Winter 1960

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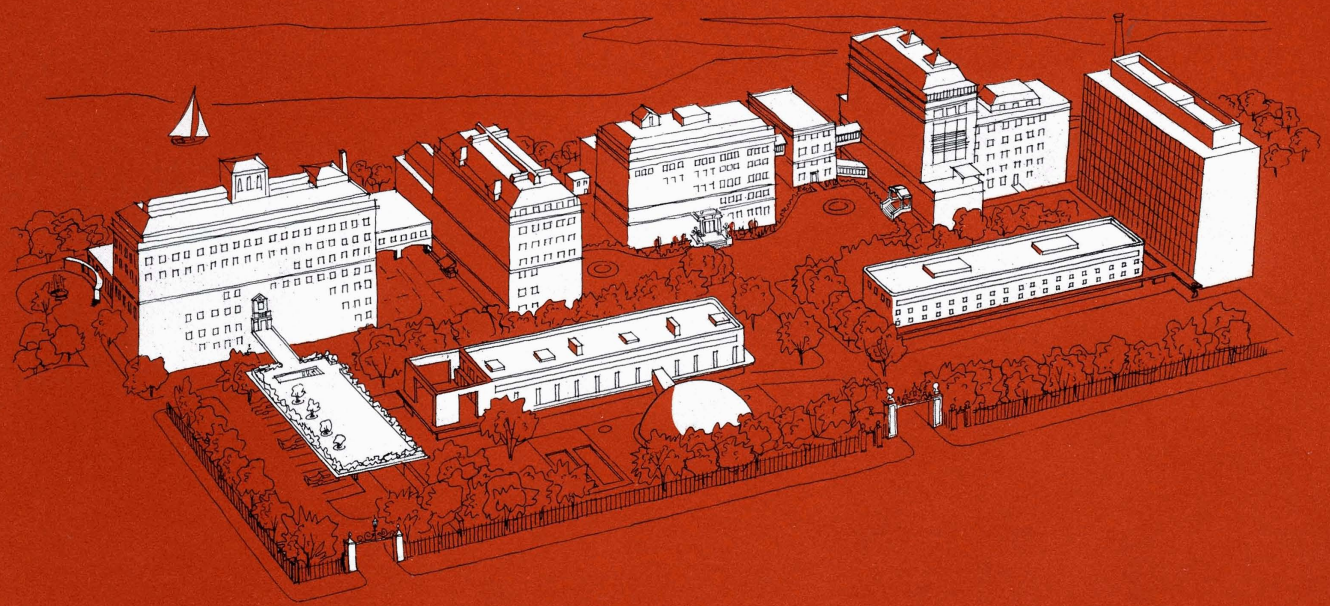
The Rockefeller University

THE ROCKEFELLER INSTITUTE *Quarterly*

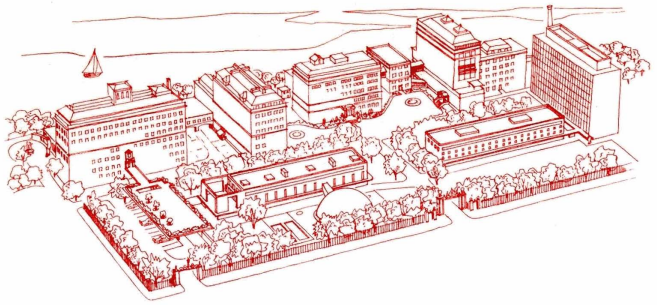
WINTER · 1960



THE ROCKEFELLER INSTITUTE · A GRADUATE UNIVERSITY AND RESEARCH CENTE

CONTENTS OF THE ROCKEFELLER INSTITUTE Quarterly

VOLUME 3 NUMBER 4 WINTER · 1960



The total extent of the Institute's thirteen-acre campus is difficult to appreciate, and already it is difficult to remember how great the recent changes have been. Over half the total area of the campus has been developed since 1953, and plans are in progress for still more new facilities in the south half of the campus, not shown in the cover sketch, to keep pace with the growth of this graduate university of science. Drawing by Charlotte Winter.

UNRAVELLING THE NEURAL PATTERNS OF REFLEX BEHAVIOR

THE QUANTITY of individual data regarding the internal and external environment communicated to our central nervous system at any moment is staggering. Yet this vast avalanche of nerve impulses is somehow integrated into directed and purposeful behavior. The nature of the nerve impulse, which Sir Charles Sherrington once called "the currency of the nervous system," was described in an earlier article (*Quarterly,* Vol. 2, No. 4). We shall attempt here to give some idea of what Sherrington might have called "the economics of the nervous system"—how the arising and transmission of nerve impulses on a large scale result in integrated behavior—and the role scientists at the Rockefeller Institute have played in studying it.

Adrian and Bronk showed how the nerve impulse is conducted in an individual nerve fiber of which there are millions of billions in our body and how the impulse in the peripheral nerves is essentially the same whether it is coursing up a nerve to report sense data to the central nervous system, or down it to result in some response of movement, secretion, tension, relaxation, etc. Gasser and Erlanger discovered how the size and velocity of the nerve impulses depend on the nature and size of the nerve fiber conducting them. But how is this vast array of impulses in the fibers of a million billion nerve cells organized to give us an orderly impression of our environment and to enable us to deal with it effectively? The answer lies largely in the central nervous system—the brain and the spinal cord—and the way in which the neurons (nerve cells) are inter-connected there.

Nearly 75 years ago the Spanish histologist, Ramon y Cajal (using Golgi's microscopic staining technique made possible by the contemporary discovery of the Daguerotype photographic process), showed that the tissue of the brain consists almost entirely of neurons. Thus he prepared the way for the view that the neuron is the essential unit of the entire nervous system. During the decades since, increasing evidence has shown that the events in the neurons of the brain and spinal cord are similar to those that have been studied in the peripheral nerves. The difference between the central nervous system and the peripheral system seems to consist more in complexity of inter-relation than in the nature of the individual processes themselves.

THE REFLEX MECHANISM

The basic interaction of nerve on nerve is the reflex, the mechanism by which a specific incoming (afferent) nerve impulse is reflected back out of the central nervous system in specific, though often complex, efferent pathways. The most simple reflexes involve only an afferent neuron connected with a corresponding efferent neuron through a junction called a synapse. Simple two-neuron reflexes (such as the jerk of the leg that results from a tap on the tendon under the knee-cap) are termed monosynaptic, for with only two nerves involved there is but a single synaptic junction between them. More complex reflexes may include one or more intermediate neurons, and hence such reflexes are called polysynaptic. Moreover, a single afferent neuron may connect through branching fibers with many efferent neurons, either directly or through inter-nuncial neurons, and the efferent neurons may also send many fibers to various destinations.

So great are the possible varieties of reflex connections that the more ardent mechanists, following Descartes, have argued that the whole of man's behavior is explainable in terms of more or less elaborate reflex mechanisms of stimulus and response. Yet what is studied in reflex response is the essentially immediate and involuntary reaction to stimulus from the external or inner (visceral) environment. Are voluntary action, memory, emotion also to be explained merely as reflex responses of greater latency and complexity? No one yet knows, but Sir Charles Sherrington, the distinguished Oxford physiologist whose work laid the foundation for much we shall have to say here, was doubtful. In the foreword to the 1947 edition of his classic work "The Integrative Action of the Nervous System" (first published in 1906 and republished in 1947 by Yale University Press) he put it thus:

"In the more organized animals of the vertebrate type the shape of the central nerve-organ allows a simple operation to reduce the animal to the Descartes condition. An overlying outgrowth of the central nerve-organ in the head can be removed under anesthesia, and on the narcosis passing off the animal is found to be a Cartesian puppet: it can execute certain acts but is devoid of mind. That it is devoid of mind may seem a dogmatic statement. Exhaustive tests, however, bear the assertion out. Thoughts, feeling, memory, percepts, connotations, etc., of these no evidence is forthcoming or to be elicited. Yet the animal remains a motor mechanism which can be touched into action in certain ways so as

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to exhibit pieces of its behavior." Speaking of the remarkable integration of these "pieces of behavior," Sherrington goes on: "...these mindless acts yet treat the animal's motor machinery as a united whole. Thus the mindless machine can walk, and run, and gallop; it can also spring. These acts include 'balance' and adjustments of poise, as well as phasic movements duly coordinated. There is integration, although purely motor integration."

THE MONOSYNAPTIC REFLEX

The details of this motor integration have been studied extensively at the Rockefeller Institute. Dr. Birdsey Renshaw, working under Dr. Gasser's general direction between 1938 and 1941, undertook to determine how simple the path from incoming neuron through the spinal cord and out again may actually be in the so-called simple spinal reflex. The existence of the ideally simple two-neuron reflex had not been demonstrated functionally, though early anatomical studies had shown that such connections exist, whatever their function may be. Using the electronic recording techniques that Dr. Gasser had pioneered, Renshaw measured the time between stimulus and response in spinal reflexes and found that no matter how close to the spine the incoming impulse is started, there is a certain brief but minimum interval before the outgoing response appears. He deduced that the delay must occur at the synapse, the junction between the incoming (sensory) nerve cell and the outgoing (motor) nerve. Of itself, this experiment would not have proved that the reflex involved only a single synapse. The evidence was decisive, however, when combined with a fact Dr. Lorente de Nó discovered before he came to the Institute. In 1934 while he was still at the Central Institute for the Deaf in St. Louis, Dr. Lorente had studied the delay time electrically in a reflex in the ocular system, which he could show anatomically to involve only a single synapse. With the time for transmission of an impulse across a single synapse as determined by Lorente (and supported by other evidence), Renshaw demonstrated that the minimum delay in the spinal reflex was too short to include *two* synapses. He concluded that it must be a simple monosynaptic reflex.

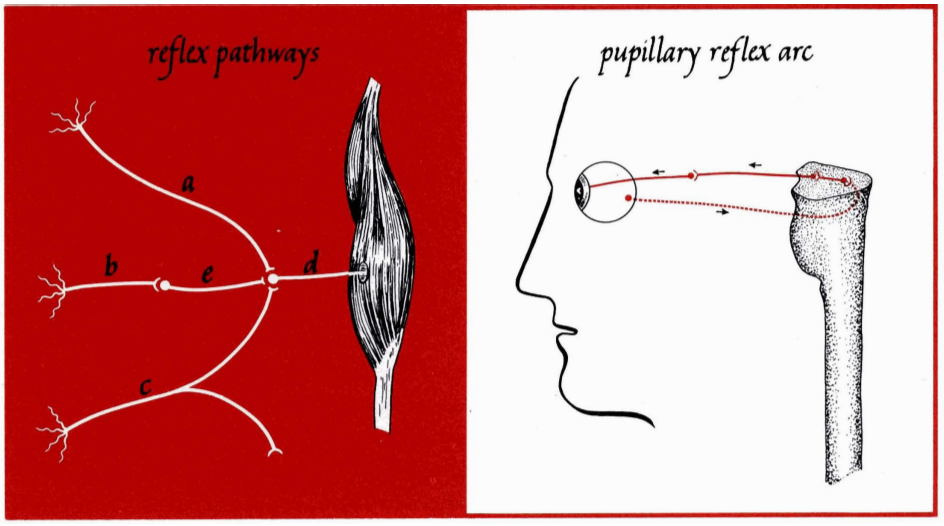
The evidence produced by Renshaw was of great value in confirming for the first time physiologically the belief the neuroanatomists since Cajal fifty years before had held, namely that simple two-neuron reflexes exist in the spinal cord. It remained, however, for Dr. David P. C. Lloyd, who came to the Institute in 1939 from Sherrington's Laboratory of Physiology at Oxford, to identify the function of these simple spinal reflexes.

Professor Lloyd examined the so-called stretch reflex which causes a muscle, when stretched by outside forces, to contract in resistance to that stretching. The knee jerk from a blow on the tendon below the kneecap is the most familiar stretch reflex. Stretch reflexes are an important class of reflexes, for they automatically maintain the tensions needed to prevent the force of gravity from bringing about collapse of our posture.

In 1943 Lloyd found that the reflex response back to a muscle can be divided into two parts, with origins in afferent fibers from two different sources, one from the muscle itself and the other from the skin near it. If the entire afferent nerve trunk *into* the spinal cord, bearing fibers from both skin and muscle, is stimulated as Renshaw had done, the complex reflex response he observed can be detected in the corresponding outgoing motor nerve. But if the stimulus comes instead from one of the remote branches of the afferent nerve near the muscle, but in the skin, the initial, simple, monosynaptic reflex response disappears completely, while responses continue to flutter out of the spinal cord with delays up to several times longer than the monosynaptic reflex. If only the nerves in the muscle itself from the so-called stretch receptors are stimulated, only the monosynaptic response appears. Thus, Lloyd had shown the stretch reflex to be monosynaptic in nature. By following the monosynaptic reflex discharge into the muscles it activated, Dr. Lloyd was able to show that the reflex is very circumscribed, being confined, as would be expected logically, to the specific muscle being stretched.

It is remarkable to note that in 1890 the neuroanatomist Cajal had supposed the existence of such highly circumscribed monosynaptic reflexes in the spinal cord, but until Dr. Lloyd's work their functional sig-

Schematic Representation of Reflex Pathways of Varying Complexity



Drawing at left: Afferent neurons (a, b, and c) may synapse with an efferent motoneuron (d) to effect a muscular response through various reflex pathways. Routes through (a) and (c) are monosynaptic pathways, though in the case of (c) a second reflex may pass to other muscles through another branch of the afferent neuron. An internuncial neuron (e) is interposed in the chain of pathway (b), forming a di-synaptic pathway.

Drawing at right: One of the reflexes controlling illumination of the retina is effected through a tri-synaptic pathway. Retinal data enter the brain stem through an afferent neuron (dotted line) and, through two interneurons, the size of the pupil is adjusted accordingly.

nificance remained in doubt. Cajal also postulated the existence of spinal reflexes involving interneurons, (thus two or more synapses) whose action he expected would be diffused through the spinal cord among a number of muscles. Dr. Lloyd has found that this diffuse type of reflex which Cajal postulated includes the so-called flexor response, such as the jerk of a limb in response to a pin prick. He stimulated a single skin nerve in a limb and examined the resultant reflex discharges in all the muscles of the limb. Some activation was found in all of them, spreading widely over the limb from a single stimulus. Twenty years after Cajal drew his conclusions, W. A. Jolly, then Physiologist at the University of Edinburgh, rightly suggested that the stretch reflex involves one spinal synapse while the flexor reflex involves two. Lloyd with precise electrophysiological techniques has now fully validated this shrewd functional deduction based on Cajal's patient and perceptive anatomical analyses. It seems clear that most, if not all, reflexes other than stretch reflexes are polysynaptic.

FACILITATION AND INHIBITION

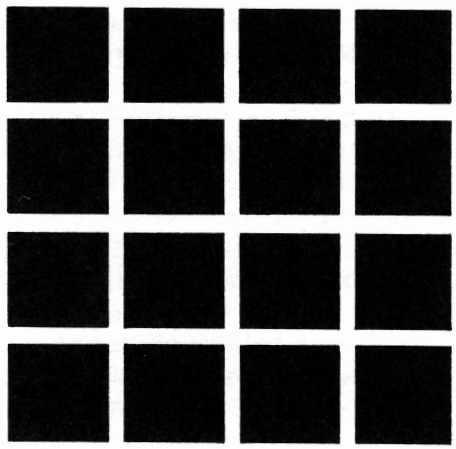
Elaborate as the nervous system may already seem, the integrative arrangements in the central nervous system are far more complex than we have indicated. Not only may a restricted stimulus provoke a restricted or diffuse response, but a restricted response may result from the combined effect of many stimuli. Moreover, the effects of nervous stimulation may at times be to inhibit the responsiveness of motor nerves, and at times to facilitate their response. Nerve cells may be elaborately interconnected with each other through branching fibers, the terminations of which impinge on the bodies of other nerves. When one nerve is excited it may depress the excitability of the nerves on which its branches impinge, or it may enhance their excitability.

The phenomena of facilitation and inhibition have been studied at the Institute for a great many years. The precise neural pathways through which they act and the mechanism by which facilitation or inhibition occurs remain but dimly understood, but progress has been made in both aspects of the problem. In 1941 Lloyd showed that in certain nerve fibers impulses that are identical with *excitatory* impulses in other fibers exert instead an *inhibitory* effect on motor neurons. This was demonstrated in simple monosynaptic or two-neuron reflexes, thus eliminating any possible explanation in terms of complicated intermediate neurons which might have been "blocked" by the incoming impulse. Lloyd, using his readily-identified monosynaptic reflex pulses, also traced the appearance of reflexes in the associated muscles of a limb and found a consistent pattern of relationships among them emerging.

He summarized the results of all this work as follows in his 1958 James Arthur Lecture on the Evolution of the Human Brain at the American Museum of Natural History: "A muscle, through its stretch-activated monosynaptic reflex connections, is controlled by itself, by its immediate synergists, and by its immediate antagonists. In turn, through like central connections, that muscle influences its neighbors, synergists, and antagonists. Thus the muscles of a given joint are mutually dependent; nothing in the way of mechanical change can happen to one without influencing the control over the others. In short, the muscle of a given joint, together with the monosynaptic reflex connections that bind them, constitute a unit. This, called the myotatic unit, is the elementary unit of postural control."

Integration and interpretation of neural data occur at many levels in the nervous system, some of which are lower than the spinal reflexes. For example, a certain amount of interpretation could be said to be involved in the differing thresholds of the sensory receptors, whereby strong stimuli are distinguished from weak ones, in the manner shown by Adrian and Bronk. Still another simple interpretive device is the mechanism of adaptation whereby continued excitation of certain sense receptors causes them to decrease in sensitivity until further stimulus becomes ineffective. Thus, certain impressions that form a continuous background of our sense data disappear from our consciousness altogether after a time.

Effect of Reciprocal Inhibition in the Human Retina



An optical illusion which can be explained in terms of reciprocal inhibition among the areas of the retina is shown above. The white bars appear gray at their intersections because response from the area of the retina on which the image of the white intersection falls is inhibited by illumination of adjacent areas on all four sides. Away from the intersection, say along a *vertical* white bar, inhibition comes from the white areas above and below, but not from the black areas left and right. Thus the retinal response from the image of the white bars is inhibited more at their intersections, which, as a result, appear gray.

RECIPROCAL INHIBITION

A kind of integration of data which involves inhibitory interaction among nerves more directly has been studied by Professor H. K. Hartline, who has been at the Rockefeller Institute since 1954. For many years he has studied the nervous action of the visual system, working with the retina of the frog and, more recently, with the compound eye of the horseshoe crab, *Limulus*. Professor Hartline has found that the nerve signals from different parts of the eye are modified and partially organized before they reach the brain. The eye consists of a mosaic of many individual receptors, each of which gives rise to a tiny nerve fiber. Dr. Hartline and his colleagues, Drs. Floyd Ratliff and William Miller, have found means to study the relationships among impulses from these individual fibers.

They find that the output of one receptor depends on the output from an adjacent receptor in such a way that perception of changes in illumination is intensified. If two adjacent receptors receive the same illumination, each inhibits the signal from

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the other. The more a receptor is excited, the greater its inhibitory effect on its neighbors. If only one is illuminated, it (being uninhibited by an adjacent receptor) produces its full signal, corresponding to whatever the intensity of the illumination may be. The result of this arrangement is that the boundary between light and dark areas is emphasized in the eye. Consider the importance of this to *Limulus:* crawling in the sandy bottom of a clear pool, the illumination to his eye from the untroubled waters above would be uniform and uninteresting. But let a shadow appear, and the danger of a predator is present. How helpful to *Limulus* that the outline of the predator's shadow, as it falls upon his eye, is automatically emphasized by an integrative network of nerve fibers that lie within the eye itself.

It seems likely that interaction of this kind occurs in the visual systems of the higher animals and there is evidence that it exists in man. It is probably for this reason that line drawings and cartoons so satisfactorily represent visual impressions of things, for our eyes like those of the *Limulus* may function in such a way that they take more notice of the boundaries of surfaces than of the surfaces themselves.

Reciprocal inhibition among receptors occurs in many sensory mechanisms and also may be involved in defining the boundary between active and inactive muscles to facilitate fine and precise movements. The manner in which this may occur has been suggested by Drs. Vernon Brooks and Victor Wilson at the Institute who have elaborated observations made at the Institute by Birdsey Renshaw. Renshaw, studying the facilitation and inhibition of reflexes in the spinal cord, found that they may be inhibited under certain conditions by discharges in adjacent motor neurons. This led him to suppose that the discharge of one motor neuron through its recurrent collateral fibers could inhibit the monosynaptic reflex of neighboring neurons. Renshaw also found evidence which has later been interpreted to indicate that the inhibitory impulses in the recurrent collaterals of active motor neurons reach neighboring motor neurons through interneurons. These hypothetical interneurons were called Renshaw cells by Sir John Eccles of the Australian National University.

Brooks and Wilson concluded that through the inhibitory effects of the recurrent collaterals and the Renshaw cells, tensions established in a muscle are inhibited from reaching the extremes one might expect from the existence of mutually excitatory pathways between motor neurons to associated muscle units. The effect corresponds precisely to the negative feedback of the cyberneticists. Brooks and Wilson have concluded further that recurrent inhibition, as they term inhibition from the recurrent collaterals, serves not only to limit the magnitude of reflex response in motor systems but to prevent the stretch reflexes from spreading their influence beyond the limits of the muscle units originally stretched. In this way fine and precise movement may be facilitated.

It would be a rare account of scientific work that could be neatly and logically closed, for science is constantly growing, and new questions emerge from the answers to old ones. It is especially so with neurophysiology. The rather detailed anatomical knowledge of the nervous system, accumulated during the first decades of this century, is only now beginning to be matched by comparable functional and physiological understanding. From many fields—cytology, biochemistry, biophysics, psychopharmacology and psychology, to name a few—this new understanding is rapidly accumulating. Much of it is emerging from work in progress at the Rockefeller Institute. To pursue the vast subject of neurophysiology to its bounds is impossible here, however, for its periphery lies at the center of other subjects, so closely interwoven are the tissues of knowledge of the biological sciences. Future articles in this series will give further evidence of the interdependence of the sciences.

FIFTY YEARS AGO AT THE ROCKEFELLER INSTITUTE

Peyton Rous Discovers the First Virus-Caused Tumor

ON OCTOBER 1, 1909, Peyton Rous, then Assistant in Pathology and Bacteriology, made the original experiment with the malignant tumor now known to cancer investigators all over the world as the Rous sarcoma. A poultry-raiser had brought to his laboratory a hen bearing a subcutaneous tumor. Excising most of the mass Dr. Rous implanted bits of it elsewhere in the same hen and in two young hens of the same brood. By November 5 the first bird and one of the others were bearing newly-developed tumors. This was the first avian tumor ever found to be transplantable. After transplanting it from bird to bird for six generations Rous succeeded in transmitting it by an extract passed through a Berkefeld filter. This step, which led shortly to proof that the tumor is caused by a virus, profoundly influenced the course of cancer research from that time until the present day.

SUMMER COURSE IN BIOLOGY

THE GRADUATE FELLOWS at the Institute who organized and taught a five-week course in biology for high school students last summer were hosts to their students at a luncheon on December 22. Also invited were the principals and science teachers from the metropolitan high schools from which the students came.

One of the purposes of the luncheon was to prepare for next summer's program by obtaining the impressions the students had formed of the course last summer and the opinions of the teachers as to changes in the manner of selecting students. President Bronk spoke to the group on the broad aims of the program of the summer biology courses and Mr. Johns Hopkins, III, described last year's course from the point of view of the organizers. Mr. Steve Arkin, now at Amherst College, commented on the program from the point of view of one of the students who had taken the course last summer.

In addition to the organizers of last year's course, some of the graduate fellows who will assist in planning the program for next summer were also present. Following the luncheon they engaged both students and teachers in a discussion of ways in which the course may profitably be modified this summer, and also how students can be selected from among a larger number of schools in the New York area.

MEMORIAL SERVICE AND DEDICATION OF THE ALFRED E. COHN LIBRARY

SEVERAL HUNDRED scientists, students, scholars, and laymen—friends and admirers of Alfred Einstein Cohn—paid homage to him at a memorial service in Caspary Auditorium on December 3, followed by dedication of the Alfred E. Cohn Library of Abby Aldrich Rockefeller Hall. One of the guests, an officer of the Corporation, wrote afterward, "I found myself privileged to sit in a sort of inner circle of a fraternity of the intellect. There was a universality to it which was heartening in this day of specialization.... Here the auditorium served as a forum for the demonstration of the fact that the scholar of the law could talk with the scholar of medicine who in turn could talk with the scholar of the arts. There is all too little of this nowadays."

President Bronk, in his introductory remarks, spoke of Alfred Cohn's forty-six years on the staff of this institution. "During all those years," said Dr. Bronk, "his life was focused in the work he carried forward here and in the realm of science and of letters. As Associate, Associate Member, Member, and Member Emeritus, he made distinguished contributions to our knowledge of the functions and diseases of the heart. As a true scholar, he was knowingly at home in almost every field of learning. He greatly enriched the intellectual life of the Institute which he loved."

FRIENDS AND COLLEAGUES

The first of the speakers was Mr. Melville H. Cane, attorney, poet, and Executor of the Cohn estate. Mr. Cane recalled Dr. Cohn's boyhood and youth in which already the unusual breadth of interests that marked his maturity was evident. Next, Dr. Henry Murray, Professor of Abnormal Psychology at Harvard University, spoke in appreciation of Alfred Cohn's scientific career. "Every scientist," he said, "is perforce a specialist, his aim being to discover facts and relations and to explain them through the generation of fitting concepts and self-consistent theories. ... Some scientists, however, including some of the most eminent, are both disposed and capable to venture beyond the precise peculiarities of their own selected sphere of special competence, and thus become generalists as well as specialists. Such a man, for better, I would say, than for worse, for richer than for poorer, was Alfred Cohn, whose virtues, whose contributions to the cultural vitality of his age, are not likely to be sufficiently appreciated by the more circumscribed professional colleagues. It is of Alfred as a generalist in science that my memories are ample, and hence it is this aspect of his total personality that I am stressing, to some extent in fear that we Americans may value less what we should value more."

It was as personal friend that Dr. Peyton Rous, Member Emeritus, spoke of Alfred Cohn. "What was he like as a person?" asked Dr. Rous. "Justice Frankfurter, who knew him best, will doubtless tell you, yet I cannot forego mentioning a few of his traits. His face was good to look upon, so understanding was it, and humorous and kind. In the photograph that shows him best (shown in the *Quarterly*, Vol. 1, No. 3, 1957, and now hung in the Cohn Library—Editor) he is listening but poised for reply, and he is already enjoying what he will say for it will be witty as well as wise. He will resort to no figures of speech nor to anecdotes, and will avoid citing authorities. He relied on his own sublimated knowledge and on his inferences therefrom. His quick-flashing mind was an exquisite instrument, perfectly attuned."

The Honorable Felix Frankfurter, Justice of the Supreme Court of the United States and friend of Alfred Cohn for nearly forty years, spoke extemporaneously of him. "If I were asked what Alfred would have cared to have deposited in memory about him, I should say something like this: he would care most to have *truth* find virtue and significance in his life.... And both his search for truth and his sense of the total significance of man, that we are not sectionalized or compartmentalized... that search for interrelationship was part of his search for truth—were, I suppose, among the illuminating aspects of him that I early discovered." After mentioning some of those most influential in Dr. Cohn's life

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Printed memorial now hung in the Cohn Library opposite a portrait of Dr. Cohn

MOST OF THE BOOKS IN THIS LIBRARY
WERE BEQUEATHED BY THE LATE

ALFRED EINSTEIN COHN

MEMBER EMERITUS OF
THE ROCKEFELLER INSTITUTE
WHO DIED ON 20 JULY 1957

ALFRED COHN WAS A SCHOLAR WHOSE INTERESTS ENCOMPASSED MANY FIELDS AND EARNED FOR HIM HIGH REGARD IN THE WORLD OF CULTURE · HIS ABIDING LOVES WERE SCIENCE, THE HEART OF MAN, AND BOOKS · THROUGHOUT HIS LIFE HE REMAINED DEEPLY ENGROSSED WITH ALL, AND SO HE HAD FULL SCOPE FOR HIS INVESTIGATIVE, PHILOSOPHICAL & LITERARY ENTHUSIASMS ·

ROSS GRANVILLE HARRISON · 1870-1959

Ross Harrison's passing on September 30, 1959 marked the end of the epoch of biology that one might rightly call its adolescence. But his life rather denotes the beginning of a new age—the fertile and prolific stage of maturity which modern biology has entered and which his work has so immensely helped to bring about.

By introducing critical experimentation into an area heavily dominated by conjecture, he cut Gordian knots of speculation and rescued embryology from falling prey to pseudoscientific obscuration. His faith in the incisive power of analysis, paired with abhorrence of sham and verbal substitutes for knowledge, endowed him with the force to solve some of the knottiest problems of development that had for long remained refractory to resolution. Thus, by a simple crucial experiment, he settled in one stroke the age old argument of whether nerves are built in segments, pipeline-fashion, or grow forth in their full length from central cells, like plants from seed. Bold in concept, but deliberate in execution, the experiment consisted of explanting the suspected cells of origin from their obscurity and uncontrollable enmeshment in the body into an extraneous nutrient medium as testing ground open to both direct viewing and control. And so he conceived and gave birth to the method of cell and tissue culture which then was fast elaborated to its present prodigious usefulness, first by Carrel at this Institute, and later by countless others in many lands.

Extending the nerve experiments *in vitro* to cells of the connective tissue, Ross Harrison also pioneered in work on the relations between cells and their fibrous matrix, which led to deeper insight into the mechanics of tissue formation in general. But he was not one to deliver himself to any one technique, even a self-created one. So, next to explantation, he developed, by the most painstaking microsurgery, techniques of embryonic transplantation, which made it possible to resubmit an isolated organ rudiment of known character to the unknown influences of the organism in novel and varied combinations, so as to learn the nature of those influences. To his and his students' studies on this subject, we owe much of our knowledge about what makes a limb, a heart, a brain, an inner ear, into what they are. In essence, this pioneering work paralleled and complemented that of his German colleague, Spemann, who later was awarded the Nobel Prize for his share in the achievement.

Observing further that at a stage when the future quality of an organ is already firmly fixed, its axial relations to the body are still quite labile, Harrison came to establish rules of polarity, and symmetry for organic form that, formally at least, resembled principles of crystallinity. It was a daring step to go on from this analogy to probing (in collaboration with Astbury) for actual evidence of crystal lattices in tissues by X-ray diffraction methods; and even though these tests were inconclusive, the basic concept has by no means been invalidated.

By graft exchanges of limbs and eyes between slow-growing and fast-growing species, he then separated for the first time the relative contributions made to the growth rate of an organ by the genetic constitution of its cells on the one hand, and by the host environment on the other, which provides nutrition, hormones and other growth requirements.

Without recounting more examples of his classical achievements, they all add up to an apotheosis of the scientific method: a problem clearly formulated; experiments of beautiful simplicity designed to solve it and then carried out with all the care required; and the results interpreted with critical restraint, yet in full evaluation of their established or potential meanings —always combining craftsmanship and scholarship. His vision in selecting most favorable objects for the solution of a given problem was as keen as his perspective in relating the conclusions to the broad issues of biology in general; just as the logical neatness with which he dissected a problem into tractable compartments matched the precision of his delicate microsurgery. He had the patience and mental discipline for observation, study, and enjoyment of minute details—a trait also reflected in his fascination with maps and railroad schedules. But travelling and mountaineering, both of which he loved, meant to him not just to go places, but to gain and retain the broad view of world and landscape which close preoccupation with detail alone cannot reveal. And similarly, he took his mind incessantly on trips of the imagination from the ground floor of factual observations to a high plane of generalization, where facts appear in true perspective and can be rated as to their meaning and significance; never so high, though, that the solid ground of facts would be all but lost from sight.

His strict adherence to sober realism also dictated his attitude of rather conservative pragmatism in the many administrative functions to which he was called and which he served with most meticulous attention. If his performance in these tasks appeared unhurried, this was but an expression of his perfectionism; time was whatever a job demanded to be done to full perfection. For one who shouldered administrative responsibilities from a sense of duty, rather than predilection, he assumed a rather heavy share; and in discharging them, he acted as an effective stabilizing force, taking a middle course between the forces of tradition and innovation.

People to him were individuals, not figures in a mass. Students thus were left to develop in their own ways, guided by his example of rigorous thinking and conscientious work, rather than by precept. Though sharply scornful of incompetence, he made, with modesty and whimsy, allowance for human foolishness. Whether in class, in the laboratory or in the Board Room, he insisted on sound reasoning from solid premises without recourse to phraseology. But all who knew him knew how the rigorous discipline of his mind was mellowed by warm kindliness and a subtle sense of humor, just as he loved to flavor meals with samples of delicious wine—some of his own vintage.

Now that this dear friend is to be with us no more, it only mildly tempers our sense of loss that, after all, his has been a full life—full of inner satisfaction and of fruits and honors; that his achievements live on in our work; and that his spirit keeps on shining as a guiding beacon.

This memorial minute was prepared for the Board of Trustees of the Rockefeller Institute by DR. PAUL WEISS, Member and Professor.

FIRST CHRISTMAS LECTURES FOR YOUNG PEOPLE GIVEN BY DUBOS

"I SHALL ALWAYS remember your Christmas Lectures as one of the highlights of my life. Your talks not only kindle better appreciation for science, but for all learning." Thus began one of many letters received by Dr. René Dubos following his lectures on the Microbial World. With this series the Rockefeller Institute joined the 135-year-old tradition of Christmas Lectures inaugurated at the Royal Institution in London and still carried on there by distinguished scientists today.

The five one-hour lectures, presented in Caspary Auditorium during the week following Christmas, were attended by nearly 500 high school students selected by their teachers from the biology classes of about 150 of the public, private and parochial schools of the New York Metropolitan Area. The National Science Foundation, through a grant to the Institute, had made it possible for Dr. Dubos to illustrate his lectures with rare and often beautiful motion pictures as well as the usual slides and demonstrations.

The dominant theme of the lectures was the unity and the richness of life; not only are the various forms of life from virus to man elaborately interrelated, but so are the science and techniques through which man seeks to understand life. Pasteur's contributions to microbiology, Dr. Dubos said, were much enhanced, perhaps even made possible, by the fact that he was first a crystallographer and brought to his experiments the techniques and knowledge of that specialty. Thus he recognized the significance of the preference of certain bacteria for optically active sugars which another, without his training, would have missed. "Chance favors the prepared mind," said Pasteur.

In speaking of the arising of the germ theory of disease, Dr. Dubos drew the attention of his audience to the fact that this theory, which is part of the picture of the world everyone of us carries with himself, is less than 100 years old. He reminded his young friends that the theory rests on indirect evidence which none of us has seen, and of which few are more than vaguely aware. Yet in spite of the fact that it is now an accepted idea that microörganisms *can* cause disease, Dr. Dubos said that even now few if any of the details of how they do so are understood. In that sense we stand not very far from the world of Robert Koch, who was one of the early advocates of the idea.

Here, too, Dr. Dubos took the occasion to point out a general aspect of the way of science. Koch is regarded as the man who established the germ theory of disease, but his conclusions rested on an immense amount of information already available, and in particular on the work of Pasteur and Lister. "There is something in the climate of the time," he said, "that often brings together—all of a sudden, within the space of a few years—the mass of information out of which a conclusion emerges in a manner almost obvious to all. For this reason one must go into scientific research, not with the object of settling in a spectacular way and once and for all some final point, but rather to become part of a living continuous process. It is true that now and then one of us is so situated in time and space that the obvious conclusion is first seen, and then that happy person is considered to be the discoverer or inventor of the new idea. In reality the process of science demands much more humility; it demands the day to day kind of work which builds up that structure of information out of which great discoveries suddenly come to light."

In his lecture on the domestication of microbes, Dr. Dubos described some economically important microbiological processes including production of penicillin and vaccines and the preservation and use of certain strains of yeast for the brewing industry. He emphasized his conviction, however, that the technology of these processes, which he showed by excellent motion pictures, will be quickly modified and ultimately replaced by entirely new processes. Purely empirical technology, such as the brewing of beer, may change little over centuries, but when reason and science are brought to bear, Dr. Dubos said, dynamic changes soon are wrought. He cited Pasteur's contributions to the wine and silk industries of France as specific examples

(continued on page eight)

THE NEW YORK TIMES

Eager young minds absorbing Dr. Dubos's Christmas lectures in Caspary Auditorium

of the effect of reason and experiment on ancient technologies.

A very personal scientific view, but an immensely stimulating one, was presented by Dr. Dubos in his last lecture on biological partnerships. His thesis was that the results of the interaction of two forms of life may be (and usually are) vastly different from what one would expect from the properties of either, alone, and perhaps more significant, as well. The lichens are a case in point—one of the most ubiquitous forms of life, growing in the Antarctic and in the desert. Lichens are actually the complex union of an alga and a fungus, neither of which is usually very adaptable or hardy. Yet, together they form what appears to be a new organism with characteristics profoundly different from those of either alone. Similar relationships exist between the nitrogen-fixing bacteria and the legume plants, where the presence of each enhances the growth of the other.

A LESSON FOR HUMANITY

Speaking of the great value placed on variegated varieties of tulips which we now know to be the result of a virus infection passed through generations of plants, Dr. Dubos said: "It seems to me there is a lesson here for human life. There is no doubt, of course, that as we mix different types of human being, that when we come into contact with each other, all sorts of difficulties are likely to arise, and now and then there are struggles from which some of us suffer. But I think also there is no doubt that, in the long run, we create a richer society with more variety of talents and of potentialities. I think it is a lesson in human behavior, as well as in humility, to consider that in the world there is not only struggle and strife, but that, all in all, mutual aid is more likely to be profitable than competition."

The greatest scientist, according to Dr. Dubos, far from being an alien in his community is a participant in its life. He expressed this view most eloquently in an impassioned response to a question that assumed there is an either-or choice facing young people as to whether they should study humanities while preparing themselves for careers in science. "But science is part of the humanities!" Dr. Dubos exclaimed. "If we are here to defend a cause it is that there is no difference—no profound difference—though there may be differences as to techniques, as to what one does. But do you realize that most of the best scientists are also good writers, many of them are musicians, many (and certainly all of the good ones) read, and they read everything?"

A BALANCED LIFE

Dr. Dubos added to his reply on the following day, for the question of how to find the right balance between time devoted to science and to other aspects of life is one that is with us all, and one of vital importance for individuals as well as society. "There is not one time," he said, "that I read something about history or literature that I am not somewhat conscience-stricken about what I should be doing in regard to my professional activities. Now is this peculiar to us in a research institution? Is it peculiar to you students preparing yourselves for a life in science? Is it peculiar to our time?"

To show that this state of affairs is not new, Dr. Dubos read an excerpt from a note written in 1876 by Charles Darwin. In his autobiography Darwin wrote that as a young man he had enjoyed poetry, the theater, art, and music.

"But now," wrote Darwin, "for many years I cannot endure to read a line of poetry. I have tried lately to read Shakespeare, and found it so intolerably dull that it nauseated me. I have also almost lost any tastes for pictures and music.... My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone on which the higher tastes depend, I cannot conceive. A man with a mind more highly organised or better constituted than mine, would not I suppose have thus suffered; and if I had to live my life again I would have made a rule to read some poetry and listen to some music at least once every week; for perhaps the parts of my brain now atrophied could thus have been kept active through use. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature."

His own conclusion, Dr. Dubos said, is that science is part of the humanities, and all of our activities really pertain to that kind of effort of the human mind to encompass larger and larger aspects of reality.

There had been doubts as to what the response of the students would be to so concentrated a course of lectures, but the attention with which they listened, the intensity of their questions, and the fact that most of those who came to the first lecture returned to hear all of them, inspired Dr. Dubos and those who organized the lectures and removed all their misgivings.

One question which Dr. Dubos considered of special importance formed the basis of a kind of epilogue with which he concluded the lectures. "The question to which I want to refer now," he said, "is one that had to do with me. One of you asked, 'Did you ever do anything else but science, and if you had your life to live over again, what would you do?'"

THE GRANDEUR OF SCIENCE

This was very close to his heart, Dr. Dubos said, because he had often had doubts about whether what he was doing was really the best thing for him, whether another field, say art, or literature, might not give more opportunity for a more total expression of oneself. He no longer wonders, he said. "I would not change my life. I would still be in science because I think science corresponds to that activity of the human mind in which there is no doubt that we are engaged in a collective effort that began long ago, and will continue long after us." He went on to quote an observation made by Aristotle, who, as he said, in many respects stood at the beginning of science as we know it. "Apparently Aristotle must have asked himself the question most of us are asking today," said Dr. Dubos. "Is it really satisfying just to bring one's bit of knowledge, so small by itself?" He closed with Aristotle's answer, appearing in the *Ethics* and incised in stone around the frieze of the National Academy of Sciences building in Washington, which he paraphrased as follows: "It is obvious, as we all realize, that the search for truth is difficult and is never complete, but even so, it is also true that every one of us adds a small bit to the structure of knowledge, and from the collection of all these efforts, there emerges a certain grandeur."

The Trustees

BARKLIE MC KEE HENRY

MR. BARKLIE MCKEE HENRY, Trustee of the Institute since 1949, is a man whose interests include literature, finance, science, and the welfare of man. Circumstances have enabled him not only to derive deep personal satisfaction from the pursuit of these interests, but through them he has contributed richly to the community as well.

Graduated *cum laude* in English from Harvard in 1924, with editorship of the *Lampoon* and a year at Oxford's Balliol College behind him, Mr. Henry became managing editor of *Youth's Companion,* a magazine with a circulation of 300,000.

In 1928 Mr. Henry left the world of literature for business and finance, but those first interests have remained with him and have re-appeared in his public life from time to time since. While at sea during the war and on the long distance cruises that have been one of his pleasures, he kept himself awake, as he puts it, by translating the poems of Horace into English. Two of them can be found in the Modern Library's *Anthology of the Latin Poets.* Mr. Henry is also Trustee of the Pierpont Morgan Library and of the American Academy in Rome. In 1953 he was appointed a member of the President's Committee on International Information Activities.

In 1930, after a brief interval with the Guaranty Company of New York, Mr. Henry was forced by the death of his parents to retire from business to give full attention to the affairs of his family. Since that time, he has devoted increasing amounts of his time to human welfare. However, he has been a Trustee of the United States Trust Company of New York since 1930, and he is also a Director of the Great Northern Paper Company.

In the dark days of 1930 he was active in the Emergency Unemployment Relief Organization in New York. He set up that group's Block Community Organization, a self-help undertaking at the local level which was remarkably successful. Later Mr. Henry became President of the New York Association for Improving the Condition of the Poor, and he organized its merger with the Charity Organization Society. He was first president of the resulting Community Service Society, the largest private family welfare organization in the United States. He was also one of the organizers of the Greater New York Fund.

In a sense the welfare agencies mentioned above deal only with the symptoms of social and individual disturbance. Significant as these may be, Mr. Henry has found his greatest satisfaction in the more fundamental fields of medicine and psychiatry. He was a Governor of New York Hospital in 1930, to become its Vice President and, later, President in the years immediately before the war. During these years he gave every support to measures that would encourage the rapprochement between medicine and psychiatry, leading to the strengthening of the psychiatric services of the New York Hospital, among other specific things. He served for some years on the first Board of Managers of the New Jersey State Diagnostic Center at Menlo Park, an activity of the State Department of Institutions and Agencies, and later he was appointed by the Governor to the New Jersey State Board of Control of Institutions and Agencies. Two years ago the Governor appointed him member of a commission to study the entire Department of Institutions and Agencies, which includes all state correctional activities, mental hospitals and clinics, welfare activities, and colonies for the retarded. The Commission's study, financed by the Rockefeller Brothers' Fund, has just been completed.

BACHRACH

Mr. Henry's high aims and scholarly interests (he is Chairman of the Executive Committee of the Carnegie Institution of Washington, a Trustee of the Institute for Advanced Study in Princeton, and Member of the Overseers' Committee to Visit Harvard College, as well as on the Princeton University Advisory Council to the Department of Philosophy) are supported by an inventive and practical side. At the New York Hospital, for example, it was his suggestion that led to the replacement of the grim bars in the psychiatric wards with the fine but secure mesh of the so-called psychiatric screens, now widely used. Skiing was a favorite sport in younger days, and with two others, Mr. Henry invented the ski-tow, the first model of which was installed in 1933 at North Woodstock, Vermont. When he was commanding a submarine chaser during the war he solved a navigational equipment shortage by substituting a ruled grid on plexiglass for the more elaborate parallel rules. These simple grids are now sold commercially.

Always fond of sailing and the sea, Mr. Henry went on active service with the Navy in 1940, first commanding a coastal mine-sweeper, then a 110-foot sub-chaser, and next a destroyer escort, operating in the Atlantic, Caribbean, and Mediterranean. He was shaking down a new destroyer escort when he was called by Secretary of the Navy Forrestal to help with contract terminations. He helped draft the report of the Dubose Board on relationships between regular and reserve officers in the Navy, and after the war he served on a Civilian Advisory Committee to the Bureau of Naval Personnel.

Mr. Henry now lives in Princeton with his second wife, Mrs. Margaret Trowbridge Griggs, whom he married in 1945. He has two children by his first marriage, Gertrude and William Barklie, both married. His stepson, Lawrence Griggs, is married to the daughter of their Princeton neighbor, Professor George F. Kennan. Mr. and Mrs. Henry have two boys, Harold and Richard, age ten and eight.

As a member of the committee of trustees appointed by Mr. John D. Rockefeller, Jr., in 1951 to consider the Institute's future, and as Chairman of the Building Committee during the critical years of launching the Institute on its new future, Mr. Henry has given abundantly of his time and experience.

MISCELLANY

Election of Two Trustees Emeriti

Dr. A. R. Dochez and Mr. John C. Traphagen, Members of the Board of Trustees for nearly 25 years, were elected Trustees Emeriti on the occasion of their resignation from active membership on the Board on October 19, 1959. In accepting these resignations with regret the Board recorded their grateful appreciation to Dr. Dochez and Mr. Traphagen for the invaluable service each has given so generously to the affairs of the Institute.

Association of Graduate Schools at Institute

More than one hundred delegates to the Eleventh Annual Conference of the Association of Graduate Schools met at the Rockefeller Institute on October 27 and 28. The Association, organized within the Association of American Universities, was welcomed to the Institute by President Bronk. On the afternoon of the first day Dr. Paul M. Gross, Vice-President of Duke University, addressed a joint meeting of the Conference with the Association of American Universities, speaking on "Some Aspects of Federal Support of Higher Education." More than forty of the country's graduate schools were represented at the Conference by their Deans and other senior academic officers. They were unanimous in expressing their appreciation "for the privilege of meeting in the beautiful and impressive setting of the Caspary Auditorium and Abby Aldrich Rockefeller Hall", as their resolution of gratitude put it.

Holiday Festivities

During the Christmas holidays the Institute was the scene of several gatherings of faculty, students and guests in warm fellowship. The Graduate Fellows opened the season with a Ball for the faculty and the administration given on December 17th in the recreation room of the Graduate Students Residence. Initiated, planned, and financed by the students, this was one of the most festive occasions that we have yet seen at the Rockefeller Institute.

On December 22nd, all those of the Institute and many of their friends and former colleagues joined President and Mrs. Bronk in carol singing in Welch Hall, followed by tea. The children had had *their* party the night before, with moving pictures and a visit from Santa Claus.

On New Year's Day President and Mrs. Bronk were hosts to nearly two hundred of the faculty and their wives at the President's House.

Other seasonal events to note in passing were the cross of lights in the great façade of the new South Laboratory building, the lighted Christmas trees on the steps of Founders Hall, and the usual splendid turkey dinner in the dining room of Welch Hall.

Sensing the purpose behind a discreet inquiry from the administration as to how many graduate students planned to be at the Institute for meals on Christmas Day, the handful remaining here made other plans so that the dining room staff could be free for their own celebration. The spirit of Christmas was probably most truly embodied in this gesture of thoughtfulness on the part of our graduate fellows and their wives.

Bronk Awarded Medal

President Bronk received a gold medal from the Society for Promoting International Scientific Relations at a meeting of the Society held in Caspary Auditorium on November 24, 1959. The medal was presented by Dr. Herman F. Mark, honorary president of the Society, who is Director of the Institute of Polymer Research at the Polytechnic Institute of Brooklyn. Dr. David Nachmansohn, Professor of Biochemistry at the College of Physicians and Surgeons, Columbia University, and president of the Society presided at the meeting. Dr. Alan T. Waterman, Director of the National Science Foundation, gave the principal address of the meeting, speaking on "Science and the Progress of Man."

The Society was originally known as The American Society of European Chemists, and its members numbering some 500 are located in many countries. Dr. Bronk is the third recipient of the Society's gold medal. The first to be so honored was Arne Tiselius, Professor of Biochemistry at the University of Uppsala; the second was the late Claude Fromageot, Professor of Biochemistry at the University of Paris.

First Book From Institute Press

The first book from the Rockefeller Institute Press, *The Atmosphere and the Sea in Motion,* was published in December, 1959, in association with Oxford University Press at a price of $15.00. Subtitled The Rossby Memorial Volume, the book consists of scientific papers by nearly 50 eminent meteorologists throughout the world who were students or colleagues of the late Carl-Gustav Rossby. Editor-in-chief was Professor Bert Bolin of the Institute of Meteorology at the University of Stockholm.

A copy of the book was presented to Professor Rossby's widow by Mr. Charles I. Campbell, Director of the Press, at the Honors Night Session of the Fortieth Anniversary Meeting of the American Meteorological Society in Boston on January 20, 1960.

Dr. Otto Westphal Gives Sigma Xi Lecture

Dr. Otto Westphal, Professor of Biochemistry at the University of Freiburg, addressed the Rockefeller Institute Chapter of the Society of the Sigma Xi on November 10, 1959. After a buffet supper in Welch Hall, featuring sauerbraten and beer in honor of the lecturer, members and guests adjourned to Caspary Auditorium to hear Professor Westphal's lecture on "Contributions of Chemistry to the Study of Specific and Non-specific Immunity."

Press to Publish Biophysical Journal

The Rockefeller Institute Press will publish the *Biophysical Journal* for the Biophysical Society beginning with the first issue in September, 1960. Professor Frank Brink, Jr., of the Institute faculty has been elected as the editor of the *Journal.* Manuscripts as well as subscriptions are now being accepted.

FACULTY ACTIVITIES

Academic Honors

H. KEFFER HARTLINE
Sc.D., Lafayette College

RICHARD E. SHOPE
Sc.D., University of Pennsylvania

Lectures, Conferences and Symposia

ALEXANDER G. BEARN
Participant, First Conference on Genetics, Josiah Macy, Jr., Foundation.

CARL BERKLEY
Participant, Conference on the Storage and Retrieval of Health Information, University of Southern California, San Jose.

ARMIN C. BRAUN
Lecture, Brookhaven National Laboratory.
Participant, American Cancer Society Conference on the Possible Role of Viruses in Cancer, Rye.
Lecture, Institute of Cancer Research, College of Physicians and Surgeons, Columbia University.

DETLEV W. BRONK
Address, Dedication of new Bronx High School of Science.
Address, 25th Anniversary Dinner, Academy of American Poets.

VINCENT P. DOLE
Participant, Symposium on Energy Balance, Upjohn Company, Kalamazoo, Michigan.
Medical Lecture Series, University of Virginia.

RENÉ J. DUBOS
Participant, Arden House Conference on Tuberculosis, Harriman, New York.
Lecture, National Science Foundation Colloquium Series, Washington.
Participant, Seventh Annual Antibiotics Symposium, Washington.

FRITZ A. LIPMANN
Address before High School Biology Teachers, New York State Society for Medical Research, Inc.

RAUL D. MACHADO
Lecture, Miami University.

KARL MARAMOROSCH
Torrey Lecture, Columbia University

ALEXANDER MAURO
Participant, Symposium on Salt and Water Metabolism, New York Heart Association.

PHILIP D. MC MASTER
Visiting Lecturer, Medical Center of the University of Florida School of Medicine, Gainesville.

DAN H. MOORE
Lecture, Biology-Medical Society, Queens College.
Participant, East Berlin Symposium on Carcinogenesis, German Academy of Science.

GEORGE E. PALADE
Lecture, Research Society of the Downstate Medical Center, State University of New York.

GERTRUDE E. PERLMANN
Lecture, Cornell University, Ithaca.

KEITH R. PORTER
Cleveland Foundation Lecture, Western Reserve University.
Lecture, Netherlands Society for Electron Microscopy, Utrecht.

HOWARD A. SCHNEIDER
Medical Lecture Series, University of Virginia.
Lecture, Ninth Gaines Veterinary Symposium, Kankakee, Illinois.
Lecture, Walter Reed Army Institute of Research, Washington.

RICHARD E. SHOPE
Lecture, Twelfth Annual Scientific Meeting, Detroit Institute of Cancer Research.
Address, Special Convocation of University Council, University of Pennsylvania.
Chairman, Fourth Session, American Cancer Society Conference on Possible Role of Viruses in Cancer.

WALTHER STOECKENIUS
Lecture, Deutsche Kolloid-gesellschaft, Oeynhausen.
Lecture, Institut de la Recherche sur le Cancer, Villejuif, France.
Lecture, Institut Pasteur, Paris Service de Biophysique.
Lecture, King's College, London.
Lecture, Research Society of the Downstate Medical Center, State University of New York.

NORMAN SUTIN
Participant, Symposium on Aqueous Solutions, American Chemical Society, Atlantic City.

EDWARD L. TATUM
John F. Anderson Memorial Lecture, University of Virginia School of Medicine, Charlottesville.

WILLIAM TRAGER
Participant, Meeting on Amebiasis, Enteric Diseases Commission, Armed Forces Epidemiological Board, San Francisco.

PAUL A. WEISS
Lecture, American Philosophical Society, Philadelphia.
Harvey Lecture, New York.
Lecture, Society for Medical Research, New York.
Lecture, Science in Education, Teachers College, Columbia University.
Wechsler Lecture, Mt. Sinai Hospital.
Lecture, Symposium on Science in Adult Education, New School for Social Research.
Participant, Argonne Symposium on Electron Microscopy, AAAS, Chicago.

V. K. ZWORYKIN
Eighth Annual Edsel B. Ford Lecture, Edsel B. Ford Institute for Medical Research.

Society Elections

ALEXANDER G. BEARN
Member, Royal College of Physicians of Edinburgh.

CARL BERKLEY
Fellow, New York Academy of Sciences.

A. TYBJAERG HANSEN
Member, Editorial Board, *Journal of the American Heart Association.*

FACULTY ACTIVITIES

(continued from page seven)

MARGERIS A. JESAITIS
Fellow, New York Academy of Sciences.

KARL MARAMOROSCH
Recording Secretary, New York Academy of Sciences.
Chairman, Division of Mycology, New York Academy of Sciences.

JAMES S. MURPHY
Fellow, New York Academy of Sciences.

CYNTHIA H. PIERCE
Fellow, New York Academy of Sciences.

THEODORE SHEDLOVSKY
Vice President, New York Academy of Sciences.

IGOR TAMM
Charter Fellow, American Academy of Microbiology, Inc.

EDWARD L. TATUM
Fellow, New York Academy of Sciences.

A. CECIL TAYLOR
Fellow, New York Academy of Sciences.

Other Appointments and Distinctions

DETLEV W. BRONK
Member, Advisory Council for the Advancement of Scientific Research and Development in New York.
Member, Board of Trustees, Washington Center for Metropolitan Studies.
Gold Medal, Society for Promoting International Scientific Relations.

RENÉ J. DUBOS
Member, National Advisory Council, Oklahoma Medical Research Foundation, Oklahoma City.
Member, Advisory Council, New York City Health Research Council.

A. TYBJAERG HANSEN
Member, WHO Advisory Panel on Cardiovascular Diseases.

FRANK L. HORSFALL, JR.
Trustee, International Medical Congress, Ltd., and International Poliomyelitis Congress, Ltd.
Chairman, Program Committee, Fifth International Poliomyelitis Conference, Copenhagen.
Chairman, Research Council, and Member, Board of Directors, The Public Health Research Institute of the City of New York, Inc.
Member, Executive Committee, The Health Research Council of the City of New York.
Trustee, the Medical Library Center of New York.
Vice Chairman, Biological and Chemical Defense Planning Board, Department of Defense.
Member, Advisory Committee, Electronic Computers in Biology and Medicine, National Academy of Sciences—National Research Council.
Member, Scientific Advisory Committee, Institute of Microbiology.
Member, Committee on Research-Basic Sciences, and Vaccine Advisory Committee, The National Foundation.
Member, Committee on Respiratory Diseases, National Tuberculosis Association.
Member, Lasker Awards Committee, American Public Health Association, Inc.

HENRY G. KUNKEL
Member, National Medical and Scientific Committee, Arthritis and Rheumatism Foundation.
Member, Study Section on General Medicine, National Institutes of Health.

KARL MARAMOROSCH
Member, Committee for Selection of Fellows and Honorary Life Members, New York Academy of Sciences.
Chairman, Insect Transmission of Disease Agents Section, Entomological Society of America, Detroit.

JAMES S. MURPHY
Chairman, Mental Health Council, State of New York.

PEYTON ROUS
Judd Award, 75th Anniversary Celebration, Memorial Hospital for Cancer and Allied Diseases, New York City.

RICHARD E. SHOPE
Member, National Foundation Committee on Virus Vaccines.
Member, Board of Medical Education and Research, and Associate Trustee, University of Pennsylvania.
Member, Biological and Chemical Defense Planning Board, Department of Defense.

EDWARD L. TATUM
Editorial Board, *Biochimica et Biophysica Acta.*

PAUL A. WEISS
Annual Weinstein Award, United Cerebral Palsy Associations.
Member, Serbian Academy of Science.
Member, Science Advisory Council to Governor of New York.

INSTITUTE MENTION

New Appointments to the Faculty

DR. LUCIEN CARO, a postdoctoral fellow from Yale University, was appointed a Guest Investigator in Dr. Palade's laboratory, effective November 1, 1959.

DR. RICHARD DAVIS, a Graduate Teaching Assistant and Fellow at Rice Institute, was made a Guest Investigator on November 1, 1959, to work with Dr. Dan Moore.

DR. MARTIN LIPKIN, formerly an Instructor in the Department of Medicine, Cornell University Medical College, was appointed a Guest Investigator, effective November 1, 1959, to work with Dr. Zworykin.

DR. GIUSEPPE MILLONIG, who was an Assistant in the Department of Pathologic Anatomy at the University of Pavia, has been appointed a Research Associate in Dr. Porter's laboratory.

DR. SIVATOSH MOOKERJEE, Professor and Head of the Department of Zoology, Presidency College, Calcutta, has been appointed a Guest Investigator in Dr. Weiss's laboratory beginning January 1, 1960.

DR. C. LENNART PHILIPSON, Assistant Professor (Docent), Institute of Virology, Uppsala, was appointed the Sophie Fricke Fellow of the Swedish Royal Academy of Science in the Rockefeller Institute, and Associate Physician to the Hospital.

DR. THOMAS H. ROZIJN, who worked in the Laboratory of Physiological Chemistry, University of Utrecht, has been made a Guest Investigator in Dr. Hotchkiss' laboratory, effective January 5, 1960.

DR. DAVID S. SMITH, a former Guest Investigator in Dr. Porter's laboratory, has been made a Research Associate.

DR. TSUNEO TOMITA, Professor of Physiology at Keio University School of Medicine, Tokyo, has been appointed a Visiting Professor of the Institute.

DR. GUMPEI URATA, a former technical official in the Institute of Public Health, Tokyo, was made a Guest Investigator in Dr. Granick's laboratory on October 30, 1959.

DR. GEOFFREY ZUBAY, who was a postdoctoral fellow at London University, has been appointed a Research Associate and will work in Dr. Lipmann's laboratory.

Faculty Terminations

DR. MENY BERGEL, who worked as a Guest Investigator in Dr. Dubos' laboratory, left on October 15, 1959, to return to the Laboratorio de Investigaciones Leprologicas, Rosario, Argentina.

DR. CHESTER DE LUCA, formerly a Guest Investigator in Dr. Hotchkiss' laboratory, left on October 31, 1959, to become an Instructor in the Department of Pediatrics, The Johns Hopkins and Sinai Hospital.

DR. SETSURO EBASHI, who was a Guest Investigator in Dr. Lipmann's laboratory, left on December 31, 1959, to return to the University of Tokyo as Professor of Pharmacology in the Faculty of Medicine.

DR. ANTONIO GALLEGO, Director of Fundación Marqués de Urquiso, Madrid, worked with Dr. Lorente de Nó for six weeks during November and December, 1959.

DR. GUIDO HARTMANN, a former Research Associate in Dr. Lipmann's laboratory, left the Institute on October 21, 1959, and is now at the Max-Planck-Institut für Zellchemie in Munich.

DR. JOSEPH F. HEREMANS, a Guest Investigator in Dr. Henry Kunkel's laboratory, left on October 24, 1959, to return to the St. Pierre Hospital in Louvain.

DR. WILLEM C. HÜLSMANN, who was a Guest Investigator in Dr. Lipmann's laboratory, returned to Amsterdam on October 27, 1959, to the Laboratory of Physiological Chemistry.

DR. GORM WAGNER, of the Department of Gynecology, Kommunehospitalet, Copenhagen, worked in Dr. Csapo's laboratory for six weeks during November and December, 1959.

DR. EICHI YAMADA, a former Research Associate in Dr. Porter's and Dr. Palade's laboratory, returned to Japan on November 20, 1959, where he works in the Department of Anatomy, School of Medicine, at Kurume University.

Visiting Professors in Residence

DR. RAYMOND M. FUOSS, Sterling Professor of Chemistry, Yale University, October 12-16, 1959.

DR. DAVID R. GODDARD, Gustave C. Kuemmerle Professor, University of Pennsylvania, November 2-6, 1959.

DR. JOHN R. PAPPENHEIMER, Visiting Professor of Physiology, Harvard Medical School, November 30-December 4, 1959.

DR. TH. DOBZHANSKY, Professor of Zoology, Columbia University, December 14-18, 1959.

Guest Speakers

BRIAN M. SHAFFER, Fellow of Trinity College, Cambridge, and Department of Bacteriology, University of Wisconsin, October 6, 1959.

EPHRAIM KATCHALSKI, Head of Biophysics Department, Weizmann Institute of Science, Rehovoth, November 9, 1959.

HENRY HARRIS, Head of the Department of Cell Biology, John Innes Institution, Hertford, England, November 17, 1959.

GIAN TOENDURY, Department of Anatomy, University of Zurich, November 19, 1959.

WILHELM BERNARD, Head of the Electronic Microscope Service, Institute for Cancer Research, Paris, November 24, 1959.

ALAN GAREN, Department of Biophysics, Massachusetts Institute of Technology, December 1, 1959.

GÖSTA EHRENSVARD, Professor of Biochemistry, University of Lund, and Department of Psychiatry and Neurology, Tulane University School of Medicine, December 8, 1959.

New Grants and Contracts

From the United States Public Health Service for the following work:

For Dr. Archibald's study of enzymes of osseous and cartilagenous tissues $11,453

For the study of the chemical and immunological nature of colicines by Dr. Goebel $39,353

For research on enzymes of porphyrin biosynthesis by Dr. Sam Granick $21,345

For Dr. Hartline's study of electrical activity of single receptors and neurons of the eye $18,780

For a study by Dr. Hotchkiss of metabolic alterations in genetic drug resistance $31,282

For investigations of biosynthetic mechanisms by Dr. Lipmann $39,934

For a study by Dr. Maramorosch of the effects of viruses in tissues of arthropods $20,573

For investigations of physiological activities of nucleoproteins by Dr. Mirsky $30,656

For a study by Dr. Pelletier of the chemistry of the aconitum and delphinium $3,375

INSTITUTE MENTION

(continued from page thirteen)

For Dr. Perlmann's work on the relation of protein structure to biological function $23,783

For investigations into the response of cells, in terms of fine structure, to common carcinogenic agents, by Dr. Porter $28,870

For studies by Dr. Schneider in experimental encephalomyelitis, and for his work on the isolation of a natural resistance vitamin $41,933

For investigation by Dr. Siekevitz of the biochemical properties of microsomal and mitochondrial membranes $17,853

For study of the structural characterization of cell membrane by Dr. Stoeckenius $13,575

For Dr. Tatum's work on the cytology and morphology of neurospora $8,334

From the National Foundation for the following work:

For Dr. Bearn's studies of heritable disorders $77,883

For continuing Dr. Henry Kunkel's investigations of immunological phenomena and genetic patterns in patients with rheumatoid arthritis $50,723

From the National Science Foundation for Dr. Niu's studies of the induction of specific protein synthesis by ribonucleic acid $33,200

From the Instituto Venezolano de Investigaciones Cientificas for underwriting a supplement to the *Journal of General Physiology,* to the Rockefeller Institute Press $9,500

From the Muscular Dystrophy Association to Dr. Csapo for his studies on excitation-contraction coupling in muscles $8,802

From the National Science Foundation for investigations of the anatomical pathway of various substances across the wall of glomerular capillaries by Dr. Palade. $4,700

DEDICATION OF THE COHN LIBRARY *continued from page five*

—the poet, George Woodberry, the historian, James Harney Robinson, Sir James MacKenzie, with whom he collaborated in cardiography, and William M. Ivins, Jr., Curator of Prints at the Metropolitan Museum—Mr. Justice Frankfurter said: "...though there were...day-to-day disparities in the stuff of our thinking or our concerns, over and beyond them or beneath them were communities, and the deepest of all communities: thinking about thinking—ultimately, perhaps one may put it, thinking about the nature of the creative process. And this is not fundamentally different, I venture to believe... between a man who was concerned with the embryo of chickens and a man who was concerned with things very far from chickens."

Though William Ivins, Alfred Cohn's good friend, could not be at the ceremony, he was there in spirit and in deed, for he sent in his stead a rare volume, the first to be added to the collection from another donor. It was a first edition of Lessing's *Laocoön,* published in 1766. In his letter asking Mr. Cane to present the book at the ceremony, Mr. Ivins said: "When I showed it to [Alfred] he handled it with very great respect—and I naughtily suspected with more than a trace of longing."

The Cohn Library, dedicated formally on this occasion, has been described before (see the *Quarterly,* Volume 1, No. 4, 1957). Speaking of it, Dr. Rous said: "To Alfred Cohn it was no mere collection of books, but equipment slowly gathered for his work and his play. When all went well and quietly, he spent many hours with it each day of his later years. Many of its volumes are hard to come by, although greatly worthwhile, and others are rare in the collector's sense...He had not bought them as rarities, having little use for such, but as records of achievement at the time when it was made. Nor were any books got for their beauty alone, though many possess it. They were all dear to him, yet he almost never put his name in one, nor did he stamp it in red with a magnificent seal he had brought from Peking. Was it because he felt himself to be only a temporary custodian of the books? Who can say? But this much is sure, that he would rejoice in their honored place in the new Institute and in the thought of what they may bestow in future upon its scholars."

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