It is a matter of merely enlightened self-interest for society to seek out a Wallace Carothers and afford him the most suitable surroundings for his genius to work in. How to do that is a problem that science may well ponder.

EUGENE C. BINGHAM

SCIENTIFIC BOOKS

VIRUS DISEASES

Virus Diseases. By Members of the Rockefeller Institute for Medical Research, THOMAS M. RIVERS, W. M. STANLEY, L. O. KUNKEL, R. E. SHOPE, F. L. HORSFALL, JR., PEYTON ROUS. Ithaca, N. Y.: Cornell University Press. 1943. $2.00.

THE title of the volume suggests a text-book. In the technical sense this is far from the case but, in content, a more illuminating insight into experimental thinking could scarcely be devised. The book comprises the Messenger Lectures on the Evolution of Civilization delivered by six members of the Rockefeller Institute at Cornell University in the spring of 1942, said lectures having "the special purpose of raising the moral standard of our political, business, and social life." Although each lecturer deals with specific aspects of the virus problem in which he has been engaged, the composite view is a varied approach to the broad biological problem of the nature of viruses and their modes of action.

In the first of the series, "Virus Diseases with Particular Reference to Vaccinia," T. M. Rivers reviews the concerted efforts to characterize vaccine virus by analysis of its antigenic, physical and chemical properties. Following the principles which have yielded such valuable information of bacterial action, the newer methods of immunochemistry, biochemical assay, enzymatic identification and physical measurements, have been employed by associates and collaborators of special skills with the result that many properties of vaccine virus in the form of elementary bodies have been determined. The manifold attack has revealed a multiplicity of antigens and the presence of chemical substances such as biotin and flavin which suggest the animate nature of the virus; it has also disclosed limitations in the interpretation of homogeneity on the basis of centrifugal or electrophoretic boundaries. The whole story is highly instructive and attractive reading.

Under the title of "Chemical Structure and the Mutation of Viruses," W. M. Stanley tells of the attempts in his laboratory to induce mutants or variants of tobacco mosaic virus by chemical alterations of the virus protein. Having determined that certain strains of the virus differed in their content of certain amino acids, it was suggested that the variations in behavior were related to these differences. Accordingly, virus chemically modified by extensive coverage of the amino and phenol groups was inoculated onto susceptible plants in the hope that the virus produced in the infected plant would resemble the modified material. This was not the case; the resultant virus was similar in nearly all respects to the usual tobacco mosaic virus; however, it was found that the virulence of the virus for a different host was decreased. Chemical treatment beyond a certain point destroyed activity. The studies represent the beginning of a stimulating approach to the fundamental problem of biological variation.

The need for transmission of the agent of an infectious disease of man to new hosts in order to study it adequately is obvious. It may come as a surprise to many that great advantages accrue to the same procedure in the investigation of virus diseases of plants. L. O. Kunkel in the lecture, "New Hosts as a Key to Progress in Plant Virus Disease Research," gives numerous examples of the benefits to be gained: the recognition of unsuspected mixed infections, the attenuation or exaltation of a virus, the appearance of otherwise unexpected properties, and the transfer to new hosts by way of an intermediate plant host, are some of them. The latter procedure has recently proved a notable success in the transfer of viruses which previously had been transmissible only by grafting. The lecture contains numerous implications of importance to the entire field of infection and adaptation.

The attention of investigators of virus diseases has been constantly attracted to Shope's studies of swine influenza. The first part of the present lecture is devoted to reviewing the history and earlier studies leading to the identification of the complex virus-bacterial nature of the disease. The remainder deals with the problem of the origin of epizootics and the residence of the virus in interepizootic periods. A summary is given of the evidence that the virus in masked form is maintained in the lung worms from infected hogs through their developmental cycle in the intermediate earthworm host and back to residence in the lungs of normal swine where proper stimuli serve to activate the virus and incite infection of the animal. The thesis clearly provides a reservoir and an explanation for the sudden reappearance of the disease in wide areas after many months of absence. The analogies and implications for human disease are discussed. In this instance again, the ingenious and skilful experimentation of the investigator are disclosed in relation to a concept, the significance of which extends beyond the biological confines of the disease primarily discussed.

In his discussion of "Human Influenza," F. L. Horsfall, Jr., considers the problem in its broad clinical sense of a symptom-complex which may be of divergent etiology and identified in terms of its distribution as pandemic, epidemic or endemic influenza. The major portion of the discussion deals with the epidemic disease, the etiology of which has been recognized in recent years. An extremely valuable review of the widespread studies is made, especially those concerned with the factors influencing resistance and the efforts toward prophylactic vaccination in which the author has been particularly interested. Critical evaluation is given of certain debated but hypothetical points. This lecture necessarily differs from others of the series in that it is concerned with the broad problem of a disease rather than detailed consideration of specific mechanisms.

The final lecture of the series, "Viruses and Tumors," is by Peyton Rous. In this, for the first time, he summarizes his views on mammalian tumors derived under a variety of influences. The clarification of the differences between the effects of viruses and chemical carcinogens is especially valuable, pointing out the *actuating* effect of the viruses in that each induces a specific type of tumor, whereas, the type of tumor evoked by the carcinogens is primarily dependent upon the natural tendencies of the host and the nature of the tissue to which the material is introduced. Further, the relation of viruses to chemical tumors, to the milk influence and to cancerous changes is presented. It is an important consideration of numerous aspects of a highly controversial subject, dealing as the author does with the biological mechanisms involved. Undoubtedly dissenting views will be expressed.

In conclusion, the purpose of this review has not been to find fault. Blunt criticism can be made of nearly any lecture for the absence of proof for ideas or the lack of interpretation of other data. Nevertheless, the purposes of a lecture are to present a point of view, correlative information and interpretations in an interesting manner. The present volume fulfills these functions to such an extent that it is highly recommended as provocative reading to biological investigators at large.

THOMAS FRANCIS, JR.

UNIVERSITY OF MICHIGAN

STELLAR SPECTRA

An Atlas of Stellar Spectra with an Outline of Spectral Classification. By W. W. MORGAN, PHILIP C. KEENAN and EDITH KELLMAN. Chicago: The University of Chicago Press. 35 pp. 2 figs. 55 photographic reproductions. 1943. $10.00.

THE "Atlas of Stellar Spectra," by Morgan, Keenan and Kellman, has for some time been awaited with keen anticipation by astronomers engaged in the practical problems of spectral classification and the determination of absolute magnitudes. At first sight it seemed rather disappointing that the text accompanying the beautiful atlas should be limited to a descriptive outline of the classification system, without any discussion of the diverse criteria employed elsewhere; and without any analysis of the astrophysical implications. An examination of the contents, however, proves the wisdom of the omissions. Such detours might incite astrophysical discussion more than the practical application which is the unique primary purpose of the Atlas.

The objective of the work has been to set up a system of classification that would be as precise as possible and that could be applied to stars of the eighth to tenth magnitudes with good systematic accuracy. This objective required a two-dimensional system: the usual coordinate correlated with temperature and the new coordinate representing the absolute luminosity. The luminosity classification introduced (in terms of groups Ia, Ib, II–V) is as arbitrary as the usual spectroscopic classification: the luminosity is simply implied in this case, as temperature was implied in the other. The procedure of classification suggested is (1) the determination of an approximate spectral class (in the usual sense); (2) determination of the luminosity class, and (3) the derivation of a more accurate spectral class by comparison with a sequence of stars in the same luminosity class. Here the emphasis is somewhat different from that ordinarily encountered: we have been accustomed to hearing astronomers call for more accurate spectral classes in order that the subsequently determined absolute magnitudes might be more accurate; here, on the other hand, the luminosity classes are necessary in order to improve the spectral classes themselves. The two problems, of course, can not be solved independently, since all the spectral lines vary to some extent both with temperature and luminosity. Thus a few successive approximations are needed for their satisfactory solution.

The Atlas itself, consisting of 55 superb photographic reproductions of Yerkes spectrograms, is an exemplification of a purpose well achieved. First, sequences of spectra illustrate the fundamental progression of spectral class for stars of the main sequence. Then, for stars of the same spectral class, the variations with luminosity are illustrated. Finally groups showing the variation of spectral class among stars of various other luminosity groups (*e.g.*, giant or supergiant) are added. Although emphasis is placed on the more common classes of stars—one of the major purposes of the proposed system of classifi-