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,