

12-1965

# The Rockefeller University Review 1965, vol. 3, no. 6

The Rockefeller University

Follow this and additional works at: [http://digitalcommons.rockefeller.edu/rockefeller\\_institute\\_review](http://digitalcommons.rockefeller.edu/rockefeller_institute_review)

---

## Recommended Citation

The Rockefeller University, "The Rockefeller University Review 1965, vol. 3, no. 6" (1965). *The Rockefeller Institute Review*. Book 17. [http://digitalcommons.rockefeller.edu/rockefeller\\_institute\\_review/17](http://digitalcommons.rockefeller.edu/rockefeller_institute_review/17)

This Book is brought to you for free and open access by the The Rockefeller University Newsletters at Digital Commons @ RU. It has been accepted for inclusion in The Rockefeller Institute Review by an authorized administrator of Digital Commons @ RU. For more information, please contact [mcsweej@mail.rockefeller.edu](mailto:mcsweej@mail.rockefeller.edu).



# THE ROCKEFELLER UNIVERSITY REVIEW

NOVEMBER • DECEMBER 1965

3



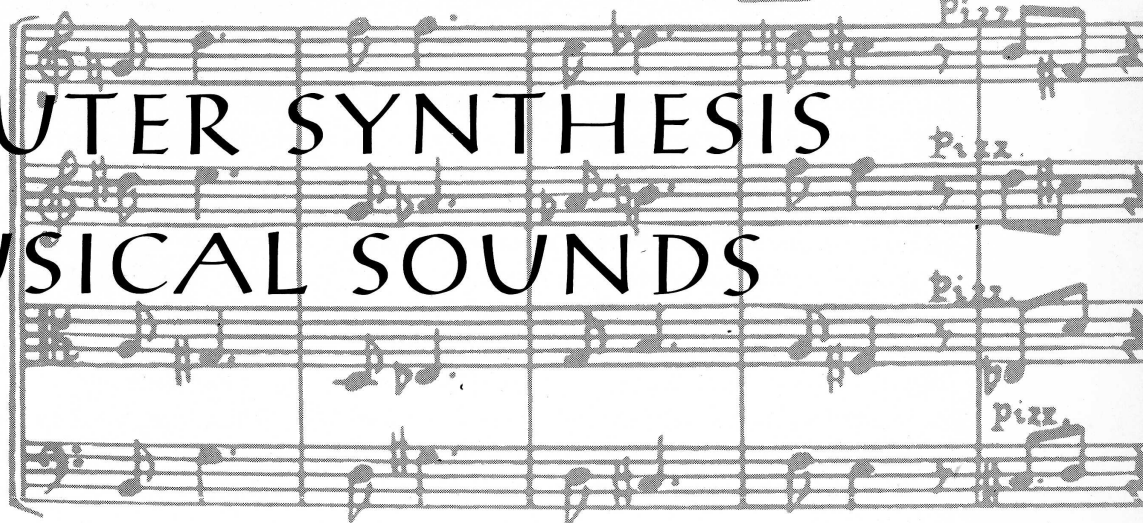




THE ROCKEFELLER UNIVERSITY REVIEW, Nov.-Dec., 1965. The Review is issued bimonthly. This is volume 3 number 6. Published by The Rockefeller University, Sixty-sixth Street and York Avenue, New York, N.Y. 10021. Second-class postage paid at New York, New York. The price for a subscription for one year is three dollars, single copies sixty cents. Copyright © 1966 by The Rockefeller University Press. Printed in the United States of America.



# COMPUTER SYNTHESIS OF MUSICAL SOUNDS



BY J. R. PIERCE

Led by such pioneers as the late Edgard Varèse, during the last quarter century composers have become increasingly interested in extending the resources of music. They have used such sources as oscillators, white noise generators, and pulse generators, rather than directly imitative instruments such as electronic organs and electrical guitars. A large body of this so-called electronic music has been composed and produced at American and European studios; for instance, the Columbia-Princeton Electronic Music Center in New York, the Experimental Music Studio at Urbana, and the Westdeutscher Rundfunk in Cologne; and a great deal of *musique concrète* has been produced by the *Groupe des Recherches* in Paris. Many of these works are available on tapes and records and are heard with increasing frequency in concert halls. Composers and engineers have developed elaborate techniques for the creative use of those sound resources previously unavailable for musical composition; and, with the help of behavioral scientists and electronic apparatus for synthesizing sound, they have also undertaken some psychoacoustic investigations. Some sound engineers—notably the author of this article—have turned from analog equipment, such as electronic music consoles or signal generators, to digital computers for producing musical sounds, since digital computers are in some respects more flexible than analog devices in synthesizing sounds and are powerful tools for analyzing complex sounds.

Dr. Pierce, who recently gave a lecture at Rockefeller entitled "Some Things We Have Learned from Synthe-

sizing Musical Sounds," is Executive Director, Research—Communications Sciences Division of the Bell Telephone Laboratories. He is well known for the development of the traveling wave tube and other devices that have had great influence on the art of communication, and he was the moving spirit behind the first communication satellite, *Echo I*. In the field of "light" literature Dr. Pierce is perhaps best known by his pseudonym, J. J. Coupling, under which he has written science fiction short stories and articles.

IT WAS INEVITABLE that some effort should be made to use modern electronic digital computers in connection with music; and, indeed, this has been done with a variety of approaches.

One possible field of use is in the analysis or production of musical scores. I myself dabbled with this idea as far back as 1950,<sup>1</sup> and others have pursued the matter far more diligently. Accounts of such work and bibliographies concerning it can be found in recent articles by Hiller and Beauchamp<sup>2</sup> and by Pierce, Mathews and Risset.<sup>3</sup>

Some five years ago, M. V. Mathews, N. Guttman, and I found a quite different application for the computer in connection with music. This was not in the analysis or composition of music, but in the production of musical sounds.

We were led into this by the use of the digital com-



puter at the Bell Laboratories as a means for simulating the performance of complex speech processing devices, such as vocoders. In such simulation, the speech is reduced to a numerical description. This description is then processed by the computer as the original speech wave would be processed by the device simulated. The computer produces a sequence of numbers which represent the output of the device, and this sequence of numbers is recorded on magnetic tape and then converted into sound.

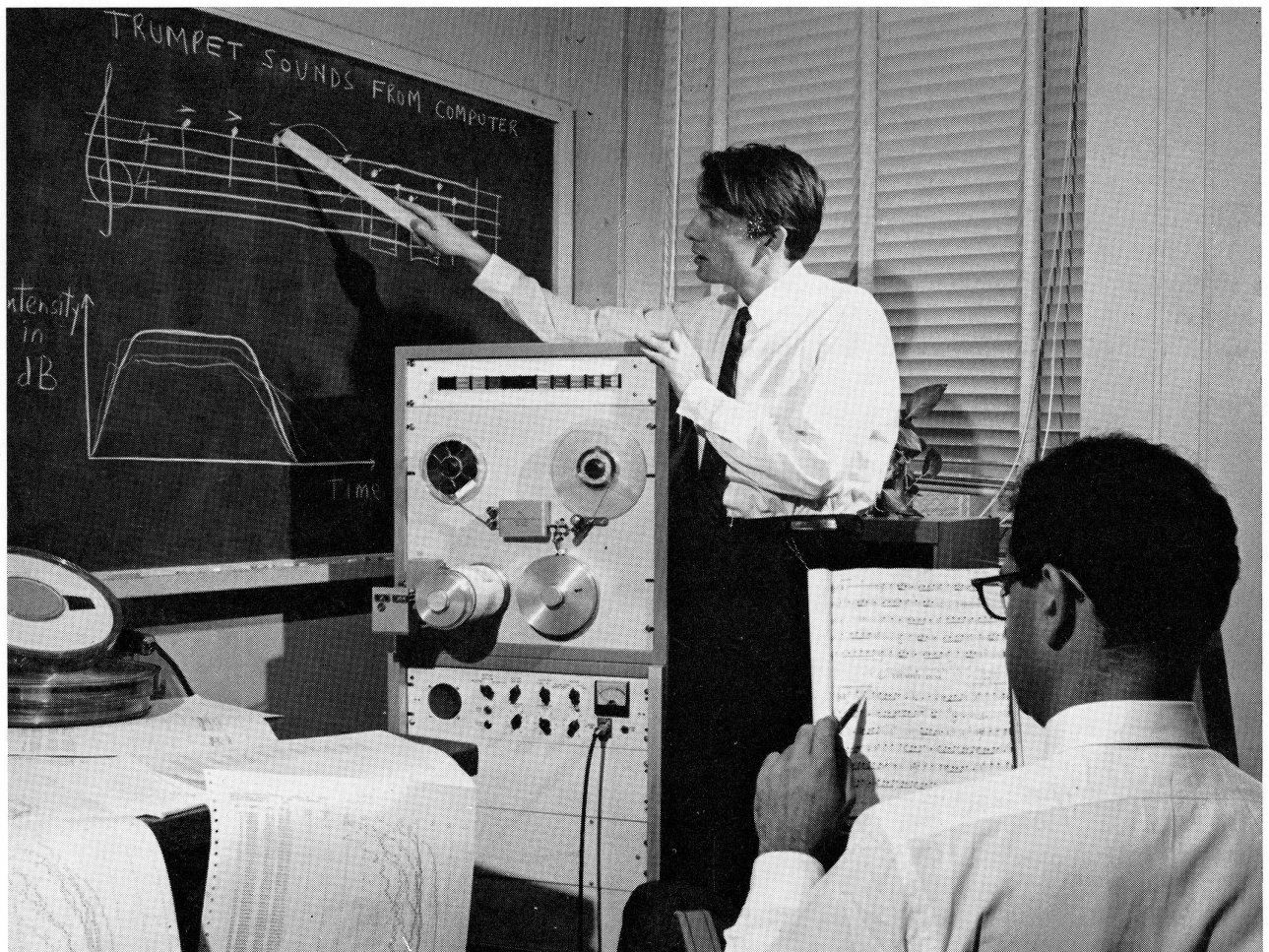
It is easy to go from this use of the computer to the idea of having the computer produce by prescribed rule a sequence of numbers to be converted into the corresponding sound. This is what we did. Our work has been described in a number of publications.<sup>4,5</sup>

The computer is an interesting source of sound,

whether the sound be synthetic speech (toward which we are working) or sounds which might be used in music. For the computer is a universal source of sound, without any of the specialization of the human voice or of musical instruments, either mechanical or electronic. A mathematical theorem, called the sampling theorem, tells us that if a musical or other sound contains no frequencies above the frequency  $B$ , the sound can be accurately and completely represented by and re-created from a series of  $2B$  numbers per second, numbers which describe the amplitude of the sound wave at equally spaced *sampling times*.

Thus, if we want to use the computer to generate sound waves with frequencies no higher than 5000 cycles per second, we cause the computer to write

*Jean-Claude Risset follows Purcell trumpet score while listening to computer-synthesized version played back on tape*





#### PROGRAM CARDS

general instructions for generating sequences of numbers specifying sounds

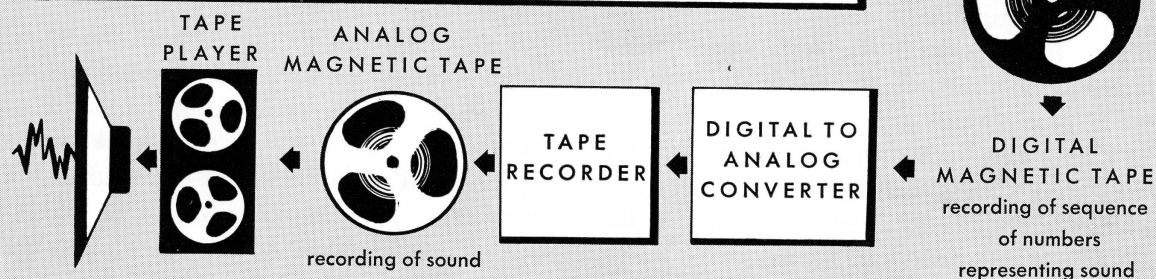
#### "INSTRUMENT" CARDS

particular instructions for wave form, attack, vibrato, tremolo, etc.

#### "NOTE" CARDS

"notes" or sequences of pitch, amplitude, duration, or rate of change of sounds that the "instruments" play

## GENERATION OF COMPUTER MUSIC



10,000 numbers per second on a magnetic tape. In order to produce a sound wave, these numbers are read out through a digital-to-analog converter. When the resulting sequence of pulses is passed through a low-pass filter whose bandwidth is 5000 cycles per second, the output will be a smooth wave, representing the sound. What numbers do we cause the computer to write? We program the computer to choose the numbers according to some rule; for instance, a very simple rule might be that the samples be ordinates of a sine wave of specified frequency and amplitude. We can go beyond this to other wave forms and to more complicated specifications.

Let me emphasize the universality of the computer. It can in principle produce any sound, not only any hearable sound, but any possible sound of limited bandwidth, whether or not the ear can distinguish that sound from other sounds.

Compared with this potential universality, the sounds we actually have produced cover a comparatively narrow range. Yet these sounds have seemed to us to have interesting, or we might say musical, qualities. The range of sounds produced overlaps the range of conventional musical sounds. The computer sounds exhibit some features which are not found in conventional music and, alas, conventional music exhibits many desirable features which we

have not been able to produce by means of the computer.

Our procedure has been to generate various sounds and present them in simple man-made musical compositions. Just hearing a sound once is insufficient for us to make a judgment concerning it. Repeating a sound indefinitely is boring. Thus, we have felt that in exploring sounds it is best to put them in some simple, short musical context. Many of our experiments are available on a Decca record, "Music from Mathematics."<sup>6</sup>

The examples given on the record are arranged in a rather arbitrary order, which somewhat obscures the progress we have made and how we were led from one thing to another. I propose to recapitulate some of the successive steps we took in attaining a greater variety and better quality of sound.

In a very early piece called "Stochatta," the musical sounds were merely sine waves and squarish waves, which were turned on and off abruptly. There was a little more flexibility than in the electronic organ in that the amplitudes of the sounds could be chosen at will and very complex rhythmic patterns could be easily produced, but in other respects the sounds of "Stochatta" are much more primitive than those of a good electronic organ.

We of course knew very well from musical lore



that variations of amplitude and frequency with time are extremely important. We surmised that an abrupt rise and gradual fall in the amplitude of a wave would give the sound a plucked quality, and that a small sinusoidal variation in frequency would add the pleasantness or warmth associated with vibrato. The validity of these conjectures is demonstrated in a short piece called "Variations in Timbre and Attack." This piece also exhibits a peculiar slurring quality associated with an abrupt frequency shift near the beginning of a note. In this piece a simple melody is played in the first three sections, but in the fourth section two quite different sequences of pure sinusoidal tones are played. However, the *difference* between the frequencies of the two simultaneous tones is always the frequency of a note of the original simple melody. And, it is the original melody that the listener hears.

There are some effects which are very difficult, if not impossible, to achieve with conventional instruments. One is an extensive or very rapid portamento — a smooth shift in frequency during the playing of a note. Another is the use of scales with arbitrary numbers of notes per octave. An early piece by M. V. Mathews, called "Numerology," exhibits both of these. In this composition a very rapid portamento in a high register gives a chirping sound. Part of the composition is written in a ten-tone equally tempered scale.

It is easy to make the computer generate pseudo-random noise. Indeed, one can generate noise with various bandwidths, and one can impose noise on periodic waves, either by adding it to the wave forms or by using the noise to modulate the amplitude or the frequency of the wave. This makes it possible to produce sounds which range from periodic to completely noisy. But because they are band limited around some central frequency, even the noisy sounds can have, if not a precise pitch, at least the quality of being high or low in pitch. Some of the potentialities of a mixture of periodic and noisy sounds are realized in a piece by M. V. Mathews, "The Second Law," and in "Noise Study," by J. C. Tenney.

Thus, at first our course was to follow a conjecture that some feature, such as wave form, or vibrato, or attack, or randomness, would have roughly predictable and musically interesting subjective effects.

This led us through a considerable range of sensation. Some things, however, eluded us. For instance, we have not yet produced anything with the sense of fullness of an orchestra or a choir of instruments. At one time we believed that adding a little randomness to sounds would produce this effect, but although a small amount of randomness does make a sound a little richer, we have never attained the sensation of many instruments, and we now know that increasing the randomness in simple ways merely makes the sound noisy.

Another frustrating thing is that although we produced sounds which seemed "plucked" — like those made by guitar, mandolin, or harpsichord — and sounds that were fluty and recorderlike and reedy, we stumbled upon no violinlike sound or brasslike sound. This led us to believe that it would be necessary to examine the sounds of orchestral instruments very closely to see if there were simple physical features of the wave form which would enable us to attain a wider variety of timbres without outright imitation.

We had reason to believe that this approach might be profitable. For instance, Fletcher, Blackham, and Stratton<sup>7</sup> had shown that the warmth of piano tones, especially in the lower register, is associated with the fact that the overtones are not strictly harmonic, but lie above the harmonic frequencies because of the stiffness of the strings. At the Bell Laboratories J. C. Tenney, in studying bell sounds, confirmed the well-known fact that overtones far from harmonic frequencies give a harsh bell sound. He also found, however, that if the overtones are exactly harmonic the sound is not like that of a bell at all and is, indeed, much less interesting.

In 1964 J. C. Tenney, who had been at the Bell Laboratories for two years, went to the Yale School of Music. He was given a National Science Foundation grant to study the relation between objective features of sound-wave forms and their subjective correlates. His aim was to discover what features of sound waves are important to the musical quality of a sound, and what features are irrelevant or unimportant. He has studied violin sounds intensively by means of computer harmonic analysis of successive pitch periods.

Helmholtz held that a moving violin bow grips the string and holds it until the original disturbance of



*Vladimir Ussachevsky at the console, Columbia-Princeton Electronic Music Center*

the string by the bow travels as a wave up to the end of the bridge near the nut, is reflected, and returns to the bow. Tenney's work indicates that this theory is faulty, and that the bow releases the string sooner than Helmholtz asserted. Tenney found that every third harmonic is weak in the upper range of violin sounds. This indicates that the string moves with the bow for about two-thirds of a cycle. Further, the deletion of harmonics which are multiples of three tends to impart a violinlike or cellolike quality to computer-generated sound.

In 1964 J. C. Risset, a young French physicist with considerable musical training and insight, came to the Bell Laboratories for a year. During that period he worked on the analysis and synthesis of trumpet

sounds. He found that a number of factors are extremely important. One is that the overtones rise later but more rapidly than the fundamental. Another is that the overtones are stronger relative to the fundamental in loud trumpet sounds than in soft trumpet sounds. This is reminiscent of the fact that the overtones are stronger in a loud or shouting voice than at normal conversational level — the reason television commercials remain insistent even when we turn the volume down. Risset was so successful in synthesizing trumpet sounds that trained musicians are unable to distinguish the synthesized from the natural sounds with better than chance accuracy.

Other examples indicate how it is possible to increase the variety of computer-produced sounds. For



instance, R. N. Shepard has produced sounds in sequence which seem to rise in pitch, step by step, yet which never in fact leave the octave.<sup>8</sup>

To the musician and, especially, to the composer, the computer offers an instrument for sound production which is in principle infinitely flexible, though the exploitation of this flexibility calls for considerable knowledge and insight. The computer has no inherent scales, harmonic intervals, or timbres, and no limitations of rhythm, tempo, or dynamics — the composer can choose freely, accepting or rejecting tradition in any degree. But, if a composer is to use a computer, he can no longer call on the instrument maker or the performing artist for help. If he wants notes or intervals outside of a traditional scale, he must specify what frequencies he wants. If he wants a particular sound quality, he must supply the computer with an objective description of a wave form which will give the desired psychoacoustic effect. If he wants to achieve expressive effects through legato, staccato, crescendo, or ritardando, he must put these into his instructions to the computer. Yet the result may eventually be worth the difficulty. And, by assuming these responsibilities, a composer can potentially go beyond the capabilities of any instruments or of any performers. Here is a challenge to composers, old and young, to master a new musical language in order to make use of a new mode of expression.

To the student of music the computer, with careful psychoacoustic experimentation, makes it possible to attack many problems experimentally which have in the past been approached chiefly "philosophically"; that is, with heated debate and disagreement. The way of science is not to seek agreement on arbitrary questions, but to discover in what range of experience we are forced into agreement by experiments which can be replicated. I think that psychoacoustics, together with the computer, can put us on firmer ground in a number of respects.

Some aspects of the question as to what "rules" of music should be attributed to acculturation and what to the nature of the human being — to the limitations and capabilities of his hearing and to his ability to remember sequences of sounds — are certainly amenable to experiment. Indeed, recent experiments by Plomp and Levelt<sup>9</sup> seem to me to show the inescapability of Helmholtz's theory that consonant intervals

are those in which the harmonics of the two tones coincide or are adequately separated in frequency. Moreover, this work casts further light on the question of consonance.

The use of the computer in producing with great ease accurate tonal and rhythmic patterns opens the way to all sorts of interesting investigations. Among these could be whether the procedures of twelve-tone composition do give an acoustic as well as a numerical unity to compositions. In plainer terms, is the sort of orderliness that twelve-tone composers introduce into their compositions apparent to the listener? (The fact that music judged as good is orderly does not imply that music which is orderly need be judged as good.)

Whatever computer generation of musical sounds can mean to composers and to students of music, it is pertinent to my work for what it means to the science and technology of acoustics. Sound quality and the problems of understanding vocal sounds and generating high-quality artificial speech are all central to communication. To arrive at an understanding of the quality of sounds calls not only for sharp minds, but for sharp ears. I feel that a strong effort on the part of musicians in the understanding and synthesis of good musical sounds will be invaluable to psychoacoustics in other fields, including that of communication.

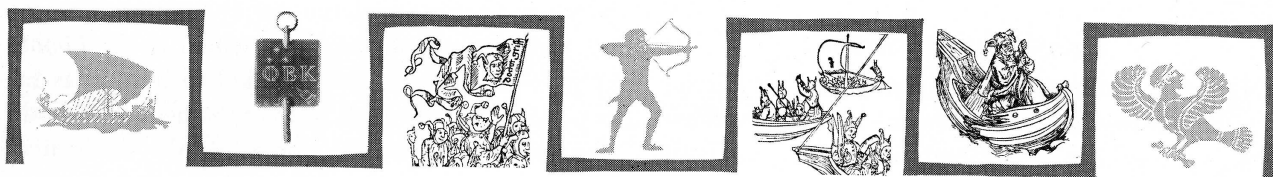
#### REFERENCES

1. COUPLING, J. J. 1950. Science for art's sake. *Astounding Science Fiction*.
2. HILLER, LEJAREN and BEAUCHAMP, JAMES. 1965. Research in music with electronics. *Science* 150: 161-169.
3. PIERCE, J. R., MATHEWS, M. V., and RISSET, J. C. Further experiments on the use of the computer in connection with music. To appear in *Gravesaner Blätter*.
4. MATHEWS, M. V. 1963. The digital computer as a musical instrument. *Science* 142: 555-557.
5. PIERCE, J. R. 1965. Portrait of the machine as a young artist. *Playboy* 12: 124.
6. "Music from Mathematics," Decca Record DL9103 (monaural) or DL79103 (binaural).
7. FLETCHER, H., BLACKHAM, E. DONNELL, and STRATTON, RICHARD. 1962. Quality of piano tones. *J. Acoust. Soc. Am.* 34: 749-761.
8. SHEPARD, R. N. 1964. Circularity of judgments of relative pitch. *J. Acoust. Soc. Am.* 36: 2346-2353.
9. PLOMP, R. and LEVELT, W. J. M. 1965. Tonal consonance and critical bandwidth. *J. Acoust. Soc. Am.* 38: 548-560.

# PHILOSOPHY

## THE PILOT OF LIFE

BY LUDWIG EDELSTEIN



IN THE BEGINNING, the ideal of Phi Beta Kappa was shrouded in becoming secrecy. The minutes of the first meeting of the Founding Fathers give only the initials of the motto adopted as the name of their society.<sup>29</sup> Now, the words to be spelled out are well known. *Philosophia biou kybernetes*, philosophy, the pilot of life: This has, from the very first, been the proud contention, the message of Phi Beta Kappa. The handshake, the brotherly love that one member owes the other, the friendly communion designed "as a recreation to the philosophic mind, satiate with investigating the various springs of human nature and human actions"<sup>29, 16</sup> — such an outward sign, such a bond of attachment, and such a community of thought and discussion are but the manifestations of the lofty creed which inspired the founders of the Society, of their conviction that philosophy must be and is, in fact, the true and only steersman of life.

Yet, if we are honest, can we deny that their belief is not ours? To be sure, we still compare human life with traveling on the high seas, but the voyage, in our opinion, is guided by altogether different forces.

The windows of our bookstores are replete with copies of novels called *The Ship of Fools* or *The Black Ship to Hell*. Our historians and sociologists and statesmen, and even most of our philosophers, are no more sanguine than are our novelists. "We sail a boundless and bottomless sea," they are fond of saying, "where there is neither starting point nor appointed destination, and where our sole aim can be to keep afloat on an even keel."<sup>18</sup> Our ship has no pilot. And were we to complain, like Odysseus, that we are being sent on a long and dangerous voyage without a steersman "to guide us on our way," the only consolation we would receive (or would accept) is the one given to Odysseus by Circe, the sorceress: "The winds will carry you"<sup>11</sup> — that is, in our language, I suppose, external circumstances and powers other than our own.

The ideal of 1775, engraved on Phi Beta Kappa keys, is, then, no longer engraved on our hearts. We disregard it, we even slight it. Are we right in doing so? This, it seems to me, is a question no one can avoid asking in the present situation as in all times,



*Philosophia biou kybernetes*



1806

for it touches upon the fundamental problems of human existence. To give an answer is difficult and hazardous. I venture to prepare the ground for finding it by recalling what has been said and can be said in favor of the message of the motto. Undoubtedly, the ideals which we reject deserve that much attention. Otherwise, their rejection is in danger of becoming dogmatic and unreasoned.

### *Philosophy as reason*

Let me begin by tracing the source from which the words *philosophia biou kybernetes* were taken, clarifying the teaching they embody and our quarrel with it. Certainly, the saying was not an invention *ex nihilo*. As has long been recognized, it is probably the Greek adaptation of a phrase of Cicero's, itself taken from a Greek author: *O vitae philosophia dux*,<sup>3</sup> "O philosophy, you leader of life."<sup>7</sup> Speaking of philosophy as "the leader" of life, Cicero thinks of it as the force that civilized men, founded their cities, created their laws, and secured their existence. In short, he thinks of philosophy as the instigator of practical and theoretical life; he defines the task of philosophy in its broadest sense. The Greek rendering that makes of philosophy "the pilot" of life shifts the emphasis not insignificantly and stresses the role that philosophy plays in an *individual's* life. As our pilot, philosophy gives direction to our voyage; it tells us where we ought to go. It brings us to the port of destination; or, if this proves impossible, it at least tells us what is the right course and makes us follow it. "Let us steer our own ship," says Seneca, "and not allow (outside) powers to sweep us from the course. He is a sorry steersman who lets the waves tear the helm from his hands, who has left the sails to the mercy of the winds and abandoned the ship to the storm; but he deserves praise, even amid shipwreck, whom the sea overwhelms still gripping the rudder and unyielding."<sup>26</sup>

As regards the word "philosophy," neither Cicero nor he who translated him into Greek does, I believe, use it in its formal sense.\* Both think of philosophy as the representative of reason, the reason which is able to discern the truth. He for whom philosophy is the pilot steers his ship by the light of those stars which shine in the world of true knowledge, "visible only to the mind, the pilot of the soul," as Plato has it.<sup>19</sup> On the square medal of Phi Beta Kappa, devised "for the better establishment and sanctitude of our unanimity," there is, in addition to the Greek letters, "an index imparting a philosophical design, extended to the three stars, a part of the planetary orbit."<sup>29</sup> These stars are, I take it, the Sun, the Moon, and Venus, the triad distinguished as the most brilliant of the planets, the great rulers of the zodiac.<sup>5</sup> They symbolize the regular and undeviating course of the heavenly signs in which the eternity of truth becomes manifest to our bodily eye, and which, as the *Timaeus* puts it, our souls are destined to imitate as far as possible — the eternal truth of the heavenly abode from which the soul has come into the world here below.<sup>21</sup>

I hasten to add that the young men who adopted the motto, though young, can hardly have been naïve in their endorsement of reason, in their belief in its power as a pilot. Almost half a century before, a very different view of reason had been expressed, one still widely acclaimed at the end of the eighteenth century, and one of which they cannot have been ignorant. As Pope says in his *Essay on Man*,<sup>22</sup>

On life's vast ocean diversely we sail,  
Reason's the card, but Passion is the gale.

Here reason and insight have no power. "The card, the compass, neither propels the ship nor determines the direction in which it is to sail." It merely enables the mariner to know in which direction he is moving. It is the passions that provide "the sole dynamic factor in human behavior." And these passions are not only diverse, they are antagonistic to one another. "Every individual's will is dominated by some ob-  
sessing 'Master Passion,' which is the 'mind's disease':

Reason itself but gives it edge and pow'r,  
As Heaven's blest beam turns vinegar more sour."<sup>15, 22</sup>

\*The contrary is maintained by Ducasse.<sup>6</sup>

How modern is the theory, even though the conclusion is not! For this chaos of individual passions in the end becomes a cosmos of harmonious living; the selfishness of the one individual is counteracted by the selfishness of the others; taken together, they mysteriously create an "according music," "the joy, the peace, the glory of mankind." For God has so ordained things; His invisible hand has arranged them in such a way that private vices become public virtues.

### *Vision of greatness*

This was perhaps the basic belief also of the fathers of the American Constitution.<sup>15</sup> It was *not* the belief that brought the founders of Phi Beta Kappa together to discuss the problems they were interested in, "remembering that everything transacted is transacted *sub rosa* and detested is he that discloses it."<sup>29</sup> Their questions were youthful questions — whether dueling is to be abolished, whether it is advantageous to a scholar to be in love — as well as questions, if not of greater depth, at least of more general concern — for instance, whether public education is preferable to private education, whether stealing in extreme want is morally permissible, whether there is anything more dangerous to civil liberty than a standing army in peace time, whether Brutus was justified in killing Caesar, whether all

affections and principles are not in some measure deducible from self-love.<sup>29</sup> In asking such questions, they sought for the true, the right, the better, for what the individual ought to do; and they hoped to ascertain it through reason, through continuous and reasonable argumentation. For they believed in what has been called the Heavenly City of the eighteenth-century philosophers.<sup>1</sup> To them, man, guided by the light of reason, seemed capable of finding out what is the good life and thus of achieving it. Certainly, he can fail in his efforts if the circumstances are against him. Even then, however, he has the consolation of knowing that he is doing the right thing, persevering in it so that his cause may have another day — here or there. Those who founded Phi Beta Kappa subscribed to Seneca's verdict that "no fortune can shut off the wise man, the reasonable man, from action . . . he is ready for either outcome: If it brings goods, he controls them; if evils, he conquers them . . . neither poverty, nor pain, nor anything else that deflects the inexperienced and drives them headlong restrains him from his course."<sup>27</sup>

I need not say that such an attitude is the very antithesis of the attitude which, in our time, tends more and more to be endorsed in matters of private and public concern. As individuals, we hardly trust in life until we can control it. Our mood is not to judge situations but to work them out by giving par-



*"As moral agents, as men who choose values," Ludwig Edelstein wrote in this adaptation of one of his last public addresses before his death in August of this year, "we draw the balance of our life and take account not of particular acts alone, but of the sum total of our existence; in short, we do not think of ourselves as voyagers, but assess our merit as pilots." The intrinsic humanitas et ratio of Ludwig Edelstein will be long esteemed and cherished by his friends at The Rockefeller University.*



ticular answers to particular problems. Sorrow and mental anguish, we have learned, need not be conquered by the mind; they can be removed from the domain of the mind once it is tranquillized by drugs. Even at the death of those whom we love, we shrink from dying a little ourselves, from withdrawing from the world of the living. This at least is the wisdom we are disposed to cherish. It is the wisdom of adjustment. We live in the moment and for it. Reality, as we call it, takes precedence over principle.

And concerning affairs of the common weal, we are wont to say that the less man clogs the free play of his mind with political doctrine and dogma, the better for his thinking. Some, to be sure, still complain of a "tired lull" and the absence at present of argument on general politics, and are disturbed by the fact that programs and ideals are forgotten by all parties. Many more, I am afraid, will agree that it is a token of greater national maturity to be un-

*"On life's vast ocean diversely we sail"*



disturbed by the workings of political philosophy, hoping that we will long continue to be undisturbed by them.<sup>17</sup> We are empiricists; we are practical, and we take pride in both. We are determined by events, not by intellectual movements. Our criterion is success or, if you prefer, "what works best." Pregnant failures, not unknown in history, which turn out to have made vital contributions to the achievement of tomorrow, go without acclaim.<sup>2</sup>

### *Man and nature*

In short, neither in private nor in public life do we trust in the pilot of the ship who says, to quote Plato's famous parable, that he must give his attention not only to the ship and its present condition, but also to the time of the year, the seasons, the sky, the winds, the stars, and all that pertains to his art, if he is to be a true ruler of a ship. Such a pilot, to us, is "in very deed . . . a star-gazer, an idle babblers, a useless fellow."<sup>20</sup> For there is no art or science of life or politics that prescribes "the right course." It is not that we argue that a ship "navigated in the happy-go-lucky manner could ever arrive into port."<sup>24</sup> We question whether there is a port into which we are destined to arrive, and whether, if there were one, we could discover it.

The Platonic parable, the plea that the ship be steered by a "true ruler,"<sup>20</sup> announced a new enterprise, a new adventure in human history. Through Greek philosophy, man, for the first time, saw and experienced himself as entirely different from nature; for the first time, he understood that he had a possession peculiarly his own, reason or spirit or however you wish to translate the Greek term *logos*.<sup>24</sup> Thus philosophers, as the Greeks would say, invented, or as we would put it, proposed the interpretation of man as a rational being. Their belief in his rationality was to constitute the common ground of the metaphysical systems that reigned through the ages up to the eighteenth century, while the counterargument of the materialists and biologists remained a weak undercurrent.<sup>25</sup> The nineteenth century became doubtful of the Greek venture. We are convinced — and it is not a matter of mere whim — that it has failed. For the proud claim of the past, we hold, has been shown, by stubborn and irrefutable facts of nature and history, to be an illusion. This is our mature judgment, in which, despite a feeling of

superiority, there is perhaps, as so often in the judgment of the aged and the more mature, an overtone of regret, of sadness that the dreams of youth should have proved to be dreams.

Are we right in our contention? I would surely go beyond all bounds of propriety, and far beyond the limits of my knowledge, were I now to indulge in a metaphysical discourse on idealism and naturalism. But there are certain experiences that have given rise to the concept of the *homo sapiens*, the rational being, just as others have given rise to other interpretations of human nature, such as the concept of the *homo faber*, man the maker, the empirical, positivistic, pragmatic being, and to many more which the philosophical anthropologist, the student of man's self-interpretations, is fond of distinguishing. And I stay within my province, I think, in raising the question of whether the data which the concept of man as a rational being summarizes are not still data to which no other concept of his self-interpretation does equal justice.

### *No — in rational thunder*

To start with, I shall quote two texts that describe what in the parlance of modern philosophy is called the human situation. I have selected them not from poetry or novels, for the poets and the novelists, though to be sure the Muses have given to them to tell the truth, are not infrequently also tellers of lies, as the old proverb has it. Nor do my examples come from philosophical textbooks, which one may suspect of bias. They are taken from the book of reality. They are simple records of what happens, not, to be sure, in times of prosperity, not in happy times when men usually recoil from facing the ultimate questions, but in situations where they act under the duress of conflict, of that life-and-death struggle which, since the First World War, has been faced almost daily in some parts of the world by people put in prisons, in concentration camps. In short, my examples are taken from accounts of members of the German and French Resistance.

The last words of one of the leaders in the German opposition to Hitler, who committed suicide, were these:

Everybody will now turn upon us and cover us with abuse. But my conviction remains unshaken: We have done the right thing. Hitler is not only the archenemy of



*"a ship navigated in the happy-go-lucky manner"*

Germany; he is the archenemy of the world. In a few hours I shall stand before God answering for my actions and my omissions. I think I shall be able to uphold with a clear conscience all that I have done in the fight against Hitler. . . . Whosoever joined the Resistance movement put on the shirt of Nessus. The worth of a man is certain only if he is prepared to sacrifice his life for his convictions.<sup>28</sup>

Sartre, simply reporting on what everyone in the Resistance experienced, speaks no differently:

Exile, captivity, and especially death . . . became for us the habitual objects of our concern. We learned that they were neither inevitable accidents, nor even constant and exterior dangers, but that they must be considered as our lot itself, our destiny, the profound source of our reality as men. At every instant we lived up to the full sense of this commonplace little phrase: Man is mortal. And the choice that each of us made of his life and of his being was an authentic choice because it was made face to face with death, because it could always have been expressed in these terms: "Rather death than. . . ." And here I am not speaking of the élite among us who were real Resistants, but of all Frenchmen who, at every hour of the night and day throughout four years, answered No.<sup>23</sup>

The power to say "No" in a given situation, the



experience described in these two documents, is, I believe, the starting point for the interpretation of man as a rational being. For although this power does not always appear with the dramatic emphasis which it has at crucial points of life, it pervades our whole existence. The ability to say *no* to the moment constitutes our humanity, and for the rationalist, it is the gift of reason. For reason is not only capable of formulating principles of insight or of action; it is first of all a liberating force, the power to negate.

### *To conceive a world*

One aspect of this reason which restrains us like a golden cord is set forth by Plato with great precision. Our appetites, he says in the *Republic*, our drives — thirst, for instance, is just thirst — are “neither of much nor little nor good nor bad, nor in a word of any kind.” The thirsty man, in so far as he thirsts, wishes nothing else than to drink, and his impulse is toward this. But something “draws him back.” There is not only that which “bids” him to drink, but also that which “forbids” him to drink. And while the one “draws and drags,” the other calculates and reckons. While thirst “drives man like a beast,” reason, instead of “bidding,” forbids; it says, “Thou must not,”<sup>20</sup> and asks us to choose. But it is not only with regard to drives and passions that reason makes us abandon unconscious responses. Living within the domain of concrete reality, we are subject to the ever-changing sense perceptions which impinge upon us. Reason opposes to these fleeting impressions of the Here and Now an emphatic No, building out of the momentary and the passing a world of permanence — of concepts, of essences. All understanding is bought at the price of denying the truth of the moment. By negating the world of perceptions, we conceive another world through reason.<sup>25</sup>

In this sense, man, compared with the animal that always says *yes* to drives and perceptions, even when it avoids them or flees from them — man, the animal endowed with reason, the being who can and does say *no*, is “the ascetic of life,” “the protestant par excellence” against sensual reality.<sup>25</sup> And it was through the use of his reason that he conquered himself and the world. The passage in Cicero from which Phi Beta Kappa’s motto is derived means just this. Whatever the role played by need, as the ancients say, by the instinct of self-preservation, by the neces-

sities of survival, at the very beginnings of human history, it was under the leadership of reason that cities were founded, that laws were formulated and governments instituted, that science arose, an objective analysis of phenomena replacing the fancies of mythology. Thus civilization was created; and with it arose the concept of humanity, of the unity of mankind, as well as the belief in continuous progress which leads man from a stage of savage and barbaric existence, where he is no more than another animal, to ever higher states of life.

This ancient philosophy of culture was obscured



*“by negating the world of perceptions, we  
conceive another world through reason”*

in the Middle Ages. The pilot of the boat was supplanted by Fortune — sometimes glad, sometimes sad — and her wheel on which men climb and fall. The lesson was that we should turn from earthly things to the contemplation of the eternal. The Renaissance spoke of Fortune as the goddess with the sail; but while she is directing the boat, man sits at the oar and rows. Resignation had given place to new trust in human strength. Soon, reason as the pilot was rediscovered. In the eighteenth century, belief in it became a commonplace. Dare to use your reason (*sapere aude*), urges Kant in the little essay in which he explains the meaning of “Enlighten-

ment." Through daring to use reason, man leaves behind the state of non-age, grows to maturity, goes farther and farther.

### *The questions*

But has reason such power? Can one assume with the rationalists of the old school that there are in man two forces entirely different in origin? Can one, in the old-fashioned way, distinguish between body and soul and maintain that reason controls impulses? Is it not in reality led by them? Does reason not evolve out of life? One cannot fail to ask these questions. In answering them, I shall again not rely on metaphysical deductions, but point to the situations and to the reflections upon them that underlie the metaphor of the ship and the pilot and the self-interpretation of man as a rational being.

"It cannot be," Plato asserts in the *Republic*, "that the same thing with the same part of itself at the same time acts in opposite ways about the same thing . . . (For) I fancy it is not well said of the archer that his hands at the same time thrust away the bow and draw it nigh, but we should rather say that there is one hand that puts it away and another that draws it to."<sup>20</sup> And the one hand we call irrational, the other, rational. We are forbidden to proceed otherwise by the law of contradiction. Or, to translate Plato's words into categories more fitting to the modern mode of thinking, the principle that transcends what we call life in the most general sense cannot be merely an element of life which belongs to the psychic and vital functions and capacities and thus falls into the provinces of psychology and biology. As a principle opposed to life, even to life in man, it is outside the realm of evolution, "and if reducible to anything, leads back to the ultimate ground of Being of which life itself is a particular manifestation." It is therefore that *logos*, reason or spirit, cannot be thought of as "an episodic fact of earthly life"; it is, as it were, of the fabric of the whole that comprises us and everything which exists.<sup>25</sup> This essay is perhaps the most searching analysis of the symbol of the *homo sapiens*.

This dualism does not, of course, gainsay the fact that these antagonistic principles are not mutually exclusive. Some rationalists, it is true, have assumed that man must make a choice between life and reason, that reason by itself is creative even of action.

This, I think, was not the conviction of Plato, or of any of the great ancient rationalists, or of those who later followed their lead. Rather, they assigned each force its own and indispensable role. The impulse to act comes from life. But it is mere response to what happens. By saying *no* to the moment, to the immediate and blind reaction, reason opens the possibility of proceeding in another way and in addition kindles a light through which reaction becomes action. Having liberated or released man from his servitude to the data of experience, having repressed his momentary wishes and instinctual drives, it proposes to



*"it is not well said of the archer that his hands at the same time thrust away the bow and draw it nigh"*

the impulse to act, which it cannot itself create, other images that provide guidance. Becoming "the pilot of the boat," reason brings about the realization of the ideas and values of which it is the source.<sup>24</sup>

Of course, the voice of reason which says "you ought not" or "you ought rather" does not necessarily provide an altogether unfailing sense of direction. No age would have claimed this. The insight into the relativity of rational thought or into the historicity of human knowledge has merely been formulated more clearly in the nineteenth and twentieth centuries; it was not foreign to the ancient rationalists or to those of the eighteenth century. Herodotus expatiated on



*"the Ship of Fools may  
arrive in port, but not even  
all of its passengers truly  
desire to go where it anchors"*

the variety of the interpretations of the lawful which is to be found among the nations of the globe. Plato and Kant emphasized the dialectical nature of reason. But for the rationalist, neither the dialectic of reason nor its involvement in the historical process proves its impotence. The good, the true, the beautiful, the planets to which the index on the Phi Beta Kappa plaque points, run their immutable and eternal course, though when we look at them from our station here on earth, they seem to have irregular motions. Likewise, the fact that mountains appear to take on different shapes from different angles of vision does not argue that there are no mountains or that they have no shape at all or any shape imaginable. The relativity and historicity of so many values must not deceive us into believing that no standards are generally accepted.\* The light of truth, broken as it is into the spectrum of individual existence, still is the reflection of the light of a truth absolute, not relative, everlasting and not waning. Through discussion, through argument, through ever renewed consideration of problems, we do find the better in the course of time — as much of the truth as mortal eyes are able to discover. That is why the unexamined life is not worth living, why the rational man indulges in matters of speculation and never desists from argumentation.

### *Pain of Prometheus*

Not only is the voyage undertaken with a fallible sense of direction; not only do new vistas come into sight where the old landscape appears in a changed form; it is also a voyage that may be stormy, that may even end in shipwreck. Suffering is an ineradicable part of life. There are victories and defeats in the history of individuals as well as of societies. And especially in the story of the spirit of liberty, the protagonist is often cast in the role of Prometheus, "de-

\*This is beginning to be admitted also by anthropologists and sociologists; see Merlan.<sup>16</sup> I have borrowed the metaphor of the mountain from Carr.<sup>2</sup>

## Das Narren Schyff.



fying the Powers of this world," powers that "are ruthless, competent, and strong, and among the properties in the play there are real lightning and a real eagle."<sup>10</sup> Yet whether we think of man as an individual or as a member of the community, it is just in the inevitable vicissitudes of life that the force of reason shows itself most strongly. The rationalist, suffering pain, asks not only "What caused it?" or "How can it be removed?" This is a matter of practical intelligence, and the answer lies with such sciences as physiology, psychology, or medicine. He asks also, "What is pain itself?" and "What must be the nature of things that such a phenomenon as pain is possible?" If encountering a poor man or seeing a man dying, he asks, "What is poverty or death?" and "What is a world in which such things happen?" Thus distinguishing essence from existence, he reaches out into another realm. He becomes conscious of the fact that he is at home not only here, but also there — that he has a dual citizenship, as it were. The suspension

of the momentary impressions, the entering into "those regions where the pure forms dwell," makes him superior to "the anguish of earthly existence" as well as to the fear and anxiety of the existentialist, unable to "realize the general, the universal," as Kierkegaard said of himself.<sup>9</sup>

It is not that suffering ceases, that through understanding the hardship of life is annihilated. The pilot, say the ancients, "is harmed by any circumstance which does not permit him to make port, frustrates all his efforts, and either carries him out to sea, or holds the ship in irons, or strips her masts"; but he is harmed "not as a pilot, but only as a voyager."<sup>27</sup> The two are, so to say, two different persons, two different roles, and he must not mistake one for the other. Although as a passenger, as a voyager, the pilot can be harmed and his concerns be thwarted; although in playing this role and in suffering even the destruction of his individuality, he is forlorn and forsaken, he is not alone in his role of pilot. His art brings him into communication with all who have reason. For reason, by its very nature, is universal, and he who clings to it is united with all who share in reason, even with those before or after him.

### *What knowing is*

This, at least in broad outlines, is an account of the situations, of the reflections upon them, which gave rise to the metaphor of the pilot and the boat. But as I have indicated before, though we may find ourselves in the same situations, we understand them quite differently. We cannot persuade ourselves that reason teaches the truth, that to some degree it makes us masters of our fate. And it sounds paradoxical to us when we are told that "there are times when a man ought to be more afraid of living than of dying."<sup>12</sup> To us, experience, the observation of "facts," rather than reason, is the great teacher. Moreover, whatever our verdict on events in our own life or in the world at large, there is, it seems, nothing we can do about them. Things happen to us; history is made without us. Last though not least, whether men be driven by desires or guided by reason, they seek the realization of their wishes and hopes; fulfillment in this life is the goal, and failure to reach it is the refutation of our aspirations. With such convictions in our hearts and minds, how can there still be belief in reason as the pilot?

Yet it is well to remember, first of all, that it is not self-evident that knowledge is the knowledge of facts. Epistemological analysis inevitably leads to the result that all statements of fact involve interpretation — that is, an act of mind. Experience is made up of both the given and our thought about it. Facts as data of experience are arrived at through conclusions.<sup>14</sup> This is most obvious in the very sciences in which we trust most. For it is (or ought to be) a truism that they do *not* study facts in the commonly acknowledged sense of the word. The phenomena the natural sciences scrutinize, the world they analyze, is a world of constructs. Knowledge and its objects, as applied to nature, are one and the same. The study of atoms, electrons, and all the other natural constituents presupposes, as perhaps its most important piece of apparatus, not merely the inquiring mind, but the scientific mind as it has been shaped by the entire history of the human race, particularly by the history of Western civilization. Each stage of theoretical knowledge and practical skill is dependent on the one previously reached, on the progress made in the past, just as it prepares for the progress to be made in the future. Once the general hypothesis was made that the world could be understood by reason, nature became, in principle, understandable. Through more specific hypotheses, constantly reformulated, understanding has increased and will increase. Thus, it makes good sense to say that nature, as that which is known or knowable, exists independently of our knowledge merely as a "potential reality" that is actualized in the process of understanding itself.<sup>8</sup>

As for the problem of actions, individually performed or taken by the body politic, wherever one stands with regard to the issue of freedom and determinism, of whether men or impersonal forces are more decisive for the course of events, he will admit that not everything is possible in human affairs. We cannot discount the objective forces which we encounter and which not infrequently subdue even the greatest and strongest. Yet we are not on that account at the mercy of circumstances. Rather, we all, whatever our place, have an ineluctable share in the things to come.

For when we are on the point of making a decision but not yet committed to one, we must choose among alternatives. No matter what our convictions, we can-

not take refuge behind the dogma that events are inevitable. And while all options are still open, the future does not as yet exist as an object, as it were, at which we may look; it is still in the making. Deliberating on the possibilities before us, we are not least influenced by what we want, by our aims and concerns. These, as much as the forces existing outside, become themselves factors determining the future which we may theoretically hold to be decided; they become a criterion of choice. Therefore, the most stubborn fact about a given situation is the way we look at it. Our understanding of ourselves is part of our destiny. This is true of the individual with regard to his own life, as well as of the statesman with regard to the public good. It is not a sign of maturity, but rather of self-deception, to ignore political ideals or ambitions and hopes. For we cannot escape our responsibility for the events that take place. To some extent, we bring them about, as the moment of decision attests.<sup>8</sup>

### *Pilot, not voyager*

Finally, there is no denying that both idealists and materialists desire to get what they want, that they wish for the fulfillment of their intentions, crave the possession of the objects for which they strive. Yet, strange as the phenomenon may be from the point of view of the naturalist, and unique as it is in the animal kingdom, man, in addition, *judges* himself and his actions. Being a self-conscious animal, he is "both actor and spectator, both performer and commentator on or critic of the performance." And while as actor and performer he seeks his own satisfaction, as spectator and commentator he has a desire for distinction, for superiority, an emulativeness which is independent of what happens to him; he has an eagerness for self-esteem and the esteem of others, an approbateness, that is founded not on what he accomplishes, but on what he endeavors to achieve.<sup>15</sup> These gifts free us from considering as values merely the acquisition and possession of the things we desire to attain; they allow us to appreciate the significance of the aims envisaged. Strength is given to the principle, "Do unto others as ye would that they should do unto you." The phrase, "I ought to do this," in contradistinction to the phrase, "I desire to do this," becomes meaningful.<sup>15</sup>

At this point we begin to think of ourselves as

moral agents, as men who choose values, and to want others to think of us as moral agents; we draw the balance of our life and take account not of particular acts alone, but of the sum total of our existence; in short, we do not think of ourselves as voyagers, but assess our merit as pilots of the boat. The issue is not one of whether we have gotten into port, but whether we have chosen the right route and steered the right course. For this is what makes the good pilot; even shipwreck, if it is caused by uncontrollable circumstances rather than lack of skill and insight, does not lower our esteem for the pilot. The requirements of his art are fulfilled when he can say, as did the Rhodian of old, "Neptune, you shall never sink this ship except on her course."<sup>27</sup>

The art of life, the reasonable steering of existence, makes no greater demand upon us. We pray and hope, as we must, that we will be fortunate in carrying out our decisions. But we learn and have to learn that even when we are defeated, our aims and ideals are not yet refuted. To be worthy of the esteem of oneself and of others whom one respects, then, counts as much as success or failure. And we realize that the satisfaction of our desires dies with the moment that brings it, whereas the judgment on ourselves stays with us throughout our lives. In the shipwreck of today, we look to the future, when others may be luckier in the struggle whose outlines in the past we barely discern and whose final outcome we cannot predict.

If we view our earthly voyage in this light, if we want to do what is right, if we want to be able to approve of ourselves and to have the approval of others for the right reason, in order that the divine gift does not lead to our debasement, reason alone, philosophy, can show us which course to follow. The Ship of Fools may arrive in port, but not even all of its passengers truly desire to go where it anchors. The Black Ship to Hell surely reaches its destination, but those who land in Orcus have been turned into shadows. The ship of the skeptic, said Kant after he had completed the work in which he attempted to vindicate reason against skepticism and dogmatism, runs ashore for safety's sake, remains lying there, and rots. Reason is the only pilot who "may steer the ship safely whither he listeth."<sup>13</sup> Philosophy, the pilot of life — it is still a message which we neglect at the peril of life itself.



# REFERENCES

Review page number precedes colon; reference page follows

1. BECKER, C. L. *The Heavenly City of the Eighteenth-Century Philosophers*. New Haven: Yale University Press, 1932.
2. CARR, E. H. *What is History?* New York: Knopf, 1962, 10: p. 171; 14: p. 30.
3. CICERO *Tusculanae Disputationes* v. 2, 5.
4. CONRAD, J. *Chance*. Garden City, New York: Doubleday, 1921, ch. 1.
5. CUMONT, F. *Astrology and Religion Among the Greeks and Romans*. New York: Putnam, 1912, p. 47; see also pp. 79 and 22.
6. DUCASSE, C. J. "The Guide of Life," *The Key Reporter*, 1958, II, 2-6.
7. FITCH, E. "Phi Beta Kappa," *The Classical Weekly*, 1909, II, 143.
8. FRANK, E. "Nature and History" and "Time and Eternity," in Ludwig Edelstein (ed.), *Knowledge, Will, and Belief*. Zürich and Stuttgart: Artemis-Verlag, 1955, 15: pp. 396ff., 390ff.; 16: p. 400ff.
9. GRENE, MARJORIE, *Dreadful Freedom*. University of Chicago Press, 1948, p. 39.
10. HAND, L. *The Spirit of Liberty*. New York: Knopf, 1960, p. 154.
11. HOMER *Odyssey* x. 501ff.
12. HOOK, S. "Pragmatism and the Tragic Sense of Life," *Proceedings and Addresses of the American Philosophical Association*, 1959, XXIII, 13.
13. KANT, I. *Prolegomena to Any Future Metaphysics*. New York: Liberal Arts Press, 1950 (1783), Introduction, p. 10.
14. LOEWENBERG, J. "The Futile Flight from Interpretation," *University of California Publications in Philosophy*, 1950, XXV, 169-352.
15. LOVEJOY, A. O. *Reflections on Human Nature*. Baltimore: The Johns Hopkins Press, 1961, 8: p. 43; 9: pp. 46ff.; 16: pp. 82, 92, 100, 106, 112, and pp. 104ff.
16. MERLAN, P. "Existentialism—A Third Way," *Proceedings and Addresses of the American Philosophical Association*, 1960, XXXIII, 43-68; 7: pp. 43ff.; 14: p. 49.
17. NAMIER, L. *Personalities and Powers*. London: Hamish Hamilton, 1955, pp. 5-7.
18. OAKESHOTT, M. *Political Education*. New York: Cambridge University Press, 1951, p. 22.
19. PLATO *Phaedrus*, 247c.
20. ——— *Republic*. 10: vi. 489d,e and 497d; 12: iv. 439, 440b; 13: iv. 439b.
21. ——— *Timaeus*, 90bff. and 41dff.
22. POPE, ALEXANDER. *Essay on Man*, Epistle II, ll. 107ff. and ll. 147ff.
23. SARTRE, JEAN-PAUL. *The Republic of Silence*. New York: Harcourt Brace, 1947, pp. 498-500.
24. SCHELER, M. "Man and History," in *Philosophical Perspectives*. Boston: Beacon Press, 1958, 10: pp. 66, 71; 13: p. 2.
25. ———. *Man's Place in Nature*. Boston: Beacon Press, 1961, 10: p. 63; 12: p. 52 and pp. 54ff.; 13: p. 36.
26. SENECA *Ad Marciam de consolatione* vi.
27. ——— *Epistulae morales* 85. 9: pp. 38ff.; 15: p. 34; 16: p. 33.
28. SHIRER, W. L. *The Rise and Fall of the Third Reich*. New York: Crest Books, 1962, p. 1395.
29. VOORHEES, O. M. *The History of Phi Beta Kappa*. New York: Crown, 1945, 7: p. 1 and p. 9; 8: p. 1; 9: p. 10 and pp. 13ff., 58.



LUDWIG EDELSTEIN

THE TRIBUTE to Dr. Edelstein which follows is adapted from a memorial notice read by George Boas at a December meeting of the Johns Hopkins History of Ideas Club. Dr. Boas — eminent philosopher and author of many books, including *Rationalism in Greek Philosophy* and *Wingless Pegasus*—was a colleague of Dr. Edelstein at the Hopkins and one of his closest friends.

THE DEATH of our friend and colleague, Ludwig Edelstein, has deprived the learned world of one of its most eminent members. Born in Germany, educated at Heidelberg, he came to the United States and the Johns Hopkins University in 1933. His career in this country included posts in the history of medicine at Hopkins, in classics at the University of Washington and the University of California, and in the general field of humanistic studies at Rockefeller University and Hopkins.

This does nothing more than briefly indicate the diversity of his interests. It cannot even suggest the vitality with which he satisfied them, the impeccable accuracy of his findings, his devotion to the art of teaching. It is the last of these which was probably the most important in his own eyes. For the books we write soon become obsolete as new problems arise and new methods of solving them become formulated. But the gratitude of our students is something which remains as the one lasting reward for our labor. In Edelstein's case this compensated

for all the grief and pain which his last years brought him. I shall not, however, dwell upon them. For he was a Stoic when confronted by evils and he bore them with equanimity. He mitigated his Stoicism only when he could bring hope and moral sustenance to others.

He had an admirable gift of identifying himself both with the living and the dead. I recall vividly a lecture he gave to one of my own classes at Hopkins in the history of philosophy. I had asked him to talk to the students about Socrates, not only because he knew much more about him than I did, but also because he was himself so perfect an example of Socratic wisdom and intellectual humility. Listening to him, one was rejuvenated, for the charm of his description — of intellectual life in Athens, of the place of Socrates in this life, of the lampoons which the philosopher stimulated in the plays of Aristophanes, and of the beautiful tributes paid him by his most famous pupil — had a kind of magic in it which made one forget one's years and listen as a boy might listen to a venerated teacher. The students sat fascinated as they began to see emerging before their eyes that legendary father of all philosophers examining the confused youngsters of Athens as well as himself. In the process of expounding the method and ideal of Socrates, Edelstein became Socratic, modest, and ironic at the same time, eloquent in the very simplicity of his rhetoric. No lecturer in that course ever received the ovation that followed.

### *Humanitas et ratio*

Yet Edelstein was never the sparkling talker, the brilliant comedian, that so many popular professors become. His voice was never raised either in anger or pleasure. He was moderate in all things and Spartan in his grief. The one type of situation that could intensify his emotions was that which involved injustice or sophistry. On such matters he was immovable, firm, uncompromising. He had left his native country as soon as it fell under the domination of the Nazis, without waiting to be persecuted himself. Later at Berkeley he and seventeen other men and women in a faculty of eight hundred refused to sign the so-called loyalty oath which the Regents, not the Legislature of the State of California, attempted to impose as a prerequisite to holding a position in the University. Unfortunately, as in so many situations

in which financial security and a love of quietude are involved, many people urged the faculty to sign, saying that such oaths were only a matter of convention, that one could sign with mental reservations, that one should not be a troublemaker, that once one had signed one could assume the Communist technique of boring from within, and that there was nothing in the oath to which one could not subscribe. To Edelstein's mind such considerations were insulting.

If there was one thing of which this man was incapable, it was hypocrisy. If he believed, as he did, that the Regents had neither the right nor the legal power to demand their special oath, he would refuse to act as if he believed that they did have that right and that power. He was obviously in a position, as a naturalized citizen, that was uncomfortable, and he might have invented justifications for conformity. But this he simply could not do. A man who had refused to bow before Hitler could hardly bow before officeholders and compromise his personal integrity and belief in the sanctity of an oath. And it may not be irrelevant to add that in this stand he was warmly seconded by his wife and justified by the courts.

There was once a student at Johns Hopkins — in philosophy, I regret to say — who had just undergone a disastrous oral examination. The poor youth resorted to all the usual excuses to explain his failure. He was tired; he had slept badly the night before; he had not understood the questions; and those that he had understood were unfair. I can still see Edelstein putting his two hands on the man's shoulders. "It is much simpler than that," he said, "just try to imagine that you might be wrong." The faculty of imagining that one might be wrong he certainly possessed himself and to an exaggerated degree. He knew that the truth is evasive and the illusion of truth seductive. He wanted to be sure before committing himself. He could not bring himself to flatter even his closest friends. Sometimes he turned out to be ingenious in finding ways of telling the truth that would not hurt their feelings. I recall sending him a book of mine that had just appeared. "It's a good book," he wrote back, "but not so good as you could have made it." What is an author to reply to that?

He was, moreover, a sincerely humble man. If he had high standards for others, he had equally high ones for himself. It is on this account that his major

works will be posthumous: his study of the seventh Platonic letter, of the idea of progress in classical antiquity, and his edition of Erich Frank's book on the Pythagorean fragments, a work which his wife was to have completed after Frank's death. His collection of the fragments of Poseidonius may never appear, though it was begun at least as early as 1936. That he worked for so long on these volumes, not because of sloth but rather from a love of accuracy, is proved by the two volumes on Aesculapius which he wrote in collaboration with his wife. Some of us may have felt that he was too much of a perfectionist, but when one is in search of the perfect, where is one to stop?

So much is but the outer aspect of this really wise and generous man. To go deeper would be, I fear, to wallow in sentimentality. His death was a great personal loss to all of us who knew him intimately, as well as a loss to the Republic of Letters. The soft radiance of his personality will continue to brighten the lives of his pupils, but how can one revivify it in words? If I were a poet, I might be able to do him justice in an elegy, but I am hardly that. Friends — we have been told by one who knew — should and can share all their possessions, but on the other hand they cannot share their inborn talents. To be a friend of Edelstein was always to be a receiver, never a donor. One could give him nothing, for he lacked nothing. One might attempt to console him in his grief and assuage his suffering, but the attempts were all futile. He was relentlessly Spartan, perhaps even too Spartan. But no one can measure another's sorrows. In attempting to do so, one reveals more of oneself than of one's friend, and in Edelstein's case self-revelation is not what is needed. It is the fate of scholars to remain as names on the spines of books, names in footnotes and indexes. We have to be content with that and, I suppose, we have nothing to complain of. But one could wish that a man so warmly alive, so liberal to his companions, so unsparing of his affection and charity, might somehow or other be integrally preserved for the future to love and to follow. Every individual, we are told, is ineffable, and if there was ever a genuine individual, it was Ludwig Edelstein. Why then attempt to accomplish the impossible? It is enough to have had the privilege of recalling his presence to those who will miss him.

## THE ROCKEFELLER UNIVERSITY

# NEWS

---

### *Awards*

PRESIDENT JOHNSON announced on December 11 that Peyton Rous and Donald D. Van Slyke, emeritus members of Rockefeller, are among those chosen to receive the nation's highest science award, the National Medal of Science. The Medal — "a symbol of the nation's desire to recognize outstanding achievement, to set an example for our youth, and to depict to the world the depth and variety of American accomplishments in science and engineering" — will be presented to Dr. Rous and Dr. Van Slyke in ceremonies at the White House this spring.

Also in December, the Paul Ehrlich Foundation announced that Dr. Rous would be the main recipient of Germany's highest medical award, the Paul Ehrlich and Ludwig Darmstaedter Prize. Dr. Rous will receive a cash prize, donated by the West German Government, and a gold plaque. The presentation will take place in Frankfurt in March.

On December 4 Eugene Lindsay Opie received the \$6500 T. Duckett Jones Memorial Award of The Helen Hay Whitney Foundation. The Award was



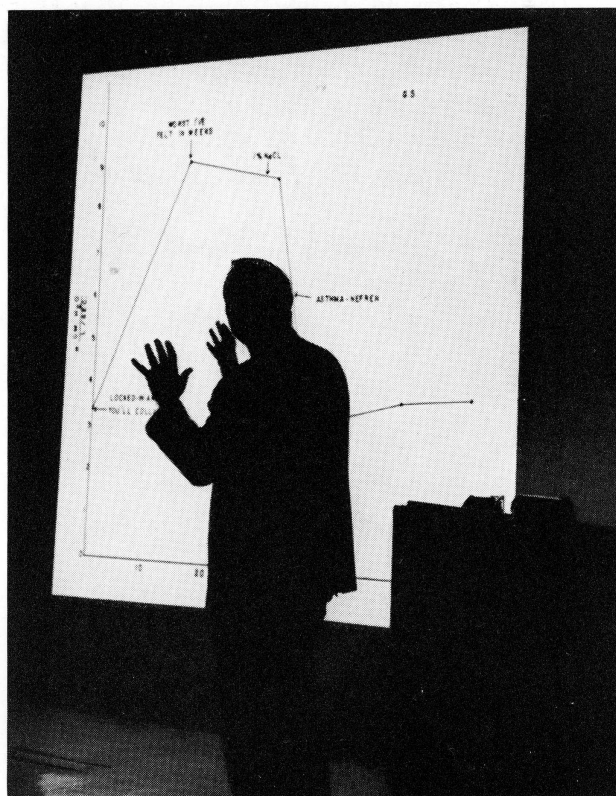
EUGENE LINDSAY OPIE



presented to Dr. Opie "in recognition of notable contributions in experimental pathology over a period of many decades." Although he retired officially in 1941, Dr. Opie has continued his medical investigations at Rockefeller as University Guest and Affiliate. His research has included work on diabetes: he was the first to observe that injury to the cells of the islands of Langerhans causes the disease; and he has contributed extensively to present knowledge of tuberculosis. He also has done pioneering work on the fundamental aspects of inflammation, necrosis, and cirrhosis of liver cells; on pneumonia; and on influenza. Dr. Opie's interest in various aspects of carcinogenesis has led to his present research on liver cancers.

## University Conferences

THE INTERACTION of cognitive and physiological determinants of emotion was one of many bridges of interchange between biologists and social scientists at the conference "Biology and Behavior: Neurophysiology and Emotion" held at Rockefeller under the



*Interaction of cognitive factors and physiological arousal*

joint auspices of the Russell Sage Foundation and the University, December 10 and 11.

Cognitive factors plus physiological arousal have long been recognized as providing the context on which an individual's interpretation of his bodily state depends. A subject alone in an experimental situation will report the psychological effect induced by injection with adrenalin as being an "as if" emotion, not a true one. But in an experimental situation where other participants are feigning different emotions — for example, in one case fear, in another euphoria — a subject injected with adrenalin will report what is for him a more true emotional experience. Furthermore, under the same state of physiological arousal he will report two different emotions, in the one case fear, in the other euphoria.

Two other sessions of the symposium considered brain mechanisms in emotion, especially the relation between the phylogenetic old brain and new brain components, and the effect of infantile experience on development and adult emotionality with implications for human behavior. A fourth session discussed recent studies of endocrine function as influenced by social and psychological considerations.

The conference, which was the first in a series of symposia dealing with topics of mutual interest to biologists and social scientists, was planned and organized by David C. Glass of the Foundation with the active collaboration of two members of the University faculty, Carl Pfaffmann and Donald R. Young. Following opening remarks by President Bronk of Rockefeller and by Orville G. Brim, Jr., President of Russell Sage, major papers were presented by Karl H. Pribram of Stanford University, Joseph V. Brady of Walter Reed Army Institute of Research, Stanley Schachter of Columbia, and Victor H. Denenberg of Purdue. The four sessions were chaired by John A. Clausen of the University of California at Berkeley, Jules Hirsch of Rockefeller, Gardner Lindzey of the University of Texas, and Carl Pfaffmann, Vice President of Rockefeller.

FACULTY AND STAFF from Rockefeller and The State University of New York met November 26 and 27 at Rockefeller in a symposium initiated by Presidents Gould and Bronk on "The Future of Biology." The symposium was an essential first step in a comprehensive, long-range assessment of the direction the

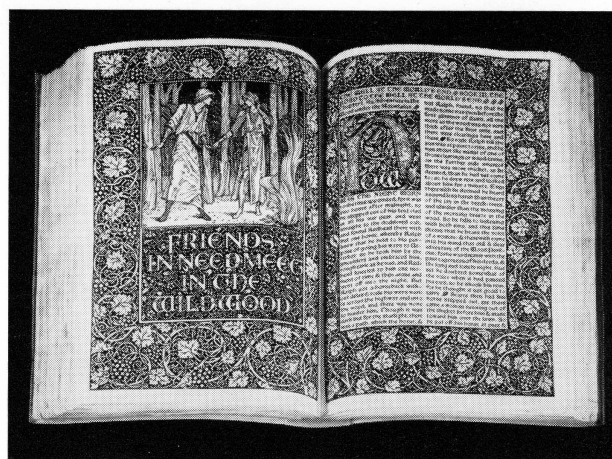
State University must take to meet present and future educational needs in the rapidly developing biological sciences. The two themes discussed were: First, what aspects of biology hold the most promise and will require the greatest focus of attention during the next ten to twenty years; and what emphases on mathematics, physics, chemistry, molecular biology, and other basic disciplines will be required to equip students to deal with and participate in these new developments? Second, what special responsibilities and what allocation of special facilities within a system of cooperating institutions will most effectively further the developments in biology which are foreseen? President Bronk, Vice President Pfaffmann, and Professors Dubos, Kac, Mirsky, Tatum, and Uhlenbeck of the Rockefeller faculty spoke on topics ranging from the "Significance of Physics in the Life Sciences" to "The Central Role of Biology in a University's Curriculum."

### ...from the bookshelf

PROGRESS IN MEDICAL GENETICS, Volume IV, edited by Arthur G. Steinberg and Alexander G. Bearn. New York and London: Grune & Stratton, Inc., 1965. Illus., 280 pages.

IN THE FOREWORD Dr. Steinberg and Dr. Bearn, who is Professor and Senior Physician in the University, express their hope that the topics covered "will be of interest not only to those working in human genetics, but also to those physicians who recognize the increasing importance of the role of heredity in our understanding of health and disease." The eight chapters include reviews of work on genetics and immunological disease; genetics and glycogen storage; congenital malformations; evolutionary aspects of human proteins; genetic control of protein structure; and serum lipoprotein allotypes in man. The final chapters discuss population studies on the aborigines of Australia and New Guinea and some of the difficulties of using twin studies for determining the relative contribution of genes and environment to phenotype.

AMONG THE bibliophilic treasures added to the collection of The Rockefeller University Library this year are the original Kelmscott Press edition of *The Well at the World's End* by William Morris, and the 1796 edition of *The Canterbury Tales* of Chaucer



Kelmscott edition of "The Well at the World's End"

edited by Thomas Tyrwhitt. These books were included in the generous gifts of Mrs. Bertha Melgaard Gardner, nurse in the University Hospital Clinic, and Mr. William Quentin Maxwell, author and educational consultant.

At the end of the last century, protean Morris, like Benjamin Franklin the century before, wrote, designed, printed, and distributed his own books — all the while leading social reforms and reviving medieval crafts. The mint copy of *The Well* presented by Mrs. Gardner was hand set in Chaucer type and illustrated with wood engravings by Morris' lifelong friend, Sir Edward Burne-Jones. Mrs. Gardner's gift of 84 books also included a set of the *American Collector* from Volume 1.

The classical scholar and fellow of the Royal Society, Thomas Tyrwhitt, is best known for exposing the fraudulent authorship of the "Rowley Poems" by the teen-age poet Thomas Chatterton. Tyrwhitt's editing of *The Canterbury Tales*, printed in Oxford at the Clarendon Press, was the first scholarly publication of Chaucer's work and an example of eighteenth-century scholarship at its best. The two-volume set given by Mr. Maxwell is in its original full calf binding. Mr. Maxwell's contribution of 131 volumes of first editions of American and English literature — many of them inscribed and autographed by the authors — contains a very rare complete set of the delightful literary magazine *The Lark*, edited and illustrated by the humorist Gelett Burgess in San Francisco in 1895–97, and including the first appearance of Burgess' famous quatrain *The Purple Cow*.

## Alumni

OF THE 1965 graduates three have remained at Rockefeller, six are associated with other institutions in the United States, and two are abroad. Thomas P. Bennett remains as a guest investigator and fellow, and Lorna Green and G. David Lange as research associates. Richard C. Blinkoff is a postdoctoral fellow at Harvard Medical School in the Department of Bacteriology and Immunology, and Paul R. Burgess has gone to the University of Utah, where he is a postdoctoral fellow in the School of Medicine; Richard D. Campbell is an assistant professor at the University of California, Irvine, in the Department of Organismic Biology; Richard A. Cellarius is a postdoctoral fellow in the Biophysics Research Division of the Institute of Science and Technology at the University of Michigan; Merrill Burr Hille remains in New York as a postdoctoral fellow in the Biochemical Department of the New York University Medical School; and Thomas B. Tomasi, Jr., is at The State University of New York at Buffalo as a professor of medicine. Bernard F. Mach is an assistant professor at the University of Geneva in the Institute of Molecular Biology, and Michael A. Ruttenberg is a postdoctoral fellow at the Weizmann Institute of Science, Rehovoth.

New positions assumed this year by alumni of earlier years include:

William F. Arndt, Jr., PH.D. '59, Naval Flight Surgeon, U. S. Naval Aerospace Medical Institute, Pensacola

David Baltimore, PH.D. '64, Research Associate, The Salk Institute, San Diego

Barry R. Bloom, PH.D. '63, Assistant Professor, Department of Microbiology and Immunology, Albert Einstein College of Medicine, New York

Robert D. Campo, PH.D. '63, Assistant Professor, Department of Biochemistry, Temple University School of Medicine, Philadelphia

Stephen Cooper, PH.D. '63, Research Associate, Department of Biochemistry, Tufts University School of Medicine, Boston

Brian A. Curtis, PH.D. '63, Instructor in Physiology, Tufts University School of Medicine, Boston

James W. Fristrom, PH.D. '64, Assistant Professor, Department of Genetics, University of California, Berkeley

John W. B. Hershey, PH.D. '63, Research Fellow in Medicine, Huntington Laboratories, Massachusetts General Hospital, Boston

Arthur Karlin, PH.D. '62, Assistant Professor of Physiology, Columbia University College of Physicians and Surgeons, New York

Bruce McEwen, PH.D. '64, Assistant Professor, Department of Zoology, University of Minnesota, Minneapolis

Suydam Osterhout, PH.D. '59, Assistant Professor of Medicine, Associate Professor of Microbiology, Assistant Dean for Admissions, Duke University Medical School, Durham

W. Carey Parker, PH.D. '63, Clerk to Associate Justice of the Supreme Court Stewart Potter, Washington

Richard L. Purple, PH.D. '64, Assistant Professor, Department of Physiology, University of Minnesota Medical School, Minneapolis

Carolyn W. Slayman, PH.D. '63, Assistant Professor, Department of Biology, Western Reserve University, Cleveland

Robert R. Traut, PH.D. '62, Research Assistant, Institute of Molecular Biology, University of Geneva

David C. White, PH.D. '62, Associate Professor, Department of Biochemistry, University of Kentucky Medical School, Lexington.



■ The Christmas season opened at Rockefeller on December 11, the night of the Winter Ball, which was arranged by the first-year graduate fellows for the faculty, students, and administration. The Children's Christmas Party on December 20 was attended by more than 350 children accompanied by their parents. As in previous years, Henry Wood was the master of ceremonies, leading the carols and introducing the expert magician and a wildly acclaimed Santa Claus (Robert Franzl). Doctors Wood and Franzl were assisted by James German (formerly an assistant professor at Rockefeller) at the piano. Dr. German was also present the following day playing the organ at the annual carol singing, at which President and Mrs. Bronk welcomed the hundreds who came to sing and wish their associates a merry Christmas. The day after New Year's the Bronks were at home to faculty, students, and other friends who were spending the holidays in New York.



■ President Bronk received the honorary degree of Doctor of Humane Letters from Albert Einstein College of Medicine of Yeshiva University, at a special convocation held November 21 marking the dedication of the College's new hospital. On December 21 Mayor Lindsay announced that Dr. Bronk had been appointed to the Science and Technology Council. The Council, which is composed of thirteen representatives of universities, foundations, and corporations, will attempt to attract science-oriented industries to New York and aid those already here. The group — which will meet monthly with Mr. Lindsay and will conduct studies into the scientific and technological advances that might affect industries in the city — is also expected to advise the new Mayor on the problems of health, air and water pollution, and transportation.

■ Among recent addresses by the faculty were the 1965 Harrelson Lectures delivered by Professor Mark Kac at North Carolina State University during the week of November 29 — December 3, and the Theodore Berlin Memorial Lecture presented by Professor George E. Uhlenbeck at Johns Hopkins University on November 18. Dr. Uhlenbeck spoke on statistical mechanics, the subject of an unfinished treatise on which he and Berlin had collaborated before Berlin joined the Rockefeller faculty in 1961. In December Dr. Uhlenbeck was appointed Special Visiting Professor to the University of Colorado, where he has spent summers conducting a course in theoretical physics.

■ Professor Donald R. Griffin has received the 1965 Phi Beta Kappa Science Award for his book *Bird Migration* (a chapter of which was adapted for publication in the May-June *Review*). The purpose of the Science Award is to encourage more literate and scholarly interpretations of the physical and biological sciences and mathematics. Dr. Griffin is the recipient of the seventh Award. The 1963 Award was given to Dr. Dubos for *The Unseen World*, published by The Rockefeller University Press.

■ During the month of November symposia and conferences in which the faculty of the University have participated include the University of Kentucky Centennial Biological Sciences Conference at which Pro-

fessor Theodosius Dobzhansky gave a talk on "A Geneticist's View of Human Equality" November 12, and the Fourth Annual Eastern United States Theoretical Physics Conference at Stony Brook, to which Professors E. G. D. Cohen and Abraham Pais contributed invited papers on November 26 and 27. Dr. Cohen spoke on "New Developments in the Kinetic Theory of Moderately Dense Gases," and Dr. Pais on "Higher Symmetries — a Summary." A few days before Dr. Pais had been a participant — together with Dr. Goldhaber of Brookhaven and Dr. Lederman of Columbia — in a half-hour sound film, "The Particle Jungle," produced by the American Institute of Physics in cooperation with Channel 13/WNDT and shown in Caspary Auditorium.

■ In December symposia participated in by the faculty included the "New Worlds in the Making" symposium held by Cutler-Hammer, Inc. in Milwaukee on December 4, at which Professor René J. Dubos spoke; the morning and afternoon sessions of the AAAS Annual Meeting symposium on "Physiological Control of Conception and Its Implications," which were summarized by Dr. Dubos at Berkeley on December 26; and a symposium in which Dr. Dubos had joined the week before on the technological society and its effects on humanity, held at the Center for Study of Democratic Institutions in Santa Barbara. At a Washington University School of Medicine colloquium on staphylococcus December 11, Professor James Hirsch spoke on "Mechanisms of Host Resistance to Infections" and Associate Professor Morse on "Biological and Immunological Properties of *Staphylococcus aureus*."

■ Cecilia Payne-Gaposchkin discussed "The Life History of a Cepheid Variable" in her Sigma Xi Lecture on November 11. Dr. Payne-Gaposchkin is Phillips Astronomer and Professor of Astronomy in Harvard University and is a National Lecturer for the Society of Sigma Xi for 1965-66.

■ Rockefeller University authors in recent issues of the *Scientific American* include Earl H. Freimer and Maclyn McCarty, who have written a review of one of medicine's most puzzling mysteries — the genesis of rheumatic fever. Their article, "Rheumatic Fever," appeared in the December issue. In the November

issue Armin C. Braun's article on "The Reversal of Tumor Growth" includes a new hypothesis on the nature of tumor growth, and the implications have attracted wide attention; of special interest was his description of a mouse "multipotential cell" (worked on by Lewis J. Kleinsmith, now a graduate fellow at Rockefeller, and G. Barry Pierce, Jr. of the University of Michigan), which on dividing was able to develop into any one of a variety of apparently normal cell types or into a highly undifferentiated tumor cell.

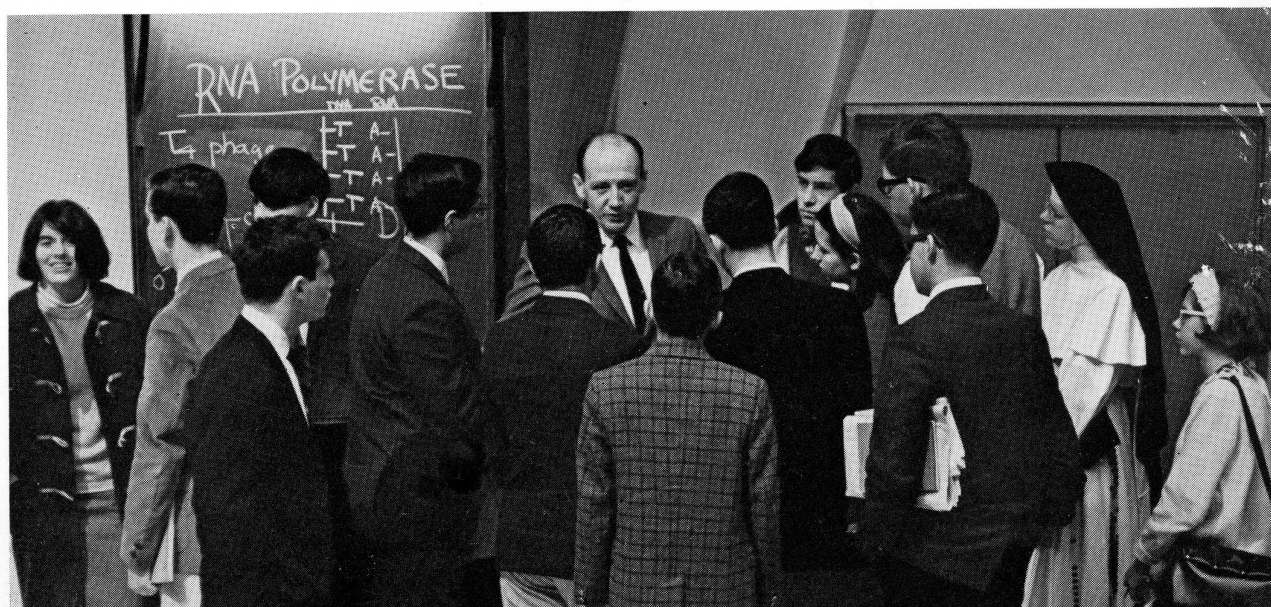
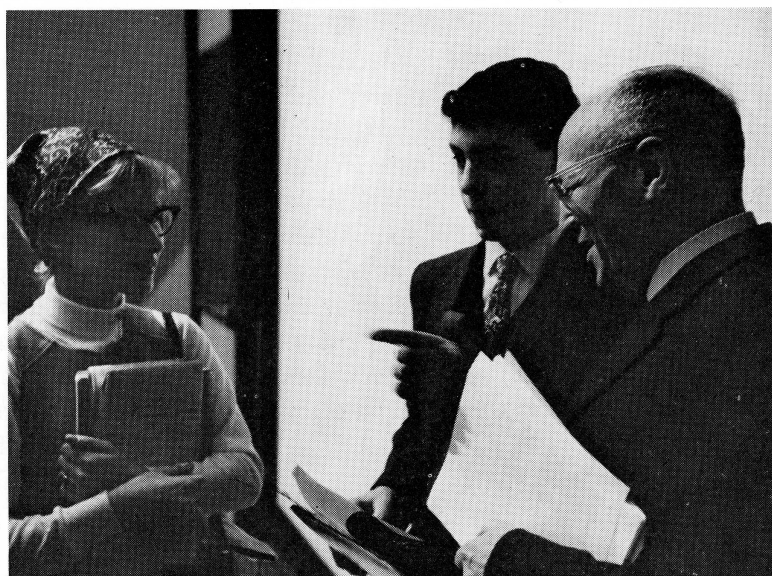
■ On December 6 Mr. Edouard Morot-Sir, cultural attaché at the French Embassy, presented a lecture on "L'évolution de la théorie française de la science depuis Henri Poincaré jusqu'à Gaston Bachelard et Jean Cavaillès." In his talk Mr. Morot-Sir, formerly

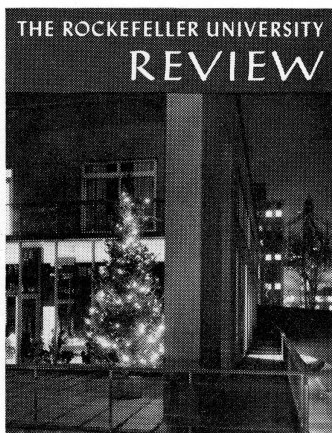
a professor of philosophy, outlined the development of the philosophy of science from purely mathematical or deductive conceptions of science to a more organismic view of the body of scientific knowledge. Mr. Morot-Sir's lecture was followed by a lively discussion to which Doctors Dubos, Frankfurt, and Shedlovsky of Rockefeller and Professor André F. Courmand of Columbia University were contributors. The French attaché spoke at the University at the invitation of Dr. Alexandre Rothen in connection with his weekly seminar devoted to the reading of French scientific texts.

■ The Rockefeller University was the subject of two articles by John Walsh appearing in the December 24 and December 31 issues of *Science*.

## 1965 Christmas lectures

*For the seventh successive season the Christmas Lectures on science, presented to 500 selected high school students, were given at Rockefeller. This year's theme—"The Cell Nucleus: Kernel of Life"—was developed by Professors Vincent G. Allfrey and Alfred E. Mirsky with warmth and humor. The four lectures were illustrated with color motion pictures of the speakers' experiments. The AAAS now also sponsors nationwide Holiday Science Lectures, modeled after the original Rockefeller University series.*





THE COVER shows the Abby Aldrich Rockefeller Hall dining room at dusk during the winter holidays. On the right, beyond the entrance arch to Caspary Auditorium, glow the lights of South Laboratory and Sophie Fricke Hall.

ACKNOWLEDGMENTS: Page 1 excerpt from score of *Illiac Suite for String Quartet* courtesy of Theodore Presser Company. Page 2 photograph courtesy of Bell Telephone Laboratories. Page 5 photograph courtesy of John Pitkin. Page 7 the article "Philosophy – the pilot of life" is republished with the kind permission of Teachers College, Columbia University, from the *Teachers College Record*, Volume 65, Number 4, January 1964. Page 8 Society key, 1806, courtesy of The United Chapters of Phi Beta Kappa. Pages 9, 12, and 13 medallions drawn by Bruce Rogers from *The Odyssey of Homer*, translated by T. E. Shaw ("Lawrence of Arabia") and printed and published by Sir Emery Walker, Wilfred Merton, and Bruce Rogers, London, 1932. Pages 10, 11, and 14 woodcuts from the original German edition of Sebastian Brant's *Narrenschiff* (*The Ship of Fools*), Basel, 1494. Page 17 photograph by Bernard Cole. Pages 19 and 21 photographs by The Rockefeller University Illustration Service. Photographs pages 20 and 24 *top* by Heka, *bottom* by The Rockefeller University Illustration Service.