



**Water Vascular System in *Asterias sp.***

**Department of Zoology**

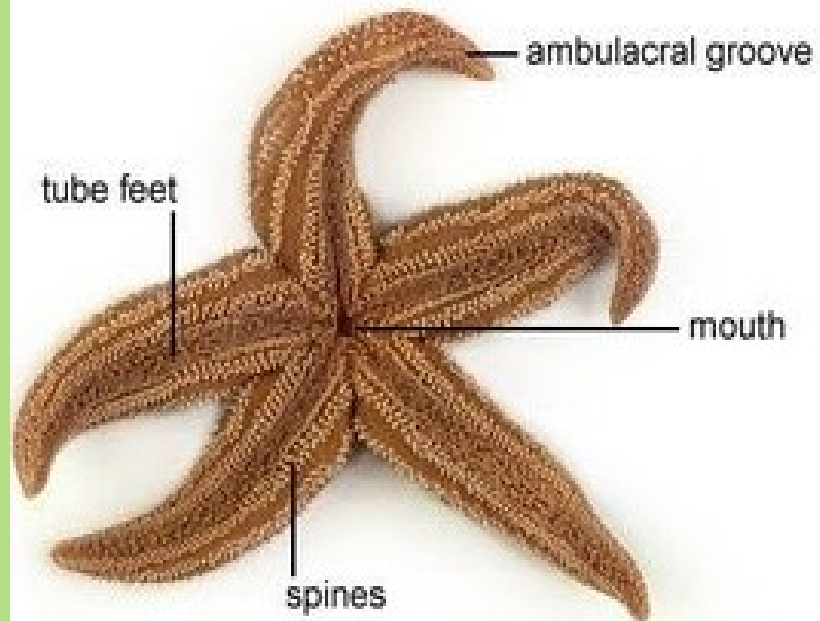
**M.B.B. College**

**Agartala**

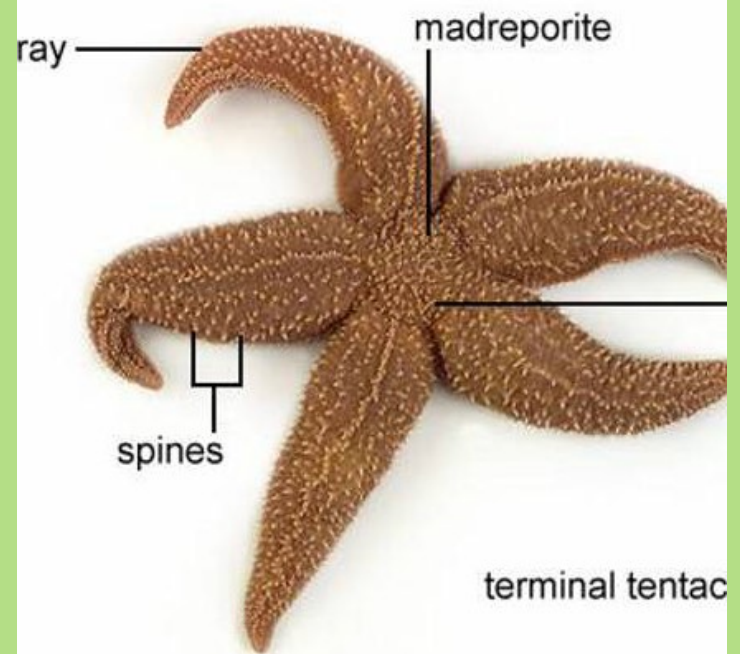
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# Star Fish

Starfish - Oral View



Starfish - Aboral View





# Water Vascular System

- This is a modified part of coelom & consists of a system of sea water filled canals having certain corpuscles. It plays most vital role in the locomotion of the animals & comprises madreporite stone canal, ring canal, radial canal, Tiedman's body, lateral canals & tube feet.

# Water Vascular System

- **Development-** The water vascular system has originated from coelom which is enterocoelomic in nature, arises from the left hydrocoel.
- **Contents-** The content is mostly sea water with a little protein and a high potassium ion content.
- **Histology-** The outermost layer is composed of ciliated epithelium. Next to it is a layer of connective tissue followed by longitudinal muscle fibres and finally flat ciliated epithelium .

# Class Asterozoidea – Sea Stars



# Madreporite

- The madreporite is a rounded calcareous plate occurring on the aboral surface of the central disc in inter-radial position. Its surface bears a number of radiating, narrow, straight or wavy grooves or furrows. Each furrow contains many minute pores at its bottom. Each pore leads into a very short, fine, tubular pore-canal. Which passes inward in the substance of the madreporite. There may be about 200 pores and pore-canal. The pore-canals unite to form the collecting canals. Which open into an ampulla beneath the madreporite.

# Madreporic Plate



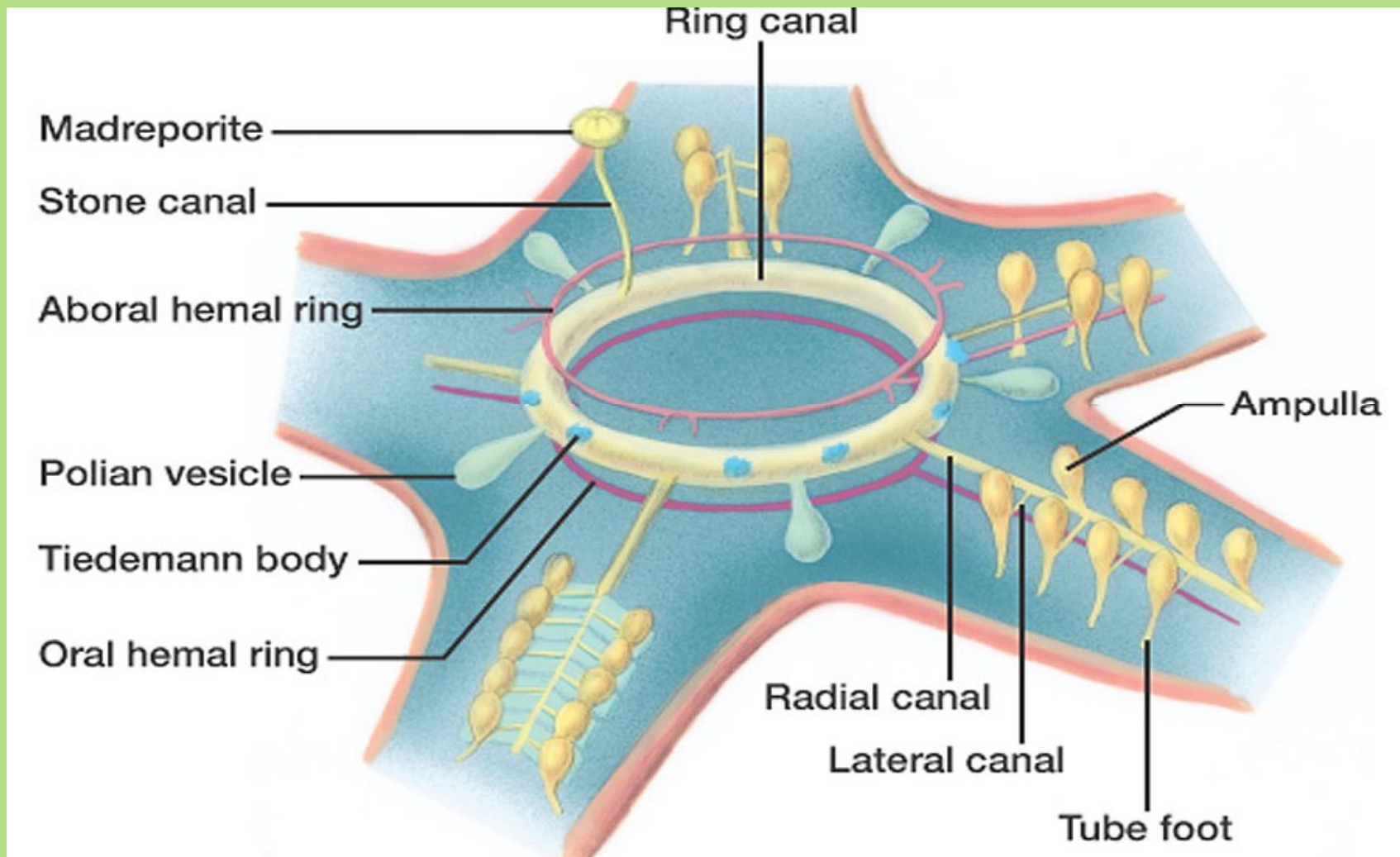
Madreporic plate controls water entry for water vascular system

# Stone Canal

- The ampulla opens into a "S" shaped stone canal. The stone canal extends downwards (orally) and opens into a ring canal, around the mouth. The walls of stone canal are supported by a series of calcareous rings. The lumen of stone canal is lined by very tall flagellated cells. In embryonic stages and young Asterias, the stone canal remains a simple tube but in adult Asterias, lumen of stone canal possesses a prominent ridge with two spirally rolled lamellae.



# Water-Vascular System of a Sea Star



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# Ring Canal

- The Ring canal or water ring is located to the inner side of the peristomial ring of ossicles and directly above (aboral) to the hyponeural ring sinus. It is wide and pentagonal or five sided.

# Tiedmann's Bodies

- The ring canal gives out inter radially nine small, yellowish, irregular or rounded glandular bodies called racemose or Tiedmann's bodies from its inner margins. The Tiedmann's body rest upon the peristomial ring of ossicles.
- The actual function of tiedmann's bodies is still unknown, however they are supposed to be lymphatic glands to manufacture the amoebocytes of the water vascular system.

# Pollian Vesicles

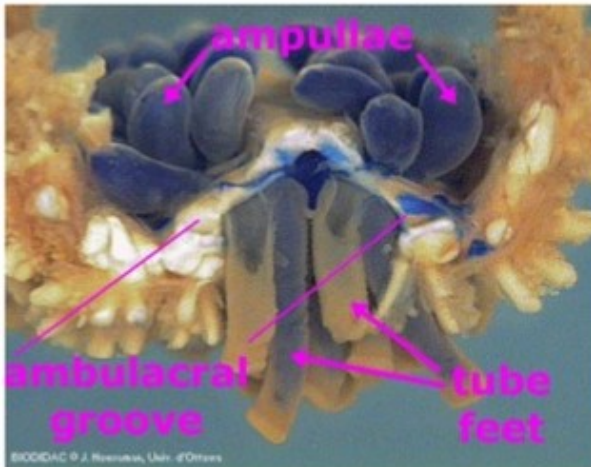
- The ring canal gives off on its outer side in the inter radial position one, two or four little, pear shaped, thin walled contractile bladder or reservoirs with long necks called pollian vesicles.
- They are supposed to regulate pressure inside ambulacral system and to manufacture amoeboid cells of ambulacral system.



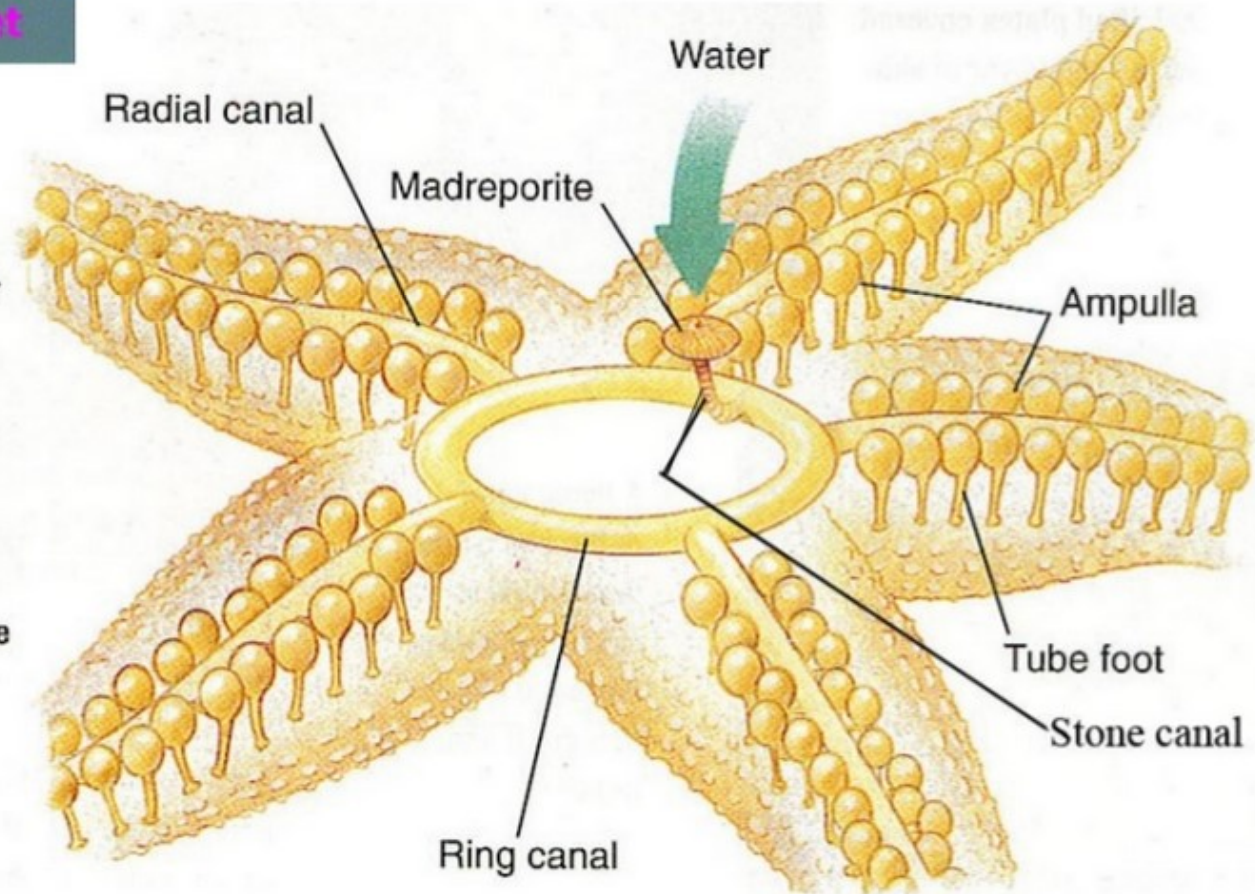
# Radial Canal

From its outer surface the ring canal gives off a radial water canal into each arm that runs throughout the length of the arm and terminates as the lumen of terminal tentacle. In the arm the radial water canal runs immediately to the oral side of the ambulacral muscles.

# Class Asterozoidea – sea stars water vascular system



- ▶ The starfish's water vascular system provides the water pressure that operates the animal's tube feet. From the madreporite, water moves into the ring canal, then into the rays through radial canals, and finally to the tube feet. The canals are like a network of water pipes attached to the tube feet. Water also exits the body through the madreporite.



# Lateral Canal

- In each arm, the radial canal gives out two series of short, narrow, transverse branches called lateral or podial canals.
- Each lateral canal is attached to the base of a tube foot and its provided with a valve to prevent backward flow of fluid into the radial canal.

# Tube Feet

- As already mentioned, there are two series of tube feet in each ambulacral groove. A tube foot is a hollow, elastic, thin walled, closed cylinder or sac-like structure having an upper sac like ampulla, a middle tubular podium & a lower disc like sucker. The ampulla lies within the arm, projecting into the coelom above the ambulacral pore which is a gap between the adjacent ambulacral ossicles for the passage of the podium.
- The tube feet are chief locomotory and respiratory organ of Asterias.



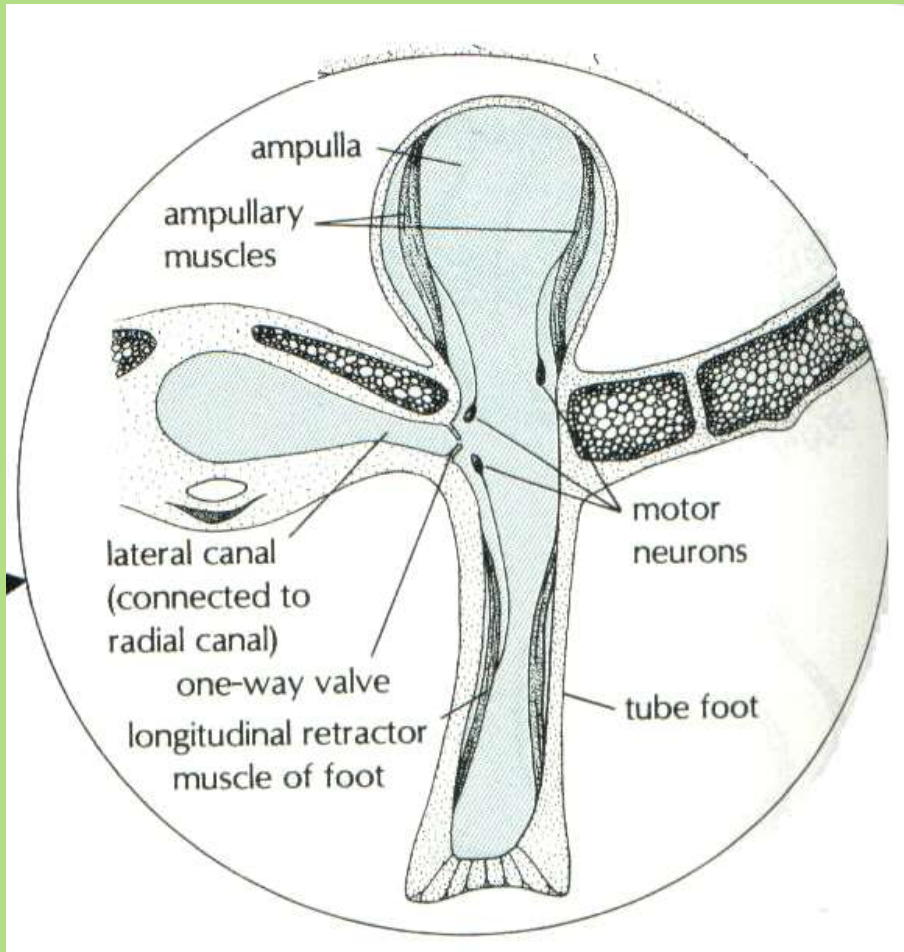
# Starfish – Tube Feet (Close Up)



# Tube Feet

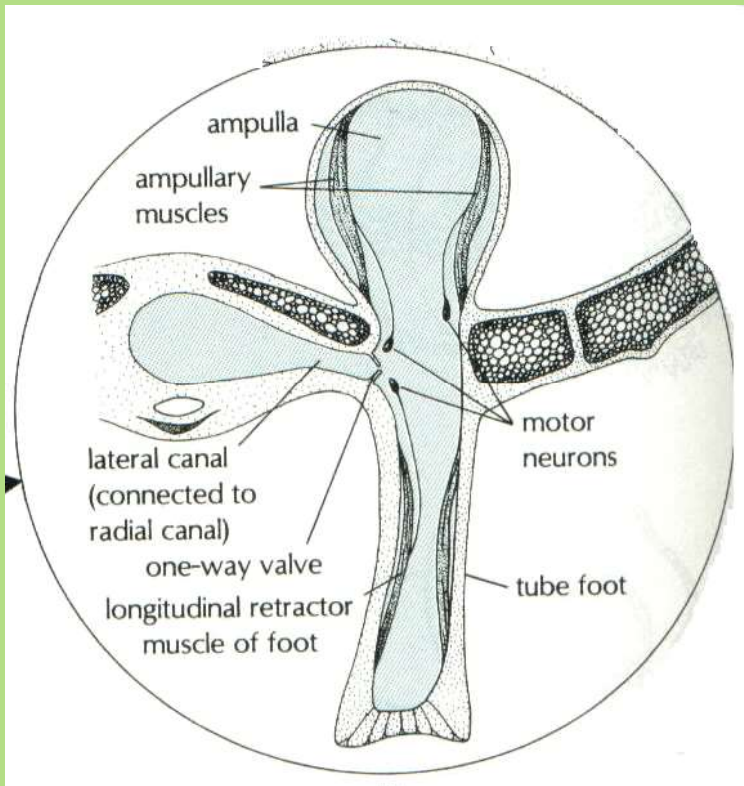


# The Ampullae 1



The ampullae are muscular, rounded, sac-like structures situated at the anterior side of the podia. Each podium is a hollow elastic tube like structure which bears at its tip a flattened portion forming a sucker for attachment. The tube feet project outwards on the body surface and lie in the ambulacral groove.

# The Ampullae 2



The ampulla contains smooth circular muscle fibres. Podium consists of retractor or longitudinal muscle on the outer side of the retractor muscle there are collagenous connective tissue sheath which is covered by cuticle on the inner side the longitudinal muscle are bounded by ciliated epithellium towards the lumen of podium.

- The levator muscles are situated near the sucker



# Function of Water Vascular System

(1) **Locomotion** : The water vascular system is used mainly for locomotion. The inner wall of the water vascular canals are provided with cilia. The beating of the cilia causes the seawater to enter through the madreporite. Finally, the seawater reaches the tube feet and their ampullae. The ampullae contract; the valves at the junction of the lateral canals and tube feet, prevent the flow of water into radial canals. The water is forced into the podia. The podia are elongated and projected out through the ambulacral groove. Then the suckers are applied to the substratum.

The tube feet now contract & push the body forward. The water from the tube feet is pushed into the ampulla. Hence, the tube feet shorten. The suckers are released. Then the ampulla contracts & the whole process is repeated.

(2) **Food Capture** : The tube feet are used to capture the prey. The suckers are used to open the shells of molluscas.

(3) **Attachment** : The Starfish can be attached to the rocks by the tube feet.

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