

# Phylum Mollusca



# General Molluscan Characteristics



= mollis = soft  
Bilateral symmetry,  
secondarily assymetrcial  
=> Soft bodied animals  
Coelomate and triploblastic

Rich fossil record



Next to arthropods, largest  
and most diverse  
Adaptive body plan

Shell etc. secreted by mantle

# General Molluscan Characteristics



Thick cuticular-epidermal mantle

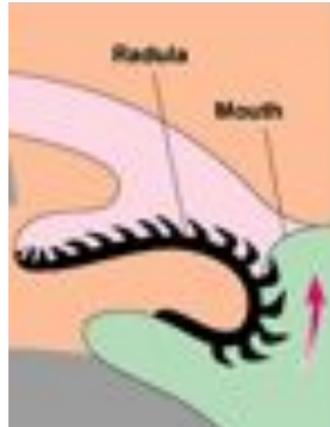
Heart in pericardial chamber

Radula

Complete gut

Microscopic to 20 m  
Giant octopus = 40kg





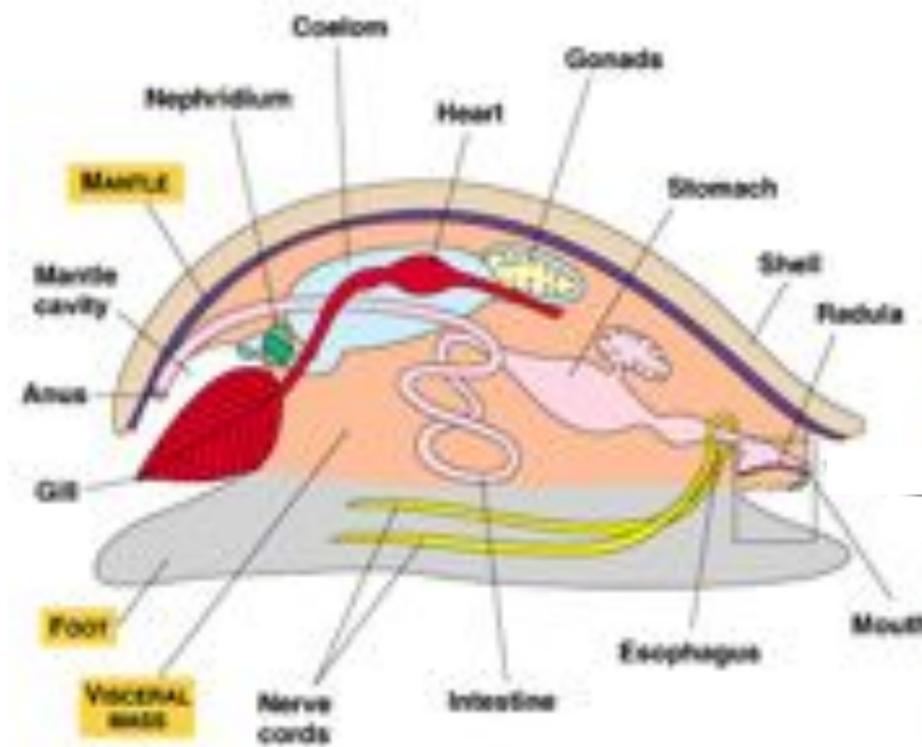
# General Molluscan Bauplan

= hypothetical ancestral mollusc

Molluscs can be derived from single model

=> incorporates diagnostic features

Reduced coelom = hemocoel



protostyle

bipectinate ctenidia

= respiration/feeding

radula/odontophore

complex

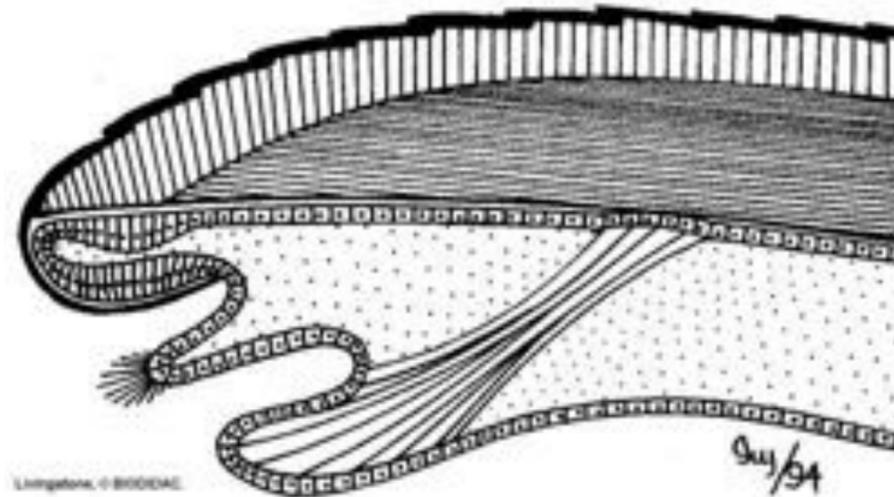
thick epidermal mantle

A. Head-Foot

B. Visceral Mass/Hump

C. Mantle/Pallium

# Shell



Periostracum

Thin layer of organic coating

= conchiolin or conchin

Prismatic

1 of 2 calcium carbonate

layers (calcite or aragonite)

Nacreous or mother of pearl

Aragonite arranged in parallel lamina, elastic biopolymers (chitin, lustrin and silk-like proteins)

Periostracum and prismatic = secreted by specialized peripheral mantle cells

Nacreous = secreted by majority of mantle

# Bodywall

Composed of

1. Cuticle

Amino acids &  
Sclerotinized  
proteins

= conchin

2. Epidermis

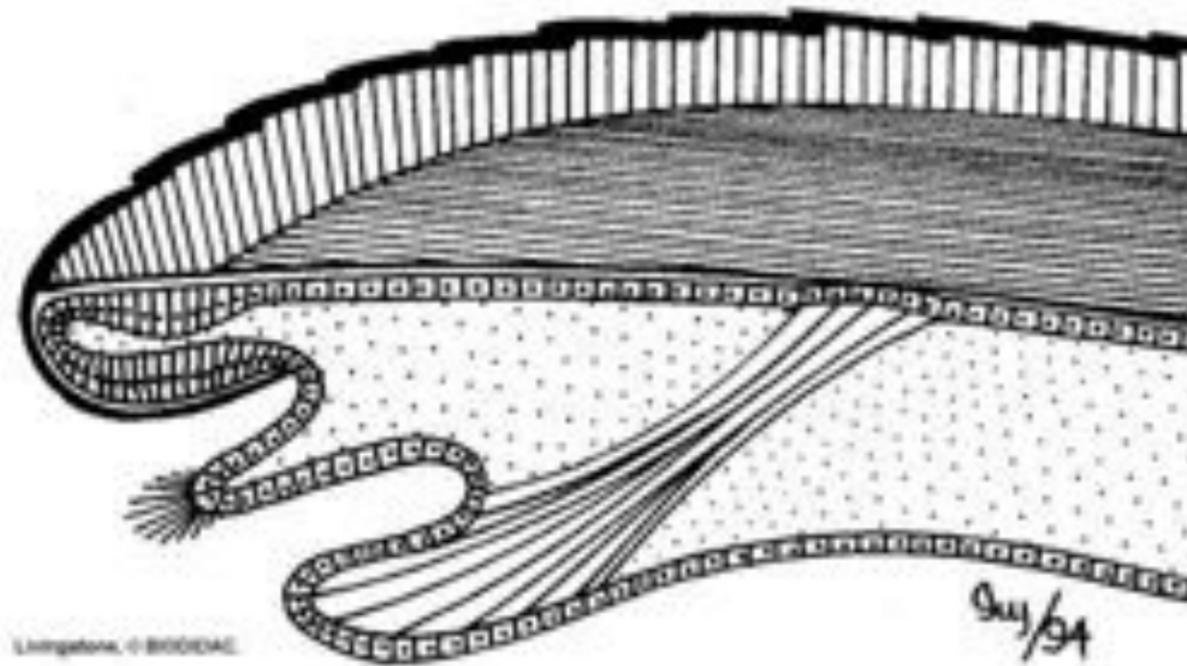
Single layer

Cuboidal or columnar, ciliated

Secrete cuticle, shell other glandular function not known

3. Muscle layer

3 distinct layers = circular, diagonal and longitudinal



# Nutrition and Feeding

= tremendous variation



(A) Grazers

= gastropods/polyplacophora  
*Patella* = epiphytes/epizooites,  
radula and mucus laden string  
*Katherina* = subradular organ  
buccal cavity, mucus



(B) Herbivores = gastropods

Large aquatic/terrestrial plants, crop/gizzard adaptations

(C) Carnivores

Aplacophora = cnidarian diet

Gastropoda = radula modified or proboscis

*Busycon/Fasciolaria* = whelks,

*Urosalpinx/Lunatia* = drillers

Bivalves = muscular septa, Cephalopods = beak



# Nutrition and Feeding

(D) Scavengers/Deposit Feeders = Aplacophora, Gastropods, Bivalves

*Strombus* = proboscis, vacuum cleaner

(E) Suspension Feeders = Gastropods, Scapopods

*Crepidula* = lengthened gills, food trapping

Pteropods = mucus net, scaphopods = captacula

(F) Filter Feeders = Bivalves

Lengthened and folded gill filaments, plankton sieved out by gills

(G) Parasites = Gastropods, Bivalves

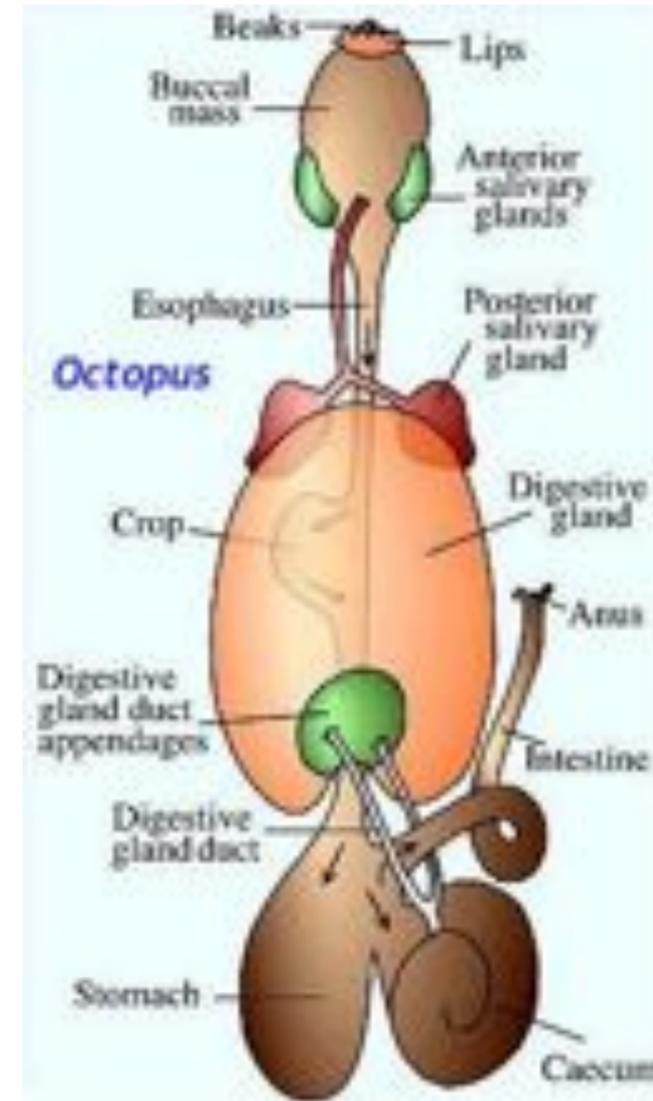
Ecoparasites = suck blood with pharynx, endoparasites = sucking proboscis, in echinoderms (Holothuroids)

*Entovalva* = endoparasite, in holothuroid gut

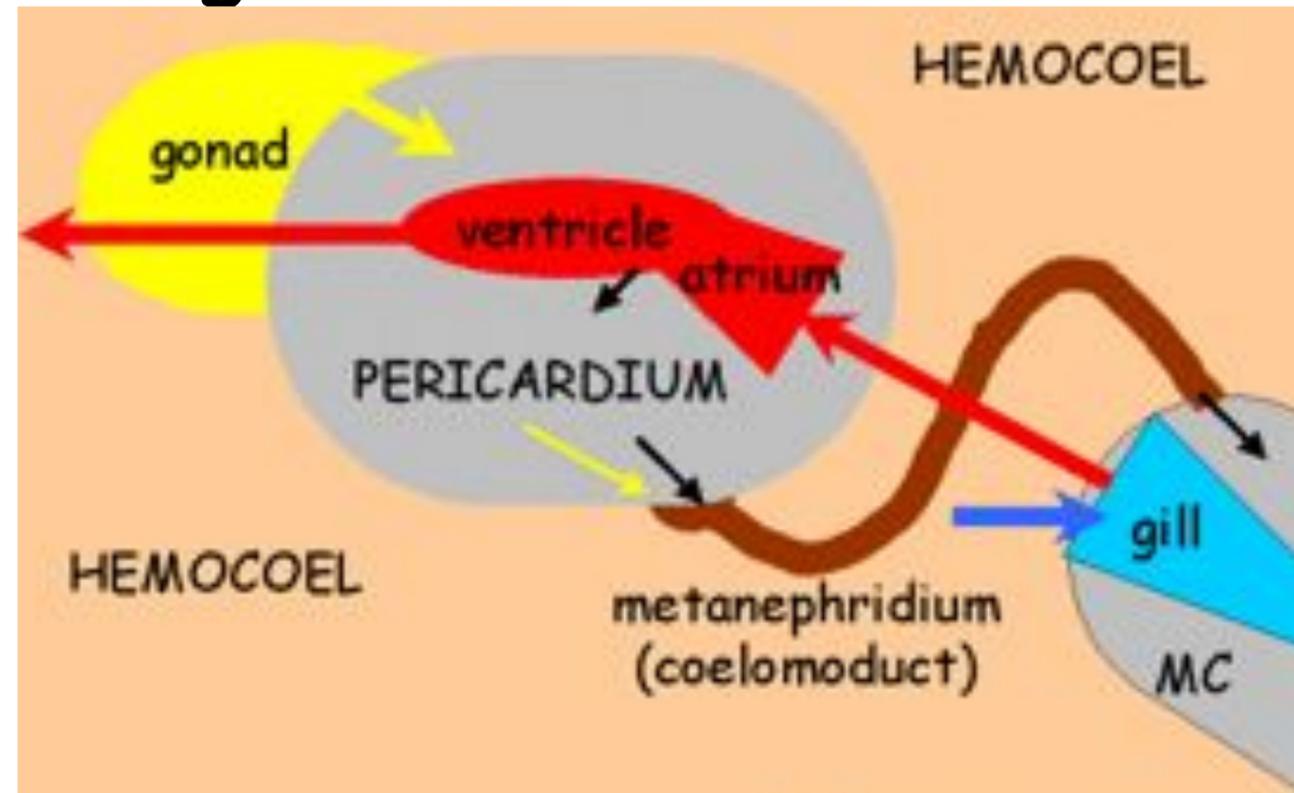


# Digestive System

Complete gut, hollow tube  
= separate mouth/anus  
Some regional specialization  
= highest degree in  
cephalopods  
Digestive glands or caecae  
= digestive enzymes  
Most digestion intracellular  
Some extracellular  
= stomach and digestive caecae  
=> the higher evolved the more  
extracellular



# Osmoregulation/Excretion/Circulation



Metanephridia = paired, called kidneys, # of pairs varies  
-> nephrostome -> pericardium -> nephridiophore, waste  
Hemolymph = open versus closed, heart & body wall  
propulsion

# Reproduction

Sexual, asexual is rare

(A) Dioecious/ Gonochoristic

Separate sexes in most molluscs

Chitons, bivalves, cephalopods

(B) Sequential Hermaphrodite

Protandric = Gastropods

male first, then female

*Crepidula fornicata*

= functional male - body size -

option to become female

=> depend on population structure

(C) Simultaneous Hermaphrodites

Both sexes in 1 animal = ovotestes

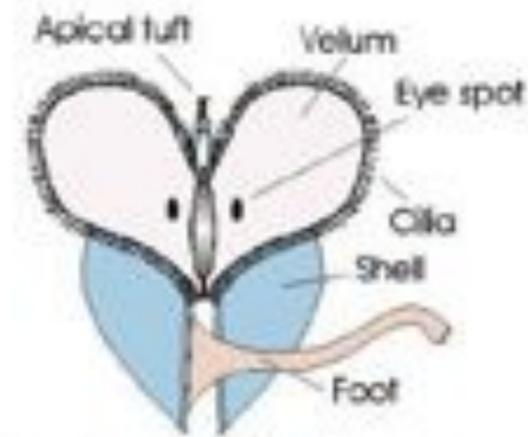
*Helix* = courtship, spicules,

determine male/female roles



# Development

Cleavage spiral (exception  
Cephalopods = meroblastic)  
Typical larva = trochophore  
Most extreme metamorphosis  
(A) Indirect = Bivalve, Gastropods  
trochophore - veliger (foot/shell)  
Free swimming or parasitic, velum  
Glochidia = fw bivalves, on gills, no  
mouth/anus, phagocytosis  
(B) Mixed = polyplacophora,  
scaphopoda  
trochophore - immature adult  
(C) Direct = Cephalopods  
Large, yolky, telolecithal eggs  
Miniature adult



# Nervous System and Sense Organs

Circumenteric ganglia, paired  
ventral nc

Most: cerebral, pleural, pedal,  
visceral, buccal

ns development = activity

Giant nerve fibers

(A) Osphradium = Sensory epithelium

Chemoreceptors, sediment monitor

Benthic predators, scavengers

(B) Cephalic tentacles = 1 pair

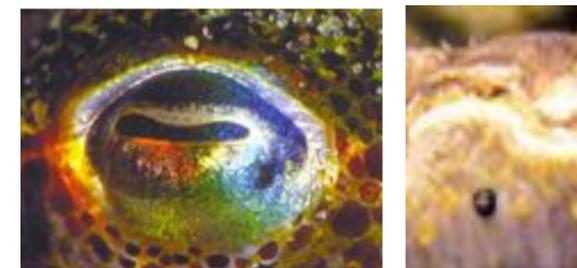
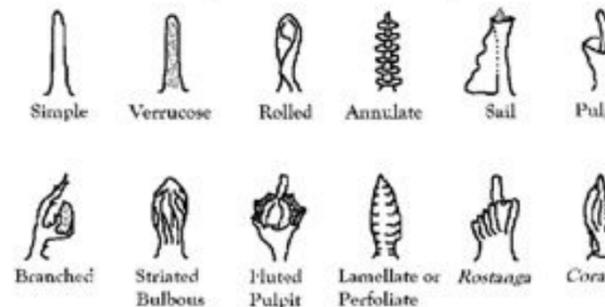
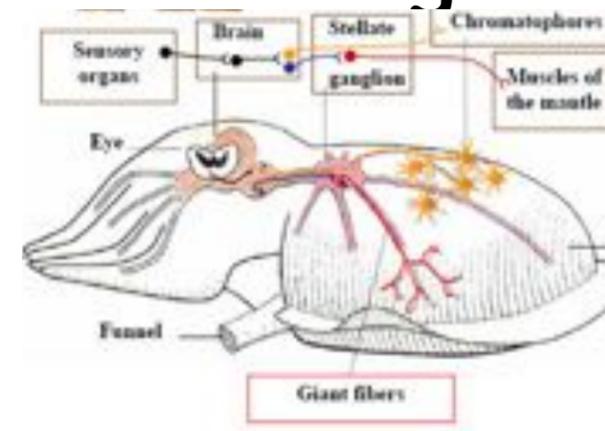
May bear eyes/chemoreceptors

(C) Rhinophores = chemoreceptors

(D) Eyes = from primitive to evolved

(E) Statocysts = mobile animals

(F) Aesthetes = polyplacophora  
photoreceptors



# Ecology/Lifestyles

(A) Hard surface dwellers = bivalves  
gastropods, polyplacophorans

1. Attached

*Crassostrea* = cement glands

*Mytilus* = byssus threads

⇒ Reduced foot, sense organs

2. Unattached

3. Boring = bivalves, e.g. *Teredo*

(B) Soft substrate dwellers

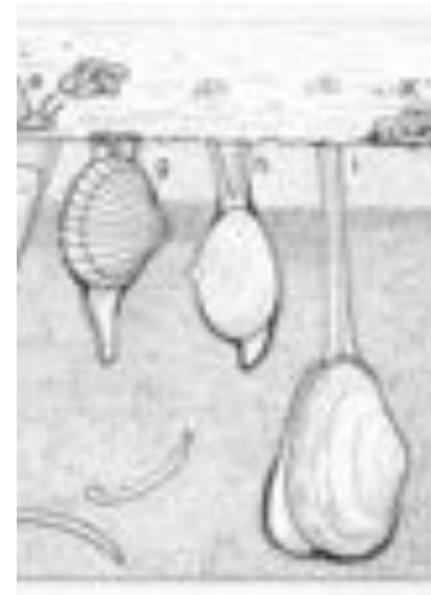
= gastropods, bivalves, scaphopods

*Polinices* large foot like plough

*Strombus* operculum digs into sand

(C) Swimmers = Cephalopods,  
gastropods, bivalves

Pteropods = foot modified



# Ecology/Lifestyles

(C) Swimmers (cont.)

Scallops = adductor  
contraction

Cephalopods = mantle, jet  
propulsion  
funnel

(D) Floaters = Gastropods

*Janthina* = raft of bubbles

*Glaucus* = bubble in stomach

(E) Parasites = Gastropods,  
Bivalves

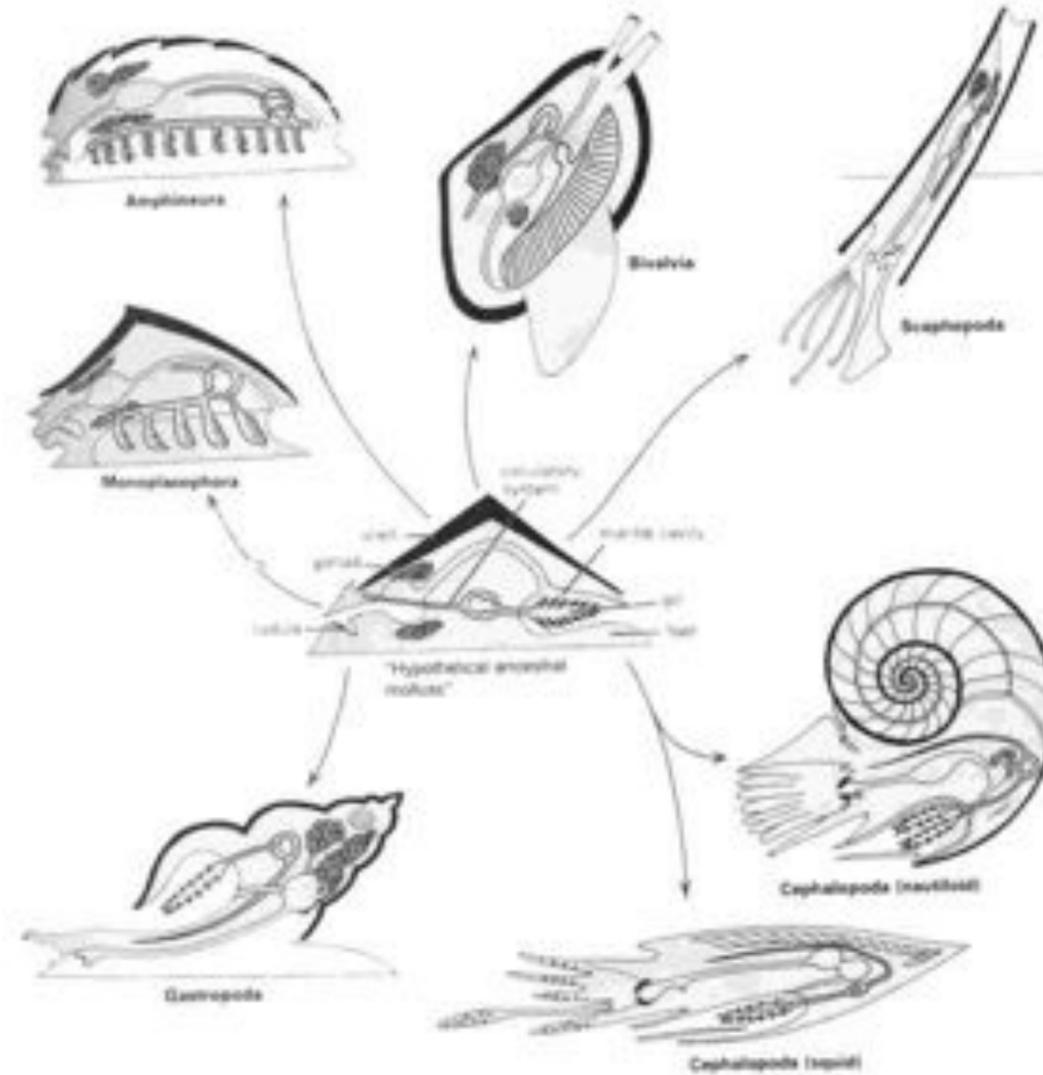
Reduced locomotion, sensory  
⇒ not typical

High degree of economic and  
ecological importance

<http://www.youtube.com/watch?v=2iXHBuSIJY>



# Molluscan Taxonomy



Aplacophora

Monoplacophora

Polyplacophora  
= Amphineura

Scaphopoda

Gastropoda

Bivalvia

Cephalopoda

# Class Aplacophora

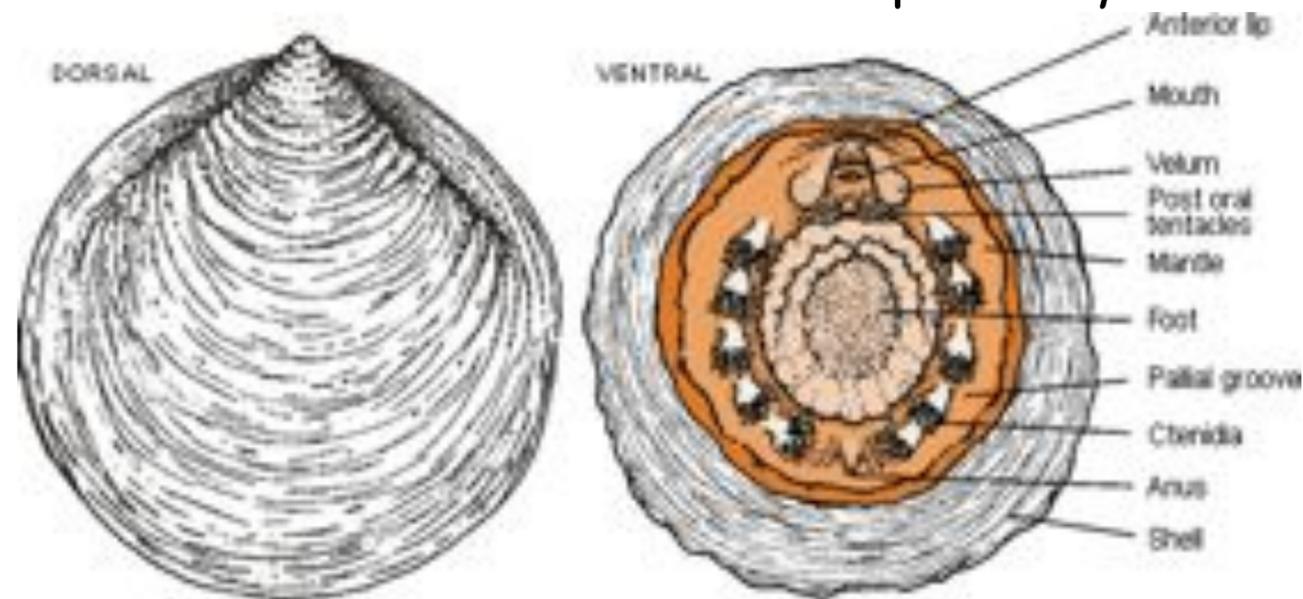


= bearing no shell  
< 300 species described  
Solenogasters, i.e.  
*Chaetoderma*  
Vermiform, cylindrical  
Calcareous spicules  
Rudimentary mantle cavity  
Ctenidia (gills) not always  
found  
Foot represented by pedal  
grove  
May not represent true  
mollusks

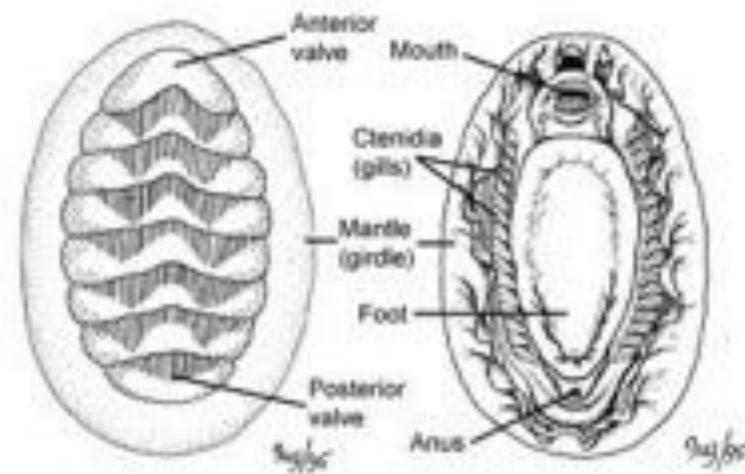
# Class Monoplacophora



= bearing one shell  
11 species described  
Thought to be extinct until  
1957, good fossil record  
< 3cm in length  
Mostly deep sea animals  
example *Neopilina*



# Class Polyplacophora



= bearing many shells

Chitons

Examples *Ischnochiton*,  
*Mopalia*, *Katherina*

About 300 described species

Flattened, elongated

8 overlapping shells, unique

articulation = greek tunic

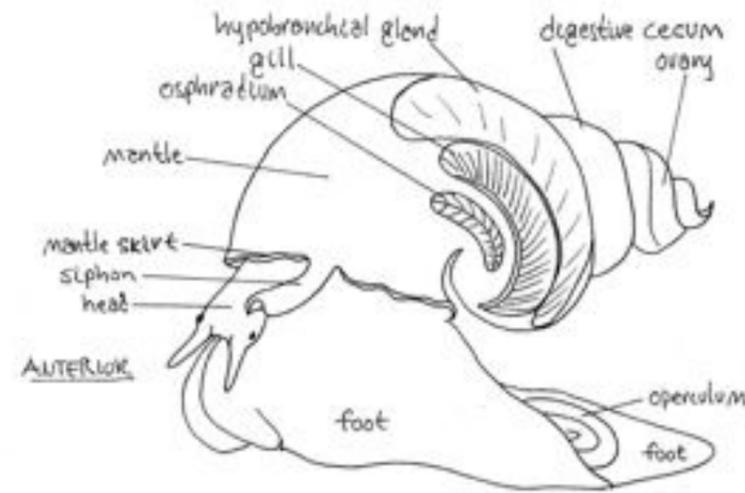
Tegumentum (conchiolin,  
spicules)

No eyes/tentacles

Marine, rocky intertidal

Homing behavior = homing scars

# Class Gastropoda



= stomach foot  
Snails and slugs

40-75,000 living species

Adaptive radiation = all habitats

Asymmetrical

Spirally coiled shell, single

Torsion

(A) Prosobranchia, i.e. *Helix*

Marine snails, operculum, gills

(B) Opisthobranchia, i.e. *Aplysia*

Seaslugs, shell lost

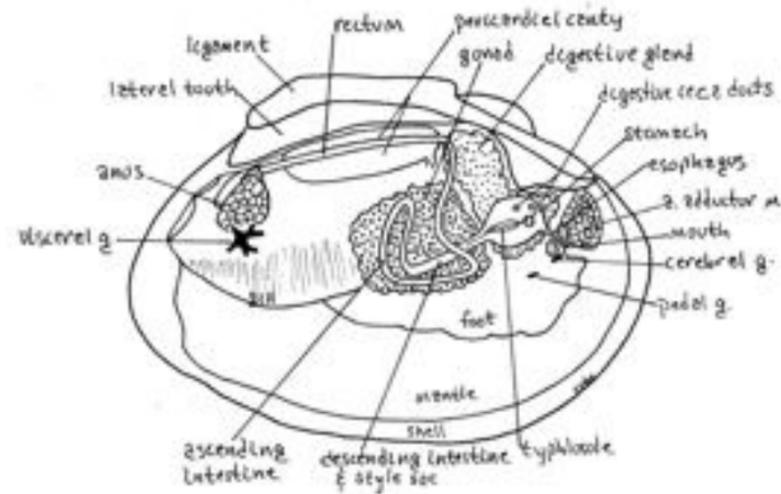
(C) Pulmonata, i.e. *Limax*

Land snails, slugs

Lungs, detorted, no larval stage



# Class Bivalvia (Pelecypoda)



= 2-shelled, hatchet foot

Over 7000 living species

Laterally compressed

2 valves, hinged

Absence of head, radula,  
sensory structures

Marine & freshwater

(A) Protobranchia, i.e. *Nucula*

Simple ctenidia, marine, deep

(B) Lamellibranchia, i.e. *Ostrea*

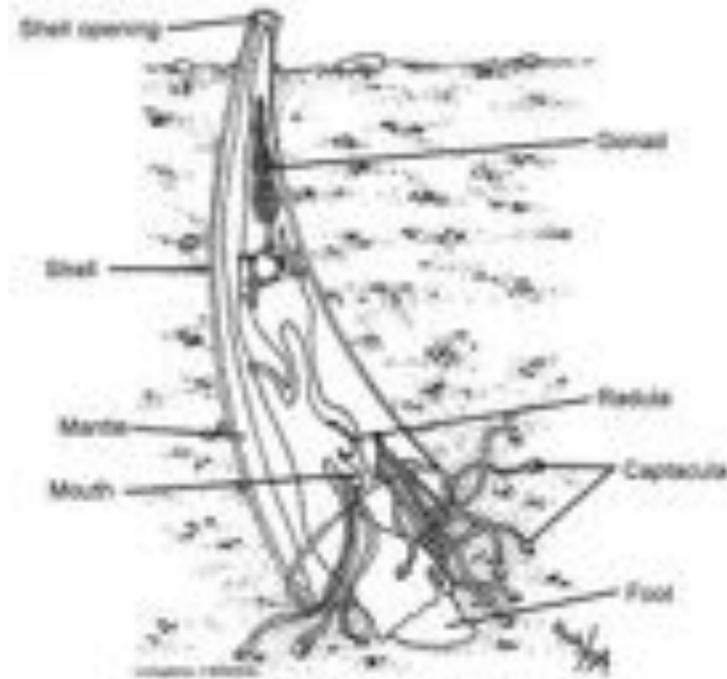
Freshwater & marine, single  
ctenidium, byssus

(C) Anomalodesmata, i.e.

*Pandora*, equivalved shells,  
marine, carnivorous



# Class Scaphopoda



= spade foot

Tusk shells, e.g. *Cadulus*

350 species

1 shell, tubular, tapering, open at both ends

No ctenidia or eyes

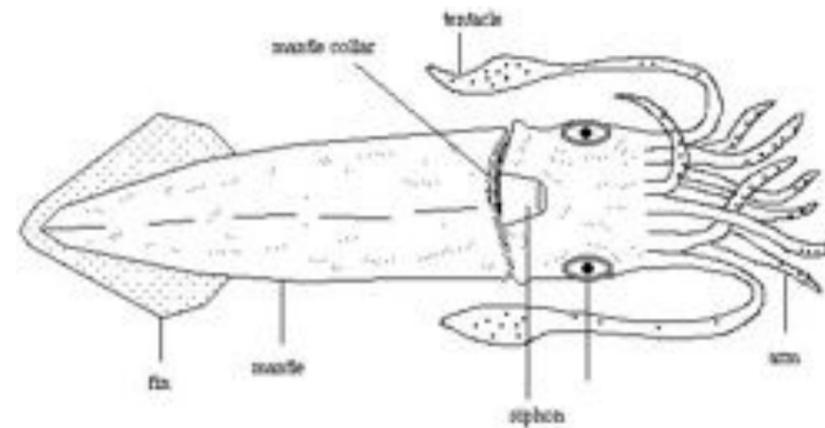
Captacula = clubbed contractile

Tentacles

No heart/ circulatory system

burrowers

# Class Cephalopoda



= head foot

650 living species

Shell reduced or lost

Head large/complex eyes

Closed circulation

Muscular funnel = jet

Propulsion

Benthic or pelagic, marine

Behaviorally complex

(A) Subclass Nautiloidea

i.e. *Argonauta*, 80-100

tentacles, no ink sac,

Chromatophores

(B) Subclass Coleoidea

8-10 arms, eyes, statocyst

Chromatophores, ink sac

