

THE „ATROPHIC” EYE OF *Platanista gangetica*

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Summary

The paper, read under the above title at the 2nd symposium of the E.A.A.M., October 1973, Duisburg, presented some anatomical details of the eye of the Ganges River Dolphin (*Platanista gangetica*). Before this paper reached the press, two more elaborate descriptions of the same subject were published (PURVES and PILLERI, 1974; DRAL and BEUMER, 1974). It seems superfluous, therefore to give the full text of the symposium paper here. Instead a brief summary is given, followed by some comments, mainly based on the mentioned publications, but also on account of the discussion which followed the reading at the symposium.

Introduction

From the typical features, of which the combined existence may be regarded as characteristic for the cetacean eye, very few were found in *Platanista*. The shape of the bulbus was not ovoid, but more nearly globular (Fig. 1). The cornea was thinner at the periphery than at the apex and it contained blood capillaries. The anterior eye chamber was wide. A lens was present (contrary to earlier statements), but its shape was far from spherical. The crystallizing process seemed to be started but was not yet advanced very far. The sclera was not thickened towards the posterior pole. In the scleral tissues the radially running

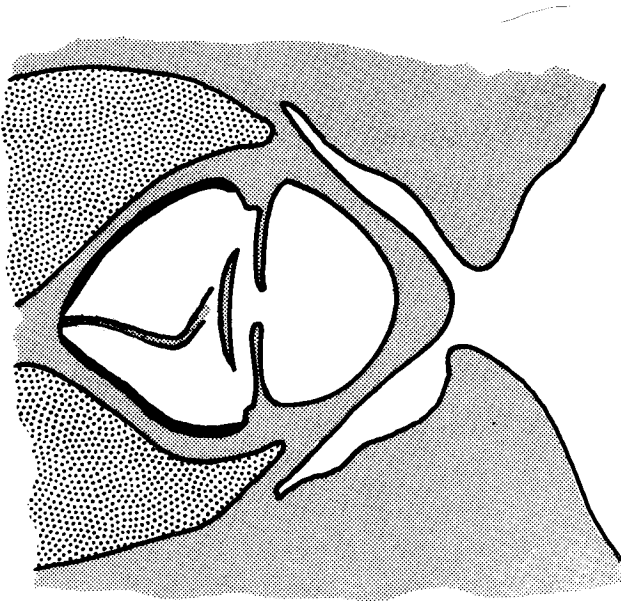


Fig. 1: Schematic horizontal section through the eye of *Platanista gangetica*.

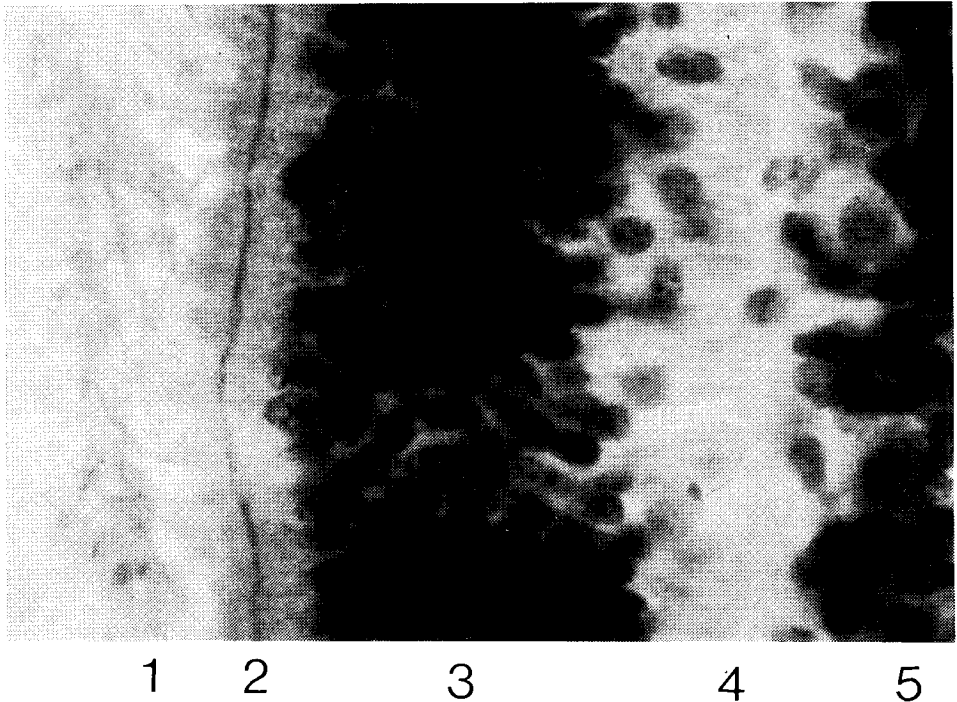


Fig. 2: Transverse section through the retina of *Platanista gangetica*. 1: photosensitive elements; 2: outer limiting membrane; 3: outer nuclear layer; 4: outer plexiform layer; 5: inner nuclear layer.

collagen fibres were lacking. Instead, the sclera appeared to be built up of adipose tissue for the main part. There were no oculomotor muscles and no *rete mirabile* around the optic nerve. The photoreceptors in the well defined retina were — as judged by the appearance of their nuclei — cone cells exclusively (Fig. 2). Moreover, there were no ciliary muscles, which conforms with other cetacean species.

Some of the aberrations from the „typical” cetacean eye are in agreement with transitory situations in embryonic development, as described for several cetacean species (PUTTER, 1903; PILLERI and WANDELER, 1964). In addition a seemingly functional *arteria hyaloidea* was found in the eye of *Platanista* and, moreover, a cellular structure surrounding the lens, which most probably represents the *tunica vasculosa lentis* in some stage of development. Both structures are normally present in embryonic eyes, but generally atrophy before or shortly after birth. The eye of *Platanista* is frequently referred to as being atrophic or degenerate. In view of the above facts it seems more correct to qualify this eye as being retarded in development.

Discussion

The description by DRAL and BEUMER (1974) was based only on two eyes of

one animal, which entails the risk that incidental abnormalities are not recognized as such. Fortunately, however, their observations were mainly in agreement with those of PURVES and PILLERI (1974), who had a larger number of *Platanista* eyes at their disposal. Their material originated from the two species, *Platanista indi* and *Platanista gangetica*, but, as stated by the authors, the eye structure of both species showed no anatomical differences.

Notwithstanding the fact that both publications confirm each other in the major respects, quite a number of details can be found in which the statements are in contradiction. With regard to the material, which is scarcely available and doubtless liable to variations, such diverging findings can be expected and we should not give them more attention than they are worth while. There are a few aspects, however, of which the importance may reach beyond the interest of descriptive anatomy and which, therefore, deserve some more attention.

Apparently, in the material of PURVES c.s. the residue of the eye lens — if present at all — did not contain a capsule. The authors, quite understandably, concluded that the membrane, occupying the space where the lens should have been, is a residue of the capsular epithelium. This has nothing to do with residues of the central vessels. DRAL c.s. observed material in which the presence of a capsule was evident. The capsule was bordered by an epithelium on the inner side. In addition, a cellular structure covered the capsule on the outer side. This is the „wrong” side for the epithelium and for this reason it cannot be an epithelial residue. The presence of some fine capillaries in it made the authors conclude that this structure probably found its origin in the vascular tunic of the lens. I wish to stress these facts and conclusions, because the interpretation has its repercussions with respect to the (eventual) embryonic character of the eye of *Platanista*.

A second point to be considered is the nature of the photoreceptor cells. DRAL c.s. defend the view that only cones are present mainly on the chromatin content of the nuclei, with some support from the observation of cone pedicle-like triangles in the outer plexiform layer and the swollen tips of the photosensitive elements, as discernable in Fig. 2. This photomicrograph also showed the nuclei in question (in the outer nuclear layer), which in reality all nuclei have the pale appearance as is apparent at the thinner places of the section. (The other nuclei on the photograph seem to be black because more of them are superimposed at these places). In contrast, PURVES c.s. stated that the nuclei have a very high chromatin content and consequently presumed that all receptors were rod cells. As indicated by DRAL c.s. the nature of these cells was of interest from an ontogenetic and phylogenetic point of view. More information is greatly needed. The fact that ciliary muscles are lacking in *Platanista* is not exceptional for a cetacean species. To the best of my knowledge an anatomical description of such a musculature has never been given for any cetacean species. In spite of that, accommodative power and ciliary muscles are repeatedly mentioned by authors whose investigations are concerned with vision, but not specially aimed to demonstrate these muscles. Their reasonings are built upon the assumption that ciliary muscles are present indeed and, seemingly, on good grounds. Any investigator, working on eyes and on cetacea, consults at least the handbooks

written by WALLS and by SLIJPER respectively. Without doubt, both authors are great authoritarians in their fields, and no one can be blamed for taking their statements for granted. Nevertheless, the statement, found in both handbooks, that the eyes of odontocetes are provided with powerful ciliary muscles, is incorrect. In both manuals the mistake concerns a minor detail. In our special interest it has far reaching consequences, so one may wonder how such a mistake crept in. The book of the late prof. SLIJPER dates from 1958 (Dutch edition). As far as we can find out, the author himself did no anatomical observations on cetacean eyes, so his statement must have its source elsewhere. The first candidate is the book of WALLS. Its first edition dates from 1942 and is mentioned in SLIJPER's list of references. Again, as far as we could find out, WALLS himself did not observe the ciliary musculature in cetacean eyes. Most probably he took his information from JOHNSON (1901), who indeed claimed powerful ciliary muscles for the harbour porpoise. In reading his admirable paper it becomes clear that JOHNSON's observations were mainly ophthalmoscopic and that, though he indeed opened an eye of *Phocoena*, he certainly did not do the relevant anatomical observations. It is more than likely that he only stated a supposition. Anatomical research of cetacean eyes by PÜTTER (1903), ROCHON-DUVIGNEAUD (1940) and others never revealed more than a trace — if any — of such a musculature. There is no evidence whatsoever to confirm the idea that cetacean eyes are provided with ciliary muscles. In the mean time, however, we are often misled by a minor mistake of some great authorities.

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