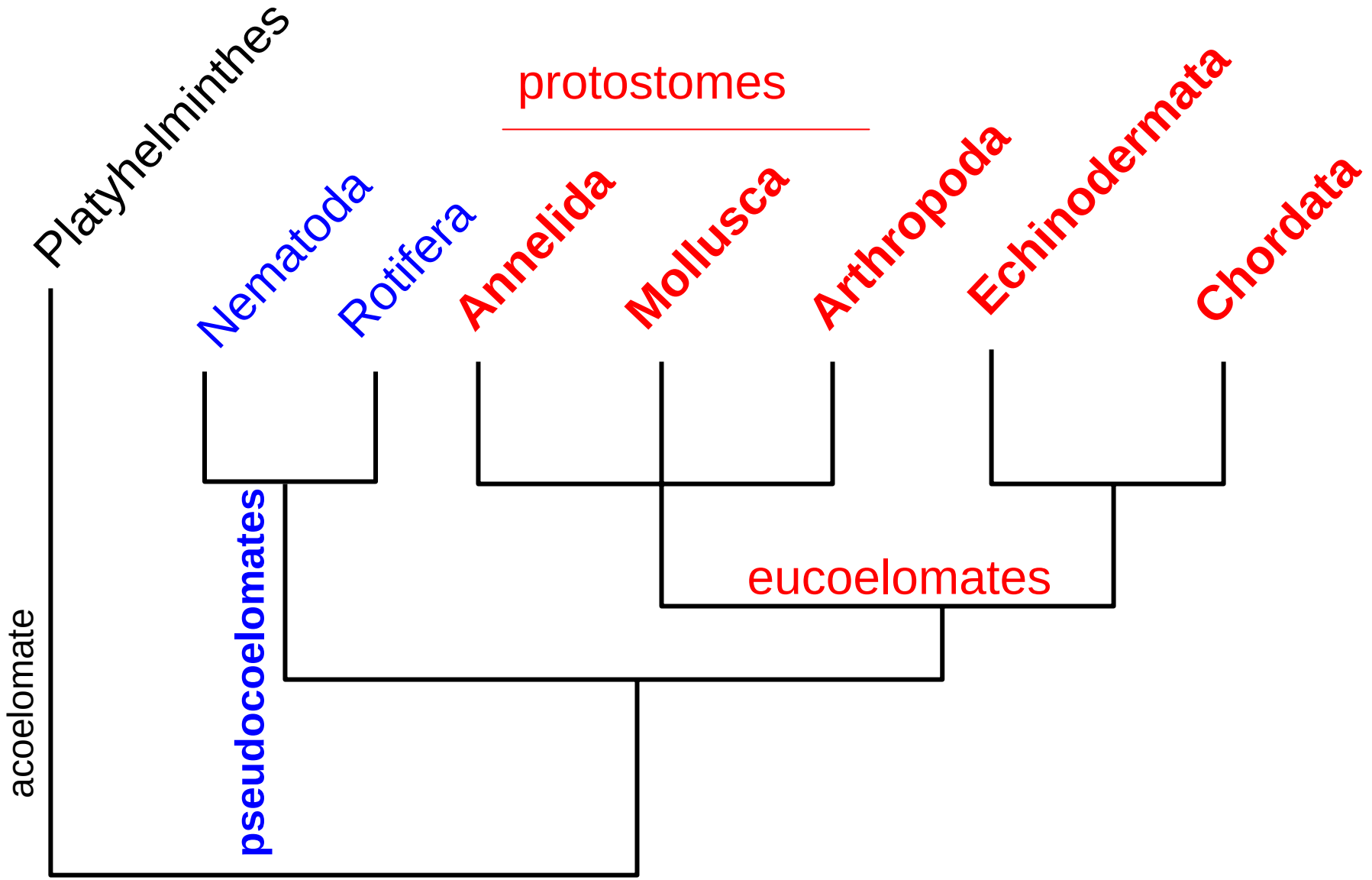
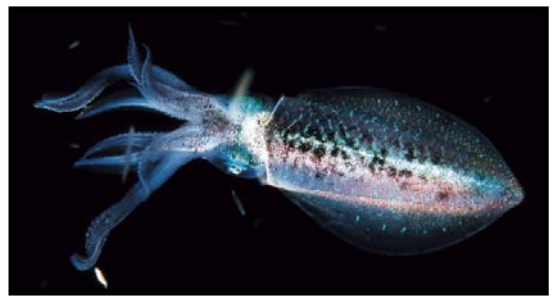

Platyhelminthes
protostomes
Nematoda
Rotifera
Annelida
Mollusca
Arthropoda
Echinodermata
Chordata
pseudocoelomates
eucoelomates
acoelomate

Phylum Mollusca

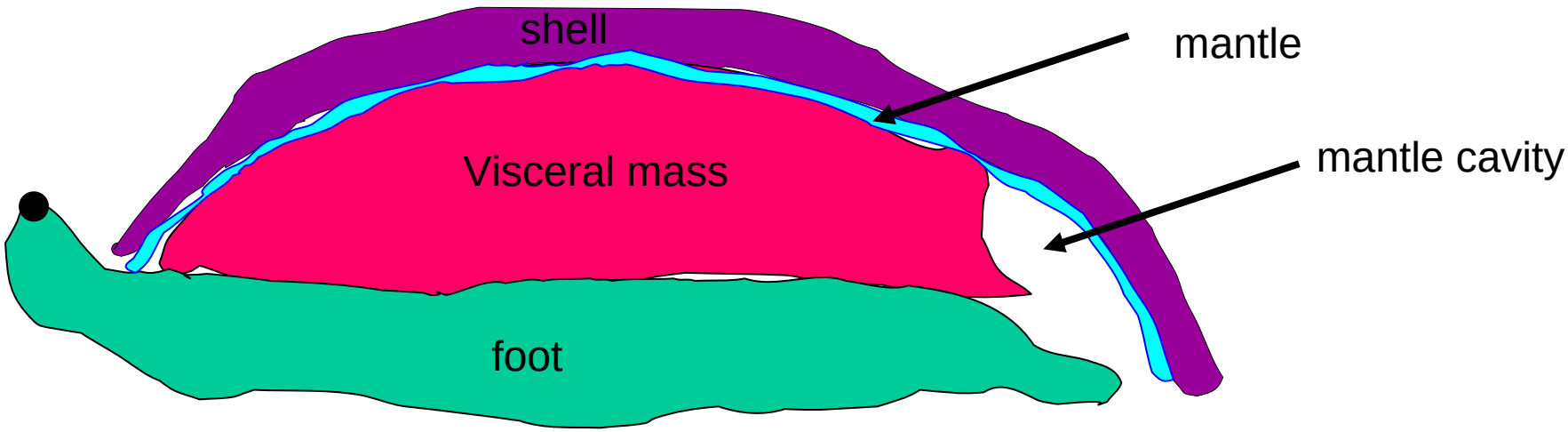
“soft bodied” animals

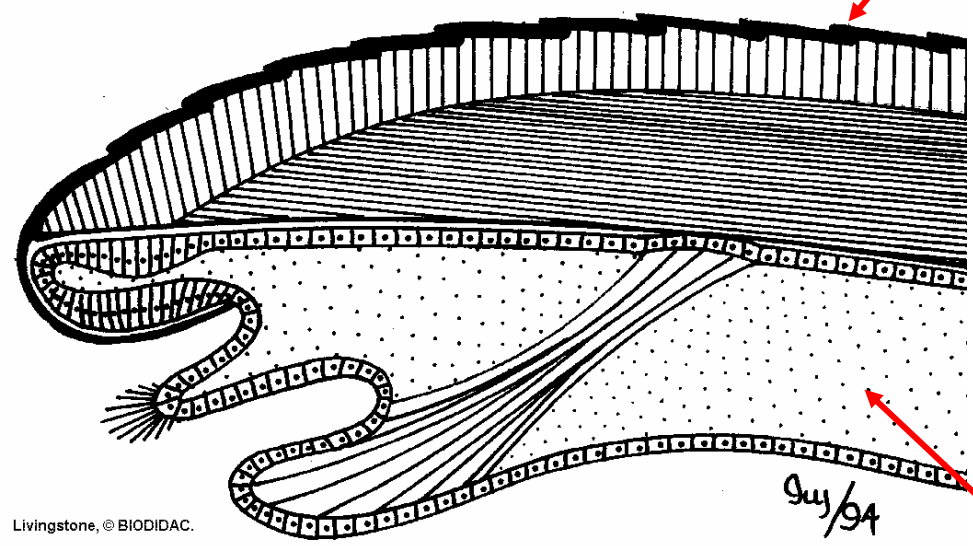


Mollusca Characteristics

Body Plan

- **head-foot:** contains sensory organs and muscles
- **visceral mass:** contains digestive, reproductive, circulatory organs
- **mantle:** skin of the dorsal body wall secretes the shell (if there is one), cavity contains gills or lungs





periostracum: conchiolin

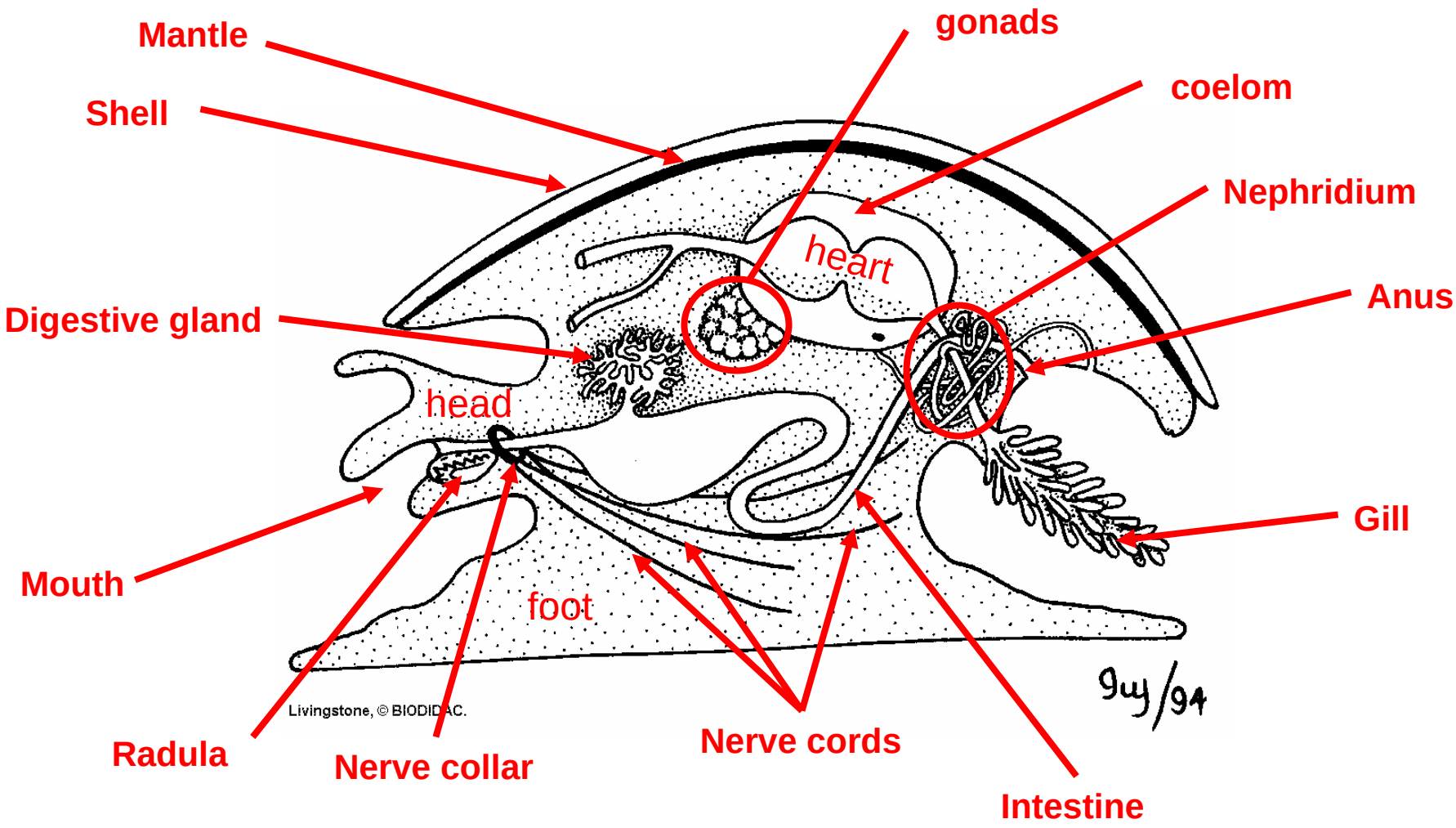
prismatic layer: calcium carbonate

nacreous layer: calcium carbonate and proteins

mantle

HAM

(Hypothetical Ancestral Mollusc)



Mollusca Characteristics

Feeding and Digestion:

There are both free living and parasitic forms

Most species use a tongue like organ called a radula when feeding

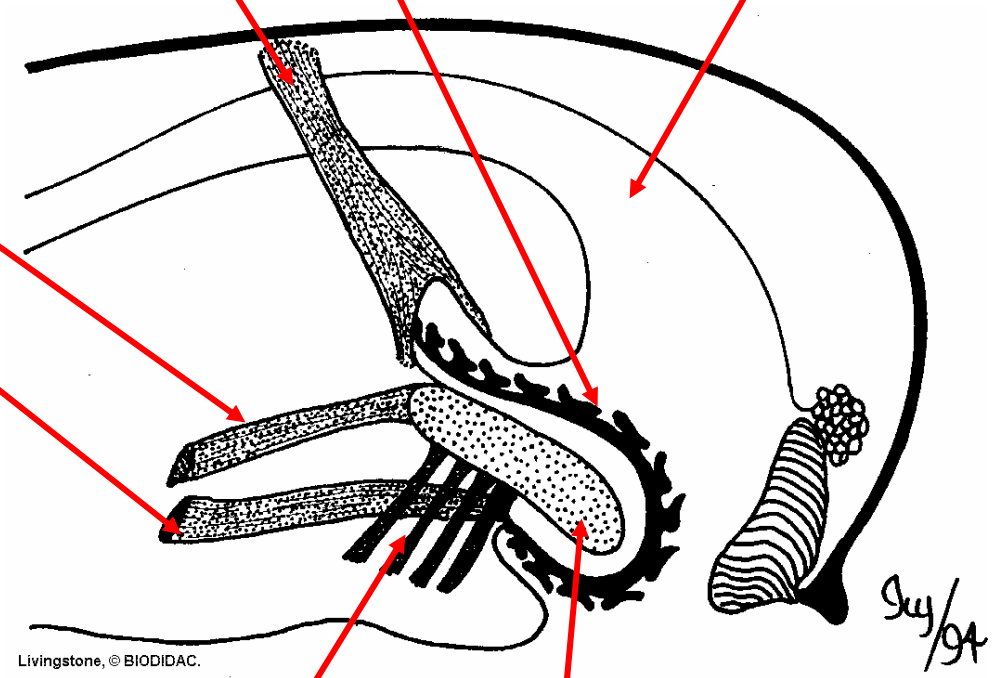
radula retractor

radula

esophagus

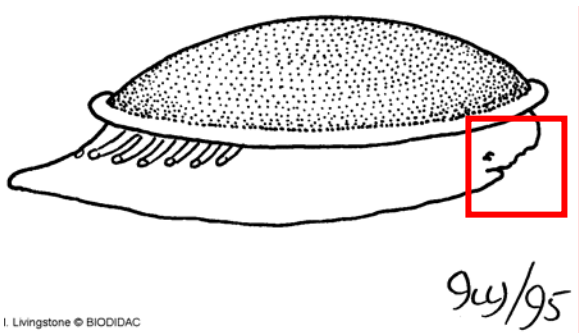
odontophore retractor

radula protractor



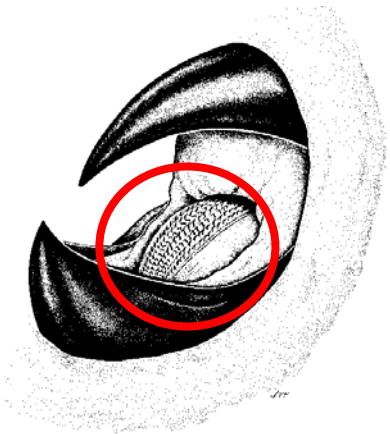
odontophore

odontophore protractor



Mollusca Characteristics

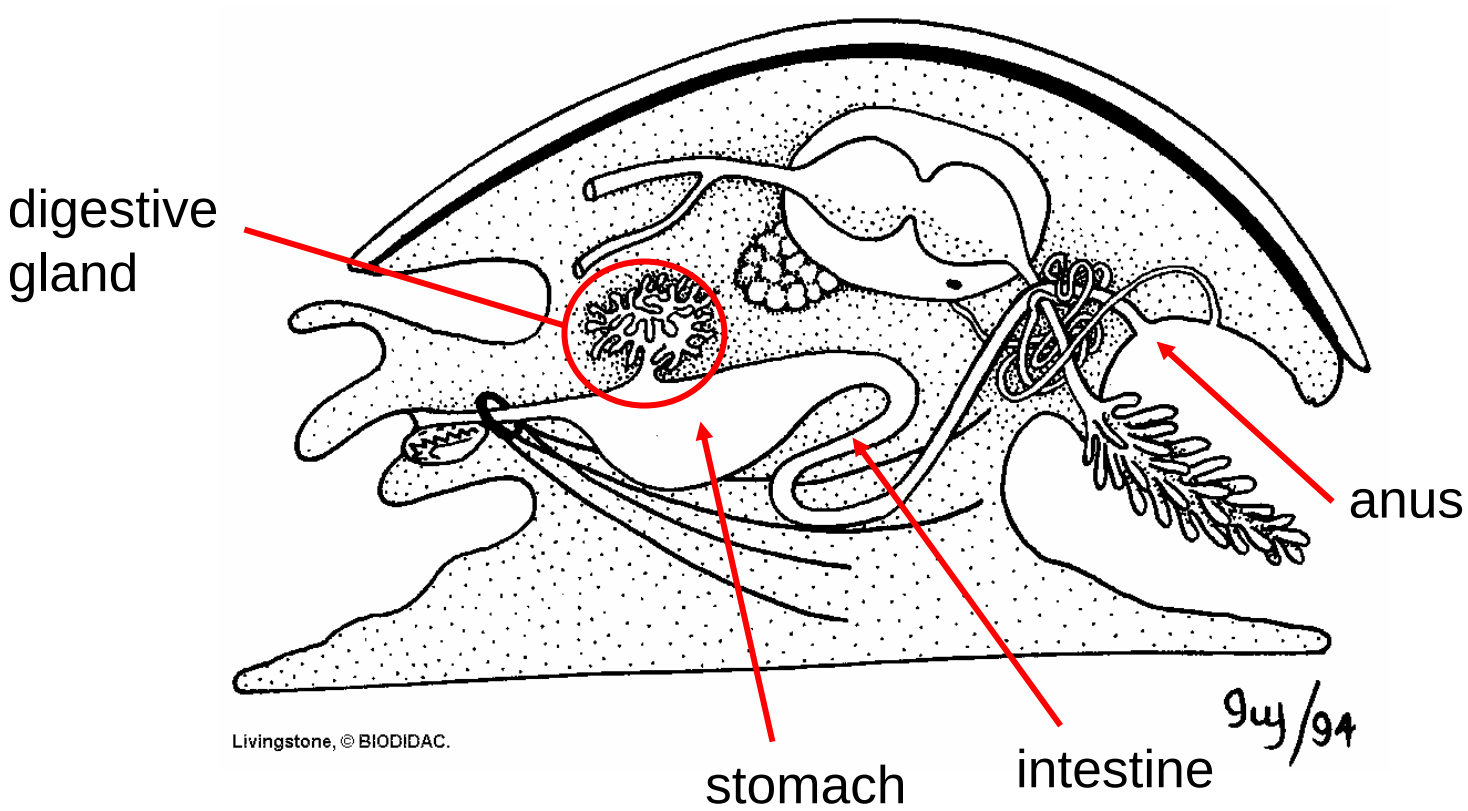
Feeding and Digestion:



Mollusca Characteristics

Digestive System

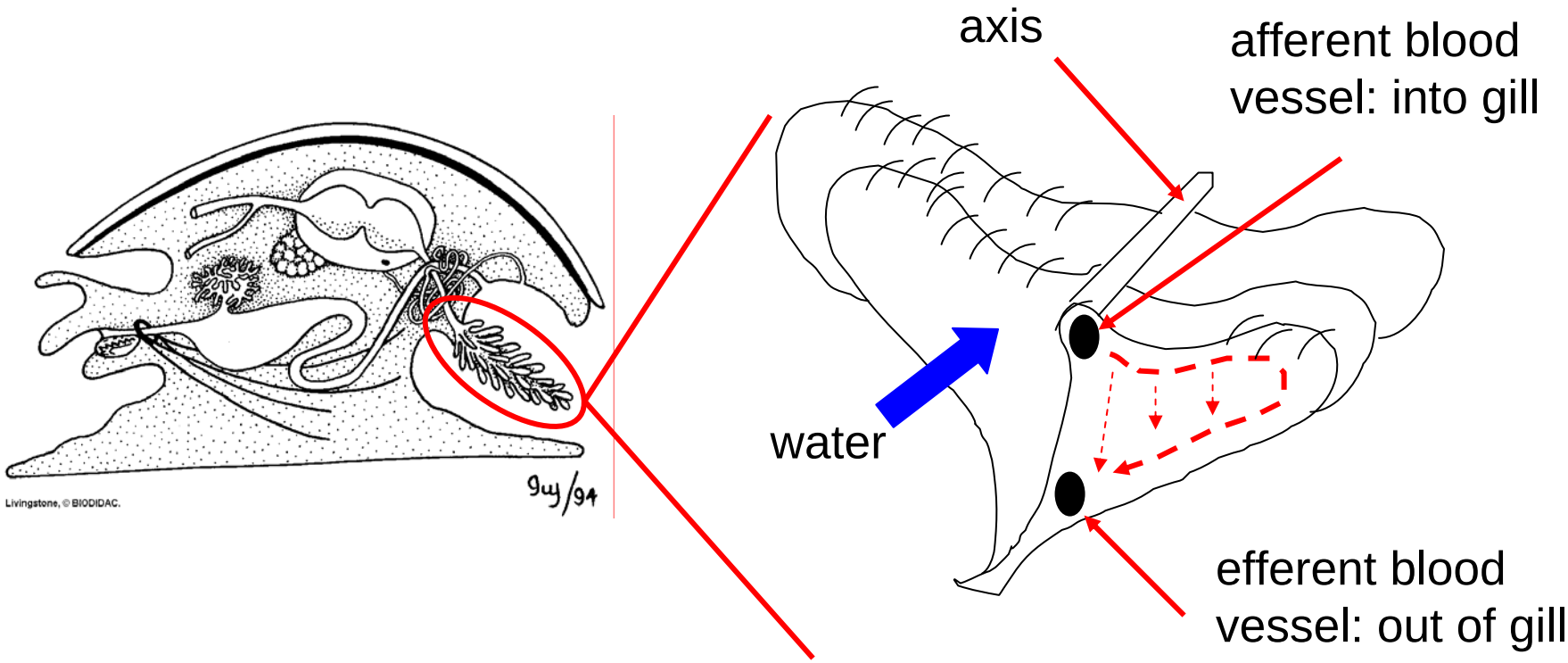
- complete with regional specialization



Mollusca Characteristics

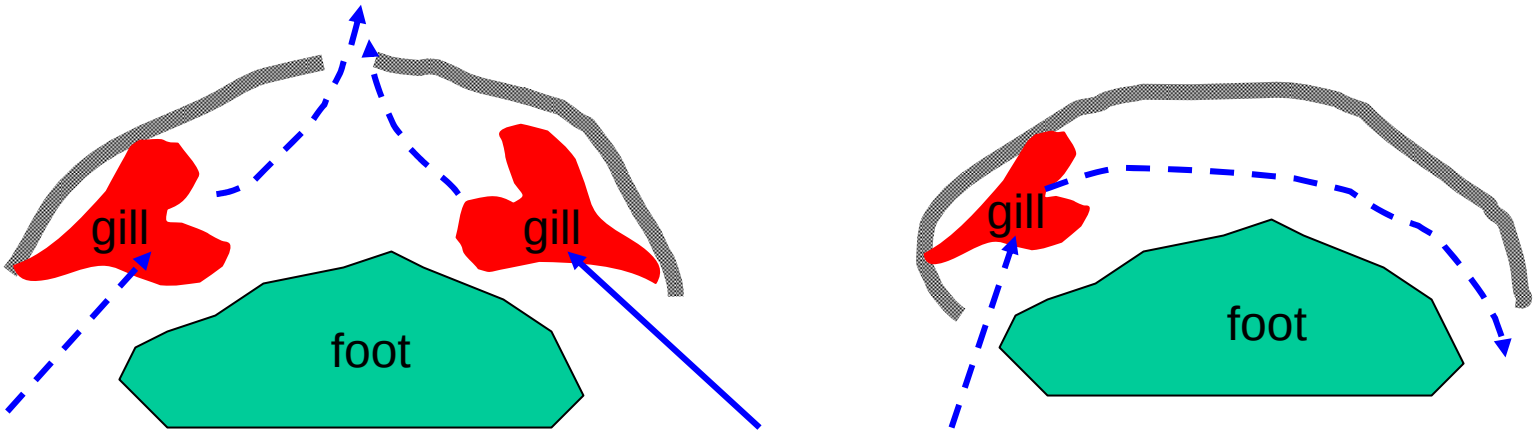
Gas Exchange

- mainly gills, however terrestrial species have evolved lungs



Mollusca Characteristics

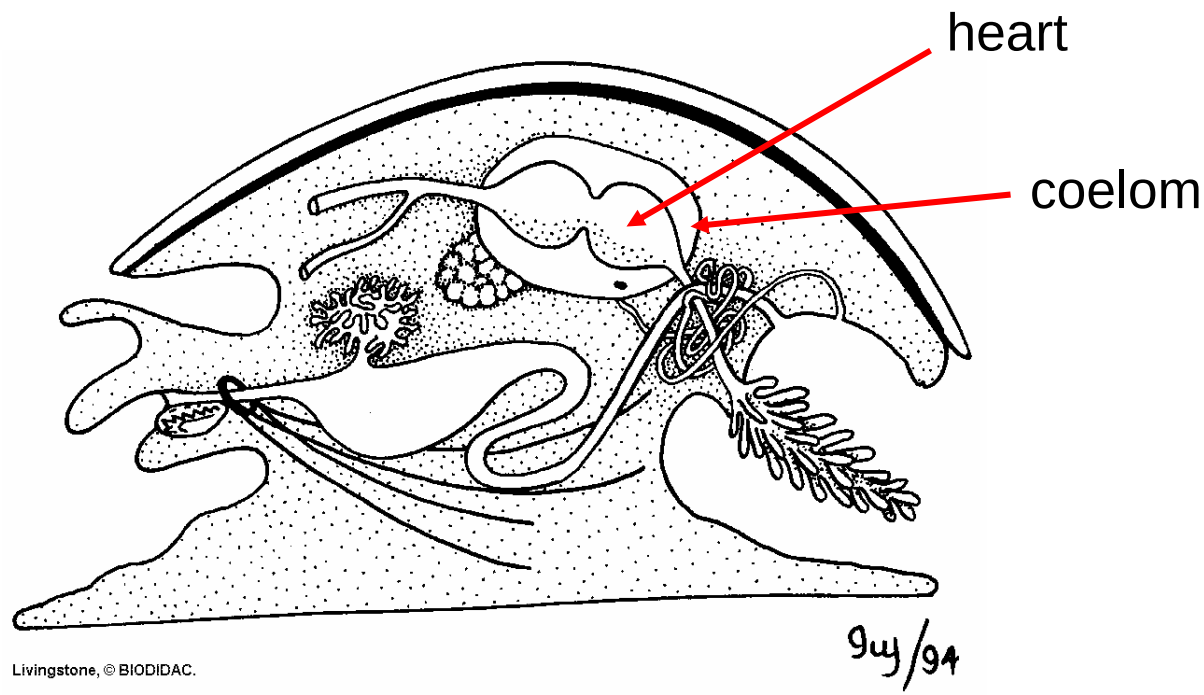
Gas Exchange



Mollusca Characteristics

Circulatory System

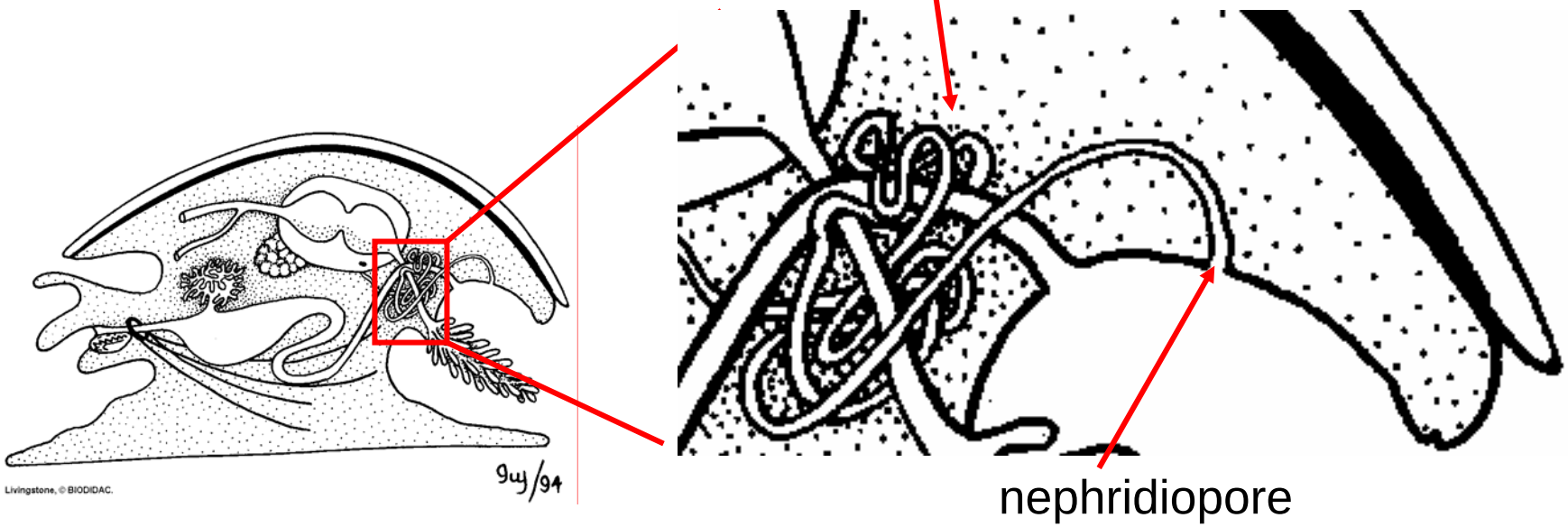
- open circulatory system (in most classes)
- heart and blood sinuses



Mollusca Characteristics

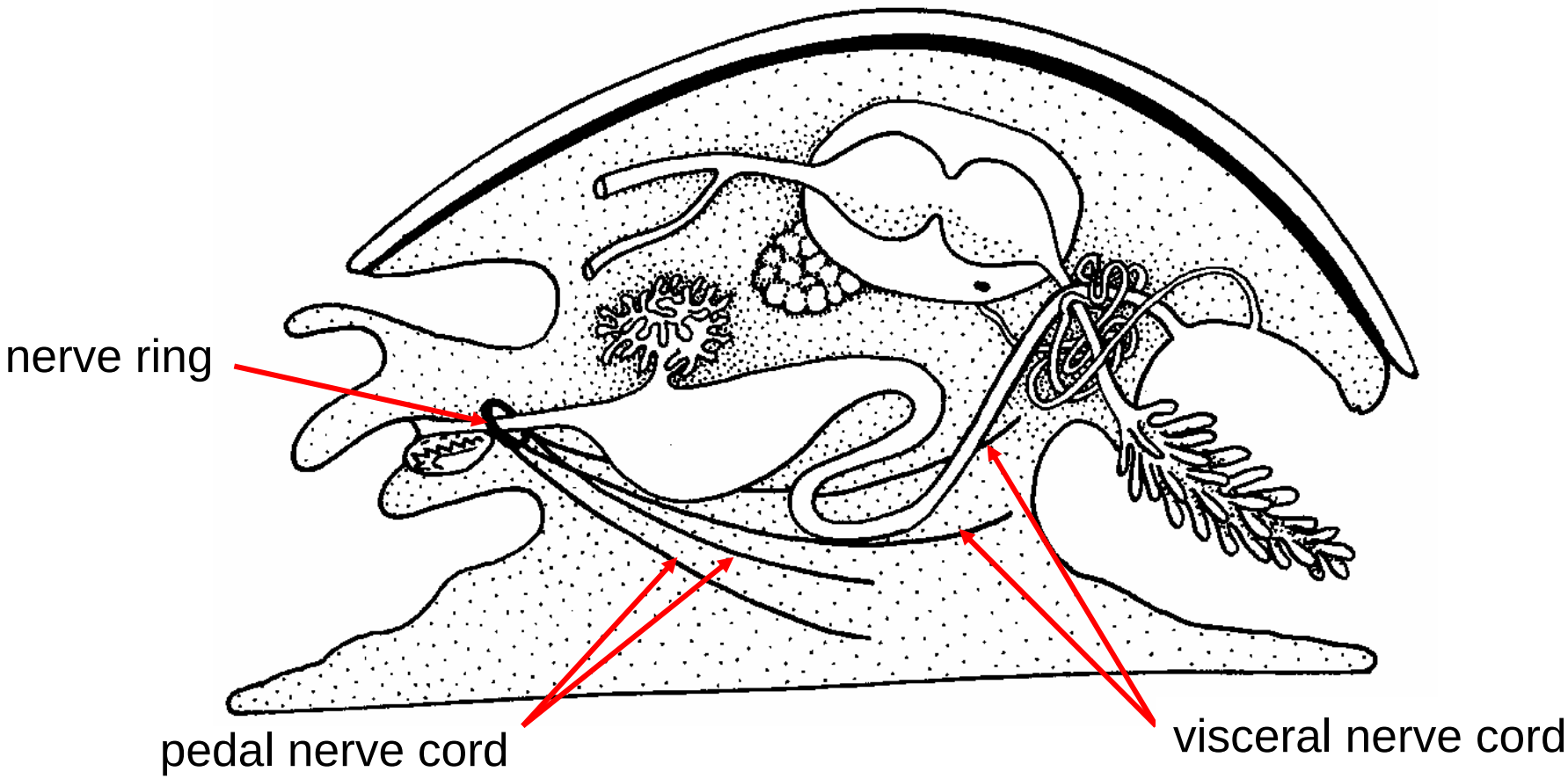
Excretion

- most have kidneys (metanephridia)
- tubules connecting pericardial cavity (coelom) and nephridiopore



Mollusca Characteristics

Nervous system

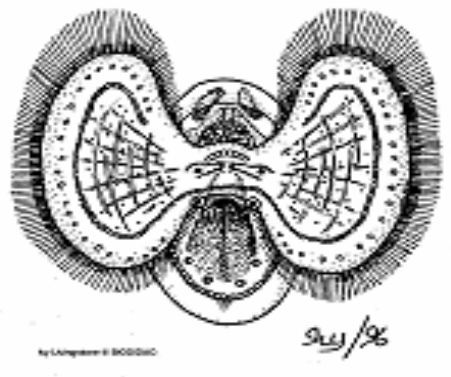


Mollusca Characteristics

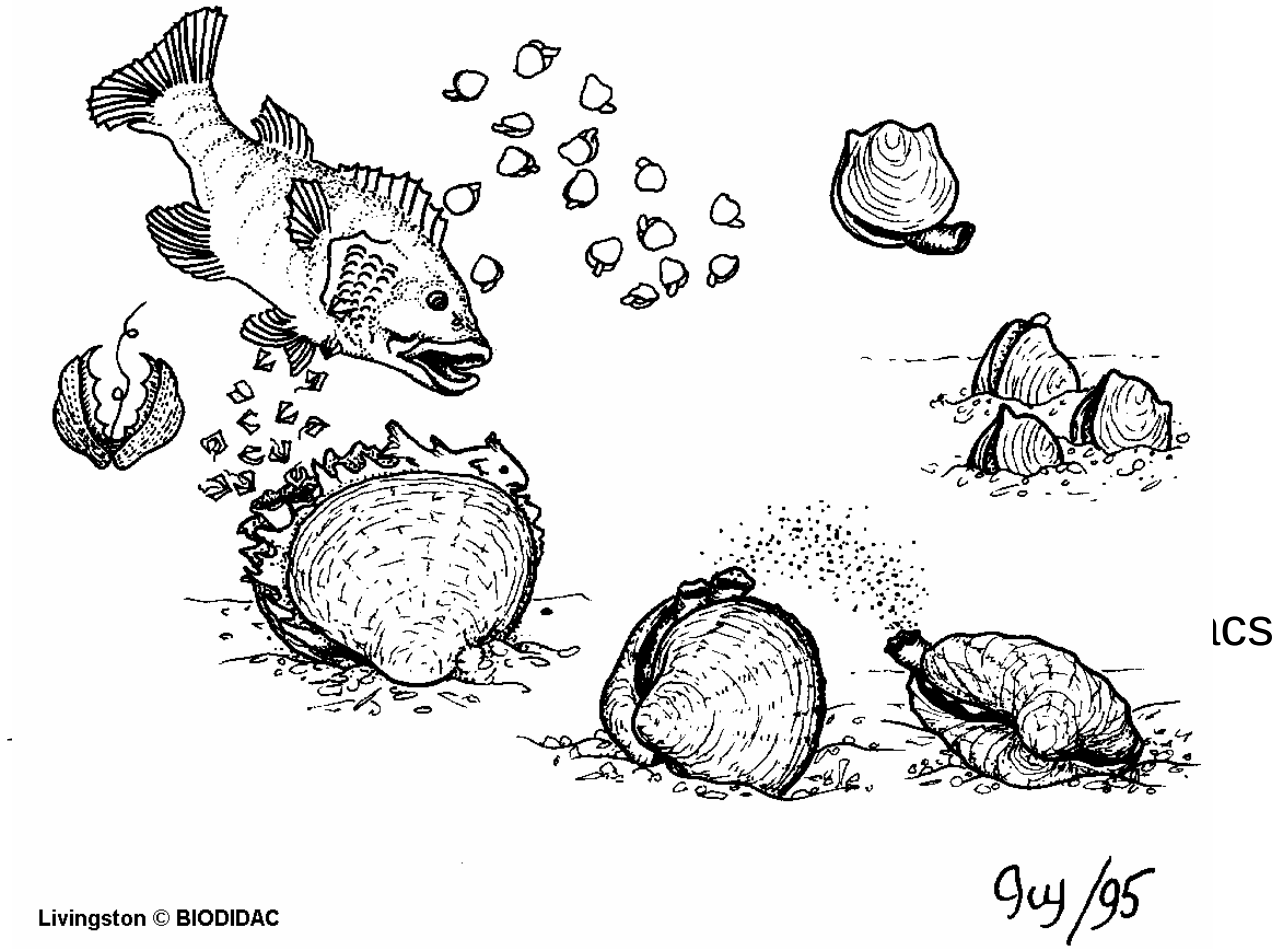
Reproduction

- monoecious and dioecious species exist
- usually internal fertilization
- indirect development with the presence of a trochophore larva (link to annelids), and in most cases also a veliger larva

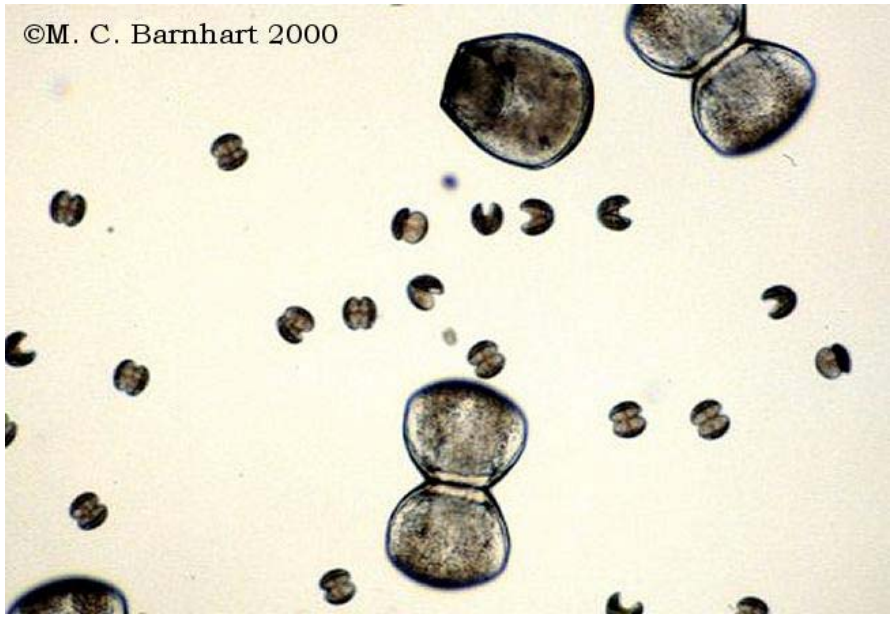
trochophore

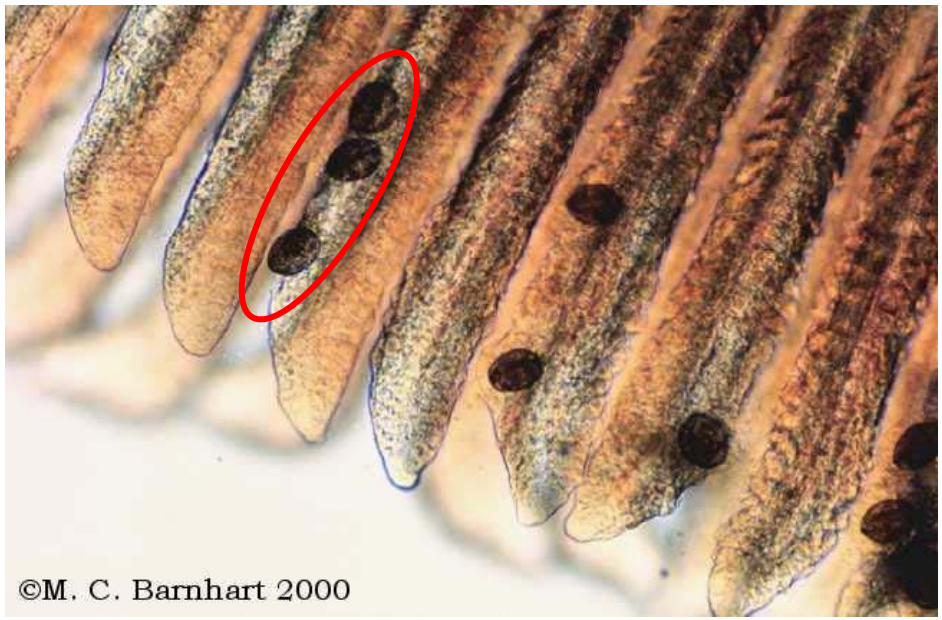


veliger



The juvenile stages of some bivalves are parasitic





Glochidia: larval bivalves that are parasitic on fish gills

Lampsilis ovata

ovisacs

Some freshwater bivalves have evolved ways of attracting hosts for their larvae.

Some species place their larva in a lure called a superconglutinate

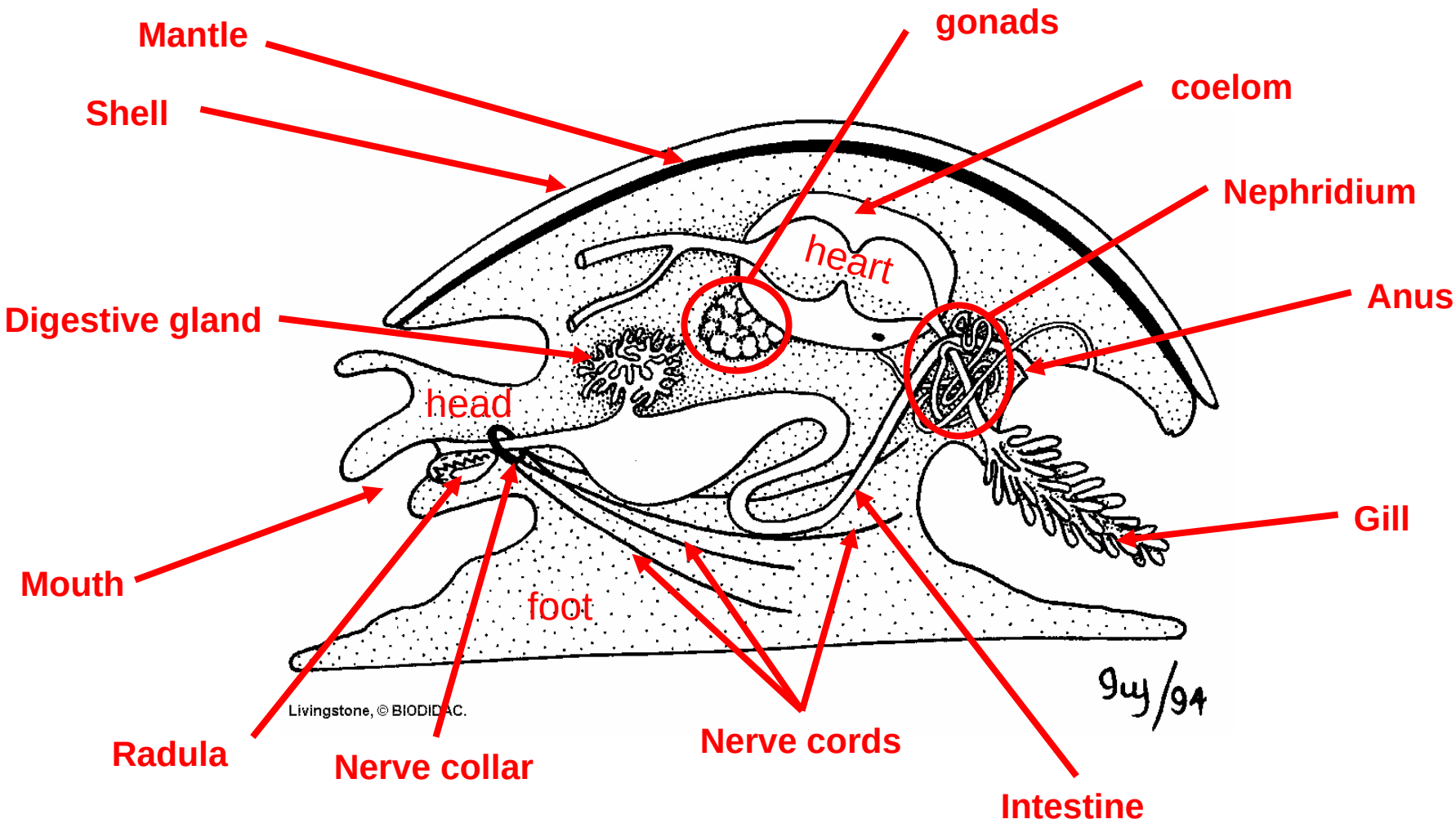
http://courses.smsu.edu/mcb095f/gallery/L_perovalis/lampsilis_perovalis.htm

Molluscan Radiation

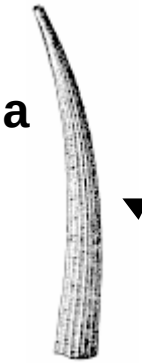
- There are approximately 128,000 living species in phylum Mollusca (35,000 are extinct)
- The great morphological diversity is the result of elaboration on the basic body plan (HAM)

HAM

(Hypothetical Ancestral Mollusc)

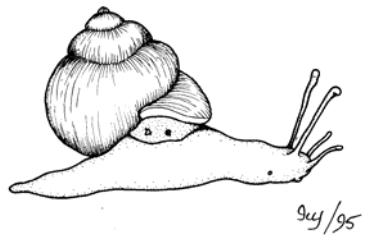


Molluscan Radiation



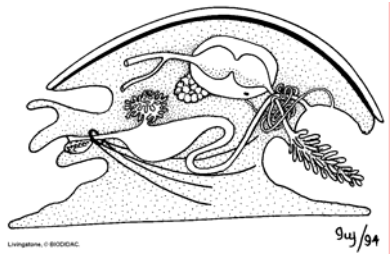
Scaphopoda

• ventral shell fusion



Gastropoda

• torsion
• coiling of the shell



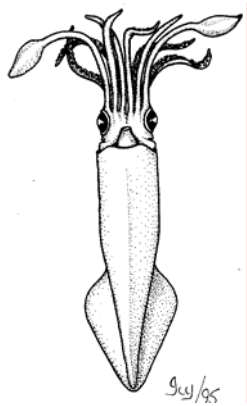
HAM

Polyplacophora

• shell consists of 8 plates

Bivalvia

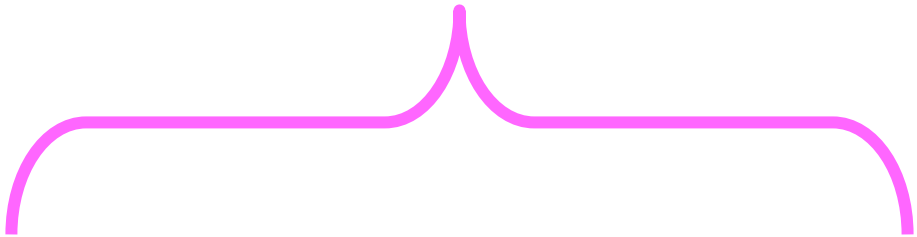
• bivalved shell
• dorsal hinge



Cephalopoda

• lobed foot
• highly developed head
• shell reduced or lost

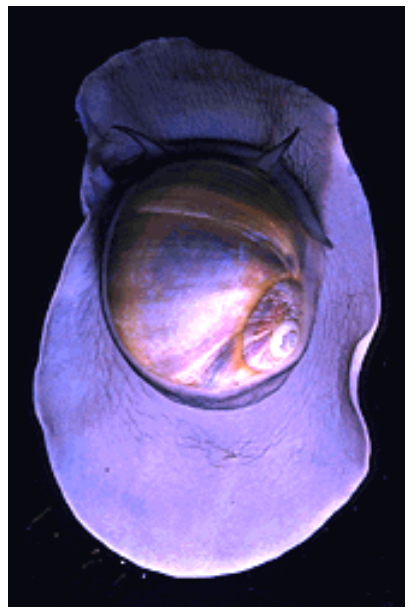
Phylum Mollusca



Class Gastropoda
Class Bivalvia
Class Cephalopoda
Class Polyplacophora
Class Scaphopoda

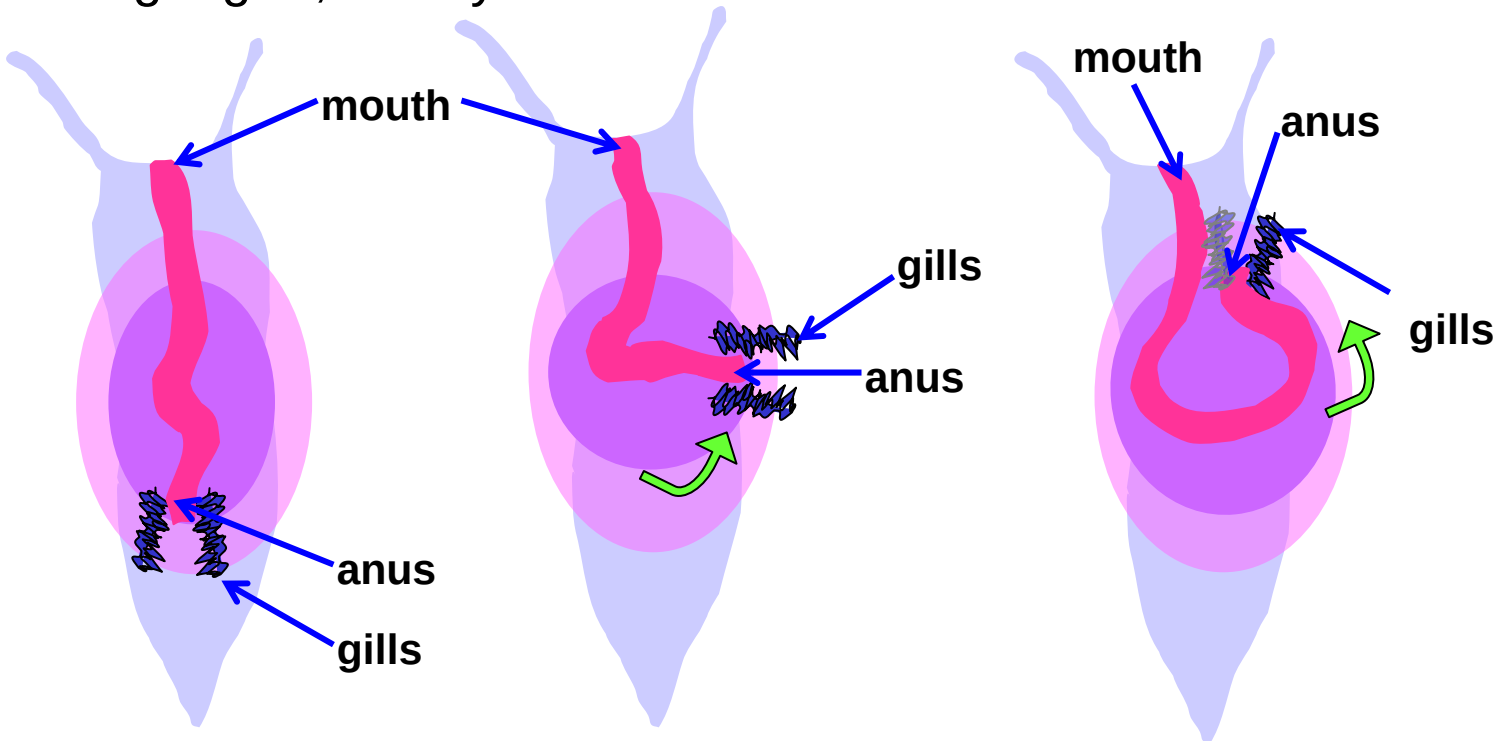
Class Gastropoda

snails and slugs

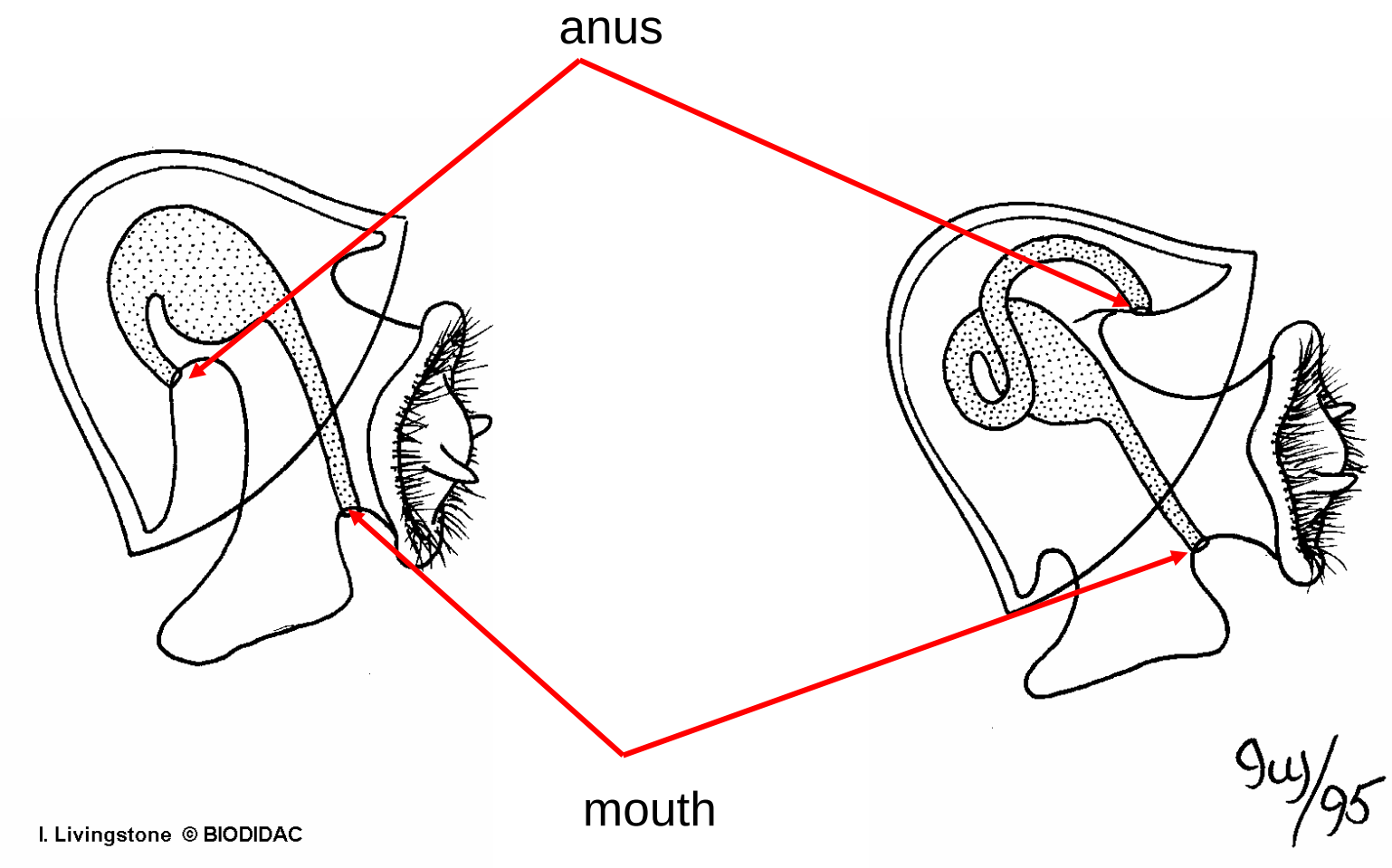


Torsion

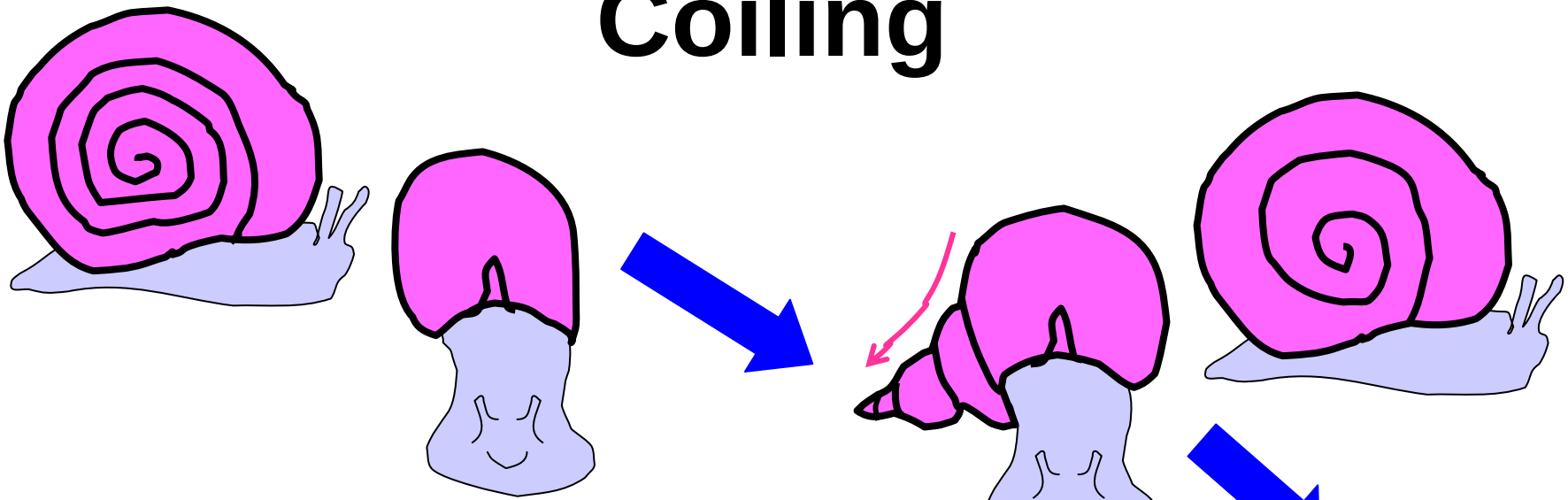
- twisting of the visceral mass through a 180° rotation
- 1st 90° rotation usually occurs at the veliger stage
- the 2nd 90° rotation usually takes longer and occurs later
- after torsion, the anus and mantle cavity end up over the head
- this poses a serious fouling problem and many gastropods have lost their right gills, kidneys and heart auricles



Larval torsion



Coiling



Apex of shell extends out making the shell more compact

Shell shifts over body for better weight distribution

Planospiral shell

Conispiral shell

Class Gastropoda

Subclass Prosobranchia

Subclass Opisthobranchia

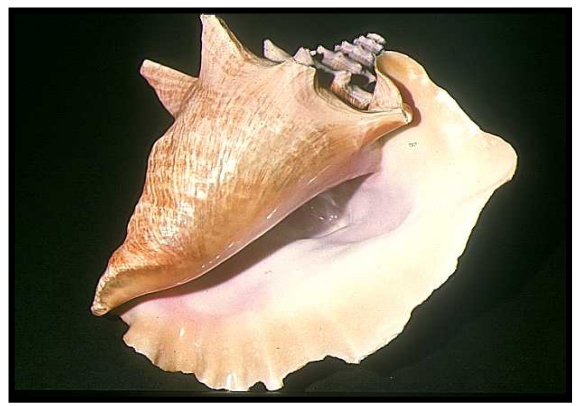
Subclass Pulmonata

Class Gastropoda

Subclass Prosobranchia

- aquatic snails (marine and freshwater)
- have undergone torsion and most have undergone shell coiling
- have gills
- all have shells
- use radula for feeding; can be herbivores, carnivores, or detritivores

In some, mantle extends over shell



Class Gastropoda

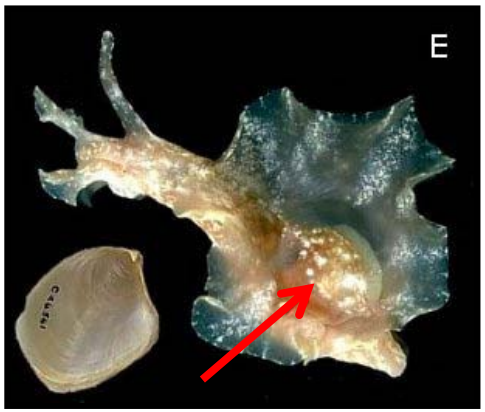
Subclass Prosobranchia

- snails often lay eggs in protective capsules

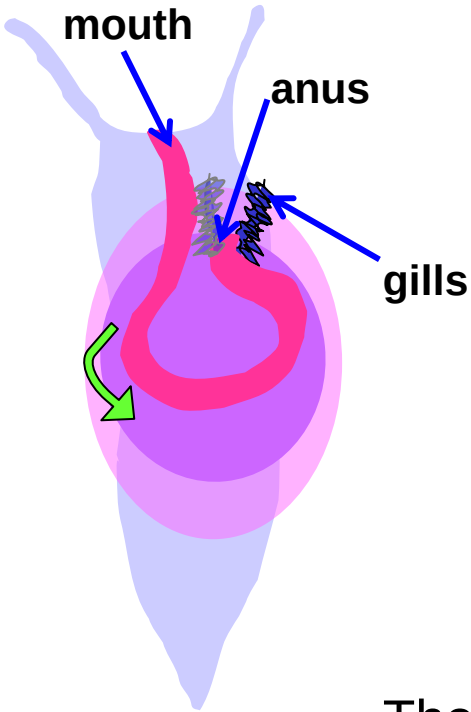
Class Gastropoda

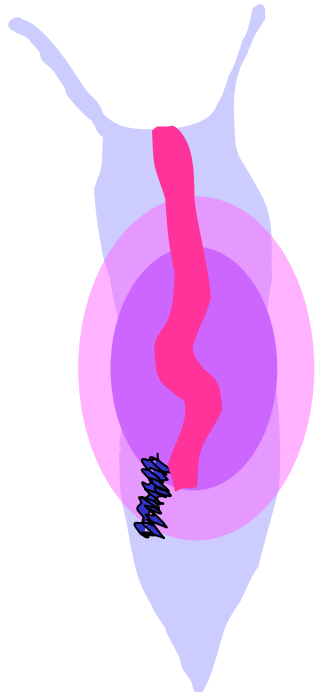
Subclass Opisthobranchia

- sea hares and sea slugs (nudibranchs)
- have undergone detorsion
- have gills
    - sea hares have a reduced shell
    - sea slugs have no shell



Detorsion





They are missing the right gill, kidney and heart auricle

Class Gastropoda

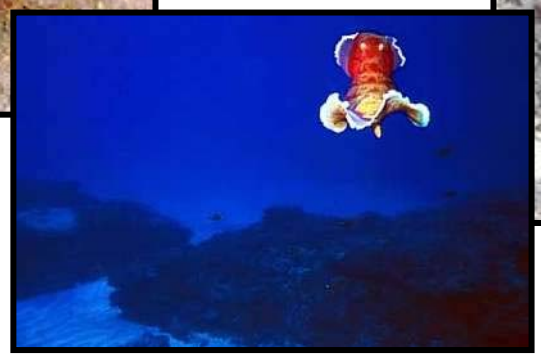
Subclass Opisthobranchia

- sea hares and sea slugs (nudibranchs)

Class Gastropoda

Subclass Opisthobranchia

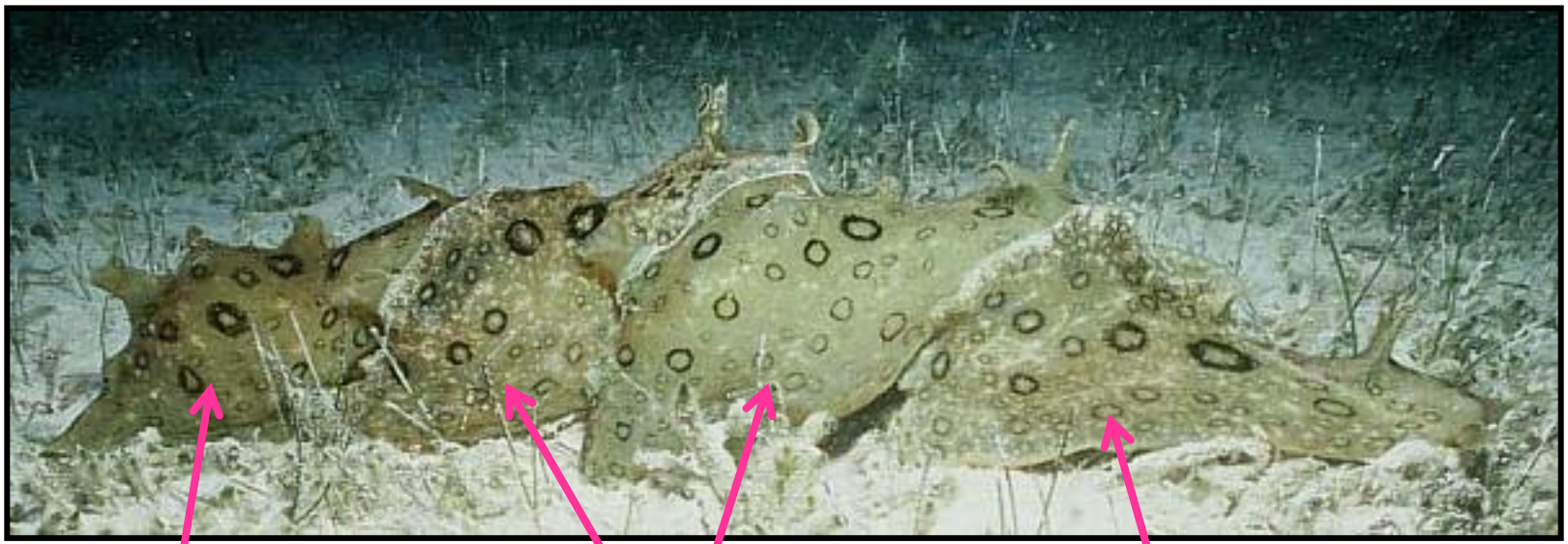
• they usually crawl along the bottom but many can also swim by using their modified mantle as “wings”



Class Gastropoda

Subclass Opisthobranchia

- all are monoecious
- sea hares often form “mating chains”



acts as male only

act as both males and females simultaneously

acts as female only

Class Gastropoda

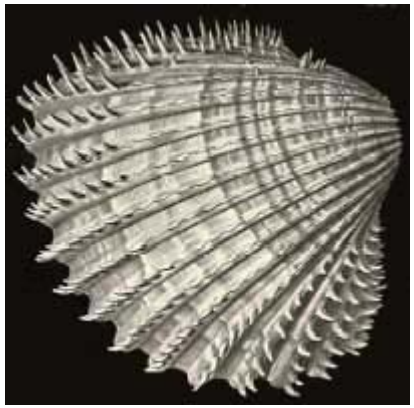
Subclass Opisthobranchia

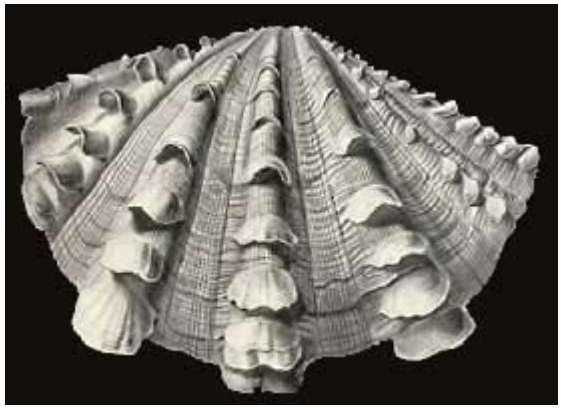
- sea slugs often lay “ribbons” of eggs which stick to the substrate

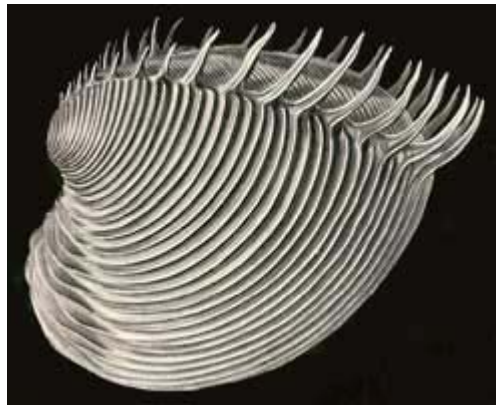
Class Gastropoda

Subclass Pulmonata

- land snails and land slugs
- have lungs
- land slugs have undergone detorsion and have lost their shell







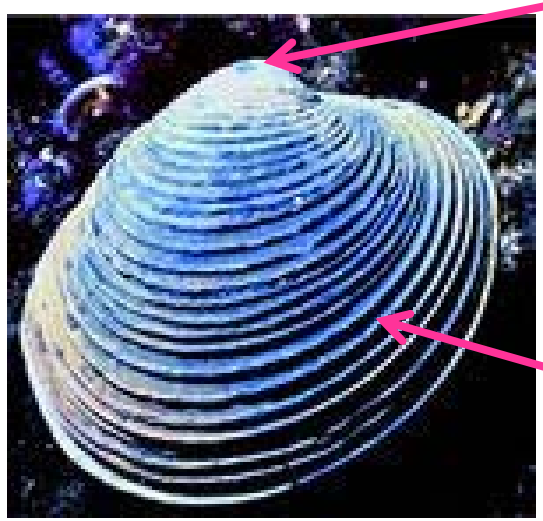
Class Bivalvia

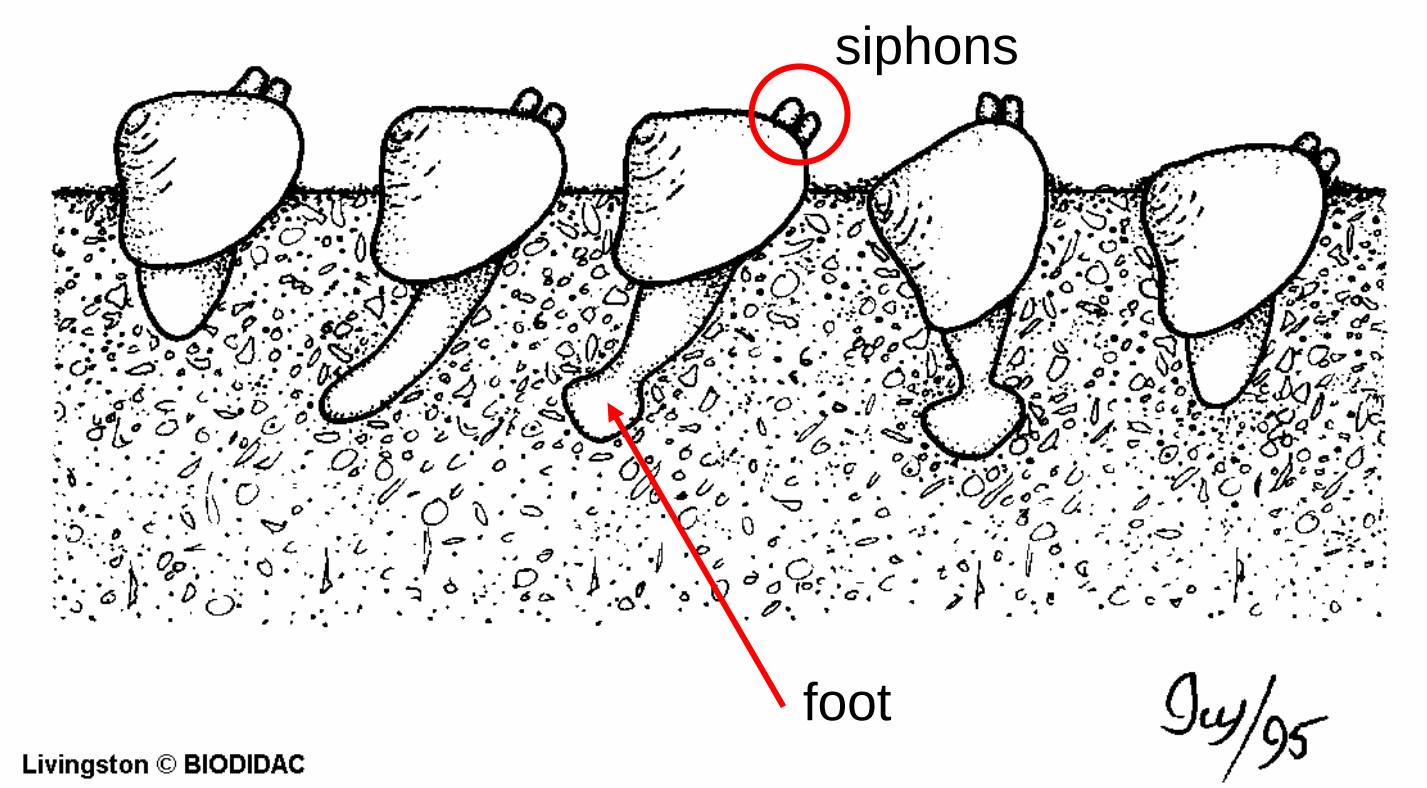
(class Pelecypoda)

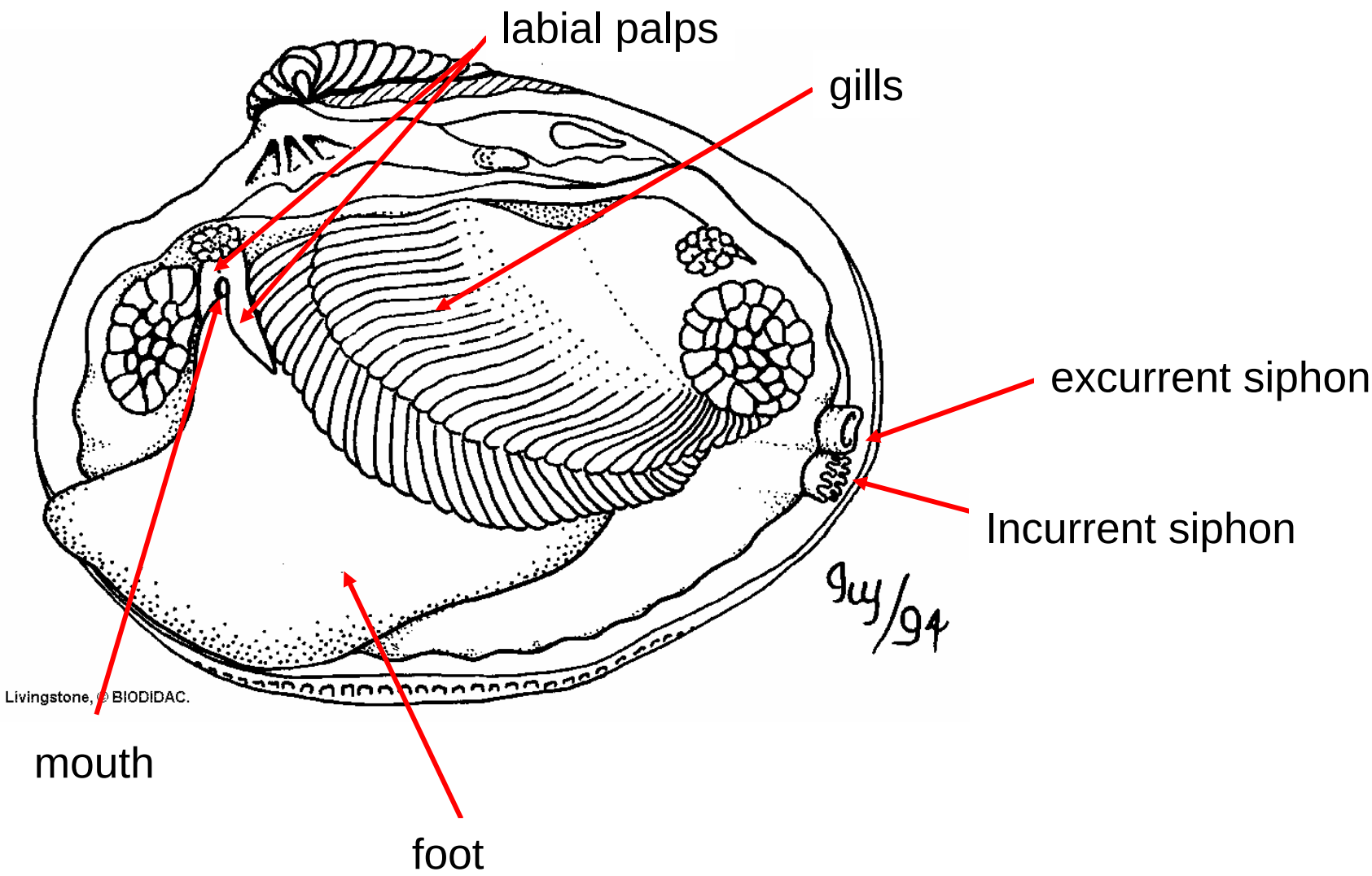
the “bivalves”

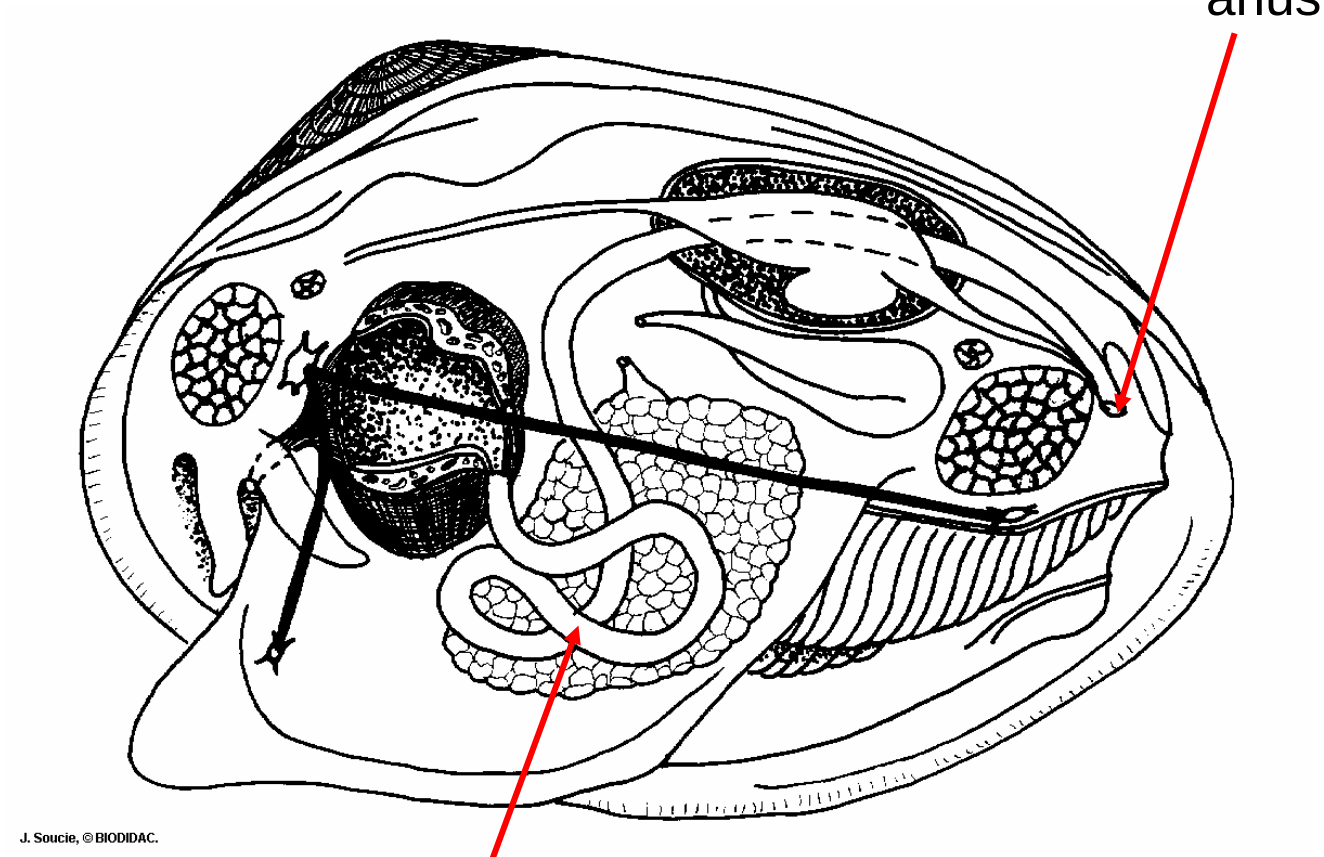
Class Bivalvia

- clams, mussels, oysters, scallops
- use gills for respiration and filter feeding
- shell is modified into a bivalved shell connected by muscles and ligaments
- no head (reduced sensory organs), no radula
- foot can be modified for digging



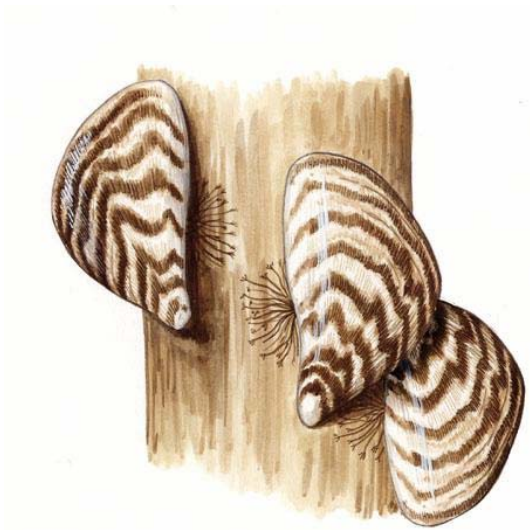

siphons
foot
Livingston © BIODIDAC


labial palps
gills
excurrent siphon
Incurrent siphon
mouth
foot
Livingstone, © BIODIDAC.

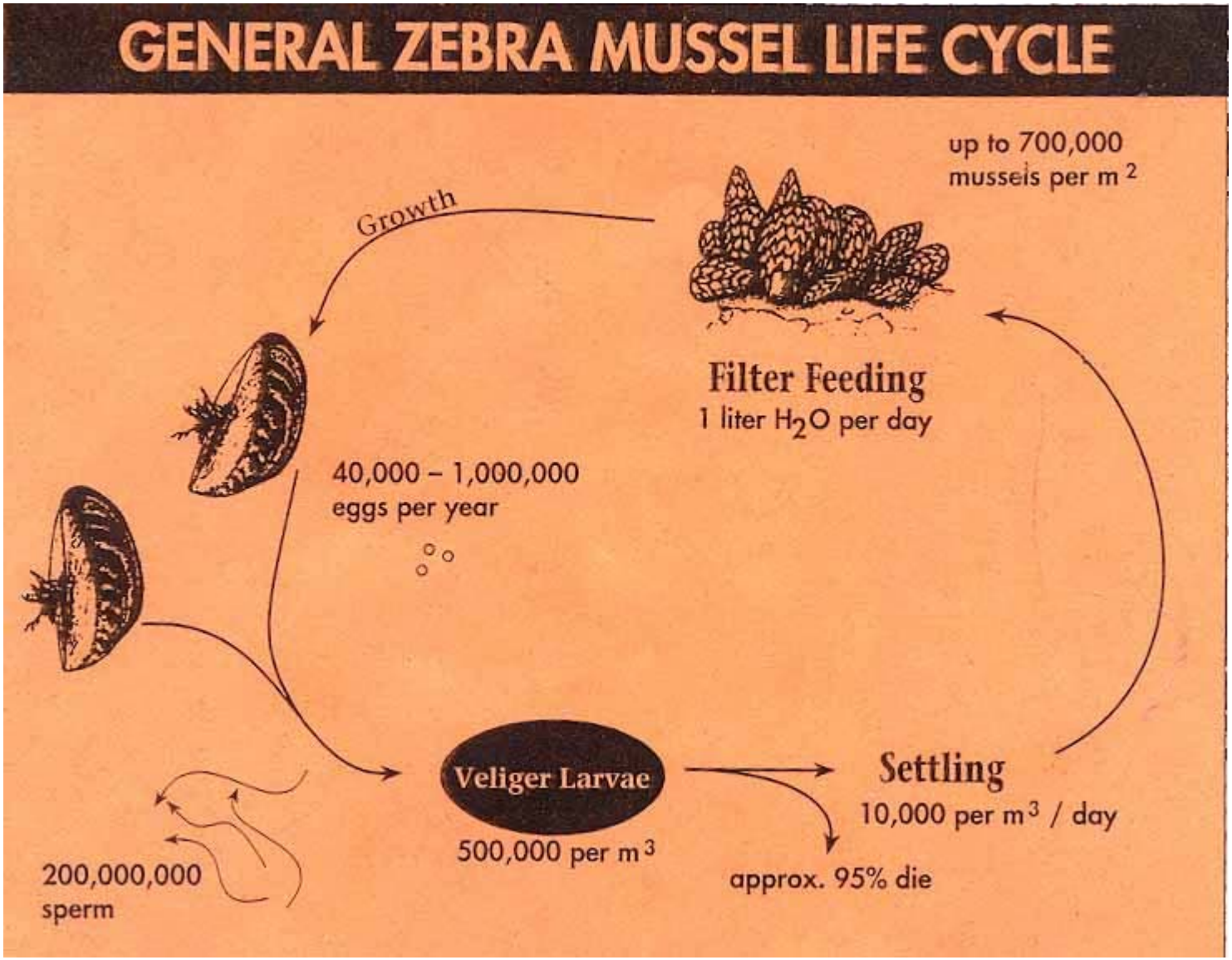

anus
intestine
J. Soucie, © BIODIDAC.

Zebra Mussels: *Dreissena polymorpha*

Native to Asia, introduced to the North America in ballast water



GENERAL ZEBRA MUSSEL LIFE CYCLE




Ontario Ministry of Natural Resources

Consequences of zebra mussel invasion:

1. Decrease in phytopalnkton (increase in water clarity)
2. Change lake food webs
3. Out compete native mussels
4. Cause physical damage to water intake pipes

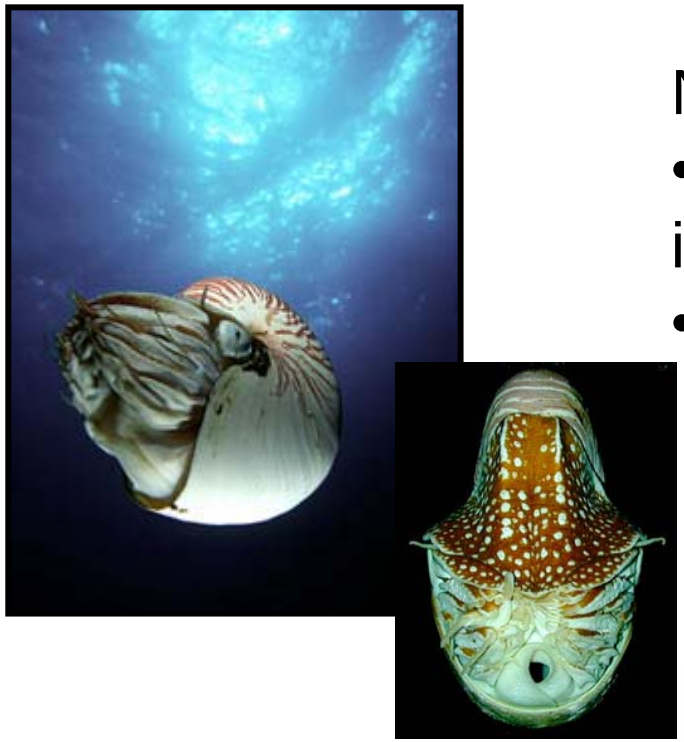
Class Cephalopoda

the squids, octopus, nautilus, and cuttlefish

Class Cephalopoda

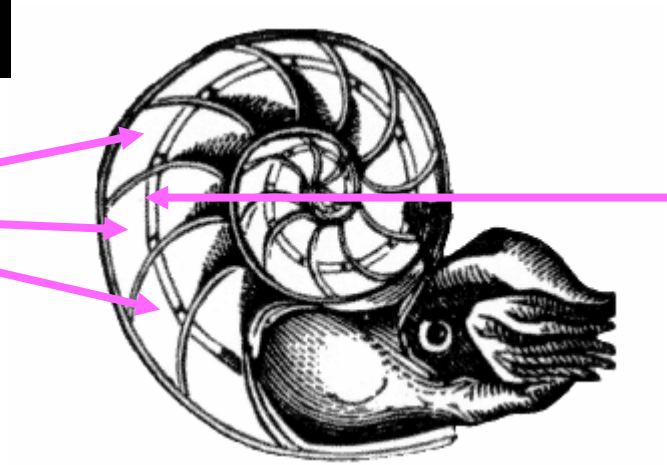
- shell is present, reduced, or lost
- all are predacious with beak-like jaws
- highly developed head and sensory organs (very intelligent)
- closed circulatory system
- swim via jet propulsion
- foot is lobed and forms tentacles
- direct development (no larvae)

Class Cephalopoda



Nautilus:

- have a chambered shell that aids in maintaining buoyancy
- chambers are filled with gas



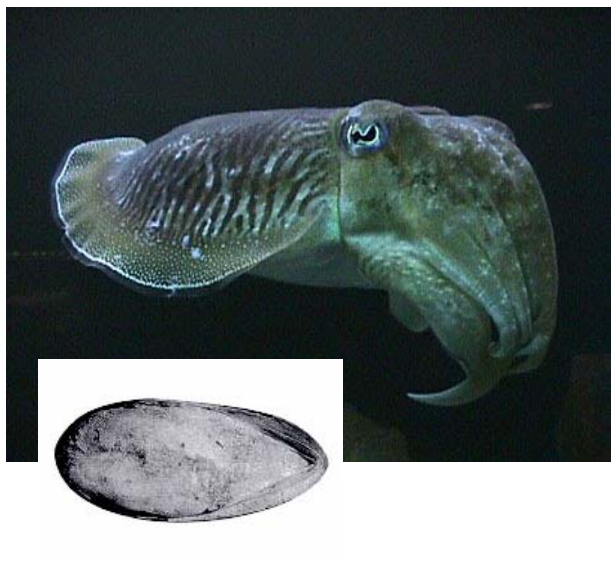
chambers

siphuncle
(cord of tissue connected to visceral mass)

Class Cephalopoda

Squids:
• have a reduced, internal shell shell called the pen

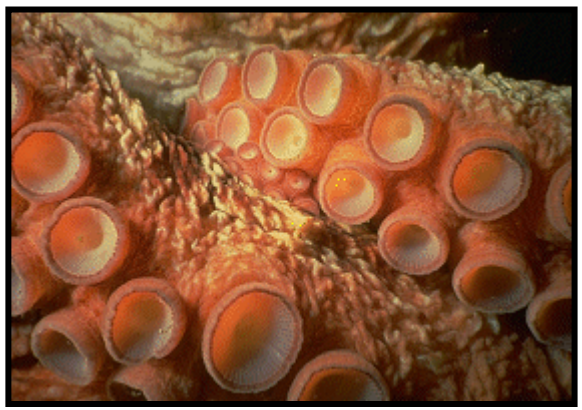
Cuttlefish:
• have a reduced, internal shell called a cuttlefish bone



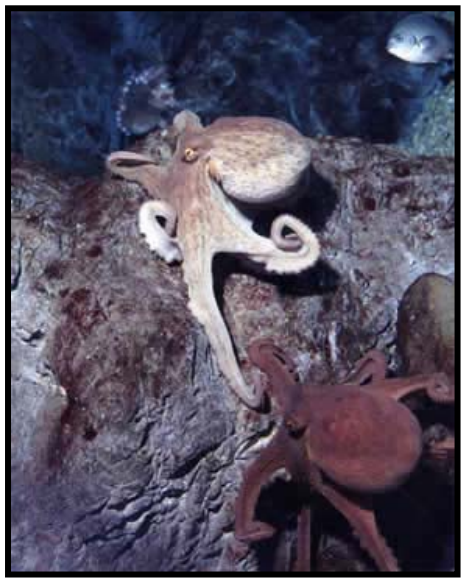
Class Cephalopoda

Octopus:

- have lost the shell completely
- most intelligent invertebrate

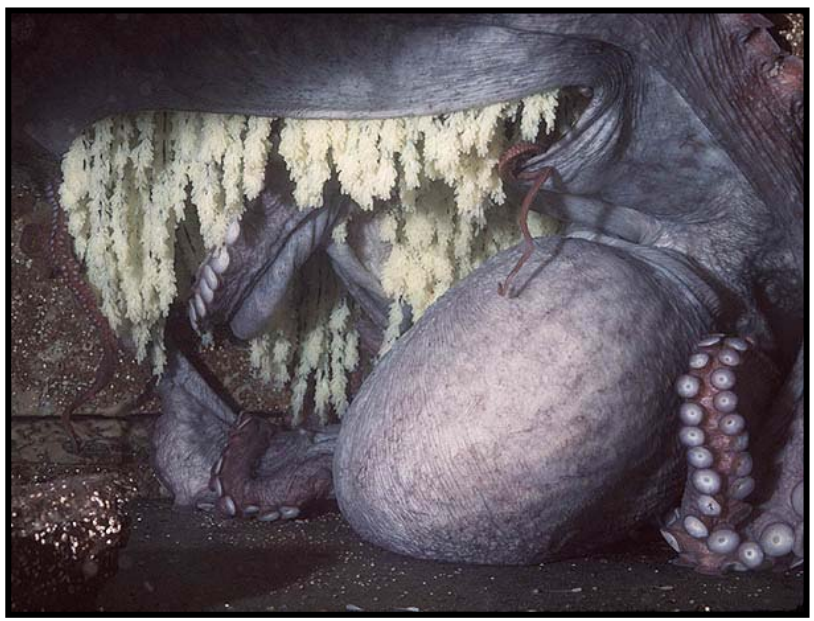


Class Cephalopoda

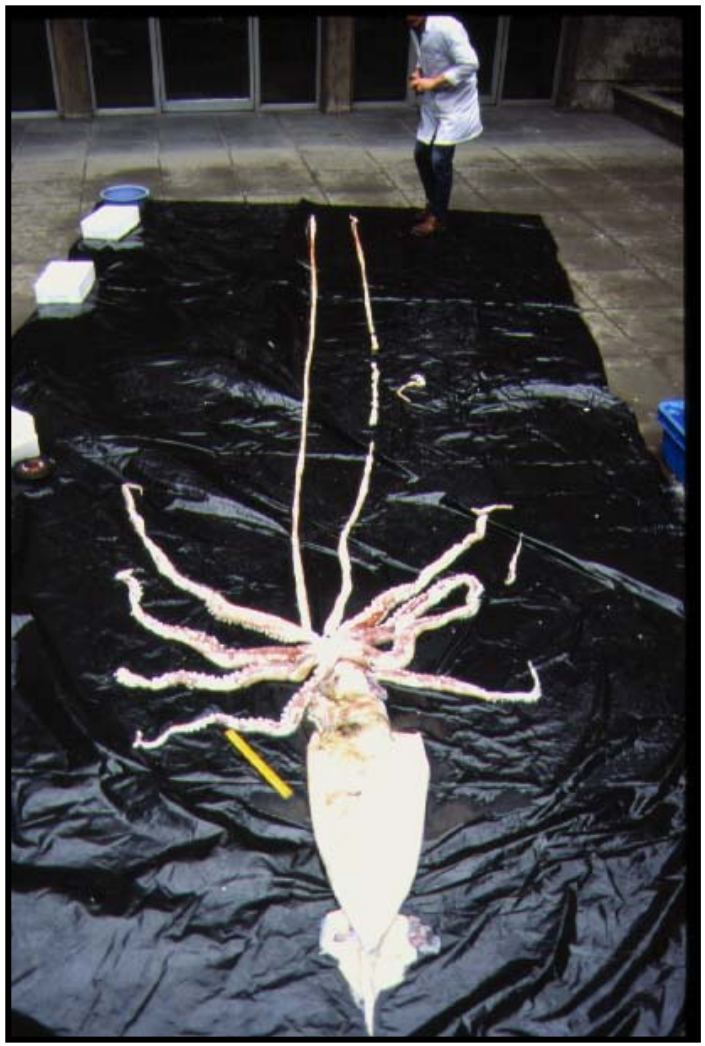


Reproduction

- male transfers a spermatophore to female using a special pair of tentacles
- female seals herself up in a den to lay eggs which she attaches to the top of the den
- she cares for these eggs (in some species up to 6.5months)
- after the eggs hatch she usually dies



Class Cephalopoda



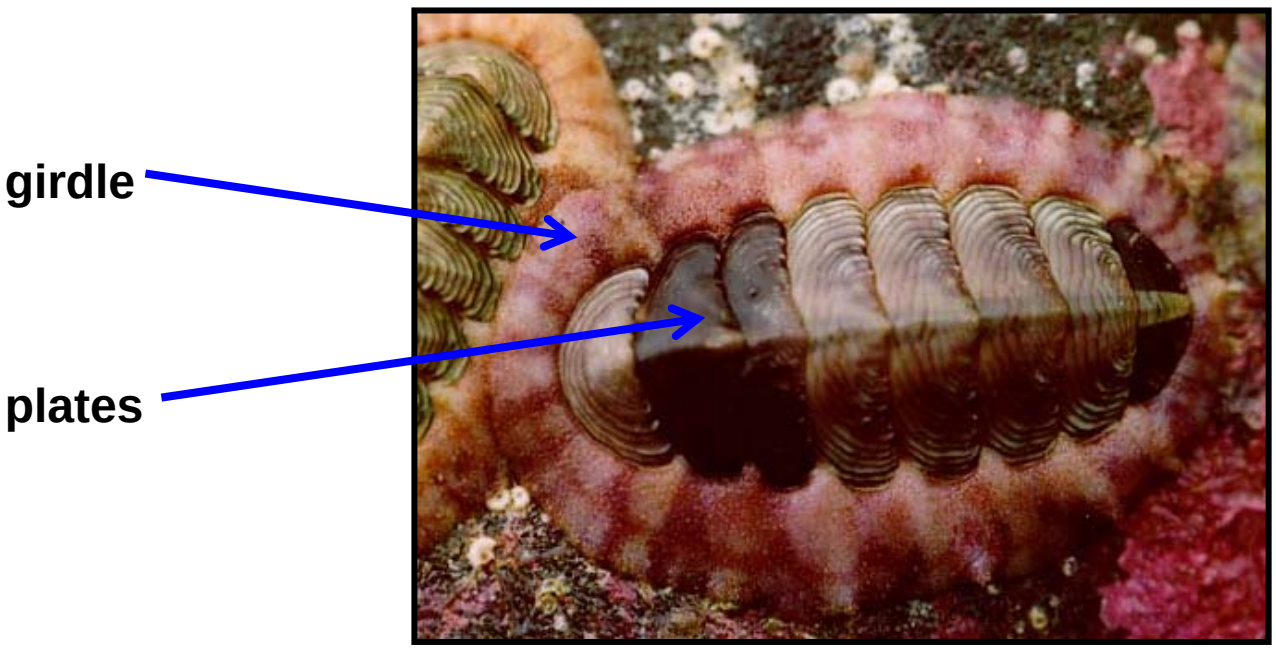
- the largest giant squid found to date have been 18 meters in length
- they live in the deep sea
- sperm whales (~20m in length) are their major predators

Class Polyplacophora

the “chitons”

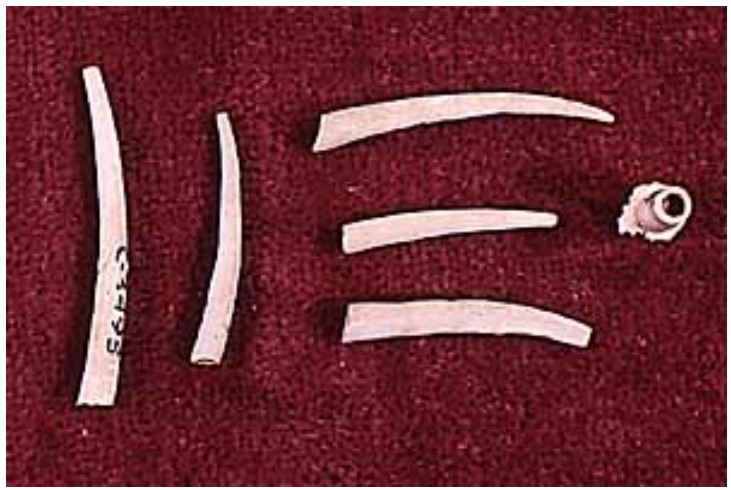
Class Polyplacophora

- have 8 rows of articulating plates
- use radula to graze algae on substrate
- mantle forms a girdle around plate edge
- no veliger larvae



Class Scaphopoda

the “tusk shells”



Class Scaphopoda

- shell is modified into hollow tube that is open at both ends
- the mantle wraps completely around the visceral mass
- sessile and feed in sediment