

Spring 1961

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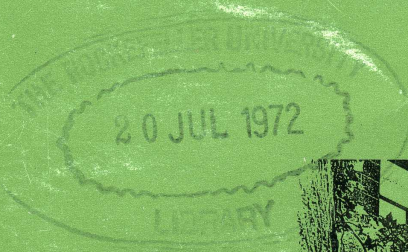
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# THE ROCKEFELLER INSTITUTE

# *Quarterly*

SPRING • 1961



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THE ROCKEFELLER INSTITUTE • A GRADUATE UNIVERSITY AND RESEARCH CENTER



*The wooded scene on the cover of this issue is at the foot of the hanging stairway to the esplanade on the north end of the campus. It is one of many such areas at the Institute which have been landscaped with quiet natural beauty by Mr. Dan Kiley. The illustration is from a photograph by Richard F. Carter.*

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**THE ROCKEFELLER INSTITUTE QUARTERLY**

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# THE MAKING OF INSTRUMENTS FOR SCIENTIFIC RESEARCH

THE INCREASING USE of physical methods in biological investigations during the past half century gave rise very early in the history of The Rockefeller Institute to the need for an instrument maker's shop. Since that time scores of techniques and devices have been developed at the Institute that are common in laboratories everywhere.

The Instrument Shop has undergone major changes twice since it was created in 1920. The first expansion occurred in 1935 when Dr. Gasser became Director of the Institute and he and Dr. Lorente undertook their studies in neurophysiology. In 1953, when President Bronk came to the Institute, broadening all of its research programs and creating new laboratories in biophysics, the Instrument Shop was greatly enlarged and installed in spacious new quarters. At the same time, because of the rapidly increasing applications of electronic techniques in research at the Institute, an Electronics Shop was created, and a future article in this series will tell of its work.

So rapidly is instrumentation for biological research developing that in the past decade the volume of work in the Instrument Shop has tripled, and in view of the persisting increase in its work, plans are being made for further expansion of the facilities. To guide this new phase of development President Bronk has created a Standing Committee of the Faculty on the Instrument Shop.

Soon after it was created the Instrument Shop's activities were stimulated by the growing interest in physical chemistry at the Institute marked by the arrival of Drs. Duncan MacInnes, Theodore Shedlovsky, Lewis Longworth, and the late Dr. Leonor Michaelis.

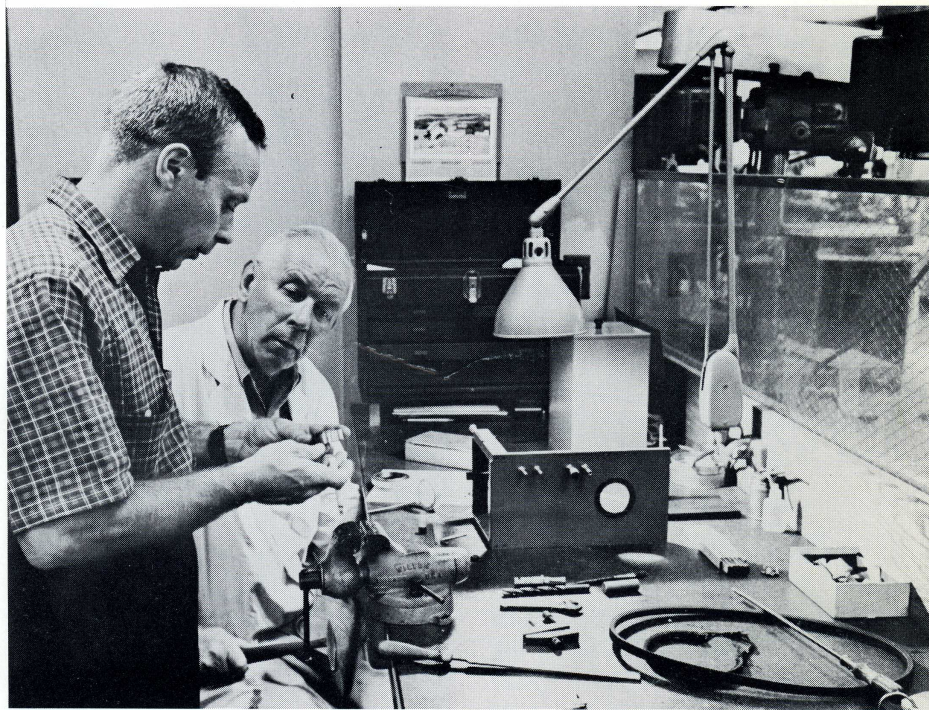
Dr. MacInnes, who made important contributions to the development of the glass electrode, and Lewis Longworth devised a system for culturing bacteria at constant pH in 1934. A few years ago Drs. Walther Goebel and Theodore Shedlovsky designed an improved version of the same device to facilitate production of the anti-bacterial agent, colicine K, elaborated by certain strains of enteric microorganisms under study in Dr. Goebel's laboratory. Al-

so, in the early 1930's, Dr. Shedlovsky and Dr. S. E. Hill, who was working in Dr. Osterhout's laboratory, designed and built a direct-reading electronic pH meter which used a novel type of glass electrode of great sturdiness and convenience. Many of these instruments were built at the Institute for various members of the staff, and they are now commercially available.

Around 1935 the interest of biologists

tracentrifuges, was pioneered by The Svedberg at the University of Uppsala and by Jesse W. Beams at the University of Virginia. Scientists at The Rockefeller Institute, aided by the Instrument Shop, have made significant contributions to the development of the ultracentrifuge as well as the more common preparative centrifuge.

Consideration of ultra high-speed centrifugation began at the Institute when Dr. Ralph W. G. Wyckoff, who had come in 1927, became interested in virus particle sedimentations being carried on by Dr. Johannes Bauer in the Rockefeller Foundation Laboratory. Wyckoff and Jonathan



*Nils Jernberg (standing), Head of the Institute's Instrument Shop, conferring with Werner Krug, Senior Instrument Designer. Photograph by George Zimbel*

began to turn to centrifugation techniques, which have provided some of the most powerful modern methods for analysis and preparation of biological materials. Centrifuges may be divided into two general classes by their function: analytical and preparative centrifuges. For preparation of materials relatively large volumes are desired. Because of their size, therefore, preparative centrifuges are usually limited in speed to fifteen or twenty thousand revolutions per minute. Analytical centrifuges, working with quite small samples, may operate at much higher speeds, up to one hundred thousand revolutions per minute or higher. The development of such high-speed centrifuges, now generally called ul-

Biscoe, a physicist, with Bauer and Edward Pickels, a graduate student in physics from Beams's laboratory in the University of Virginia, produced a successful and economical air-driven centrifuge for molecular sedimentations. Pickels had come to the Institute fresh from the experience of having spun a tiny rotor to 1,200,000 rpm at the University of Virginia, but practical ultracentrifuges for laboratory use are limited (largely by the strength of their rotors) to speeds far lower. Wyckoff and his associates, pressing for ever-higher rotational speeds, tested the strengths of rotors of various materials and designs by driving them to disintegration velocities. Neigh-

*(continued on page two)*

boring laboratories in Flexner Hall still recall the terrifying explosions which resulted. On at least one occasion fragments were blown through the ceiling of the laboratory and into the floor above.

The ultracentrifuge work was aided, perhaps decisively, by the skill and ingenuity of Josef W. Blum in the Instrument Shop. Blum had joined the staff in 1935 when Dr. Gasser undertook to modernize the shop and staff it with excellent instrument makers. Blum was at first a temporary worker, assisting Dr. Bauer in ultracentrifuge development, but in 1939 he was made head of the Instrument Shop.

Dr. Wyckoff left the Institute in 1938 to join the staff of Lederle Laboratories, and later he became Director of the Laboratory of Physical Biology at the National Institutes of Health. Biscoe, who had come from the Massachusetts Institute of Technology, also left in 1938, and he is now Professor of Physics in the University of Maine. Pickels remained with the Rockefeller Foundation Laboratory until 1946, when he resigned to form his own company, Specialized Instruments Corporation (Spinco), in California.

#### PRECISE CONTROL AT 60,000 RPM

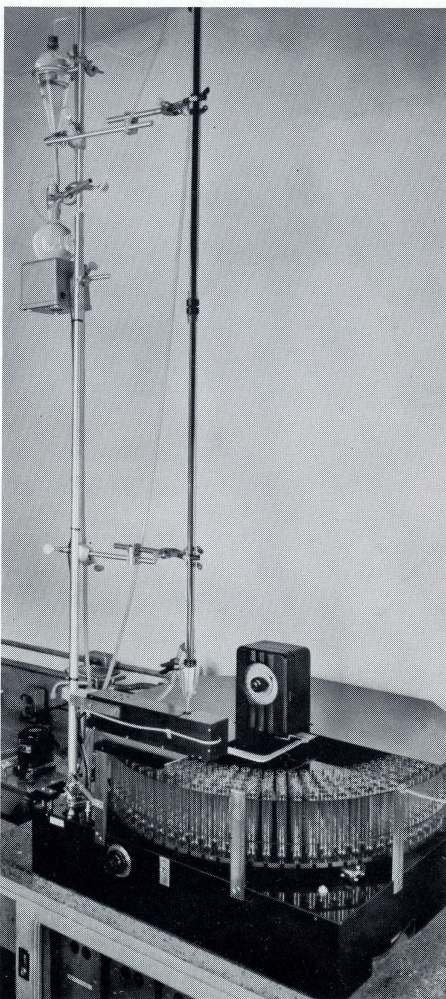
While Wyckoff and his associates were concentrating on ever-higher rotational speeds, the physical chemists at the Institute, notably Duncan MacInnes and Alexandre Rothen, were devising means for more precisely measuring and regulating rate of rotation. By 1941, Rothen, with the assistance of Blum in the Instrument Shop, succeeded in constructing a centrifuge that could be operated at 60,000 rpm with a precision of one revolution per second for several hours. With this precisely operating apparatus Rothen was able to check the molecular weights of a number of biologically important proteins being studied at the Institute. Notable among these was the well-defined crystalline ribonuclease prepared by Kunitz. When Rothen determined with confidence that the molecular weight of this protein was around 13,000 he upset the prevailing hypothesis that proteins would all be constructed of units having molecular weights in the neighborhood of 17,600.

Rothen persisted in his efforts to determine molecular weights with increasing

accuracy by ultracentrifuge sedimentation rates, and he succeeded in reducing the limits of error to a few per cent. To improve the sharpness of separations, Rothen provided freezing coils so that his centrifuge could be operated at 0° centigrade in vacuum, the only such machine in the world at that time.

By 1948 Paul Ecker in MacInnes's laboratory and Blum in the Instrument Shop had constructed an air-driven centrifuge with an electromagnetic speed control developed by Beams at the University of Virginia which could be controlled with a variation of only 0.1 per cent at 60,000 rpm. The errors that remained in determining molecular weights were due largely to the difficulty of measuring accurately and controlling the temperature of the centrifuge rotor. This problem has not yet been adequately solved.

Though development and construction

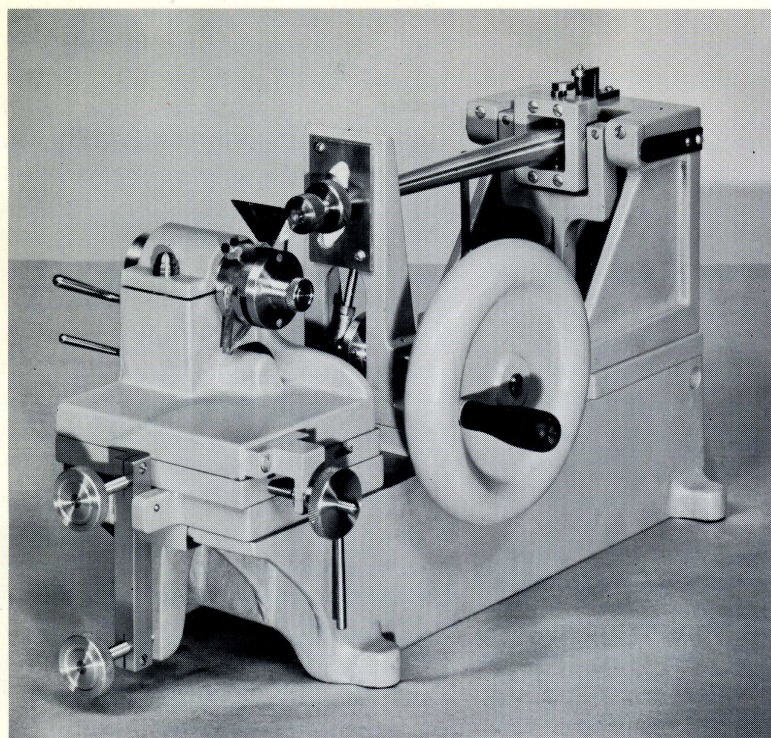


*An early model of the automatic fraction collector developed by Drs. Moore and Stein*

of high-speed centrifuges was one of the major occupations of the Instrument Shop during the years of World War II, other work of significance was of course carried on. Blum devoted considerable attention to development of a simple and practical centrifuge for laboratory preparations, operating at speeds of up to 20,000 rpm. Adapting a design introduced by Dr. Karl T. R. Lundgren of St. Göran Hospital in Sweden, the so-called angle centrifuge, Blum fabricated his rotors of a solid block of light metal drilled radially to accept sample tubes inclined in fixed positions between horizontal and vertical. These machines are compact, economical, and efficient for laboratory preparations. Unlike the elaborate and noisy air turbine drives of the ultracentrifuge, the drives of these small centrifuges were electric motors. Blum designed a self-centering direct drive that would permit slightly unbalanced rotors to find their natural center of rotation so that laboratory technicians were freed from laborious balancing of samples. These centrifuges were the prototypes of those that are now seen in biological laboratories everywhere.

Wartime research occasionally carried the laboratories far afield. For example, a problem which Dr. Theodore Shedlovsky undertook for the Navy's Bureau of Aeronautics involved measurement of the exact temperature of the air around a moving aircraft. This is more difficult than it might seem, for air impinging directly on a rapidly moving thermocouple is compressed and therefore heated, while air around a protected thermocouple is at lowered pressure, and thus chilled. Shedlovsky solved the problem by housing two thermocouples in cones, one facing into the air stream, the other facing away from it. The readings of both thermocouples varied with air speed, but they varied systematically, so that with suitable circuitry the velocity effect could be eliminated.

Rothen, whose work in centrifuge development has already been described, also developed other apparatus, among which his "ellipsometer," like the centrifuge, has gone on to a commercial career of its own. The ellipsometer was devised by Rothen to measure thicknesses of films only one or a few molecules thick. Instead of using interference methods, Rothen took advantage of the known fact that a thin film over a reflecting surface will change the



Porter-Blum  
microtome for  
cutting ultra-  
thin sections

polarization of light in a way dependent on the film thickness. With his ellipsometer, constructed by Josef Blum in the Instrument Shop and described in 1944, Rothen has been able to measure thicknesses within 0.2 Angstrom units, or about one billionth of an inch.

The development of partition chromatography, particularly starch column chromatography introduced by Synge in 1944, made possible fractionation of milligram quantities of material which could then be further investigated by conventional microchemical techniques. The collection of the fractions as they emerged drop-by-drop from the starch column, sometimes over periods of many hours, was laborious and time consuming. Professors Moore and Stein, in adapting the column technique for their studies of amino acids and peptides, developed an automatic fraction collector which can be left unattended for several days while a small volume of material is separated into as many as 320 fractions of equal size. The device, which was engineered by Josef Blum, measures out drops of effluent into sample tubes in a circular rack beneath the column. After a predetermined number of drops, a motor rotates the rack one notch to position another tube under the column. After a complete rotation, filling 80 tubes, the effluent line is automatically moved radially to an-

other ring of 80 tubes and so on until 320 fractions have been collected.

The first model of the automatic fraction collector, constructed in 1946, is still in operation in the laboratory of Professors Moore and Stein. To make the machine more readily available, they gave their design to a commercial equipment supplier, and since that time automatic fraction collectors have become standard items in the catalogues of numerous manufacturers of equipment for biochemical research.

#### THE PORTER-BLUM MICROTOME

Dissatisfied with existing microtomes for cutting thin sections for electron microscopy, Dr. Keith Porter, a few years ago, set about to devise an improved model for his own use. Working with Josef Blum he produced what is now widely known as the Porter-Blum microtome. That it was exceptionally satisfactory is indicated by a statement in a recent text on techniques of electron microscopy that "it probably will be the instrument bought by most American laboratories for some years to come." While other instruments may perform as well in skilled hands, Porter's microtome gives consistently good results even when used by relative novices, cutting successive slices in the neighborhood of a few millionths of an inch in thickness. To advance the knife on the specimen such mi-

nute distances, many systems, including Porter's own first design, depend on thermal expansion of the parts of the instrument as it is warmed. Blum, however, designed an automatic mechanical advance that contributes in no small way to the good performance of the microtome.

Blum left The Rockefeller Institute in 1954 shortly after this work was completed to become Director of Design and Development of Ivan Sorvall Co., Inc., in Norwalk, Connecticut. Supervision of the Instrument Shop has been in the hands of Nils Jernberg since that time. Jernberg's training began as an apprentice in the instrument shop of the University of Lund when he was fourteen. After serving in the Royal Air Force he studied electronics at the Technical Institute in Stockholm, graduating in 1947. He was employed as a designer by a manufacturer of electrocardiographs prior to coming to the United States. He was brought to this country in 1951 by the late Ivan Sorvall, to work in Sorvall's instrument-making firm. Jernberg has seen the Institute's Instrument Shop grow from a three-man group with only a single modern precision lathe to the present staff of a dozen skilled machinists.

For many years the shop has been collaborating with Dr. Lyman Craig in developing a completely robotized and wholly reliable counter-current distribution apparatus that could be left unattended for an entire weekend, while it performs one of the finely discriminating chemical separations described by Dr. Craig in his recent article in the *Quarterly* (Fall, 1960, Volume 4, Number 3). A device somewhat similar mechanically was developed recently for Dr. Trager to simplify the *in vitro* culturing of intracellular protozoan parasites which require periodic and carefully controlled exchanges of the media on which they are grown. Fresh culture medium, kept under refrigeration until needed, is automatically withdrawn, warmed appropriately, and introduced into specially designed flasks, replacing exhausted medium, which is also automatically removed.

By helping to provide techniques and instruments such as have been described here, the Instrument Shop has enabled scientists at the Institute and elsewhere to extend the perceptions of their senses, to refine the precision of their manipulations, and to free their attention from routine for the pursuit of their most creative insights.

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## The Trustees

WILLIAM J. ROBBINS

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FOR FIFTY YEARS teaching and research in plant physiology have been the dominant interests of Dr. William J. Robbins, Director Emeritus of The New York Botanical Garden, Emeritus Professor of Botany, Columbia University, and Trustee of the Institute since 1956.

He was born in North Platte, Nebraska, and as a boy spent many summers on his uncle's farm in Pennsylvania where he learned to love the land and all that grows on it. His parents were educators, and from the combination of these early influences his interest in botany developed.

Although he majored in mathematics, physics and classical languages as an undergraduate at Lehigh University, biology attracted him most. After a year as assistant in biology at Lehigh he transferred to Cornell University where he received the Ph.D. degree in botany in 1915.

Soon after completing his graduate studies at Cornell, Dr. Robbins went to the Alabama Polytechnic Institute where he was professor of botany, chairman of the department, and plant physiologist. While there he demonstrated the existence of specific soil bacteria capable of destroying definite organic compounds toxic to higher plants, and initiated studies on the cultivation of excised roots. Dr. Robbins was very happy in Alabama, but a minor crisis in his family, followed shortly by the major crisis of the entry of the United States in World War I, cut short his career there.

Emerging as a second lieutenant from the Sanitary Corps in 1918, Dr. Robbins spent a year as a soil biochemist for the Department of Agriculture's Bureau of Plant Industry in Washington. At the age of twenty-nine he was called as professor of botany and head of the department to the University of Missouri where he remained for eighteen years. In 1930 he was made Dean of the Graduate School, and in 1933-34 he served for a year as acting President of the University.

At Missouri Dr. Robbins continued studies on the growth of excised roots which he had begun at Alabama, and he investigated the effect of hydrogen ion

concentration on a variety of plant responses. He also began there studies on the relation of vitamins and similar substances to the growth of higher plants and fungi. In this work he demonstrated that plants, as well as animals, require vitamins for normal growth.

Dr. Robbins was deeply interested in these investigations at Missouri, but he was increasingly alarmed at the extent to which administrative responsibilities were interfering with them, and when he was invited in 1937 to become Director of The New York Botanical Garden, he happily accepted—on condition that he should have time for research. The Board of Man-



agers of the Garden willingly acceded, and the Rockefeller Foundation provided a grant for laboratory equipment, which enabled him and his associates to carry out an extensive program of research.

Only a steadfast determination, supported by an understanding wife, the former Christine F. Chapman (a botany student he met in graduate school at Cornell), has enabled Dr. Robbins to avoid being drawn completely into administration. In 1928 he went to the Paris office of the Rockefeller Foundation to assist in their program of post-doctoral fellowships, and when he returned he was confronted with an offer of a position in the Foundation's New York office. But the Robbinses chose instead to return to teaching and research at Missouri. The directorship of the Botanical Garden became more of an administrative chore than Dr. Robbins had expected. He soon reorganized areas in

which improvements were needed, but the increased programs demanded increased financial support. With Joseph R. Swan, President of Smith, Barney and Co., and new president of the Garden, Dr. Robbins and a Committee on Plans and Development undertook a fund-raising program that resulted, among other things, in the establishment of new curatorships and various improvements in the physical plant, including a million-dollar laboratory completed in 1956.

When Dr. Robbins became Director Emeritus in 1957 he had a number of investigations in progress in his own laboratories at the Botanical Garden, and some of these he is still in the process of completing. In addition to his activities at the Garden, Dr. Robbins is currently occupied as a consultant to the Speyer Animal Medical Center, which is strengthening its role as an educational and scientific institution as it prepares to occupy a new building adjacent to the Institute. Dr. Robbins is also a member of the Board of Directors of the Boyce Thompson Institute, and a Trustee of the Fairchild Tropical Garden, and member of the Scientific Advisory Committee of the Institute for Microbiology at Rutgers University.

Dr. Robbins was President of the American Philosophical Society for three years and its Executive Officer for one year. During this period he accomplished much for the Society, including the construction of a new library building. This spring the members presented him with a sterling silver replica of the inkstand which was used at the signing of the Declaration of Independence and an illuminated book in which was engraved a tribute to his achievements while in office. Dr. Robbins also served the National Academy of Sciences—National Research Council as its treasurer for twelve years, and he has been president of the Botanical Society of America and the Torrey Botanical Club, as well as vice-president of the American Association for the Advancement of Science.

His first honorary degree was a D.Sc. in 1937 from Lehigh University, which thus compensated for his frustration there twenty-five years before when his master's thesis in the histology of plant grafts foundered because his professor, a zoologist, did not know that wood could not be sectioned like animal tissues on the department's rotary microtome. Dr. Robbins was

awarded the Barbour Medal of the Fairchild Tropical Garden in 1954, and the Eloise Luquer Medal of the Garden Club of America in 1957, followed by its Sarah Gildersleeve Fife Award in 1958, and the Silver Achievement Medal of the Federated Garden Clubs of New York State in 1961.

The Robbinses have three sons, the eldest of whom, Frederick, shared the Nobel Prize in Medicine and Physiology in 1954 with Drs. John F. Enders and Thomas H. Weller for their work on the application of tissue culture methods to the study of viral infections. He is now Professor of Pediatrics, Western Reserve University, and Director, Department of Pediatrics and Contagious Diseases, City Hospital, Cleveland, Ohio. William C. Robbins, now Assistant Professor of Clinical Medicine, Cornell University Medical College, and Assistant Attending Physician, New York Hospital for Special Surgery, New York City, was a guest investigator at The Rockefeller Institute from 1954 to 1957 with Dr. Maclyn McCarty. Their youngest son, Dan, is chief engineer of Photostat Corporation, Rochester, N. Y., a subsidiary of ITEX Corporation.

### *Conference of Biological Editors*

The Institute was host to fifty members of the Conference of Biological Editors during a two-day session on February 3 and 4. The meeting was arranged by Associate Professor William Trager, who is editor of the *Journal of Protozoology*. The Conference is a permanent body established by the American Institute of Biological Sciences to consider problems common to all biological journals. One of its achievements is the compilation of a "Style Manual for Biological Journals," published last year.

Professor Paul Weiss addressed the Conference on "Research Strategy and Publication Policy." Working sessions included a discussion of page charges in biological journals led by Professor William Stein, as well as sessions on consideration of standards for accepting manuscripts, the effect of editorial policies on productivity, the training of biologists for scientific writing, and further work on the style manual.

### *The Great Challenge*

For the fourth successive season the CBS Television symposium series "The Great Challenge," was broadcast from Caspary Auditorium. Nineteen programs have been presented in the series since it was organized in the spring of 1958 to focus the attention of the American public on problems to be met and solved if the United States is to maintain world leadership.

Topics this year were: World Strategy of the United States as a Great Power (February 19); International Communism (March 5); Changing Patterns of Our Political System (March 12); and American Frontiers in the Sixties (March 26). Among those who participated in the discussion were Dr. Arnold Toynbee, the Honorable Adlai E. Stevenson, Mr. Robert Kennedy, and Dr. James R. Killian.

### *Seminar for Science Writers*

Progress in tissue culture techniques and advances in biochemistry were described by Professors Paul Weiss and Alfred Mirsky to twenty-six journalists from various parts of the country at a luncheon given at the Institute on March 16. Dr. Douglas Whitaker, who acted as host at the luncheon, reviewed the activities of the Institute. The visit, which was part of a ten-day seminar for science writers organized by New York University and sponsored by the National Science Foundation, also included visits to Bell Telephone Laboratories, Brookhaven National Labora-

tory, and the Sloan-Kettering Institute, as well as lectures by distinguished scientists from many laboratories and institutions throughout the United States.

### *The Season's Music*

The musical season at the Institute has included more than a dozen concerts in Caspary Auditorium covering a wide range of the musical arts. Three performances were given by the New York Chamber Soloists, a balanced and unified group which can perform great chamber music calling for combinations which are not usually heard. Other artists heard during the season were the Lyric Trio, the Juillard String Quartet, the Grishman-Ryce Duo, and Martina Arroyo, soprano. Two programs of sonatas for violin and harpsichord were played by Robert Gerle and Albert Fuller, and the Amor Musicae returned for the third season to present a program of seventeenth- and eighteenth-century compositions.

The Contemporary Music Society presented two concerts at the Institute, one for electronic music with ballet. The National Council of Women, in conjunction with an Inter-American Seminar, gave a concert of Latin American music featuring the compositions of Villa-Lobos.

The final concert of the year will be given in April by the Renaissance Chorus of New York. Composed of young people interested in the music of the Renaissance, this group includes one of the Institute's graduate fellows, Marc Estrin.

### *Quotation*

Professor Mark Kac on the future of Mathematics:

The extreme purists in our midst urge division and separation. Like Plato, centuries before them, they see in applications of mathematics "mere corruption and annihilation of the one good in mathematics" and they want mathematics to return to "the unembodied objects of pure intelligence." In their horror of one kind of professionalism they are creating another—professional purism.

Our extreme pragmatists preach division and separation on different grounds.

I would view separation as a tragedy, and I consider its prevention to be a major challenge of the years to come. The two great streams of mathematical creativity are a tribute to the universality of the human genius. Each carries its own dreams and its own passions. Together they generate new dreams and new passions. Apart both may die—one in a kind of unembodied sterility of medieval scholasticism and the other as a part of military art.

*From "Mathematics: Its Trends and its Tensions," Occasional Paper number ten published by The Rockefeller Institute Press.*

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## FACULTY ACTIVITIES

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### *Academic Appointment*

KARL MARAMOROSCH

Visiting Professor, University of Pennsylvania and the Wistar Institute.

### *Lectures, Conferences and Symposia*

CARL BERKLEY

Participant, Bio-Engineering Symposium, sponsored by the Foundation for Medical Technology, Washington, D.C.

DETLEV W. BRONK

Address, Annual Dinner, Engineers Joint Council.

Address, Duke University Faculty Club.

Address, 40th Anniversary Meeting, Highway Research Board.

Dedication Address, Goddard Space Flight Center.

Address, Science Symposium, Trinity College.

VERNON B. BROOKS

Invited participant, Conference on Cerebral Dominance, The Johns Hopkins University School of Medicine.

ARPAD I. CSAPO

Address, Los Angeles Obstetrical and Gynecological Society.

Lecture, Ciba Foundation Symposium on Progesterone and the Defense Mechanism of Pregnancy, London.

University Lecture, University College, London.

Lecture, Faculty of Sciences, University of Paris.

RICHARD M. FRANKLIN

Seminar, Biology Division, Oak Ridge National Laboratory.

ROBERT E. FRANZL

Participant, Conference on Recent Advances in the Knowledge of Adrenocortical Hormones, National Institutes of Health, Bethesda.

GEORGE J. JACKSON

Invited lecture, Zoology Department, Rutgers University.

Participant, Discussion of Science and Art in the United States, U.S. Information Agency's German Radio Service.

DANIEL E. KOSHLAND, JR.

Lecture, The RESA Lecture, Union Carbide Company, Bound Brook, New Jersey.

Lecture, The University Lecture in Biology, Syracuse University.

FRITZ A. LIPMANN

Lecture, Annual lectureship of The Hospital of the Good Samaritan, Los Angeles.

DAVID P. C. LLOYD

Participant, Symposium on the Biology of Skin—The Eccrine Glands and Eccrine Sweating, Brown University.

KARL MARAMOROSCH

Lecture, New York Academy of Sciences.

Lecture, University of New Hampshire.

PHILIP D. MCMASTER

Invited Speaker and participant, Conference on Recent Advances in the Knowledge of Adrenocortical Hormones, National Institutes of Health, Bethesda.

DAN H. MOORE

Seminar, Roswell Park Memorial Institute, Buffalo, New York.

GEORGE E. PALADE

Lecture, Sigma Xi Society, Brown University.

Lecture, Medical Research Society, Yale University.

Lecture, Division of Biological Sciences, University of Chicago.

S. WILLIAM PELLETIER

Invited lecture, Boyce Thompson Institute for Plant Research.

Participant, International Symposium on Natural Products, Stanford University.

KEITH R. PORTER

Lecture Series, University of Michigan Institute of Science and Technology.

Lecture, Genetics-Cytology program, University of Indiana.

Biology Lecture Series, Tulane University.

HOWARD RASMUSSEN

Lecture, Department of Biology, Harvard University.

Lecture, Department of Biochemistry, University of Wisconsin.

HOWARD A. SCHNEIDER

Address, Special Libraries Association, New York.

Lecture, Walter Reed Army Institute of Research, Washington, D.C.

RICHARD E. SHOPE

Lecture, Gehrman Lectures, University of Illinois.

Participant, Symposium on World Medicine, Yale University.

DAVID S. SMITH

Lecture, University of Chile.

Lecture, Institute of Biophysics, University of Brazil.

IGOR TAMM

Lecture, New York University School of Medicine.

WILLIAM TRAGER

Invited lecture, University of Massachusetts.

PAUL A. WEISS

Opening Address, Conference of Biological Editors, The Rockefeller Institute.

Lecture, Cooperative Forum, Inc., Washington, D.C.

VICTOR J. WILSON

Invited Speaker, Symposium on Recent Contributions of Basic Research to Paraplegia, Los Angeles.

Lecture, Downstate Medical Center, State University of New York.

Lecture, Society for Biology and Medicine, Brooklyn College.

VLADIMIR K. ZWORYKIN

Participant, Bio-Engineering Symposium, sponsored by the Foundation for Medical Technology, Washington, D.C.

### *Society Elections*

M. A. ATAMER

Member, The Society for the Study of Blood.

GEORGE W. CORNER

Honorary Member, The Rockefeller Institute Chapter of the Society of Sigma Xi.

W. J. V. OSTERHOUT  
Honorary Member, The Rockefeller Institute Chapter of the  
Society of Sigma Xi.  
PAUL A. WEISS  
Vice President, Harvey Society.

### *Other Appointments and Distinctions*

DETLEV W. BRONK  
Trustee-at-Large, University Corporation for Atmospheric Research.

FRANCIS O. HOLMES  
Advisor to The Philippine Government.  
Plant Virologist for the Food and Agriculture Organization of the United Nations.

DANIEL E. KOSHLAND, JR.  
Membership committee, American Society of Biological Chemists.

DAVID P. C. LLOYD  
Member, Neurology Study Section, U.S. Public Health Service.

KARL MARAMOROSCH  
Member, Committee on Awards for Professional Recognition,  
American Phytopathological Society, North Eastern Division.  
Member, Standing Committee on Sectional Activities, New York Academy of Sciences.

PAUL A. WEISS  
Member, Honorary Advisory Board, *Life Sciences*.  
Member, Advisory Board, *Journal of Biorheology*.  
Member, Scientific Council, Institute for Advancement of Medical Communication.

### *New Appointments to the Faculty*

ERELA ELIZUR, Research Associate with Assistant Professor Fox. On leave from the Hebrew University-Hadassah Medical School, Jerusalem, where he is Instructor.

MYRON C. LEDBETTER, Research Associate with Professor Porter. Formerly Guest Investigator and Fellow with Professor Porter.

ROBERT O. SCHEFFER, Research Associate with Professor Braun. Formerly Guest Investigator with Professor Braun.

B. I. H. SCOTT, Guest Investigator with Professor Weiss. On leave from the University of Tasmania, where he is Senior Lecturer in Physics.

ALEXANDER TOMASZ, Guest Investigator with Professor Hotchkiss. Fellow of the American Cancer Society. Formerly National Institutes of Health Fellow in the Department of Biochemistry, Columbia University.

EDWIN C. WOOD, Research Associate with Associate Professor Csapo. On leave from the University of London, where he is Senior Lecturer in the Institute of Obstetrics and Gynaecology, Queen Charlotte's Maternity Hospital.

### *Departures from the Faculty*

TOKUHIKO HIGASHI, Guest Investigator with Assistant Professor Gottschall, left the Institute February 9 to work at The Mary Imogene Bassett Hospital, Cooperstown, New York.

ROBERT J. HILL, Research Associate with Professor Craig, resigned March 1 to accept a United States Public Health Service Senior Research Fellowship at the University of Tennessee.

DAVID M. LOCKE, Research Associate with Professor Craig, resigned April 1 to join the staff of the American Chemical Society News Service in New York as a technical writer.

KARL MARAMOROSCH, Assistant Professor with Professor Braun, resigned March 1 to accept a position at the Boyce Thompson Institute for Plant Research.

SIVATOSH MOOKERJEE, Guest Investigator with Professor Weiss, left the Institute March 1 to return to the Department of Zoology, Presidency College, Calcutta, where he is Professor of Zoology.

BARBARA K. PETRACK, Research Associate with Professor Lipmann, resigned March 1 to accept a position at Geigy Research Laboratories, Ardsley, New York.

### *Visiting Professors in Residence*

JOSEPH B. BIRDSSELL, Professor of Anthropology, University of California at Los Angeles, January 9-13, 1961.

ALEXANDER VON MURALT, Professor of Physiology, University of Bern, Switzerland, January 6-February 7, 1961.

EPHRAIM KATCHALSKI, Professor of Biochemistry and Director of the Biological Department, The Weizmann Institute of Science, Rehovoth, February 13-March 23, 1961.

MICHAEL FISCHBERG, John Wilfred Jenkinson Memorial Lecturer and Director of Embryological Laboratories, Department of Zoology and Comparative Anatomy, University of Oxford, March 11-April 16, 1961.

### *Guest Speakers*

BARUJ BENACERRAF, Department of Medicine, New York University Medical Center.

E. S. CANELLAKIS, Department of Pharmacology, Yale University School of Medicine.

R. R. A. COOMBS, Department of Pathology, University of Cambridge.

DAVID ELSON, The Weizmann Institute of Science, Rehovoth.

ROBERT GALAMBOS, Walter Reed Army Institute of Research, Washington, D.C.

ALFRED GIERER, Max Planck Institute for Virus Research, Tübingen, Germany.

TERU HAYASHI, Department of Zoology, Columbia University.

S. J. HOLT, Courtauld Institute of Biochemistry, Middlesex Hospital Medical School, University of London.

JOHN C. KENDREW, The Medical Research Council Unit for Molecular Biology, Cavendish Laboratories, Cambridge, England.

YVES LA PORTE, Department of Physiology, University of Toulouse, France.

ILSE LASNITZKI, Strangeways Laboratories, University of Cambridge.

JAMES V. NEEL, Department of Human Genetics, University of Michigan.

GUEST SPEAKERS *continued from page seven*

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VLADIMIR PRELOG, School of Chemistry, Swiss Federal Institute of Technology, Zurich.

MICHAEL SELA, Department of Biophysics, The Weizmann Institute of Science, Rehovoth.

EDMUND W. SINNOTT, Sterling Professor Emeritus, Yale University.

CURT STERN, Department of Zoology, University of California, Berkeley.

ICHIJI TASAKI, National Institute of Neurological Diseases and Blindness, Bethesda.

TORSTEN A. TEORELL, Department of Physiology, University of Uppsala.

A. C. TROSHIN, Institute of Cytology, Leningrad.

W. E. VAN HEYNINGEN, Sir William Dunn School of Pathology, University of Oxford.

BIRGIT VENNESLAND, Department of Biochemistry, University of Chicago.

SAMUEL B. WEISS, Department of Biochemistry, Argonne Cancer Research Hospital, University of Chicago.

EMIL WITSCHI, Department of Zoology, State University of Iowa.

*New Grants and Contracts*

From the American Cancer Society to Dr. Braun for investigating the physiological and biochemical basis for autonomous growth of plant tumor cells \$1,150

From the American Heart Association, Inc. to Dr. Mauro for development of a transistorized pacemaker for remote stimulation of the heart by radio frequency transmission \$2,200

From the Association for the Aid of Crippled Children to Dr. Hotchkiss for studies in transmission genetics \$3,300

From the Health Research Council of the City of New York:

To Dr. Dubos for study of infection in disease-free and germ-free animals \$60,820

To Dr. Tamm for investigation of the interaction of human viruses with receptors \$30,679

To Dr. Weiss for work on the dynamics of nerve growth and nerve regeneration \$30,000

From the Lillia Babbitt Hyde Foundation to Dr. Dan Moore to provide a Hitachi electron microscope \$40,000

From the Muscular Dystrophy Associations of America, Inc. to Dr. Csapo for studies on excitation-contraction coupling in muscles \$2,322

From the National Foundation to Dr. Kunkel for his work on the rheumatoid factors as antibodies to gamma globulin \$53,588

From the National Science Foundation to Dr. Porter for investigation of wall formation in cells of meristematic plant tissues \$17,300

From The Population Council, Inc. to Dr. Csapo for work on the mechanism of the maintenance and termination of pregnancy \$12,960

From the United States Public Health Service:

To Dr. Bearn for biochemical and genetical studies on human serum proteins \$21,813

To Dr. Csapo for investigation of functional myometrial disorders \$44,208

To Dr. Dubos for a training grant in human biology \$195,252

To Dr. Goebel for study of the chemical and immunological nature of colicines \$26,830

To Dr. Granick for study of enzymes of porphyrin biosynthesis \$14,950

To Dr. Hotchkiss for investigations of metabolic alterations in genetic drug resistance \$29,782

To Dr. Jesaitis for study of the function of the glucose component of viral nucleic acids \$35,724

To Dr. Kunkel for studies of immunological mechanisms in rheumatoid arthritis \$44,916

To Dr. Palade for work on the isolation and characterization of cellular membranes \$12,017

To Dr. Perlmann for investigation of the relation of protein structure to biological function \$26,341

To Dr. Pierce for work on the latency and reactivation of bacterial infections \$22,088

To Dr. Porter for studies of the effect of carcinogens on cell fine structure \$22,885

To Dr. Stoeckenius for investigation of the structural characterization of cell membranes \$10,925

To Dr. Trager for an electron microscope study of intracellular parasitism \$17,940