

An adult and a larva taken from Marble Cave were sectioned in the usual manner. The lens and iris in both were normal. The only difference in the histological structure of the eye, when compared with the normal salamander (*Amblystoma jeffersonianum*), is found in the retina.

In the larvae all the layers of the retina are well developed. The ganglionic layer is much thicker than that of the *Amblystoma*, having many rows of cells instead of one or two. All the other layers are normally present, the rod and cone layer being well developed. The retina in the larva is much thicker than in the adult. In the adult the rods and cones have disappeared, there being only an occasional process from the outer nuclei.

In all the sections thus far studied we have been unable to detect the slightest indication of an outer molecular layer in the adult, while in the larva this layer is normally developed. The ganglionic layer is thicker in the larva than in the adult. In this respect the adult approaches the normal more than the larva does. The Müllerian fibres are profusely present in both larva and adult.

#### SUMMARY.

1. The larval retina approaches the normal (*Amblystoma*) more than the adult.\* The only apparent difference is a thickening of the ganglionic layer.
2. The retina is thicker in larva than in adult.
3. All the layers are present in the retina of the larva, while in the adult the rods and cones and the outer molecular layer have not been made out; the inner molecular layer is thinner.
4. The ganglionic layer is thicker in larvae than in adult.

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#### THE BLIND RAT OF MAMMOTH CAVE.\* BY CARL H. EIGENMANN AND JAMES ROLLIN SLONAKER.

HABITS AND HABITAT, BY CARL H. EIGENMANN. No. 32.

In his origin of species, sixth edition, Vol. I, page 171, Darwin says that the eyes of *Neotoma* of Mammoth Cave are "lustrous and of large size; and these animals, as I am informed by Prof. Silliman, after having been exposed for about a month to a graduated light, acquired a dim per-

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\*Contribution from the Zoölogical Laboratory of the Indiana University.

ception of objects." The cave rat, *Neotoma*, is still abundant in Mammoth Cave. It is found in the rotunda near the entrance of the cave and in the more distant parts of the cave. Its tracks are numerous, and in places little paths have been made by the rats where they run backward and forward along ledges of rock. Since, however, a track once made in a cave remains unchanged by wind or weather, the abundance of rats, as judged by their tracks, may be misleading. A number of traps were set in the rotunda. During three days one trap was sprung and one had the bait removed. No rats were caught in the traps and none were caught alive. I discovered one rat rolling a mouse trap about which was too small for it to enter. When approached with a light the rat turned about



Fig. 1. Mammoth Cave Rat.



Fig. 2. Common Gray Rat.

and stared at the light. It then ran to a pile of rocks but did not attempt to hide; instead the rat ran to one end of the pile, then along the top back to where I stood, when it stopped and again stared at the light. An attempt to catch the rat sent it running back and forth along the ledges of rock at the side of the cave. Finally the rat came to the ground again, and despairing of catching it alive it was killed. Its eyes appeared to be large and protruding very much as in the common rat. Without question the rat noticed the light. It had no hesitation in running from place to place. The manager of the Mammoth Cave Hotel, Mr. H. C. Ganter, later caught four rats which he sent by express. Only one arrived alive; one had been partly eaten by the others. The living one is now caged. It is quite gentle. It permits itself to be stroked. Occasionally it pushes an object away with a sideward motion of the fore foot. If

provoked it snaps at the object. During the daylight it sits quietly in a nest it has formed for itself of cotton batting, which it pulled into a fluffy mass. At night it is frequently moving about in its cage. Turning on an electric light near its face always produces a twitching of the eyelids; so there can be no doubt that the light is perceived. An object held some distance from the cage either on one side or another is always perceived, but just how precise its vision is has not been determined. Its hearing is acute.

THE EYE. BY J. R. SLONAKER.

As far as I have been able to ascertain, little or no microscopical investigation has been made on the eye of the Mammoth Cave rat.

A glance at a photograph of a cave rat (Fig. 1) shows that the eye is as prominent as in the common gray rat (Fig. 2).

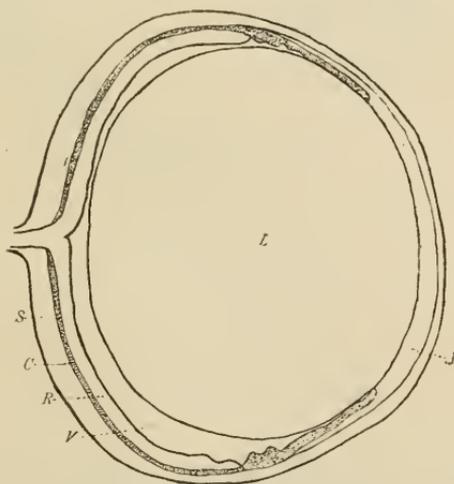


Fig. 3. Mammoth Cave Rat ( $\times 8$ ).

If the elements of the retina have the same function in the cave rat as in other rats, we may approach closely to their power of sight under favorable conditions, by comparing their retina with that of those living in the light. For such a preliminary comparison I have chosen the nearest allied form which I could readily get, the common gray rat (*Mus decumanus*).

The eye of the cave rat is, if anything, larger in proportion to its body weight than that of our gray rat (Figs. 3 and 4). The lens is in each case enormously large in proportion to the eye, so large, in fact, that very little space is left for the aqueous and vitreous humors. The pupil is capable of very wide dilation, as is true with most nocturnal animals.

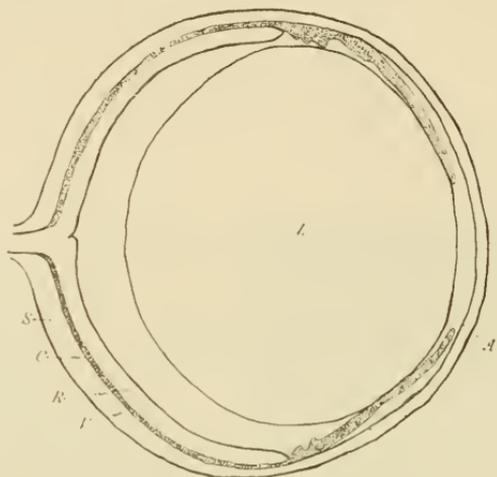


Fig. 4. Common Gray Rat (C. S.).

- A. Aqueous Chamber.
- C. Choroid and Pigment Layers.
- L. Lens.
- R. Retina.
- S. Sclerotic.
- V. Vitreous Chamber.

The head of the cave rat, being more rounded and less pointed than that of the gray rat, permits of a slightly deeper eye-socket. However, these two rats resemble each other in their "pop-eyed" appearance when frightened.

A microscopical comparison of the retina also shows little difference. Bits of retina from corresponding parts of the eye of a cave rat and a gray rat were hardened by the same process, sectioned the same thickness and stained alike, so that the sections are directly comparable. Fig. 5 represents semi-diagrammatic camera drawings of two such sections.

At a glance one can see that there is very little difference excepting in the thickness of the retina, that of the cave rat being thicker. This difference, however, may be due to the fact that Fig. 5a, is from a very large cave rat, while Fig. 5b is from a half-grown gray rat. The thickness, however, bears about the same ratio to the size of the eye in each

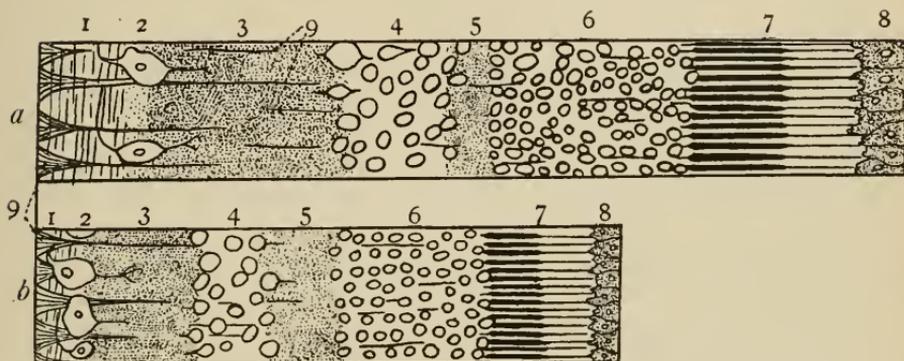


Fig. 5. Semi-diagrammatic camera drawings ( $\times 265$ ).

- a. Mammoth Cave Rat.
- b. Common Gray Rat.
  1. Nerve Fibre Layer.
  2. Nerve Cell Layer.
  3. Inner Molecular Layer.
  4. Inner Nuclear Layer.
  5. Outer Molecular Layer.
  6. Outer Nuclear Layer.
  7. Rod and Cone Layer.
  8. Pigment Layer.
  9. Supporting Fibres of Müller.

case. This greater thickness is largely due to an increase in the size of the cells of corresponding layers of the retina in the cave rat. Only a single instance need be given. The rod and cone layer of the cave rat is composed of decidedly longer and larger elements than the same layer of the common rat. But with the exceptions of these minor differences in the thickness of the layers and in the size of the cells, the two retinæ are nearly alike.

Basing our conclusions on the histological structure of the eye, we may infer that the cave rat has the power of seeing as distinctly as the common gray rat.