ZOOA-CC2-3-TH (Non-Chordates II-Coelomates)

Water-Vascular System in Echinodermata

In course of evolution, various animal groups have incorporated various adaptive features for a better life in relation to their environment. One unique feature is water-vascular system in echinoderms. This is not found in any other animal groups. The system comprising of internal coelomic canal and surface appendages serves various purposes, chiefly locomotion and other physiological functions.

The water vascular system is enterocoelic in origin and arises from the left hydrocoel. It exhibits radial symmetry from the beginning and is equally developed in all Echinoderms.

General Plan of Water Vascular System

A basic plan of the system chiefly comprises of following components:

A. Ring/Circular/Circum-oral Canal

(i) This is a circular canal encircling the mouth,

(ii) Involved in water-flow.

B. Radial Canals

(i) These are tubular prolongations that radiate from the ring canal
(ii) Their number corresponds to the radii.

(iii) Each canal terminates blindly at the arm-end and gives off branches on either sides along its course.

(iv) Involved in water-flow through the system.

C. Lateral Canals

(i) These are lateral extensions of radial canals on its either sides.

(ii) Each canal joins a tube-foot and is provided with a valve at the junction between tube-feet and the lateral canal.

D. Podia or Tube-feet

(i) These are hollow, cylindrical or conical process of the body wall.
(ii) It consists of two parts (a) a vesicular part : the ampulla that lies in the body cavity, (b) a tubular portion, that projects outside the body surface and lies in the ambulacral groove.

(iii) These are connected with lateral canal. The junction between them and lateral canals are guarded by valves, that prevent the back flow of water from tube-feet to radial canals.

(iv) Its walls are usually lined with rich longitudinal muscles, involved in the contraction of ampula during locomotion.

E. Stone or Sand Canal

(i) The canal that connects ring canal to the madreporite, running across the body cavity is called the stone canal.

(ii) This is surrounded by a wider canal, called axial sinus.

(iii) Its walls are rigid due to presence of a large amount of calcareous matter.

F. Madreporite

(i) This is a plate-like structure, situated on the aboral surface of the body, and open to the exterior.

(ii) The plate is perforated with numerous small canals, lined with cilia, which open into madreporic ampulla, that leads into the stone canal.

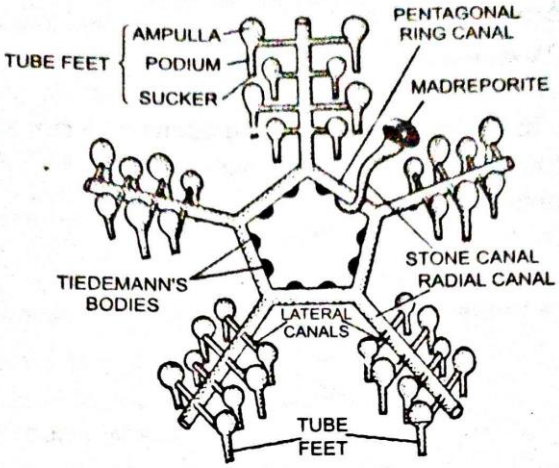


Fig. 6.6. *Asterias*. Water-vascular system

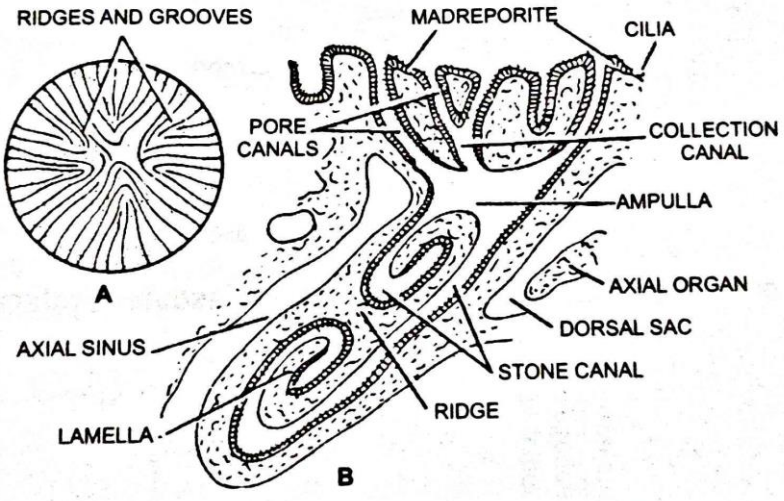


Fig. 6.7. *Asterias*. Madreporite. **A**-As seen from outside; **B**. Vertical section

G. Accessory Appendages :

(a) Polian Vesicles :

(i) These are bladder-like bodies. Oua

(ii) Situated in interadial portion and opens into ring canal.

(iii) Usually manufacture amoeboid cells.

(b) Tiedemann's Body:

(i) Gland-like bodies
(ii) Present in interradii position
(iii) These are thought to manufacture cells for water vascular system.

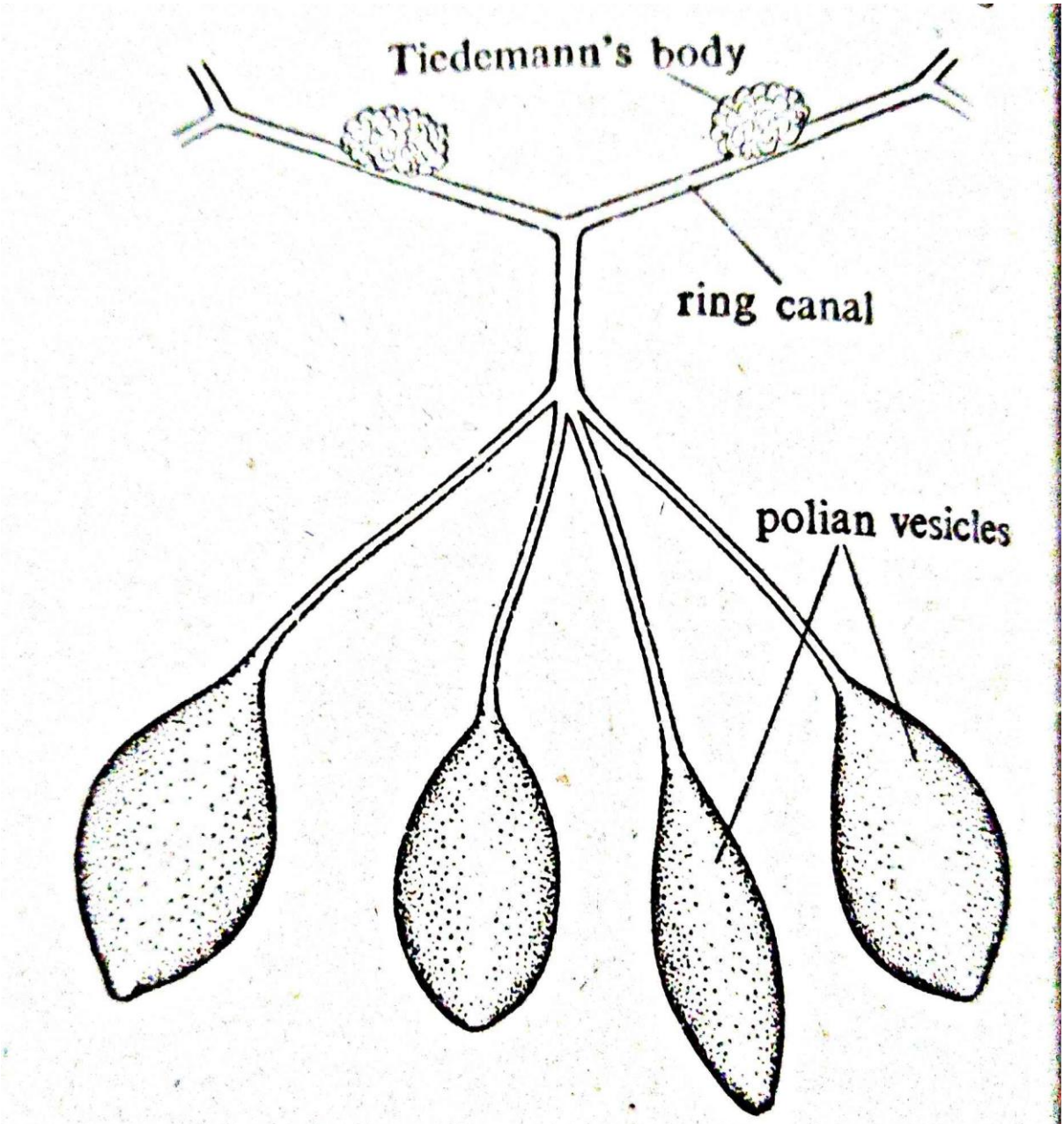
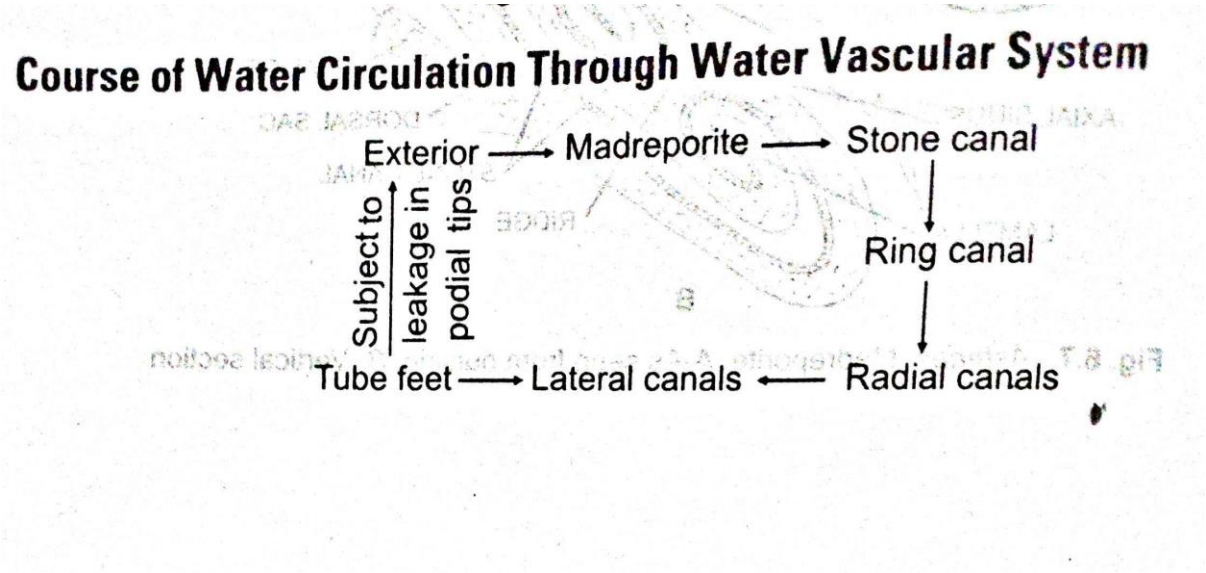


Fig. 18.29. Cluster of polian vesicles of *Astropecten*.



Functions of Water Vascular System

(a) Locomotion: The main function of water vascular system locomotion. During locomotion the system serves like a hydraulic system. Ampulla contracts, the valve in the lateral canals closes, and water is formed into the podium, which elongates. Elongated podia come in contact with the substratum, the suckers adhere. After adhesion, the longitudinal muscles of th podium contract shortening the podium and forcing the fluid back into the ampulla, ultimately moving the animal forward. UTSETE V lerret
Other parts of water vascular system function in maintaining the proper water pressure, necessary for the working of podia and ampullae. Water passes in the following direction :

madreporite → stone canal → ring canal → polian vesiclesed on nago natural lo llew signstore su radial canal → Tube-feet

During locomotion the podium swings forward, grips the substratum, and then moves backward by contraction. In a particular section of an arm, most of the tube-feet perform the same step, and the animal moves forward. During progression one or two arms acts as leading arms, and the podia in all the arms move in the same direction.

(b) Respiration: Thin walls of tube-feet may help in the respiratory exchange of gases in those echinoderm who have non-suctorial tube-feet. e.g.,1) Ophiuroidea.
(c) Food collection: Tube-feet also help in capturing and handling the food particles. home atobomidas 10 tot momento al rotato
(d) Sensory function : In echinoderms, where tube-feet are branch-like and bear terminal tentacles act as olfactory organs and thus sensory in functions
(e) Excretory function : Podia in Ophiuroidea are found to serve excretory function.