OPHTHALMOLOGY

Regeneration of the Lens of the Eye in the Rabbit

In a recent communication, Chanturishvili[1] reports his re-investigation of the detailed embryology of the lens in Amphibia and refers to work on higher forms in his laboratory at Tiflis. He and his fellow-workers, in particular Sikharulidze[2], are of the opinion that the lens fibres are derived from cells which are neural in origin, and which require for the initiation of fibre production the products of the cytolysis of epidermal elements.

As a corollary of their view of lens development the Tiflis workers have introduced small fragments of cytolysing fœtal tissues into the lens capsules of adult animals from which all easily separable contents had been evacuated. They report that whereas simple evacuation without implant is followed by very little regeneration (the familiar aphakic state following the operation of extracapsular lens extraction), the addition of the implant is followed by the regeneration of a lens nearly normal in size and structure.

On a visit to Tiflis in 1955 one of us (P. G. 'E.) was enabled, by the courtesy of Prof. Chanturishvili, to see something of this work there. Later, Prof. Chanturishvili most kindly placed at our disposal, in the fullest possible detail, particulars of the techniques employed by him and his co-workers.

At Prof. Chanturishvili's suggestion, we repeated here the experimental implantation of cytolysing fœtal tissue taken from the lid commissure of a three-week embryo into the evacuated lens capsules of six normal rabbits according to the technique of Tamara Sikharulidze. We kept suitable control animals in which the lens capsule contents had been simply evacuated without implantation. This work was done because it was hoped that Prof. Chanturishvili would be able to attend the Oxford Ophthalmological Congress and to demonstrate this material of ours there. In the event, he was not able to do so, but these rabbits were demonstrated there by us in July 1958, 12 weeks after operation.

At that time there were marked differences to be seen between those evacuated lenses which had received implants and those which had not. Whereas the animals without implants showed the normal aphakic post-operative condition of collapsed and apposed capsular walls, those which had received implants showed inflated and in some cases spheroidal lens capsules, the contents and shape of which had a refractive power approximating to that of normal lens. This process of regeneration is continuing eleven months after operation.

Prof. Chanturishvili visited this Department in August 1958 and allowed us to examine his embryological preparations and generously presented us with material. He states that about 16 months are needed for full regeneration, but our most promising rabbits have lenses already little different from the normal in size. The iris can be seen to be supported by the convex anterior surface of the lens as in the normal eye, whereas in the aphakic controls the unsupported iris presents a concave surface to the observer.

Assessment of the structural and functional state of each lens in an ophthalmological sense has been made at frequent intervals by evaluation of the refractive condition of each eye as a whole by ophthalmoscopy and skiascopy. Whereas the normal unoperated eye in our rabbits is from zero to two and a half dioptres hypermetropic, the aphakic control eyes have consistently been found to be of the order of ten to fifteen dioptres hypermetropic. By notable contrast, the eyes which had received implants have been found, in the areas of incipient lens regeneration, to be comparable in refractive power to the normal as early as eight weeks after operation.

The progressive variations in shape and appearance of the lens capsule and its contents in each case have also been surveyed by frequent slit-lamp biomicroscopy. In every lens which received a fœtal implant the anterior and posterior capsule walls have become separated in part, and in some instances fully. The lens has assumed a progressively spheroidal shape. Relucence of the substance within the capsule suggests that it possesses optical properties comparable with those of a normal lens and differing from those of aqueous humour.

The approximately lenticular shape of the most successful examples and their relatively transparent and homogeneous contents make possible a satisfactory ophthalmoscopic view of fundus detail. Even in the best, however, there are some variations of optical density still remaining. These may possibly be ascribed to incomplete cytolysis of implanted material, or to incomplete removal of the original contents of the lens capsule. On the other hand, some of them may represent a stage in a process of regeneration not yet complete. Distortions of shape and incomplete separation of the capsule walls, which were found particularly in our first few operations, are probably due to faulty technique.

The preliminary observations reported here seem so far to confirm the findings of the Tiflis workers in the rabbit.

We propose to repeat our work here on a larger scale to allow the sectioning of regenerating lenses at all stages. It seems to us that this filling out of the capsule in so short a time may perhaps be ascribed to the secretion of a 'ground substance', in which fibres may grow later, more probably than to actual immediate growth of functional fibres.

Sikharulidze reports retarded but satisfactory regeneration of lenses in rabbits after the removal of cataracts induced chemically. At present we are engaged in a repetition of our work using rabbits which have received high doses of local irradiation.

D. Stenhouse Stewart
Paul G. 'Espinasse
Department of Zoology,
The University, Hull. Feb. 20.

[1] Chanturishvili, P. S., *Trans. Ophthal. Soc. U.K.*, **78**, 411 (1958).
[2] Sikharulidze, T. A., *Bull. Acad. Sci. Georg. S.S.R.*, **14**, 337 (1956).

PHYSIOLOGY

Induction of Arginase in Rabbit Epithelium by the Shope Rabbit Papilloma Virus

In studies of the mechanism of action of the Shope virus in causing papillomas on the skin of rabbits, comparative tests were made of active transport of amino-acids into papilloma cells and into normal and hyperplastic rabbit epithelium. The method used was that recently reported by Rogers and Woodhall[1].

Papilloma epithelium taken at intervals varying from 10 days to one month from the time of inoculation of the papilloma virus was cut into tiny pieces,