

aromatic acylons. This leads to a discussion of the complex forms of tautomerism displayed by the reductones. There are detailed accounts of the chemistry of the simplest member (triose reductone) and its derivatives, of reductones containing thiol or amino groups, aromatic and heterocyclic reductones, vinyl-homologues of reductones, and substances of the reductic acid type. Two of the main chapters are devoted to ascorbic acid and its derivatives, and to a consideration of the biochemistry of vitamin C and its analogues.

The book will be of great value to all whose work involves compounds containing the endiol system ( $\text{—C(OH)=C(OH)—}$ ) or its dehydro form ( $\text{—CO—CO—}$ ). Clear accounts are given of the theoretical background to the synthetic reductones, but in the important case of L-ascorbic acid one looks in vain for a connected statement of the evidence upon which the accepted structure is based. The necessary information is indeed recorded (although in ref. 7 on p. 196 the name of the journal is incorrect), but it is found in various places, and there is little indication of the many fundamental problems presented by the chemistry of ascorbic acid and its analogues.

In the chapter on biochemical aspects—where admittedly the number of possible references is legion—it is a pity that an omnibus reference to a review article (p. 305) should tend to obscure the very important part played by S. S. Zilva in the development of our knowledge of vitamin C. In view of the recent work by Calvin, it is doubtful whether many chemists would agree that glycolaldehyde (p. 298) or formaldehyde (p. 309) can be regarded seriously as precursors of the carbohydrates in photosynthesis. One feature is, however, well brought out in this section—namely, the extraordinary complexity of the problems involved in ascertaining the biological role taken by L-ascorbic acid and the little progress that has been made in this field despite all the efforts of the past few years.

It is clear that the reductone system still holds many important secrets both for the chemist and the biologist to uncover.

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## PHYSIOLOGICAL OPTICS

### Light, Colour and Vision

By Prof. Yves Le Grand. Approved translation by Dr. R. W. G. Hunt, Dr. J. W. T. Walsh, and F. R. W. Hunt. Pp. xiii+512. (London: Chapman and Hall, Ltd., 1957.) 63s. net.

**T**HIS book is a translation of Vol. 2 of Prof. Le Grand's "Optique Physiologique", and the first word must be one of congratulation to the team of translators. They have done a first-class job, as we might indeed expect they would, and they can derive much satisfaction from the fruit of their very considerable labours. There has evidently been close and cordial co-operation between author and translators, and the opportunity has been taken to report work of more recent date than 1948, when the French edition was first published.

The book is essentially a survey of researches on visual perception, with the main emphasis on colour vision. Comparison with Helmholtz's "Physiological Optics" is suggested on the jacket, but perhaps a more valid parallel would be with Parsons's "Colour Vision". Certainly, Sir John would have rejoiced, if he had lived a few weeks longer, to have seen the publication in Britain of this worthy successor

to his own book, which was itself a landmark in the development of the subject.

The contents are divided into two Sections, with Section A headed "Experimental Facts", and Section B "Theories of Vision", but the merits of this division are not too clear. Thus, of the five chapters comprising Section B, three of them deal with the anatomy, the photochemistry and the electrophysiology of the retina respectively, and are primarily factual rather than theoretical. On the other hand, in the fifteen chapters comprising Section A, covering radiation, photometry, colorimetry, normal and anomalous colour vision, thresholds of various sorts, and spatial and temporal effects, a number of theoretical tit-bits have crept in.

One of the most effective of these is on p. 271, where the author discusses Fechner's integration of discrimination steps to produce a scale of sensation *S*. He concludes that "it may be questioned whether there is any reality in this quantity *S* which has lost all the attributes that are needed for a scale of constant intervals and that were assigned to it by Fechner in order to define it". In spite of this denunciation, the logarithmic relation between stimulus and sensation will no doubt continue to plague us for many years to come.

Le Grand's balanced account of colour vision theories does not conceal the fact that he himself is a Young-Helmholtz 'three-components' man and he regrets the disfavour into which Young's theory has undeservedly fallen among certain physiologists. Of the zone theories which are an elaboration of Young's theory, he recognizes that they may correspond with physiological facts, but that only experiment can confirm or deny this. He also reminds us that whatever the retinal basis for colour discrimination may be, the identification of the messages between retina and brain, and their decoding in the brain, have still to be explained.

Occasionally, Le Grand's judgment seems to falter, as when he suggests on p. 287 that all colour threshold problems can be solved from the discrimination ellipses in the chromaticity chart. Again, the manner in which on p. 302 he brushes aside after-images as an annoyance to the physicist, apparently unworthy of his study, is somewhat out of keeping with the general tenor of the book. Then his reference on p. 336 to the experiments by Horner and Purslow, in which the size of field was found to affect the red-green mixture required to match a yellow in the Nagel anomaloscope, does not explain that their observations were made with an unrestricted natural pupil and with the observer stationed at various distances from the anomaloscope field. The phenomenon is of very real interest, but it seems to be connected more with the pupil diameter than with the size of field, since the same effect is not observed with an instrument using an artificial pupil.

But these are minor criticisms of what is undoubtedly a very fine book. It is written by a physicist who has himself made notable original contributions, both theoretical and experimental, to the subject of vision, and who has taken a keen interest in its historical background. Above all, he brings out the mystery which still surrounds most visual problems and which adds so much to their attraction. For their complexity and inherent scientific interest, they compare favourably with the problem of launching a *sputnik*, their study is far less expensive and their solution is happily not a matter involving national military prestige.

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