simplest conceivable living unit would thus be a moleculobiont—a catalyst particle of molecular dimensions, capable of autocatalysis (self-reproduction). The ability to undergo heritable changes is generally observed in living units, and seems to be a third criterion of life, although we can conceive of units incapable of this basis of evolution. Heritable changes in biocatalysts (demonstrated in the case of genes but probable also with enzymes, carriers and prosthetic groups), underlie changes in chemical output due to synthesis and analysis, which in turn are the basis of changes visible in structure, form, physiology and function.

It has long been known that many of the phenomena developed by and in living units may be simulated by non-living systems. Traces of colloidal substances may cause crystallizing material to assume beautiful flower- or fern-like forms. "Colloidal gardens" have long been used as lecture demonstrations, and may be grown by dropping, *e.g.*, a crystal of copper sulfate into sodium silicate solution. "Enzoon," long thought to be a relict of early life, may be nothing but a Liesegang ring formation. Besides the interesting artifacts described by Dr. Herrera in his note above referred to, he has mentioned and illustrated many others in his paper on "Plasmogeny,"[4] and in the same book Professor Stéphane Leduc (Nantes) in a paper on "Solutions and Life" has described and illustrated similar work of his own. Petrologists (*e.g.*, Sir J. S. Flett) have described and simulated dendictic and margaritic forms found in rocks, and window-pane ice often shows beautiful plant- and flower-like tracery.[2]

Although these various artifacts may simulate many of the forms and activities of truly living units, none of them has as yet been shown to exhibit the criteria of life above outlined, which, on the other hand, are all shown by the smallest known bionts (genes, viruses, bacteriophages). Since the same physico-chemical forces and principles dominate both living and non-living units, it seems reasonable to believe that life originated by the chance formation of an autocatalytic unit of molecular dimensions; for the smaller its size, the greater the probability of its formation. Ultramicroscopic bionts which might develop now would have small chance of surviving to form a new race, because of the great number and variety of predatory forms of life now existing. And conditions existing when the first life emerged must have been quite different from present conditions on the earth. Very few living units can even now synthesize their necessary molecules from the "bare rocks," but are largely dependent upon molecules furnished by other bionts. Food thus has an important evolutionary biochemical aspect, and there is truth in the dictum: "Rien n'est la proie de la mort; tout est la proie de la vie."

JEROME ALEXANDER

NEW YORK, N. Y.

QUOTATIONS

THE WOODS HOLE MARINE BIOLOGICAL LABORATORY

THE meetings of the Corporation and Trustees this year were of special significance for they mark the end of Dr. F. R. Lillie's long and fruitful service as an active officer, and the beginning of Mr. Riggs's term as president. Dr. Lillie came to Woods Hole as a beginning investigator in 1891. Nine years later he was made assistant director, and after Dr. Whitman's death in 1908, he became director. During the years that followed, this institution, under his guidance, grew rapidly in prestige and in size. When the extensive building program, which gave us the Brick Building, the Dormitory and the Apartment House, was completed in 1925, he retired as director and was made president of the corporation, a position which he has held until now. Thus, he has seen the laboratory grow from infancy to maturity, and during the intervening years has played a very large part in shaping its policies. It is our good fortune that he will continue to work here and advise those who in the past have relied on his sound judgment and foresight.

To succeed him the trustees named as president Mr. Lawrason Riggs, for the past eighteen years our treasurer. The precedent of having a non-biologist in this position was set many years ago when Mr. C. R. Crane, the generous patron of the laboratory, was chosen. The office of vice-president was created, and was filled by the election of Dr. E. Newton Harvey, professor of physiology at Princeton. Mr. Donald Brodie was made treasurer. He is not a stranger to Woods Hole. For many years he was associated with Mr. Crane, and thus became familiar with the affairs of the laboratory. Dr. Otto Glaser was elected clerk of the corporation in place of Dr. P. B. Armstrong, who resigned. These officers assume their new responsibilities at a critical time. We are confident that under their leadership this institution will continue to serve its primary purpose of encouraging biological research, and will maintain its prestige.

The trustees elected eleven new members of the corporation and named Dr. Glaser and Dr. Metz to serve on the executive committee. The corporation re-elected all the trustees whose terms of office expired

[4] A. L. Herrera, pp. 81–91, and S. Leduc, pp. 59–79, "Colloid Chemistry, Theoretical and Applied," Vol. II.

this year, and elected Dr. Eric Ball and Dr. Eugene F. DuBois to fill the places of Dr. A. P. Mathews and Dr. S. O. Mast, who were made trustees emeriti. Finally, Dr. Lillie was elected president emeritus.

Mr. Riggs, as treasurer, reported that the laboratory is free from indebtedness and has a small reserve fund. The director showed, by means of charts, how the annual income has dropped in the last two years from $170,000 to $130,000. To balance the budget, the executive committee has been forced to make drastic cuts in the appropriations for many of the departments, particularly for research and for the library. While it is true that we can not now buy much apparatus nor receive and pay for foreign journals, we shall presently have to expend considerable amounts for both of these essential items of our equipment.

Dr. Little explained how apparatus now must be repaired and altered to serve new needs, and emphasized the fact that investigators must adapt themselves to these unwelcome conditions. The librarian, Mrs. Montgomery, spoke of the microfilm service which is now in operation. Already it is extensively used. Indeed, we soon may be unable to fulfill all the requests for films.

In the present conditions, it is difficult, if not impossible, to predict the future. But we must assume that next year, research and instruction will continue here at Woods Hole. In the fifty-five years of its existence, this laboratory has maintained these activities without interruption. Every effort will be made to keep them in full operation.—*Dr. Charles Packard, director of the laboratory, in The Collecting Net.*

SCIENTIFIC BOOKS

MATHEMATICS

Mathematics—Its Magic and Mastery. By AARON BAKST. New York: D. Van Nostrand Co., Inc. 1941. $3.95.

To Discover Mathematics. By GAYLORD M. MERRIMAN. New York: John Wiley and Sons, Inc. 1942. $3.00.

Mathematics and the Imagination. By EDWARD KASNER and JAMES NEWMAN. New York: Simon and Schuster. 1940. $2.75.

To tear from mathematics the veil of misconception which obscures it in the popular mind and to reveal it in aspects as antithetical as may be to the cramped or forbidding ones of the elementary schoolroom is a quest which is currently calling forth a swelling volume of literary effort. The reading public is no longer a stranger to prospectuses and prefaces which beckon with promises of easy and painless instruction in the ways and uses of numbers, or which give voluble assurances of a ready entrance into the temple where the beauties and sublimities of mathematics lie revealed, and where all may grasp the grandeur and boldness of its harmonies and symmetries or of its all-pervading utilities. Mathematics, one is assured, is ineradicably ingrained in human thought and achievement. *Ipso facto* some modicum both of understanding of its subject-matter and appreciation of its essence is no less than a *sine qua non* of the educated and cultured man. To supply these desiderata the proffered volumes exist.

As must be, different readers will differently appraise the success which crowns each specific effort. The mark aimed at is high—perhaps too high. Poor and friendless thing though the more standard mathematical textbook may be, it is certainly no parvenu. Its claims of ancestry go back to Euclid often with much more justice than to the name which graces its title page, and over its evolution both savants and pedagogues have labored much. However popular it may be to eschew it, its earmarks will assert themselves, whenever the mere discourse about mathematics yields to any actual presentation of theory or fact. By the same token, the extant body of truly significant mathematical ideas was not easily come by. It was, on the contrary, a halting accretion, the crystallization of inordinately sustained and groping effort. There is small evidence that we are brighter than were our ancestors. It seems a far cry, therefore, from the great Gaus' misgivings as to the wit of the "Boethians," to the ostensibly easy confidence with which many present-day writers essay upon the exposition of abstract and basic ideas to any tyro, if he will but think.

Of the volumes here specifically under review, that which makes least demand upon previous knowledge is "Mathematics—Its Magic and Mastery." Written in an engaging style, and amply supplied with figures and entertaining vignettes, approximately one half of the book's 790 pages are designed largely for amusement. This is the magic of it. Easy discussions of the elementary arithmetic processes are flavored with parlor tricks, with examples of the coincidences which attach to combinations of numbers appropriately adjusted to their base of notation, with interesting visualizations of large numbers or very small ones, with puzzles, codes, etc. This will entertain all who enjoy the manipulation of numbers or who delight in the manifold disclosures of curious and unexpected regularities. In the later pages the domi-