resulted in a lightening. Cutting the cord caudal to the level of the 10th vertebra in a dark fish, and stimulating the medulla led to a lightening of the entire fish. Cutting only the sympathetic chains posterior to the level of the 10th vertebra in other dark fish and stimulating the medulla produced a lightening cephalad to the cut while the fish remained dark back of the incision. Cutting the sympathetic anterior to the 10th vertebra resulted in a darkening of the anterior end of the fish. Then, when the animal was dark adapted, stimulating the cord caused the animal to lighten caudal to the cut sympathetic.

Since the caudal region of a fish (caudal to the 10th vertebra) was able to adapt both light and dark with the cord destroyed, the body wall incised, and only the sympathetic chain intact, the only possible course of fibers, if any were present, that might cause a darkening when stimulated, would be by way of the sympathetic chain. The cord was cut in several fish anterior to the 10th vertebra, and they immediately became dark. They were then placed in a light tank, and after 10 days when some fading had occurred, the sympathetic chains were electrically stimulated, and immediately a complete lightening resulted rather than a darkening.

From these experiments, it seems logical to conclude that the melanophores in an 'intermediate' fish are in a partially contracted condition, due to stimuli from a center which is in tonic activity. Furthermore, it would seem plausible that inhibition of this tonic center leads to expansion of the melanophores. Supplementing the center with stimuli causes further contraction. Since no nerves have been found whose stimulation resulted in a darkening, it seems possible that the expanded melanophore is in a state of rest.

THE EFFECTS OF COVERING AND ROTATING THE EYES ON THE MELANOPHORIC RESPONSES IN *FUNDULUS HETEROCLITUS*

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To determine whether or not adaptation to light or dark backgrounds was related to stimulation of different portions of the retina, experiments were devised to cut off the light entering the eye from above or below.

In the first experiments thin copper half circles were blackened with paint and fitted into the front of the orbit. This proved unsatisfactory. The eye was depressed and practically no light could enter. Consequently, the fish responded variably when placed in light or dark vessels.

A second method proved satisfactory. A rectangular area around the eye was outlined with stitches under which the ends of thick paper blinders were slipped. These were easily adjusted, did not depress the eye nor produce any other injury and remained securely in place for many hours. Before the blinders were attached the adaptative powers of the fish were tested to see whether or not they responded readily. Covering either the anterior or posterior halves of both eyes delayed the adaptation slightly, but in all instances it was complete after 20 minutes.

The results of the other experiments are summarized in the following table:

Group	*Kind of container* *Amount of visual field exposed* *Kind and position of light*	*Melanophore response*
1	dark container upper half exposed daylight, 250 f.c., above	51 dark
2	dark container lower half exposed daylight, 250 f.c., above	15 lightish, 45 intermediate
3	white container upper half exposed daylight, 250 f.c., above	6 intermediate 29 darkish, 8 dark
4	white container lower half exposed daylight, 250 f.c., above	57 light
5	entire field exposed daylight, 450 f.c., below dark container	40 light, 21 intermediate
6	dark container entire field exposed artificial light, 100 f.c., below	5 lightish, 41 intermediate
7	dark container upper half exposed artificial light, 100 f.c., below	8 intermediate, 1 darkish, 7 dark
8	dark container upper half exposed daylight, 450 f.c., below	7 intermediate, 5 darkish, 3 dark
9	dark container lower half exposed daylight, 450 f.c., below	6 light, 14 intermediate
10	dark container lower half exposed artificial light, 100 f.c., below	29 light, 48 intermediate
11	white container upper half exposed artificial light, 100 f.c., below	6 intermediate 31 darkish, 4 dark
12	white container lower half exposed artificial light, 100 f.c., below	11 light, 5 lightish

The duration of exposure was usually 30 minutes. Periods as long as 2 hours produced no different effects.

The sequence of the color responses upon which this data is based is as follows:

light—lightish—intermediate—darkish—dark

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. Differencs 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,