Chapter 5 : Triploblastics Coelomates Protostomes Metazoans: Molluscs

Presented by Pr. SOUTTOU Karim

Course of Zoology

I. – Phylum Mollusca

*After Arthropods, Molluscs constitute the largest branch of the animal kingdom, with more than 100,000 current species and 35,000 fossil species.

*It is a very diverse group, which includes forms as different as chitons, mussels, snails, octopuses.

I. – Phylum Mollusca

***Mollusks inhabit aquatic or humid environments; most are marine (all Aplacophorans, Monoplacophorans, Polyplacophorans, Cephalopods, Scaphopods), some groups have colonized fresh water (Gasteropods, Bivalves) and the terrestrial domain (Pulmonate Gasteropods).**

***They can be phytophagous (Gasteropods) or carnivorous (Cephalopods). Some species of gastropods are parasites.**

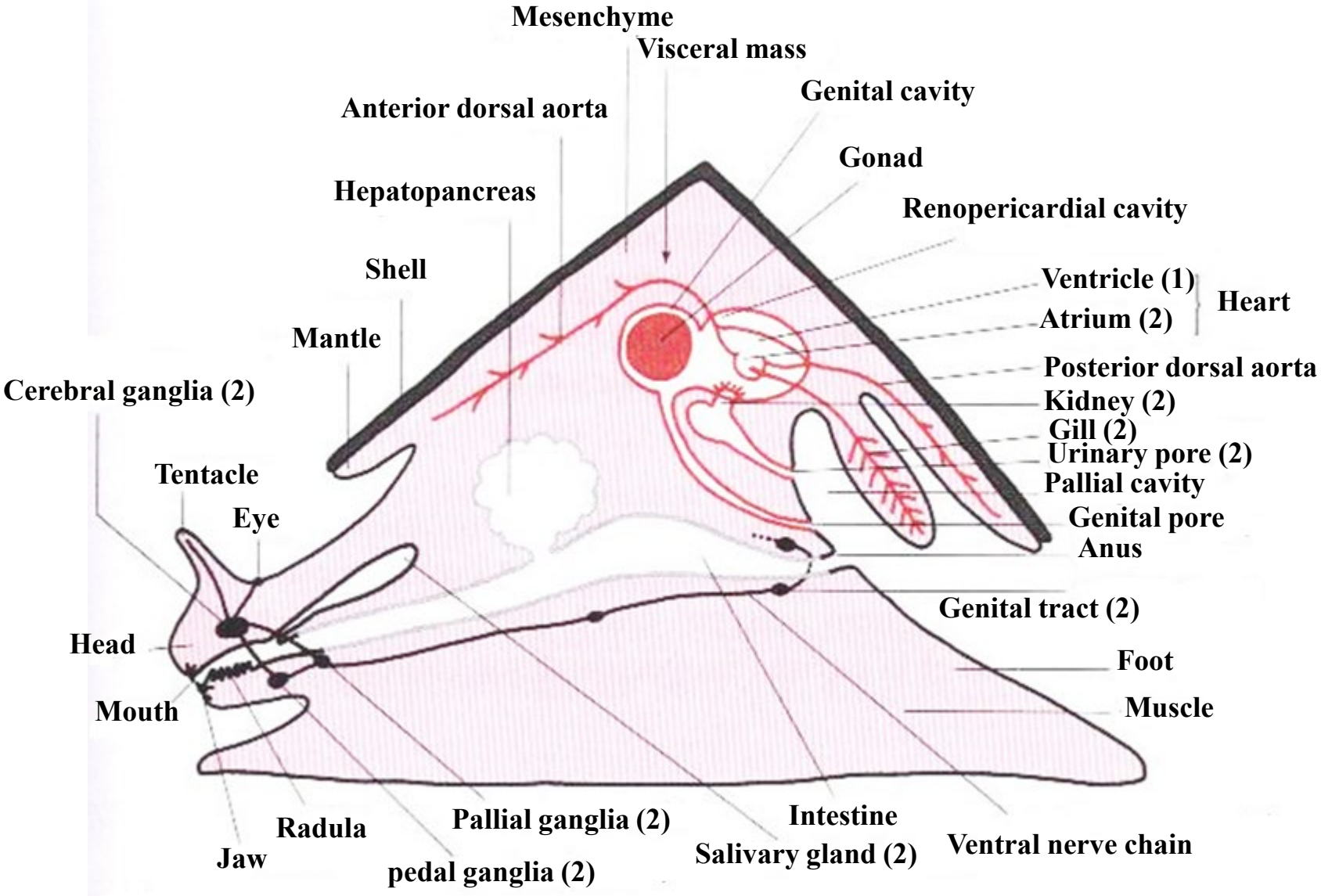
I. – Phylum Mollusca

***A mollusk archetype consists of 4 parts: the head, the muscular foot, the visceral mass, the mantle, which secretes the shell and delimits a pallial cavity.**

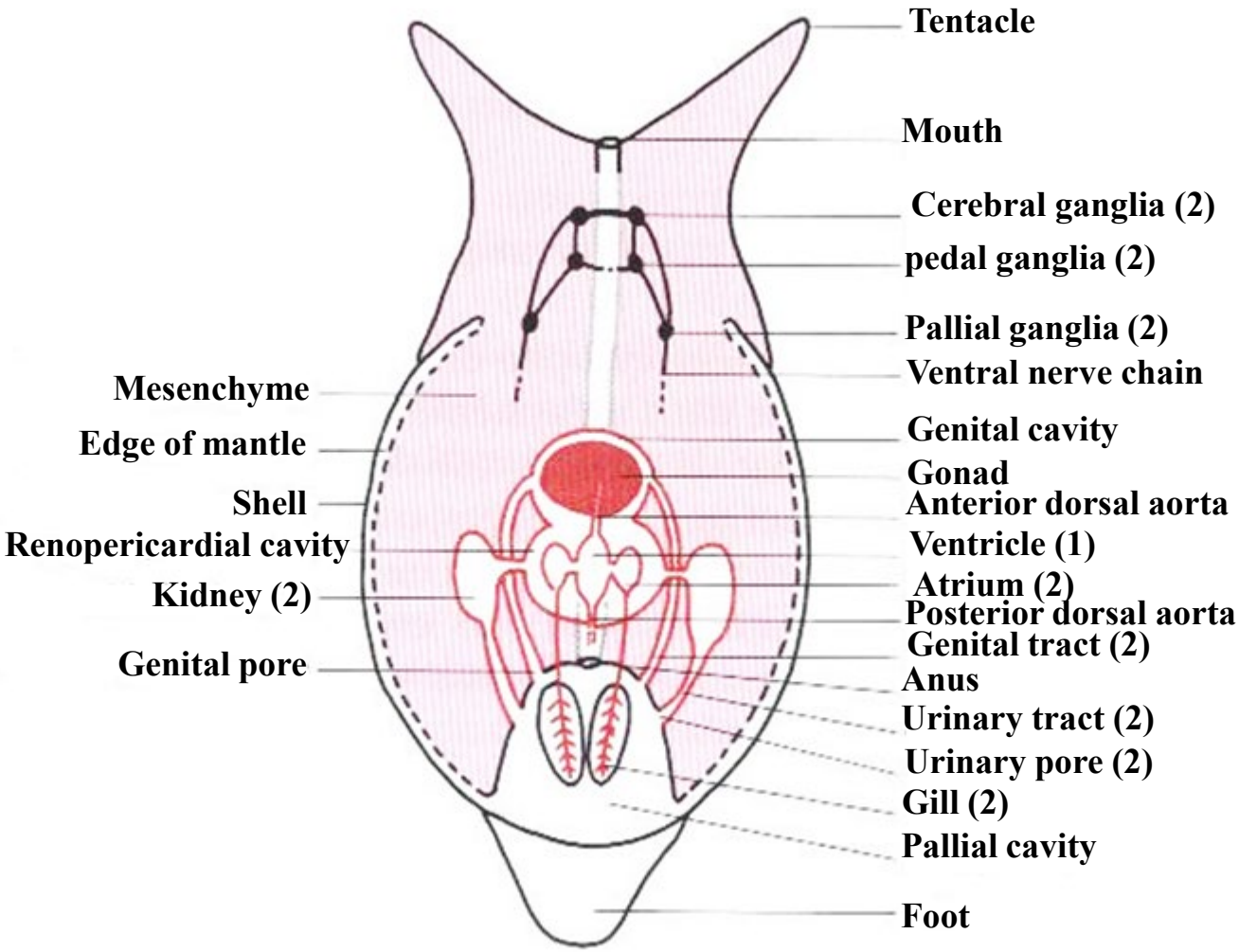
***The mantle is an integument that secretes calcareous formations.**

***The radula is a chitinous oral structure. The comb-shaped gills (the ctenidia).**

I. – Phylum Mollusca



I. – Phylum Mollusca



Frontal cut of ancestral mollusc

I. – Phylum Mollusca

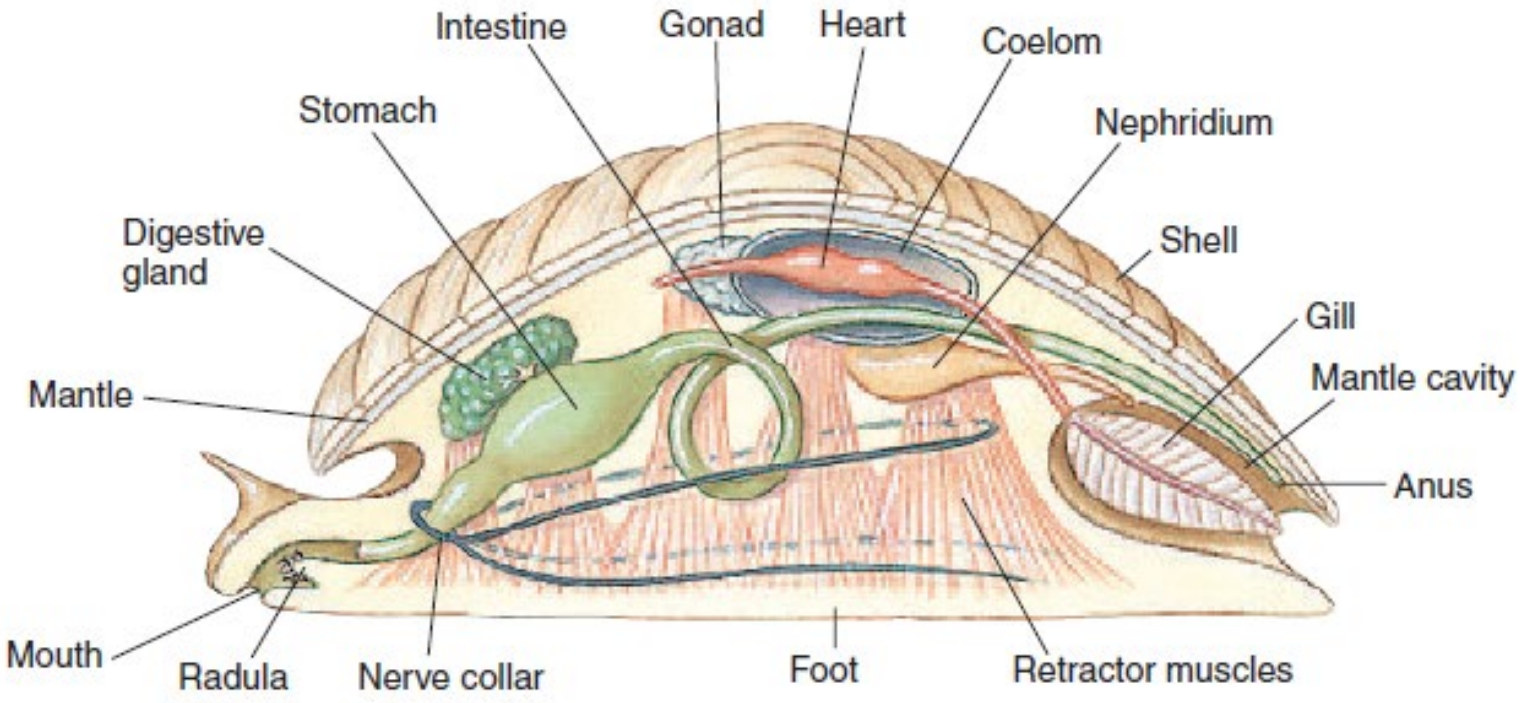


Figure: Generalized mollusc. Although this construct is often presented as a "hypothetical ancestral mollusc" (HAM), most experts now agree that it never actually existed. It is an abstraction used to facilitate description of the general body plan of molluscs

I. – Phylum Mollusca

*Molluscs are separate sexes.

*Fertilization is most often external, but can be internal in some cephalopods.

*Females are most often oviparous.

*The larva is of the trochophore type; during development it transforms into a veliger larva, then into an adult.

*Development is direct in terrestrial gastropods and cephalopods.

I. – Phylum Mollusca

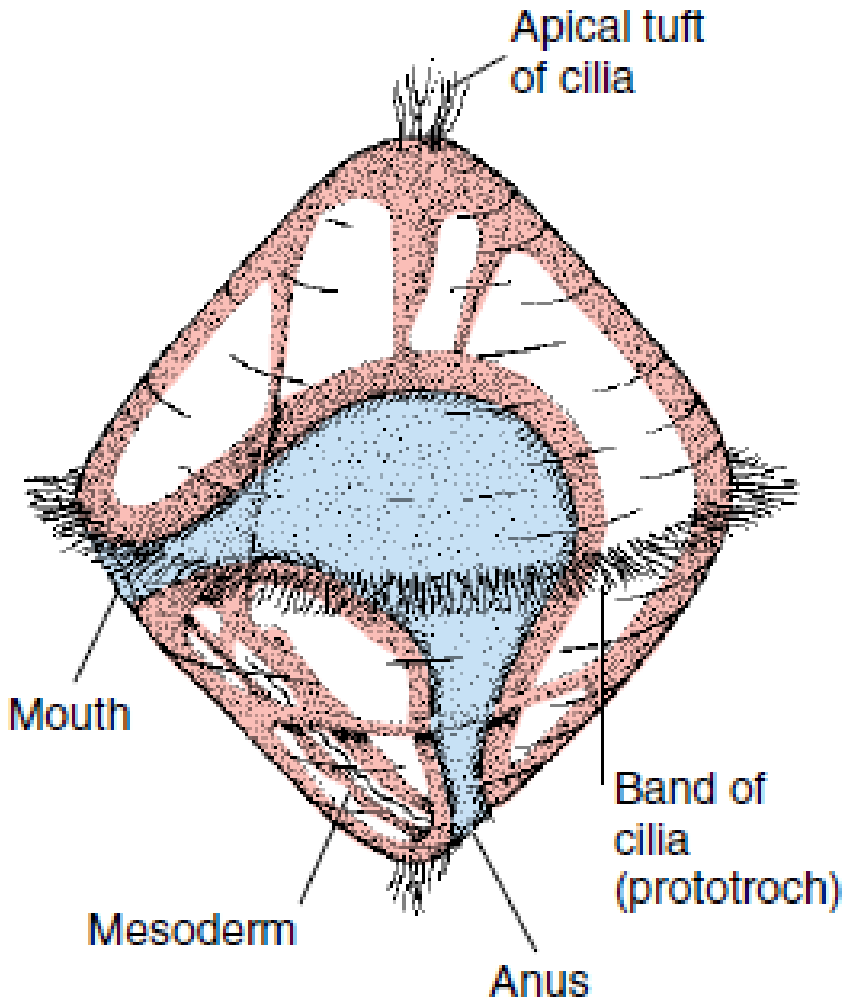


Figure: Trochophore Larva

I. – Phylum Mollusca

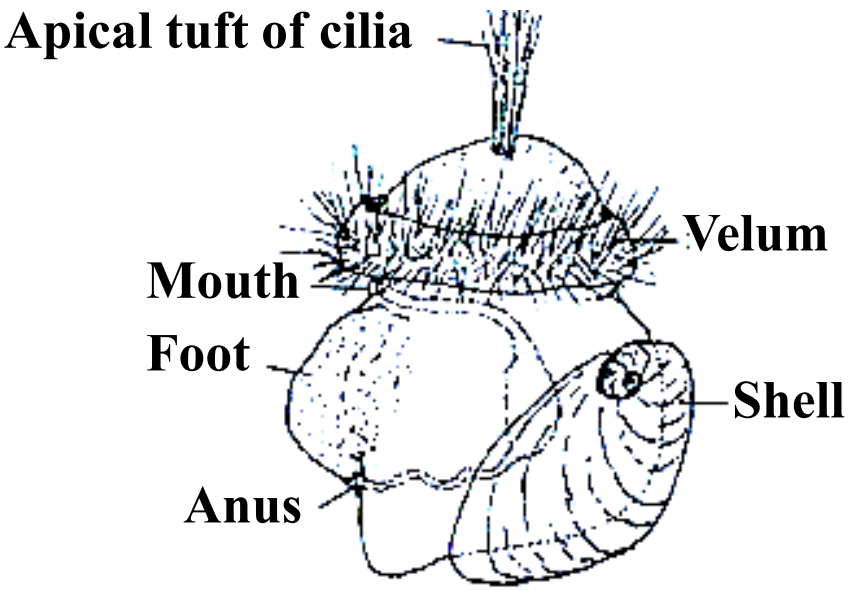


Figure: Veliger larva

Phylum Mollusca

1.– Class 1 Aplacophora (absence of shell).

2. – Class 2 Polyplacophora (many dorsal calcareous plate secreted by the mantle).

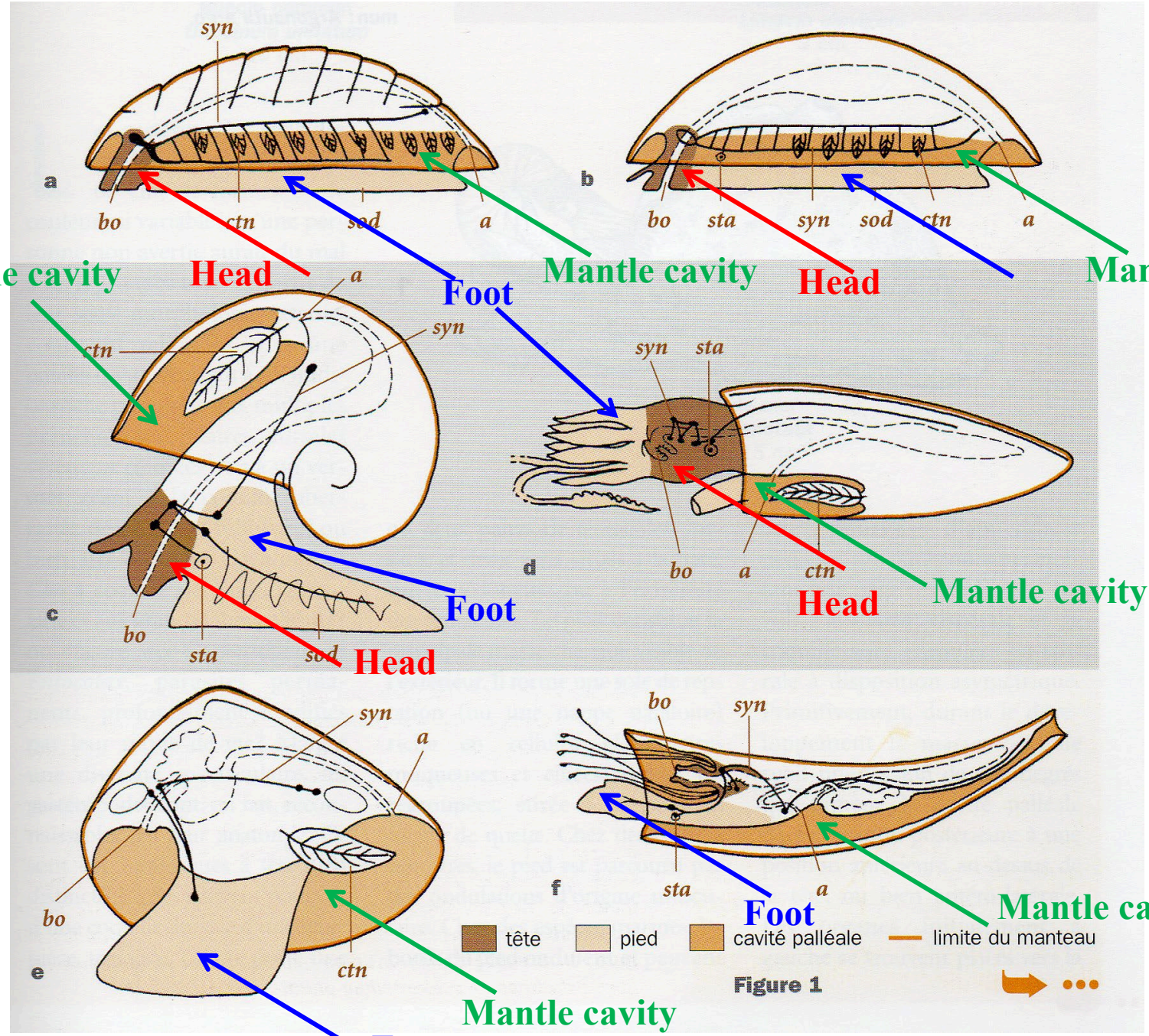
3. – Class 3 Monoplacophora (one dorsal calcareous plate secreted by the mantle).

4.- Class 4 Scaphopoda

5. – Class 5 Gastropoda (Gastro : stomach; podos : foot).

6. – Class 6 Bivalvia (Bi : two; valves : valves or shell (Lamellibranch)

7. – Class 7 Cephalopoda (Caphalo : head; podos : foot).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cavité palléale
limite du manteau

Figure 1

Molluscs Aplacophora

Molluscs Polyplacophora

Molluscs Monoplacophora

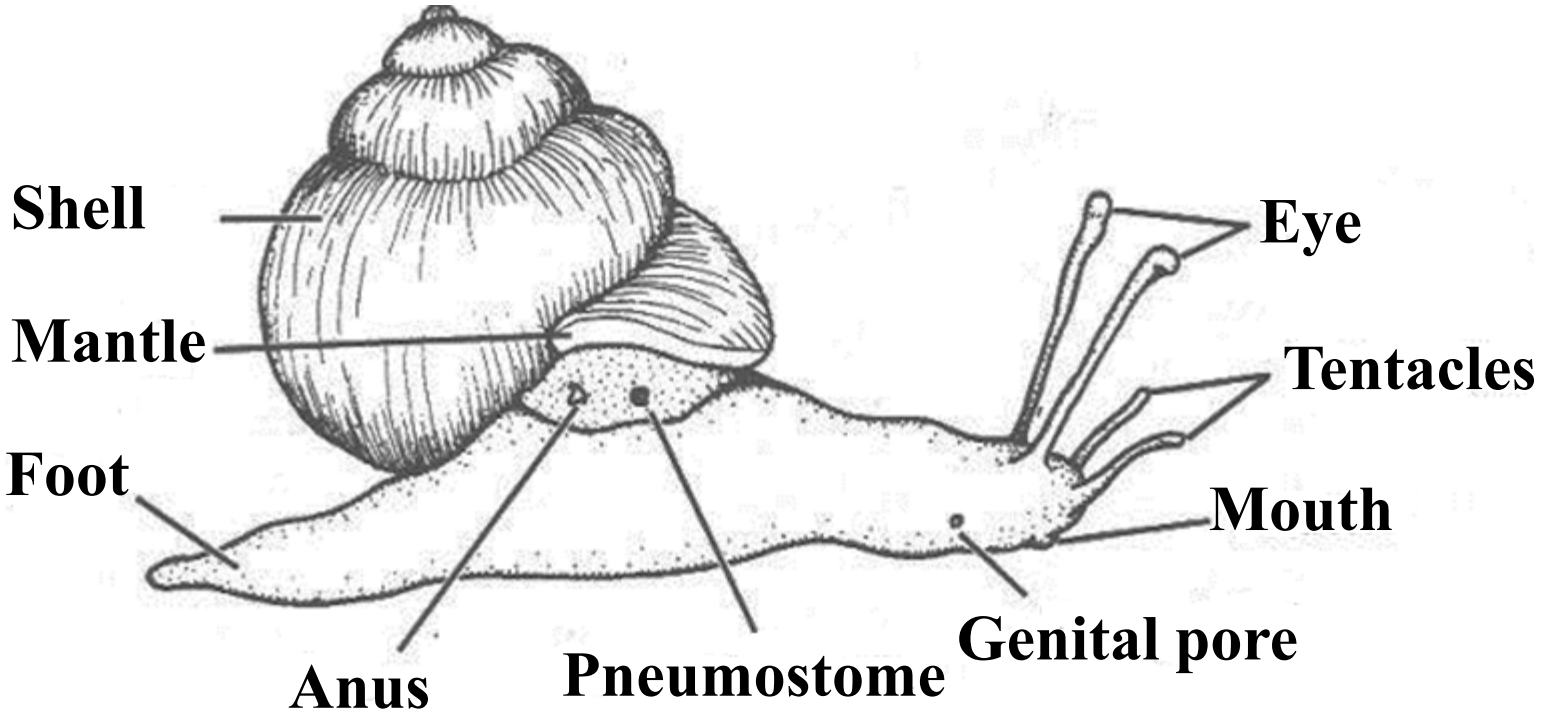
Molluscs Gastropoda

Molluscs Scaphopoda

Molluscs Bivalvia

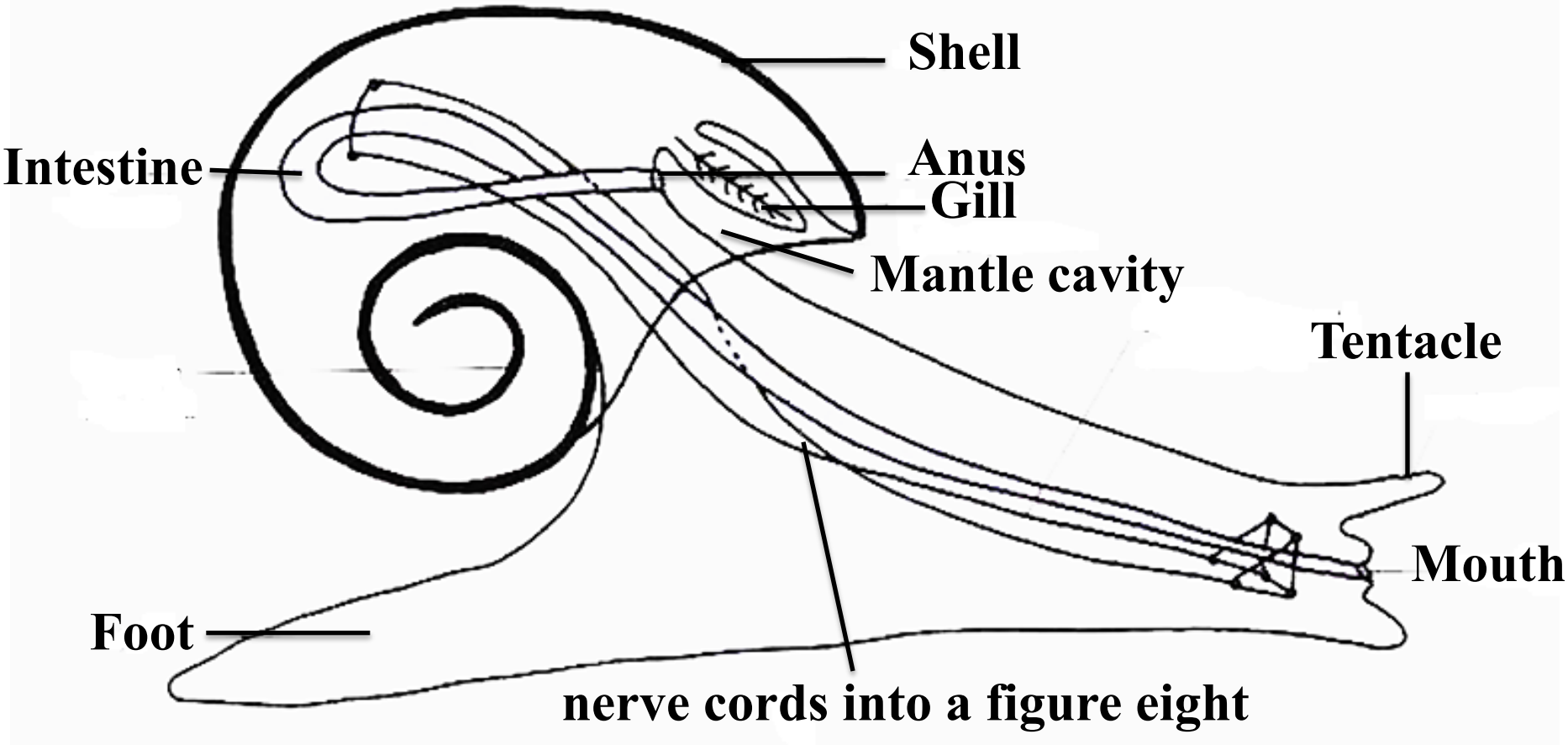
Molluscs Cephalopoda

1. Class 1 : Gastropoda



Mollusc Gastropoda Pulmonate

1. Class 1 : Gastropoda



Mollusc Gastropoda Prosobranchia

1. Class 1 : Gastropoda

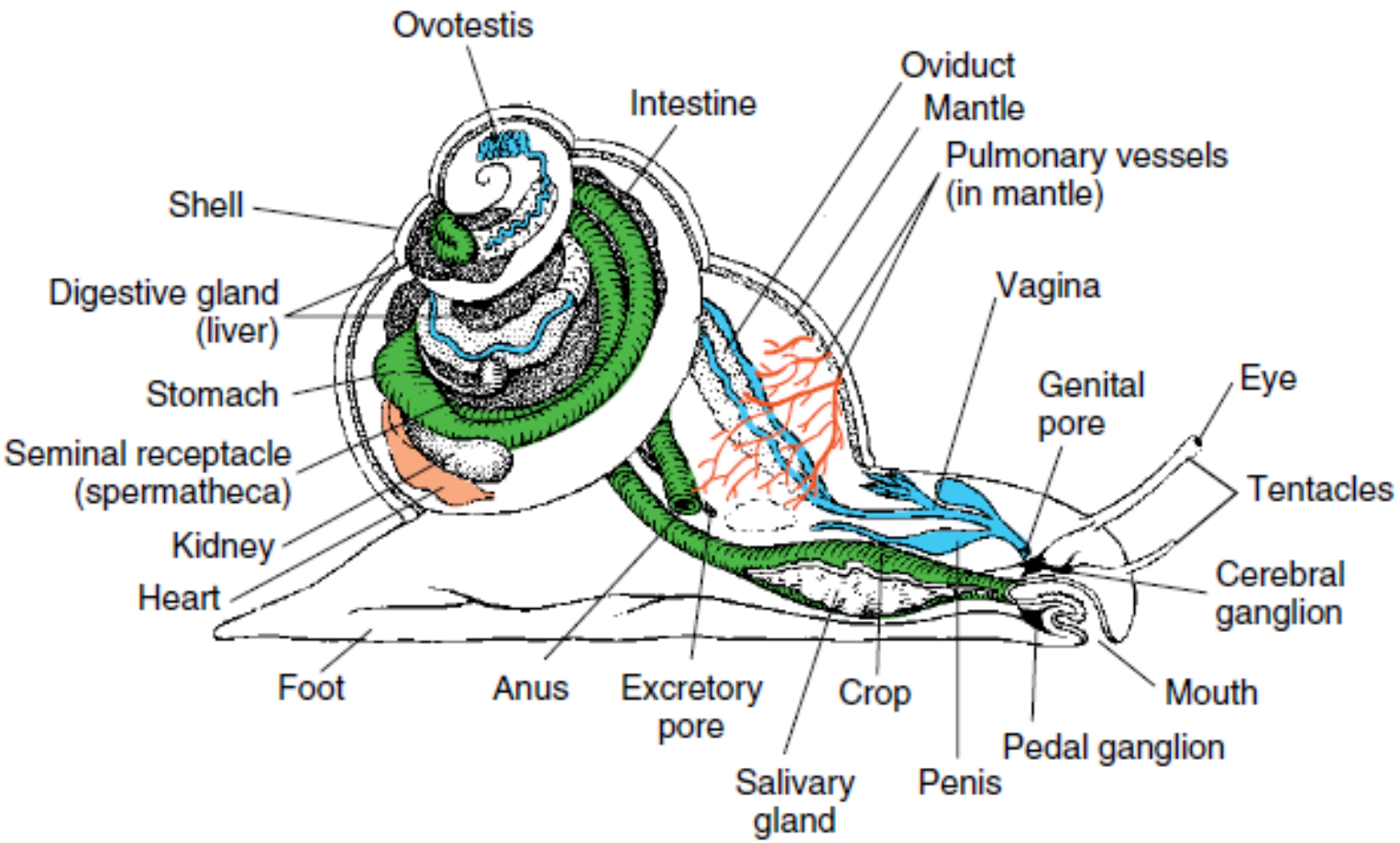


Figure: Anatomy of a pulmonate snail

1. Class 1 : Gastropoda

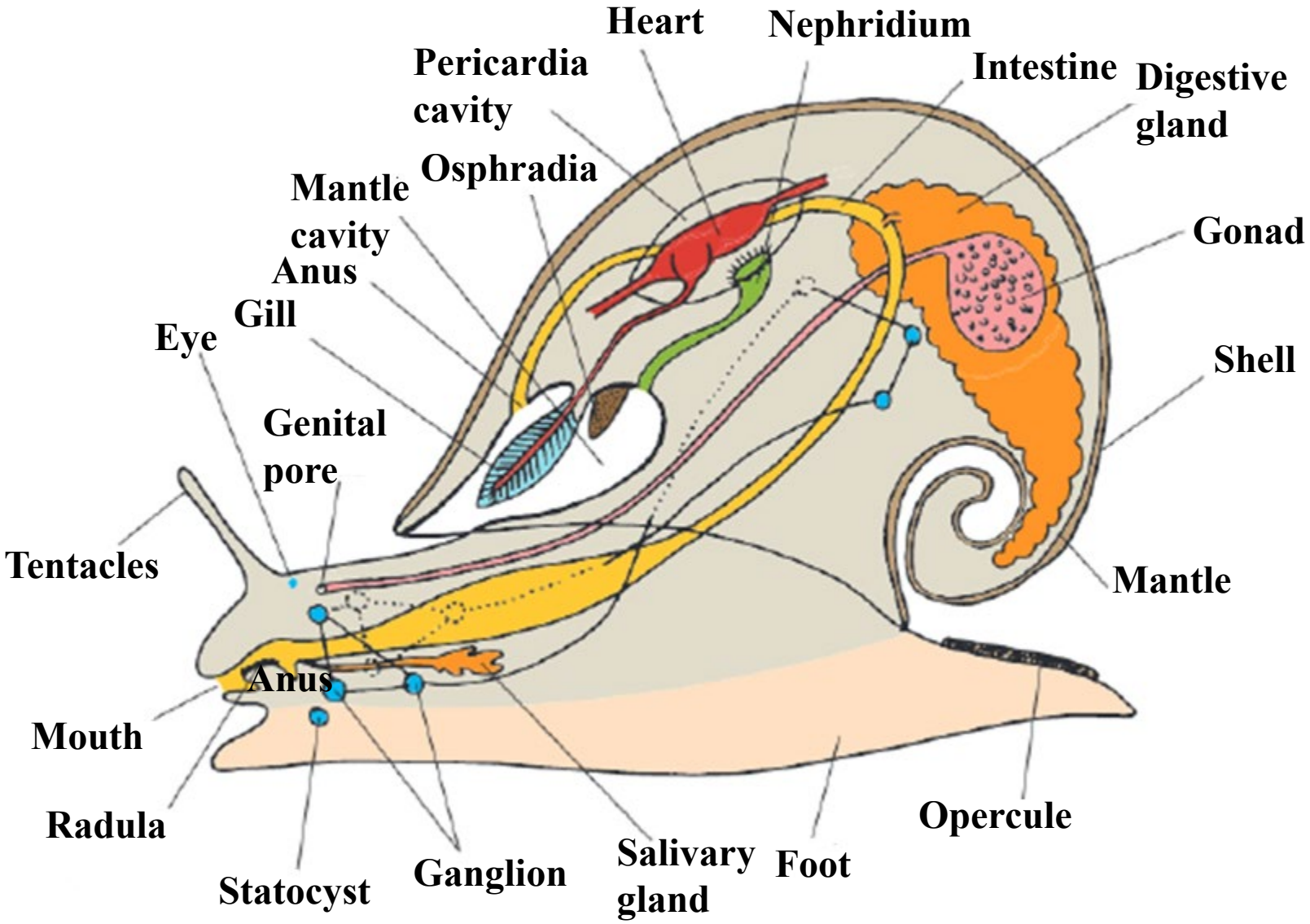
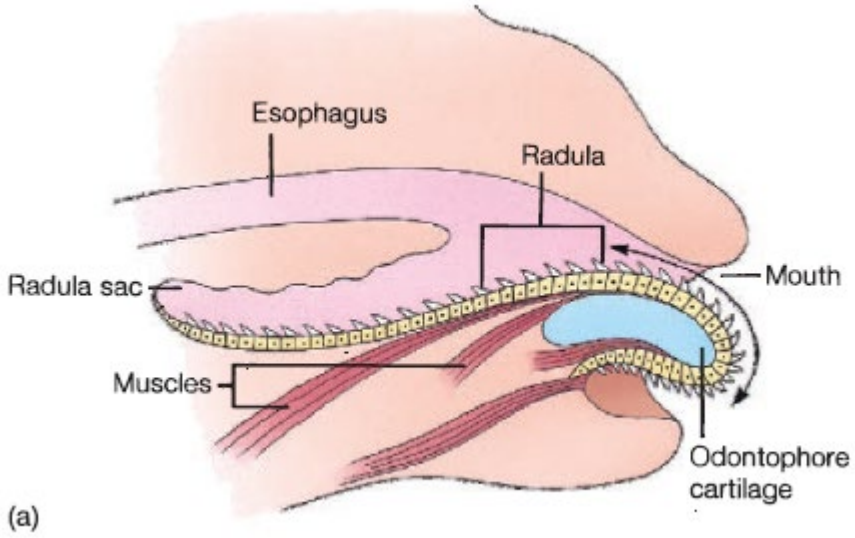


Figure: Anatomy of Gastropoda Prosobranchia

1. Class 1 : Gastropoda



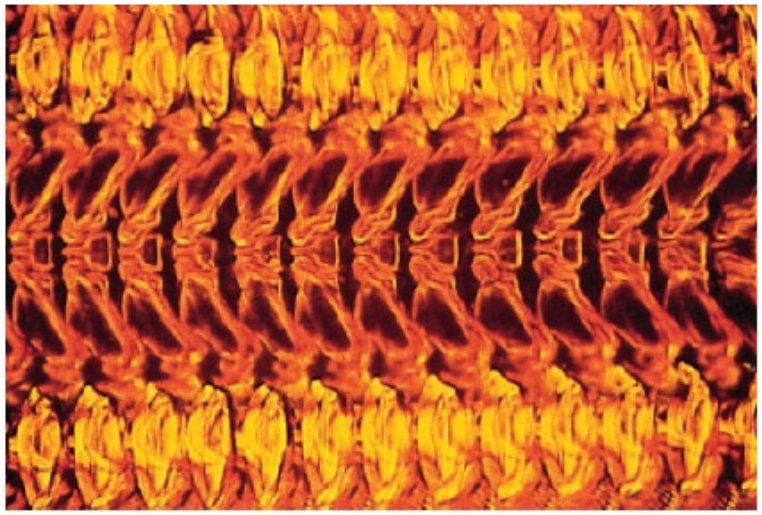

(b)

Figure: Radular Structure

(a) The radular apparatus lies over the cartilaginous odontophore. Muscles attached to the radula move the radula back and forth over the odontophore (see arrows).

(b) Micrograph of radular teeth arrangement of the marine snail, *Nerita.*

1. Class 1 : Gastropoda

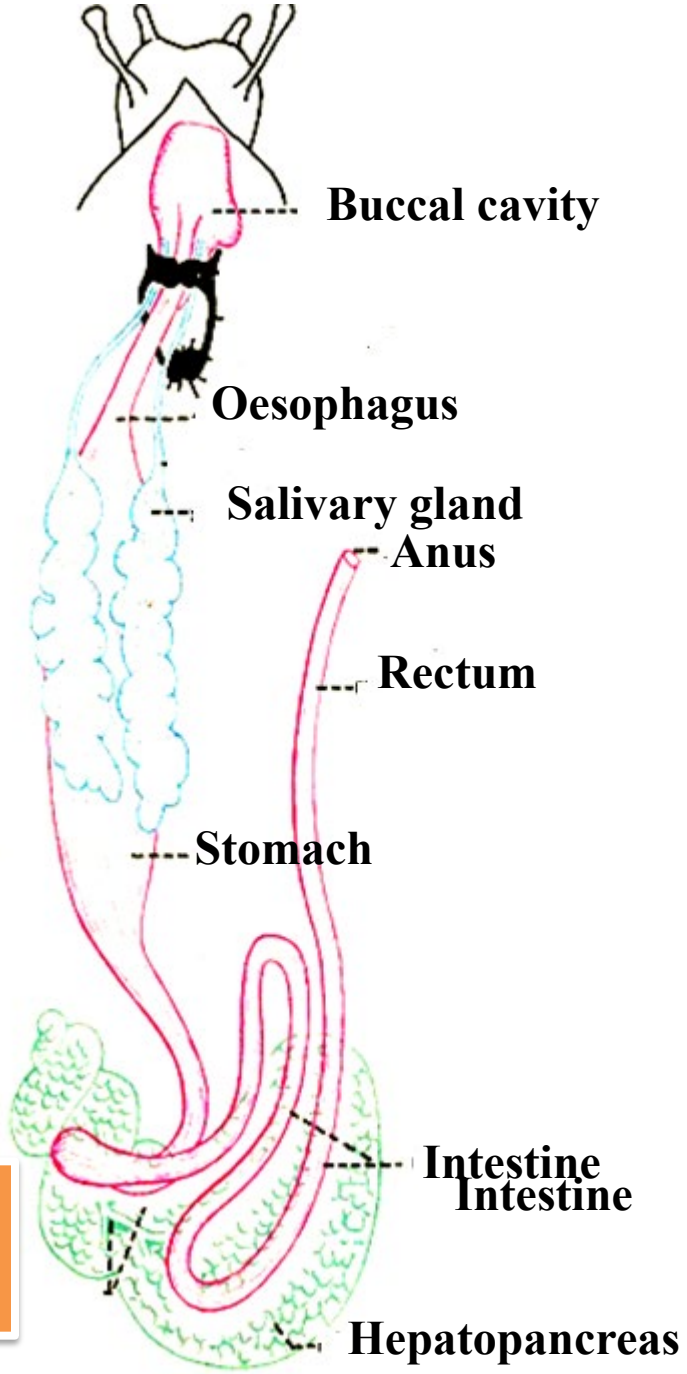


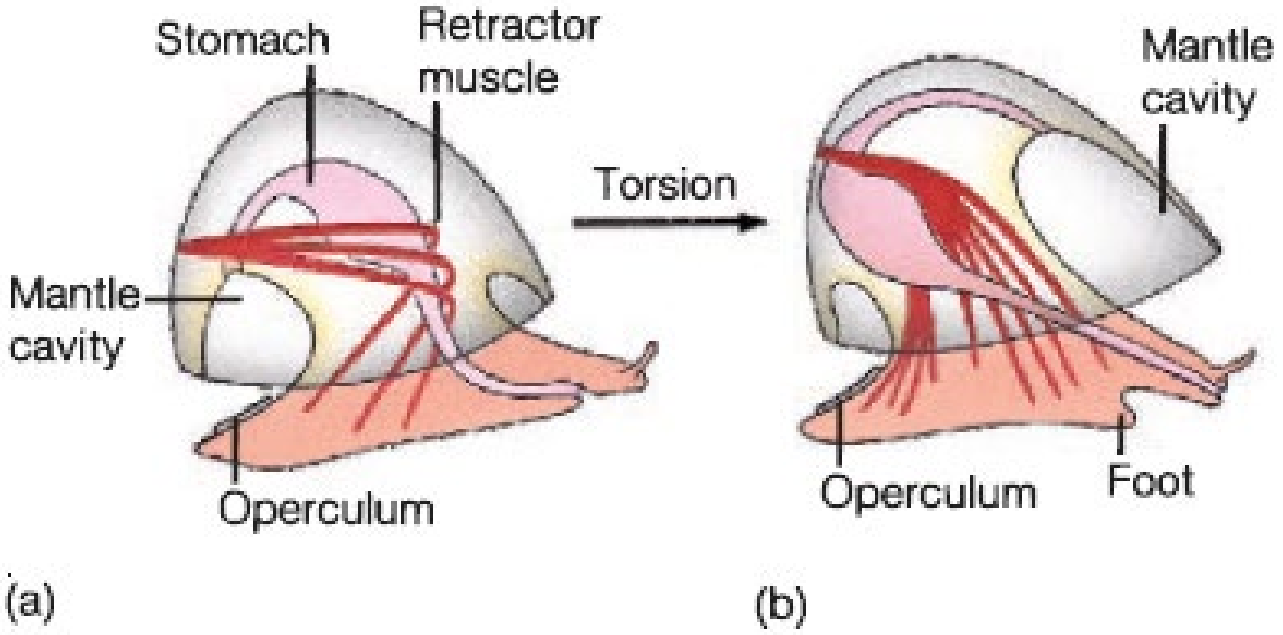
Figure : Digestive system of Gastropoda

1. Class 1 : Gastropoda

***The torsion of the visceral mass at 180°, at a specific stage of their development: This torsion has the effect of (1) Bringing the pallial cavity and its dependencies forward, (2) Moving the anus forward near the mouth, (3) Crossing the nerve chain in 8.**

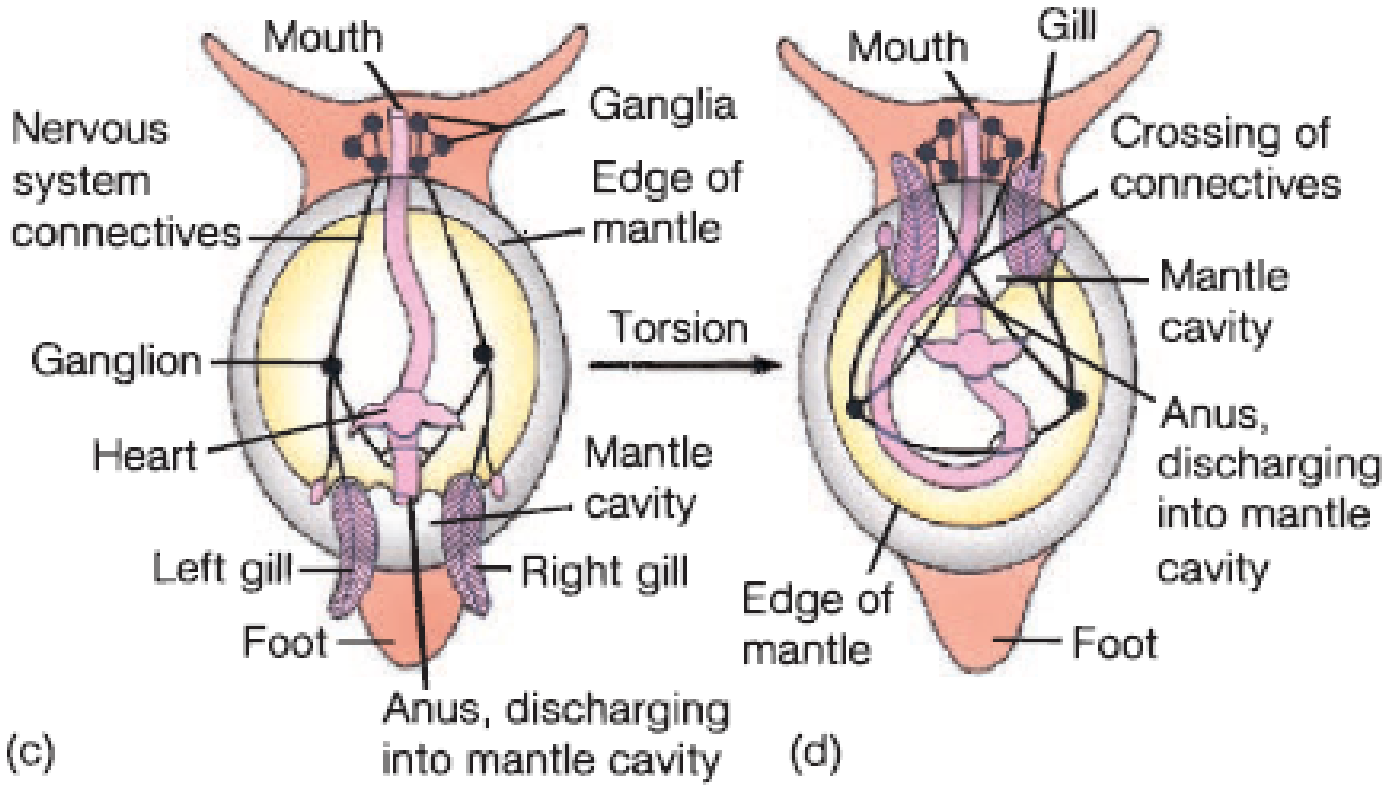
***The phenomenon of torsion occurs during the development of the veliger larval stage.**

***Its initial cause is the asymmetrical growth of the right and left musculature that attaches the shell to the head-foot complex.**



a) A pretorsion gastropod larva. Note the posterior opening of the mantle cavity and the untwisted digestive tract. *(b)* After torsion, the digestive tract is looped, and the mantle cavity opens near the head. The foot is drawn into the shell last, and the operculum closes the shell opening.

Figure: Torsion in Gastropods



(c) A hypothetical adult ancestor, showing the arrangement of internal organs prior to torsion. *(d)* Modern adult gastropods have an anterior opening of the mantle cavity and the looped digestive tract.

Figure: Torsion in Gastropods

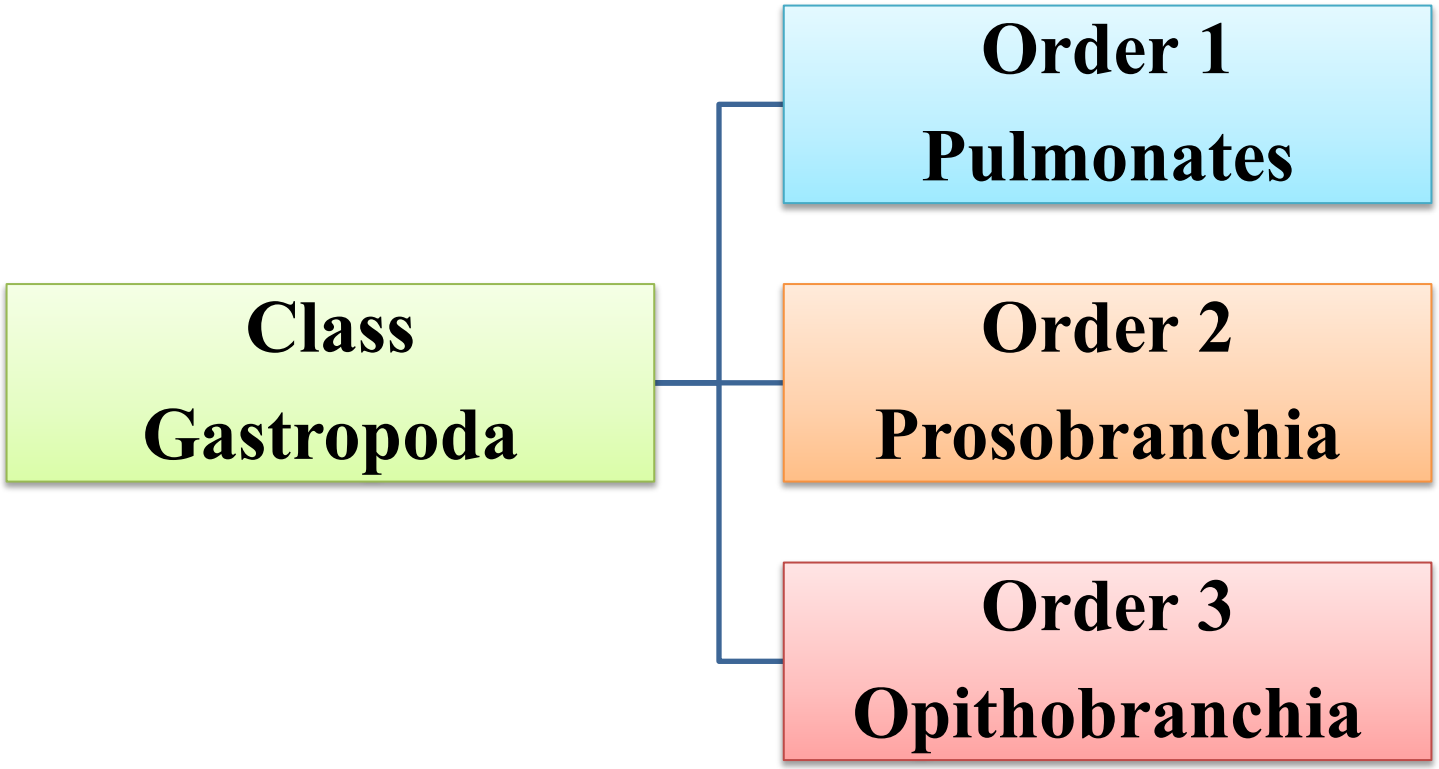
1. Class 1 : Gastropoda

*Gastropods have separate sexes (Prosobranchs) or are hermaphroditic (Pulmonates, Opisthobranchs). The first larval stage is a trochophore, which however remains inside the egg in all gastropods, except the most primitive.

*The majority of marine gastropods have a free swimming veliger larva, which derives from the trochophore. The veliger has new structures compared to the trochophore, these are the foot, tentacles, eyes and a shell.

*All Pulmonates and some Prosobranchs do not have free larval stages. These stages can however appear inside the egg.

1. Class 1 : Gastropoda



1. Class 1 : Gastropoda

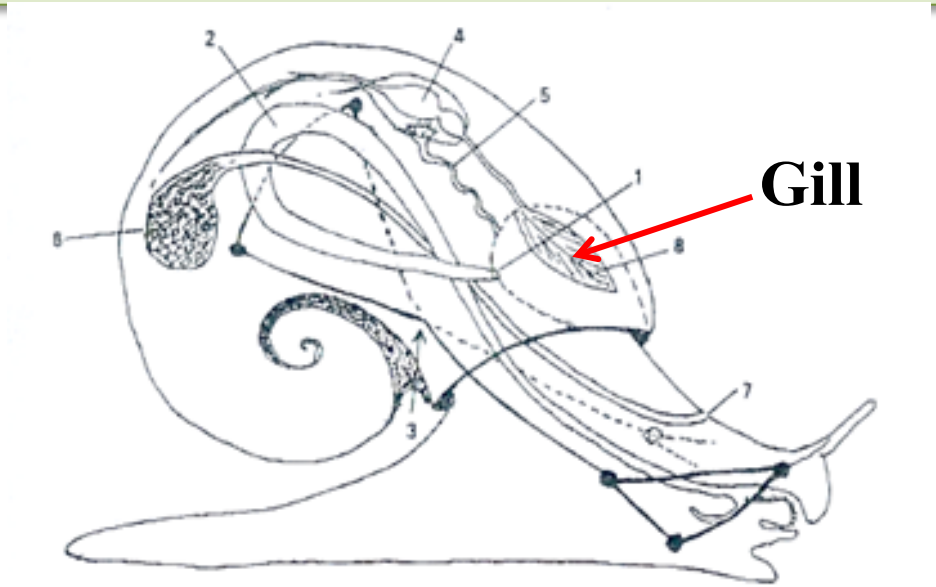


Figure: Gastropoda Prosbranchia

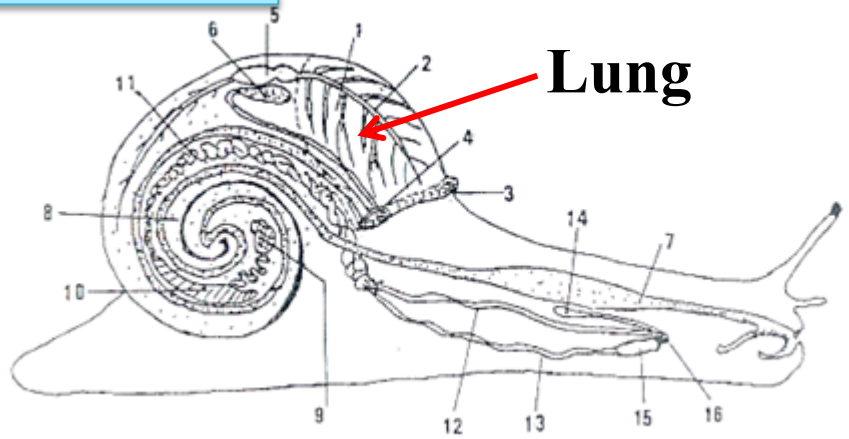


Figure: Gastropoda Pulmonate

1. Class 1 : Gastropoda

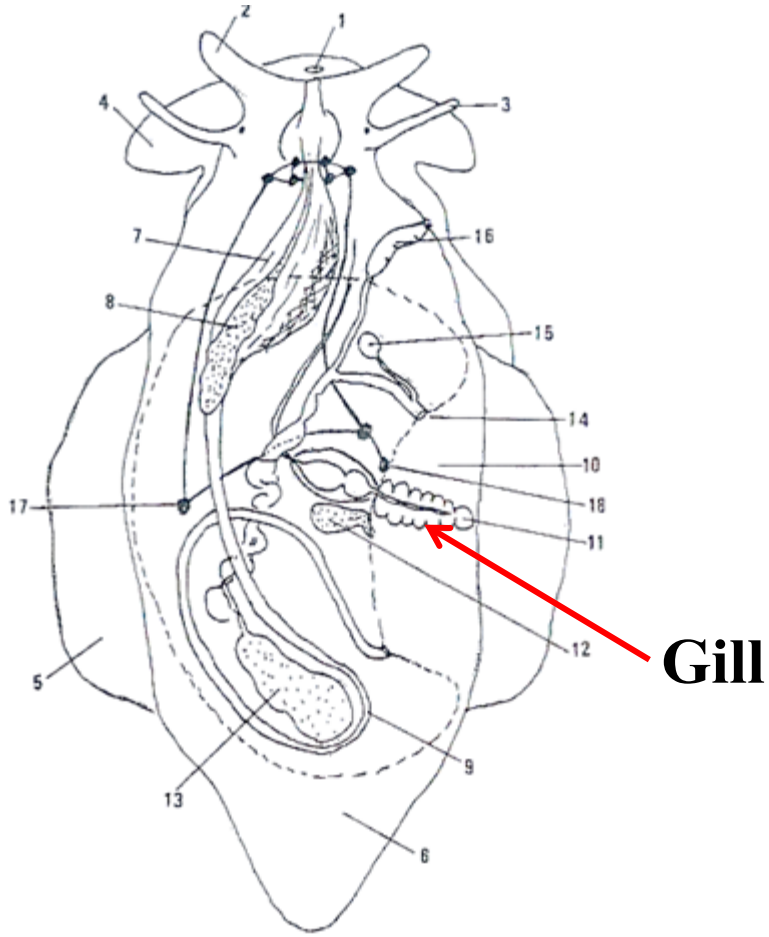


Figure: Gastropoda Opisthobranchia

1. Class 1 : Gastropoda

Milax sowerbyi

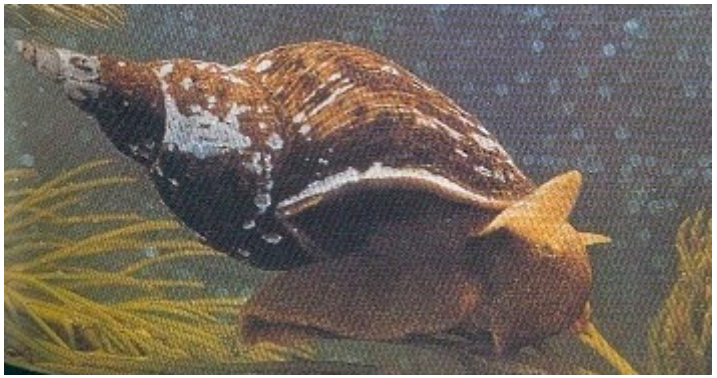
Limax flavus

Cochlicella acuta

Theba pisiana

1. Class 1 : Gastropoda

Helix aspersa



Limnaea stagnalis

Nudibranchia : sea Mollusc Gastropoda without shell, with branchial respiration

2. Class 2 : Bivalvia

*Bivalvia represent the largest class of molluscs after gastropods, with 10,000 current species and several thousand fossil forms.

*The group is essentially marine, with some representatives adapted to life in fresh water.

*Bivalvia are mostly burrowing and sedentary species. They are filter-feeding microphages that feed on particles brought by the current and inhale them up to their mouths. Their food is mainly plankton and organic detritus suspended in the water.

2. Class 2 : Bivalvia

2. Class 2 : Bivalvia

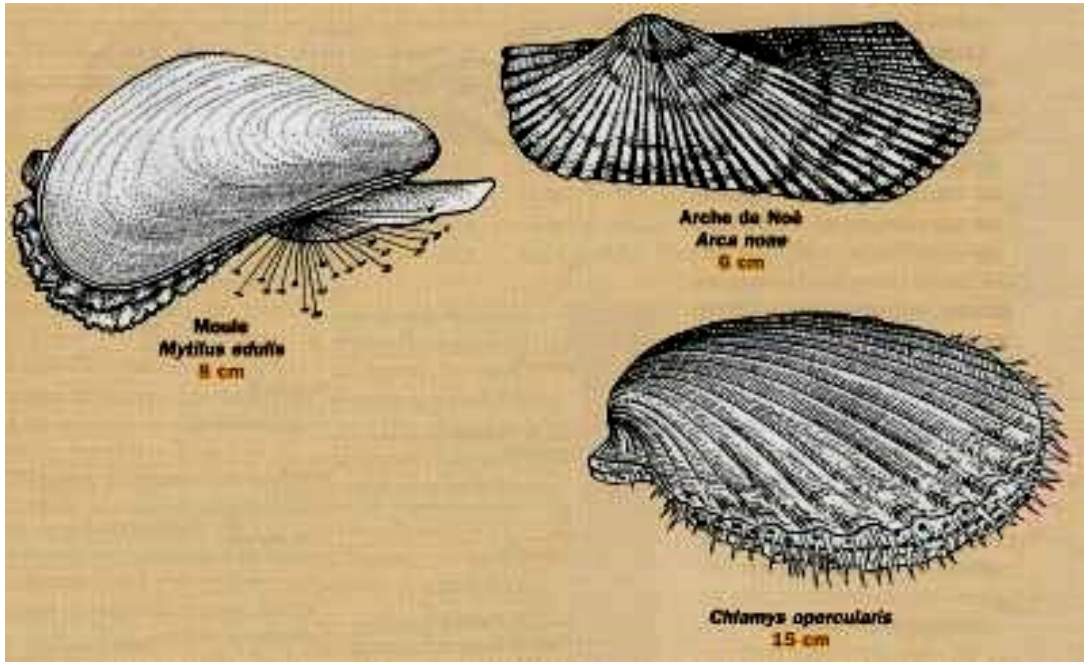
Some specific derived characters:

***The shell at the adult stage is made up of 2 valves compressed laterally and articulated between them by a mid-dorsal hinge and a non-calcified ligament.**

***Absence of head**

***Absence of radula**

***Presence of 2 gills**

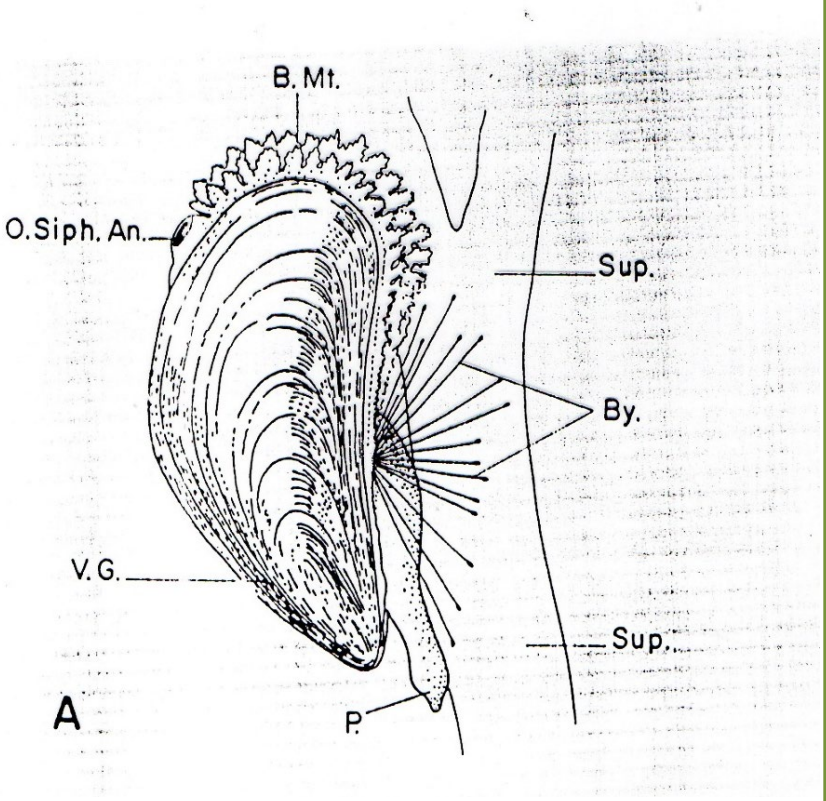


2. Class 2 : Bivalvia

Some specific derived characters:

***A special gland at the base of the foot, the byssogenic gland, produces the byssus, made up of adhesive protein filaments that stick to the substrate and have the property of hardening on contact with water.**

***The byssus (by) is important for sedentary species attached to a substrate.**



2. Class 2 : Bivalvia

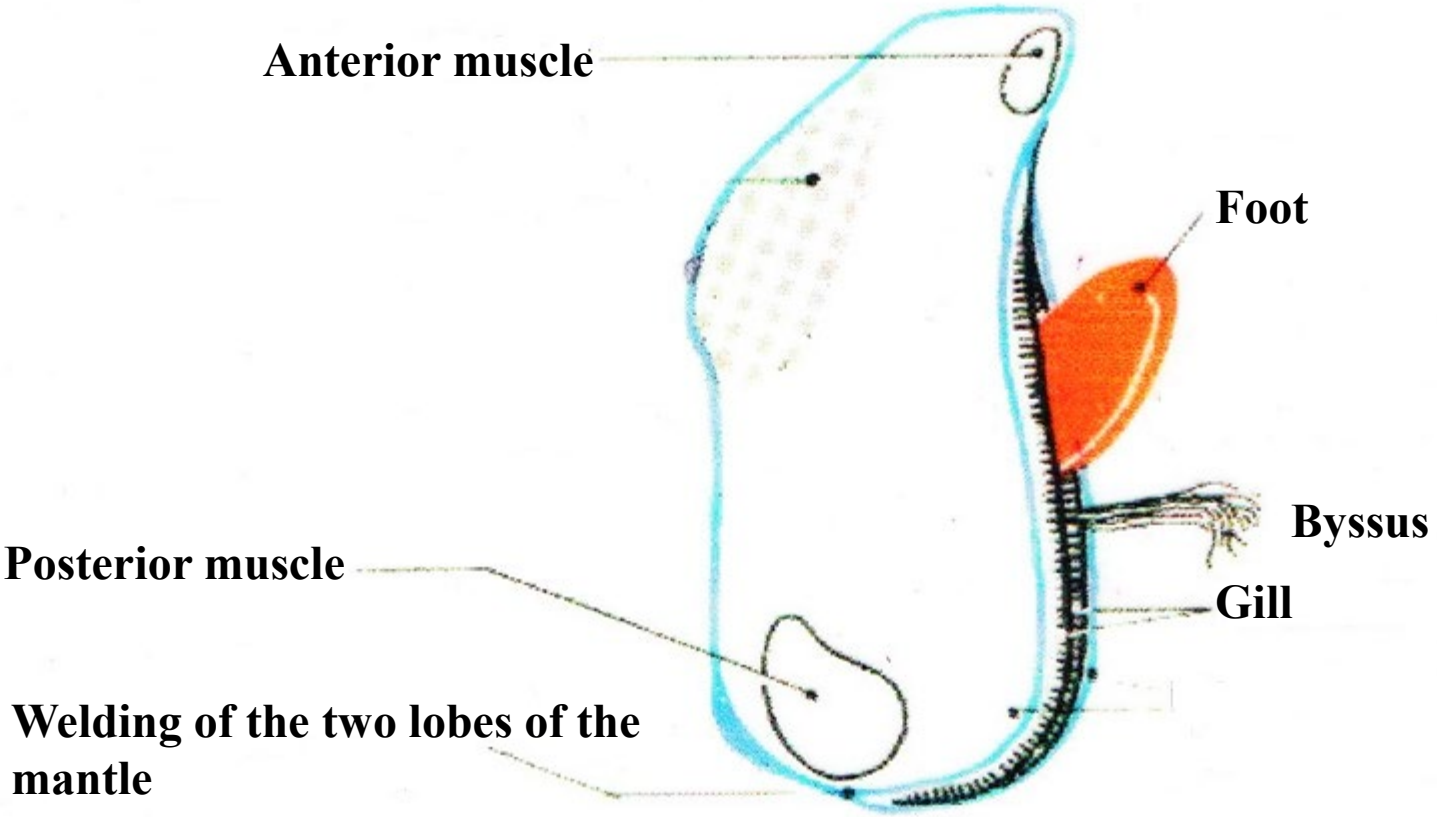


Figure: Body of mussel, profile view

2. Class 2 : Bivalvia

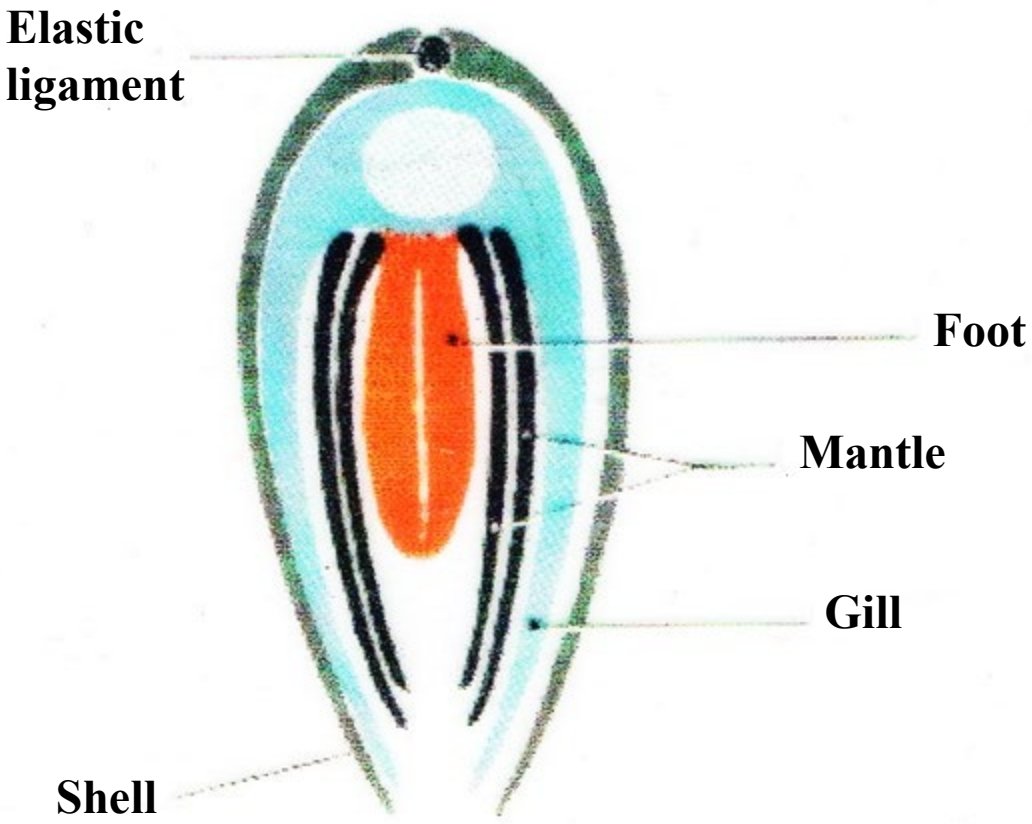


Figure: Body of mussel, cross section

2. Class 2 : Bivalvia

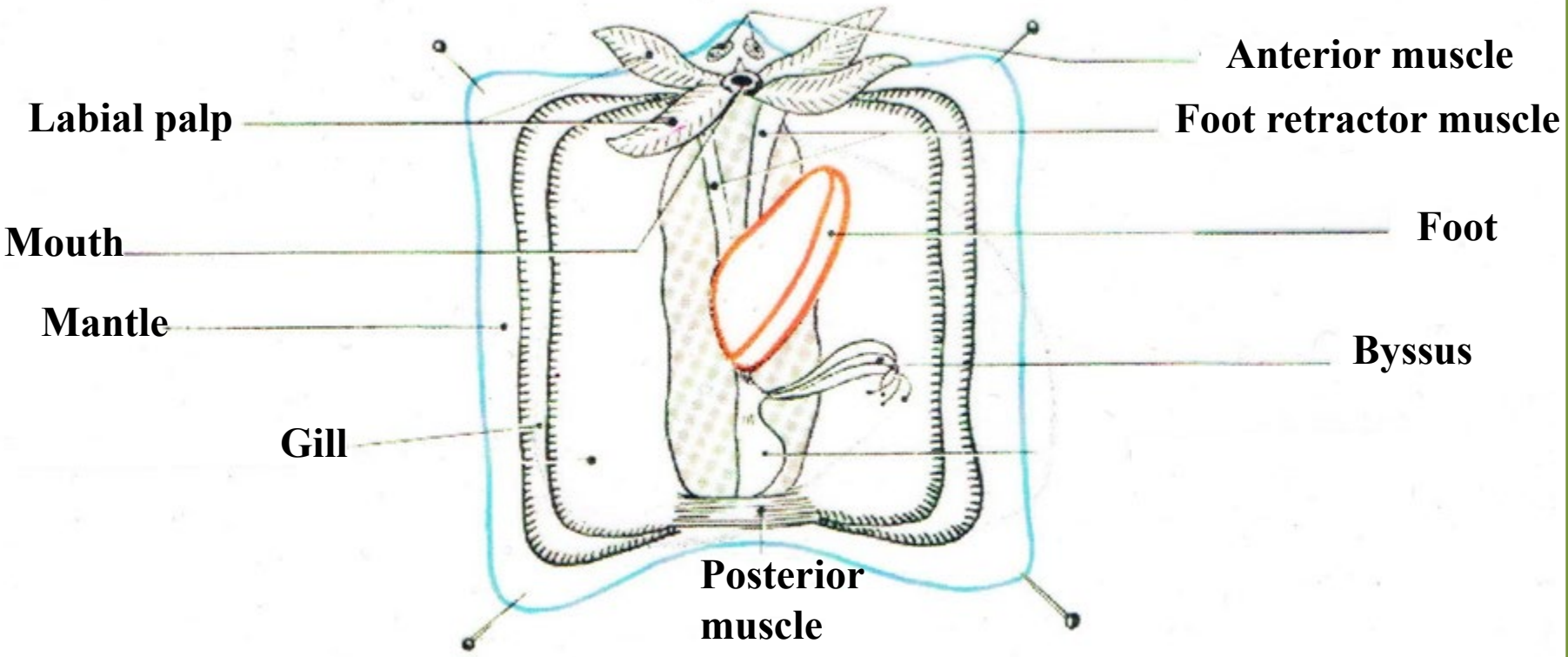


Figure: Body of mussel, ventral face

2. Class 2 Bivalvia

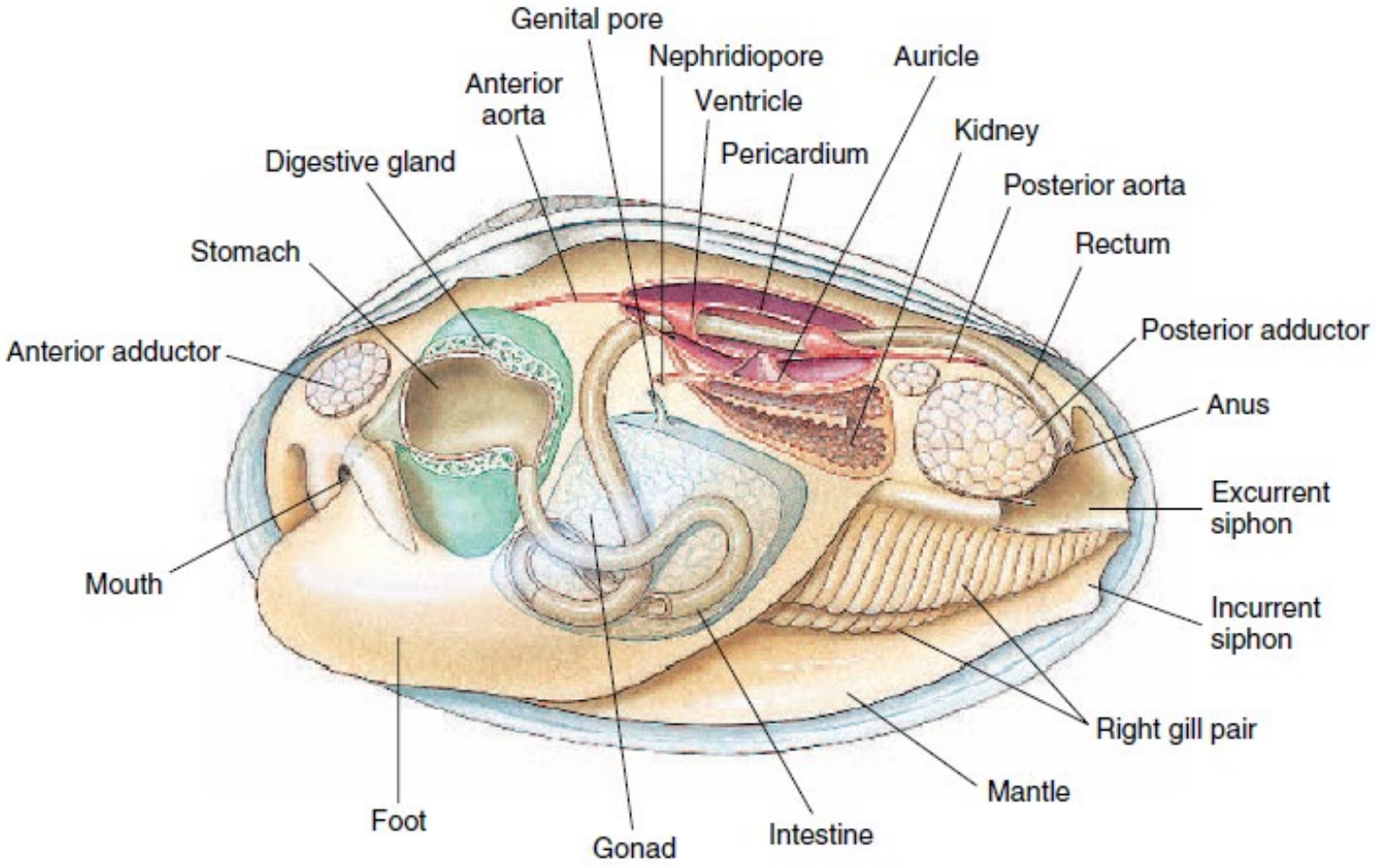


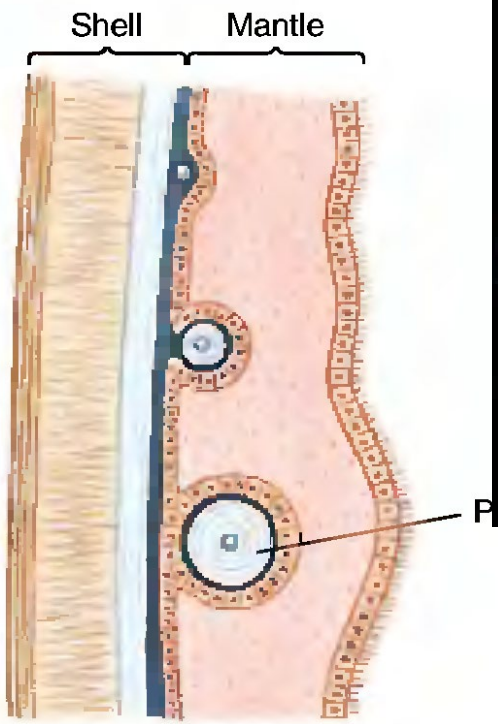
Figure: Anatomy of Bivalvia

2. Class 2 Bivalvia

***The sexes are most often separate; except for a few species that are hermaphroditic.**

***Fertilization is normally external, sometimes it occurs in the mantle cavity.**

2. Class 2 : Bivalvia



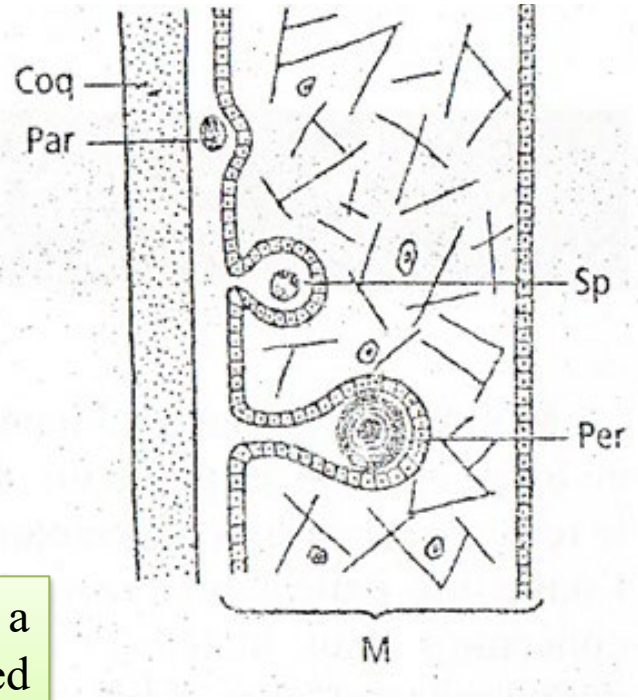


Figure: Formation of pearl between mantle and shell as a parasite or bit of sand under the mantle becomes covered with nacre.

3. Class 3 : Cephalopoda

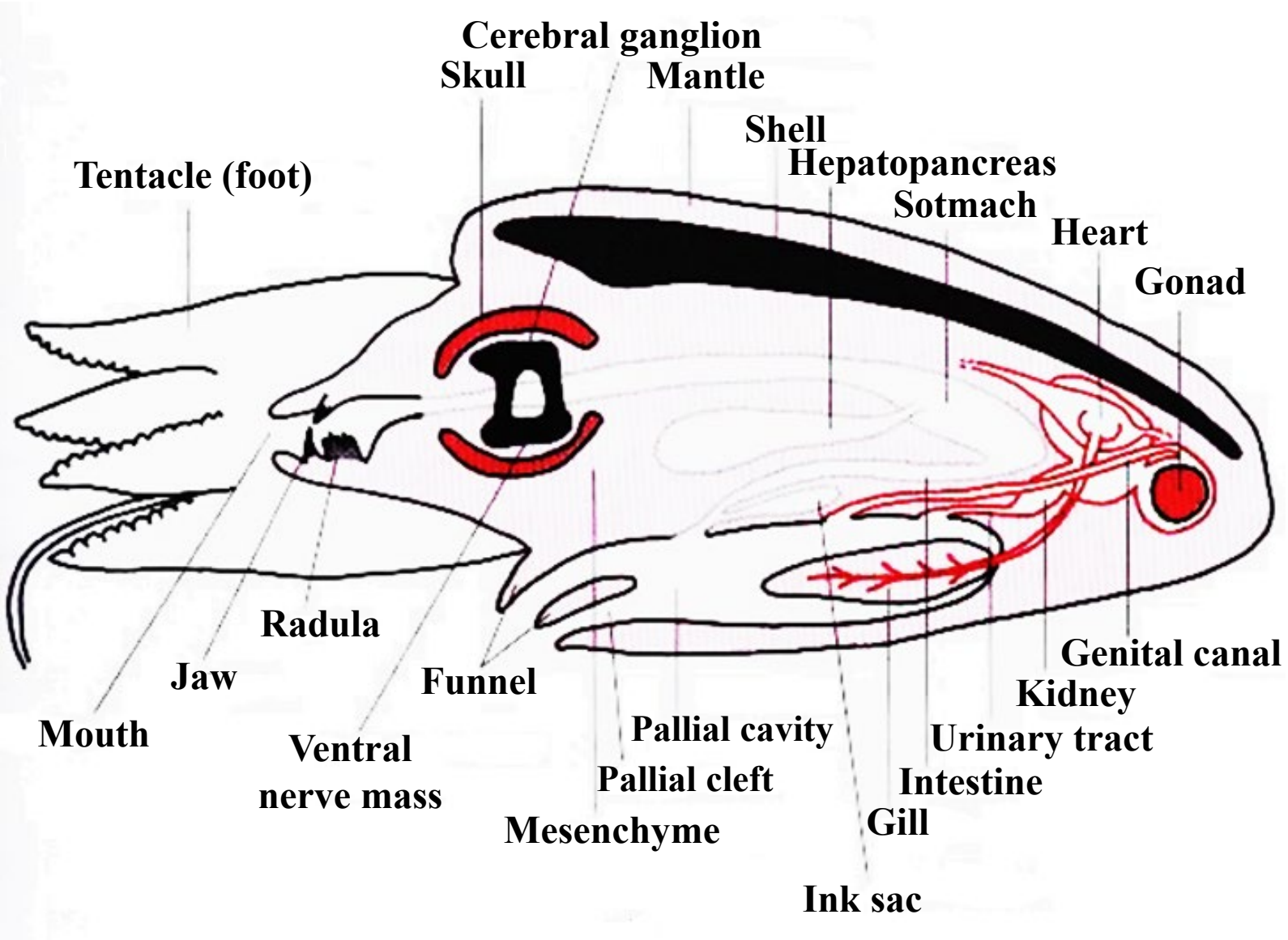
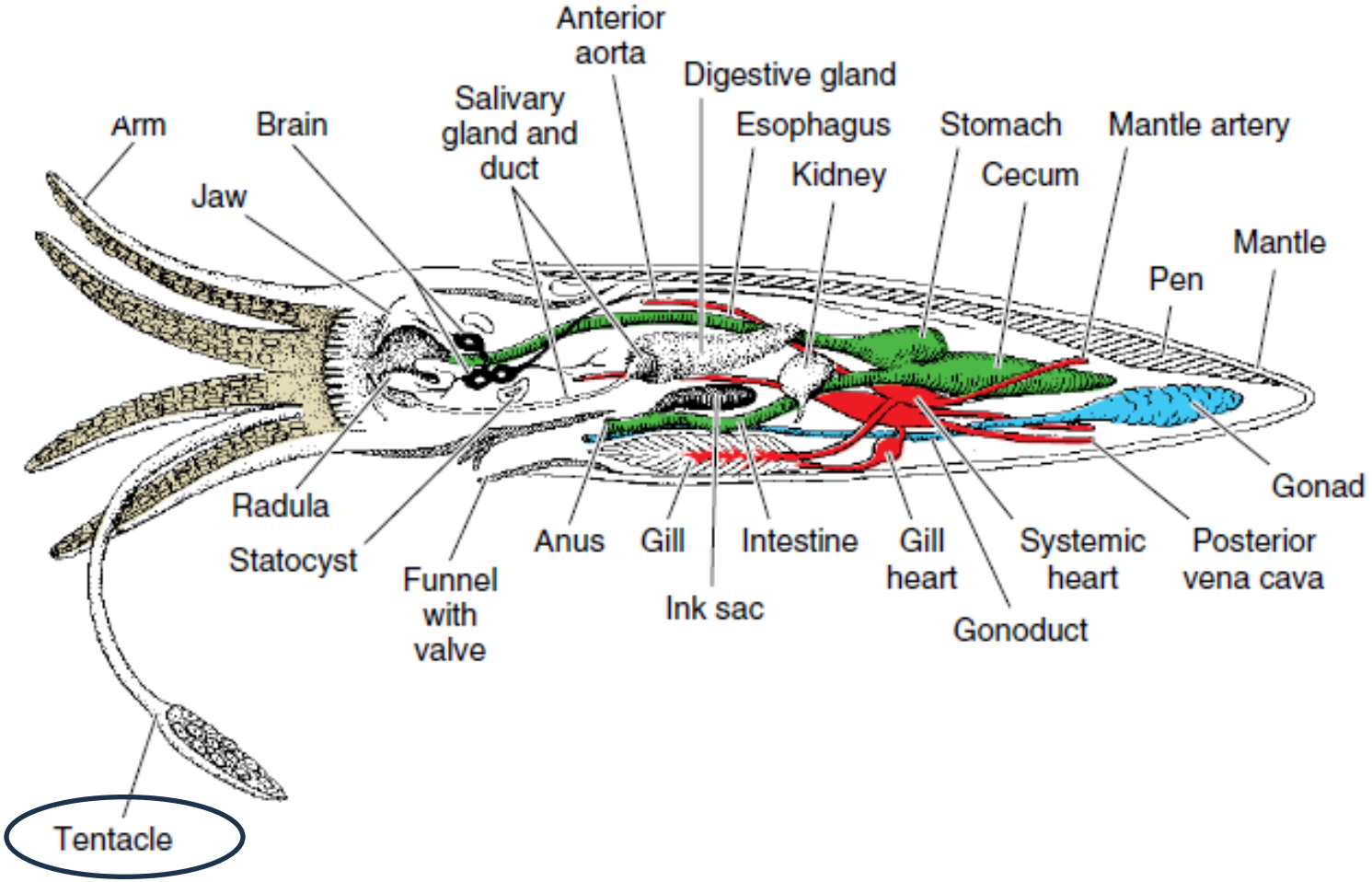


Figure: Anatomy of Cephalopoda

3. Class 3 : Cephalopoda

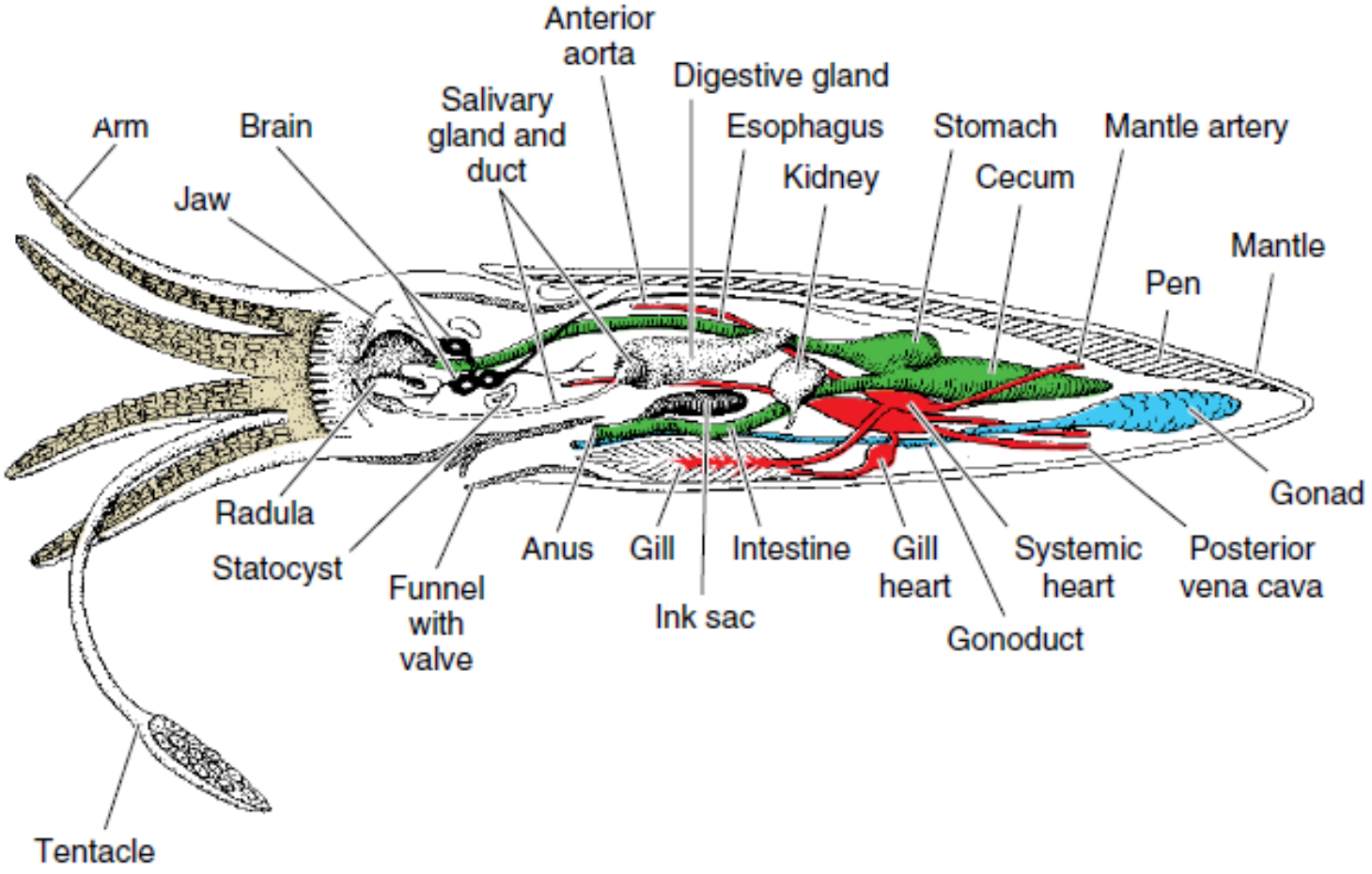
Some specific derived characters:

***The anterior part of the foot is modified into multiple prehensile tentacles.**



Some specific derived characters:

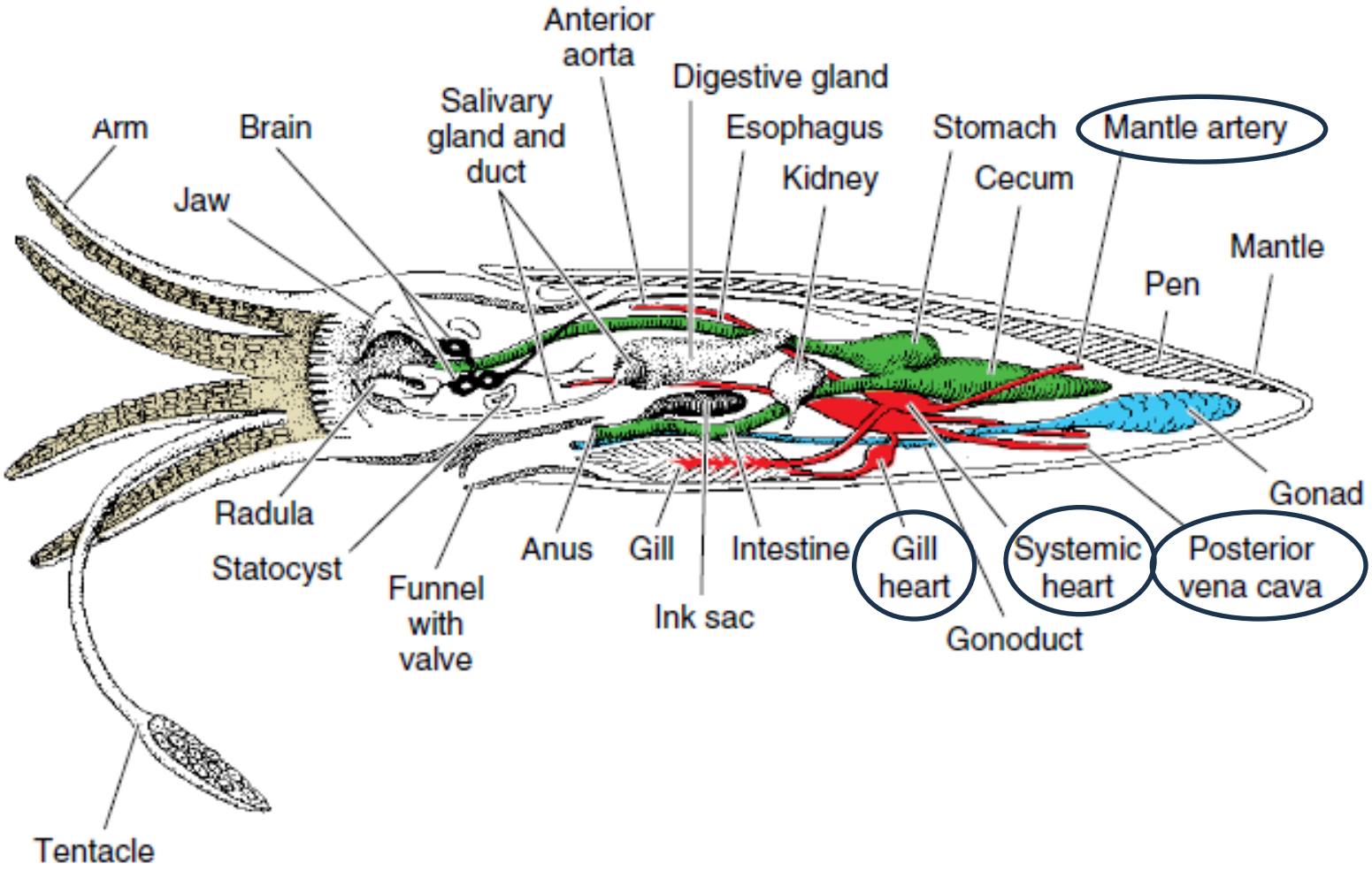
***The posterior part of the foot forms the siphon, a muscular funnel made up of 2 lobes rolled into a horn. This organ ensures the expulsion of water from the mantle cavity.**



3. Class 3 – Cephalopoda

Some specific derived characters:

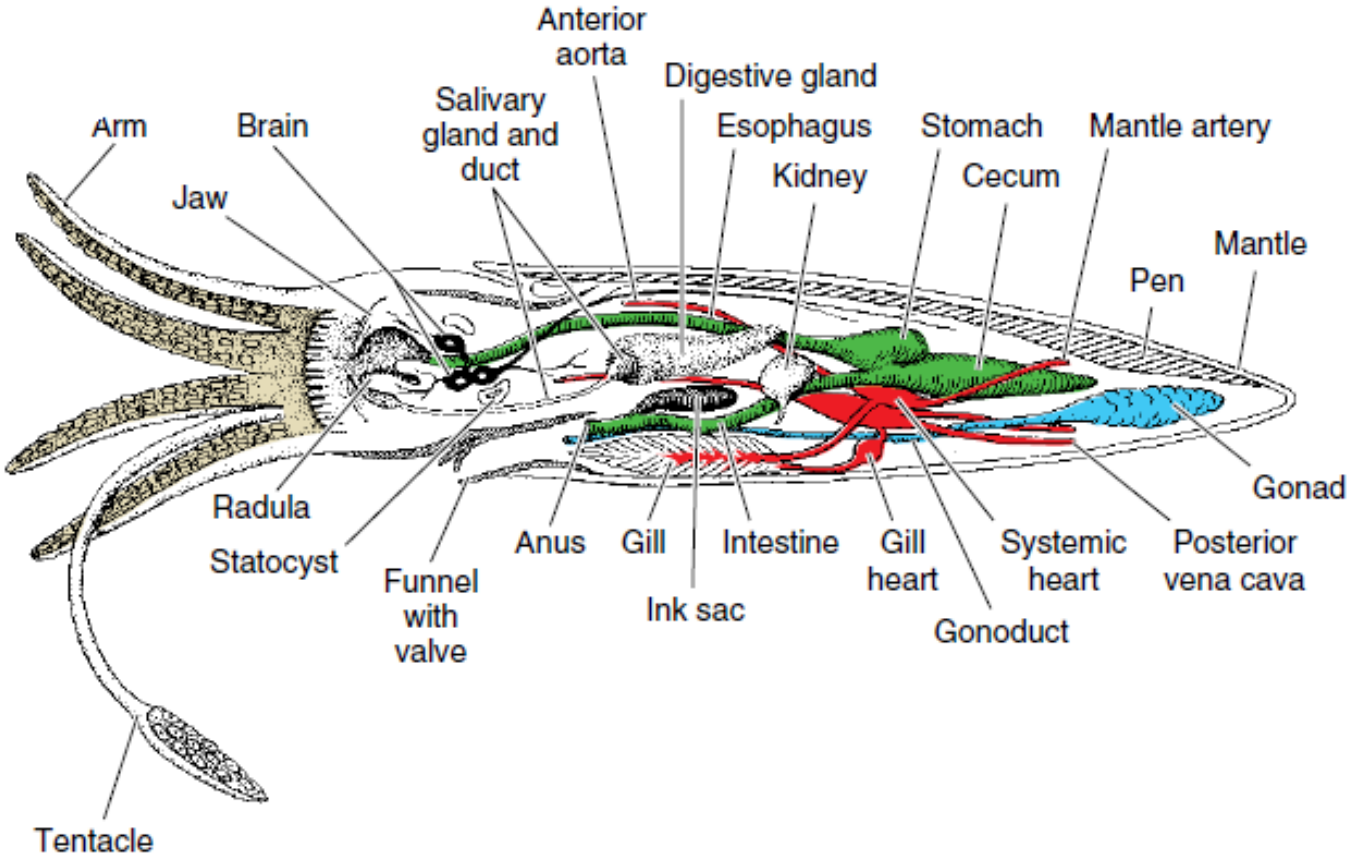
***The circulatory system is closed in cephalopods.**



3. Class 3 – Cephalopoda

Some specific derived characters:

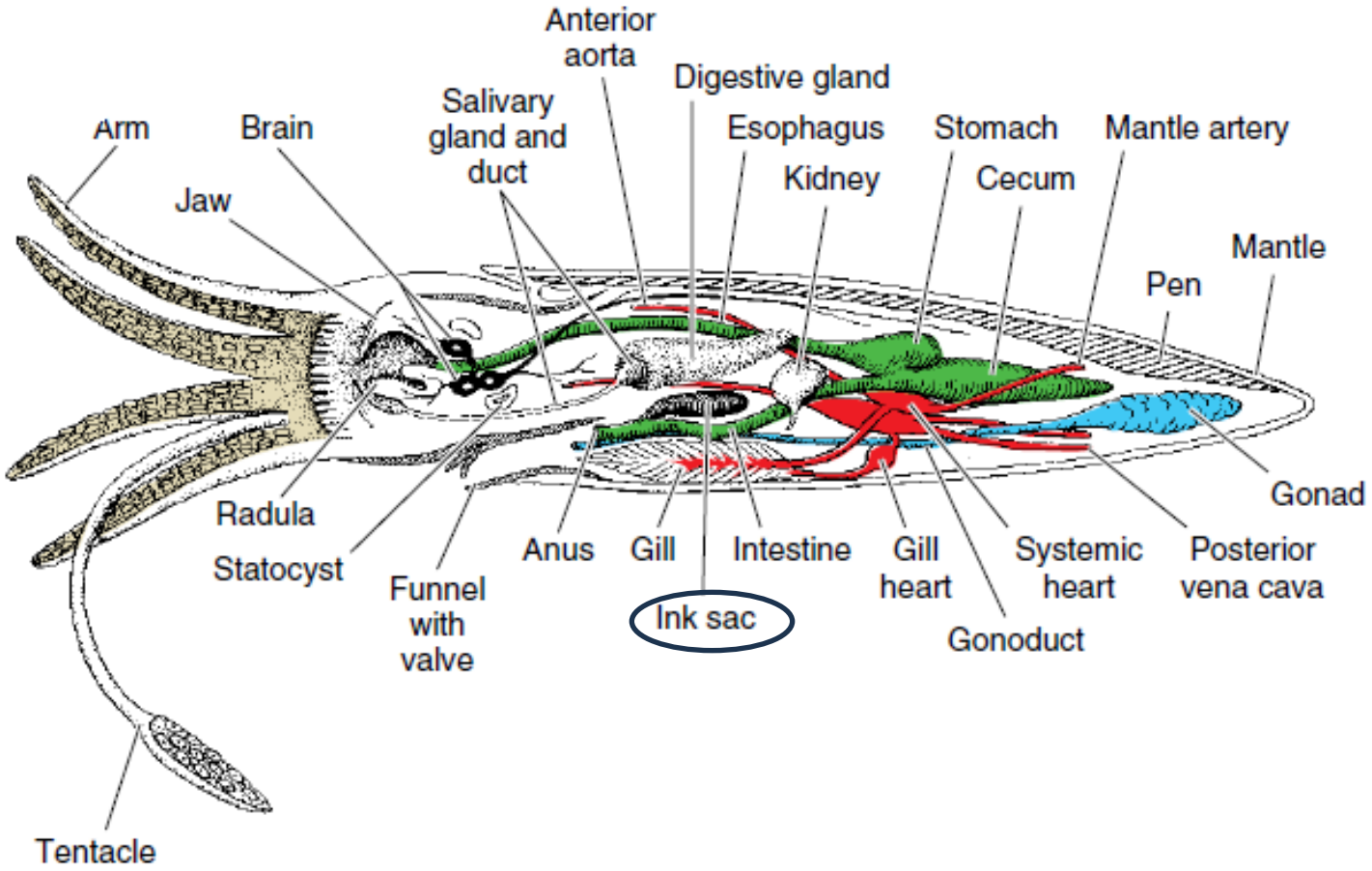
***The nervous system becomes extremely centralized in cephalopods, and forms a "brain" protected by a cartilaginous capsule that functions**



3. Class 3 – Cephalopoda

Some specific derived characters:

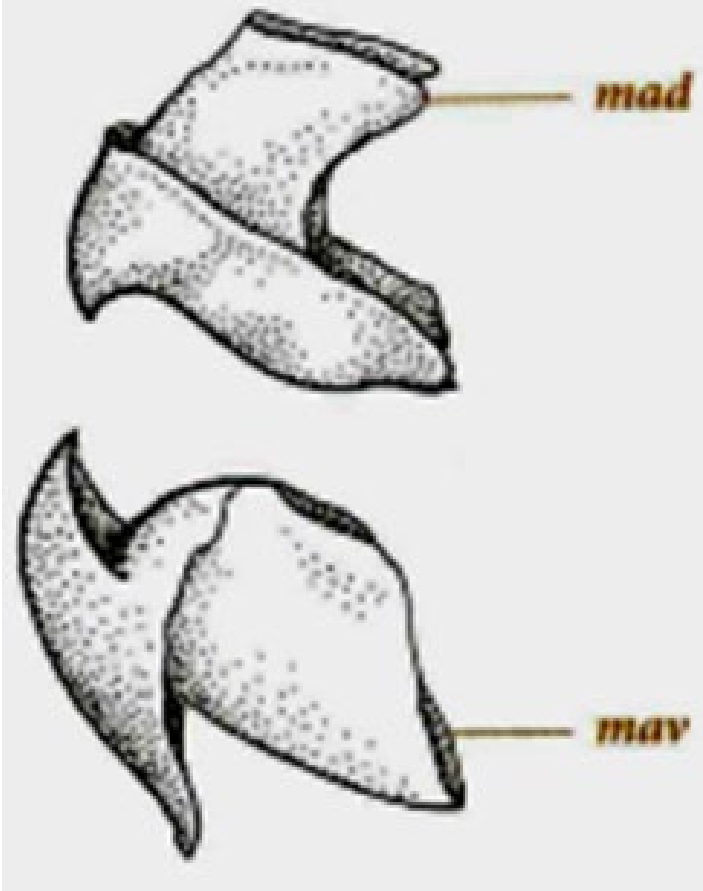
***There is an ink sac, a dark liquid discharged when the animal feels threatened.**



3. Class 3 – Cephalopoda

Some specific derived characters:

***There are 2 mandibular skeletal pieces in the shape of a parrot's beak.**



3. Class 3 – Cephalopoda

***In cephalopods the sexes are separate.**

***The spermatophores produced by the male are transported by a specialized tentacle (the hectocotylus) into the pallial cavity of the female.**

***Development is direct, that is to say without a larval stage (trochophore or veliger). Cephalopod embryos resemble small adults.**

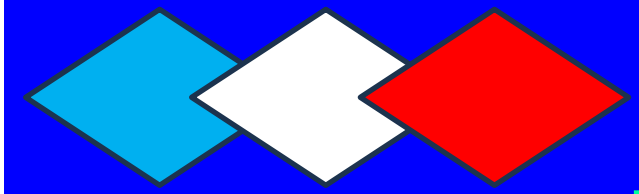
3. Classe 3 – Céphalopodes

Photo : Benyahia

Loligo vulgaris de la baie de Zemmouri El Bahri, dans l'Est algérois

Photo : Benyahia

Octopus vulgaris (Baie de Zemmouri El Bahri en 1999)



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