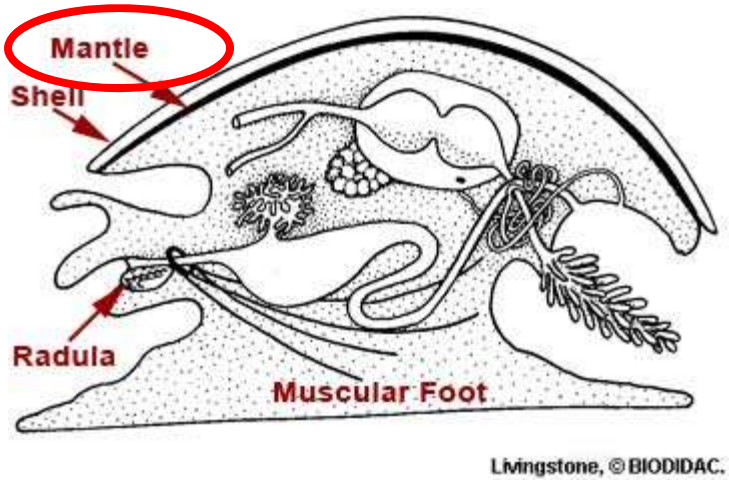
Chapter 7

Marine Animals Without a Backbone

Molluscs

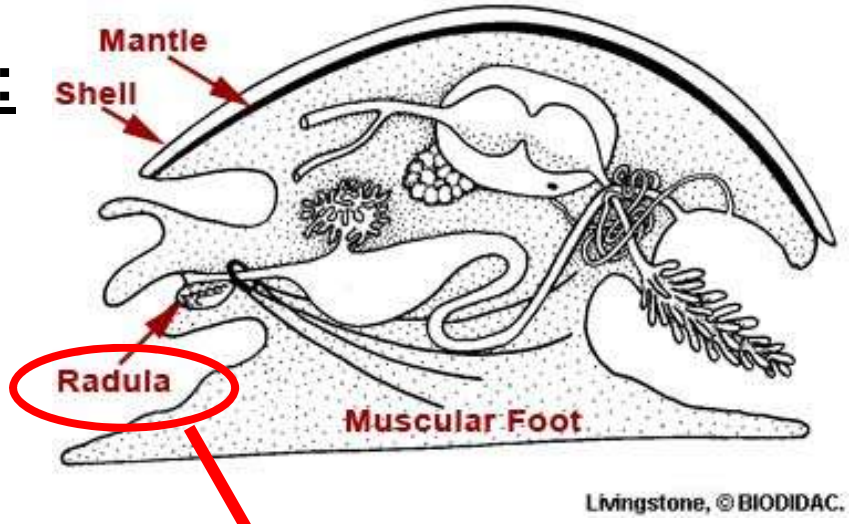
- **Characteristics of Phylum:**
  - More than 200,000 species
  - Name means "soft body"
  - Basic body plan – head, muscular foot and visceral mass in most species
  - Mantle- secretes shell, waste disposal, sensory reception, respiration

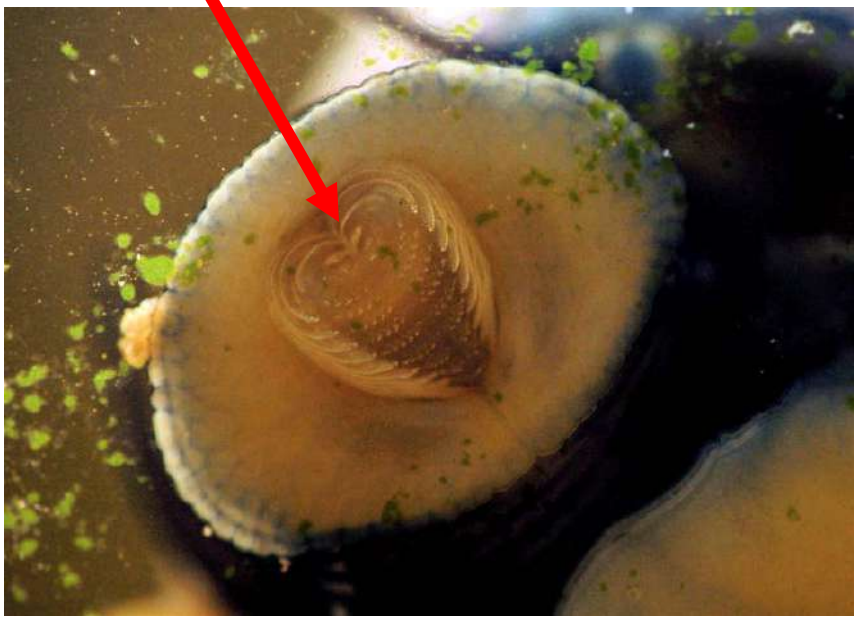


Livingstone, © BIODIDAC.

Molluscs

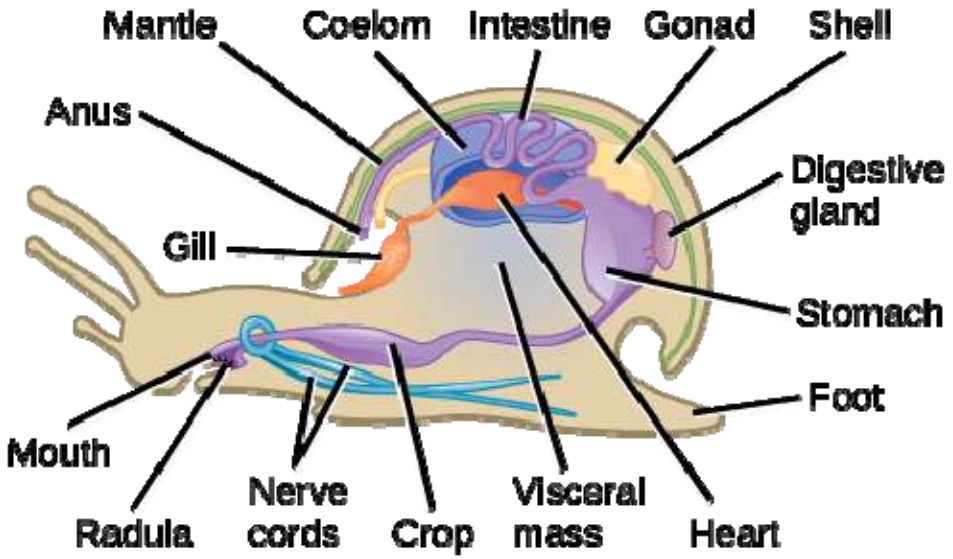
- **Characteristics of Phylum:**
  - Many have a shell of calcium carbonate
  - Radula for grazing is unique to this group
  - Some are deposit feeders, others carnivores, some use radula for scraping algae, encrusting animals, etc. off substrates





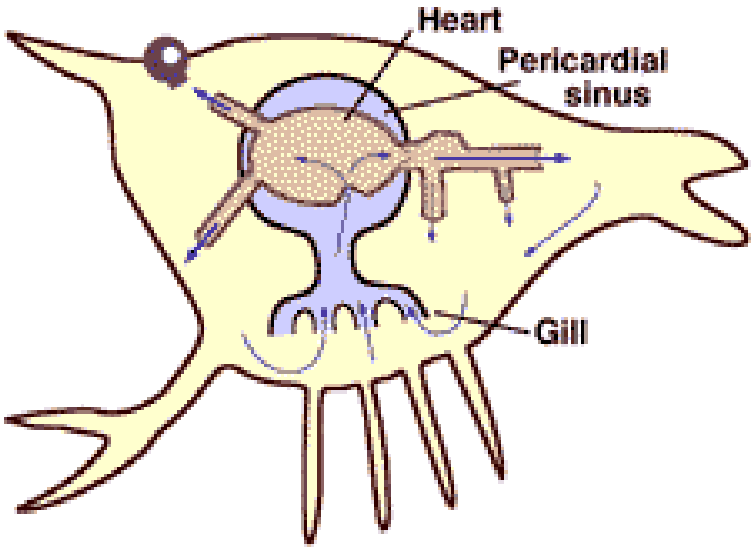
Molluscs

- **Characteristics of Phylum:**
  - Well developed nervous system
  - Open circulatory system
  - Complete digestive system
  - Trochophore larvae develops into a planktonic veliger (final) larvae complete with shell (miniature version of adult)

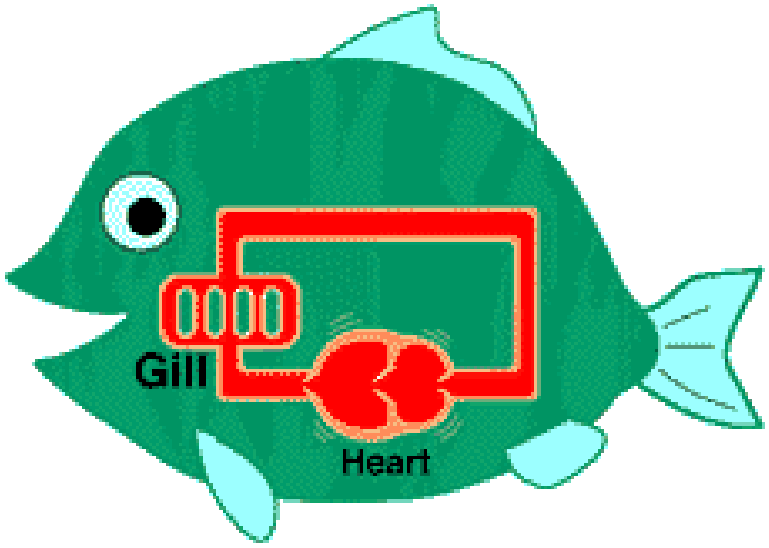


Trochophore

Circulatory Systems



Open Circulatory System

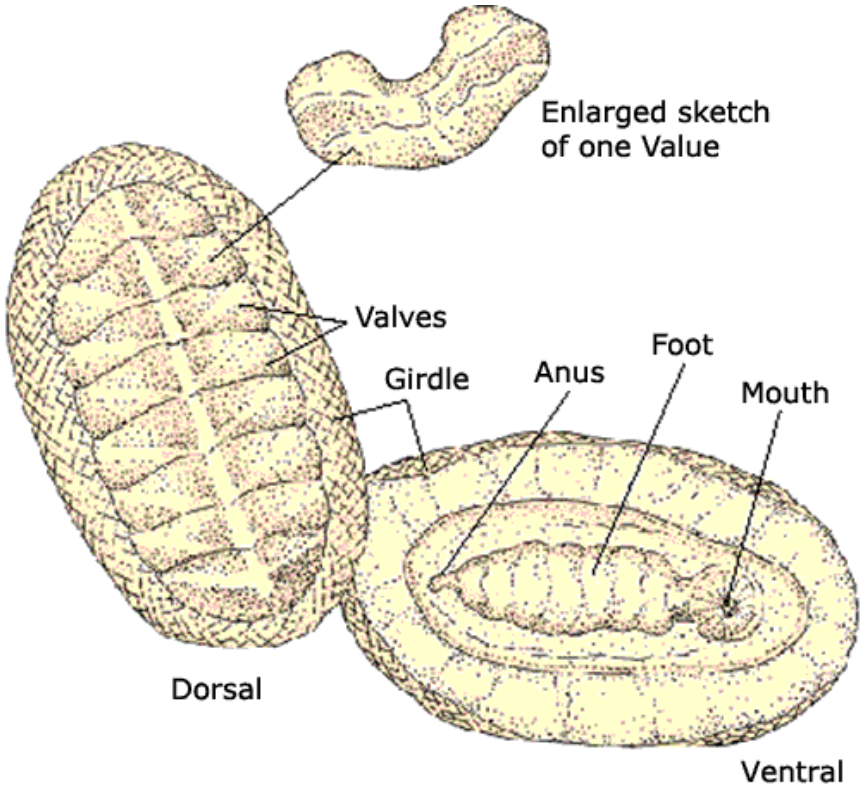


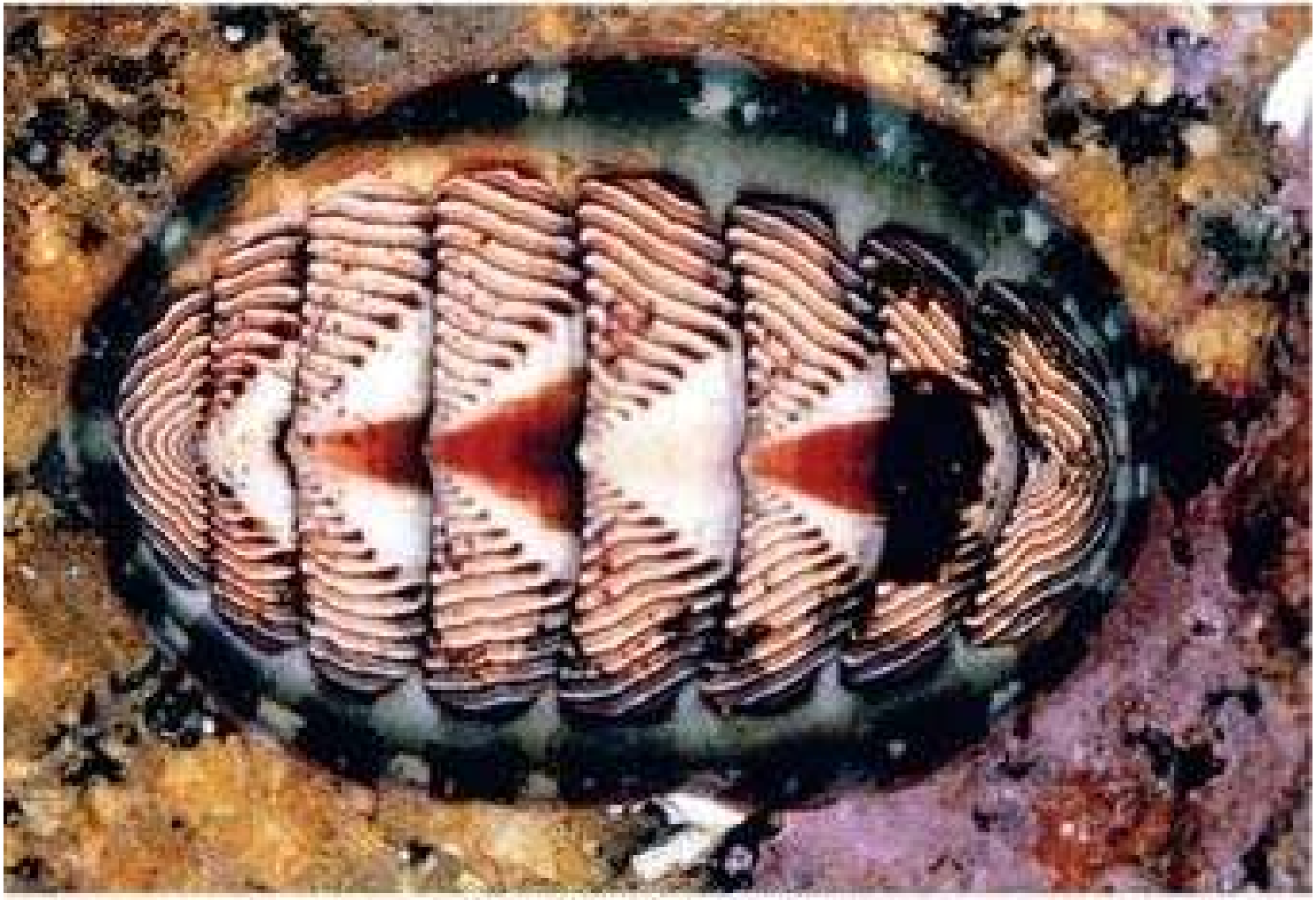
Closed Circulatory System

Types of Molluscs

Chitins

- 800 species
- All marine
- Dorsal shell of 8 plates.
- Ventral muscular foot.
- Ventral mouth with radula
- Mostly found in shallow water, coastal environments of hard substrate
- Many graze on algae & small animals in marine intertidal zone (area between high and low tides)





Kjell B. Sandved/Visuals Unlimited

Types of Molluscs

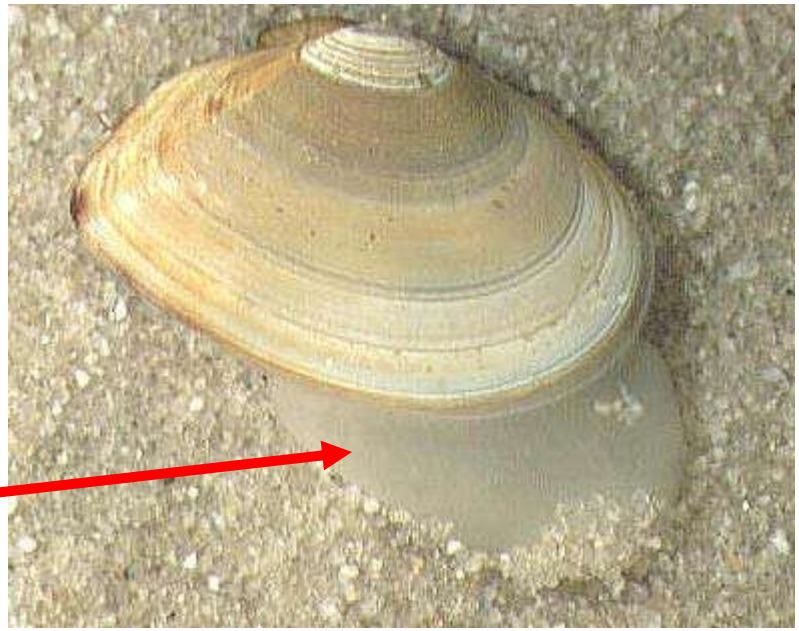
Bivalves

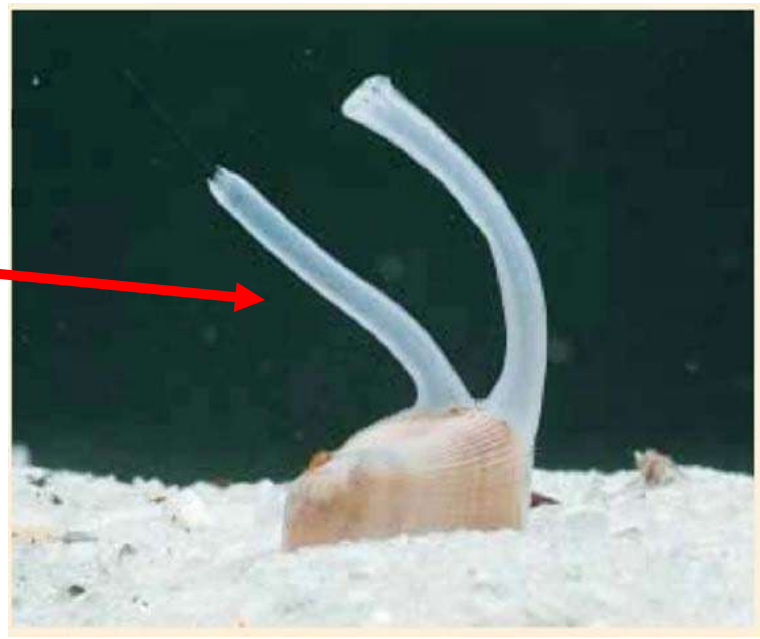
- (Clams, Oysters, Scallops, Mussels, etc.
  - Two shells or “valves”
  - Oldest part of the shell is called the umbo
  - Shell grows out from the umbo in concentric rings
  - No head present
  - No radula present

Types of Molluscs

Bivalves

- Adductor muscles secure valves together
- Muscular foot used for burrowing in bottom and other locomotion
- Water circulated with siphons

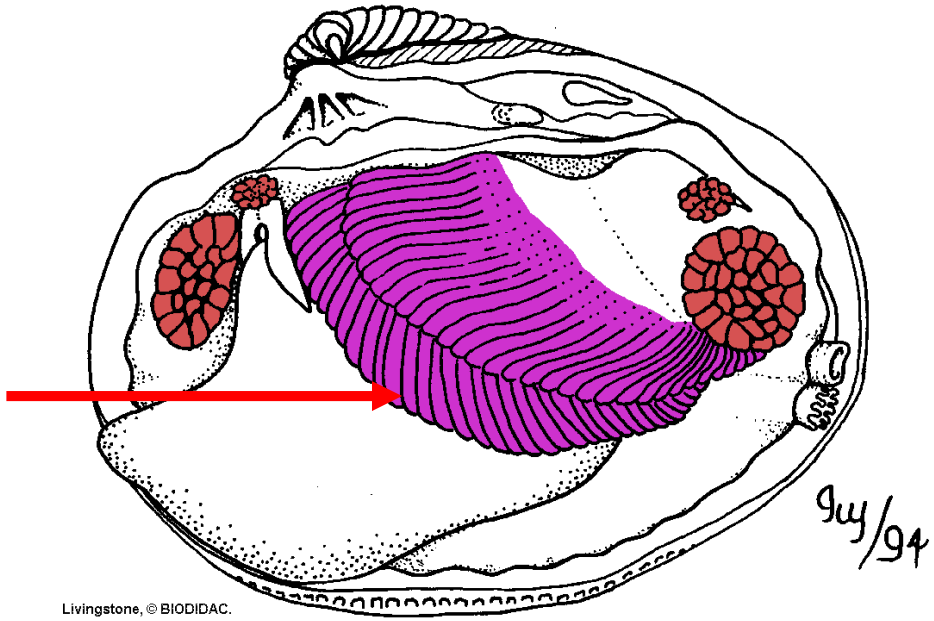




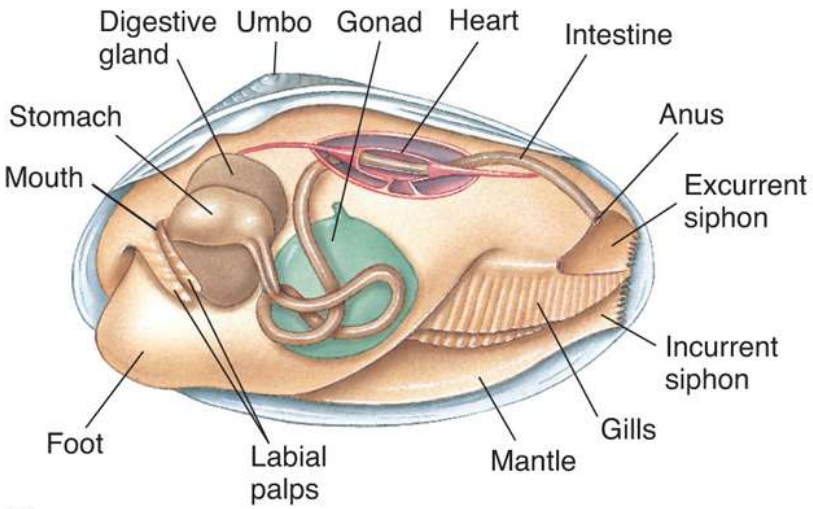
Types of Molluscs

Bivalves

- Gills for respiration & food gathering (filter feeding)
- Some species burrow, others attach to hard substrates via byssal threads, or grow attached to each other



Byssal threads



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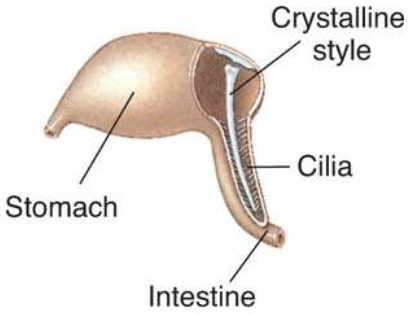

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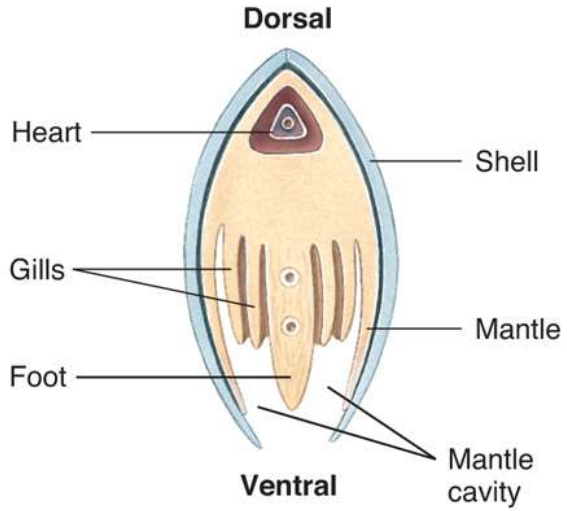

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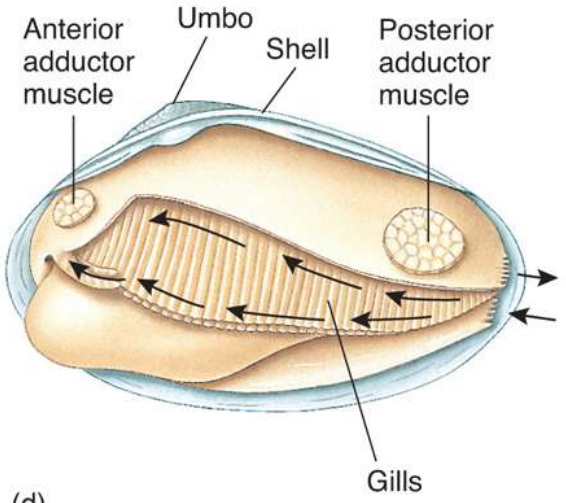

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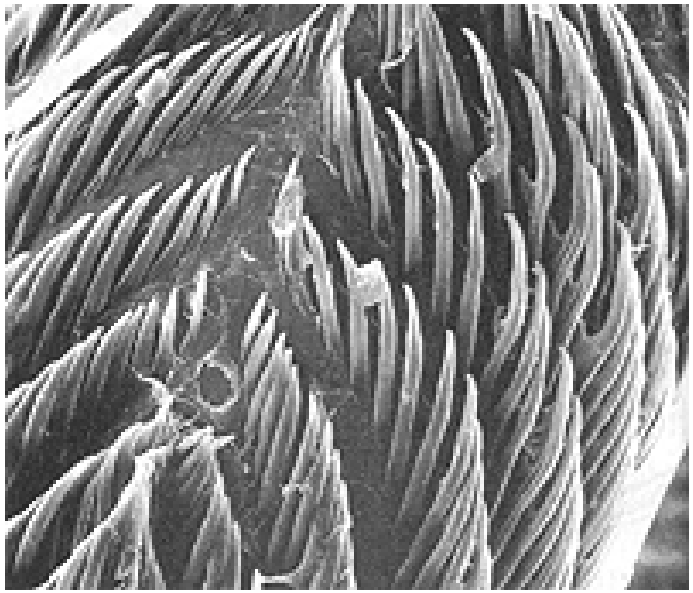
Types of Molluscs

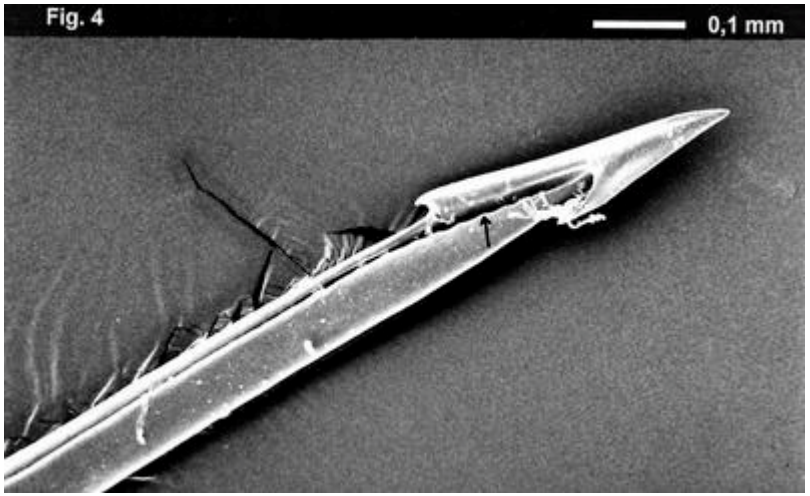
- **Gastropods**
  - –Largest class of molluscs, about 75,000 species
  - –Name means "belly-footed"
  - –Coiled shell on most species
  - –No shell on sea slugs (nudibranchs)

Nudibranch

Types of Molluscs

- **Gastropods**
  - Radula for grazing on plants in most, some are deposit feeders
  - Some species are carnivorous and use radula for prey capture (some will even prey on members of the same species)

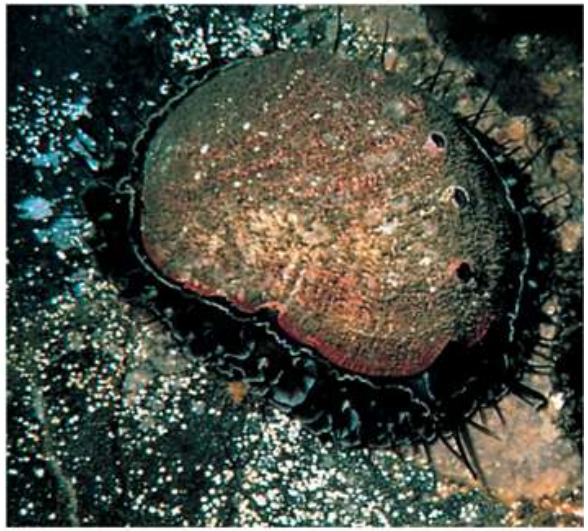




Harpoon-like radula

Littorina obtusata,
North Atlantic Ocean

© Charlie Arneson



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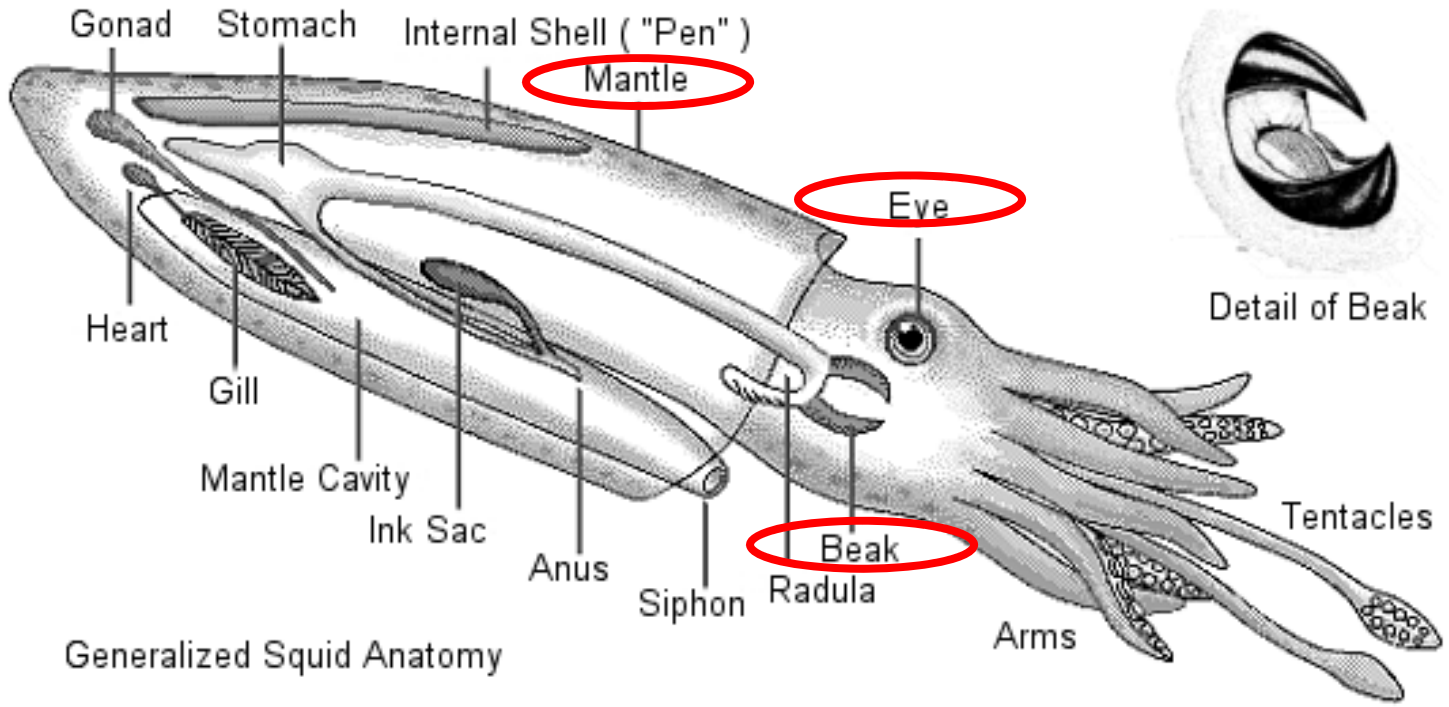
Types of Molluscs

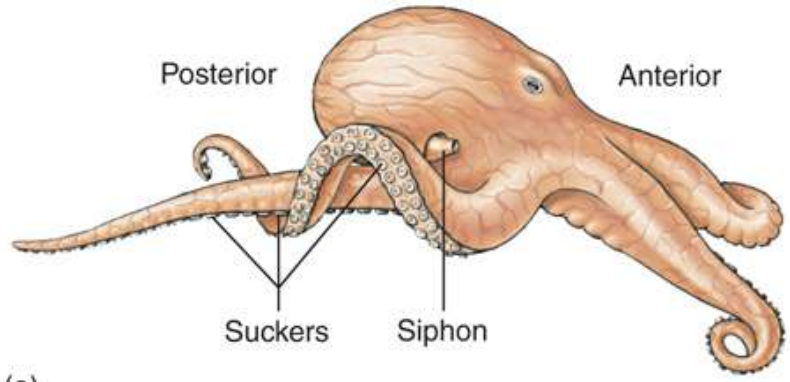
- **Cephalopods**
  - –Squid, Octopus, Nautilus, & Cuttlefish
  - –All 650 species marine
  - –Fast swimming predators due to water jet propulsion

Cephalopod jet propulsion
https://www.youtube.com/watch?v=9OIjaHIrM0U

Types of Molluscs

- **Cephalopods**
  - –Well developed eyes
  - –Thick mantle covers the body
  - –Use beak-like jaws and radula to crush or rip prey
  - –Adapted tentacles





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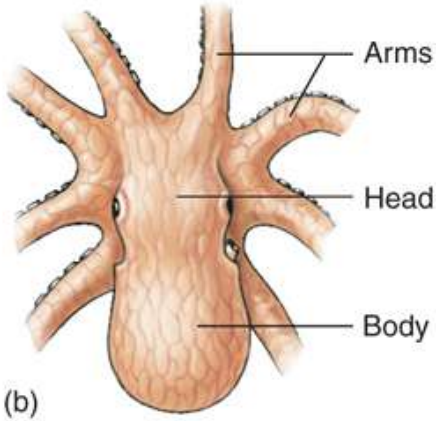

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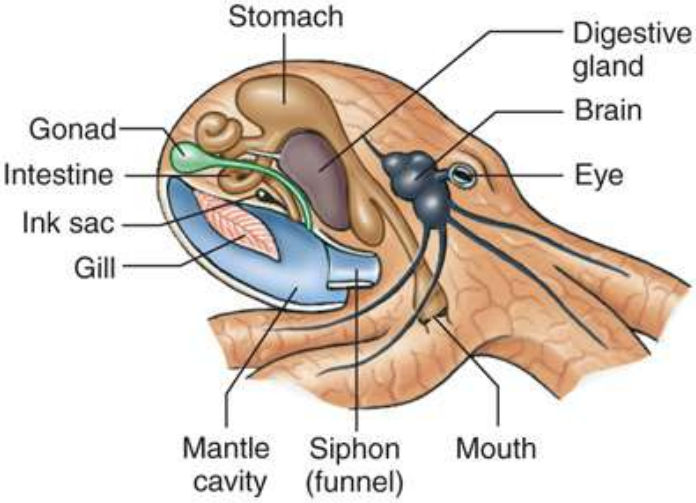


(c)

Blue-ringed octopus (*Hepalochlaena*), tropical Indian and Pacific oceans

Types of Molluscs

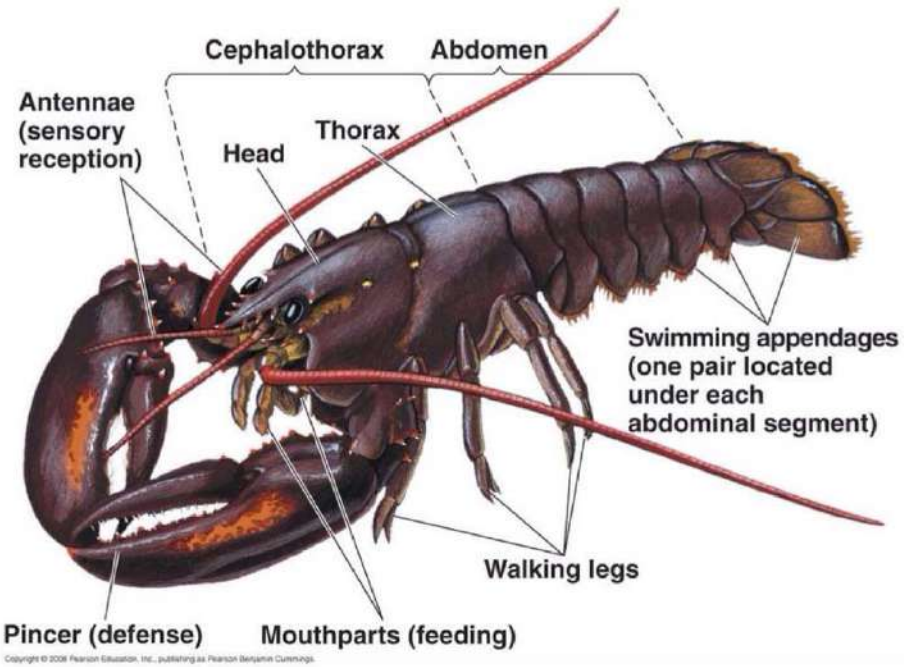
- **Cephalopods**
  - Shell internal or absent in most
  - Most advanced invertebrates
  - In octopus, the shell has been replaced by a beak-like jaw which can deliver a powerful bite
  - Some octopus have toxic bites
  - Ink sac is also seen in octopus to allow escape from predators
  - A stiff internal “pen” is seen in squid is a modified shell

Arthropods

- **Characteristics of Phylum**:
  - About 1 million species known, mostly marine
  - Most marine species are in a group of arthropods called crustaceans
  - About 75% of all animals on earth are arthropods

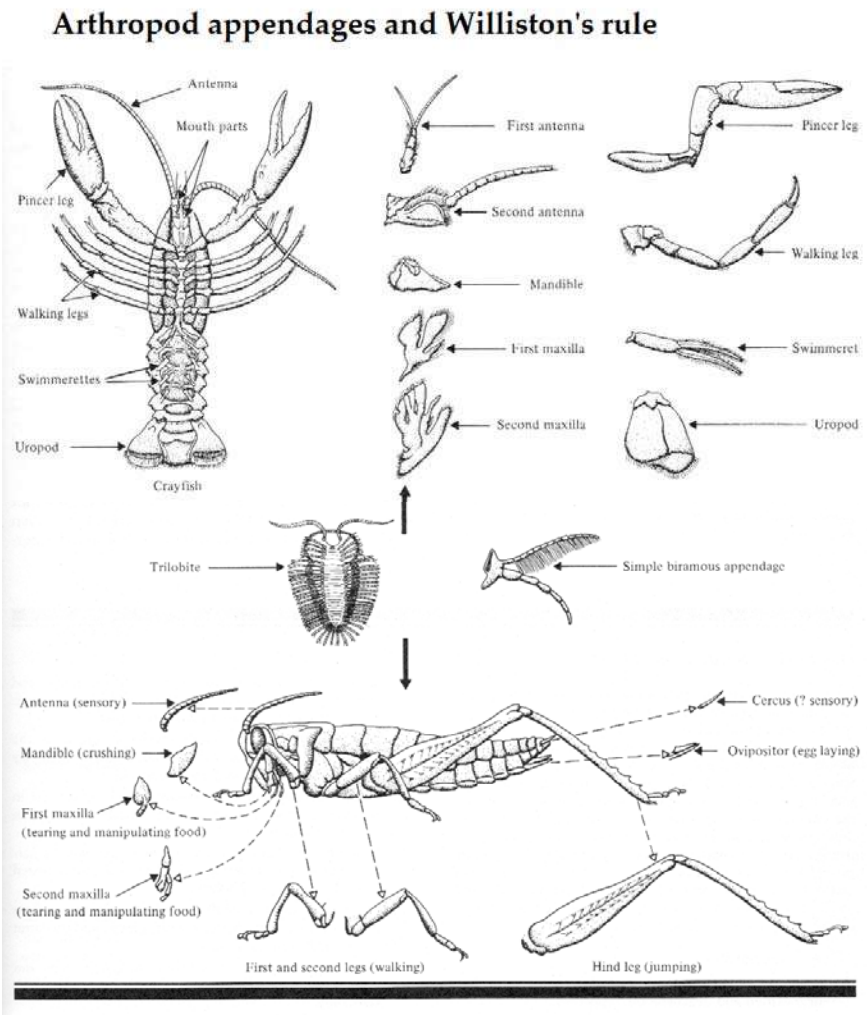
Arthropods

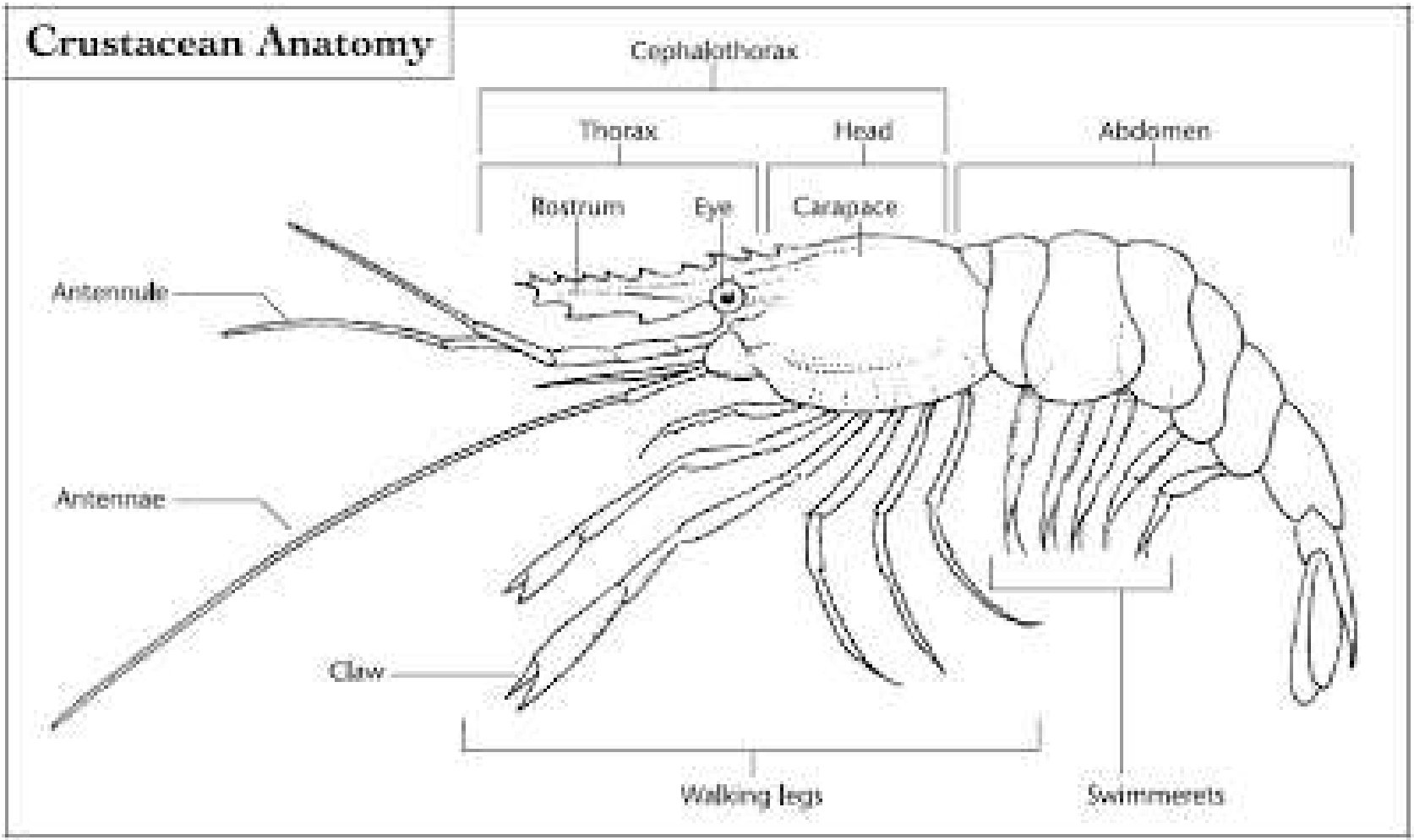
- **Characteristics of Phylum**:
  - Chitin exoskeleton- hard, but light and moderately flexible
  - Since the skeleton is external, an arthropod must shed the shell to be able to grow – this process is called molting. There is a soft new shell underneath.



Arthropods

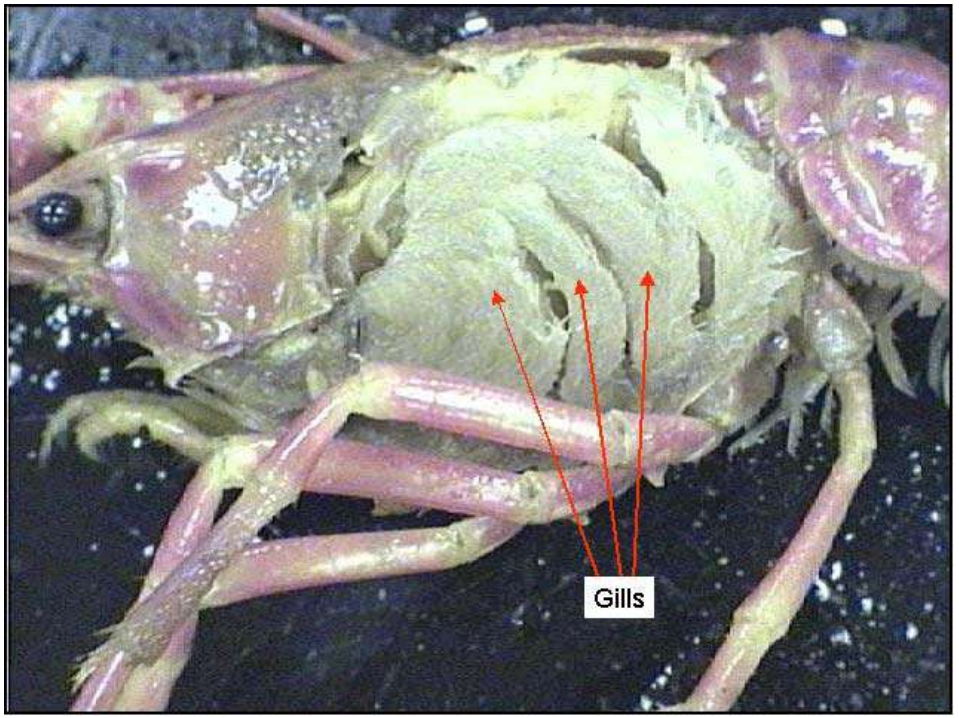
- **Characteristics of Phylum**:
  - Jointed appendages
  - Many divided into sections called head, thorax and abdomen
  - Specialized segmentation- segments combined for specific functions
  - Specialized eye & sensory organs- wide angle of vision




Crustacean Anatomy
Cephalothorax
Thorax
Head
Abdomen
Rostrum
Eye
Carapace
Antennule
Antennae
Claw
Walking legs
Swimmerets

Arthropods

- **Characteristics of phylum:**
  - Specialized respiratory structures, gills, used for gas exchange
  - Some are filter feeders, some scavengers, others carnivores



Arthropods

- **Characteristics of phylum**:
  - Male transfers sperm directly to female to ensure reproductive success
  - In some species, female will house eggs for a time until they are further developed

Peacock Mantis Shrimp

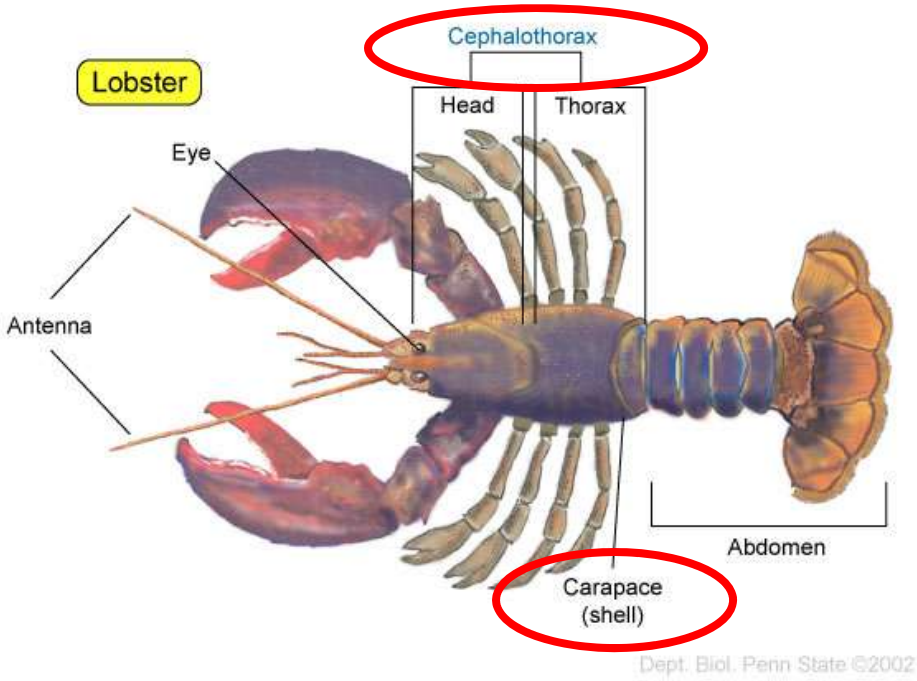
Arthropods

- **Characteristics of phylum:**
  - Females can store sperm for fertilization at a later time
  - Many arthropods have complex behaviors including mating rituals

Horseshoe Crab

Types of Marine Arthropods

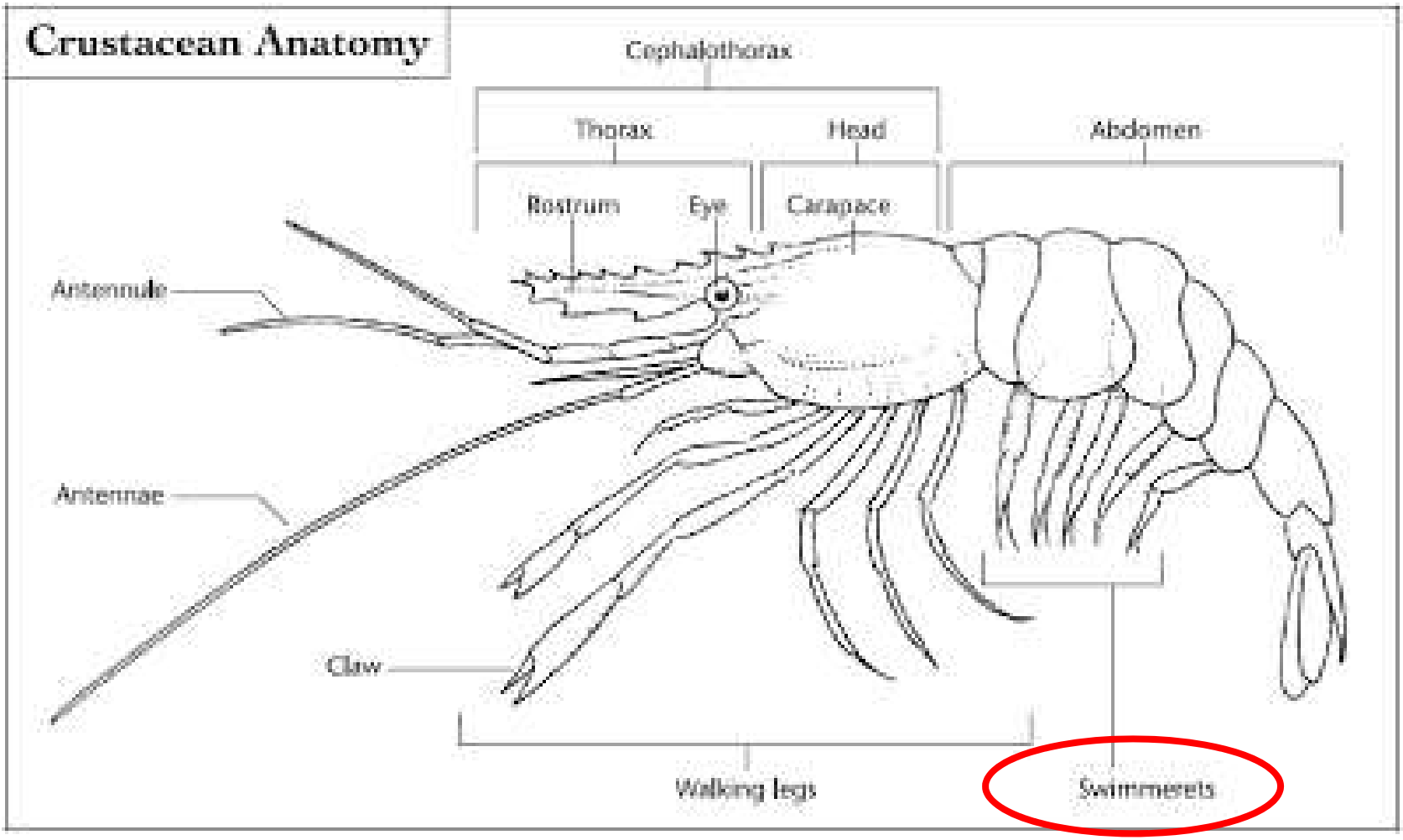
- **Crustaceans**
  - –68,000 species
  - –2 pairs antennae
  - –Gills for respiration
  - –Head and thorax fused into a single unit called a cephalothorax
    - –entire external body is called the carapace

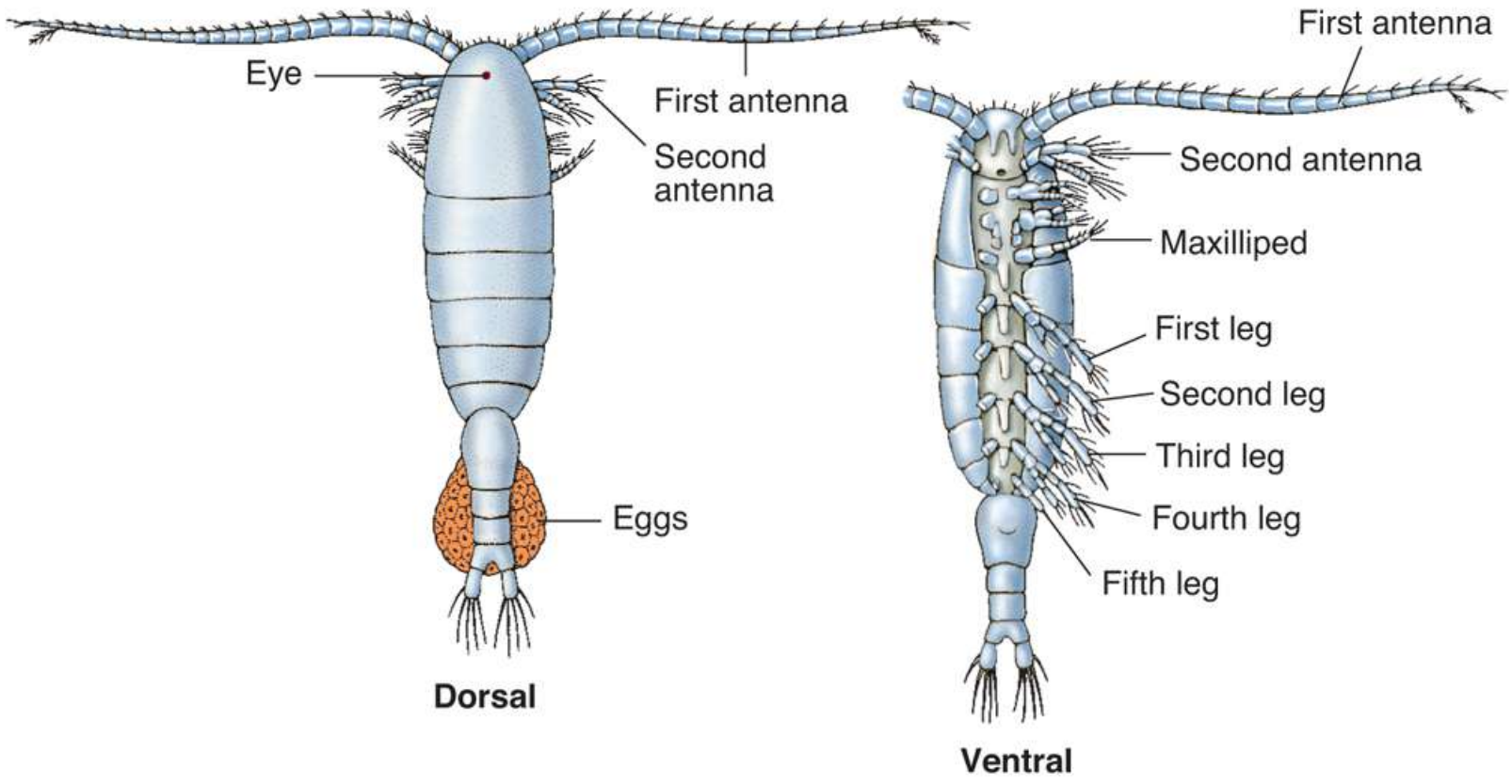


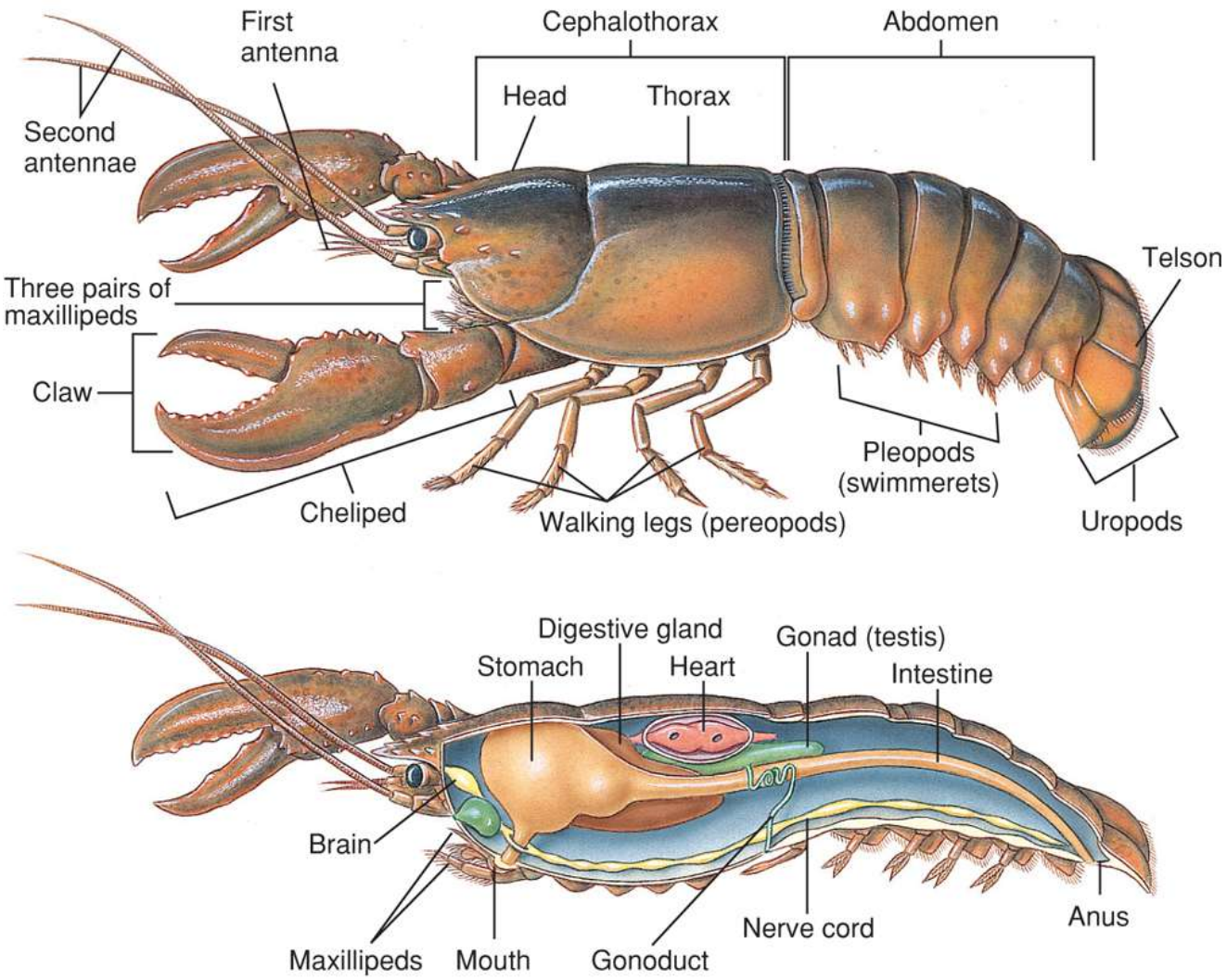
Types of Marine Arthropods

- **Crustaceans**
  - Large array of appendages specialized for different functions; ex: pinchers on crabs, swimmerettes on the underside of shrimp hold developing eggs, etc.
  - Types of crustaceans – copepods, barnacles, amphipods, isopods, crabs, shrimp, lobsters, etc.

Copepod


Crustacean Anatomy
Cephalothorax
Thorax
Head
Abdomen
Rostrum
Eye
Carapace
Antennule
Antennae
Claw
Walking legs
Swimmerets





Types of Marine Arthropods

- **Horseshoe crabs-**
  - –5 pairs of legs, first pair modified in males for reproduction
  - –Females larger than males
  - –Mating pairs come onto beaches each spring to breed and lay their eggs in wet sand

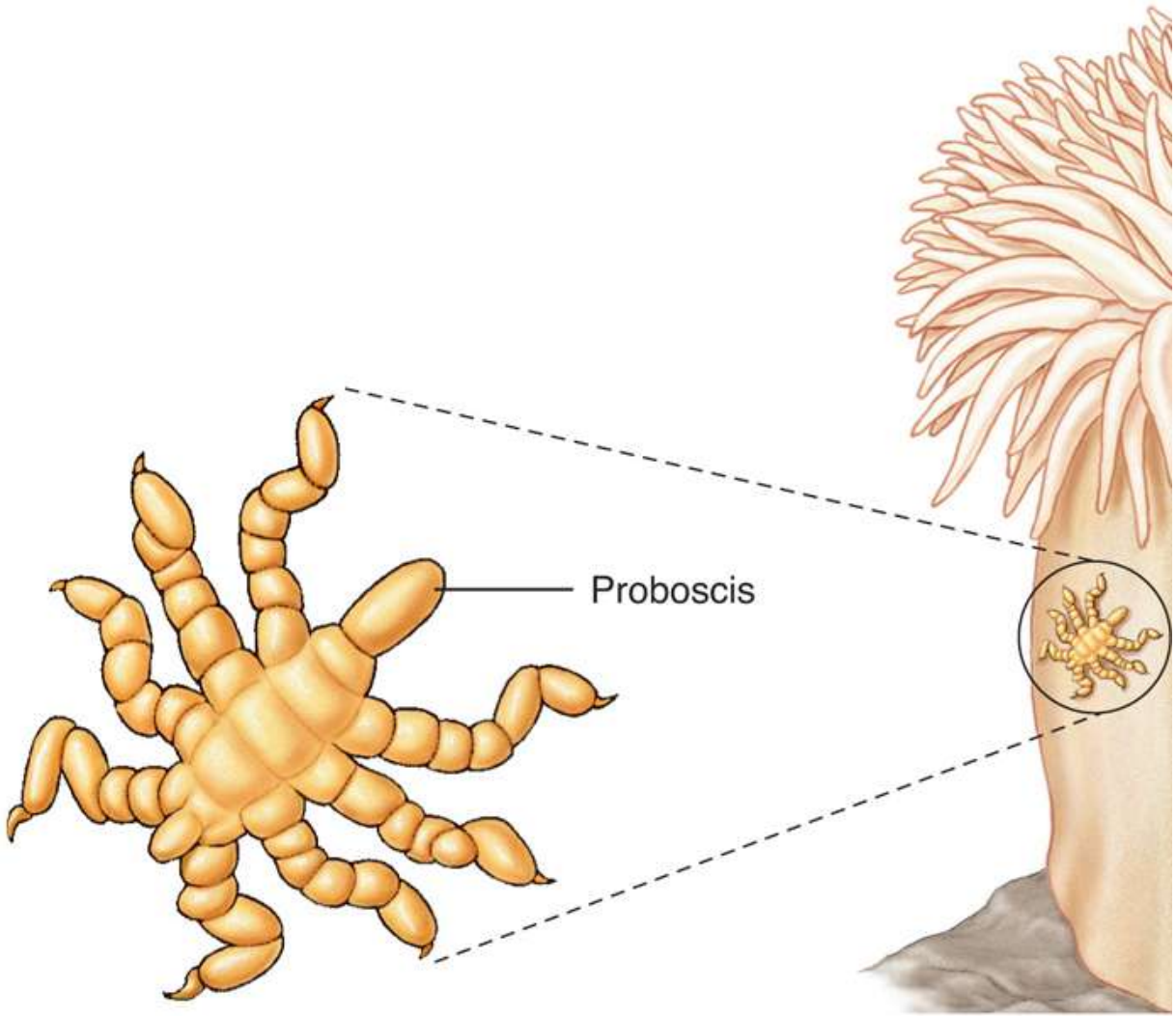
Types of Marine Arthropods

- ***Horseshoe crabs-***
  - –Among the oldest creatures on earth – they have remained virtually unchanged for millions of years
  - –They live and borrow in soft sediments, normally near shore where they feed on other invertebrates and scavenge.

Woods Hole Oceanographic Institute

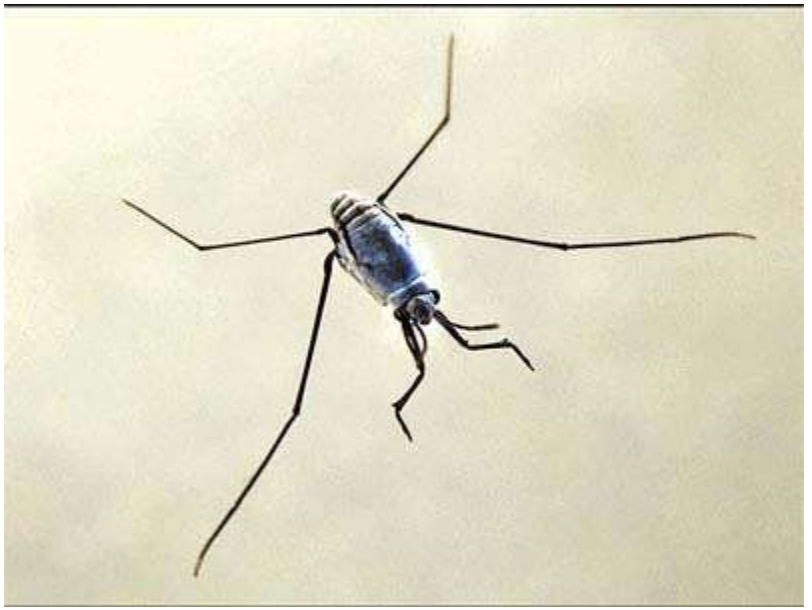
Types of Marine Arthropods

- **Sea Spiders:**
  - Four of more pairs of jointed legs
  - Not insects or true spiders
  - Possess a mouth and proboscis for feeding
  - Mainly feed on sea anemones and hydrozoans (they are voracious predators!)
  - More common in cold waters, but can be found worldwide



Types of Marine Arthropods

- **Insects:**
  - Very few marine insects exist
  - Many insects feed in the intertidal zone at low tide, but these are just temporary visitors



Sea Skater