Photoreceptors

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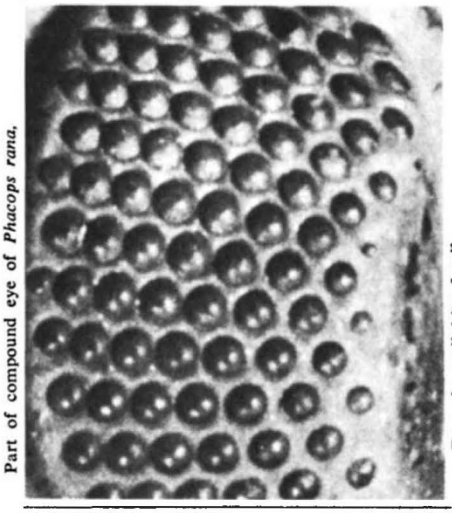
Photoprocesses, Photoreceptors and Evolution. By Jerome J. Wolken. (Academic: New York and London, November 1975.) $19.50; £10.15.

I WAS sadly disappointed that the promises of the title of this book, and its preface, were not fulfilled. The rapid progress of research into photosynthesis, vision and other fields of photobiology would make an overview of the relationship of the sun to life processes most timely. Unfortunately, Dr Wolken's approach is seriously biased by his own interest in invertebrate photoreceptors, resulting in a book that is badly out of balance—for example, the vision chapters occupy 110 pages, photosynthesis is confined to 27, and evolution, although appearing in several section headings, is barely mentioned in the text.

At best, the book presents a survey of visual photoreceptor structures in vertebrates and invertebrates, but most of the information, including the illustrations, appeared in Dr Wolken's earlier monographs. Beyond this, the text is a mixture of wide-eyed statements about the wonders of nature, and a mass of unrelated and often misleading facts, making a book that is not only difficult to read but that has to be read with the greatest wariness. In his preface, Dr Wolken says that the book is not intended for experts, but I find it hard to recommend it to anyone without a fair knowledge of both photobiology and evolution: there is much that is irrelevant, out-of-date, and—more serious—much that is omitted; for example, a Jablonski energy level diagram (carelessly copied from another author) is included without any explanation; a page is devoted to the geological time scale, but this is not mentioned again; 10 pages are given to a short account of bioluminescence that seems to have no place in the text, for in the author's own words, "The relationship of bioluminescence to photoreception . . . in evolutionary development is far from understood"; and so on.

The book is nicely produced, but I am curious about the two-inch wide margins; are these intended to raise the book into the 'coffee table' category, or are they for the reader's own additions? I had hoped to learn more about the bearing of light on evolution, but beyond token references to Darwin, Mendel and Karl Marx, the only photobiological system discussed in evolutionary terms is vision. Even in this restricted field, the fascinating story of the development of photoreceptors is barely mentioned, and we are given little more than a repetition of George Wald's 20-year-old theories on the evolution of visual pigments. There is no mention of the work of Bridges, Munz, McFarland and others over the past 10 years even though this has provided some hard facts about the relationship of visual pigments to environmental factors. In view of this poor treatment of evolution, and the sketchy information on primary photoprocesses, I suggest that the intending reader should ignore the first and third words in the title, and regard the book simply as a rather limited survey of photoreceptors. □



Part of compound eye of *Phacops rana*, a Devonian trilobite fossil

George Duncan

Photoreceptor Optics. Edited by A. W. Snyder and R. Menzel. Pp.x+523. (Springer: Berlin and New York, 1975.) DM 97; $41.80.

THIS book comprises a collection of papers that were presented at a colloquium in October 1974. Any text that is published within nine months of the meeting that conceived it is indeed remarkable and *Photoreceptor Optics* is doubly laudable because its chapters are so cross-referenced and deftly edited that we are made to feel that the authors were interested and indeed stimulated by the papers of their coparticipants.

The text is concerned with "how the optical properties of photoreceptors —their arrangement, orientation, shape, size, refractive index and membrane properties—influence their absorption of light and establish many of their specialised functions", and the initial section gives the most comprehensive treatment available of the role of wave guide optics in photoreceptor processes. The excellent theoretical chapter by A. W. Snyder is essential reading for all who debate the reasons for the intrinsic directionality of photoreceptors, or the importance of optical coupling between receptors.

After the mathematical rigour of the initial section, the second and third sections on photoreceptor membranes provides light relief, especially when introduced by a contribution by P. A. Liebman that manages to be both nutritious and easily digested. He provides a good review of the classical problem of determining the contents of photoreceptor cells by optical means, but he also gives us a glimpse of his very interesting present work on the axial diffusion of photopigment in cones. His findings go a long way to explain the difference in the distribution pattern of radiotracers in vertebrate rods and cones found by R. W. Young. He also focuses our attention on the small and hitherto unnoticed axial gradient of birefringence in rods, and on the basis of the observation, he spins a marvellous (and convincing) tale of the ageing of lipids in the rod–disc membrane.

Although the importance of pigment granule migration is acknowledged throughout this book, there is only one short paper on the possible photomechanical mechanisms at play, and that, by W. H. Miller, simply amplifies an earlier work by Miller and Cawthon. They suggest that microtubules mediate the movement of pigment granules in *Limulus* and they base their argument on the fact that the application of colchicine causes the same centripetal movement of shielding pigment as light does. It would be interesting in this respect for someone to repeat the experiments of W. A. Hagins who reported in a brief communication ten years ago that there was in fact no pigment migration when the illuminated photoreceptor (in this case cephalopod) was bathed with sodium-free medium.

The great complexity of the arthropod photoreceptor system is highlighted by G. A. Horridge in the concluding section. From an analysis of intracellular microelectrode data, he found that there were two discrete sizes of quantum bumps in cells 1–6 of the fly's ommatidium. The miniature potentials elicited by 333-nm light are in fact larger than those produced by 500-nm light incident on the same cell, and so it seems that there are probably two transduction mechanisms within the same cell. It also seems likely that one pigment lies above the other and therefore orthodromic illumination and antidromic illumination may be differentially absorbed.

Although this text is within reach of the corporate rather than individual pocket, the conscientious researcher in the field of photoreceptor optics should ensure that he has ready access to a copy. □