UG CBCS Semester-I

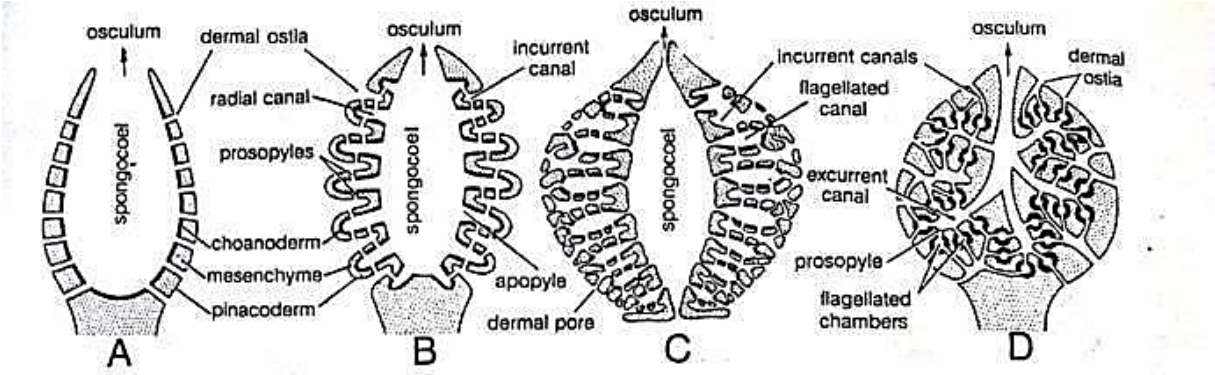
Canal system in Sponges

What is canal system

A distinguishing feature of all sponges is the perforation of body surface by numerous apertures for the ingress and egress of water current. Inside body, the water current flows through a certain system of spaces collectively forming the canal system.

Function of water current

The most vital role in the physiology of sponges is played by water current on which their life depends. All exchanges between sponge body and external medium arc maintained by means of this current. Food and oxygen are brought into body and excreta and reproductive bodies carried out. This current is caused by beating of flagella of collar cells.



Canal system of sponges. A—Ascon type. B—Simple sycon type. C—Complex syconoid type with cortex, D—Leucon type.

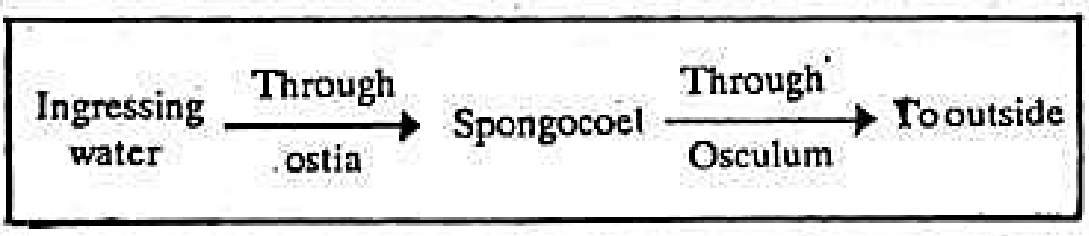
Types of canal system

The arrangement and complexity of internal channels vary considerably in different sponges. Accordingly, the canal system has been divided into three types—ascot, sycon and leucon.

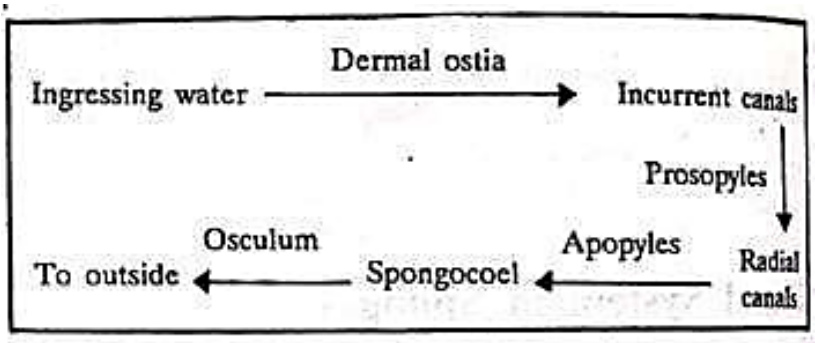
1. Ascon type. It is the simplest type of canal system which is found in asconoid sponges, like *Leucosolenia*, and in olynthus stage in the development of all syconoid sponges. Its body surface is pierced by a large number of minute openings called incurrent pores or ostia. These pores are intracellular spaces within tube-like cells, the porocytes, which extend radially into mesenchyme, and open directly into spongocoel. The spongocoel is the single, large, spacious central cavity in the sponge body. It is lined by the flagellated collar cells or choanocytes.

Spongocoel opens to outside through a narrow circular opening, the osculum, located at the distal free end, and often fringed with large monaxon spicules.

Surrounding sea water enters the canal system through ostia. Flow of water is maintained by the beating of flagella of collar cells. Rate of water flow is slow, because the large spongocoel contains much water which cannot be pushed out readily through a single osculum. Course taken by water current in the body of sponge may be shown as under:

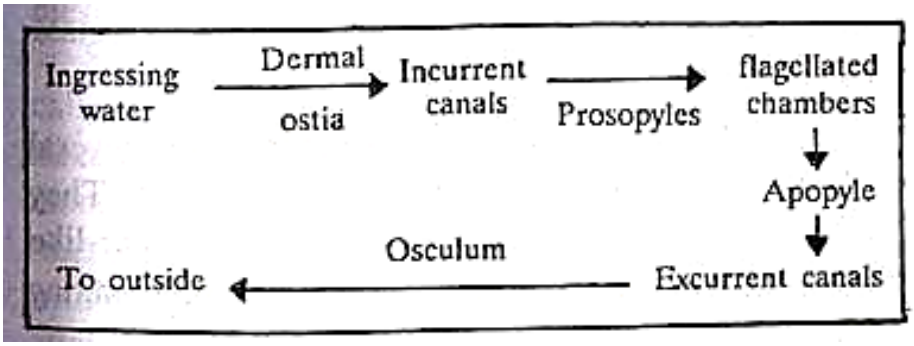


2. Sycon type. Sycon type of canal system is a more complex system of pores and canals and is characteristic of syconoid sponges, like *Scypha* (=*Sycon*) and *Grantia*. It can be theoretically derived from the asconoid type by horizontal folding of its wall. Embryonic development of *Scypha* clearly shows the asconoid pattern converting into syconoid pattern. Body wall of syconoid sponges includes two types of canals, incurrent and radial, paralleling and alternating with each other. Both types of canals end blindly in body wall but are interconnected by minute pores. Incurrent pores or dermal ostia, found on the outer surface of body, open into the incurrent canals. These canals are non-flagellated, as they are lined by pinacocytes, and lead into adjacent radial canals through minute openings, called prosopyles. It is not clear whether prosopyles are channels through porocytes but it is definite that, in the adult, they are simple intercellular spaces. Radial canals are flagellated chambers, as only they are lined by choanocytes. These canals open into the central spongocoel by internal Ostia or apopyles. Spongocoel is a narrow, non-flagellated cavity lined by pinacocytes. It opens to exterior through an excurrent pore, the osculum, similar to that of ascon type. Course of water current may be represented as given below:



In more complex sycon type, as illustrated by *Grantia*, the incurrent canals are irregular, branching and anastomosing, forming large sub-dermal spaces. This is due to development of cortex, involving pinacoderm and mesenchyme, spreading over the entire outer surface of sponge.

3. Leucon type. As a result of further folding of body wall, the sycon type gives rise to a still more complex canal system, the leucon type. This is characteristic of leuconoid sponges, such as *Spongilla*. Here radial symmetry is lost and canal system has become very irregular. Flagellated chambers are small, spherical and lined by choanocytes. All other spaces are lined by pinacocytes. Incurrent canals open into flagellated chambers through prosopyles. Flagellated chambers, in their turn, communicate excurrent canals through apopyles. Excurrent canals are developed as a result of shrinkage and division of spongocoel which has appeared. Thus, excurrent canals communicate with the outside through an osculum. Course taken by water current is as follows:



Though leucon type of canal system appears be the modification of sycon type, in many calcareous sponges, leucon type is developed directly without passing through ascon and sycon types in their embryogeny. In Demospongiae, leuconoid condition is derived from a larval stage, called rhagon. Sponogocoel of rhagon is surrounded by flagellated opening into it through very wide apopyles. A single osculum opens at the top of spongocoel. Canal system of rhagon larva does not occur in any adult sponge. In Demospongiae, leucon type of canal system is also termed the rhagon type because of its derivation from rhagon stage.

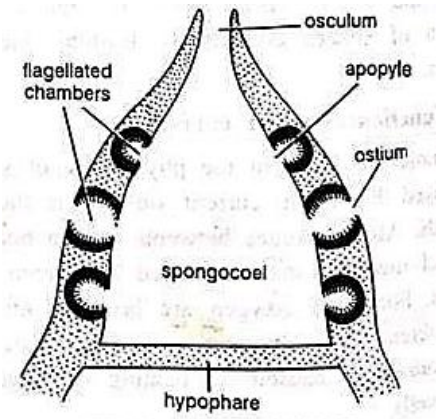


Fig. 2. *Rhagon* larva in V.S.

Leucon type of canal system presents three successive grades in its evolutionary pattern:

(a) Eurypylous type. It is the simplest and most primitive leucon type of canal system. In this type, the flagellated chambers communicate directly by broad apertures, the apopyles, with excurrent canals. Ex. *Plakina*.

(b) Aphodal type. In this type, the apopyle is drawn out as a narrow canal, called aphodus. This connects the flagellated chamber with excurrent canal. Ex. *Geodia*.

(c) Diplodal type. In some sponges, besides aphodus, another narrow tube, called prosodus, is present between incurrent canal and flagellated chamber. The pattern is called the diplodal type, Ex. *Spongilla, Oscarella*.

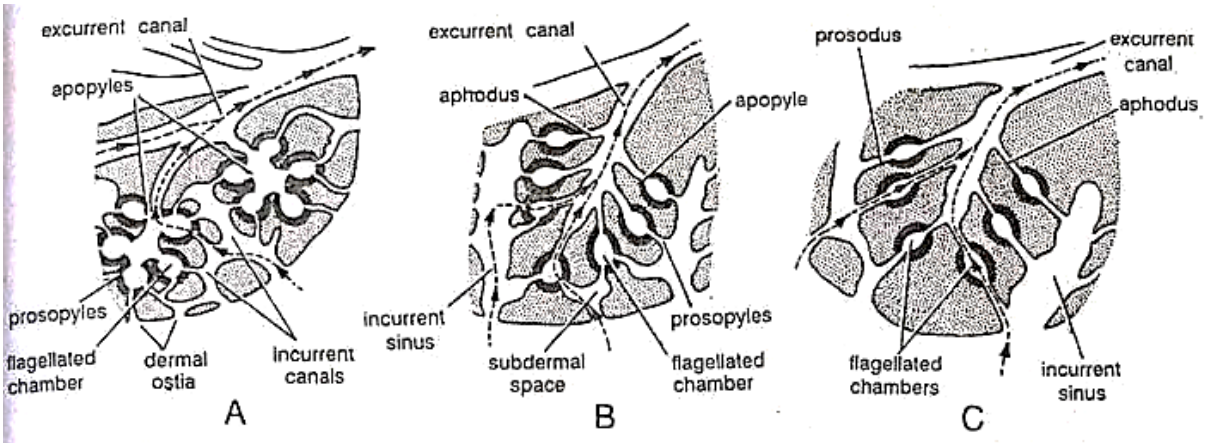


Fig. 3. Grades in leucon type of canal system. A—Eurypylous. B—Aphodal type. C—Diplodal type.

References:

Kotpal RL (2013). Modern Text Book of Zoology: Invertebrates (10th edition). Rastogi Publications, India.