Structure and Life History of Sycon

BSc. Part I Zoology (Subsidiary)

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1. Habit and Habitat of Sycon:

Sycon is a marine sponge and remains attached to solid substrata like rocks, shells of molluscs and corals. The name of genus, Sycon, is replaced by Scypha by de Laubenfels (1936). But in our present discussion the name Sycon is retained. The different species of sponges under the genus do not tend to live at greater depths in the ocean.

2. Structure of Sycon:

The sponges exhibit a great diversity in form. They range from a very simple to more complicated forms. Sycon occupies an intermediate status from the point of structural diversities. It has the form of branched cylinders of about 2.5 to 7.6 cm. in length. All the branches are connected together at the base which remains attached to the sub-stratum.

Though the body has a firm consistency, it is slightly flexible. Close examination of the surface reveals the presence of innumerable minute inhalent pores or ostia. The free end of each cylindrical branch possesses an opening at the summit. This opening is known as osculum.

3. Canal System of Sycon:

Sycon, like all other sponges, possesses the characteristic anatomical peculiarity—the canal system. It permeates the body with water channels. It plays a very important role in the life of Sycon. Brusca and Brusca (2003) have used the term aquiferous system instead of canal system.

The particular type of canal system encountered in Sycon is known as the syncoid (Stage I) type which is practically more advanced than the asconoid canal system.

The canal system consists of the following parts:

(i) Paragastric cavity or gastral cavity or spongocoel:

If the cylindrical body of Sycon is bisected longitudinally, it is observed that the outer large opening, called osculum, leads into a large central canal. This canal is called paragastric cavity or gastral cavity or spongocoel.

Although this cavity is variously named, the name of spongocoel seems to be more appropriate. The wall of the Sycon is lined by ectodermal flattened cells, called pinacocytes. The osculum is surrounded by a layer of cells, called myocytes which are contractile in nature and act as sphincter. The spongocoel opens to the exterior through the osculum.

(ii) Radial canals:

The body wall lining of the spongocoel is out-pushed at regular intervals as finger-like projections. These projections are called radial canals. The wall of the radial canal is lined with flagellated collar cells or choanocytes. The outer end of the radial canal is blind but the inner end is open which communicates with the spongocoel through the excurrent canal.

(iii) Incurrent canal:

In between two successive radial canals, a tubular space, called incurrent canal or inhalent canal, is present, thus radial canals and incurrent canals are arranged alternately and the latter opens to the exterior through ostia. The inner end of the incurrent canal is blind. The wall of the incurrent canal is lined by ectodermal, flat pinacocytes.

Between the incurrent canal and radial canal there is a thickened mesogloea, called gastral cortex. The ostia are situated on the pore membrane which are intercellular openings and are surrounded by contractile myocytes. These myocytes act as sphincters, by which they regulate the diameter of the openings.

(iv) Prosopyles:

The wall between the incurrent and radial canals is pierced by numerous minute pores called prosopyles. In Sycon, each prosopyle is an intercellular space or channel while in Leucosolenia these pores are intracellular. Through these pores, the incurrent canals open into the radial canals.

The prosopyles are the openings of the porocytes, generally believed to be modified pinacocytes. The porocytes are thick-walled cylinder-like structure with a nucleus in the cytoplasm at one side. It is highly contractile and controls the inflow of water.

(v) Ex-current canals:

The radial canals communicate into the spongocoel through short, wide canals, called excurrent canals. The wall of the excurrent canal is lined by flat, pinacocytes.

(vi) Apopyles:

The excurrent canals open into spongocoel by internal ostia or apopyles. The apopyles are surrounded by contractile myocytes.

4. Physiology of Water Current Production in Sycon:

The circulation of water in Sycon takes place in the following way. The course of water current has been studied by the application of fine carmine particles to the surface of the body. The water rushes inside the body through numerous ostia along the external surface.

Each ostium or dermal pore leads into an incurrent canal. From the incurrent canal, the water flows inside the radial canal through prosopyle. From radial canal water passes out through apopyles into the spongocoel. The spongocoel is thus a common chamber within which all the radial canals of the body open.

The spongocoel ultimately opens to the exterior through an aperture, the osculum. Water enters inside the body through numerous doors (ostia) but passes out through a single opening (osculum). The planar beating of the flagella of choanocytes in the radial canals produces a current which in one hand draws the water inside and on the other hand forces it to go out.

5. Microscopic Organization of Sycon:

The microscopic organisation shows the presence of a single layer of cells covering the outer surface of the body. This outer layer is designated as the dermal layer. Needlelike spicules are seen to project from this layer. This layer is composed of large cells called the pinacocytes.

The spongocoel is lined by a layer of flattened endodermal cells, Radial canals are lined by peculiar collar cells, each having a long whip-like flagellum. These cells are called the choanocytes or collar cells or gastral cells.

Each choanocyte has a round or oval body. It possesses a nucleus and one or many vacuoles in its cytoplasm. The free end of the cell body has a comparatively longer flagellum and the base of the flagellum is surrounded by a contractile transparent collar-like outgrowth of the cytoplasm.

The flagellum arises from the basal granule which is connected with the blepharoplast by a root called rhizoplast. Electron microscopic studies have revealed that the collar-like outgrowth is composed of cytoplasmic tentacles. The number of such tentacles varies from 20 to 30. The sectional view of flagellum under E. M. reveals the pattern of 9 + 2 arrangement of microtubules, like the flagella of flagellates.

The spicules, which constitute the skeleton of Sycon, develop from the scleroblasts. These structures are regularly arranged and protect the softer parts. Triradiate as well as tetraradiate spicules are common. Besides these, simple club-like oxeote spicules are also present.

The intermediate layer, called mesohyl or mesenchyme, which consists of a gelatinous proteinaceous matrix, contains spicules and numerous amoeboid cells.

The amoeboids are of many types and are as follows:

1. Archaeocytes:

They are undifferentiated embryonic amoebocytes which are large in size and their nuclei show distinct nucleoli. They are totipotent in nature and can transform into different kinds of cells, needed by the animal. They play a role of digestion, eliminating waste material and can give rise to both sperms and ova.

2. Collenocytes:

Most of the other cells are smaller and stellate-shaped and possess radiating processes. These cells are usually called collenocytes or connective tissue cells. They remain fixed by cytoplasmic processes.

3. Chromocytes:

These are pigmented amoebocytes with lobose pseudopodia.

4. Thesocytes:

These amoebocytes are storage cells with lobose pseudopodia.

5. Myocytes:

These are fusiform and highly contractile cells, found around the osculum, apopyles and other pores. These cells are arranged in circular fashion and act as a sphincter and regulate the diameter of the openings. So water flow through osculum is regulated.

6. Gland cells:

These cells are found attached to the body surface by long strands and -secret lime.

The osculum, prosopyles and apopyles have elongated narrow cells which prolong into narrow fibres around the aforesaid apertures and help them to close, when necessary.

6. Nutrition, Respiration and Excretion in Sycon:

The sponges feed on micro-organisms which enter into the body along with the water current. The choanocytes engulf them and pass them to the amoeboid cells situated below the choanocytes. The digestion takes place inside the amoeboid cells and assimilated products are conveyed to the various parts of the body.

Thus nutrition is holozoic and digestion is intracellular, a process comparable to that of protozoans. Some amoeboid cells often contain chlorophyll or green pigments and carry out autotrophic nutrition like green plants.

The presence of algae within the sponge body also helps in nutrition. Respiration and excretion take place by diffusion. The contractile vacuoles are recorded in the amoeboid cells of freshwater sponges which probably play important role in osmo-regulation and excretion.

7. Reproduction in Sycon:

Sycon reproduces both asexually and sexually. During asexual reproduction it produces bud and sometimes produces special bodies resembling the gemmules of freshwater sponges.

During sexual reproduction, both sperms and ova are produced from the archaeocytes which are present in the mesoglea. It is claimed that the sex cells are also produced from adult choanocytes. The sperm cells have long tails and swim freely in water current. The ova are amoeboid and wander through the mesoglea.

The ova may grow up in size by ingesting other cells. The sperm cell does not enter the ovum directly. The union is assisted by a choanocyte. When sperm cells enter the radial canal, the choanocyte which is nearer to the egg captures it. The choanocyte which absorbs the sperm discards its flagellum and collar and comes very near the egg.

This choanocyte is named as the carrier cell. The sperm subsequently loses its tail and enters the egg. The carrier cell is ultimately absorbed. The early development takes place within the body of the mother sponge. When the development is complete, the larva forces its way into the radial canal and finally to the exterior.

8. Development of Sycon:

The fertilized egg or zygote divides repeatedly to form a round mass of cells. It is mostly covered with homogeneous cells but at one end a few thickly granulated cells appear.

The homogeneous cells grow flagella and completely enclose the granulated cells. Soon the cells at one half lose their flagella and become large and granular. The hollow and swimming larva at this stage is called amphiblastula stage and the larva in this stage leaves the parent body.

Gradually, the flagellated cells invaginate and finally the granular cells completely enclose the flagellated cells. The flagellated cells form the choanocyte lining while the granular cells give rise to the dermal epithelium. The larva fixes itself to a substratum and an aperture, called osculum, appears at the free end.

Further growth results into the thickening of the wall within which flagellate cells traverse and thus leads to the formation of radial canals. Numerous pores appear on the sides to form inhalent apertures.