TOPIC: PORIFERA:CHARACTERISTICS,CANAL SYSTEM

LECTURE NO:08
B.SC PART 1
ZOOLOGY(HONS.)-PAPER I-GROUP A
CHAPTER 4
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Scypha or *Sycon*

Classification:

PHYLUM - PORIFERA

CLASS - CALCAREA

ORDER - HETEROCOELA

GENUS - *SCYPHA*

Habit and Habitat:-

Scyphy or *Sycon* is commonly called as 'urn sponge or crown sponge' because of its typical shape. *Scyphy* or *Sycon* is marine sponge.This has been found widely in nature. It is found attached to submerged rocks in shallow water near coast. It occur solitary or as branching colonial form (Fig.12).Several species of *Scyphy* are *S. elegans, S.ciliatum, S.lingua* and *S. gelatinosum* etc.

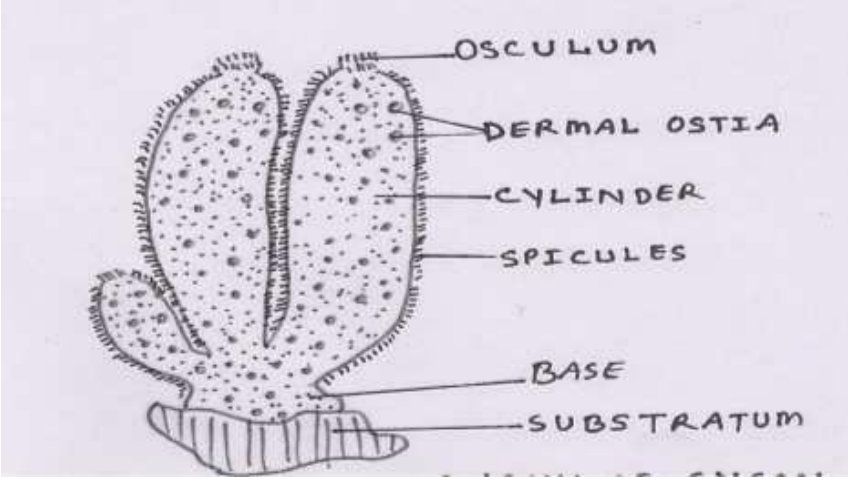

Fig.12: Colony of Sycon

Structure:

External morphology:

Shape- The colony has the appearance of a branching tree.It consists of two to several cylindrical branches connected together to a stolon at their bases. The latter is attached to substratum. Each cylinder is vase like (Fig.12).

Size- The size of a cylinder varies from 2-8cms.

Colour- The sponge presents various shades of grey or light brown colour.

Osculum and oscular fringe:

The free distal end of each cylinder has wide opening, the osculum or exhalent pore.

It is surrounded by numerous straight needles like calcareous spicules arranged in a circle.

Dermal pores or *ostia*:

Body surface of *Sycon* has regularly arranged polygonal elevations separated lines or furrows. In furrows present numerous apertures, the ostia or inhalant pores and open into current canals. Entire body surface has spicules protruding out from it.

Canal System in *Sycon:*

Sycon, like all other sponges, possesses the characteristic peculiarity-the canal system. The body wall of sponges is folded to produce complex system of pores and canals for entrance of water current. Scypha or *Sycon* represents *Sycon* type of canal system (Fig.13 and 14).

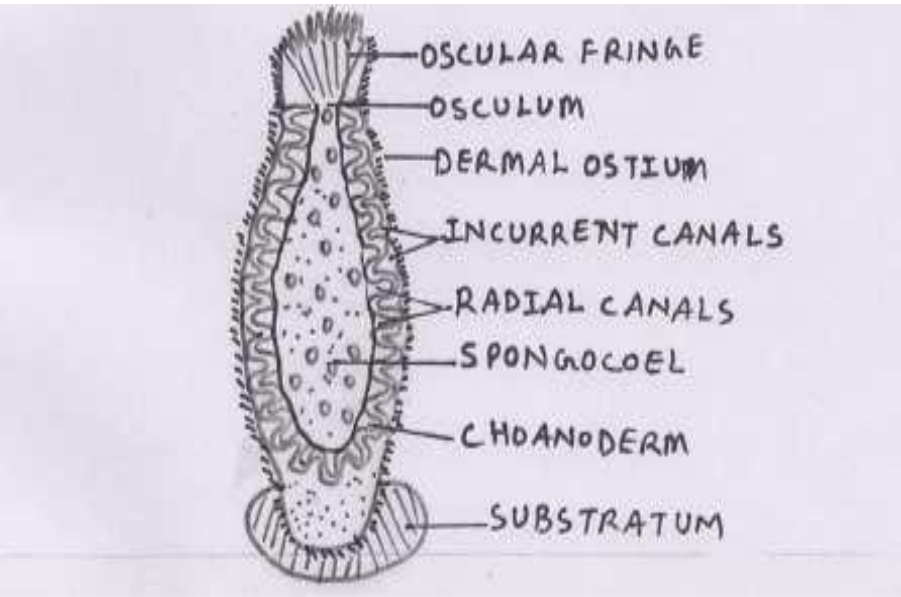

Fig.13:L.S of a single cylinder to show internal structure & Canal System

Its components are:

Ostia or dermal pores- The external body surface is

covered by thin pore membrane. It bears two or more

openings, the ostia or the dermal pores.

The pores are surrounded by myocytes.

These can reduce the diameter of dermal pores and thus reduce amount of inco

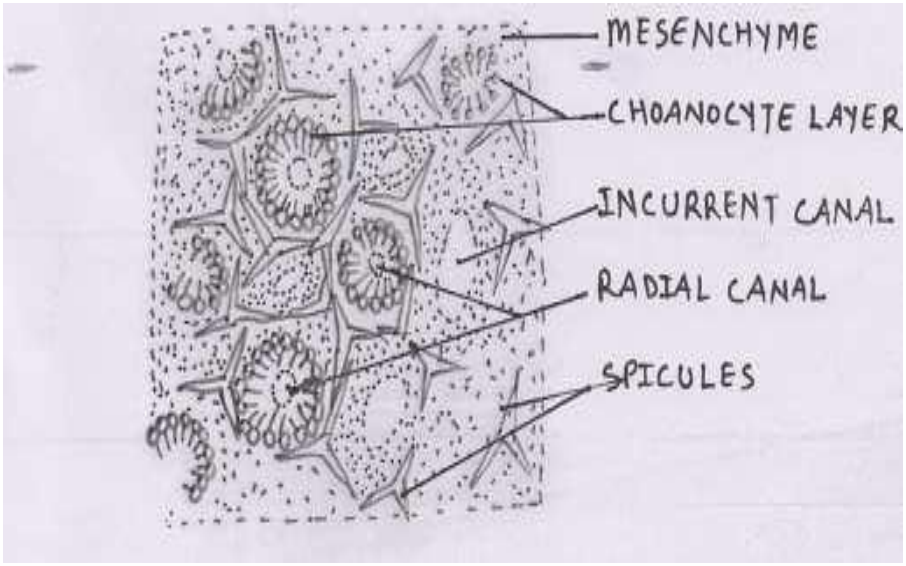

Fig.14: V.S of Sycon

In current cannels- These are narrow spaces placed radially between adjacent radial canals.These are lined with pinacocytes and opens outside by ostia.

3. Prosopyles- Incurrent canals communicate with radial canals by prosopyles.

4. Radial or flagellated canals- The body of *Sycon* invaginates to form thimble-shaped chambers. Chambers are lined by flagellated choanocytes and called flagellated chambers or radial canals. The radial canals and incurrent canals lie parallel and alternate to each other and are separated by mesenchyme. Radial canals end at their outer ends but open into spongocoel.

5. Apopyles- The openings of radial canals into spongocoel are called apopyles or gastric ostia.

Spongocoel- It's the large central cavity into which radial canals open through apopyles.The choanocytes line radial canals and

spongocoel is lined by flattened pinacocytes. Spongocoel is central space all along the length of body.

Osculum- The spongocoel opens to outside by a terminal opening, the osculum. Osculum is surrounded is surrounded by a contractile myocytes. These form a sphincter which regulates the rate of water flow.

Mechanism of water circulation:

The water current is produced and water is pumped into the body by beating of flagella of choanocytes which line the radial canals. A wave of spiral undulations passes from base to tip of each flagellum and water is pushed in. Water enters the body by ostia into incurrent canals, from there by prosopyles into radial canals and then by apopyles it reaches spongocoel and discharge into exterior by osculum (Fig.15, 16 and 17).

In other way, the path of water into the canal system can be represented as following-

Water from outside

↓

Dermal ostium

↓

Exter
In current canal ior

↓ ↑

Osculu
Prosopyle m

↓ ↑

Radial canal → Apopyle → excurrent canal → Gastric ostium → Paragastric cavity

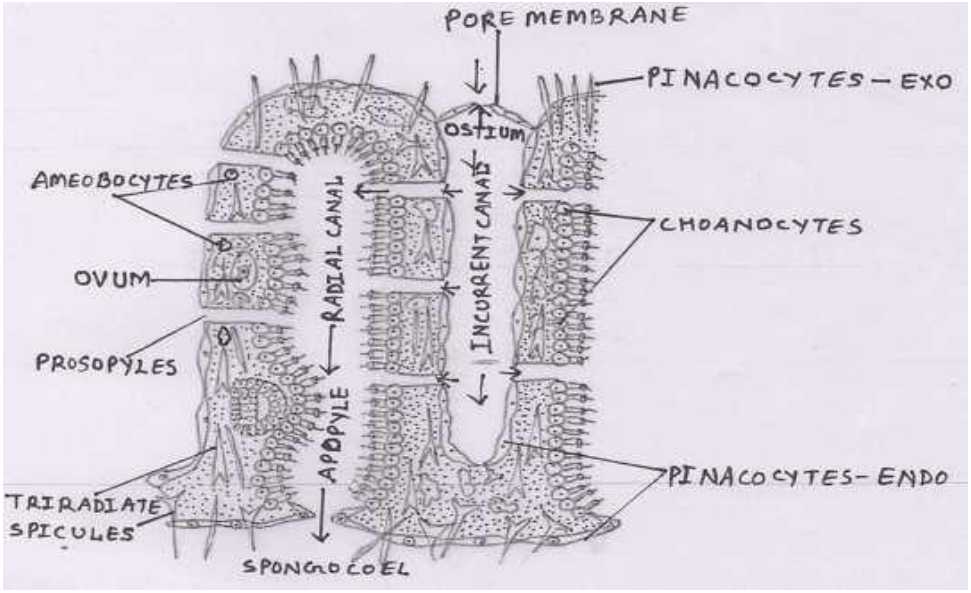

Fig.15 Representation of Body wall showing one In-current & one Radial Canal.

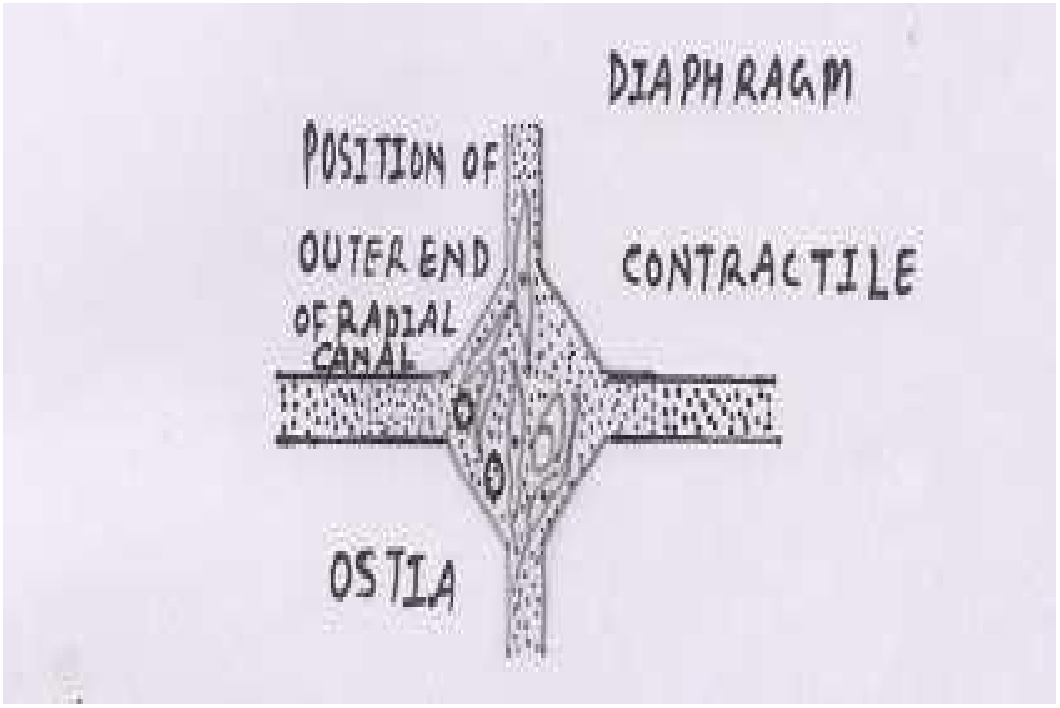

Fig.16 Sycon surface view of pore membrane showing Ostia

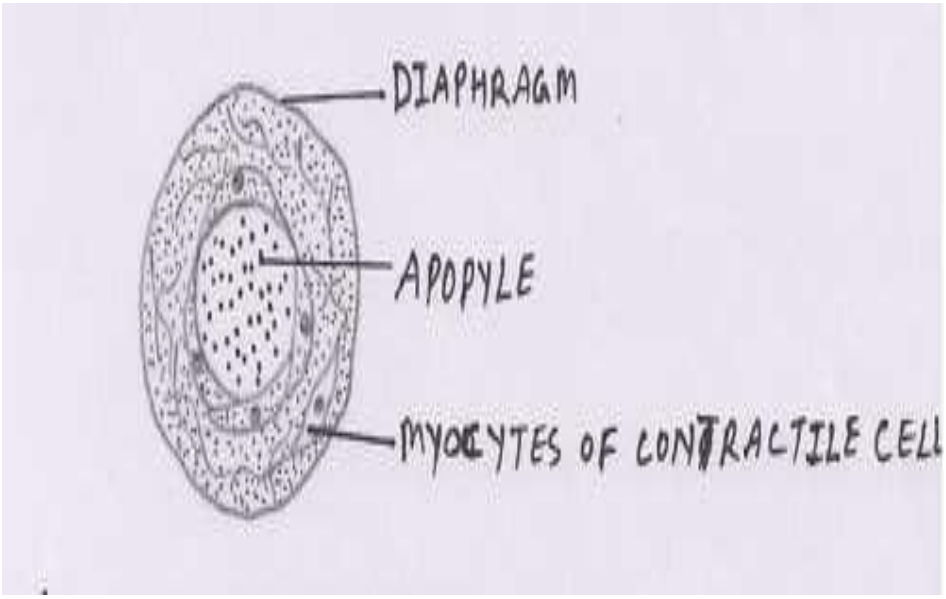

Fig.17 Sycon: An apopyle lined by myocyter

Importance of water circulation of canal system:

Water current plays a very important role in the physiology of the sponges. The water circulation system helps the sponges in nutrition, digestion, respiration, excretion and reproduction. The water current brings in food and oxygen and it takes away waste products.

Nutrition

Scypha feeds on particles of organic matter and small living organisms, like a diatoms, bacteria and protozoa; they are drawn in the water current.

Digestion- It is entirely intracellular, as in protozoa. Partly digested food is taken up by amoebocytes in which digestion is completed, the amoebocytes transport and supply the digested food to all parts of the body.

Respiration-

The Gaseous exchange occurs by simple diffusion, between the cells of sponge and the current of water. Water entering body is rich in oxygen and facilities exchange of gases. The rate of consumption of Scypha was found to range from 0.16 ml.of oxygen per gram of fresh weight per hour in the smaller specimens to 0.04ml. in the larger ones.

Excretion- While outgoing, water current removes CO_2 and nitrogenous products.

Reproduction-The spermatozoa enters body of other sponges along water current.

Reproduction in *Sycon:*

The sponges reproduce both asexually and sexually.

Asexual Reproduction –Asexual reproduction occurs throughout the Porifera. The asexual reproduction takes place by budding, regeneration and gemmule formation.

By budding - During favorable conditions *Sycon* reproduces by budding.

The buds arise basally near its attachment and then constrict off after sometime to lead independent existence (Fig.18).

By regeneration - Sponges have a great power of regeneration. They not only replace parts lost during injury, but any piece of body can grow into complete sponge.The process is however very slow and is completed in months or years. The regeneration power is used for cultivation of bath sponge industrially.

c) **By Gemmule formation**- Gemmules are not formed in *Sycon*.

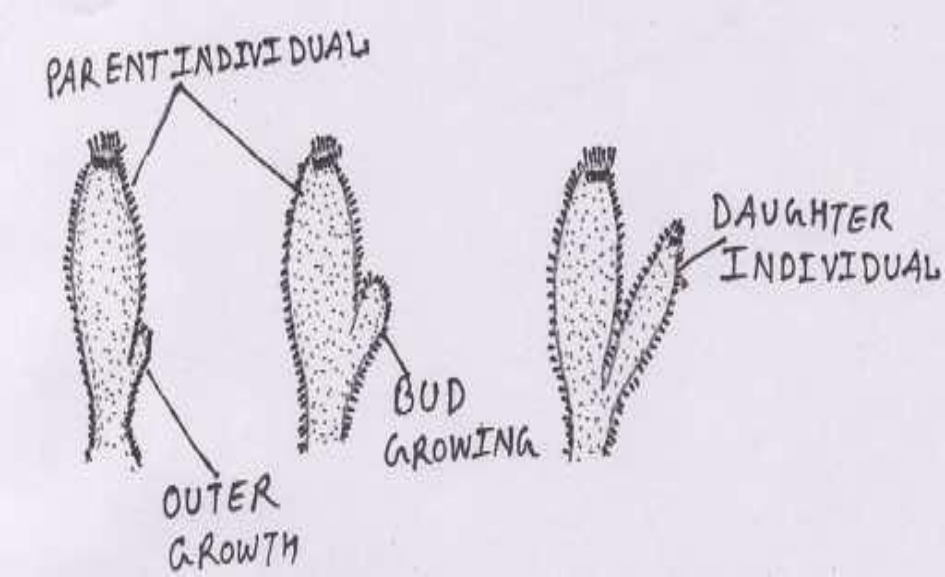

Fig.18 Sycon: Budding stage in Sycon

Sexual Reproduction

Both male and female gametes are formed inside body of same animal (hermaphrodite) Gametes develop specialized amoeboid cells, called archaeocytes found in mesenchyme.

Spermatogenesis-sperms are produced from amoebocyte or spermatogenesis and get surrounded by one or more flattened cells cover cells. The spermatocyte divides two to three times and cells develop into sperms. Mature sperm has round head with nucleus and long tail (Fig.19).

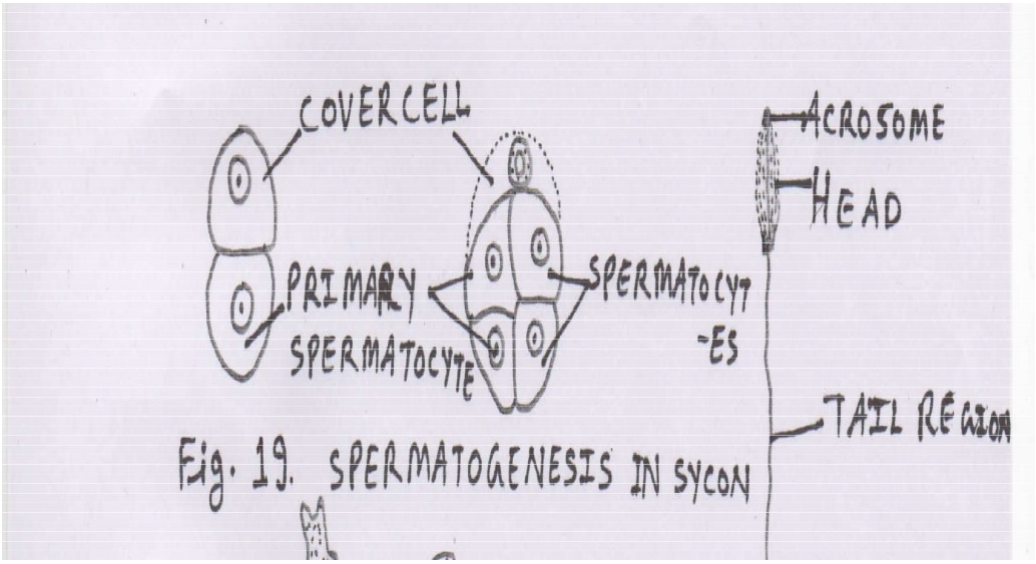

Fig.19 Spermatogenesis in Sycon

Oogenesis- Oocyte is differentiated into an enlarged amoebocyte with nucleus. It increase in size, stores food material, is nourished by choanocytes called trophocytes or nurse cells. Its nucleus undergoes two maturation divisions (meiosis) to form ovum (Fig.19).

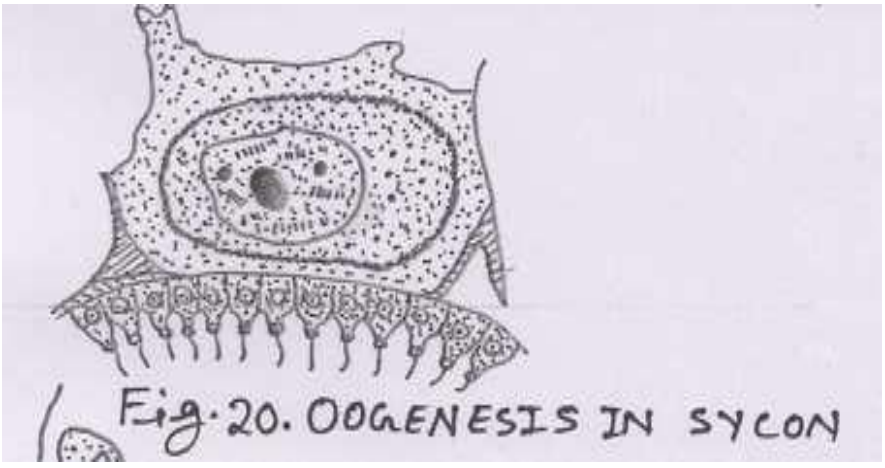

Fig.20 oogenesis in Sycon

Fertilization- The fertilization is internal and cross fertilization occurs. The sperm does not enter directly in the ovum but reaches a radial canal and is dispersed by the water currents (Fig.21).

Sperm cell enters the nurse cells or choanocyte adjacent to mature oocytes, which becomes amoeboid and fuses with ovum liberating the sperm. The nuclei of ovum and sperm fuse and form zygote.

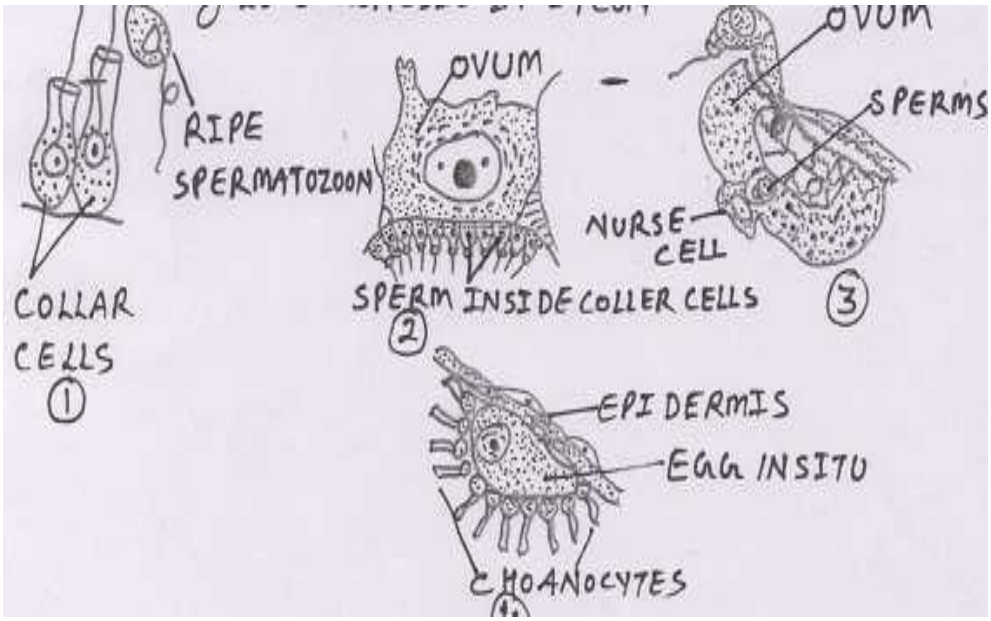

Fig.21: Fertilization in Sycon

Development of *Sycon:*

Cleavage- The divisions are holoblastic and development occurs inside the

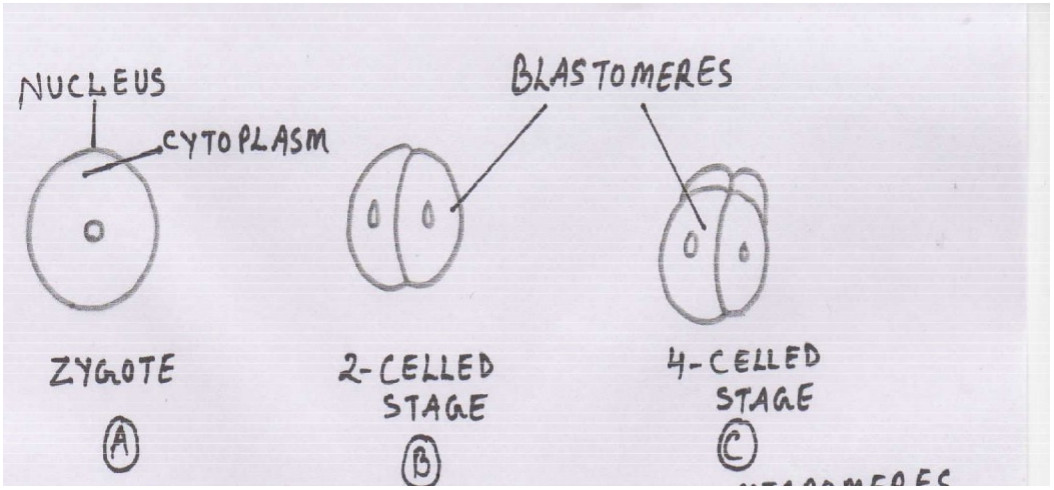

Fig.22 Cleavage in Sycon

The 1st three divisions are vertical and produce pyramidal plate of 8 cells.

The 4th division is horizontal and divides blastomeres unequally into 8 micromers and 8 macromers (Fig. 22: A to E).

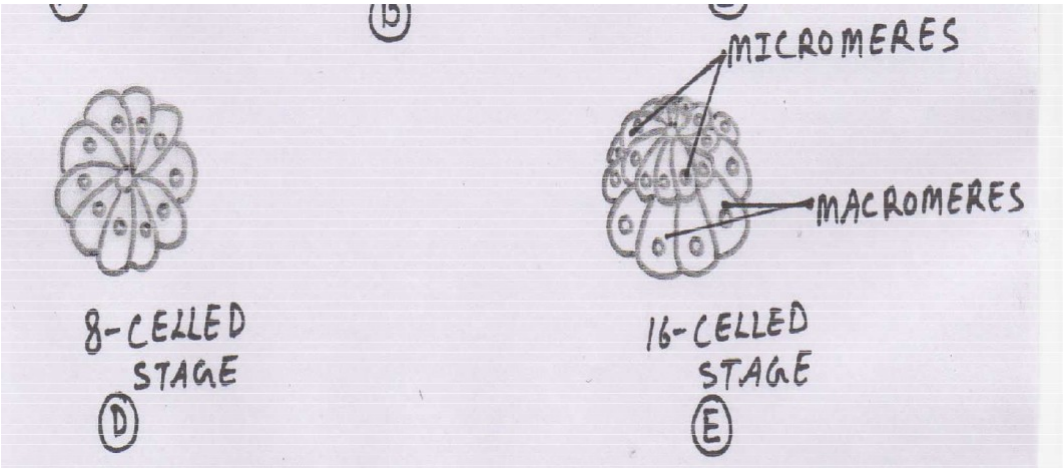

Fig.23 Cleavage in Sycon

A cavity develops in between and embryo enters into the blastula phase. Micromeres divide more rapidly and develop flagella at their free ends, while macromere becomes rounded and represents the stomoblastula.

Stomoblastula- one side of stomoblastula is composed of many small, elongated, flagellated micromeres, while other side composed of Micromers.

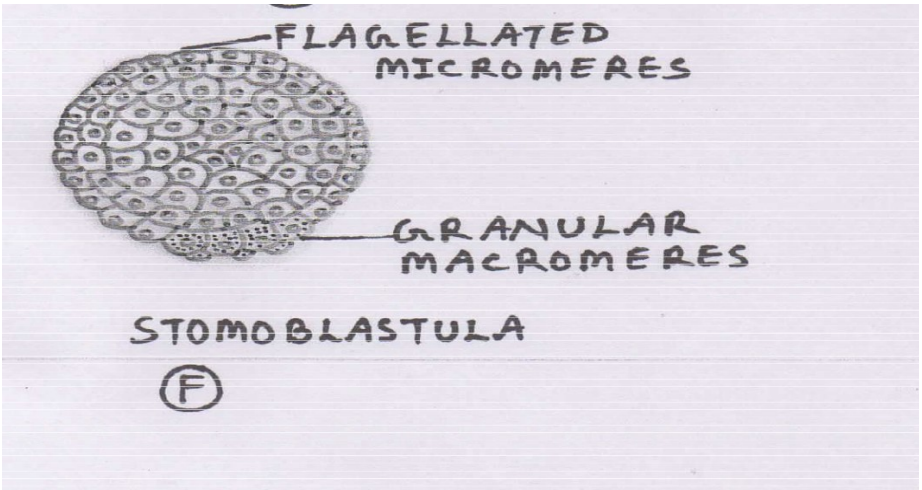

Fig.24 Stomoblastula in Sycon

Inner cavity (blastocoel) opens outside through the mouth.

It is used to engulf the surrounding amoebocytes for nutrition.

Amphiblastula- The stomoblastula undergoes inversion and flagellated ends of

flagellated cells comes to lie to the exterior.

The flagellated stomoblastula is called amphiblastula larva. The fully formed amphiblastula is set free into radial canal (Fig. 22: G to H).

It escapes by osculum along the water current and leads free swimming existence and undergoes gastrulation by invagination and emboly.The flagellated cell invagination into blastocoel and macromere grows over them by rapid multiplication. Thus gastrula is formed.

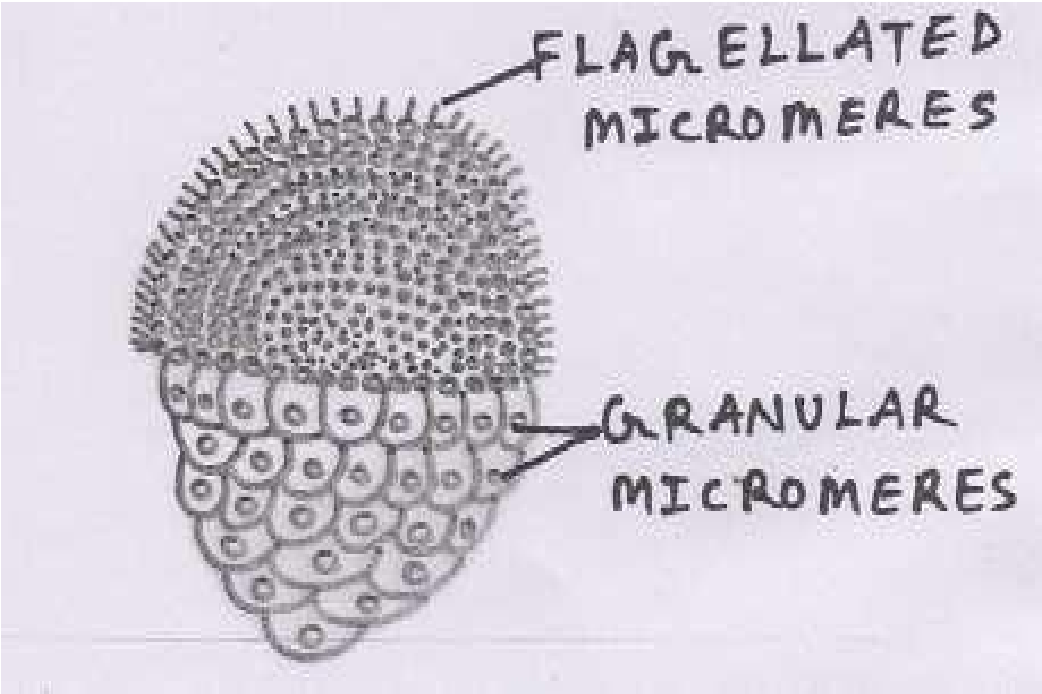

Fig.25 Amphiblastula in Sycon

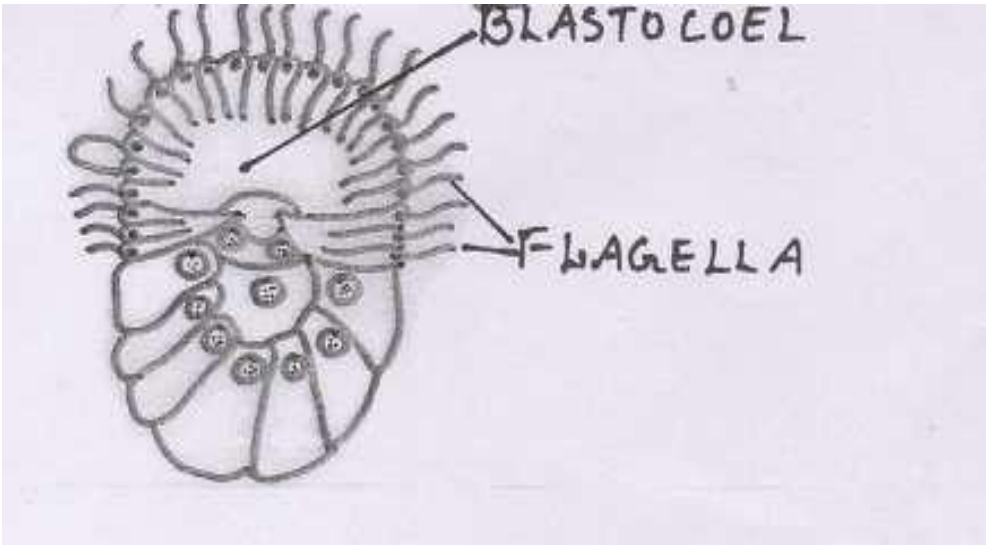

Fig.26 Development in Sycon (T.S of Amphiblastula)

Gastrula- Gastrula has two layer bodies.
Outer layer is granular, ectoderm and inner is non-granular flagellated cells, endoderm.

The central cavity opens outside by opening called blastopore (Fig. 22: I to J).

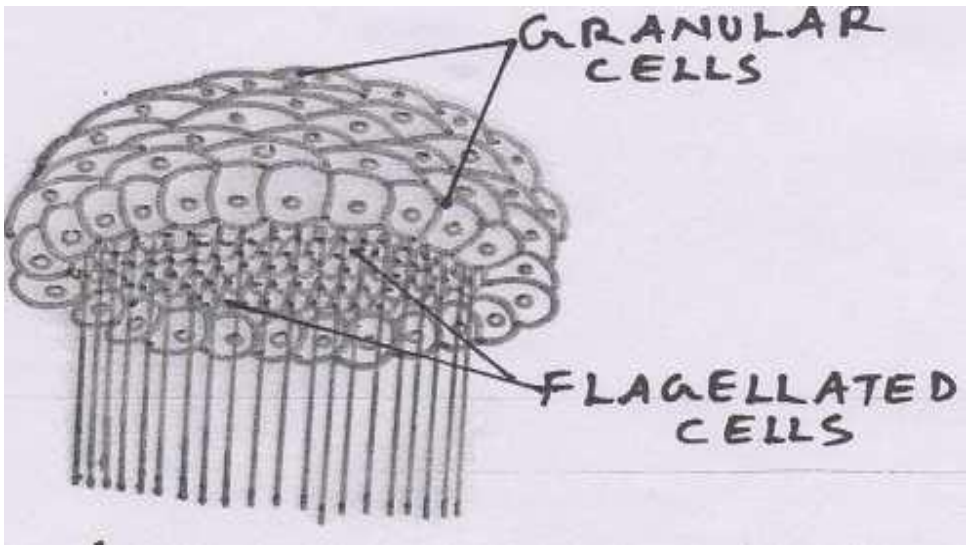

Fig.27 Gastrulation in Sycon

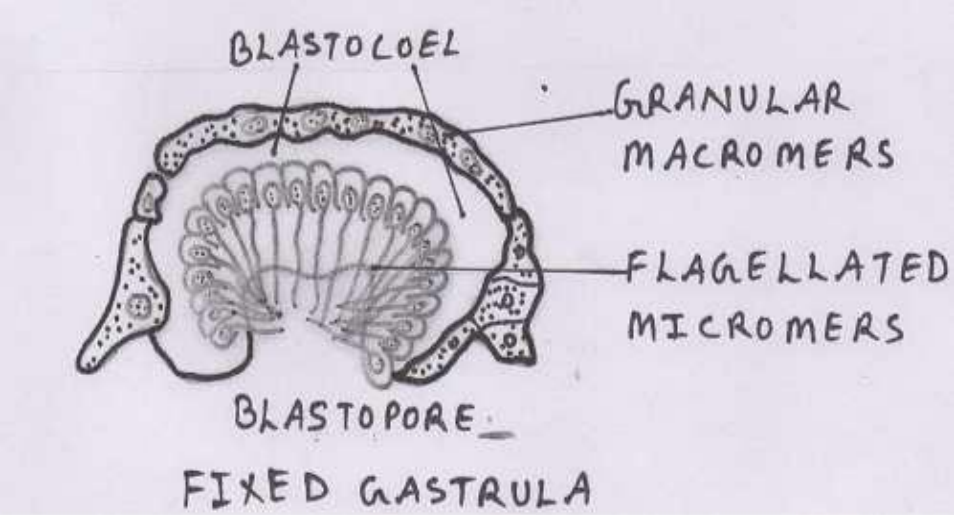

Fig.28 Fixed Gastrula

5. **Metamorphosis (Post embryonic development)** - The gastrula adheres to substratum like rock, sea weeds, etc., by its blastoporal end and undergoes metamorphosis to form adult *Sycon*.

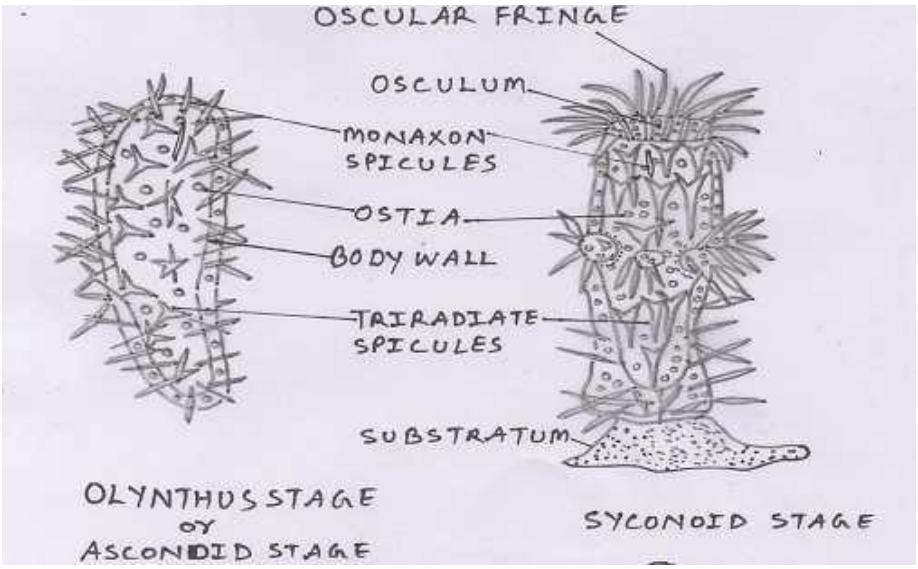

Fig.29 Post embryonic development in Sycon

The larva lengthens into a cylinder and develops osculum at free distal end.

The non-granular flagellated cells of endoderm form choanocytes.

The granular non-flagellated cells of ectoderm give rise to pinacocytes of dermal epithelium.

The body wall gets perforated by Ostia and Olynthus stage is attained by *Sycon* (Fig. 23: K to L). The choanocytes are shifted in these radial canals and the body wall increase in thickness, the adult Scypha is formed and its colony develops.