

Phylum

Subphylum

Class

Subclass

E  
C  
H  
I  
N  
O  
D  
E  
R  
M  
A  
T  
A

Homalozoa (Extinct)

Crinozoa

Crinoidea

Inadunta (Extinct)

Articulata

Asterozoa

Asteroidea

Ophiuroidea

Concentricycloidea

Echinozoa

Echinoidea

Holothuroidea

Perischoechinoidea

Euechinoidea

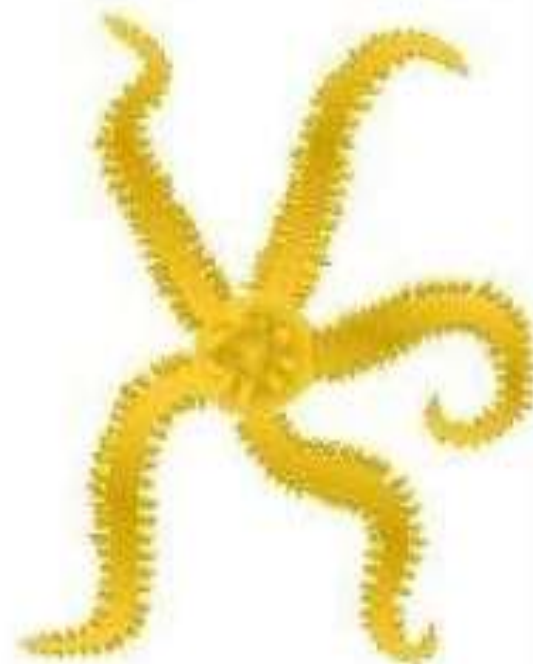
# INTRODUCTION

- ▶ Jacob Klein (1734) coined this term by observing sea urchin
- ▶ For long term these were in "Radiata" along with Coelenterata
- ▶ Leuckert (1874) separated these from Radiata as they are more evolved
- ▶ Spiny skinned marine animals
- ▶ Have economic values like fertilizer ( $\text{CaCO}_3$ ), food, As Scavengers and also can cause great loss to oyster beds. +

# Echinoderms



Starfish (asteroid)



Brittlestar (ophiuroid)



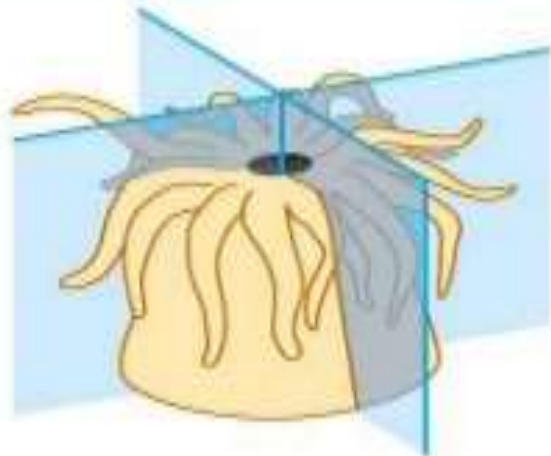
Sea cucumber (holothurid)



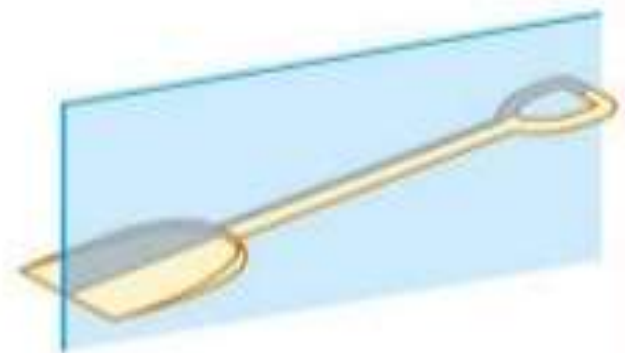
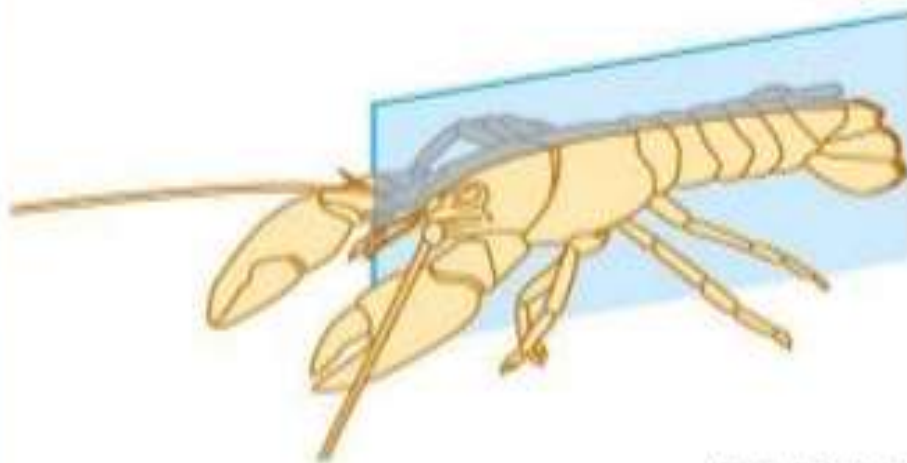
Sea urchin (echinoid)

# Characteristics of Echinoderms

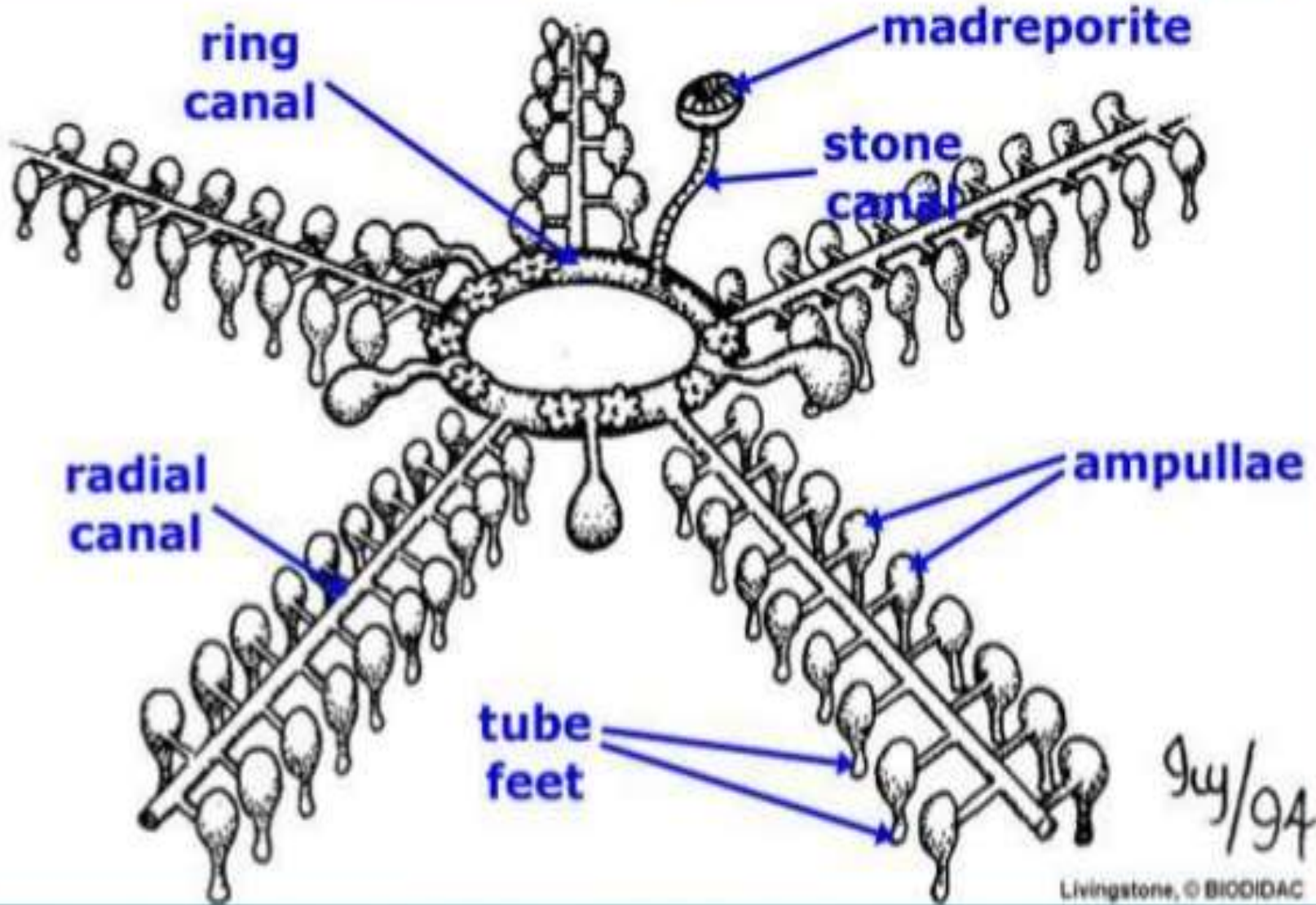
- One of the strangest and most unusual phyla in the animal kingdom.
- Echinoderms are deuterostomes, which they have in common with the chordates.
- All of the other invertebrates we learned about this semester have been protostomes.
- No cephalization or brain, very few specialized sensory organs.



**(a) Radial symmetry**



**(b) Bilateral symmetry**



9/4/94

# General characters

- ▶ Feeds on small animals, plants and organic debris
- ▶ Digestive system- coiled tube, anus in aboral surface or absent in some
- ▶ Locomotion is by tube feet which are also help in nutrition and respiration
- ▶ Respiration- papulae/ dermal branchiae(star fish), peristomial gills(sea urchins), genital bursae(brittle stars) and respiratory trees(holothurians)
- ▶ Haemal system-open type, not well developed , heart is absent, blood vessels don't have definite walls and are enclosed in coelomic canals
- ▶ Definite excretory organs are absent. Nitrogenous wastes are ammonia, urea, and creatine. Sent out by diffusion through tube feet and papulae

# General characters

- ▶ Nervous system is poorly developed. Brain is absent, a circum oral ring and radial nerves are present
- ▶ Sense organs are poorly developed and are represented by tentacles, eyes and statocysts
- ▶ Sexes are separate, sexual reproduction, sexual dimorphism is absent. Gonads are large and simple. Gonoducts may/ may not present. Fertilisation is external in sea water.
- ▶ Development is indirect with a free swimming larval stage.
- ▶ Few echinoderms are viviparous like *Asterina gibbosa*, *Chiriodata contorta*
- ▶ Exhibits high power of regeneration, Autotomy is seen

# Classification

- ▶ Classified into four sub phyla.
- ▶ Namely
  - ▶ Echinozoa
  - ▶ Homalozoa
  - ▶ Crinozoa
  - ▶ Asterozoa

# Class Echinoidea

## (Sea Urchins and Sand Dollars)

- Members of 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 an **Aristotle's lantern**.
- The Aristotle's lantern is used for chewing food, and it has teeth that are controlled by both retractor muscles and protractor muscles.

# Class Echinoidea (Sea Urchins and Sand Dollars)

- Sand Dollar



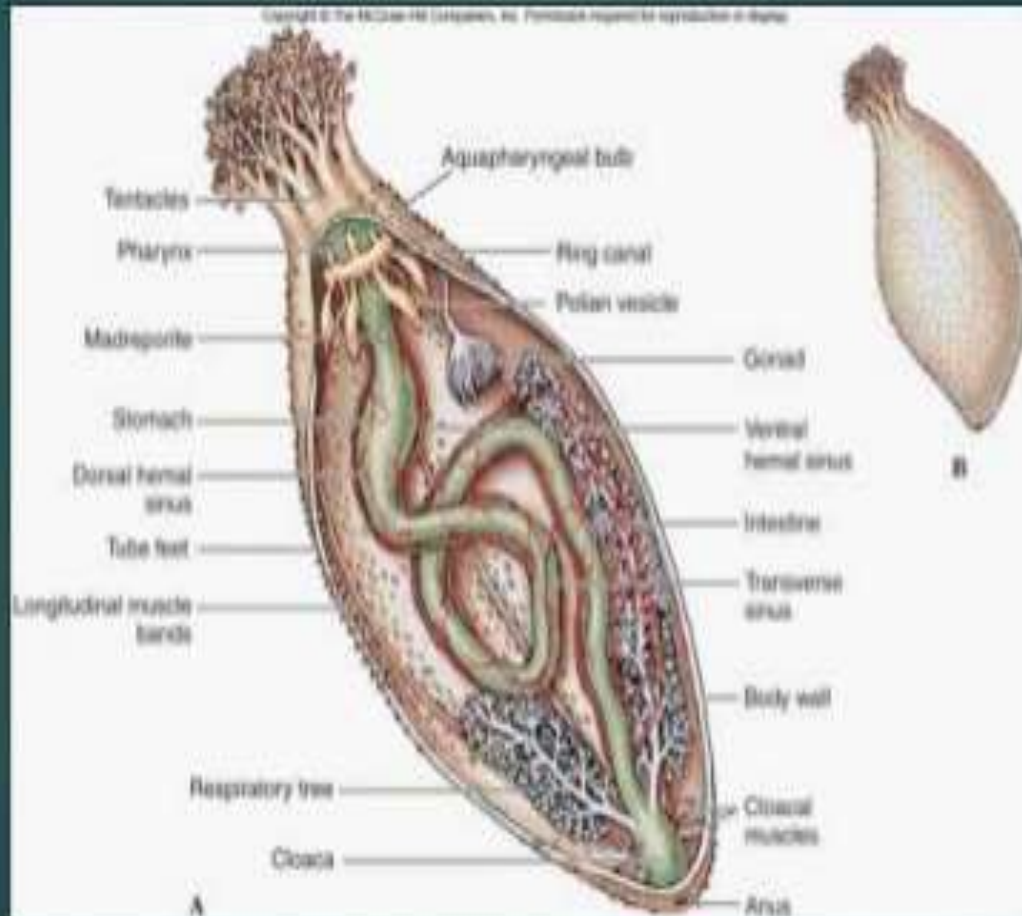
Sea Urchin



## Class Holothuroidea (Sea Cucumbers)

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

# Sea Cucumber Anatomy



# Sub-phylum3: Crinozoa

- ▶ Primarily spherical individuals with plates
- ▶ Partial, semi- radial symmetry
- ▶ Mouth and anus are on oral side. And alimentary canal is “U” shaped
- ▶ Attach to substratum by aboral side and lead sedentary life
- ▶ Arms present, surrounds mouth, show branching nature
  - ▶ Divided into five classes namely
    - ▶ Cystoidea
    - ▶ Blastoidea
    - ▶ Heterostalia
    - ▶ Eocrinoidea
    - ▶ Paracrinoidea
    - ▶ but only Eocrinoidea are living all others are extinct

# 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 more arms, each with many lateral branching **pinnules** arranged like barbs on a feather.
- Feather stars resemble sea lilies without a stalk.

# Sea Lilies and Feather Stars



# Sub- phylum4: Asterozoa

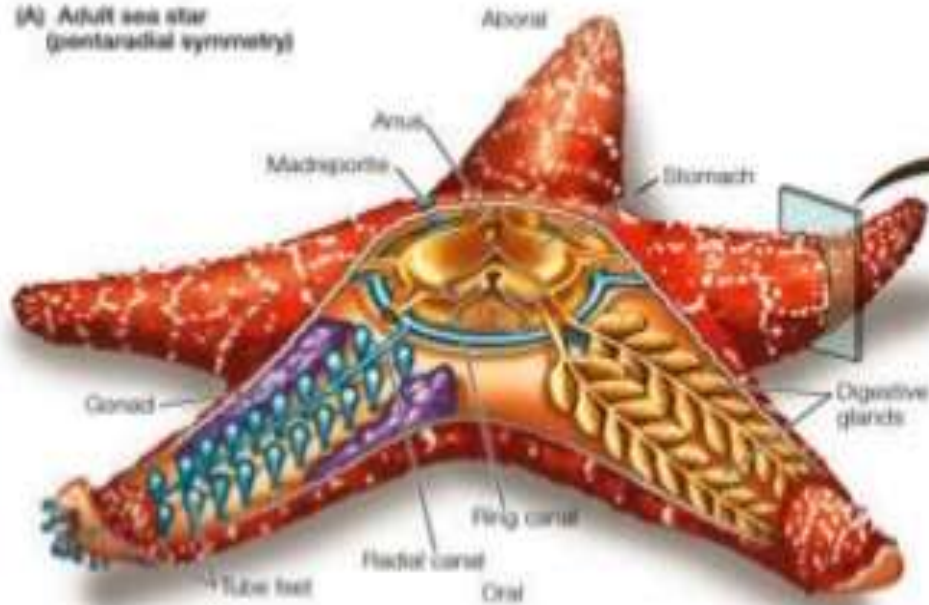


## Class Asteroidea (Sea Stars)

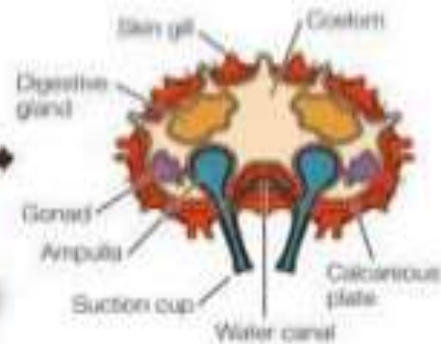
- Sea stars or starfish typically have five arms which is called pentaradial symmetry
- Mouth is on the oral side. The side that is opposite of the mouth is the aboral side.
- Ambulacral grooves radiate out along the arms from the mouth located on the oral side.
- Tube feet (also called podia) stick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

# General Anatomy of an Echinoderm

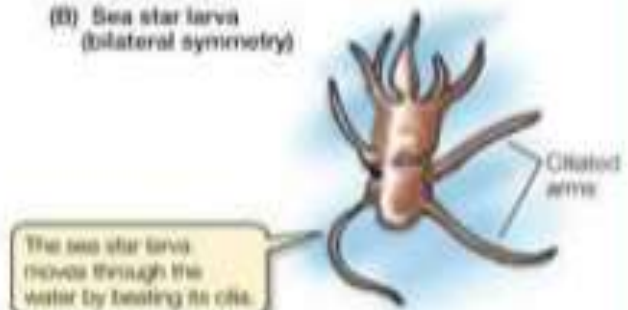
(A) Adult sea star (pentaradial symmetry)



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

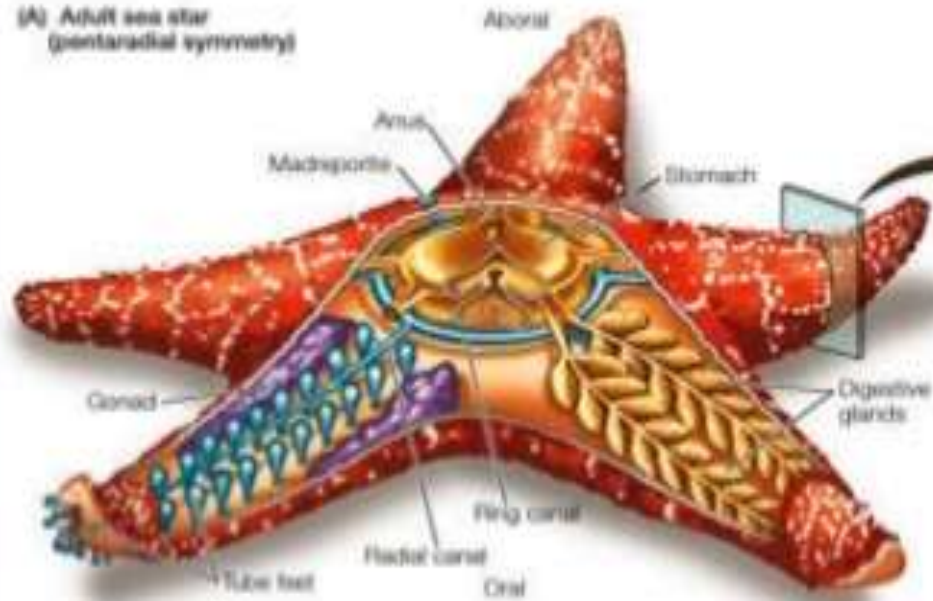


(B) Sea star larva (bilateral symmetry)

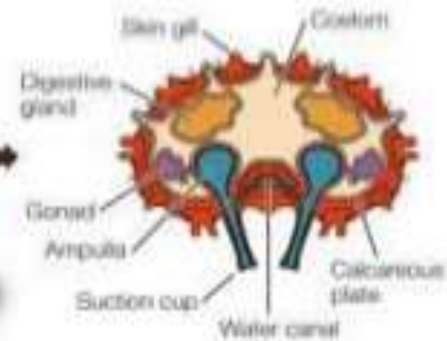


# General Anatomy of an Echinoderm

(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)



# Sea Star Regeneration



# Brittle Stars



## Class Ophiuroidea (Brittle Stars)

- Arms of brittle stars are more slender than species in class Asteroidea (sea stars and starfish).
- Tube feet are used for feeding, but not locomotion like 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 waste is expelled out the mouth.

## 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, nervous system, and reproduction is very similar to the members of class Asteroidea.
- Sexes are usually separate, and brittle stars can undergo regeneration and autotomy just like the sea stars.