The results in groups 5, 6, 9, and 10 clearly show that there is a difference in response when the upper or lower portions of the retina are stimulated. Individuals in these groups would certainly have become dark if an equality existed in the eye. All the animals in the same group tended to become the same color. Differences of intensity among the individuals of the group exist probably because of the slight variation in the amount of the eye covered.

As a further means of demonstrating that separate stimulation of the upper and lower portions of the retina would cause different effects, the eye was rotated 180°, and stitched in place. Twenty-two fish treated in this manner, with the light from above, immediately became lightish to 'intermediate' regardless of the light or dark vessels in which they were placed. One could expect no other response since the upper portion, which is now down, receives stimulation in both the light and dark vessels. When the fish were placed in dark vessels with the light from below, then only the lower portion, now on the upper side, received stimuli, and a distinct darkening occurred in 13 of the 22. When these were returned to a dark vessel with the light from above, they took their original lighter shade.

It is believed that these observations show: that the upper and lower portions of the eye of *Fundulus* are different; that when neither half is stimulated, an 'intermediate' condition exists; that when light rays strike the upper portion, a response of lightening follows; when the lower portion is stimulated, in the absence of stimuli to the upper region, darkening ensues; and that the upper portion dominates, since in a light dish with light from above, the fish becomes light.

THE STRUCTURE AND DISTRIBUTION OF THE RODS AND CONES IN THE EYE OF *FUNDULUS HETEROCLITUS*

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Since covering and rotating the eyes (see previous abstract) showed that stimulation of different portions of the retina elicited different color responses in the fish, histological examinations were made to see if a difference in structure existed between the regions of the retina.

After the fish had been in complete darkness for eighteen hours, the lens was removed from the eye in the darkness and then the eye was fixed either in Bouin's or Held's fluids. Vertical sections of the eye, stained in various hematoxylins and eosin, show that the dorsal region, comprising about 70% of the retinal cup, differs structurally from the ventral region. The optic nerve, which leaves the optic cup slightly ventral to its center, is included in the dorsal region.

Rods, 1 μ in width, and two types of cones comprise the dorsal portion. The rods, which are about twice as numerous as the cones,

consist of an inner granular segment, and a much longer outer segment. The lentiform body of the inner segment which is difficult to demonstrate appears planoconvex in shape. Cones, designated as type I, in this dark-adapted eye have a long myoid, a large oval granular lentiform body, and a small conical-shaped outer segment. In the peripheral end of the lentiform body deeply staining granular masses are also found. These cones may easily be missed in the eye since they are so completely masked by the outer segments of the rods. Their structure, however, definitely indicates that they are cones. Cones of type II are equally as numerous as type I, and have a similar width of about 5 μ at the level of the lentiform body. Their myoids are very short and the lentiform body contains a large, distinct, so-called oil globule, masses of deeply staining material and granular inclusions. Because of their distinct oil globule, these cones are very prominent and easily seen. Whether these two types of cones are different because of function or the state of activity is not known, but it would seem that they are functionally different since they are not similar in the same preparation.

The ventral portion or the lower 30% of the eye consists of rods and cones of type I. The rods, twice as numerous as the cones, are like those in the upper region except at the transition from the upper to the lower regions where they are longer, causing a thickening of the retina which is easily discernible in the sections. This thickening is also very evident in the whole fixed eyes, and it outlines the lower region as a crescent-shaped area. Cones of type II (those with oil globules in the lentiform body) have never been found. Cones of type I are present but much smaller than those in the upper region, being only about 2 μ wide through the lentiform body.

From histological sections and experiments on covering the eye it would seem that the lower region is for the the utilization of the light that comes from above in the absence of light from below, causing the animal to become dark. Stimulation of the upper portion containing rods and well-developed cones of different types, by light from below causes a light adaption.

THE REACTIONS OF FRAGMENTS OF THE LARVAE OF *AGLAIS ANTIOPA* LINN. TO SOUNDS

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Many caterpillars respond more or less vigorously to sounds by abrupt cessation of locomotion and freezing, contraction of certain longitudinal muscles or both (c.f. Minnich '36). Even fragments of the caterpillar body may continue to show muscular contraction (Minnich 1925, 1936), as shown by experiments on the caterpillars of the mourning cloak butterfly, *Aglais antiopa* Linn., and of the milkweed butterfly, *Danias plexippus* Linn. When the decapitated bodies of these caterpillars were divided into approximately equal