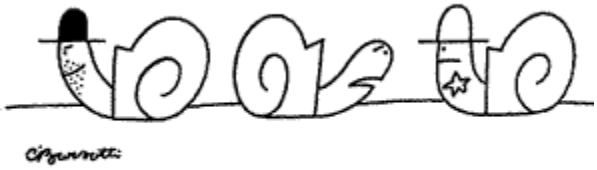
Zoology - PHYLUM MOLLUSCA

I. Compared and Contrasted to Pseudocoelomate Animals

"I don't care if she is a tape dispenser. I love her."

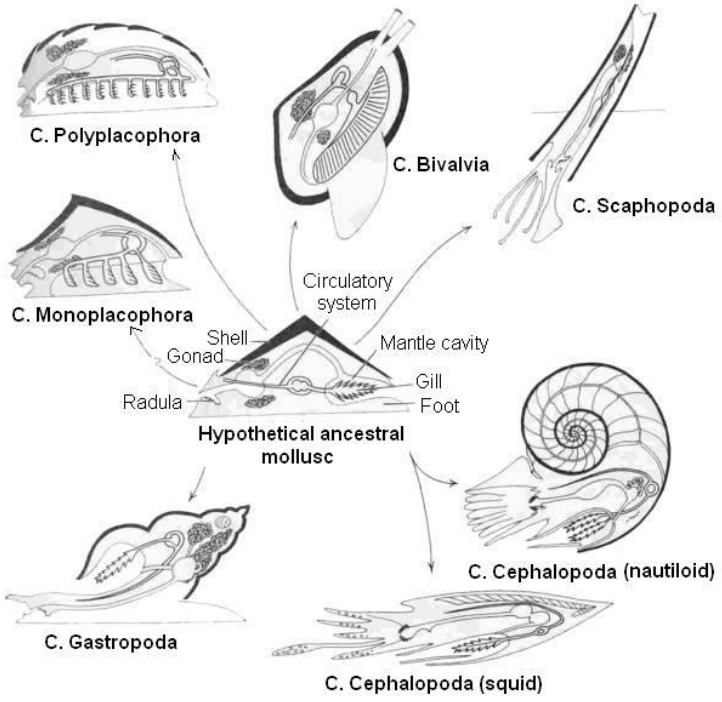
A. They are like the pseudocoelomate animals in that…
   1. They lack _____.
   2. They are _____ and generally mobile.
   3. They have well developed sense organs.



"He's long gone, sheriff--you'll never catch him."

B. They are more complex than the pseudocoelomate animals in that …
   1. They are our first group of animals with a true coelom. They are _____.
   2. All organs – including respiratory & circulatory – are present.
   3. They have a fleshy _____ that often secretes a _____.
   4. They have a rasping organ – the _____ – with which to feed.
   5. Cephalopods have a highly developed eye.

II. Characteristics of Phylum Mollusca



A. Contains nearly _____ living species and 35,000 fossil species.
   1. This rivals the arthropods in diversity of body forms & sizes
   2. Also rivals arthropods in terms of ecological success.
      a. Found in almost all environments: marine, freshwater, terrestrial

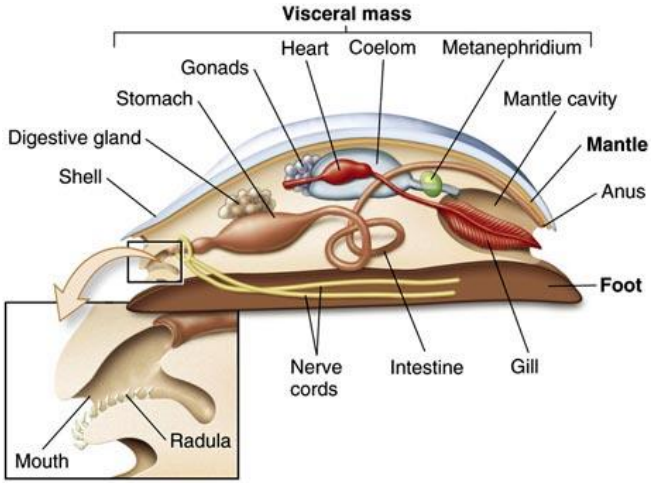
B. Includes snails, slugs, clams, octopuses, squids

C. Members of the phylum are bilateral and unsegmented.

D. Have a reduced eucoelom usually located around the _____ (pericardial cavity)
   1. Eucoelom sometimes surrounds the lumen of the gonads & part of kidney

E. Molluscan Body Plan:

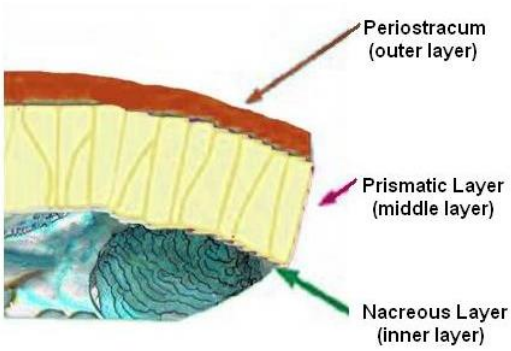
1. _____ - used for locomotion, digging, or modified for feeding
2. _____- contains digestive, circulatory, respiratory, and reproductive organs
3. _____ - formed by two folds of skin.
    a. Provides protection
    b. Increases surface area for gas exchange
    c. Secretes the shell in those molluscs that have one
    d. Provides locomotion in the _____
    e. Creates the mantle cavity between the mantle and the visceral mass which houses the _____
4. _____ - rasping tongue
    a. Not all molluscs have a radula, but if an animal does have one, it is a mollusc.



F. **All organ systems are present**

- Digestive System - complete (from mouth to anus) with radula
- Respiratory System - gills, lungs, mantle, epidermis
- Skeletal System - shell in most, usually external, internal in some
- Muscular System - complex system, not just longitudinal or circular
- Excretory System - _____ (kidneys); distinct organs not just scattered cells as are protonephridia
- Nervous System - is a complex of several ganglia; plus have specialized sense organs for touch, smell and vision
- Circulatory System – usually with a _____ _____
    - _____ system - no capillaries - just sinuses, with a dorsal heart
    - _____ system - capillaries present (found only in _____)
- Reproductive System - usually dioecious, monoecious in some

G. **Molluscan shell structure**

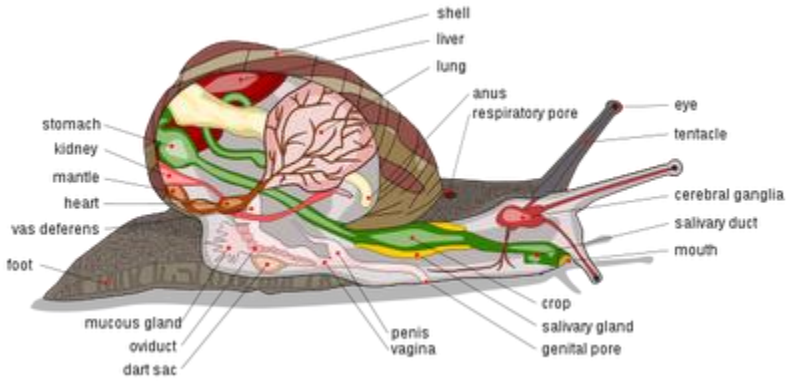


1. _____ layer - outer horny layer; organic material
2. _____ layer - middle layer, calcium carbonate
3. _____ layer – mother of pearl

Molluscan classes

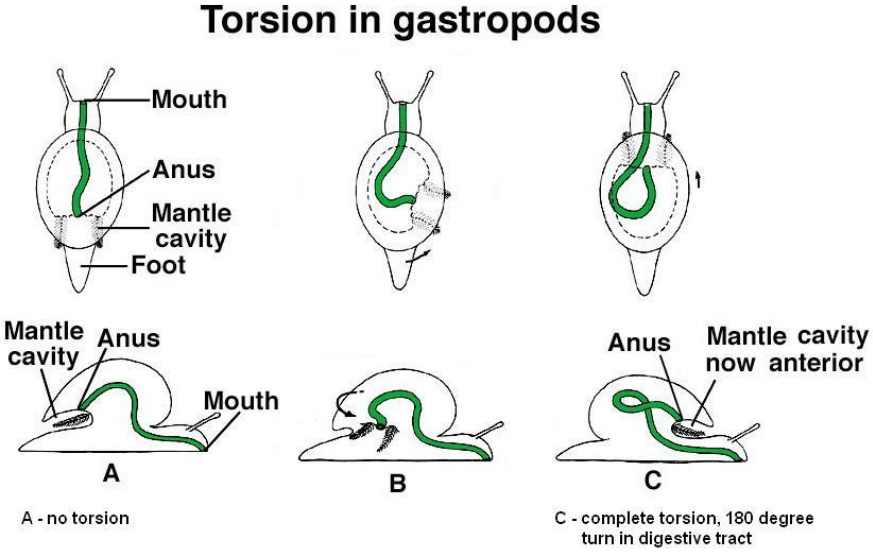
MOLLUSCAN CLASSES

I. Class Gastropoda - _____



A. The largest of all molluscan classes, most of the ~40,000 living species
B. Shelled forms are called snails, forms w/o shells are called slugs.
C. Tentacles with eyes; 2 pair in terrestrial species
D. Head well developed, anterior
E. Well developed ventral foot

F. Most species show _____- twisting of body to the right (it is not coiling)



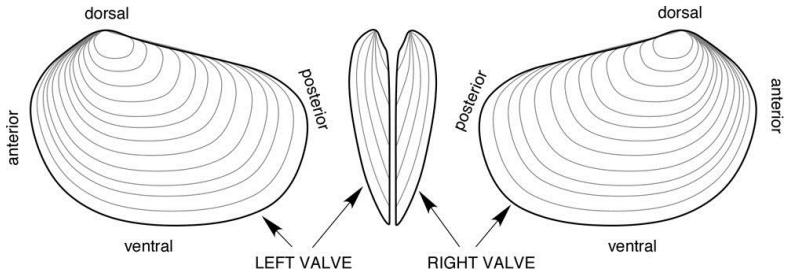
1. Primitive condition- no Torsion (A in figure)
2. Advanced condition – Torsion (B in figure)
3. Really advanced – Detorsion (C in figure)
4. Adults asymetrical due to torsion
5. Torsion results in:
   a. loss or reduction of organs on right side
   b. allows for snail to withdraw into shell in the following order: _____

G. Feeding - well developed radula
1. in some radula modified; i.e., cone shells. **Are cone shells the mostly deadly animal on earth?** Watch this video: http://youtu.be/zcBmMPJrrKk
2. most are scrapers, a few are predators

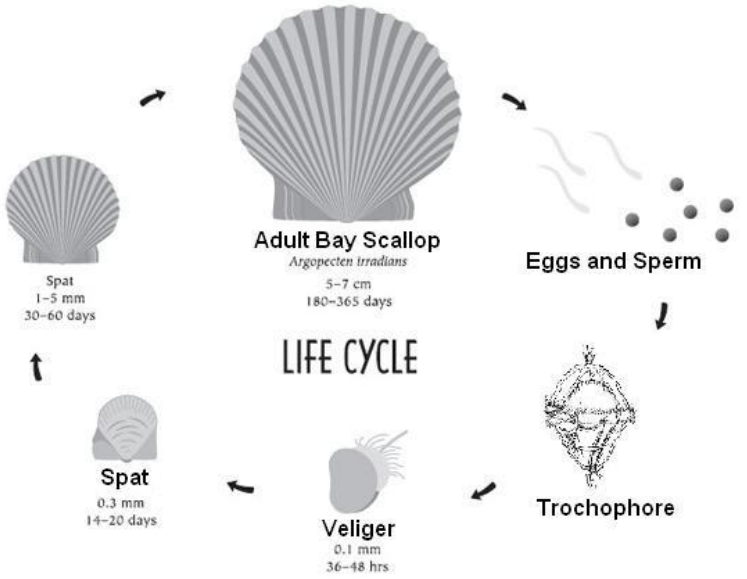
H. Respiration - in most species gastropods have well developed _____ in mantle cavity
1. terrestrial snails have functional _____ in mantle cavity

I. Reproduction - most gastropods are _____, but cross-fertilization is the rule
1. Some are dioecious
2. Usually rely upon internal fertilization
3. Marine species have trochophore larvae
4. Freshwater and terrestrial species have direct development

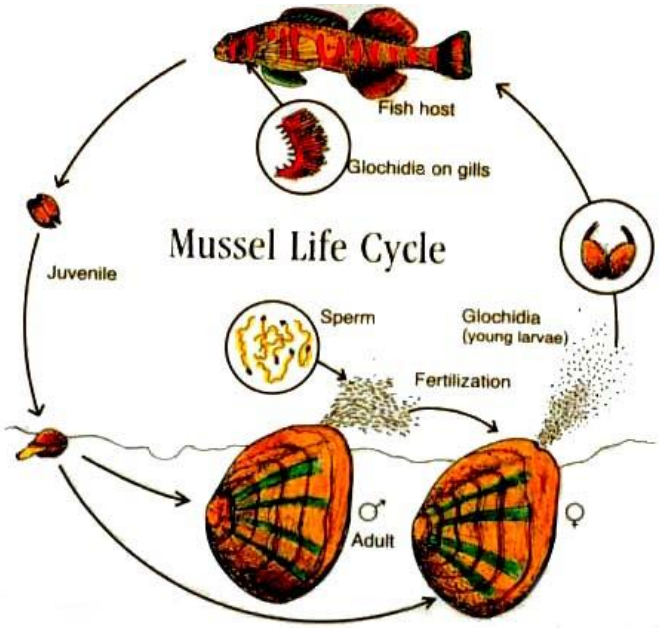
II. **Class _____ (= Pelecypoda) - clams, scallops, oysters**



A. ~8,000 living spp., mostly marine
    1. There are many freshwater spp.
    2. There are NO terrestrial spp.
B. Shell is divided into two parts (valves) and is hinged
    1. Body is laterally compressed
    2. No head or radula
    3 Large hatchet shaped foot
C. Filter feeders
D. Their gills have multiple functions
    1. Respiration
    2. Feeding
    3. Reproduction
E. Most are _____ (e.g., oysters) or very slow movers (clams);
    1. A few move actively (scallops): http://youtu.be/_2iXHBuSIJY
F. Their heart is situated in pericardial cavity (=coelom)
    1. Moves blood around to kidney, gills, and mantle
    2. There are a limited number of true blood vessels
G. Reproduction in bivalves - They are _____



1. Marine species life cycle; e.g., oysters
    a. Eggs are produced by females & released
    b. Fertilization is mostly external
    c. The embryo develops through a _____, then _____, and _____ stage to reach adulthood.
    d. Very high reproductive potential (50,000,000 eggs/yr)



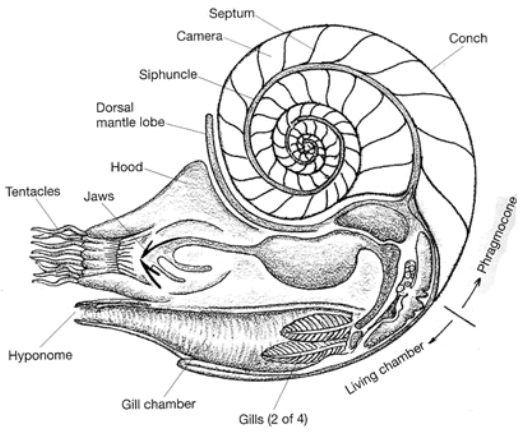
2. Some freshwater species life cycle; e.g. mussels
   a. Females produce eggs which are kept internally
   b. Internal fertilization
   c. They develop in mother's water tubes into bivalved _____
   d. Glochidium larva live as a parasite on _____ (attached to gills or skin) for several weeks.
   e. They disengage & sink to the bottom to live as independent adults
   f. High reproductive potential

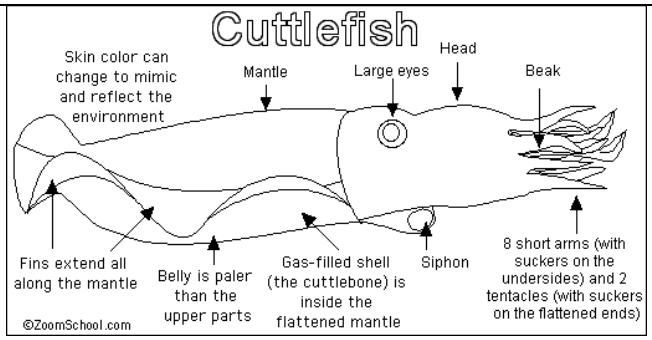
III. Class _____ - octopods, squids, & chambered Nautilus

A. Most of the 650 living spp. are active swimmers.
   1. Most species of octopus have secondarily assumed a _____ lifestyle.
   2. Includes _____– largest known invertebrate (up to 20 meters long with tentacles)
   3. Includes the most intelligent & the fastest swimming aquatic invertebrates (_____)
   4. Includes forms with external shells (_____) & internal hard shells (_____)


"This whole secret handshake thing was your idea, so YOU figure out how to undo it!"

Nautilus	Cuttlefish
	

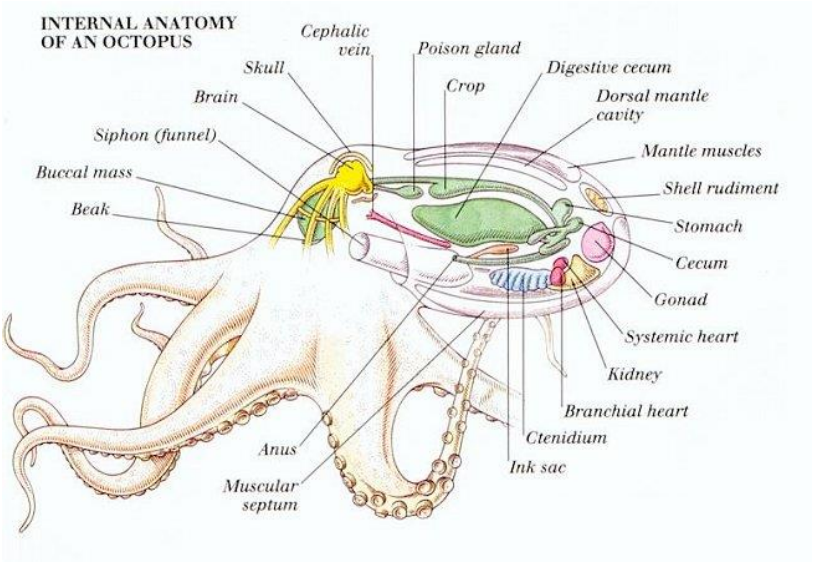




Video of Cuttlefish:
http://youtu.be/AoK3qoihrU8

B. All are marine _____
C. All have extreme modification of the foot
1. i.e., _____ and _____ homologous to molluscan foot

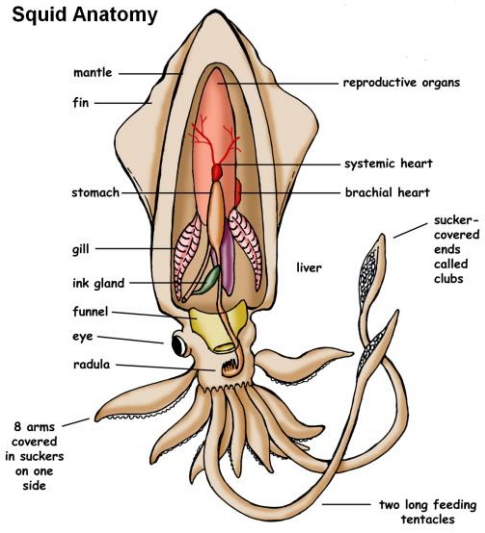
Watch this video of octopus camouflage: http://youtu.be/ckP8msIgMYE
Watch this video discussing what octopods do for a living: http://youtu.be/5oExwxkuT_c



D. Shows highest development in molluscs of:
1. Brain
2. Eyes - have cornea, lens, retina; sees real images
3. Nerves
d. Locomotion (with _____)
4. Circulatory system (_____) with developed blood vessels; complex heart (an adaptation to an active lifestyle

5. Radula is modified into _____ - for predation
6. Has _____ for protection

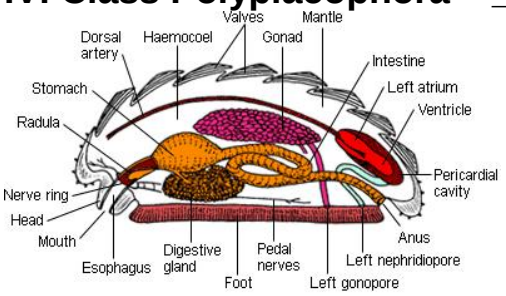
D. Reproduction - dioecious
1. Show some sexual _____
2. Males have modified tentacles for sperm transfer and holding female in copulation
3. Fertilization is internal
4. No free living larvae; egg hatches into a juvenile



5. Some (e.g., octopus) show maternal care
6. Due to higher survivability of offspring, they show lower reproductive potential

E. Respiration
1. Well developed pair of gills
2. Gills with well developed blood vessels

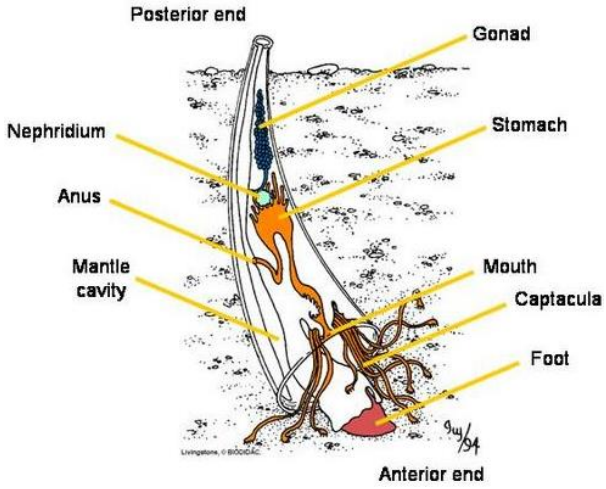
IV. Class Polyplacophora – _____ - "_____ plates"



A. Usually have 8 overlapping dorsal plates or shells
B. Reduced head, no eyes or tentacles
C. All marine
D. Usually live on rocky shores
E. Have radula, gills
F. External fertilization
G. Scrape algae
H. Approximately 600 described species are generally flattened & elongated animals

V. Class Scaphopoda - _____

A. slender, tubular shells open at both ends
B. ~350 described species, all marine, between 3 & 6 cm long (max. of a living species is 15 cm)
C. Lie buried in soft sediments, in shallow to moderately deep water (usually < than 2,000 meters deep), the larger end facing downward & the smaller aperture projecting above the surface.
D. Mouth is surrounded by tentacles bearing adhesive knobs, which capture small organisms
E. No defined head
F. No gills, respiration across mantle



VI. Class Monoplacophora - "_____"

A. Until _____, they were known only from fossils. There are only 11 described living species

B. All Monoplacophorans are known from deep marine waters (>12,000 feet)

C. They have a single circular (cap-like) shell with radula.

D. They possess many primitive features & studies of their internal anatomy have provided much fuel for debates about molluscan evolution.

VII. C. Aplacophora - "without plates"

A. deep marine, not much is known about them

B. There is debate over separating them into two classes:

1. C. Caudofoveata – small worm-like molluscs that live buried head down in the sea floor. ~70 described living species
2. C. Solenogastres – small worm-like molluscs that live symbiotically (or feed upon) cnidarians. They have no shell, eyes, or tentacles. ~250 described species, usually living over 200 meters deep, where they are sometimes quite abundant