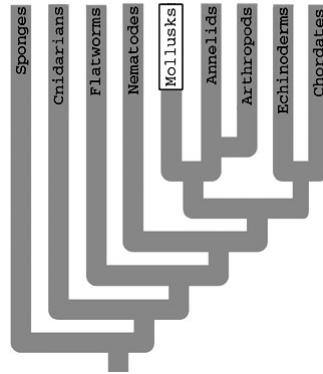


**Phylum Mollusca - Mollusks** - includes snails, slugs, clams, scallops, oysters, cuttlefish, squid, octopus

Widespread and abundant in marine, freshwater and terrestrial habitats  
Surpassed by only arthropods in terms of success on land

Includes some of the largest invertebrates:  
giant squid, and giant clam

Economically important as human foods, sources of pearls and other shell materials, some destructive to submerged wood, some introduced forms have caused ecological damage, some serve as intermediate hosts for human parasites, some can cause damage to crops



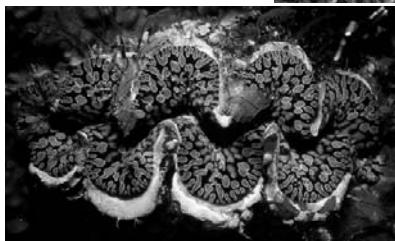
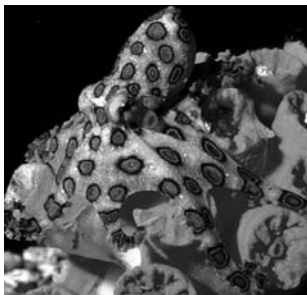
Seven classes of mollusks - Four classes covered here

**Class Polyplacophora** - chitons

**Class Gastropoda** - Snails, slugs, limpets

**Class Bivalvia** - Clams, oysters, scallops

**Class Cephalopoda**- Squids, octopus, cuttlefishes, *Nautilus*



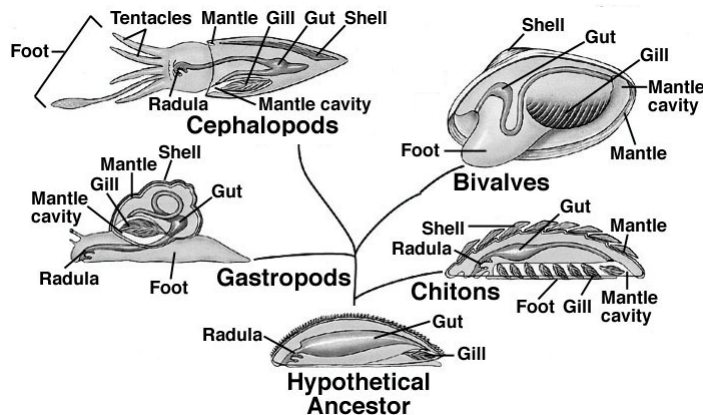
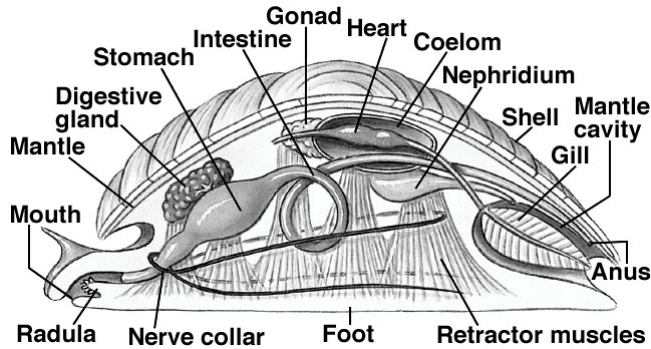
Mollusk body plan: **head-foot, visceral mass, mantle**

**head-foot** - continuous muscular mass - with sensory and feeding structures associated with head, and foot for locomotion

**visceral mass** - contains organs of digestion, reproduction, circulation, excretion

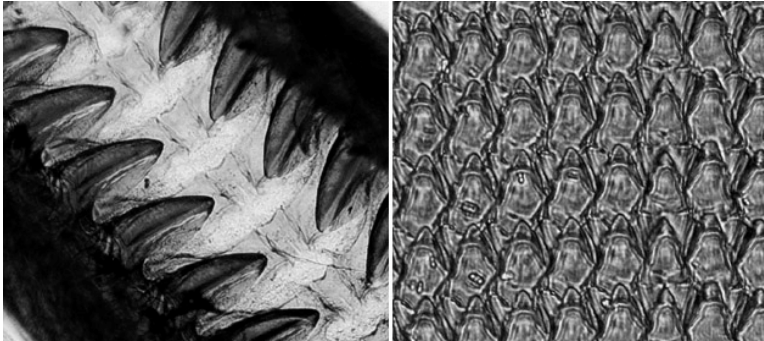
**mantle** - covers visceral mass and secretes shell

mantle cavity contains gills, and ducts for reproduction and excretion



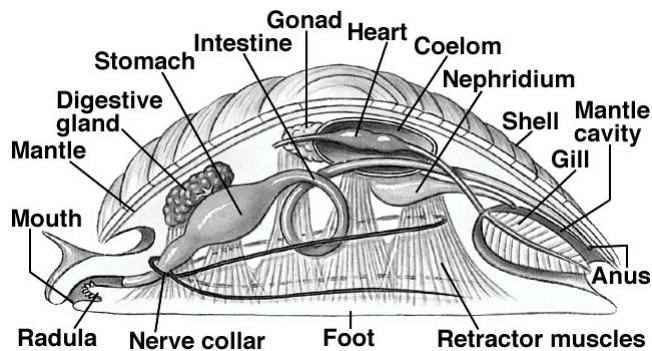
Basic body plan has been modified for different purposes in the different classes - Chitons closest to basic plan. Gastropods have twisted visceral mass. Bivalves have lost head, and gills are used for feeding. Cephalopods have modified foot into tentacles, and mantle is used for jet propulsion.

All mollusks except Bivalves possess a rasping, tongue-like, radula - composed of dozens of rows of chitinous teeth  
 Some gastropods scrape algae with radula, others use radula to tear apart prey or drill holes in shells of their prey



Circulatory system is open in most  
 Heart collects blood from gills and pumps to sinuses that extend through body  
 Cephalopods have a closed system of vessels and auxiliary hearts  
 Coelom is primarily represented by small area around the heart

Nephridium for excretion- collects fluid from coelom and empties into mantle cavity - valuable solutes resorbed by walls of tubule



## Reproduction

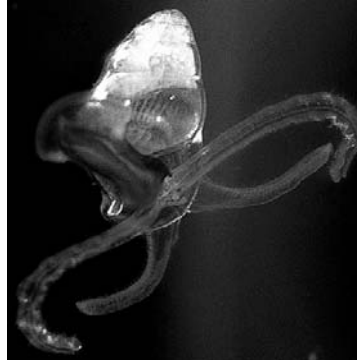
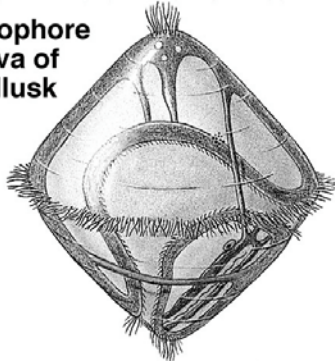
Most have separate sexes, some hermaphroditic, some change sex, most have internal fertilization, copulation between males and females (except in bivalves)

Mollusks dispersed through larval forms

Many have free-swimming trochophore larvae

A second free-swimming veliger stage may precede adult form

**Trochophore  
Larva of  
Mollusk**



## Class Polyplacophora - Chitons

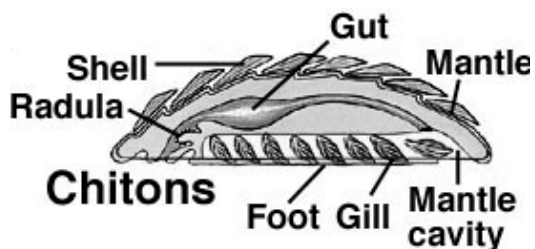
Have oval bodies, and shell with eight overlapping plates

Very similar to basic body form

Chitons creep along on broad, flat foot

Foot surrounded by mantle cavity with series of gills

Most are shallow water herbivores that graze on algae



**Class Gastropoda - Snails and Slugs**

Primarily marine, with many freshwater and terrestrial forms

Most have shell, shell lost in slugs

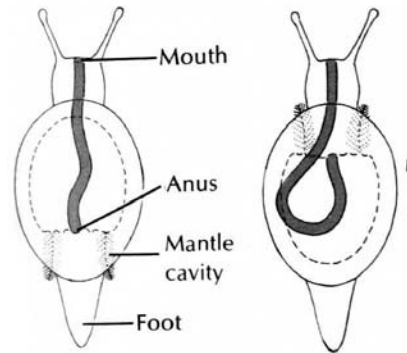
Head possess paired tentacles that may have terminal eyes



Visceral mass asymmetrical because of torsion (twisting) during development

120° twist results in loss of right gill and positioning of anus to the right of the head

Coiling of shell due to one side of snail growing faster than other - not due to torsion



Varied feeding habits

Terrestrial herbivores can be serious garden pests

Oyster drills bore into other mollusk shells, kill and eat body

Cone shells are predators with harpoon-like radula

Some sea slugs (nudibranchs) eat cnidarian polyps and incorporate stinging cells



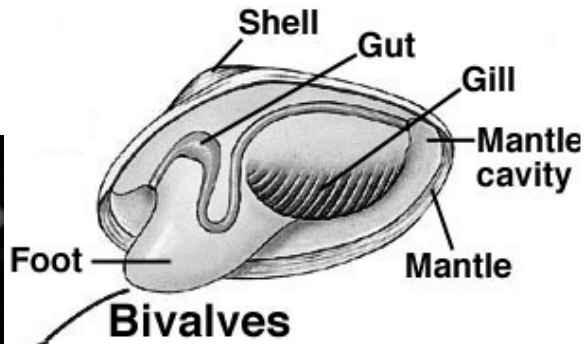
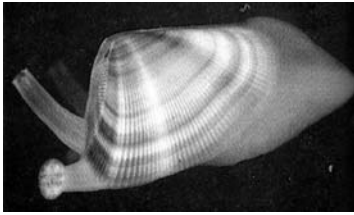
Terrestrial forms evolved a rudimentary lung under mantle

Air has much more oxygen than water - a lung is more efficient than a gill in air

Freshwater forms evolved from terrestrial forms and lack gills

**Class Bivalvia - Bivalves**

Includes clams, scallops, mussels, oysters



Have a single shell with two valves - hinged at top - held together by a ligament - closed by adductor muscles

Mantle covers entire body - secretes shells and ligament, often forms incurrent and excurrent siphons

Two pairs of gills are located under folds of the mantle - used for feeding and gas exchange

Foot is wedge-shaped - can be extended for crawling, burrowing, anchoring

Most forms are sedentary filter feeders

Food particles collected on gills and entangled in mucus - cilia on gills convey food to mouth

Planktonic larval stage (trochophore) allows dispersal

Scallops are unique, very mobile forms swim by open and closing shell



Abundant in marine and freshwater habitats

Freshwater mussels distributed worldwide

More than 500 species live in lakes and rivers of North America

Larvae brooded in special pouch in gill chamber

Larvae are parasites on fish - larvae are called glochidia

**Class Cephalopoda - Octopus, Squid and *Nautilus***

Active predators - most lack external shell (except *Nautilus*)

Foot has evolved into a series of tentacles

8 in octopus, 10 in squid, up to 90 in *Nautilus*

Tentacles snare prey, beaklike jaws bite, radula pulls prey into mouth



Have highly developed nervous systems

Rapid responses result from giant nerve fibers attached to mantle

Eyes are elaborate with retina similar to that in vertebrates

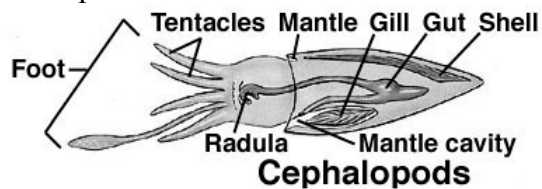
Exhibit complex behaviors and high level of intelligence

Take water into mantle and expel it through siphon for propulsion

Change direction of movement with siphon

May eject dark fluid to confuse predators

Most have closed circulatory system that provides more efficient circulation



Sexes are separate

Specialized tentacle in male transmits spermatophore to female

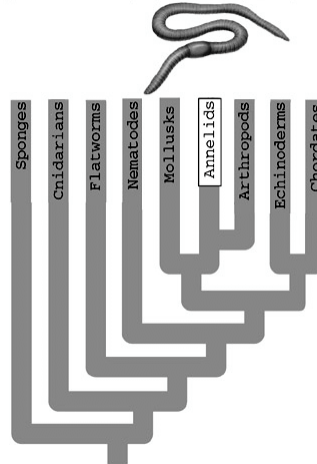
Eggs fertilized as they leave the oviduct

extensive parental care in some

**Phylum Annelida - Annelids - Segmented Worms**

includes sandworms, fanworms, bristleworms, earthworms, leeches

most are marine, but they are also common on land and in freshwater

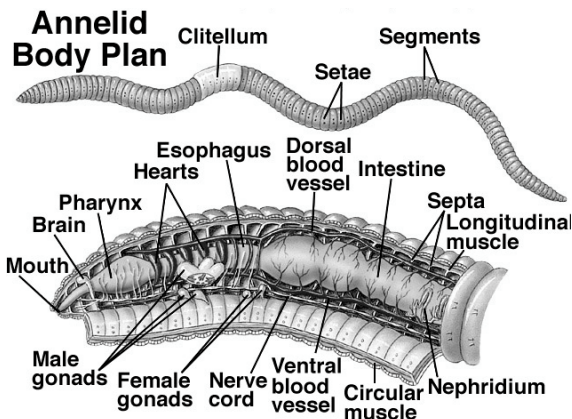


Segmentation is the key innovation for this group

Segments - modular structure - allows evolutionary and functional flexibility - slight modifications result in new functions

Each segment is a relatively complete unit - each partitioned from the others by septa,

Each segment contains its own excretory organs, and nerve concentrations that control the actions of the segment called "ganglia"



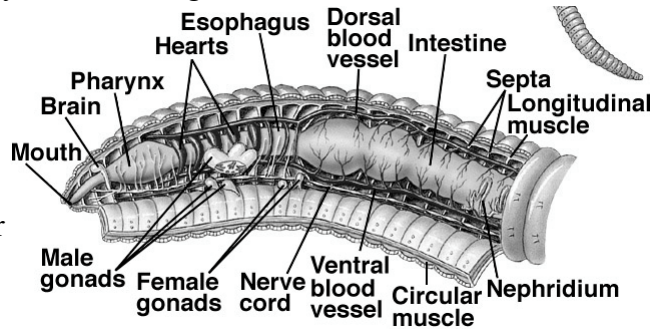
Each segment can expand or contract independently - with circular and longitudinal muscles working around water-filled coelom

Segments are specialized for specific functions

Anterior segments for feeding and sensory input - one segment has a brain that can control ganglia of other segments - connected by two ventral nerve cords

Other segments contain hearts that distribute blood through a closed circulatory system to all segments

Excretion by segmental nephridia - empty coelomic fluid to outside and recover solutes



Gas exchange occurs at body surface

Three classes of Annelids

**Class Polychaeta** - marine worms - fan worms, feather worms, tube worms, bristleworms, sandworms, etc.

**Class Oligochaeta** - earthworms - both terrestrial and freshwater

**Class Hirudinea** - leeches - mostly freshwater, some terrestrial and marine



**Class Polychaeta - Polychaetes -**

“many bristles” - marine worms

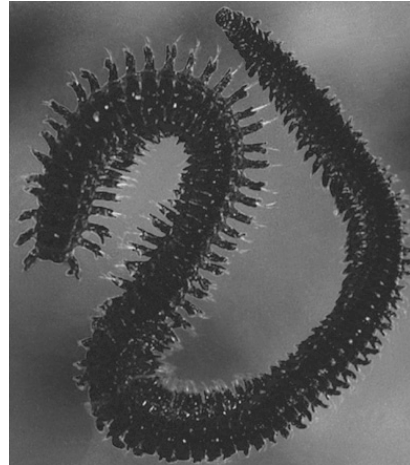
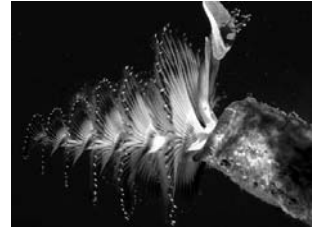
Have well developed heads with specialized sensory and feeding structures

Have paddle-like parapodia - for locomotion and aid in gas exchange - with many bristles called “setae”

Separate sexes with external fertilization -

Have trochophore larva - like some mollusks

An important link in marine food chains - many live in association with sponges, mollusks, echinoderms, crustaceans



**Class Oligochaeta - “few bristles” - Earthworms**

Usually burrow in soil - lack eyes - but have sensory systems that detect light, touch, and moisture

Have fewer setae than polychaetes - important in burrowing for anchoring segments in burrow

Eat soil and organic debris - muscular gizzard grinds food - castings deposited at surface - increase soil aeration and porosity

Hermaphroditic - individuals meet - clitellum of each forms mucus ball around partners - exchange sperm - eggs deposited into mucus ball - dries into “cocoon” - no larvae - fertilized eggs hatch as small immature worms



## Class Hirudinea - Leeches

Most are freshwater, some terrestrial and marine - most are predators or scavengers, some are parasites

Loss of septa between segments, most have no setae

Have suckers at both ends for prey capture, attachment, and locomotion

Hermaphroditic with mating similar to earthworms

leeches appear to have evolved from earthworms

Example: *Hirudo medicinalis*

the medicinal leech - a

parasite - mouth has

chitinous teeth, attaches,

bites, secretes anticoagulant

“hirudin” -

leeches are used to remove blood from beneath skin after surgery and from some wounds



Hirudin is used to prevent clot formation during surgery