

origin or geologic history and sticks closely to factual observations. Yet it is a pity that he has not often taken pains to point out which observations tend to support a given hypothesis, for his long experience in the region gives him a unique opportunity to do so.

The volume is certainly the best general summary available and will be widely read. At the same time, its local flavor clearly illustrates the continuing need for a concise presentation of the geological evolution of the African continent addressed to the scientific profession at large.

BRIAN J. SKINNER

*Department of Geology and
Geophysics, Yale University,
New Haven, Connecticut*

New World Archeology

Prehistory of North America. JESSE D. JENNINGS. McGraw-Hill, New York, 1969. xiv + 402 pp., illus. \$9.95.

Prehistory of North America is an introductory synthesis written as a textbook. It follows a logical progression, giving an outline of methods, descriptions of prehistoric cultures, and discussions of theoretical issues. It should fulfill its intended function well. Descriptions of sites and artifacts are accompanied by numerous drawings; there are no photographic illustrations. Archeological social reconstructions are discussed, but the author relies on ethnographic analogy where possible.

Continent-wide culture stages provide the organizational theme for Jennings's account of the establishment of big-game hunters and the subsequent development of a stable Archaic hunting-and-collecting way of life. In dealing with aspects of the succeeding Formative stage the book necessarily takes on a more specific regional organization.

Classic stage cultures of Central America are not considered, but the origins of plant domestication in Mexico are included because these events transformed the Archaic lifeway. The Arctic is treated as a unique region because its cultures do not fit the author's definition of the Archaic stage; they lack the necessary "total exploitation" of vegetal resources. This is the least convincing argument in the book.

It is Jennings's discussion of hypotheses and future problems that provides the most interesting and informative passages; from the catalog of what we

do not yet know an overview of the current status of American archeology emerges. The probability of an Asiatic-chopper-tool substratum and the likelihood of significant Old World stimulus in the Americas are examples of still-unresolved problems regarding which the author believes fieldwork may provide evidence in the future.

Jennings thinks that the terms "Woodland" and "Mississippian" have outlived their usefulness but does not attempt to devise replacements—wise from the textbook point of view but disappointing from that of synthesis. He does, however, put forward the concept of *archaic efficiency* as a modification and extension of the idea of primary forest efficiency. Archaic-stage technology, utilizing new raw materials by means of innovations in tools, provided a stable way of life, regardless of regional differences. Efficiency resulted in increase in population to the supportive capacity of the land. The author asserts that the Archaic stage would have lasted indefinitely had not outside stimulus resulted in regional changes after 2000 B.C.

Jennings clearly regards the idea of archaic efficiency as the most important contribution of his new synthesis of North American prehistory. There is no denying that he has provided much food for thought as well as an admirable text.

ROGER T. GRANGE, JR.

*Department of Anthropology,
University of South Florida, Tampa*

Microbial Biochemistry

Bacterial Physiology and Metabolism. J. R. SOKATCH. Academic Press, New York, 1969. xii + 444 pp., illus. \$14.50.

The major catabolic and biosynthetic pathways in many bacterial genera are now firmly established, and there is also detailed knowledge of the enzymic reactions. A teacher faced with providing a course for graduate students or senior undergraduates in bacterial biochemistry can quickly alienate the class by recitals of metabolic pathways and fermentation balances. It seems better to give the principles, with detailed treatment of selected examples, and Sokatch's book should be a most suitable adjunct to a course in which this is attempted. It provides broad, accurate, and up-to-date coverage of metabolic pathways in bacteria, supple-

mented with physiological background and with molecular biology.

The book is divided into three parts: on physiology, energy metabolism, and biosynthetic metabolism. The first section includes a general discussion of the diverse nutritional requirements of bacteria ranging from the chemolithotrophs to the exacting Lactobacillaceae. There is also a thorough description of the characteristics of bacterial growth in batch and continuous culture and under synchronous conditions. This section ends with a most useful chapter on the chemical composition of bacteria, which includes recent work on the lipids and on the surface layers.

Energy metabolism is treated in logical sequence, beginning with a discussion of the utilization of oligosaccharides, followed by a chapter on sugar transport, a process whose nature is now being clarified by the isolation of specific transport proteins. Anaerobic and aerobic breakdown of carbohydrate is considered in detail, with emphasis on the experimental approaches used to reveal the mechanisms. Utilization of nitrogenous compounds and of aromatic hydrocarbons is also covered well. In addition to descriptions of the enzymic steps, there are many useful figures and schemes showing the chemical structures of the various intermediates. The work with *Mycobacterium phlei* is given the most attention in the chapter on aerobic electron transport and coupled phosphorylation, but the diversity of the systems by which these processes occur in bacteria is clearly pointed out. The principles of photophosphorylation in photosynthetic bacteria are briefly discussed, and the oxidation of inorganic substrates by the chemoautotrophs receives quite extensive treatment. The methane-producing bacteria are not considered in this book, an omission which must surely be remedied in future editions, in view of present interest in these organisms.

Biosynthesis is given comprehensive treatment. This section considers not only the formation of monomers but also synthesis of cell wall materials, complex lipids, nucleic acids, and proteins. A good synopsis is provided of studies of protein synthesis and its regulation up till 1968; this should provide a framework for the student trying to keep up with the current literature. "Classical" biosynthesis is covered in detail, beginning with the utilization of carbon dioxide by photosynthetic and chemosynthetic bacteria and with brief

mention of nitrogen fixation. The various biosynthetic pathways (including recent work on fatty acid synthesis) are well presented with abundant illustration, and regulation by feedback control, by allosteric effectors, and by enzyme multiplicity is adequately and clearly summarized. The biosynthesis of B-group vitamins is neglected, though there is now sufficient knowledge of this area for it perhaps to have rated some attention.

A particular virtue of this book is the emphasis given to the experimental approaches that have led to the establishment of pathways and mechanisms. Another virtue is the comprehensive and up-to-date list of references that accompanies each chapter. The references have been critically selected and include both original and review articles.

The author has succeeded in his purpose of writing a book suitable for graduate students of bacteriology and biochemistry which avoids repetition of the basic biochemistry to be found in the standard texts. He has also succeeded in providing the established worker with an invaluable reference book which includes extensive author and subject indexes to make information-hunting an easy task. He has covered a big field of knowledge in a well-organized fashion and with clarity.

J. LASCELLES

*Department of Bacteriology,
University of California, Los Angeles*

Invertebrate Visual Systems

Insect Vision. GEORGI A. MAZOKHIN-PORSHNYAKOV. Translated from the Russian edition by Roberto and Liliana Masironi. Timothy H. Goldsmith, Transl. Ed. Plenum, New York, 1969. xiv + 306 pp., illus. \$22.50.

Within the past 30 years our understanding of the organization and function of the vertebrate visual system has undergone some almost miraculous advances aided by the techniques of electron microscopy and electrophysiology, in addition to improvements in the psychophysical methods of testing the intact organism. Visual physiologists are in a good position to relate structure and function on many levels of organization in fish, amphibians, and mammals, including primates. A similar extension of our knowledge has taken place in the invertebrate phylum

Arthropoda, especially with regard to insects. In this book Mazokhin-Porshnyakov has not only reviewed the current state of our knowledge concerning the visual system of insects, he has also pointed out what is lacking or unclear.

The book is a somewhat updated version of the Russian original. As of the date of the original publication (probably 1965; the date 1956 given in the translation is apparently a misprint), the review was up to date. Much new work has been published since then, but only a small portion was considered when the text was being revised prior to translation. However, a review monograph is most useful not in its timeliness but rather in furnishing the basis for future work. This Mazokhin-Porshnyakov's book does. Indeed, we have here an extremely comprehensive, well-written (even in translation), yet highly critical work. To take full advantage of it, however, one should use it in conjunction with sources of more up-to-date information [for example: W. H. Miller, G. D. Bernard, and J. L. Allen, "The optics of insect compound eyes," *Science* **162**, 760 (1968)].

Although the subject index is less complete than one would wish in a reference work, its function is served to a large extent by the very complete table of contents. The bibliography is also quite complete and will be very useful. There are a large number of misprints, but few of them will cause any significant misunderstanding.

The subjects covered range from detailed anatomy (including the optics of the various insect eyes) to the construction of light traps for insects. As the author has himself made extensive investigations of color vision in insects, one expects and will find an extensive discussion of this subject. One of the most useful things about the book is the author's discussion of his own work and that of other Russian workers with which he is familiar. Until now much of this Russian work has been available only in the original Russian and therefore was difficult to obtain and understand.

The main emphasis throughout the work is on the eye, equal consideration being given to optics and physiology and structure and function. The only serious omission I have detected is in the discussion of the effect of diffraction on the resolving power of the eye. The theoretical case considers only monochromatic light, yet the experi-

mental studies are all based on black-and-white targets. Certainly the white-light case is much more complicated to handle theoretically; but it has been handled with respect to the human eye (Y. Le Grand, *Form and Space Vision*, Indiana University Press, 1968) and should at least be mentioned as it applies to the insect eye.

The author does not keep his own prejudices hidden, but he does, in general, state the opposing points of view fairly and even sometimes puts them in a stronger position than have their original proponents. Although there are many names revered in the physiology and other sciences of the insect eye, only one is immune to criticism in the text—that one, understandably enough, is I. P. Pavlov. The discussion of the electroretinogram (ERG) as originally classified by Autrum and amended by others is masterly.

As the author points out in his concluding remarks, our present knowledge based on all the nonbehavioral studies is insufficient for a complete understanding of insect vision. In these few concluding pages, the paths of future research are clearly charted. It would be worthwhile to all who are interested in extending their knowledge of insect vision to read these pages carefully. I certainly hope that before a decade has passed (for so rapidly is the field changing) Mazokhin-Porshnyakov will publish a critical revision of his book.

MYRON L. WOLBARSH

*Department of Ophthalmology,
Duke University,
Durham, North Carolina*

Books Received

The Acoustical Foundations of Music. John Backus. Norton, New York, 1969. xiv + 314 pp., illus. \$7.95.

Advanced Calculus. Harold M. Edwards. Houghton Mifflin, Boston, 1969. xvi + 512 pp., illus. \$10.50. Houghton Mifflin Series in Basic Mathematics.

Applications of Mental Health Statistics. Uses in Mental Health Programmes of Statistics Derived from Psychiatric Services and Selected Vital and Morbidity Records. Morton Kramer. World Health Organization, Geneva, 1969 (U.S. distributor, American Public Health Association, New York). 112 pp., illus. Paper, \$3.

The Architecture of the Well-Tempered Environment. Reyner Banham. University of Chicago Press, Chicago, 1969. 296 pp., illus. \$15.

Bernhard Eduard Fernow. A Story of

(Continued on page 1290)