PHYSIOLOGICAL AND HISTOCHEMICAL STUDIES ON THE VISION OF SOME FISHES

ABSTRACT

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In the present investigation, certain physiological, histochemical as well as some biochemical studies on the eyes of common carp, Cyprinus carpio, catfish, Clarias batrachus and a marine fish pomfret, Stromateus argenteus, have been performed, which are summarized as follows:

(1) The protein-polysaccharide complex, acid mucopolysaccharide components in the cornea and lens of the above fishes have detected histochemically. The mucopolysaccharides have also been extracted from these tissues and an attempt has been made to analyze some sugar fractions by paper chromatography following acid hydrolysis of the crude extract.

The nature of the extracted mucopolysaccharides has been investigated by paper electrophoresis in various buffer systems and their Rf values have been compared with some standard mucopolysaccharides such as, chondroitin sulfate A, B, C, heparan sulfate and keratan sulfate. It has been found that all the mucopolysaccharides behave like sulfated mucopolysaccharides in the electrophoretic field. The significance of the occurrence of this important constituent in connection to the vision of fish has been discussed.

(2) Report on the enzymology on fish ocular system is very scanty and an attempt has been made to study the sodium-potassium

activated adenosine triphosphatase ($Na^+ - K^+$ - ATPase) histochemically in the cornea and lens of Cyprinus and Clarias.

(3) A study on the significance of reducing substances, particularly of ascorbic acid, in energy generation in cornea and lens of Cyprinus and Clarias has been attempted. Histochemical detection as well as biochemical estimation of ascorbic acid has been performed spectrophotometrically. It is known that ascorbic acid in the biological system not only occurs as free form (AA) but also occurs in bound form as ascorbigen (ASG). It is also known that ascorbic acid is continually acted upon by a number of oxidizing enzymes. Further, Chinoy (1967,1969) has reported that in living system exogenous as well as endogenously added ascorbic acid forms a complex with macromolecules like proteins and nucleic acids. Isherwood and Mapson (1962) have suggested that in a tissue, the actual concentration of ascorbic acid represents the excess, formed in synthesis over that used in the cornea and lens has been studied by simultaneous estimation of (i) free form of ascorbic acid, (ii) bound form of ascorbic acid or ascorbigen (ASG), (iii) enzymic utilization of ascorbic acid (AAU) and (iv) complexing of ascorbic acid with macromolecules.

(4) An investigation on the retinal pigment (melanin) migration in Cyprinus and Clarias eye has been performed. It is

known that the pigments act as screening substance and the migration is under the control of various photic stimulations such as dark and light and is also affected by other factors.

Effects of 5-HT, colchicine and cyclic-AMP on the movement of retinal pigment in the dark adapted eyes of Cyprinus and Clarias have been investigated. It has been found by comparing with controlled light adapted eyes that these substances stimulate pigment dispersion simulating the light adapted state. Even a lower concentration of 0.3 mM of colchicine stimulated the pigment dispersion similar to light adapted state.

Moreover, a preliminary study on the effect of light and dark conditions on the neurosecretory system of Cyprinus and Clarias has been performed in view of the suggestion of Veron (1973) regarding the influence of neurosecretion on pigment migration. Ali (1964) also suggested that there might be some relationship between hormone and light and dark adaptations. It has been found that during dark adaptation a large accumulation of neurosecretory granules takes place while in the light adapted state there is a significant reduction in the neurosecretory substances in the neurosecretory cells of diencephalon of brain presumably due to axonal transport.

(5) It is known that some pigments fluoresces in the presence of U-V irradiation in dark and one such fluorescent compound is pteridine. This pigment has been extracted from the cornea and lens of Cyprinus, Clarias and Stromateus and analyzed by paper chromatography. The chromatograms yielded strong fluorescence following their examination under U-V light in dark. The possible roles of pteridine in the ocular structures have been discussed in terms of vision.

(6) An attempt has been made to study the visual pigments from the photoreceptor cells such as rods and cones. The visual pigment has been analyzed spectrophotometrically following extraction from the retina of Cyprinus and Clarias. The retinal extract contained presumably a bleached product or photoproduct ranging between 400-404 nm in both the fishes, similar to a product (400 nm) obtained in the retina of crucian carp by Reuter (1973).
