

Dr. H. N. Sinha Arts and Commerce  
College, Patur

Zoology Department

Presented By,  
Asst. Prof. Sangita Telgote

# WATER VASCULAR SYSTEM OF ECHINODERMATA

- Echinoderms have a dermal endoskeleton made up of **calcareous ossicles**.
- A **water-vascular system** that controls tentacle-like projections called **podia or tube feet**.
- Development begins with a free-swimming, **bilateral larva**, and a **metamorphosis** into an adult with **radial symmetry**.

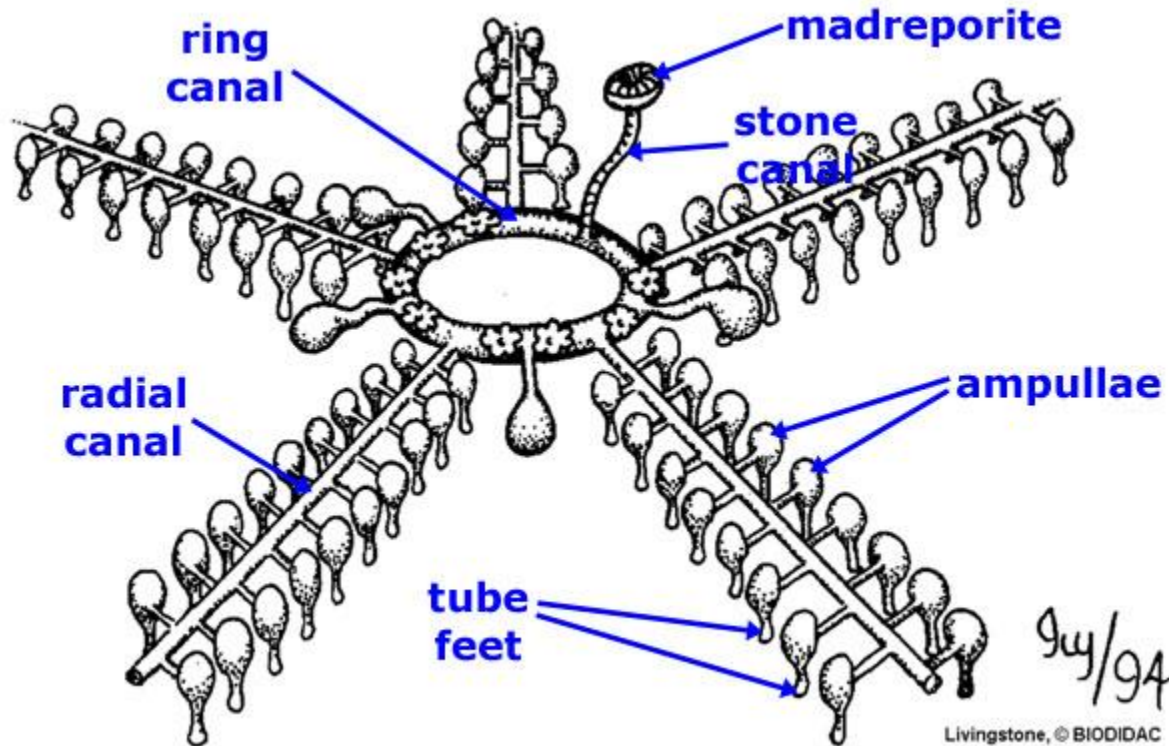
- One of the strangest and most unusual of all the phylums in the animal kingdom.
- Echinoderms are **deuterostomes**, which they have in common with the chordates. All of the other invertebrates we learned about this semester have been protostomes.
- No cephalization or brain or central nervous system, very few specialized sensory organs.

# The Water-Vascular System

- Echinoderms have a unique system of canals and specialized tube feet that make up the [water-vascular system](#) .
- The water-vascular system's primary function is for locomotion and for gathering food.
- Additionally the water-vascular system also plays a role in respiration and excretion.

- The water-vascular system enters the body through an opening called the **madreporite**.
- The madreporite leads to a canal called the **stone canal**. The stone canal leads to a ring around the mouth called the **ring canal**.
- The ring canal branches off into **radial canals**, and the radial canals branch off into **lateral canals**. The lateral canals lead to muscular sacs called **ampullae**, and the ampullae lead to the **podia or tube feet**.

# WATER VASCULAR SYSTEM

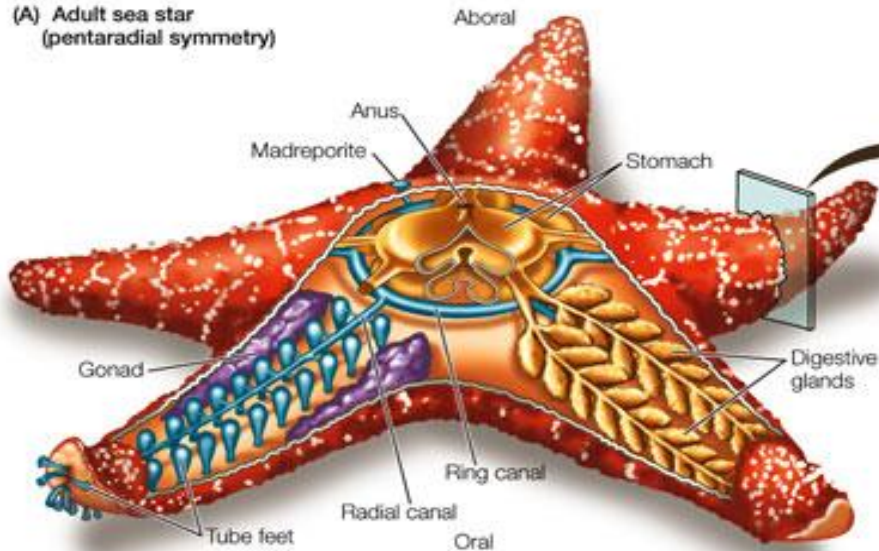


# Class Asteroidea (Sea Stars)

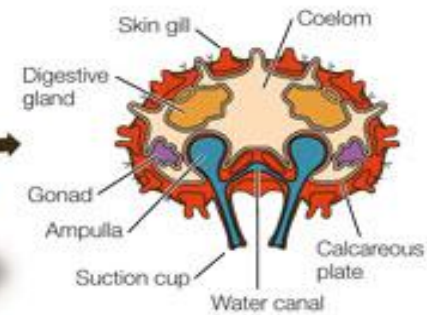
- Sea stars or starfish typically have five arms which is called **pentaradial symmetry**.
- Mouth is on the **oral side**. The side that is opposite of the mouth is the **aboral side**.
- **Ambulacral grooves** radiate out along the arms from the mouth located on the oral side.
- **Tube feet (also called podia)** stick out from the ambulacral grooves.
- **Radial nerves** run the length of the grooves.

# General Anatomy of an Echinoderm

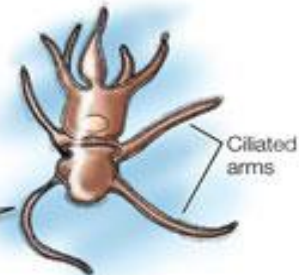
(A) Adult sea star  
(pentaradial symmetry)



Each arm has a full complement of organs. This arm has been drawn with the digestive glands removed to show the organs lying below.



(B) Sea star larva  
(bilateral symmetry)



The sea star larva moves through the water by beating its cilia.



# Feeding and Digestive System

- Sea stars typically have two stomachs
- A larger and lower cardiac stomach and the smaller upper pyloric stomach
- Sea stars are opportunistic carnivores
- They feed upon molluscs, crustaceans, polychaetes, small fish, and other echinoderms
- They hunt by grabbing their prey with their tube feet. Then they evert their stomach (turn it inside out) and secrete digestive enzymes

# Sea Star eating an Anchovy



# Class Ophiuroidea (Brittle Stars)

- Arms of brittle stars are more slender than members of the class Asteroidea (sea stars)
- Tube feet are used for feeding, but not locomotion as in the sea stars
- Locomotion is by movement of their arms
- The madreporite is located on the oral surface, unlike the sea star's madreporite, which is located on the aboral surface
- Five movable plates on the oral surface that serve as jaws. They have no anus, so food that is not digested is expelled out the mouth

# BRITTLE STARS



# Class Ophiuroidea (Brittle Stars)

- Because the arms are so slender, all of the major organs are in the central disc (body)
- The water-vascular system and nervous system is very similar to the sea star's
- Reproduction is similar also. Sexes are usually separate, and regeneration and autotomy are common to the brittle stars

# Brittle Stars



# CLASS ECHINOIDEA

## (Sea Urchins and Sand Dollars)

- Animals in class Echinoidea have a compact body or shell called a **Test**.
- Echinoids lack arms, but their test is still divided into five parts like the sea star's and brittle star's.
- Inside a sea urchin's test is a coiled digestive system and a complex chewing mechanism called **Aristotle's lantern**.
- Aristotle's lantern, which is used for chewing food, has teeth that are controlled by retractor and protractor muscles.

# **Class Echinoidea** **(Sea Urchins and Sand Dollars)**

**Sand Dollar**



**Sea Urchin**





# Class Holothuroidea (Sea Cucumbers)

- Sea cucumbers are elongate and have 10-30 **oral tentacles** around the mouth that are modified tube feet
- Strangely, although there appears to be an anterior end, cephalization is absent
- Respiration occurs in a unique network of tubes and branches called the **respiratory tree**
- When threatened, sea cucumbers can discharge long sticky toxic substances called **Cuvierian tubules**

# Sea Cucumbers

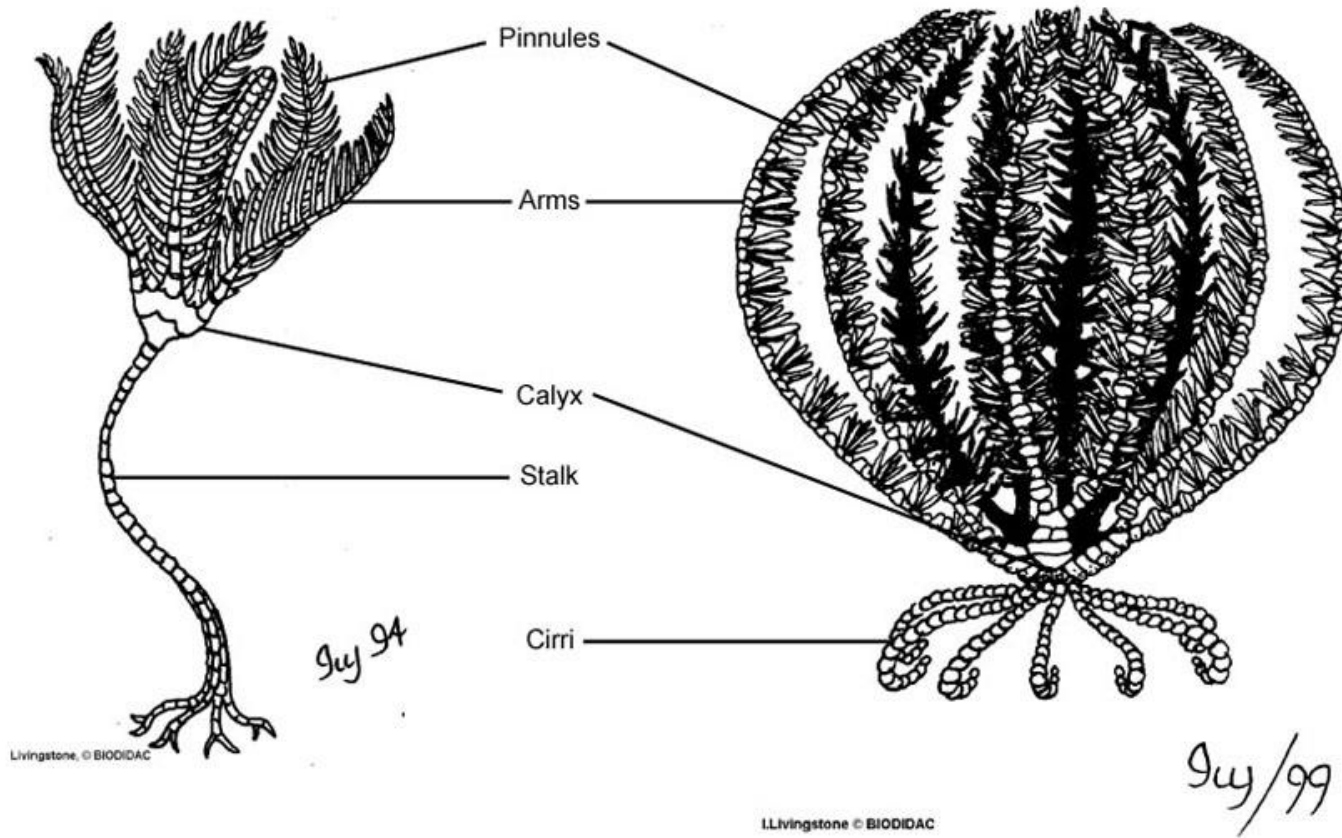


# Class Crinoidea

## (Sea Lilies and Feather Stars)

- Their bodies are attached to the ocean floor for at least part of their life
- The **calyx** (body) of a sea lily is attached to a **stalk** on the aboral side
- The **stalk** attaches to the ground surface
- Five flexible arms branch to form many more arms, each with many lateral **pinnules** arranged like barbs on a feather.
- Feather stars resemble sea lilies without a stalk

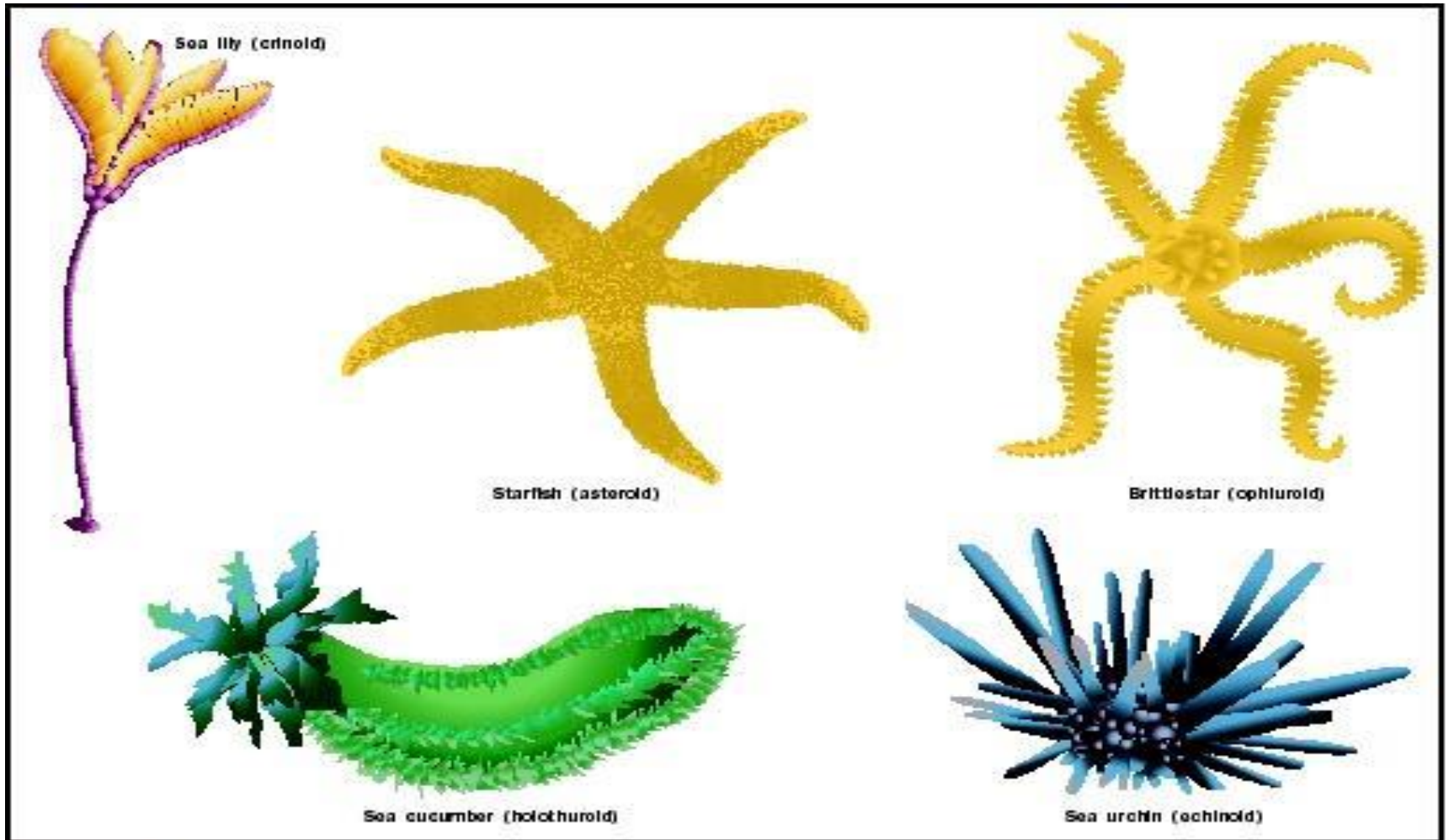
# Sea Lily Anatomy



# Feather Star



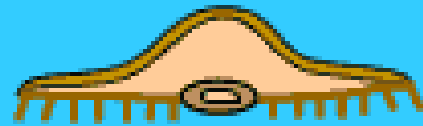
# ECHINODERMS



# Echinoderms

## The body form of Five Types of Echinoderm

Sea Cucumbers (Holothuroidea)

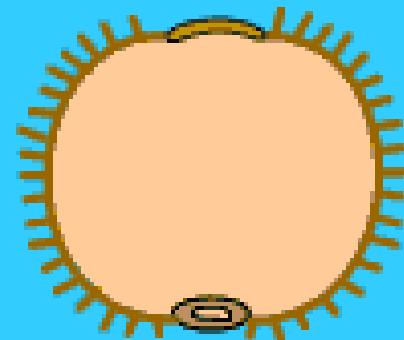
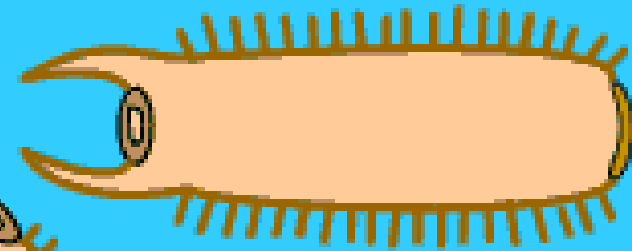
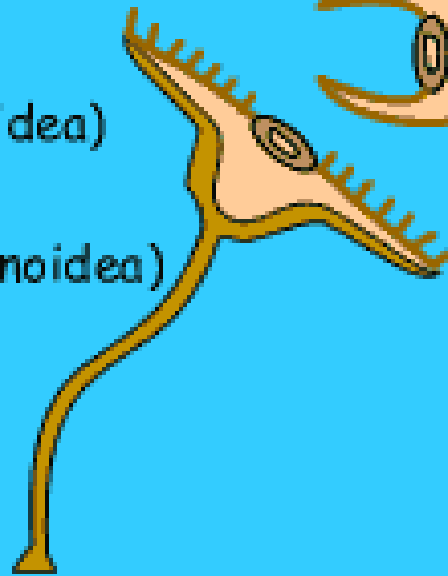


Sea-stars (Asterozoa)

Sea Lilies (Crinozoa)



Brittle-stars (Ophiurozoa)



Sea-Urchins (Echinozoa)