

## Book reviews

**The Ocular and Cerebrospinal Fluids.** Edited by L. Z. BITO, H. DAVSON, and J. D. FENSTERMACHER. 1977. Pp. 561, figs., tables, refs. Academic Press, London (£20)

In 1956 Dr Hugh Davson produced a memorable monograph on *The Physiology of the Ocular and Cerebrospinal Fluids*, and by a fortunate concatenation of circumstances he has been able, 20 years later and under the auspices of the Fogarty International Centre, to organise a symposium on the same topics. This symposium, which was held in May 1976, brought together contributions from the many research workers who have intrepidly voyaged into regions which 20 years ago could be referred to as 'backwaters of physiology'. The contributions in this volume show that the backwaters have now become navigable seaways within which many different interests are represented.

The volume contains 40 contributions, of which 18 deal directly with the eye. Most of these are reviews and reports of experimental rather than clinical studies, though the contribution on papilloedema from Cogan and Kuwabara is an obvious exception. Of the review papers those by Raviola (blood-ocular barriers), Tripathi (morphology of outflow systems), Bill (physiology of aqueous drainage), and Langham (pharmacology of aqueous outflow) are especially valuable, and the papers by Bito and Wallenstein on the transport of prostaglandins and by Eakins on the breakdown of the blood-aqueous barrier break new ground and provide excellent introductions to fresh fields of interest. The papers dealing with cerebrospinal fluid and the blood-brain barrier are no less valuable, and one must single out the reviews by Brightman (morphology of blood-brain interfaces), Oldendorf (blood-brain barrier), and Welch (hydrocephalus).

As is always the case with papers provided at a symposium, the quality of the contributions is not uniformly high. Some have been added in reply to others presented at the meeting and, while valuable in their content, will prove difficult reading for the uninitiated.

The editors might have attempted to make a rather more logical arrangement of their subject-matter; excellent as the contents are for the cognoscenti, they will prove hard going for the tyro. Nevertheless, I believe that this 'Fogarty Symposium' will be an invaluable source of useful information and ideas for many years to come.

DAVID F. COLE

**Ocular Therapeutics and Pharmacology.** 5th edn. By PHILIP P. ELLIS. 1977. Pp. 283, tables, refs. Mosby, St. Louis (£15.60)

This textbook has undergone an extensive revision in its fifth edition, and new chapters on carbonic anhydrase inhibitors and local anaesthetics have been added. The aim of the book is to provide, firstly, a quick reference to treatment, both medical and surgical, of specific disorders, and secondly to give the usage, dosage, and side-effects of

the drugs used in ophthalmology. It is a useful reference book for an ophthalmic library, although the less experienced eye surgeon may at times be confused by the number of therapeutic possibilities which are suggested.

J. H. DOBREE

## Correspondence

### Pathogenesis of optic disc swelling

TO THE EDITOR, *British Journal of Ophthalmology*  
SIR, Your editorial on 'Pathogenesis of Optic Disc Swelling' (September 1978, pp. 579-580) makes the all too common mistake of equating swelling of the disc from ischaemia and similar causes, wherein there is undoubted blockage of axonal transport, with papilloedema from raised intracranial pressure (ICP), wherein at least in the early stages any such blockage is questionable and should be questioned. I am assured, by Tso himself at the 1976 Cambridge symposium, that blockage of axonal flow is not consistent with continuance of normal function. One feature of papilloedema from raised ICP is that normal vision usually continues without interference, apart from variable enlargement of the blind spot, for many weeks or months. I watched 1 case for 5 months who kept normal vision to the end and whose discs on ophthalmoscopy showed nothing suggestive of axonal transport blockage (Primrose, 1976). Prolonged or severe cases may indeed show some suggestive signs on and around the disc, and one would expect these to be cases with some interference with vision, e.g., peripheral constriction of the fields or obscurations, which are both probably from vascular insufficiency and a warning that further severe visual failure is imminent.

Blockage of axonal transport is all very well for the 'final common pathway' but it just won't do for the early stages of papilloedema. The site of such blockage is understandably similar to that found in experimental acute glaucoma and hypotony (Tso and Hayreh, 1977) and posterior ciliary artery occlusion (McLeod, 1976), but how can this be a cause or an early sign in papilloedema from raised ICP when vision is so conspicuously unaffected? These disturbances upset the hydrodynamic balance at a site susceptible for anatomical reasons to vascular insufficiency, and it is surely anoxia from this which causes the blockage. Hayreh's idea (Hayreh, 1977) seems to be that raised retrolaminar tissue pressure from the raised ICP causes some blockage of axonal transport which, from the nerve swelling at the tight hole at Bruch's level, leads to pressure on the thin-walled veins, thus explaining away the venous (and other) congestion so consistently found. A continuing CSF pressure of 300 to 400 mm H<sub>2</sub>O (22 to 29 mmHg) seems to be sufficient to produce papilloedema, and a tissue pressure of that level does not damage other nervous tissue (Hayreh, 1977). It doesn't seem to me sufficient by itself to impair axonal flow.

One must seek other reasons for the particular susceptibility of the disc, and the vascular hypothesis, which your editorial ignores, offers a means of explaining both

the early engorgement with normal function and a reason for axonal blockage when it does occur. The retrolaminar tissue suffers a reduction of blood flow from shunting to the prelaminar tissue, which shares its blood supply. It would be the first part to suffer from stasis anoxia when things become severe (Primrose, 1976).

Minkler *et al.* (1978) are quoted as favouring a mechanical cause. Yet they at least discuss a vascular cause and think to exclude it only because the central part of the nerve being furthest from the ciliary supply is spared.

A very different interpretation is possible. The retrolaminar tissue supplied by ciliary arteries is deprived by steal; the fine vessels are not empty but the flow is greatly reduced. But the axial part of the retrolaminar tissue receives some supply from the central retinal artery which is not subject to steal, hence this part with its related central field is not so susceptible (Primrose, *in press*). These authors, and others, would have us believe that the papilloedema produced by hypotony, after cryotherapy sufficient sometimes to produce hyphaema, is the same as that of raised ICP. Their finding of inflammatory cells in the oedematous disc is one indication that it is not the same. Also where in all this experimental work are there any tests to show good visual function? Even if acuity tests are not possible in animals some note of the briskness or otherwise of the pupillary reactions would be of value.

Of course there are mixed cases wherein there is papilloedema as well as axonal blockage. I've seen it myself, and the vision has been impaired. It is most evident clinically in cases of accelerated hypertension in which vision is commonly impaired to some degree and there is a recognised element of ischaemia from patchy small-vessel occlusion (Ashton, 1972). One hopes this letter makes good some of the deficiencies of the editorial and helps to give a more balanced view.

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- SIR, Three crucial issues have been raised by Mr Primrose regarding optic disc swelling from raised intracranial pressure.
- (i) *Is obstruction of axoplasmic transport compatible with continuing axolemmal conduction of nerve impulses?* Axoplasmic transport and axolemmal conduction are both completely interrupted by localised destruction or ischaemic dissolution of an axon. However, the transport and conduction functions of axons are distinct processes, and there is abundant evidence to suggest that axolemmal conduction can continue along an axon subjected to a partial blockage of axoplasmic transport, e.g., in retinal ganglion cell axons after raising the intraocular pressure (Anderson and Henderickson, 1974). The partial obstruction of axoplasmic transport postulated in clinical papilloedema and demonstrated in experimental papilloedema (Tso and Hayreh, 1977a) is thus compatible with continuing visual function. Nevertheless, how long an axon can survive and continue to conduct action potentials in the face of a partial axoplasmic transport block remains to be established.
- Observation of the behaviour of many of the animals with implanted intracranial balloons (Hayreh, 1977a) suggested that their vision was not markedly impaired; however, although visual evoked responses were recorded in 1 animal, more detailed electrophysiological testing would have been valuable. Conversely, detailed psychophysical testing of patients with papilloedema may reveal a variety of functional alterations which are not detected on visual acuity and routine visual field testing.
- (ii) *Is early papilloedema associated with obstruction of axoplasmic transport?* Hayreh has repeatedly stressed (Hayreh and Hayreh, 1977a; Hayreh, 1977a) that the disc swelling produced in his experimental model is equivalent to early or moderate papilloedema as seen clinically. Even in early experimental papilloedema the principal cause of disc swelling is distension of axons (as opposed to interstitial oedema), and these histological findings correlate with the ophthalmoscopic and angiographic picture (Tso and Hayreh, 1977b; Hayreh and Hayreh, 1977a). However, although partial obstruction of rapid and slow axoplasmic transport was clearly demonstrated in these animals (Tso and Hayreh, 1977a), no observations relating the severity of the transport block (as demonstrated autoradiographically) to the stage or severity of the disc swelling were made.
- Comparison of the ophthalmoscopic appearance of the disc in early papilloedema with that in conditions which Mr Primrose concedes involves an axoplasmic transport block (e.g., ischaemic optic neuropathy) supports the concept that similar pathophysiological mechanisms are operating in the prelaminar region.
- (iii) *What is the cause of the axoplasmic transport block in papilloedema?* Hayreh (1977b) has speculated that the cause of the laminar transport block is mechanical (from transmission of raised intracranial pressure to retinal ganglion cell axons in the optic nerve), whereas visual loss in chronic papilloedema results from prelaminar ischaemia secondary to the mechanically induced optic disc swelling (Hayreh,

## Correspondence

1977a). Neither of these assertions, however, is based on definite evidence. The relevance, for example, of the observation (Hayreh, 1976, 1977b) that fluorescein can diffuse from the cisterna magna to the vitreous cavity via the subarachnoid space, optic nerve, and optic disc is unclear.

The prelaminar venular congestion mentioned by Mr Primrose was observed to be a late event during the development of experimental papilloedema (Hayreh and Hayreh, 1977b). Nevertheless, this in no way detracts from the possibility that an ischaemic mechanism may be operating in the retrolaminar ciliary artery territory (as postulated, though unsubstantiated, by Mr Primrose) and may be contributing to the axoplasmic transport block in papilloedema.

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## Early postoperative sterile hypopyons

SIR, The article by Hunter (1978) mentions a high incidence of hypopyons following lens extraction and describes them as being sterile. The physiological reasons presented by the author explaining these hypopyons may be correct, but the possibility of infection is not mentioned.

The minimum infective dose even for virulent staphylococci is much greater than hitherto thought (Elek, 1959). That the actual number of bacteria implanted in an eye is an important factor was proved by Maylath and Leopold (1955), who injected into the cornea, anterior chamber, and vitreous of rabbits' eyes varying doses of different species of pathogenic bacteria. Their work was confirmed by Crompton *et al.* (1962) who

assessed the virulence of small doses of several species injected intracamerally. In untreated rabbits, depending on the dose and species of bacteria used, a graded response is produced from no reaction to a transient hypopyon or panophthalmitis with destruction of the eye.

Maylath and Leopold (1955) found that positive cultures of intraocular infections were difficult to obtain in rabbits, and this was confirmed (Crompton *et al.*, 1962). All ophthalmologists must be aware of the difficulty in culturing organisms from the anterior chamber of patients with panophthalmitis. Hunter (1978) assumes that the hypopyons he described are sterile. A likely cause in some of these patients would be small doses of virulent bacteria or larger doses of nonpathogens. It would be unfortunate if this interesting paper encouraged complacency in aseptic technique.

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SIR, While I appreciate Mr Crompton's concern over the maintenance of the highest standards of aseptic technique, I do not consider that my article (Hunter, 1978) endangers these standards.

In the introduction to this article it is stated that the initial reaction was to investigate and treat these hypopyons as being of infective origin, and, additionally, the operating theatre was closed on the first two occasions. However, no organism was cultured nor was any source of potential contamination found, this despite a total of 5 hypopyons in the first and 3 in the second affected lists (Theodore (1965) considered that *Pseudomonas aeruginosa* was the infectious agent in all known instances of multiple infection). Other major centres in England had also noted an apparent increase in early postoperative hypopyons, but none considered them by investigation results, presentation, or behaviour to be infective in type.

Forster *et al.* (1978) obtained positive cultures from 50% of vitreous and to a lesser extent anterior chamber aspirates in endophthalmitis, but it was considered clinically unjustified to proceed with these aspirations during the series described, as in all other respects these were routine quiet postoperative eyes. In particular there was no lid oedema, chemosis, or loss of anterior chamber or corneal clarity (Fasanella, 1957; Theodore, 1978; Peyman *et al.*, 1978), no undue pain, and the hypopyons were well established by 24 hours (Allen and