



✘ Biology of animals



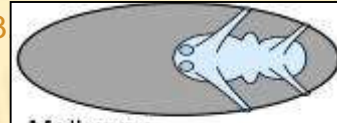
by Oldřich Nedvěd, Faculty of Science, USB

MOLLUSCA

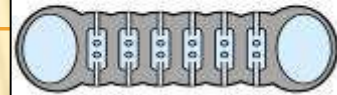
✗ body plan

+ coelom

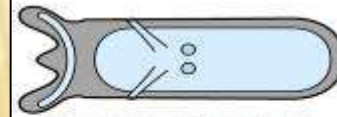
✗ schizocoel, mixocoel



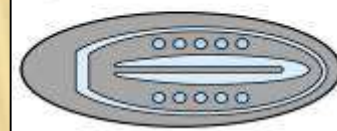
Mollusca



Annelida



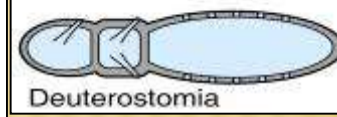
Sipuncula, Brachiozoa



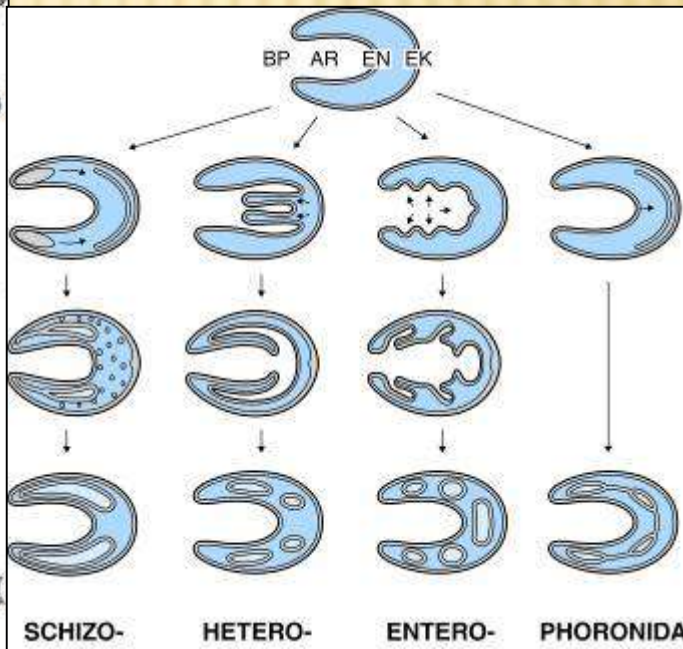
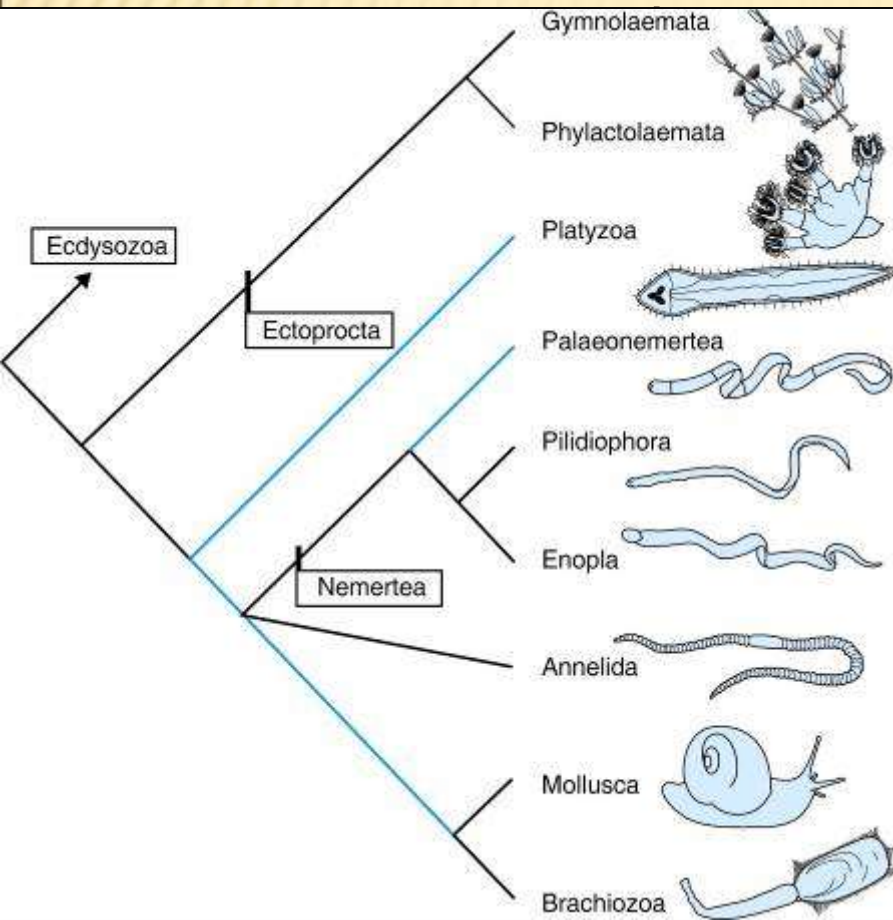
Nemertea



Chaetognatha

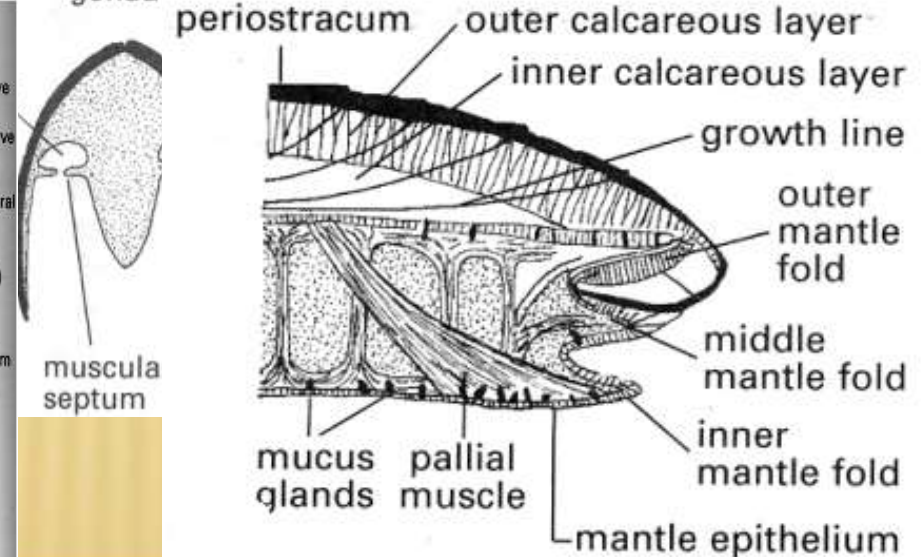
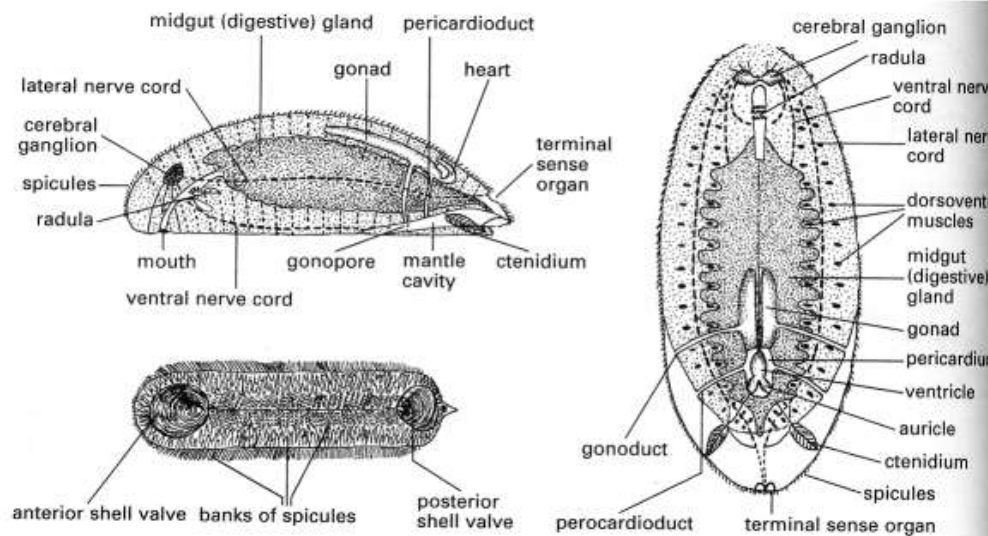
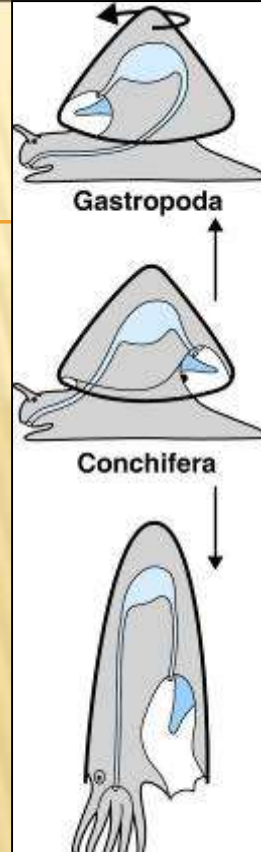
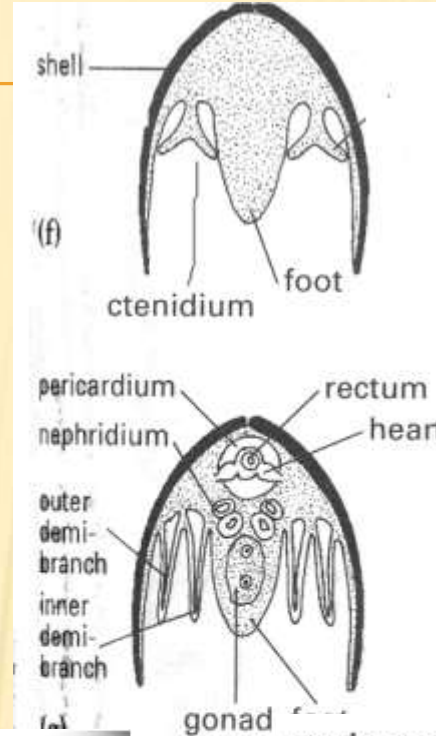


Deuterostomia



MOLLUSCA

- +soft body
- +hard shell
- +mantle
- +gills
- +foot



MOLLUSCA

✕ shell

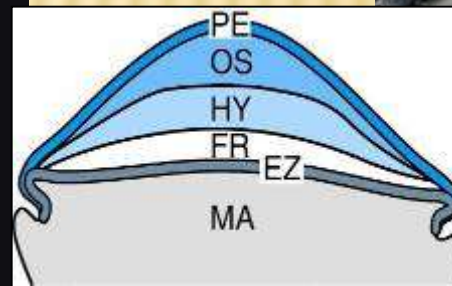
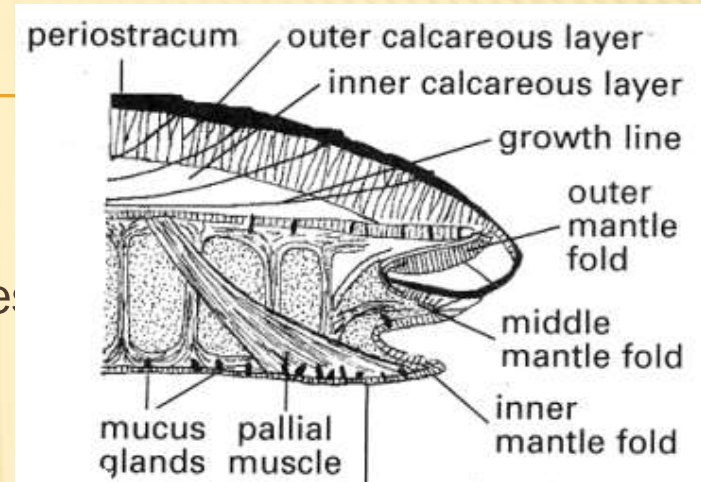
✕ periostracum

- ✕ conchiolin: protein tanned with quinone

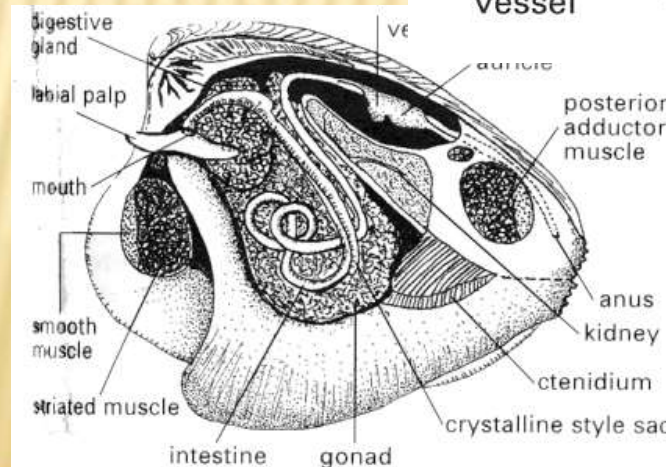
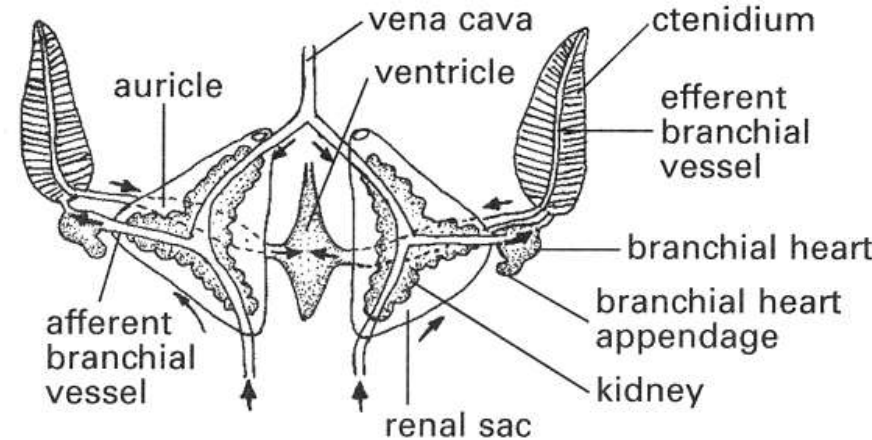
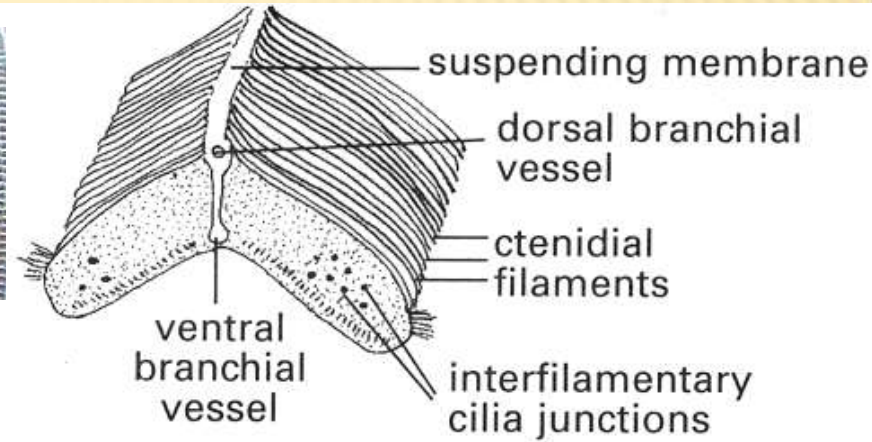
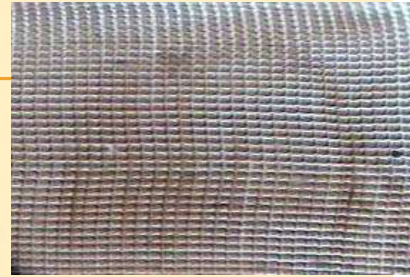
✕ ostracum

✕ hypostracum

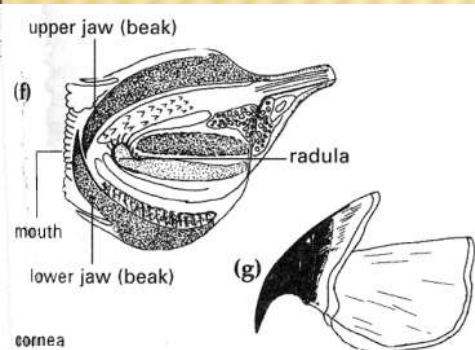
- ✕ inorganic: CaCO_3 - aragonit, calcit
- ✕ proteins



MOLLUSCA



- ✘ digesting system
 - + jaws - chitinose
 - + radula - chitinose
 - + hepatopankreas
- ✘ respiratory system
 - + ctenidia
- ✘ circulatory system
- ✘ excretory system



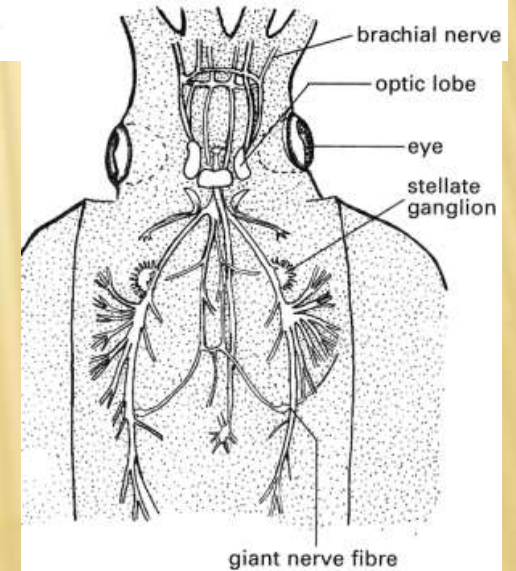
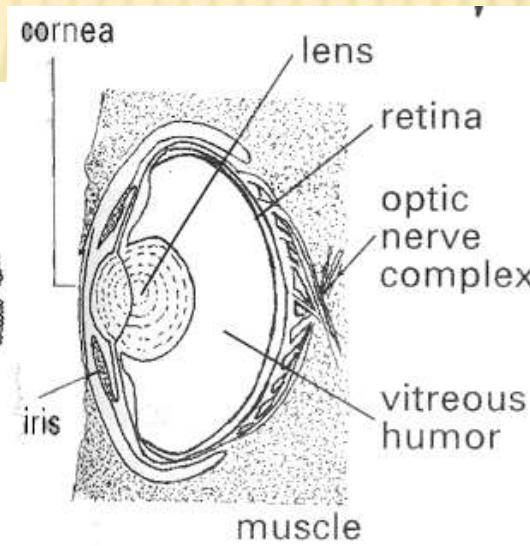
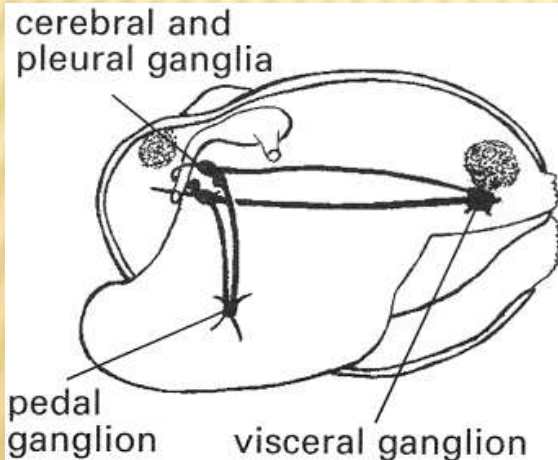
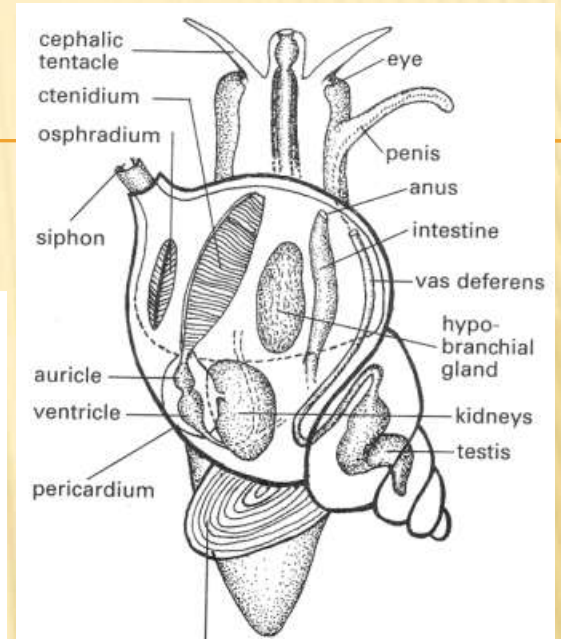
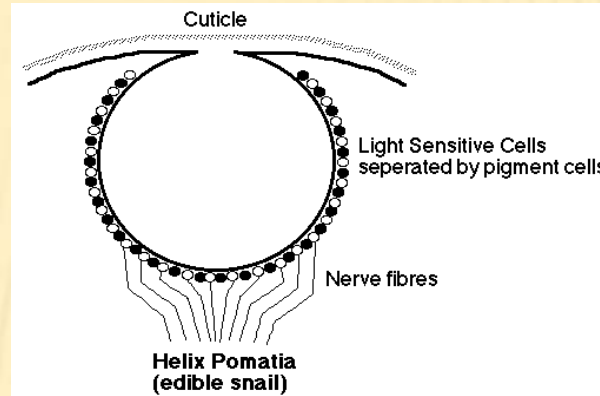
MOLLUSCA

✘ nervous system

✘ senses

+ osphradium

+ eye



MOLLUSCA

✘ movement

+foot

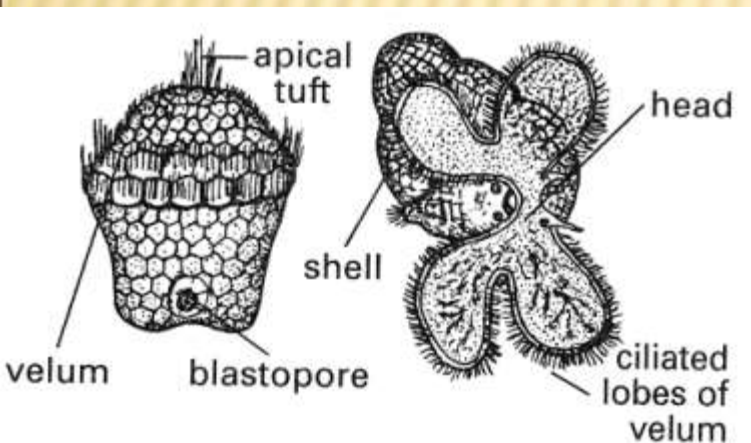
+swimming

✘ development

+larva trochophora or veliger

+lecitotrophic

+direct in freshwater and terrestrial



MOLLUSCA

✕ ecology

+edible

+pearls

+agricultural pests

+parasite hosts

+wood and rock boring



MOLLUSCA

✘ system - 50 000 extant species + 35 000 fossil

+ Aplacophora

✘ Solenogastres - 250

✘ Caudofoveata - 70

+ Polyplacophora - 800

+ Conchifera

✘ Monoplacophora - 11

✘ Bivalvia - 8 000

✘ Gastropoda - 40 000

✘ Scaphopoda - 350

✘ Cephalopoda - 650



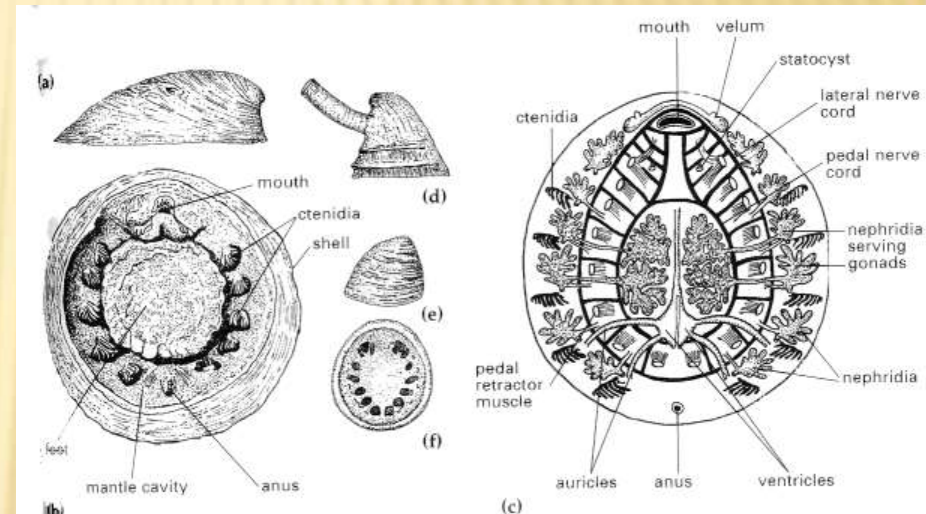
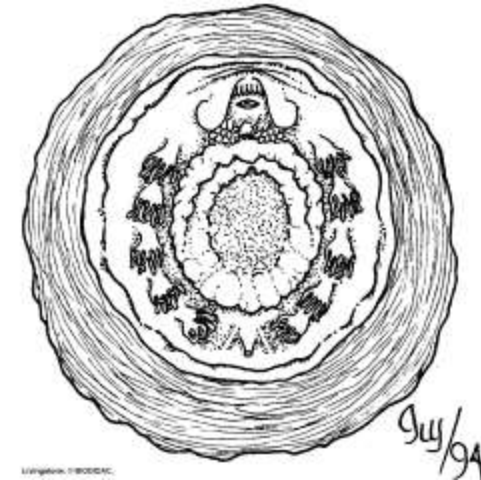
POLYPLACOPHORA – CHITONS

- + flat, 1-30 cm
- + eight dorsal plates
- + mantle ridge
- + foot, mouth
 - × volvation
- + tidal zone, algae



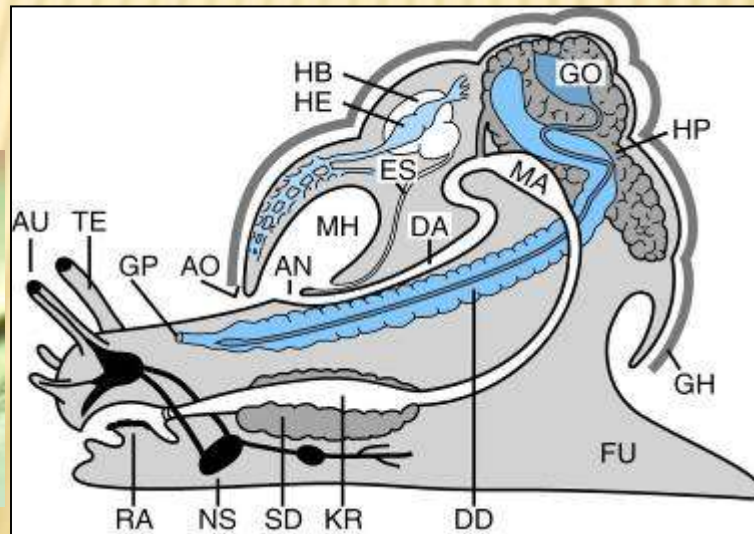
MONOPLACOPHORA

- + (Tryblidia = Neopilinida)
- + formerly known from fossils
- + living found in 1952
- + in deep see
- + one shell
- + rounded foot
- + mantle ridge
- + some inner organs segmented



GASTROPODA – SNAILS, SLUGS

- +most species rich
- +marine, freshwater and terrestrial
- +head with mouth, antennae, eyes
- +foot flat, mucus, chitinous operculum



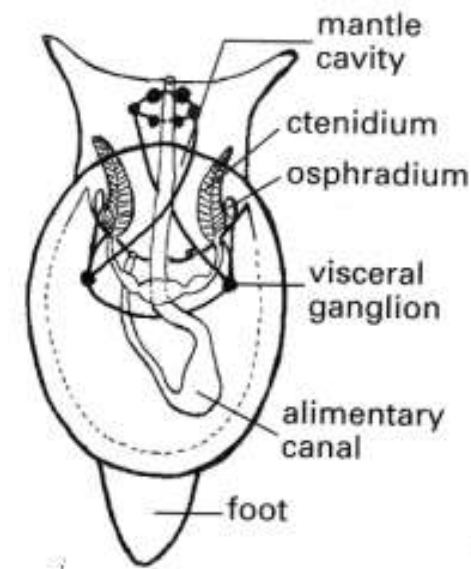
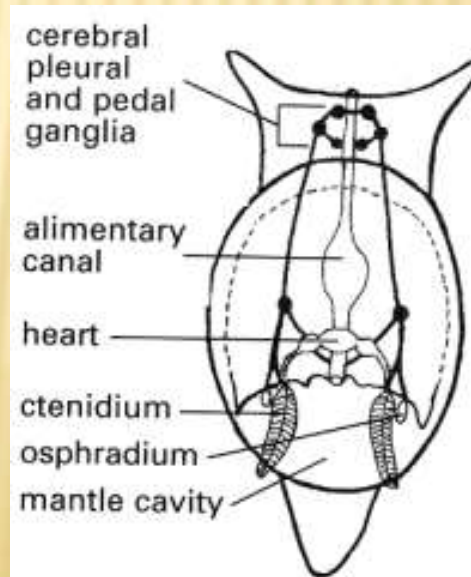
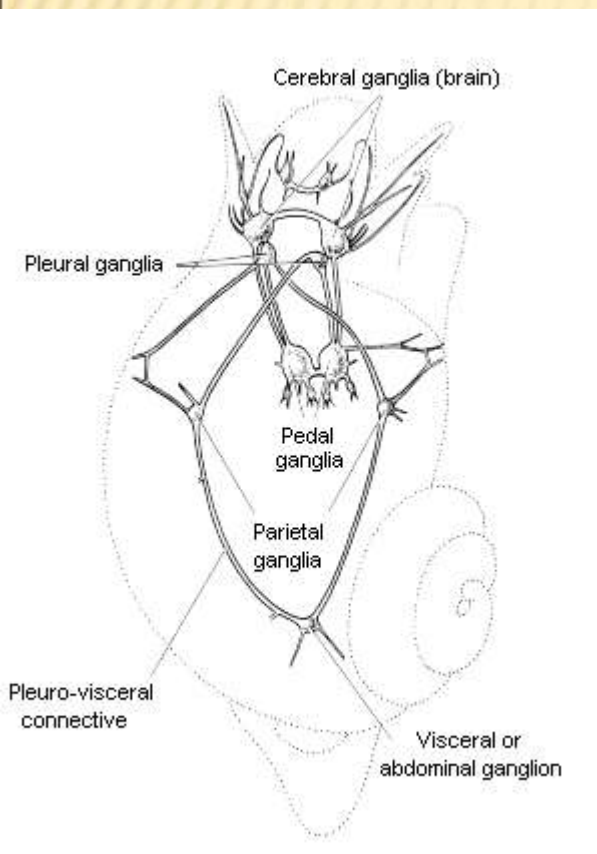
GASTROPODA

+torsion

×nerves crossover

+gaqnglia

×cerebral, parietal, pedal, pleural



GASTROPODA

+shell

×cap, conus, spiral, right-wound

×naked slugs



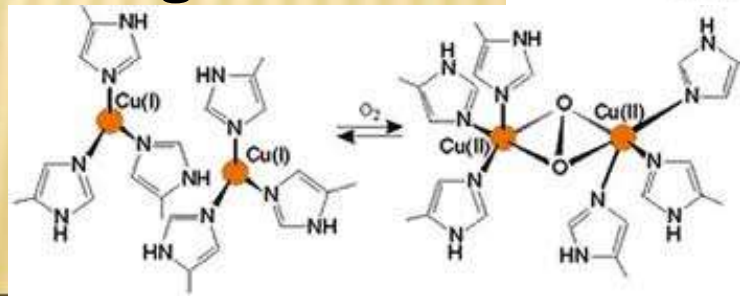
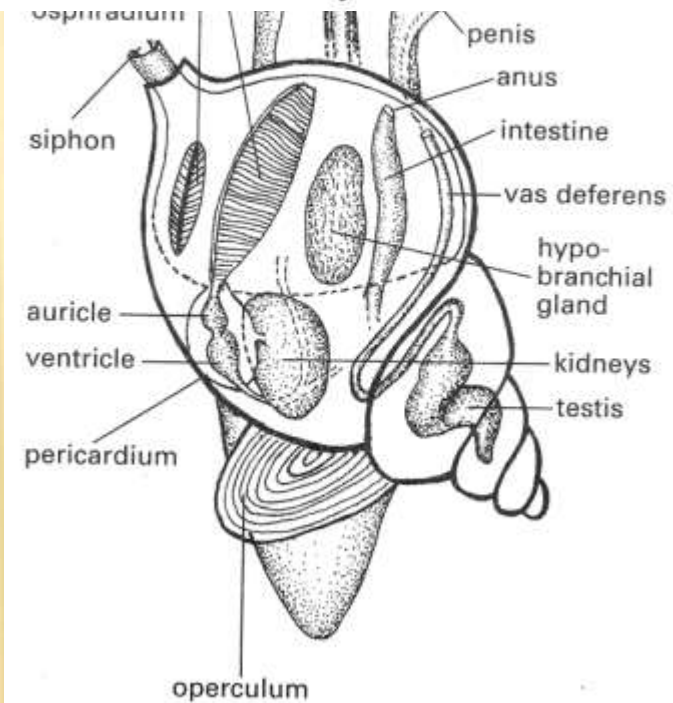
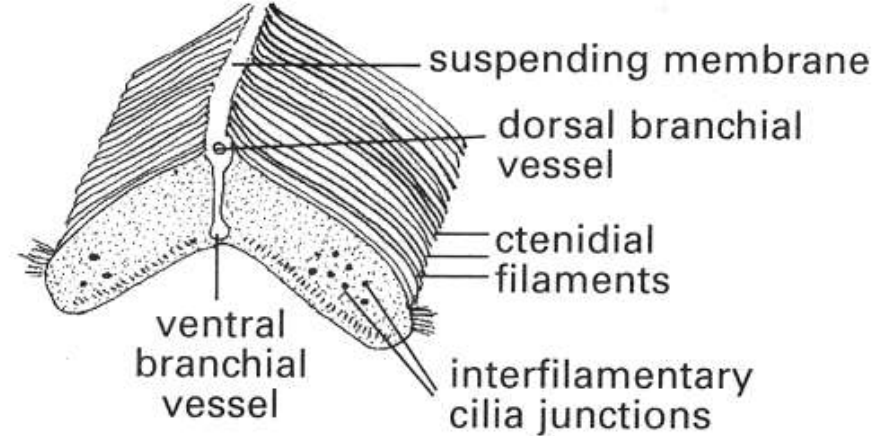
GASTROPODA

+respiration

- × gills (1-2 ctenidia)
- × secondary skin outgrowth
- × mantle cavity
 - * secondary gills
 - * lungs

+circulatory system

- × heart
 - * 1-2 auricles, 1 ventriculus
- × flow through kidneys and gills
- × open
- × hemocyanin = cyan



GASTROPODA

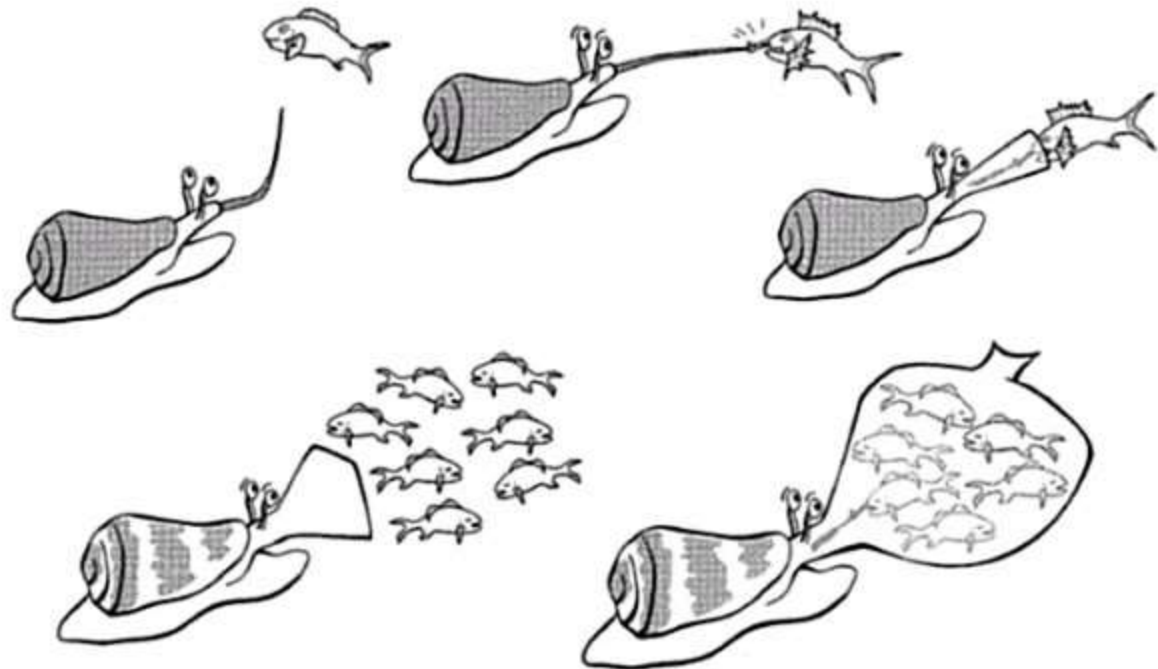
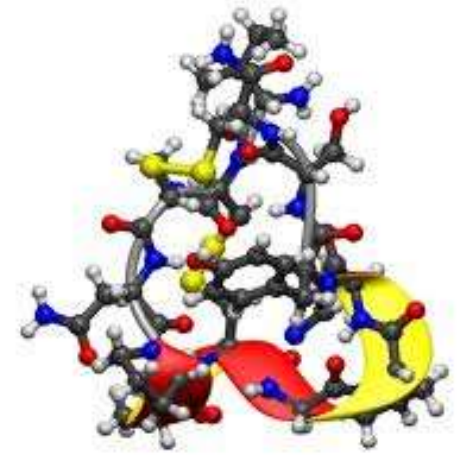
+food

× grazing

× fishing (poisonous Conoidea)

★ oligopeptides 15-30 residues, numerous disulfide

★ Analgesics



GASTROPODA

+ Prosobranchia

+ marine, few freshwater and terrestrial

- × Patelloidea - limpets
- × Haliotoidea - abalones
- × Neogastropoda – thick shells



GASTROPODA

+Opisthobranchia

- ×marine, shell reduced
- ×sea hare, nudibranchs



GASTROPODA

- + Pulmonata – terrestrial and freshwater
 - × lungs
 - × thin shell
 - × Basommatophora - freshwater
 - × Stylommatophora – snails, slugs



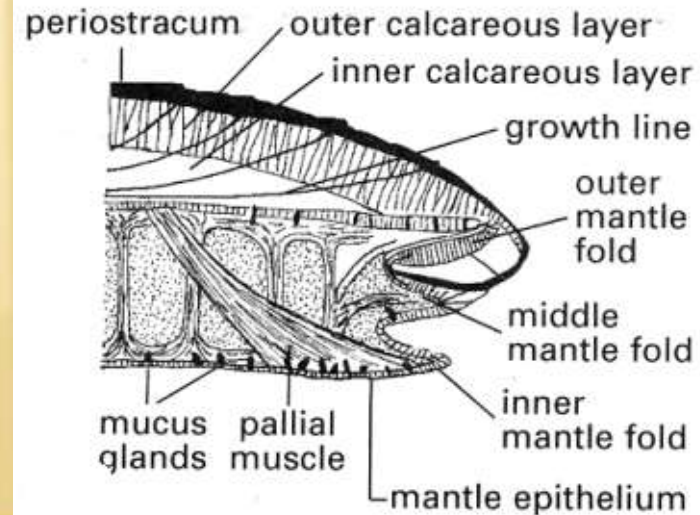
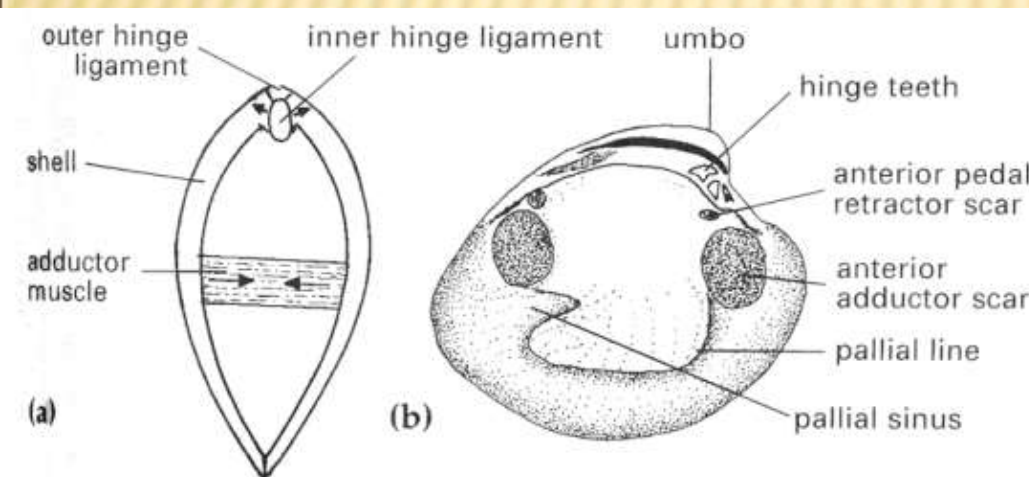
BIVALVIA - CLAMS

✘ = Pelecypoda - bivalves, oysters, mussels, clams...

+ laterally flattened

+ two valves shell (left and right)

+ adductor muscles



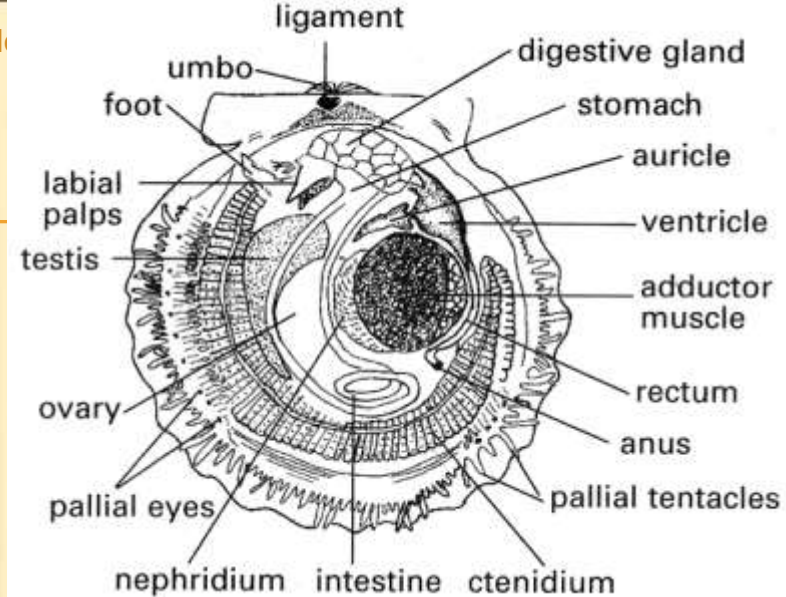
BIVALVIA

+foot

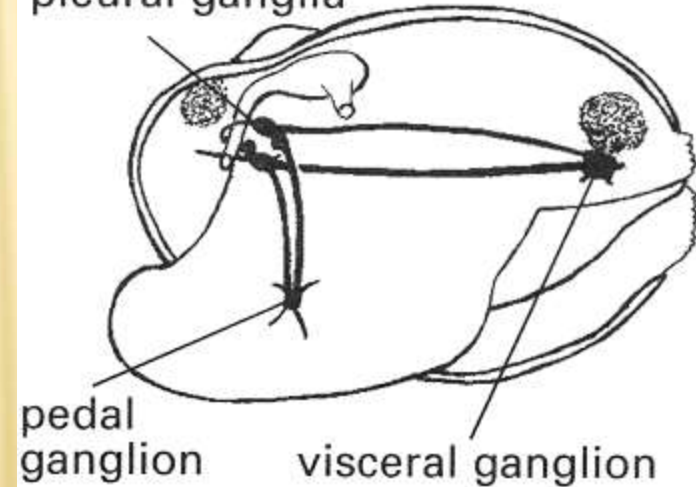
×wedge shaped

×or sedentary

+no head



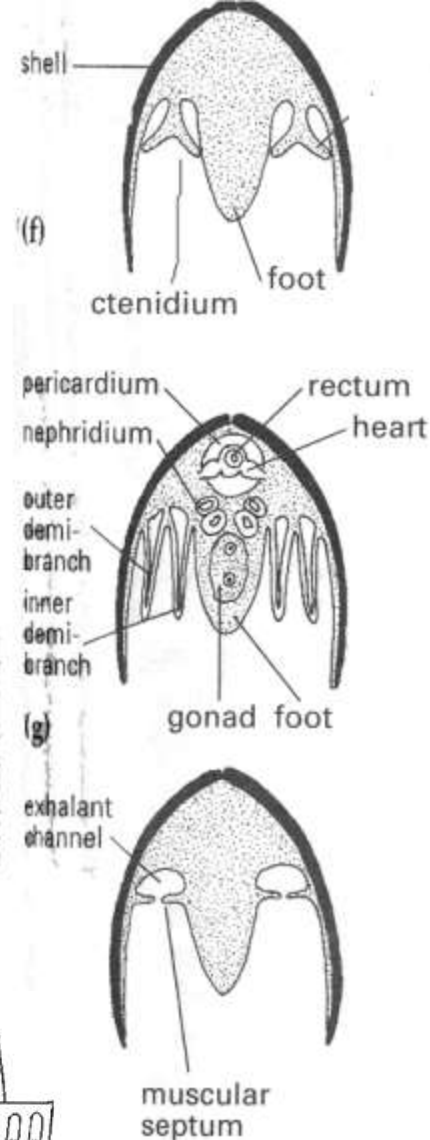
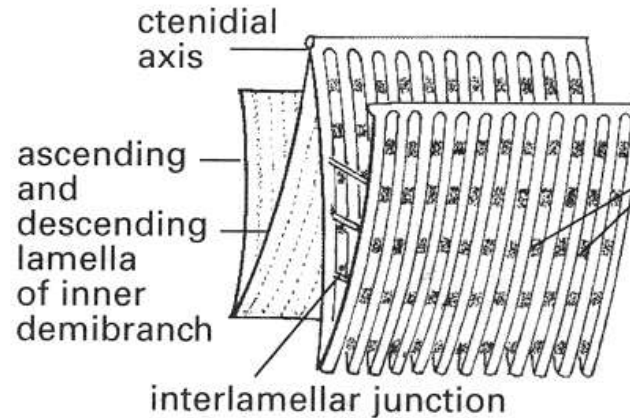
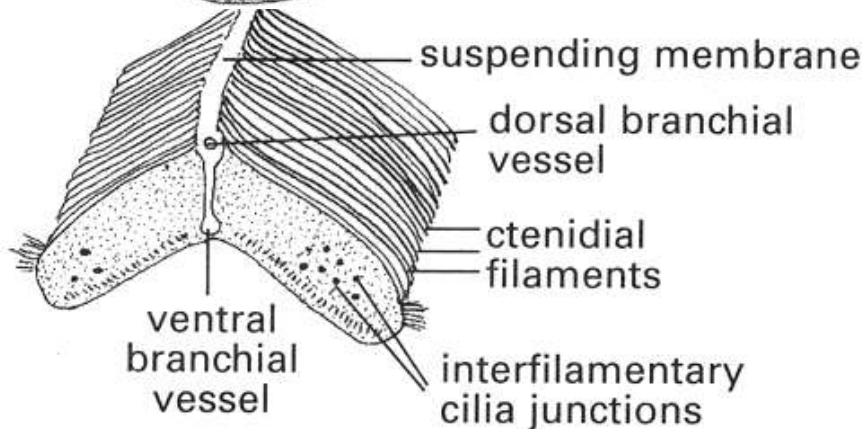
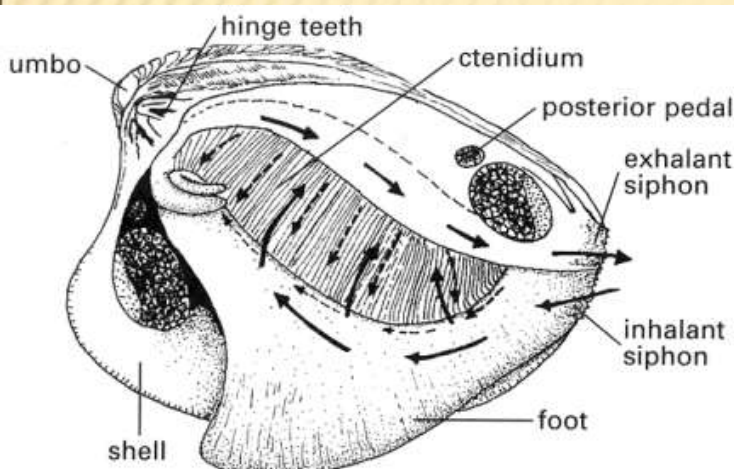
cerebral and pleural ganglia



BIVALVIA

+respiratory system

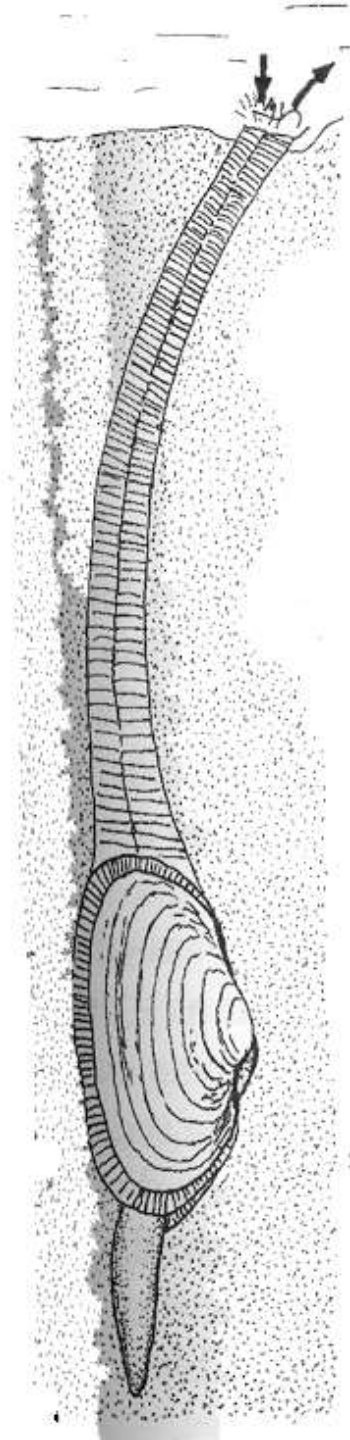
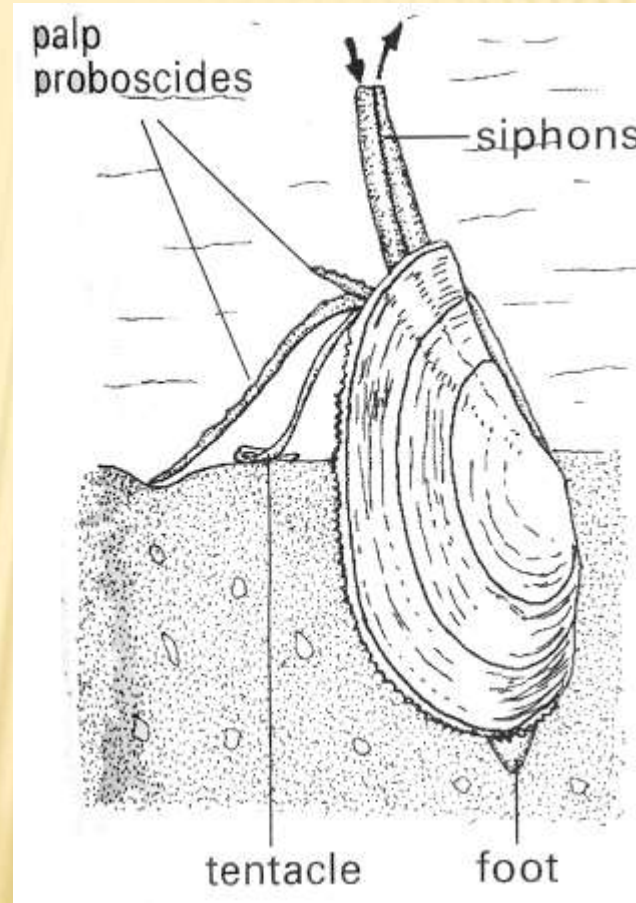
- ✗gills in mantle cavity
- ✗flagellar water current
- ✗inhalant and exhalant openings



BIVALVIA

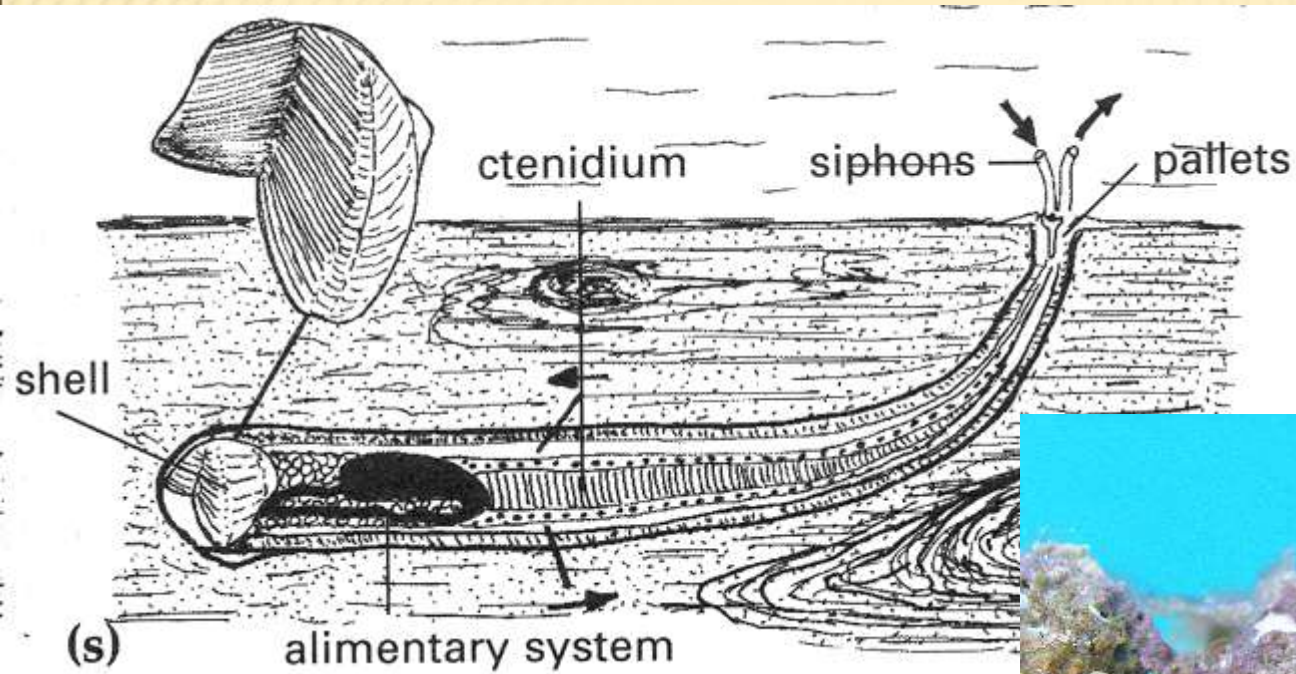
+marine and freshwater

×digging



BIVALVIA

+boring

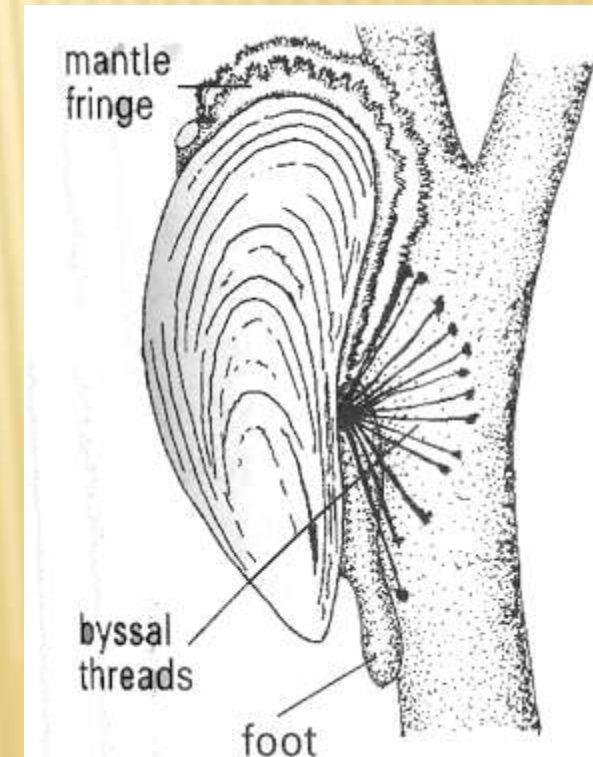
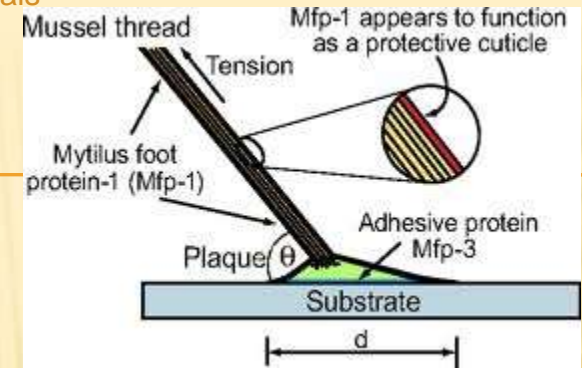


BIVALVIA

+sedentary

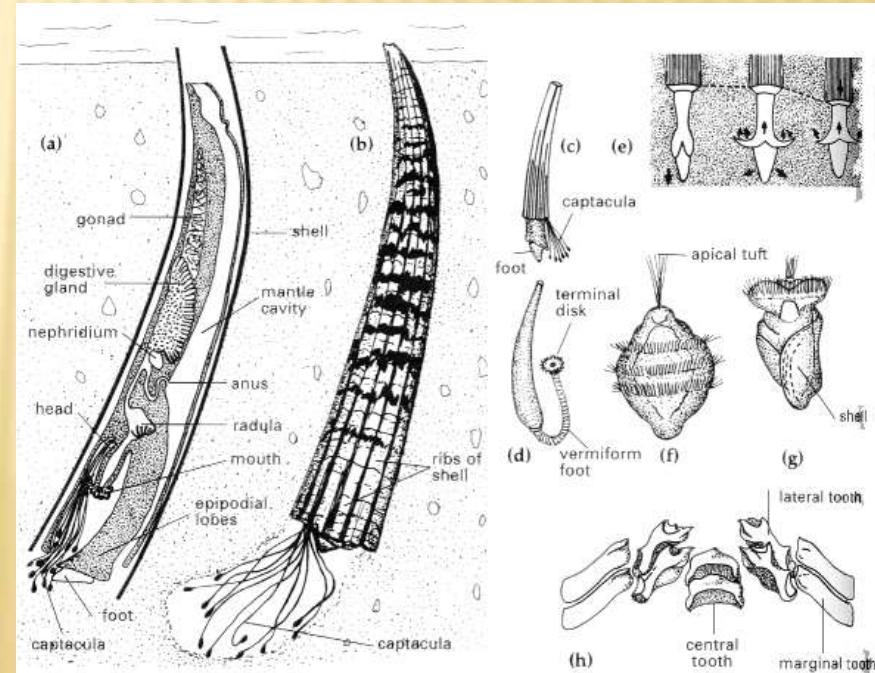
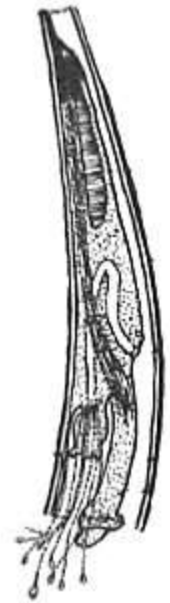
+byssal threads

+500 MPa



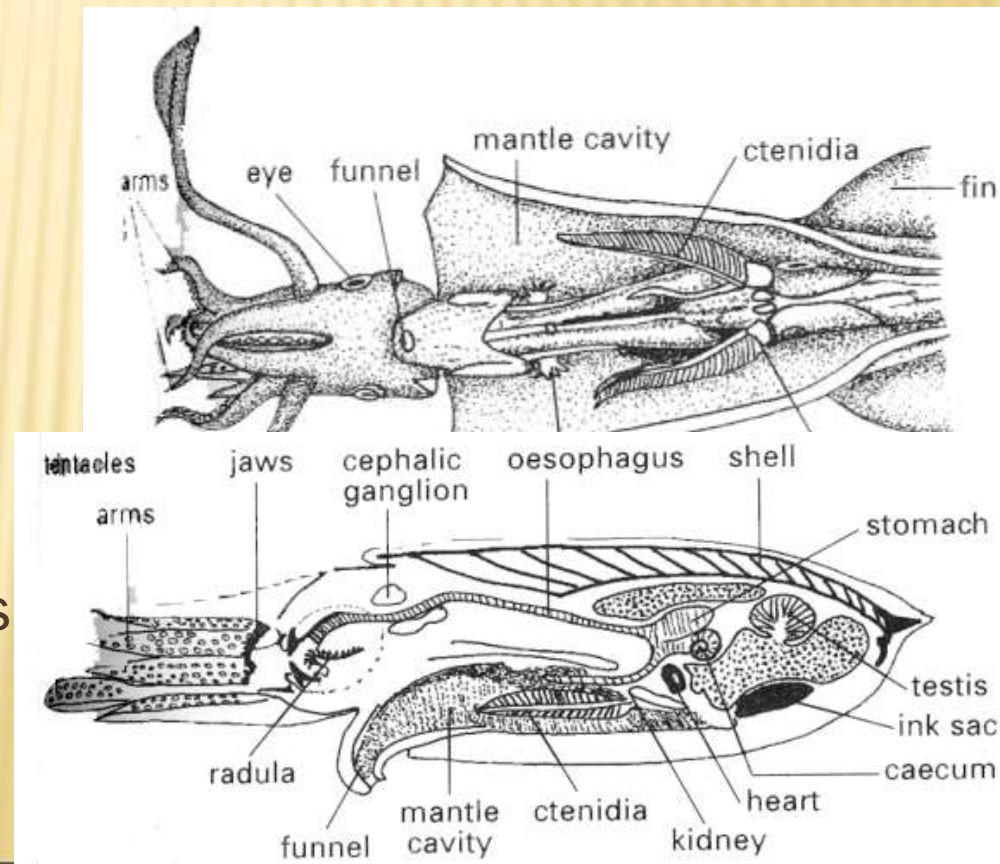
SCAPHOPODA – TUSK SHELLS

- +cylindric shell
- +digging in sediment
- +head reduced



CEPHALOPODA

- +squids, cuttlefish, octopuses
- +physically and mentally perfect
- +largest invertebrates (20 m)
- +most fast invertebrate swimmers
 - ×jet propulsion
- +head
 - ×tentacles
 - ×eyes
 - ×jaws
 - ×salivary and venom glands
 - ×mantle covers body



CEPHALOPODA

+respiratory system closed

+defence

× ink - melanin

× jaws

× venom

× tetrodotoxin, 5-hydroxytryptamine, hyaluronidase, tyramine, histamine, tryptamine, octopamine, taurine, acetylcholine, and dopamine.

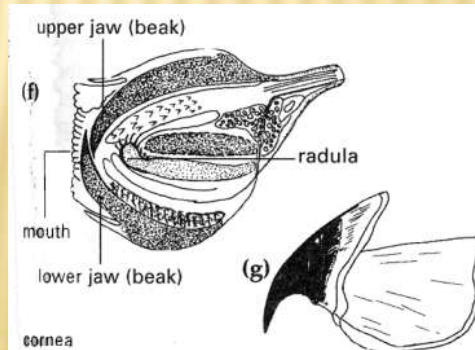
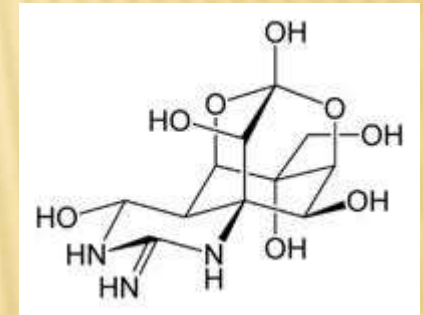
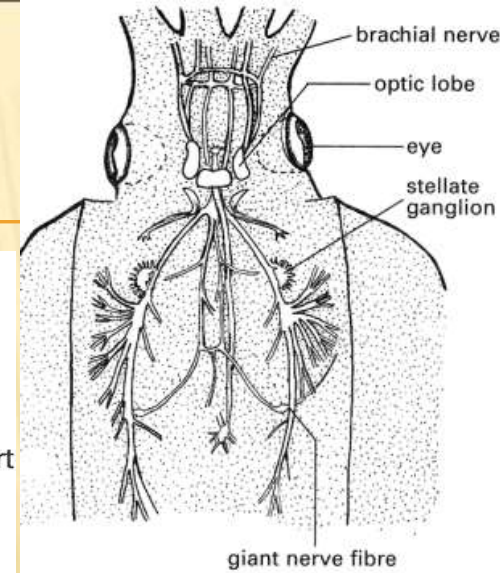
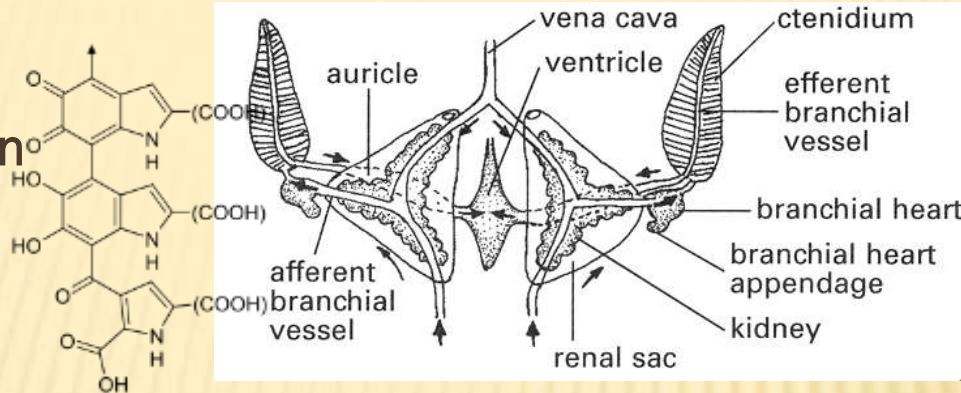
× cryptic coloration, warning coloration

+nervous system

× brain

× communication

× chromatophores



CEPHALOPODA

Biology of animals



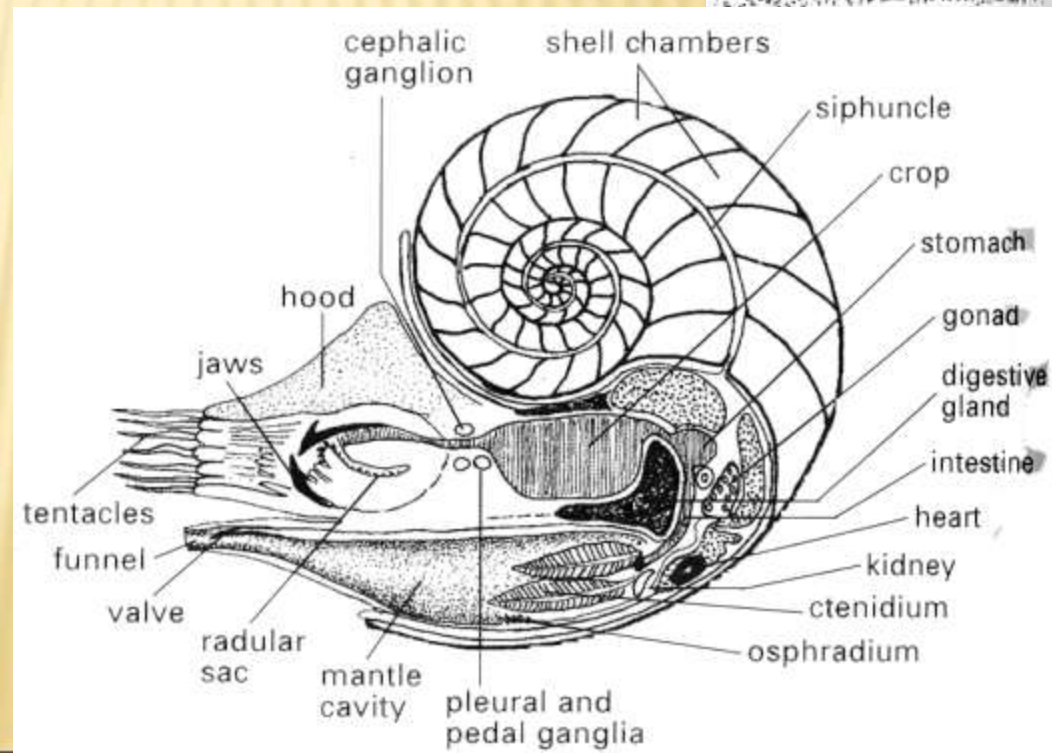
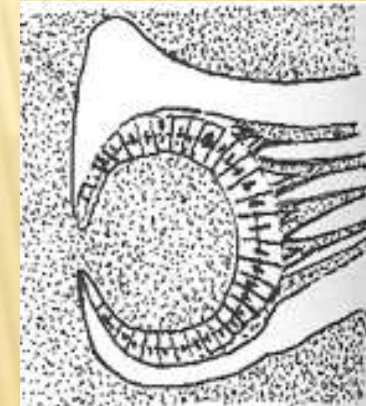
CEPHALOPODA

+Tetrabranchia = Nautiloidea –

+spiral shell

×septa

×eyes without lens

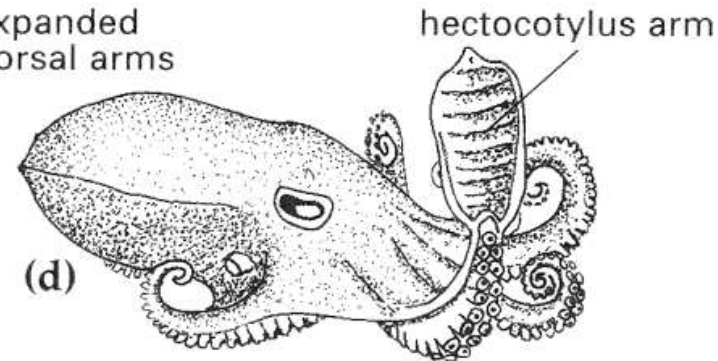
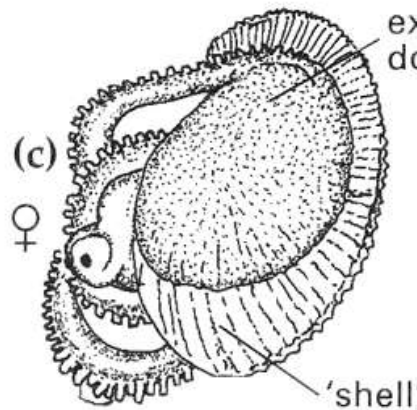
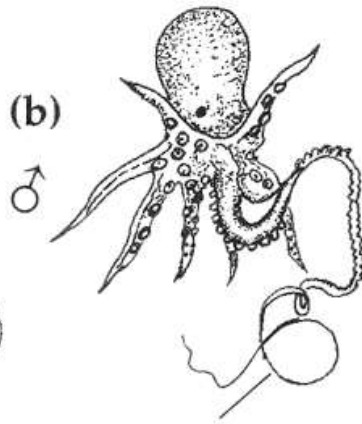
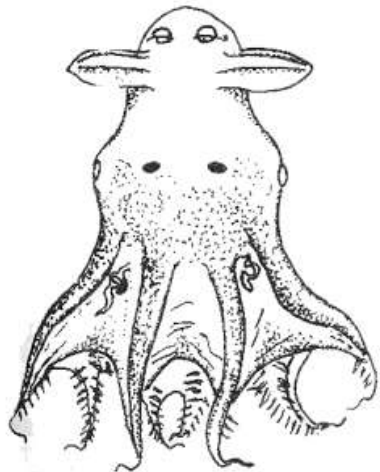
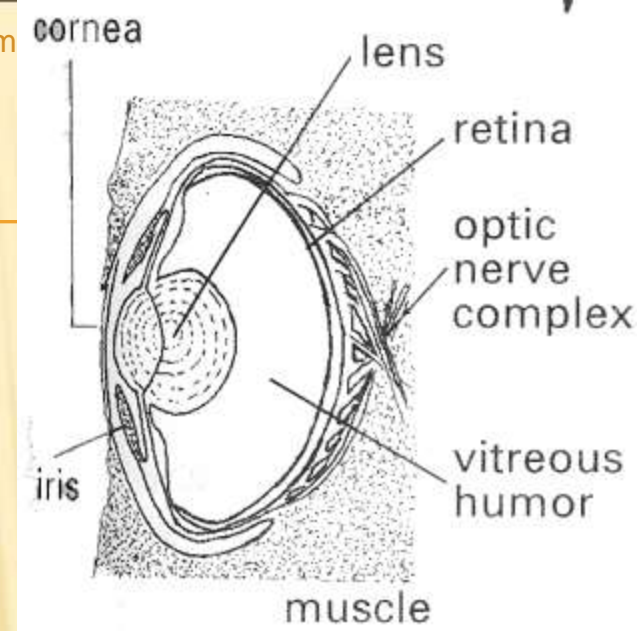


CEPHALOPODA

+Dibranchia =
Coleoidea -

- × shell reduced
- × 8-10 tentacles with suckers
- × perfect chamber eyes

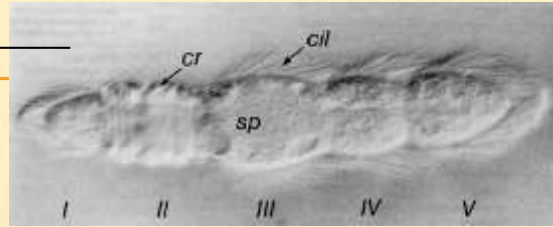
- Decabrachia
 - catfish, squid=calamari
- Octobrachia
 - octopus



hectocotylus arm

BILATERIA

1. Mesozoa



2. Eubilateria

1. Deuterostomia



2. Protostomia

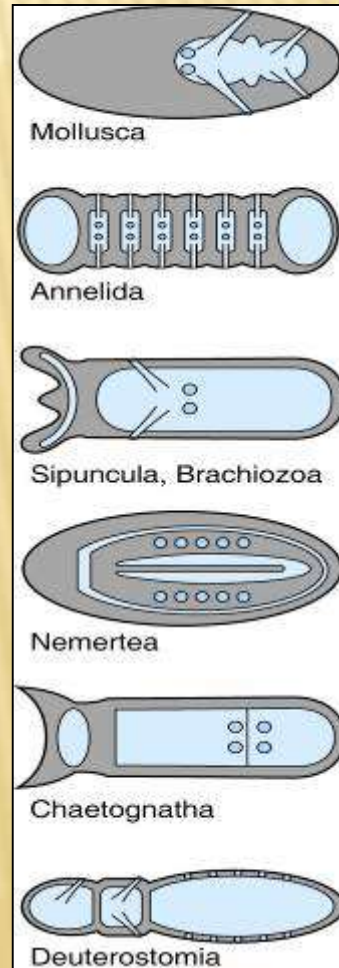
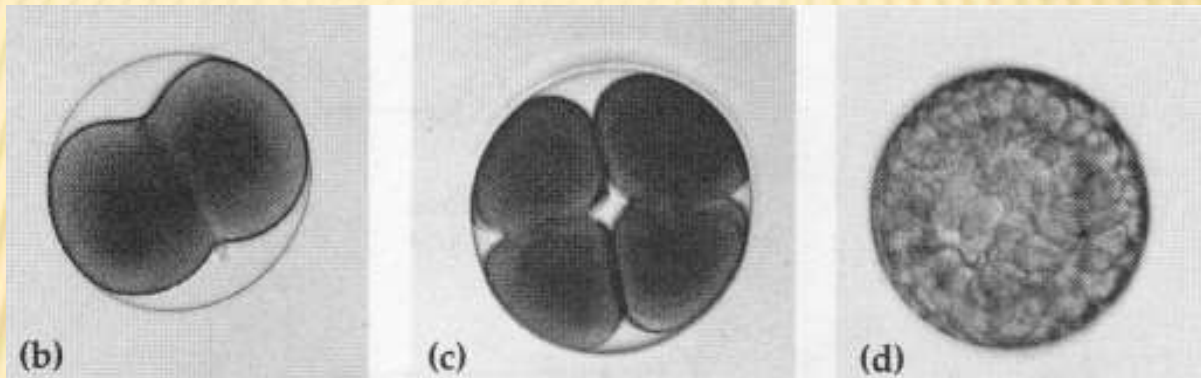
1. Lophotrochozoa

2. Ecdysozoa



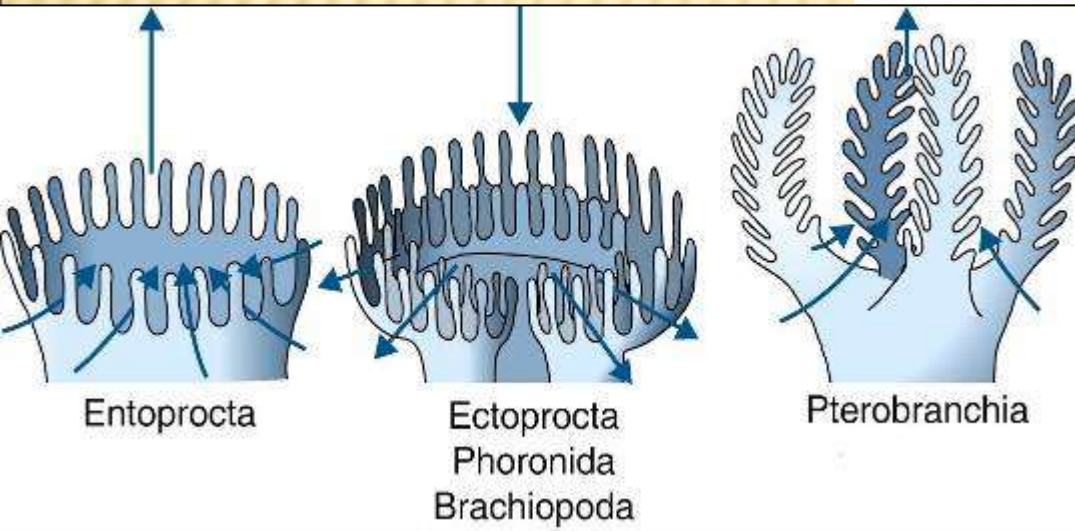
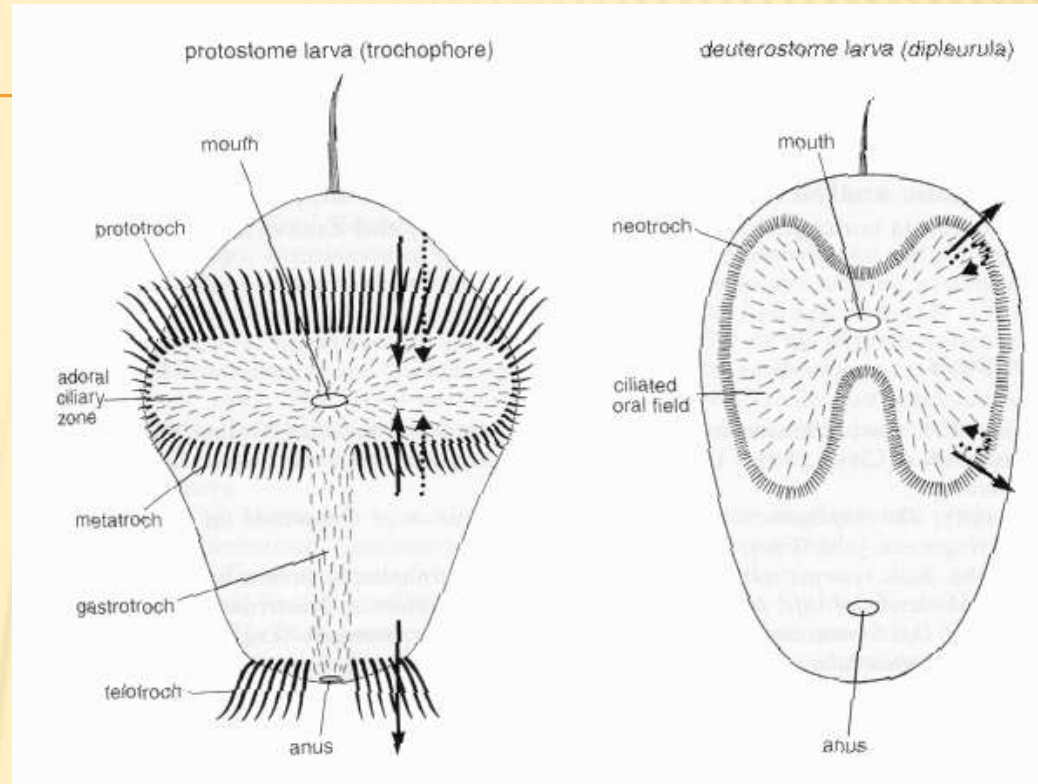
DEUTEROSTOMIA

- ✗ radial cleavage
- ✗ three segmented coelom



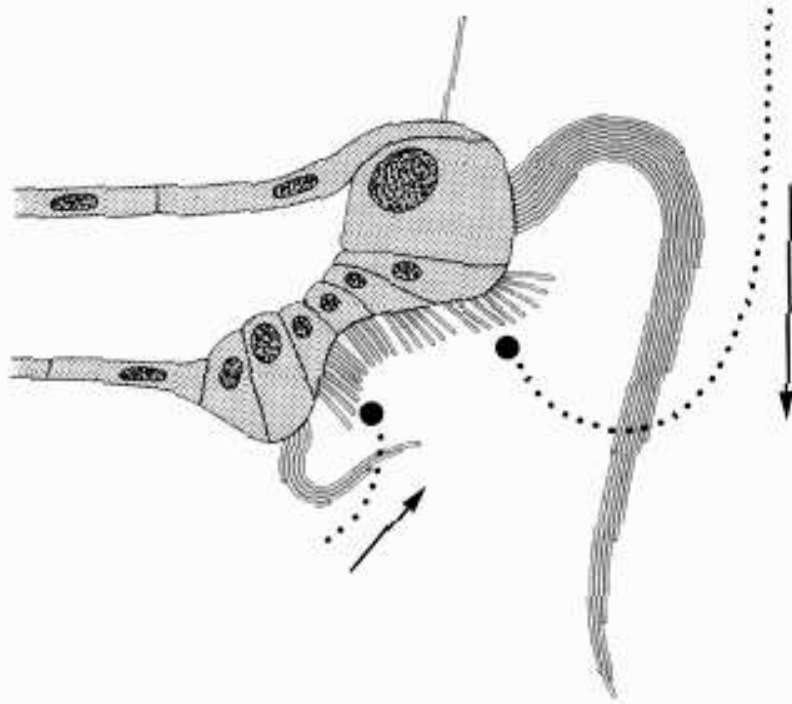
DEUTEROSTOMIA

- + larva dipleurula
- + collecting system

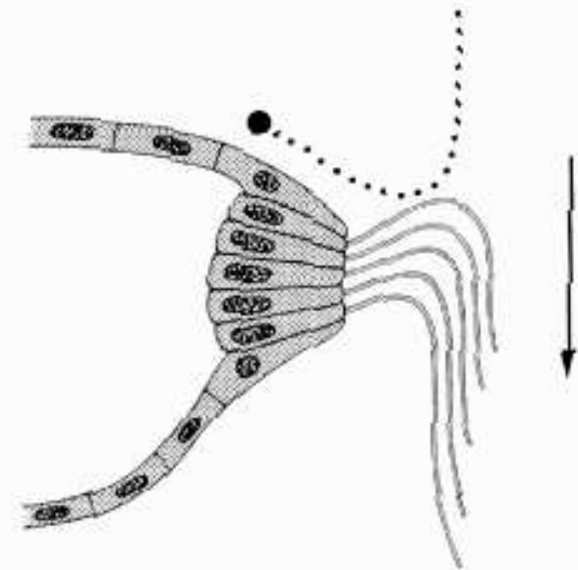


DEUTEROSTOMIA

downstream-collecting system

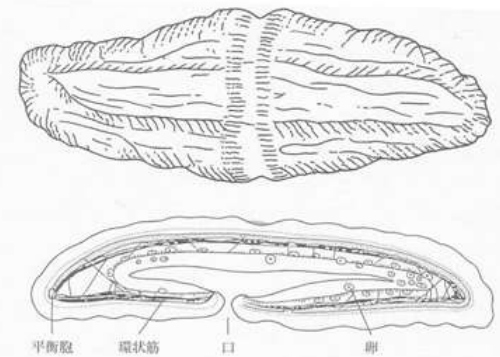


upstream-collecting system

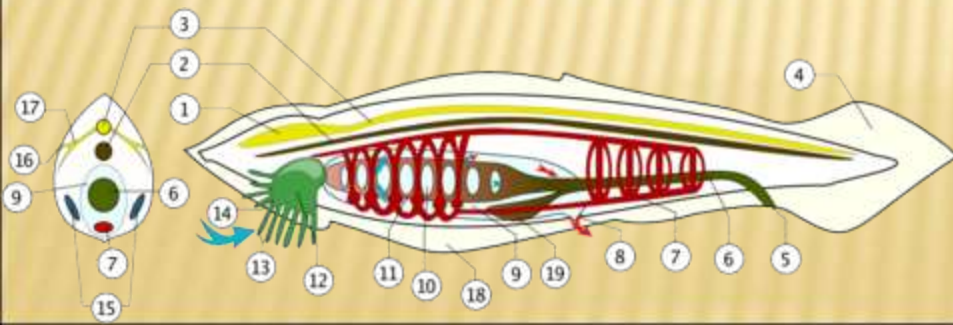
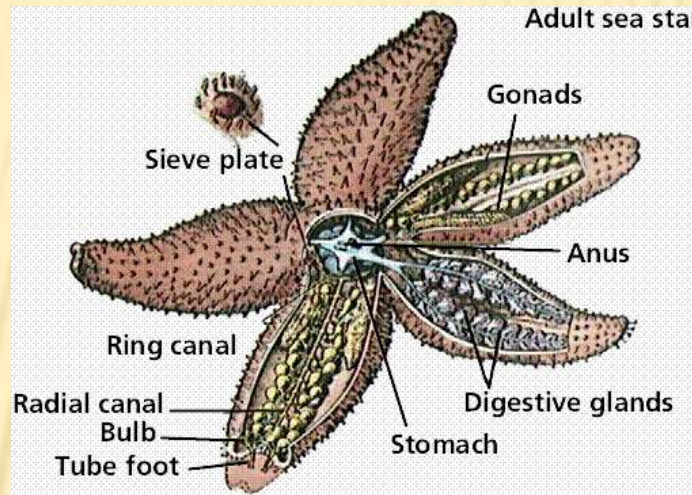


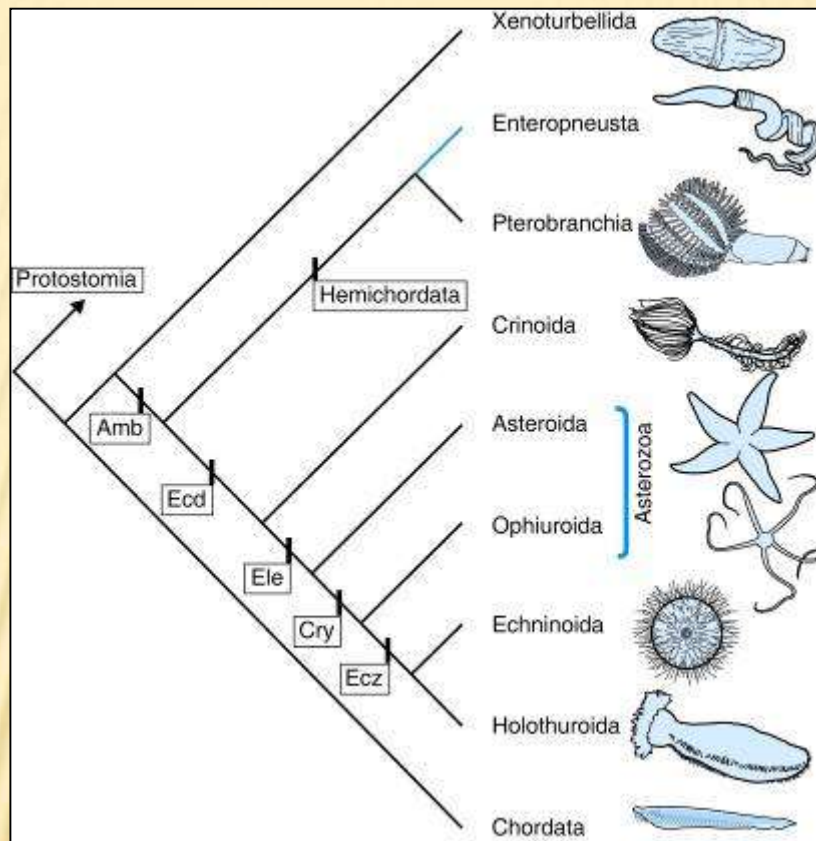
DEUTEROSTOMIA

- + Acoelomorpha
- + Xenoturbellida
- + Echinodermata
- + Hemichordata
- + Chordata



珍渦虫 *Xenoturbella bocki* の体制
 上：外形，下：内部構造（縦断面）
 図は「無脊椎動物の多様性と系統」（裳華房）より





XENOTURBELLIDA



✘ history

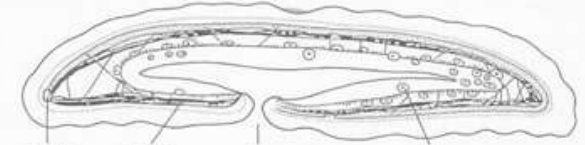
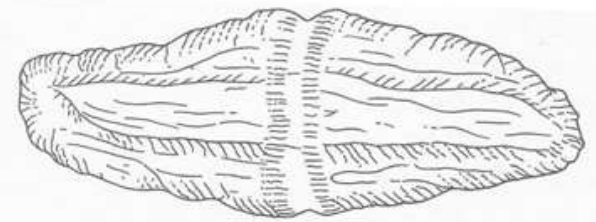
- + described in 1949
- + name; Platyhelminthes
- + museum specimens
- + molecular – Mollusca, Bivalvia, Nuculidae, *Nucula tenuis* 97%
- + embryogeny of clams, metamorphosis not seen
- + 2003 new data - Deuterostomia



✘ body plan

- + slug like
- + 3 cm
- + no brain, neural network
- + no intestine, no excretory organ, no gonad

XENOTURBELLIDA



珍渦虫 *Xenoturbella bocki* の体制
上：外形，下：内部構造（縦断面）
図は「無脊椎動物の多様性と系統」（裳華房）より

× reproduction

+ unknown

× ecology

+ muddy bottom of Scandinavian fjords (100 m)

× food

+ predator: benthos,

+ bivalves including eggs, larvae

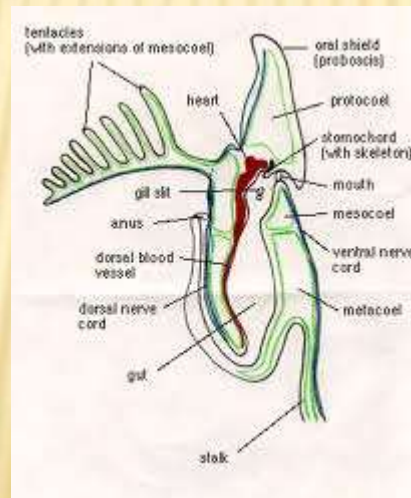
× system

+ *Xenoturbella bocki*; *Xenoturbella westbladi*



Hemichordata

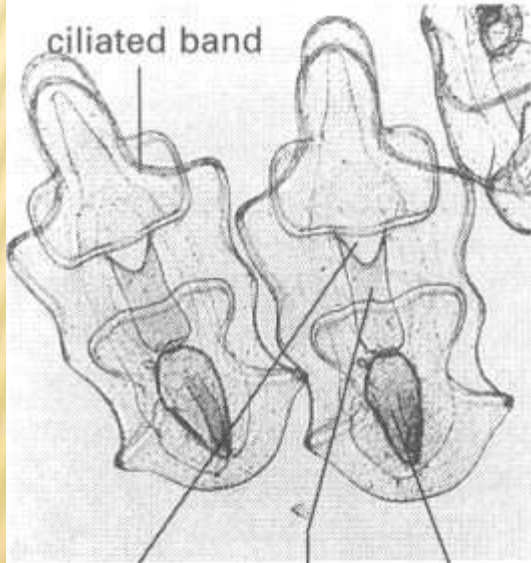
- stomochord
- pharynx = gill basket
- Enteropneusta
 - digging in sediment
- Pterobranchia
 - filtrators
 - in colonies



ECHINODERMATA

✗ body plan

- + bilateral larva
- + secondary pentaradial adult
- + terciary pentabiradial



ECHINODERMATA

✘ skeleton

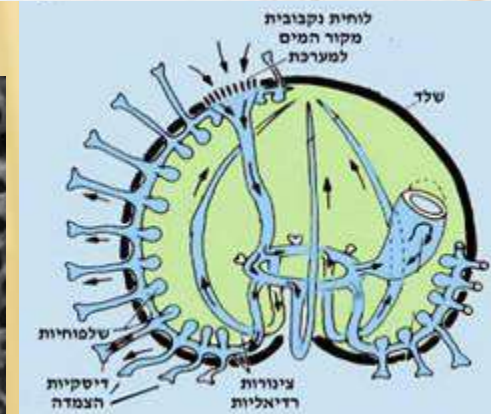
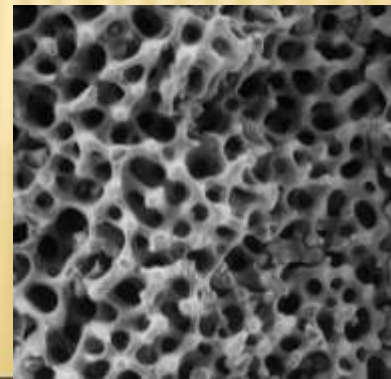
- + endoskeleton
- + mesodermal

✘ ambulacral system

- + tubes and sacs
- + madreporit
 - ✘ communication with sea water
 - ✘ osmoregulation

+ pseudopodia

hydraulic force



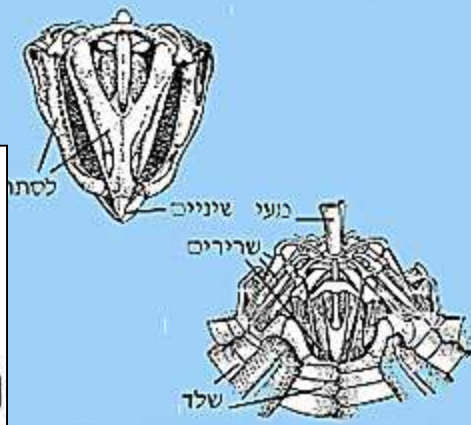
ECHINODERMATA

✗ respiration

- + skin
- + pseudopodia
- + papulae – coelomic
- + bursae – invaginations = lungs
- + water lungs in rectum
- + peristomial gills



ECHINODERMATA



✗ food

+ filtrators

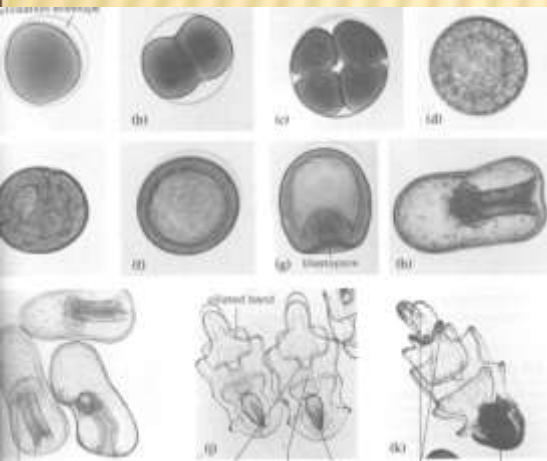
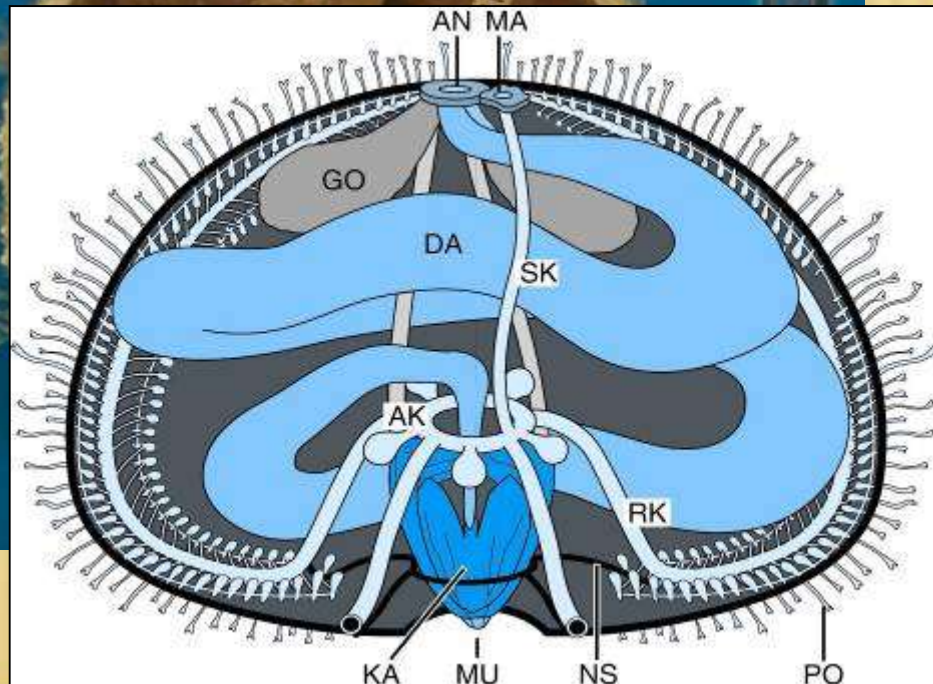
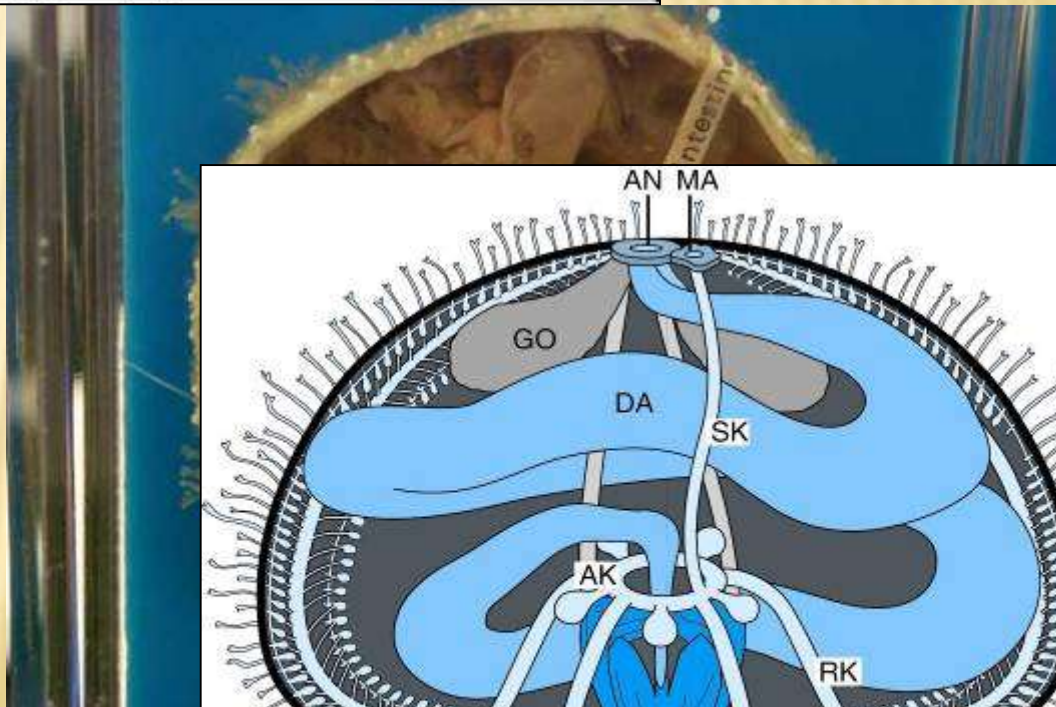
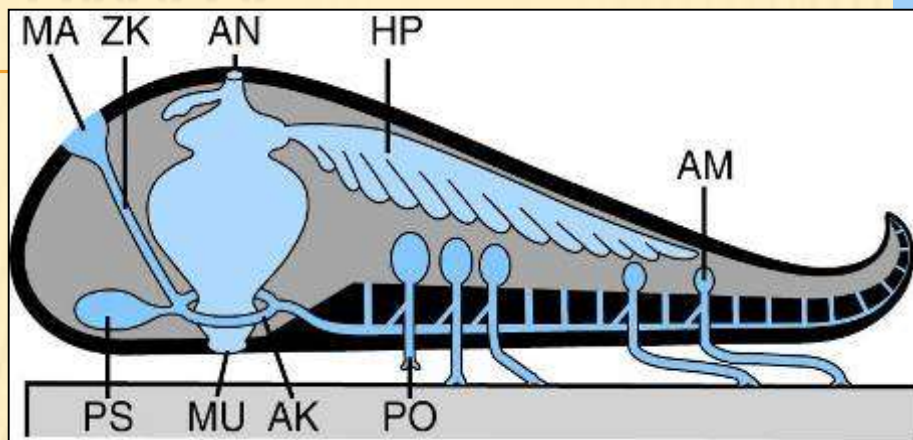
+ predators

+ herbivores

+ detritovors

✗ reproduction

+ radial cleavage



ECHINODERMATA

✗ reproduction

+ asexual

✗ paratomy, regeneration

✗ ecology

+ marine

+ coral reefs - crown of thorns
(*Acanthaster*)

+ destroy oysters

+ food

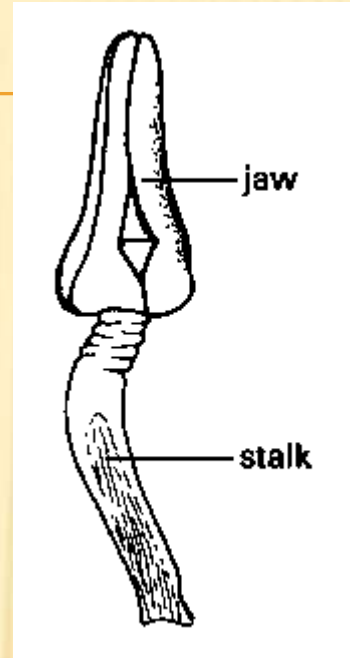
✗ sushi: urchin eggs, sea
cucumbers



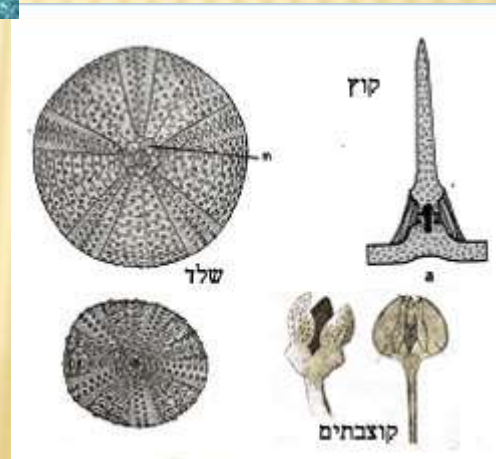
ECHINODERMATA

- defence

- skeleton
- spines
- pedicellaria
- sticky excretion
- gut autotomy
- regeneration



"comet" - regeneratred arm
"שביט" זרוע שנקטעה ועברה שיקום



ECHINODERMATA

- ✗ system - 6000 spp.
- + Crinoida - 550
- + Asteroidea – sea stars: 1500
- + Ophiuroidea - 2000
- + Echinoida – sea urchins: 950
- + Holothuroidea – sea cucumbers 900





CHORDATA



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