first meeting, and Douglas Anderson is the moderator of the second meeting, consisting of 7 cases of angle closure glaucoma. The panels consist of eminent researchers into glaucoma and are different in each symposium (except for Robert Shaffer, who was present in both, and whose comments are always to the point, profound yet essentially practical). The case presentations are halted at certain points for discussions and generalisations, and much ground is covered. The bias of the symposium is towards the solution of specific everyday problems, and, not unexpectedly, the level of discussion varies widely between traditional views and controversial and stimulating statements.

It is clearly impossible to discuss the 19 chapters individually, but perhaps a few statements and opinions may be singled out for their interest. Assessment of the diurnal variations in pressure is best carried out by sporadic checks at the clinic at different hours, or by home tonometry; inpatient hospital phasing is not so reliable, as it involves a profound change in the patient's routine. Almost all the panelists commonly used the water drinking test, but tonography is no longer a routine investigation, being reserved for special cases. A recent spate of litigation cases in the US concerning juvenile glaucoma prompts several panelists to perform tonometry on every co-operative subject regardless of age. However, Shaffer would limit this to cases with suspicious-looking discs and to those persons in whom it can be carried out in a reasonably short time.

Epinephrine almost certainly improves outflow facility fairly rapidly and not, as was thought, after a long latent period. The peak of its dose-response curve appears to be at the 1% concentration of active drug in the short term, though it may be as high as 2% in the long term (Bernard Becker). Stability of adrenaline solution is greater with the bitartrate and the hydrochloride (Epifrin, Glaucon) than with the borate (Epinal, Eppy), but the borate compounds are more comfortable to use. Although little statistical evidence has been adduced, there is an impression that the disc cup changes more readily if it is already large (John Hetherington). In ocular hypertension the pressure responses to, and patient tolerance of, treatment are important factors in deciding when and how much to treat. In drainage operations vitreous aspiration is increasingly recommended to prevent sealing up of the drainage aperture by vitreous. Provocative tests in angle closure glaucoma remain essentially unreliable. The least unsatisfactory tests are the dark room test and the prone test. Mydriatic tests give many false positives. Neither the patient's advanced age nor a considerable degree of widening of the angle with pilocarpine should weaken our resolve to operate on every case of acute angle closure glaucoma (Pollack). However, tonography has a place in evaluating the chances of success of peripheral iridectomy after an acute attack: if $C \leqslant 0{\cdot}1$, we can expect over 75% of failures (Shaffer).

The volume is beautifully presented and contains several illustrations and clear tables. JOHN ROMANO

Mechanisms of Colour Vision. By W. S. STILES. 1978. Pp. 287, figs., tables, refs. Academic Press, London (£14)

This book contains some of the important papers published during the last half century by Dr W. S. Stiles, a doyen amongst visual physicists. The title is slightly misleading, because the author's wide erudition has enabled him to range not only over the mechanisms of colour vision but also over those of vision in general. The papers are reproduced photographically, and in an introductory chapter there is an indication of the extent to which the author may have wished to modify earlier views. Some of the papers may be hard to trace in the original, and for this reason newcomers to the field have every reason to be grateful for the appearance of the book. Its method of production, however, entails repetition, and this may cause a justifiable grumble on economic grounds. R. A. WEALE

Correspondence

On difficulties in deciding the aetiology of cataract

TO THE EDITOR, *British Journal of Ophthalmology*

SIR, Because the lens fibre system contains only 1 type of cell it has a fairly limited number of ways in which it can respond to injury and on interference with its nutrition. It is therefore extremely difficult from the appearance of the cataract, and the clinical examination of a few cases, to decide whether a history of exposure to a known cataractogenic agent is proof that this agent is important in the genesis of cataract in man, as has been implied, for instance, in the recent study by Zaret and Snyder (1977).

As an example of such a difficulty we may consider a patient employed in servicing radar equipment who had a history of intermittent exposure over a period of 20 years to 3-cm microwaves from high-intensity sources of up to 60 kW. He developed cataract at the age of 52 with reduced vision in each eye. Slit-lamp examination showed interesting features in both lenses. There was vacuolation of the anterior capsule and striate changes in the anterior cortex, while at the posterior pole there were vacuoles and a feathered appearance of lens fibres. No other changes in the eye were apparent, and the intraocular tensions were normal.

It was possible at a later date to examine these lenses by light and electron microscopy. There were large areas of fibre disruption at the anterior pole, and portions of the anterior epithelium appeared to have suffered some necrosis. In addition the superficial cataractous lens fibres were separated from the capsule by clefts filled with albuminous fluid. At the posterior pole the lens fibre membranes had produced myeloid whirls and numerous granular bodies. From these appearances, which can all be seen in senile cataract, it was not possible to state that the changes were character-

istic of microwave cataract. This was so despite the initial somewhat unusual slit-lamp appearance.

It would seem, therefore, that to establish beyond reasonable doubt that, for example, microwave radiation is significant in the production of cataract in human subjects it will be necessary to perform a controlled study of patients which have been exposed to this hazard and matched for age to those not so exposed.

Some statistical considerations along these lines also have a bearing on the problem of attributing causation in the absence of a demonstrable noxious stimulus. In view of the relatively young ages of the cataract patients considered by Zaret and Snyder (1977) one has to face the question whether a non-avionic aetiology is statistically defensible. Before any of the necessary assumptions is dismissed out of hand it may be as well to suggest that such an analysis would have been expected in the original paper on the ground that an explanation on an avionic basis would in any case have to stand up to an epidemiological comparison on an age-for-age basis, as suggested above.

We have to form an estimate of the number of cataracts, C, in different age groups in a defined population. According to Van Heyningen (1975) this is about five times greater in the USA than values appropriate for the United Kingdom and Israel (Caird, 1973). It is easily shown from those studies that, for ages younger than 70, the relation between C and age, A, is given approximately by

$$\log C + 5{\cdot}8 = 0{\cdot}048\ A \qquad (1)$$

In other words, with a 1:10 chance of a cataract extraction at the age of 100 this drops by a factor of 250 at the age of 50. The age distribution of New York approximates to the rectangular type of reasonably healthy modern urban populations (Money, 1973), that is, the fraction, S, of people in the various age groups are approximately equal within the average life span. The latest figures available for New York's population distribution are dated 1974, and the 30 to 40 band is somewhat narrow, at 10% owing to the first world war period. The population, P, of New York is approximately $1{\cdot}2\times10^7$, and the number, S, of ophthalmic surgeons in that city 250. The mean number of cataract extractions per annum per surgeon (in a given age group) is

$$a = C_p\ P/S \qquad (2)$$

It will be recalled that the value C is to be multiplied by a factor f, estimated to be 5, to give values appropriate to New York. For the age group 30 to 40, $C \approx 4 \times 10^{-5}$ and $p \approx 0{\cdot}10$.

Substitution into equation (2) gives $a = 0{\cdot}96$. This is an average value per surgeon per year for the age group of 30 to 40.

However, patients do not arrive as fractions, and one has to ask oneself about the probability of seeing none, 1, 2, 3, 4, etc. As these events are mercifully rare, the calculus of Poisson sums is applicable. According to this (*cf.* Davson, 1976), the probability of an event occurring 0, 1, 2 . . . m times when its average occurrence is a, is given by $\Pi_m = (a^m/m!)e^{-a}$. Thus for $m = 0$, $\Pi = 0{\cdot}38$, or the chance of not getting such a patient any one year is 2:5. Similarly, the chance of getting just 1 is 0·37, or 1:3; and that of getting 2 is 0·18, or 1:5. In other words the chance of getting at least 1 patient in the above age group is 0·63:1 in 1 year or 2 in 3 years.

Now these values are clearly high odds in our context and kept low by the assumption that all New York surgeons have an equal chance. If British surgeons are anything to go by, specialisation takes place within the field, and this means that the chances of those interested in the matter are going to be correspondingly increased.

Insufficient information is available to enable one to allow for the fact that the data on cataract statistics vary in their specificity. While, as pointed out earlier, Zaret and Snyder have provided evidence for the existence of cataracts observed also in radiation environments, they have omitted to provide an estimate of dosages, exposure times, etc., and also omitted to apply probability calculations whereby to test the statistical validity of their conclusions. The above estimate does not rule out their opinion. On the other hand, an application of the t test to the appropriate Poisson data shows that, to render the conclusion of the above authors valid, the incidence of so-called avionic cataracts would have to be greater by almost an order of magnitude for one to be able to establish a significant relation between them and unspecified radiations.

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Notes

Computers in ophthalmology

A course in application of computers to the care of ophthalmic patients and in clinical research will be held on 5–6 April 1979, in St. Louis, Missouri. For further information contact Robert Greenfield, DSc., Biomedical Computer Laboratory, Washington University School of Medicine, 700 South Euclid Avenue, St. Louis, Missouri 63110, USA.