XX. A PRELIMINARY REPORT ON THE OPTIC TRACT OF EYELESS FLIES

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Among the many mutations which have occured in the fruit fly, *Drosophila melanogaster*, one of the most interesting is that known as "eyeless." Eyeless, a condition in which the compound eyes are much reduced in size or altogether lacking, was first observed by Mildred Hoge Richards, in 1914 and has been bred ever since as a distinct race. This character was at once found to be definitely heritable and the gene responsible for it was located in the fourth chromosome.

There is considerable variation in the character of eyeless flies. A fly may have no eyes at all, two very small eyes, or one larger and one smaller eye. By selection Dr. T. H. Morgan has recently increased the percent of totally eyeless flies.

The present problem is concerned with the internal structure of the optic tract of this race, with the idea of determining how much of this optic tract is lacking in eyeless. Heads of normal

EXPLANATION OF PLATE III.

FIG. 1. Diagram of a frontal section through the head of a normal wild fly.

FIG. 2. Diagram of a frontal section through the head of a fly of of eyeless stock, having ommatidia present on both sides of the head.

FIG. 3. Diagram of a frontal section through the head of a fly of eyeless stock, totally eyeless on one side of the head but having ommatidia present on the other side of the head.

FIG. 4. Diagram of a frontal section through the head of a fly of eyeless stock, totally eyeless on both sides of the head.

FIG. 5. Diagram of a longitudinal section of a single ommatidium.

1. opticon
2. epitopticon
4. brain proper
5. ommatidia
6. facets
7. facet
8. lens
9. external pigment cell
10. sheath of retinulae cells
11. rods of the rhabdome
12. internal pigment cell
13. nerves
14. retinular nucleus
15. basilar membrane

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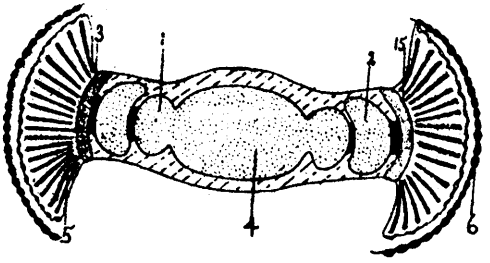

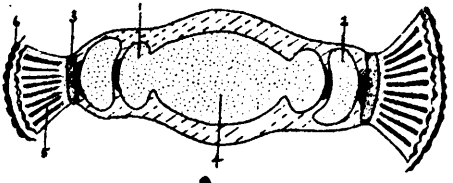

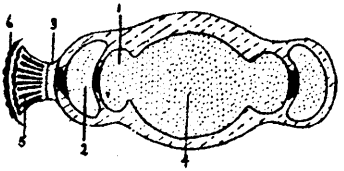

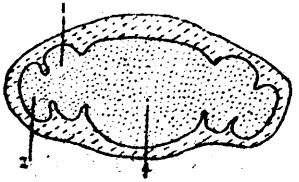

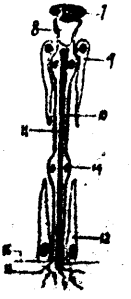

wild flies were first sectioned and then compared with those of the mutation.

The structure of the normal wild fly is as follows: the compound eye, as in all insects, is composed of a cone shaped group of single eyes or ommatidia. Each ommatidium, which registers a portion of the field of vision, has an outer corneal facet, a lens like structure, a group of retinulae or nerve end cells with a supporting axis group of rods comprising the rhabdome. Nerve fibrils pass from the retinulae through a basement membrane to the distal ganglion of the optic tract. This group of ommatidia making up "the compound eye" is connected to the brain by a series of three optic ganglia. The distal ganglion next to the eye is called by Hickson the periopticon and is composed of bundles of nerve fibrils. The middle ganglion, he calls the epioptican and the proximal, the optican. Each of these latter two consists of a matrix through which is scattered nerve fibrils, the whole designated by Hickson as a neurospongium. Between the optican and epiopticon and between the epioptican and perioptican the nerve fibrils decussate. The optican is connected immediately to the brain and there is no true optic nerve as in crustacea.

There has been considerable discussion in the past as to the homology of these parts with the optic tract of other animals. Berger regarded the slight constriction between the opticon and the brain as equivalent to the optic nerve. Hickson agrees with him, and considers all the structures between the lens and the brain as equal to the retina, and the retinulae and rhabdome as equivalent to the rod and cone layer of other forms. Wheeler, on the other-hand, regards the optic nerve as peripheral to the optic ganglion. For our purpose it is unnecessary to consider these homologies since we are concerned only with a comparison between the normal and the eyeless.

In eyeless flies, as previously stated, there may be no ommatidia at all, a few ommatidia, or simply a number of ommatidia smaller than the normal. In all cases where there is simply a reduction in the number of ommatidia, all of the three ganglia of the optic tract are present. The reduction in number of ommatidia is, however, accompanied by a reduction in the size of the optic ganglia.

When no ommatidia are present and the fly is totally eyeless there is never any periopticon. In these cases the two proximal ganglia are much concentrated, so that their structure is sometimes difficult to make out. All of our evidence indicates that these two inner ganglia still persist even though there may be no external indication of an eye.

The perioptican is so closely connected to the eye itself that it is not surprising that it should be wanting in the totally eyeless, but it does seem surprising to find so much of the optic tract left when it no longer has any function.