories of the federation. The college has made rapid progress in developing a complete agricultural curriculum, and in initiating basic agricultural research to supplement the investigations being undertaken by government agricultural experiment stations. To help the college in Salisbury purchase books and laboratory equipment needed for the agricultural program, The Rockefeller Foundation has made a two-year grant of $39,200.

Makerere College in Kampala, Uganda, now the University College of East Africa, began to formulate a degree course under a Faculty of Agriculture in 1953 with funds from the governments of Kenya, Tanganyika, and Uganda, and from the Colonial Development and Welfare Fund. Classroom, dormitory, and laboratory facilities have been constructed, and a 340-acre farm with an engineering workshop and botanic garden established. At present one of the few institutions in East Africa for comprehensive training in the agricultural sciences, Makerere College is expected to become a key school in the field and to serve an extensive region. A Foundation grant of $35,000 will help the college strengthen its program in agriculture during a three-year period.

Through its research program, the University College in Ibadan, Nigeria, is making important contributions to the solution of some of Nigeria's basic agricultural programs. Among the projects now in progress are studies of farm management and marketing practices in Nigeria, development of farm machinery suitable for use by small land owners in the humid tropics, research on poultry production as a first step in the establishment of a commercial broiler industry in the country, and studies of litter feeding of swine with local feed materials. To provide some of the equipment needed for these investigations, The Rockefeller Foundation has appropriated $31,500 for use by the University College over a three-year period.

UNIVERSITY OF ALASKA

STUDIES OF GRASSES AND LEGUMES

In 1956 and 1957 surveys were made of forage plants and their diseases in Alaska as a first step in the development of grass and legume species adapted to the extreme environmental conditions of the new state. Some 70 grass and 40 legume species, including both indigenous and exotic varieties, were collected for detailed study of taxonomy, morphological variation, and reaction to diseases and insect pests. Selections will be made of strains that combine disease resistance, insect tolerance, cold hardiness, and other essential characteristics for use as forage, turf, and cover crops.

To help support the researches on grass and legume species, in which the Alaska Agricultural Experiment Station and the University of Wisconsin are cooperating, The Rockefeller Foundation has appropriated $30,000 to the University of Alaska.

WEST VIRGINIA UNIVERSITY

RESEARCH ON THE PHYSIOLOGY OF FUNGI

For some years researchers led by Dr. J. G. Leach in the Department of Plant Pathology of West Virginia University have given special attention to the biosynthesis and the role of carotenoid pigments in fungi. They were among the first to show that carotene—an organic pigment essential in the production of vitamin A in the human body—can be economically derived from fungi, and the manufacture of carotene from fungi has become a sizeable commercial process.

The function of carotene in the growth processes of fungi, however, is far from clear. It may have only a transitory function and be produced only under stress. Or carotene may serve to protect the light-sensitive mechanisms of fungi, be connected with oxygen tension, or play a special role in the production of spores.

To help finance continued research on the physiological function of carotene in fungi, in which the Department of Plant Pathology is cooperating with the Department of Biochemistry, The Rockefeller Foundation has made a three-year grant of $25,600 to West Virginia University, Morgantown.

PURDUE UNIVERSITY

RESEARCH ON GENETIC VARIATION

One of the most significant and troublesome characteristics of plant parasites is the fact that their genetic characters can so change that they can attack previously resistant hosts. The plant rust fungi are particularly notorious for the production of new races of increased or more diverse virulence in spite of the apparent lack of a sexual stage in nature during which this diversity might arise. Professor Ralph M. Caldwell of Purdue University will lead research on a representative member of this group, the wheat leaf rust fungus, in an effort to throw light on the mechanisms of genetic variation.

The Purdue scientists will attempt to achieve greater understanding of the virulence variation phenomenon and of the hypersensitivity resistance now used for the control of cereal rusts. Their researches should also contribute to studies of tolerance and resistance in mature plants as other practical steps in the development of cereals resistant to fungi.

A Rockefeller Foundation grant of $24,000 to Purdue University, Lafayette, Indiana, will help finance the investigations over a three-year period. The program directed by Professor Caldwell has led to the development of disease-resistant varieties which were planted on 92 per cent of the wheat acreage and 72 per cent of the oat acreage in Indiana in 1958.

UNIVERSITY OF ADELAIDE

WAITE AGRICULTURAL RESEARCH INSTITUTE

Long noted for its research in soil science, the Waite Agricultural Research Institute of the University of Adelaide, Australia, has in recent years placed increasing emphasis on agricultural chemistry. Among the distinguished studies now in progress are those on enzyme systems and cell chemistry of Dr. R. K. Morton, who has demonstrated that particulate material separated from disrupted animal and plant cells undergoes considerable structural change that affects the enzymatic activities of the isolated particles.

Dr. R. J. Best, well known for research on the tobacco mosaic virus, is now working on investigations of the spotted wilt of tomato and the viruses of clovers and other forage crops. Other staff members are studying the nature and structure of the colloidal clay minerals which play an important role in the retention of essential mineral nutrients.

To meet half the costs of an electron microscope needed for the institute's researches, The Rockefeller Foundation has appropriated $22,400 to the University of Adelaide.

The new facility will be available to all the sections of the institute and to a number of the scientific departments of the university as well.

SOUTH PACIFIC COMMISSION

RESEARCH ON THE RHINOCEROS BEETLE

Since 1955 the South Pacific Commission has been studying the diseases of the Rhinoceros beetle, an insect pest of great economic importance to the copra-producing islands of the South Pacific, to determine whether the beetle might be more easily and cheaply controlled by directing its own diseases against it than by chemical or mechanical methods. The effects of the beetle's two principal diseases have now been carefully assessed, but the causal organisms and mode of transmission have not yet been determined.

To enable the South Pacific Commission, Noumea, New Caledonia, to continue its fundamental studies of these diseases for another 18 months, The Rockefeller Foundation appropriated $22,175 during 1958. The research was begun with the assistance of a $47,000 Foundation grant.

COMMISSION FOR AGRARIAN REFORM AND HOUSING

SURVEY OF LAND-HOLDING SYSTEMS

In 1956 the Peruvian government established the Commission for Agrarian Reform and Housing and charged it with responsibility for preparing a broad program looking toward the solution of Peru's housing and land problems. The commission has completed its report on housing, and has now turned to the problems of land tenure on the coast, where low rainfall makes irrigation a major factor, and on the eastern slope of the Andes, where the orderly settlement on undeveloped land of the population moving down from the highlands is of the first importance.

Before proposing definite measures, commission members wish to observe the various land reform procedures devised in other countries, and have selected Italy, Germany, the Netherlands, Bolivia, and Mexico for primary attention. A Rockefeller Foundation grant of $22,000 to the Commission for Agrarian Reform and Housing, Lima, will help meet the expenses of studies in other countries by members of the commission during a two-year period.

BIOCHEMICAL INSTITUTE OF THE FOUNDATION FOR CHEMICAL RESEARCH

ANTI-FUNGAL FACTORS IN ECONOMIC CROP PLANTS

Nobel laureate Artturi I. Virtanen, head of the Biochemical Institute of the Foundation for Chemical Research, Helsinki, Finland, is directing a study of the biochemical basis of disease resistance in economic crop plants. In the past two years Professor Virtanen and his associates have isolated and identified a number of chemicals occurring naturally in rye, red clover, carrots, alfalfa, corn, and wheat which help to protect them against attack by various pathogenic fungi. Currently they are exploring the hypothesis that a group of flavones present in the plants may be precursors in the formation of the protective substances.

To help defray the costs of the research on anti-fungal factors through the next two years, The Rockefeller Foundation has made a two-year grant of $20,000 to the Biochemical Institute.

PAN AMERICAN AGRICULTURAL SCHOOL

POSTGRADUATE SCHOLARSHIPS

The Pan American Agricultural School, Tegucigalpa, Honduras, is one of the leading centers for vocational training in agriculture in Latin America. Students come to the school not only from Honduras, but also from the other countries of Central and South America.

During the past ten years The Rockefeller Foundation has contributed $52,500 to enable the director and staff of this outstanding institution to send several honor graduates each year to North American colleges of agriculture for further training. Thus far, 16 of these students have gone to the University of Florida, where nearly half have graduated with honors. Renewing its aid for the scholarship program, the Foundation in 1958 made a two-year grant of $20,900 to the Pan American Agricultural School.

UNIVERSITY OF NEBRASKA

RESEARCH ON CORN GENETICS

In recent years a number of plant geneticists working with corn have proposed that heterozygosity, per se, is primarily responsible for the increased yield of corn hybrids. They have suggested that the maximum yield of corn hybrids will be achieved by combining inbred lines that have demonstrated a high combining or yielding potential with inbreds that show a low combining ability, on the assumption that the high combining lines will have a large number of dominant, and the low combining lines a large number of recessive genes for yield.

Evidence from other studies in corn genetics suggests that additive genetic variance, or the accumulation of the maximum number of dominant growth factors in the progeny of hybrids, will produce maximum yields.

To collect data that may help evaluate these proposals, plant scientists at the University of Nebraska plan a four-year study of the genetics of hybrid corn. To help support the program, which will be conducted by the Department of Agronomy in the College of Agriculture, the Foundation has appropriated $20,000 to the university.

OTHER GRANTS

United States

New England

Dr. Paul C. Mangelsdorf, director, Botanical Museum, Harvard University, Cambridge, Massachusetts, and Mrs. Mangelsdorf: to visit centers of research on corn genetics in Latin America; $2,000;

Middle Atlantic

Boyce Thompson Institute for Plant Research, Inc., Yonkers, New York: expenses of a fourth international conference on plant growth regulators; $10,000;

Dr. Marlin G. Cline, professor of soil science, Cornell University, Ithaca, New York: to review research in soil management and water use in the Soviet Union; $2,500;

University of Maryland, College Park: a study of the biology and control of plant parasitic nematodes, by the Department of Botany, College of Agriculture; $10,000;

National Research Council, Washington, D.C.: study of agricultural losses caused by pests, to be undertaken by the Committee on Agricultural Pests; $9,500;

Pan American Sanitary Bureau, Washington, D.C.: to establish a technical advisory group on diseases transmitted between animals and man in the Americas; $9,700;

Fund for grants of amounts not exceeding $500 for allocation under the supervision of the Foundation's Director for Agriculture; $5,000;

South

University of Florida, Gainesville: study of tropical soils under conditions of changing cultivation; $2,300;

North Carolina State College, Raleigh:

Research on the cytology and genetics of fungi in the School of Agriculture, under the direction of Dr. R. R. Nelson; $9,000;

Dr. H. F. Robinson, head, Department of Genetics and Experimental Statistics; to confer with American and Mexican agriculturists in Mexico; $600;

Central West

University of Minnesota, Institute of Agriculture, St. Paul: Alfred Wolfgang Koch, plant pathologist, Goettingen, Germany; to serve as research assistant at the institute; $1,200;

Purdue Research Foundation, Lafayette, Indiana: Dr. Herbert H. Kramer, professor of agronomy, Purdue University; to review crop improvement research in the Soviet Union; $1,500;

University of Wisconsin, Madison:

Dr. Glenn S. Pound, chairman, Department of Plant Pathology, College of Agriculture; to visit laboratories of plant pathology in Europe; $3,100;

Dr. Noble Clark, College of Agriculture; to visit agricultural research centers in Poland; $1,500;

West

Dr. Charles E. Logsdon, plant pathologist, Experiment Station, University of Alaska, College: to visit centers of plant pathology research in northern Europe; $1,650;

University of California:

At Davis:

Field research and collection of peppers in South America, by Dr. Paul G. Smith, associate professor of vegetable crops, College of Agriculture; $3,600;

At Riverside:

Dr. J. M. Wallace, plant pathologist, Citrus Experiment Station, College of Agriculture, and Mrs. Wallace; to visit Latin American centers of research on citrus virus diseases; $3,400;

University of Hawaii, Honolulu: graduate training in the College of Agriculture for young agriculturists from Asian countries; $10,000;

Utah State University, Logan:

Dr. D. Wynne Thorne, director, Utah State Agricultural Experiment Station; to review research in soil management and water use in the Soviet Union; $2,100;

Dr. Howard B. Peterson, head, Department of Agronomy; to attend the UNESCO Arid Lands Symposium in Teheran, Iran; $1,000;

Canada

IX International Botanical Congress, Canada: expenses of botanists from overseas participating in the congress, to be held in Montreal during August, 1959; $10,000;

Latin America

Austral University of Chile, Valdivia: books, journals, instruments, and equipment for the Faculty of Agricultural Sciences; $18,450;

Ing. Gregorio Amunátegui, professor of agricultural economics, Catholic University of Chile, Santiago: to visit agricultural institutions in Latin America and the United States; $2,750;

University of Chile, Santiago: to invite Dr. John Einset, associate head, Department of Pomology, New York State Agricultural Experiment Station, Geneva, to assist in the reorganization of the Department of Pomology, Faculty of Agronomy; $9,575;

University of Concepción, Chile: equipment for the soils and irrigation laboratory, Faculty of Agronomy; $10,000;

Dr. Isaias Tagle V., Institute of Veterinary Investigations, Santiago, Chile: to consult with the staff and conduct research at the Institute of Veterinary Investigations, Guayaquil, Ecuador; $1,400;

Dr. Guillermo Ramos Núñez, chief, Sugar Cane Section, Agricultural Experiment Station, Palmira, Colombia: to visit centers of research on sugar cane in the Caribbean area, the southern United States, and Mexico; $1,525;

University of Caldas, Manizales, Colombia: laboratory equipment for the Faculty of Agronomy; $10,000;

Colombian Academy of Exact Sciences, Bogotá: toward publication of additional scientific material in the Academy's Review; $5,000;

Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica:

Cooperative research in horticulture by the institute and The Rockefeller Foundation Mexican Agricultural Program; $12,250;

Laboratory equipment for the Plant Industry Department; $8,900;

Juan Diaz Bordenave, editor, *Extension in the Americas;* to study agricultural journalism at The Rockefeller Foundation Mexican Agricultural Program; $5,250;

Ing. Luis Rodríguez, professor of plant pathology, Faculty of Agronomy and Veterinary Medicine, Central University, Quito, Ecuador: to visit agricultural experiment stations in Colombia, Costa Rica, Mexico, and the United States; $1,825;

Institute of Veterinary Investigations, Guayaquil, Ecuador: equipment and supplies; $1,000;

Ing. Gabriel Murillo Peralta, professor of plant pathology, Antonio Narro College of Agriculture, University of Coahuila, Saltillo, Mexico: to visit centers of potato research while in Europe; $790;

Institute for the Improvement of Sugar Cane Production, Mexico City, Mexico: studies of the biological control of insect pests of sugar cane and forage grasses; $11,240;

Dr. Oscar Valdés Ornelas, director, School of Veterinary Medicine, National University of Mexico, Mexico City: to visit veterinary schools in the United States; $1,300;

Ministry of Agriculture, Northwestern Agricultural Research Center, Sonora, Mexico:

Dr. Enrique Ortega Torres, head, Soils Laboratory; to visit centers of soil research in the United States; $700;

Dr. Nicolás Sánchez Durón, director; to visit centers of soil research in the United States; $700;

National School of Agriculture, Chapingo, Mexico:

Ing. Nicolás Aguilera Herrera, professor of soil science; to confer with soil scientists at the University of California; $800;

Ing. Alfredo Campos Tierrafría; to visit the United States in connection with the completion of a research project in plant pathology; $750;

Dr. Marcos Ramírez Genel, entomologist, The Rockefeller Foundation Mexican Agricultural Program, Mexico City: to visit centers of research on the conservation of stored grain in Latin America; $600;

Technological Institute and School of Advanced Study of Monterrey, Mexico:

Ing. Leonel Robles Gutiérrez, director, School of Agriculture; to visit agricultural institutions in Latin America and to attend a conference of phytoparasitologists in Santiago, Chile; $2,045;

Ing. Rogelio González, professor of irrigation, School of Agriculture; to visit centers of research on irrigation in the United States; $1,200;

Ministry of Agriculture, Agricultural Experiment Station of La Molina, Lima, Peru: equipment and supplies for the Division of Plant Protection; $7,000;

Dr. Teodoro Ramos Saco, dean, Faculty of Veterinary Medicine, University of San Marcos, Lima, Peru: additional expenses of visits to centers of veterinary research in Mexico, Canada, and the United States; $520;

University of the Republic, Montevideo, Uruguay:

To construct a greenhouse for the Faculty of Agronomy; $10,000;

Support of the entomology program of the Faculty of Agronomy; $10,000;

Dr. Hebert Trenchi, Faculty of Veterinary Medicine; to visit Cornell University, Ithaca, New York; $825;

Europe

Dr. Sigmund Frauendorfer, lecturer and librarian, State College of Agriculture and Forestry, Vienna, Austria: to study documentation and information retrieval practices, as related to agriculture, in American libraries; $1,440;

Dr. Wilhelm Rudorf, director, Max Planck Institute for Plant Breeding, Cologne-Bickendorf, Germany: to visit The Rockefeller Foundation Mexican Agricultural Program; $600;

American Farm School, Salonica, Greece: study of broiler poultry management; $8,600;

University of Bari, Italy: to construct a greenhouse for the Institute of Plant Pathology, Faculty of Agriculture; $10,000;

University of Pavia, Italy: laboratory equipment and research expenses of the Genetics Center, L. Spallanzani Institute of Zoology; 5,000,000 Italian lire (about $8,250);

Dr. T. P. Loosjes, deputy librarian, State Agricultural Library, Wageningen, Netherlands: to visit libraries and related institutions in the United States; $2,100;

Dr. T. H. Thung, director, Laboratory for Virology, State Agricultural University of Wageningen, Netherlands: to visit plant science research institutions in the United States and Canada; $1,930;

Agricultural College, Cracow, Poland:

Dr. Helena Baczkowska, head, Poultry Department; to visit poultry breeding centers in the United States and Great Britain; $3,250;

Dr. Zygmunt Ewy, head, Department of Animal Physiology; to visit agricultural research centers in the United States and Great Britain; $3,200;

Dr. Tadeusz Ruebenbauer, Department of Plant Breeding; to visit university departments of plant breeding and agricultural experiment stations in the United States; $3,050;

Dr. and Mrs. Bohdan Dobrzanski, Department of Soil Science, Agricultural College, Lublin, Poland: to visit agricultural research centers in the United States; $5,600;

Dr. Teresa Hulewicz, assistant professor of cytogenetics, Agricultural College, Olsztyn, Poland: to visit centers of research in genetics in the United States; $3,250;

Dr. Emil Chroboczek, Department of Vegetable Production, College of Agriculture, Skierniewice, Poland: to visit university departments of vegetable production and agricultural experiment stations in the United States and Canada; $3,050;

Dr. Josef Janicki, head, Chair of Agricultural Technology, High School of Agriculture, Poznan, Poland: to visit agricultural research centers in the United States; $3,350;

Dr. Edmund Malinowski, director, Institute of Genetics, Skierniewice, Poland: to visit genetics laboratories in Western Europe; $2,000;

Dr. S. A. Pieniazek, director, and Mrs. Pieniazek, Institute of Pomology, Skierniewice, Poland: to visit fruit growing centers in the United States; $5,750;

Dr. Damazy Tilgner, head, Institute of Technology of Animal Products, Gdansk, Poland: to visit agricultural research centers in the United States; $3,150;

Dr. Eugeniusz Ralski, manager, Plant Immunology Division, Plant Breeding Institute, Cracow, Poland: to visit departments of plant pathology and immunology in the United States; $2,900;

Dr. Antoni Spryszak, lecturer, Department of Experimental Husbandry, Polish Academy of Sciences, Bydgoszcz: to visit the laboratory of Dr. Agner Neiman-Sørenson in Copenhagen, Denmark; $1,600;

Dr. Jerzy Woyke, director, Bee Culture Department, Warsaw College of Agriculture, Poland: to visit centers of genetics research while in the United States; $700;

Experiment Station for Plant Improvement, Elvas, Portugal: laboratory equipment and travel expenses in connection with research on black stem rust of wheat by Dr. J. C. Santiago; $6,000;

Dr. Adrian F. Posnette, head, Pathology Section, East Malling Research Station, Kent, England: to visit botanical centers in the United States and Canada; $2,475;

Rothamsted Experimental Station, Harpenden, England:

Frederick G. W. Jones, head, Department of Nematology; to visit nematology research centers in the United States; $2,335;

Dr. Frederick Charles Bawden, deputy director and head, Plant Pathology Department; to visit plant pathology laboratories in the United States; $1,920;

University of Reading, England: laboratory equipment for the Department of Physiology, National Institute for Research in Dairying, Shinfield; $3,600;

Africa

Department of Agriculture, Entebbe, Uganda: scientific journals and library materials for the main Agricultural Research Station at Kawanda; $3,700;

South Asia

Dr. S. M. Sircar, reader in botany, University of Calcutta, India: to observe studies in plant physiology at leading agricultural institutions in Europe and the United States; $5,500;

Dr. L. B. Singh, director, Horticultural Research Institute, Saharanpur, India: to visit horticultural research stations and leading universities in the United States and Europe; $4,450;

Mrs. Surjeet Malhan, home science consultant, New Delhi, India: to study extension methods at institutions in the United States; $3,650;

Dr. Abdul Aziz Ressang, professor of animal pathology, Faculty of Veterinary Science, University of Indonesia, Bogor: to visit veterinary colleges and animal disease research institutes in Europe and the United States; $4,750;

University of Peshawar, Pakistan: library books and audio-visual equipment for the Faculties of Agriculture and Home Economics; $9,500;

University of the Punjab, Lahore, Pakistan: books, journals, and other library materials for the College of Home Economics and Social Science; $1,000;

Dr. H. N. Mukerjee, regional soil fertility specialist for Asia and the Far East, Food and Agriculture Organization of the United Nations, Bangkok, Thailand: to visit agricultural experiment stations in the United States; $3,850;

Kasetsart University, Bangkok, Thailand: scholarship funds and special field equipment for the Department of Home Economics; $10,000;

Ministry of Agriculture, Bangkok, Thailand:

Roem Purnariksha, chief technical officer, Department of Agriculture; to visit tropical research programs in the United States, Latin America, India, and Africa; $4,775;

Pongpit Piyapongse, Rice Department; to undertake graduate study in soil science at the University of California, Davis; $1,700;

Far East

University of Adelaide, Australia:

Dr. Colin M. Donald, dean, Faculty of Agriculture; to visit universities and research institutes in Europe, the United States, and Ceylon; $2,750;

Dr. Allen Kerr, lecturer in plant pathology; to visit centers of research in plant pathology in the United States; $2,350;

Dr. K. W. Finlay, Waite Agricultural Research Institute; to visit research and educational institutions in North America; $1,350;

Dr. Ichiro Tanaka, head, Department of Plant Pathology and Entomology, Hokkaido National Agricultural Experiment Station, Sapporo, Japan: to confer with plant pathologists at universities and experiment stations in Europe and the United States; $4,250;

Dr. Takeshi Tanaka, professor of botany, Kagoshima University, Japan: to visit universities and marine biology institutes on the Pacific coast of the United States; $3,050;

Kyoto University, Japan: research on growth substances in mushrooms, in the Department of Applied Botany of the Faculty of Agriculture; $6,000;

Kyushu University, Fukuoka, Japan:

An X-ray spectrometer for the Department of Soils, Faculty of Agriculture; $5,800;

Dr. Kaoru Ehara, assistant professor of agronomy; to visit universities and experiment stations in Europe to observe work in grassland management and forage crop production; $4,250;

National Institute of Agricultural Sciences, Tokyo, Japan:

Dr. Masatsugu Fukaya, head, Division of Entomology; to visit universities and agricultural experiment stations in Europe and the United States; $4,650;

Masatada Oyama, chief, Division of Soil Survey; to visit agricultural research centers in the United States; $4,160;

Dr. Yoshito Yamasaki, chief, Division of Genetics; to visit institutions in the United States and Europe; $3,550;

Okayama University, Japan: Dr. Ryuhei Takahashi, professor of plant breeding, Ohara Institute for Agricultural Biology, Kurashiki; to visit the United States to confer with outstanding barley breeders at selected universities and experiment stations; $3,400;

Tokyo University, Japan:

Professor Teruo Yamasaki, assistant professor of entomology; to confer with scientists in the fields of insect toxicology and insect physiology at universities and experiment stations in the United States and Canada; $3,550;

Dr. Hisao Aruga, professor of sericulture; to confer with scientists in the fields of genetics, biochemistry, entomology, and insect pathology at universities and experiment stations in the United States and Canada; $3,450;

Dr. Jozo J. Murayama, dean emeritus and instructor in entomology, Yamaguchi University, Japan: to collect and study bark beetles and pinhole borers in the Philippines and Borneo; $2,900;

R. W. Brougham, pasture ecologist, Department of Scientific and Industrial Research, Palmerston North, New Zealand: to visit universities and agricultural experiment stations in Hawaii, the United States, and Jamaica; $3,350;

Central Philippine University, Iloilo City: to renovate and equip a laboratory of soil science; $10,000;

Miss Josefina F. Santa Cruz, Forest Products Research Institute, Los Baños, Philippines: to accept a graduate assistantship in pulp and paper technology at Syracuse University, New York; $1,400;

University of the Philippines, Quezon City:

Books, periodicals, and supplies for the library of the College of Agriculture, College, Laguna; $10,000;

Textbooks and library materials for the College of Forestry, College, Laguna; $10,000.

Operating Programs

INTRODUCTION

The agricultural operating units of The Rockefeller Foundation in four widely separated countries—Mexico, Colombia, Chile, and India—form the major elements of a single international program. The objective of this program is to improve and increase the production of the basic food crops and at the same time to strengthen agricultural education, research, and extension in these countries and in the regions they represent.

All the operating projects are supported and administered in cooperation with appropriate governmental agencies.

As the value of the projects to the local economies becomes increasingly obvious, the proportion and firmness of local support similarly increase.

The training of qualified agricultural scientists is closely integrated with the activities of the operating units. Training opportunities are offered on an inservice basis in the units themselves, and by means of scholarships and fellowships for advanced study in other countries.

The parallel development of local governmental and institutional support for the projects and of a corps of qualified professional agronomists to man them, will make it possible for the Foundation gradually to withdraw from the enterprise. This process of turning the projects over to local leadership is now taking place in the oldest of the units, the one in Mexico, and is being planned in the others.

For the costs of the agricultural operating program in 1959, the Foundation appropriated $2,135,380, which with another appropriation of $50,000 for a closely related agricultural extension project in the State of Mexico brings the total provided to date for these purposes to $10,266,798.

LATIN AMERICA

The operating centers in Mexico, Colombia, and Chile constitute a regional unit. Both in Mexico, where work was begun in 1943, and in Colombia, where investigations date back to 1950, an extensive body of validated information and proved materials has been accumulated. These form a natural basis for the extension of the results to neighboring countries.

Methods and materials for corn improvement developed in Mexico and Colombia are being extended into the six republics of Central America through a Cooperative Corn Improvement Project. Conducted originally by Foundation staff members, this project is now carried on largely by Mexican, Colombian, and Central American agricultural scientists. By starting with methods and materials from Colombia and Mexico, the six national cooperating units have been able to achieve improvement in production and yield in two to three years which would otherwise have taken several times that long. The value of the work has already been demonstrated and firm support by local governments and agencies has been enlisted.

The research done in Colombia is now being successfully used in Ecuador through a cooperative cereal improvement project which is already paying dividends in the local economy.

All three Latin American units are cooperating in an informal manner with the agricultural agencies in Peru. In that country demonstrable progress is being made in the improvement of wheat, corn, beans, and potatoes.

The three operating programs, in accord with their seniority, are moving toward the goals set at the time of their establishment. More and more of the application and extension of the results is being undertaken by local scientists. Many of these have inservice experience in experimental agriculture in the operating units and advanced training abroad with the assistance of Foundation scholarships and fellowships. As the local scientists assume responsibility, Foundation staff members are giving an increasing proportion of their time to investigations on the more basic aspects of agricultural research and to service as consultants.

That the operating units should be blended into the agricultural education pattern of the countries concerned has been a guiding policy of the Foundation's effort from the first. The decision of Mexican authorities to inaugurate graduate instruction leading to the M.S. degree at the National School of Agriculture, Chapingo, provides an opportunity to take a long step toward this objective. A most encouraging development is the recent decision of the Mexican government to open the doors of the graduate school to students from foreign countries. The graduate school, a new addition to one of the oldest schools of agriculture on the North American continent, can become a strong force for improvement not only in Mexico itself but in all of Latin America.

In Mexico the program operates through the Office of Special Studies of the Ministry of Agriculture and Animal Industry; the office is supported jointly by the Foundation and the Ministry. Four experiment stations are directed by the office: a central station in Chapingo, near Mexico City, on land adjoining the campus of the National School of Agriculture; a regional station for the tropics in Cotaxtla, near Veracruz; a station for the rich agricultural region called the Bajío, near La Piedad, Michoacán; and a station devoted chiefly to small grains in the northwest, near Ciudad Obregón, Sonora. Close association also is maintained with stations operated by various state and other agricultural agencies.

Under progressive leadership the State of Mexico introduced intensive extension work some years ago in which investigations at the Santa Elena experiment station near Toluca are coordinated with the activities of a group of extension agents posted in various sections of the state. This program has been expanded by the employment of specially trained women who work with rural women and children in the improvement of village life. These women study for a period of about two months each year and spend the remainder of the year living in the villages. Here they set up headquarters, usually in the village schoolhouse, and initiate improvement projects with the children and their families. Their activity is closely coordinated with that of the regional agronomists.

The Colombian program is conducted through the Office of Special Investigations, which is a unit of the Department of Agricultural Research ("DIA") of the Ministry of Agriculture. DIA operates all the government's experiment stations, including the central laboratories and farm near Bogotá, Tibaitatá; a rapidly developing tropical station near Montería; and the newly acquired southern station in the llanos near Villavicencio.

The Chilean program operates similarly through an Office of Special Studies, jointly supported by the Ministry of Agriculture and the Foundation. The work is at present concentrated on cereal crops and on forage and pasture improvement, and land has been acquired for two experiment stations.

INDIA

The operating program in India, although somewhat isolated geographically from those in Latin America, is closely related to them in many ways. A number of staff members have had previous experience in Latin America and it has proved possible to use information and plant materials from the Latin American programs in starting the work in India. Less than two years old, the Indian program is making extraordinarily rapid progress through the cooperation and support of the Indian agricultural agencies.

The program in India from the first has included both food crop improvement and agricultural education. The crops selected for emphasis in the initial part of the research work are maize—more important as a food in India than is generally realized—and the sorghums and millets. These projects are operated through a central experiment station at the Indian Agricultural Research Institute, New Delhi, in conjunction with a well organized network of regional stations and substations.

The Indian Agricultural Research Institute is the institution through which the Foundation cooperates in regard to agricultural education. In the summer of 1958 the institute was recognized as a university for the purpose of granting degrees. Classes began in the autumn, with 100 students matriculating for M.Sc. and 150 for Ph.D. degrees. In the few weeks between the official recognition of the institute and the opening of the fall term, nearly 900 applicants sought admission. Only those were accepted as Ph.D. degree candidates who, in addition to meeting other requirements, had taken first division honors when they received their M.Sc. degrees.

The institute is completely directed by Indian leaders. The Foundation has aided in the construction of some of the buildings and with laboratory and library equipment. The Foundation is also helping by providing a visiting senior professor in each major subject division; the visiting professors come for a period of at least one year. The Foundation has also aided in providing consultants and advisors for other phases of university management and administration.

The Indian program is cooperative with the Ministry of Food and Agriculture and the Indian Council for Agricultural Research.

Grants with Long-Range Relation to World's Food Supply

UNIVERSITY OF WISCONSIN

RESEARCH ON SOLAR ENERGY

With scientists already forecasting the eventual depletion of such conventional sources of energy as coal and oil, the problem of harnessing for man's use the diffuse, renewable energy of the sun assumes increasing importance. Even without a long-term need for new energy sources, the development of simple solar energy devices would be of great value to the peoples of unindustrialized countries where coal, oil, and electric power are either unavailable or too costly for widespread use.

Over three years ago scientists at the University of Wisconsin embarked on a major program of research on the utilization of solar energy with the primary goal of producing prototypes of simple, low-cost equipment, such as solar cookers and engines and solar operated refrigerators, for underdeveloped areas. A design for a solar cooker is close to completion, and field tests of improved models are already under way in cooperation with The Rockefeller Foundation's agricultural programs in Mexico and Colombia. Fundamental studies of refrigeration are well advanced, and good progress has been made on focusing reflectors for the generation of steam.

Long-range research projects under the Wisconsin program concern photochemistry, photoelectricity, solar radiation measurements, and the storage of electrical energy by nonconventional means.

A new Foundation grant of $250,000, with the balance of an earlier grant in the same amount, will help finance the research on solar energy through the period ending June 30, 1962.

UNIVERSITY OF ARIZONA

ARID LANDS RESEARCH

More than one-third of the land area of the earth lies in semiarid and arid zones, where one of the principal conditions of plant, animal, and human life is limited moisture.

This region, most of which is underdeveloped, will increase in importance as the world's population grows and the struggle for food intensifies. More needs to be learned of the mechanics of the region's influence as an environment.

To secure a better understanding of how environment and life interact in arid areas, a group of scientists at the University of Arizona have undertaken a three-year interdisciplinary study. The program will include research in the fields of archaeology, biology, climatology, geochronology, and geohydrology.

Dr. David L. Patrick will head a committee, composed of a representative of each participating research group, which will review and coordinate the project as a whole. Insofar as possible, field work will be concentrated in the same area within the Sonoran Desert, the Gila-San Simón River Basin.

The evolution of the basin, the extreme variability of precipitation in all the world's arid regions, a variety of other meteorological problems peculiar to arid lands, the ecology of the desert, the effects of a deficient and variable water supply upon the living patterns of primitive man in the Southwest, and a wide range of related subjects will be studied.

Individual investigators will present research results in a series of Arid Lands Colloquia to be held as part of the project. Among the questions to be discussed are: How did the desert valley deposits that now constitute the principal aquifers in arid regions evolve? How have present-day hydrological problems come about? What is the best way to assess and use natural ground water resources?

As part of its program in nonconventional agriculture, The Rockefeller Foundation has made a three-year grant of $201,800 to the University of Arizona toward the costs of its research on arid lands.

ROTHAMSTED EXPERIMENTAL STATION

RESEARCH ON PLANT PROTEINS

Dr. N. W. Pirie and his colleagues at the Rothamsted Experimental Station are approaching the need for augmented protein supplies for human and animal nutrition—the most serious aspect of the world food problem—by studying methods for extracting and using as food the protein of noneconomic plants and the leafy by-products of crops grown for other purposes. An ingenious device developed by the group uses relatively simple procedures to separate and purify leaf protein by shredding, pressing, and filtering the raw material. The product can be used immediately, or frozen and stored without significant loss of protein.

In the next few years Dr. Pirie and his associates intend to construct a large-scale machine suitable for a processing depot, and a simple, rugged unit for use in villages where protein deficiency is most widespread. The group will also investigate more extensively the problems of storage, preparation, and utilization of plant protein, and secure more specific data on the protein fractions of different crops.

A grant of $75,000 from the Foundation to the Rothamsted Experimental Station, Harpenden, England, will help support the researches on protein extraction during the next five years.

TOKUGAWA INSTITUTE FOR BIOLOGICAL RESEARCH

RESEARCH ON ALGAE

The growing imbalance between the world's population and its food supplies has spurred research on such nonconventional sources of nutrition as the single-celled algae, plants that are found in large quantities in both salt and fresh water. Because dry algae may have a protein content of as much as 56 per cent, considerably higher than that of multicellular green plants, and are acceptable when combined with other foods, they show great promise as a food supplement in protein-deficient areas.

One of the world's leading authorities on algae is Professor Hiroshi Tamiya, director of the Tokugawa Institute for Biological Research in Tokyo, Japan. Professor Tamiya and his group have developed their research on the culture and basic physiology of algae into one of the distinguished programs in the field. A unique apparatus for the mass cultivation of algae developed at Tokugawa is now operating, and algae are being distributed to institutes and universities in Japan for testing as possible human and animal food. Plans for the future include improvement of the methods for mass culture of algae, further studies of the suitability of different strains, and continued basic biochemical and physiological research on micro-algae.

A new grant of $27,000 to the Tokugawa Institute will continue Rockefeller Foundation assistance to the work of Professor Tamiya and his associates for an additional five-year period.

OTHER GRANTS

University of Maryland, College Park: research on the genetics, inorganic nutrition, and comparative biochemistry of algae; $13,000 for a two-year period;

Polytechnic Institute of Brooklyn, New York: Dr. Wataru Sakai, professor of applied chemistry, Kyushu University, Fukuoka, Japan; for studies at the institute; $1,500;

Rothamsted Experimental Station, Harpenden, England: a carbon dioxide analyzer; $1,500.

Other Appropriations

OTHER APPROPRIATIONS

GRANTS WHICH FALL somewhat outside the specific programs, or which include elements relating to more than one aspect of the Foundation's work, are taken from general funds. In 1958 ten appropriations and 26 smaller grants were of this character.

HUNGARIAN REFUGEE AID PROGRAM

In 1958 The Rockefeller Foundation appropriated an additional $500,000 for its program of emergency aid in the arts and sciences for Hungarian refugees and for aid to cooperating educational institutions. As has been the case since 1956 when the Foundation's Hungarian program started, these funds are used chiefly for support of refugee students and scholars at 13 Austrian institutions of higher learning. From the new grant have been provided funds to meet stipends for over 600 students and scholars and the related expenses of the Austrian institutions in administering these funds through the end of the 1958-1959 academic year.

The 1958 grant brings to more than $2,000,000 the amount provided by the Foundation since December, 1956, for various types of assistance to Hungarian refugee students and scholars in the arts, sciences, and the professions.

The major allocations made in 1958 are listed below. In addition, a fellowship was awarded to a Hungarian refugee scholar who had been considered for an award during the initial period of the program but who could not take up the fellowship until 1958. The balance of approximately $67,000 in the grant at the end of 1958 will be used toward continued support for the refugee program in 1959.

University of Vienna, Austria:

Support of its program for Hungarian refugee students; 1,880,000 Austrian schillings (about $75,200);

Support of its program for Hungarian refugee research scholars; 300,000 Austrian schillings (about $12,000);

Technical Institute, Vienna, Austria:

Support of its program for Hungarian refugee students; 1,670,000 Austrian schillings (about $66,800);

Support of its program for Hungarian refugee research scholars; 60,000 Austrian schillings (about $2,400);

Academy for Music and Dramatic Arts, Vienna, Austria: support of its program for Hungarian refugee students; 546,000 Austrian schillings (about $21,840);

Academy for Plastic Arts, Vienna, Austria: support of its program for Hungarian refugee students; 514,000 Austrian schillings (about $20,560);

Institute for World Trade, Vienna, Austria: support of its program for Hungarian refugee students; 504,000 Austrian schillings (about $20,160);

Academy of Applied Art, Vienna, Austria: support of its program for Hungarian refugee students; 210,000 Austrian schillings (about $8,400);

Institute for Agriculture, Vienna, Austria:

Support of its program for Hungarian refugee students; 210,000 Austrian schillings (about $8,400);

Support of its program for Hungarian refugee research scholars; 50,000 Austrian schillings (about $2,000);

Institute of Veterinary Science, Vienna, Austria: support of its program for Hungarian refugee students; 126,000 Austrian schillings (about $5,040);

University of Innsbruck, Austria:

Support of its program for Hungarian refugee students; 1,460,000 Austrian schillings (about $58,400);

Support of its program for Hungarian refugee research scholars; 160,000 Austrian schillings (about $6,400);

University of Graz, Austria:

Support of its program for Hungarian refugee students; 1,050,000 Austrian schillings (about $42,000);

Support of its program for Hungarian refugee research scholars; 150,000 Austrian schillings (about $6,000);

Technical Institute, Graz, Austria:

Support of its program for Hungarian refugee students; 680,000 Austrian schillings (about $27,200);

Support of its program for Hungarian refugee research scholars; 60,000 Austrian schillings (about $2,400);

Mozart Academy for Music and Dramatic Arts, Salzburg, Austria: support of its program for Hungarian refugee students; 355,000 Austrian schillings (about $14,200);

Mining Institute, Loeben, Austria: support of its program for Hungarian refugee students; 210,000 Austrian schillings (about $8,400);

American Council for Emigrés in the Professions, Inc., New York: toward the administrative expenses of its program for the selection and placement of Hungarian refugees in the professions; $20,000.

POLISH SCIENCE PROGRAM

When, in May of 1957, the Foundation appropriated $300,000 to assist scientific study in Poland, selected Polish universities and research institutions were invited to submit lists of the research supplies, minor equipment, and scientific literature they wished to procure. All lists were received by the end of the year.

Detailed information about the projects and needs of the Polish scientists, and precise cost estimates for the materials requested by them, made it clear that to accomplish the broad aims of the 1957 grant, more funds would be needed. Therefore, in 1958 the Foundation made an additional grant of $200,000 for the Polish science program.

The materials shipped to Poland have gone to educational and scientific centers throughout the country, including the universities, medical academies and institutes, and agricultural schools at Warsaw, Poznan, Wroclaw, and Lublin, and the universities, medical academies, and institutes at Cracow and Lodz. Also aided were 19 of the research institutes of the Polish Academy of Sciences, and at least 6 agricultural stations under the Ministry of Agriculture.

In separate appropriations, the Foundation in 1958 made available an additional $400,000 for fellowships and scholarships for Polish scientists.

COUNCIL FOR FINANCIAL AID TO EDUCATION, INC.

Troubled by the growing financial problems of institutions of higher learning in the United States, and particularly of private colleges and universities, a group of educators and businessmen founded the Council for Financial Aid to Education in 1952. The council's directors have since then initiated a variety of activities designed to promote better understanding of the needs of higher education and to aid indirectly in securing for it more adequate financial support from American business concerns.

In the belief that it can make its greatest contribution to national welfare by mobilizing increased public interest in American higher education, the council seeks to encourage continuing and adequate voluntary support from all sources for all institutions of higher learning in the country. It attempts, through personal consultations, publications, various types of meetings, and cooperation with other agencies in the field, to bring the opportunities and the responsibility for educational support to the personal attention of leaders in business, industry, labor, civic, and service organizations throughout the country.

The council is gradually becoming a clearinghouse of information on the financial needs of American colleges and universities, on their sources of support, and, to the extent authorized by them, on various donors' aid-to-education policies and programs. It provides materials for free distribution to interested organizations and persons, and additional publications at cost to any business concern, university, college, association, or individual.

Since its establishment the council has been supported by major American philanthropies—the Carnegie Corporation of New York, the Fund for the Advancement of Education, the Alfred P. Sloan Foundation, and the Rockefeller-endowed General Education Board. The Rockefeller Foundation contributed to the council's support in 1958 with a $300,000 grant for use during the period ending December 31, 1963.

COLUMBIA UNIVERSITY

ADVANCED SCIENCE WRITING PROGRAM

Columbia University, through its Graduate School of Journalism, has inaugurated a program of special training to increase the number of science writers able to present scientific information accurately and interestingly to the general public. In formulating the new program, the school has had the advice and guidance of Columbia faculty members in journalism and the sciences, and of the National Association of Science Writers.

One of the major parts of the science writing program is a communications workshop for journalists who wish to develop a specialty in science writing or to broaden their knowledge of a scientific field. It will consist of supervised study at research projects in the New York area, internships with established science writers, advanced seminars and round-table discussions with members of the scientific faculties at Columbia, guided reading, and special meetings with leaders in research and development. The work will be individually tailored to give each of the participants the type of experience which seems most likely to develop his personal qualifications.

The Graduate School of Journalism will also develop special seminars for regular journalism students who have shown particular aptitude for scientific and technological reporting, offer a writing course to selected graduate students in the scientific faculties to help them communicate more effectively with one another and with the lay public, and hold annual congresses at which professional science writers and scientists will discuss new scientific developments and techniques of presenting them to the public.

To help Columbia University finance fellowships to the communications workshop, The Rockefeller Foundation has appropriated $100,000 for use over a three-year period. Other phases of the science writing program are largely self-supporting.

NEW YORK UNIVERSITY

PUBLIC ATTITUDE TOWARD SCIENCE NEWS

As part of a plan to improve and increase science news in the popular media, New York University in 1957 sponsored a survey to determine how the public felt about science, what sort of people they thought scientists were, and whether they considered science important, interesting, or merely curious. The group interviewed included persons in all age ranges, regions, religions, income brackets, and degrees of education, and the data obtained indicated that many of them would favor increased science coverage, even at the expense of sport or social news.

The inclusion in the first survey, made six months before the launching of Sputnik I, of questions concerning satellites provided an unusual opportunity to examine the changes in public information and interest resulting from extensive news coverage of the first successful launching of an earth satellite. A second survey was made, therefore, six months after Sputnik I, to discover how much the public had learned in the interval. The results were striking. Over half the people interviewed in the first survey had heard nothing at all about earth satellites. In the second survey, only 8 per cent of those interviewed had heard nothing, and 64 per cent had relatively detailed and accurate knowledge of the subject. Within a matter of months, and possibly less, a sample representing half the country's population had been educated concerning some of the possibilities of the space age through the standard news media.

Both surveys were made by the Survey Research Center of the University of Michigan under the joint auspices of New York University and the National Association of Science Writers. A 1956 grant of $70,000 from the Foundation, and a $25,000 grant made in 1958, provided the financial support. A small grant, made in 1954, financed a preliminary survey of the public's attitude toward science.

UNITED STATES BOOK EXCHANGE

EXPANSION OF ITS ACTIVITIES

The United States Book Exchange, organized in 1949 with support from the Foundation, operates as a nonprofit, self-supporting clearinghouse for libraries throughout the world. Located in Washington, D.C., the exchange annually distributes some 400,000 publications including, in addition to books, back copies of all professional and learned journals published in the United States. Also included are many journals of foreign publication that deal with the natural sciences, social sciences, and humanities.

In 1958 The Rockefeller Foundation made a grant of $35,000 to the United States Book Exchange. These funds will be used over a two-year period in effecting an expansion of the services offered by the exchange to foreign countries.

SPECIAL PURPOSE APPROPRIATIONS

In 1958 the Foundation made two appropriations to meet certain special expenses related to its own staff. One grant of $1,110,500 will be used to fund supplemental annuity obligations for retired staff members. The second grant, of $73,750, will cover the salary, travel, and other expenses of Foundation staff members on loan to other organizations.

OTHER GRANTS

American Association for the Advancement of Science, Washington, D.C.:

Toward the expenses of the First International Oceanographic Congress; $10,000;

A conference on the support and the organization of science in the United States; $10,000;

A study of the attitudes of young people toward science and toward careers in science; $9,000;

Asia Society, New York: development of a basic library collection on Asia; $10,000;

Columbia University, New York:

Council for Atomic Age Studies; preparatory work in connection with six regional conferences on atomic age research, by Christopher Wright; $10,000;

Professor John Foster, Graduate School of Journalism; to observe some of the important current scientific developments in Europe; $2,400;

Institute of International Education, New York: a conference on Inter-American Exchange of Persons, held in Puerto Rico during October, 1958; $10,000;

National Academy of Sciences, Washington, D.C.:

Expenses of the International Conference on Scientific Information; $10,000;

Toward expenses in connection with a visit to research institutions and medical schools in the Soviet Union by six American women scientists; $10,000;

University of Cambridge, England:

Development of plans, under the direction of Lord Adrian, vice-chancellor, for the establishment of Churchill College; $10,000;

Dr. Fred Hoyle, Faculty of Mathematics; to visit the Massachusetts Institute of Technology, Cambridge, and the offices of the International Business Machines Corporation, Poughkeepsie, New York, to complete computations on his stellar evolution project; $1,700;

University of Michigan, Ann Arbor: expenses of United States delegates to the Tenth General Assembly of the International Astronomical Union, held in Moscow during August, 1958; $10,000;

University of Oxford, England: planning studies in connection with the founding of a new college; $10,000;

A scholarship program to enable Nigerians to study in the fields of agriculture, biological and medical sciences, and public health in other countries, to be administered by the Ministry of Education, Lagos, Nigeria; $10,000;

Hodding Carter, editor and publisher, *Delta Democrat-Times,* Greenville, Mississippi, and Mrs. Carter: to visit Africa under the auspices of the United States-South Africa Leader Exchange Program; $8,000;

Imperial Ethiopian College of Agricultural and Mechanical Arts, Dire Dawa: expenses of guest lecturers in the liberal arts; $7,500;

International Rescue Committee, Inc., New York: expenses incurred in formulating the Polish Medical Aid Project and in maintaining contacts with the pharmaceutical companies contributing medicines for the project; $7,500;

National Bureau of Standards, Washington, D.C., and the World Health Organization, Geneva, Switzerland: expenses of a meeting of the International Commission on Radiological Units and Measurements in Geneva during 1958; $7,500;

Princeton University Press, New Jersey: to publish and distribute experimental instructional material in elementary physics; $4,500;

A conference concerning national health agencies and preparation of related material; $2,500;

Teachers Insurance and Annuity Association of America, New York: preparation of a plan to provide college loan funds; $2,500;

International Commission on Radiological Protection, R. Sievert, chairman: expenses of a planning meeting to be held in New York to discuss future international cooperation on radiation effects and protection; $2,000;

A fund to provide dollars for visa fees and similar charges in connection with the travel of Polish Rockefeller Foundation fellows and grantees, to be administered by the Disbursing Officer, United States Embassy, Warsaw; $1,000;

Additional expenses of publishing and distributing a directory of scholarship and other training awards made by The Rockefeller Foundation; $1,000;

Dr. Everett Needham Case, president, Colgate University, Hamilton, New York, and Mrs. Case: to observe educational developments at universities in Indonesia and Singapore while in Southeast Asia; $475;

Archibald F. Ward, Jr., visiting professor of psychiatry, Medical College of Virginia, and staff member, Eastern State Hospital, Williamsburg: to visit Nova Scotia in connection with a pilot study of possible special training in mental health for clergymen; $260.

Fellowships

FELLOWSHIPS AND OTHER STUDY AWARDS

THE Foundation's fellowship appointments are integrated with the interests of its several programs. Through fellowships, chiefly for postdoctoral study, the Foundation seeks to advance knowledge in a wide variety of fields in medical education and public health, biological and medical research, agriculture, the social sciences, and the humanities. Fellowships are awarded on an international basis to outstanding men and women who have completed their specialized training, and who have shown promise of making important contributions to their fields of study in their native countries.

During 1958 a total of 580 persons held Foundation fellowships; 301 fellowships that began in previous years continued active into 1958, and 279 new awards became active during the year. Their distribution by program is as follows:

	Fellowships from previous years continued into 1958	New awards in 1958	Number of fellows active in 1958
Agriculture	64	43	107
Biological and Medical Research	43	43	86
Humanities	39	28	67
Hungarian Refugee Program	10	1	11
Medical Education and Public Health	90	77	167
Polish Science Program	10	51	61
Social Sciences	45	36	81
	301	279	580

The fellows during 1958 came from 51 different countries. Countries represented by three or more fellows were:

Argentina	12	Korea	3
Australia	13	Lebanon	10
Belgium	3	Mexico	32
Brazil	27	Netherlands	3
Ceylon	3	Norway	6
Chile	28	Pakistan	7
Colombia	38	Peru	3
Finland	3	Philippines	17
France	4	Poland	61
Germany	7	Sweden	7
Hungary	14	Switzerland	3
India	60	Thailand	5
Indonesia	9	Turkey	25
Iran	3	United Kingdom	16
Italy	6	United States	13
Japan	103		

Fellowships were also held during 1958 by individuals from the following countries: Austria (2); Bolivia (1); Burma (1); Canada (2); Denmark (2); Ecuador (1); Ghana (1); Greece (1); Guatemala (1); Iraq (1); Israel (2); Jamaica (2); Libya (1); New Zealand (1); Portugal (2); Puerto Rico (2); Trinidad (1); Uganda (1); United Arab Republic (2); and Uruguay (2). Seven fellows during 1958 were appointed from the World Health Organization.

The Rockefeller Foundation made available a total of $1,425,000 for its regular fellowship activities during 1958, allocated for use by the various programs. To support the fellowship program during 1959 the Foundation has appropriated $1,475,000.

In 1958 the Foundation also made available $1,325,000 for its special expanded program of fellowships, scholarships, and training awards for men and women from Asia, Latin America, the Middle East, and Africa. With these funds additional awards were made to candidates from the four geographical areas mentioned above, of whom 86 received fellowships, 56, scholarships, and five, training awards. In support of the supplementary program during 1959, the Foundation has appropriated $1,125,000.

To continue a Polish Science Program initiated in 1957, the Foundation appropriated a total of $400,000 in two separate allocations during the year. In 1958 61 Polish fellows and 4 Polish scholars held appointments, 23 in agriculture, 17 in biological and medical research, and 25 in medical education and public health. Within a program made possible by grants for emergency aid in the arts and sciences for refugee Hungarians, 11 fellows held awards during the year.

The Foundation for the first time in 1958 appropriated funds to be allocated to institutions where Foundation fellows are engaged in study and research. Recognizing that the disparity between universities' expenses and their income from tuition and fees is most apparent at the advanced level of fellowship study, the Foundation made available $500,000, to be disbursed in units of $1,000 for each full year a fellow spends at a university and $500 for each half-year. The grants are unrestricted, and are in addition to tuition and other fees also paid by the Foundation through its fellowship awards.

In addition to the fellowships awarded and administered directly by The Rockefeller Foundation, national agencies have awarded fellowships with funds contributed in 1958 and previous years by the Foundation. These agencies administered a total of 116 fellowships during 1958:

Association for Asian Studies	4
British Medical Research Council	13
Canadian Humanities Research Council	2
National Research Council	
Medical Sciences	16
Social Science Research Council	81
	116

Below is a listing of individuals whose fellowships, awarded under the regular and special programs of The Rockefeller Foundation, became active in 1958, and six fellows appointed in the same year by the Medical Research Council of Great Britain. The fellowships awarded by the British Council have been included in this listing because the fellows received guidance and supervisory assistance from Foundation fellowship advisors.

The following information is included for each individual: name; country of origin; date of birth; highest degree; major field of interest; fellowship-awarding agency or program; institution with which fellow was affiliated when appointed; principal countries of fellowship study; and date of fellowship.

AAS, DAGFINN (*Norway*) *b. 1927.* M.A., Univ. of Oslo 1955. Sociology (SS). Appointed from Inst. of Social Research, Oslo. *Place of Study:* U.S.A., 1958–.

ABARCA BERTETTI, FRANCISCO (*Chile*) *b. 1928.* Pharmacist, Univ. of Concepción 1952. Experimental Biology—Biochemistry (BMR). Appointed from Univ. of Chile, Santiago. *Place of Study:* U.S.A., 1958–.

ADAMSKA-LISIECKA, HALINA (*Poland*) *b. 1921.* M.D., Acad. of Med., Lodz, 1951. Endocrinology (MEPH). Appointed from Acad. of Med. *Place of Study:* Belgium, 1958–.

AKAMATSU, YASUYUKI (*Japan*) *b. 1928.* M.D., Nara Med. Coll.

1950. Pathology (MEPH). Appointed from Osaka Univ. *Place of Study:* U.S.A., 1958–.

ALICHNIEWICZ, ANDRZEJ (*Poland*) *b. 1918.* M.D., Univ. of Lodz 1947. Cardiac Surgery (MEPH). Appointed from Acad. of Med., Lodz. *Place of Study:* U.S.A., 1958–.

ALVAREZ, ALFRED (*United Kingdom*) *b. 1929.* M.A., Univ. of Oxford 1956. Literary Criticism (DH); Literature (H). Appointed from 1) Univ. of Oxford; 2) while guest lecturer at Princeton Univ. *Place of Study:* U.S.A., 1955-56; 1958–.

APESS MAHMUD, CAMILO (*Mexico*) *b. 1930.* M.D., Univ. of San Luis Potosí 1957. Basic Medical Sciences (MEPH). Appointed from Univ. of San Luis Potosí. *Place of Study:* U.S.A., 1958–.

ARTIGAS JARA, JORGE (*Chile*) *b. 1927.* M.D., Univ. of Chile, Santiago, 1953. Parasitology (MEPH) Appointed from Univ. of Chile. *Place of Study:* U.S.A., 1958–.

BACKIEL, TADEUSZ (*Poland*) *b. 1922.* Ph.D., Central Coll. of Agric., Warsaw, 1952. Marine Resources (A). Appointed from Inst. of Inland Water Fisheries, Warsaw. *Place of Study:* U.S.A., 1958–.

BARDA, SULEYMAN (*Turkey*) *b. 1915.* Docent, Univ. of Istanbul 1952. Economics (SS). Appointed from Univ. of Istanbul. *Place of Study:* U.S.A., 1958–.

BELLE, EDWARD ALEXANDER (*Canada*) *b. 1929.* Ph.D., McGill Univ., Montreal, 1957. Biology —Virology (BMR). Appointed while teaching fellow at Univ. of Toronto. *Place of Study:* Trinidad, 1958–.

BHARADWAJ, TEJ PRAKASH (*India*) *b. 1929.* M.D., Agra Med. Coll. 1954. Experimental Pathology (MEPH). Appointed from Topiwala Natl. Med. Coll., Bombay. *Place of Study:* U.S.A., 1958–.

BHAT, HATTANGADI SHASHIDHAR (*India*) *b. 1921.* M.S., Christian Med. Coll., Vellore, 1953. Surgery (MEPH). Appointed from Christian Med. Coll. *Place of Study:* U.S.A., 1958–.

BIDZINSKI, JERZY (*Poland*) *b. 1928.* M.D., Acad. of Med., Warsaw, 1952. Anesthesiology—Neurochemistry (MEPH). Appointed from Acad. of Med. *Place of Study:* Canada, 1958–.

BINDRA, ONKAR SINGH (*India*) *b. 1932.* Assoc., Indian Agric. Research Inst., New Delhi, 1953. Agriculture — Economic Entomology (A). Appointed from Madhya Pradesh Dept. of Agric., Gwalior. *Place of Study:* U.S.A., 1958–.

BIRCH, CYRIL (*United Kingdom*) *b. 1925.* Ph.D., Univ. of London 1954. Intercultural Understanding (H). Appointed from Univ. of London. *Place of Study:* U.S.A., 1958–.

BITTENCOURT, DELMONTE (*Brazil*) *b. 1918.* M.D., Univ of São Paulo 1945. Cardiovascular Surgery (MEPH). Appointed from Univ. of São Paulo. *Place of Study:* U.S.A., 1958–.

BLASZCZAK, WLADYSLAW (*Poland*) *b. 1917.* Ph.D., Higher School of Agric., Poznan, 1956. Plant Science—Pathology (A). Appointed from Inst. of Phytopathology, Higher School of Agric. *Place of Study:* U.S.A., 1958–.

BÓBR, JAN (*Poland*) *b. 1920.* Lic. Med., Acad. of Med., Cracow, 1952. Biology — Microbiology — Immunology (BMR). Appointed from Acad. of Med. *Place of Study:* Scotland, 1958–.

BOCZEK, JAN (*Poland*) *b. 1927.* D.Sc., Inst. of Plant Protection, Pulawy, 1958. Plant Science — Economic Entomology (A). Appointed from Inst. of Plant Protection, Poznan. *Place of Study:* U.S.A., 1958–.

BOSE, SISIR KUMAR (*India*) *b. 1920.* M.B., Med. Coll., Calcutta, 1946. Pediatric Radiology (MEPH). Appointed from Inst. of Child Health, Calcutta. *Place of Study:* U.S.A., 1958–.

BROWN, WALTER ERIC (*United States*) *b. 1918.* Ph.D., Harvard Univ. 1949. Soil Science (A). Appointed from Tennessee Valley Authority. *Place of Study:* Netherlands, 1958–.

BURNSTOCK, GEOFFREY (*United Kingdom*) *b. 1929.* Ph.D., Univ. of London 1956. Physiology (BMRC). Appointed from Univ. of Oxford. *Place of Study:* U.S.A., 1958–.

CABUT, MARTHA SUSANA (*Argentina*) *b. 1926.* Chemist, Natl. Univ. of La Plata 1953. Pharmacology (MEPH). Appointed from Natl. Univ. of Cuyo, Mendoza. *Place of Study:* U.S.A., 1958–.

CADIZ, TEODORE G. (*Philippines*) *b. 1920.* M.S., Louisiana State Univ. 1956. Plant Science—Horticulture (A). Appointed from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1958–.

CARDENAS RAMOS, FRANCISCO (*Mexico*) *b. 1926.* M.S., Colorado Agric. and Mechanical Coll. 1954. Plant Science — Genetics and Plant Breeding (A). Appointed from Cotaxtla Experiment Station, Veracruz. *Place of Study:* U.S.A., 1958–.

CARRASCO, ALMA DELIA (*Uruguay*) *b. 1933.* Grad., Univ. School of Nursing, Montevideo, 1954. Nursing Education (MEPH). Appointed from Univ. School of Nursing. *Place of Study:* U.S.A., 1958–.

CASTILLO, LEOPOLDO S. (*Philippines*) *b. 1921.* M.S., Cornell Univ. 1955. Animal Science — Dairy (A). Appointed from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1958–.

CASTRONOVO, ALFONSO JORGE PEDRO (*Argentina*) *b. 1917.* M.S., Univ. of Minnesota 1954. Plant Science — Breeding and Pathology (NSA); Plant Science—Genetics and Plant Breeding (A). Appointed twice from Inst. of Applied Botany, Castelar. *Place of Study:* U.S.A., 1953-54; 1958–.

CERVELLINI, ADMAR (*Brazil*) *b. 1920.* Prof. Cat., Univ. of São Paulo 1953. Biochemistry (A). Appointed from Luiz de Queiroz Coll. of Agric., Piracicaba. *Place of Study:* U.S.A., 1958–.

CHMIEL, JÓZEF (*Poland*) *b. 1924.* M.D., Acad. of Med., Poznan, 1951. Biochemistry — General (BMR). Appointed from Acad.

of Med. *Place of Study:* U.S.A., 1958–.

CHOJECKI, ZYGMUNT (*Poland*) *b. 1914.* M.D., Acad. of Med., Warsaw, 1950. Gastroenterology (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

CHRUSCIEL, TADEUSZ LESLAW (*Poland*) *b. 1926.* M.D., Acad. of Med., Cracow, 1951. Biochemistry — Pharmacology (BMR). Appointed from Polish Acad. of Sciences, Cracow. *Place of Study:* England, 1958–.

CHUNG, KYU (*Korea*) *b. 1923.* Visual Arts (H). *Place of Study:* U.S.A., 1958–.

COATS, ALFRED WILLIAM (*United Kingdom*) *b. 1924.* Ph.D., Johns Hopkins Univ. 1953. Economics (SS). Appointed from Univ. of Nottingham. *Place of Study:* U.S.A., 1958–.

COBO A., ALEX (*Colombia*) *b. 1922.* M.D., Long Island Coll. of Med., State Univ. of New York 1946. Surgery (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* U.S.A., 1958–.

COHN, BERNARD S. (*United States*) *b. 1928.* Ph.D., Cornell Univ. 1954. History (H). Appointed from Univ. of Chicago. *Place of Study:* England, 1958–.

COLBRAN, ROBERT CHESTER (*Australia*) *b. 1926.* M.S., Univ. of Queensland, Brisbane, 1954. Plant Science—Entomology (A). Appointed from Queensland Dept. of Agric. and Stock, Brisbane. *Place of Study:* U.S.A., 1958–.

COLLISON, PETER CHEESEBOROUGH (*United Kingdom*) *b. 1925.* Ph.D., Univ. of Birmingham 1953. Sociology (SS). Appointed from Univ. of Oxford. *Place of Study:* U.S.A., 1958–.

CONCHA BARAHONA, JUAN (*Chile*) *b. 1918.* M.D., Univ. of Chile, Santiago, 1947. Physiology (MEPH). Appointed from Univ. of Concepción. *Place of Study:* Colombia, 1958–.

CORREA VELEZ, PELAYO (*Colombia*) *b. 1927.* M.D., Univ. of Antioquia, Medellín, 1952. Pathology (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* U.S.A., 1958–.

CRAWFORD, LIONEL VIVIAN (*United Kingdom*) *b. 1932.* Ph.D., Univ. of Cambridge 1958. Virology (BMR). Appointed from Univ. of Glasgow. *Place of Study:* U.S.A., 1958–.

CROWLEY, FRANCIS KEBLE (*Australia*) *b. 1924.* D.Phil., Univ. of Oxford 1951. Political Science (SS). Appointed from Univ. of Western Australia, Nedlands. *Place of Study:* England, 1958–.

CUERVO ARANGO, CARLOS (*Brazil*) *b. 1922.* M.D., Univ. of Rio Grande do Sul, Pôrto Alegre, 1949. Surgery (MEPH). Appointed from Univ. of Rio Grande do Sul. *Place of Study:* U.S.A., 1958–.

DAS, CHITTARANJAN (*India*) *b. 1918.* Assoc., Indian Agric. Research Inst., New Delhi, 1950. Plant Science — Pathology (A). Appointed from State Agric. Coll., Calcutta, and West Bengal Directorate of Agric., Calcutta. *Place of Study:* U.S.A., 1958–.

DE GUZMAN, EMERITA V. (*Phil-*

ippines) b. 1929. M.S., Cornell Univ. 1956. Plant Science—Physiology (A). Appointed from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1958–.

DEL ROSARIO, MARIA SALOME (*Philippines) b. 1932.* M.S., Kansas State Coll. 1957. Plant Science—Pathology (A). Appointed twice from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1955-57; 1958–.

DONOSO, ALFREDO OSVALDO (*Argentina) b. 1933.* M.D., Univ. of Buenos Aires 1957. Neurophysiology (MEPH). Appointed from Univ. of Buenos Aires. *Place of Study:* Brazil, 1958–.

DRYL, STANISLAW (*Poland) b. 1922.* Dr.Nat.Sc., Univ. of Lodz 1951. Biology — Protozoology (BMR). Appointed from Nencki Inst. of Experimental Biology, Warsaw. *Place of Study:* U.S.A., 1958–.

DUENAS LEHMANN, ALVARO (*Colombia) b. 1930.* M.D., Xavier Univ., Bogotá, 1957. Public Health (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* U.S.A., 1958–.

DURAN RIVERA, FABIO (*Colombia) b. 1930.* M.D., Xavier Univ., Bogotá, 1957. Basic Medical Sciences—Pathology (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* Colombia, 1958–.

DYBICKI, JERZY (*Poland) b. 1923.* M.D., Acad. of Med., Gdansk, 1949. Surgery (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

EBASHI, SETSURO (*Japan) b. 1922.* Dr.Med.Sc., Tokyo Univ. 1954. Biochemistry — Pharmacology (BMR). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

EDLER, ANA (*Brazil) b. 1928.* Law, Univ. of Brazil, Rio de Janeiro, 1955. Drama (H). Appointed from Univ. of Bahia, Salvador. *Place of Study:* U.S.A., 1958–.

EDWARD, JOHN CHINNAYYA (*India) b. 1920.* Ph.D., Univ of Madras 1952. Plant Science — Pathology (A). Appointed from Allahabad Agric. Inst. *Place of Study:* U.S.A., 1958–.

ELSHAWI, NASAR NADEEF (*Iraq) b. 1928.* Ph.D., George Washington Univ. 1956. Virology (MEPH). Appointed from Royal Fac. of Med., Baghdad. *Place of Study:* Sweden, 1958–.

ESPINOSA ELORZA, ENRIQUE (*Chile) b. 1930.* M.D., Univ. of Chile, Santiago, 1955. Physiopathology (MEPH). Appointed from Univ. of Chile. *Place of Study:* England, 1958–.

FEITH, HERBERT (*Australia) b. 1930.* M.A., Univ. of Melbourne 1955. Political Science (SS). Appointed while research fellow at Cornell Univ. *Place of Study:* U.S.A., 1958–.

FIGUEIREDO, EURICO ALVARENGA (*Brazil) b. 1920.* M.D., Univ. of Minas Gerais, Belo Horizonte, 1944. Experimental Biology — Biochemistry (BMR). Appointed from Univ. of Minas Gerais. *Place of Study:* U.S.A., 1958–.

FITKO, REMIGIUSZ (*Poland) b. 1925.* Vet. Phys. Dipl., Univ. of Warsaw 1950. Veterinary Science (A). Appointed from Central

Coll. of Agric., Warsaw. *Place of Study:* Canada, 1958–.

FODNES, JON FREDRIK (*Norway*) *b. 1920.* M.D., Univ. of Oslo 1947. Public Health (MEPH). Appointed from Norwegian Health Directorate, Oslo. *Place of Study:* U.S.A., 1958–.

FRANCO QUEVEDO, BERTHA (*Colombia*) *b. 1936.* Nurse, Univ. of Valle, Cali, 1955. Nursing Education (MEPH). Appointed from Departmental Univ. Hosp., Cali. *Place of Study:* U.S.A., 1958–.

FRYER, DONALD WILFRED (*Australia*) *b. 1920.* M.Sc., London School of Economics and Political Science 1942. Economics (SS). Appointed from Univ. of Melbourne. *Places of Study:* England, U.S.A., 1958–.

FRYKENBERG, ROBERT ERIC (*United States*) *b. 1930.* M.A., Univ. of Minnesota 1953. History (H). Appointed while grad. student at Univ. of California. *Place of Study:* England, 1958–.

FUKS, MOYSES ABRAHAM (*Brazil*) *b. 1929.* Dr. in Pharmacy and Biochemistry, Univ. of Brazil, Rio de Janeiro, 1952. Experimental Biology — Immunochemistry (BMR). Appointed from Univ. of Brazil. *Place of Study:* U.S.A., 1958–.

FURUKAWA, TARO (*Japan*) *b. 1922.* M.D., Kyoto Univ. 1946. Biology —Physiology (BMR). Appointed from Osaka City Univ. Med. School. *Place of Study:* U.S.A., 1958–.

GAD, HOLGER LYCKE (*Denmark*) *b. 1916.* Ph.D., Univ. of Aarhus 1957. Economics (SS). Appointed from Univ. of Aarhus. *Place of Study:* U.S.A., 1958–.

GAITAN MARULANDA, EDUARDO (*Colombia*) *b. 1932.* M.D., Natl. Univ. of Colombia, Bogotá, 1954. Endocrinology — Metabolism (MEPH). Appointed while teaching at Tulane Univ. of Louisiana. *Place of Study:* U.S.A., 1958–.

GALLO Z., HERNANDO (*Colombia*) *b. 1919.* M.D., Natl. Univ. of Colombia, Bogotá, 1944. Basic Medical Sciences—Surgery (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* U.S.A., 1958–.

GIAMBIAGI, JUAN JOSÉ (*Argentina*) *b. 1924.* Ph.D., Univ. of Buenos Aires 1950. Theoretical Physics (BMR). Appointed from Univ. of Buenos Aires. *Place of Study:* U.S.A., 1958–.

GIRALDO, LUIS ERNESTO (*Colombia*) *b. 1931.* M.D., Univ. of Valle, Cali, 1958. Public Health (MEPH). Appointed from Univ. of Valle. *Place of Study:* U.S.A., 1958–.

GOFFARD, NELLY (*Belgium*) *b. 1916.* Edith Cavell-Marie Depage Inst., Brussels, 1939. Nursing Education (MEPH). Appointed from Edith Cavell-Marie Depage Inst. *Place of Study:* U.S.A., 1958–.

GÖKÇEN, MEDIHA (*Turkey*) *b. 1923.* Grad., Red-Moon Nursing School, Istanbul, 1945. Nursing Education (MEPH). Appointed from Univ. of Istanbul. *Place of Study:* U.S.A., 1958–.

GOLDSTEIN, JAN (*Poland*) *b. 1913.* M.D., Acad. of Med., Lodz, 1951. Surgery (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

Gómez Marín, Vivar (*Colombia*) *b. 1926.* Nurse, Univ. of Valle, Cali, 1955. Nursing Education (MEPH). Appointed from Univ. of Valle. *Place of Study:* Puerto Rico, 1958–.

Gondokoesoemo, Abdul Aziz (*Indonesia*) *b. 1921.* International Relations (SS). Appointed from Ministry of Foreign Affairs. *Place of Study:* U.S.A., 1958–.

Gordillo Lemos, Guido (*Colombia*) *b. 1927.* M.S., Univ. of Valle, Cali, 1954. Biochemistry (MEPH). Appointed from Univ. of Valle. *Place of Study:* U.S.A., 1958–.

Govel, Hem Chandra (*India*) *b. 1923.* M.B.B.S., Glancy Med. Coll., Amritsar, 1948. Public Health (MEPH). Appointed while student at Columbia Univ. *Place of Study:* U.S.A., 1958–.

Granger, Maria José de Santa Marta (*Portugal*) *b. 1930.* Dipl., Technical School of Nursing, Lisbon, 1958. Nursing Education (MEPH). Appointed from Technical School of Nursing. *Place of Study:* U.S.A., 1958–.

Graziani, Augusto (*Italy*) *b. 1933.* Libera Docenza, Univ. of Naples 1957. Economics (SS). Appointed from Univ. of Naples. *Place of Study:* U.S.A., 1958–.

Grönroos, Paul Wilhelm (*Finland*) *b. 1925.* M.D., Univ. of Helsinki 1956. Biology—Virology (BMR). Appointed from Univ. of Helsinki. *Place of Study:* Australia, 1958–.

Grove Valenzuela, Hiram (*Chile*) *b. 1922.* M.S., Univ. of California 1956. Agriculture—Agronomy (NSA); Plant Science—Agronomy (A). Appointed from 1) Ministry of Agric., Santiago; 2) Office of Special Studies, Santiago. *Place of Study:* U.S.A., 1955–56; 1958–.

Guerrero Figueroa, Roberto (*Colombia*) *b. 1930.* M.D., Natl. Univ. of Colombia, Bogotá, 1956. Neuroanatomy — Neurophysiology (MEPH). Appointed from Univ. of Cartagena. *Place of Study:* Colombia, 1958–.

Guerrero Velasco, Helena (*Colombia*) *b. 1933.* Nurse, Univ. of Valle, Cali, 1956. Nursing Education (MEPH). Appointed from Univ. of Valle. *Place of Study:* U.S.A., 1958–.

Gülmezoglu, Ekrem (*Turkey*) *b. 1927.* M.D., Univ. of Istanbul 1951. Mycology — Virology (MEPH). Appointed from Univ. of Ankara. *Place of Study:* U.S.A., 1958–.

Gürelli, Nevzat (*Turkey*) *b. 1923.* Docent, Univ. of Istanbul 1957. Criminology (SS). Appointed from Univ. of Istanbul. *Place of Study:* U.S.A., 1958–.

Hassan, Muhammad Amjad (*Pakistan*) *b. 1928.* M.S., Punjab Agric. Coll., Lyallpur, 1954. Soil Science (A). Appointed from Ministry of Agric., Karachi. *Place of Study:* U.S.A., 1958–.

Hill, Errol Gaston (*Jamaica*) *b. 1921.* Grad. Dipl., Royal Acad. of Dramatic Art, London, 1951. Drama (H). Appointed from Univ. Coll. of the West Indies, Mona. *Place of Study:* U.S.A., 1958–.

HINUMA, YORIO (*Japan*) *b. 1925.* M.D., Tohoku Univ., Sendai, 1950. Biology—Virology (BMR). Appointed from Tohoku Univ. *Place of Study:* U.S.A., 1958–.

HIRAO, TAKEHISA (*Japan*) *b. 1925.* M.D., Chiba Univ. 1949. Biology—Physiology (BMR). Appointed from Gunma Univ., Maebashi. *Place of Study:* Italy, 1958–.

HOLLINGER, MALINDA BELLE (*United States*) *b. 1930.* B.S.N., Meharry Med. Coll. 1953. Nursing Education (MEPH). Appointed from Meharry Med. Coll. *Place of Study:* U.S.A., 1958–.

HOLLOWAY, PHILIP JOHN (*United Kingdom*) *b. 1927.* L.D.S., Univ. of London 1950. Nutrition (BMRC). Appointed from Med. Research Council Labs., Hampstead. *Place of Study:* U.S.A., 1958–.

HORUBALA, ADOLF (*Poland*) *b. 1925.* D.Sc., Central Coll. of Agric., Warsaw, 1954. Biochemistry (A). Appointed from Central Coll. of Agric. *Place of Study:* U.S.A., 1958–.

IACONO, GUSTAVO (*Italy*) *b. 1925.* Libera Docenza, Univ. of Naples 1956. Social Psychology (SS). Appointed from Univ. of Naples. *Place of Study:* U.S.A., 1958–.

ICHINOHE, MINORU (*Japan*) *b. 1926.* M.Agr., Hokkaido Univ., Sapporo, 1950. Plant Science — Nematology (A). Appointed from Natl. Inst. of Agric. Research, Tokyo. *Place of Study:* U.S.A., 1958–.

INOUE, YOHIMI (*Japan*) *b. 1920.* Bungakushi, Kyushu Univ., Fukuoka, 1951. Intercultural Understanding (H). Appointed from Kyushu Univ. *Place of Study:* U.S.A., 1958–.

ISHIDA, KIICHI (*Japan*) *b. 1923.* D.V.M., Tokyo Univ. 1945. Veterinary Science (A). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

JAKSCH, HANS JÜRGEN (*Germany*) *b. 1930.* Dr.Pol.Sc., Johann Wolfgang Goethe Univ., Frankfurt, 1957. Economics (SS). Appointed from Johann Wolfgang Goethe Univ. *Place of Study:* U.S.A., 1958–.

JANUSZEWICZ, WLODZIMIERZ (*Poland*) *b. 1927.* M.D., Acad. of Med., Warsaw, 1952. Internal Medicine — Hypertension (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

JENNETT, WILLIAM BRYAN (*United Kingdom*) *b. 1926.* F.R.C.S., England, 1952. Physiology — Neurophysiology (BMRC). Appointed from Univ. of Manchester. *Place of Study:* U.S.A., 1958–.

JERATH, BAL K. (*India*) *b. 1921.* M.P.H., Univ. of California 1955. Preventive and Social Medicine (MEPH). Appointed from Christian Med. Coll., Ludhiana. *Place of Study:* U.S.A., 1958–.

JHA, PARMESHWARI PRASAD (*India*) *b. 1928.* Assoc., Indian Agric. Research Inst., New Delhi, 1953. Soil Science (A). Appointed from Bihar Dept. of Agric., Sabour. *Place of Study:* U.S.A., 1958–.

JOEBHAAR, BANIAMIN (*Indonesia*) *b. 1929.* Intercultural Understanding (H). Appointed from Publishing Dept., Pembangunan Ltd., Djakarta, and *Siasat*, Djakarta. *Place of Study:* U.S.A., 1958–.

JOHANSEN, LEIF (*Norway*) *b. 1930.* Cand.Econ., Univ. of Oslo 1954. Economics (SS). Appointed from Univ. of Oslo. *Place of Study:* England, 1958–.

JUSZKIEWICZ, TEODOR (*Poland*) *b. 1922.* Ph.D., Univ. of Lublin 1956. Veterinary Science (A). Appointed from Veterinary Inst., Pulawy. *Place of Study:* U.S.A., 1958–.

KABATA, ALINA (*Poland*) *b. 1929.* Ph.D., Inst. of Soil Science and Plant Cultivation, Pulawy, 1957. Soil Science (A). Appointed from Inst. of Soil Science and Plant Cultivation. *Place of Study:* U.S.A., 1958–.

KALETA, ZBIGNIEW (*Poland*) *b. 1926.* M.D., Acad. of Med., Warsaw, 1951. Biology — Physiology (BMR). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

KARTASUBARNA, EDIE (*Indonesia*) *b. 1923.* Sardjana Seni Rupa, Univ. of Indonesia, Bandung, 1954. Visual Arts (H). Appointed from Univ. of Indonesia. *Place of Study:* U.S.A., 1958–.

KASPRZYK, ZOFIA MARIA (*Poland*) *b. 1917.* Docent, Univ. of Warsaw 1956. Biochemistry (A). Appointed from Inst. of Plant Physiology, Warsaw. *Place of Study:* U.S.A., 1958–.

KASTURI BAI, SUNDARAM (*India*) *b. 1932.* B.S., Christian Med. Coll., Vellore, 1954. Nursing Education (MEPH). Appointed from Christian Med. Coll. *Place of Study:* U.S.A., 1958–.

KATO, IWAO (*Japan*) *b. 1925.* M.D., Hokkaido Univ., Sapporo, 1956. Biology — Bacteriology (BMR). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

KAWADE, YOSHIMI (*Japan*) *b. 1924.* Rigakuhakushi, Tokyo Univ. 1957. Biology—Virology (BMR). Appointed from Kyoto Univ. *Place of Study:* U.S.A., 1958–.

KLINGER ROITMAN, JAIME (*Chile*) *b. 1929.* M.D., Univ. of Chile, Santiago, 1954. Gastroenterology (MEPH). Appointed from Univ. of Chile. *Place of Study:* U.S.A., 1958–.

KNESCHAUREK, FRANCESCO (*Switzerland*) *b. 1922.* Dr.Habil. (Privat-dozent), Swiss School of Economics and Public Administration, St. Gallen, 1957. Economics (SS). Appointed from Swiss School of Economics and Public Administration. *Place of Study:* U.S.A., 1958–.

KONDO, KYOJI (*Japan*) *b. 1920.* Nogakuhakushi, Tokyo Univ. 1955. Animal Science—Breeding (A). Appointed from Nagoya Univ. *Place of Study:* U.S.A., 1958–.

KÖNIG, HEINZ (*Germany*) *b. 1927.* Docent, Univ. of Münster 1958. Economics (SS). Appointed from Univ. of Münster. *Place of Study:* U.S.A., 1958–.

KOTTEGODA, SRI RAMACHANDRA (*Ceylon*) *b. 1919.* D.Phil., Univ. of Oxford 1954. Pharmacology (MEPH). Appointed from Univ. of Ceylon, Colombo. *Place of Study:* U.S.A., 1958–.

Kozlowski, Kazimierz (*Poland*) *b. 1928.* Med. Degree, Univ. of Poznan 1952. Pediatrics — Radiology (MEPH). Appointed from Univ. of Poznan. *Place of Study:* U.S.A., 1958–.

Kozminski, Stefan (*Poland*) *b. 1920.* M.D., Univ. of Wroclaw 1950. Vascular Surgery (MEPH). Appointed from Acad. of Med., Wroclaw. *Place of Study:* U.S.A., 1958–.

Krykowski, Euzebiusz (*Poland*) *b. 1927.* Med. Degree, Acad. of Med., Lodz, 1952. Internal Diseases — Hematology (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

Kun, Joseph (*United States*) *b. 1931.* B.A., Lóránd Eötvös Scientific Univ., Budapest, 1956. Intercultural Understanding (HRP; H). Appointed while grad. student at Harvard Univ. *Place of Study:* U.S.A., 1957-58; 1958–.

Kurabayashi, Yoshimasa (*Japan*) *b. 1926.* M.Ec., Hitotsubashi Univ., Tokyo, 1956. Economics (SS). Appointed from Hitotsubashi Univ. *Place of Study:* U.S.A., 1958–.

Kurban, Amal K. (*Lebanon*) *b. 1928.* M.D., American Univ. of Beirut 1952. Internal Medicine (MEPH). Appointed from American Univ. of Beirut. *Place of Study:* U.S.A., 1958–.

Kwoczynski, Jan Kazimierz (*Poland*) *b. 1915.* M.D., Univ. of Wroclaw 1949. Cardiology (MEPH). Appointed from Acad. of Med., Warsaw. *Place of Study:* U.S.A., 1958–.

Lantican, Ricardo Manzo (*Philippines*) *b. 1933.* M.S., North Carolina State Coll. 1956. Plant Science — Genetics and Plant Breeding (A). Appointed from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1958–.

la Rivière, Jan Willem Maurits (*Netherlands*) *b. 1923.* Ph.D., Technological Univ. of Delft 1958. Biochemistry — Microbiology (BMR). Appointed from Technological Univ. of Delft. *Place of Study:* U.S.A., 1958–.

Larroche, Jeanne - Claudie (*France*) *b. 1925.* M.D., Univ. of Paris 1955. Biology — Histology, Embryology (BMR). Appointed from Center of Neonatal Biological Research, Claude Bernard Assn., Paris. *Place of Study:* U.S.A., 1958–.

Larsson, Stig Bertil (*Sweden*) *b. 1928.* D.V.M., Royal Veterinary Coll., Stockholm, 1957. Biochemistry (BMR). Appointed from Royal Veterinary Coll. *Place of Study:* Italy, 1958–.

Lazo Araya, Waldo (*Chile*) *b. 1930.* Lic. in Biology, Univ. of Chile, Santiago, 1955. Experimental Biology — Protozoology (BMR). Appointed from Univ. of Chile. *Place of Study:* U.S.A., 1958–.

Leski, Ryszard Artur (*Poland*) *b. 1925.* Ph.D., Central Coll. of Agric., Warsaw, 1957. Plant Science — Entomology (A). Appointed from Research Inst. of Pomology, Skierniewice. *Place of Study:* U.S.A., 1958–.

Lewin Campaña, Jorge (*Chile*) *b. 1923.* M.D., Univ. of Chile, Santiago, 1950. Pharmacology

(MEPH). Appointed from Catholic Univ. of Chile, Santiago. *Place of Study:* U.S.A., 1958–.

LIMA-DE-FARIA, ANTONIO JOSÉ CORTESÃO PAIS (*Sweden*) *b. 1927.* D.Phil., Univ. of Lund 1956. Plant Science — Genetics (A). Appointed from Univ. of Lund. *Place of Study:* U.S.A., 1958–.

LIPA, JERZY JÓZEFAT (*Poland*) *b. 1932.* Ph.D., Univ. of Warsaw 1958. Plant Science — Economic Entomology (A). Appointed from Inst. of Plant Protection, Poznan. *Place of Study:* U.S.A., 1958–.

LISZKA, OSKAR (*Poland*) *b. 1915.* Specialist in Surgery, Neurosurgical Clinic, Cracow, 1953. Neurosurgery (MEPH). Appointed from Acad. of Med., Wroclaw. *Place of Study:* U.S.A., 1958–.

LOCKWOOD, DAVID (*United Kingdom*) *b. 1929.* Ph.D., London School of Economics and Political Science 1957. Sociology (SS). Appointed from London School of Economics and Political Science. *Place of Study:* U.S.A., 1958–.

LÓPEZ SANTOLINO, ALFREDO (*Colombia*) *b. 1931.* Lic., Univ. of Salamanca, Spain, 1955. Biochemistry — Physiology (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* Colombia, 1958–.

LUCARELLI, VITTORIO (*Italy*) *b. 1928.* M.A., A. Pacinotti Univ. Coll., Pisa, 1952. Economics (SS). Appointed from Internatl. Univ. of Social Studies, Rome. *Place of Study:* U.S.A., 1958–.

MACHADO, RAUL DODSWORTH (*Brazil*) *b. 1917.* Agronomist, Natl. School of Agron., Rio de Janeiro, 1940. Experimental Biology — Electron Microscopy (BMR). Appointed from Oil Inst., Ministry of Agric., Rio de Janeiro. *Place of Study:* U.S.A., 1958–.

MACIEJEWSKA - POTAPCZYK, WACLAWA (*Poland*) *b. 1915.* Ph.D., Univ. of Lodz 1955. Biochemistry — Nucleic Acids (BMR). Appointed from Univ. of Lodz. *Place of Study:* England, 1958–.

MANITIUS, ANDRZEJ (*Poland*) *b. 1927.* Med.Cand., Acad. of Med., Gdansk, 1956. Biochemistry (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

MANJARREZ MORENO, ARMANDO (*Mexico*) *b. 1928.* D.Sc., Natl. Univ. of Mexico, Mexico City, 1957. Experimental Biology — Organic Chemistry of Natural Products (BMR). Appointed from Natl. Univ. of Mexico. *Place of Study:* U.S.A., 1958–.

MARCZYNSKA, ANTONINA (*Poland*) *b. 1927.* M.D., Acad. of Med., Cracow, 1952. Biochemistry — Intermediate Metabolism (BMR). Appointed from Acad. of Med. and Ministry of Health, Cracow. *Place of Study:* U.S.A., 1958–.

MARMOLEJO, MARÍA J. (*Colombia*) *b. 1928.* Nurse, Univ. of Costa Rica, San José, 1954. Nursing Education (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* Puerto Rico, 1958–.

MARROQUIN ROBLES, FERNANDO (*Mexico*) *b. 1931.* M.D., Natl.

Univ. of Mexico, Mexico City, 1957. Basic Medical Sciences (MEPH). Appointed from Natl. Univ. of Mexico. *Place of Study:* U.S.A., 1958–.

MARTIN, ROSS MURDOCH (*Australia*) *b. 1929.* M.A., Victoria Univ. Coll., Wellington, New Zealand, 1954. Political Science (SS). Appointed from Australian Natl. Univ., Canberra. *Place of Study:* England, 1958–.

MATHIAS, ANTHONY PETER (*United Kingdom*) *b. 1926.* Ph.D., Univ. of London 1953. Pharmacology (BMRC). Appointed from Univ. Coll., London. *Place of Study:* U.S.A., 1958–.

MATSUURA, SHIGEHARU (*Japan*) *b. 1925.* M.Ed., Kyushu Univ., Fukuoka, 1958. Education (H). Appointed while grad. student at Kyushu Univ. *Place of Study:* U.S.A., 1958–.

MAYNTZ, RENATE MARGARETE DOROTHEA (*Germany*) *b. 1929.* Ph.D., Free Univ. of Berlin 1953. Sociology (SS). Appointed from Free Univ. of Berlin. *Place of Study:* U.S.A., 1958–.

MENDOZA L., GUNNAR (*Bolivia*) *b. 1915.* Univ. of Sucre 1932-36. History — Archives (H). Appointed from Natl. Archives and Natl. Library, Sucre. *Places of Study:* U.S.A., Bolivia, 1958–.

METCALFE, EDNA VALERIE (*WHO*) *b. 1911.* Dipl. in Public Health, Victoria Univ. Coll., Wellington, New Zealand, 1949. Nursing Education (MEPH). Appointed from World Health Organization. *Place of Study:* U.S.A., 1958–.

MICHAEL, RICHARD PHILIP (*United Kingdom*) *b. 1924.* Ph.D., Univ. of London 1958. Physiology—Neurophysiology (BMRC). Appointed from Inst. of Psychiatry, Maudsley Hosp., London. *Place of Study:* U.S.A., 1958–.

MICHAJLIK, ALEKSANDER (*Poland*) *b. 1922.* M.D., Acad. of Med., Warsaw, 1952. Clinical Biochemistry (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

MICHALSKA, MARIA JADWIGA (*Poland*) *b. 1923.* Ph.D., Univ. of Lodz 1958. Biochemistry — Nucleic Acids (BMR). Appointed from Acad. of Med., Lodz. *Place of Study:* England, 1958–.

MILLS, HARRIET CORNELIA (*United States*) *b. 1920.* M.A., Columbia Univ. 1946. Intercultural Understanding (H). Appointed while grad. student at Columbia Univ. *Place of Study:* U.S.A., 1958–.

MINAI, AHMAD (*Iran*) *b. 1921.* M.A., Univ. of Glasgow 1949. Economics (SS). Appointed from Ministry of Foreign Affairs, Teheran. *Place of Study:* U.S.A., 1958–.

MIODUSZEWSKA, OLGA (*Poland*) *b. 1927.* Phys.Dipl., Acad. of Med., Lodz, 1952. Histopathology (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

MITCHELL, ELIZABETH (*United Kingdom*) *b. 1921.* Sister Tutor Cert., Univ. of Edinburgh 1948. Nursing Education (MEPH). Appointed from Royal Victoria Hosp., Belfast. *Place of Study:* U.S.A., 1958–.

MONIER, ROGER (*France*) *b. 1924.*

Ph.D., Univ. of Paris 1954. Biochemistry — General (BMR). Appointed from Radium Inst., Paris, and Natl. Center for Scientific Research, Paris. *Place of Study:* U.S.A., 1958–.

MONTALVO, JOSÉ MIGUEL (*Colombia*) *b. 1928.* M.D., Univ. of Tennessee 1957. Pediatrics (MEPH). Appointed while assistant resident, Univ. of Tennessee. *Place of Study:* U.S.A., 1958–.

MONTEIRO, ISMENIA DE FATIMA PINTO (*Portugal*) *b. 1932.* Dipl., Technical School of Nursing, Lisbon, 1953. Nursing Education (MEPH). Appointed from Technical School of Nursing. *Place of Study:* U.S.A., 1958–.

MORI, MASAO (*Japan*) *b. 1921.* Bungakushi, Tokyo Univ. 1943. Intercultural Understanding (H). Appointed from Tokyo Univ. *Place of Study:* Turkey, 1958–.

MURAI, MINORU (*Japan*) *b. 1922.* M.A., Hiroshima Univ. of Arts and Sciences 1944. Philosophy of Education (H). Appointed from Keio Univ., Tokyo. *Place of Study:* U.S.A., 1958–.

MURAMATSU, MINORU (*Japan*) *b. 1923.* M.P.H., Johns Hopkins Univ. 1951. Public Health (IHD; MEPH). Appointed twice from Inst. of Public Health, Tokyo. *Place of Study:* U.S.A., 1950-51; 1958–.

NACIMIENTO, AMADEO CELESTINO (*Argentina*) *b. 1933.* M.D., Univ. of Buenos Aires 1958. Neurophysiology (MEPH). Appointed from Univ. of Buenos Aires. *Place of Study:* Brazil, 1958–.

NAKAGAWA, KEIICHIRO (*Japan*) *b. 1920.* M.A., Tokyo Univ. 1948. Economics (SS). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

NAKAMURA, MASAHIRO (*Japan*) *b. 1919.* D.M.S., Kyushu Univ., Fukuoka, 1949. Biochemistry — Microbiology (BMR). Appointed from Kurume Univ. *Place of Study:* U.S.A., 1958–.

NAND, NITYA (*India*) *b. 1925.* Ph.D., Univ. of Cambridge 1950. Biology — Biochemistry (BMR). Appointed from Central Drug Research Inst., Lucknow. *Place of Study:* U.S.A., 1958–.

NATARAJAN, ADAYAPALAM TYAGARAJA (*India*) *b. 1928.* Ph.D., Univ. of Delhi 1957. Plant Science — Genetics and Plant Breeding (A). Appointed from Indian Agric. Research Inst., New Delhi. *Place of Study:* U.S.A., 1958–.

NIELUBOWICZ, JAN (*Poland*) *b. 1915.* M.D., Univ. of Warsaw 1947. Experimental Surgery (MEPH). Appointed from Polish Acad. of Sciences, Warsaw. *Place of Study:* U.S.A., 1958–.

NISHI, SADAO (*Japan*) *b. 1922.* M.S., Tokyo Univ. 1950. Plant Science — Horticulture (A). Appointed from Natl. Inst. of Agric. Sciences, Hiratsuka. *Place of Study:* U.S.A., 1958–.

NIWELINSKI, JÓZEF (*Poland*) *b. 1920.* Ph.D., Jagiellonian Univ. of Cracow 1949. Biology — Physiology — Histology (BMR). Appointed from Polish Acad. of Sciences, Cracow. *Place of Study:* England, 1958–.

NKETIA, JOSEPH HANSON (*Ghana*) *b. 1921.* B.A., Univ. of London 1949. Music (H). Appointed from Univ. Coll. of Ghana, Achimota. *Place of Study:* U.S.A., 1958–.

NOJIMA, SHOSHICHI (*Japan*) *b. 1924.* Yakugakushi, Tokyo Univ. 1947. Biochemistry — Lipids (BMR). Appointed from Natl. Inst. of Health, Tokyo. *Place of Study:* U.S.A., 1958–.

NØRGAARD, CARL AAGE (*Denmark*) *b. 1924.* Cand.Jur., Univ. of Aarhus 1954. International Relations (SS). Appointed from Univ. of Aarhus. *Place of Study:* Switzerland, 1958–.

NOWICKI, JAN (*Poland*) *b. 1915.* M.D., Univ. of Warsaw 1939. Surgery (MEPH). Appointed from Inst. of Tuberculosis, Warsaw. *Place of Study:* U.S.A., 1958–.

NOWOSIELSKI, OLGIERD ALEKSANDER (*Poland*) *b. 1930.* M.S., Central Coll. of Agric., Warsaw, 1953. Soil Science (A). Appointed from Central Coll. of Agric. *Place of Study:* U.S.A., 1958–.

ODA, MASAHIKO (*Japan*) *b. 1928.* Degree in Med.Sc., Tokyo Univ. 1958. Biology—Virology (BMR). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

OGATA, MANABU (*Japan*) *b. 1921.* D.V.M., Tokyo Univ. 1943. Veterinary Science (A). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

OHNISHI, EIJI (*Japan*) *b. 1925.* Gakushi, Tokyo Univ. 1946. Biochemistry — Enzymes (BMR). Appointed from Tokyo Metropolitan Univ. *Place of Study:* U.S.A., 1958–.

OIKAWA, TOSHIKIKO (*Japan*) *b. 1925.* Dr.Med.Sc., Tohoku Univ., Sendai, 1953. Biophysics — Electrophysiology (BMR). Appointed from Tohoku Univ. *Place of Study:* U.S.A., 1958–.

OKUNO, TAKESHI (*Japan*) *b. 1928.* M.D., Tokyo Univ. 1954. Biology — Virology (BMR). Appointed from Natl. Inst. of Health, Tokyo. *Place of Study:* U.S.A., 1958–.

OLIVEIRA, DALMO NUNEZ GONÇALVES DE (*Brazil*) *b. 1932.* M.D., Univ. of Recife 1956. Basic Medical Sciences (MEPH). Appointed from Univ. of Recife. *Place of Study:* U.S.A., 1958–.

ORAZI, ORFEO OSVALDO (*Argentina*) *b. 1920.* Dr. in Pharmacy and Biochemistry, Natl. Univ. of La Plata 1944. Experimental Biology — Organic Chemistry of Natural Products (BMR). Appointed from Natl. Univ. of La Plata. *Place of Study:* U.S.A., 1958–.

OROZCO, GUILLERMO (*Colombia*) *b. 1908.* M.D., Univ. of Antioquia, Medellín, 1933. Medicine (MEPH). Appointed from Univ. of Valle, Cali. *Place of Study:* U.S.A., 1958–.

ORTEGA CASTRO, JACOBO (*Mexico*) *b. 1929.* M.S., Oklahoma State Univ. 1958. Plant Science — Pathology (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

OSADA, YASUTAKA (*Japan*) *b. 1923.* M.D., Tokyo Univ. 1948. Hematology (MEPH). Appointed from Inst. of Public Health, Tokyo. *Place of Study:* U.S.A., 1958–.

OSAKI, KENJI (*Japan*) *b. 1920.* Ph.D., Osaka Univ. 1945. Biophysics — X-ray Crystallography (BMR). Appointed from Osaka Univ. *Place of Study:* Israel, 1958–.

OSTERGAARD, GEOFFREY NIELSEN (*United Kingdom*) *b. 1926.* Ph.D., Univ. of Oxford 1953. Political Sociology (SS). Appointed from Univ. of Birmingham. *Place of Study:* U.S.A., 1958–.

PATEL, RAMJIBHAI MADHAVBHAI (*India*) *b. 1930.* M.S., Bansilal Amritlal Coll. of Agric., Anand, 1956. Biometry (A). Appointed from Inst. of Agric., Anand. *Place of Study:* U.S.A., 1958–.

PATEL, RATILAL AMBALAL (*India*) *b. 1921.* M.S., Bansilal Amritlal Coll. of Agric., Anand, 1953. Plant Science — Genetics and Plant Breeding (A). Appointed from Inst. of Agric., Anand. *Place of Study:* U.S.A., 1958–.

PAULUS, OLIVIO, JR. (*Brazil*) *b. 1927.* M.D., Univ. of Paraná, Curitiba, 1952. Basic Medical Sciences — Pediatrics (MEPH). Appointed from Univ. of São Paulo, Ribeirão Preto. *Place of Study:* U.S.A., 1958–.

PAYASLIOGLU, ARIF TURGUT (*Turkey*) *b. 1926.* LL.D., Univ. of Ankara 1952. Political Science (SS). Appointed from Univ. of Ankara. *Place of Study:* U.S.A., 1958–.

PAZARD, JANE (*Belgium*) *b. 1925.* Grad. in Nursing, Univ. School of Nursing, Brussels, 1955. Nursing Education (MEPH). Appointed from Univ. School of Nursing. *Place of Study:* U.S.A., 1958–.

PETERSON, ROALD ARNOLD (*Uruguay*) *b. 1913.* M.S., North Dakota Agric. Coll. 1939. Plant Science — Botany (A). Appointed from Inter-American Inst. of Agric. Sciences, Montevideo. *Place of Study:* U.S.A., 1958–.

PHANSALKAR, SADASHIV VINAYAK (*India*) *b. 1927.* Ph.D., Univ. of Poona 1955. Biochemistry — Nutrition (BMR). Appointed from Indian Council of Med. Research, Coonoor. *Place of Study:* U.S.A., 1958–.

PICHAICHARNARONG, AYUSA (*Thailand*) *b. 1924.* M.S., Cornell Univ. 1953. Animal Science — Physiology (A). Appointed from Kasetsart Univ., Bangkok. *Place of Study:* U.S.A., 1958–.

PITCHFORD, JOHN DAVID (*Australia*) *b. 1932.* M.Com., Univ. of Tasmania, Hobart, 1955. Economics (SS). Appointed from New South Wales Univ. of Technology, Sydney. *Place of Study:* England, 1958–.

PLEBANSKI, JERZY (*Poland*) *b. 1928.* Ph.D., Univ. of Warsaw 1954. Theoretical Physics (BMR). Appointed from Univ. of Warsaw. *Place of Study:* U.S.A., 1958–.

POTES GUTIERREZ, JAIME (*Colombia*) *b. 1926.* M.D., Xavier Univ., Bogotá, 1952. Basic Medical Sciences—Medicine (MEPH). Appointed from Univ. of Valle, Cali. *Places of Study:* Colombia. U.S.A., 1958–.

PRICE, CHARLES ARCHIBALD (*Australia*) *b. 1920.* D.Phil., Univ. of Oxford 1952. Demography (SS).

Appointed from Australian Natl. Univ., Canberra. *Place of Study:* Canada, 1958–.

PRYCZKOWSKI, JERZY (*Poland*) *b. 1931.* M.B., Acad. of Med., Gdansk, 1955. Cardiovascular Surgery (MEPH). Appointed from Acad. of Med. *Place of Study:* England, 1958–.

PUYET, JEAN HENRI (*Lebanon*) *b. 1921.* M.D., Univ. of Paris 1947. Public Health (MEPH). Appointed from United Nations Relief and Works Agency, Beirut. *Place of Study:* U.S.A., 1958–.

QUIROGA VASQUEZ, ALICIA (*Chile*) *b. 1928.* Univ. of Chile, Santiago, 1954. Drama (H). Appointed while on Fulbright Scholarship, Carnegie Inst. of Technology. *Place of Study:* U.S.A., 1958–.

RACY, JOHN CECIL (*Lebanon*) *b. 1932.* M.D., American Univ. of Beirut 1956. Clinical Psychiatry (MEPH). Appointed while resident at Strong Memorial Hosp., Univ. of Rochester. *Place of Study:* U.S.A., 1958–.

RADHAKRISHNAMURTY, BHYRAVABHOTLA (*India*) *b. 1927.* Assoc., Indian Agric. Research Inst., New Delhi, 1956. Plant Science—Genetics (A). Appointed from Central Tobacco Research Inst., Rajahmundry. *Place of Study:* U.S.A., 1958–.

RADOVANOVIC, MILIVOJE (*WHO*) *b. 1920.* M.D., Univ. of Belgrade 1947. Public Health — Epidemiology (MEPH). Appointed from World Health Organization, New Delhi. *Place of Study:* U.S.A., 1958–.

RAJAGOPALAN, PYLORE KRISHNA IYER (*India*) *b. 1930.* M.S., Benares Hindu Univ. 1951. Biology —Virology (BMR). Appointed from Virus Research Centre, Poona. *Place of Study:* U.S.A., 1958–.

RAJATASILPIN, ANUSITH (*Thailand*) *b. 1925.* M.P.H., Univ. of Med. Sciences, Bangkok, 1958. Basic Medical Sciences (MEPH). Appointed from Univ. of Med. Sciences. *Place of Study:* U.S.A., 1958–.

RAMOS, OSWALDO LUIS (*Brazil*) *b. 1928.* M.S., McGill Univ., Montreal, 1955. Clinical Medicine (MEPH). Appointed from Paulista School of Med., São Paulo. *Place of Study:* U.S.A., 1958–.

RAO, AHALYA (*India*) *b. 1925.* M.R.C.P., Royal Infirmary, Edinburgh, 1955. Biology—Medical (BMR). Appointed from School of Tropical Med., Calcutta. *Place of Study:* U.S.A., 1958–.

RAW, ISAIAS (*Brazil*) *b. 1927.* M.D., Univ. of São Paulo 1954. Experimental Biology — Biochemistry (BMR). Appointed from Univ. of São Paulo. *Place of Study:* U.S.A., 1958–.

RESTREPO G., JORGE EMILIO (*Colombia*) *b. 1932.* M.D., Univ. of Antioquia, Medellín, 1957. Surgery (MEPH). Appointed from Univ. of Antioquia. *Place of Study:* U.S.A., 1958–.

RING, ISTVAN (*Hungary*) *b. 1924.* M.D., Univ. of Med. Sciences, Budapest, 1951. Public Health (HRP). *Place of Study:* U.S.A., 1958–.

RODRIGUEZ VALDES, ANTONIO ELISEO (*Mexico*) *b. 1926.* M.S., Univ.

of Minnesota 1954. Plant Science — Pathology (A). Appointed from Rockefeller Foundation Mexican Agricultural Program, Cotaxtla Experiment Station, Veracruz. *Place of Study:* U.S.A., 1958–.

ROY, NARENDRA NATH (*India*) *b. 1923.* Assoc., Indian Agric. Research Inst., New Delhi, 1953. Plant Science — Genetics and Plant Breeding (A). Appointed from Maize and Paddy Research Station, Kalimpong. *Place of Study:* U.S.A., 1958–.

RUBIO LINARES, GUILLERMO (*Mexico*) *b. 1929.* M.D., Natl. Univ. of Mexico, Mexico City, 1957. Experimental Biology — Biochemistry (Nutrition) (BMR). Appointed from Hosp. for Nutritional Diseases, Mexico City. *Place of Study:* U.S.A., 1958–.

RULFO VIZCAINO, JUAN NEPOMUSENO PEREZ (*Mexico*) *b. 1918.* Literature (H). *Place of Study:* Mexico, 1958–.

RUSZKOWSKI, MARIAN (*Poland*) *b. 1923.* Phys. Dipl., Acad. of Med., Poznan, 1952. Protein Chemistry (MEPH). Appointed from Acad. of Med. *Place of Study:* U.S.A., 1958–.

SALMERON ROIZ, FERNANDO (*Mexico*) *b. 1925.* M.A., Natl. Univ. of Mexico, Mexico City, 1955. Philosophy (H). Appointed from Univ. of Veracruz, Jalapa. *Place of Study:* Germany, 1958–.

SAMIY, ABDOL HUSSEIN EBTEHAJ (*Iran*) *b. 1930.* M.D., Cornell Univ. 1956. Physiology (MEPH). Appointed while assistant resident in med. at Cornell Med. Coll.—New York Hosp. *Place of Study:* U.S.A., 1958–.

SAN JUAN, MARIO O. (*Philippines*) *b. 1921.* M.S., Cornell Univ. 1956. Plant Science — Pathology (A). Appointed from Univ. of the Philippines, College. *Place of Study:* U.S.A., 1958–.

SANO, SEIYO (*Japan*) *b. 1926.* Dr. Med.Sc., Kyoto Univ. 1956. Biochemistry — Proteins (BMR). Appointed from Kyoto Univ. *Place of Study:* U.S.A., 1958–.

SANTOS, BIENVENIDO N. (*Philippines*) *b. 1911.* M.A., Univ. of Illinois 1942. Literature (H). Appointed from Legazpi Coll. *Place of Study:* U.S.A., 1958–.

SANWAL, SHIVA DATT (*India*) *b. 1924.* Dr.Med.Sc., New York Univ. 1957. Medical Education (MEPH). Appointed from Univ. of Lucknow. *Place of Study:* India, 1958–.

SARATHCHANDRA, VEDITANTIRIGE EDIRIWEERA RANJITA (*Ceylon*) *b. 1914.* Ph.D., Univ. of London 1949. Drama (H). Appointed twice from Univ. of Ceylon, Peradeniya. *Places of Study:* Japan, India, U.S.A., 1955-56; Japan, 1958–.

SATOO, TAISITIROO (*Japan*) *b. 1918.* Dr.Agr.Sc., Tokyo Univ. 1956. Plant Science — Physiology (A). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

SCHIEBER HERBSTREUTER, EUGENIO (*Guatemala*) *b. 1929.* M.S., Univ. of Wisconsin 1957. Plant Science — Pathology (A). Appointed from Inter-American Cooperative Agric. Service, La Aurora. *Place of Study:* U.S.A., 1958–.

SEKULA, JAN (*Poland*) *b. 1919.* M.D., Jagiellonian Univ. of Cracow. 1948. Otology (MEPH). Appointed from Acad. of Med., Cracow. *Place of Study:* U.S.A., 1958–.

SHAFI, CH. MUHAMMAD (*Pakistan*) *b. 1919.* M.S., Univ. of the Punjab, Lahore, 1951. Plant Science — Genetics and Plant Breeding (A). Appointed from West Pakistan Dept. of Agric., Lahore. *Place of Study:* U.S.A., 1958–.

SHAH, CHAMPAKLAL BHOGILAL (*India*) *b. 1926.* M.S., Bansilal Amritlal Coll. of Agric., Anand, 1956. Plant Science — Physiology (A). Appointed from Inst. of Agric., Anand. *Place of Study:* U.S.A., 1958–.

SHARMA, NATHI LAL (*India*) *b. 1917.* M.D., Univ. of Lucknow 1953. Pediatrics (MEPH). Appointed from Univ. of Lucknow. *Place of Study:* U.S.A., 1958–.

SLOWIKOWSKI, JAN (*Poland*) *b. 1915.* M.D., Univ. of Wroclaw 1951. Surgery (MEPH). Appointed from Acad. of Med., Wroclaw. *Place of Study:* U.S.A., 1958–.

SNEATH, PETER HENRY ANDREWS (*United Kingdom*) *b. 1923.* M.A., Univ. of Cambridge 1950. Bacteriology (BMRC). Appointed from Natl. Inst. of Med. Research, London. *Place of Study:* U.S.A., 1958–.

SONOBE, ITSUO (*Japan*) *b. 1929.* LL.B., Kyoto Univ. 1954. Law (SS). Appointed from Kyoto Univ. *Place of Study:* U.S.A., 1958–.

SOOFI, MAHMOOD AHMAD (*Pakistan*) *b. 1925.* M.A., Govt. Coll., Lahore, 1951. Intercultural Understanding (H). Appointed from Govt. of West Pakistan, Lahore. *Place of Study:* Canada, 1958–.

STEPIEN, LUCJAN S. (*Poland*) *b. 1912.* Habil., Acad of Med., Lodz, 1951. Neurosurgery (MEPH). Appointed from Polish Acad. of Sciences, Warsaw. *Place of Study:* Canada, 1958–.

STUMPF, CHRISTOPH (*Austria*) *b. 1924.* M.D., Univ. of Vienna 1951. Biology — Physiology (BMR). Appointed from Univ. of Vienna. *Place of Study:* U.S.A., 1958–.

SUKHABANIJ, KACHORN (*Thailand*) *b. 1913.* B.A., Chulalongkorn Univ., Bangkok, 1940. History (H). Appointed from Thailand Historical Commission and Ministry of Education Textbooks Commission, Bangkok. *Place of Study:* U.S.A., 1958–.

SÜLER, MUALLA (*Turkey*) *b. 1926.* M.D., Univ. of Istanbul 1949. Child Psychiatry (MEPH). Appointed while resident at Bellevue Hosp., New York. *Place of Study:* U.S.A., 1958–.

SUNAGA, HIROSHI (*Japan*) *b. 1919.* Dr.Med.Sc., Nagoya Univ. 1952. Public Health (MEPH). Appointed from Nagoya Univ. *Place of Study:* U.S.A., 1958–.

SZENBERG, ALEKSANDER (*Poland*) *b. 1917.* M.D., Fac. of Med., Zurich, 1941. Biochemistry—Cytochemistry (BMR). Appointed from Polish Acad. of Sciences, Warsaw. *Place of Study:* Australia, 1958–.

SZYNKIEWICZ, ZBIGNIEW MARIAN (*Poland*) *b. 1926.* D.V.M., Univ.

of Warsaw 1951. Microbiology—Bacteriology (A). Appointed from Univ. of Warsaw. *Place of Study:* U.S.A., 1958–.

TAKAGAKI, GENKICHIRO (*Japan*) *b. 1927.* Dr.Med.Sc., Keio Univ., Tokyo, 1956. Biochemistry (BMR). Appointed from Keio Univ. *Place of Study:* U.S.A., 1958–.

TAKAGI, KIYOKO (*Japan*) *b. 1918.* M.A., Tokyo Univ. 1956. Intercultural Understanding (H). Appointed while grad. student at Tokyo Univ. *Place of Study:* U.S.A., 1958–.

TAKAGI, MAKOTO (*Japan*) *b. 1930.* M.A., Amherst Coll. 1955. Political Science (SS). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

TAKAYANAGI, SHIN-ICHI (*Japan*) *b. 1921.* Hogakushi, Tokyo Univ. 1944. Law (SS). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

TAKEMURA, SHOSUKE (*Japan*) *b. 1924.* Rigakushi, Nagoya Univ. 1949. Biochemistry — Nucleic Acids (BMR). Appointed from Nagoya Univ. *Place of Study:* England, 1958–.

TAMANOI, YOSHIRO (*Japan*) *b. 1918.* B.A., Tohoku Univ., Sendai, 1941. Economics (SS). Appointed from Tokyo Univ. *Place of Study:* U.S.A., 1958–.

TAMATE, HIDEO (*Japan*) *b. 1922.* B.S., Tohoku Univ., Sendai, 1947. Animal Science—Nutrition (A). Appointed from Tohoku Univ. *Place of Study:* U.S.A., 1958–.

TANEJA, PRAN NATH (*India*) *b. 1916.* M.R.C.P., London, 1946. Pediatrics (MEPH). Appointed from Irwin Hosp., New Delhi. *Place of Study:* U.S.A., 1958–.

TASAKI, IWAO (*Japan*) *b. 1923.* V.Agr., Tokyo Imperial Univ. 1945. Animal Science—Nutrition (A). Appointed from Nagoya Univ., Anjo. *Place of Study:* U.S.A., 1958–.

TELKKÄ, ANTTI JUHANI (*Finland*) *b. 1922.* M.D., Univ. of Helsinki 1949. Biophysics—Electron Microscopy (BMR). Appointed from Univ. of Helsinki. *Place of Study:* U.S.A., 1958–.

THOMAS, SOSAMMA (*India*) *b. 1928.* B.S., Univ. of Madras, Vellore, 1951. Nursing Education (MEPH). Appointed from School of Nursing, Kerala. *Place of Study:* U.S.A., 1958–.

TILLER, KEVIN GEORGE (*Australia*) *b. 1931.* M.S., Univ. of Adelaide 1957. Soil Science (A). Appointed from Commonwealth Scientific and Industrial Research Organization, Adelaide. *Place of Study:* U.S.A., 1958–.

TITO DE MORAES, MARIA PALMIRA MACEDO (*WHO*) *b. 1912.* Lic., Univ. of Lisbon 1951. Nursing Education (IHD; MEPH). Appointed from 1) Natl. Dept. of Health, Portugal; 2) Pan American Sanitary Bureau. *Places of Study:* U.S.A., Canada, 1936-39; U.S.A., 1958–.

TOKUYAMA, JIRO (*Japan*) *b. 1919.* M.A., Tokyo Univ. 1944. International Relations (SS). Appointed from Joint Staff Council, Defense Agency, Tokyo. *Place of Study:* U.S.A., 1958–.

TOMIYAMA, KOHEI (*Japan*) *b. 1917.* D.Agr., Hokkaido Univ., Sapporo, 1955. Plant Science — Pathology (A). Appointed from Hokkaido Natl. Agric. Experiment Station, Sapporo. *Place of Study:* U.S.A., 1958–.

TOMOEDA, MUNEMITSU (*Japan*) *b. 1924.* B.S. in Pharmacy, Tokyo Univ. 1946. Biochemistry—Pharmacology (BMR). Appointed from Kyushu Univ., Fukuoka. *Place of Study:* U.S.A., 1958–.

TRZEBINSKI, JANUSZ (*Poland*) *b. 1920.* Kandidat, Acad. of Agric., Poznan, 1957. Biochemistry (A). Appointed from Inst. of Plant Breeding, Lab. of Biochemistry, Bydgoszcz. *Place of Study:* Sweden, 1958–.

TSUCHIYA, KENZABURO (*Japan*) *b. 1921.* Dr.Med.Sc., Keio Univ., Tokyo, 1950. Public Health (MEPH). Appointed from Keio Univ. *Place of Study:* U.S.A., 1958–.

UDOMSAKDI, SUCHINDA (*Thailand*) *b. 1928.* M.P.H., Univ. of Med. Sciences, Bangkok, 1957. Microbiology (MEPH). Appointed from Univ. of Med. Sciences. *Place of Study:* U.S.A., 1958–.

UEDA, KENJI (*Japan*) *b. 1927.* M.A., Kokugakuin Univ., Tokyo, 1954. Intercultural Understanding (H). Appointed from Kokugakuin Univ. *Place of Study:* U.S.A., 1958–.

URITANI, IKUZO (*Japan*) *b. 1919.* D.Sc., Tokyo Univ. 1955. Biochemistry (A). Appointed from Nagoya Univ. *Place of Study:* U.S.A., 1958–.

USTÜNEL, BESIM (*Turkey*) *b. 1927.* Ph.D., Univ. of Istanbul 1951. Economics (SS). Appointed from Univ. of Istanbul. *Place of Study:* U.S.A., 1958–.

VALENZUELA ENCINA, RAUL (*Chile*) *b. 1923.* M.D., Univ. of Chile, Santiago, 1951. Ophthalmology (MEPH). Appointed from Univ. of Chile. *Place of Study:* U.S.A., 1958–.

VAN DOORENMAALEN, WILLIAM JACOB (*Netherlands*) *b. 1924.* M.D., Univ. of Amsterdam 1957. Embryology (BMR). Appointed from Univ. of Amsterdam. *Place of Study:* U.S.A., 1958–.

VARGAS FERNANDEZ, LUIS (*Chile*) *b. 1912.* M.D., Univ. of Chile, Santiago, 1937. Pathology — Biochemistry (MEPH). Appointed from Catholic Univ. of Chile, Santiago. *Place of Study:* England, 1958–.

VARMA, LEELA (*India*) *b. 1926.* M.S., Univ. of Lucknow 1952. Obstetrics — Gynecology (MEPH). Appointed from Univ. of Lucknow. *Place of Study:* U.S.A., 1958–.

VILLA TREVINO, SAUL (*Mexico*) *b. 1933.* M.D., Natl. Univ. of Mexico, Mexico City, 1957. Basic Medical Sciences — Pathology (MEPH). Appointed from Natl. Univ. of Mexico. *Place of Study:* U.S.A., 1958–.

VON WETTSTEIN, DIETRICH HOLGER (*Sweden*) *b. 1929.* D.Phil., Univ. of Stockholm 1957. Plant Science —Genetics (A). Appointed from Forest Research Inst., Stockholm. *Place of Study:* U.S.A., 1958–.

WALCOTT, DEREK ALTON (*Jamaica*) *b. 1930.* B.A., Univ. Coll. of the

West Indies, Mona, 1953. Drama (H). Appointed from Univ. Coll. of the West Indies. *Place of Study:* U.S.A., 1958–.

WEGELIUS, CARL OTTO (*Finland*) *b. 1920.* Ph.D., Univ. of Helsinki 1952. Biology—Cytology (BMR). Appointed from Univ. of Helsinki. *Place of Study:* U.S.A., 1958–.

WHEELWRIGHT, EDWARD LAWRENCE (*Australia*) *b. 1921.* M.A., Univ. of St. Andrews 1949. Economics (SS). Appointed from Univ. of Sydney. *Place of Study:* U.S.A., 1958–.

WIACKOWSKI, STANISLAW KAZIMIERZ (*Poland*) *b. 1929.* Ph.D., Central Coll. of Agric., Warsaw, 1956. Animal Science—Entomology (A). Appointed from Research Inst. of Pomology, Skierniewice. *Place of Study:* U.S.A., 1958–.

WITKOWSKI, ANDREW SLAVOMIR (*Poland*) *b. 1930.* Magister Degree, Jagiellonian Univ. of Cracow 1954. Chemistry (BMR). Appointed while on scholarship at Harvard Univ. *Place of Study:* U.S.A., 1958–.

WOJTCZAK, ANDRZEJ (*Poland*) *b. 1933.* Clinical Biochemistry — Water and Electrolyte Metabolism (MEPH). Appointed from Acad. of Med., Poznan. *Place of Study:* U.S.A., 1958–.

WREZLEWICZ, WLADYSLAW (*Poland*) *b. 1918.* Docent, Univ. of Wroclaw 1955. Surgery (MEPH). Appointed from Acad. of Med., Wroclaw. *Place of Study:* Denmark, 1958–.

YAMAGUCHI, SEIYA (*Japan*) *b. 1926.* Igakuhakushi, Kyushu Univ., Fukuoka, 1955. Industrial Medicine (MEPH). Appointed from Kyushu Univ. *Place of Study:* U.S.A., 1958–.

YAMANE, ICHIRO (*Japan*) *b. 1920.* B.S., Tokyo Univ. 1942. Soil Science (A). Appointed from Tohoku Univ., Sendai. *Place of Study:* U.S.A., 1958–.

YASUHIRA, TETSUJI (*Japan*) *b. 1913.* B.A., Tokyo Univ. 1936. Economics (SS). Appointed from Tokyo Metropolitan Univ. *Place of Study:* U.S.A., 1958–.

YOO, KANG YUL (*Korea*) *b. 1920.* Visual Arts (H). *Place of Study:* U.S.A., 1958–.

ZACHARIAH, PARAPEEDICAIL (*India*) *b. 1931.* M.B.B.S., Christian Med. Coll., Vellore, 1954. Biochemistry (MEPH). Appointed from Christian Med. Coll. while student at Univ. of Oxford. *Place of Study:* England, 1958–.

ZARNITZ, MARIE LUISE (*Germany*) *b. 1927.* Dr.Nat.Sc., Univ. of Freiburg 1958. Biochemistry — Enzymes, Immunochemistry (BMR). Appointed from Univ. of Freiburg. *Place of Study:* U.S.A., 1958–.

ZAWAHRY, MOHAMED ABD-EL-MONEIM EL- (*United Arab Republic*) *b. 1926.* M.P.H., Univ. of North Carolina 1957. Epidemiology (MEPH). Appointed from Ministry of Health, Alexandria. *Place of Study:* U.S.A., 1958–.

ZBROZYNA, ANDRZEJ WOJCIECH (*Poland*) *b. 1923.* M.D., Univ. of Warsaw 1947. Biology—Physiology (BMR). Appointed from Nencki Inst. of Experimental Biology, Warsaw. *Place of Study:* England, 1958–.

OTHER STUDY AWARDS

In addition to its fellowship appointments in 1958, the Foundation made 89 special awards to persons from 23 countries.

ADIMIHARDJA, SALEH (*Indonesia*) *b. 1922.* Intercultural Understanding (H). Appointed from Railway Workers Trade Union, Bandung. *Place of Study:* U.S.A., 1958–.

AGUNDIS, OMAR (*Mexico*) *b. 1933.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1958. Plant Science—Agronomy (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

ALCAYAGA CASALI, SERGIO (*Chile*) *b. 1926.* Ing.Agr., Univ. of Chile, Santiago, 1951. Soil Science (A). Appointed from Ministry of Agric., Santiago. *Place of Study:* U.S.A., 1958–.

ANAND, SATISH CHANDRA (*India*) *b. 1930.* M.Sc., Benares Hindu Univ. 1954. Plant Science — Genetics (A). Appointed from Inst. of Plant Industry, Indore. *Place of Study:* U.S.A., 1958–.

ANGELES ARRIETA, HERMILO HUGO (*Mexico*) *b. 1932.* Ing.Agr., Natl. School of Agric., Chapingo, 1956. Plant Science — Genetics and Plant Breeding (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

ANTHONIO, QUIRINO BANDELE OLATUNJI (*Nigeria*) *b. 1932.* Cand. B.Sc.(Agr.), Univ. Coll., Ibadan. Agricultural Economics (SS). Appointed while student at Univ. Coll. *Place of Study:* England, 1958–.

BANDONG, FRANCISCO C. (*Philippines*) *b. 1931.* B.S., Univ. of the Philippines, College, 1952. Animal Science—Breeding—Poultry (A). Appointed from Bureau of Animal Industry, Manila. *Place of Study:* U.S.A., 1958–.

BARBOSA, ANTONIO STOCKLER (*Brazil*) *b. 1926.* D.V.M., Rural Univ. of the State of Minas Gerais, Belo Horizonte, 1952. Animal Science — Nutrition (A). Appointed from Rural Univ. of the State of Minas Gerais. *Place of Study:* U.S.A., 1958–.

BARCELONA, GLORIA R. (*Philippines*) *b. 1927.* B.S., Univ. of the Philippines, Quezon City, 1949. Economics (SS). Appointed from Univ. of the Philippines. *Place of Study:* U.S.A., 1958–.

BARRIGA SOLORIO, CELIO (*Mexico*) *b. 1929.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1957. Plant Science — Genetics (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

BARROS NIEVES, OVIDIO (*Colombia*) *b. 1925.* Ing.Agr., Natl. Univ. of Colombia, Medellín, 1957. Plant Science — Pathology (A). Appointed from Tulio Ospina Experiment Station, Medellín. *Place of Study:* U.S.A., 1958–.

BERNARDI, JOSÉ BOTTER (*Brazil*) *b. 1920.* Eng.Agr., Luiz de Queiroz Coll. of Agric., Piracicaba, 1944. Plant Science—Horticulture (A). Appointed from Inst. of Agron., Campinas. *Place of Study:* U.S.A., 1958–.

BHATIA, VIR G. (*India*) *b. 1932.* M.A., Harvard Univ. 1958. Economics (SS). Appointed while grad. student at Harvard Univ. *Place of Study:* U.S.A., 1958–.

BHATTI, MOHAMMAD BAKHSH (*Pakistan*) *b. 1928.* M.Sc., Univ. of the Punjab, Lyallpur, 1955. Food Technology (A). Appointed from Punjab Agric. Coll., Lyallpur. *Place of Study:* U.S.A., 1958–.

BOJANOWSKI, JAN (*Poland*) *b. 1921.* M.S., Central Coll. of Agric., Warsaw, 1948. Plant Science — Genetics (A). Appointed from Inst. of Genetics, Skierniewice. *Place of Study:* U.S.A., 1958–.

BORJA, CONCORDIA RIVERA (*Philippines*) *b. 1927.* B.S., Univ. of the Philippines, College, 1950. Agriculture—General (Chemistry) (A). Appointed from Univ. of the Philippines. *Place of Study:* U.S.A., 1958–.

CAGLEVIC DRAGICEVIC, MILAN (*Chile*) *b. 1928.* Ing.Agr., Univ. of Chile, Santiago, 1954. Plant Science — Pathology (A). Appointed from Ministry of Agric., Santiago. *Place of Study:* U.S.A., 1958–.

CARVALHO, SILVIO DE MAGALHÃES (*Brazil*) *b. 1934.* Eng.Agr., Rural Univ. of the State of Minas Gerais, Viçosa, 1957. Agricultural Extension (A). Appointed from Rural Assistance and Credit Assn., Belo Horizonte. *Place of Study:* Mexico, 1958–.

CHAUDHURI, MUZAFFER AHMED (*Pakistan*) *b. 1922.* M.A., Univ. of Dacca 1944. Political Science (SS). Appointed from Univ. of Dacca. *Place of Study:* England, 1958–.

CHAVES, GERALDO MARTINS (*Brazil*) *b. 1928.* M.A., Inter-American Inst. of Agric. Sciences, Turrialba, Costa Rica, 1953. Plant Science — Pathology (A). Appointed from Rural Univ. of the State of Minas Gerais, Viçosa. *Place of Study:* U.S.A., 1958–.

CHAVEZ R., SABINO (*Mexico*) *b. 1932.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1957. Soil Science (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

CHERID, ABDULKADIR (*Indonesia*) *b. 1932.* Intercultural Understanding (H). Appointed from Indonesian Moslem Labor Union, Semarang. *Place of Study:* U.S.A., 1958–.

CHIANG, VIVIAN WEI-CHENG (*Hong Kong*) *b. 1934.* Music (H). Appointed while student at Ecole Normale de Musique de Paris. *Place of Study:* France, 1958–.

DA MOTA, FERNANDO SILVEIRA (*Brazil*) *b. 1929.* Eng.Agr., Eliseu Maciel School of Agron., Pelotas, 1950. Climatology (A). Appointed from Agron. Inst. of the South, Pelotas. *Place of Study:* U.S.A., 1958–.

DE ALBA FLORES, GABINO (*Mexico*) *b. 1925.* Ing.Agr., Natl. School of Agric., Chapingo, 1950. Plant Science — Genetics (A). Appointed from Technological Inst. and School of Advanced Studies of Monterrey. *Place of Study:* U.S.A., 1958–.

DE CASTRO, ABEILARD FERNANDO (*Brazil*) *b. 1923.* Agronomist, Rural Univ., Rio de Janeiro, 1948. Soil Science (A). Appointed from Rural Univ. *Place of Study:* U.S.A., 1958–.

DÍAZ RODRÍGUEZ, GENARO (*Colombia*) *b. 1931.* B.S., Michigan State Univ. 1955. Soil Science (A). Appointed from Ministry of Agric., Bogotá. *Place of Study:* U.S.A., 1958–.

DIRDJOSEWOJO, R. L. (*Indonesia*) *b. 1919.* Intercultural Understanding (H). Appointed from United Oil Workers Union, Djakarta. *Place of Study:* U.S.A., 1958–.

ESPINO TEJEDA, SILVESTRE (*Mexico*) *b. 1931.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1957. Plant Science — Genetics and Plant Breeding (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

FALANGHE, HELCIO (*Brazil*) *b. 1927* Doctor, Luiz de Queiroz Coll. of Agric., Piracicaba, 1955. Food Technology (A). Appointed from Luiz de Queiroz Coll. of Agric. *Place of Study:* U.S.A., 1958–.

FERNÁNDEZ BACA, SAUL (*Peru*) *b. 1931.* D.V.M., Univ. of San Marcos, Lima, 1956. Animal Science — Dairy (A). Appointed from Univ. of San Marcos. *Place of Study:* U.S.A., 1958–.

FLORES REYES, ISAIAS P. (*Mexico*) *b. 1927.* Ing.Agr., Natl. School of Agric., Chapingo, 1951. Plant Science — Horticulture (A). Appointed from Technological Inst. and School of Advanced Studies of Monterrey. *Place of Study:* U.S.A., 1958–.

FONTES, JOÃO TILLEMONT (*Brazil*) *b. 1925.* Eng.Agr., School of Agron., Cruz das Almas, 1949. Plant Science — Economic Entomology (A). Appointed from Biological Inst. of Bahia, Salvador. *Place of Study:* U.S.A., 1958–.

FUENTES CASTAÑÓN, ADOLFO (*Guatemala*) *b. 1931.* Perito Agrónomo, Natl. School of Agric., Bárcena, 1952. Plant Science — Genetics and Plant Breeding (A). Appointed from Inter-American Cooperative Agric. Service, Guatemala City. *Place of Study:* Colombia, 1958–.

GARCIA, GLICERIO MALUYO (*Philippines*) *b. 1918.* B.S., Univ. of the Philippines, College, 1941. Plant Science — Genetics and Plant Breeding (A). Appointed from Dept. of Agric. and Natural Resources, Manila. *Place of Study:* U.S.A., 1958–.

GARCÍA CABRERA, DIOMEDES CLARO (*Uruguay*) *b. 1912.* Ing.Agr., Univ. of the Republic, Montevideo, 1940. Plant Science — Agronomy (A). Appointed from Fac. of Agron., Salto. *Place of Study:* U.S.A., 1958–.

GARCÍA OSEGUEDA, WALDEMAR

(*Guatemala*) *b. 1930.* Perito Agrónomo, Natl. School of Agric., Bárcena, 1953. Plant Science — Pathology (A). Appointed from Inter-American Cooperative Agric. Service, Guatemala City. *Place of Study:* Mexico, 1958–.

GARTNER NICHOLLS, ALVARO (*Colombia*) *b. 1923.* Ing.Agr., Natl. Univ. of Colombia, Medellín, 1958. Plant Science — Genetics and Plant Breeding (A). Appointed from Palmira Experiment Station. *Place of Study:* U.S.A., 1958–.

GARZA FALCON, EDUARDO R. (*Mexico*) *b. 1930.* Ing.Agr., Technological Inst. and School of Advanced Studies of Monterrey 1957. Plant Science — Genetics and Plant Breeding (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

GARZA MONTEMAYOR, ANTONIO (*Mexico*) *b. 1932.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1955. Plant Science—Genetics and Plant Breeding (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

GARZA TREVIÑO, RICARDO (*Mexico*) *b. 1934.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1957. Plant Science—Agronomy (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

GIL FLORES, JAVIER (*Mexico*) *b. 1932.* Ing.Agr., Natl. School of Agric., Chapingo, 1955. Plant Science—Agronomy (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

GÓMEZ L., JAIRO ANTONIO (*Colombia*) *b. 1929.* Ing.Agr., Natl. Univ. of Colombia, Palmira, 1954. Soil Science (A). Appointed from Ministry of Agric., Bogotá. *Place of Study:* U.S.A., 1958–.

GRIOT, MARIO (*Argentina*) *b. 1914.* Ing.Agr., Univ. of Buenos Aires 1936. Agricultural Extension (A). Appointed from Natl. Inst. of Agric. and Livestock Technology, Buenos Aires. *Place of Study:* U.S.A., 1958–.

HERRERA S., GUILLERMO (*Honduras*) *b. 1926.* B.S., Mississippi State Coll. 1954. Animal Science — Dairy (A). Appointed from Pan American School of Agric., Tegucigalpa. *Place of Study:* U.S.A., 1958–.

KANAMORI, HISAO (*Japan*) *b. 1924.* LL.B., Tokyo Univ. 1948. Economics (SS). Appointed from Economic Planning Agency, Tokyo. *Place of Study:* England, 1958–.

KHAN, MUHAMMAD ABDULLAH (*Pakistan*) *b. 1929.* M.Sc., Punjab Agric. Coll., Lyallpur, 1954. Plant Science — Genetics (A). Appointed from Punjab Agric. Coll. *Place of Study:* U.S.A., 1958–.

KRAEMER, PAUL (*Nicaragua*) *b. 1928.* Diplom-Landwirt, Univ. of Bonn 1952. Plant Science—Entomology (A). Appointed from Ministry of Agric. and Livestock, Managua. *Place of Study:* U.S.A., 1958–.

LOTERO C., JAIME (*Colombia*) *b. 1930.* Ing.Agr., Natl. Univ. of Colombia, Medellín, 1955. Plant Science—Agronomy (A). Appointed from Ministry of Agric., Bogotá. *Place of Study:* U.S.A., 1958–.

MALDONADO VALENZUELA, ROBERTO (*Chile*) *b. 1923.* Commercial Engineer, Univ. of Chile, Santiago, 1955. Economics (SS). Appointed from Univ. of Chile. *Place of Study:* U.S.A., 1958–.

MARICONI, FRANCISCO DE ASSIS MENEZES (*Brazil*) *b. 1925.* Eng. Agr., Luiz de Queiroz Coll. of Agric., Piracicaba, 1949. Plant Science — Entomology (A). Appointed from Biological Inst., São Paulo. *Place of Study:* U.S.A., 1958–.

MÁRQUEZ MAYAUDON, CARLOS (*Mexico*) *b. 1925.* Biólogo, Natl. Univ. of Mexico, Mexico City, 1952. Plant Science — Economic Entomology (A). Appointed from Natl. Univ. of Mexico. *Place of Study:* U.S.A., 1958–.

MASSAD, CARLOS A. (*Chile*) *b. 1932.* Commercial Engineer, Univ. of Chile, Santiago, 1956. Economics (SS). Appointed while student at Univ. of Chicago. *Place of Study:* U.S.A., 1958–.

OGATA, SHOITZU (*Japan*) *b. 1927.* Nogakushi, Hokkaido Univ., Sapporo, 1950. Soil Science (A). Appointed from Hokkaido Univ. *Place of Study:* U.S.A., 1958–.

ORSI, EUJANDIR WILSON DE LIMA (*Brazil*) *b. 1929.* D.Agr., Univ. of São Paulo, Piracicaba, 1953. Plant Science — Plant Breeding (A). Appointed from Univ. of São Paulo. *Place of Study:* Italy, 1958–.

PACHECO VELOZ, RAFAEL (*Ecuador*) *b. 1925.* Ing.Agr., Central Univ., Quito, 1953. Soil Science (A). Appointed from Dept. of Agric., Ministry of Development, Quito. *Place of Study:* U.S.A., 1958–.

PALADINES M., OSVALDO LYONEL (*Ecuador*) *b. 1931.* Ing.Agr., Central Univ., Quito, 1954. Animal Science — Dairy (A). Appointed from Inter-American Cooperative Agric. Service, Quito. *Place of Study:* U.S.A., 1958–.

PATEL, AMBOOBHAI UMEDBHAI (*India*) *b. 1930.* B.Ed., Maharaja Sayajirao Univ., Baroda, 1954. Agricultural Education (A). Appointed from Sheth M.C. School of Agric., Anand. *Place of Study:* U.S.A., 1958–.

PILLAY, TRICHINOPOLY NATARAJ DATHATHRY (*India*) *b. 1931.* B.S., Osmania Univ., Hyderabad, 1953. Plant Science — Horticulture (A). Appointed from Dept. of Agric., Andhra Pradesh. *Place of Study:* U.S.A., 1958–.

POSADA OCHOA, LÁZARO (*Colombia*) *b. 1930.* Ing.Agr., Natl. Univ. of Colombia, Palmira, 1954. Plant Science — Economic Entomology (A). Appointed from Tibaitatá Experiment Station, Bogotá. *Place of Study:* U.S.A., 1958–.

PUENTE FLORES, FIDENCIO (*Mexico*) *b. 1929.* Ing.Agr., Antonio Narro Coll. of Agric., Saltillo, 1958. Soil Science (A). Appointed from Office of Special Studies, Mexico City. *Place of Study:* U.S.A., 1958–.

RASAD, ANWAR (*Indonesia*) *b. 1924.* Intercultural Understanding (H). Appointed from United Oil Workers Union, Sungei Gerong. *Place of Study:* U.S.A., 1958–.

RODRÍGUEZ, ARGOS ARGENTINO (*Argentina*) *b. 1925.* Ing.Agr., Univ. of Buenos Aires 1949. Plant Science — Genetics (A). Appointed from Inst. of Applied Botany, Castelar. *Place of Study:* U.S.A., 1958–.

RODRÍGUEZ, RICARDO A. (*Costa Rica*) *b. 1930.* M.S., Purdue Univ. 1955. Plant Science — Pathology (A). Appointed from Ministry of Agric. and Industries, San José. *Place of Study:* U.S.A., 1958–.

ROQUIA, FELIXBERTO D. (*Philippines*) *b. 1922.* M.S., Univ. of the Philippines, Los Baños, 1956. Plant Science—Horticulture (A). Appointed from Mindanao Agric. Coll., Musuan. *Place of Study:* U.S.A., 1958–.

SALDARRIAGA VELEZ, ALFREDO (*Colombia*) *b. 1926.* Ing.Agr., Natl. Univ. of Colombia, Palmira, 1953. Plant Science — Economic Entomology (A). Appointed from Ministry of Agric., Medellin. *Place of Study:* U.S.A., 1958–.

SALHUANA MACKEE, WILFREDO SERGIO (*Peru*) *b. 1928.* Ing.Agr., Natl. School of Agric., La Molina, 1951. Biometry (A). Appointed from Natl. School of Agric. *Place of Study:* U.S.A., 1958–.

SHAYAL, SAAD ELDIN MOHAMMED (*United Arab Republic*) *b. 1921.* B.Sc.(Agr.), Univ. of Cairo 1942. Econometrics (SS). Appointed from Ministry of Agric., Cairo. *Place of Study:* U.S.A., 1958–.

SIERRA, FRANCISCO ADOLFO (*Honduras*) *b. 1924.* B.S., Univ. of Florida 1955. Soil Science (A). Appointed from Pan American School of Agric., Tegucigalpa. *Place of Study:* U.S.A., 1958–.

SILVA FUENTES, JORGE (*Chile*) *b. 1928.* Agronomist, Univ. of Chile, Santiago, 1952. Plant Science — Agronomy (A). Appointed from Ministry of Agric., Temuco. *Place of Study:* U.S.A., 1958–.

SIVARAJASINGHAM, SIVASUPRAMANIAM (*Ceylon*) *b. 1932.* B.Sc., Univ. of Ceylon, Peradeniya, 1954. Soil Science (A). Appointed while on Allen Seymour Olmstead Fellowship, Cornell Univ. *Place of Study:* U.S.A., 1958–.

SJAHARUDDIN SUTAN PAMUNTJAK (*Indonesia*) *b. 1921.* Teachers Coll., Indonesia. Intercultural Understanding (H). Appointed from Central Council of the Democratic Labor Union and Indonesian Natl. Farmers Organization. *Place of Study:* U.S.A., 1958–.

SKUPIN, JANUSZ STANISLAW (*Poland*) *b. 1934.* Magister of Chemistry, Adam Mickiewicz Univ., Poznan, 1955. Biochemistry (A). Appointed from Higher School of Agric., Poznan. *Place of Study:* U.S.A., 1958–.

SOEDARMO, DJOKO (*Indonesia*) *b. 1928.* D.V.M., Univ. of Indonesia, Bogor, 1956. Veterinary Science (A). Appointed from

Univ. of Indonesia. *Place of Study:* U.S.A., 1958–.

SOERATNO (*Indonesia*) *b. 1930.* D.V.M., Univ. of Indonesia, Bogor, 1956. Veterinary Science (A). Appointed from Univ. of Indonesia. *Place of Study:* U.S.A., 1958–.

SOETJAHJO (*Indonesia*) *b. 1915.* Intercultural Understanding (H). Appointed from Postal, Telegraph, and Telephone Union, Bandung. *Place of Study:* U.S.A., 1958–.

SOHAL, TAKHAT SINGH (*India*) *b. 1926.* M.Sc., Univ. of the Punjab, Lahore and Chandigarh, 1955. Agricultural Extension (A). Appointed from Punjab Dept. of Agric., Ludhiana. *Place of Study:* U.S.A., 1958–.

SOSROMARSONO, SOEMARTONO (*Indonesia*) *b. 1930.* Engineer, Univ. of Indonesia, Bogor, 1956. Plant Science — Economic Entomology (A). Appointed from Univ. of Indonesia. *Place of Study:* U.S.A., 1958–.

TAN HOK SENG (*Indonesia*) *b. 1925.* D.V.M., Univ. of Indonesia, Bogor, 1957. Veterinary Science (A). Appointed from Univ. of Indonesia. *Place of Study:* U.S.A., 1958–.

TEIXEIRA PRIMO, ARMANDO (*Brazil*) *b. 1932.* Eng.Agr., Univ. of Rio Grande do Sul, Pôrto Alegre, 1957. Plant Science—Agronomy (A). Appointed from Univ. of Rio Grande do Sul. *Place of Study:* Mexico, 1958–.

TYAGANATARAJAN, TYAGARAMA (*India*) *b. 1928.* Dipl. in Library Science, Univ. of Madras 1951. Intercultural Understanding — Library Science (H). *Place of Study:* U.S.A., 1958–.

VALDES FABRES, ALBERTO (*Chile*) *b. 1931.* Ing.Agr., Univ. of Chile, Santiago, 1954. Soil Science (A). Appointed from Ministry of Agric., Santiago. *Place of Study:* U.S.A., 1958–.

VASSILIOU, SIMOS GEORGHIOU (*Cyprus*) *b. 1919.* B.Sc.(Econ.), London School of Economics and Political Science 1953. Economics (SS). Appointed from H.M.G. Secretariat, Nicosia. *Place of Study:* U.S.A., 1958–.

VEGA FRANCO, EDUARDO (*Colombia*) *b. 1924.* M.A., Univ. of Economics, Bogotá, 1950. Agricultural Economics (SS). Appointed from Agric. Credit Bank, Bogotá. *Place of Study:* U.S.A., 1958–.

VILLAVIZA Y NIMES, QUIRINO (*Philippines*) *b. 1927.* M.S., Central Luzon Agric. Coll., Nueva Ecija, 1957. Biometry (A). Appointed from Central Luzon Agric. Coll. *Place of Study:* U.S.A., 1958–.

VOYSEST VOYSEST, OSWALDO (*Peru*) *b. 1933.* Ing.Agr., Natl. School of Agric., La Molina, 1957. Plant Science — Genetics and Plant Breeding (A). Appointed from Cooperative Agric. Research Program, Lima. *Place of Study:* Mexico, 1958–.

YANO, NOBUHIRO (*Japan*) *b. 1926.* B.S., Tokyo Univ. 1951. Animal Science—Dairy (A). Appointed from Natl. Inst. of Agric. Sciences, Chiba. *Place of Study:* U.S.A., 1958–.

YAQUB CHAWDHRY, MUHAMMAD *(Pakistan) b. 1921.* M.Sc., Punjab Agric. Coll., Lyallpur, 1954. Plant Science — Genetics (A). Appointed from Research Station, Lyallpur Dept. of Agric. *Place of Study:* U.S.A., 1958–.

YUIZE, YASUHIKO *(Japan) b. 1928.* M.A., Hokkaido Univ., Sapporo, 1951. Economics (SS). Appointed from Natl. Research Inst. of Agric. and Forestry, Tokyo. *Place of Study:* U.S.A., 1958–.

Report of the Treasurer

REPORT OF THE TREASURER

IN THE FOLLOWING PAGES is submitted a report of the financial transactions of The Rockefeller Foundation for the year ended December 31, 1958.

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LYBRAND, ROSS BROS. & MONTGOMERY

CERTIFIED PUBLIC ACCOUNTANTS

2 BROADWAY, NEW YORK 4, N. Y.

AUDITORS' REPORT

To the Board of Trustees,
The Rockefeller Foundation:

We have examined the balance sheet of The Rockefeller Foundation as of December 31, 1958 and the related statements of principal fund, appropriations and payments, unappropriated authorizations, income available for commitment and office and equipment fund for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and statements of principal fund, appropriations and payments, unappropriated authorizations, income available for commitment and office and equipment fund present fairly the financial position of The Rockefeller Foundation at December 31, 1958, and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(*Signed*) Lybrand, Ross Bros. & Montgomery

March 6, 1959.

BALANCE SHEET — DECEMBER 31, 1958

ASSETS

Marketable securities principally at cost or market quotations at date of gift (market quotations December 31, 1958, $640,548,564.50)		$197,481,640.06
CURRENT ASSETS:		
Cash on deposit		5,220,400.97
Advances and deferred charges	$ 734,840.85	
Accounts receivable	1,006,135.12	1,740,975.97
Office and equipment at approximate net depreciated cost		184,917.19
		$204,627,934.19

FUNDS AND OBLIGATIONS

Principal Fund	$135,594,715.41
COMMITMENTS:	
Unpaid Appropriations	62,269,986.63
Income Available for Commitment	6,507,341.10
CURRENT LIABILITIES:	
Accounts payable	70,973.86
Office and Equipment Fund	184,917.19
	$204,627,934.19

PRINCIPAL FUND

Balance, December 31, 1957		$142,401,485.58
Add:		
Amount by which the proceeds of securities sold during the year exceeded the ledger value	$167,518.17	
Anonymous gift received	20,000.00	
Bequest from Estate of Irving Smith Cranford	5,711.66	193,229.83
		$142,594,715.41
Deduct:		
Amount transferred to Income Available for Commitment in accordance with action taken by Trustees at meeting of December 2-3, 1958		7,000,000.00
Balance, December 31, 1958		$135,594,715.41

APPROPRIATIONS AND PAYMENTS

Unpaid appropriations, December 31, 1957		$57,010,851.96
Appropriations during the year	$31,592,157.00	
Unused balances of appropriations allowed to lapse	1,214,165.80	30,377,991.20
		$87,388,843.16
Payments on 1958 and prior years' appropriations		25,118,856.53
Unpaid appropriations, December 31, 1958		$62,269,986.63

UNAPPROPRIATED AUTHORIZATIONS

Balance, December 31, 1957	$715,924.00
Deduct:	
Appropriation for which funds were previously authorized	715,924.00
Balance, December 31, 1958	$ —0—

INCOME AVAILABLE FOR COMMITMENT

Balance, December 31, 1957		$ 6,464,161.56
Add:		
Income and refunds:		
Income from securities	$22,692,469.52	
Refunds on closed appropriations	12,777.22	
Amount transferred from Principal Fund as of December 31, 1958	7,000,000.00	
Unused balance of appropriations allowed to lapse	1,214,165.80	30,919,412.54
		$37,383,574.10
Deduct:		
Appropriations	$31,592,157.00	
Less:		
Appropriation for which funds were previously authorized	715,924.00	30,876,233.00
Balance, December 31, 1958		$ 6,507,341.10

OFFICE AND EQUIPMENT FUND

	BALANCE DEC. 31, 1957	CHANGES DURING 1958 ADDITIONS	DEPRECIATION	BALANCE DEC. 31, 1958
Library	$ 9,029.00	$ 2,848.49	$ 3,333.49	$ 8,544.00
Equipment	161,314.77	24,792.28	33,544.52	152,562.53
Paris Office:				
Part interest in Paris office building	23,810.66			23,810.66
	$194,154.43	$27,640.77	$36,878.01	$184,917.19

APPROPRIATIONS AND UNAPPROPRIATED AUTHORIZATIONS

Commitments, December 31, 1957:		
Unpaid appropriations	$57,010,851.96	
Unappropriated authorizations	715,924.00	$57,726,775.96
Add:		
Appropriations	$31,592,157.00	
Deduct:		
Appropriation for which funds were previously authorized	715,924.00	
	$30,876,233.00	
Deduct:		
Appropriations lapsed during the year	1,214,165.80	29,662,067.20
		$87,388,843.16
Deduct:		
Payments on 1958 and prior years' appropriations		25,118,856.53
Commitments, December 31, 1958:		
Unpaid appropriations		$62,269,986.63

FINANCE COMMITTEE'S STATEMENT OF TRANSACTIONS RELATING TO INVESTED FUNDS

FOR THE YEAR ENDED DECEMBER 31, 1958

PURCHASED		
$4,000,000	United States of America 1½% Treasury Notes April 1, 1963 @ 92.25	$ 3,690,000.00
½	share International Business Machines Corp. Common (Par $5) @ 161.25	161.25
2,800	shares Peoples Gas Light & Coke Co. Common (Par $25) @ 41. plus the surrender of 30,800 rights	114,800.00
		$ 3,804,961.25
BEQUEST FROM ESTATE OF IRVING SMITH CRANFORD		
256	shares Oakite Products, Inc. Common @ 20.	$ 5,120.00
OTHERWISE ACQUIRED		
$4,000,000	United States of America 1¼% Treasury Certificates of Indebtedness May 15, 1959 received in exchange for a like amount of United States of America 2⅜% Treasury Bonds June 15, 1958 @ 100.	$ 4,000,000.00
11,000,000	United States of America 1⅝% Treasury Certificates of Indebtedness August 1, 1959 received in exchange for a like amount of United States of America 2¼% Treasury Bonds September 15, 1956-59 @ 99.3295454	10,926,250.00
1,000,000	United States of America 3⅜% Treasury Certificates of Indebtedness "E" November 15, 1959 received in exchange for a like amount of United States of America 2½% Treasury Bonds December 15, 1958 @ 99.95	999,500.00
1,530	shares American Electric Power Co., Inc. Common (Par $10) received as a stock dividend on 61,200 shares of Common (Par $10) of record 12/9/59	—0—
24,750	rights American Telephone & Telegraph Co. received on 24,750 shares of Capital (Par $100) owned of record 1/24/58 @ 2.88884606	71,498.94
15,423	shares Consolidated Edison Co. of New York, Inc. Common (No Par) received in conversion of $701,000. Consolidated Edison Co. of New York, Inc. 4½% Conv. Deb. February 15, 1972 @ 49.31174544 plus $28.49 in lieu of fractional share of stock	760,535.05
1,675	" First National Bank of Chicago Common (Par $100) received as a stock dividend on 6,700 shares of Common (Par $100) owned of record 7/15/58	—0—

137½	" International Business Machines Corp. Common (Par $5) received as a stock dividend on 5,500 shares of Common (Par $5) owned of record 1/6/58	$ —0—
1,400	" International Paper Co. Common (Par $7.50) received as a stock dividend on 70,040 shares of Common (Par $7.50) owned of record 11/21/58	—0—
30,800	rights Peoples Gas Light & Coke Co. received on 30,800 shares of Common (Par $25) owned of record 10/2/58	—0—
5,000	shares Standard Oil Co. (New Jersey) Capital (Par $7) received as a stock dividend on 1,000,000 shares Standard Oil Co. (Indiana) Capital (Par $25) owned of record 11/14/58. Taken into the books at the sales price @ 58.385714	291,928.57
		$17,049,712.56
		$20,859,793.81

SOLD		PROCEEDS	LEDGER VALUE
$299,000	Consolidated Edison Co. of New York 4½% Conv. Deb. February 15, 1972 @ 116.116806	$ 347,189.25	$ 324,907.69
4,000,000	United States of America 1½% Treasury Notes April 1, 1960 @ 98.75	3,950,000.00	3,827,500.00
30	shares American Electric Power Co., Inc. Common (Par $10) @ 40.938	1,228.14	514.15
24,750	rights American Telephone & Telegraph Co. @ 2.88884606	71,498.94	71,498.94
24,000	shares Canadian Industries Limited Common (No Par) @ 17.88643263	428,779.72	529,706.30
12,000	" Fireman's Fund Insurance Co. Capital (Par $2.50) @ 58.3862616	700,635.14	630,479.95
40	" International Paper Co. Common (Par $7.50) @ 89.92475	3,596.99	1,349.29
20	" Monsanto Chemical Co. Common (Par $2) @ 33.961	679.22	484.55
256	" Oakite Products, Inc. Common @ 20.	5,120.00	5,120.00
5,000	" Standard Oil Co. (New Jersey) Capital (Par $7) @ 58.385714	291,928.57	291,928.57
8,300	" Union Pacific Railroad Co. Common (Par $10) @ 35.5083265	294,719.11	178,559.51
11,485	" Union Tank Car Co. Capital (No Par) @ 31.54927557	362,343.43	68,127.48
20,000	" United Fruit Co. Capital (No Par) @ 38.698294	773,965.88	1,133,989.79
		$7,231,684.39	$ 7,064,166.22

FINANCE COMMITTEE'S STATEMENT OF TRANSACTIONS RELATING TO INVESTED FUNDS — *concluded*

		LEDGER VALUE
OTHERWISE DISPOSED OF		
$ 701,000	Consolidated Edison Co. of New York, Inc. 4½% Conv. Deb. February 15, 1972 converted into 15,423 shares Consolidated Edison Co. of New York, Inc. Common (No Par) @ 108.4969386	$ 760,563.54
11,000,000	United States of America 2¼% Treasury Bonds September 15, 1956-59 exchanged for a like amount of United States of America 1⅝% Certificates of Indebtedness August 1, 1959 @ 99.3295454	10,926,250.00
4,000,000	United States of America 2⅜% Treasury Bonds June 15, 1958 exchanged for a like amount of United States of America 1¼% Certificates of Indebtedness May 15, 1959 @ 100.	4,000,000.00
1,000,000	United States of America 2½% Treasury Bonds December 15, 1958 for a like amount of United States of America 3⅜% Treasury Certificates of Indebtedness November 15, 1959 @ 100.	1,000,000.00
		$16,686,813.54
LEDGER VALUE REDUCED		
24,750	shares American Telephone & Telegraph Co. Capital (Par $100) by the value of 24,750 rights @ 2.88884606	$ 71,498.94
	Amortization of bond premiums	17,805.71
		$ 89,304.65
		$23,840,284.41

RECONCILIATION

Ledger value of securities December 31, 1957		$200,462,130.66
Purchased	$ 3,804,961.25	
Bequest from Estate of Irving Smith Cranford	5,120.00	
Otherwise acquired	17,049,712.56	20,859,793.81
		$221,321,924.47
Sold	$ 7,064,166.22	
Otherwise disposed of	16,686,813.54	
Ledger value reduced	89,304.65	23,840,284.41
Ledger value of securities December 31, 1958		$197,481,640.06

SCHEDULE OF SECURITIES ON DECEMBER 31, 1958

BONDS	PAR	LEDGER VALUE PRICE	LEDGER VALUE TOTAL	MARKET QUOTATIONS PRICE	MARKET QUOTATIONS TOTAL
American Telephone & Telegraph Co. 3⅞% 34 yr. Deb. July 1, 1990	$ 2,000,000	102.592	$ 2,051,836.70	92.00	$ 1,840,000.00
Dallas Power & Light Co. 4¼% 1st Mtge. December 1, 1986	500,000	100.792	503,960.68	98.00	490,000.00
General Motors Acceptance Corp. 5% 20 yr. Deb. August 15, 1977	1,000,000	97.50	975,000.00	107.50	1,075,000.00

SCHEDULE OF SECURITIES—*continued*

BONDS—*concluded*	PAR	LEDGER VALUE PRICE	LEDGER VALUE TOTAL	MARKET QUOTATIONS PRICE	MARKET QUOTATIONS TOTAL
Illinois Bell Telephone Co. 4¼% Series "E" March 1, 1988	$ 1,000,000	101.332	$ 1,013,323.74	98.00	$ 980,000.00
International Bank for Reconstruction and Development 3½% October 15, 1971	1,000,000	98.00	980,000.00	92.50	925,000.00
Michigan Bell Telephone Co. 4⅜% 35 yr. Deb. December 1, 1991	1,000,000	102.138	1,021,382.36	99.00	990,000.00
The Mountain States Telephone & Telegraph Co. 4⅜% 31 yr. Deb. February 1, 1988	1,000,000	101.216	1,012,156.53	99.00	990,000.00
Pacific Gas & Electric Co. 4½% 1st & Ref. Mtge. "AA" December 1, 1986	1,000,000	101.401	1,014,011.06	101.625	1,016,250.00
Public Service Electric & Gas Company 4⅜% 1st & Ref. Mtge. November 1, 1986	1,000,000	101.175	1,011,754.08	99.00	990,000.00
Scott Paper Company 3% Conv. Deb. March 1, 1971	1,000,000	103.610	1,036,099.32	105.75	1,057,500.00
United States of America Treasury Bonds:					
2¾% — Sept. 15, 1961	1,920,000	100.00	1,920,000.00	97.5625	1,873,200.00
2½% — Nov. 15, 1961	9,000,000	100.029	9,002,615.94	96.625	8,696,250.00

2½% — Aug. 15, 1963	11,000,000	99.460	10,940,554.94	94.4375	10,388,125.00
2½% — June 15, 1962-67	11,200,000	98.739	11,058,762.94	90.125	10,094,000.00
2½% — Dec. 15, 1964-69	12,000,000	96.305	11,556,562.50	87.0625	10,447,500.00
2½% — June 15, 1967-72	9,000,000	98.941	8,904,650.50	85.625	7,706,250.00
United States of America 1⅞% Treasury Notes February 15, 1959	8,000,000	100.032	8,002,567.25	99.875	7,990,000.00
United States of America 1½% Treasury Notes April 1, 1963	4,000,000	92.25	3,690,000.00	91.625	3,665,000.00
United States of America 2½% Savings Bonds "G" October 1, 1962	1,000,000	100.00	1,000,000.00	96.70	967,000.00
United States of America 1¼% Treasury Certificates of Indebtedness May 15, 1959	4,000,000	100.00	4,000,000.00	99.375	3,975,000.00
United States of America 1⅝% Treasury Certificates of Indebtedness "C" August 1, 1959	11,000,000	99.330	10,926,250.00	99.375	10,931,250.00
United States of America 3⅜% Treasury Certificates of Indebtedness November 15, 1959	1,000,000	99.95	999,500.00	100.25	1,002,500.00
			$92,620,988.54		$88,089,825.00

SCHEDULE OF SECURITIES — *continued*

STOCKS	SHARES	LEDGER VALUE PRICE	LEDGER VALUE TOTAL	MARKET QUOTATIONS PRICE	MARKET QUOTATIONS TOTAL
American Electric Power Co., Inc. (Par $10)	62,700	$ 17.138	$ 1,074,570.80	$ 54.125	$ 3,393,637.50
American Telephone & Telegraph Co. Cap. (Par $100)	24,750	132.088	3,269,169.30	225.00	5,568,750.00
Canadian Industries Limited (No Par)	15,000	22.071	331,066.44	17.62679	264,402.00
Christiana Securities Co. (Par $100)	200	5,568.00	1,113,600.00	14,100.00	2,820,000.00
Consolidated Edison Co. of N. Y., Inc. (No Par)	15,423	49.312	760,535.05	65.00	1,002,495.00
Consolidated Natural Gas Co. Cap. (Par $10)	300,000	16.189	4,856,806.82	50.75	15,225,000.00
Continental Insurance Co. Cap. (Par $5)	25,000	36.588	914,713.17	61.75	1,543,750.00
Continental Oil Co. Cap. (Par $5)	300,000	6.718	2,015,418.15	63.125	18,937,500.00
Corning Glass Works (Par $5)	12,500	35.593	444,917.79	102.00	1,275,000.00
Crown Zellerbach Corporation (Par $5)	22,500	26.274	591,167.64	57.875	1,302,187.50
Dow Chemical Co. (Par $5)	21,500	23.025	495,033.83	76.50	1,644,750.00
Fireman's Fund Insurance Co. Cap. (Par $2.50)	13,000	52.540	683,019.94	58.75	763,750.00
First National Bank of Chicago (Par $100)	8,375	139.689	1,169,895.85	343.00	2,872,625.00
Freeport Sulphur Co. (Par $10)	30,000	74.396	2,231,877.90	99.00	2,970,000.00
General Electric Co. (Par $5)	60,000	19.674	1,180,424.14	78.375	4,702,500.00
Goodrich, B. F. Co. (Par $10)	50,000	36.798	1,839,893.41	81.00	4,050,000.00
Hartford Fire Insurance Co. Cap. (Par $10)	25,000	87.141	2,178,527.78	186.00	4,650,000.00

Inland Steel Co. (No Par)	10,000	74.95	749,507.83	144.625	1,446,250.00
Insurance Company of North America Cap. (Par $5)	25,000	96.476	2,411,908.38	136.00	3,400,000.00
International Business Machines Corp. (Par $5)	5,638	117.137	660,417.08	535.00	3,016,330.00
International Nickel Co. of Canada Ltd. (No Par)	55,000	41.636	2,289,969.82	88.25	4,853,750.00
International Paper Co. (Par $7.50)	71,400	33.071	2,361,266.01	117.625	8,398,425.00
Kennecott Copper Corporation (No Par)	30,000	58.539	1,756,180.37	98.50	2,955,000.00
Monsanto Chemical Co. (Par $2)	31,600	24.228	765,595.10	39.375	1,244,250.00
National Lead Co. (Par $5)	15,300	48.811	746,805.13	111.75	1,709,775.00
The Ohio Oil Co. (No Par)	200,000	17.292	3,458,394.00	39.875	7,975,000.00
Peoples Gas Light & Coke Co. (Par $25)	33,600	31.469	1,057,373.46	50.50	1,696,800.00
Phelps Dodge Corporation Cap. (Par $12.50)	70,000	26.358	1,845,087.74	60.375	4,226,250.00
Socony Mobil Oil Co. Inc. Cap. (Par $15)	300,000	25.927	7,778,152.30	48.375	14,512,500.00
Standard Oil Co. of California Cap. (Par $6.25)	200,000	9.468	1,893,562.39	59.75	11,950,000.00
Standard Oil Co. (Indiana) Cap. (Par $25)	1,000,000	14.185	14,184,717.71	47.25	47,250,000.00
Standard Oil Co. (New Jersey) Cap. (Par $7)	6,000,000	5.006	30,037,173.47	57.625	345,750,000.00
Travelers Insurance Co. Cap. (Par $5)	25,000	34.255	856,385.00	93.50	2,337,500.00
Union Carbide Corporation (No Par)	20,000	85.790	1,715,807.93	126.125	2,522,500.00
Union Pacific R.R. Co. (Par $10)	41,700	21.513	897,100.17	35.625	1,485,562.50
Union Tank Car Co. Cap. (No Par)	100,000	5.931	593,186.57	37.00	3,700,000.00

SCHEDULE OF SECURITIES — *concluded*

STOCKS — *concluded*	SHARES	LEDGER VALUE PRICE	LEDGER VALUE TOTAL	MARKET QUOTATIONS PRICE	MARKET QUOTATIONS TOTAL
United States Steel Corporation (Par $16-2/3)	20,000	$41.115	$ 822,293.22	$96.25	$ 1,925,000.00
Westinghouse Electric Corporation (Par $12.50)	20,000	61.227	1,224,541.52	73.125	1,462,500.00
Weyerhaeuser Timber Co. Cap. (Par $7.50)	120,000	13.3716	1,604,588.31	47.125	5,655,000.00
			$104,860,651.52		$552,458,739.50

SUMMARY

	LEDGER VALUE	MARKET QUOTATIONS
Bonds	$ 92,620,988.54	$ 88,089,825.00
Stocks	104,860,651.52	552,458,739.50
	$197,481,640.06	$640,548,564.50

Geographical Distribution of Grants, 1958

GEOGRAPHICAL DISTRIBUTION OF GRANTS, 1958

	Amount $	*page*
UNITED STATES		
ALASKA		
UNIVERSITY OF ALASKA		
Alaska Agricultural Experiment Station: research	30,000	361
Plant pathology: C. E. Logsdon; travel	1,650	368
ARIZONA		
AMERICAN INSTITUTE FOR FOREIGN TRADE		
Brazilian history: W. L. Schurz; travel	3,900	281
UNIVERSITY OF ARIZONA		
Arid lands: research	201,800	383
Indian art: exhibit and conference	4,000	293
CALIFORNIA		
RAND CORPORATION		
Conference on legal problems of outer space: expenses	6,250	330
ST. MARY'S COLLEGE		
Political theory: V. C. Ferkiss; research	4,000	339
SAN FRANCISCO ART ASSOCIATION		
Information center on contemporary artists: establishment	14,750	291
SAN FRANCISCO BALLET GUILD		
San Francisco Ballet Company: expenses of new productions	25,000	290
SAN FRANCISCO MUSEUM OF ART		
Art lending program: expenses	6,400	292
STANFORD UNIVERSITY		
Agricultural economics: B. C. Swerling; research	1,000	335
History of the Turkish Revolution: E. Z. Karal and F. P. Latimer, Jr.; research	15,000	271
Japanese studies: development	110,000	263
Sociology of law: T. Kawashima; research	5,000	335

	Amount $	*page*
Uncertainty factors in decision-making: research	117,300	313
University administration: seminar	66,000	265
UNIVERSITY OF CALIFORNIA		
Berkeley:		
English language instruction: J. H. Sledd; travel	3,685	302
Epidemiology: W. C. Reeves; travel	1,500	247
Russian-Polish relations: W. Lednicki; research	27,200	269
South Asian languages: development of study program	60,000	266
Virology: C. A. Knight; travel	1,000	247
Davis:		
Vegetable crops: P. G. Smith; travel and research	3,600	368
Los Angeles:		
Nursing: development of doctoral program	10,000	182
Oriental music: development of program	39,000	286
Physiology of yoga: research	2,500	210
Riverside:		
Citrus virus diseases: Dr. and Mrs. J. M. Wallace; travel	3,400	368
UNIVERSITY OF SAN FRANCISCO		
Legal philosophy: R. A. Vachon, S.J.; study	3,500	339
UNIVERSITY OF SOUTHERN CALIFORNIA		
Legal philosophy: C. Q. Christol; study	5,000	335
VIRUS STUDIES	26,000	240

CONNECTICUT

AMERICAN SHAKESPEARE FESTIVAL THEATRE AND ACADEMY, INC.		
Appointment of full-time director and related expenses	50,000	283
Drama education: M. Saint Denis; writing	2,000	293
CONNECTICUT COLLEGE		
Summer School and Festival of the Dance: expenses	40,000	285
WESLEYAN UNIVERSITY		
Political theory:		
E. E. Schattschneider; research	5,000	338
C. E. Vose; study	8,000	338
YALE UNIVERSITY		
Cowles Foundation for Research in Economics: support	310,000	309
Legal philosophy: W. F. Berns; research	1,500	340
Medical education: W. E. Bloomer; travel	1,100	178
Virology: R. M. Taylor; travel	2,600	247

DISTRICT OF COLUMBIA

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE		
Conference on science: expenses	10,000	396
First International Oceanographic Congress: expenses	10,000	396
Youth's attitude toward science: study	9,000	396

	Amount $	*page*
AMERICAN COUNCIL OF LEARNED SOCIETIES		
Encyclopedia of Islam: preparation of new edition	15,000	271
AMERICAN TYPE CULTURE COLLECTION		
Viral and Rickettsial Registry and Distribution Center: expansion	1,000	248
AMERICAN UNIVERSITY		
History of Washington, D.C.: C. M. Green; preparation	26,000	279
LIBRARY OF CONGRESS		
Latin American poetry: recording and cataloguing	6,950	292
Moroccan music: P. Bowles; study	6,800	292
NATIONAL ACADEMY OF SCIENCES		
International Conference on Scientific Information: expenses	10,000	397
Genetics: research	50,000	219
Visits by American women scientists to the Soviet Union: expenses	10,000	397
NATIONAL BUREAU OF STANDARDS AND THE WORLD HEALTH ORGANIZATION		
Meeting of the International Commission on Radiological Units and Measurements: expenses	7,500	398
NATIONAL RESEARCH COUNCIL		
Committee on Agricultural Pests: research	9,500	367
Nutrition: research	300,000	224
Tropical medicine and hygiene: study	26,000	176
PAN AMERICAN SANITARY BUREAU		
Advisory group on zoonoses: establishment	9,700	367
Laboratory services: D. Geib; expenses	1,300	195
PERMANENT COMMITTEE FOR THE OLIVER WENDELL HOLMES DEVISE		
History of the Supreme Court: preparation	37,500	336
UNITED STATES BOOK EXCHANGE		
Establishment of new headquarters: expenses	35,000	395

FLORIDA

UNIVERSITY OF FLORIDA		
Contemporary German foreign policy: F. H. Hartmann; research	8,500	334
International law: O. Svarlien; research	9,300	334
Jurisprudence: W. O. Weyrauch; study	10,000	337
Research library on the Caribbean: development	7,500	272
Soil science: research	2,300	367

GEORGIA

ATLANTA UNIVERSITY		
Political theory: S. D. Cook; study	8,000	337

	Amount $	*page*
UNIVERSITY OF GEORGIA		
Legal philosophy: G. S. Parthemos; research	5,000	339
HAWAII		
HONOLULU ACADEMY OF ARTS		
Far Eastern cultural history: G. H. Kerr; appointment as advisor	7,200	272
UNIVERSITY OF HAWAII		
Agriculture: graduate training program	10,000	368
Comparative music: B. B. Smith; travel	1,000	274
Fijian and Samoan art: E. A. Stasack; study	2,500	274
Oriental music: development of teaching materials	2,000	274
ILLINOIS		
AMERICAN COLLEGE OF RADIOLOGY		
Film on radiation hazard control: preparation	65,000	169
AMERICAN LIBRARY ASSOCIATION		
Office of International Relations: support	130,000	295
Library reference services: seminar	40,450	295
Training of Indian librarians: expenses	15,500	295
AMERICAN PHILOSOPHICAL ASSOCIATION, WESTERN DIVISION		
Philosophy: W. A. R. Leys; study	7,950	280
ASSOCIATION OF AMERICAN MEDICAL COLLEGES		
Service to the Association for the Study of Medical Education in Great Britain: expenses	1,500	181
FUND FOR THE INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS, INC.		
Triennial meeting: expenses of participants	10,000	326
NORTHWESTERN UNIVERSITY		
Life of Leon Walras: W. Jaffe; research	4,300	318
UNIVERSITY OF CHICAGO		
Asian economic history: meeting	2,000	327
Geography: J. Roglic; travel	3,500	327
Indian cultural history: J. A. B. van Buitenen; research	3,500	273
Political science: E. C. Banfield; study	5,500	339
Section of Nuclear Medicine: establishment	500,000	159
Sumatran languages and cultures: Mr. and Mrs. G. E. Williams; research	3,000	273
UNIVERSITY OF ILLINOIS		
Biochemistry: research	10,000	231
INDIANA		
PURDUE RESEARCH FOUNDATION		
Agronomy: H. H. Kramer; travel	1,500	368

	Amount $	page
PURDUE UNIVERSITY		
Botany and plant pathology: research	24,000	362
UNIVERSITY OF NOTRE DAME		
Law: symposium	2,500	336

LOUISIANA

TULANE UNIVERSITY OF LOUISIANA		
Biochemistry: W. B. Wendel; travel	2,550	181
Epidemiology and parasitology: E. C. Faust; travel	2,100	181

MARYLAND

JOHNS HOPKINS UNIVERSITY		
Cytology and virology: G. O. Gey; travel	600	248
Foreign policy: R. Hilsman; study	9,000	334
International health administration: A. J. Patterson; book preparation	3,850	195
UNIVERSITY OF MARYLAND		
Algae: research	13,000	386
Nematology: research	10,000	367

MASSACHUSETTS

AMERICAN ACADEMY OF ARTS AND SCIENCES		
Conference on arms limitation: expenses	1,200	336
BOSTON MUSEUM OF FINE ARTS		
Seminar on application of science to examination of works of art: expenses of publication and of E. T. Hall	2,150	293
BOSTON UNIVERSITY		
Nursing: research project	9,000	178
FLETCHER SCHOOL OF LAW AND DIPLOMACY		
United Nations technical assistance: K. J. K. Amma; completion of doctoral dissertation	1,410	328
HARVARD UNIVERSITY		
Biography of Franklin D. Roosevelt: F. Freidel; preparation of additional volumes	6,000	281
British national and foreign policy: S. H. Beer; research	9,000	333
Center for International Affairs: research	120,000	329
Community leadership: research	10,000	318
Corn biology: research	69,650	354
Corn genetics: Dr. and Mrs. P. C. Mangelsdorf; travel	2,000	367
Genetics: statistical analysis	4,000	223
Harvard-Yenching Institute:		
A. Fang; study	12,320	272
Korean studies; support	225,000	261
S. Nakayama; study	1,200	281

	Amount $	page
Hematology: J. H. Jandl; travel	2,000	178
Neurophysiology: M. A. B. Brazier; travel	3,100	210
Political theory: L. Hartz; study	8,000	338
Resources for scientific research and development: study	10,000	333
INSTITUTE ON RELIGION IN AN AGE OF SCIENCE		
Summer conference: expenses	5,000	281
MASSACHUSETTS INSTITUTE OF TECHNOLOGY		
Calibration of neutron beam: expenses	17,000	178
Economic development: research	38,680	324
Economics: L. Hirsch; book completion	3,500	327
International relations: L. W. Martin; study	5,500	334
Metal casting for sculpture: A. Duca; research	10,000	291
MCLEAN HOSPITAL		
Neurochemical symposium: expenses of participants	10,000	209
MOUNT HOLYOKE COLLEGE		
German cultural history: P. Viereck; travel and study	3,000	281

MICHIGAN

MICHIGAN STATE UNIVERSITY		
Economics: J. M. Hunter; travel	750	328
Political science:		
R. Horwitz; study	6,000	339
G. A. Schubert, Jr.; book completion	1,500	339
UNIVERSITY OF MICHIGAN		
Genetics: J. V. Neel; travel	2,050	182
Legislative representation: study	140,000	312
Linguistics: training for Egyptian teachers	26,000	298
Medical School: faculty exchange program	9,000	182
Meeting of the International Astronomical Union: expenses of American participants	10,000	397
Sociology: H. Miner; study	1,800	328
Theory of consumer behavior: research	150,000	310
WAYNE STATE UNIVERSITY		
Nursing: F. Sherbon; travel	5,400	182

MINNESOTA

ST. OLAF COLLEGE		
Political philosophy: H. V. Hong; study	4,650	339
UNIVERSITY OF MINNESOTA		
Plant interaction: research	88,500	350
Plant pathology: A. W. Koch; visiting appointment	1,200	368
Political theory: H. McClosky; study	6,500	338
WALKER ART CENTER		
Experimental art appreciation program: support	10,000	292

	Amount $	page
MISSISSIPPI		
DELTA DEMOCRAT-TIMES		
International cultural exchange:		
Mr. and Mrs. H. Carter; travel	8,000	398
MISSOURI		
HARRY S. TRUMAN LIBRARY INSTITUTE FOR NATIONAL AND INTERNATIONAL AFFAIRS		
Library development	48,700	277
ST. LOUIS UNIVERSITY		
Radiobiology: development of program	62,000	170
WASHINGTON UNIVERSITY		
Physiology: G. M. Schoepfle; travel	700	211
Political philosophy: J. H. Kautsky; study	8,000	338
NEBRASKA		
UNIVERSITY OF NEBRASKA		
Corn genetics: research	20,000	366
Mexican history:		
S. R. Ross; preparation of guide to sources	14,500	280
NEW HAMPSHIRE		
DARTMOUTH COLLEGE		
Natural and medical sciences and mathematics: development of teaching and research	1,500,000	248
NEW JERSEY		
INSTITUTE FOR ADVANCED STUDY		
Social sciences: development	60,000	316
PRINCETON UNIVERSITY		
Comparative religion: K. S. Murty; study	5,250	281
Econometric research program: support	75,000	315
Princeton University Press:		
instructional material in physics; expenses of publication and distribution	4,500	398
RUTGERS, THE STATE UNIVERSITY		
Latin American literature: translation	4,500	293
Microbiology: H. A. Lechevalier; travel	5,000	215
NEW YORK		
AMERICAN COUNCIL FOR EMIGRÉS IN THE PROFESSIONS, INC.		
Art: J. Domjan; expenses of supplies	1,500	302

	Amount $	page
AMERICAN INTERNATIONAL MUSIC FUND, INC.		
Contemporary music: support of new program	27,000	289
ASIA SOCIETY		
Library development	10,000	396
BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH, INC.		
Conference on plant growth regulators: expenses	10,000	367
BROOKLYN MUSEUM		
Conference on conservation of art works: expenses	4,400	293
CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE		
Bilderberg Group: expenses of American participants	10,000	333
United Nations General Assembly: study	14,600	333
COLGATE UNIVERSITY		
Higher education: Dr. and Mrs. E. N. Case; travel	475	399
COLUMBIA UNIVERSITY		
Administration of outer space: research	20,000	330
Biochemistry: E. Chargaff; travel	3,235	232
Chinese drama: Chou W.-c.; study	1,500	294
Columbia University Press:		
American Trade Union Democracy; publication	5,000	334
Conferences on atomic age research:		
C. Wright; preparatory work	10,000	397
Electronic music: development of program	175,000	282
History of science:		
S. Morgenbesser and E. Nagel; studies	9,700	280
International organization: research	125,000	328
Law and social change: W. Friedmann; study	2,500	339
Linguistics: seminar	830	274
Nursing education: establishment of fund	6,000	178
Science: J. Foster; travel	2,400	397
Science writing program: development	100,000	393
Training for Indonesian librarians: expenses	95,620	297
United Nations diplomacy: A. W. Rudzinski; research	9,500	334
Wage-price spiral: research	8,500	334
Zen Buddhism: R. De Martino; travel and study	2,500	280
CORNELL UNIVERSITY		
Anthropology: preparation of teaching materials	9,620	272
Arts in Indonesia: C. Holt; study	3,000	272
Higher education:		
Mr. and Mrs. A. G. Pringgodigdo; travel	10,000	272
Law: H. Freeman; research	8,000	338
Linguistics:		
Training for Egyptian teachers	66,000	298
G. H. Fairbanks; travel	1,000	272
Medical College:		
orientation course for foreign fellows; expenses	30,000	174
New York State College of Agriculture: research	75,000	352
Political science: H. M. Roelofs; study	3,000	338
Soil science: M. G. Cline; travel	2,500	367

	Amount $	*page*
COUNCIL FOR FINANCIAL AID TO EDUCATION, INC.		
General support	300,000	392
ELMIRA COLLEGE		
Contemporary Turkish life: M. B. Swearingen; travel and study	2,850	274
GROVE PRESS		
Latin American literature: D. M. Allen; travel	2,850	293
HASKINS LABORATORIES		
Marine biology: L. Provasoli; travel	1,850	217
HEALTH INSURANCE PLAN OF GREATER NEW YORK		
Hypertension: completion of study	5,000	195
HOFSTRA COLLEGE		
Theatre equipment: research and development	8,750	292
INSTITUTE OF INTERNATIONAL EDUCATION		
Conference on Inter-American Exchange of Persons: expenses	10,000	397
INTERNATIONAL GRAPHIC ARTS SOCIETY, INC.		
Experimental print-lending program: expenses	39,400	285
INTERNATIONAL RESCUE COMMITTEE, INC.		
Polish Medical Aid Project: expenses	7,500	398
JUILLIARD SCHOOL OF MUSIC		
American theatre: M. Saint Denis; travel	5,225	292
LONG ISLAND BIOLOGICAL ASSOCIATION		
Annual symposia: expenses	25,000	213
MEDICAL SOCIETY OF THE COUNTY OF KINGS AND THE ACADEMY OF MEDICINE OF BROOKLYN		
Library development: preliminary survey	10,000	178
MONTEFIORE HOSPITAL		
Medical education: K. E. Hite; travel	1,800	179
NATIONAL CITIZENS' COMMITTEE FOR THE WORLD HEALTH ORGANIZATION, INC.		
Visits by assembly delegates: expenses	7,500	179
NATIONAL COUNCIL OF THE CHURCHES OF CHRIST IN THE UNITED STATES OF AMERICA		
World Order Study Conference: preparation of material	10,000	333
NATIONAL LEAGUE FOR NURSING, INC.		
Practical nursing program: support	8,500	179
NEW SCHOOL FOR SOCIAL RESEARCH		
City planning: J. Jacobs; study	10,000	291
Political philosophy: H. B. White; study	9,000	337
Sociology: A. Brodersen; research	9,900	333

	Amount $	*page*
NEW YORK HOSPITAL — CORNELL MEDICAL CENTER		
Public health nursing: study	9,524	179
NEW YORK PUBLIC LIBRARY		
Gabriela Mistral papers: arrangement and microfilming	5,200	293
NEW YORK UNIVERSITY		
Hebrew culture: A. I. Katsh; travel	4,000	281
Medicine: M. Hasek; travel	2,090	179
Public attitude toward science: survey	25,000	394
Radiobiology: development of program	500,000	158
POLYTECHNIC INSTITUTE OF BROOKLYN		
Applied chemistry: W. Sakai; study	1,500	386
POPULATION COUNCIL		
Fellowships	300,000	320
ROCKEFELLER FOUNDATION HUNGARIAN REFUGEE AID PROGRAM	500,000	389
ROCKEFELLER INSTITUTE		
Genetics: A. G. Bearn; travel	3,150	223
Physiology: A. Csapo; travel	1,600	217
SOCIAL SCIENCE RESEARCH COUNCIL		
Research fellowships and grants in aid	600,000	307
SYRACUSE UNIVERSITY		
Political science: S. G. Brown; study	2,000	340
TEACHERS INSURANCE AND ANNUITY ASSOCIATION OF AMERICA		
College loan fund plan: preparation	2,500	398
UNIVERSITY OF ROCHESTER		
Allergy: D. E. Johnstone; travel	780	180
International Congress of Biochemistry: expenses of delegates	6,000	231
VIRUS STUDIES	366,000	240
WORLD MEDICAL ASSOCIATION		
World conference on medical education: expenses	10,000	181

NORTH CAROLINA

NORTH CAROLINA STATE COLLEGE		
Cytology and genetics of fungi: research	9,000	367
Genetics: H. F. Robinson; travel	600	368
UNIVERSITY OF NORTH CAROLINA		
Department of Medicine: development	250,000	164
Medical care: H. T. Clark, Jr.; travel	2,875	181
Medical education: Dr. and Mrs. C. H. Burnett; travel	4,200	181

OHIO

HEBREW UNION COLLEGE — JEWISH INSTITUTE OF RELIGION		
Advanced religious studies: conference	4,440	281

	Amount $	page
KARAMU HOUSE		
Music building: construction and equipment	30,000	289
UNIVERSITY OF CINCINNATI		
Epidemiology and industrial health: J. J. Phair; travel	3,050	182
UNIVERSITY HOSPITALS OF CLEVELAND		
Medicine: J. T. Boyer; travel	1,322	182
WESTERN RESERVE UNIVERSITY		
Medical education: Dr. and Mrs. T. H. Ham; travel	4,500	182

OKLAHOMA

UNIVERSITY OF OKLAHOMA		
Political philosophy: E. Fogelman; study	6,400	338

PENNSYLVANIA

LEHIGH UNIVERSITY		
History: L. H. Gipson; research and writing	36,000	279
NATIONAL BOARD OF MEDICAL EXAMINERS		
Language tests: study	6,000	179
PENNSYLVANIA STATE UNIVERSITY		
Insecticides: research	24,000	194
Political philosophy: N. Riemer; study	8,000	338
UNIVERSITY OF PENNSYLVANIA		
American studies: R. E. Spiller; travel	1,000	274
City planning: conference	10,000	291
Phonetics: equipment	3,000	302
Urban design: research	36,000	287
UNIVERSITY OF PITTSBURGH		
Congenital malformation: study	10,000	195
Medical education: Dr. and Mrs. L. A. Gregg; travel	5,100	179
Pediatric urology: W. B. Kiesewetter; travel	1,000	180
Radiation health:		
A. Ciocco; travel	1,900	179
C. C. Li; travel	1,900	179
T. Parran; travel	1,900	180
N. Wald; travel	1,900	180
WASHINGTON AND JEFFERSON COLLEGE		
Political philosophy: B. Nimer; study	5,000	339

PUERTO RICO

DEPARTMENT OF HEALTH OF PUERTO RICO		
Medicine and public health:		
G. Arbona; travel	600	180
R. A. Ferrer; travel	3,100	180

	Amount $	*page*
UNIVERSITY OF PUERTO RICO		
Legal philosophy: H. Silving; study	8,000	338
Medical care: staff travel	5,000	180
Physiology: R. M. Reinecke; travel	250	180

RHODE ISLAND

BROWN UNIVERSITY		
Biology laboratory: construction and equipment	560,000	249

TENNESSEE

VANDERBILT UNIVERSITY		
Graduate Training Program in Economic Development: support	300,000	319
Jurisprudence: S. E. Stumpf; study	9,000	337
Southern United States: legal studies	9,000	334

TEXAS

GENETICS SOCIETY OF AMERICA		
Congress of Genetics: expenses of participants	5,000	223
Post-Congress visits by Latin American delegates: expenses	4,000	223
INSTITUTE OF RELIGION, TEXAS MEDICAL CENTER		
Effect of religion on the sick: study	10,000	181
SOUTHERN METHODIST UNIVERSITY		
International law: expenses of professorship	40,000	332
UNIVERSITY OF TEXAS		
Algae: research	13,000	230
Ecology: research	10,000	214

UTAH

UNIVERSITY OF UTAH		
Surgery:		
W. J. Burdette; travel	1,330	183
Survey	8,000	182
UTAH STATE UNIVERSITY		
Arid lands: H. B. Peterson; travel	1,000	369
Soil science: D. W. Thorne; travel	2,100	369

VERMONT

MIDDLEBURY COLLEGE		
Institute of Soviet Studies: Russian language courses	10,000	272

	Amount $	page
VIRGINIA		
MEDICAL COLLEGE OF VIRGINIA		
Mental health: A. F. Ward, Jr.; travel	260	399
UNIVERSITY OF VIRGINIA		
Hematology: O. Thorup, Jr.; travel and study	2,500	181
WASHINGTON		
UNIVERSITY OF WASHINGTON		
Economics: H. T. Oshima; study	11,400	325
Medicine: A. G. Motulsky; travel	2,500	207
National Taiwan University:		
Development of American studies and social sciences	5,370	326
Development of humanities	10,000	272
WEST VIRGINIA		
AMERICAN SYMPHONY ORCHESTRA LEAGUE, INC.		
Advanced training in conducting: support	49,500	284
WEST VIRGINIA UNIVERSITY		
Physiology of fungi: research	25,600	361
WISCONSIN		
UNIVERSITY OF WISCONSIN		
African history: P. D. Curtin; travel	1,200	282
Agriculture: N. Clark; travel	1,500	368
Indian languages and literature: development	46,750	267
Medical education: J. Z. Bowers; travel	1,552	182
Political science: H. C. Hart; study	1,200	328
Plant pathology: G. S. Pound; travel	3,100	368
Solar energy: research	250,000	382

NORTH AMERICA

BERMUDA		
BERMUDA BIOLOGICAL STATION, ST. GEORGE'S WEST		
Construction and equipment	52,000	211
CANADA		
LAVAL UNIVERSITY, QUEBEC		
Medical education: study	25,000	176
MCGILL UNIVERSITY, MONTREAL		
Political science:		
T. Hodgkin; study	7,500	272
R. C. Pratt; travel and study	6,000	334

	Amount $	*page*
NATIONAL BALLET GUILD OF CANADA, TORONTO		
National Ballet Company of Canada: expenses of new productions	26,250	290
NINTH INTERNATIONAL BOTANICAL CONGRESS, MONTREAL		
Expenses of participants	10,000	369
UNIVERSITY OF TORONTO		
Phosphatides: research	9,000	231

MEXICO

	Amount $	*page*
AGRICULTURAL OPERATING PROGRAM	208,970	377
Entomology: M. Ramírez G.; travel	600	371
Research, demonstration, and extension program of the State of Mexico: support	50,000	380
COLEGIO DE MÉXICO, MEXICO CITY		
Contemporary Mexican history: research and training	123,692	276
D. DEMAREST, MEXICO CITY		
Contemporary Mexican literature: travel	750	294
INSTITUTE FOR THE IMPROVEMENT OF SUGAR CANE PRODUCTION, MEXICO CITY		
Pest control: research	11,240	370
MEXICAN CENTER FOR SCIENTIFIC AND TECHNICAL DOCUMENTATION, MEXICO CITY		
Equipment and staff travel	8,700	186
MINISTRY OF AGRICULTURE, MEXICO CITY		
Northwestern Agricultural Research Center:		
E. Ortega T.; travel	700	370
N. Sánchez D.; travel	700	370
NATIONAL INSTITUTE OF NUTRITION, MEXICO CITY		
Biochemistry and nutrition:		
Research	90,000	225
Research	10,000	230
NATIONAL SCHOOL OF AGRICULTURE, CHAPINGO		
Graduate training program: development	50,000	357
Plant pathology: A. Campos T.; travel	750	371
Soil science: N. Aguilera H.; travel	800	371
NATIONAL UNIVERSITY OF MEXICO, MEXICO CITY		
Plant chemistry: B. Arreguín L.; travel	1,300	234
Veterinary medicine: O. Valdés O.; travel	1,300	370
Virology: research	1,460	247
PAN AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY, COMMISSION ON HISTORY, MEXICO CITY		
Archival administration: meeting	2,600	302

	Amount $	page
TECHNOLOGICAL INSTITUTE AND SCHOOL OF ADVANCED STUDIES OF MONTERREY		
Agriculture: L. Robles G.; travel	2,045	371
Irrigation: R. González; travel	1,200	371
UNIVERSITY OF COAHUILA, SALTILLO		
Antonio Narro College of Agriculture:		
G. Murillo P.; travel	790	370
UNIVERSITY OF GUANAJUATO, LEÓN		
Department of Pathology: equipment	10,000	186
UNIVERSITY OF SAN LUIS POTOSÍ		
Department of Physiology: equipment	600	186
Microbiology: equipment	10,000	186
Radioisotope techniques: E. Tellez G.; study	1,350	186
UNIVERSITY OF SONORA, HERMOSILLO		
Agriculture and animal husbandry: research and teaching	60,000	356

WEST INDIES

CURAÇAO

CARIBBEAN MARINE BIOLOGICAL INSTITUTE		
Marine biology: J. S. Zaneveld; travel	2,180	217

JAMAICA

UNIVERSITY COLLEGE OF THE WEST INDIES, MONA		
Hematology: J. E. MacIver; travel	1,600	207
Linguistics: seminar	2,300	282
Marine biology: equipment	10,000	214
Medicine: E. K. Cruickshank; travel	700	183
Obstetrics: H. G. Dixon; travel	250	208
Pathology:		
G. A. Stirling; travel	1,500	214
L. N. Went; travel	1,500	214
Pharmacology: P. P.-c. Feng; travel	2,200	183

TRINIDAD

VIRUS RESEARCH PROGRAM, PORT-OF-SPAIN	67,750	240

CENTRAL AND SOUTH AMERICA

INTER-AMERICAN MAIZE IMPROVEMENT PROGRAM	89,500	377
LATIN AMERICAN SCHOLARSHIPS IN AGRICULTURE	200,000	377

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ARGENTINA		
NATIONAL UNIVERSITY OF LA PLATA		
Institute of Physiology: equipment	10,000	183
Physiology: R. R. Rodriguez; travel	3,000	183
UNIVERSITY OF BUENOS AIRES		
Biochemistry: research	9,900	231
Histophysiology: R. E. Mancini; travel	2,050	217
Institute of Physiology: staff training	10,000	183
Organic chemistry: research	7,100	231
Physiology: research	10,000	209
UNIVERSITY OF CUYO, MENDOZA		
Medical education:		
J. Itoiz; travel	1,000	208
R. Muratorio P.; travel	3,500	183
School of Medicine: equipment and supplies	100,000	203
BRAZIL		
BRAZILIAN INSTITUTE OF EDUCATION, SCIENCE, AND CULTURE, SÃO PAULO		
Science Development Program: support	50,000	251
INSTITUTE OF HEMATOLOGY, RIO DE JANEIRO		
Human genetics: research	2,000	224
MEDICAL EDUCATION AND PUBLIC HEALTH FIELD SERVICES	35,600	192
MINISTRY OF HEALTH, RIO DE JANEIRO		
Oswaldo Cruz Institute: research	7,600	215
NATIONAL ARTISTIC AND HISTORIC PATRIMONY, RIO DE JANEIRO		
Art conservation: E. Motta; travel	2,750	293
PAULISTA SCHOOL OF MEDICINE, SÃO PAULO		
General development	600,000	160
Medicine:		
M. Iunes; travel	2,800	184
Staff travel	4,150	184
SCHOOL OF SOCIOLOGY AND POLITICS OF SÃO PAULO		
Sociology: H. Saito; travel and study	3,200	327
UNIVERSITY OF BAHIA, SALVADOR		
Physiology: staff travel and study	4,700	210
Theatre School: development	28,000	287
UNIVERSITY OF BRAZIL, RIO DE JANEIRO		
Higher education: E. L. Vianna; travel	3,450	252
Medical education: C. Cruz L.; travel	2,200	183
Social sciences: experimental project	9,000	326
UNIVERSITY OF CEARA, FORTALEZA		
Institute of Mathematics: supplies	1,000	252

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UNIVERSITY OF PARÁ, BELÉM		
Department of Parasitology: equipment and supplies	10,000	184
UNIVERSITY OF RECIFE		
Institute of Mycology:		
A. Chaves B.; travel	480	215
Expenses of visiting investigators	6,000	215
UNIVERSITY OF RIO GRANDE DO SUL, PÔRTO ALEGRE		
Department of Therapeutics: equipment	30,000	206
Higher education: L. Pilla; travel	3,550	252
UNIVERSITY OF SÃO PAULO		
Ribeirão Preto:		
Enzyme chemistry: J. Moura Gonçalves; research	600	232
Pharmacology: M. O. da Rocha e Silva; travel	2,550	184
Physiology: J. V. P. Leite; travel and study	2,625	184
São Paulo:		
Biochemistry: G. Cilento; research	4,905	232
Drosophila population genetics: research	30,000	222
Economic history: research and training	9,250	326
Enzyme chemistry: research	45,000	227
Inorganic chemistry: E. Giesbrecht; research	5,150	232
Marine biology: P. Sawaya; travel	1,400	217
University Press: equipment	6,600	301
VIRUS RESEARCH PROGRAM, BELÉM	33,500	240

CHILE

AGRICULTURAL OPERATING PROGRAM	146,000	377
AUSTRAL UNIVERSITY OF CHILE, VALDIVIA		
Faculty of Agricultural Sciences: equipment	18,450	369
CATHOLIC UNIVERSITY OF CHILE, SANTIAGO		
Agricultural economics: G. Amunátegui; travel	2,750	369
Histology and cytology: research	3,800	216
Pharmacology: F. Huidobro T.; travel	2,700	184
Rehearsal Theatre: equipment	35,000	287
INSTITUTE OF VETERINARY INVESTIGATIONS, SANTIAGO		
Veterinary medicine: I. Tagle V.; travel	1,400	369
MEDICAL EDUCATION AND PUBLIC HEALTH FIELD SERVICES	16,250	192
UNIVERSITY OF CHILE, SANTIAGO		
Biochemistry: O. Cori; travel	1,550	184
Cardiac surgery: W. Sunkel; travel	630	185
Medicine:		
Graduate training program	10,000	184
R. Katz; travel	500	185
Pomology: J. Einset; visiting appointment	9,575	369
Structure of brain tissue: A. Martinez; research	1,800	237
UNIVERSITY OF CONCEPCIÓN		
Soils and irrigation laboratory: equipment	10,000	369

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COLOMBIA		
AGRICULTURAL OPERATING PROGRAM	197,250	377
COLOMBIAN ACADEMY OF EXACT SCIENCES, BOGOTÁ		
Support of the academy's Review	5,000	370
MINISTRY OF AGRICULTURE, BOGOTÁ		
Palmira Agricultural Experiment Station: G. Ramos N.; travel	1,525	369
NATIONAL UNIVERSITY OF COLOMBIA, BOGOTÁ		
Faculty of Agronomy, Medellín: teaching and research	46,500	355
Faculty of Agronomy, Palmira: teaching and research	60,000	355
Faculty of Veterinary Medicine: teaching and research	50,000	355
UNIVERSITY OF THE ANDES, BOGOTÁ		
Institute of economic research: appointment of director	36,000	325
UNIVERSITY OF ANTIOQUIA, MEDELLÍN		
School of Library Science: development	265,000	294
UNIVERSITY OF CALDAS, MANIZALES		
Faculty of Agronomy: laboratory equipment	10,000	369
Faculty of Medicine: faculty exchange program	2,000	185
Medical library development	10,000	185
Medicine: F. Aranzazu; travel and study	1,850	185
Physiology: H. Orozco O.; travel and study	1,850	185
UNIVERSITY OF CARTAGENA		
Biochemistry: teaching equipment	10,000	185
Faculty of Medicine: library development	10,000	185
UNIVERSITY OF VALLE, CALI		
Clinical laboratory: H. Zuleta C.; travel	2,900	185
Departmental University Hospital: development	100,000	167
Faculty of Medicine: faculty exchange program	3,000	185
Medical education: G. Velázquez P.; travel	3,750	185
Nutrition: conference	2,400	233
Pathology: C. Restrepo; travel	2,225	186
Radiology: R. Jaramillo H.; travel	2,650	186
Social medicine: J. A. Montoya O.; travel	2,300	186
University administration: E. L. Ortiz; travel	1,700	186
COSTA RICA		
INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES, TURRIALBA		
Agricultural journalism: J. Diaz B.; travel and study	5,250	370
Horticulture: research	12,250	370
Plant Industry Department: equipment	8,900	370
ECUADOR		
CENTRAL UNIVERSITY, QUITO		
Plant pathology: L. Rodríguez; travel	1,825	370

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INSTITUTE OF VETERINARY INVESTIGATIONS, GUAYAQUIL		
Equipment and supplies	1,000	370
EL SALVADOR		
UNIVERSITY OF EL SALVADOR, SAN SALVADOR		
Obstetrics and gynecology: J. Bustamante; travel	1,100	186
HONDURAS		
PAN AMERICAN AGRICULTURAL SCHOOL, TEGUCIGALPA		
Graduate scholarships	20,900	365
PERU		
COMMISSION FOR AGRARIAN REFORM AND HOUSING, LIMA		
Land-holding problems: staff travel	22,000	364
MINISTRY OF AGRICULTURE, LIMA		
Division of Plant Protection: equipment	7,000	371
Cooperative Program of Agricultural Experimentation: potato improvement program; development	40,000	358
NATIONAL UNIVERSITY OF SAN AGUSTÍN, AREQUIPA		
Faculty of Medicine:		
J. Chiriboga; travel	800	187
faculty exchange program	6,000	187
UNIVERSITY OF SAN MARCOS, LIMA		
Faculty of Veterinary Medicine:		
construction and equipment	175,000	346
T. Ramos S.; travel	520	371
Taxonomic botany and plant geography: research	9,200	215
URUGUAY		
MINISTRY OF PUBLIC HEALTH, MONTEVIDEO		
Research Institute of Biological Sciences:		
equipment and research expenses	35,000	213
J. R. Sotelo; travel	1,000	237
UNIVERSITY OF THE REPUBLIC, MONTEVIDEO		
Biochemistry: research	27,500	228
Entomology: research	10,000	371
Faculty of Agronomy: greenhouse construction	10,000	371
Physiology: H. Mazzella E.; visiting professorship	1,000	211
Veterinary medicine: H. Trenchi; travel	825	371

EUROPE

AUSTRIA

STATE COLLEGE OF AGRICULTURE AND FORESTRY, VIENNA		
Library science: S. Frauendorfer; travel	1,440	372

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UNIVERSITY OF GRAZ		
Biologically active compounds: research	15,000	236
UNIVERSITY OF VIENNA		
Institute of Statistics: equipment	80,350	314

BELGIUM

UNIVERSITY OF BRUSSELS		
Chemical embryology and biochemistry: equipment	75,000	226
Faculty of Medicine and Pharmacy: equipment	20,000	235
UNIVERSITY OF GHENT		
Institute of Biochemistry: equipment	7,000	231

DENMARK

UNIVERSITY OF AARHUS		
Postgraduate School of Nursing: teaching materials and equipment	10,000	187
UNIVERSITY OF COPENHAGEN		
Surgery: H. H. Wandall; travel	2,600	216

FINLAND

BIOCHEMICAL INSTITUTE OF THE FOUNDATION FOR CHEMICAL RESEARCH, HELSINKI		
Anti-fungal factors: research	20,000	365
UNIVERSITY OF HELSINKI		
Faculty of Medicine: equipment	47,000	205
Measurement of power relations: research	6,175	318
Medicine: E. Orma; travel	800	218
Pharmacology: A. V. Vartiainen; travel	225	234
Sociology: research	10,000	326
Virology: research	40,000	238
UNIVERSITY OF TURKU		
Basic science institutes: establishment of full-time assistantships	61,200	204
Department of Medical Chemistry: research equipment	21,000	229
Pharmacological Institute: research equipment	5,000	232

FRANCE

CONGRESS FOR CULTURAL FREEDOM, PARIS		
Philharmonia Hungarica: general support	66,750	299
INSTITUTE OF APPLIED ECONOMICS, PARIS		
Economics: research	50,000	323
NATIONAL FOUNDATION OF POLITICAL SCIENCES, PARIS		
Political behavior: research	10,000	318

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UNIVERSITY OF STRASBOURG		
Medicine: J. Schwartz; travel	2,975	233

GERMANY

CHRISTIAN ALBRECHT UNIVERSITY, KIEL		
Economics: E. Schneider; travel	4,355	318
IFO-INSTITUTE FOR ECONOMIC RESEARCH, MUNICH		
Long-term economic projection: research	24,000	317
MAX PLANCK INSTITUTE FOR PLANT BREEDING, COLOGNE-BICKENDORF		
Agriculture: W. Rudorf; travel	600	372
UNIVERSITY OF HEIDELBERG		
Philosophy: K. Lowith; travel	470	282
UNIVERSITY OF MUNICH		
America Institute: research	31,700	268
Animal behavior: research	15,000	209

GREECE

AMERICAN FARM SCHOOL, SALONICA		
Poultry management: study	8,600	372
UNIVERSITY OF ATHENS		
Medicine: B. C. Malamos; travel	1,100	187

ITALY

STATE CERAMIC INSTITUTE, FAENZA		
Ceramics: research equipment	10,000	291
UNIVERSITY OF BARI		
Institute of Plant Pathology: greenhouse construction	10,000	372
X-ray crystallography: research equipment	5,600	237
UNIVERSITY OF MILAN		
Zoology: V. Leone; travel	1,700	217
UNIVERSITY OF NAPLES		
Genetics:		
G. Montalenti; travel	600	223
M. Siniscalco; travel	600	223
Human genetics: research	6,600	223
Institute of General Pathology: equipment	8,500	231
Sanitary Engineering Laboratory: teaching and research	15,000	187
UNIVERSITY OF PARMA		
Human genetics: research	10,000	222

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UNIVERSITY OF PAVIA		
Genetics:		
Equipment and research expenses	8,250	372
Teaching and research	80,000	218
UNIVERSITY OF ROME		
Biologically active compounds: research	15,000	236
UNIVERSITY OF TURIN		
Institute of Political Science: research and advanced training	45,000	316

NETHERLANDS

STATE AGRICULTURAL LIBRARY, WAGENINGEN		
Library science: T. P. Loosjes; travel	2,100	372
STATE AGRICULTURAL UNIVERSITY OF WAGENINGEN		
Plant science: T. H. Thung; travel	1,930	372

NORWAY

HEALTH SERVICES OF NORWAY, OSLO		
Health services: J. Bjørnsson; travel	4,000	187
NORWEGIAN RADIUM HOSPITAL AND NORSK HYDRO'S INSTITUTE FOR CANCER RESEARCH, OSLO		
Clinical chemistry and pathophysiology: L. Eldjarn; travel	2,500	233
UNIVERSITY OF OSLO		
Human genetics: research	10,700	222
Protein and carbohydrate chemistry: research	18,500	230

POLAND

ACADEMY OF MEDICINE, CRACOW		
Pharmacology: J. Supniewski; travel	2,900	233
Physiology: J. Kaulbersz; travel	3,700	216
Surgery: J. Bogusz; travel	2,950	187
ACADEMY OF MEDICINE, LODZ		
Medical education: M. Stefanowski; travel	2,925	187
ACADEMY OF MEDICINE, POZNAN		
Biochemistry: Z. Stolzmann; travel	3,400	232
Internal medicine: J. Roguski; travel	2,975	187
Rehabilitation: W. Dega; travel	1,400	188
ACADEMY OF MEDICINE, WARSAW		
Medical education: A. Biernacki; travel	3,500	188
ACADEMY OF MEDICINE, WROCLAW		
Medical education and surgery: W. Bross; travel	3,050	188
Microbiology: S. Slopek; travel	3,600	216

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AGRICULTURAL COLLEGE, CRACOW		
Animal physiology: Z. Ewy; travel	3,200	372
Poultry breeding: H. Baczkowska; travel	3,250	372
Plant breeding: T. Ruebenbauer; travel	3,050	372
AGRICULTURAL COLLEGE, LUBLIN		
Agriculture: Dr. and Mrs. B. Dobrzanski; travel	5,600	373
AGRICULTURAL COLLEGE, OLSZTYN		
Genetics: T. Hulewicz; travel	3,250	373
COLLEGE OF AGRICULTURE, SKIERNIEWICE		
Vegetable production: E. Chroboczek; travel	3,050	373
COPERNICUS UNIVERSITY, TORUN		
Zoology: H. Szarski; travel	3,650	216
DEPARTMENT OF EXPERIMENTAL HUSBANDRY, POLISH ACADEMY OF SCIENCES, BYDGOSZCZ		
Animal husbandry: A. Spryszak; travel	1,600	373
HIGH SCHOOL OF AGRICULTURE, POZNAN		
Agricultural technology: J. Janicki; travel	3,350	373
HIRSZFELD INSTITUTE OF IMMUNOLOGY, POLISH ACADEMY OF SCIENCES, WROCLAW		
Virology: H. Makower; travel	87	248
INSTITUTE OF GENETICS, SKIERNIEWICE		
Genetics: E. Malinowski; travel	2,000	373
INSTITUTE OF HEMATOLOGY, WARSAW		
Blood research: Z. A. Zawadzki; travel	400	188
INSTITUTE OF POMOLOGY, SKIERNIEWICE		
Fruit culture: Dr. and Mrs. S. A. Pieniazek; travel	5,750	373
INSTITUTE OF TECHNOLOGY OF ANIMAL PRODUCTS, GDANSK		
Agriculture: D. Tilgner; travel	3,150	373
JAGIELLONIAN UNIVERSITY OF CRACOW		
Botany: A. Bajer; travel	2,050	223
Embryology and cytology: Z. Grodzinski; travel	3,100	216
Neuroanatomy: J. Kreiner; travel	3,575	216
Zoopsychology and ethology: R. J. Wojtusiak; travel	2,500	210
PLANT BREEDING INSTITUTE, CRACOW		
Plant immunology: E. Ralski; travel	2,900	373
POSTGRADUATE MEDICAL INSTITUTE, WARSAW		
Medical education and endocrinology: W. Hartwig; travel	2,870	188
ROCKEFELLER FOUNDATION POLISH SCIENCE PROGRAM		
Fellowships	400,000	391
Research equipment, supplies, and library materials	200,000	391

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STATE INSTITUTE OF HYGIENE, WARSAW		
Virology: F. Przesmycki; travel	2,900	247
UNIVERSITY OF LODZ		
Microbiology: B. Zablocki; travel	3,300	216
UNIVERSITY OF WARSAW		
Chemistry: W. Kemula; travel	3,075	232
Plant genetics and taxonomy: W. Gajewski; travel	3,450	223
UNIVERSITY OF WROCLAW		
Genetics: W. Kunicki-Goldfinger; travel	1,400	224
WARSAW COLLEGE OF AGRICULTURE		
Genetics: J. Woyke; travel	700	373
WOLSKI HOSPITAL, WARSAW		
Medical education: L. Manteuffel; travel	3,000	188

PORTUGAL

EXPERIMENT STATION FOR PLANT IMPROVEMENT, ELVAS		
Black stem rust of wheat: research	6,000	373
TECHNICAL SCHOOL FOR NURSES, LISBON		
Nursing:		
R. R. Ramos; travel	2,730	188
C. M. Regala; travel	2,730	188

SWEDEN

INTERNATIONAL COMMISSION FOR RADIOLOGICAL PROTECTION		
Planning meeting: R. Sievert; travel	2,000	398
SWEDISH ROYAL ACADEMY OF SCIENCES, STOCKHOLM		
Limnology: L. Brundin; travel	2,000	217
UNIVERSITY OF LUND		
Economic and demographic history: research equipment	4,700	318
Genetics: research	40,000	220
UNIVERSITY OF STOCKHOLM		
Biochemistry and cell physiology: L. Ernster; travel	1,825	234
UNIVERSITY OF UPPSALA		
Enzyme research: B. G. Malmström; travel	1,700	234

SWITZERLAND

FEDERAL TECHNICAL INSTITUTE, ZURICH		
Biochemistry: research	15,000	230
UNIVERSITY OF GENEVA		
Genetic epistemology: research	141,000	275
UNIVERSITY OF ZURICH		
Experimental biology: research equipment	50,000	212

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WORLD HEALTH ORGANIZATION, GENEVA		
Repertory of practice: preparation	25,000	193

UNITED KINGDOM

BRITISH ACADEMY, LONDON		
Humanities and social sciences research: survey	17,100	301
EAST MALLING RESEARCH STATION		
Botany: A. F. Posnette; travel	2,475	374
LISTER INSTITUTE OF PREVENTIVE MEDICINE, LONDON		
Enzyme preparation: W. J. Whelan; travel	2,000	233
MEDICAL RESEARCH COUNCIL OF GREAT BRITAIN, LONDON		
Fellowships in the medical sciences: support	150,000	202
Sir Harold and Lady Himsworth: travel	2,600	207
Social medicine: J. A. H. Lee; travel	3,525	189
QUEEN'S UNIVERSITY OF BELFAST		
Irish economic pamphlets: cataloguing	3,200	318
ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN		
Equipment	1,500	386
Nematology: F. G. W. Jones; travel	2,335	374
Nutrition: research	75,000	385
Plant pathology: F. C. Bawden; travel	1,920	374
ROYAL CANCER HOSPITAL, LONDON		
Protein research: D. M. Phillips; travel	2,900	233
ROYAL COLLEGE OF NURSING, LONDON		
Library science: A. M. C. Thompson; travel	2,300	189
ROYAL COLLEGE OF PHYSICIANS, LONDON		
Association for the Study of Medical Education: support	28,500	175
ROYAL SOCIETY OF MEDICINE, LONDON		
Library support	68,400	193
UNIVERSITY OF BIRMINGHAM		
Biologically important compounds: research equipment	13,000	236
Preventive medicine: C. R. Lowe; travel	2,075	188
UNIVERSITY OF BRISTOL		
Biochemistry of alkaloids: research	3,500	232
UNIVERSITY OF CAMBRIDGE		
Biochemistry: V. M. Ingram; visiting professorship	1,600	233
Chemistry: P. Sykes; travel	2,350	233
Churchill College: development of plans	10,000	397
History of English criminal law: completion	42,750	331
Journal of African history: support	14,250	280
Stellar evolution project: F. Hoyle; travel	1,700	397
Symposium on ornithology: support	2,000	217

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UNIVERSITY OF DURHAM		
King's College, Newcastle upon Tyne:		
Biochemistry; research	15,000	230
Radiation chemistry; research equipment	8,500	236
UNIVERSITY OF EDINBURGH		
Influence of science on the visual arts:		
C. H. Waddington; study	2,000	294
UNIVERSITY OF GLASGOW		
Virology: M. G. P. Stoker; travel	6,000	246
UNIVERSITY OF LEEDS		
Radiochemistry and biomedicine: research equipment	7,000	236
UNIVERSITY OF LIVERPOOL		
Department of Biochemistry: research equipment	8,500	231
Physiology: R. A. Gregory; travel	500	218
UNIVERSITY OF LONDON		
Embryology: research	2,900	215
Government and politics in Ghana: D. G. Austin; study	16,000	333
Guide to materials on South Asia in the British Isles: preparation	23,650	270
Law of outer space: B. Cheng; research	6,700	330
Mammalian genetics: research	35,000	220
Muslim art: D. S. Rice; study	1,860	274
Parasitology: P. C. C. Garnham; travel	2,500	189
Plant physiology and genetics: research equipment	9,000	215
UNIVERSITY OF OXFORD		
Consumer behavior: comparative study	14,080	318
Crystallography: research	35,625	235
Economic development: S. H. Frankel; research	4,100	327
Hebrew literature: D. Patterson; travel and study	2,700	281
Neurohistology: research	19,950	209
Planning studies related to the establishment of a new college: expenses	10,000	397
Social sciences:		
research, training, and library development	142,500	311
UNIVERSITY OF READING		
National Institute for Research in Dairying, Shinfield:		
Department of Physiology; research equipment	3,600	374
UNIVERSITY OF SHEFFIELD		
Department of Microbiology: research equipment	8,500	231
Proteins: research	8,000	231
UNIVERSITY OF SOUTHAMPTON		
Nuclear magnetic resonance: D. J. E. Ingram; research	800	237
VICTORIA UNIVERSITY OF MANCHESTER		
British Association for American Studies:		
development of program	150,500	262
Medical education: G. A. G. Mitchell; travel	2,245	189

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WELSH REGIONAL HOSPITAL BOARD, CARDIFF		
Biochemistry of the nervous system: research	33,500	208

YUGOSLAVIA

	Amount $	page
SERBIAN ACADEMY OF SCIENCE, BELGRADE		
Institute of Medical Research: research equipment	2,400	216
UNIVERSITY OF LJUBLJANA		
Institute of Pathophysiology: equipment and supplies	2,400	216
UNIVERSITY OF SARAJEVO		
Institute of Pharmacology: research equipment	2,750	233
UNIVERSITY OF ZAGREB		
Department of Medicine: research equipment	2,200	207
Public health: B. Kesic; travel	3,060	189
Virology: research equipment	25,000	239
YUGOSLAV ACADEMY OF SCIENCES AND ARTS, ZAGREB		
Medicine and public health: research equipment	33,000	205

AFRICA

BELGIAN CONGO

	Amount $	page
LOVANIUM UNIVERSITY, LEOPOLDVILLE		
Medical School and University Hospital: development	230,000	162
Nursing: building construction	75,000	163

ETHIOPIA

	Amount $	page
IMPERIAL ETHIOPIAN COLLEGE OF AGRICULTURAL AND MECHANICAL ARTS, DIRE DAWA		
Liberal arts: expenses of guest lecturers	7,500	398

GHANA

	Amount $	page
MINISTRY OF HEALTH, ACCRA		
Mosquito control: L. J. Charles; travel	950	189

MOROCCO

	Amount $	page
MINISTRY OF FOREIGN AFFAIRS, RABAT		
Library development in international relations	5,000	335

NIGERIA

	Amount $	page
A. FABIYI		
Virology: travel and study	2,765	247

	Amount $	page
MINISTRY OF EDUCATION, LAGOS		
Scholarships in the sciences: support	10,000	397
PRIME MINISTER'S OFFICE, EXTERNAL AFFAIRS BRANCH, LAGOS		
Library development in international relations	5,000	335
UNIVERSITY COLLEGE, IBADAN		
Faculty of Agriculture: research	31,500	359
University Press: appointment of a full-time manager	34,200	300

RHODESIA AND NYASALAND

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RHODES-LIVINGSTONE INSTITUTE FOR SOCIAL RESEARCH, LUSAKA		
Research and library development	3,500	327
UNIVERSITY COLLEGE OF RHODESIA AND NYASALAND, SALISBURY		
Department of Agriculture: equipment and library materials	39,200	359
Economic behavior: study	10,000	326
Social sciences: equipment and library materials	2,230	326

SUDAN

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MINISTRY OF FOREIGN AFFAIRS, KHARTOUM		
Library development in international relations	5,000	335

UGANDA

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DEPARTMENT OF AGRICULTURE, ENTEBBE		
Agricultural Research Station: library development	3,700	374
MAKERERE COLLEGE, THE UNIVERSITY COLLEGE OF EAST AFRICA, KAMPALA		
Faculty of Agriculture: research and teaching	35,000	359
Social sciences: research and staff travel	2,850	327

UNION OF SOUTH AFRICA

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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, JOHANNESBURG		
Medical education: Dr. and Mrs. H. S. Gear; travel	6,800	189
SOUTH AFRICAN INSTITUTE FOR MEDICAL RESEARCH, JOHANNESBURG		
Tropical medicine and malaria: B. de Meillon; travel	1,550	247
UNIVERSITY OF NATAL, DURBAN		
Physiology: T. Gillman; travel	2,600	210
UNIVERSITY OF WITWATERSRAND, JOHANNESBURG		
Pathology: H. B. Stein; travel	2,200	207
VIRUS RESEARCH PROGRAM, JOHANNESBURG	29,900	240

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UNITED ARAB REPUBLIC		
AMERICAN CENTER FOR RESEARCH IN EGYPT, CAIRO		
Muslim art: J. A. Williams; travel	3,000	274
M. BOUTROS GHALI		
Literature and North American life: travel	3,400	273
MIDDLE EAST		
IRAN		
MINISTRY OF FOREIGN AFFAIRS, TEHERAN		
Library development in international relations	5,000	335
IRAQ		
AL-HIKMA UNIVERSITY OF BAGHDAD		
Business administration: W. H. Zukowski; visiting professorship	10,000	326
MINISTRY OF FOREIGN AFFAIRS, BAGHDAD		
Library development in international relations	5,000	335
ROYAL COLLEGE OF MEDICINE, BAGHDAD		
Medical education: Dr. and Mrs. A. A. Allawi; travel	6,360	189
ISRAEL		
GOVERNMENT HOSPITAL, TEL-HASHOMER		
Genetics: research	10,000	222
HEBREW UNIVERSITY, JERUSALEM		
Middle Eastern history: D. Ayalon and U. Heyd; study	5,000	273
LEBANON		
AMERICAN UNIVERSITY OF BEIRUT		
Medical division: support	100,000	168
TURKEY		
MINISTRY OF HEALTH AND SOCIAL ASSISTANCE, ANKARA		
School of Hygiene: supplies	10,000	190
NATIONAL CONSERVATORY OF ANKARA		
Drama Department: teaching materials	750	292
Music: Mr. and Mrs. A. A. Saygun; travel	8,500	292
TRUSTEES OF ROBERT COLLEGE, ISTANBUL		
General education in the humanities: development	115,000	297
Humanities: D. Garwood; advanced study	10,000	301

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TURKISH-AMERICAN UNIVERSITY ASSOCIATION		
Educational organizations: S. Katipoglu; travel	4,200	302
UNIVERSITY OF ANKARA		
Faculty of Medicine: equipment and supplies	170,000	165
Medicine: staff travel	5,000	190
Theatre Institute: G. H. Redford; visiting appointment	9,000	292
UNIVERSITY OF ISTANBUL		
American studies: V. Turhan; travel	3,000	274
Turkish literature: A. H. Tanpinar; study and travel	6,100	292

SOUTH ASIA

BURMA

FOREIGN OFFICE, RANGOON		
Library development in international relations	5,000	335

CEYLON

MINISTRY OF DEFENCE AND EXTERNAL AFFAIRS, COLOMBO		
Advanced training abroad for young Ceylonese in the field of foreign service	10,000	333
Library development in international relations	5,000	335
MINISTRY OF HEALTH, COLOMBO		
Medical and health services: V. Wijewardene; travel	700	190
UNIVERSITY OF CEYLON, COLOMBO		
Faculty of Medicine: equipment and library development	57,000	172

INDIA

AGRICULTURAL OPERATING PROGRAM	226,960	377
ALL-INDIA INSTITUTE OF MEDICAL SCIENCES, NEW DELHI		
Preventive and social medicine: E. M. Holmes, Jr.; travel	400	190
Teaching and research equipment	100,000	166
BALWANT RAJPUT COLLEGE, AGRA		
Agriculture: equipment and library development	200,000	345
BOMBAY NATURAL HISTORY SOCIETY		
General support	10,000	214
BOSE INSTITUTE, CALCUTTA		
Biochemistry: research	10,000	230
CALCUTTA SCHOOL OF TROPICAL MEDICINE		
Tropical medicine: R. N. Chaudhuri; travel	4,600	207
CENTRAL RICE RESEARCH INSTITUTE, CUTTACK		
Rice improvement: equipment and library materials	125,000	347

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CHRISTIAN MEDICAL COLLEGE, VELLORE		
Medical Record Library Department: development	21,000	177
Nursing education: F. Taylor; travel	1,750	190
G. R. MEDICAL COLLEGE, GWALIOR		
Pharmacology: research	6,000	231
HORTICULTURAL RESEARCH INSTITUTE, SAHARANPUR		
Horticulture: L. B. Singh; travel	4,450	374
INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI		
Library: construction of new wing	100,000	348
INDIAN COUNCIL OF MEDICAL RESEARCH, NEW DELHI		
Neuropathology: D. K. Dastur; travel	1,550	234
Postgraduate medical fellowships: support	58,000	171
Research fellowships: support	10,000	252
INDIAN SCHOOL OF INTERNATIONAL STUDIES, NEW DELHI		
Staff training program: support	75,000	321
INSTITUTE OF CHILD HEALTH TRUST, CALCUTTA		
Equipment and library development	45,000	173
S. MALHAN		
Home science extension methods: travel	3,650	374
MEDICAL COLLEGE HOSPITAL, TRIVANDRUM		
Radiobiology and cancer therapy: M. P. Joseph; travel	4,225	191
MEDICAL EDUCATION AND PUBLIC HEALTH FIELD SERVICES	48,210	192
MUSLIM UNIVERSITY, ALIGARH		
History of the Sikhs: preparation	22,000	271
NATIONAL ACADEMY OF LETTERS, NEW DELHI		
Literature: K. R. Kripalani; travel	7,550	292
NUTRITION RESEARCH LABORATORIES, COONOOR		
Biochemistry and nutrition: V. N. Patwardhan; travel	4,550	232
PERMANENT SECRETARIAT OF THE ASIAN-AFRICAN LEGAL CONSULTATIVE COMMITTEE, NEW DELHI		
Library development in international relations	2,500	336
SETH GORDHANDAS SUNDERDAS MEDICAL COLLEGE, BOMBAY		
Cardiology: K. K. Datey; travel	4,000	190
TRAINED NURSES' ASSOCIATION OF INDIA, DELHI		
Nursing: L. Devi; travel	4,300	191
UNIVERSITY OF BOMBAY		
Biochemistry and nutrition: A. Sreenivasan; travel	4,400	232
UNIVERSITY OF CALCUTTA		
Medical education: S. Mitra; travel	3,900	190
Plant physiology: S. M. Sircar; travel	5,500	374

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UNIVERSITY OF DELHI		
Higher education: V. K. R. V. Rao; travel	760	275
Modern Indian history: B. Prasad; travel and study	6,025	281
Comparative studies in Indian and Western music: development	106,850	264
UNIVERSITY OF LUCKNOW		
King George's Medical College:		
B. B. Bhatia; travel	4,350	191
Library development	34,000	174
B. N. Sinha; travel	4,550	190
Staff appointment	1,570	191
UNIVERSITY OF MADRAS		
Biochemistry: research	10,000	231
UTTAR PRADESH MEDICAL AND HEALTH SERVICES, LUCKNOW		
Public health: K. M. Lal; travel	239	191
VIRUS RESEARCH PROGRAM, POONA	119,500	240
P. N. Bhatt: travel	2,640	247

INDONESIA

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TAN G.-L.		
Sociology: travel and study	2,200	327
MINISTRY OF FOREIGN AFFAIRS, DJAKARTA		
Library development in international relations	5,000	335
UNIVERSITY OF INDONESIA, BOGOR		
Animal science: A. A. Ressang; travel	4,750	374

PAKISTAN

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UNIVERSITY OF PESHAWAR		
Faculties of Agriculture and Home Economics: library books and audio-visual equipment	9,500	375
UNIVERSITY OF THE PUNJAB, LAHORE		
College of Home Economics and Social Science: library development	1,000	375

THAILAND

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CHULALONGKORN HOSPITAL, BANGKOK		
Virology: Ambhan D.; travel	564	248
FACULTY OF PUBLIC HEALTH, BANGKOK		
Microbiology and virology: C. Yamarat; travel	4,400	191
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, BANGKOK		
Soil science: H. N. Mukerjee; travel	3,850	375

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KASETSART UNIVERSITY, BANGKOK		
Agriculture: equipment and library materials	100,000	349
Department of Home Economics:		
scholarships and equipment	10,000	375
MINISTRY OF AGRICULTURE, BANGKOK		
Soil science: P. Piyapongse; travel and study	1,700	375
Tropical agriculture: R. Purnariksha; travel	4,775	375
MINISTRY OF FOREIGN AFFAIRS, BANGKOK		
Library development in international relations	5,000	336

VIETNAM

DEPARTMENT OF FOREIGN AFFAIRS, SAIGON		
Library development in international relations	5,000	336

FAR EAST

AUSTRALIA

AUSTRALIAN NATIONAL UNIVERSITY, CANBERRA		
Department of Microbiology: research equipment	30,000	239
Experimental pathology: F. C. Courtice; travel	4,525	252
CANBERRA UNIVERSITY COLLEGE		
Southeast Asian studies:		
Dr. and Mrs. A. H. Johns; travel	2,500	274
DEPARTMENT OF HEALTH OF AUSTRALIA, MELBOURNE		
Hematology and anthropology: R. T. Simmons; travel	2,000	224
UNIVERSITY OF ADELAIDE		
Agriculture: C. M. Donald; travel	2,750	375
Department of Zoology: research equipment	8,000	215
Plant pathology: A. Kerr; travel	2,350	375
Waite Agricultural Research Institute:		
K. W. Finlay; travel	1,350	375
Research equipment	22,400	363
UNIVERSITY OF MELBOURNE		
Department of Anatomy: research equipment	12,000	236
UNIVERSITY OF SYDNEY		
Department of Medicine: research equipment	14,250	207
Physiology: P. O. Bishop; travel	2,260	210
UNIVERSITY OF WESTERN AUSTRALIA, NEDLANDS		
Ecology: research	10,000	214
International relations:		
Professor and Mrs. F. Alexander; travel	900	319

HONG KONG

UNIVERSITY OF HONG KONG		
Library science: Ng T.-K.; travel	4,125	273

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JAPAN		
CHIBA UNIVERSITY		
Neuroanatomy and neurophysiology: research	10,000	209
DOSHISHA UNIVERSITY, KYOTO		
American studies and social sciences: development	60,000	267
ECONOMIC PLANNING AGENCY, TOKYO		
Economics: Mr. and Mrs. S. Okita; travel	10,000	326
FUKUSHIMA MEDICAL COLLEGE		
Pathology: H. Sato; travel	1,225	234
GUNMA UNIVERSITY, MAEBASHI		
Endocrinology: S. Tanaka; travel	1,200	234
HOKKAIDO NATIONAL AGRICULTURAL EXPERIMENT STATION, SAPPORO		
Plant pathology: I. Tanaka; travel	4,250	375
HOKKAIDO UNIVERSITY, SAPPORO		
Cytology: research	6,500	215
Endocrine physiology: research	5,400	209
Medicine: K. Takeda; travel	700	208
Physiology and neuropsychiatry: research	10,000	209
INSTITUTE OF PUBLIC HEALTH, TOKYO		
Public health: K. Saito; travel	1,600	191
INSTITUTE OF STATISTICAL MATHEMATICS, TOKYO		
Statistics: K. Matusita; travel and study	7,700	326
JAPAN METEOROLOGICAL AGENCY, TOKYO		
Oceanography: Y. Takenouti; travel	1,250	217
KAGOSHIMA UNIVERSITY		
Botany: T. Tanaka; travel	3,050	376
Physiology: M. Goto; travel and study	1,725	210
KANAZAWA UNIVERSITY		
Chemistry: research	10,000	230
KYOTO PREFECTURAL MEDICAL UNIVERSITY		
Enzyme chemistry: research	10,000	230
KYOTO UNIVERSITY		
Anatomy: H. Nishimura; travel	4,280	207
Biochemistry: O. Hayaishi; travel	1,200	234
Department of Applied Botany: research	6,000	376
Modernization of Japan: research	9,220	280
Pharmacy: N. Koga; travel	1,225	234
Social sciences and American studies: development	60,000	322
Traffic engineering: E. Kometani; travel and study	4,000	327
Wheat genetics: research	39,500	358
KYUSHU UNIVERSITY, FUKUOKA		
Agronomy: K. Ehara; travel	4,250	376
Department of Soils: research equipment	5,800	376
Institute of Mathematics: equipment and library materials	4,000	327

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NAGASAKI UNIVERSITY		
Neurophysiology: research	2,500	210
NATIONAL INSTITUTE OF AGRICULTURAL SCIENCES, TOKYO		
Entomology: M. Fukaya; travel	4,650	376
Genetics: Y. Yamasaki; travel	3,550	376
Research equipment	82,850	351
Soil science: M. Oyama; travel	4,160	376
NATIONAL INSTITUTE OF GENETICS, MISIMA		
Animal genetics: T. H. Yosida; travel	865	224
NATIONAL INSTITUTE OF HEALTH, TOKYO		
Immunochemistry: K. Ishizaka; travel	360	234
Virology: research	130,000	237
OCHANOMIZU UNIVERSITY, TOKYO		
Philosophy and education: K. Fujita; travel	3,200	302
OKAYAMA UNIVERSITY		
Medical School: radiation equipment	2,150	195
Plant breeding: R. Takahashi; travel	3,400	376
OSAKA PREFECTURE LIBRARY		
Library science: Y. Nakamura; travel	800	302
OSAKA UNIVERSITY		
Genetics: H. Kikkawa; travel	3,050	223
Science and medicine library: construction	100,000	250
Physiological chemistry: M. Suda; travel	1,250	217
SCIENCE COUNCIL OF JAPAN, TOKYO		
Islamic civilization: visiting scholars	8,060	272
TOHOKU UNIVERSITY, SENDAI		
Bacteriology: M. Kuroya; travel	1,700	247
Medical education: E. Kimura; travel	925	191
TOKUGAWA INSTITUTE FOR BIOLOGICAL RESEARCH, TOKYO		
Algae: research	27,000	385
TOKYO UNION THEOLOGICAL SEMINARY		
Department of Philosophy: development	8,000	280
TOKYO UNIVERSITY		
Bacteriology: Y. J. Homma; travel	960	208
Chemistry: research	5,000	230
Entomology: T. Yamasaki; travel	3,550	376
Political science: K.-I. Fukuda; travel and research	340	340
Protein chemistry: research	10,000	230
Sericulture: H. Aruga; travel	3,450	376
Tissue culture: research	5,000	215
WASEDA UNIVERSITY, TOKYO		
American literature: N. Tatsunokuchi; travel and study	5,000	273
Drama: T. Kawatake; travel and study	600	273
Philosophy: S. Uyeda; travel	550	273

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YAMAGUCHI PREFECTURAL MEDICAL COLLEGE, UBE		
Department of Physiology: research equipment	6,000	210
YAMAGUCHI UNIVERSITY		
Entomology: J. J. Murayama; travel and research	2,900	377
YMCA INSTITUTE FOR TRAINING AND RESEARCH, TOKYO		
Religious studies: Dr. and Mrs. S. Saito; travel	2,600	302
YOKOHAMA NATIONAL UNIVERSITY		
Mechanism of catalysis: research	3,000	232

KOREA

KOREA UNIVERSITY		
Asiatic Research Center: J. Harvey; visiting appointment	6,000	273
KOREAN BROADCASTING SYSTEM ORCHESTRA, SEOUL		
Musical direction: Lim W.-S.; travel and study	3,150	293
SEOUL NATIONAL UNIVERSITY		
Comparative music: Lee H.-K.; travel	2,050	293

NATIONAL REPUBLIC OF CHINA

ACADEMIA SINICA, TAIPEI		
History: Chang K.-Y.; travel and research	1,800	336
Institute of History and Philology: research	45,000	278
NATIONAL CHENGCHI UNIVERSITY, TAIPEI		
Graduate study: library development	100	328
NATIONAL TAIWAN UNIVERSITY, TAIPEI		
English literature: Hsia T.-A.; travel and research	6,050	272
Social sciences and humanities: summer seminars	6,500	272

NEW CALEDONIA

SOUTH PACIFIC COMMISSION, NOUMEA		
Entomology: research	22,175	364

NEW ZEALAND

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, PALMERSTON NORTH		
Pasture ecology: R. W. Brougham; travel	3,350	377

OKINAWA

UNIVERSITY OF THE RYUKYUS FOUNDATION, SHURI CITY		
Visiting scholar program: support	8,400	301

PHILIPPINES

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CENTRAL LUZON AGRICULTURAL COLLEGE, NUEVA ECIJA		
Laboratory equipment and supplies	75,000	353
CENTRAL PHILIPPINE UNIVERSITY, ILOILO CITY		
Soil science laboratory: renovation and equipment	10,000	377
DEPARTMENT OF EDUCATION, MANILA		
Education and drama: V. Bernardino; travel	800	302
DEPARTMENT OF FOREIGN AFFAIRS, MANILA		
Library development in international relations	5,000	335
FOREST PRODUCTS RESEARCH INSTITUTE, LOS BAÑOS		
Pulp and paper technology: J. F. Santa Cruz; graduate assistantship	1,400	377
UNIVERSITY OF THE PHILIPPINES, QUEZON CITY		
College of Agriculture: library development	10,000	377
College of Forestry: library development	10,000	377
Literature: N. V. M. Gonzalez; travel and writing	1,600	274

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