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Correspondence

Operations on the eyes of Africans

To the Editorial Committee of the **British Journal of Ophthalmology**

SIRS,—Concerning the article "Failure of Filtering Operations in the African" by N. H. Welsh (*British Journal of Ophthalmology*, 1970, **54,** 594), I should like to bring to your attention our publication, Excision of Tenon's Capsule in Fistulizing Operation on Africans. With this technique we obtained success rates of more than 90 per cent., and it became clear that Tenon's capsule excision prevented scarring and closing of the bleb.

It should become the operation of choice in Africans. Subsequent experience in many patients and further follow-up of the group originally described confirmed our results.

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Yours faithfully,
I. BEN-SIRA

March, 4 1971

References

BEN-SIRA, I., and TICHO, U. (1969) *Amer. J. Ophthal.*, **68,** 336

Book reviews

Physiology of Colour and Pattern Vision. By K. MOTOKAWA. 1970. Pp. 283, 137 figs. Igaku Shoin, Tokyo; Springer, Berlin. (DM 72; U.S. $18.)

This book describes and discusses the long series of researches on the visual process carried out in the last 25 years by Motokawa and his co-workers in Japan. The work falls broadly into two categories: electrophysiological, including the discovery of the so-called X-component of the electroretinogram, and psychophysical, concerned mainly with the observations and implications of the effects of pre-exposed light stimuli on the electrical phosphene. It is this latter work – particularly with Motokawa's name – that has sometimes puzzled vision researchers in the West, and which seems to have remained separated from the main stream of development in visual science. No doubt partly responsible for this situation are two facts. Firstly, the basic initial papers appeared in the aftermath of the war, often in less easily accessible Japanese journals and, secondly, phosphene measurements of the Motokawa type involve a difficult technique and would appear to need (for success) suitable trained subjects. The present book is particularly welcome as providing an authoritative, coherent, and well-written account of the whole development, covering details of the method, the principal experimental studies, and the extensive superstructure of deduction and theory erected on the results obtained.

When a single brief electric pulse is passed through the retina, *via* electrodes applied to the forehead, the minimal current needed to produce a luminous repsonse (phosphene) defines the electrical threshold, and its reciprocal, the electrical excitability. In 1949, Motokawa showed that excitability was increased if a light stimulus were applied to the retina at any time in the period from about 0·5 to 10 sec. before the pulse. He introduced the quantity

$$\zeta = [(E - E_0)/E_0]\ 100$$

as a measure of the "physiological effect" of the light stimulus, where E_0 is the excitability of the dark-adapted retina in its resting state, and E is the excitability at a particular moment after a specified pre-exposure of one (or more) light stimuli. Practically all the psychopyhsical work reported depends on measurements of ζ. A few examples of the very many results obtained may be quoted. After a brief monochromatic stimulus, the shape of the curve of ζ against time is characteristic only of the wavelength of the stimulus, an increase in its intensity merely having the effect of raising the whole curve. If the stimulus is applied at the fovea, the time course shows a maximum value of ζ at a time increasing from 1 to 3 sec. as the wavelength moves from red to blue, while for violet stimuli there are two peaks, at 1 and 3 sec. For peripheral stimuli of sufficiently low intensity, all wavelengths give a single peak occurring at the same time (2 sec.). By these and other experiments with single monochromatic stimuli, Motokawa is able to derive so-called "physiological sensation curves" attributed to the rod system for peripheral stimuli and to 'red', 'green', and 'blue' cone systems for foveal stimuli. While his derivations are not always as rigorous as could be desired, the curves so obtained resemble spectral sensitivity curves for rod and cone systems arrived at by entirely different methods. When more than one light stimulus is used, the scope of Motokawa's method is extended to inductive effects. If a coloured stimulus is applied a second or two before a white stimulus and on the same retinal area, the white only ζ-time curve is raised and its peak time is displaced in a way depending on the colour (direct induction, correlate of successive contrast). If the coloured stimulus is applied in an area adjoining that of the white, similar effects are observed, except that the modifications of the ζ-time curve are those which would be produced by direct induction using a stimulus of the complementary colour (indirect induction, correlate of simultaneous contrast.) The indirect induction produced by one coloured stimulus can be neutralized by the indirect induction of a (third) stimulus of the same colour. Also the indirect inductive effects of two coloured stimuli can cancel out if their colours are complementary. In further work, still more elaborate spatial and temporal distributions of pre-exposed stimuli are used – the measured quantity being always ζ – and Motokawa reaches the general conclusion that the inductive effect of a light stimulus has many of the properties of a wave propagation over the retina. He determines the velocity of propagation and demonstrates reflection (a supplementary white bar stimulus both blocks the spreading induction and re-directs it as a reflected wave), refraction, diffraction, and Doppler effect. In another group of experiments, the inductive field round the figures of familiar optical illusions (*e.g.*, the Müller-Lyer figure) was measured and plotted as a contour of constant ζ value. From the characteristics of such diagrams, explanations, or at least interpretations, of the illusions are derived. When the single electric pulse for generating phosphenes is replaced by alternating current stimuli of various frequencies, the action of pre-exposed monochromatic light stimuli is shown to be most pronounced at certain 'resonance' points where the wavelength of the light and the frequency of the alternating current stand in a special relation. These resonances are associated with different receptor mechanisms in the retina, of which Motokawa identifies three in the fovea and four in the periphery, in addition to a resonance produced by the rod system.

Unfortunately, little work on phosphenes on the lines of Motokawa's has been done outside the laboratories of his school. Riggs, Cornsweet, and Lewis (1957) observed the enhancement of excitability by a pre-exposed light stimulus but could not confirm the wavelength dependence of the effect. This is attributed by Motokawa to their use of an inappropriate measuring technique. Whatever reservations may be felt about Motokawa's data and his inferences from them, there is no doubt that further independent checks on the salient results should be made.

In the objective electrophysiology – the electroretinogram, slow potentials, and spike activity, lateral geniculate and cortical response, receptive fields, etc. – which occupies the first three of the eleven chapters of the book, the author's researches dovetail with much current work, and he gives an interesting and detailed review of the present situation as he sees it.

In all, this is a book that every library concerned with the visual sciences will need to have.

Postoperative Disturbances of Wound Healing. (Postoperative Wundheilungsstörungen.) Edited by F. W. GIERHAKE. 1970. Pp. 74, 15 figs. Springer, Berlin. (DM 19.80.)

In this stimulating work, the authors deal with disturbances of primary wound healing from both bacterial and other more mysterious causes. When accurate records of careful observations are analysed they find an overall figure of 10 to 15 per cent. abnormality in healing. It is most important to rely on careful statistics and not estimates and subjective impressions, and the examination of records of over 30,000 general operations cover series both before and after the second world war. The incidence of complications shows no change despite the introduction of antibiotics which may indeed have led to less strict asepsis in surgery. The role of bacteria and antibiotics is detailed and other factors are considered. The age of the patient and acuteness of the condition concerned are important; time of year is not. Figures vary with the nature of the operation but the statistics for different series of the same operation are consistent. Although the patient's age and the duration of the operation are two factors which have worsened recently, improved anaesthesia and earlier mobility have countered them. The references and index are good and the editor's observations on the principles of sound wound healing, and especially his insistence on the need for continued asepsis, will apply to ophthalmic surgery as much as to the general surgery he considers.

Physiological Bases of Light and Colour Sensations. (Physiologische Grundlagen der Helligkeits-fund Farbempfindungen.) By W. STARKIEWICZ. 1970. Pp. 128, 41 figs, 81 refs. Ophthalmological Monographs No. 39. Thieme, Leipzig. (D.M. 37.)

The author surveys the physiology of vision and the relation of the physiological data to the perception of light and colour. He believes that only under unusual conditions are the perceptions strictly related to the stimulus and the physiological processes in the retina and the optic pathways. Under normal familiar circumstances, the impressions are modified by psychical adaptation, especially by verbal associations mediated from Broca's centre. The author calls this auditory cooperation a "verbal reflex". It appears difficult to distinguish between normal and unusual circumstances. Further, the reviewer calls as witness Duke-Elder who stated that "the vision of colour in normal illumination is no less problematic than vision in abnormal illumination". The combination with tactile impression, which the author recommends for the re-education of a faulty localization after squint operations, has been practised for a long time. The statements that psychological adaptation can succeed in perceiving as upright an image which has been inverted by a "prism" and that a nervous impulse is travelling up to a "meningeal" centre are obvious mistakes. The author believes in the generally accepted three-cone colour theory of Young-Helmholtz. The explanation offered by this theory for the phenomenon of simultaneous and successive contrast, and that of complementary-coloured after-images is not very convincing, though it has to be admitted that Hering's teaching of dissimilation and assimilation is also open to criticism. The old conception that different sense perceptions have to make use of different nerve fibres is controversial, since it has been demonstrated that elements in the optic nerve and in the lateral geniculate body react differently to an "on" stimulus of light waves than to an "off" stimulus. It is conceivable that the same cone reacts in eliciting a different colour sensation by different wavelengths of light. Hitherto even the electron microscope has shown no anatomical difference between the cones which are supposed to react independently on red, green, or blue light waves. The author describes with remarkable certainty,