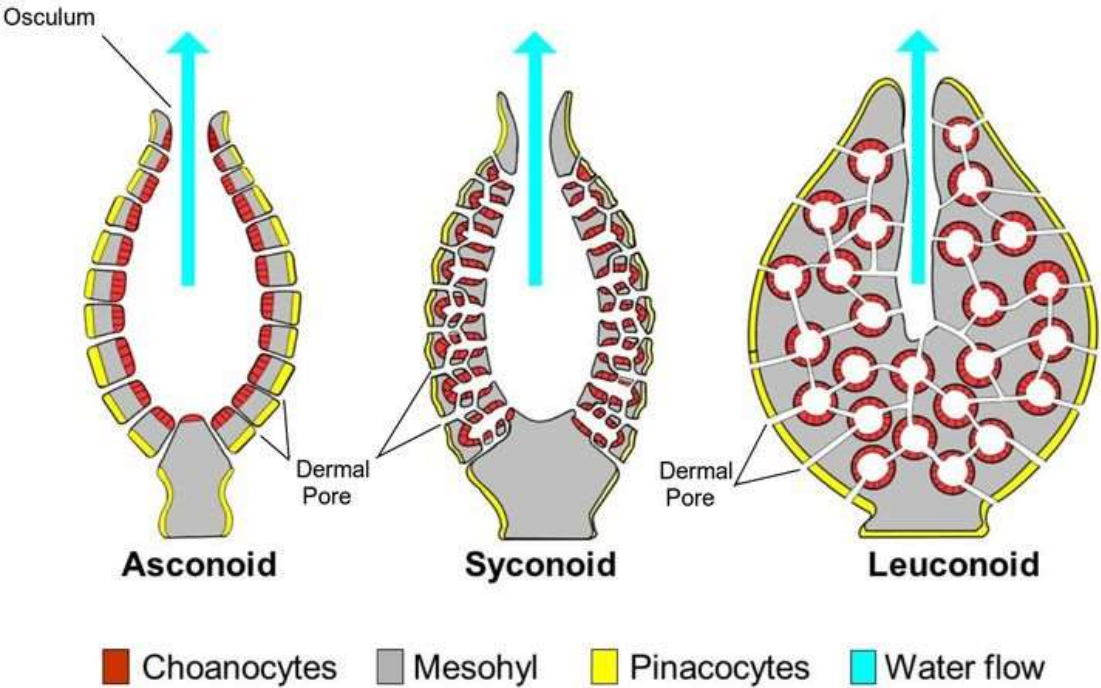




## PORIFERA-Canal System

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- All the body cavities traversed by water currents, nourishing the sponge from the time it enters by the pores until it passes out by the osculum, are collectively referred to as canal system.

Thus canal system is a system of inter communicating cavities bathed by the currents of water that aids the sponges to carry out vital life processes like nutrition , respiration, excretion, reproduction etc.

It is found in simplest form in *Olynthus*, but in others it has attained varied degree of complexity.

The body wall of the sponges is folded to produce a complex system of pores and canals for the entrance of water current. Depending upon the arrangement of these canals in sponges, the canal system is of many types. But, there are usually four types of canal system met within sponges, they are,

- Asconoid type
- Syconoid type
- Leuconoid type.
- Rhagon type

# Canal System Components

**A typical canal system is composed by following components:**

**(a) Incurrent canal** – It opens externally to the outside by a small pore known as incurrent pore or ostium, but internally it ends blindly.

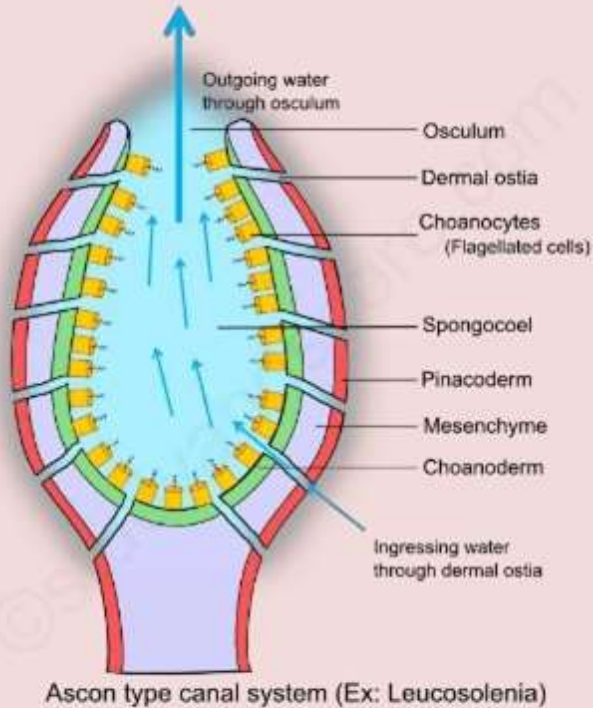
**(b) Radial canal or excurrent canal-** It is closed externally but opens internally by minute pores or apopyles into a central cavity or cloacal cavity or gastral cavity or spongocoel, which cannot be compared in any way with the stomach or intestine of other animals.

**(c) Prosopyle-** It is a smaller canal or passage-way connecting incurrent canal with radial canal.

The incurrent canals are lined by flat squamous cells and their functions are only to form water conduits and to form a smooth and firm surface.

The radial canals are lined by collar cells opening at the surface and are provided with flagella or whips. The lashing movements of flagellum procure the food particles and push them into the cell-mouth. Thus, this is food-capturing arrangement of sponges. Spongocoel or cavity is lined by a thin gastric epithelium. It opens to the outside by an aperture, called osculum.

# Ascon type



- **Asconoid Canal System**

- This type of canal system occurs in only a very few sponges like *Leucosolenia* which are small in size having vase like radially symmetrical body. It is a simplest type of canal system with the following salient features:
  - ➤ The body wall is thin walled and unfolded with poorly developed mesenchyme.
  - ➤ There are numerous intra cellular perforations in the body wall the **ostia or incurrent pores** which pass through **porocytes** into spongocoel.
  - ➤ The spongocoel which opens outside by single terminal osculum is lined all over by choanocytes.
  - ➤ The route followed by the water currents is ostia, spongocoel and osculum.

The water current impelled by the flagella of the choanocytes passes through the incurrent pores into the spongocoel and out through the osculum. Furnishing in its passage food and oxygen and carrying away metabolic wastes. Asconoid type of canal system is found only in few sponges, **e.g., Olynthus, Leucosolenia.**

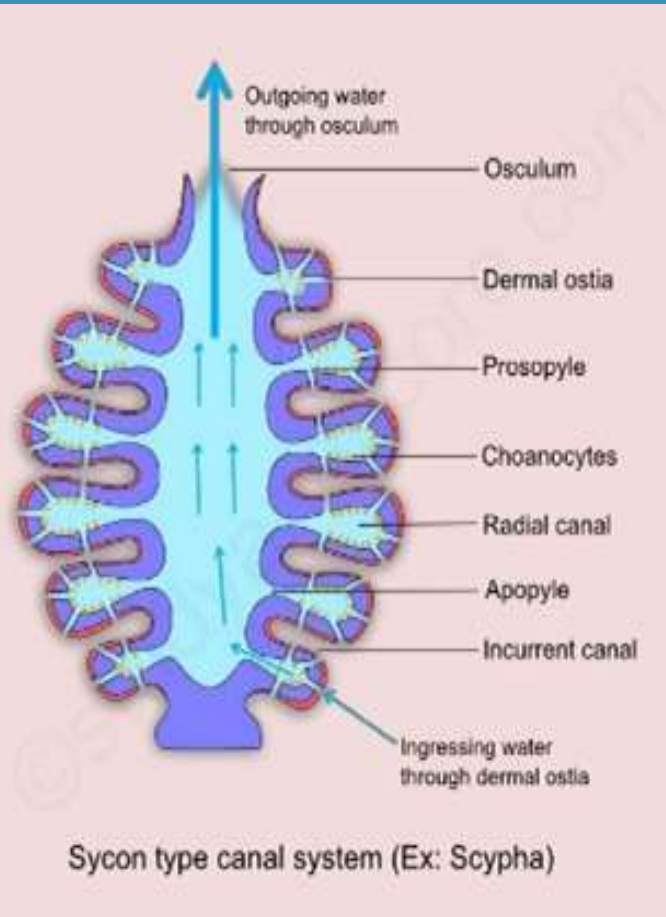
### The course of water current

water from exterior → incurrent pores → spongocoel → osculum → water out

According to Hyman, the important features of the asconoid structure are the simple wall and the complete continuous lining epithelium of choanocytes, interrupted only by the inner ends of the porocytes. The asconoid type of sponge superficially resembles a typical gastrula.



# Sycon type



- **Syconoid Canal System**

- This type of canal system is slightly complicated and advanced than asconoid one with following important features:
  - ➤ The body wall of the sponge is thick and folded with well developed mesenchyme.
  - ➤ The radial canals that are formed by out pushing of body wall are lined by choanocytes hence better called flagellated canals.
  - ➤ The incurrent canals with epidermal lining formed between radial canals open to the exterior through dermal ostia and into the radial canals through prosopyles.
  - ➤ The radial canals open into spongocoel by internal ostia.
  - ➤ This type of canal system is found in **Sycon, Sycetta, Grantia** etc.

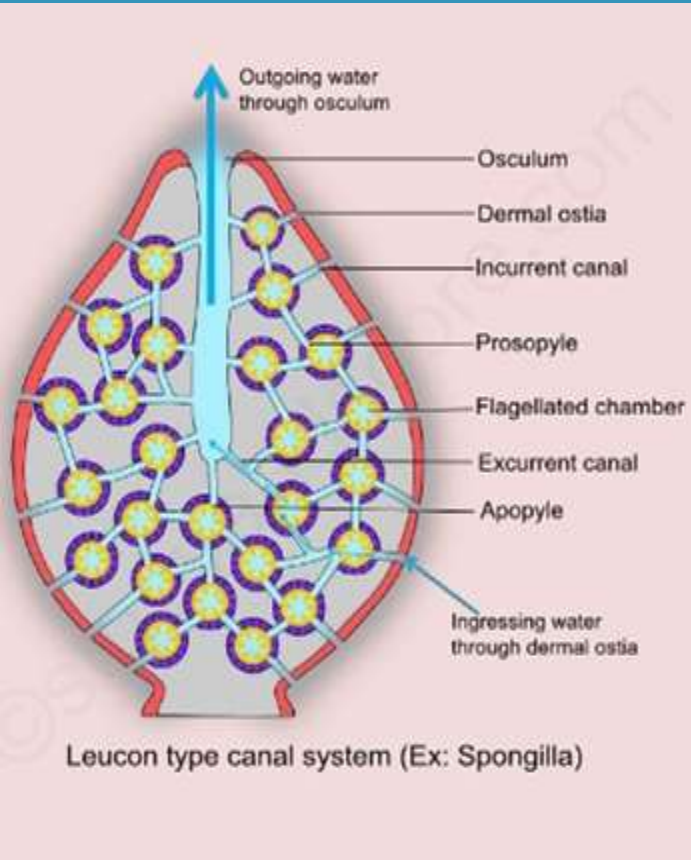
The water current in syconoid sponges takes the following route

Dermal pores → incurrent canals → prosopyles → radial canals → internal ostia (apopyles) → spongocoel → osculum → out

**The syconoid sponges differ from the asconoid type in two important particulars:**

- (i) In the thick folded walls containing alternating incurrent and radial canals and
- (ii) In the breaking of the choanocyte layer, which no longer lines the whole interior but is limited to certain definite chambers (radial canals).

# Leucon type



- **Leuconoid Canal System**
- It is the complex type of canal system which in calcareous sponges is attained through modification of asconoid and syconoid stages and has following features:
  - ➤ The mesenchyme forms extensive dermal and gastral cortex resulting thickening of sponge wall
  - ➤ The ostia lead into incurrent canals which are irregular and often branched.
  - ➤ The spongocoel is either narrow or lacking.
  - ➤ The radial canals are folded to form flagellated chambers.
  - ➤ The flagellated chambers lead into excurrent canals that either open into spongocoel or outside through osculum.
  - ➤ There are four types of variations presented by leuconoid type of canal system viz. **Eurypylous, Prosodal, Aphodal and Diplodal (1)**
  - ➤ This type of canal system is found in ***Leucilla, Geodia, Oscarella, Spongilla*** etc.

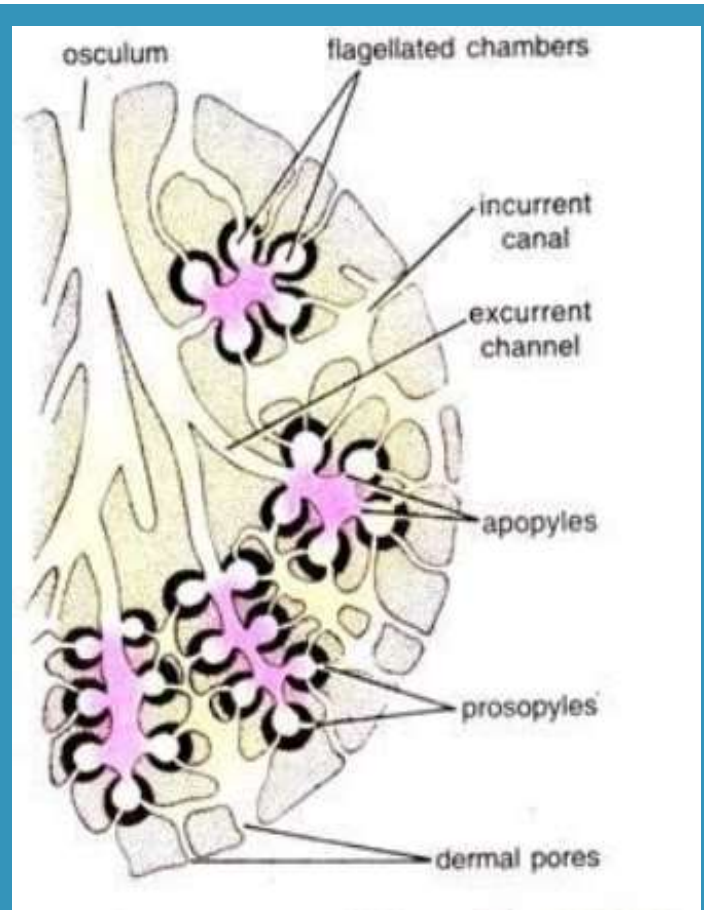
The **main characteristics** of the leuconoid type of canal system are the limitation of the choanocytes to small chambers, the great development of the mesenchyme, and the complexity of the incurrent and excurrent canals.

## The course of water current

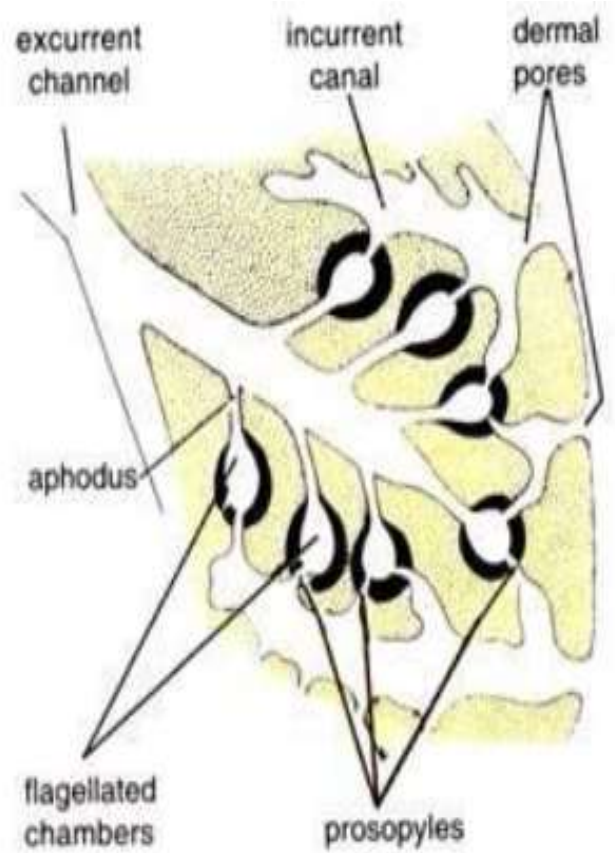
Dermal ostia → incurrent canals → prosodus (if present) → prosopyles → flagellated chambers → apopyles → aphodus (if present) → excurrent canals → larger channels → oscula → out

## Variations within leucon type

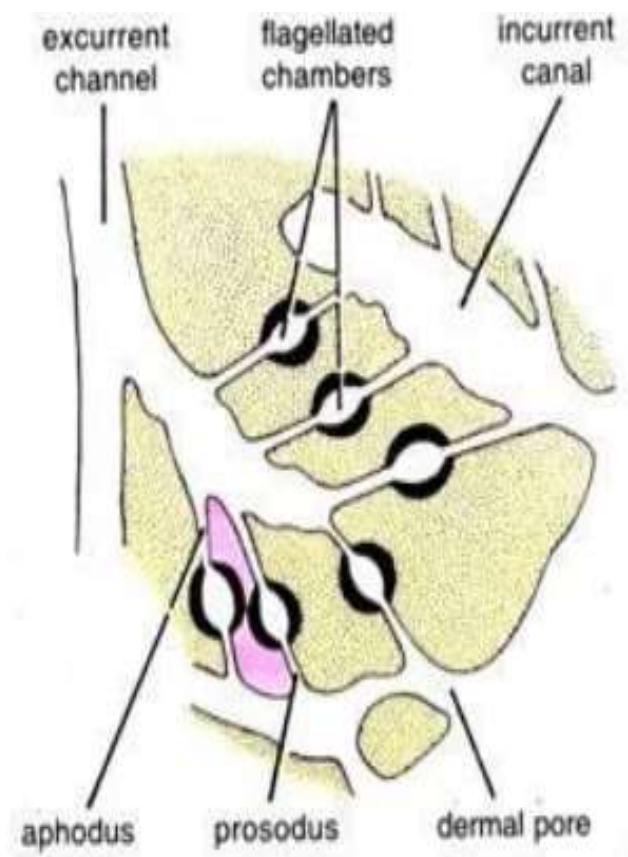
- The leuconoid type of canal system exhibits numerous variations but presents three stages of evolution, viz., **eurypylous, aphodal, and diplodal.**
- **(a) Eurypylous:**
- In the eurypylous leuconoid type of canal system, the flagellated chambers are wide and thimble-shaped, each opening directly into the excurrent canal by a wide aperture called apopyle and receive the water supply direct from the 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.
- **(b) Aphodal:**
- 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 space → incurrent canals → prosopyles → flagellated chambers → aphodus → excurrent canals → spongocoel → oscula → out
- This type of canal system is found in Geodia and Stelleta.
- **(c) 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.



**Leuconoid type of canal system with eurypylous chambers**



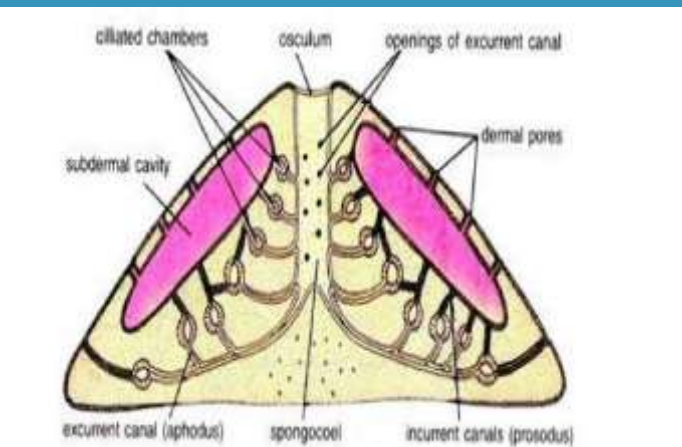
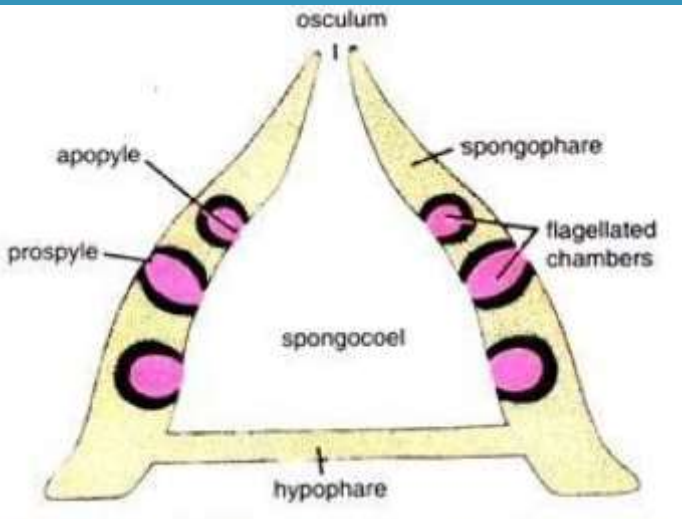
**Leuconoid type of canal system with aphodal chambers**



**Leuconoid type of canal system With diplodal chambers**



# Rhagon type



**Spongilla –Diagrammatic vertical section showing rhagon type of canal system**

- In calcareous sponges, the leuconoid structure may be attained by way of asconoid and syconoid stages. But in Demospongiae it is derived from a stage termed a rhagon 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 is called spongophare.
- Spongocoel is bordered by oval flagellated chambers opening into it by wide apopyles. Between the chambers and the epidermis lies a considerable thickness of mesenchyme traversed by incurrent canals and subdermal spaces. Dermal pores or ostia open into sub-dermal spaces which extend below the entire surface of the body. Eg-spongilla
- Branching incurrent canals lead from the sub-dermal spaces into small flagellated chambers which have been formed by breaking down of radial canal, the flagellated chambers alone are lined by choanocytes. From the flagellated chambers ex-current canals lead into a spongocoel.
- The incurrent and ex-current canals may be complex and branched. The spongocoel opens by a single osculum.
- **The course of current of water is**
- Ostia → sub-dermal spaces → incurrent canals → prosopyles → flagellated chambers → apopyles → ex-current canals → spongocoel → osculum → out.

# Functions of the canal system

The canal system which draws water current inside the sponge's body and maintains a continuous uninterrupted flow of water, plays a vital role in the physiology of sponges, because it serves the various kinds of functions.

## **(i) Nutrition:**

The sponges are holozoic and bring various kinds of microscopic organisms as food such as bacteria, diatoms, protozoans and other organic particles with the water current inside the body. The selected food are digested by choanocytes of the flagellated chambers and serves the purpose of nutrition.

## **(ii) Respiration:**

A continuous flow of water brings oxygen inside, and exchange of gases takes place between the dissolved oxygen of the flowing water and the cells of the sponge along the course of water flow.

## **(iii) Excretion:**

The outgoing flow of water current removes the various kinds of metabolic waste materials such as ammonia, urea, uric acid and other nitrogenous excretory products.

## **(iv) Reproduction:**

The incoming water current brings sperms which are captured by the choanocytes and help in fertilization.

# Comparative analysis of canal system in porifera

Points	Asconoid Type	Syconoid Type	Leuconoid Type	Rhagon Type
1. Wall	Simple.	Evaginated to produce radial and incurrent canals.	Irregular.	Simple.
2. Mesenchyme	Simple and thin. Completely traversed by porocytes.	Thickened and not completely traversed by porocytes.	Highly elaborated, traversed by incurrent canals or subdermal spaces.	Considerably thickened, traversed by incurrent canals and subdermal spaces.
3. Choanocytes	Lined the spongocoel.	Limited to the radial canals.	Limited to the flagellated chambers. Flagellated chambers open by narrow apolyes.	Limited to the flagellated chambers which open by wide apopyles.
4. Spongocoel	Spacious.	Spacious.	Usuaally obliterated.	Spacious.

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