Nocturnal and diurnal changes in the color of certain fishes, with notes on their sleeping habits. A. E. VERRILL.

While investigating the nocturnal habits of fishes, etc., in the aquaria of the laboratory of the U. S. Fish Commission, at Wood's Holl, in 1885 to 1887, I unexpectedly discovered that many species of fishes, and also the common squid (*Loligo Pealei*) take on special colors at night, while asleep, or at rest, in a feeble light. These observations have not hitherto been published, because I hoped to have had opportunities to continue them and make them more complete. It is now my hope that others, with better opportunities, may take up the subject. My observations were made after midnight, when everything was quiet, for fishes sleep very lightly. The gas jets near the aquaria were turned down as low as consistent with distinct vision, and great care was taken not to jar the floor or furniture. With these precautions I was able to detect many species in the act of sleeping. Some of them took unexpected positions when asleep.

The most common change in colors of the sleeping fishes consisted in a general darkening of the dark spots, stripes or other markings, by which they become more distinct and definite. This was the case with various flounders, minnows (*Fundulus*), the black sea-bass (*Serranus furvus*), the sea-robins (*Prionotus evolans* and *P. palmipes*), the king-fish (*Menticirrus nebulosus*) and several other species.

In all these cases the change of color is in the direction of increased protective coloration, the dark markings being generally connected with their habits of resting naturally at night among eel-grass and sea weeds. The young fishes often showed greater changes than the adults.

Other species showed a much greater change in color, for the pattern of coloration was itself entirely changed. Thus the common scup, or porgy (*Stenotomus chrysops*), while active in the daytime, is of a beautiful silvery color with bright, pearly, iridescent hues. But when asleep it takes a dull bronzy tint and is crossed by about six conspicuous, transverse, black bands, a coloration well adapted for concealment among eel grass, etc. If awakened by suddenly turning up the gas, it almost instantly takes on its silvery color, seen in the daytime. This experiment was tried many times.

A common file-fish (*Monacanthus*), which is mottled with dark olive-green and brown in the daytime, when asleep becomes pallid gray or almost white, while the fins and tail become black. These are nocturnally protective colors. The file-fishes, when asleep, often lean up obliquely against the glass of the aquaria, with the belly resting upon the bottom in very queer positions. The tautog, or black fish (*Tautoga onitis*), commonly sleeps on one side, often partly buried in sand or gravel, or under the edges of stones, much after the fashion of flounders, thus suggesting the mode in which the flounders may have developed from symmetrical fishes in consequence of this mode of resting, becoming chronic as it were.

Notes on the Phylogeny of the Carnivora. W. B. SCOTT. (Read by title.)

The Peripheral Nervous System of Nereis Virens. F. E. LANGDON.

This study was made partly on material living and unstained; partly on that stained by methelene blue and examined either fresh or fixed by Bethe's method, and partly on that prepared by the more common methods.

The spindle-shaped sensory cells described by Retzius as isolated are really grouped into semi-organs which have a definite distribution over the body. Each organ consists of a fusiform group of cells whose bodies lie below the epidermis or in its base. The cuticular markings over the

organs in the appendages of the body are like those over the sense organs of Lumbricus. Over the body itself each cuticular marking is concave on the exterior and the very thick cuticula encloses beneath each marking an ovoid cavity through which pass the outer ends of the sensory cells. Each sensory cell usually bears several sensory hairs, and these hairs cannot be retracted normally as supposed by Retzius.

In the gill lobes of the parapodia, the base of the palps, the prostomium and several anterior metameres is found a second kind of sense organ, apparently a light-perceiving organ, not previously described.

In the center of each organ is a slender, flexible tube, open to the exterior and continuous with the cuticula. Around this tube the club-shaped peripheral ends of 100 or more bi- or multipolar nerve cells are arranged in a spiral of from 8 to 14 turns. The bodies of these cells are irregularly grouped in or beneath the base of the epidermis; the central nerve fibre passes to the central nervous system; the peripheral fibre is at first slender, but ends in the club-shaped enlargement mentioned above. The tip of this enlargement, and sometimes the entire enlargement itself, is filled with a clear, highly refractive, lens-like substance.

The central fibres from both diffuse and light-perceiving organs end in *apparent* nerve baskets around the ganglion cells of the central nervous system.

Beside the four eyes and the two pairs of sense organs of unknown function described by Retzius, the prostomium contains a third pair of organs near the anterior pair of Retzius. The groups of ganglion cells described by Retzius near the anterior eyes are not, as that author supposed probable, concerned with the innervation of the eyes; the preparations from which this study was made show plainly the nerve bundles passing from the eyes to the brain.

Epidermal Sense Organs in Certain Polychætes. Margaret Lewis.

The epidermal sense organs were studied in two members of the annelid family of the Maldaniæ, both by means of ordinary methods and by the use of methylin blue. The following are the chief conclusions:

1. That multicellular sense organs are present throughout the integument of the two polychæte annelids *Clymenella torquata* and *Clymene longa*.

2. That the cells of these sense organs are spindle-shaped, bipolar nerve cells.

3. That the individual cells making up a sense organ show great variation in the distance of the enlargement containing the nucleus from the cuticula. This enlargement may be close to the cuticula, at half the height of the epidermis or sunk to the base of the epidermis.

4. That the cells of the sense organs possess at their peripheral ends sensory hairs.

5. That from the deep end of each cell proceeds one process which turns at an angle beneath the epidermis toward the central nervous system.

6. That in many respects the sensory cells of these epidermal sense organs show a striking resemblance to the epidermal sense cells which Retzius describes for *Nereis;* the chief difference being that Retzius found only isolated sense cells in the epidermis of *Nereis*, whereas in these Maldanids these sense cells without exception are grouped into definite sense organs.

The Eyes of Limax maximus. A. P. Henchman.

The eye consists of six parts: (1) Optic ganglion, (2) Sclerotic capsule, (3) Retina, (4) Vitreous humor, (5) Lens, and (6) Corneal layer. The optic ganglion is a funnel-shaped enlargement of the optic nerve, containing oval nuclei. The sclerotic capsule is a thin, firm layer of connective tissue, containing at intervals oval