Book Reviews

Retinal structure and colour vision: a restatement and an hypothesis. E. N. Willmer. Cambridge, Engl.: at the Univ. Press, 1946. Pp. xii + 231. (Illustrated.) $4.50.

This book is essentially the statement of an hypothesis of color vision. It contains a Foreword, a Preface, seven chapters, and an Addendum. The Foreword, by W. D. Wright, recommends the book with obvious misgivings. The Preface, by the author, tells us that what follows is "frankly provocative and speculative." And so, indeed, it is.

The first chapter is mainly histological description of the retinal elements, including not only the rods and cones, but the neural elements as well. The second chapter, which treats of the functions of the retinal elements, presents information about nerve impulses, dark adaptation, the spectral sensibilities of the rods and cones, and about visual purple and visual violet.

With the third chapter the presentation of the hypothesis begins and is continued through the next three chapters. The seventh chapter deals with color blindness and with the bearing of Willmer's hypothesis on it.

The Addendum, written after the rest of the book was in press, records some recent experiments on color vision of the fovea and further elaborates the hypothesis. It closes with a general statement of the ideas involved. A list of references and two indexes follow.

The essential thesis of this book rests on the fact that only two receptors—rods and cones—can be differentiated histologically in the retina. The author then assumes that color vision depends on the combined action of these two receptors. The rods are mainly concerned with the short-wave or blue and green end of the spectrum; the cones, with the long-wave or yellow and red end of the spectrum. The various color sensations result from the relative stimulation of the two receptor systems by the different parts of the spectrum.

The main quantitative prop for this novel idea comes from manipulation of the spectrum luminosity curves of the rods and cones when these are of equal height or equal area. If for each wave length one plots the cone luminosity as abscissa and the rod luminosity as ordinate, the resulting curve roughly resembles the standard international (ICI) spectrum locus plotted on a right triangle. Some additional assumptions and a logarithmic plot of the cone and rod luminosities for each wave length result in a diagram which vaguely resembles the just discriminable chromaticity step data developed by MacAdam and by Wright for the color domain. A further translation from luminosity to frequency of nerve impulses in rod and cone fibers yields curves which describe in a roughly quantitative way the saturation of the spectrum and the addition of white to spectral colors.

Finally, since one of the central facts of color vision is its trichromatic nature, a third receptor is added to the rods and cones. This is a hypothetical non-dark-adapting day-rod whose properties are not defined too clearly, but whose spectral sensibility may be different from that of ordinary rods. The fovea centralis is described as composed of cones and of these non-adapting day-rods, which makes it dichromatic, as some experiments appear to show.

All this is amusing and speculative, and would have made an interesting afternoon's conversation between the enthusiastic author and a more critical mentor. Presented as a book of over 200 pages, however, the idea becomes labored and unconvincing. Its central thesis rests on a misconception. The rod and cone luminosity curves are usually drawn to equal heights for convenience, not because they are really so. Actually the rod maximum is about 50 times as high as the cone maximum. Moreover, while some observers have a few rods in the fovea, many people show none. Still, color vision is essentially a phenomenon of the fovea.

The audience of this perverse book is a limited one, because only those who are thoroughly familiar with the data of vision in general and of color vision in particular can read it with the necessary critical evaluation. Others will surely become confused, not only because of the strange and incomplete nature of the ideas, but because of the mistakes and misunderstandings, of which there are many.

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Statistical analysis in biology. (2nd ed.) K. Mather. New York: Interscience, 1947. Pp. 267. $5.00.

Because of its clarity, the first edition of this book gained considerable favor among biologists. The revised second edition is changed in no fundamental respect. It includes a new chapter on the angular transformation for proportions and the probit transformation for dosage-response data, written in the same clear style. Other changes involve the addition of footnotes, corrections of typographical errors, and new dating of references.

The book covers the common tests of significance, the normal deviate test, the t-test, the X^2-test, and the analysis of variance F-test, exhibiting their use in a considerable variety of biological experiments. The mathematical models of frequency distributions which arise most often in practice are explained rather thoroughly. These include the binomial, the normal, and the Poisson distributions. Three chapters on two or more variates and a chapter on estimation of unknown parameters complete the volume.

The author has placed emphasis on the advantages of planning experiments in order to extract maximum information from the observations. More emphasis might be placed upon the principles and methods of estimation, carrying the exposition of these methods along with the discussion of tests of significance rather than relegating them to a late chapter. An introduction to the concepts of the power of a statistical test and of errors of the first and second kind in testing statistical hypotheses might not be amiss in a volume of this sort, although an exposition for students in the nonmathematical sciences might present a considerable problem.

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