

## Optic Regression in a Subterranean Mysid (Crustacea, Mysidacea)

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### INTRODUCTION

Anophthalmy is a characteristic feature of many subterranean and cavernicolous animals including crustaceans. In these animals one can see all grades of degeneration of the visual organs ranging from members with eyes functional to a limited extent to those totally blind. In all these cases, it is the ommatidial region which is most affected. Thus in the subterranean isopods and amphipods discovered in New Zealand (Chilton, 1894) and in *Niphargus* (Nicoles, 1966) the ommatidia have undergone varying degrees of degeneration. In the stalked-eyed *Cambarus setosus* (Fingerman et al., 1964) the degeneration has affected even the distal optic ganglia.

During the course of a study of the blind, subterranean mysid, *Lepidomysis longipes* (Pillai and Mariamma), inhabiting the freshwater wells of Kottayam, S. India, it was found that the animal showed a remarkable instance of reorientation of the optic ganglia and a modification of their alignment vis-a-vis the brain as a result of optic regression.

### EYES OF THE EMBRYO

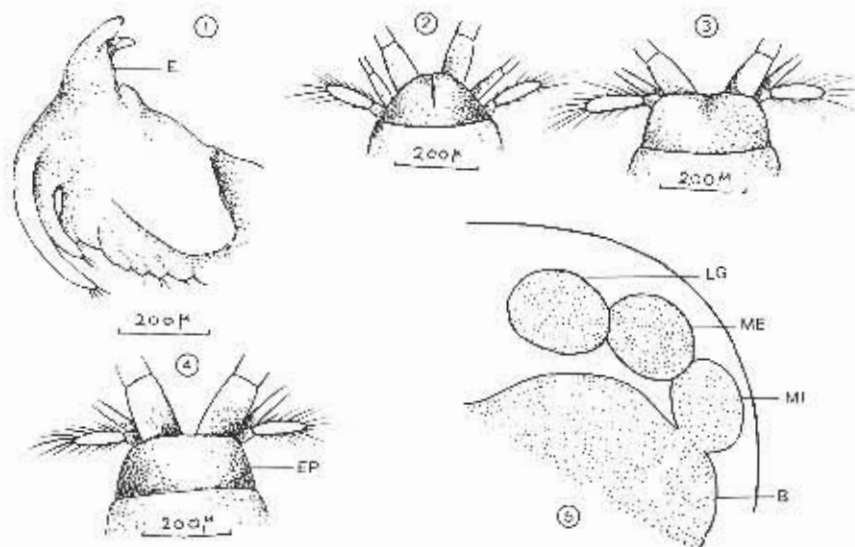
A short description of the eyestalk and the optic ganglia of the embryo is necessary in this connection. The eyes (fig. 1) of the embryo are paired and stalked, projecting as in the embryos of epigeal forms (Nair, 1938). However, they differ from those of the latter in the complete absence of ommatidial elements. Where the ommatidia ought to have been, there is a transparent cone-like projection covered by a thin cuticle. The eyestalk encloses the normal complement of the three optic ganglia, viz, *lamina ganglionaris*, *medulla externa* and *medulla interna*, arranged one behind the other in the usual fashion. The *medulla terminalis* projects, though only slightly, into the optic peduncle.

### EYES OF THE JUVENILE

In juveniles just released from the brood pouch and about 1.9 mm long, the optic peduncles approach each other. They (figs. 2-4) gradually merge and by the time

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*Explanation to lettering*

B— Brain; E— Eye of the embryo; EP— Eyeplate of the adult; LG— Lamina ganglionaris; ME— Medulla externa; MI— Medulla interna.

Fig. 1. The anterior region of the late embryo of *L. longipes*.

Fig. 2-4 Stages in the coalescence of the eyes.

Fig. 5. A diagrammatic sketch to show the arrangement of the optic ganglia in the adult (only the right side is shown).

the animal is 2.5 mm long, the two peduncles are completely fused and the optic ganglia come to lie inside a single eyeplate.

During the fusion of the eyestalks, the ganglionic elements inside them become rearranged in such a fashion that they form an arc on either side of, and anterodorsal to, the brain. Consequently, the original distal end of the lamina ganglionaris of one side comes to face that of the other along the median line. The medulla externa lies external to this and the medulla interna lies farthest from the median line, connected to the medulla terminalis which itself has by now been pushed back into the protocerebrum.

## EYES OF THE ADULT

In the adult, the visual organs show the following arrangement (fig. 5). The optic ganglia are arranged in the form of an arc anterodorsal to the brain. The *lamina ganglionaris* lies on either side of the median line, facing each other and anterodorsal

to the brain. External to this is the *medulla externa* more or less in the outer corner of the eyeplate. On the posterior side of the externa is the *medulla interna* which is closely connected to the *medulla terminalis*. The optic nerve is absent, unlike the condition reported in the blind amphipod, *Niphargus* (Nicoles, 1966).

The study of the eye of *L. longipes* thus shows that while the dioptric apparatus and the optic nerve has disappeared, the optic ganglia persist. The *lamina ganglionaris* is much less affected than in *Niphargus*, though the *medulla terminalis* gets pushed back into the protocerebrum.

It is interesting to compare the ganglionic components of the eye of *L. longipes* with those of an epigeal mysid like *Praunus flexuosus* (Mayrat, 1956). In this latter species which has functional, stalked eyes, the ganglia are arranged in a straight line anteroposteriorly. The medulla interna is the largest of the ganglia, unlike *L. longipes*, where it is smaller than even the lamina. The 'banded' structure of the optic ganglia which Mayrat describes in *P. flexuosus* is absent in *L. longipes*, in which the ganglia present a homogeneous structure. Nicoles (1966) also has not described a 'banded' structure in the optic ganglia of *Niphargus*.

No hypodermal thickening that can be considered as an ocular vestige is discernible in the eyes of *L. longipes*. The place normally housing the ommatidia is occupied by numerous small cells which lie at the summit of the lamina. These cells seem to represent the vestiges of the neurons usually found connected with the lamina of the stalked-eye crustaceans.

In the degenerate eyes of *Cambarus setosus*, Fingerman et al. (1964) describe the *lamina ganglionaris* as vestigial, the *medulla externa* as in "considerable degeneration" and the *medulla interna* as "greatly reduced". It would appear that the optic ganglia of *L. longipes* managed to escape complete degeneration because of their unusual orientation in relation to the brain. This surmise could be proved or disproved by a study of the eye of the other species of *Lepidomysis* in which the eyestalks are double.

A comparative study of the eyes of other species of *Lepidomysis* could not be undertaken as we did not succeed in securing specimens. However, the very fact that all the three species viz., *L. servatus* (Fage), *L. bottazzi* (Caroli) and *L. quinterensis* (Villalobos) have stalked, paired eyes shows that their eyes have not undergone the same degree of degeneration as in *L. longipes*, even though all of them are subterranean. In these species, the eyes show varying degrees of reduction in their ommatidial elements (Fage, 1924; Caroli, 1924 and Villalobos, 1951).

A more detailed study of the eye elements vis-à-vis the brain is in progress to find out the extent of modification of the nerve paths from the brain to the eyes and vice versa.

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## SUMMARY

The eyes of the blind subterranean mysid, *Lepidomysis longipes* are stalked and paired in the embryonic condition. They fuse together in the adult and the optic ganglia are enclosed in a single eyeplate. The ganglia are arranged in the form of an arc on either side anterodorsal to the brain inside the single eyeplate.

## RÉSUMÉ

Chez l'embryon du Mysidacé souterrain et aveugle *Lepidomysis longipes*, les yeux sont pairs et pédonculés. Chez l'adulte, ils fusionnent et les ganglions optiques sont inclus dans une unique lame optique où ils se disposent suivant un arc antérodorsal de chaque côté du cerveau.

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