Phylum: Mollusca

Type study: Pila globosa

Topics: General characters, Respiration and Reproductive system

Introduction to Pila

- Apple snail, Pila, is a freshwater snail and is quite abundant in **freshwater ponds and lakes**
- They are distributed in the **Oriental and Ethiopian regions of the world.**
- A few species of this genus is found in India, of which the most common species is ***Pila globosa.***
- It is one of the largest freshwater molluscs.

Pila globosa

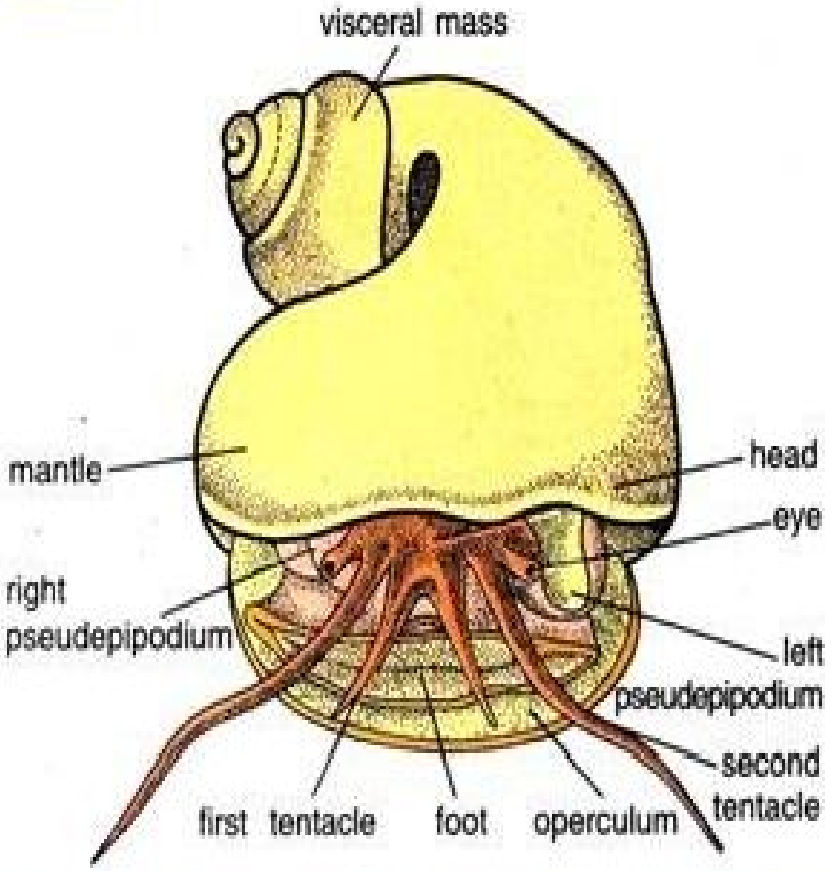


Fig. 60.4. *Pila globosa*. Front view of the animal after removal of the shell.

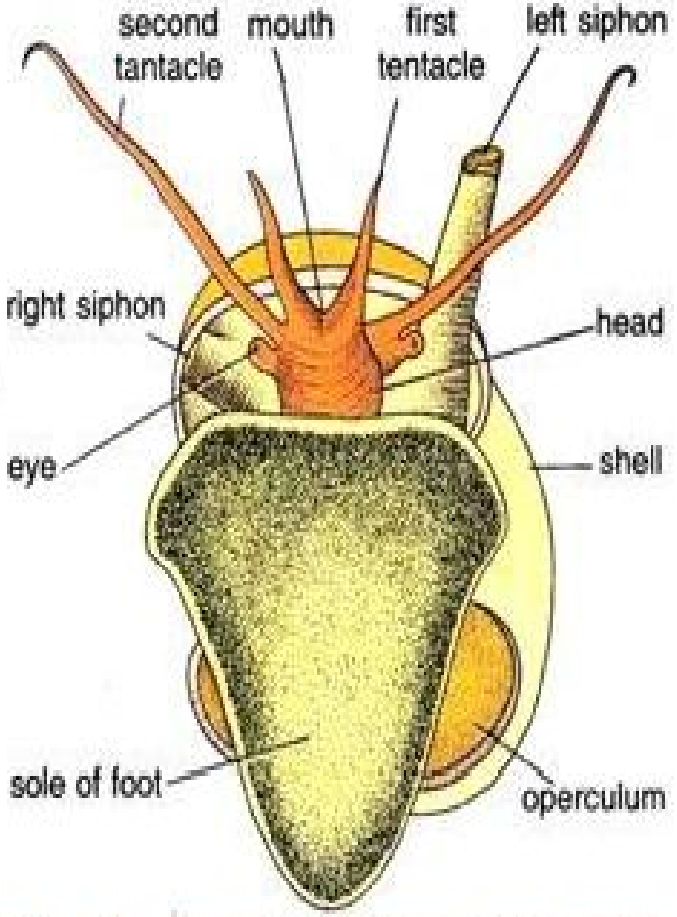


Fig. 60.5. *Pila globosa*. A living animal seen from the ventral side showing the elongated siphon formed by the left pseudepipodium.

Habit and Habitat of Pila

- ***Pila globosa*** **is abundantly found in ponds, pools, tanks, lakes and rice fields.**
- They may also be found in **fresh water streams, rivers and even in brackish water of low salinity**.
- They are **herbivorous** and therefore, quite abundant in waters, having succulent aquatic vegetation.
- They are **amphibious form** being adapted for life in water as well as on land.

- For this they are provided with, two fold respiratory adaptations.
- They **respire in water** by **ctenidium** and on **land by pulmonary sac**.
- Therefore, they possess **double mode of respiration**.
- During prolonged drought they undergo **aestivation for a long time** and **during rains they return to normal**.
- When disturbed it withdraws itself into its spirally **coiled shell** and seals **the Opening with its operculum**

Structure of Pila

- The body of Pila is enclosed in a thick spirally-coiled **globular univalve shell.**
- The shell has the form of an **elongated cone coiled** around a central axis in a spiral manner.
- A single revolution of the shell around the axis is called a whorl.
- The extreme top of the shell is called the apex , which is regarded as the oldest part of the body.
- Starting from the apex the other whorls — the penultimate whorl and body whorl are large so as to enclose the greater part of the body.
- The first whorl is smallest and the last one is largest

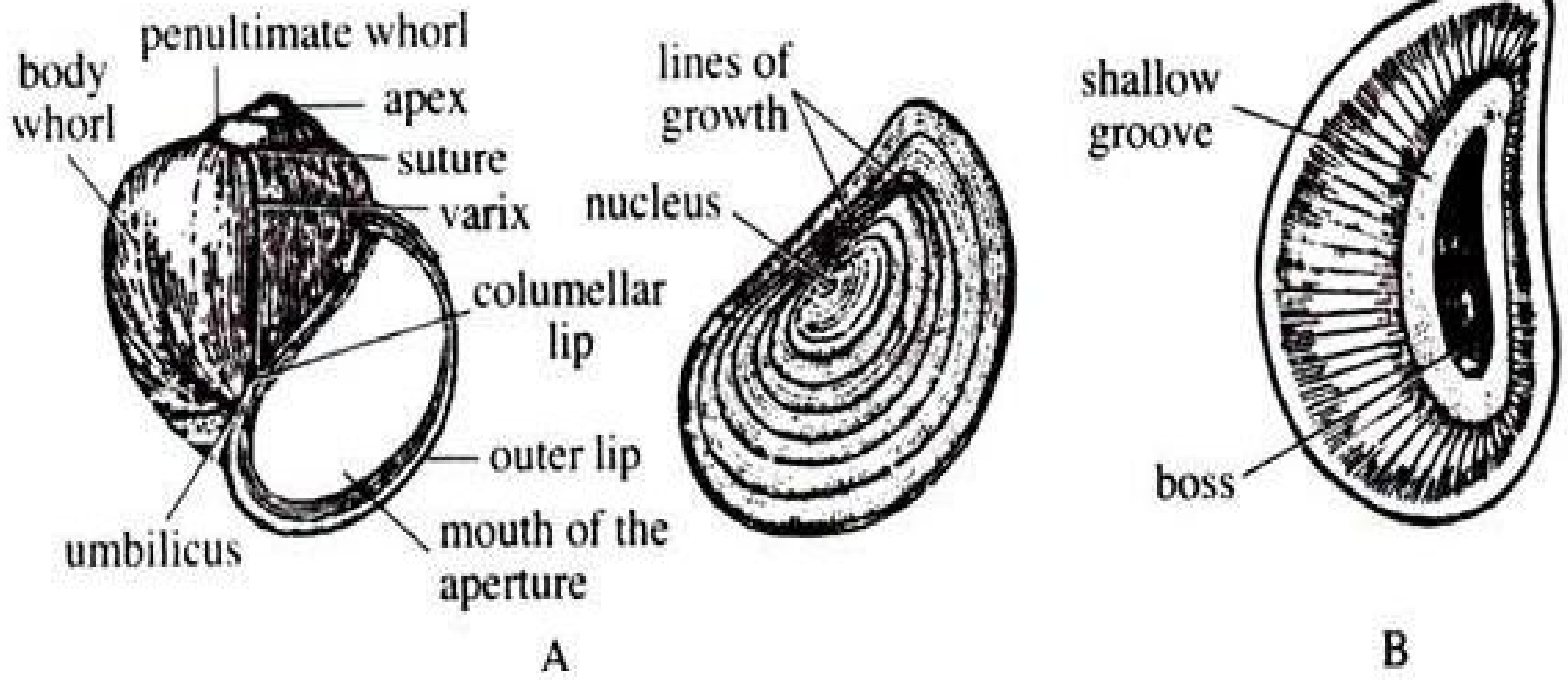


Fig. 1.80 : A. Showing the structure of shell, B. Operculum, of *Pila*.

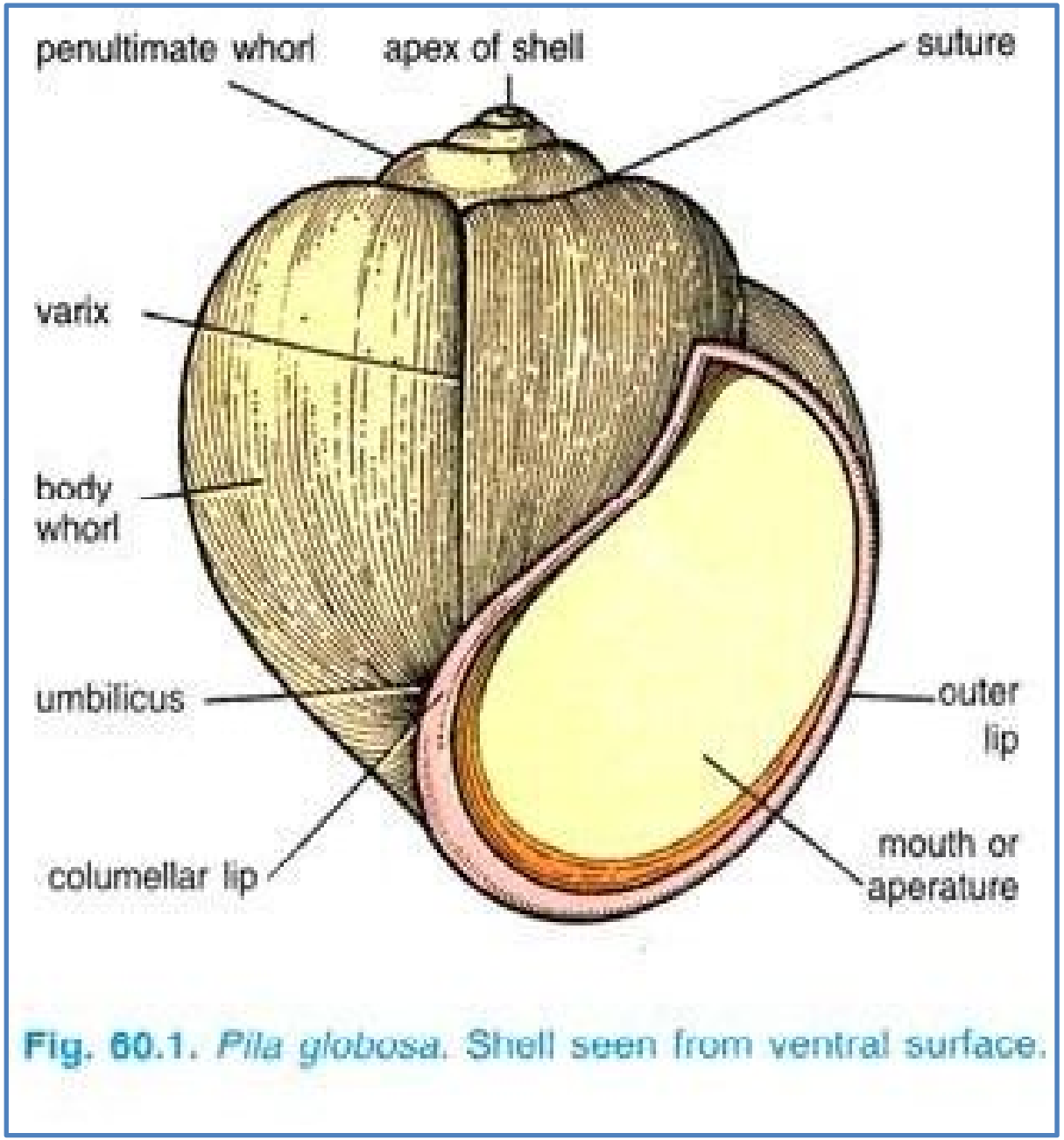


Fig. 60.1. *Pila globosa*. Shell seen from ventral surface.

- The body of Pila is divisible into the **head, foot and visceral mass.**
- Head is well marked and prolonged into a partly contractile snout.
- It carries **two pairs of tentacles**.
- The longer pair is filament-like, hollow and contractile.
- At the base of each tentacle projects a small, stumpy eyestalk or ommatophore bearing a prominent bead-like eye at its tip.
- The shorter pair of tentacles is called **labial palps** or first tentacle and is regarded as the anterio-lateral prolongation of the snout.
- Two fleshy projections, called **nuchal lobes or pseudoepipodia,** are seen on the two sides of the head.

- The skin covering the visceral mass forms the pallium or mantle.
- **The mantle sub serves three functions in the life of Pila:**
- (i) Protects the visceral mass and head,
- (ii) Serves as an **additional respiratory organ**
- (iii) Secretes the shell with the help of the shell-secreting nacreous glands at the free margin of the mantle.

- The general body cavity in the adult, is **haemocoel.**
- The true coelom is greatly reduced and is represented by the pericardial cavity and the cavities around the kidney.
- The **foot of Pila helps in locomotion.**
- The flat sole of the foot helps Pila to move very slowly by creeping on the substratum.

Pila globosa -Reproductive organs Male

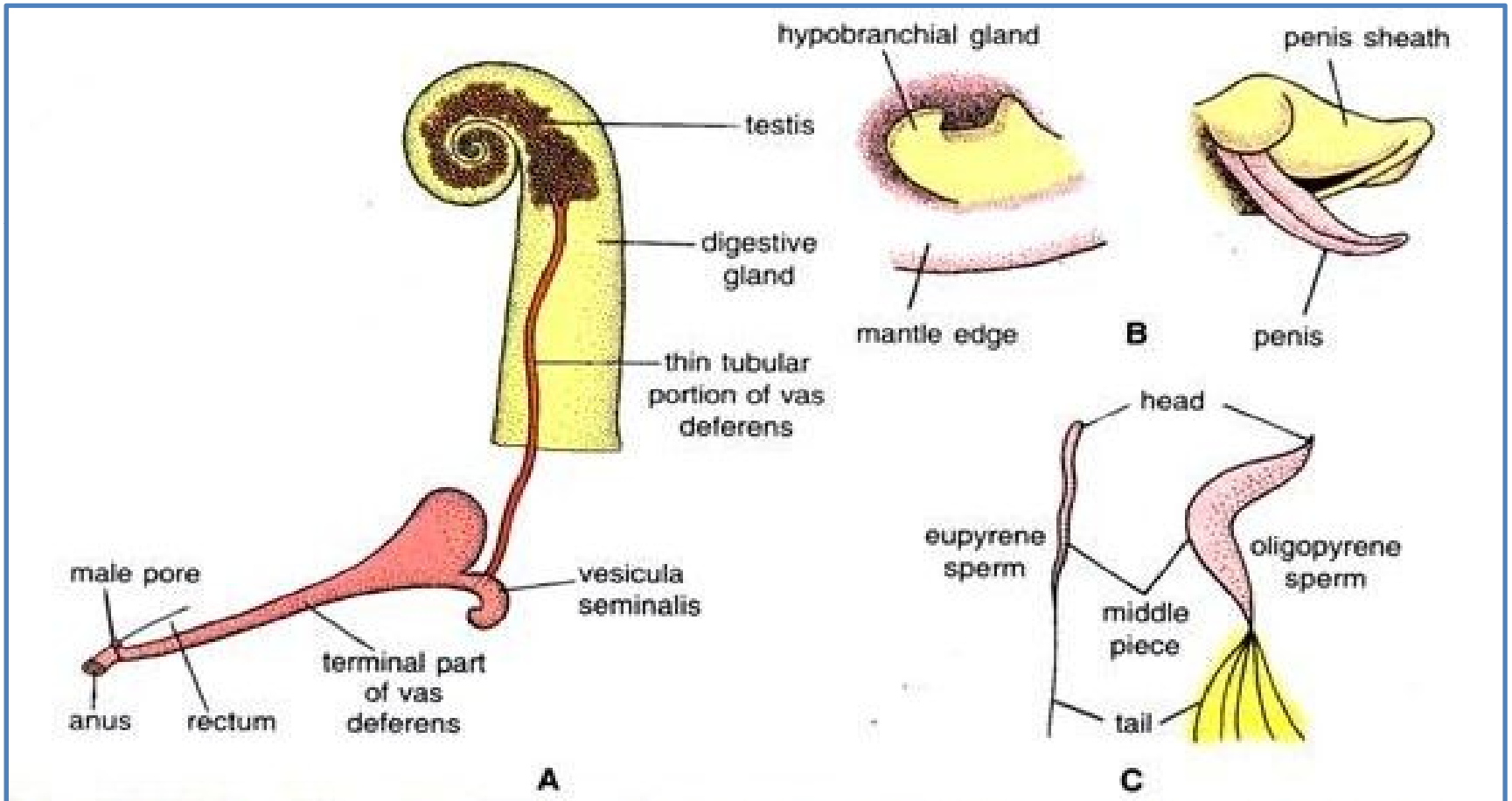


Fig. 60.28. *Pila globosa*. A—Male reproductive organs; B—Male copulatory organs in surface and ventral view; C—Sperms.

Reproductive System of *Pila globosa*

- In *Pila globosa*, the sexes are separate.
- The shell of the male is usually smaller in size and less swollen than the female.
- There is a well developed copulatory organ in the male but it is quite rudimentary in the female.

(i) Male Reproductive Organs of *Pila globosa*

- **The male reproductive organs consist of:**
- 1. Testis with its fine vasa efferentia
- 2. Vas deferens with the vesicula seminalis and the terminal glandular part of the vas deferens
- 3. Penis with its sheath
- 4. Hypobranchial glands

Female Reproductive Organs:

- **The female reproductive organs consist of**
- 1. Ovary with numerous minute ducts
- 2. Main oviduct
- 3. Receptaculum seminis
- 4. Uterus
- 5. Vagina
- 6. Hypobranchial gland.

Ovary:

- The ovary in the female lies in the same position as the testis in the male but it is not so extensive.
- It occupies the upper and inner surfaces on the first 2 – 2½ whorls and is covered over by a thin but stout skin-coat.
- Ovary is a much branched structure of a light orange colour which becomes darker in fully mature individuals

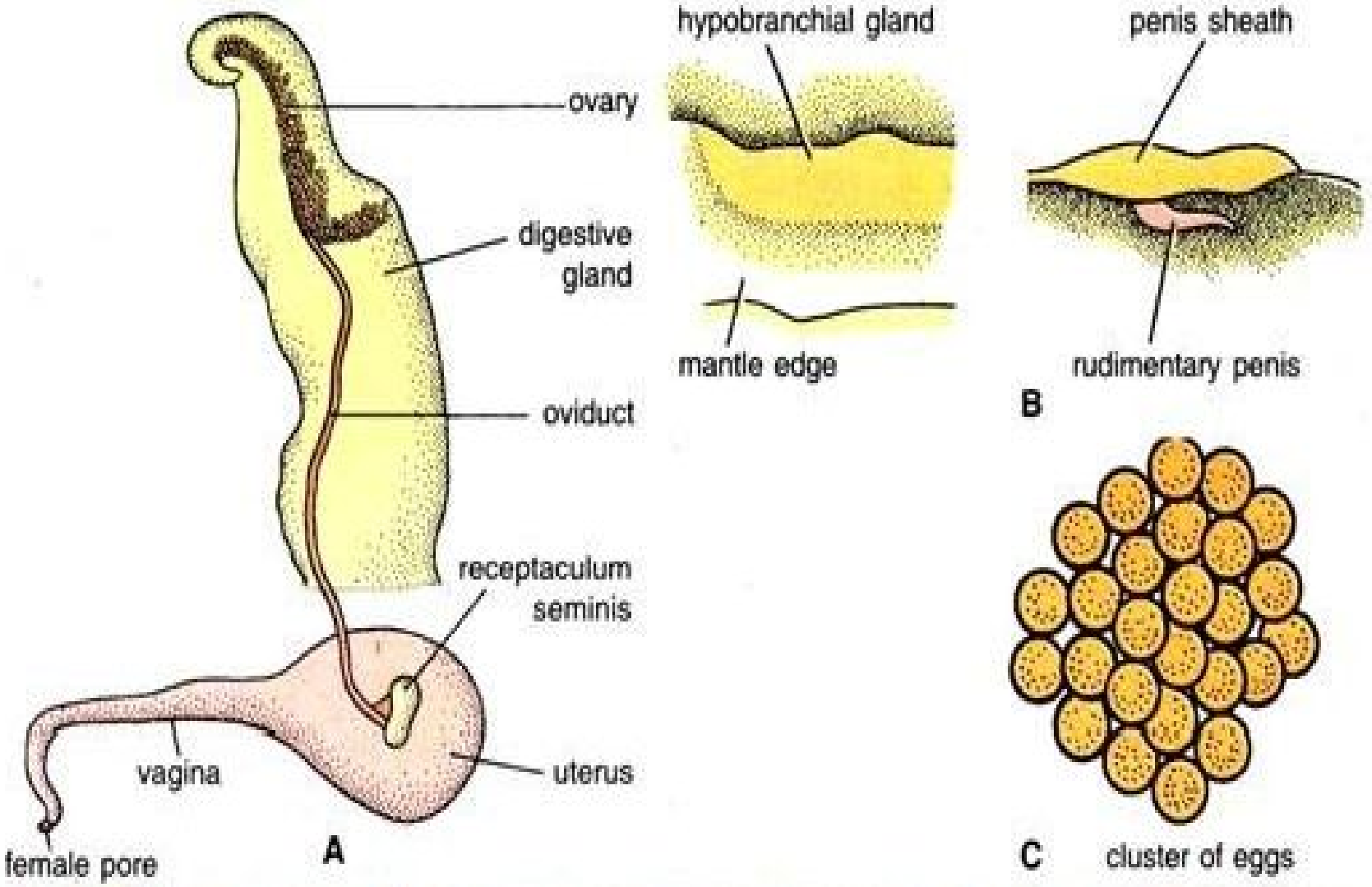


Fig. 60.29. *Pila globosa.* A—Female reproductive organs; B—Female copulatory organs in surface and ventral view; C—Eggs.

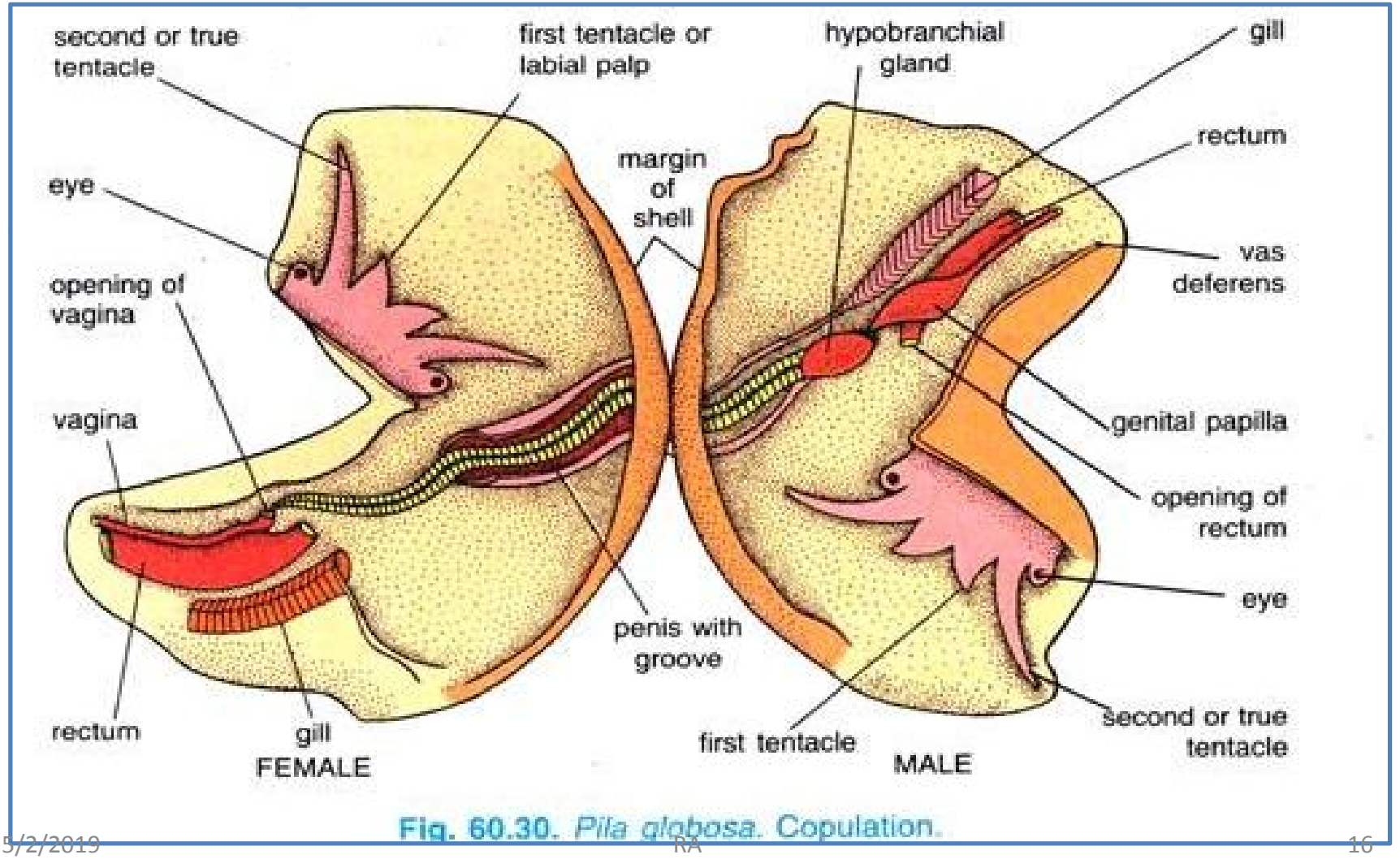


Fig. 60.30. *Pila globosa*. Copulation.

Fertilisation of Pila globosa:

- **Eggs are fertilised in the uterus** and oviposition starts a day or two later.
- The **fertilised eggs are laid in masses of 200 to 800 in moist earth near ponds and lakes.**

Development of Pila globosa:

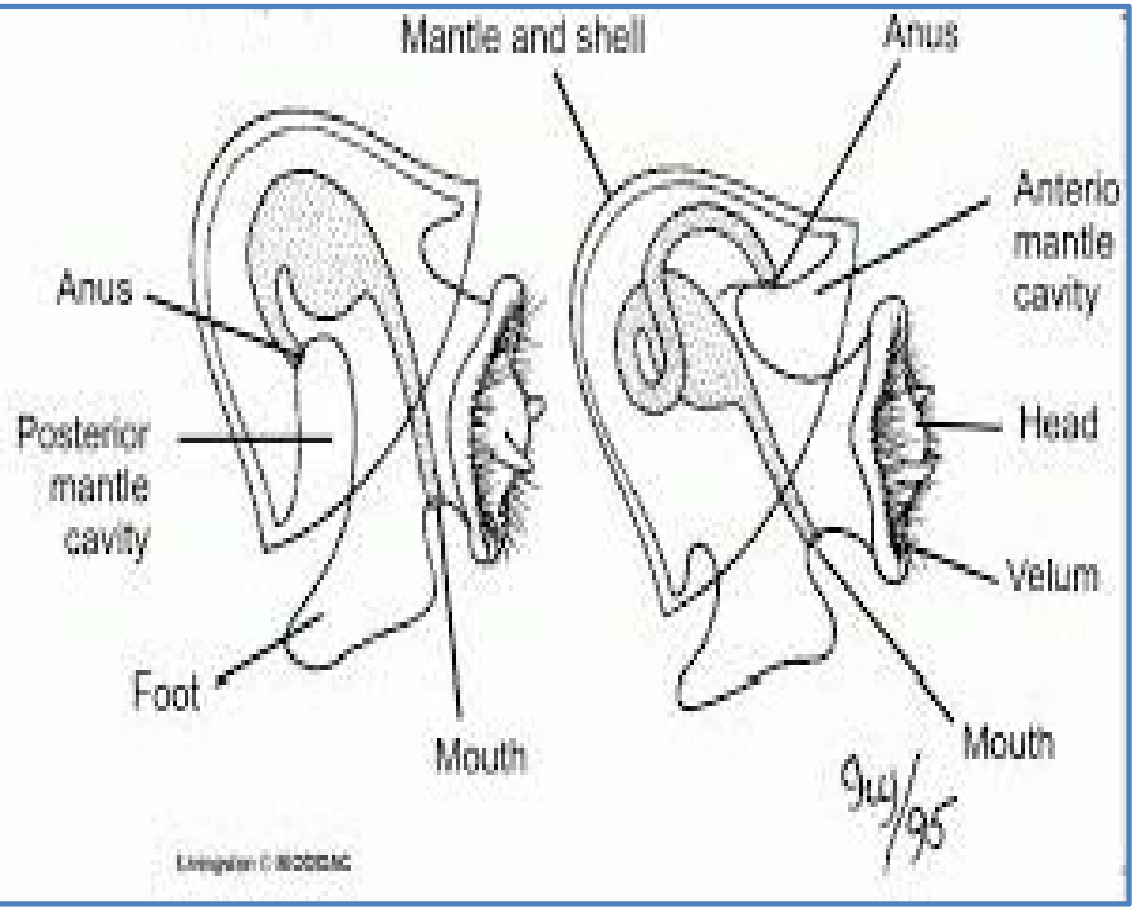
- In their development Mollusca pass through **two larval stages**, there is a **trochosphere larva which soon grows into a veliger larva**.
- The development of **the trochosphere is the same as in polychaete Annelida**.
- The typical **trochosphere develops in Patella**.

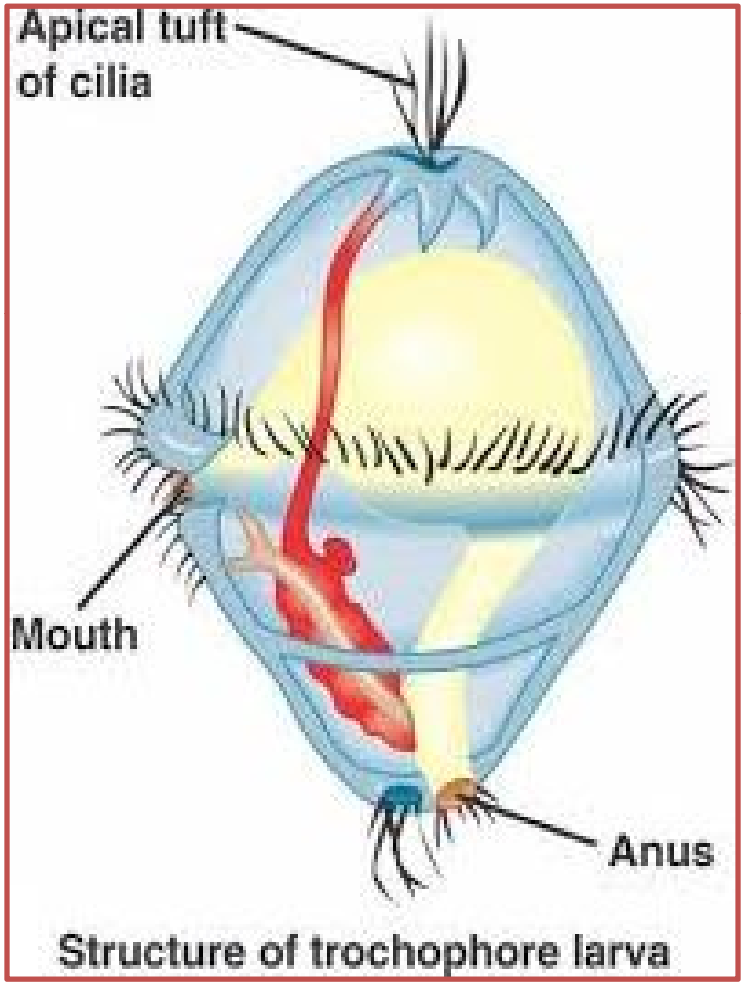
- A free- swimming **trochosphere is found only in some primitive gastropods**, such as Diotocardia, but in all others the trochosphere stage is reduced and passed within the egg.

- More characteristic **of marine gastropods is a free swimming veliger larva** which hatches from the egg.

- The **veliger is a modified trochosphere** but represents a more advanced stage of development, its organs show greater degree of development than those in the trochosphere larva.
- It has a **ciliated apical organ on the head, a curved gut, larval nephridia and a ciliated pre-oral prototroch**; but it has organs not found in the trochosphere.

Veliger and trochosphere larva





Respiratory Organs of *Pila globosa*

- The respiratory organs consist of a **single ctenidium or gill**, **a pulmonary sac or lung** and a pair of nuchal lobes.

1. Ctenidium or Gill:

- The ctenidium or gill is the **organ of aquatic respiration**.
- The ctenidium is situated on the **dorso lateral wall of the branchial chamber of the mantle cavity**.
- It is composed of a **long series of thin triangular leaflets** or **lamellae**, lying parallel to each other, which are attached to the mantle wall by their broad bases but have their apices hanging free in the branchial chamber.
- The line of attachment of the lamellae to the wall of the mantle forms the ctenidial axis.

- The ctenidial axis is provided with an afferent blood vessel (carrying deoxygenated blood) and an efferent blood vessel (carrying oxygenated blood) from gills to heart.
- All the gill lamellae are not of the same size; these are largest in the middle and gradually smaller towards the two ends.
- Such a **gill is known as monopectinate gill**.

- Each lamella bears transverse ridges or pleats on both its anterior and posterior surfaces.
- These pleats are low ridges gradually decreasing in size from the base of the lamella to its apex.
- Each ridge contains branches of blood vessels.

- Each lamella has a smaller right side, which receives blood from the afferent vessel, is called the afferent side and a longer left side, from which blood goes into the efferent vessel, is called the efferent side.

Respiratory organs in Pila

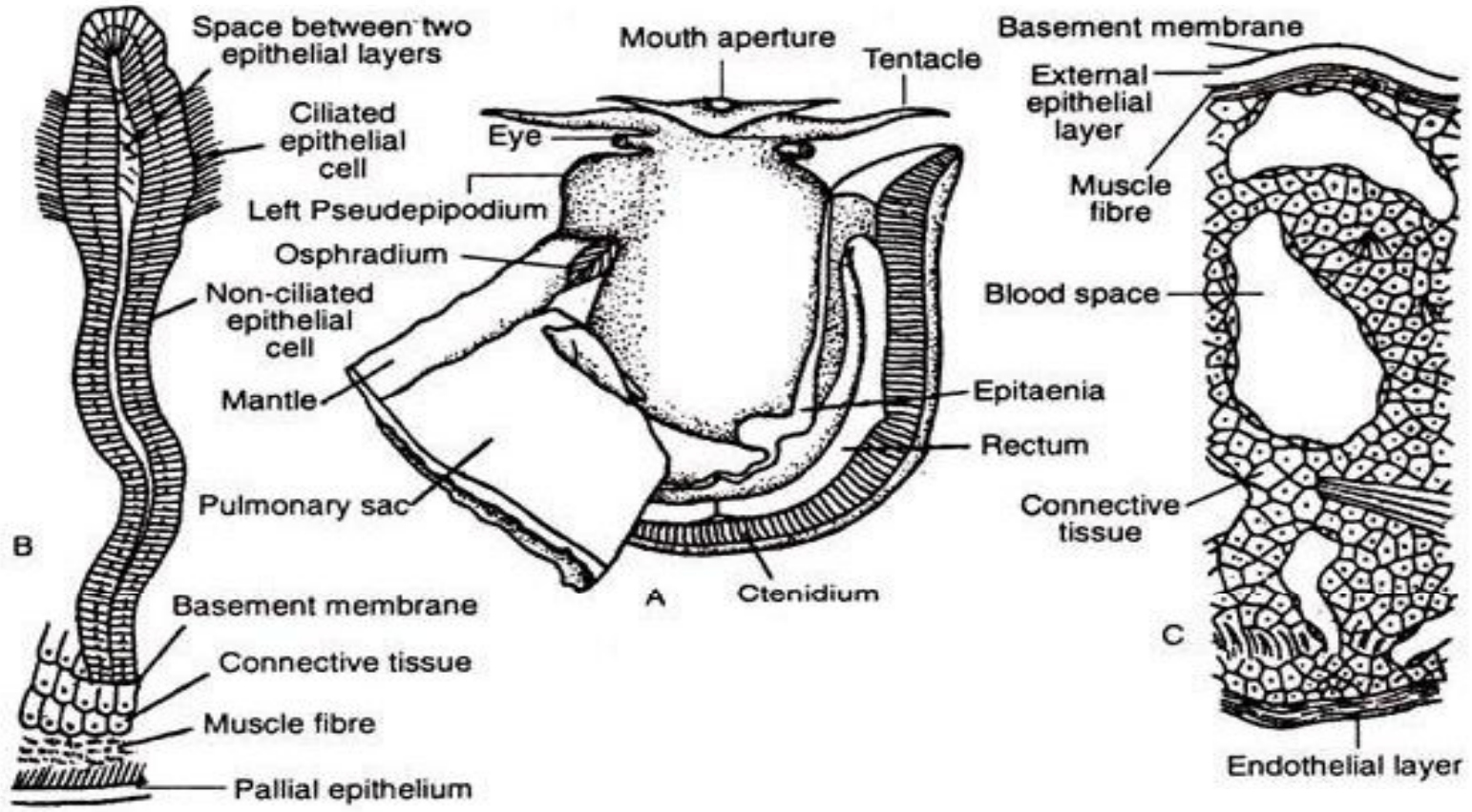


Fig. 16.13: Respiratory organs in *Pila*. A. The mantle is partially displaced to show the position of ctenidium. B. Transverse section of a branchial lamella. C. Diagrammatic sectional view of the outer wall of the pulmonary sac.

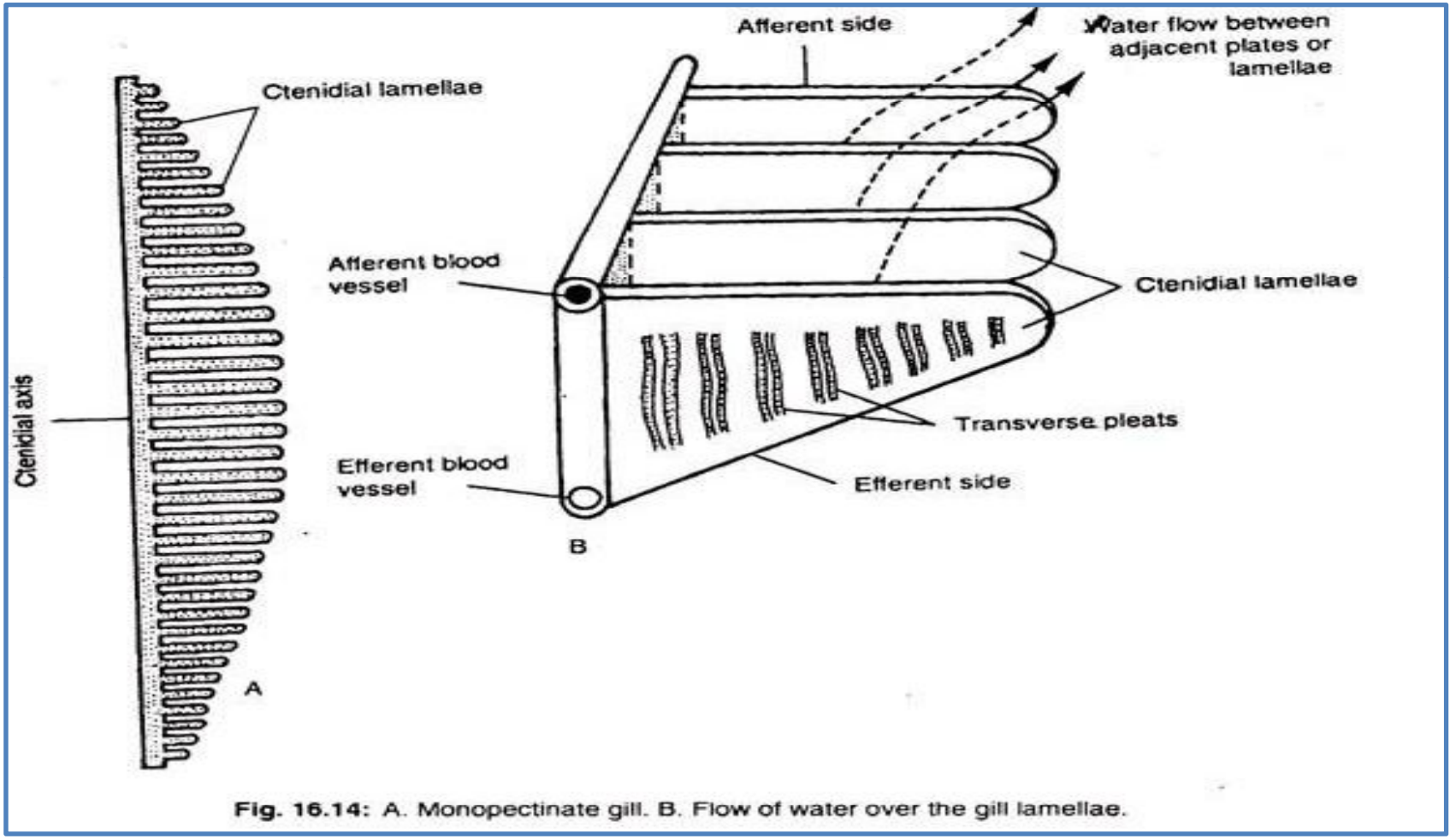


Fig. 16.14: A. Monopectinate gill. B. Flow of water over the gill lamellae.

2.Pulmonary Sac or Lung:

- The **pulmonary sac or lung** is a closed cavity like a bag which hangs from the dorsal wall of the mantle in the pulmonary chamber.
- The **dorsal wall of the pulmonary sac is densely pigmented, while the ventral wall is creamy white.**
- The walls of the **sac are highly vascular, i.e., richly supplied with blood vessels.**
- The pulmonary sac **communicates with the pulmonary chamber of the branchial** cavity by an aperture known as the pneumostome.

There are two types of respiration

- **(i) Aquatic Respiration:**
- True aquatic respiration takes place when the snail lies at the bottom of a pond or aquarium, when it is floating or lying suspended in mid-water and when it is attached to plants or Weeds in water.
- At this time the head and foot is fully extended and the two nuchal lobes further increase in size and the left lobe takes the form of a distinct gutter in which a current of water flows.
- In aquatic respiration a current of water enters the l**eft nuchal lobe and first comes in contact with the osphradium which** tests the nature of the water.
- It enters the mantle cavity and **passes over the epitaenia** into the branchial chamber to bathe endothelial layer blood space the ctenidium, then the current passes out through the right nuchal lobe.
- The ctenidium takes in oxygen from the current of water and gives out carbon dioxide which diffuses into water.

- **Aerial Respiration:**
- The pulmonary sac or lung is used in aerial respiration in two ways. When the snail comes to the surface of water its **left nuchal lobe** projects as a tube above the water and air is drawn into it, the air goes **to the pulmonary chamber and then into the lung**.
- When the snail comes on land it **takes in air directly into its lung through the mantle cavity and no siphon is formed by the left nuchal lobe.**
- In both types of **aerial respiration alternate contractions and relaxations of the muscles of the lung walls take place**, when the muscles contract the **floor of the lung gets arched increasing its cavity and air is drawn into the lung,**
- when the **muscles relax the cavity of the lung decreases and air is expelled, inward and outward movements of the head and foot also help in the process of taking in air.**
- The blood vessels in the lung take in oxygen from the air and give out carbon dioxide .
- *Pila globosa* also respires by its pulmonary sac during aestivation period by means of the air already imprisoned in the pulmonary sac.

- Reference
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- http://www.notesonzoology.com/marine-animals/study-notes-on-pila-mollusca/1777