

## MECHANISMS OF VISION

### Visual Mechanisms

Edited by Prof. Heinrich Kluver. (Biological Symposia, Vol. 7.) Pp. viii+322. (Lancaster, Pa.: The Jacques Cattell Press, 1942.) n.p.

THIS volume is the outcome of a symposium on "Visual Mechanisms" organized in September 1941 for the celebrations of the fiftieth anniversary of the University of Chicago. It is in twelve chapters, each written by specialists engaged in research on particular aspects of vision and each dealing with the advances and outstanding problems in a special field. With such a composition it might well have become no more than a series of disconnected reviews, but the authors and editor have made it into something which can be read straight through with pleasure by anyone interested in vision. Careful arrangement of the subject-matter is partly responsible, for we are led by easy stages from the material to the mental, from the photochemical reactions of the retina to the problems of visual recognition and learning. Thus the first chapter is by Selig Hecht, written with his usual lucidity, on the number of quanta needed for visual sensation. The chemistry of the visual pigments is dealt with by A. C. Krause and George Wald, there is a middle section on the activities of the visual pathways as they are revealed by electrophysiological techniques, and this leads up to the discussions by Lashley and Klüver on the way in which visual stimuli can be supposed to determine behaviour.

The book is a record of rapid progress made in the last few years, mainly along lines opened up by new techniques of physics and chemistry. The lines of advance were often unexpected and some of the classical problems of vision are not much nearer solution. There is no chapter on colour vision, for example, and probably there would not be much excuse for one, although Hartline and Granit have added significant data. But to compensate there is a valuable discussion of the factors determining visual acuity by Marshall and Talbot, based on the new electro-physiological methods. One of the basic (but seldom discussed) problems of vision is how we see, sharply defined, a straight line the geometrical image of which subtends in width only a small fraction of a retinal receptor. Marshall and Talbot have mapped the visual cortex in monkeys and have found that for the fovea the pathway from each cone expands on its way to the striate area, giving probably a direct connexion with a hundred cortical cells apart from any spread due to cross connexions at different levels. Thus the cortical mosaic has a much finer grain than the retinal; and they show that for a variety of reasons it is the cortical mosaic and not the retinal which decides the acuity of vision, the retinal mosaic being discounted by eye movements as well as by diffraction, while the cortical contrasts are intensified in a way which restores the sharpness of outline. In another chapter Bartley considers brightness discrimination from the same angle. Neither of these contributions makes easy reading, but arguments about neurone systems must always suffer from the complexity of the events with which they deal. Both chapters are certainly worth study as evidence that the analysis of activity in the units of the nervous system has already given place to attempts at synthesis, to the formulation of principles governing the distribution of activity in large groups

of interconnected units. In the brain the messages from sense organs are not projected on a blank surface, but on one with a constantly changing activity of its own. We can begin to see what sort of interactions can occur and how the whole field may influence what happens in a limited arrival area: in fact the gap between the nerve impulses of the physiologist and the total configurations of the psychologist seems no longer immeasurably wide.

The two psychologists whose chapters end the book have never treated the gap between physiological and psychological aspects as if it were too wide to be contemplated with decency. Lashley has been concerned with it throughout his work and has made it far less formidable by defining the main obstacles. In this volume he deals particularly with the problem of learning and of 'stimulus equivalence'. What sort of physiological mechanism can explain our recognition of the letter A whenever we meet it? What we recognize is not the stimulation of certain neurones which have been sensitized by repeated use, for the neurones will vary with the size of the letter and its position in the visual field. Lashley rejects various theories but thinks that reverberating circuits in the cortex and interference patterns offer a more hopeful prospect. We must wait and see: meanwhile Klüver's article shows the fallacies of assuming that animals must see things as we do, and shows the careful analysis of behaviour which is essential before we can argue from the monkey to man.

Klüver rightly stresses some of the dangers of the comparative method when we are dealing with the visual system as a whole, but there is no doubt of its value when we are concerned only with the receptor apparatus. The descriptions of the anatomy of the retina by Walls and Polyak illustrate this and so do the chapters on the chemistry of the visual pigments. Wald's deals particularly with the relation of rhodopsin to vitamin A (a relation which Krause treats with some reserve), and the zoologist will be specially interested in his account of porphyropsin, the pigment in the eyes of freshwater fish, related to  $A_2$  as rhodopsin is related to  $A_1$ , and of the rhodopsin- $A_1$  system in molluscs and arthropods.

The volume is worthy of the notable occasion for which it was designed. Though the War may limit its circulation we are deeply indebted to all who have taken part in it, for they have given us a welcome reminder of some of the fundamental problems of science.

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## TEMPERATURE CONTROL

### Temperature Control

By A. J. Ansley. Pp. viii+126+6 plates. (London: Chapman and Hall, Ltd., 1942.) 13s. 6d. net.

ANY regular reader of a journal devoted to physics, or to scientific instruments, or to chemistry or to industrial chemistry, will find several articles each year in which a thermostat or controlled-temperature bath is described. In the view of its author, each of these new designs is superior to any of the old ones, and in fact they usually incorporate improvements, and are usually particularly suited to the problem in hand. Given then this vast mass of literature, it is certain that an investigator confronted with the problem of building a thermostat