found several well-marked forms of epidermal organs, one of which is characterized by the presence of intracellular sacks or ampullæ leading into anastomosing canals. Such organs contain both sensory and glandular cells, but in the gland cells alone are found the intracellular sacks.

These organs present several well-marked conditions corresponding with different stages of functional activity. One suggestive condition shows the following details of structure. In the upper part of each gland cell are two sacks lying one within the other and separated by a considerable space. This intervening space is traversed by many delicate filaments connecting the walls of the two sacks. The inner sack becomes continuous at its outer end, with a narrow canal, while the outer sack is continuous with a sheath surrounding this canal. The several canals unite to form larger canals, and there finally results one main duct opening to the exterior. This duct is surrounded by a broad sheath, which is a continuation of the sheaths enveloping the ampullæ and primary canals. By the side of the main duct, within its enveloping sheath, is a large nucleus surrounded by a clear area, which probably represents a vacuole. Regarding this nucleus the ampullæ, canals and sheaths the following hypothesis is offered. The sheath of the main duct and its branches, including the radial vesicles surrounding the ampullæ, together constitute a cell of very irregular shape, a cell which in form may be compared to a bunch of grapes with its stem. This single cell contains the main duct, its branches and their terminal ampullæ, and itself reaches down flask-shaped processes containing the ampullæ, which are embedded in the outer ends of the surrounding gland cells. The walls of the outer sacks, and their continuations as the outer wall of the sheath, represent the boundary of this highly differentiated cell.

The Development of the Adhesive Organ of Amia. Jacob Reighard. (Presented for Miss Jessie Phelps.)

The adhesive organ of *Amia* consists of a pair of semicircular or sausage-shaped ridges forming together an incomplete ring on the end of the snout of the young larva. Each ridge is a row of six to eight epithelial cups which open on the surface of the snout. Their cells secrete a mucus by means of which the animal attaches itself.

The organ is formed in a very early stage as a diverticulum of the fore gut. This diverticulum subsequently divides into two, each of which continues to communicate for a time with the cavity of the foregut.

Each of the two diverticula later separates from the foregut, becomes elongated and curved into the form of a semicircle and divides into from six to eight closed vesicles. The vesicles finally open to the exterior and are thus converted into cups.

After being functionally active for a time the organ is pushed beneath the surface by the thickening ectoblast, becomes infiltrated with leucocytes, and finally disappears (larvæ of 20 to 25 mm.) without leaving any trace behind it.

The integumentary sense organs appear in the neighboring ectoblast, quite independently of the adhesive organ.

Dean's comparison of the cups of the adhesive organ with the integumentary sense organs is thus seen to be untenable.

Notes on Loxosoma Davenporti. W. S. Nickerson.

A pair of flask-shaped glandular organs is commonly present in the American species of *Loxosoma*, attached by their broader rounded ends nearly opposite the lower end of the stomach, one upon each side. Each consists of a central core of 4 or 5 glandular cells and a peripheral layer of flattened epithelial cells continuous with the epithelial body-covering of the animal. The gland

cells have basal nuclei and cytoplasm filled with fine granules; their distal ends extend outward to a minute pore at the extremity of the flask. After the discharge of their contents the central cells appear shriveled, and it is probable that the whole organ is soon afterwards lost. Individuals lacking one or both flask-organs are frequently observed. After being lost, the structure is reformed in the same position. It arises as a conical thickening of the ectoderm, of which the central cells take on a glandular function, and the lateral ones form the epithelial covering. Similar organs have not been described as occurring in any other endoproct. The function of their secretion is unknown.

On the outer surface of each tentacle just at the margin of the lophophore there is a single large cell which forms a slight protuberance. Its nucleus is large and situated near the deeper surface; the cytoplasm shows a number of delicate lines extending through it perpendicularly toward the free surface, which is covered by a thickened portion of the cuticula, having the form of a flattened disk or of a saucer with its concave surface outward. The observation of the living animal shows that these structures are unicellular suckers or organs for attachment by means of which the little creature fixes itself by the margin of its expanded lophophore while changing the position of its foot attachment.

The reproductive system of *L. Davenporti* presents the rare condition of proterogynic hermaphroditism. Both kinds of sexual products arise in the single pair of gonads, the ova being formed before the sperm. The evidence for this consists in finding in the same individual a functional ovary on one side of the body, while the gonad of the other side contained, together with an evidently degenerating ovum, a mass of cells showing various stages of spermatogenesis up to the mature spermatozoa with tails. Animals which are functionally males are relatively few during the summer months.

Buds remain attached to the parent till well matured. They vary in number from 1 or 2 to 12. Abnormal buds lacking tentacles, digestive organs, reproductive system, etc., are not infrequently present. They consist of a small rounded body borne on a slender stalk. The proximal side of the lophophore margin forms a blunt projection against which the rest of the margin can be opposed, thus closing the atrial cavity. The epithelium lining the atrium is composed of large glandular cells. The relation of these buds to the parent is not different from that of the normal buds, nor does their attachment persist longer. They appear to be incapable of leading an independent existence and have no known function. They are probably manifestations of a tendency to produce modified members of the colony comparable with the avicularia of certain Ectoprocta, a tendency derived from stock-building ancestors and which has not yet been eliminated. According to this hypothesis we must regard the non-colonial habit of life of *Loxosoma* as secondarily acquired, perhaps in adaptation to its semi-parasitic or commensal mode of life, not, as has been assumed heretofore, as a primitive condition.

Embryos are present, attached to the 'mammary organ' of the parent during July and August. On the embryo a pair of buds arise very early and are fully formed by the time it becomes free from the parent. Soon after the buds separate from it the embryo perishes without undergoing a metamorphosis.

On the Motor Reactions of Paramecium. H. S. JENNINGS.

THE paper was an analysis of the mechanism of reactions to stimuli in the ciliate infusorian *Paramecium*. To all classes