REFERENCES

Halsey, J. T. and Evans, E. M., 1937, *Bull. Mt. Desert Island Biol. Lab.*, p. 31.
Mackay, M. E., 1931, *Contr. Can. Biol. and Fish., N.S.*, **7**, 19.
Wyman, L. C. and Lutz, B. R., 1932, *Biol. Bull.*, **62**, 17.

THE REGIONS OF THE RETINA RELATED TO THE DIFFERENT CHROMATOPHORIC RESPONSES IN *FUNDULUS HETEROCLITUS*

EARL O. BUTCHER
Biological Laboratory, Hamilton College

In a previous study (Butcher '37) it was found that the upper 70% of the *Fundulus* retina contained rods, and single and double cones, and that the lower region had only rods and double cones. In addition to the difference in cone distribution, a specialized crescentic region, containing more double cones and rods than any other part of the eye, was present only in the lower region.

Since the cone content of the upper and lower regions of the retina of *Fundulus* differed, and knowing that *Fundulus* adapted well to yellow, experiments were made to see if *Fundulus* could adapt equally as well to a yellow background above as to one below.

Female fish were placed in large crystallizing dishes so that they had a yellow background below and white paper above, while the backgrounds for similar fish were reversed in other dishes. All dishes were exposed in the same way to daylight which entered through the sides of the dish. The fish with a yellow background below were very yellow in thirty minutes, but those with yellow paper above showed only slight, if any, adaption after two and a half hours. Fish kept for as long as eleven hours in a dish with a yellow background above and milk glass and a 150 watt bulb below, so that they received an illumination of 450 f.c., failed to show little, if any, adaptation. A 60 watt bulb, giving an illumination of 200 f.c., and a yellow background below caused a very marked yellow coloration of fish in thirty minutes. These experiments indicated that the specialized cones of the upper region were possibly related to the yellow adaptation of the body.

Covering and rotating the eyes of *Fundulus* (Butcher and Adelmann '37), indicated that the upper region of the eye of *Fundulus* was associated with the adaption to light backgrounds and the lower portion to the darkening of the body. Confirmatory evidence of this regional difference was sought during the last summer by various methods.

When fish were securely fastened in glass tubes, and the tubes were rotated so that the fish were upside down, they became lightish in a black container. Dark adaptation occurred as soon as they were returned to their normal position. These experiments definitely indicated that there must be some localization in the eye since fish inverted were light and the fish right side up were dark in the same black container.

In order to eliminate the dorsal region of the eye, the conjunctiva

was cut on the dorsal side, and the eye was gently turned ventrally. A crescentic cut was then made through the coats of the eye dorsal to the optic nerve, and the conjunctiva was sutured back to the edge of the orbit. With the dorsal half of the eye destroyed, the fish became very dark in both black and white dishes. In complete darkness an intermediate shade was assumed. When the lower region of the eye was destroyed by the method used on the upper region, fish became lightish to light in a white dish and intermediate in a black dish. Since they lacked the lower half of the eye, they were unable to adapt dark. A very uniform response was obtained in these various experiments. More confirmatory evidence of regional differences in the eye was thus obtained.

The dispersion of pigment and the length of myoids of retinal elements are similar in the upper and lower regions of the eyes of both light and dark fish. Therefore, pigment migration and the elongation of the retinal elements do not account for this mechanism of adaptation.

The lower region of the eye differs from the upper region in having a specialized crescentic ridge and no single cones. The differing response of the two regions of the eye, however, may not be due to these structural differences, but it may be due to the difference in distribution of the optic nerve fibers of the two regions of the eye in the C.N.S. Information has not been secured on the destination of the nerve fibers. Confirmation has thus been secured that the upper region of the eye is associated with the adaptation to light background and the lower portion to the darkening of the body. The responses are due to either the qualitatively different regions of the eye or to different central connections.

REFERENCES

Butcher, Earl O. and Howard B. Adelmann, 1937, The effects of covering and rotating the eyes on the melanophoric responses in *Fundulus heteroclitus*. *Bull. Mt. Desert Is. Biol. Lab.*, p. 16.

Butcher, Earl O., 1937, The structure and distribution of rods and cones in the eye of *Fundulus heteroclitus*. *Bull. Mt. Desert Is. Biol. Lab.*, p. 18.

THE EFFECTS OF ANESTHETICS ON CHROMOSOME BEHAVIOR DURING POLAR BODY FORMATION IN THE EGGS OF THE SNAIL *NASSA*

GAIRDNER MOMENT
Goucher College, Baltimore

One of the first questions that arise regarding the behavior of chromosomes concerns the causes which underlie the difference between mitosis and meiosis. In the case of eggs the factors responsible for the formation of polar bodies present a second though closely related problem. Except for some centrifuging experiments on polar bodies (Conklin, 1917; Clement, 1935), previous work of an experimental nature on either of these problems is almost non-existent (see