

**B.Sc. Zoology Part I****CANAL SYSTEM IN PHYLUM PORIFERA (SPONGES)**

All the cavities of the body traversed by the currents of water, which nourish the sponge from the time it enters by the pores until it passes out by the osculum, are collectively termed canal system. In the *Olyntus* canal system is seen in its simplest type. In other forms it may attain a high degree of complexity, but its general evolution can nevertheless be reduced to simple process of growth on the part of primitive *Olyntus* resulting in folding of the walls and accompanied by a restriction of the collared (choanocyte) cells to certain regions. In the gradual and continuous process of differentiation three distinct types of organization can be distinguished. There are usually three types of canal system met within sponges, viz., **asconoid type, syconoid type and leuconoid type.**

**1. Asconoid Type:-**

- Asconoid type of canal system is the simplest of all the types.
- In this there is a radially symmetrical vase-like body consisting of a thin wall enclosing a large central cavity the spongocoel opening at the summit by the narrowed osculum.
- The wall is composed of an outer and inner epithium with a mesenchyme between.
- The outer or dermal epithelium here termed epidermis consists of a single layer of flat cells.
- The inner epithelium, lining the spongocoel is composed of choanocytes.
- The mesenchyme contains skeletal spicules and several types of amoebocytes, all embedded in a gelatinous matrix.
- The wall of the asconoid sponge is perforated by numerous microscopic apertures termed incurrent pores or ostia which extend from the external surface to the spongocoel.
- Each pore is intracellular, i.e., it is a canal through a tubular cell called a porocyte.
- The water current impelled by the flagella of the choanocytes passes through the incurrent pores into the spongocoel and through the osculum furnishing in its passage food and oxygen and carrying away metabolic wastes.
- The water current in the asconoid sponges follow the following route:-

**Water from exterior → incurrent pores → spongocoel → osculum  
→ water out.**

- Asconoid type of canal system is found only in few sponges, e.g., *Olyntus*, *Leucosolenia*.

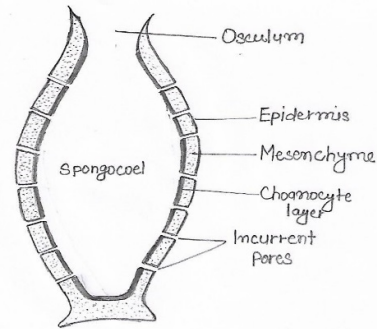


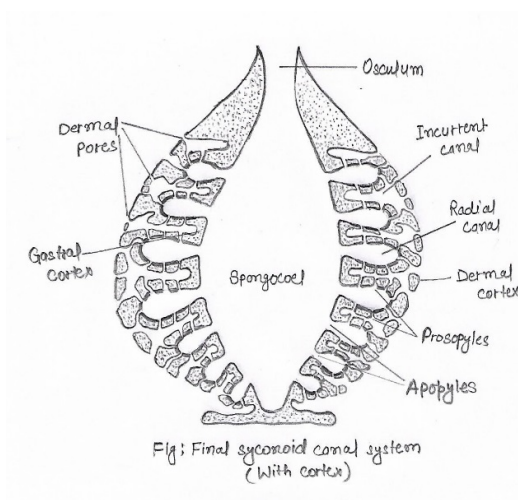
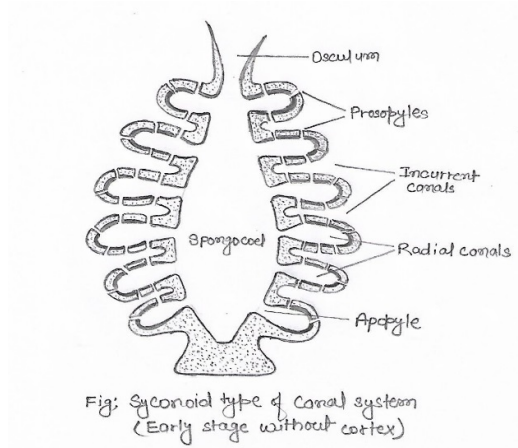
Fig: Asconoid type of canal system

## 2. Syconoid Type:-

- Syconoid type of canal system is the first stage above the asconoid type.
- It is formed by the out pushing of the wall of an asconoid sponge at regular intervals into finger like projections, called radial canals.
- At first these radial canals are free projections and the outside water surrounds their whole length, for there are no definite incurrent channels.
- But in most syconoid sponges, the walls of radial canals fuse in such a manner as to leave between them tubular spaces, the **incurrent canals** which open to the exterior between the blind outer ends of the radial canals by apertures termed **dermal ostia** or **dermal pores**.
- Since these incurrent canals represent the original outer surface of the asconoid sponge they are necessarily lined by epidermis.
- Radial canals being the out pushing of the original spongocoel are necessarily lined by choanocytes and are therefore, better called **flagellated canals**.
- The interior of the syconoid sponge is hollow and forms a large spongocoel which is lined by the flat epithelium derived from epidermis.
- The openings of the radial canals into the spongocoel are termed **internal ostia**.
- The spongocoel opens to the exterior by the single terminal osculum.
- The wall between the incurrent and the radial canals is pierced by numerous minute pores called **prosopyles**.
- The water current in syconoid sponges take the following route:-

**Dermal pores** → **incurrent canals** → **prosopyles** → **radial canals**  
 → **internal ostia (apopyle)** → **spongocoel** → **osculum** → **out**.

- The syconoid structures occurs in two main stages.
- The first type illustrated in a few of the heterocoelous calcareous sponges, especially members of the genus *Sycon*.
- In the second stage, the epidermis and mesenchyme spread over the outer surface forming a thin or thick **cortex** often containing special cortical spicules.



### 3. Leuconoid Type:-

- As a result of further process of out folding of the choanocyte layer and thickening of body wall the leuconoid type of canal system develops
- The choanocyte layer of radial canal of the syconoid stage evaginates into many small chambers, and these may repeat the process, so that clusters of small rounded or oval flagellated chambers replace the elongated chambers of the syconoid stage.
- The choanocytes are limited to these chambers.
- Mesenchyme fills in the space around the flagellated chambers.
- The spongocoel usually obliterated and the whole sponge becomes irregular in structure and indefinite in form.
- The interior of the sponge becomes permeated by many incurrent and excurrent canals join to form larger excurrent canals and spaces which lead to the oscula.
- The surface is covered with epidermal epithelium and pierced by many dermal pores (ostia) and oscula.
- The dermal pores lead into incurrent canals that branch irregularly through the mesenchyme.

- The incurrent canals lead into the small rounded flagellated chambers by opening still termed prosopyles.
- The flagellated chambers open by apertures called apopyles into excurrent channels, and these unite to form larger and larger tubes, of which the largest lead to the oscula.
- The course of water current is:-

**Dermal ostia → incurrent canals → prosodus (if present) → prosopyles → flagellated chambers → apopyles → aphodus (if present) → excurrent canals → larger channels → oscula → out.**

- The leuconoid type of canal system exhibits numerous variations but presents three stages of evolution, viz., **eurypylous**, **aphodal** and **diplodal**.

**(i) Eurypylous type:-**

- In the eurypylous leuconoid type of canal system, the flagellated chambers are wide and thimble-shaped, each opening directly into the excurrent canal by a wide aperture called apopyle and receive the water supply direct from incurrent canal through the prosopyle.
- The current of water takes the following route:-

**Dermal pores or ostia → subdermal spaces → incurrent canals → prosopyles → flagellated chambers → apopyles → excurrent canals → spongocoel → oscula → out.**

- This type of canal system is found in *Leucilla*.

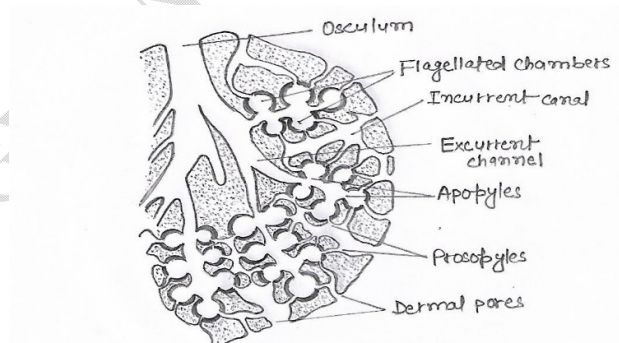


Fig: Leuconoid type of canal system with eurypylous chambers

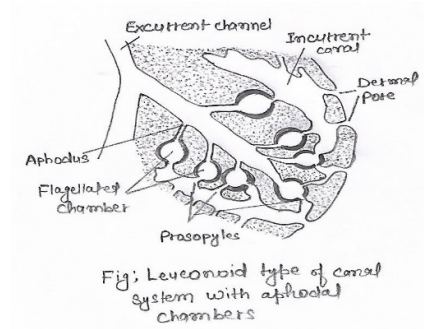
**(ii) Aphodal Type:-**

- In the aphodal leuconoid type of canal system, the flagellated chambers are small and rounded.
- The opening of each flagellated chamber into the excurrent canal is drawn out into a narrow tube, usually not of great length, termed aphodus.
- The relation of the flagellated chambers to the incurrent canals remain as before.

- The route of water current is as follows:-

**Dermal pores or ostia** → **subdermal spaces** → **incurrent canals** → **prosopyles** → **flagellated chamber** → **aphodus** → **excurrent canals** → **spongocoel** → **oscula** → **out**.

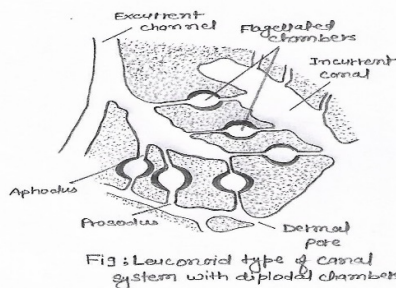
- This type of canal system is found in *Geodia* and *Stelleta*.



### (iii) Diplodal:-

- In some cases there is also a narrow current tube, the prosodus between the incurrent canal and the flagellated chambers, such a condition is called diplodal.
- This type of canal system is found in *Oscarella*, *Spongilla* etc.
- The current of water takes the following route:-

**Dermal pores or ostia** → **subdermal spaces** → **incurrent canals** → **prosodus** → **flagellated chambers** → **aphodus** → **excurrent canals** → **spongocoel** → **oscula** → **out**.

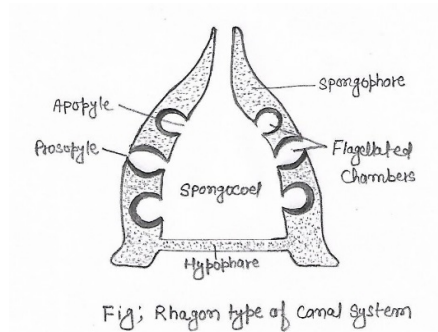


### 4. Rhagon Type:-

- This type of canal system is found in demospongiae which in turn arises by direct rearrangement of the inner cell mass.
- The rhagon type of sponge has a broad base and it is conical in shape with a single osculum at the summit.
- The basal wall is termed the hypophare which is devoid of flagellated chambers.
- The upper wall bearing a row of small, oval flagellated chambers called spongophare.

- Spongocoel is bordered by oval flagellated chambers opening into it by wide apopyles.
- Dermal pores or ostia open into subdermal spaces which extend below the entire surface of the body.
- Branching incurrent canals lead from the subdermal spaces into small flagellated chambers which have been formed by breaking down of radial canal, the flagellated chambers are lined by choanocytes lead into spongocoel.
- The spongocoel opens by a single osculum.
- The course of water current of water is:-

**Ostia** → **subdermal space** → **incurrent canals** → **prosopyle**  
→ **flagellated chambers** → **apopyles** → **excurrent canals**  
→ **spongocoel** → **osculum** → **out.**



### FUNCTIONS OF CANAL SYSTEM

- The canal system helps the sponges in nutrition, respiration, excretion and reproduction.
- The current of water which flows through the canal system brings the food and oxygen and takes away the carbon dioxide, nitrogenous wastes and faeces.
- It carries the sperms from one sponge to another for fertilization of the ova.
- Canal system increases the surface area of sponges and increase the volume that is why the ratio of surface area and volume remain fixed.