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CONVOCATION 1968

On June 11, 1968 The Rockefeller University awarded twenty-one Doctorates in Philosophy to its tenth and largest graduating class — the young scientists whose work is described in the following pages — and the degree of Doctor of Science hono-ris causa, *to J. George Harrar, humanitarian, educator, scientist, and President of The Rockefeller Foundation. The degrees were conferred by President Bronk. In speaking of the purposes of the University at the first Academic Convocation in 1959, Dr. Bronk stated movingly, "We hope that here we may make an environment in which men and women may explore the frontiers of natural knowledge as a happy, joyous quest that will enrich their lives and the lives of those about them." There was little doubt among those who watched the smiling young scholars step forward to receive their degrees on June 11th, that they fulfill this hope as they join one hundred others who now research and teach in thirty-nine universities throughout the world.*

Gudrun Staub Bennett

A.B. VASSAR COLLEGE
PRESENTED BY GERALD MAURICE EDELMAN

This has been an exciting decade in molecular biology. We have seen the genetic code written down, the three-dimensional structure of proteins analyzed, the scheme of protein synthesis outlined, and, in general, the biological language refreshed. In fact, there are some who would say that the language is complete and there are no more poems to be written.

But we are left with a few unsolved problems. The one that looms largest is that great fabricator of language itself, the brain. For a long time the physiologists and psychologists have been describing its rich phenomenology. Now the molecular biologists are becoming interested in this most complicated of material objects. It is obvious that much cataloguing must be done before we construct a neural code. Most of the molecules of the brain remain undescribed, and they are buried in a complex matrix that was not designed for the convenience of chemists. Nevertheless, neurochemistry is growing rapidly and solid progress is being made.

It is in this field that Gudrun Staub Bennett decided to work. Shortly after her arrival here in 1961 she began to learn about the physiology and physics of the nervous system. This she did by studying neurophysiology with Dr. Hurlbut, Dr. Connelly, and Dr. Brink. Well-armed with this knowledge, she came to me to learn something about protein molecules and immunology. By combining these various fields, she joined the ranks of cataloguers of brain molecules. She has isolated and described a new protein that is present in brain and nervous tissue but has not been detected in other tissues. The isolation was achieved by immunizing rabbits with extracts of brains from rats. The antisera were then used to detect components in rat brain that were not detectable in other organs. By using this assay in conjunction with modern fractionation techniques, she isolated an acidic protein that she named antigen α. Although this protein is one of hundreds, only a few have been studied so far, and her studies are a notable addition to our knowledge. Only when we have isolated and characterized the specific macromolecules of nervous tissue can we expect to make rapid advances in analyzing the nervous system in detail.

Mrs. Bennett has also confirmed and extended an earlier observation in the field of neurochemistry. She showed that spreading cortical depression induced by potassium ions is accompanied by a decrease in incorporation of amino acids into the brain proteins. This observation was made in conscious rats, and it promises to be useful in studies of learning.

In her work, Mrs. Bennett has been assiduous, thorough, and courageous. She has made an effort to span disciplines and has worked in a most difficult area. She has benefited from the breadth of the program in this University; we who have been her colleagues have benefited from her pleasant companionship.

I have said that the brain is the most complicated material object. Mrs. Bennett, who is married to one of our distinguished alumni, has given me reason to question this view. At the time that she presented her thesis she also presented the world with a baby daughter. She has thus shown herself simultaneously to be mistress of two difficult acts of creation. We look forward to her continuing in both fields.

Jack Winningham Bradbury

B.A. REED COLLEGE
PRESENTED BY DONALD REDFIELD GRIFFIN

It is one of the real glories of this golden age of science in America, and at The Rockefeller University in particular, that what we used to think were incompatible disciplines are now combined by specially favored students into the visceral experience of their formative years. Jack W. Bradbury exemplifies this phenomenon. He came to the Rockefeller in 1963, after an unusually full scientific youth. Even before entering college, he studied marine zoology with G. E. MacGinitie at the Kerckhoff Marine Laboratories of California Institute of Technology. At Reed College he began neurophysiological experiments with G. F. Gwilliam on sensory systems of marine invertebrates, and this brought him for three summers to the Marine Biological Laboratory at Woods Hole. This was followed by intensive wrestling with the biophysics of receptors, and this, in turn, led to a joint paper with Ronald Millecchia and Alexander Mauro on "Simple photoreceptors in *Limulus polyphemus.*"

When our academic spectrum was extended into the behavioral sciences in 1966, Bradbury was attracted

by the research program jointly operated by the University and the New York Zoological Society. His first active involvement was a summer's exposure to the rich fauna of the tropics at the Zoological Society's William Beebe Tropical Research Station in Trinidad. There he assisted Lincoln Brower of Amherst College in the backbreaking work of ambitious field experiments designed to measure the protection against predators afforded edible butterflies by colors that resemble the warning patterns of distasteful insects. But his sustained enthusiasm was aroused by the orientation behavior of bats.

Bats anticipated radar and sonar by fifty million years or so, and, in this long evolutionary history of operational experience with echolocation, they have learned not only to detect and locate small and distant moving objects, but also to discriminate between them. To study how bats make such discriminations between echoes from their probing sonar signals, Bradbury selected as experimental animals the largest species of bat available. This was *Vampyrum spectrum,* the false vampire. They do not feed on blood, but are strict carnivores. A sleeping bird or lizard resting on a branch returns echoes, but so do hundreds of other, inedible objects. Bradbury brought this problem into the laboratory, specifically into the Animal Behavior Laboratory established by the New York Zoological Society near the Bronx Zoo for our joint research program. He devised training procedures through which the bats were required to distinguish between two very similar objects with no cues available other than the echoes they returned. The targets were designed to return echoes that were almost identical in loudness during the straight and level flight path used by at least one bat, as Bradbury established by infrared photography in a pitch-dark flight chamber. This bat appeared to be using the acoustic fine structure in the echo spectrum as the basis for its successful discrimination—that is, the differences in relative intensities of the octave range of frequency contained in each echo. When these patterns of echo spectrum were experimentally eliminated, this animal lost its ability to discriminate. But another bat learned to solve the problem by flying a more tortuous flight path that approached the targets at angles where their echoes differed in total intensity. Thus Bradbury showed that different individuals of the same species of bat solve discrimination problems by different tactics, but that one successful mechanism is the resolution of differences in echo spectrum.

Bradbury will now launch into a still more complex and challenging area of research, the structure and function of animal societies. Working under the inspiration of Professor Marler, he will return for a year to the Beebe Research Station in Trinidad to study social systems of bats and their ecological adaptations. He will thus approach the Rockefeller ideal of becoming an articulate scientist not only trained but accomplished in several significantly related fields of endeavor.

David Douglas Brayshaw

B.S. LAFAYETTE COLLEGE
PRESENTED BY NICOLA NAJIB KHURI

Starting with Rutherford, experiments involving collisions between particles have constituted the main method for exploring the atomic, nuclear, and subnuclear structure of matter. In elementary particle physics, the relatively simple problem of collision of two particles cannot be understood in isolation. The always inherent possibility of the creation of more particles makes the two-body problem and the many-body problems inevitably interlocked. This has renewed and deepened the interest of theorists in problems involving the simultaneous collisions of several particles.

The first question to receive much attention was that of three-body collisions. Here, one immediately faces some of the centuries-old problems of three-body mechanics that date back to Newton. Eight years ago the Russian mathematician Faddeev made a major contribution to our understanding of the three-body problem. He was to formulate mathematical equations that enable us, in principle, to calculate the properties of three-body collisions, given those of the two-body collision.

Most theorists have at some time or another in their lives struggled with some feature of the stubborn three-body problem. David Brayshaw decided to start his scientific career by challenging it. David's interest in the three-body problem was first aroused during the summer of 1966, which he spent at Brookhaven National Laboratory working with Dr. Ronald Peierls. After his return to the Rockefeller in the fall

of that year, he soon realized that, before he could make any real progress on the three-body problem, a better technique for handling the two-body problem was needed. His first major contribution was to develop a new mathematical method for solving the equations of scattering theory. He then proceeded to show that his method can be successfully applied to the three-body equations proposed by Faddeev. As a first concrete application, he used these equations to show the relation between certain two-body and three-body nuclear systems. He has only just begun using this powerful method, and I am confident that in the near future it will lead to other fruitful results.

David — the first high-energy physicist to graduate from this young university — has shown great devotion to his work and has pursued both his studies and his research with undeflected energy. He has amply demonstrated that he has both the ingenuity and the skill for a promising future in scientific research. Next fall he will join the staff of the physics department at Columbia University. In addition to continuing his present work there, he will be teaching a course in mathematical physics to more than thirty first-year graduate students.

Albert Hudson Cass, Jr.

A.B. DARTMOUTH COLLEGE
PRESENTED BY ALEXANDER MAURO

It might seem surprising that a very intelligent young adult, in the pursuit of scientific knowledge, should spend countless hours staring at soap films, which, as we all know from watching children blowing soap bubbles, display exotic and, on occasion, even psychedelic colors. But I hasten to reassure you that Albert Cass has hardly spent these past five years at Rockefeller frivolously blowing soap bubbles. Rather, he has been pursuing subject matter of deep intellectual significance, as have many distinguished scientists — among others, the two illustrious physicists, Isaac Newton and Josiah Willard Gibbs — who have found the soap film worthy of serious investigation.

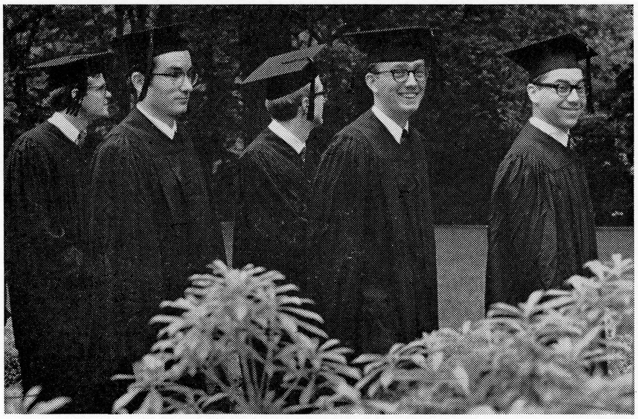
The physiologists' interest in soap films derives from the hypothesis that a closely related structure — a soap film turned inside out — has many features in common with the exquisitely thin layer of matter present at the surface of every biological cell, the cell membrane. Our introduction to this subject began six years ago when Alan Finkelstein, then a graduate student at Rockefeller, and I visited our friends Don Rudin and Paul Mueller in Philadelphia to observe at first hand their recently developed technique of forming a lipid film two molecules thick. This film, several millimeters in diameter, thus provided for the first time a physical model of the hypothetical structure that hitherto had been merely a subject of speculation by physiologists.

A number of laboratories have undertaken the study of this model system — with Rudin and Mueller leading the way — and indeed have found that many properties observed in biological cell membranes can be reproduced with a film suitably modified by chemical agents. Their remarkable success encouraged Albert, working both here at Rockefeller and at the Einstein Medical School with Alan, to study how water moves across the lipid film — an important and characteristic property of the cell membrane. If the lipid film is relevant to the cell membrane, it is of crucial importance to examine carefully its properties with regard to water permeability and to compare the results with extensive data obtained over the past four decades by many investigators in their studies of diverse cell types. Indeed, with meticulous and skillful experiments involving the measurement of minute quantities of water moving across the lipid film, Albert has succeeded in demonstrating that the model film displays the permeability to water that is seen, for example, in the red blood cell or the egg cell that produces the porcupine-like spiny sea urchin, with which you may be familiar. Moreover, in experiments pertaining to salts and other molecules, the data again have supported the relevance of the film to the cell membrane.

After extending his present investigation over the next six months, Albert will move on as a post doctoral fellow to the University of California in La Jolla, where he will study the ability of nerve cells to generate neural impulses with changes in temperature. The mechanism underlying thermoreception, he hopes, can be elucidated by the striking temperature sensitivity he has observed in the electrical properties of the lipid films.

Despite the remarkable successes I have outlined all too briefly, it is too early to predict how the lipid film model will help to provide the answers we hope will explain the many fascinating properties of the

cell membrane. It is certain, though, that all of us who have worked with Albert will be eagerly following his progress as he makes the contributions which surely will develop from this new and exciting field of membrane biophysics.



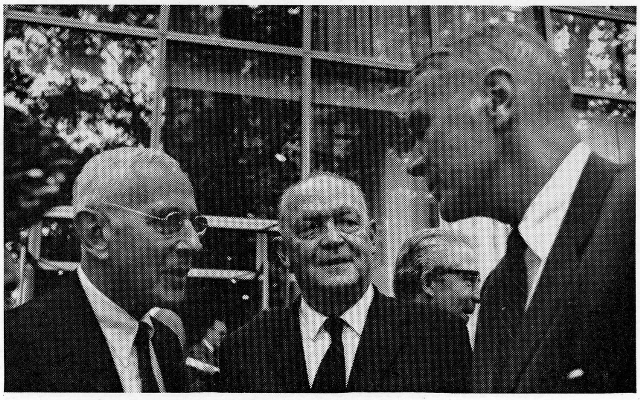
Richard William Compans

B.A. KALAMAZOO COLLEGE

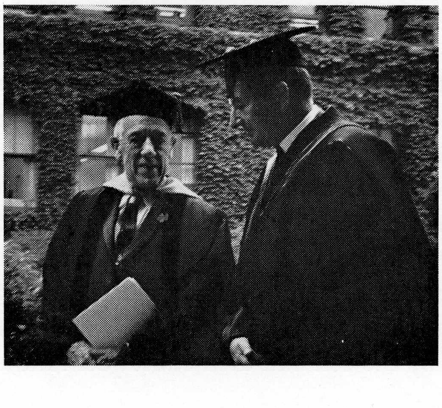
PRESENTED BY PURNELL WHITTINGTON CHOPPIN

Looking back over the progress of Richard Compans, one is reminded of several of the many features of The Rockefeller University which serve to make it a unique institution. One of these is the Welch Hall dining room, where I first met Dick soon after he arrived. During that chance lunchtime meeting we had a long conversation about viruses in general and the work in our laboratory. Dick has probably forgotten this conversation, but I like to think that it played some small role in his decision to enter the field of virology, for him a totally new area.

Dick was a chemistry major in college, and had spent an additional year studying organic chemistry at the University of Bonn. One of the major reasons he wished to come to The Rockefeller University was that it offered the unusual opportunity to begin graduate study without committing himself, in advance, to a specific area. Thus, the field of organic chemistry was deprived of Dick's talents, and virology and our laboratory were enriched.



After making his decision for virology, Dick proceeded to acquire the necessary background in cell biology and to extend his biochemical knowledge. He selected for study a parainfluenza virus, a member of a group that includes mumps and measles viruses and is of great biological interest. Most of his efforts have been concentrated not on the whole virus, but on an even smaller, subviral particle — the internal component or nucleocapsid of the virus. This helical structure, coiled like a spring within the outer coat of the virus, consists of protein and RNA, the viral genetic material. By a clever, yet simple and gentle method, Dick was the first to succeed in isolating this delicate component from a virus of this important group. He went on to develop methods for its purification, described its physical and chemical properties, and subsequently separated the RNA from the protein for further study.



Dick's work on viral nucleocapsid represents a major contribution to the field of virology. In addition, he has studied the assembly of this complex virus, showing in lucid detail how the nucleocapsid is wrapped up in its outer envelope at the cell membrane. These studies, done in collaboration with Kathryn Holmes, present what is probably the clearest picture available of the assembly of the parainfluenza, mumps, and measles group of viruses.

Throughout Dick's research, the use of the electron microscope was essential, and he was fortunate to have here at The Rockefeller University the wise counsel and expert guidance of Drs. Samuel Dales and George Palade.

Nathaniel Hawthorne wrote that the world owes its progress to men ill at ease. If this is true, then Dick Compans is the exception that proves the rule, because he goes about his work in the most serene yet effective manner that one can imagine. To paraphrase a Rolls-Royce advertisement, when Dick is working at 60 miles an hour, the loudest noise one hears is the ticking off of results.

Dick will soon be leaving to join Professor Frank Fenner's laboratory to gain experience in animal virus genetics. We will thus be sending to Australia a mature scholar, a talented scientist, and a good friend.

Barbara Alexander Ehrenreich

B.A. REED COLLEGE

PRESENTED BY ZANVIL ALEXANDER COHN

The transformation of a graduate student into a scholar and investigator is a complex phenomenon – poorly understood by student and faculty alike – but ultimately based upon motivation and hard work. This transition was successfully accomplished by Barbara Ehrenreich, a young woman with a strong background in the physical sciences who wished to explore the realm of living systems.

After an apprenticeship in which she mastered the techniques of cell biology and the lore of tissue culture, she selected a problem and began her independent studies. (I might say that the initial efforts of the mathematician-physicist when confronted with the laboratory mouse were not without humor to our more seasoned personnel.) Barbara decided to investigate the mechanisms by which large molecules are taken up by the cell and their subsequent intracellular fate. By employing radioactively tagged proteins she was able to follow these molecules as they were first entrapped within a fluid-filled vesicle and then transported deep into the cytoplasm. There, they were exposed to digestive enzymes and extensively degraded into small building blocks – amino acids. These fragments were then either excreted back into the cell's environment or utilized for the synthesis of new proteins. One of the questions raised by her experiments was whether the breakdown of proteins was completed within the confines of the digestive vacuole or the lysosome. Through the skillful use of morphological and biochemical techniques she was able to answer this question with reasonable certainty, namely, that macromolecules must be hydrolyzed to very small units before they are able to penetrate the lysosomal membrane and escape into the ground substance of the cell. These studies represent a solid contribution to our understanding of intracellular cytomembranes and to the digestive capacities of mammalian cells.

Barbara's professional accomplishments can be measured in many ways – and I could mention the publication of papers in scientific journals and the presentation of her research before national audiences. These would omit, however, other important aspects of her career at the University. First, she entered our laboratories as Barbara Alexander and is graduating as Mrs. Barbara Ehrenreich – an event in which her research adviser played only a minor role. Second, she is intensely interested and involved in the problems of our modern society – whether they are political, the health of underdeveloped nations, or the distress in our local ghettos. In each of these areas she has contributed her energies and talents, and will continue to do so as a member of the scientific community.

Scott Montgomery Grundy

B.S. TEXAS TECHNOLOGICAL COLLEGE

M.S., M.D. BAYLOR UNIVERSITY COLLEGE OF MEDICINE

PRESENTED BY EDWARD HAMBLIN AHRENS, JR.

The honoring of 21 graduands here today certainly poses interesting problems in space, motion, and time. It reminds me of the tourist in Italy who asked why they were considering a clock on the Tower of Pisa. He was told: "Why have the inclination, if you

don't have the time?" Now, I don't have all the time I need to tell you about Dr. Scott Grundy, but I do have the inclination.

He completed training as a physician at Baylor University in Houston in 1960, served an internship in medicine there, then was a resident in pathology. During those years, and even during medical school, he found enough hours for productive laboratory work, and carried an appointment as instructor in biochemistry at the same time. By the time he arrived here in 1962 to become a graduate fellow, he had twelve research reports to his credit.

In our laboratory for the last six years he has been more a colleague than a student; he has worked as one of us, with his own patients and in his own laboratory on questions which sprang to mind at the bedside. During this time he fulfilled all his basic science requirements so quietly that his partners in research were almost unaware that occasional absences were spent writing examinations for that most exacting faculty — biochemistry.

Dr. Grundy's thesis work represents a highly original application of laboratory science to health problems in man — and this in the finest tradition of the clinical research for which the Hospital of this institution has been distinguished since its doors opened in 1910. The content of his work is well known to this faculty and to his colleagues and, indeed, it is already highly regarded in the scientific world outside. I would rather describe the point of it all to his family than to the scientists here, for the other-cultured Grundys who have supported and encouraged him for 35 years may find themselves somewhat in the position of Francis Crick's wife: she found she was getting no more fireside chats about DNA after she informed Crick one day that gravity stopped three miles above the earth's surface.

What Dr. Grundy discovered, he discovered in man. To put it simply, he has defined with great precision the movement in and out of the body of one of its essential components — cholesterol. To some, even on this campus, cholesterol is a kind of scare word, because of its association with heart attacks and other disorders of the blood vessels. But consider for a moment that the surface of every cell in the body is made of a membrane in which cholesterol is a key unit; consider that the sex hormones are built from cholesterol; consider also that the body's detergents are made in the body entirely from cholesterol. Realizing these facts, you can appreciate that it was important to learn how much cholesterol the human body can make every day, where it puts it, how it gets rid of it, and what factors control these movements. If the Chairman of our Board of Trustees will lend me a word from the financial sphere — and I won't mind a high rate of interest — I would like to say that Dr. Grundy has shown how to measure the economy of cholesterol, and has studied many of the factors which regulate that economy. In so doing he learned in man what others had not yet learned in laboratory animals.

This pioneering effort stems from Dr. Grundy's sincere desire to understand a compelling health problem peculiar to man — arteriosclerosis. His research here brings to life the motto on this University's official seal — Pro Bono Humani Generis — for the good of mankind.

President Bronk, I am delighted to present to you a talented man who is keenly aware of the relevance of his training to the University's goals and to the aspirations of its founding family — my colleague and close friend — Dr. Scott Grundy.

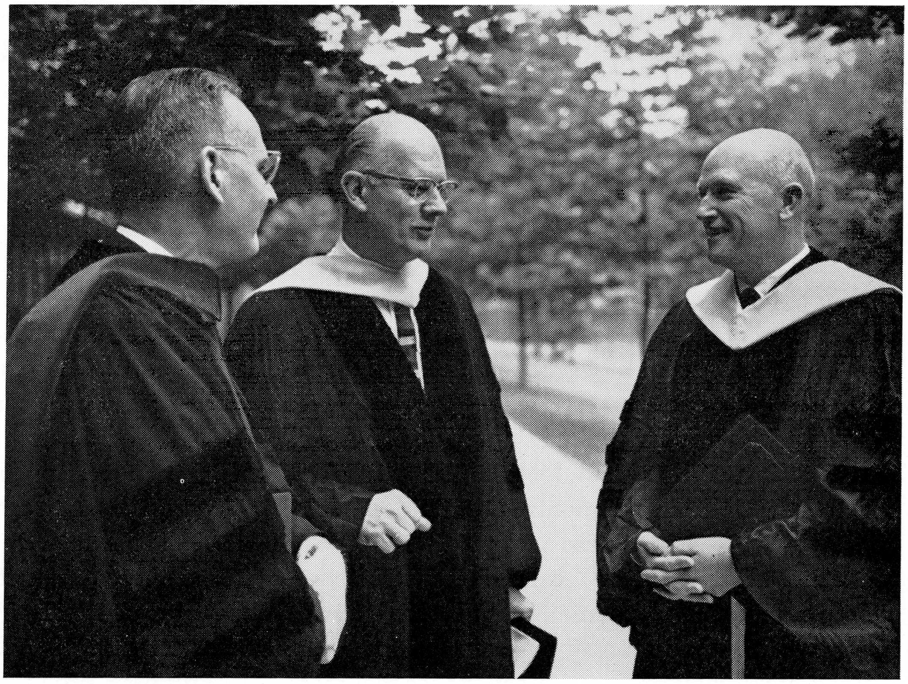
Helen Arnold Herron

A.B. RADCLIFFE COLLEGE

PRESENTED BY DAVID CHARLES MAUZERALL

Helen Arnold Herron arrived at the Rockefeller with both an excellent academic background in mathematics and an excellent genetic background in photobiology. Her father, Dr. William Arnold, has contributed several of the classical experiments and concepts to the field of photosynthesis. At first, Helen compromised these backgrounds by beginning a genetic problem with *Euglena* — itself a sort of compromise between the animal and plant worlds. In the end, it seems genetics triumphed, for she did her thesis on a classical problem in photosynthesis — the greening process in a plant. Hopefully, we are not seeing the end of these desirable backgrounds, for Helen has married a fellow student, David Herron, who is also interested in photochemistry.

Helen's research work was extremely efficient and skillful. She studied how the chloroplast in a mutant of *Chlorella* greens, i.e., how it assembles its pigment at the active site of the photosynthetic unit. This is



the site where the magic of photosynthesis occurs — where the energy of the light beam is converted to chemical energy and begins its long struggle to reverse the voracious demands of mammalian respiration and life.

Helen correlated pigment production with photosynthetic activity — that is, oxygen production — using a very sensitive device to detect oxygen. The device had been developed by my former student, Jay Burr. She found that the assembly of the pigments proceeds in a random fashion with respect to interaction and distance between the pigments. The theory of energy transfer between the pigment molecules indicates that only a rather small gain would be obtained by having a highly structured array for the antenna-like pigment molecules — and this at a large cost of specific structural information having to be supplied by the cell. So Helen's results are quite reasonable, assuming only that cells are reasonably capitalistic when it comes to balancing energy interest against entropy invested. A quantitative analysis of the light requirement for oxygen production during the greening of these *Chlorella* led Helen to propose a decrease in the isolation of the photosynthetic unit. The concept of such a unit was first proposed by her father and Professor Emerson many years ago.

Another result of Helen's work, and one she intends to continue to study, is a way to prepare the energy traps of the photosynthetic units with minimal contamination by the accessory or "aerial" pigments. Such preparations have been made by rather brute-force treatments of cells with detergents and physical disruption, but her new, more purely biological preparation is of great value: it would allow the direct study of the isolated photosynthetic unit in vivo.

Helen is a rather shy person with an odd Bostonian accent and a Midwestern smile coupled with an engaging openness. She has a surprising ability to ask disabling questions, and always shows a certain embarrassment when she corrects your mistakes. These are the personal qualities I remember most.

David Ian Hirsh

B.A. REED COLLEGE

PRESENTED BY FRITZ ALBERT LIPMANN

Proteins are assembled by condensation of twenty amino acids; each of them has a distinct chemical individuality. They must be put together in the right

order if they are to make sense. In preparation, each of these twenty is activated by a specific enzyme, which energizes it and links it to a special carrier that directs it into the right spot on the assembly line in protein biosynthesis. After the general mechanism of activation was understood, one of the most exciting tasks became finding out how each of the twenty activating enzymes is tuned to activate specifically only one of the twenty amino acids.

David Hirsh started exploring with a fresh mind the reactivity of various enzymes to hydroxylamine, a reagent for activated organic acids that has long been used in assays for amino acid activation. His study soon revealed striking differences in the reactivity of the aminoacyl enzyme complex to hydroxylamine. His problem became more and more fascinating, because this chemical tool permitted prying into the anatomy of the complex. He found that, irrespective of the source of the enzyme, the response to hydroxylamine scaled from zero for threonine to very fast for the aromatic amino acids. This indicated a surprisingly variable accessibility of the activated amino acids buried in their particular enzyme complexes.

An analysis of the interaction between enzyme complex and reagent revealed interesting differences in the reaction mechanism for different amino acids. In this manner, Dave Hirsh's work has given us a new insight into the biochemical behavior of individual amino acids – the magic twenty, which, in a sense, we might call the "meat and bone" of every living creature.

From here he is going to one of the great laboratories – the Molecular Biology unit in Cambridge, England. We wish him well, but we will surely miss him.

Kathryn Voelker Holmes

A.B. RADCLIFFE COLLEGE

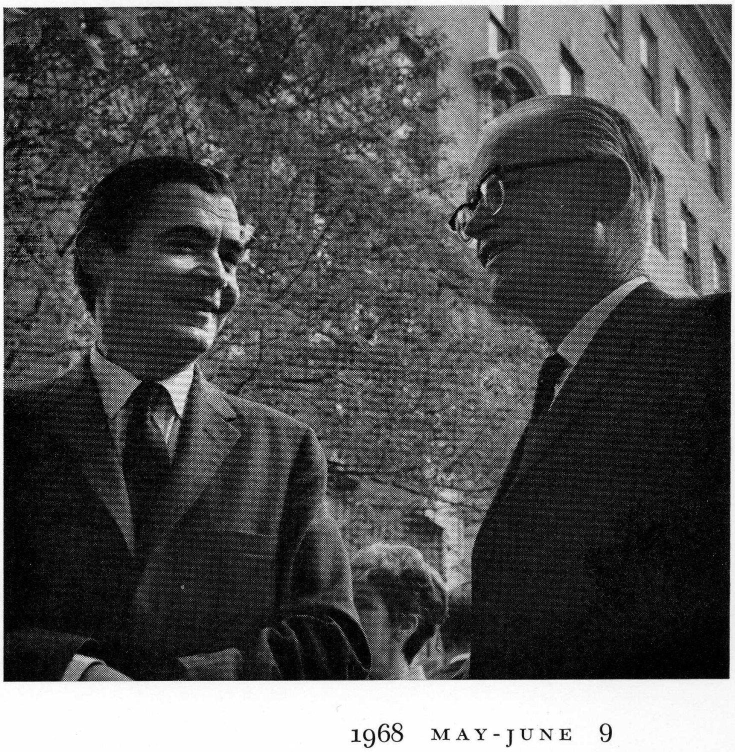
PRESENTED BY PURNELL WHITTINGTON CHOPPIN

Kathryn Voelker Holmes majored in biology at Radcliffe College. She came to The Rockefeller University with a strong desire to study, in her own words, the operation of cells, and began a search for a challenging problem. When she first observed that cells infected with certain viruses fuse together to form giant cells, the die was cast. From that moment, Kay's scientific interests focused on understanding how this dramatic fusion occurs, and on determining the effects of fusion on cells and on the multiplication of the virus within cells.

To carry out these studies on the social behavior of virus-infected cells, it was necessary for Kay to dig deeply into several areas of virology and cell biology, and to master many experimental techniques. I mention only two: her excellent photomicroscopic time-lapse movies of virus-infected cells, which are not only scientifically revealing but also esthetically beautiful; and her important electron microscopic studies, which were made possible through the guidance of Drs. Samuel Dales and George Palade.

Kay has developed an excellent system for the study of virus-induced cell fusion, and defined biochemical and physical characteristics of the fusion reaction. By studying the effects of a parainfluenza virus on several different cell types, she has shown that whether a given cell lives or dies after infection depends on the response of the cell membrane, a concept of potential importance in understanding the mechanism of certain disease processes.

Kay's contributions extend beyond the field of virology. Since the mid-nineteenth century, cytologists have noticed the distinctive arrangement of the multiple nuclei within giant cells, but the explana-



tion for this was obscure. Kay's work has shown that the migration and arrangement of nuclei within giant cells are guided by intracellular structures known as microtubules. These observations have thrown light on the transport of particles within cells, and have added new knowledge concerning the functions of microtubules, whose importance to the cell in a variety of ways is becoming increasingly apparent. Kay will continue her studies on microtubules when she joins Professor Keith Porter's laboratory at Harvard.

Randall Holmes, Kay's husband, is about to receive from New York University both an M.D. and a Ph.D. Undoubtedly, this team will go through life as Dr. and *Mrs.* Holmes; however, since the N.Y.U. graduation is not until tomorrow, Kay and we can take some satisfaction in the fact that for one day at least, it will be Dr. and *Mr.* Holmes.

No description of Kay's academic career would be complete without mention of her obvious enthusiasm and talent for teaching. This has been especially apparent in her activities in the Summer Biology Program for high school students. On many occasions over the past few years, these students have returned to discuss their educational progress with Kay. It is not only because of her past accomplishments, but also with particular cognizance of the fact that a doctor was first defined as a teacher, that I take pleasure in presenting Kathryn Voelker Holmes for the degree of Doctor of Philosophy.

Alan Mitchell Kapuler

B.S. YALE UNIVERSITY
PRESENTED BY EDWARD REICH

Alan Kapuler was born and grew up in Brooklyn. After attending public schools there, he entered Yale with the intention of proceeding to medical school for the ultimate purpose of performing medical research. Perhaps because of a long-standing interest in plants, he settled in the laboratory of Giles, which was a center for the study of the mold *Neurospora.* There, Kapuler came to know Harris Bernstein, who triggered his interest in microbial genetics and molecular biology. Bernstein and Kapuler constructed and published a provocative theory that accounted for the phenomenon of interallelic complementation. This phenomenon presented a problem of considerable interest at the time. In addition, Kapuler performed experiments designed to increase understanding of the genetic control of color development in fungi.

During this period, he decided to forego medical school and became committed to a career in research. Shortly after his arrival here he entered the laboratory of Dr. Norton Zinder, where he obtained additional training in the exciting area of molecular genetics and biology. Then he began to seek new challenges in those problems of greater complexity that exist in higher forms, and joined the laboratory of Dr. Armin Braun to study plant tumors. By applying his experience in microbiology, Kapuler devised an experimental system that made possible a quantitative approach to several aspects of tumor induction by the causative bacteria. Having reached this point, he perceived that a deeper understanding of the interaction between the bacterial pathogen and the plant host required an approach based on chemistry. Therefore, he joined our laboratory for training in biochemistry.

In his first project he prepared a variety of nucleic acids and nucleotides; these compounds were chemically modified at specific positions and were used to analyze problems related to the mechanisms by which nucleic acids are produced. Owing to his curiosity and to the energy with which the work was pursued, Kapuler soon made a series of unexpected observations that developed into his thesis research. His thesis presents several important insights into the structural requirements of nucleic acid synthesis and into molecular shape changes that take place during the formation of the nucleic acid polymers. The successful conduct of this work reflected extensive knowledge spanning numerous areas of science; these he assimilated voraciously, and because the experimental approach was new, it required resourcefulness and great technical skill. During this period, Kapuler was pursuing still another line of work. This latter effort created the conditions that will permit biochemical analysis of the mechanisms by which viruses may cause cells to become malignant. I am happy that President Bronk is appointing Kapuler to the faculty so that he may continue this important work here.

Because scientific research is an activity in which emotional factors predominate, I would like to tell

you something of Kapuler's approach to science. When he was about 11 years old, his family moved into a house that included a conservatory, and his father began to raise orchids. Within a few years, Alan became somewhat of an authority on these plants, and when he was 17 years old he joined a group that had been organized to search for new species in South America. Since coming here, Kapuler and his fellow student Vincent Hascall have made two unguided trips into unexplored areas of the Andes. Their efforts resulted in the discovery of numerous new species; they were awarded several prizes by floral societies and their findings were included in a book.

As one might expect from an amateur of orchids, Alan possesses a fine sense of form, and his commitment to science shows a keen appreciation of the colorful, the elegant, and the unusual. In attempting to achieve the unusual he is undeterred by the time required, disdainful of unfavorable odds, and oblivious to physical discomfort. With his flair for discovery, I can easily visualize him signing up zestfully as the biologist on the great expeditions of Captain Cook. Kapuler could be described as a climber in search of mountains. Mountain climbing is perilous, as a misstep may bring the climber abruptly back to earth, but Kapuler's tenacity and abilities give him a good chance of reaching the highest peaks.

Lewis Joel Kleinsmith

B.S. THE UNIVERSITY OF MICHIGAN
PRESENTED BY VINCENT GEORGE ALLFREY

Lewis Kleinsmith came to The Rockefeller University in 1964. He was a graduate of the University of Michigan, having won six Awards, two Scholarships, and two Research Fellowships. He had spent two years at the University of Michigan Medical School and by 1964 he was the senior author of half-a-dozen research papers. (A typical Rockefeller University student!)

I recall our first scientific encounter very clearly. He wanted to talk about my work on histones and I wanted to talk about his paper on the multipotentiality of single carcinoma cells. In his work with Dr. G. B. Pierce, Lew had established the remarkable fact that some animal tumor cells can revert to normal cells that are no longer cancerous. This finding extended to animal cells the generality of the important observations made here by Dr. Armin Braun on the reversible nature of some plant tumors. Thus, as we enjoyed Doctor and Mrs. Bronk's hospitality at the reception for new Graduate Fellows, we could see the beginnings of a warm scientific partnership.

Lew was interested in the chemistry of the cell nucleus, and he had just become aware of some fundamental new work in Dr. Lipmann's laboratory. There, Dr. Thomas Langan had discovered that cell nuclei contain a major protein fraction that actively incorporates phosphate groups.

We were both curious about this phenomenon, and decided to investigate how and why nuclei phosphorylate such proteins. This was not an easy problem, despite the generous advice and assistance of Dr. Langan, but Lew had a sure touch in the laboratory. He planned ahead, he was meticulous – which was fortunate for us, considering how much radioactive phosphorus passed through his hands without making the laboratory uninhabitable. He had a mature approach; he was always well-informed, confident but careful, and admirably self-critical.

In a surprisingly short time he had mastered the techniques required to study this new problem. Beginning with isolated nuclei, he demonstrated that phosphate uptake was limited to only certain classes of nuclear proteins; that these proteins were constantly accepting and releasing phosphate groups; and that this activity was related to the biosynthetic activity of the nucleus. The hypothesis was proposed that these reactions might be related to gene activation for ribonucleic acid synthesis, since it would offer a mechanism for changing the state of the chromosomes at times when cells must initiate new synthetic activities. This hypothesis was tested on human white cells, which were induced to divide in tissue culture. It was found that phosphate uptake into the nuclear proteins increased immediately upon stimulation of the cells, and that the peak of phosphorylation is reached prior to the time at which ribonucleic acid synthesis is accelerated. Thus it appears that phosphoprotein metabolism has some relevance to changing patterns of chromosomal activity, and a new and promising area has been opened for further study.

Lewis Kleinsmith combined excellence in labora-

tory work with very high standards of scholarship. His opinions and mature advice were frequently sought after by other Graduate Fellows — a sincere and meaningful testimony to his ability. I believe that he made the most of his opportunities here at the Rockefeller. It was always a two-way arrangement in which he gave as well as received. He is a credit to our system of self-directed scholarship and investigation. He now leaves us to join the faculty of the University of Michigan at Ann Arbor. I can only say, with a mixture of pride and regret, that they are getting one of our best.

Thomas James Murphy

B.S. FORDHAM UNIVERSITY

PRESENTED BY EZECHIEL GODERT DAVID COHEN

On his last visit to The Rockefeller University, Professor Peter Debye confirmed to me the truth of the following story. When seated behind his desk one day in 1925 in his office in the Technical University in Zurich, an unknown visitor from Norway was suddenly announced. There entered a tall stranger who walked silently the full length of the office towards the desk, bent down, and said solemnly: "Professor Debye, your theory of strong electrolytes contains an error." Whereupon Debye, after begging the stranger to sit down and discuss his objections, offered him an assistantship for the next year.

The stranger's name was, of course, Lars Onsager. More than 40 years later, one morning in 1967, when Professor Onsager was sitting behind his desk in his visitor's office at The Rockefeller University, an unknown tall student suddenly entered his office, walked towards his desk and said: "Professor Onsager, I believe your theory of strong electrolytes contains an error." Whereupon Onsager, after begging the student to sit down and discuss his objections, offered him an assistantship for the next year.

The student's name was, of course, Thomas J. Murphy. Tom Murphy started his research work with me in 1965, and soon made his mark by proving the theorem that three identical hard spheres moving in infinite space can never collide more than four times.

He then shifted his attention to the theory of the classical electron gas, and was able to extend this theory considerably. After the completion of this work — which also involved extensive machine calculations — he investigated the Debye-Huckel-Fuoss-Onsager theory of strong electrolytes. Here, again, he went beyond what was known at the time. He simplified the theory considerably, and in so doing discovered several inconsistencies in the Fuoss-Onsager theory of ion conductivity. In addition, he was able for the first time to estimate numerically the full effect of deviations from the Debye-Huckel superposition approximation in asymmetrical electrolytes. If I may add another historical footnote: the theoretical results he obtained compared very well with the still-unsurpassed experiments on ion conductivity carried out by Shedlovsky at this University in the early '30s.

The collaboration between Tom and me has been most profitable and stimulating, and can perhaps best be characterized in the words of The Rockefeller University catalogue as a collaboration "as junior and senior colleagues."

Tom is an independent thinker and a hard worker. He is perseverant and not afraid to get his hands dirty on long and involved calculations. I see a bright future ahead of him.

Kenneth David Nadler

B.S. RENSSELAER POLYTECHNIC INSTITUTE
PRESENTED BY SAM GRANICK

Kenneth Nadler came to my laboratory with a background in physics and engineering. To Ken, a living cell was a machine filled with complicated gadgets and control mechanisms. He wanted to study how a plant organelle, a colorless proplastid, grows and differentiates into a large green chloroplast. Essentially, such a study is part of the problem of how a plant becomes green.

Ken's difficulty at the start was to make the transition from the thinking and empathy of physics to that which went into biology. He found at first hand how difficult it was to grow a uniform stand of barley, that living material was in a constant process of change, and that it required constant attention even on the Lord's day of rest.

To study proplastid differentiation, Ken used as probes specific inhibitors of the manufacture of proteins and nucleic acids. As far as he was able to reconstruct the differentiation, the process seems to go as follows.

When barley seeds are grown in the dark, the colorless proplastids in the leaf cells enlarge and carry on a furious synthesis of a multitude of enzymes, proteins, and ribosomes. They store these materials within themselves. Soon this synthesis and storage come to a halt. Now let light fall on the proplastids. Then one specific enzyme is made – the synthetase of δ-aminolevulinic acid. Only this enzyme must be made to permit differentiation, during which chlorophyll is formed and the stored materials become reorganized. In this reorganization the delicate, magical, green discs are formed that function in photosynthesis. In short, the proplastid first stores up what it needs for the differentiation step, then light triggers the formation of a single limiting enzyme, then differentiation proceeds by reorganization of the stored materials.

When we think about this type of control of development it seems obvious. Wait until everything has accumulated that is needed for the next step of development; then trigger that step by making one key enzyme. Such a control mechanism may be one way to phase the development of an organelle, or cell, or tissue. In our laboratory we have encountered a similar type of control in studies of the mechanism by which a red blood cell develops. Thus, Ken's studies on barley have made more evident what we think may turn out to be one of the general phasing principles of developmental biology.

Ken, may you have the good fortune to continue the studies you have just so well begun, as we have had the good fortune to learn with you.

Earl LeRoy Parr

B.A. UNIVERSITY OF KANSAS
PRESENTED BY JAMES GERALD HIRSCH

Earl Parr came to the Rockefeller in 1963 after graduating from the University of Kansas with a major in physics. Earl had decided to switch to biology, but he was quite uncertain as to his field of specialization. One of the seminars Earl attended during his first year was concerned with human population control. Dr. Sheldon Segal discussed in some detail the use of intrauterine contraceptive devices, and pointed out that the mechanism of action of these so-called IUDs was unknown. This topic fascinated Earl, and for two years he worked diligently in the Population Council laboratories, attempting to confirm or refute in animal models the mechanisms previously proposed by others to explain how IUDs work. These studies, dealing with such aspects as uterine motility, were for the most part negative, but on microscopic examination he did notice a peculiar cellularity of those uterine specimens containing devices. He followed this lead in our laboratory and soon identified the extra cells as white blood cells of a certain type. Earl then showed in a series of elegant experiments that this inflammatory white-cell response was in every instance correlated with local infertility. These studies encompassed various types of devices in various species.

The results clearly pointed to a mechanism involving accumulation of white cells and release from them of factors toxic for fertilized ova. Earl was able to test this hypothesis directly by maintaining four-day-old fertilized rat ova in test tubes and showing that addition of extracts of white cells – or of other cell types, as well – prevented the normal development from morula to blastocyst stage. These discoveries have both basic and practical importance, shedding light on factors that influence early devel-

opment of mammalian ova, and pointing the way toward possible design of a more effective IUD.

Certainly I need not emphasize to this audience the paramount importance of human population control. Scientific and social techniques to effect this control must be discovered and applied soon if the human species is to continue to prosper, or even to survive. The best insurance that this or any other pressing problem will be solved is to attract our most capable young people to work in the area. It is therefore encouraging that Earl Parr will continue, after postgraduate training at Oxford, in a career centered on the biology of reproduction.

Brian Howard Poole

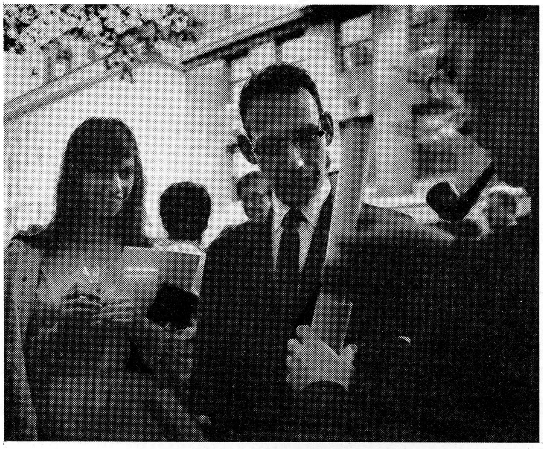
B.SC. MCMASTER UNIVERSITY
PRESENTED BY CHRISTIAN RENÉ DE DUVE

When Brian Poole joined our group four years ago, he was already the author of a scholarly review article on the control of growth, which he had prepared in the laboratory of Dr. Paul Weiss, and which he presented at an international meeting in Helsinki. He was also co-author, with Dr. Frankfurt, of a rather abstruse note on the meaning of teleology, which appeared in *The British Journal for the Philosophy of Science.* He is now author or co-author of a number of papers, which include much of what is known at the present time concerning a new group of cytoplasmic particles, the peroxisomes. He is also, I should add, the author of an extensive library of computer programs. This brief catalogue should give you some idea of Brian's talents, interests, and achievements as a scholar.

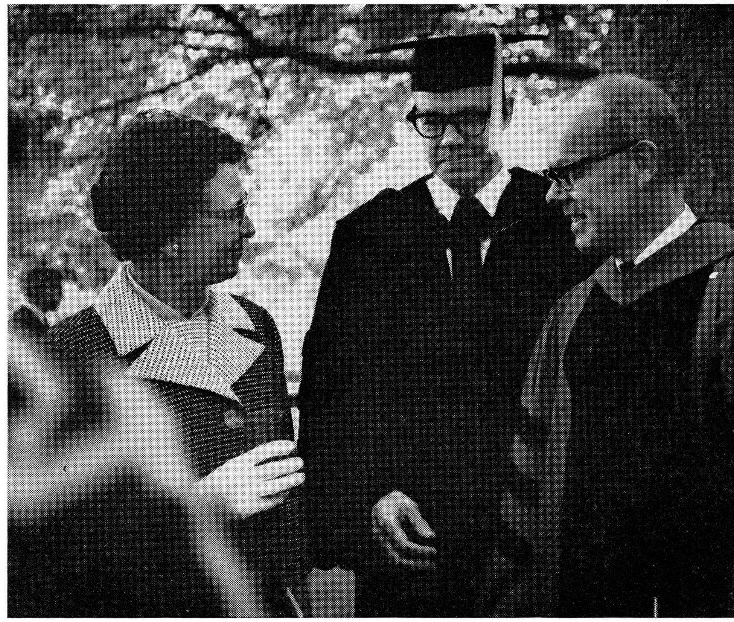
As to the particular subject of his dissertation, let me say simply that it has depended heavily on the development of new techniques for the large-scale purification of peroxisomes from rat liver; for the automated analysis of their enzymes; for the separation of their individual proteins. It has required complex and delicate experiments designed to probe the mechanisms whereby the peroxisome proteins are assembled and broken down. It has also involved the exploration of theoretical models as a means of understanding some of the physical and kinetic properties of the particles. In short, it has been a work with many different facets. The outcome is a solid and notable contribution to cell biology.

I wish I could tell you more about this, but time is limited, and I would like to touch briefly on another, more personal, aspect of my relationship with Brian Poole. It has something to do with the mechanism of acquisition and communication of continuously expanding knowledge by means of unexpansible brains. The computer is one answer to the problem; specialization is another. But they are not the whole answer. The main reason we are not completely overwhelmed by the progress of science is that much of the knowledge that is available at any time eventually becomes irrelevant. It is the function of each generation to distill and concentrate the knowledge of its time, discarding all that is trivial or has become obsolete. The little that is left is quickly passed on to the next generation, leaving it free to acquire more and start a new concentration cycle.

In simple words, I am trying to say that whatever a professor may have to give is bound to be exhausted rapidly. From then on, the students is on his own and, if he is worth his salt, he in turn becomes the teacher. These thoughts, for what they are worth, represent



Brian's practical contribution to my philosophical education. For never have I found myself speechless so soon, or have I been taught so much, as in my association with him. It is particularly appropriate, therefore, that he should be awarded a Doctorate in Philosophy.



Paul Arms Price

B.A. POMONA COLLEGE
PRESENTED BY WILLIAM HOWARD STEIN

Paul Price came to the Rockefeller from Pomona College four years ago. He was interested in the molecular events that take place in living organisms, and thus, perforce, in the bio-catalysts — the enzymes — that maintain and direct living processes. An early association here with Dr. Daniel Koshland spurred his enthusiasm and crystallized his desire to understand more of how enzymes work.

When Dr. Koshland left for Berkeley, Paul joined Stanford Moore and me on the fifth floor of Flexner Hall. He began his researches with our talented young associate Teh-Yung Liu, and his thesis project gradually evolved into the study of pancreatic deoxyribonuclease, an enzyme that has long been known but has presented a difficult challenge to the chemist. DNase, as the enzyme is called, catalyzes the hydrolysis of DNA. The protein has had an eventful association with The Rockefeller over the years. It was used in 1944 by Avery, McLeod, and McCarty in their epochal investigations which showed that DNA is the pneumococcal transforming factor that carries genetic information. Soon thereafter the enzyme was crystallized by our own Dr. Moses Kunitz.

Earlier investigators had found, however, that the enzyme's instability made it difficult to study. Paul Price was successful in proving that this instability was a result of the action of traces of proteolytic enzymes that had survived the usual isolation procedures. When he ingeniously removed these proteinases, DNase was stable and amenable to detailed study. Paul characterized his purified material and then investigated the active site of the enzyme. He was able to learn that a histidine residue is essential for catalytic activity. With characteristic skill and independence, Paul here succeeded where others had failed, because he wisely insisted on studying the enzyme in the presence of the metallic ions, such as calcium, magnesium, or manganese, that are essential for its activity. Paul found that if the three-dimensional arrangement of the enzyme is disrupted by a mild chemical procedure, the native structure and biological activity will only be regained if these metallic ions are present during the refolding process. These unusual results have important implications for the biosynthesis of DNase.

It is clear that Paul Price has already learned many significant things about this enzyme; more importantly, he has opened the way for future investigations in greater depth. Some of these he will pursue himself as he takes up his first post on the faculty of the biology department at the University of California, San Diego. Paul has the homing instincts with which Californians are so often endowed, and he is soon to return to his native state. We shall be sorry to see him leave, for we have enjoyed his quiet but stimulating presence in the laboratory. It has been good to have him as a colleague and to watch him grow in his understanding of biochemistry.

Daniel B. Rifkin

A.B. PRINCETON UNIVERSITY
PRESENTED BY WILLIAM HENRY KONIGSBERG

A man with a keen eye, Dan Rifkin has focused his gaze on women, art, and science. The acuity of his

vision is testified to by his success in all three endeavors: in the first, as a happy husband of a beautiful and talented wife who is one of our students; in the second, as a satisfied collector of Peruvian antiquities; and in the third, as an accomplished research scientist.

While Mr. Rifkin may have considered that the proper study of mankind is man, his first efforts were directed toward the elucidation of the structure of the hemoglobin of a close relative, the chimpanzee. Daniel showed that the amino acid composition of the tryptic peptides of the β chains of chimpanzee hemoglobin had the same composition as those from human hemoglobin, an indication that the structures of the β chains of chimpanzee and human hemoglobins are identical. Mr. Rifkin descended another branch of the phylogenetic tree and began examining hemoglobins from various strains of inbred mice. During this investigation his patience, skill, and perception were rewarded. He made the important observation that in the α chains of certain strains of inbred mice two different amino acids occupied the same position in the molecule. This discovery raised questions about the possibility of structural gene duplication and about the possibility of ambiguity in the biosynthesis of the α chain. Strong arguments can be offered that the presence of these two amino acids at a single site in the α chain must have been the result of alternate ways of translating the messenger RNA that specified the amino acid sequence of this protein.

Although the questions raised by Mr. Rifkin's discovery remain largely unanswered, his observation has caused scientists to reexamine their notions about the fidelity of protein biosynthesis in mammalian systems. Mr. Rifkin will now turn his attention to the study of the Rous sarcoma virus in the laboratory of Dr. Edward Reich.

Lawrence Stuart Sturman

B.S., M.S. NORTHWESTERN UNIVERSITY
M.D. NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
PRESENTED BY IGOR TAMM

Lawrence Stuart Sturman came to us from Northwestern University with a strong background in biochemistry and medicine. His scientific outlook can be summed up by saying that he wanted to bring the biochemical approach to bear on problems in whole living organisms. He decided to undertake the study of viruses and the infections they cause. Experimental virus infections provide model systems where a disease can be studied in its natural animal host and where cellular mechanisms can, at the same time, be closely examined in the test tube.

Larry decided to study one of a group of encephalitis viruses of mice, discovered in 1934 by Max Theiler of The Rockefeller Foundation Virus Laboratories. These are small and simple viruses, whose genetic material—ribonucleic acid—contains only enough information to code for about ten proteins.

Larry was quickly successful in finding cell culture systems in which Theiler's virus grew well and produced the characteristic picture of cell damage. But what proved of special interest was that in some cell types the multiplication of the virus was severely restricted, although the infected cells still degenerated. By this finding, Larry established the first example of host-dependent restriction of multiplication in small ribonucleic acid-containing viruses of animals. He went on to show that restriction of viral growth is associated with restriction in the synthesis of the viral ribonucleic acid. He has also succeeded in isolating a variant of Theiler's virus that grows well in cells that will not support the parent virus; this and other evidence strengthen the concept that each virus has highly specific requirements for successful multiplication—requirements which only certain cells can meet.

Larry has thus extended significantly our knowledge of host-dependent restriction of viral growth—a phenomenon whose great importance has only recently been fully realized. It is fitting that Larry has accomplished this here, as it was Richard Edwin Shope of our University who laid the foundation in this field thirty-five years ago.

Larry is a man with wide interests and an extraordinary capacity for work. Through his studies he has developed a broad understanding of host-virus relationships, and is well prepared for the work which he will now undertake in the National Institutes of Health. I would like to add that for both Larry and

his wife Audrie, who is an accomplished artist, our University and our city have been a cultural home both have enjoyed to the fullest and to which both have contributed richly.

Robley Cook Williams, Jr.

A.B. CORNELL UNIVERSITY
PRESENTED BY LYMAN CREIGHTON CRAIG

At lunch one day nearly five years ago, I happened to sit next to a pleasant young man, Robley Williams, who I quickly discovered was one of our new Graduate Fellows. He had recently received the bachelor's degree from Cornell University and seemed rather open-minded about the choice of a major area in which to specialize. His undergraduate training had been strong in physics, mathematics, and chemistry, and he expressed a desire to use this background to explore certain areas of biology, hoping eventually to contribute something to a better understanding of key unresolved problems. He was at that stage obviously uncommitted.

About a year later I seemed to find him frequently in the ultracentrifuge room talking with Dr. David Yphantis, who was in charge of our ultracentrifuge and who was using this tool to study the way in which certain molecules in solution tend to clump together in loose combination but still remain in solution. This tendency happens to be a basic property of biologically important molecules, and is of great significance in biochemistry because it contributes to the selective character of key substances. The complete nature of the forces involved in this selectivity has thus far partially eluded the inquiry of our most brilliant chemists.

For the highest selectivity, large, complicated molecules seem to be required, a fact that suggests the involvement of many different forces acting in concert. Since detailed study of such intricate molecules is difficult, the study of simpler ones that show part of the effect could offer interest if a suitable model substance of small molecular size could be found. A survey of the literature led to a class of substances called tyrocidines — antibiotic polypeptides discovered thirty years ago in this University by Drs. Dubos and Hotchkiss — which seemed to offer promise as models.

Here was the type of problem Robley had been looking for, and he pursued it with great vigor for the next few years. By using various separation tools, the mathematics of probability, and a computer, he learned much about the conditions under which the individual tyrocidines are attracted to each other and bind preferentially. He demonstrated that even relatively small molecules can be amazingly selective in their interactions with other molecules. (We speak of relatively small molecules because a tyrocidine is only about one-tenth the size of the smallest protein or enzyme molecule.) Even so, the basic unit has 179 atoms, each arranged in space in a specific way. The associated complex may contain 50 to 100 of these units, depending on the solvent environment, also arranged in space in a specific way.

Robley's research problem was quite a technical one, but it allowed him to contribute new understanding to an old but very important problem in biochemistry.

Timothy Cheney Williams

B.A. SWARTHMORE COLLEGE
M.A. HARVARD UNIVERSITY
PRESENTED BY DONALD REDFIELD GRIFFIN

The homing abilities of animals have long intrigued zoologists. Robert Ardrey has called upon homing behavior as evidence of a basically important factor in all behavior of animals and men, the urgent attraction to a home territory. A major scientific question concerning the homing of animals has always been the sensory basis for their orientation; in short, how they find their way. One limitation of most previous experiments has been the lack of any information concerning where the homing animal actually travels. Does it take a "bee line," or does it search, explore, or merely wander?

Williams graduated with honors from Swarthmore College in 1964, after participating actively in seminars in both biology and psychology and working with Kenneth Rawson and Peter Hartline on the homing of small terrestrial mammals. He began grad-

uate work at Harvard, where he was easily persuaded that flying mammals presented still more interesting challenges than mice. At the William Beebe Tropical Research Station of the New York Zoological Society in Trinidad, Williams found a species of bat that was ideally suited for a study of homing. These bats, *Phyllostomus hastatus,* returned almost 100 per cent of the time in a single night after being carried to distances of several miles. Furthermore, they were large enough to carry small radio transmitters by which their actual flight paths could be traced. With the energetic assistance of Mrs. Williams, the full range of homing capability of this species was worked out by releasing them at all corners of the 40-mile-square island of Trinidad. Homing was excellent from 15 to 20 miles, but much poorer from 30 or 40 miles. *Phyllostomus hastatus* have well-developed sonar, but it seems highly unlikely that sound of any sort could guide them over distances measured in miles. Vision was an obvious alternative, and Williams tested this possibility by comparing the homing of blindfolded and normal bats. To control for possible irritation or other disturbance from the blindfolds, he used control bats equipped with goggles that were identical to the blindfolds except for plastic windows through which reasonably clear vision was possible. When followed by radio tracking, the bats with goggles oriented themselves almost as well as normal animals, and most of them flew quite directly home from distances up to ten miles. Blindfolded bats, however, wandered aimlessly and appeared disoriented. Furthermore, bats released at 35 miles were equally disoriented even with their eyes free from any impediment. Evidently some visual landmarks were used for visual piloting, and the most likely possibility was that the range of forested hills along the northern coast of Trinidad was visible from those release points where the bats showed rapid and accurate homeward headings.

These experiments are only the beginning of a broadening program by which Williams plans to attack the problems of animal navigation. He will turn next to transoceanic migrations of birds. He will work at the Woods Hole Oceanographic Institution, where both physiology and orientation behavior of sea birds can be studied through improved methods of radio telemetry. Perhaps some day he will tell us how the golden plover find their way from Newfoundland to South America, even under cloudy skies.

J. George Harrar

DOCTOR OF SCIENCE, HONORIS CAUSA
PRESENTED BY DETLEV WULF BRONK

It is our custom to choose a scholar each year whose ideals and achievements mark him as a worthy colleague and admirable example for those who receive our degree on Convocation Day. In that illustrious sequence of eminent scholars, each class remembers one with especially high regard, for he was one of them. Each has been a scholar who has sought to further knowledge by aiding others in their intellectual endeavors as well as in his own quest for understanding of the laws of nature. Each has had a deep desire to improve the quality of human life.

Such a one is George Harrar whom we have asked to be the twenty-second to receive our degree this morning.

A strong motive in the life of George Harrar was revealed when, as a young graduate of Oberlin, he went to Puerto Rico to profess botany in that needy country. From then till now he has sought to use his high competence as a scientist in order to satisfy the needs of hungry people. He has done more than that: he teaches peoples of poorer countries to help themselves with the aid of science. In Mexico, in the Philippines, in South America, in Asia, and in our own country, he is known as one of the fathers of modern agriculture. He has formulated a grand strategy for the conquest of hunger.

For almost half the span of The Rockefeller Foundation, George Harrar has played a major role in furthering the Foundation's humane objective "to promote the well-being of mankind throughout the world." During seven years his genius for enabling others to fulfill their aspirations has given new scope and meaning to the office of President of our sister institution.

In recognition of your distinguished achievements in furtherance of science, your selfless aid of scientific colleagues, your historic aid to countless people in need of food and hope, I confer on you, J. George Harrar, the honorary degree of Doctor of Science of The Rockefeller University.

"...an expression of esteem and affection"

The traditional proceedings of the Convocation were suspended after the granting of degrees, as the Board of Trustees and the Faculty "claimed a brief moment for an expression of esteem and affection for their President."

"I express on behalf of all the Trustees," said Mr. David Rockefeller, Chairman, "their tremendous gratitude to Dr. Bronk for his brilliant leadership and their deep affection as a friend." Professor Alfred Mirsky, Librarian, was then introduced by Vice President McCarty, to speak for the Faculty and to present a collection of rare original 18th- and 19th-century editions, including the treasured Travels *by William Bartram, London, 1792,* see page 21, *and the first volumes of the* Transactions of the American Philosophical Society, *Philadelphia, 1786-1793.*

Praises for Dr. Bronk's extraordinary achievements as President of the University overflowed the closing weeks of the academic year. One of the first of many happy occasions was a dinner given by the Academic Senate on May 29th in the Abby. "As a mathematician," remarked Professor Mark Kac, master of ceremonies for the evening, "I fear paradoxes most. Since by Dr. Bronk's own admission this is the ninth time that he is retiring, I propose that for the purposes of these proceedings we restore logical calm by redefining retirement to mean plunging into different and more strenuous endeavors." The remarks of Professors René J. Dubos and Gerald M. Edelman appear on the pages which follow.

On June 4th, at an informal dinner for President Bronk at the Century Club, the Trustees announced their intention to construct a building to be known as the Detlev Bronk Library and to establish a University Professorship in his name. The Trustees also presented to Dr. Bronk a miniature blue and gold spinnaker for his yacht *King Haakon.* As this is written, the full-blown version, in the colors of the University, is flying from the bow of Dr. Bronk's boat on the Atlantic en route to Maine. A few weeks later at another warm and gracious occasion, President and Mrs. Bronk were the guests of honor at a dinner given by Mr. and Mrs. David Rockefeller at their home in Pocantico Hills. Mr. Rockefeller, acting for the other Trustees, presented Mrs. Bronk with a gold and turquoise bracelet.

A surprise dinner was given for Dr. Bronk on June 5th by the members of the University's first graduating class, who returned from far and near. The next afternoon, all of the students, past and present, gave a reception in the Faculty and Students Club, at which the bronze sculpture shown on the cover of this issue of the *Review* was presented to the University in honor of President and Mrs. Bronk. Remarks by Alan Finkelstein PH.D. '63, Robert B. Barlow, Jr. PH.D. '67, and Herbert E. Longenecker, Jr., Graduate Fellow, stressed their appreciation of Dr. Bronk's ideals of graduate education which had guided and inspired their careers. "I am deeply moved," Dr. Bronk responded with feeling," that so many of you, and all who went before, have come." And he added, "I would speak my thanks for your friendship, your spirit of adventure, and your youthful courage to rebuild outworn patterns of learning. Let your purpose be 'to sail beyond the sunset.... Much work of noble note may yet be done.'"

DAVID ROCKEFELLER

11 June 1968

Were it not for the imagination and courage and genius of one great man we would not be enjoying this happy Convocation here today—we would not be sitting here in this beautiful Caspary Hall or enjoying the other buildings that have appeared on the University campus in the past fifteen years—there would be no students here, indeed, we would in all probability still be an Institute rather than a University. I refer of course to Dr. Detlev Bronk. Alas, this is the last Convocation of The Rockefeller University at which he will preside. Our one consolation is the thought that he will continue here at the University. But I would be derelict in my duties as Chairman of the Board of the University were I not to express on behalf of all of the Trustees our tremendous gratitude to Dr. Bronk for his brilliant leadership in these past fifteen years, and our deep affection as a friend.

RENÉ J. DUBOS

29 May 1968

I understand that Det Bronk is planning to spend the forthcoming years working on the role of social forces in the development of natural sciences—especially with regard to events at the Rockefeller. Since many of you know little of the early years of our institution, it might be of general interest, and perhaps even of some use to Det, to mention a few facts concerning the history of our campus.

Everyone knows that the ground on which we are located was still a farm at the beginning of the century. But of greater relevance to our scientific activities, is the fact that the Rockefeller campus was surrounded by brewing establishments until almost 1930: the Central Brewing Co. at 68th St.; the Ehret Malt House on 64th St.; and the Doelger Brewery a little further south.

An English historian of science once wrote an essay defending the view that much of experimental science has emerged from brewing practices. It is a rather pleasant thought that the conversion of barley into beer has involved physicists in the problems of gas pressure, chemists in the structure of starch,

enzymologists in the mechanisms of alcoholic fermentation, and bacteriologists in the study of yeasts and bacteria. Our campus was thus fated by its geographical association with breweries to focus its interest on the natural sciences. And since alcohol obviously affects mental processes, we were bound eventually to turn our attention to the behavioral and social sciences, and to philosophy.

There were other interesting aspects to the old campus. On the east side, we had then free access to the muddy banks of the East River along what was called Exterior Street — before Mr. Moses transformed this rustic roadway into the concrete harshness of FDR Drive.

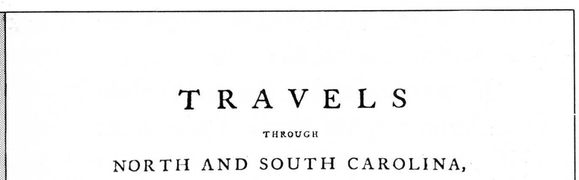
Some 100 feet west of where we are dining tonight, an outdoor grill was at the center of a slightly ill-kept vacant lot, with half-broken, old-fashioned benches, extending to our fence on York Avenue. On spring and summer evenings, the staff used to share barbecues with the local mosquitoes amidst the semi-wild brush.

On the west side of York Avenue, at the corner of 67th Street, there was a barber shop operated by a Hungarian whom several of us affectionately remember as Dirty Joe — a name he well deserved. Dirty Joe would drink beer and hum Viennese waltzes while telling us the local gossip (academic and otherwise), running a gambling operation, and also carving our hair and skin.

Even for those who, like me, have little taste for beer and outdoor cooking, there is pleasant nostalgia in evoking the bucolic atmosphere of these bygone days. But now the chemistry, biology, and sociology of beer have given way to more esoteric forms of science. The neighborhood has changed, and so has our campus. It is of the nature of these changes that I now wish to speak.

Most of the changes that have occurred around us

One of eleven rare Americana presented to President Bronk by the Faculty.
Coleridge derived much of the imagery of Kubla Khan *from Bartram's* Travels.


TRAVELS

THROUGH

NORTH AND SOUTH CAROLINA,

GEORGIA,

EAST AND WEST FLORIDA,

THE CHEROKEE COUNTRY,

THE EXTENSIVE TERRITORIES OF THE MUSCOGULGES OR CREEK CONFEDERACY,

AND THE COUNTRY OF THE CHACTAWS.

CONTAINING

AN ACCOUNT OF THE SOIL AND NATURAL PRODUCTIONS OF THOSE REGIONS;

TOGETHER WITH

OBSERVATIONS ON THE MANNERS OF THE INDIANS.

EMBELLISHED WITH COPPER-PLATES.

By *WILLIAM BARTRAM.*

PHILADELPHIA: PRINTED BY JAMES AND JOHNSON. 1791.

LONDON:

REPRINTED FOR J. JOHNSON, IN ST. PAUL'S CHURCH-YARD.

1792.

in midtown Manhattan have resulted in the obliteration of the past, and usually in the creation of a heartless and treeless atmosphere. All too often, the change has been the equivalent of converting a park into a parking lot. In contrast, what used to look like a vacant lot on our campus has been converted into a park – Manhattan's most alluring park. It is a park that constitutes an evolutionary development of its historical past, and that indeed incorporates the past instead of destroying it. The row of plane trees that runs from 64th to 68th Street has become an avenue which complements the avenue of the 66th Street entrance. The outdoor grill is no longer there, but there is the Abby, which is much more to my taste. Then, there are fountains and benches which attract those who search for peace, privacy, and poetry in the midst of the city and which, certainly, will attract them even more in the future.

The breweries have disappeared but we have the bar, which, among other things, serves even beer to the few who want it. Furthermore, the intellectual influence of the breweries survives and has become richer by evolving. For several decades we were exclusively concerned with the material basis of life and knew of spirits only the alcohol produced by yeast and anaerobic fermentation. Now we are graduating into the problems of behavior; the most subtle distillations of the human spirit pervade the floors occupied by mathematicians and philosophers in the South Laboratory Building. We shall evolve still further, I am convinced, when Det emerges from his social and historical studies to make us embarrassed at taking so little heed of the forces that have shaped science in the past and are reshaping it today.

From its beginning and throughout its history, our institution has nurtured young physicians and scientists from all over the world. This educational purpose has been extended to predoctoral fellows – even to high school students. It reaches now beyond the orthodox natural sciences into the new areas of knowledge on which will depend the survival of technological society and of Western civilization.

It would be a sad occasion if we were gathered here today only to evoke the past and to honor Det as he leaves the Presidency for other creative tasks. But fortunately there is much more than that to be said. We can speak of the future as well as of the past. Observing our campus, and those who work on it, reminds us of the fact that the only way to remain young and strong is to evolve.

I know of some ten research institutes that were founded around the turn of the century in Europe, Asia, and in this country. Some of these institutes have shrunk almost into oblivion, some have retained essentially the size they had at the time of their creation, a few have become somewhat larger. Smaller or larger, all of them have aged because they have retained the structures, attitudes, and commitments they had when they became famous or important. They have aged and probably will die because they have not known how to evolve.

In contrast, our campus is still evolving physically. This is shown by the new row of honey locust and plane trees running north to south along the western length of the dormitory. It is shown also by the tower arising at the south end. But more importantly, our institution is evolving because scientifically it is responding to the intellectual and social preoccupations of our times. The natural sciences remain the basis of our approach, but we are beginning to bring them to bear on the behavioral and social sciences.

Like other organisms, social organisms can continue to prosper only by evolving. Houses grow organically through the addition of rooms, gables, and appendages to accommodate new members of the family and new social habits. Universities are struggling to discover how they can simultaneously remain faithful to the advancement of knowledge, become more involved in social affairs, and satisfy the longing of students for initiative and independence. From slow-paced country roads to multilane parkways, from one-room school houses to complex educational systems, all human creations must continuously evolve in response to changing human needs and dreams.

Our institution is as vigorous and creative as it was when it came into existence because Det has injected into its corporate structure the possibility for creative evolution in our own professional lives. Thanks to him, our future will not be merely an extrapolation of the past but rather a new venture growing out of our history.

GERALD M. EDELMAN

29 MAY 1968

IN SOME vague but nonetheless profound sense all outstanding men are our fathers. It is not vague to call Dr. Bronk the father of The Rockefeller University, although it is a cliché that he might find insupportable. It is better, I think, to say that he is the maker of this University, an arbiter of its tastes, a lover of its past, and a guardian of its future. As one of the sons of the University, it is my privilege to speak of him and of his accomplishments.

It is the duty of fathers to serve as examples and sometimes as warnings. Correspondingly, it is the duty of sons to admire but it is their habit to rebel. I have been a student, an assistant physician, an associate dean, and a faculty member under Dr. Bronk's leadership, and I am certain you will agree that I should have had ample opportunity to rebel. I have, at times, rebelled against policy, but always with admiration for the man who formulated that policy. The measure of a man is his behavior at such times of test, not his behavior under flattering conditions. I remember his deep unrelenting concern for my criticism – a concern spiced with rage at my obvious stupidity, but leavened at all times with a real tolerance and fairness, above all, with a kind of conscience that I do not feel has been celebrated enough.

Let me say at the outset what I think is original, precious, and remarkable about this University as Dr. Bronk has conceived it. It is best said, I think, by borrowing a phrase from a famous historical work, *The Civilization of the Renaissance in Italy,* by Jacob Burckhardt. Part One of that book speaks of the State as a work of art. In the Renaissance this was a new fact in history – the State as the outcome of reflection and calculation, the State as a work of art. In the present age of overwhelming bureaucracy and specialism in multiversities, it is the idea of the university as a work of art which Dr. Bronk has espoused and reinvented. Let me spell out what this means, because the clamoring and confusion are at our gates and something of value in this idea must be preserved.

The program here has been concerned with a number of abstractions, all important to a university as a work of art. Now sometimes the stupidest way to say something is by abstraction, and the most intelligent is by citing a particular. Let me first cite the abstractions, because they come easier to me, and then mention the particulars.

Dr. Bronk's artistry has been concerned, I believe, with four elements of style: first, the sense of place; second, the organic sense of time or of appropriateness; third, the emphasis on judgment and a sense of the whole as contrasted to expertise – in other words, the appreciation that acts are more important than agencies; fourth, the idea of continuing purpose coupled with the willingness to change.

I should like to give some substance to these categories. First of all the sense of place. I think it is obvious to any casual visitor that The Rockefeller University is a miraculous garden set in a modern and often ugly Babylon. To cross the interface is a dramatic experience; time and space change and there is a favorable slowing of defense mechanisms – a slowing so necessary for creative thought. I have often heard people ridicule the effort made toward beauty in this place; I have witnessed them succumb to a state of silent admiration after exposure to it.

Now this is not a superficial thing; it recognizes the deep and orderly connections between our senses and our thoughts. This profound relationship was seized upon and vigorously extended by Dr. Bronk, who has the insight to preserve what was already known but is too easily forgotten. Too often, the specialists will say it does not matter: just give them a lab and freedom from the administrators and all will go well. But all does not go well when the scene or the sense of place is not attended to.

Incidentally, on this point, let me note the jealous zeal with which Dr. Bronk has protected us against intruders and Ostrogoths. Let some hapless outsider park his car in the wrong place and all the ancient wrath will fall on his head, sometimes in the person of the President himself.

Let me turn from the sense of place to the sense of time and of appropriateness of occasions. I have never seen a man less compulsive about modern schedules and bureaucratic compulsions, nor one more willing to allow each individual to grow on his own time scale. You might say that this is a fault and inefficient. But an artist building a university does not think of efficiency. He realizes that human scholars are strongest at the point of *inefficiency* – most likely to create and least likely to reiterate the same

old dogmas. Only a man who has been an engineer can know how superbly to neglect input over output when it is irrelevant. As a former student, I can testify how important this is and how many of us would not have flourished had Dr. Bronk not realized the appropriateness of our plans rather than their efficiency.

The next characteristic of a university as a work of art is that people there recognize that acts are more important than agencies. This does not mean that ends are more important than means. It is just a fancy way of saying that one man of judgment is worth a million expert specialists. I know the conventional argument about modern specialization and the power it has given us. But look at the consequences: doctors who speak to their instruments but not to their patients; university presidents who spend all their time with industrialists and government officials and none with their students and faculty; and a peculiar and desperate double standard among the students about which I shall speak in a moment.

But first consider Dr. Bronk's attitude. Once, I went to him to praise and suggest promotion for a young scientist. I cited papers, technical details, and local achievements. The President restrained his pique. Finally he looked up and said: "Is he our kind of man?" Now that is a snobbish-sounding phrase, but what he clearly meant is that here we take for granted that a man knows technique; what we do not take for granted is whether he has any sense or sensibility. Acts rather than agencies, sense in addition to technique.

Dr. Bronk's own ways of solving administrative dilemmas, his acts, are ingenious, improvisatory at times, but almost always wise in addition to being brilliant.

Let me speak finally about the fourth requirement for universities as art forms: continuing purpose coupled with the willingness to change.

I could never understand why Dr. Bronk didn't act immediately on my counsels in the Dean's Office. Now that I am out of it, I have seen him take some of my advice and that of others wiser than I am, when before he seemed obdurate. He did not learn from us; that is a facile explanation, for everybody knows that it is difficult for older men to learn from younger men. Instead, he decided when the advice should be appropriately enacted in terms of the purposes of the University. Then he changed, not before; and a wise thing it was that he did not act at the wrong time.

I have spoken of Dr. Bronk in terms of his gifts, his dedication, and his ideas. I should say something about his personal warmth and also about his concern for friends and friendship. Since I have been speaking of fathers and sons and the sense of place, let me recall the occasion when my father came to meet Dr. Bronk. It was when I graduated, I believe, and Detlev and Helen Bronk invited the graduates and their parents to dine at their home, black tie. I counseled my father, who shares the antipathy of many to that mode of dress, and told him who our host was — that, like my father, he had university connections in Baltimore, that in fact he used to be President of Johns Hopkins, and that I hoped my father would bear with the dignity of the occasion. Upon entering the President's House and the library, my father immediately noticed the bookcases. He said, "Now there is a man who appreciates good carpentry," and he reached down to the floor, in fact to his knees, to check the shelves. I was mortified. A little later Dr. Bronk came by. My father said, "Dr. Bronk, I understand that you once were in Baltimore. Did you know Lewellys Barker?" Dr. Bronk said — warmly, of course —"One of my closest friends," and my father said, "What is he doing now?" Dr. Bronk said, "Dead." "You don't say! What of?" "A stroke," said Dr. Bronk. And so down the list, reminiscing. Finally they were discussing their own infirmities with obvious pleasure. My father, who has vasomotor rhinitis, a disease akin to hay fever, advanced the theory that it was important to keep the morning light from falling upon one's nose, when I finally managed, completely embarrassed, to pull him away from Dr. Bronk. My father said only one thing of this occasion. He said, "What a nice fellow."

As a son of the University, I see new acts of rebellion elsewhere more than here. Dr. Bronk told me that he welcomes the spirit if not the acts, and that young people should continue to criticize. I wondered then what he was like when he took over the Johnson Foundation at the University of Pennsylvania at the age of 32. I concluded that he must have been a tiger, and that he had the grace to remember it. But the new acts of rebellion are not within the old frame. They are strange, exotic, seemingly anarchic or at best negative, and the students *seem* to want it both ways: they don't want to get the tech-

The student reception for the President in the Faculty and Students Club

nique at a cost, and they want to simulate the judgment without the experience. My response is obviously that of an arteriosclerotic of the over-thirty generation. But I can give the students some advice, for there is no doubt about the honesty of their feelings or their fervor. Let them seek out leaders among their peers who have the qualities of Detlev Bronk. Let them argue with *them* rather than with us and follow their advice when it is sound. More often than not it will be.

In closing, let me say that artists who build universities are men of strategy rather than of tactics. Dr. Bronk is an artist who built a University from an Institute in the face of some dissent. It is forgivable that at times he railed at us for our failure to perceive his strategy. It is admirable that even in the face of disagreement he forged us into a faculty whose willingness to serve voluntarily is commendable. It is appropriate to say that he has our gratitude and admiration for having achieved the most difficult of accomplishments: a work of art as a proposal for continuing works of even greater beauty. I propose a toast to his health and to that of Helen Bronk, who so graciously complements him.

ALAN FINKELSTEIN

6 June 1968

Dr. Bronk, I am here to express to you the thanks and appreciation of the students and alumni of The Rockefeller University, and alumni of The Rockefeller Institute...for Medical Research. I think we all feel that we have participated here in a unique educational and intellectual experience, and we are cognizant that the permissive atmosphere, the spirit, and the ethos existing within the student program, originated—and was fostered, primarily, indeed entirely—through your efforts. While many of us have expressed personally to you our thanks, it was felt appropriate that the students and alumni as a group should in some concrete way (actually, in this case, in a bronze way) register their appreciation.

We wish to present this sculpture to The Rockefeller University in your and Mrs. Bronk's name, to stand on the grounds as a symbol of our gratitude for your friendship and fellowship... (and fellowships), and also as an expression of the genuine affection that we feel toward you and the program you established.

New Trustees

John W. Gardner and Philip Handler have been elected Trustees of The Rockefeller University, it was announced in May by David Rockefeller, Chairman of the Board of Trustees.

Mr. Gardner graduated from Stanford University in 1935 and received his Doctor of Philosophy degree from the University of California in 1938. As a psychologist, he served on the faculties of the University of California, Connecticut College, and Mount Holyoke. He was on the staff of the Carnegie Corporation of New York from 1946 to 1965 and served as President of the Corporation from 1955 to 1965. He has recently been Secretary of the United States Department of Health, Education, and Welfare and is now Chairman of the Urban Coalition. He has received the National Academy of Sciences' Public Welfare Medal and the Presidential Medal of Freedom.

Mr. Handler received his baccalaureate degree from the College of the City of New York, and the PH.D. from the University of Illinois in 1939. He has been a member of the faculty of Duke University since 1939, Professor of Biochemistry since 1949, and Chairman of the Department since 1950 and James B. Duke Professor of Biochemistry since 1961. Mr. Handler is Chairman of the National Science Board of the National Science Foundation, a former member of the President's Science Advisory Committee, and a member of the National Academy of Sciences.

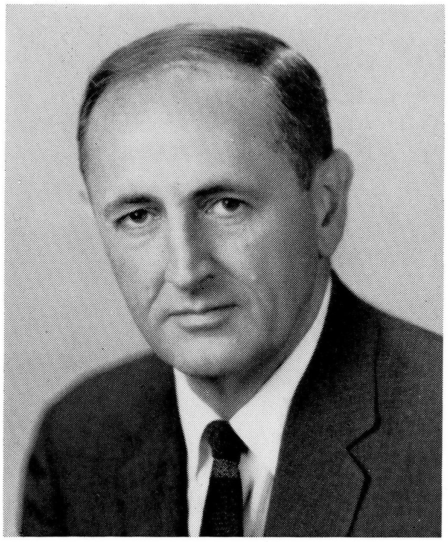
Anniversary Dinner

CONTINUING a custom begun last year, members of the faculty and staff who have completed 25, 40, or 50 years of service were honored at a dinner in Welch Hall on June 13th. The hosts and hostesses were the 57 who had been thus recognized in 1967. After a reception and dinner, Rockefeller University chairs bearing their names and years of tenure were presented by President Bronk to those who have completed 25 years of service: Mabel H. Bright, Elinor M. Clayton, George Murnane, Bertha Schnabel, John C. Traphagen, and George H. Whipple.

David Rockefeller, Chairman of the Board of Trustees, gave silver bowls in recognition of 40 years of devotion to the University and inscribed with the names of the recipients: Michael T. Brown, Lewis G. Longsworth, Bernard J. Mattimore, Alfred E. Mirsky, George Murnane, Margery Pedersen, Alexandre Rothen, Theodore Shedlovsky, and Gertrude C. Smith.

At the end of the dinner, President Bronk spoke of the gratitude of all members of the University family to all others:

> Here at The Rockefeller University, to myself I often say: This is America as I like it, as I want it. And then I ask: Why so? Because we are surrounded by green growing things and natural beauty? Yes. Because we have vital youth among us? Yes. Because it is a company of unselfish, reasonable people who know the satisfactions of working together to make the lives of people everywhere healthier, happier, and better.



JOHN W. GARDNER

PHILIP HANDLER

This university we love has been built by the daily acts of all who have labored here 'for the good of human kind' as our motto reads. Some may say that each can do so little that its consequence is small. I can say, *that* is not so. For I have been privileged to watch the many efforts of you all grow into this institution all of us have created.

In our work and life together, deep friendships have been formed and affections have been rooted.

As we have happily worked together, we have learned and been reminded that

No man lives by his own unaided efforts –
No man lives unto himself alone –
Each shapes the lives of those about him.

In the totality of all that you and your colleagues have done yesterday and today and will do tomorrow, there will be written the history of our great university.

Eli Lilly Award

John J. Cebra ph.d. 1960, Associate Professor of Biology at The Johns Hopkins University, received the 1968 Eli Lilly Award in Microbiology and Immunology in Detroit on May 5 at the 68th Annual Meeting of the American Society for Microbiology. Dr. Cebra was selected in recognition of his contributions to several aspects of antibody systems, particularly the structure and synthesis of immunoglobulins and the nature of the combining site.

While a Fellow at Rockefeller, Dr. Cebra attacked one of the most difficult immunological problems, that of characterizing antigenic determinants of protein antigens. At that time very little work of this nature had been done with protein antigens; previous work on characterization of antigenic determinants had been done largely with polysaccharides. In these studies on the antigenic sites of silk fibroin, he took advantage of modern methods of peptide fractionation and was able to isolate peptides of various sizes that retained the capacity to combine with antiserum against soluble silk fibroin. This work, published in the *Journal of Immunology* in 1961, made an important contribution to our understanding of factors determining antigenic specificity in proteins. In pursuing his studies on antibody structure and specificity, Dr. Cebra spent a year as National Foundation Fellow in the laboratory of Dr. Ephraim Katchalski at The Weizmann Institute of Science, Israel. He returned to the United States in 1961 to join the faculty at the University of Florida, where he progressed from Instructor to Associate Professor and formed an active research group working largely on antibody synthesis. Dr. Cebra assumed his present position at The Johns Hopkins University, Department of Biology, last year. Recently his research interests have focused on IgG, IgA, and IgM immunoglobulins.

James F. Mitchell Award

Professor Edward H. Ahrens, Jr. shares, with Dr. Donald S. Fredrickson of the National Heart Institute, The James F. Mitchell Foundation 1968 International Medical Research Award. Dr. Paul C. Kiernan, President of the Foundation, presented inscribed silver bowls to the recipients of the award at a luncheon in Washington, D.C. on May 17 "in recognition of their outstanding contributions to the physiology of lipoproteins and plasma lipids and their significance in certain diseases." The Special Assistant to the President of the United States for Science and Technology, Dr. Donald F. Hornig, spoke on the occasion, and Prof. C. J. F. Böttcher of the University of Leiden led a symposium on themes related to the work of Dr. Ahrens and Dr. Fredrickson.

Professor Ahrens received the B.S. and M.D. degrees from Harvard University and has been associated with Rockefeller since 1946, when he became Assistant Physician to the Hospital. Dr. Ahrens came here to study liver disease and subsequently became interested in fat metabolism and biochemistry. From 1949-51 he collaborated with Professor Lyman C. Craig in studies of the separation of lipids by countercurrent distribution, and since 1952 has continued to work on chromatographic methods and their application to clinical studies of disorders of fat metabolism.

The Mitchell Foundation Award recognized the contributions of Dr. Ahrens and his colleagues to a better understanding of mechanisms causing arteriosclerosis in man (March-April 1968 *Review*, pages 14-16). He became Associate Professor in 1955 and Professor in 1960.

Honoris Causa

Among the members of the Faculty who received the honorary degree of Doctor of Science during the commencement season were:

professor theodosius dobzhansky, Northwestern University – "His vast contributions to the science of

evolutionary genetics place him in the distinguished company of Darwin and Mendel. Society is philosophically richer because of his profound and lucid discussions of the biological basis of man's nature and destiny."

PROFESSOR RENÉ DUBOS, St. John's University—"father of antibiotics and one of the greatest living scientists . . . he believes firmly in the perfectibility of man, and as a brother he has advanced man's physical perfectibility immeasurably by his victories over pneumonia, tuberculosis, and infection, and his insights into immunity and resistance to disease, the effect of physiochemical and biological environment on human life, and the socio-medical problems both of underprivileged and affluent communities." And from Beloit College, Wisconsin — "one of the world's most distinguished scientists, a scholar whose life-saving achievements in the field of medical research continue to bring vital benefits to the human community . . . concerned leader in the vital struggle to create a more healthful and productive environment for all people."

¶

¶ President Bronk delivered the Arthur Holly Compton Memorial Lecture at Washington University in St. Louis on May 1st, and two days later presided at a special two-day convocation on "Individual Responsibility in a Free Society" at Bucknell University, where Lord Adrian — Rockefeller University Trustee Emeritus — and President-elect Frederick Seitz were featured speakers. Also in May, Dr. Bronk gave the Monie A. Ferst Memorial Lecture at the Georgia Institute of Technology Sigma Xi awards dinner in Atlanta.

¶ President-elect Seitz was appointed to a four-year term on the governing board of Princeton University at the Annual Meeting of The Princeton Alumni Association in June. Dr. Seitz — who received the PH.D. degree from Princeton in 1934 — succeeds Dr. William O. Baker, Vice President for Research, Bell Telephone Laboratories, as Graduate Alumni Trustee.

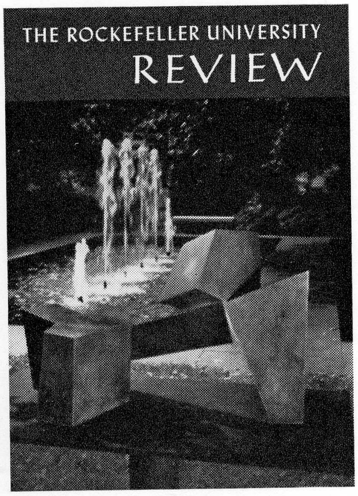
¶ Professor Jules Hirsch has received the 1968 Distinguished Alumnus Award from the Alumni Association of the University of Texas Southwestern Medical School at Dallas, for his "outstanding contribution and dedicated service to mankind."

¶ A conference on methadone treatment programs operating in eleven cities in the United States and Canada was held in Caspary Hall in May. Workshops and exhibits for the physicians running the various programs were included, plus a plenary seminar for community leaders and businessmen. Professor Vincent P. Dole originated the technique of using massive doses of the synthetic drug methadone to block the euphoric action of heroin and thus enable many addicts to become useful, productive members of society.

¶ Professors Gerald M. Edelman and Norton D. Zinder were elected Fellows of the American Academy of Arts and Sciences at the 188th Annual Meeting of the Academy in May.

Alumni

ALUMNI who have accepted new appointments this year include: David C. White PH.D. 1962, who has been promoted from Associate Professor of Biochemistry to Professor at the University of Kentucky College of Medicine; Charles F. Stevens PH.D. 1964, formerly Assistant Professor, Department of Physiology and Biophysics, University of Washington Medical School at Seattle, who is now Associate Professor; Paul T. Englund PH.D. 1966, United States Public Health Service Fellow, Department of Biochemistry, Stanford University School of Medicine since 1966, who will become Assistant Professor in the Department of Physiological Chemistry at The Johns Hopkins University School of Medicine this September; Harvey F. Lodish PH.D. 1966, American Cancer Society Fellow, in the Laboratory of Molecular Biology, University Postgraduate Medical School, Cambridge, since leaving Rockefeller, who will become Assistant Professor of Biology at the Massachusetts Institute of Technology on July 1st; and James D. Foch, Jr. PH.D. 1967, who has been a Member of Technical Staff of the Bell Telephone Laboratories, who will go to the University of Colorado this fall as Assistant Professor in Aerospace Engineering.



THE COVER shows the bronze sculpture which the students presented to the University on June 6th in honor of President and Mrs. Bronk. Story on page 20. The gardens and fountains west of the Abby are in the background. The sculptor is Professor James Rosati of Yale University. Photograph by Richard F. Carter.

ACKNOWLEDGMENTS: page 5 *center,* 14 *top,* and 15 by Joseph Barnell. Page 20 by Heka. Pages 1, 5 *top and bottom,* 8, 9, 12, 14 *bottom,* and 19 by The Rockefeller University Illustration Service.