

## THE ORIGIN OF CAVE FAUNAS. BY C. H. EIGENMANN.

[Abstract.]

There are two prominent views of the origin of the cave faunas and of their degenerate eyes.

The following from Ray Lankester presents one of these views: Supposing a number of some species of arthropod or fish to be swept into a cavern or to be carried from less to greater depths in the sea, those individuals with perfect eyes would follow the glimmer of light and eventually escape to the outer air or the shallower depths, leaving behind those with imperfect eyes to breed in the dark place. A natural selection would thus be effected. In every succeeding generation this would be the case, and even those with weak but still seeing eyes would in the course of time escape, until only a pure race of eyeless or blind animals would be left in the cavern or deep sea.

2. "The existence of these blind cave animals can be accounted for only by supposing that their remote ancestors began making excursions into the cave, and, finding it profitable, extended them, generation after generation, further in, undergoing the required adaptations little by little."—Herbert Spencer, *Popular Science Monthly*, XLIII, 487 and 488.

The first of these views is based on two facts, as everyone familiar with caves and their faunas will readily agree. These facts are, first, the author's lack of knowledge about caves and his disregard of the nature of the animals inhabiting them.

The second of these theories is more nearly applicable to the blind fishes. A partial adaptation to do without eyes is found in those species inhabiting the swamps of the Southern States. The eyes of *Chologaster cornutus* are very simple. In the species living under rocks and in caves, *Ch. agassizii*, there is a high development of the tactile organs, with a more perfect eye than in those living in the open. These fishes were adapted to do in part without light before they entered the caves and before their eyes had become seriously degenerate.

With the subsequent suppression of the eye in darkness natural selection can not have operated, as Lankester supposed, for species of the *Amblyopsidae* with well-developed eyes still live in the caves by the side of those with mere vestiges of eyes.

Amblyopsidæ, whether blind or seeing, if kept in an aquarium darkened at one end seek the dark. They were not swept into the caves, but entered them deliberately and avoided coming out into the light. In short, they were able to establish themselves in caves because they were able to do without light, having simplified eyes and highly developed sense organs; they do not possess highly developed sense organs and degenerate eyes because they were accidentally swept into caves. The further degeneration of the eye in total darkness and the greater perfection of the sense organs are separate questions.

---

THE AMBLYOPSIDÆ AND EYES OF BLIND FISHES. BY C. H. EIGENMANN.

[Abstract.]

Our knowledge of the eyes of the North American blind fishes is based on the result of gross dissections of *Amblyopsis* made by Wyman before 1872 and on a brief account of the eyes of two specimens of *Typhlichthys* by Kohl (1895). Kohl's specimens, coming from Missouri, were made to do duty for the blind fishes in general. His paper is poor in the material examined and entirely perverse in his interpretation of the conditions observed. He does not state the habitat of his specimens. A comparative study of the eyes of *Typhlichthys* from Mammoth Cave and from Missouri led me to suspect that his specimens came from Missouri, and in this I found I was correct. The *Typhlichthys* inhabiting the underground streams of Missouri is very different from that inhabiting Mammoth Cave, and, unfortunately for the generalizations of Kohl, the difference lies in the structure of the eye.

The North American blind fishes are especially favorable for the study of degeneration and of many questions bearing on the origin of cave faunas because they have seeing representatives living in the open and others living with them in the caves.

The members of the Amblyopsidæ and their distribution is as follows:

*Chologaster cornutus*. Abundant in the lowland swamps of Southern States.

*Chologaster agassizii*. Subterranean streams in Tennessee and Kentucky and probably identical with the next.

*Chologaster papilliferus*. In springs of Union and Jackson counties, Illinois.

*Amblyopsis spelaeus*. Widely distributed in underground streams in the Ohio valley.

*Typhlichthys subterraneus*. Subterranean streams, chiefly south of the Ohio River.

*Typhlichthys rosæ*. Subterranean streams west of the Mississippi.

All have been examined except the *Chologaster agassizii*. *Chologaster papilliferus* possesses the most highly developed eye, but even in it there are many signs of degeneration; in *Chologaster cornutus* the outer nuclear and inner nuclear layers have each been reduced to a single series of cells, and the ganglionic layer to cells widely separated from each other. The lens and vitreal body are still apparently normal. In all the other species examined the lens and the vitreal cavity are minute or absent.

The ganglionic layer is, in *Amblyopsis* and *T. subterraneus*, a central, solid mass of cells; in *T. rosæ* even this has disappeared, and the eye has been reduced to 0.040 mm.—0.050 mm., or to one-third the diameter of the eye of *T. subterraneus*. The result of degeneration is not the same on the same layers in the different species. The degeneration is not the result of arrested development or of ontogenic degeneration. The eye of the blind fish reaching its greatest point of degeneration in *T. rosæ*, is the result of phyletic degeneration, begun before the fish entered the caves. The degenerate eye is not primarily due to the cave habitat. The eyes of those species living in the light are prophetic of the eyes of those living in the dark.

---

#### A NEW BLIND FISH. BY C. H. EIGENMANN.

[Abstract.]

In the caves of Missouri lives a species of *Typhlichthys*. It is known from the description of Garman of its outer form, the description of its habits by Miss Hoppin and from the description of its eye by Kohl. In external characters it is very similar to *Typhlichthys subterraneus* from the Mammoth Cave. It differs from that species widely in the structure of the eye. This trans-Mississippi species has been named *rosæ* for the rediscoverer of the California *Typhlogobius*, a pioneer in the study of Biology among women, Mrs. Rosa Smith Eigenmann.