The subterranean egg-burrow of this saltatory urodeles resembles somewhat closely that of *Ichthyophis*. The eggs are retained in a cluster and attended and kept moistened, probably with urine, by the female. A series of embryos taken from a single burrow will shortly be described.

New Facts regarding the Development of the Olfactory Nerve. W. A. Locy.

The early embryonic history of the olfactory nerve is known. There has been little advance in this direction since the appearance of Marshall's paper in 1878, who gave the history of the nerve prior to the formation of the lobe and anticipated by suggestion most of the views since expressed regarding its nature and relationships. The chief advances have been made in determining the source of the fibers (His, Disse and others), and in the minute structure of the olfactory lobe, ganglion, etc. (Cajal, Retzius and others). But, in the meantime, the early embryonic history has not been elucidated, and, even to-day, we do not possess the complete history of this nerve in any one animal.

This paper presented in outline the history of the olfactory nerve in *Acanthias* from its earliest appearance to adult conditions, embracing (*a*) the embryonic history of the olfactory nerve prior to the formation of the lobe, and (*b*) the formation of the olfactory lobe, its various transformations, and the subsequent history of the nerve. The chief point of interest consists in demonstrating a hitherto unrecognized olfactory nerve, and determining its history and relationships to the olfactory bundle. The new nerve arises from the summit of the forebrain near the median plane, and passes laterally into communication with the main olfactory and thence into the olfactory cup. It is the first one to appear and may, therefore, be primitive. It is ganglionated. It was discovered by dissections of very small embryos—it lies in such a position that its relationships would not be appreciated by study of sections made in any of the conventional planes.

There are two distinct, widely separated connections existing simultaneously between the olfactory epithelium and the brain-wall, one is dorsal and median (the new nerve) and the other is lateral. The latter is complex, consisting of two main divisions. The new nerve can be demonstrated in specimens, as early as 6–8 mm. in length. The two brain connections are well seen in embryos 16 mm. and upwards; they are very evident from 20mm. forwards. The lobe begins in specimens about 25mm. long; it is still small at 38mm., but well developed at 44 mm. and upwards. The fibers of the new nerve were traced into the olfactory epithelium. It was also shown to perish in the adult.

Review of Recent Evidence on the Segmentation of the Primitive Vertebrate Brain. W. A. Locy. (Read by title.)

The Metameric Value of the Sensory Components of the Cranial Nerves. C. Judson Herrick.

The primary segmental or branchiomeric nerve is conceived as comprising four components: somatic motor, viscero-motor, somatic sensory (general cutaneous) and viscero-sensory (communis). No cranial nerve of any gnathostome vertebrate has retained all these components.

In the head each sensory component, as a physiological adaptation, has been concentrated so that all its fibers tend to be related to a single center in the brain—the fasciculus communis (f. solitarius) and chief vagus nucleus in the case of the visceral sensory and the spinal fifth tract and related nuclei, chief sensory trigeminal n. and n. funiculi, in the case of the somatic sensory. This involves reduction of each component in some segments and hyper-

trophy in others. Thus, the somatic sensory is represented only in the V and X nerves and the visceral sensory in the typical branchiomeric nerves, X, IX, VII.

Now when in course of vertebrate evolution specialized sense organs appear in addition to the two primary components, their nerves and intra-cranial centers will appear sporadically, depending upon the distribution of the specialized sense organs in question. These nerves will in general follow the courses of the previously existing somatic or visceral nerve trunks wherever possible, hence the formation of complex nerve trunks containing several of the components. Each of these cenogenetic systems of sense organs, like the palingenetic systems, tends to be related to a single intracranial center. At present we may enumerate the following such systems:

1. Taste buds related to the fasciculus communis (f. solitarius) and its associated nuclei, the chief vagus nucleus (lobus vagi of fishes).

2. Terminal buds of the outer skin; terminal relations as in the last case, plus in some fishes the lobus facialis.

3. Lateral line organs, or neuromasts, related to the tuberculum acusticum and cerebellum, plus in some fishes the 'lobus lineæ lateralis.'

4. Ear; central connection as in the last case.

5. Eye; related to the mesencephalon.

6. Nose; related to the primary prosencephalon.

7. Pineal organ; related to the diencephalon?

Diagrams were exhibited illustrating the actual relations of these components as determined by reconstruction from serial sections in the bony fish, *Menidia;* and emphasis was laid upon the necessity of taking these qualitative differences in the nerves into account before trying to work out their metamerism.

The Maxillary and Mandibular Breathing Valves of Teleost Fishes. ULRIC DAHLGREN.

THE discovery of a pair of membranous valves placed just inside of the teeth and working automatically to prevent water from leaving by the mouth while they permit its free entrance, has enabled the act of breathing in fishes to be clearly described. These valves complete the pump-like structure of the oral cavity, the other pair, or posterior valves, being the branchiostegal membranes.

In breathing, but two muscular forces must be applied, one to expand the oral cavity by moving the opercular frames outward and another to contract the oral cavity by moving them inward; when expanding, water comes in through the mouth, being prevented from entering through the gill clefts by the branchiostegal membranes, which act *automatically* and independently of and contrary to the opercular frames to which they are attached; when contracting, water is forced out of the gill clefts, but is prevented from leaving through the mouth by the valves in question, which act *automatically.* While breathing, it is true, the fish opens and shuts its mouth somewhat, but this is due not to its effort to prevent a regurgitation of the respiratory stream, but to the relation of its mandible to the opercular frames.

When the valves are cut, the fish is compelled to use muscular force to prevent regurgitation.

On the Early Development of the Catfish (Noturus). F. B. SUMNER.

1. No horizontal cleavage takes place till the 64-cell stage or after, and, when it occurs, does not result in a definite two-layered condition of whole germ-disc.

2. The blastomeres resulting from the early cleavages retain their continuity with the protoplasmic network of the yolk. No sharp line of separation, such as Sobotta,