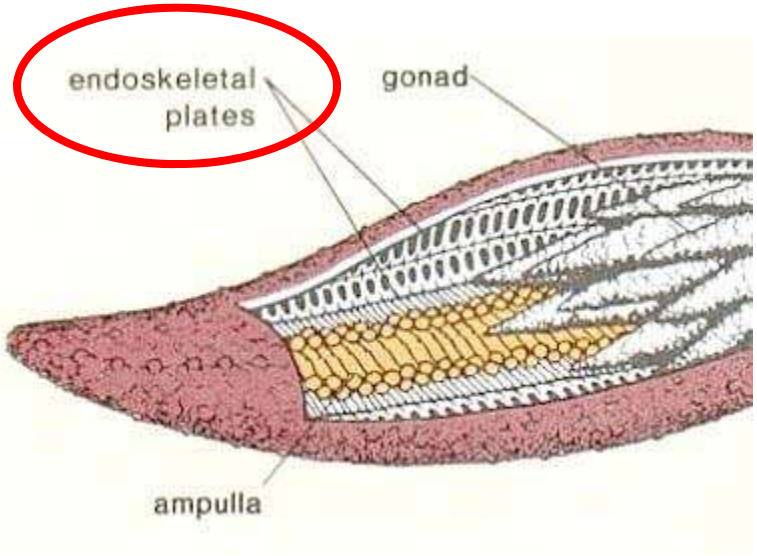
Chapter 7

Marine Animals Without a Backbone

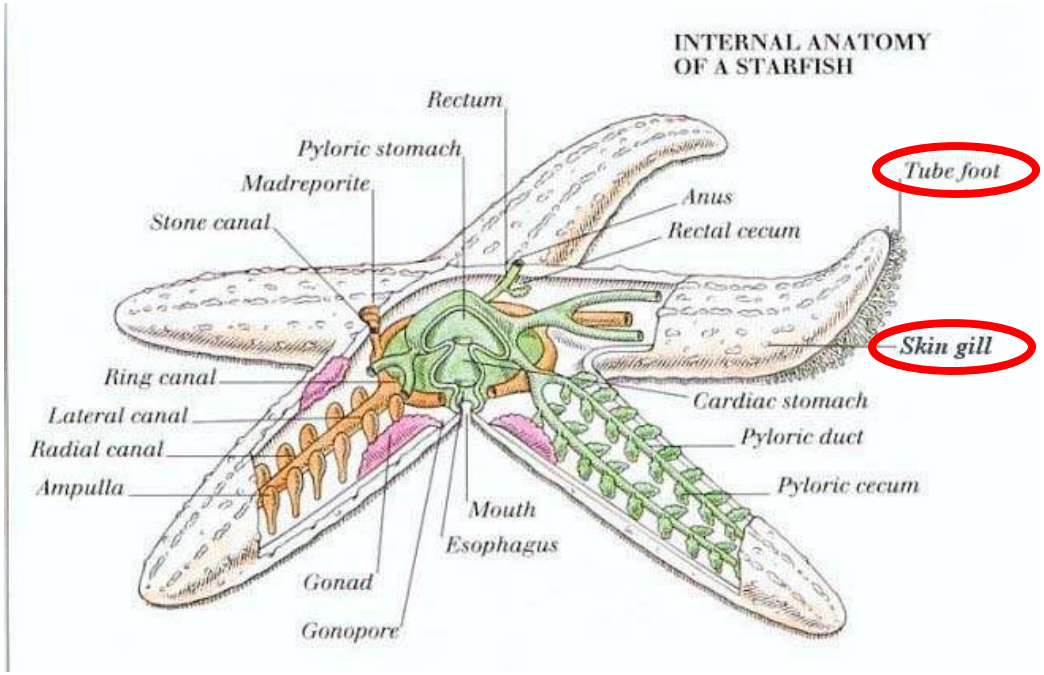
Echinoderms

- **Characteristics of Phylum:**
  - Name means "Spiny Skin"
  - Endoskeleton
    - Skeleton on inside of body
    - Covered by tissue
  - All 7000 species exclusively marine



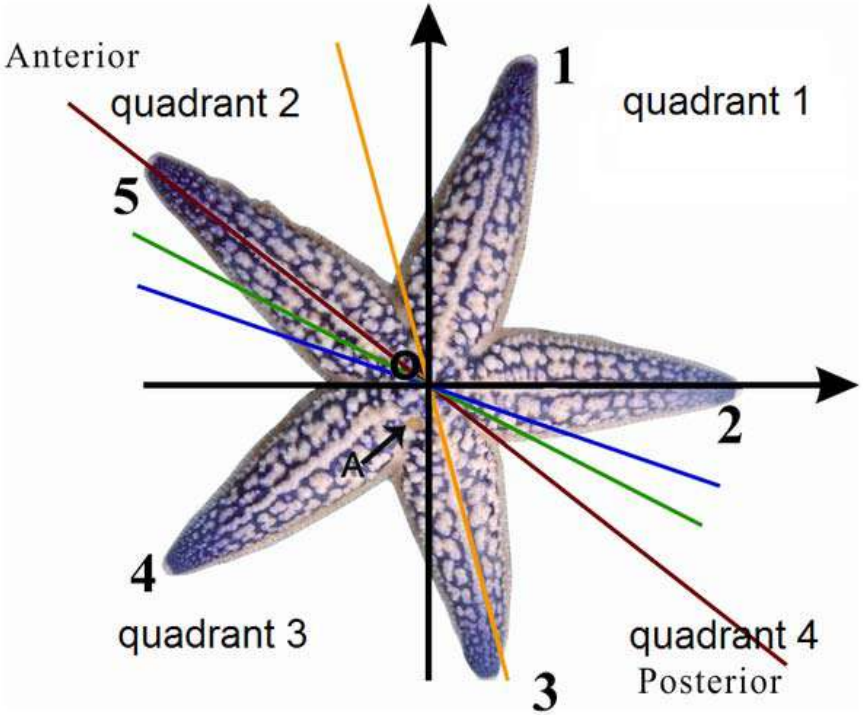
Echinoderms

- **Characteristics of Phylum:**
  - Water vascular system with tube feet important in feeding and locomotion
  - Skin gills for respiration.



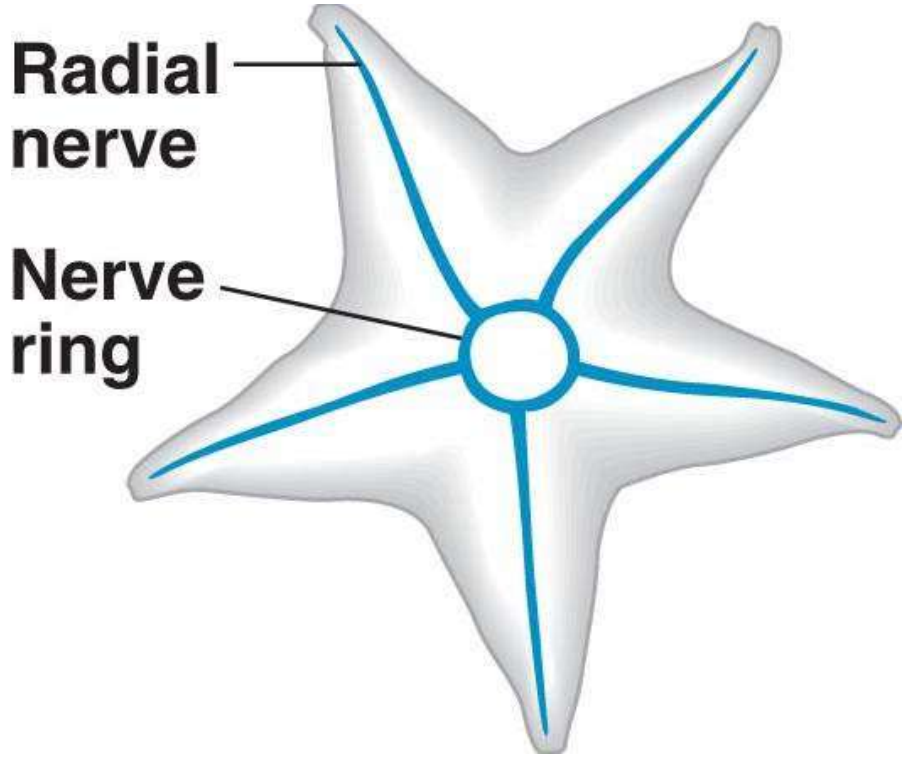
Echinoderms

- **Characteristics of Phylum:**
  - Radial symmetry in adults
    - larvae are bilaterally symmetrical



Echinoderms

- **Characteristics of Phylum:**
  - Nervous system is decentralized (no brain) this allows any portion of the body to lead
  - Can regenerate lost body parts

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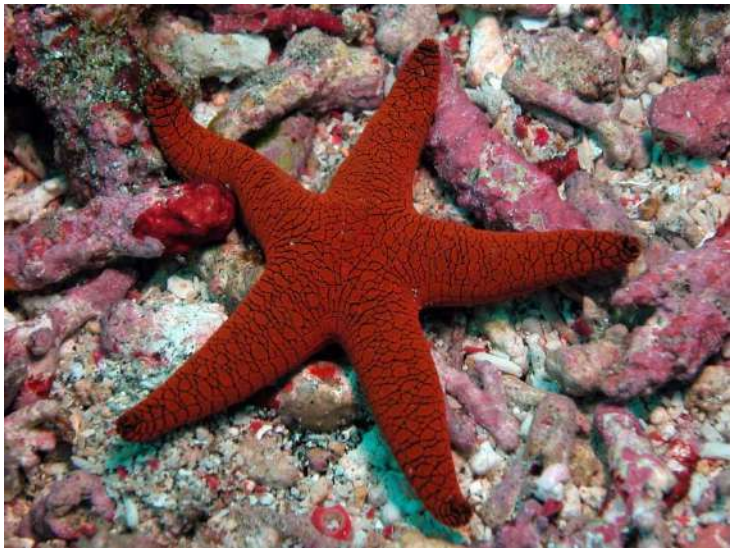
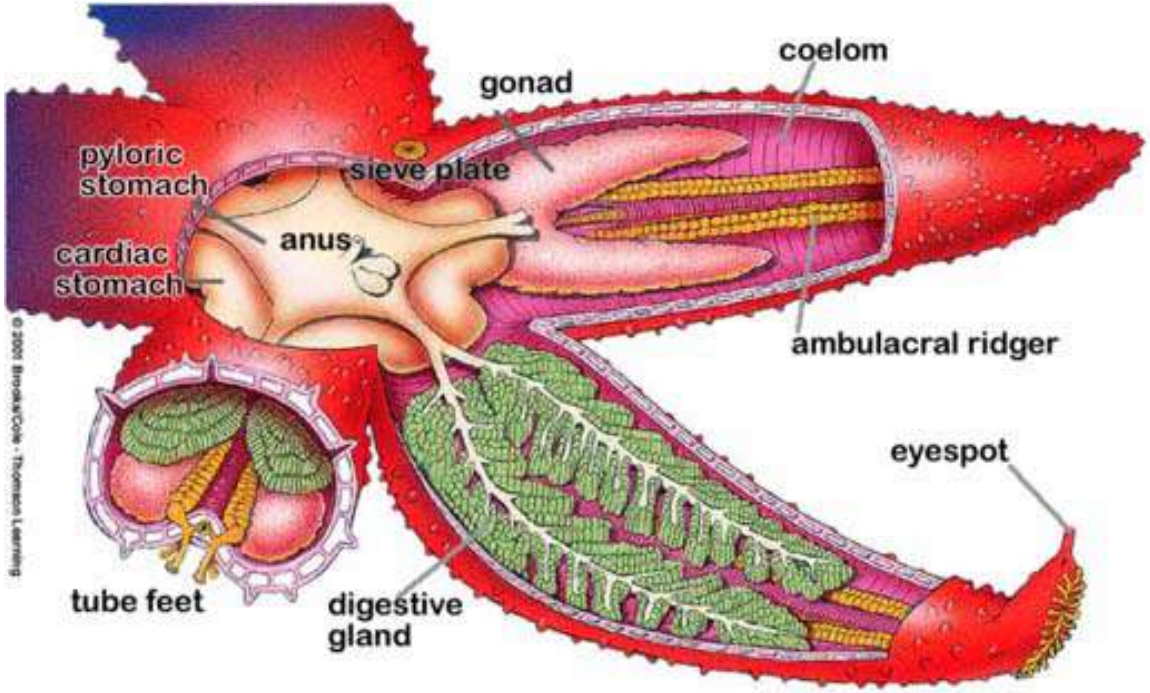
Types of Echinoderms

- **Sea stars-**
  - Move with tube feet
  - Have a central disc in center of body surrounded by five arms (or multiples of 5 arms)
    - some species have 50 arms)



Types of Echinoderms

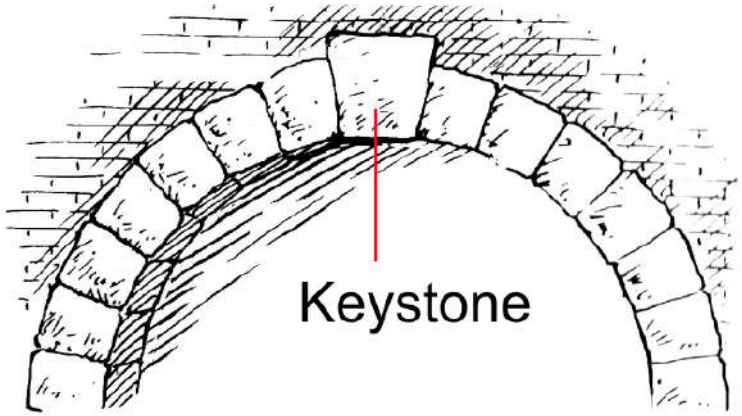
- **Sea stars-**
  - Internal organs extend through the entire body, including the arms
  - Calcium carbonate plates are loosely embedded in spiny skin making them slightly flexible



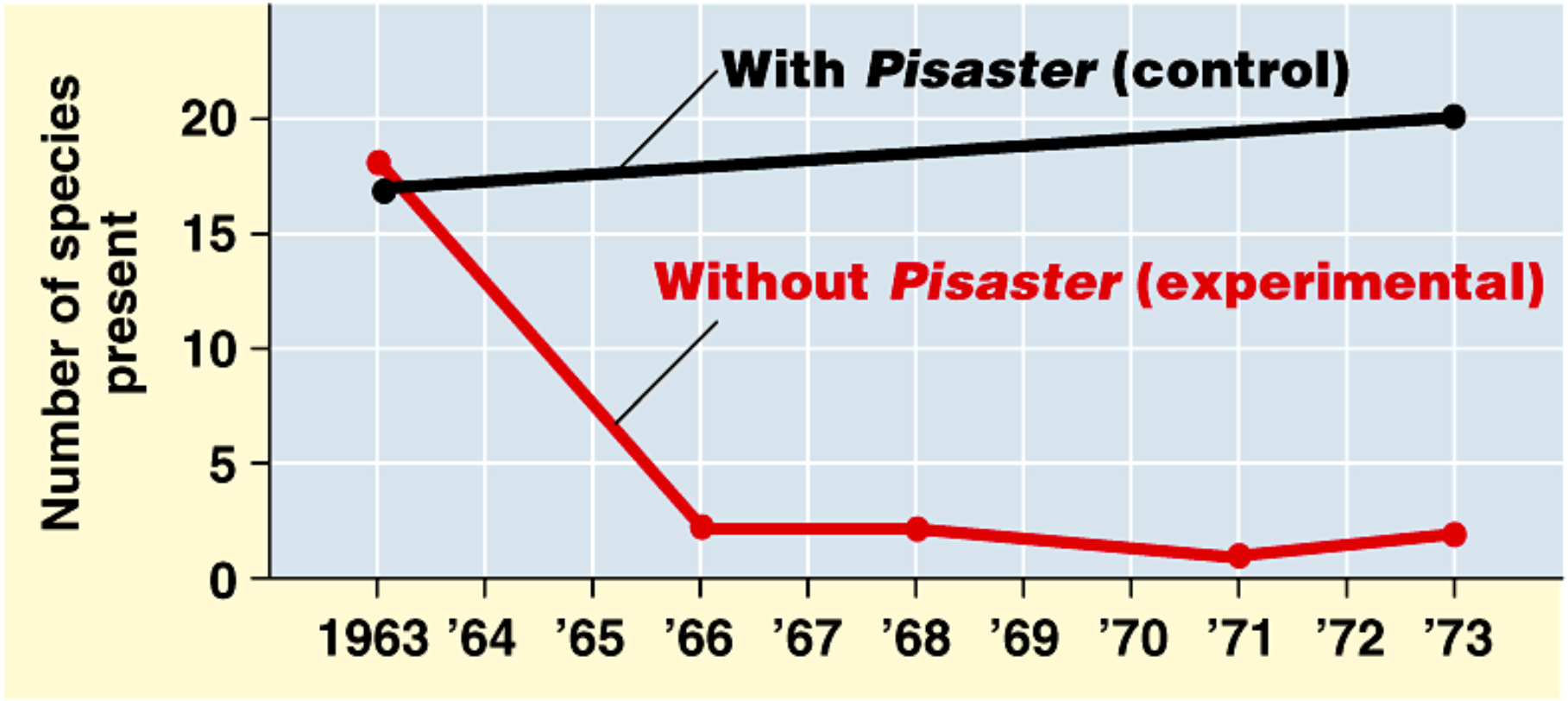
Types of Echinoderms

- **Sea stars-**
  - Carnivores that normally consume shellfish and coral
    - Play an important role is controlling shellfish populations
    - Keystone species in many ecosystems

- What is a keystone species?
  - a species on which other species in an ecosystem largely depend where removing them would change the ecosystem drastically.



Pisaster ochraceus



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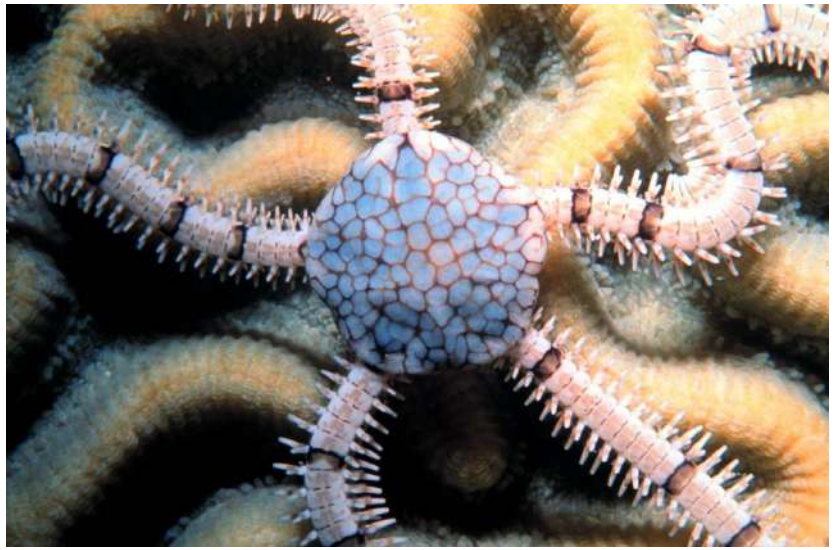
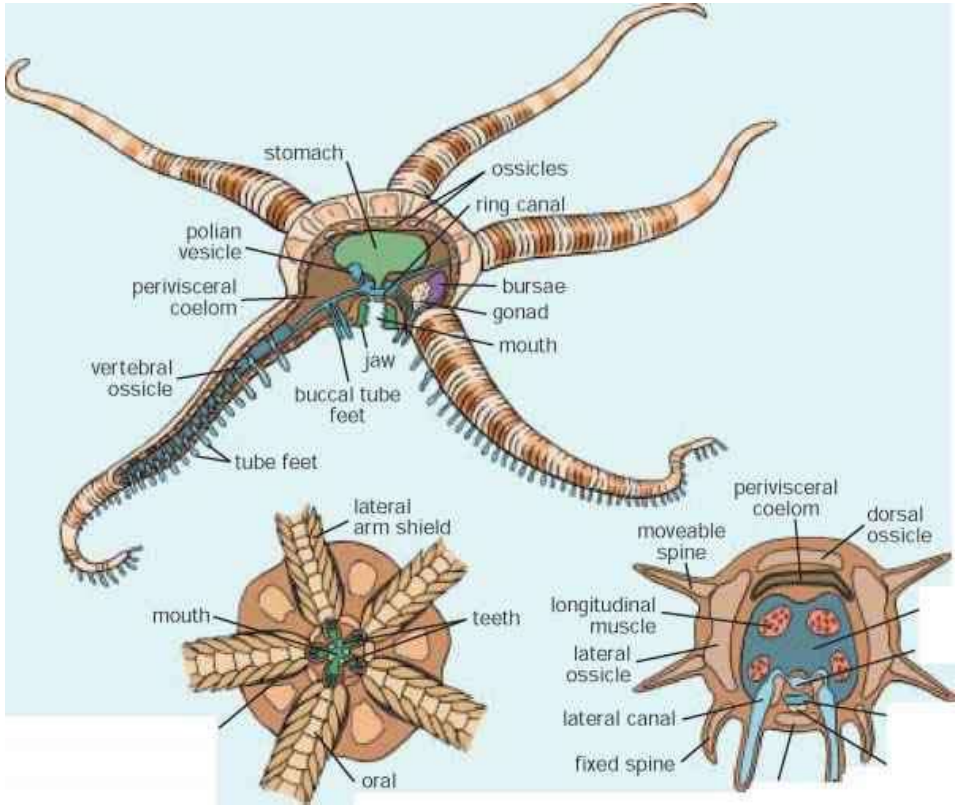
Types of Echinoderms

- **Brittle stars**
  - Like sea stars, they have a central disc surrounded by arms
  - Five arms seen in brittle stars are thin and covered in numerous spines



Types of Echinoderms

- **Brittle stars**
  - Internal organs are restricted to the central disc
  - The tube feet present in brittle stars are without suckers and used for feeding on detritus and small animals



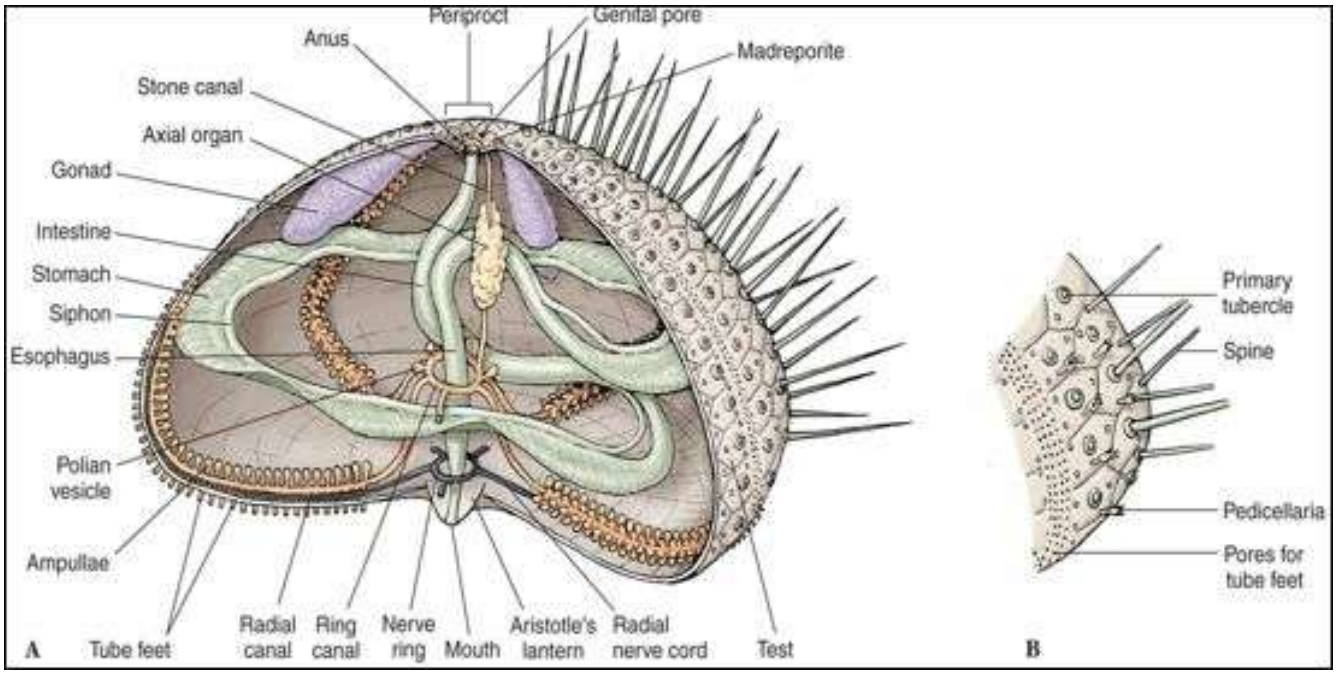
Types of Echinoderms

- **Sea Urchins, Sea Biscuits, Sand Dollars**
  - Elongated, movable spines much longer than those sea in other groups
  - Rigid plates are fused into a solid structure called a "test"

Test

Types of Echinoderms

- **Sea Urchins, Sea Biscuits, Sand Dollars**
  - Move with tube feet
  - Mouth on the bottom, anus on top of body

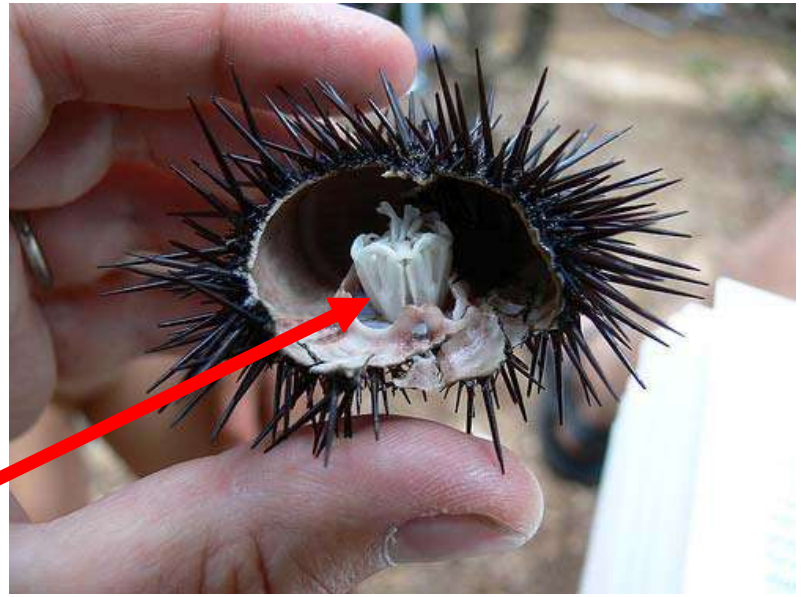


Sea Biscuit

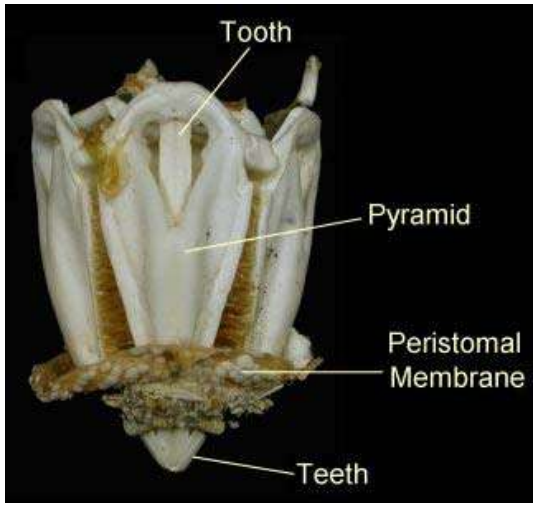
Sand Dollar

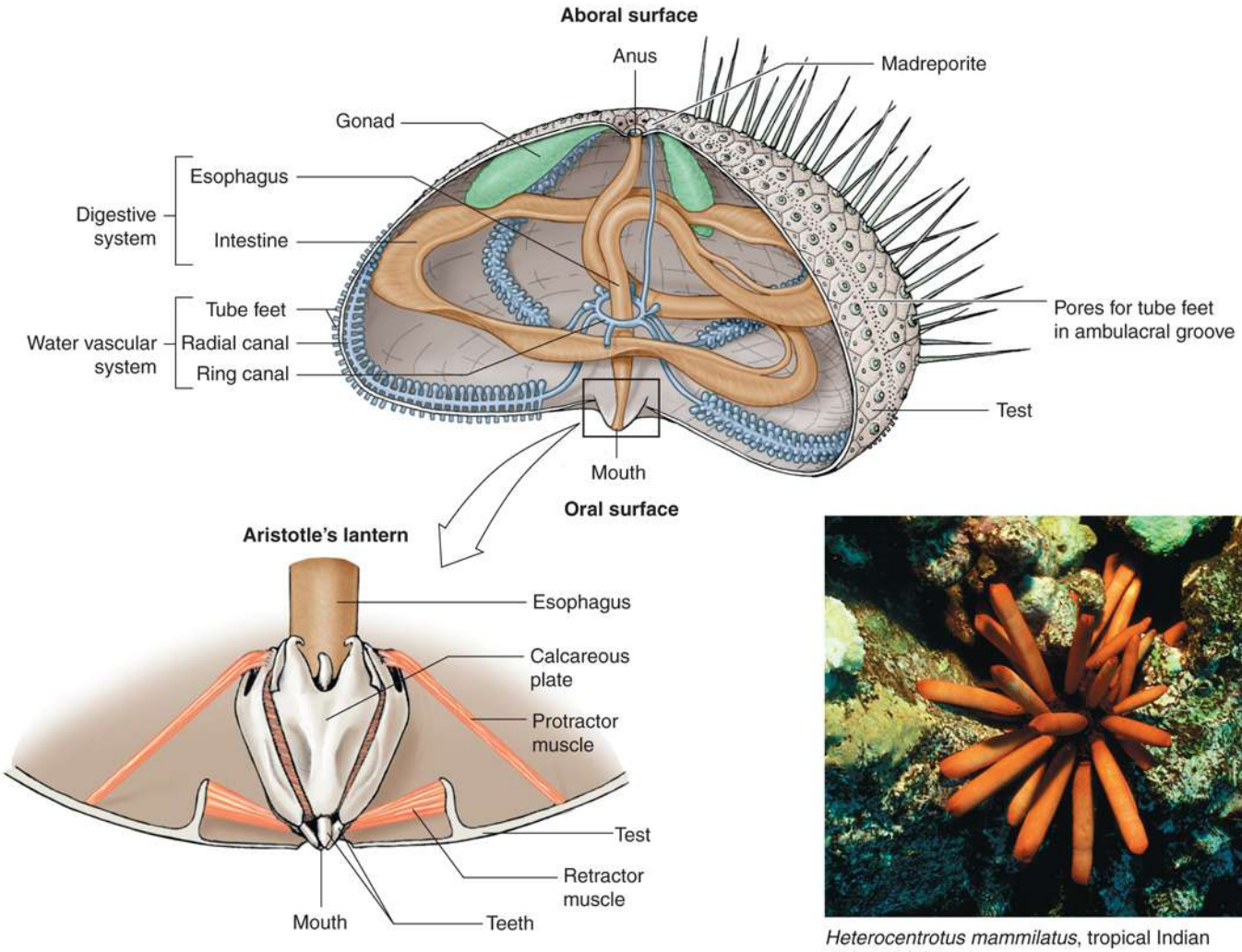
Types of Echinoderms

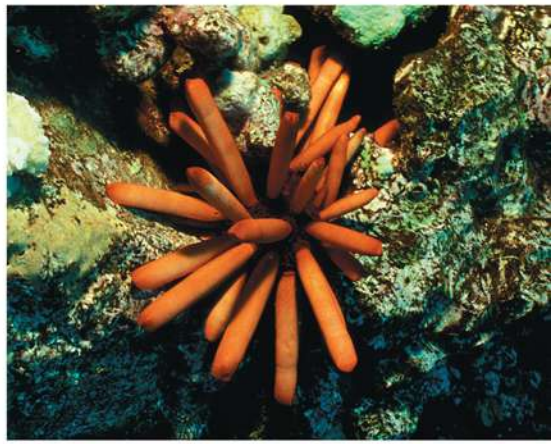
- **Sea Urchins, Sea Biscuits, Sand Dollars**
  - Biting mouth for grazing– Aristotle's lantern is the feeding structure of muscles and mouthpieces



  - Feed on detritus, encrusting organisms, algae or anything else they can scrape off surfaces







Heterocentrotus mammilatus, tropical Indian and Pacific Ocean.

Types of Echinoderms

- **Crinoids**
  - 600 species are typically found in deep water
  - Represented by feather stars and sea lilies

Types of Echinoderms

- **Crinoids**
  - Sea lilies live attached while feather stars are mobile

Sea Lily

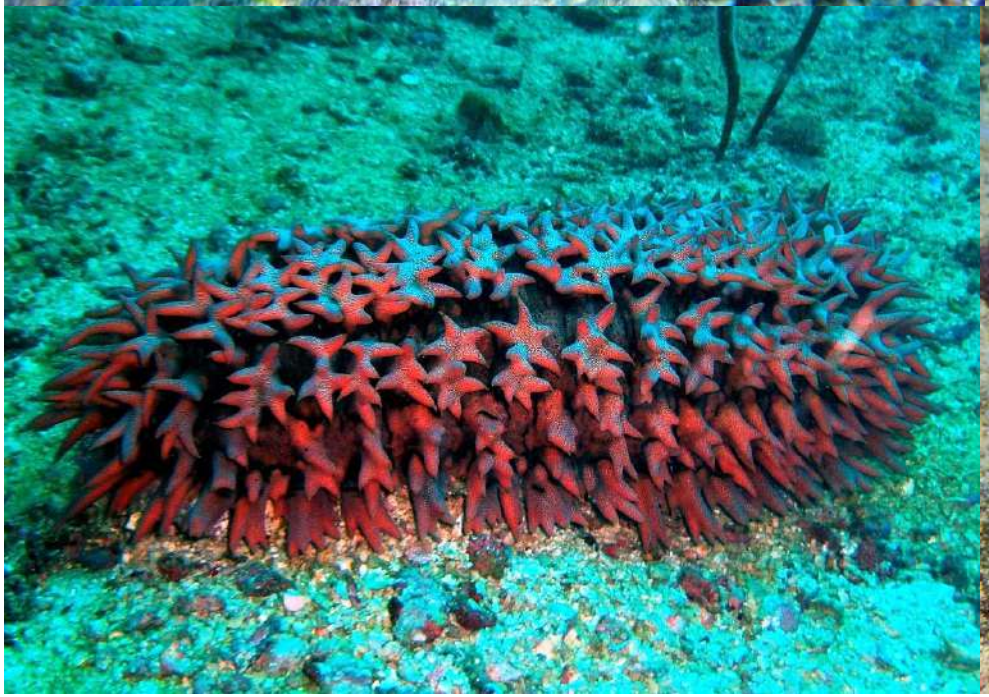
Feather Star

Types of Echinoderms

- **Crinoids**
  - These organisms have 5 or more arms that branch out for suspension feeding
  - Some use a mucous net to aid in food capture

Types of Echinoderms

- **Sea cucumbers**
  - Five rows of two feet are restricted to one side, where the animal lies
  - The plates found in the sea cucumbers are loosely embedded in the thick skin
  - They are deposit feeders

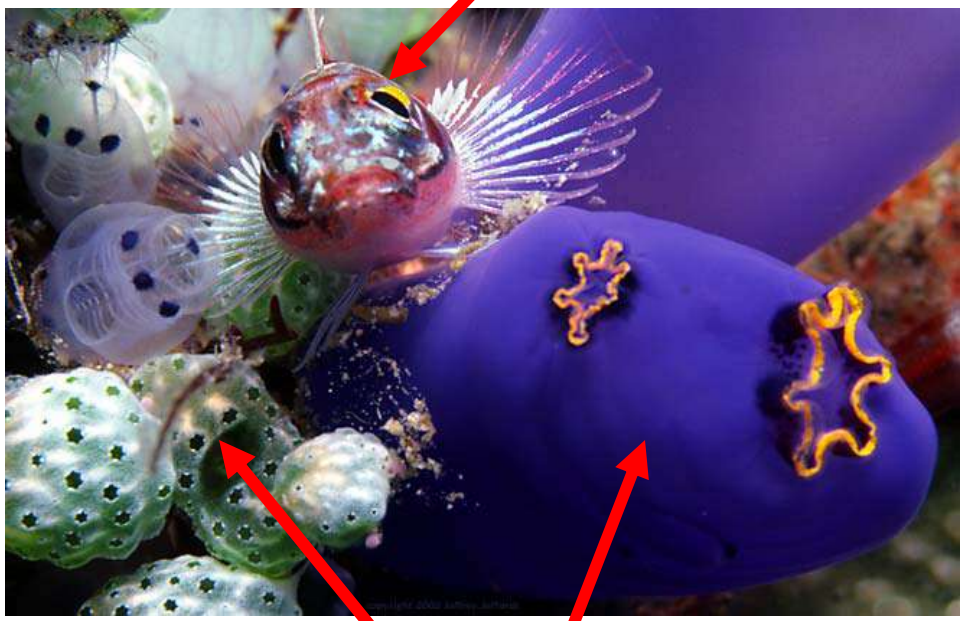


Types of Echinoderms

- **Sea cucumbers**
  - Sea cucumbers have a interesting predator escape plan called evisceration,
    - where they expel the internal organs;
    - it is assumed this allows escape for the sea cucumber.
    - https://www.youtube.com/watch?v=aCxKFc3XtJs
  - Since all echinoderms have regenerative capabilities, these internal organs will grow back.

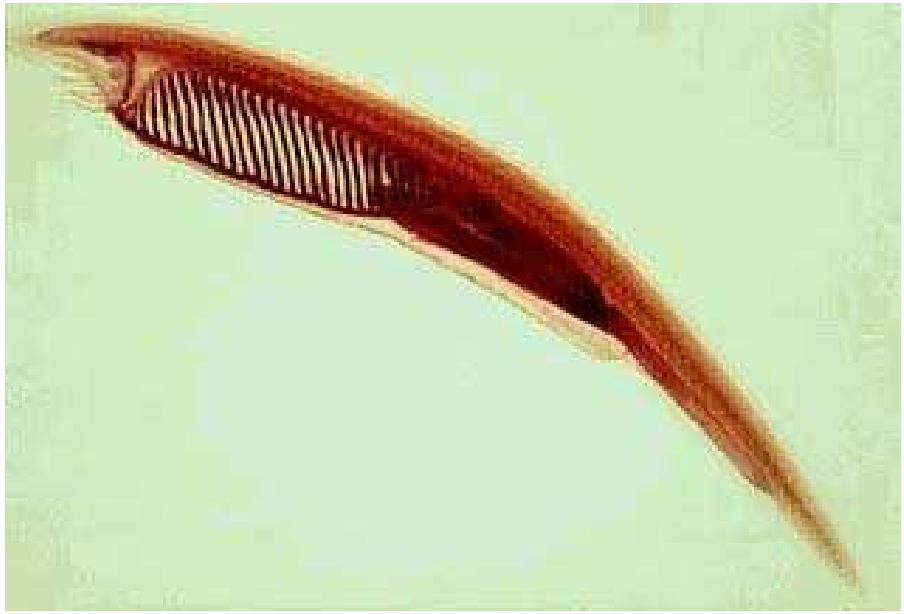
Invertebrate Chordates

- The Phylum Chordata is a phylum that contains
  - two invertebrate groups, tunicates and lancelets,
  - as well as many other, more familiar animals such as fish, amphibians, reptiles, birds and mammals.



Invertebrate Chordates

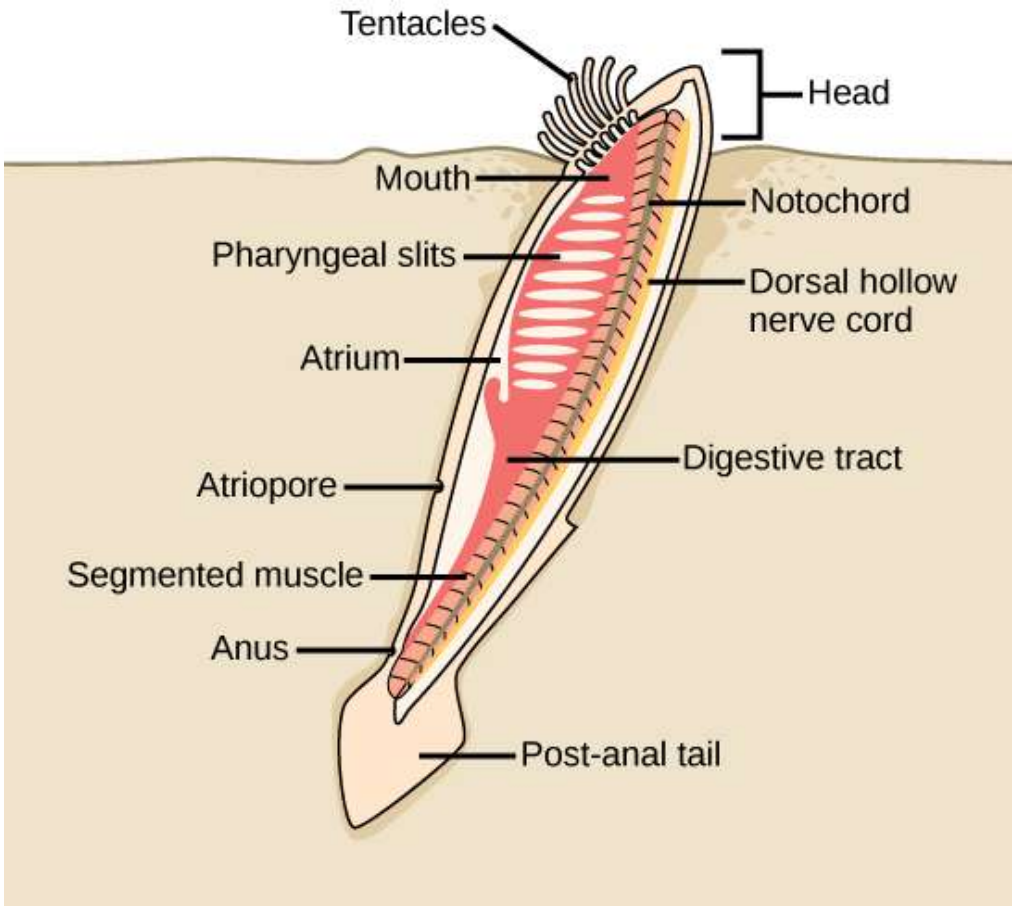
- Chordates have several features that are seen at least during some portion of the life.
- Lancelets are the only chordates that possess all the features as adults.



Lancelet

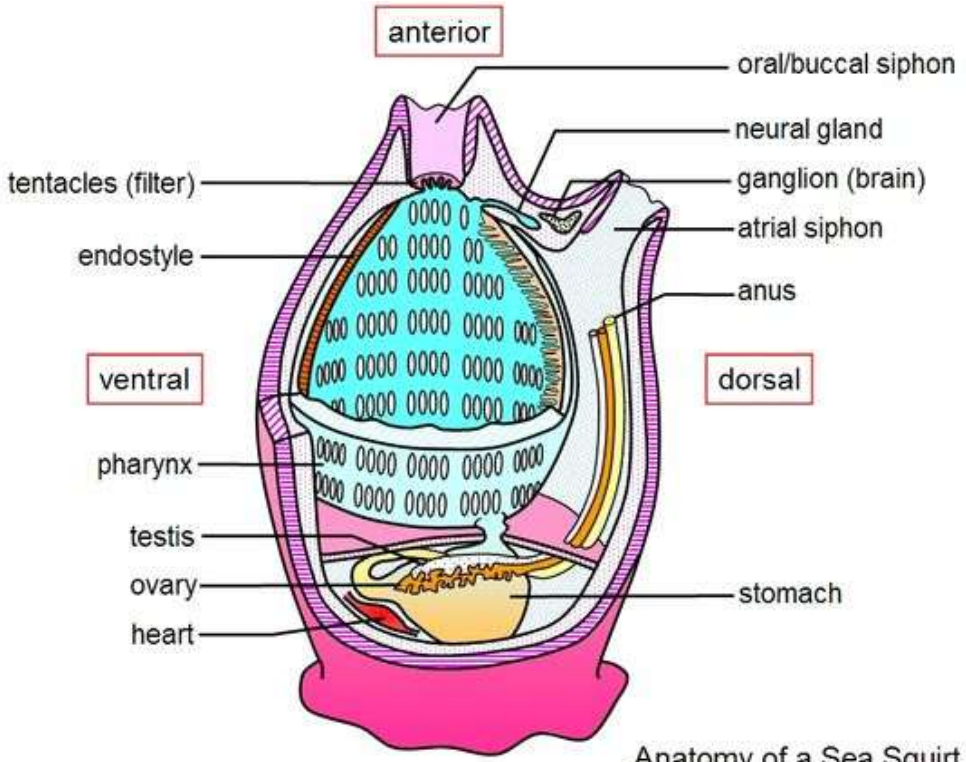
Invertebrate Chordates

- Characteristics of Chordates:
  - Notochord - nerve cord support
  - Tubular nerve cord
  - Muscular pharynx
  - Gill slits
  - Post-Anal Tail
  - Ventral heart

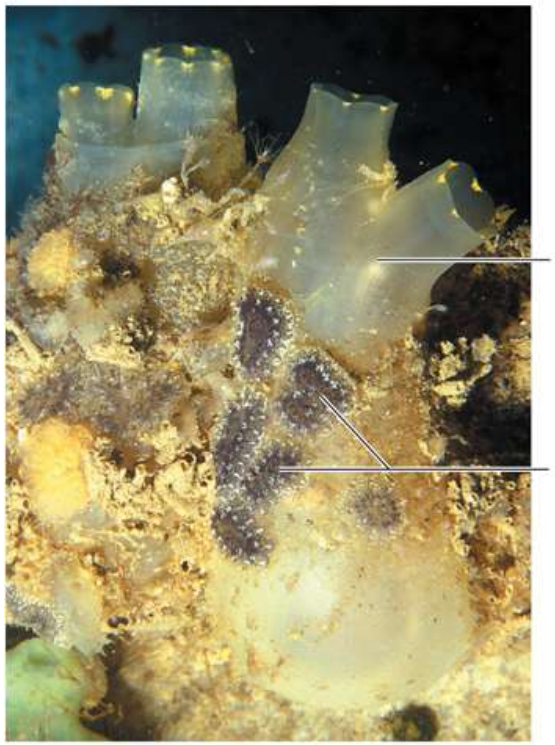


Types of Invertebrate Chordates

- **Tunicates**:
  - All 3000 known species are marine
  - Commonly called "sea squirts"
    - they filter feed via an incurrent siphon and "squirt" water out an excurrent siphon after the water has been filtered

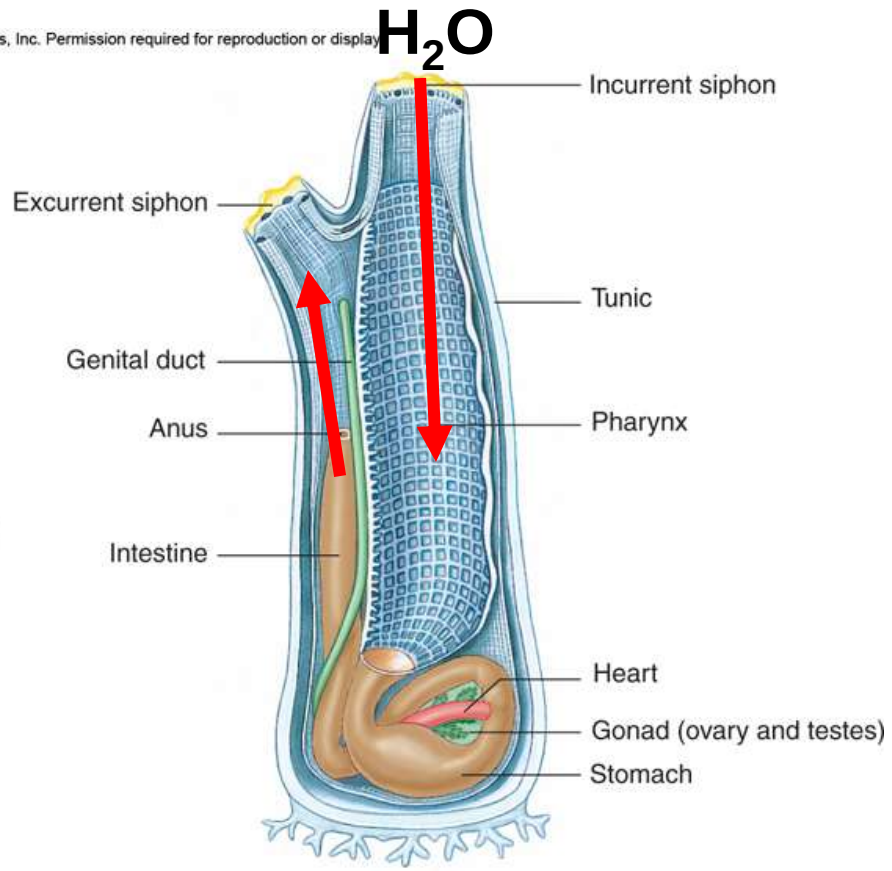


Anatomy of a Sea Squirt



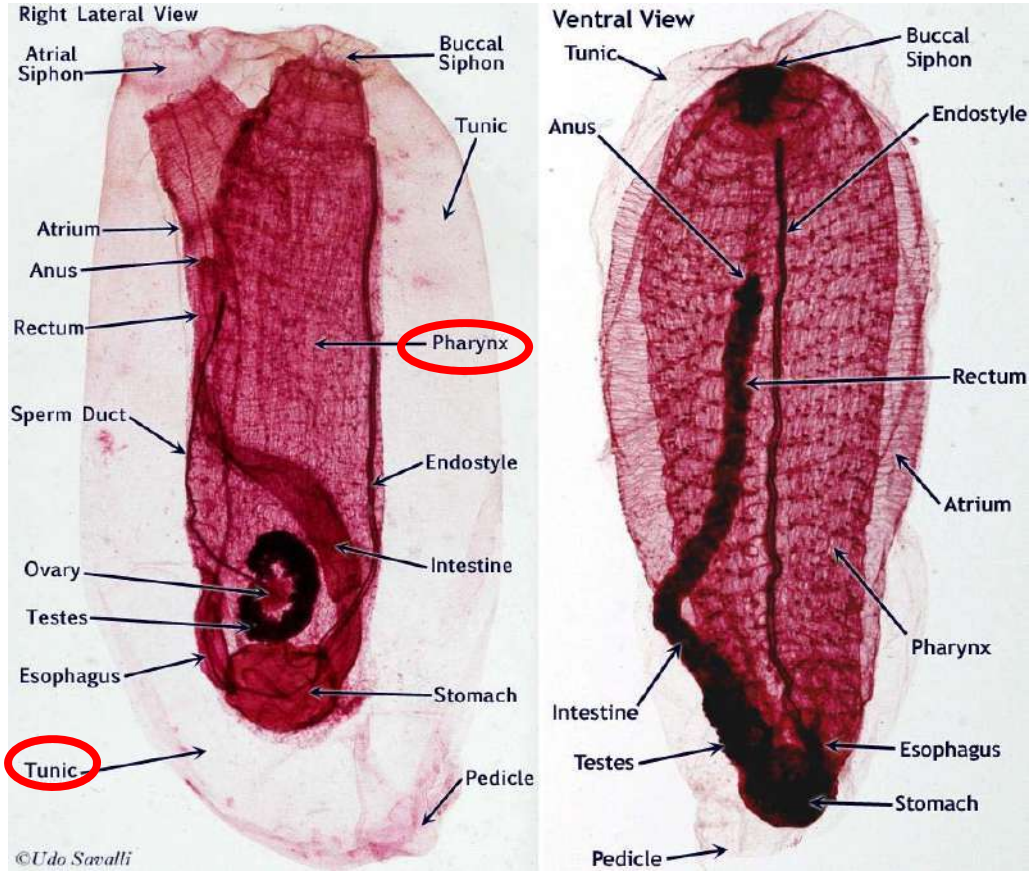
Cliona intestinalis, fouling species worldwide, and *Botryllus schlosseri*

© Bill Ober



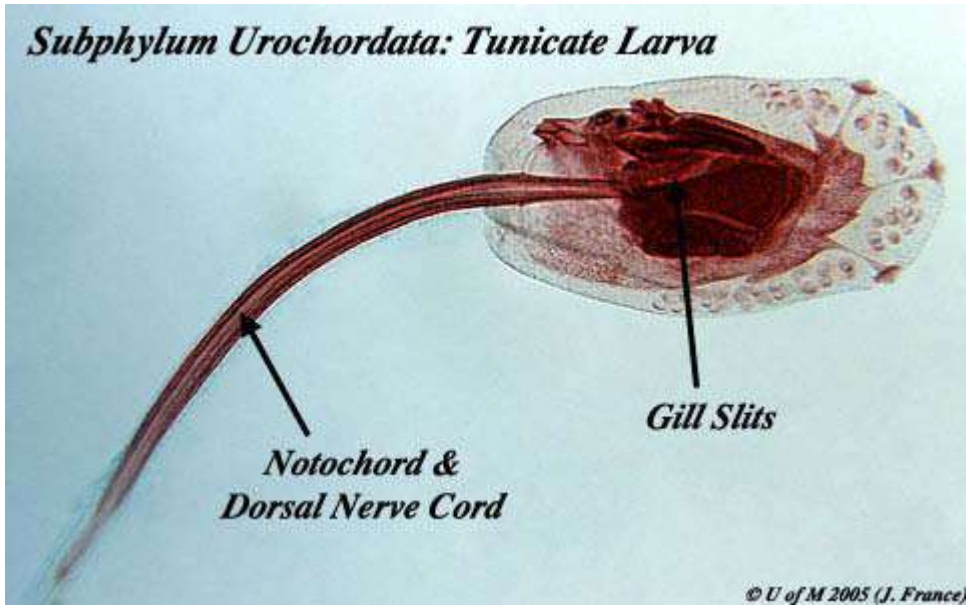
Tunicates

- Larvae has chordate characteristics that are not seen in adults- only pharynx remains
- Called tunicates because of thick outer covering called a tunic

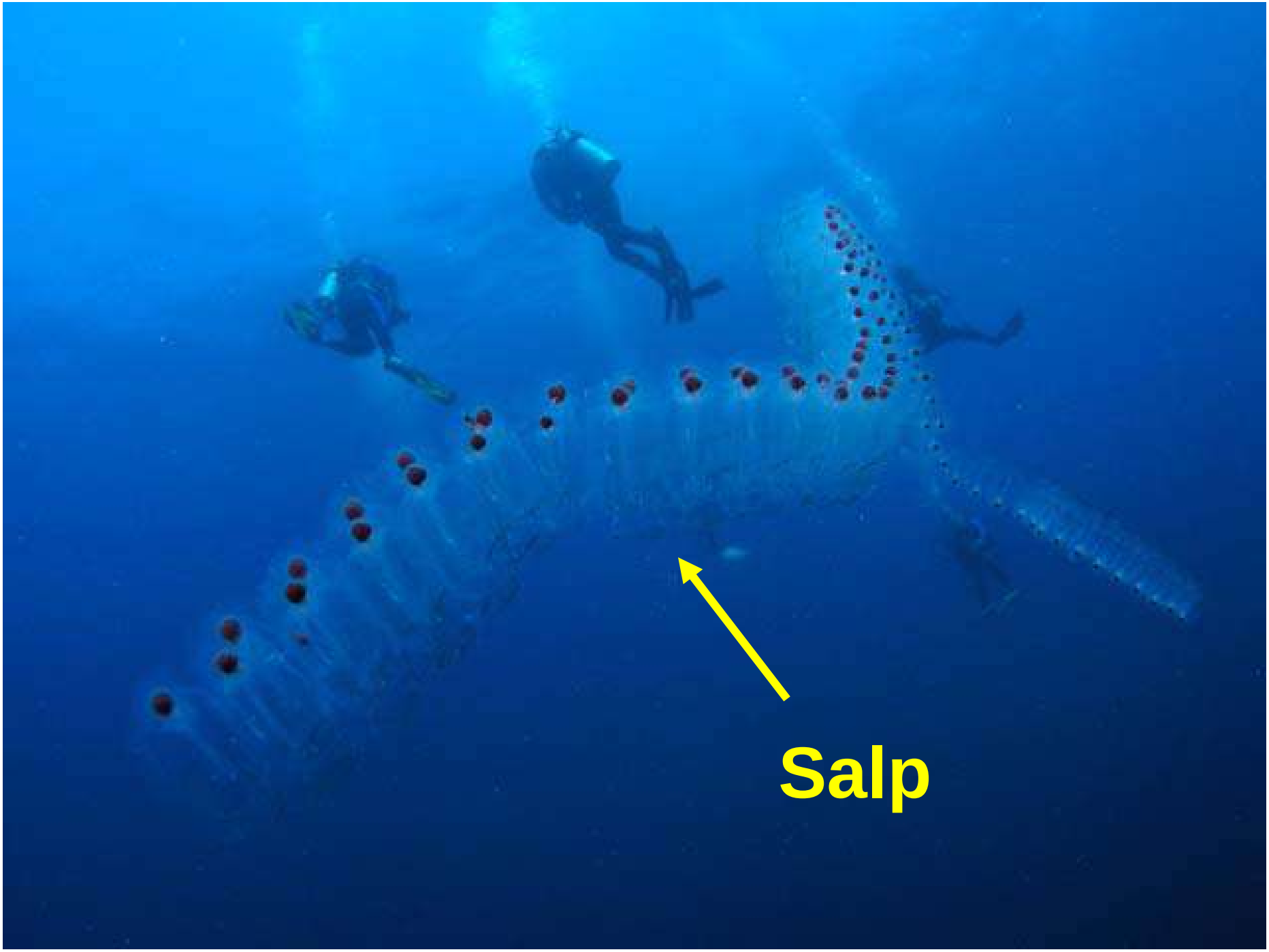


Tunicates

- Larvae are free swimming after fertilization occurs in open water- mass reproduction
- Adults normally live attached to boats, docks, reefs, or other hard substrate

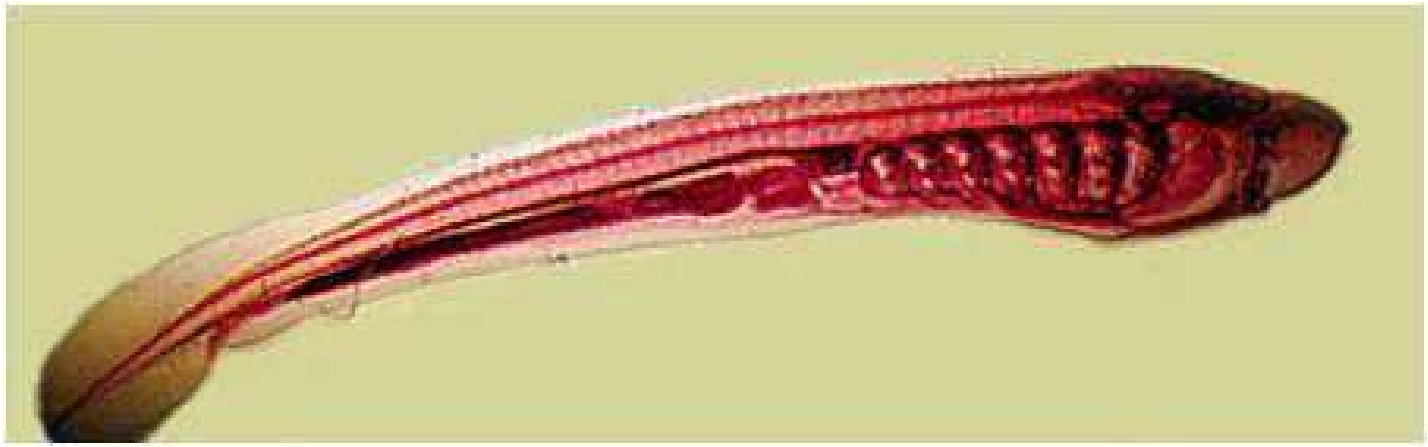


On boat propeller


Salp

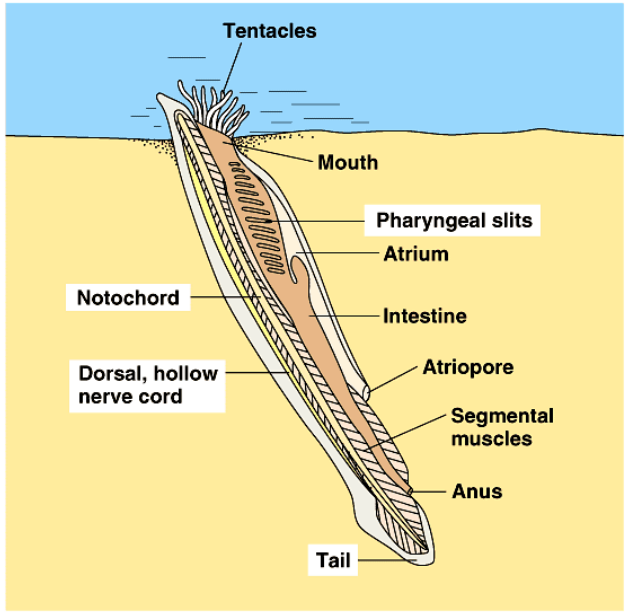
Types of Invertebrate Chordates

- **Lancelets**
  - 23 species
  - Very small, only up to 3 inches long
  - Laterally compressed and elongated
  - Live in shallow marine waters as filter feeders



Types of Invertebrate Chordates

- **Lanceletes**
  - Body shows segmented muscle tissue
  - Notochord attached to the muscles
  - Gills are used to filter food, not in respiration
  - Possess all chordate features as an adult
    - Only lack backbone that separates them from vertebrates



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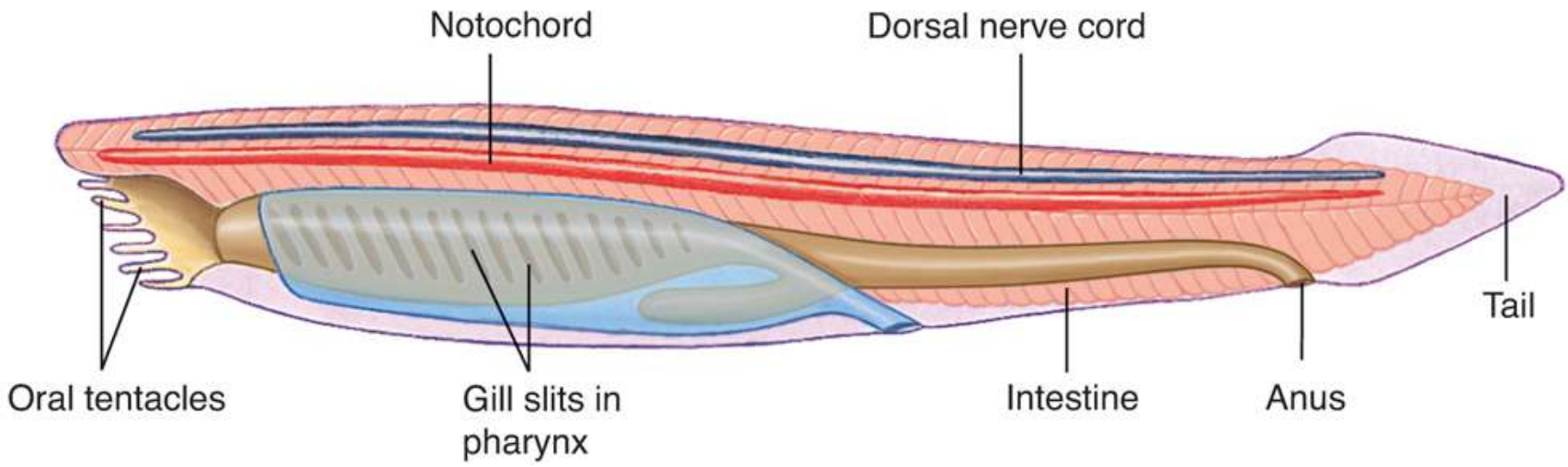

Characteristics of Major Animal Phyla

Table 7.1 Some of the Most Important Characteristics of the Major Animal Phyla

Phylum	Representative Groups	Distinguishing Features	General Habitat	Significance in the Marine Envionment	Level of Organization	Symmetry	Segmentation	Body Cavity	Digestive Tract	Respiratory Exchange	Circulatory System
Porifera (sponges)	Sponges 	Collar cells (choanocytes)	Benthic	Filter feeders	Cellular	Asymmetrical	No	None	None	Body surface	None
Cnidaria (cnidarians)	Jellyfishes, sea anemones, corals 	Nematocysts	Benthic, pelagic	Predators, passive suspensic feeders; corals are importan reef builders	Tissue	Radial	No	None	Incomplete	Body surface	None
Ctenophora (comb jellies)	Comb jellies 	Ciliary combs, colloblasts	Mostly pelagic	Predators	Tissue	Radial	No	None	Incomplete	Body surface	None
Platyhelminthes (flatworms)	Turbellarians, flukes, tapeworms 	Flattened body	Mostly benthic, many parasitic	Predators, many parasitic	Organ system	Bilateral	No	None	Incomplete or absent	Body surface	None
Nemertea (ribbon worms)	Ribbon worms 	Long proboscis	Mostly benthic	Predators		Bilateral	No	Proboscis cavity	Complete	Body surface	Closed
Nematoda (nematodes)	Nematodes, roundworms 	Body round in cross section	Mostly benthic, many parasitic	Many parasitic, deposit feeders		Bilateral	No	Pseudocoelom	Complete	Body surface	None
Annelida (segmented worms)	Polychaetes, oligochaetes, leeches 	Segmentation	Mostly benthic	Predators, deposit feeders, passive suspension feeders		Bilateral	Yes	Coelom	Complete or absent	Gills or body surface	Closed
Sipuncula (peanut worms)	Peanut worms 	Long, retractable anterior end	Benthic	Predators		Bilateral	No		Complete	Body surface	None
Echiura (echiurans)	Echiurans 	Non-retractable proboscis	Benthic	Predators		Bilateral	No			Body surface	Closed
Mollusca (molluscs)	Snails, clams, oysters, octopuses, chitons 	Foot, mantle, radula (absent in some groups)	Benthic, pelagic	Predators, grazers, filter feeders, some parasitic		Bilateral	No			Gills	Open or closed
Arthropoda (arthropods)	Crustaceans (crabs, shrimps), insects 	Exoskeleton, jointed legs	Benthic, pelagic, some parasitic	Predators, grazers, filter feeders, some parasitic		Bilateral	Yes			Gills (in many crustaceans)	Open
Ectoprocta (bryozoans)	Bryozoans 	Lophophore, colonial	Benthic	Filter feeders		Bilateral	No			Body surface	None
Phoronida (phoronids)	Phoronids 	Lophophore, worm-like body	Benthic	Filter feeders		Bilateral	No			Body surface	Closed
Brachiopoda (lamp shells)	Lamp shells 	Lophophore, clam-like shells	Benthic	Benthic		Bilateral	No			Body surface	Open
Chaetognatha (arrow worms)	Arrow worms 	Transparent body with fins	Mostly pelagic	Mostly pelagic		Bilateral	No			Body surface	None
Echinodermata (echinoderms)	Sea stars, brittle stars, sea urchins, sea cucumbers 	Tube feet, five-way radial symmetry, water vascular system	Mostly benthic	Predators, deposit feeders, passive suspension feeders		Radial (adults) Bilateral (larvae)	No			Body surface	None
Hemichordata (hemichordates)	Acorn worms 	Dorsal, hollow nerve cord, gill slits	Mostly benthic	Deposit feeders		Bilateral	Reduced			Body surface	Part closed, part open
Chordata (chordates)	Tunicates, vertebrates (fishes, reptiles, birds, mammals) 	Dorsal, hollow nerve cord, gill slits, notochord	Benthic, pelagic	Predators, grazers, filter feeders		Bilateral	Reduced			Gills, lungs	Closed