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. GEORGII 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 experimental 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. WOLBARSHT
Department of Ophthalmology,
Duke University,
Durham, North Carolina

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

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