of the parent tissues into a radial flagellated chamber and passes to the exterior with the outgoing stream of water. The invaginated dermal cells are pushed out again and the "amphiblastula ” swims away (fig. 38, *e).* (Possibly the granular dermal cells, by prolifera­tion, may form a solid mass blocking up the blastocoel completely, so that we have a solid embryo.) The larva now fixes itself by the anterior flagellated pole (which, according to Schulze, becomes permanently invaginated, thus giving rise to a true gastrula, fig. 38, *f, g),* and the dermal cells spread themselves out over the gastral cells, which they completely cover. The fixed larva (“ pupa ”) consists of a solid mass of gastral cells enclosed in a single layer of now flattened dermal cells. Presently the gastral cavity appears (or reappears) in the middle, around which the gastral cells arrange themselves in a single layer. The young sponge elongates upwards, some of the dermal cells form porocytes which become perforated by prosopyles, others migrate into the gelatinous mesogloea and form scleroblasts, from which spicules are developed. The cells of the gastral layer acquire collars in addition to their flagella, an osculum is formed by perforation at the apex, and the young sponge begins to feed. It is now in the Olynthus condition (fig. 38, *h)* and is exactly comparable to a simple *Leucosolenia* individual. As it grows older radial flagellated chambers are budded out around the central gastral cavity and the collared cells lining the latter are replaced by pavement-epithelium derived from the dermal layer.

An interesting account of the development of *Leucosolenia (Clathrina) blanca* has been given by E. A. Minchin. Segmentation is regular and complete, resulting in the formation of a hollow, ciliated, oval blastula (fig. 39, *A*), with a large blastocoel and a wall composed of a single layer of columnar flagellated cells and a pair of very large granular cells at the posterior pole. The latter are primitive archaeocytes and are destined to give rise to the amoebo- cytes and germ-cells of the adult. The flagellated cells will give rise to all the other cells of the adult, both dermal and gastral. The larva becomes free-swimming in this condition. Here and there individual flagellated cells (destined to form the cells of the dermal layer) lose their flagella and, becoming amoeboid, migrate into the blastocoel, which presently becomes completely filled with such cells. The larva is thus converted into a solid “ parenchymula,” in which the archaeocytes remain unchanged in their original position at the posterior extremity. It now fixes itself and flattens out upon the substratum in the pupal condition. During the metamorphosis which now ensues the majority of the cells of the inner mass (dermal cells) pass out to the exterior again between the flagellated cells (gastral cells), over which they spread themselves in the form of a dermal layer of flattened epithelium. Some of the dermal cells, however, remain in the inner mass as porocytes; the primitive archaeocytes have divided up into amoebocytes; and porocytes, amoebocytes and the cells of the gastral layer are all crowded together in the interior of the pupa. The pupa now elongates vertically. A gastral cavity appears in the interior. The cells of the gastral layer arrange themselves around this cavity and develop their collars and flagella. At first, however, the gastral cavity is lined by the porocytes, which presently separate and migrate out­wards.@@1 Scleroblasts migrate inwards from the dermal layer and secrete spicules. An osculum and prosopyles are formed as in *Sycon* and the Olynthus stage is reached.

The development of sponges in general appears to be characterized by a remarkable want of uniformity in the arrangement of the different kinds of cells of which the larva is composed. Two, or possibly three, primary groups of cells are universally present; the flagellated cells, which will give rise to the collared cells of the adult, the non-flagellated (granular) cells, which will give rise to the dermal layer and its derivatives, and possibly the primitive archaeocytes (perhaps to be regarded as undifferentiated blastomeres). It may be considered as doubtful, however, whether the primitive archaeocytes can in all cases be distinguished from the primitive dermal cells. The latter are in some cases (amphiblastula type) grouped at the posterior pole of the larva *(Sycon),* while in other cases (parenchymula type) they may pass inwards and completely fill the interior, blocking up the blastocoel and perhaps also freely projecting at the hinder end (fig. 39, *F).* At the time of the metamorphosis the dermal cells pass to the outside and come to completely enclose the gastral cells, so that the two layers acquire their proper relative positions. The sponge larva in many respects closely resembles the Coelenterate “ planula,” with its ectoderm and endoderm, but it is very doubtful how far this comparison is valid, and in the present state of our knowledge it is perhaps better to avoid the use of the terms ectoderm and endoderm in dealing with the sponges altogether. The idea naturally suggests itself that the two primary layers of the Sponge correspond to those of the Coelenterate, but in a reversed position, the inner layer of the one being the outer layer of the other, and vice versa, and this idea has found expression in the name *Enantiozoa* which has been proposed for the group by Yves Delage, but which has not met with general acceptance.

*Physiology.*

Comparatively little is known of the physiology of sponges. The most obvious expression of the vital activity of the organism is the stream of water which flows in through the dermal pores or ostia and out through the vents or oscula. That this stream is maintained by the undulatory movements of the flagella of the collared cells there can be no doubt, but the fact that the movements of the flagella of different cells are not co-ordinated, so that they do not act in unison, indicates that the mechanical problem involved is not so simple as is usually supposed. There can be no doubt that the incoming stream brings with it minute food-particles, consisting of fragments of organic matter, alive or dead, and also the oxygen required for purposes of respiration; while the outgoing stream removes faecal products and waste matter (excreta). The rate of flow appears to be regulated by the opening and closing of the pores and vents, or of intermediate apertures such as the apopyles or exhalent openings of the flagellate chambers. This opening and closing may be effected by the activity of definite muscular sphincters (fig. 34, 2) or, in the case of some prosopyles, by the contractility of the porocytes themselves.

The ingestion of the food particles is no doubt effected in large measure by the collared cells, which seem to feed much in the same manner as independent collared monads (Choanoflagellata). It seems not improbable that Sollas’s membrane may be a temporary structure which assists in arresting food particles as they pass through the flagellate chambers. There is reason to believe also that amoebocytes (in this case therefore phagocytes) may capture minute organisms on their way through the canal system, and even porocytes are sometimes credited with this power. Digestion, no doubt, is, at any rate chiefly, intracellular. The amoebocytes probably serve not only to ingest food themselves but also to receive surplus food from the collared cells and distribute it through the sponge (fig. 34. 5).

Nothing definite is known as to the function of excretion, but here, as in the case of nutrition, it seems likely that collared cells and amoebocytes are both concerned.

@@@1 The position of the porocytes inside the collared cells appears at first sight very anomalous, but Minch in has shown that this condition is actually repeated in the adult sponge every time the gastral cavity is obliterated by contraction.