



UNIVERSITY CONSTANTINE1 – FRÈRES MENTOURI



INSTITUTE OF VETERINARY SCIENCES

# THE molluscs



## I) Definition

Molluscs are **soft-bodied, unsegmented** invertebrates, usually protected by a **calcareous shell**. They include species of varying sizes and colours. They are either terrestrial or aquatic.

## II) Common characteristics

- A well-developed circulatory system
- Gills or lungs for respiration
- A ventral foot for locomotion or peribuccal tentacles for grasping
- The soft, unarticulated body has a mouth opening and often bears a calcareous shell

## III) External organisation

### 3.1 The head

It is present in some species and absent in others; it bears a mouth opening equipped with a horny tongue called a **radula**, located at the tip of the head. It also bears the eyes and sensory tentacles.

### 3.2 The foot

This is a muscular organ typical of molluscs, used for locomotion. This organ takes different forms across species.

### 3.3 The visceral mass

The mantle bounds it and varies in shape and development among species.

### 3.4 The shell

The mantle secretes it and comprises, from the outside in:

- A cuticle that can take on different colours.
- A layer of limestone.

- A layer formed of alternating lamellae of calcium carbonate and organic matter.

## **IV) Internal organisation**

### **4.1) Respiratory system**

In land molluscs, respiration takes place via lungs, whereas in aquatic molluscs it occurs via gills.

### **4.2) Digestive system**

It consists of a variable mouth opening, which may be absent (in some species).

In cephalopods, tentacles are present around the mouth, equipped with suction cups to capture prey and bring it to the mouth.

Near the rectum is a special gland called **the ink sac**, which secretes ink that the animal expels to camouflage itself when a predator approaches.

## **V) Classification of molluscs**

### **5.1) Gastropods**

Gastropods (gastêr: belly and podos: foot)

#### **5.1.1) Anatomical and biological characteristics**

- The head is clearly distinct; it bears one or two pairs of tentacles and two eyes situated at the tips of the tentacles.
- The foot of gastropods consists of a broad ventral surface that enables attachment or locomotion by crawling.
- The vast majority of gastropods possess a shell.
- The mantle entirely or partially covers the visceral mass, the outer part of which secretes the shell and the inner part, which forms the pallial cavity.
- They are herbivores, detritivores, and some are predators.

- The shell is univalve and may be coiled around an axis.

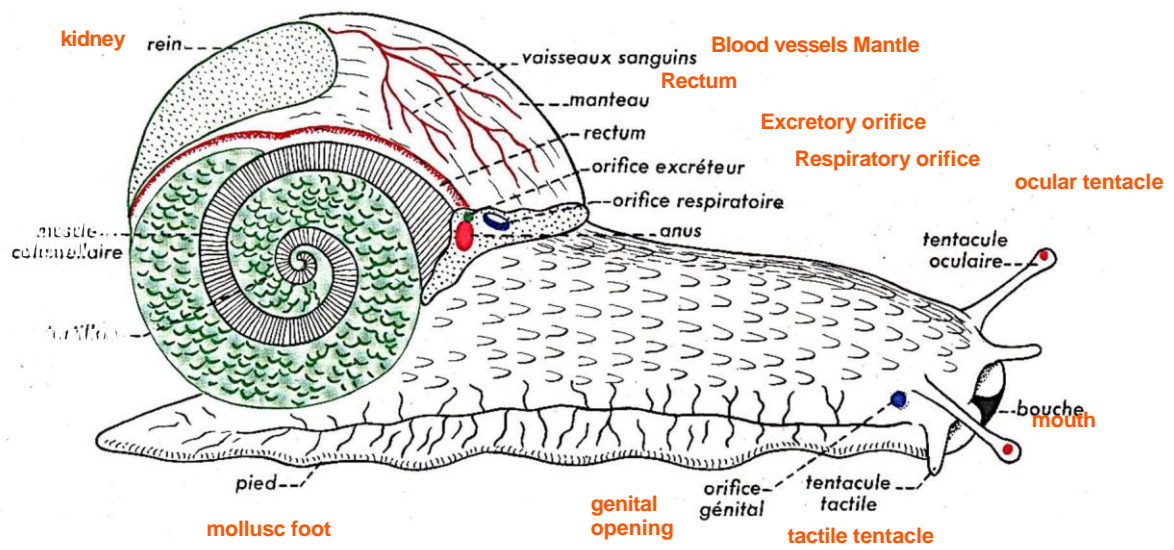


Diagram 1 shows a terrestrial gastropod.

## 5.2) Bivalves

### 5.2.1) Anatomical and biological characteristics

- Bivalves are aquatic molluscs.
- They have no head.
- Bilateral symmetry.
- The shell consists of two valves that cover the right and left sides of the body.
- The shell is closed by the contraction of one or two adductor muscles, each of which attaches to the inner surface of the two valves.
- There are two siphons allowing water to enter the pallial cavity (inhalant or ventral siphon) or to be expelled outwards (exhalant or dorsal siphon).
- The foot, a mobile muscular organ, is sometimes axe-shaped and enables locomotion (burrowing) or attachment to the substrate via elastic filaments (byssus).
- Most species are microphagous, feeding either on plankton or organic particles suspended in the water (suspensivores) or on food collected from the seabed.
- The vast majority of bivalves are dioecious.

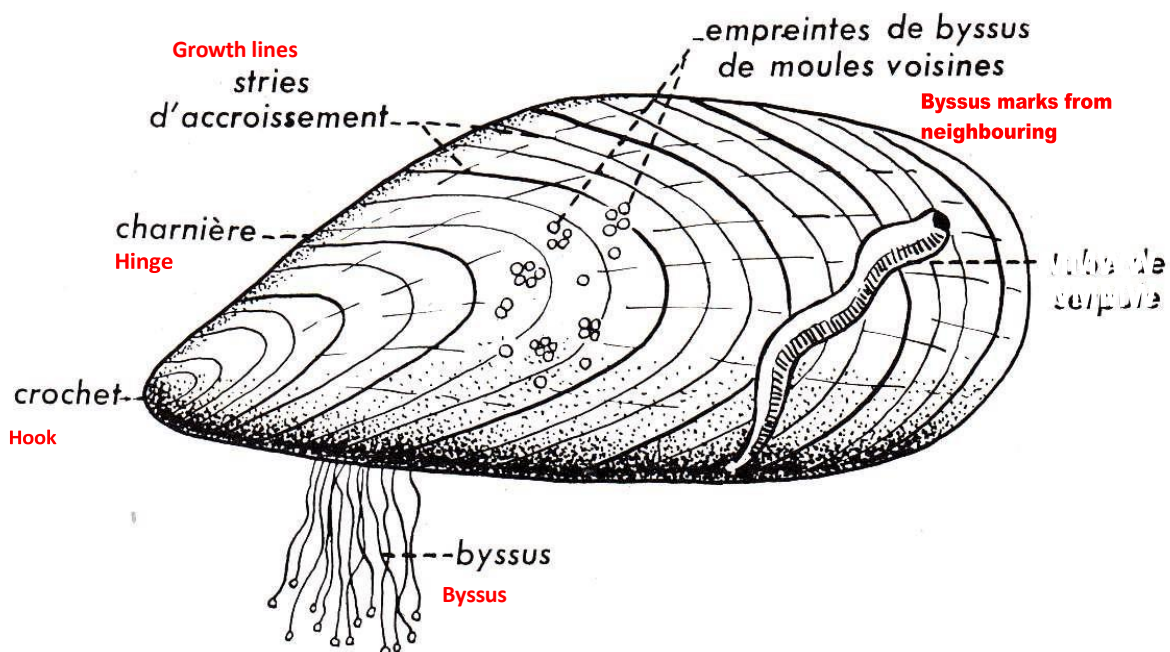
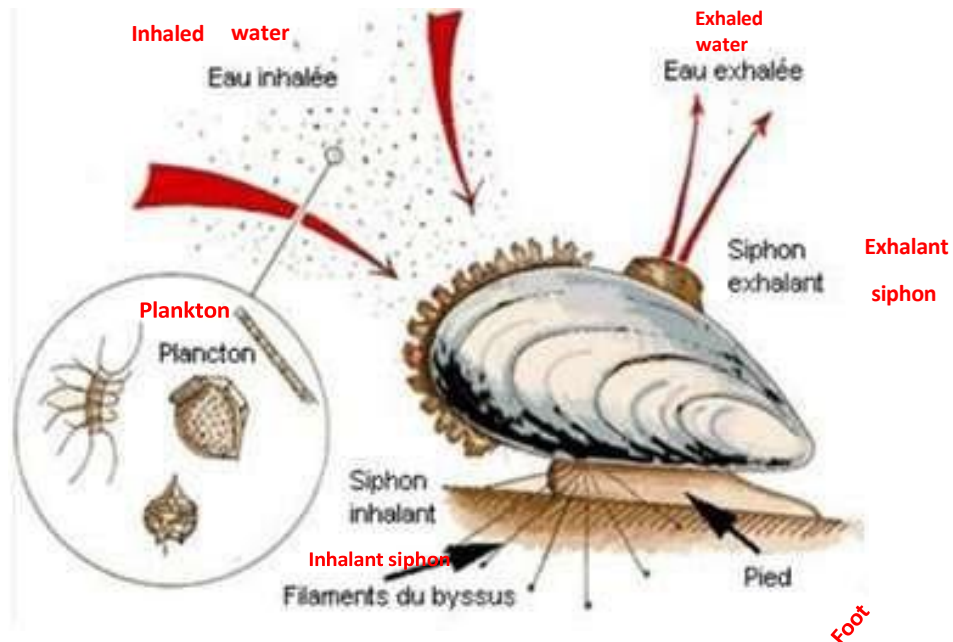


Diagram 2 shows the outer surface of a mussel

- Oxygen exchange occurs through the gills. Water rich in dissolved oxygen enters the mantle cavity through the inhalant siphon. The gill filaments filter it before being expelled by the exhalant current.



**Diagram 3** shows respiration and feeding in mussels

- Mussels are dioecious molluscs. Fertilisation takes place in seawater; the female's eggs are released into the pallial cavity, where the sperm fertilise them. The sperm, released into the water by the males, are carried into the female's cavity by the incoming water flow. This results in the formation of a veliger larva, which remains pelagic for 3 to 5 weeks, depending on water temperature. At the time of metamorphosis, the young mussel settles on the seabed and attaches itself. It reaches adulthood after 2 years.

### 5.2.3) Classification of bivalves

There are several criteria for classifying bivalves:

The main criterion for Classification is the shape of the gills: **protobranchs**, **filibranchs**, **eulamellibranchs** and **septibranchs**.

The number of teeth and their arrangement at the hinge: **heterodont**, **anodont**, **schizodont**, **parodont**.

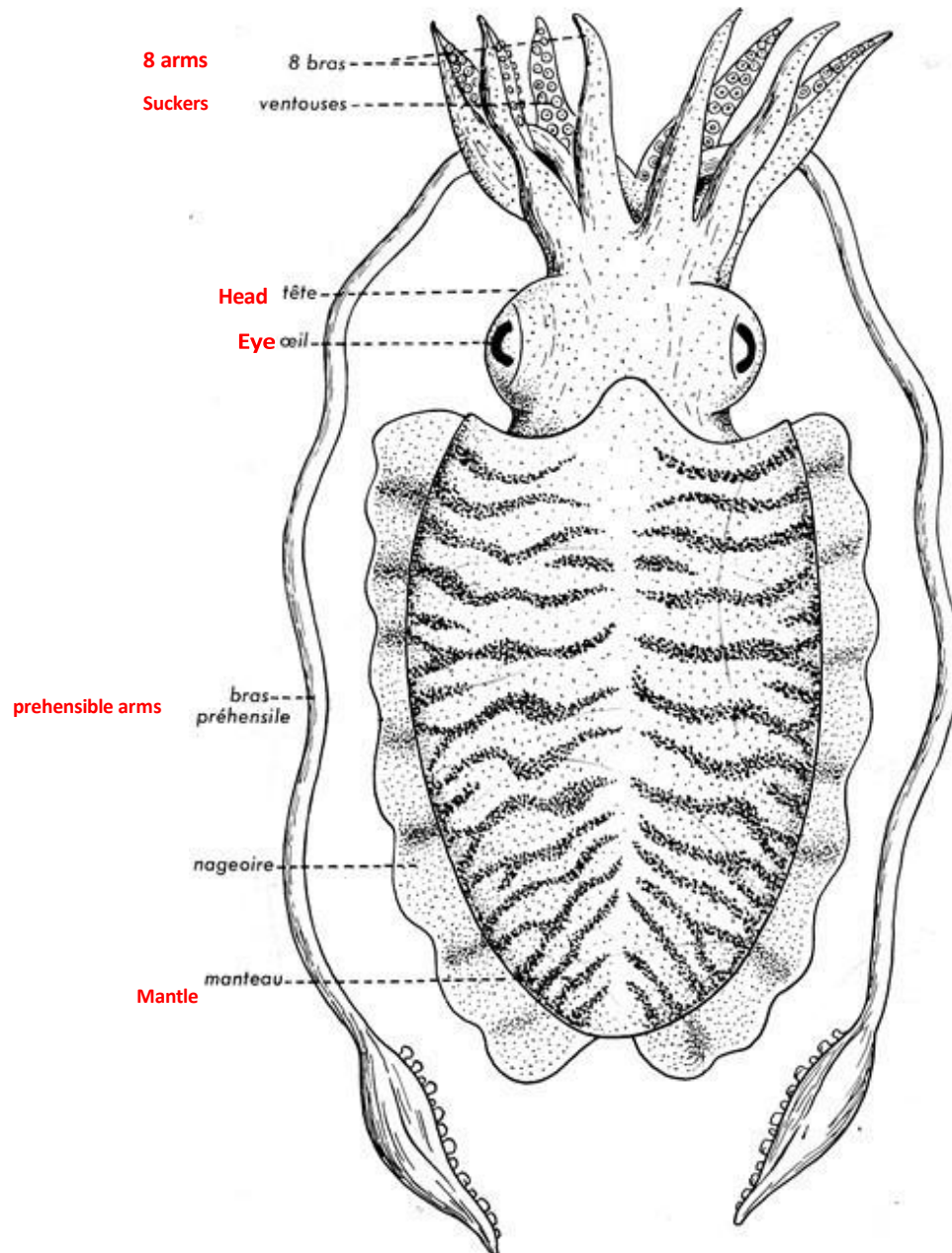
Finally, they can be characterised by the shape of the valves: **inequivalve** or **equivalve**.

By the pallial impression (left by the mantle on the shell): integripalliate, sinupalliate. And finally, the position of the ligament: external or internal.

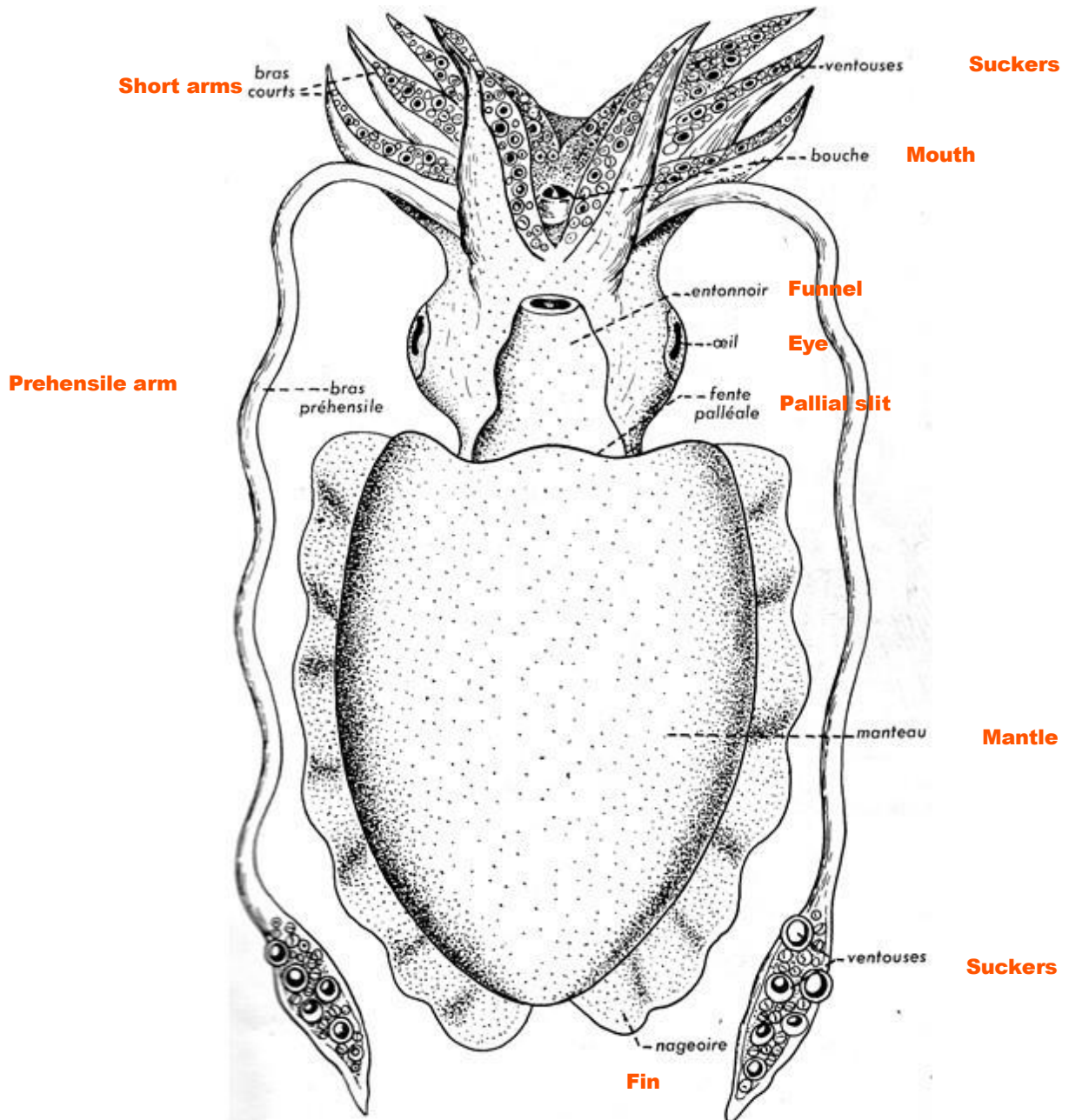
## 5.3) Cephalopods

### 5.3.1) Anatomical and biological characteristics

- The body exhibits bilateral symmetry.
- Peribuccal appendages, arms or tentacles surround the head.
- The foot is transformed into tentacles.
- The shell may be internal, external or absent.
- They are predators; they feed on crustaceans, molluscs and fish.
- They are sexually dimorphic (males and females). Fertilisation is internal.
- The male deposits his sperm using a specialised tentacle (the hectocotylus) into the female's mantle cavity.
- In cuttlefish and squid, the females lay eggs that are attached to various substrates, such as seaweed and sponges, and leave them to their fate.
- Hatching occurs between 20 and 40 days, depending on the water temperature, once the yolk sac has been depleted.



**Diagram 4** shows the dorsal side of a cephalopod mollusc



**Diagram 5** shows the ventral side of a cephalopod mollusc

### 5.3.2) Classification of cephalopods

According to the number of gills, one can distinguish two groups: **the Tetrabranchia**, which have 4 gills, represented by **Nautiloids** from the Latin nautilus = sailor. Nautiloids have a coiled shell. Today, only a few species remain.

**The Dibranchia**: they have a single pair of gills, and the shell is internal or absent. There are two orders:

#### 5. 3.2.1) Order Decapoda

- They have ten tentacles or arms, eight of which are short and two of which are long.
- They are good swimmers.
- They have a shell. (Example: the cuttlefish)
- They can move in various ways; they can propel themselves backwards by sucking in water and expelling it through the siphon. They can also use their tentacles to push off the ground.
- The mantle and tentacles can change colour depending on the environment or during courtship displays.
- They protect themselves by using homochromy or by releasing a jet of ink, which blocks the predator's chemical receptors or vision and also serves as a warning to their fellow octopuses.

#### 5.3.2.2) Order Octopoda

- They have 8 tentacles.
- A shell is often absent.
- They are sedentary. (The octopus).

## VI) Harmfulness of molluscs

Slugs and snails are herbivorous molluscs. Slugs have a varied diet, mostly plant matter, but they may also eat animal waste. The common slug and the grey slug tend to feed on plants at ground level and appear to be attracted to already damaged plants. During droughts, small slugs tend to live in the soil and feed on the underground parts of plants. The behaviour of molluscs regarding plant choice

Moreover, the amount consumed varies by species. Some species can consume up to 50% of their body weight in a single night.

Slugs often transmit infectious agents to plants. Other species, such as the limnaea, can affect animal health, as they form part of the life cycle of the large fluke, a disease that causes considerable economic losses in sheep and cattle.

### **6.1) Control of harmful molluscs**

Among biological methods, garden predators such as hedgehogs can be introduced to feed on slugs and snails. We can also use sawdust or crushed eggshells.

As for chemical methods, iron phosphate appears to be an effective slug control.





The use of calcium cyanamide remains a risky solution.

# UNDERSTANDING MOLLUSCS: A COMPREHENSIVE GUIDE

## I) DEFINITION

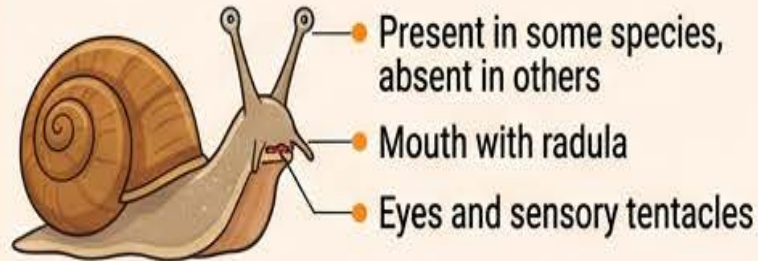


## II) COMMON CHARACTERISTICS

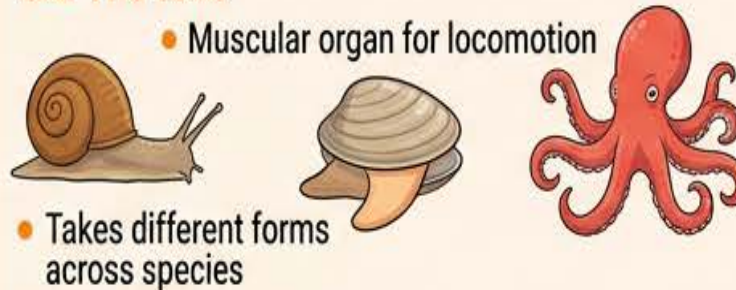
-  A well-developed circulatory system
-  Gills or lungs for respiration
-  A ventral foot for locomotion or peribuccal tentacles for grasping
-  The soft, unarticulated body has a mouth opening and often bears a calcareous shell

## III) EXTERNAL ORGANISATION

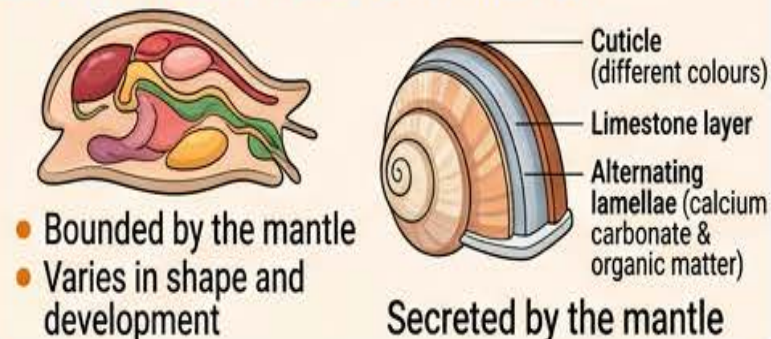
### 3.1 The head



### 3.2 The foot



### 3.3 The visceral mass 3.4 The shell



## IV) INTERNAL ORGANISATION

### 4.1) Respiratory system

- Land molluscs: Lungs



Land molluscs: Lungs    Aquatic molluscs: Gills

### 4.2) Digestive system



Land molluscs: Lungs    Aquatic molluscs: Gills

- Variable mouth opening (may be absent)
- Cephalopods: Tentacles with suction cups for prey capture
- Ink sac near rectum secretes ink for camouflage



# COMPARISON OF MOLLUSC CLASSES: GASTROPODS, BIVALVES, & CEPHALOPODS



## 5.1 GASTROPODS

(gastêr: belly and podos: foot)



### ANATOMICAL & BIOLOGICAL CHARACTERISTICS



Distinct head; 1-2 pairs of tentacles, 2 eyes at tips.



Broad ventral foot for attachment or crawling locomotion.



Vast majority possess a shell. Univalve, may be coiled.



Mantle covers visceral mass; outer secretes shell, inner forms pallial cavity.



Herbivores, detritivores, and some are predators.

## 5.2 BIVALVES



### ANATOMICAL & BIOLOGICAL CHARACTERISTICS



Aquatic molluscs.

They have no head.



Bilateral symmetry.



Shell consists of two valves (right and left sides).



Shell closed by contraction of one or two adductor muscles.



Two siphons for water entry (inhalant/ventral) and exit (exhalant/dorsal).



Mobile muscular foot, sometimes axe-shaped, for burrowing or attachment (byssus).



Most species are microphagous, suspensivores (plankton, particles) or seabed feeders.



Vast majority of bivalves are dioecious.

## 5.3 CEPHALOPODS



### ANATOMICAL & BIOLOGICAL CHARACTERISTICS



Body exhibits bilateral symmetry.



Peribuccal appendages, arms or tentacles surround the head.



The foot is transformed into tentacles.



Shell may be internal, external or absent.



They are predators; feed on crustaceans, molluscs and fish.



Sexually dimorphic (males and females). Fertilisation is internal.



Male deposits sperm using a specialised tentacle (hectocotylus) into female's mantle cavity.



In cuttlefish and squid, females lay eggs attached to substrates (seaweed, sponges) and leave them.



Hatching occurs between 20 and 40 days, depending on water temperature, once yolk sac is depleted.

# Glossary

<b>Term</b>	<b>Definition</b>
<b>Circulatory System</b>	<i>The system responsible for transporting blood and other substances throughout the body.</i>
<b>Gills</b>	<i>Respiratory organs that extract oxygen from water in aquatic molluscs.</i>
<b>Lungs</b>	<i>Respiratory organs found in land molluscs, used for breathing air.</i>
<b>Radula</b>	<i>A horny, tongue-like structure found in some molluscs used for scraping food.</i>
<b>Tentacles</b>	<i>Sensory or grasping appendages in molluscs, often found around the mouth.</i>
<b>Mantle</b>	<i>The soft part of the mollusc's body that secretes the shell and forms the pallial cavity.</i>
<b>Visceral Mass</b>	<i>The central mass of internal organs in a mollusc, enclosed by the mantle.</i>
<b>Shell</b>	<i>A calcareous structure secreted by the mantle, protecting the mollusc's body.</i>
<b>Foot</b>	<i>A muscular organ used by molluscs for locomotion or attachment.</i>
<b>Gastropods</b>	<i>A class of molluscs with a distinct head, tentacles, and a coiled shell.</i>
<b>Bivalves</b>	<i>Aquatic molluscs with a two-valved shell and no distinct head.</i>
<b>Cephalopods</b>	<i>Molluscs with a well-developed head, arms or tentacles, and a bilateral body symmetry.</i>

<b><i>Inhalant Siphon</i></b>	<i>The tube through which water enters the pallial cavity in bivalves.</i>
<i>Exhalant Siphon</i>	<i>The tube through which water exits the pallial cavity in bivalves.</i>
<b><i>Homochromy</i></b>	<i>The ability of cephalopods to change color to match their environment.</i>
<i>Byssus</i>	<i>Strong, fibrous threads used by bivalves like mussels for attachment to substrates.</i>
<b><i>Dibranchia</i></b>	<i>Cephalopods with two gills, including octopuses and squids</i>
<i>Tetrabranchia</i>	<i>Cephalopods with four gills, such as the nautilus.</i>
<b><i>Hectocotylus</i></b>	<i>A specialized tentacle in male cephalopods used for transferring sperm to females.</i>
<i>Dioecious</i>	<i>Species that have distinct male and female individuals.</i>