Monoamine metabolites in aqueous humour

The circulation of aqueous humour has much in common with that of the cerebrospinal fluid (CSF) (Davson, 1956). From studies by Häggendal & Malmfors (1963, 1965) and Andén, Häggendal & others (1964), it has been established that the iris, the choroid and the retina contain monoamines. It has also been suggested that their main functions are as transmitters (see Andén, Carlsson & Häggendal, 1969). The assumption that amines are released in these organs is supported by the finding of monoamine metabolites in the iris (Kramer & Potts, 1971).

For several years we have been concerned with studies on the influx and efflux of acid monoamine metabolites in the CSF (Andersson & Roos, 1966, 1968, 1972; Andersson, 1968, 1969). If aqueous humour, like CSF, contains acidic metabolites of monoamines, this would offer a new approach to the study of the action of drugs on monoamines in the eye and a simple method for studying the transport of acid monoamine metabolites from aqueous humour to the blood. Also, since there are similarities between CSF and aqueous humour dynamics, the aqueous humour might be useful as a model for studies of the monoamine metabolites in the cns.

Aqueous humour was removed from the anterior chamber of the eyes of dogs and rabbits by needle puncture under general anaesthesia with sodium pentobarbitone. The concentrations of 5-hydroxyindoleacetic acid (5-HIAA) and homovanillic acid (HVA) were determined according to Sharman (1960) and Korf, Roos & Werdinius (1971), respectively. In the controls no drugs except the anaesthetic were given. In another series, probenecid was injected either intravenously (50 mg/kg) or intrathecally (1 mg) at different time intervals before removal of aqueous humour (Table 1).

Table 1. *The concentrations of 5-HIAA and HVA in aqueous humour before and after probenecid. The values are ng/ml ± s.e. (n).*

	Dog	Rabbit
5-HIAA controls	6 ± 3 (6)	1 ± 1 (8)
5-HIAA after probenecid	26 ± 5 (6)	29 ± 6 (16)
HVA controls	35 ± 6 (7)	14 (1)
HVA after probenecid	66 ± 3 (2)	64 (1)

5-HIAA and HVA are considered to be the main acid metabolites of 5-hydroxytryptamine (5-HT) and dopamine respectively in brain and CSF. These metabolites are transferred from the brain either by active transport into blood or by diffusion into the CSF. It has been suggested that probenecid blocks the active transport mechanism for 5-HIAA and HVA from the brain and the CSF into blood. Several investigations have shown that administration of probenecid causes an increase of the concentrations of the metabolites both in brain and in CSF (Guldberg, Ashcroft & Crawford, 1966; Werdinus, 1966; Neff, Tozer & Brodie, 1967; Andersson & Roos, 1968 c).

The present experiments with aqueous humour show a similar pattern to those with CSF (Table 1). The concentration of 5-HIAA is near the limit measurable in the aqueous humour of normal animals, but increases considerably after administration of probenecid. These results suggest the possible metabolism of the monoamines in the retina.

The routes of transport for aqueous humour in the eye are much shorter than in the CSF system. This will probably simplify the studies of metabolite transport to and

from aqueous humour because it is only a two compartment system. It is also probable that drugs which are known to influence the synthesis and release of monoamines in the brain can be studied by observing changes in the aqueous humour. Furthermore, it will be very interesting to see, whether the monoamine metabolites content of the aqueous humour is changed in different pathological conditions of the eye. It has for instance been shown that there is an increase of monoamine metabolite in CSF in hydrocephalus (Andersson & Roos, 1966, 1968, b, c; Andersson, 1968, 1969). There may possibly be an elevation of the metabolites in aqueous humour in glaucoma, a condition which has many points of resemblance with hydrocephalus.

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Interaction between sodium metabisulphite and PMN

It has been reported that the antibacterial activity of phenylmercuric nitrate (PMN) is lost on autoclaving with sodium metabisulphite (Buckles, Brown & Porter, 1971). Richards & Reary (1972), however, found that autoclaved solutions of the same PMN-metabisulphite mixture possessed greater antibacterial activity than either of the individual components alone. We have made atomic absorptiometric determinations of the PMN present in these solutions and assessed the effect of pH on the antibacterial activity of PMN and PMN-metabisulphite solutions.

Atomic absorptiometric determinations of PMN were made using both the air-acetylene flame technique and the cold-vapour method (Hingle, Kirkbright & West, 1967; Hatch & Ott, 1968). Whereas PMN (0·002% w/v) and fresh PMN