

The rabbit retina contains mainly rods. Besides rods, the retina also contains cones and other types of photoreceptor cells, differing in the shape of their outer and inner segments, and also endings of central dendrites.

Although the processes taking place in the receptor portion of the visual system have been the subject of frequent investigation, much remains to be explained: in particular, some workers hold the view that retinas consisting purely of rods or of cones may exist. Walls [6] doubts whether retinas containing only rods can exist, and consider that at least a few cones are essential. Other workers [1, 4, 5] state that cones are absent in the rabbit retina. Yet others [2, 3] could find no well-defined cones in the retina of these animals, sharply distinguishable from rods.

The study of this problem is interesting in order to clarify the vision of the rabbit, having in mind the fact that the retina of this animal is frequently used as a test object in physiological research.

#### EXPERIMENTAL METHOD

Rabbit retinas were used as the test object. The material was taken 1, 5, 7, 10, 15, and 20 days and 1, 2, 3, 4, 5, and 6 months after birth of the animals. Paraffin sections 8-10  $\mu$  in thickness were stained with hematoxylin-eosin and studied. Other sections, cut to a thickness of 40, 50, 60, 70, 80, and 90  $\mu$ , were impregnated with silver chromate by Golgi's method.

#### EXPERIMENTAL RESULTS

Neither rods nor cones could be seen in the retina of young rabbits aged 1 day. Differentiation of the general nuclear layer into external and internal was visible only in the central parts of the retina. By the 5th day after birth, differentiation of the nuclear layers of the retina is complete, and in the outer nuclear layer small swellings due to groups of cells which are the precursors of the inner segment of the rods and cones are visible through the outer limiting membrane. Only undeveloped outer segments of rods and cones, which are formed from one centriole of the inner segment of the rods and cones, were visible in the retina of animals aged 7-10 days. By the 15th day the rods and cones appeared fully formed and were indistinguishable from these structures in the retina of the adult animal. At this age, the outer segment of the rods was cylindrical in shape, and stretched toward the pigmented epithelium. The inner segment appeared wider than the outer, was impregnated more intensively with silver, and gradually narrowed into the cell body, which was located in the outer nuclear layer. The rods in the nucleus contained chromatin in large granules, separated by one or two pale bands. Another process from the body of the rod ran into the outer reticular layer where it terminated in a pinhead swelling (Fig. 1A). The outer segment of the cone was conical in shape and appeared shorter than the outer segment of the rod. The inner segment of the cone was swollen and lay immediately next to the body of the cone (Fig. 1B), which, again, was located immediately beneath the outer limiting membrane, or sometimes a little above it. The chromatin substance of the cones was reticular in structure. The central process ran downward from the body of the cones toward the outer reticular layer, where it terminated in a pyramidal expansion.

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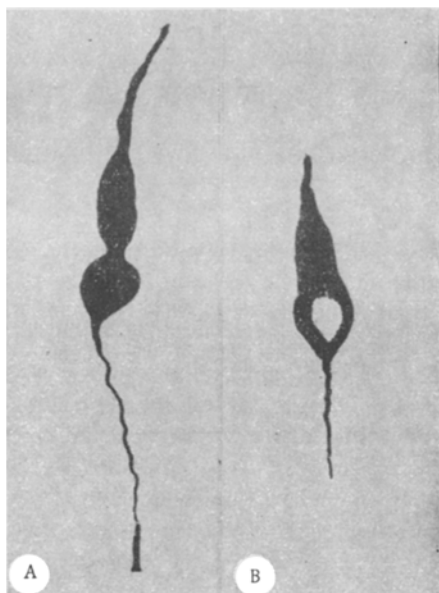


Fig. 1

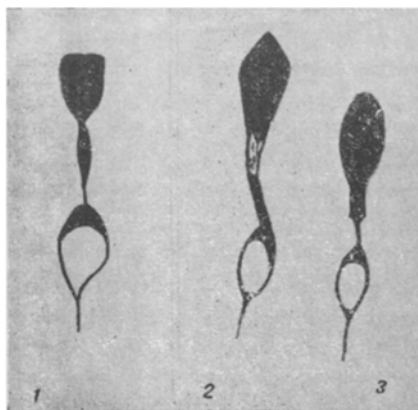


Fig. 2

Fig. 1. Rod (A) and cone (B) photoreceptor cells of the rabbit retina. Golgi, 400  $\times$ .

Fig. 2. Photoreceptor cells of the rabbit retina. 1) Type a; 2) type b; 3) type c. Golgi, 1350  $\times$ .

Besides the few photoreceptors of the cone type, other types of photosensitive elements, differing in the shape of their outer and inner segments, also were observed (Fig. 2).

1. Type a. The outer segment is wide, gradually becoming thinner as it changes into the narrower inner segment, which is spindle-shaped. The inner segment gradually narrows to become the cell body. Both segments are readily impregnated.

2. Type b. This differs from type a by the fact that the wide outer segment is less sharply demarcated from the inner segment.

3. Type c. The outer segment consists of a wide outer part and a narrower inner part, which is less intensively impregnated on the side in contrast with the outer part. The inner segment is immediately adjacent to the cell body.

The bodies of cells of types a, b, and c lay in the outer nuclear layer, and central processes from the bodies of these cells ran into the outer reticular layer. Processes of photoreceptor cells of types a and b terminated in pinhead thickenings, while those of the type c cells terminated in pyramidal expansions.

Although, therefore, the rabbit retina is principally of the rod type, cones and other types of photoreceptor cells were found in it. Because of their structural features, types a and b must evidently be regarded as varieties of rods, and type c as a variety of cones. Subsequent investigations to discover the physiological nature of these types of photoreceptor cells will be interesting.

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