freely enter the mantle chamber. When the foot is partially retracted and the sphincter muscle around the anterior opening contracts, this channel is entirely obliterated. A strong contraction of both longitudinal and radial pallial muscles, and a further retraction of the foot, fold the mantle and the elastic cuticle into the mantle chamber. At the same time the contraction of the adductor muscles bring the calcareous margins of the shell nearer together, and the mantle chamber is nearly obliterated. As the anterior opening has been closed, the water contained in the mantle chamber is driven through the small posterior opening. Relaxation of the pallial muscles and protrusion of the foot again affords ample opportunity for water to enter the mantle chamber, and the elastic cuticle expands this chamber to its greatest capacity.

By means of the jets thus formed animals frequently swim some feet before settling to the bottom.

Most lamellibranchs possess the power of sending jets of water from the mantle chamber, but they generally depend upon forcibly shutting the shell. Pecten and others swim by means of currents produced in this way, but with most it seems to do little more than free the mantle chamber of dirt. Other forms such as the soft clam, *Mya*, send very strong jets out of their siphons, and depend upon the contraction of muscles in the mantle as well as on closing the shell, to do it.

Until something further is known about the life and feeding habits of Solenomya, we can hardly expect to know the full significance of this mode of expelling water. Very possibly the jets are of value in cleaning the mantle chamber and burrow, and the animal has made use of them secondarily as a means of locomotion.

The ciliary mechanism in the branchial chamber of the pelecypoda: J. L. KELLOGG.

The fact is well known that minute particles of matter suspended in water, whether they are to be used as food or not, are, upon coming in contact with the surface of the gills; driven forward and transferred to the inner surfaces of the palps. By these organs they are passed, in the same manner, to the mouth.

It is usually assumed that the animal is able to control this automatic process of filling the digestive tract only by closing the shell and thus preventing the ingress of water bearing suspended matter. There exists, however, a complex mechanism, differing in many respects in different species, by means of which suspended particles may be removed from the body, while water necessary for respiration (especially in active forms such as *Yoldia*) still continues to flow into the branchial chamber.

This mechanism in the common soft clam, *Mya*, may be described briefly as follows:

(1) There is to be found a complete ciliation of the inner surfaces of the mantle folds. Cilia drive foreign bodies from all points of these surfaces to vortices (one on either mantle fold), situated at the side of the opening for the foot in the fused mantle edge, anteriorly. The vortices are within reach of the palps, and food here collected may be taken by them. If the accumulated matter is not desired, the mass eventually falls upon a ciliated tract which carries it posteriorly along the ventral median line of the fused mantle edges, to a bay at the base of the branchial or *incurrent* siphon. From this point it is lost from the body, by the violent contractions of the adductor muscles, resulting in the discharge of the greater part of the water contained in the branchial cavity.

(2) The general ciliation of the surface of the visceral mass causes a movement of particles to a vortex opposite the base of the branchial siphon. Perhaps if desirable, this material upon the surface of the

visceral mass may be transferred to the inner surface of the mantle, referred to above. If not, it is discharged through the branchial siphon on the contraction of the adductor muscles.

(3) Gills, as is well known, collect matter and conduct it forward along a ventral groove to the palps.

(4) The inner surfaces of the palps bear ciliated ridges. In a peculiar manner, the cilia of the ridges drive particles to the mouth. Around the entire margin of the palp is a tract on which the ridges do not extend. Its cilia swiftly carry matter away from the mouth, throwing it off from the posterior, free tips of the palp, into the branchial chamber. Eventually this may be discharged from the body as previously described. By muscular movement these edges may be applied to any surface within reach, sweeping it clean of particles which it may be bearing, and casting the material into the branchial chamber.

In *Yoldia*, which lives in soft mud, the mechanism of the palp, though it performs the same general function, is very much more complex. The plate gills, also, which collect particles with amazing swiftness, may, if desirable, transfer them to the palps, or may be rid of the material by allowing it to pass up through a peculiarly constructed passageway between two plates to the epibranchial chamber, whence it is carried from the body by the stream of water continually being discharged through the epibranchial chamber.

This mechanism is very different in different forms, due to structural peculiarities of regions bearing cilia, and to the habits and needs of various species. We have facts sufficient to show that, without hindrance to the respiratory processes, Pelecypods have the power of collecting food by means of a very complex mechanism; or at will, through the muscular movement of certain ciliated surfaces, of removing any material which it may be desirable to prevent from entering the digestive tract. Data is being collected for a description of this mechanism in as many species as possible.

Observations upon the development of Phascolosoma. J. H. GEROULD.

The forms that were used for investigation were *Phascolosma gouldii*, *Ph. vulgare* (Blainv.) and *Ph. elongatum* (Keferst.) The ova which are ready for maturation are swept into the nephridia by the action of the cilia of nephrostome and of the internal surface of the nephridium. The eggs that are found within the nephridia, prior to their ejection through the nephridiopore, have the spindle of the first polar globule with ten rod-shaped chromosomes already formed. The astrosphere of the male pronucleus precedes the nucleus in the migration of both toward the center of the cytoplasm; it usually divides before the union of the two pronuclei. The segmentation nucleus contains twenty chromatic filaments which split longitudinally.

The alternating directions of the cleavage planes as far as forty-eight cells are identical with those in corresponding stages in the eggs of annelids, most molluscs, etc. The most striking peculiarity in *Phascolosoma* is the large size of the first set of 'micromeres,' which in quadrants A, B and C are distinctly larger than their sister cells at the vegetative pole. The 'macromeres' throughout the course of cleavage are of small size.

The mesoderm is derived from d^4, which in the one instance observed divided in harmony with the regular alternation in direction; its posterior derivative divided immediately to form a second mesoblast. In the divisions of the cells of the somatic plate deviations from the rule of alternation in the direction of cleavage were observed.

The rosette, cross and intermediate cells