General Zoology II

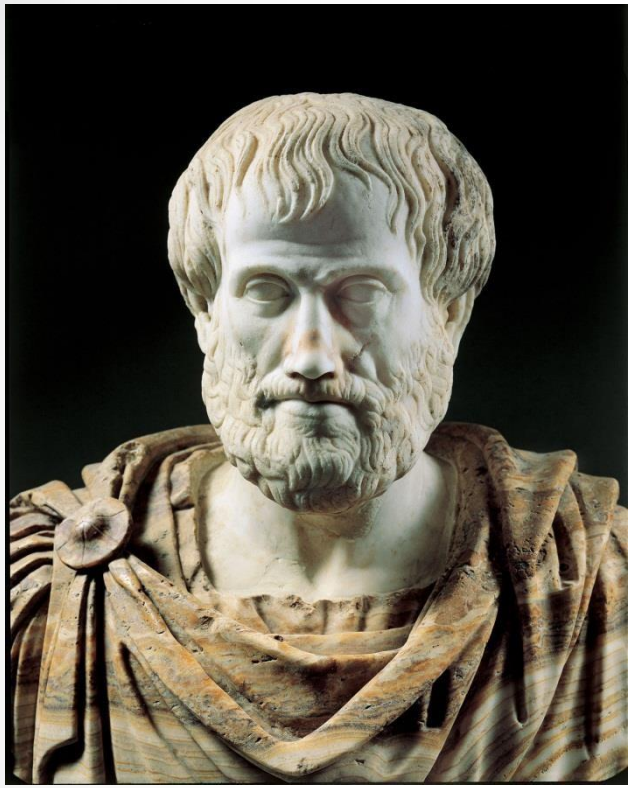
(Systematic Zoology)

Freshmen

Basic Science Group

2023

- **Animal taxonomy** is the branch of Zoology concerned with the identification, description, nomenclature and classification of different kinds of animals.
- Currently, more than a million animal species are known to facilitate their study and to understand the various relationships between their groups



Aristotle

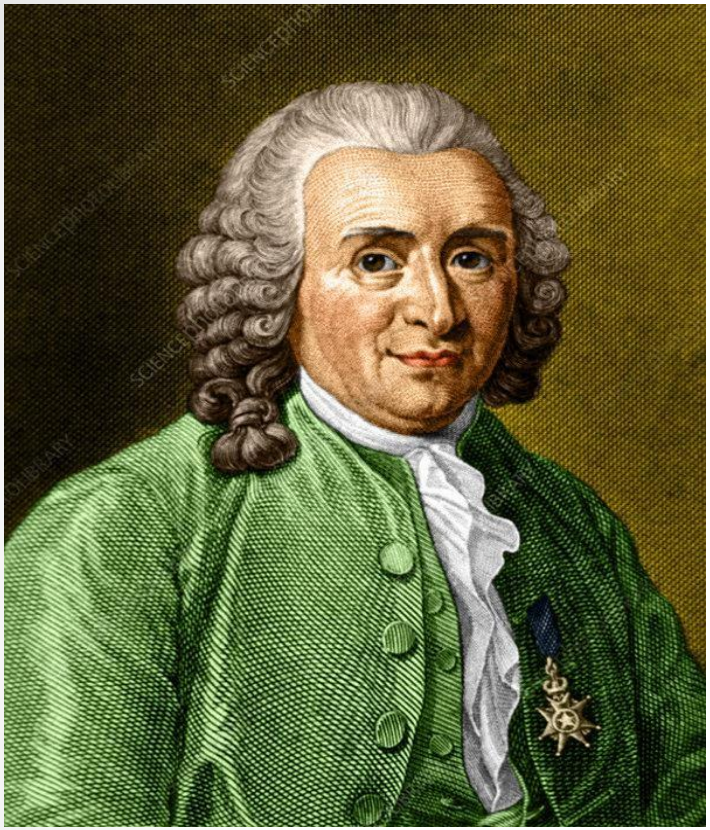
The Greek philosopher Aristotle (384-322 B.C.) was among the earliest scientists who attempted classifying living organisms. He proposed classifying animals on the basis of the presence or absence of red blood into two groups: Enaima (with blood cells) and Anaima (without blood cells).

This was followed by other attempts to classify animals according to the environment they live in as terrestrial, aquatic and aerial, or according to the type of food they use into carnivorous and herbivorous.

John Ray

Gradually, however, the idea of classifying animals was emerged according to the morphological similarities between them. This idea was formulated clearly in the 17th century by the English naturalist John Ray (1627-1705) whose system can be considered as the first scientific approach to animal classification.

- Moreover, he was the first to give a precise definition of the species, the basic unit for classification of living organisms.
- He defined the species as” an assemblage or grouping of animals which are morphologically similar and which interbreed freely with one another, but they commonly do not interbreed with other species, and if they do so, they produce infertile (sterile) hybrids”.



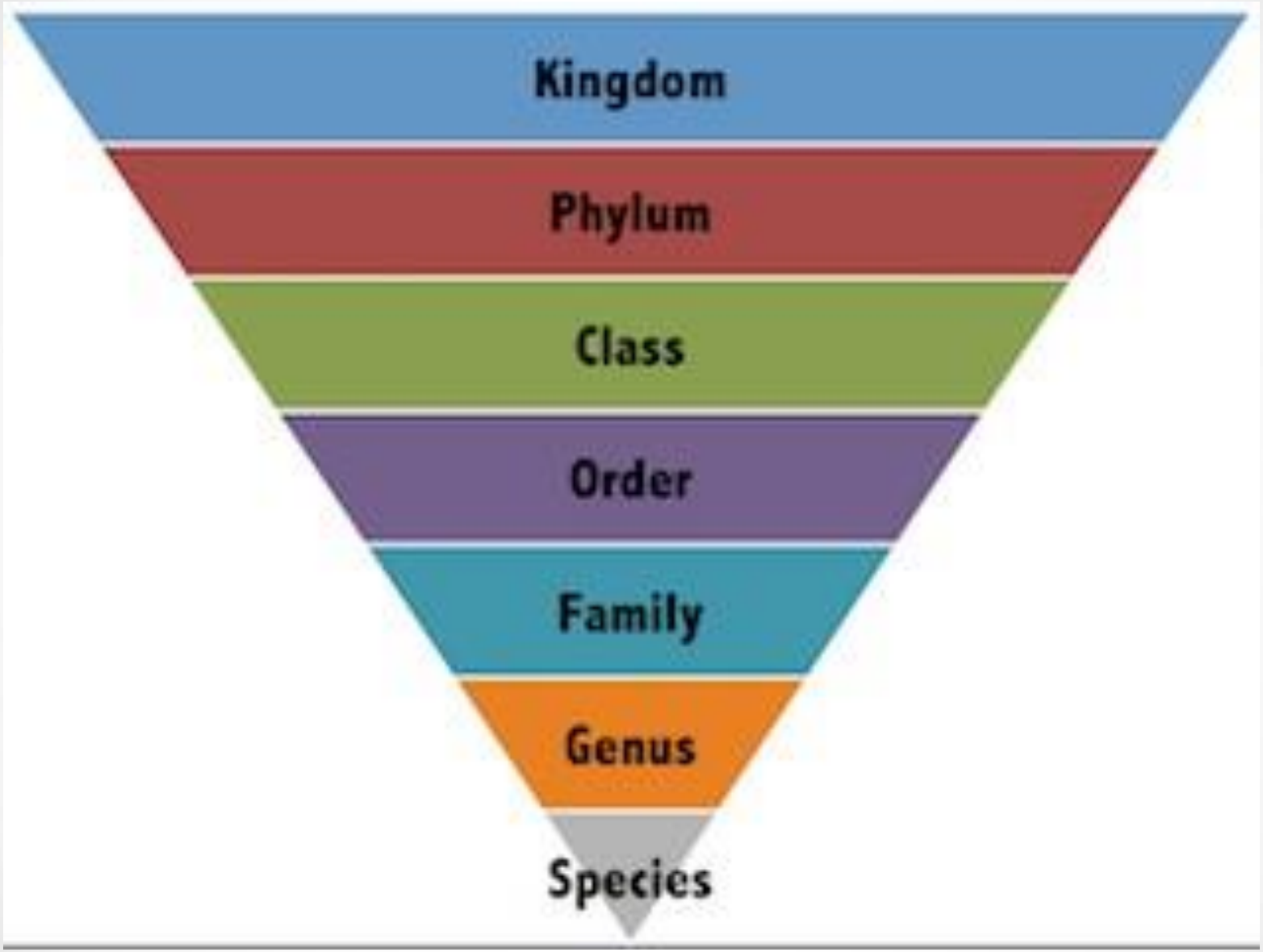
Linnaeus

Later the Swedish naturalist Linnaeus (1707-1778) came and laid down the basis of the system of classification we use nowadays. He classified living organisms according to the morphological and anatomical similarities between them.

He also devised the system of binomial nomenclature by which each type of organism is given a name composed of two words; the first is the name of the genus, and the second is the name of the species. Both are Latin and are written underlined or typed in italics. The name of the genus starts with a capital letter and that of the species with a small letter

Nowadays, the classification of animals is not based upon morphological and anatomical features but also on biochemical, genetical, embryological and physiological characters.

Species having many features in common are placed in the same genus. Similarly, related genera are grouped in a family, and families with certain common characteristics constitute an order, and orders in turn are grouped into classes. From these classes, the higher taxonomic groupings known as phyla are formed. Although the relationships between the different phyla may not be obvious, it is always possible to arrange them according to the degree of complexity of structure and function into larger groups known as subkingdoms or branches


Kingdom
Phylum
Class
Order
Family
Genus
Species

Thus, the animal kingdom is classified into three subkingdoms:

- Subkingdom Protozoa: This subkingdom includes a single phylum, Phylum Protozoa, the members of which are referred to as unicellular animals (acellular) since the body of each is formed of a single protoplasmic mass that performs all life activities.

- Subkingdom Parazoa: this includes a single phylum, Phylum Porifera, the members of which are simple multicellular animals commonly known as sponges. The body of the animal is formed of many cells which are not much differentiated and do not form proper tissues.

- Subkingdom Metazoa: This includes the rest of the animal phyla. The body in these animals is composed of many cells which are well differentiated into distinct types and form definite tissues. The different phyla of the Metazoa show gradations from simple structural organization to complicated organ systems in the body.

Modern classification:

Scientist Robert H. Whittaker put a new classification system in 1969; this system was called Modern Classification. Whittaker classified living organisms into 5 kingdoms: Monera, Protista, Fungi, Plantae and Animalia.

- **Kingdom: Monera**
- 1 cell, no true nucleus - prokaryote (genetic material scattered and not enclosed by a membrane).
- Examples - bacteria, blue-green bacteria.
- **Kingdom: Protista**
- 1 cell, have a true nucleus – eukaryote
- Examples - Amoeba, Diatom, Euglena, Paramecium, some algae (unicellular), etc….

- **Kingdom: Fungi**
- **Kingdom: Plantae**
- **Kingdom: Animalia (animals)**
- multicellular
- have nuclei
- do move
- **Examples - sponge, jellyfish, insect, fish, frog, bird, man.**

Subkingdom: Protozoa

Phylum: Protozoa

General characters:

- The great majority is very small in size and can only be seen by the aid of the light microscope. There are few species, which can be seen by the naked eye.
- Many species live as solitary individuals, while a few live in colonies.

- They are unicellular organisms where they contain one nucleus. The cytoplasm is usually differentiated into outer clear ectoplasm and inner granular endoplasm.
- They move either by pseudopodia, flagella or cilia and some have no locomotory organelles.
- Holozoic nutrition is the most common type of nutrition. Some protozoa exhibit holophytic nutrition.

Classification:

Phylum Protozoa is divided into four classes on the basis of the locomotory organelles found in the various species as follows:

Class: Sarcodina

They include protozoa which move by pseudopodia. e.g. *Amoeba*, *Entamoeba*,….etc.

Class: Mastigophora

They include protozoa which move by one or more flagella. e.g. *Trypanosoma*, *Euglena*,….etc.

Class: Ciliophora

They include protozoa which move by cilia. e.g. *Paramecium*, *Vorticella*,….etc.

Class: Sporozoa

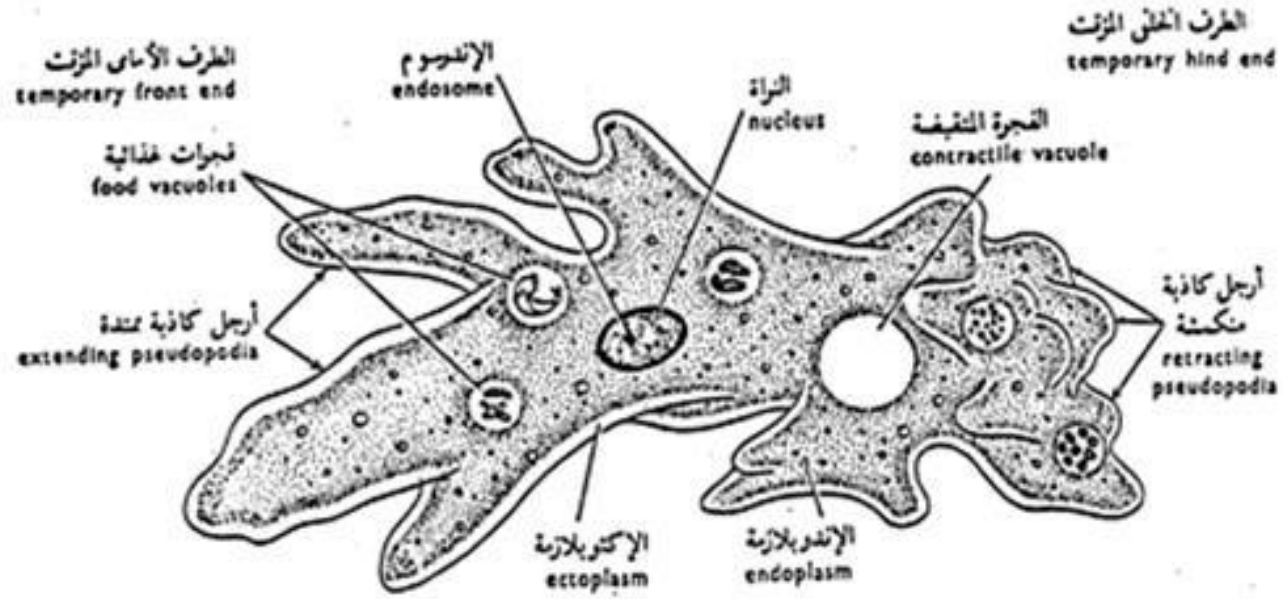
They include protozoa which have no distinct locomotory organelles. They produce resistant spores towards the end of their life cycle. e.g. *Plasmodium*, *Monocystis*,….etc.

Class: Sarcodina

***Amoeba* sp.**

- **Habitat:** It is usually found in freshwater ponds and ditches.
- **Morphology:** *Amoeba* is a small jellylike mass which is constantly changing its shape due to the formation of pseudopodia. The body is surrounded by a plasma membrane, and the cytoplasm is differentiated into outer clear ectoplasm, and inner granular endoplasm. The endoplasm contains food vacuoles, a granular nucleus with a distinct endosome, and a clear contractile vacuole.

أميبا
AMOEBA

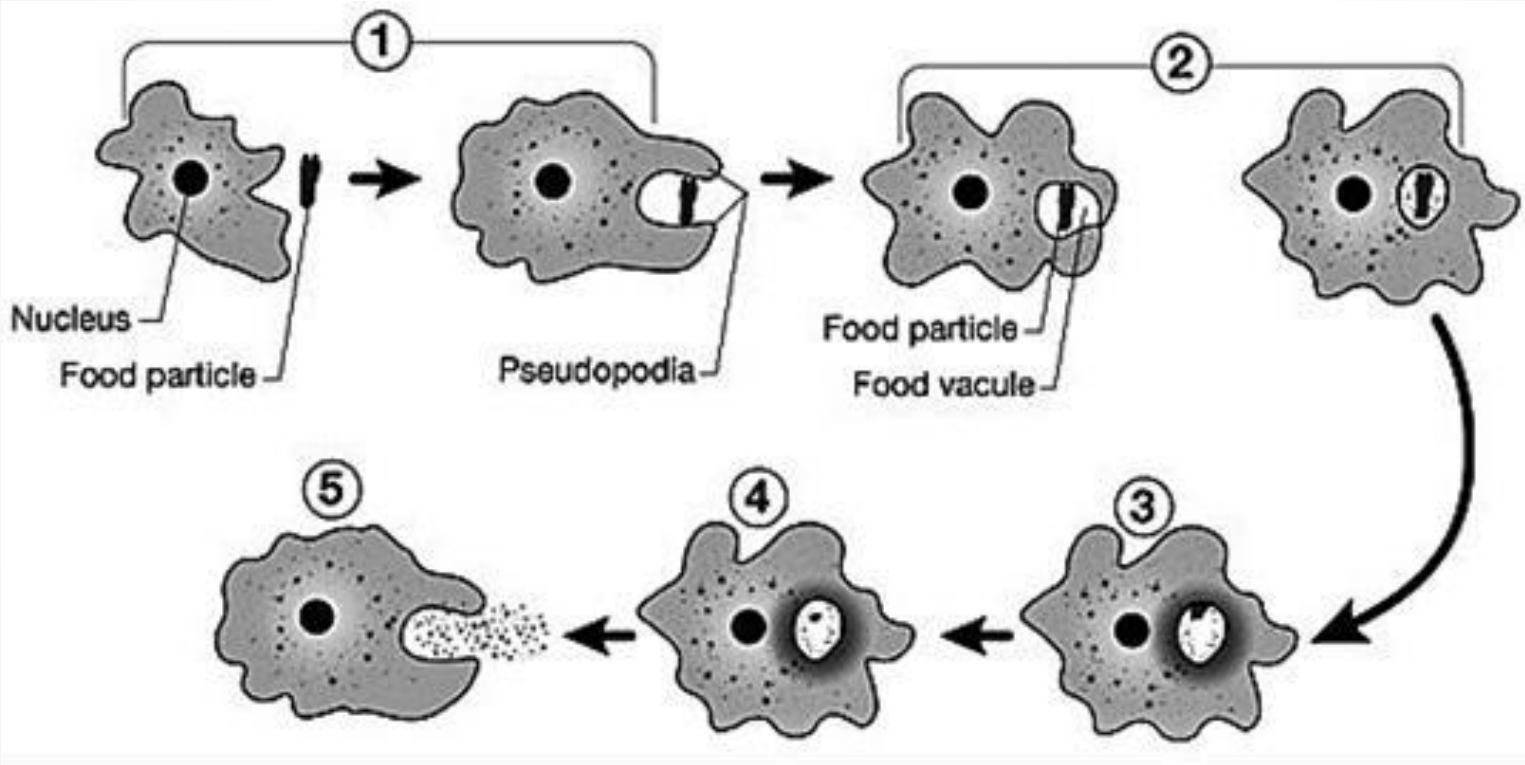


- **Locomotion:**

Amoeba moves and captures food by means of the pseudopodia which arise at any point on the body surface. The sort of irregular movement is very slow and it is called amoeboid movement.

- **Nutrition:**

The mode of nutrition in *amoeba* is known as holozoic nutrition. It involves the ingestion, digestion, absorption, assimilation and egestion of food material. *Amoeba* does not have any specialized organ for nutrition. Its entire process is carried through the body surface with the help of pseudopodia.


1
2
Nucleus
Food particle
Pseudopodia
Food particle
Food vacule
5
4
3

- **Osmoregulation:**

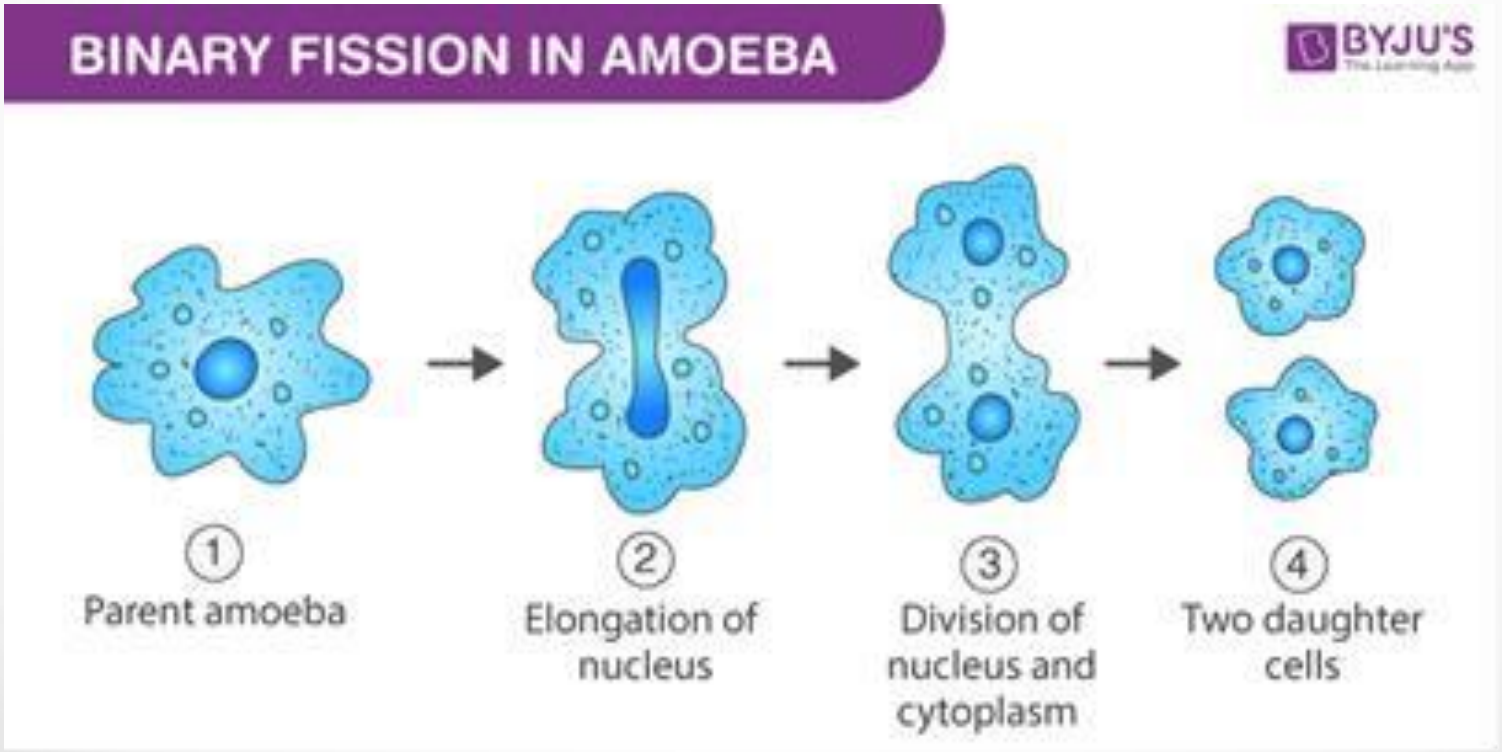
This is carried out by the contractile vacuole which bursts at regular intervals expelling to the exterior the excess water which diffuses into the cytoplasm from the surrounding medium.

- **Respiration and excretion:**

Exchange of respiratory gases between *Amoeba* and its environment takes place by simple diffusion. The products of nitrogenous metabolism diffuse in a similar way through the body surface to the outside.

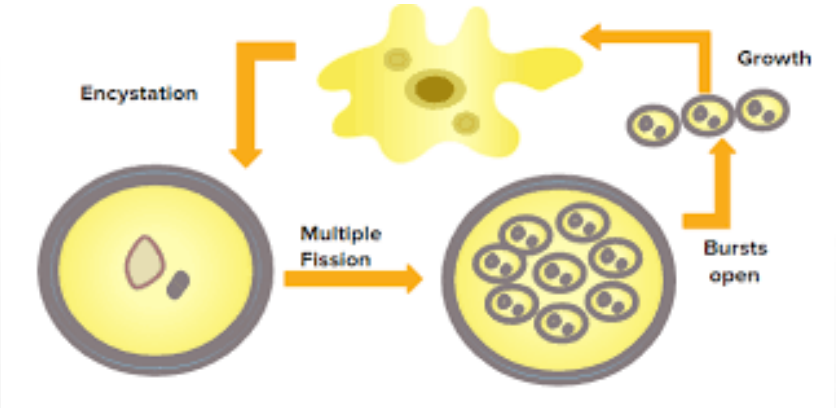
- **Reproduction :**

Amoeba reproduces only asexually by binary fission. The nucleus extends and divides into two parts which move away from each other. The division of cytoplasm follows the division of the nucleus. So, two amoebae are produced from a single parent.



- **Encystment :**

During adverse environmental periods, many amoebas survive by encystment where the amoeba becomes circular, loses most of its water, and secretes a cyst membrane that serves as a protective covering. They reproduce by multiple fission (the organism divides equally into more than two different parts and they grow up to form new individuals). When the environment is again suitable, the envelope ruptures, and the daughter amoebae emerge.



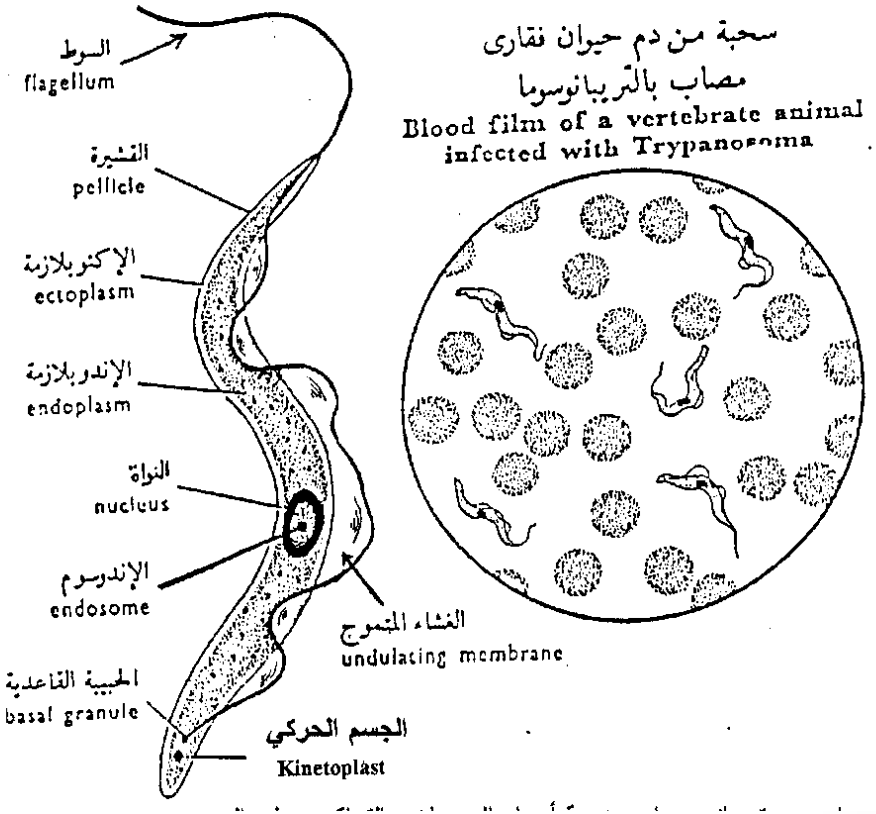
Class: Mastigophora

***Trypanosoma* sp.**

- **Habitat:** *Trypanosoma* live as a parasite in the blood and some tissues of many vertebrates (definitive or final host).
- **Morphology:** *Trypanosoma* has a fusiform body. There is a firm pellicle that maintains the shape of the body. The cytoplasm is divided into an outer ectoplasm and an inner endoplasm. In endoplasm, there is a large oval nucleus with a central endosome. There is a long flagellum arises from a basal granule or blepharoplast and it is joined to the body by a thin undulating membrane, and it continues anteriorly in front of the body as a free flagellum. A large granule known as the parabasal granule or kinetoplast is located very close to the blepharoplast.

تريبانوسوما

TRYPANOSOMA



- **Locomotion:**

Trypanosomes swim in the blood plasma of the host by the vibratile movements of the flagellum and the undulating membrane.

- **Nutrition:**

The mode of nutrition in trypanosomes is parasitic because it draws its food from the host by simple diffusion. However, recent studies with the electron microscope showed that trypanosomes exhibit pinocytosis.

- **Osmoregulation:**

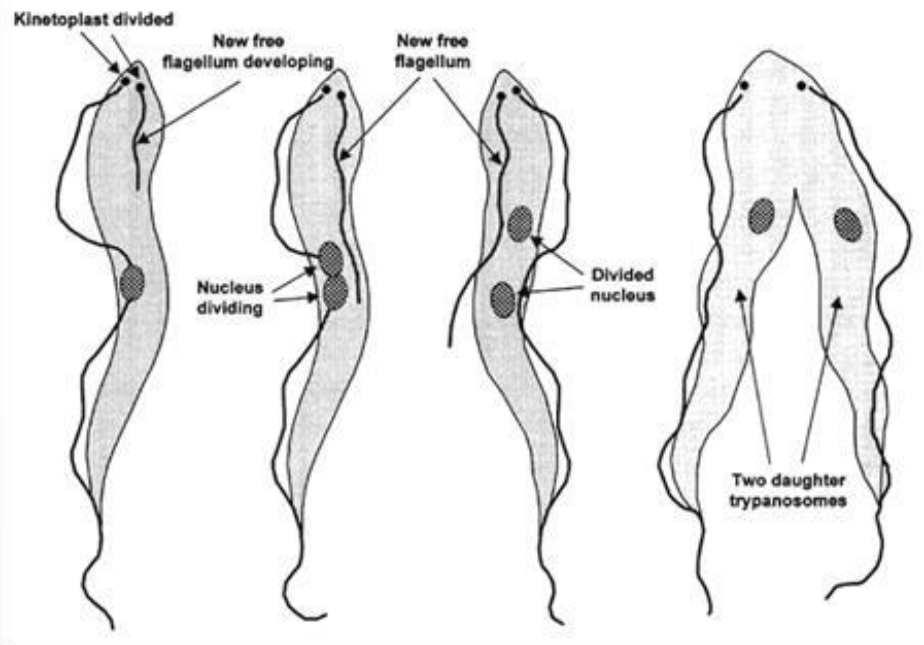
No osmoregulatory mechanisms are required by trypanosomes and accordingly contractile vacuoles are absent.

- **Respiration and excretion:**

Exchange of oxygen and carbon dioxide between trypanosomes and their environment occurs by simple diffusion through the body surface. The excretory products are also eliminated by simple diffusion through the body surface.

- **Reproduction :**

Trypanosomes reproduce only asexually throughout their entire life cycle by longitudinal binary fission. The blepharoplast and parabasal granule divide, and this is followed by the nucleus. The body then splits lengthwise into two equal parts, starting from the anterior end. One part retains the original flagellum, while the other forms a new flagellum.



Subkingdom: Parazoa

Phylum: Porifera

General characters:

- Sponges are sessile and mostly marine animals.
- Theyare regarded as the most primitive multicellular animals.
- They vary in form from thin flattenedcrusts to vas-shaped, branched, globular or irregular shaped bodies.

- The body is perforated by numerous pores, canls or chambers through which water continuously flows, hence the name Porifera.
- The body cells are far less specialized. There is no coordination between the activities of similar cells and therefore they do not form proper tissues.
- They have a skeleton of calcareous spicules, or of organic sponging fibers.
- They are holozoic and digestion is entirely intracellular.
- They respire and excrete by simple diffusion.

- They have no sensory or nerve cells, thus coordination of their activities is very limited and their responses to stimuli are local and very slow.
- They reproduce asexually by budding, and have a remarkable power of regeneration.

  They also reproduce sexually by gametes, and have free swimming larvae.

- **Classification:**

Generally, sponges exhibit three structural grades with increasing complexity, referred to as the **Ascon, Sycon and Leucon types.**

Ascon type

***Leucosolenia* sp**

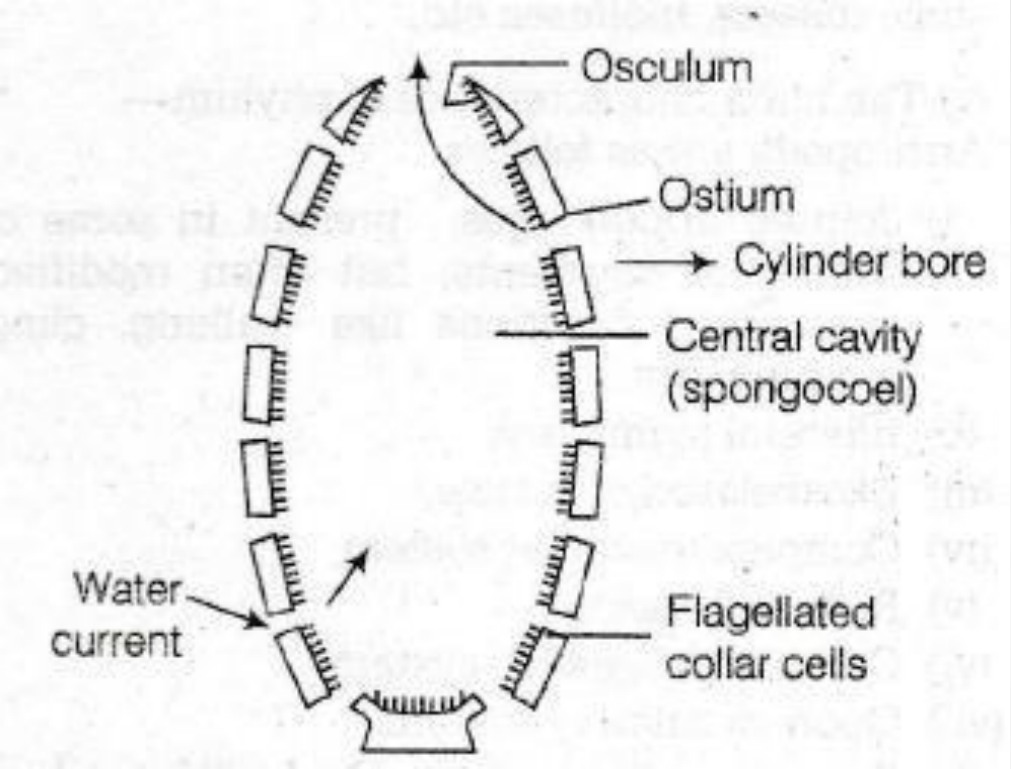
- This is the simplest structural type of sponges in which the body is tube
  or vase-shaped.
- Sponges of this type are all small and are not usually solitary but live in
  colonies.

- The body wall surrounds a central cavity known as paragastric

  cavity lined with flagellated cells.

- The wall is thin contains many openings (ostia) which lead

  directly to paragastric cavity which opens outside through

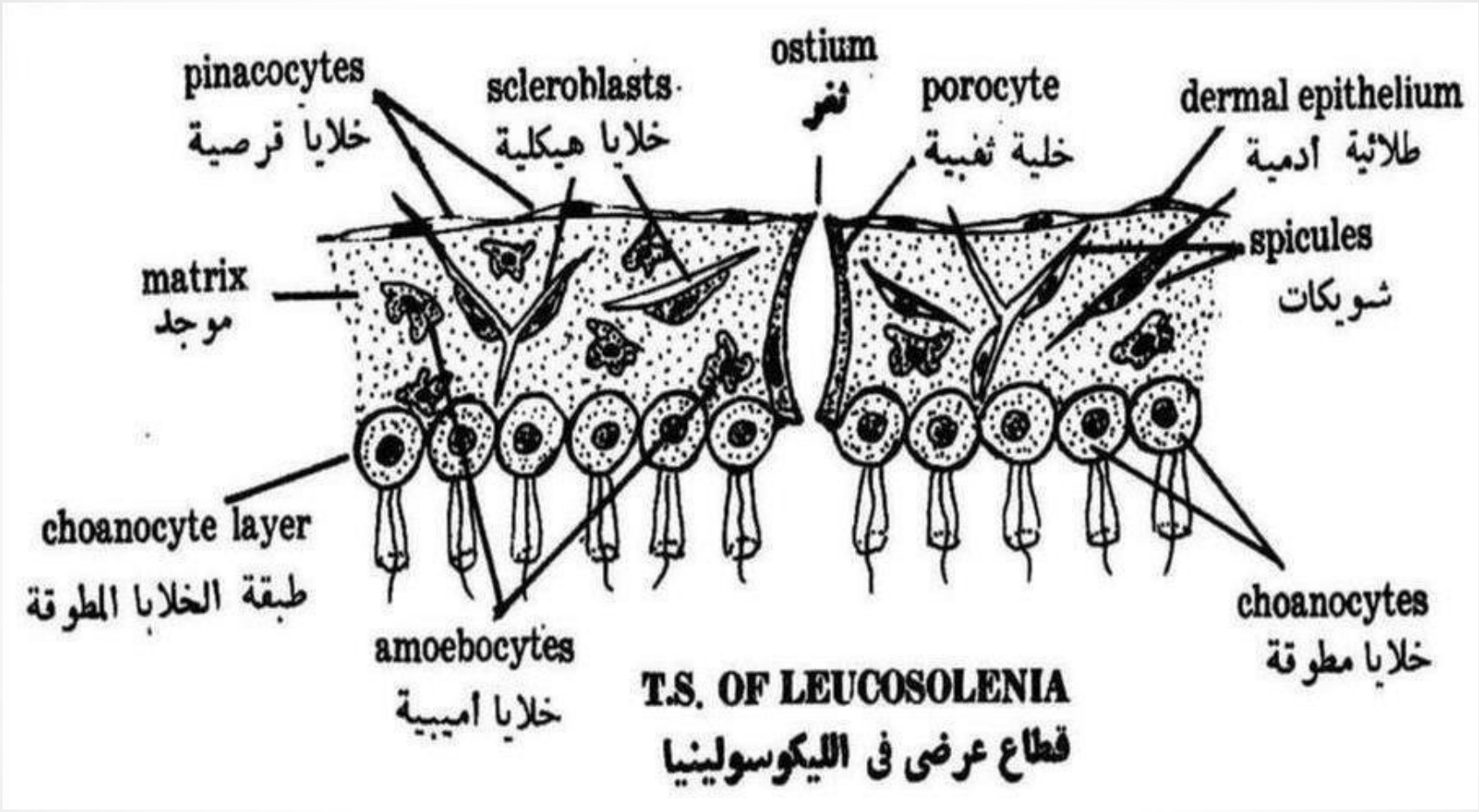

Osculum
Ostium
Cylinder bore
Central cavity
(spongocoel)
Water
current
Flagellated
collar cells

The body wall of *Leucosolenia* consists of two cellular layers

The dermal layer: the outer layer is thin flattened cells known as pinacocytes. The inner layer is composed of scattered cells embedded in non-living jelly substance. These cells are of three types (**scleroblasts, amoebocytes and porocytes**).

Scleroblasts secrete calcareous spicules**, amoebocytes** can develop into any other cell in the body and **porocytes** acts as a pore**.**

The gastral layer: contains choanocytes with flagellates extend to the paragastric cavity.



T.S. OF LEUCOSOLENIA

قطاع عرضى فى الليكوسولينيا

Sycon type

***Sycon* sp**

- This is a **solitary marine sponge**, live attached to rocks in shallow waters; it has a **vase shaped body** with a single large osculum at the free end.
- The body wall is relatively thick, folded forming **many horizontal flagellated chambers** (radial canals).
- The flagellated chambers are lined with **choanocytes**.
- Water is drawn through the **ostia** into the **inhalant canals**, then pass to the **flagellated chambers** then to the **paragastric cavity**, and finally to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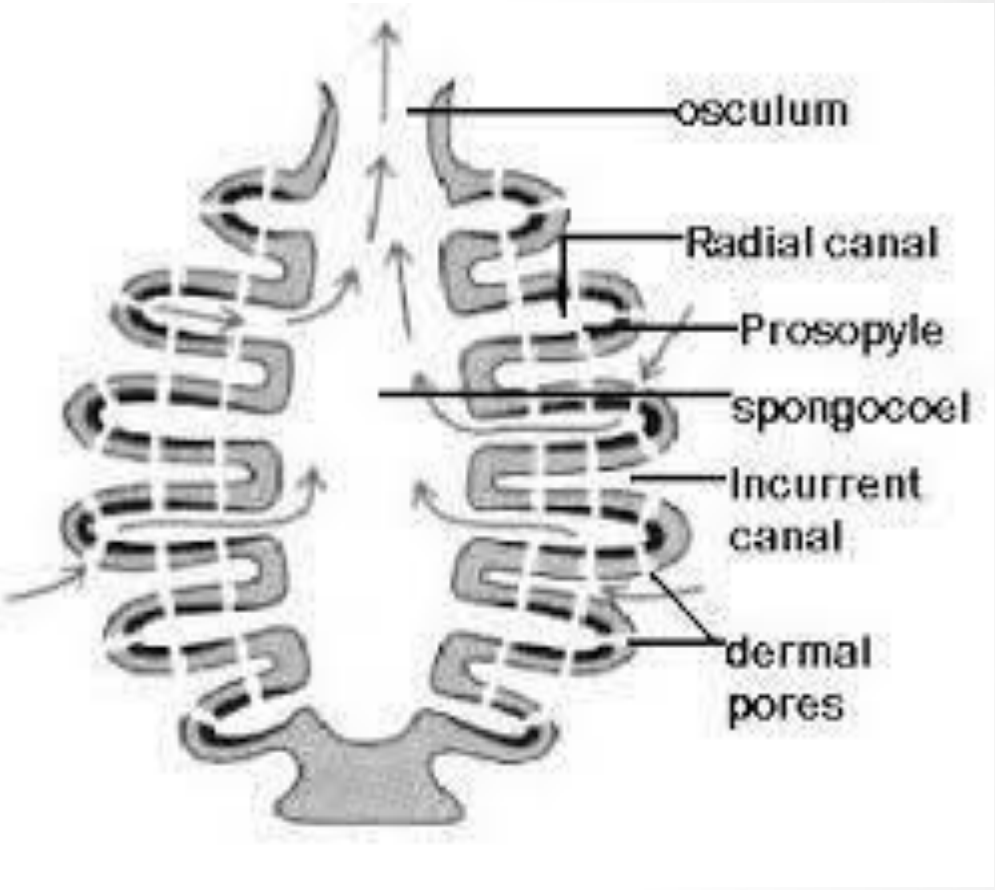
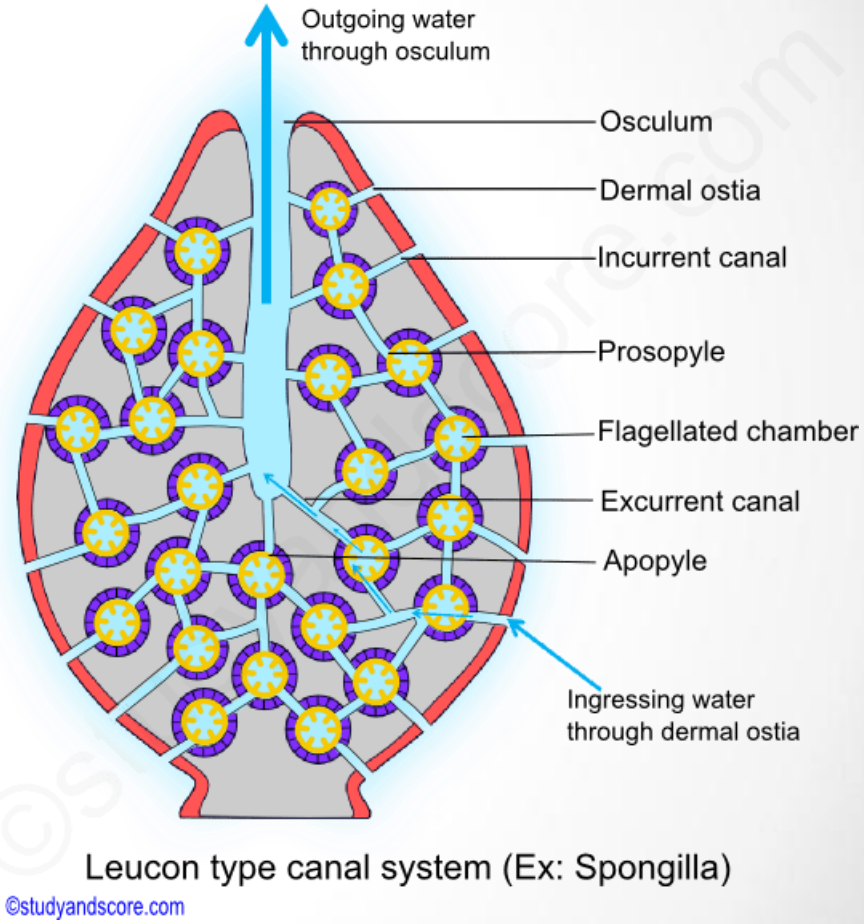

osculum
Radial canal
Prosopyle
spongocoel
Incurrent canal
dermal pores

Leucon type

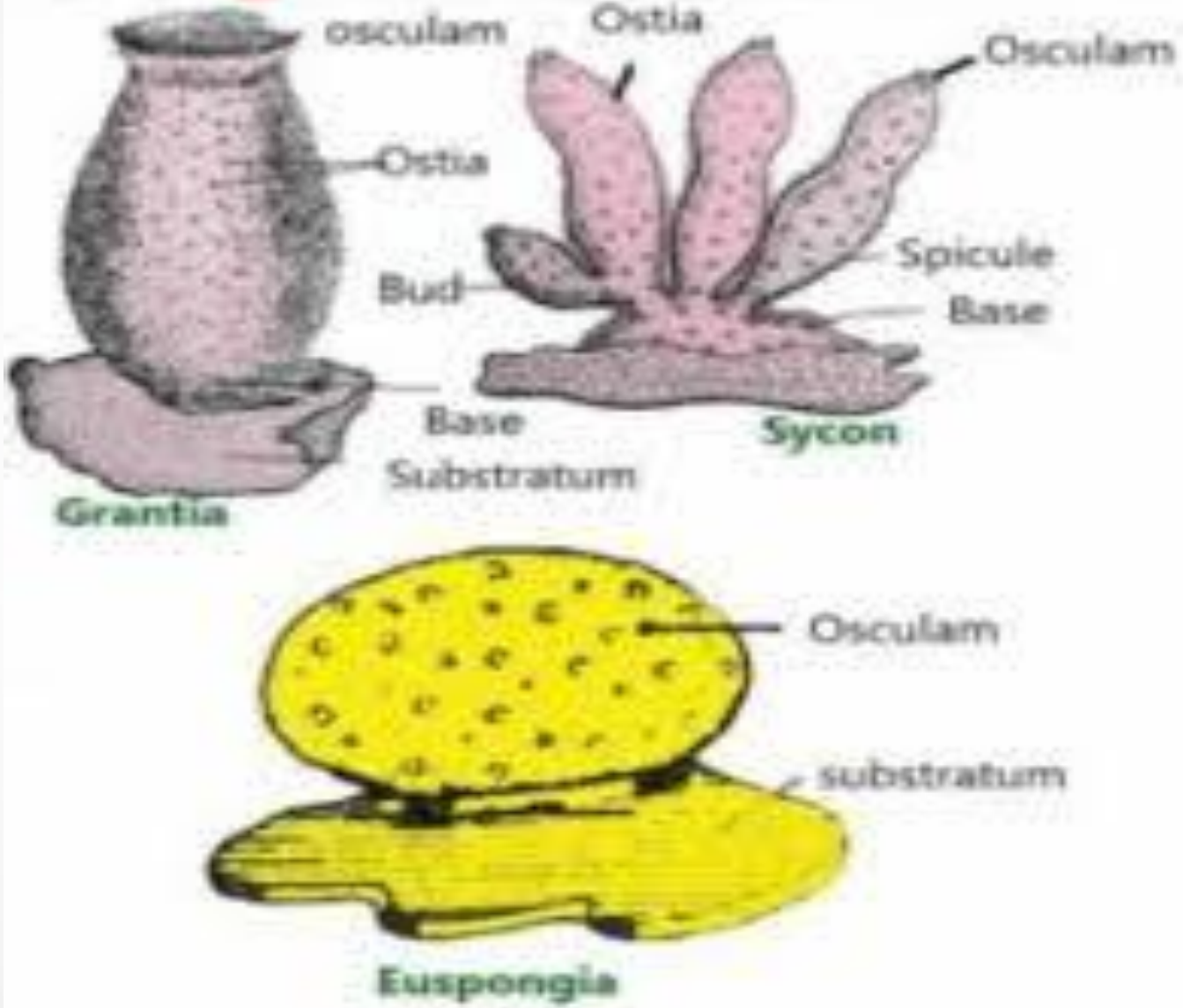
***Euspongia* sp**

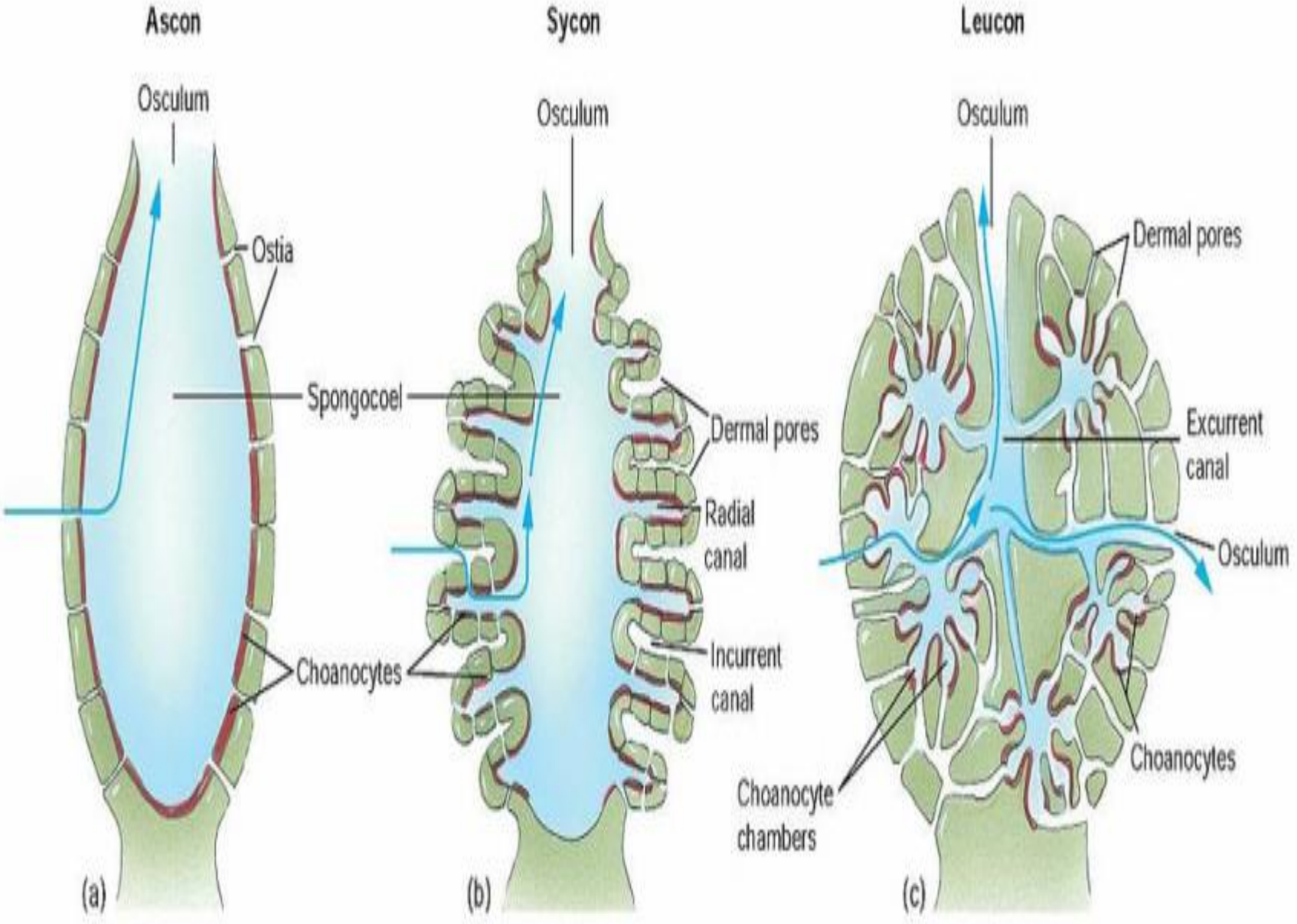
- **Spherical**, irregular or cup shape.
- They live on the sea bottom attached to rocks.
- The body surface contains **minute ostia**, in between there are several larger oscula with more complex structure.
- It contains a complex network of branching spongin fibres extends within the jelly and gives the animal the characteristic spongy texture.
- The layer of **choanocytes** is highly folded and the paragastric cavity is reduced.
- The ostia found on the outer surface lead into large subdermal cavities, from which narrow branched inhalant canals extend to the flagellated chambers.



Leucon type canal system (Ex: Spongilla)

Phylum Porifera




Ascon
Osculum
Ostia
Spongocoel
Choanocytes
(a)
Sycon
Osculum
Dermal pores
Radial canal
Incurrent canal
(b)
Leucon
Osculum
Dermal pores
Excurrent canal
Osculum
Choanocytes
Choanocyte chambers
(c)

Life processes in sponges

- **Nutrition:**

Sponges are holozoic, feeding on fine organic particles and small organisms brought in their bodies by the water current. Digestion occurs intracellularly and the amoebocytes distribute the digested products to other cell types.

- **Respiration and excretion:**

Respiration is carried out by simple diffusion. Exchange of respiratory gases takes place directly between the cells and the flowing water. Excretion of nitrogenous wastes also takes place by simple diffusion, and excreted material is carried away by the outflowing water.

- **Reproduction:**

Reproduction occurs by asexual or sexual means:

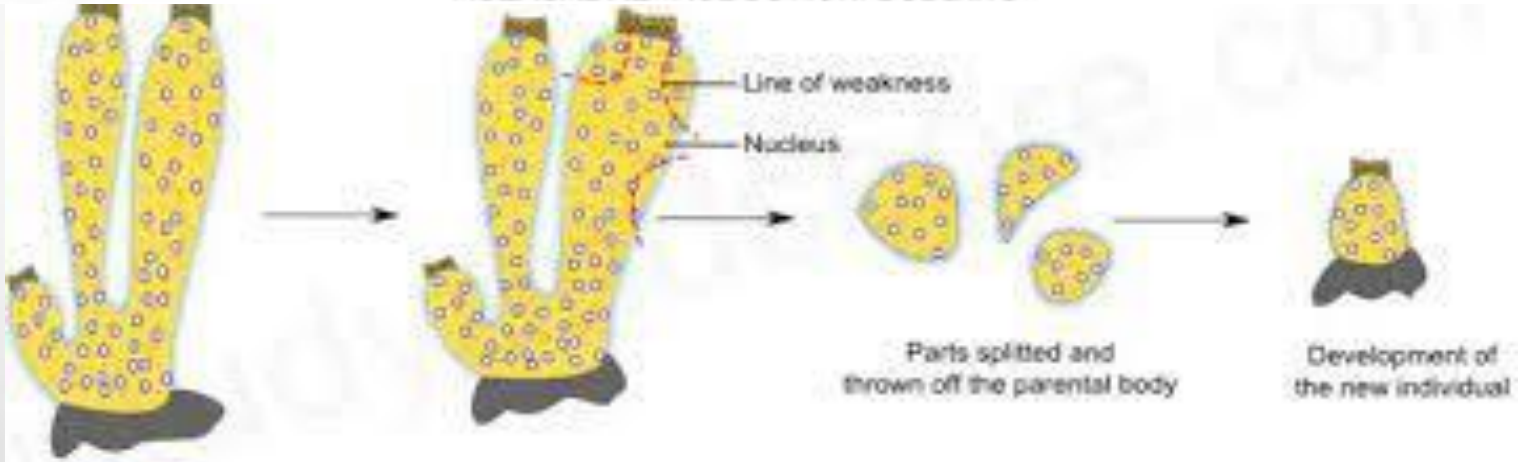
- **Asexual reproduction**

❖ **Budding:** sponges commonly reproduce by developing external buds which grow to form new individuals. These buds either separate from the parent or remain attached to it, thus forming a colony of several individuals.

❖ **Regeneration:** sponges have the capacity to replace lost or injured parts of their bodies, a process known as regeneration. If a living sponge is broken into pieces, a complete individual may grow from each piece.

Asexual reproduction

ASEXUAL REPRODUCTION: BUDDING

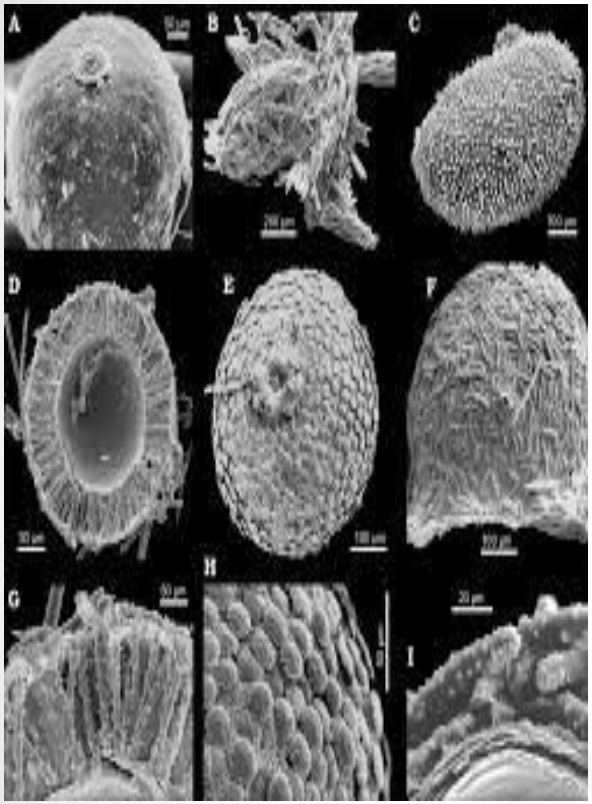


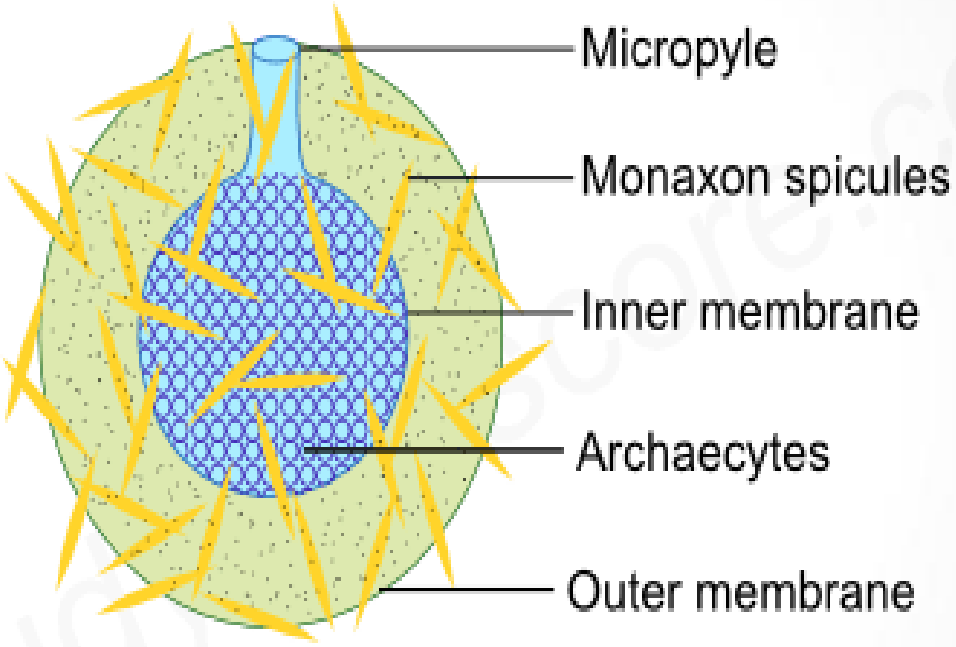
ASEXUAL REPRODUCTION: FISSION

Gemmules of Sponges

- Gemmules are **asexual** reproductive bodies of most of the freshwater and a few marine sponges.
- These are internal buds and are response to the **hostile environment**.
- These are small, hard, ball-like structure consisting of an outer capsule and an inner mass of amoebocytes.
- These are resistant to desiccation (drying out), freezing, and anoxia (lack of oxygen) and can lie around for long periods of time.
- Under favorable conditions, the mass of amoebocytes come out in water and develops into a young sponge.

https://www.youtube.com/watch?v=9EWlwfpgcPc



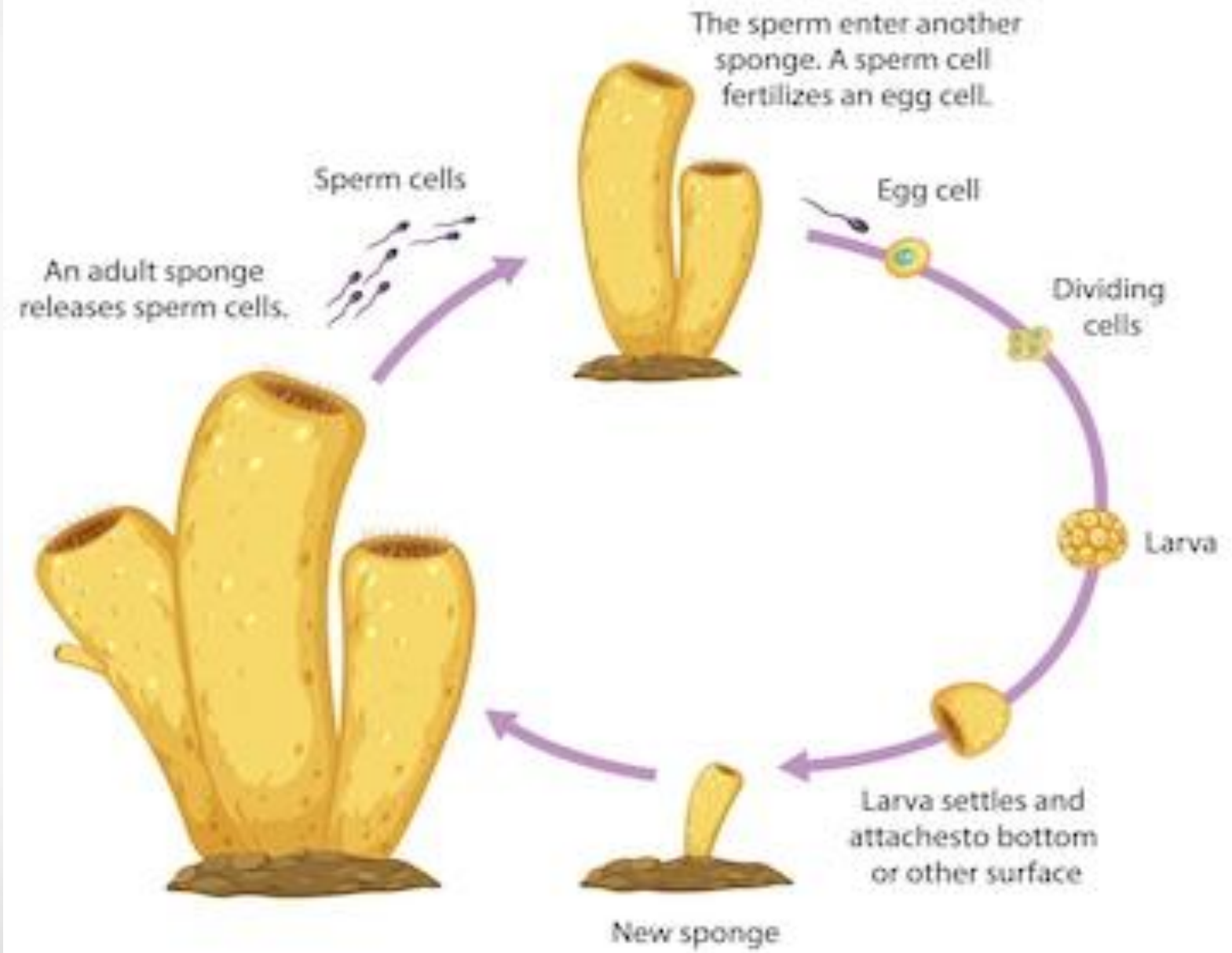


ASEXUAL REPRODUCTION: GEMMULE FORMATION

- **Sexual reproduction**

The ova remain in the jelly, while sperms leave the sponge by means of the water current to fertilize the ova and a zygote is formed. The zygote divides repeatedly forming a hollow ball of cells called the amphiblastula. This amphiblastula breaks out of the jelly and escapes with the outflowing water to live as a free-swimming larva for some time and a double-walled gastrula is formed. The gastrula settles down on a rock, attaches to it and develop into a sponge.

Sexual Reproduction of Sponges



Kingdom: Animalia

البعديات الحقيقية

Subkingdom: Eumetazoa

جوفمعويات اللاسعات

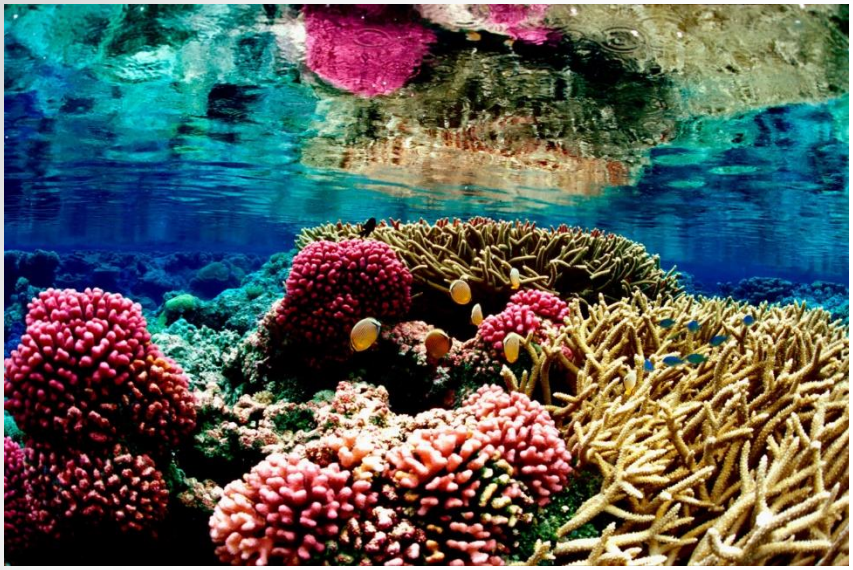
Phylum: Cnidaria (Coelenterata)

Diploblastica

Phylum: Cnidaria (Coelenterata)

General characters:

- Simple sessile aquatic metazoans, mostly marine and a few live in freshwater.
- Many are colonial (ex.: Corals). Some are solitary (ex: sea anemone).
- They are radially symmetrical.
- There are two layers in the body (ectoderm, endoderm) separated by a jelly – like mesogloea.
- They have nematocysts or cnidocytes, hence the name cnidaria. They are stinging structures not found in any other phylum.
- There is a single cavity (the gastrovascular cavity or coelenteron cavity).

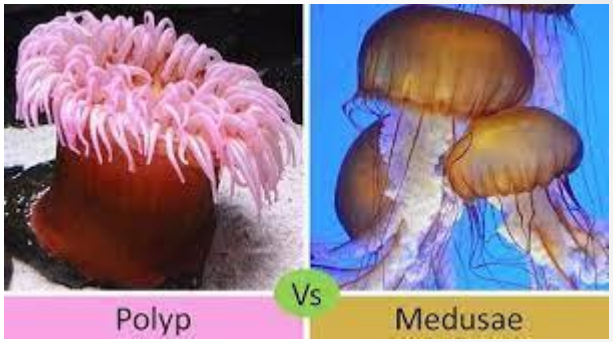


Corals

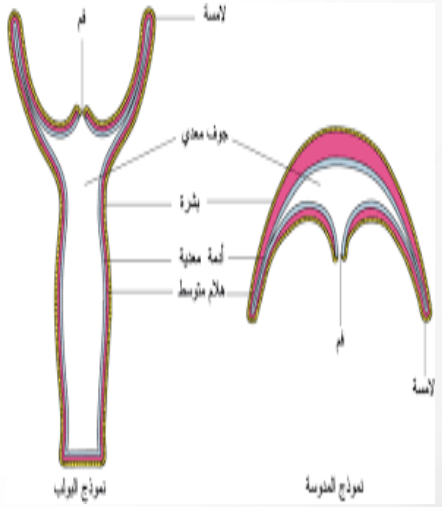
sea anemone

Phylum: Cnidaria (Coelenterata)

General characters:



- Respiration and excretion by simple diffusion.
- They have a simple diffuse nervous tissue in the form of a nerve net.
- They reproduce **asexually** by budding, and **sexually** by gametes.
- Polyp and medusa are the two different forms of cnidarians.



Polyp is hydroid form which is sessile with mouth-up orientation. **Medusa** is umbrella or bell shaped with mouth down orientation.

- Some forms with external calcareous skeleton.

Classification of Phylum: Cnidaria (Coelenterata)

Class 1: Hydrozoa

Most have the polyp and medusa forms during the life cycle.

Order 1: Hydroidea

Have the polyp form only: ex.:*Hydra*

Order 2: Calyptoblastea

Have the two forms (polyp and medusa) ex.: *Obelia*

Class 2: Scyphozoa

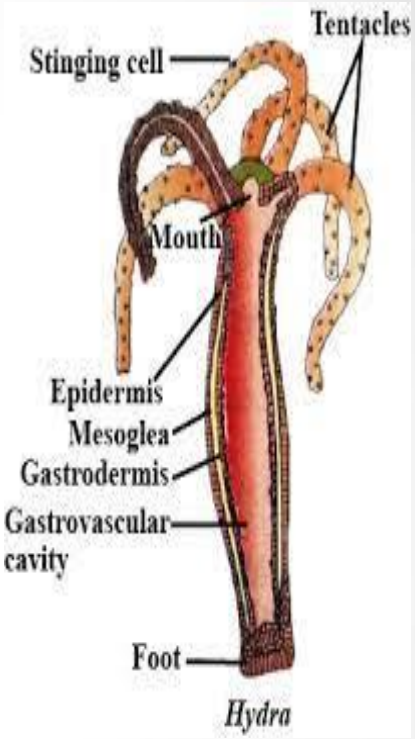
Contains the jelly-fishes, have only the medusa form.

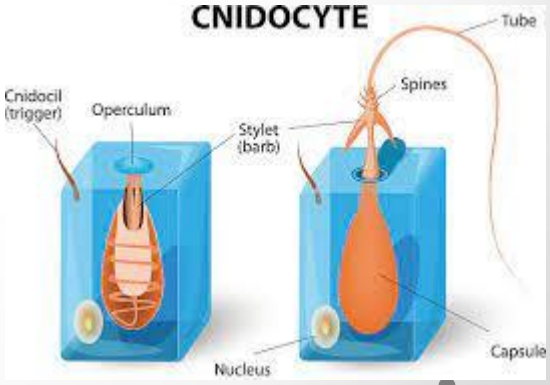
Class 3: Actinozoa

includes sea anemones and corals, the polyp form only

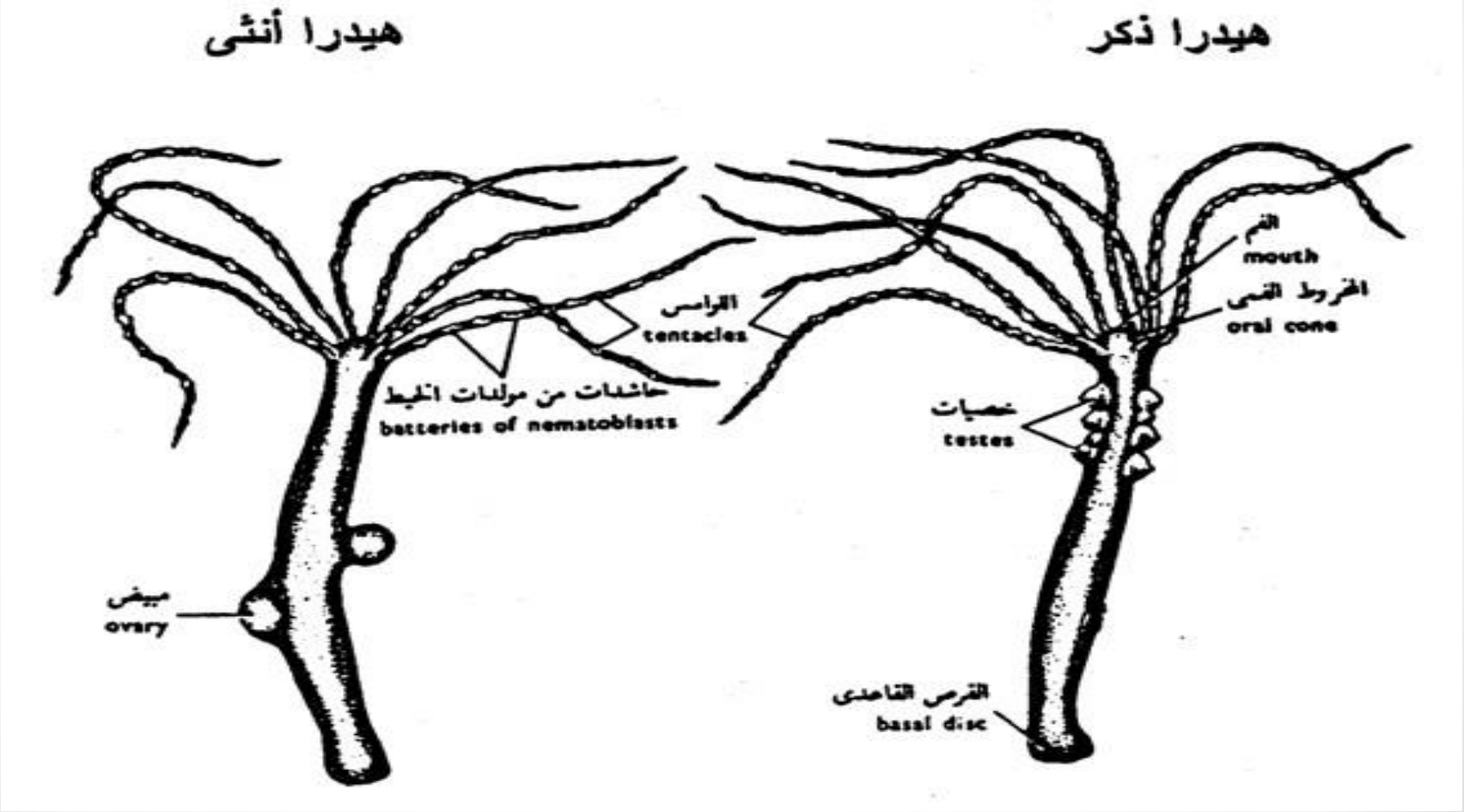
Hydra

- is a genus of small, fresh-water organisms. It measures from 2 to 20 mm in length.
- has a tubular, radially symmetric body, secured by a simple adhesive foot called the basal disc.
- At the free end of the body (the oral cone), there is a mouth opening surrounded by 6 to 8 thin, mobile tentacles.
- Each tentacle is clothed with highly specialized stinging structures called nematocysts.





Hydra


هيدرا أنثى
هيدرا ذكر
القرامس
tentacles
حاشيات من مولدات اللسع
batteries of nematoblasts
مبيض
ovary
الفم
mouth
الفرط الفمى
oral cone
خصيات
testes
القرص القاعدى
basal disc

Hydra

- If Hydra attacked, the tentacles can be retracted to small buds, and the body column itself can be retracted to a small gelatinous sphere.
- is generally sedentary or sessile, but **do move**, especially when hunting. They have different distinct methods for moving: **'looping'**, **'somersaulting'**, **floating**, swimming.
- mainly feeds on aquatic invertebrates such as Daphnia and Cyclops.

Locomotion in Hydra

Looping = walking:

- the body at first extends and then bends and fixes the tentacles to the substratum.
- It then releases the attachment of the basal disc, reattaches the basal disc near the tentacles and again take an upright position by releasing its tentacles.

Locomotion in Hydra

Looping = walking

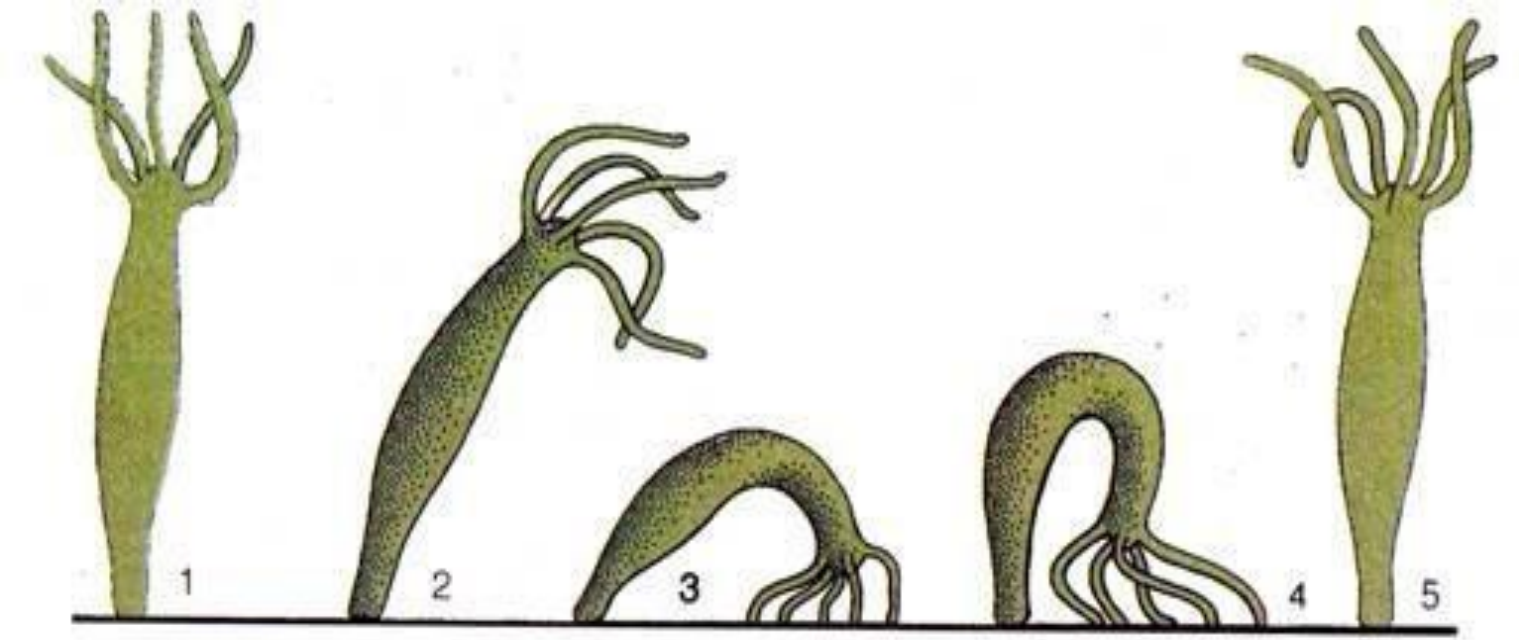


Fig. 31.15. *Hydra* showing looping movements.

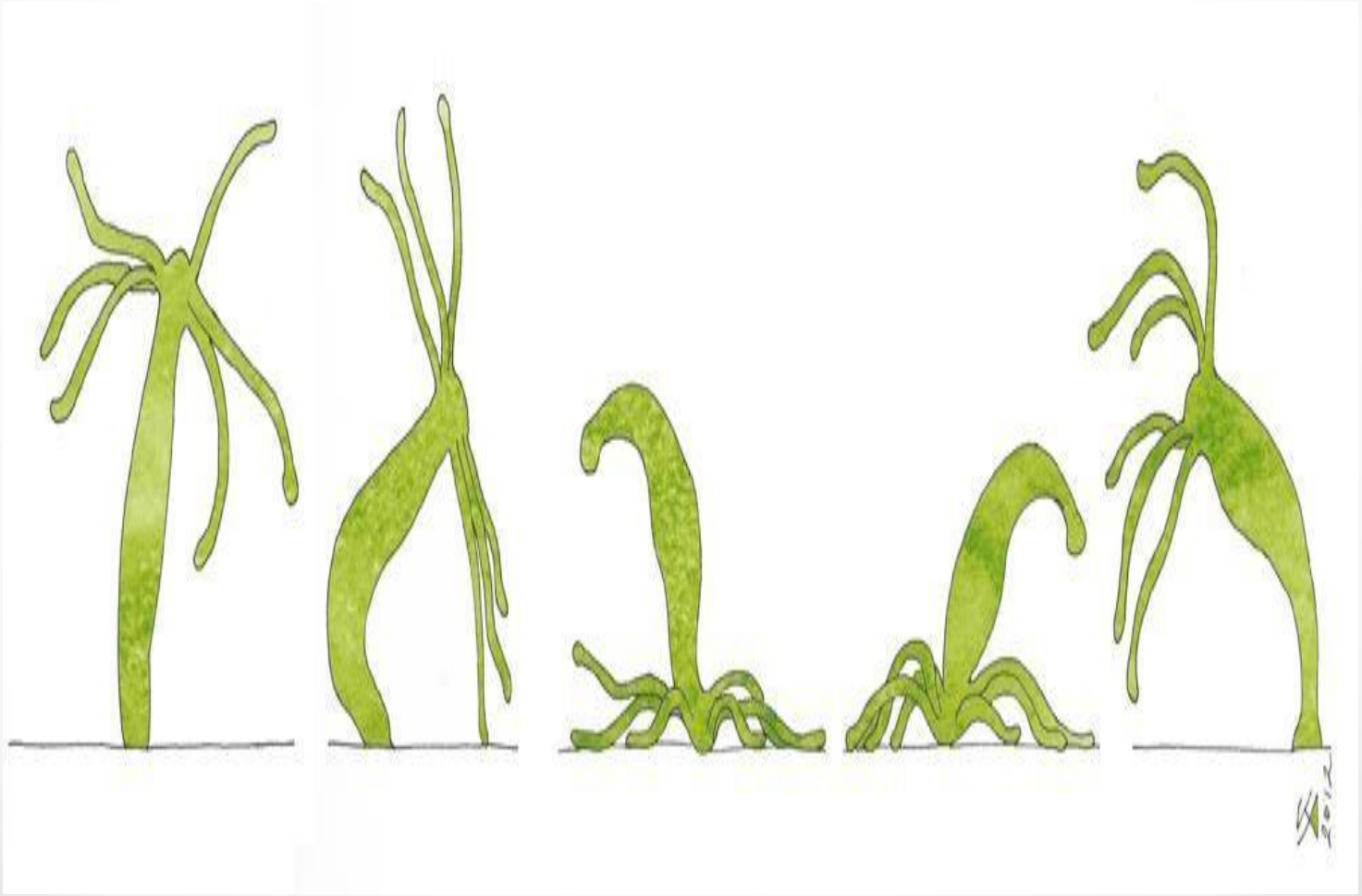
Locomotion in Hydra

Somersaulting:

- Hydra extends its body and is bent to one side to place the tentacles on the substratum.
- The basal disc is freed from its attachment, and the animal stands on its tentacles.
- The body is then extended and bent to place the basal disc on the substratum, the tentacles loosen their hold and the animal regains an upright position.

Locomotion in Hydra

Somersaulting:



Locomotion in Hydra

Floating:

Hydra can produce a bubble of gas secreted by some ectodermal cells of the basal disc which helps the animal to float on the surface of the water and is passively carried from one place to another by water current.

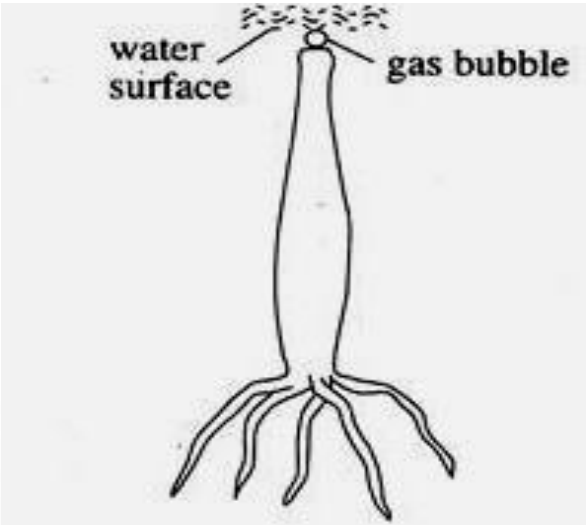


Fig. 2.21 : Floating in *Hydra*.

Locomotion in Hydra

Swimming:

By freeing itself from the substratum and with the help of wave-like movements of the tentacles.

Locomotion in Hydra

Climbing

Hydra can climb by attaching its tentacles to some distant objects and then releasing the basal disc and by contracting the tentacles the body is drawn up to a new position.

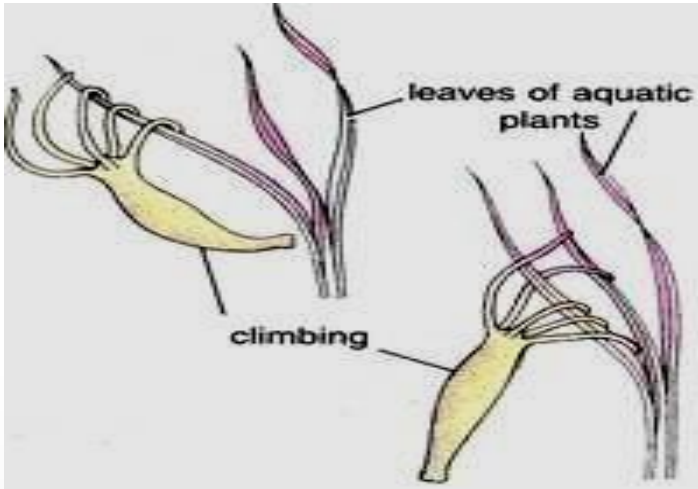
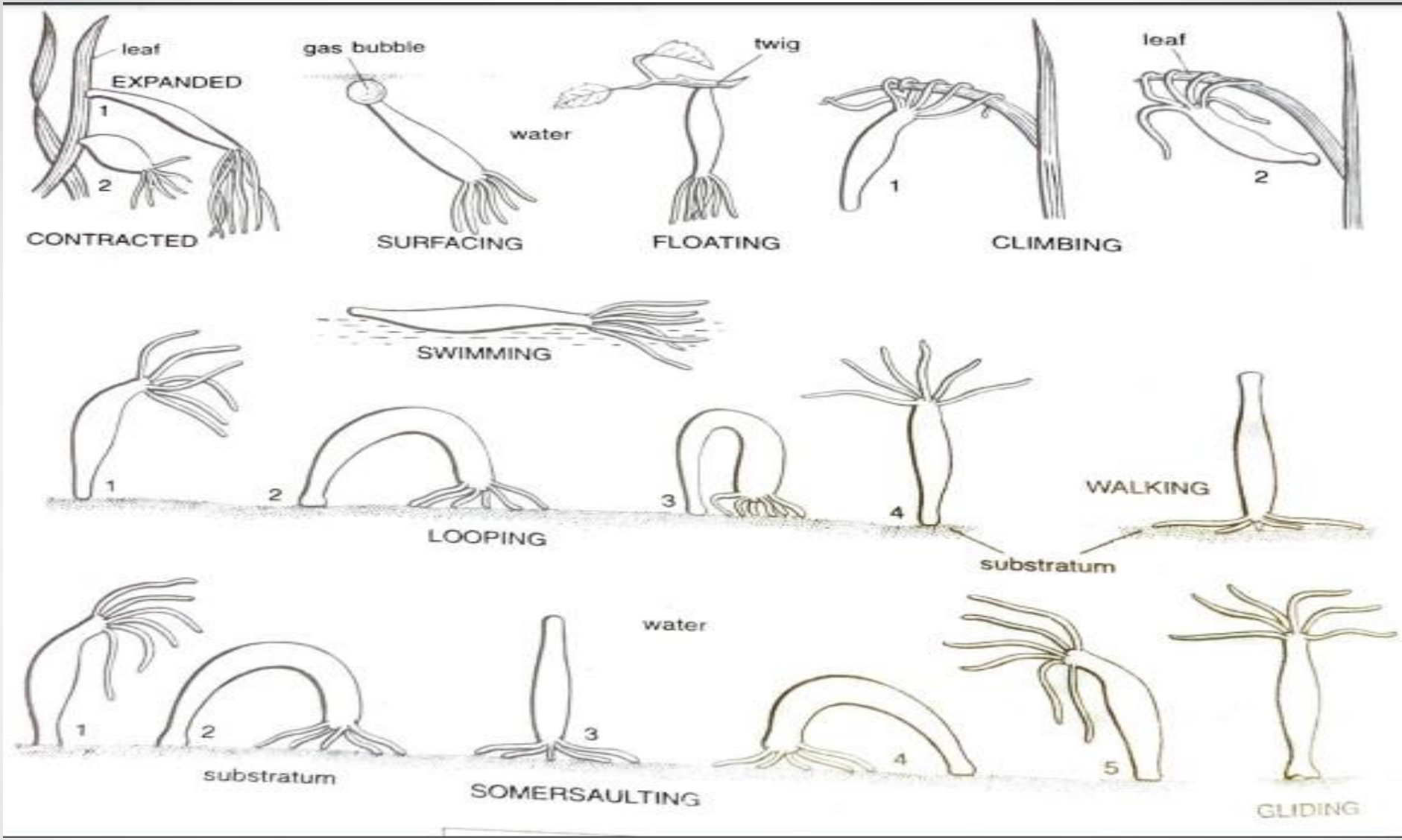


Fig. 31.19. *Hydra* showing climbing.



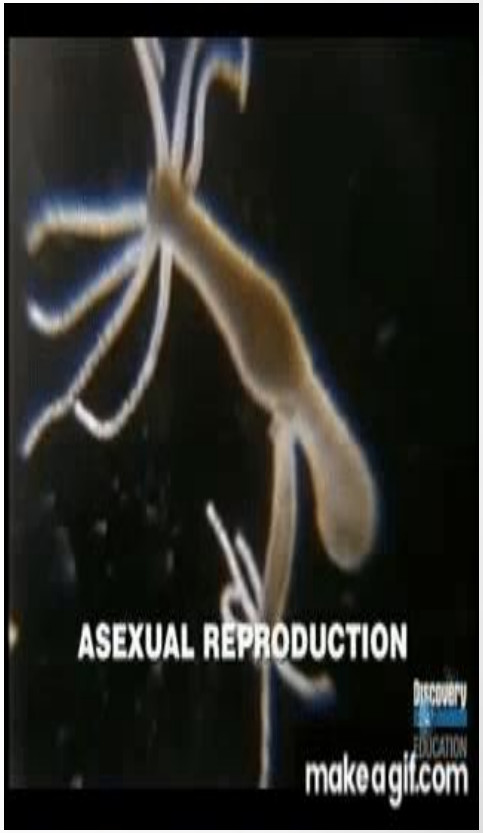
https://www.google.com/search?q=movement+in+hydra+gif&source=lmns&bih=608&biw=1007&hl=en&sa=X&ved=2ahUKEwj8v7vY99P9AhVfkCcCHWTyCVoQ_AUoAHoECAEQAA#fpstate=ive&vld=cid:29d158a5,vid:KP5MYRW3v10

Habitat in Hydra

- Habit and Habitat: is sedentary, marine colonial form found attached on the surface of sea weeds, molluscan shells, rocks and wooden piles in shallow water up to 80 meters in depth.
- is cosmopolitan in distribution, forming a whitish or light-brown plant-like fur in the sea; hence, the common name sea-fur is assigned to it.

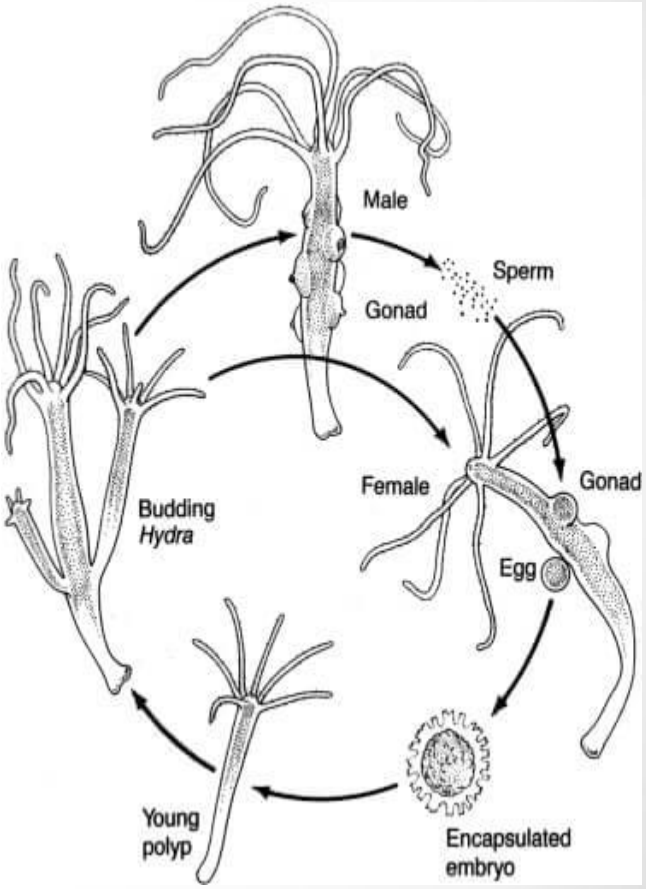
Reproduction in Hydra

- When food is plentiful, many Hydra reproduce asexually by producing **buds** in the body wall, which grow to be miniature adults and break away when they are mature.
- When Hydra is well fed, a new bud can form every two days.
- When conditions are harsh, often before winter or in poor feeding conditions, sexual reproduction occurs in some Hydra.
- Swellings in the body wall develop into either ovaries or testes. The testes release free-swimming gametes into the water, and these can fertilize the egg in the ovary of another individual.



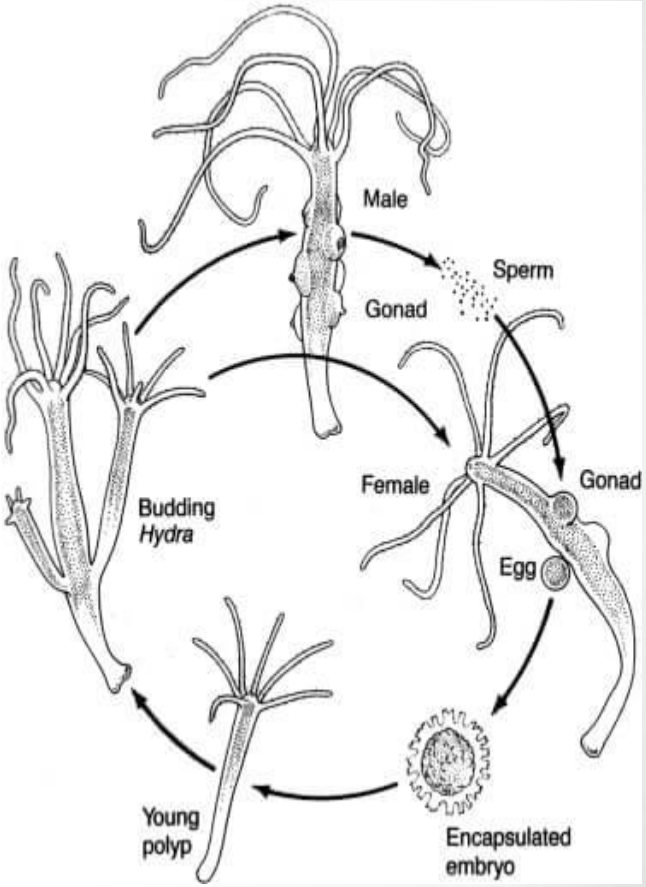
Reproduction in Hydra

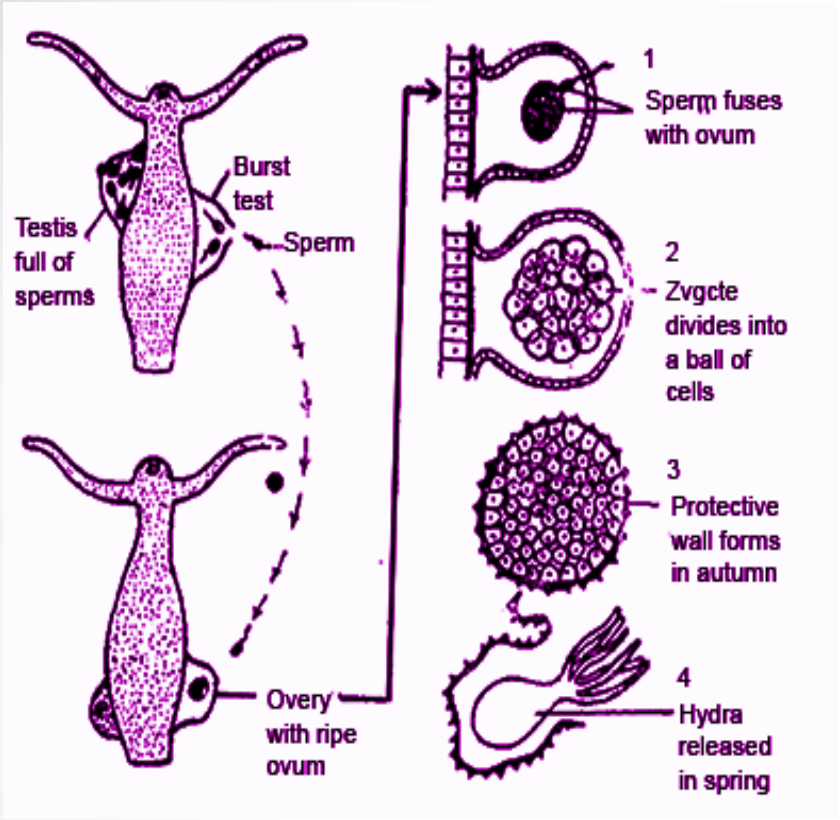
- Sexual reproduction occurs in harsh environment.
- Sexes are separated
- The testes and ovary didn’t developed at the same time testes first.
- Tested located upward near to the oral cone
- Ovary located down near the basal disc.
-

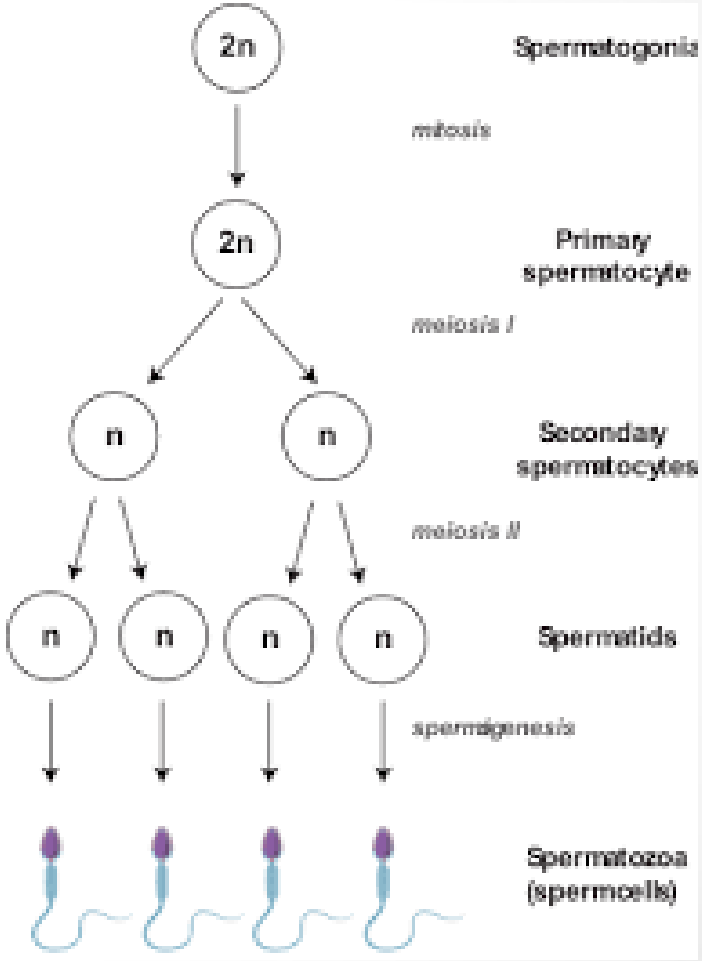


Reproduction in Hydra

- Sperm formed by spermatogenesis, and when fully developed sperms ejects throw a small pore in the testes.
- Ovum formed by engulfing the nearest cells, then grow filled with nutrients.
- When ovum fully developed it ruptured the covering layers and be ready for fertilization.
- The fertilization occurs while the ovum is still attached to the female to form zygote.
- Zygote developed to form blastula then gastrula, then forming adult Hydra




Testis full of sperms
Burst test
Sperm
Overy with ripe ovum
1
Sperm fuses with ovum
2
Zygote divides into a ball of cells
3
Protective wall forms in autumn
4
Hydra released in spring


2n
Spermatogonia
mitosis
2n
Primary spermatocyte
meiosis I
n
n
Secondary spermatocytes
meiosis II
n
n
n
n
Spermatids
spermiogenesis
Spermatozoa (spermcells)

Kingdom: Animalia

Subkingdom: Metazoa

Phylum: Platyhelminthes

Triploblastica

Phylum: Platyhelminthes

General characters:

- They are the first animals which illustrate the development of organ system.
- May be free living or parasites.
- They are soft bodied, unsegmented worms.
- They are bilateral symmetry and dorsoventrally flat worms.
- They show three germinal layers i.e. ectoderm, mesoderm and endoderm.
- A true body cavity or coelom is absent, and the space between the body organs is filled with loose parenchyma.
- Muscular system is well developed.
- The alimentary canal is either absent or highly branched.
- Anus is absent.

Phylum: Platyhelminthes

General characters:

- Excretory system consists of flame bulbs or flame cells or protonephridia connected to the excretory ducts.
- Circulatory and respiratory systems are absent.
- Nervous system and sense organs are poorly developed, consists of a pair of ganglia connected to 3 pairs of nerve cords.
- Usually hermaphrodite animals.
- Fertilization is internal and development may be direct or indirect

Direct development: It is a type of development in which an embryo develops into a mature individual without involving a **larval stage**.

Indirect development: It is a type of development that involves a sexually-immature larval stage, having different food requirement than adults.

Classification of Platyhelminthes

Class 1 Turbellaria

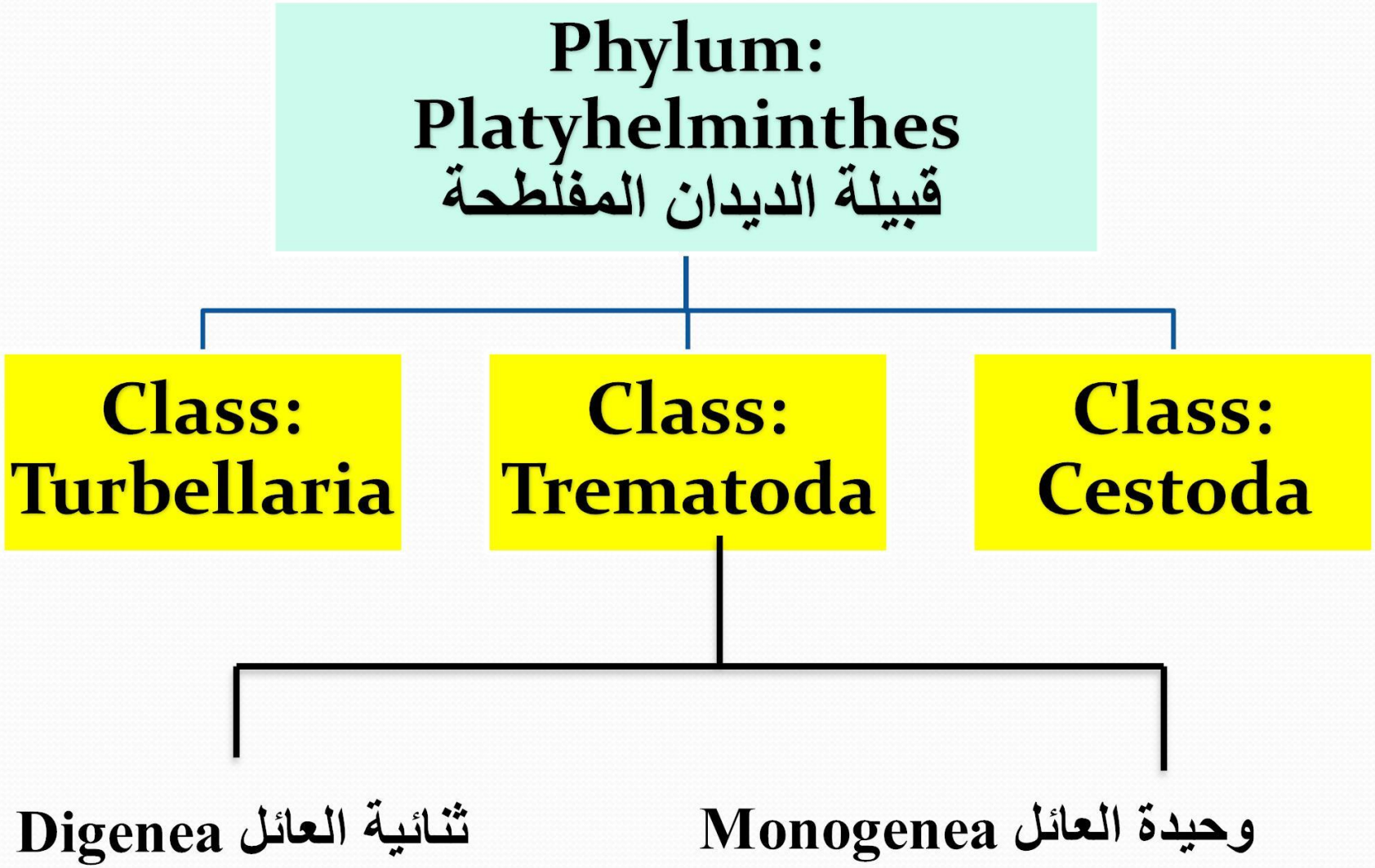
- Mostly Free-living fresh water organism
- Body: dorso-ventrally flattened
- Hooks and sucker usually absent
- Examples: *Planaria*

Class 2 Trematoda

- Mostly parasitic
- Body: dorso-ventrally flattened leaf like
- Hooks and sucker are present
- Examples; *Fasciola hepatica* (Liver fluke) *Schistosoma* (blood fluke)

Class 3 Cestoda

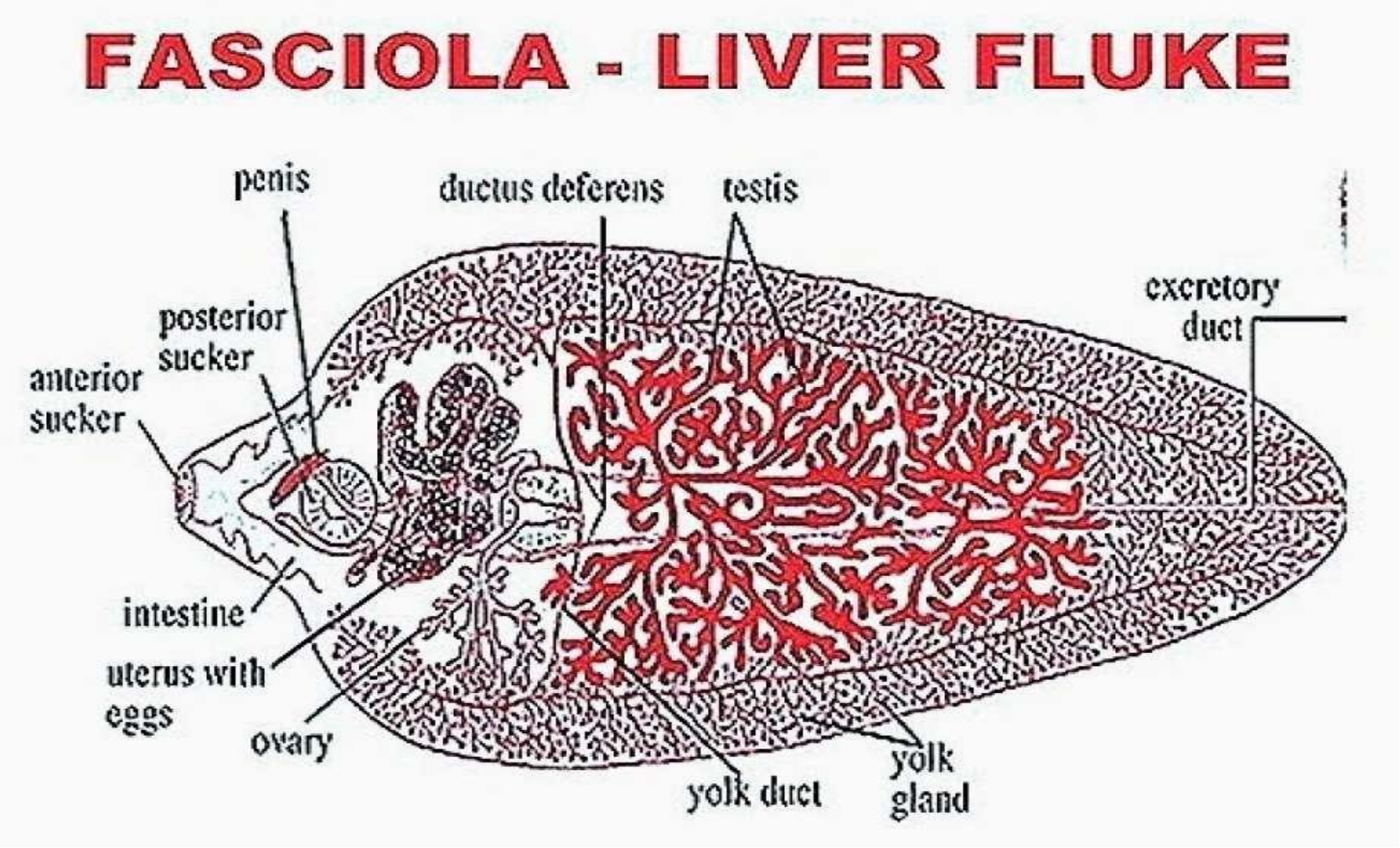
- Exclusive parasitic
- Body: dorso-ventrally flattened tape like
- Hooks and sucker are present
- Digestive system-absent
- Excretion: Protonephridia with flame cell
- Examples: *Taenia* (tapeworm)


Phylum:
Platyhelminthes
قبيلة الديدان المفلطحة
Class:
Turbellaria
Class:
Trematoda
Class:
Cestoda
ثنائية العائل Digenea
وحيدة العائل Monogenea

The Liver Fluke (Fasciola hepatica)

- Fasciola hepatica is an endoparasite with a leaf-like, dorsoventrally flattened body. It is commonly known as liver-fluke.
- It lives inside the bile-duct of liver in sheep, goats and cattle. It causes a disease called **liver-rot** in sheep.
- It is conical in shape, about 25 mm long and about 15mm in breadth. It is narrow at the anterior end, broad in the middle and tapers towards the posterior end.
- It has two suckers, an oral sucker or anterior sucker at the tip of the head lobe and a ventral sucker or acetabulum behind the head lobe, on the ventral side.

The Liver Fluke (Fasciola hepatica)



The Liver Fluke (Fasciola hepatica)

Digestive System

- The digestive system is very simple. It is formed of a mouth, the pharynx, oesophagus and the intestine.
- The mouth is sub-ventral in position. It is surrounded by the oral sucker. It leads into a funnel-shaped muscular pharynx.
- The pharynx is surrounded with pharyngeal glands. The lumen of the pharynx is very narrow, which leads into a short, narrow esophagus.

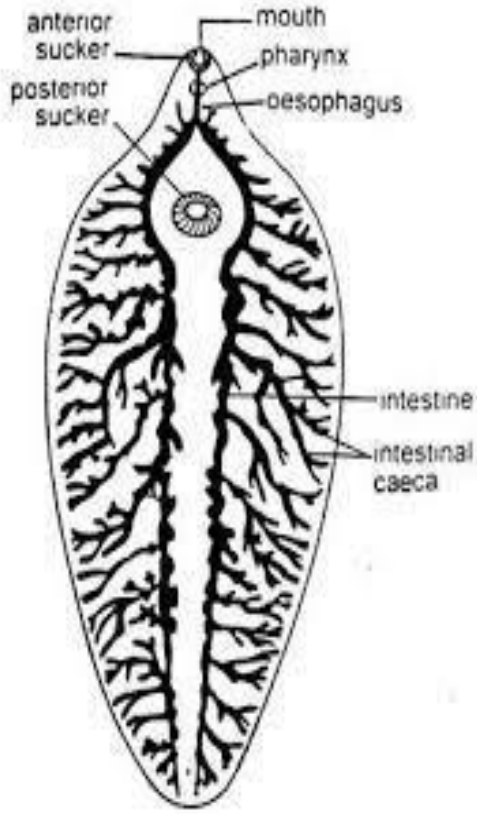


Fig. 22.4. Fasciola hepatica. Digestive system (ventral view)

The Liver Fluke (Fasciola hepatica)

Digestive System

- The oesophagus is followed by the intestine.
- The intestine soon after its origin divides into two branches called caeca.
- Each caecum runs up to the posterior end where it ends blindly.
- Each caecum is divided into a number of branching diverticula.
- The anus is absent.
- The liver fluke feeds on the blood and bile of the host.
- It sucks the liquid food by the muscular pharynx.

The Liver Fluke (Fasciola hepatica)

Digestive System

- As the food is already in the digested state and fit for absorption, the digestive glands are completely absent.
- The food is absorbed in intestine.
- The branches of diverticula transport the digested food to the different parts of the body along the parenchyma.

The Liver Fluke (Fasciola hepatica)

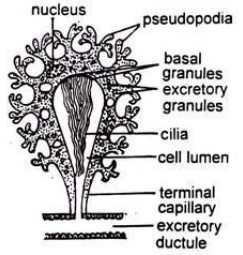


Fig. 22.6. Fasciola hepatica. A flame cell

Excretory System

- The excretory system in liver fluke is formed of protonephridia.
- It has no internal opening.
- It consists of a median longitudinal excretory canal.
- The canal opens to the outside at the posterior end of the animal by an excretory pore.
- The excretory canal gives out many branches.
- Each branch ends in a cell called flame cell.

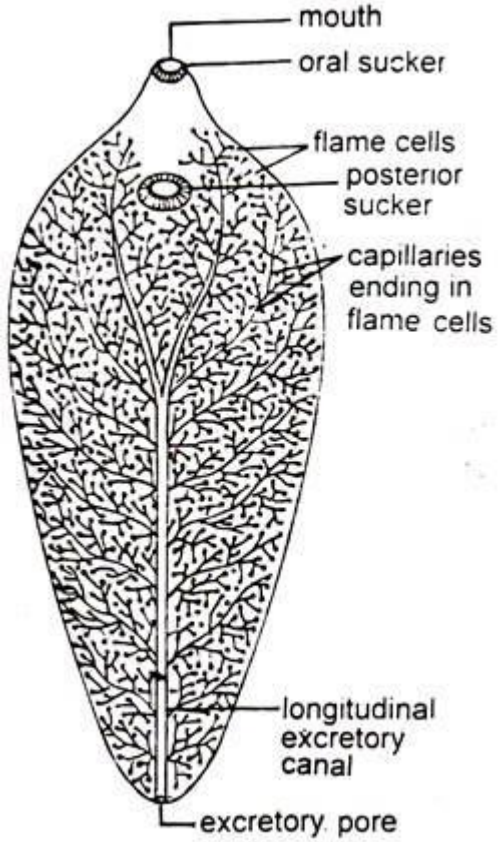


Fig. 22.5. Fasciola hepatica. Excretory system

The Liver Fluke (Fasciola hepatica)

Excretory System

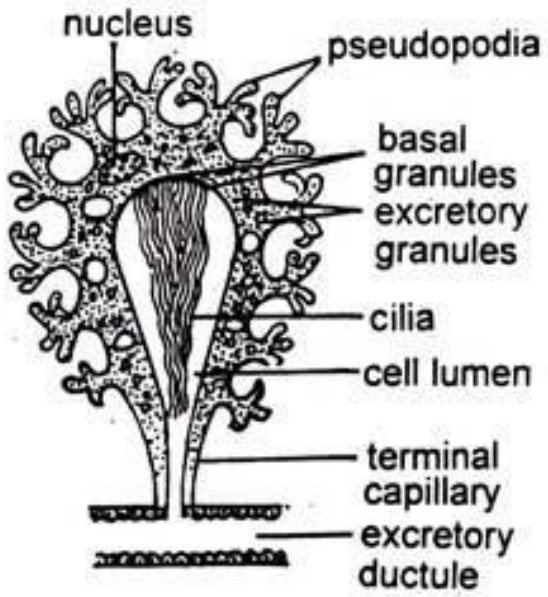
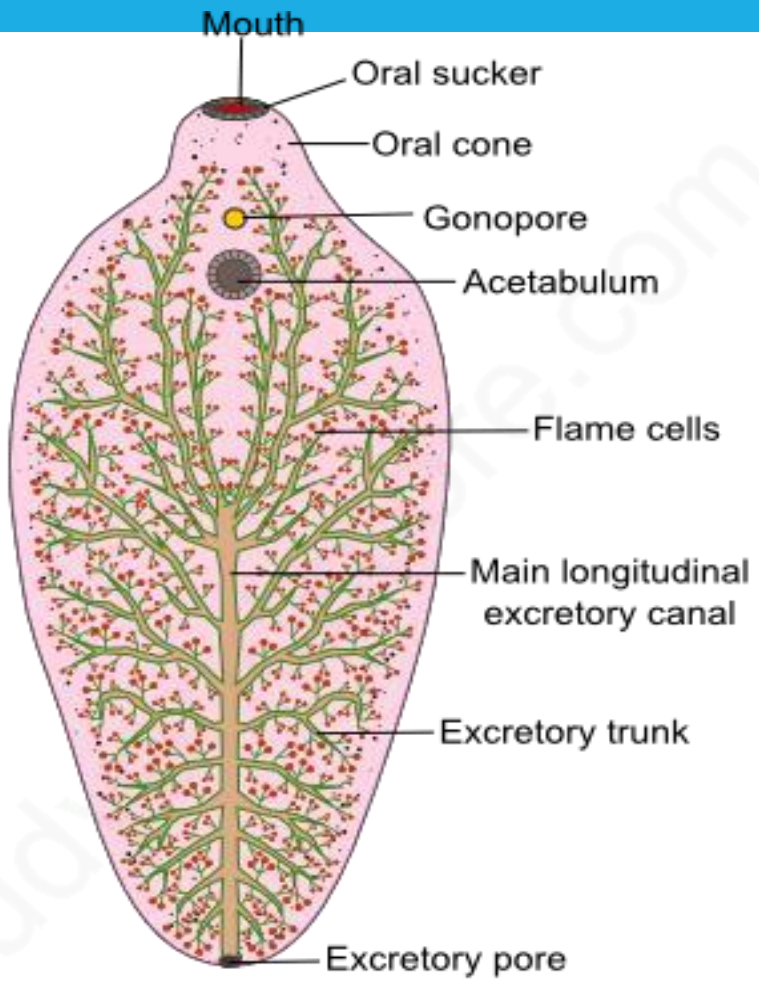


Fig. 22.6. Fasciola hepatica. A flame cell



FASCIOLA-PROTONEPHREDIAL SYSTEM

The Liver Fluke (Fasciola hepatica)

Reproductive System

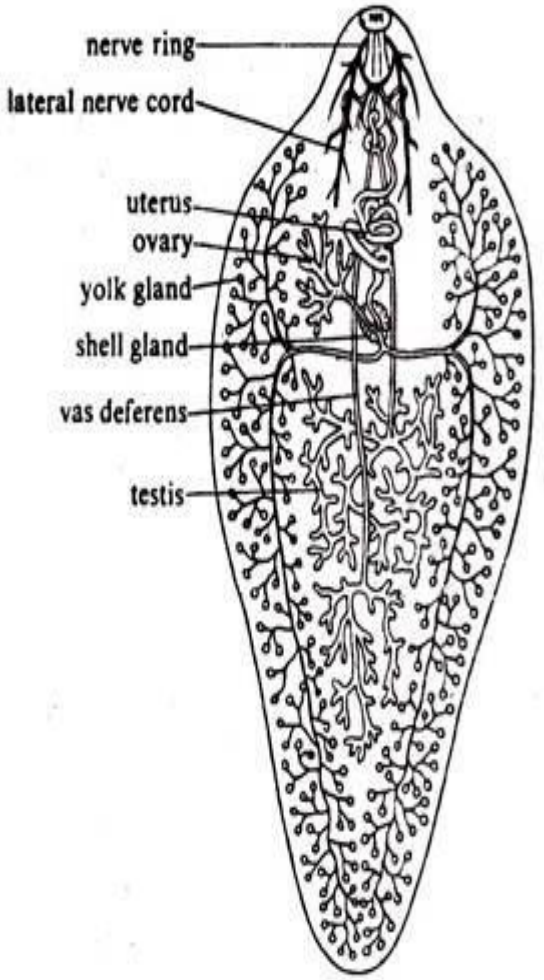
- Liver fluke is hermaphrodite. Both male and female reproductive organs are present in the same animal.
- It contains complicated reproductive organs.
- The male and female genital ducts open into a common chamber, the genital atrium.
- The genital atrium opens outside through the common genital aperture

The Liver Fluke (Fasciola hepatica)

Reproductive System

Male Reproductive System

- It consists of two testes. They are tubular and highly branched.
- A vas deferens arises from each testis.
- The two vasa deferentia run forward and join to form a median bag- like structure the seminal vesicle.

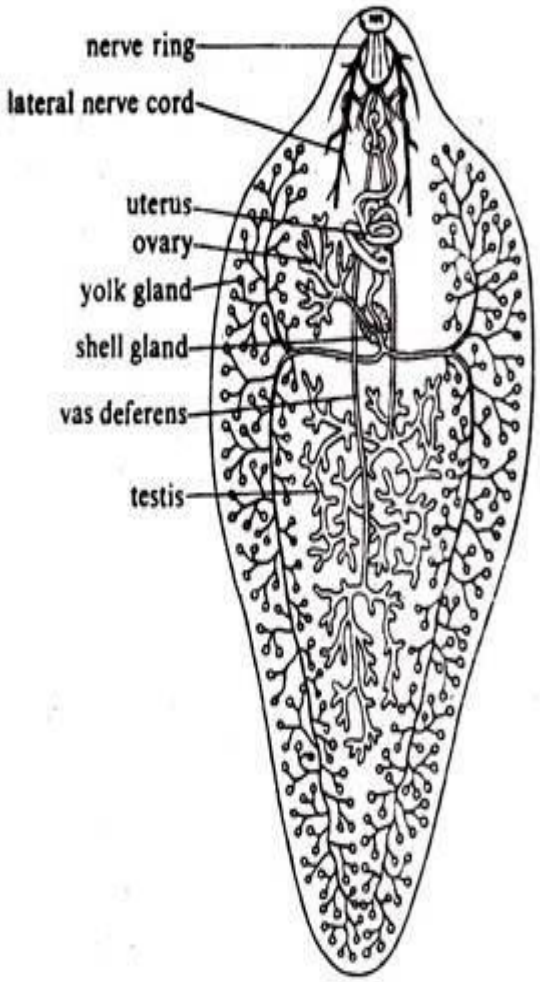


The Liver Fluke (Fasciola hepatica)

Reproductive System

Male Reproductive System

- The sperms produced by the testes are stored in **the seminal vesicle**.
- The seminal vesicle leads into a narrow tube, the **ejaculatory duct.**
- The ejaculatory duct opens into a muscular tube called **Cirrus**.
- It opens into the genital atrium by the **male genital aperture**

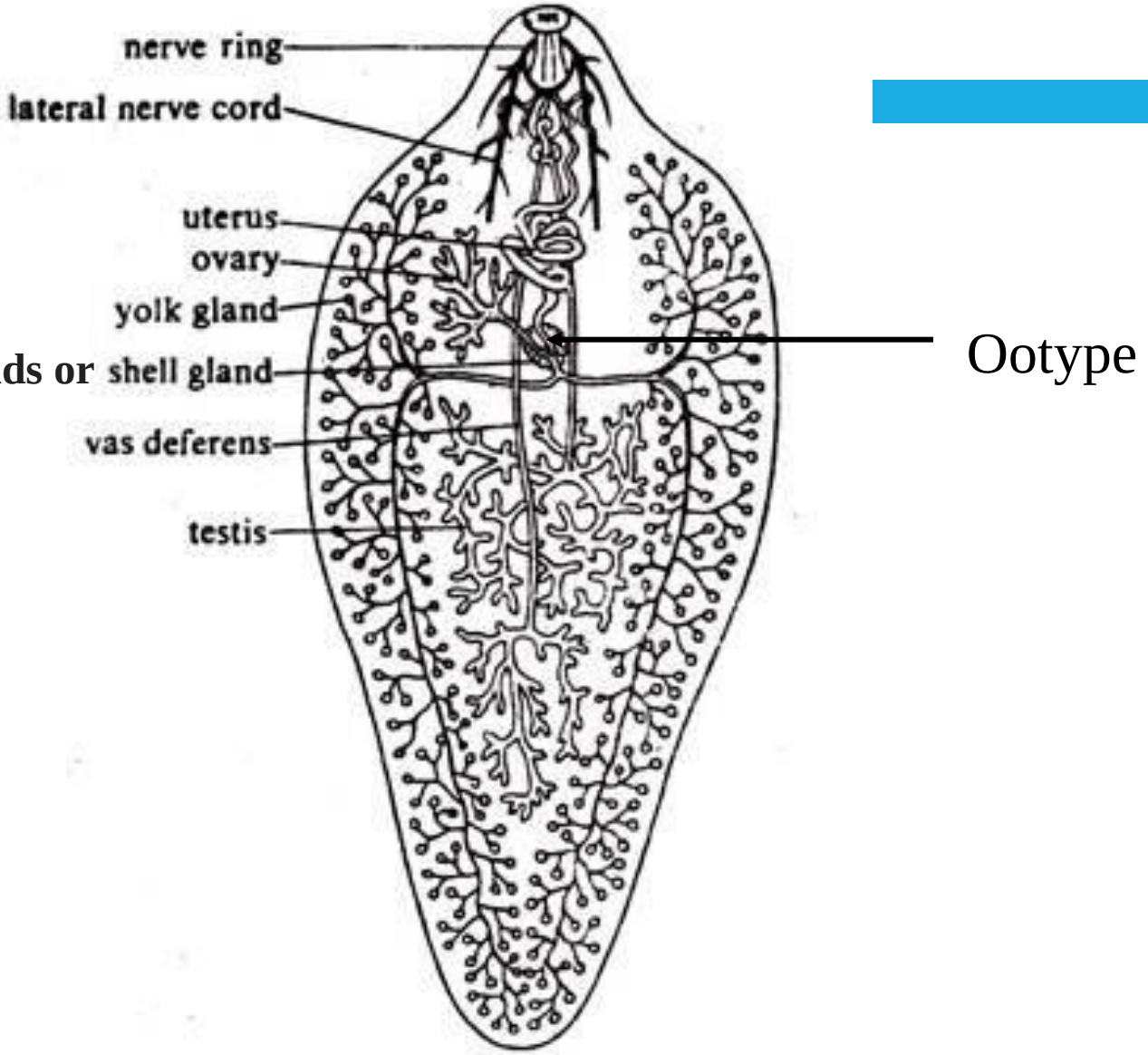


The Liver Fluke (Fasciola hepatica)

Reproductive System

Female Reproductive System

- The female reproductive system is formed of a **single ovary**.
- It is **tubular and branched**. It lies in the middle of the body in front of the testes.
- An oviduct arises from the ovary. It runs forward and joins the vitelline duct.
- There are numerous small rounded yolk glands or vitellaria on the sides of the body.
- These glands secrete yolk and the shell. A minute duct known as yolk duct arises from each yolk gland.
- All yolk ducts unite into an anterior longitudinal vitelline duct and a posterior longitudinal vitelline duct on each side.


nerve ring
lateral nerve cord
uterus
ovary
yolk gland
Mehli's glands or shell gland
vas deferens
testis
Ootype

The Liver Fluke (Fasciola hepatica)

Reproductive System

Female Reproductive System

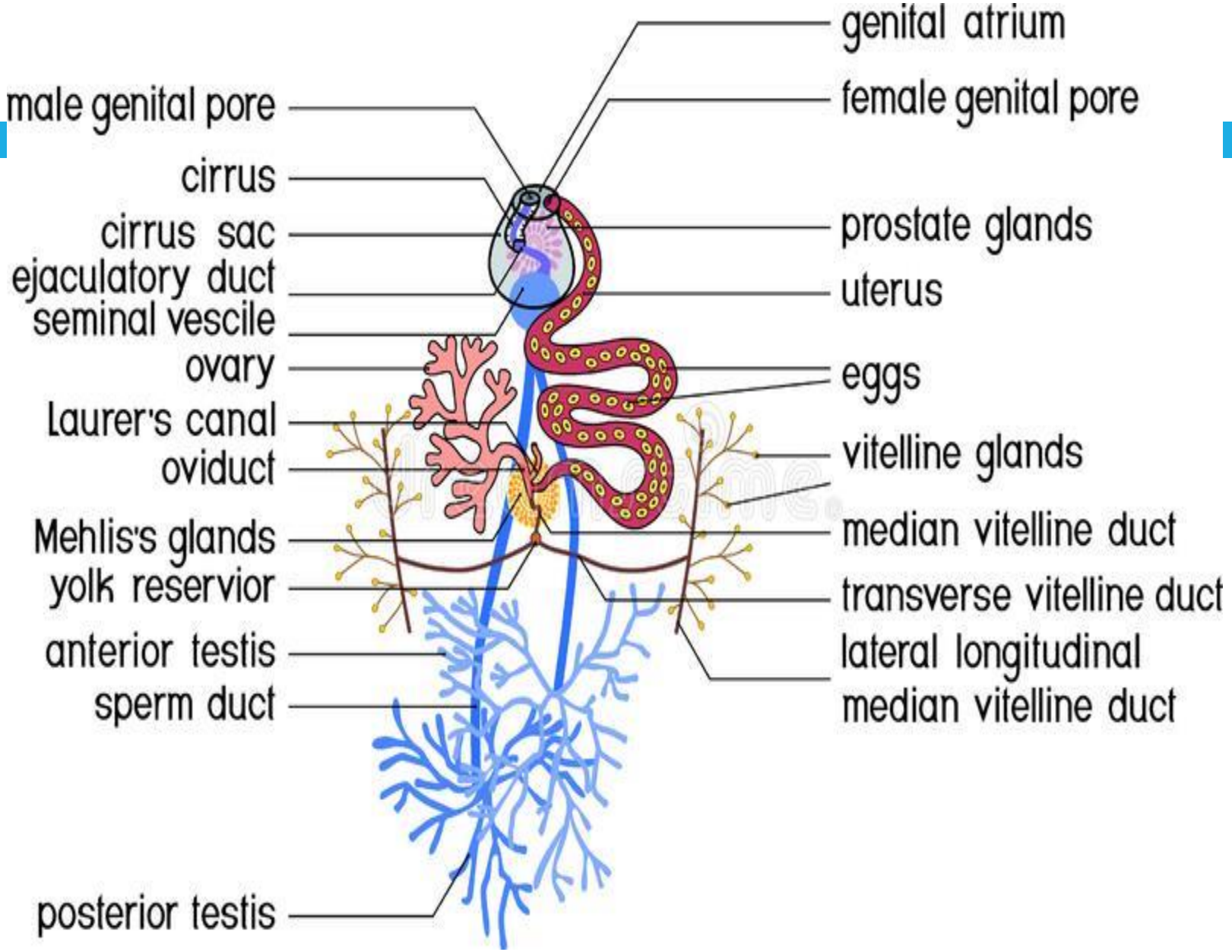
- The two longitudinal ducts join to form a transverse vitelline duct.
- The transverse vitelline ducts of the two sides run inward and join to form a median vitelline duct which runs forward and joins the oviduct.
- The junction of median vitelline duct and the oviduct is slightly dilated to form an ootype.
- Around the ootype there is a mass of unicellular Mehli's glands or shell glands.
- The secretion of Mehli's glands lubricates the passage of eggs in the uterus.
- It also activates the sperm and hardens the egg shell.

The Liver Fluke (Fasciola hepatica)

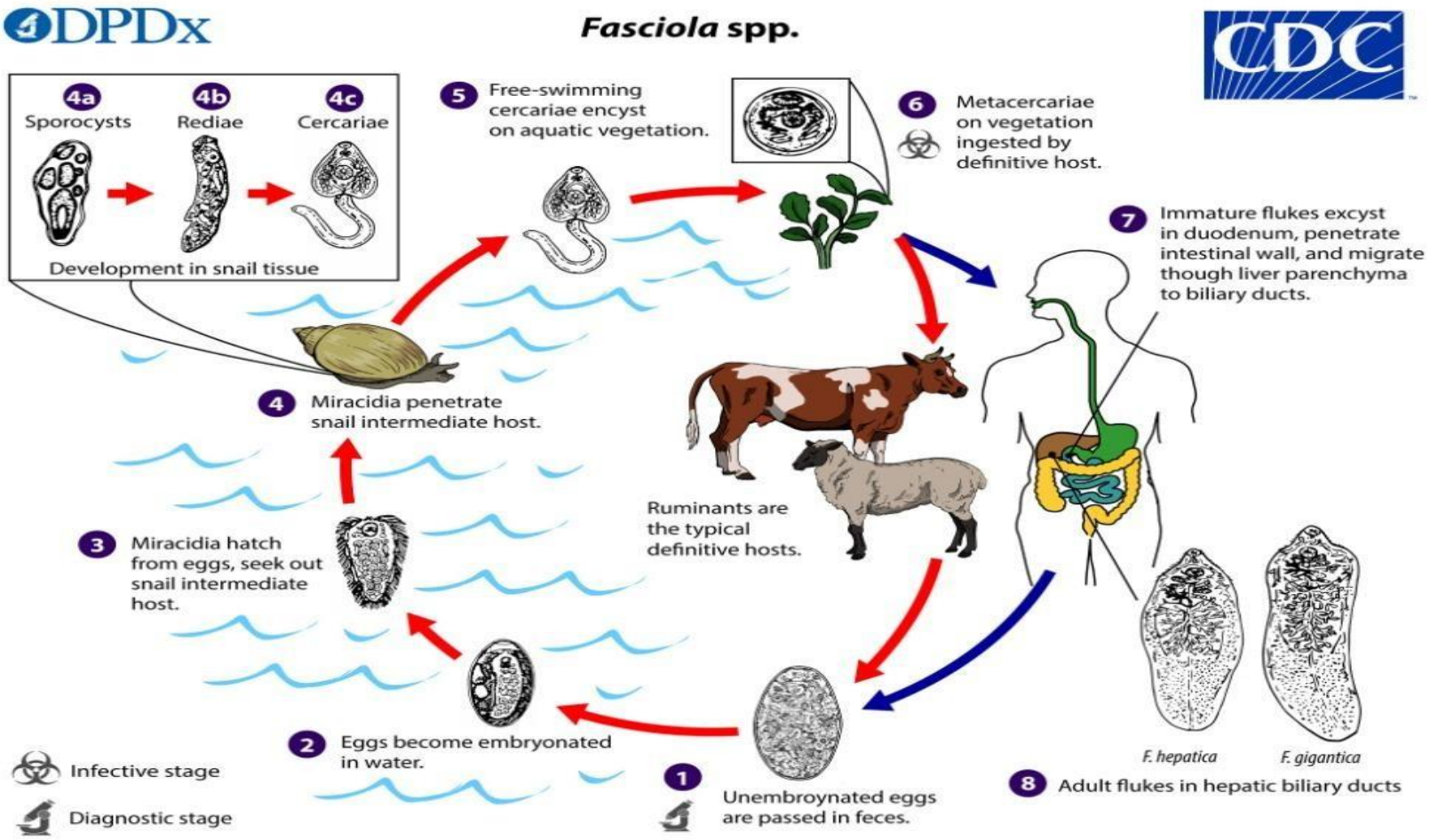
Reproductive System

Female Reproductive System

- From the ootype arises a large duct called **uterus**.
- The uterus runs forwards as a coiled tube and opens to the exterior through the female genital pore close to the male genital pore.
- From the ootype arises another canal known as Laurer's canal.
- It runs vertically upwards and opens on the mid- dorsal surface.
- During copulation, the sperms are received from the other fluke through this canal.
- So it is also termed copulation canal.


genital atrium
female genital pore
male genital pore
cirrus
cirrus sac
ejaculatory duct
seminal vescile
ovary
Laurer's canal
oviduct
Mehlis's glands
yolk reservior
anterior testis
sperm duct
posterior testis
prostate glands
uterus
eggs
vitelline glands
median vitelline duct
transverse vitelline duct
lateral longitudinal
median vitelline duct

The Liver Fluke (Fasciola hepatica) life cycle



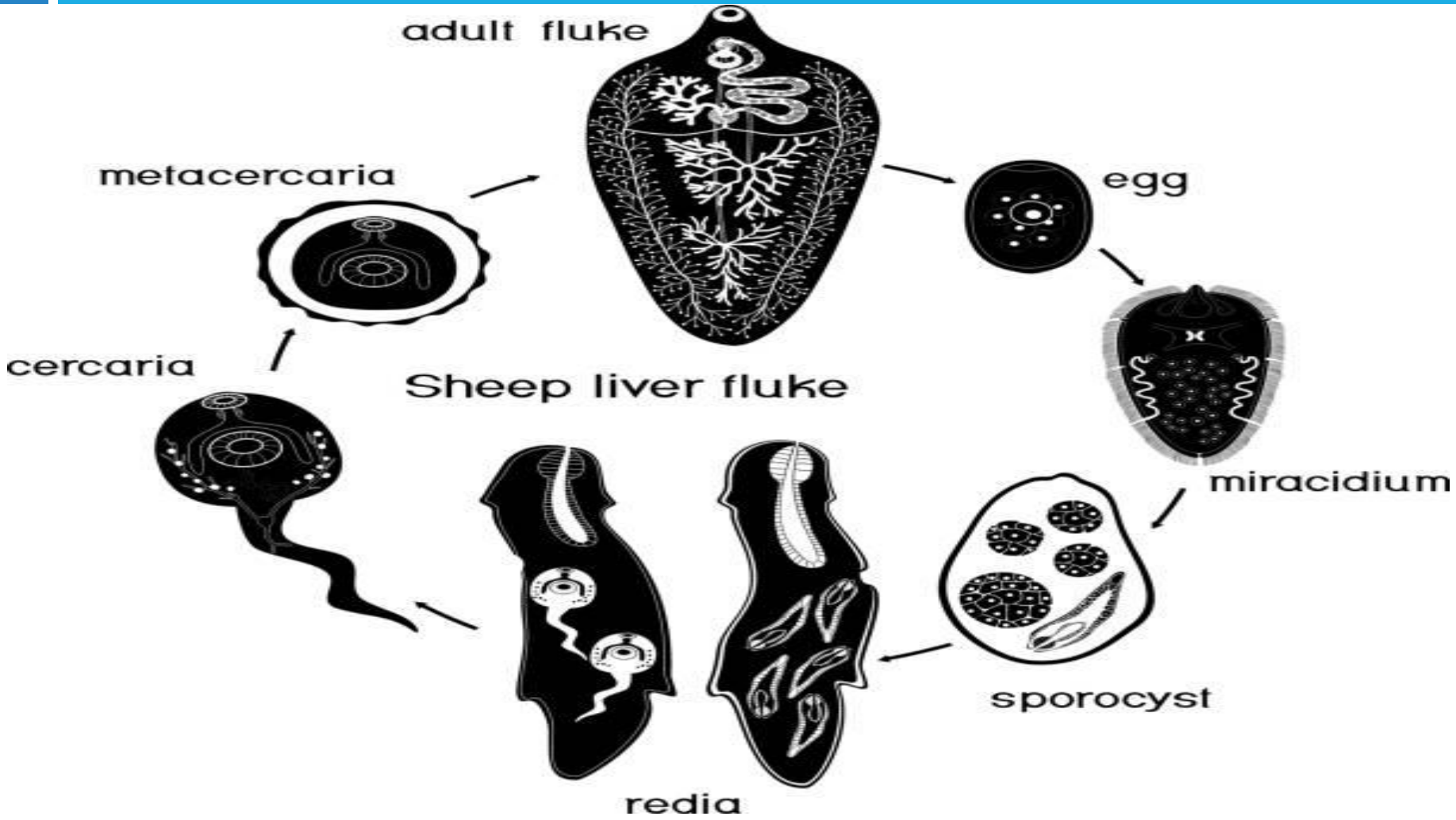
The Liver Fluke (Fasciola hepatica) life cycle

- Immature eggs are discharged in the biliary ducts and passed in the stool.
- Eggs become embryonated in freshwater over ~2 weeks;
- embryonated eggs release miracidia, which invade a suitable snail intermediate host (Lymnaea caillaudi for f. gigantic and Lymnaea truncatula for f. hepatica.
- In the snail, the parasites undergo several developmental stages (sporocysts, rediae, and cercariae).
- The cercariae are released from the snail and encyst as metacercariae on aquatic vegetation or other substrates.
- Humans and other mammals become infected by ingesting metacercariae-contaminated vegetation (e.g., watercress).

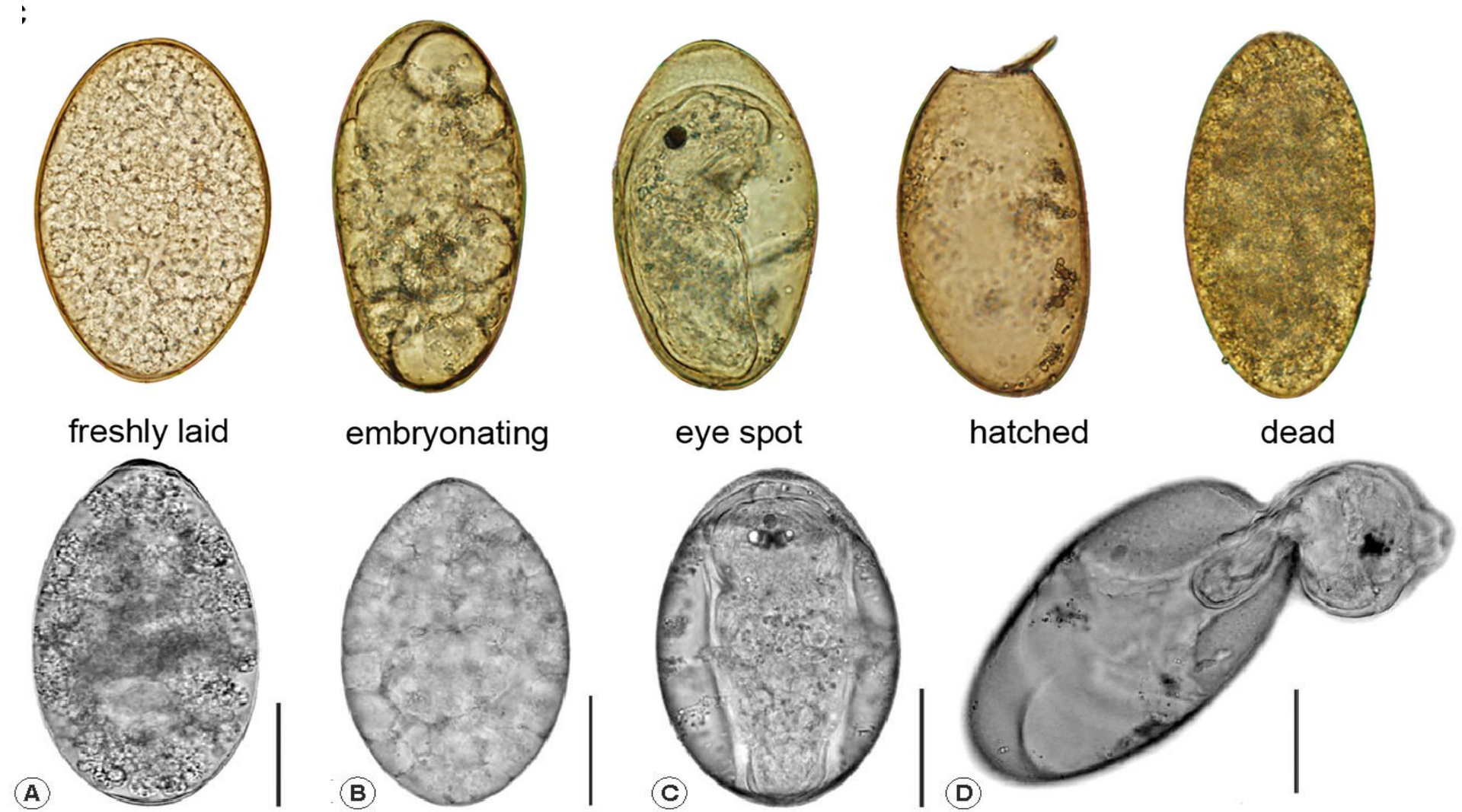
The Liver Fluke (Fasciola hepatica) life cycle

- After ingestion, the metacercariae excyst in the duodenum and
- penetrate through the intestinal wall into the peritoneal cavity.
- The immature flukes then migrate through the liver parenchyma into biliary ducts, where they mature into adult flukes and produce eggs.
- In humans, maturation from metacercariae into adult flukes usually takes about 3–4 months; development of F. *gigantica* may take somewhat longer than F. *hepatica*.

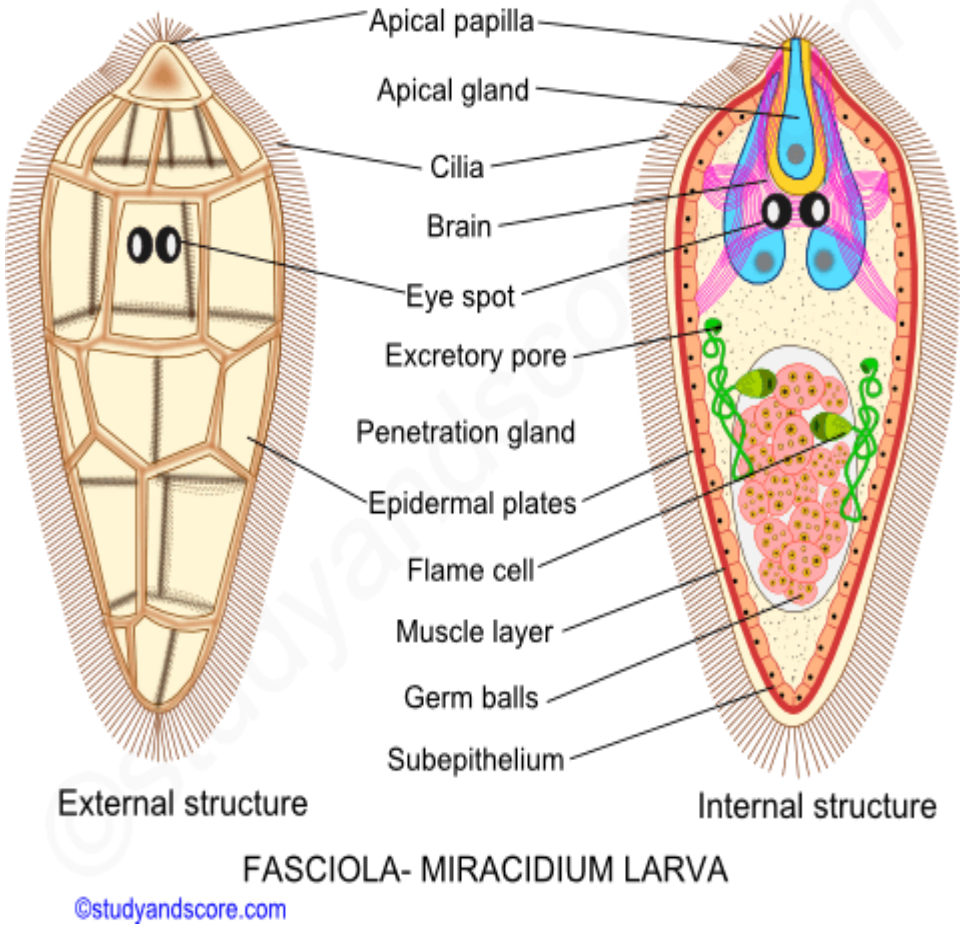
life cycles of digenea



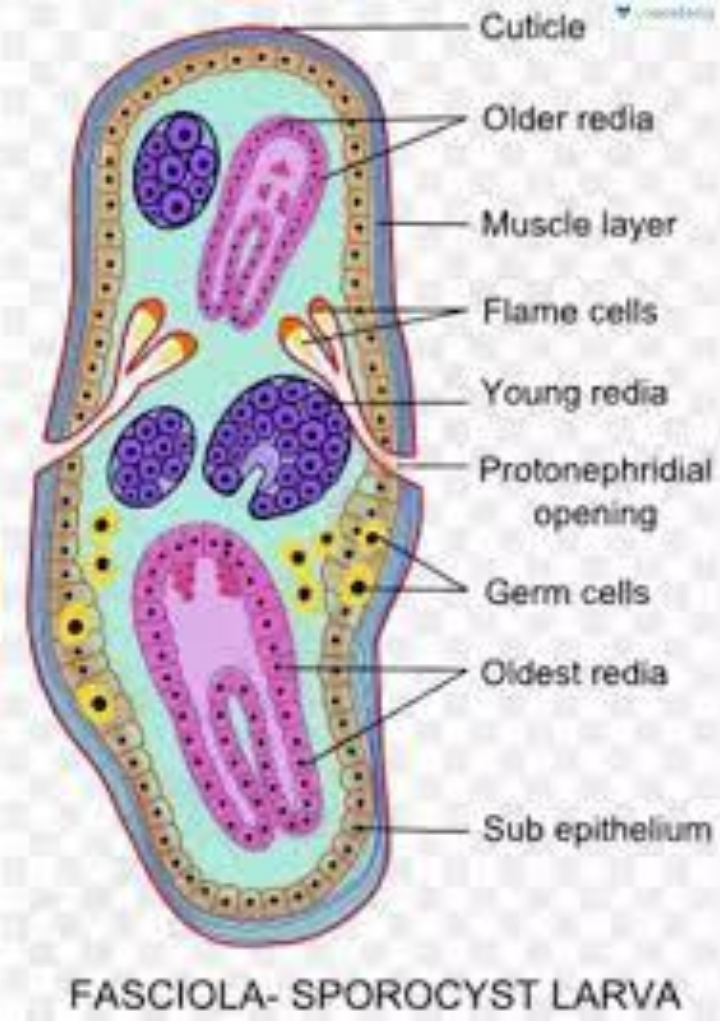
Egg



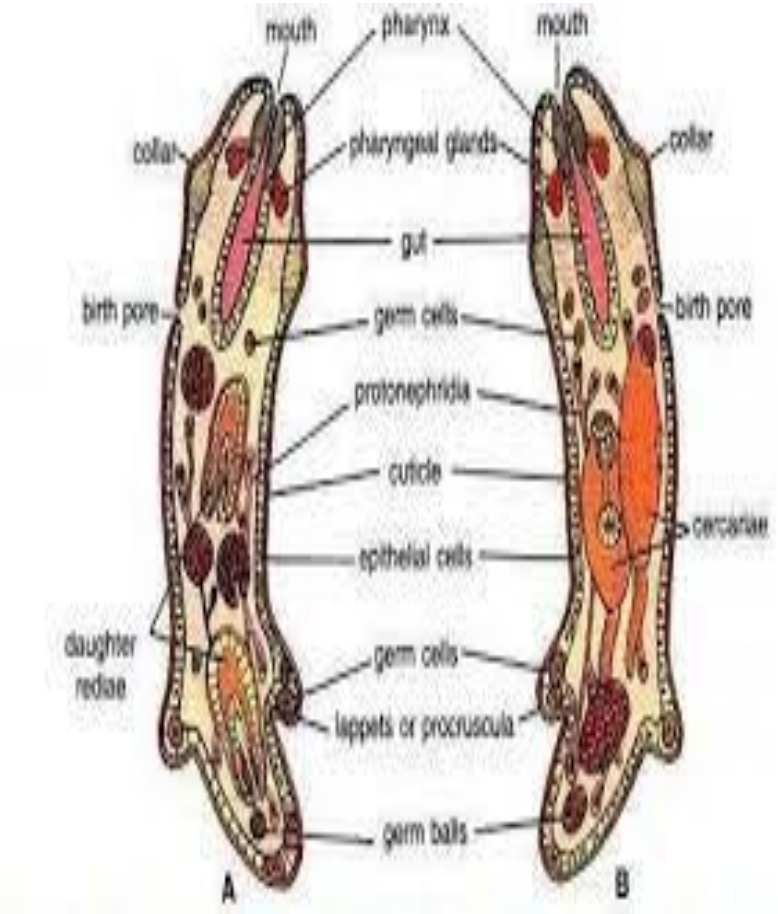
Miracidium


Apical papilla
Apical gland
Cilia
Brain
Eye spot
Excretory pore
Penetration gland
Epidermal plates
Flame cell
Muscle layer
Germ balls
Subepithelium
External structure
Internal structure
FASCIOLA- MIRACIDIUM LARVA
©studyandscore.com

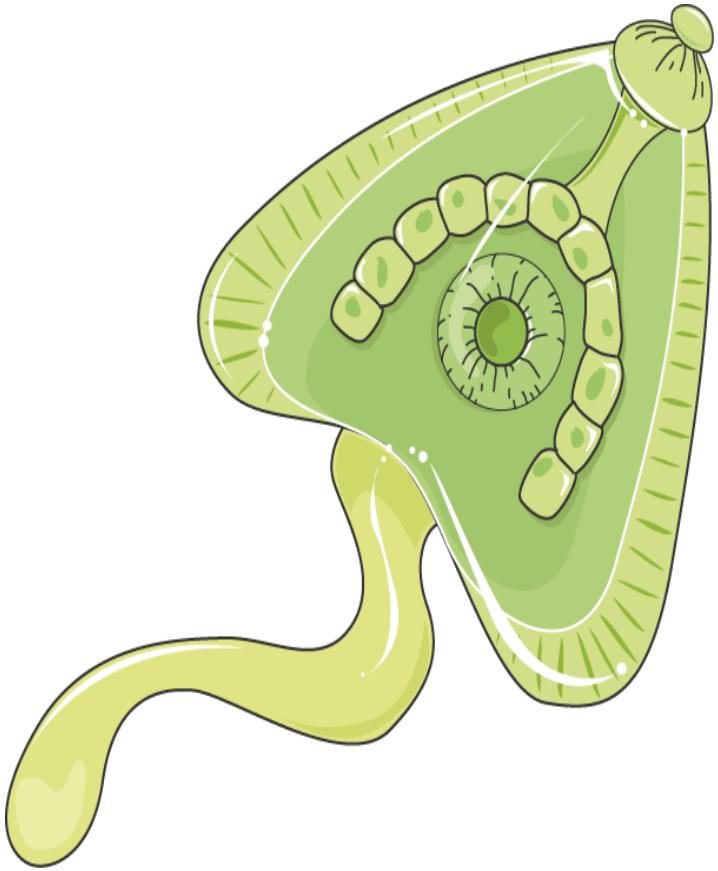
Sporocyst


Cuticle
Older redia
Muscle layer
Flame cells
Young redia
Protonephridial opening
Germ cells
Oldest redia
Sub epithelium
FASCIOLA- SPOROCYST LARVA

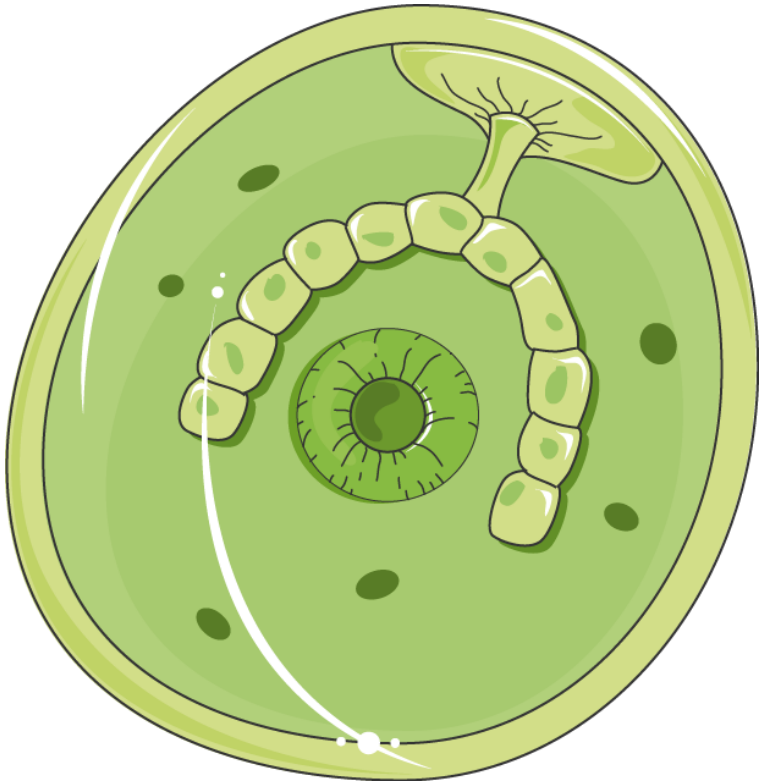
Daughter redia



Cercariae



life cycles of digenea



Meta cercaria

life cycles of digenea

Adult

Subkingdom: Metazoa
Phylum: Aschelminthes

General characters:

- They may be free living (aquatic and terrestrial) or parasitic on plants and animals.
- They are bilaterally symmetrical, triploblastic and pseudocoelomate animals.
- The body is cylindrical and unsegmented with smooth cuticle and well developed muscle fibers.
- The digestive system is complete with a mouth and an anus.

- The excretory system is composed of few cells (renettes) which are drawn into two longitudinal tubes opening into one excretory pore.
- No respiratory or circulatory systems.
- Nervous system is composed of circum-oesophageal nerve ring leading to 6 anterior and 6 posterior trunks.
- Sexes are separated; often females are longer than males.

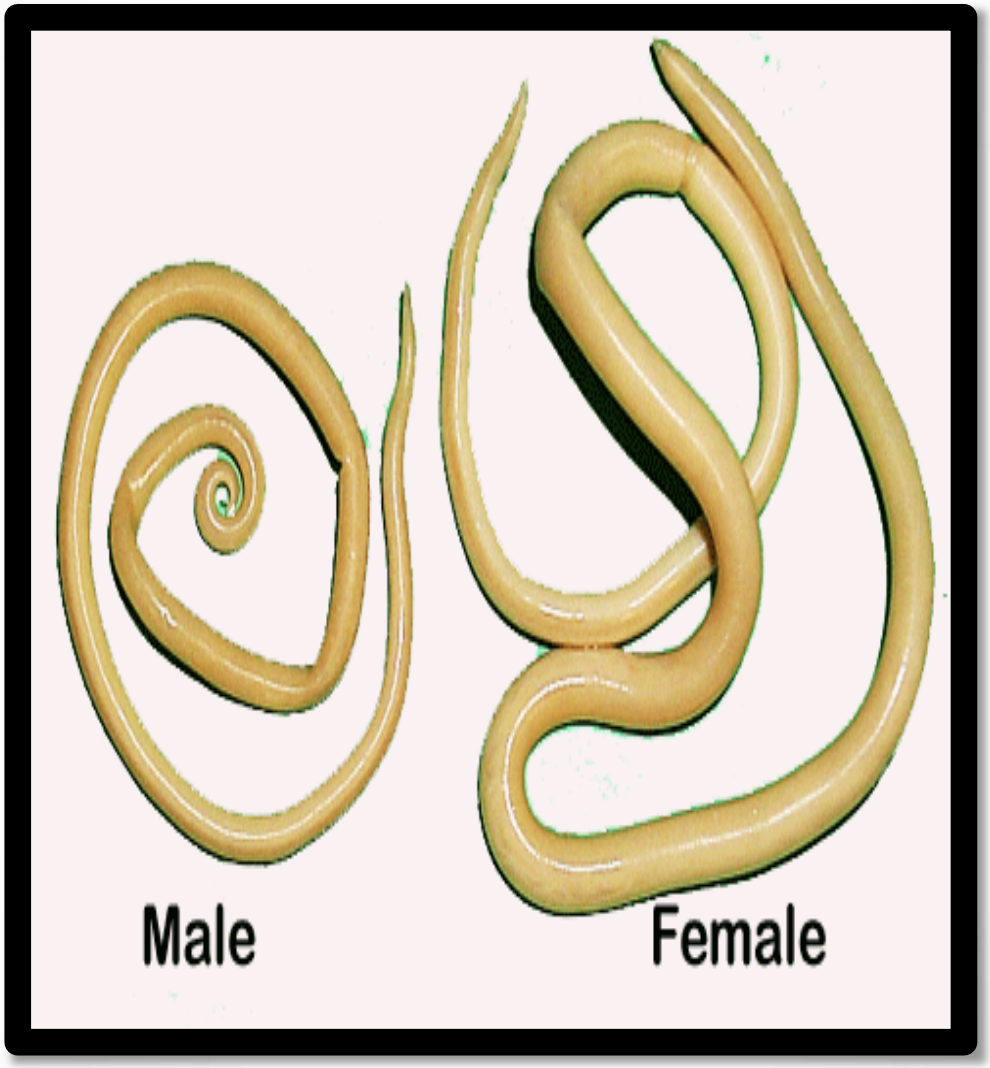
Class: Nematoda

Ascaris

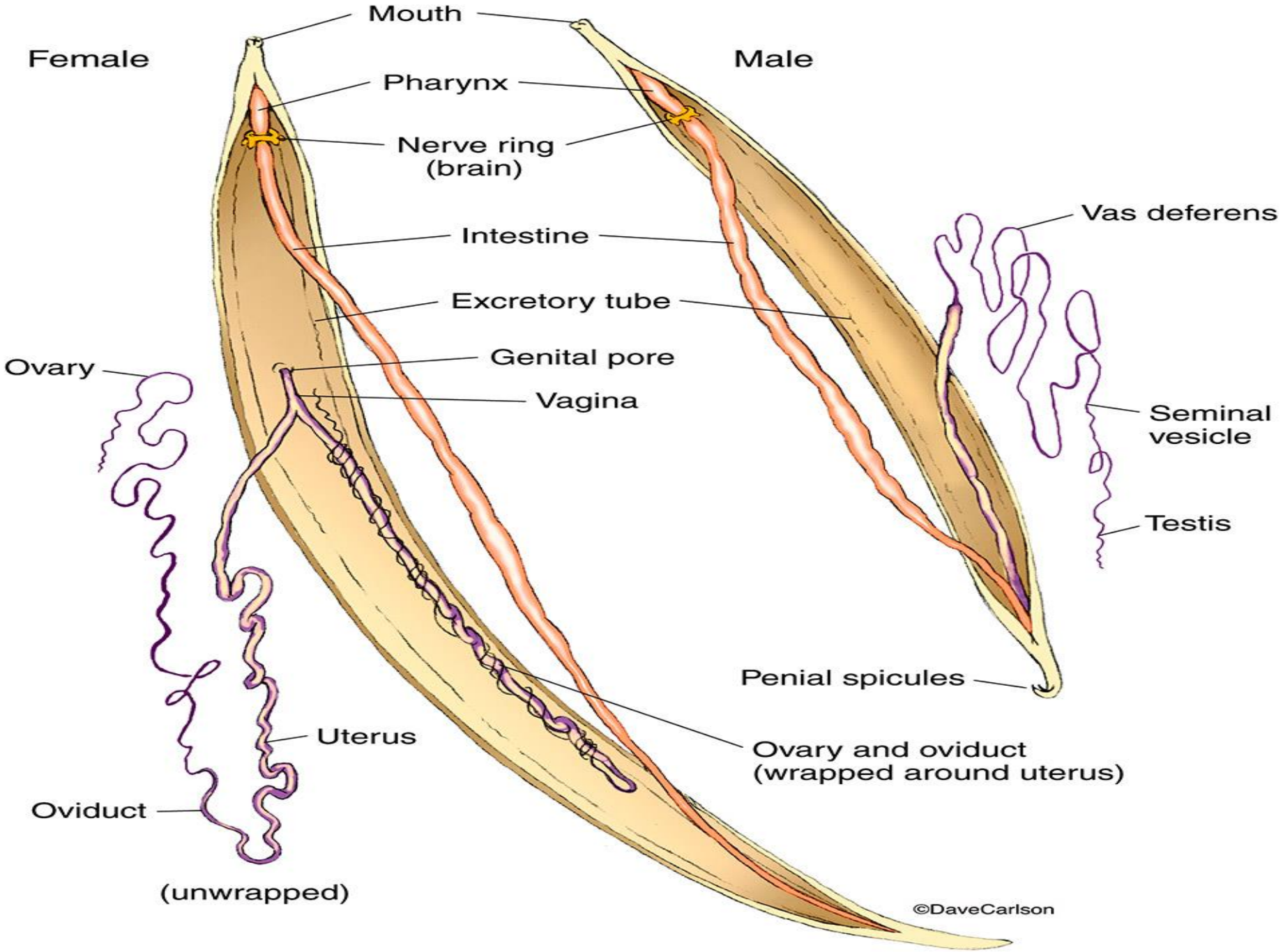
- Some species of this genus are the largest round worms.
- There are 3 species: *A. lumbricoides* which lives in the small intestine of man, *A. megalocephala* lives in the small intestine of the horse and *A. vitulorum* in that of the cow. They resemble each other closely and differ in few details.

Ascaris lumbricoides

- It lives in in the lumen of the intestinal tract of man.
- The body form is cylindrical, the two ends are tapering. The female is the larger and has a straight posterior end, while the male is slender and has a sharply curved posterior end.
- There are 4 longitudinal lines run the entire length of the body, 2 thin white dorsal and ventral lines and 2 broader and darker lateral lines.

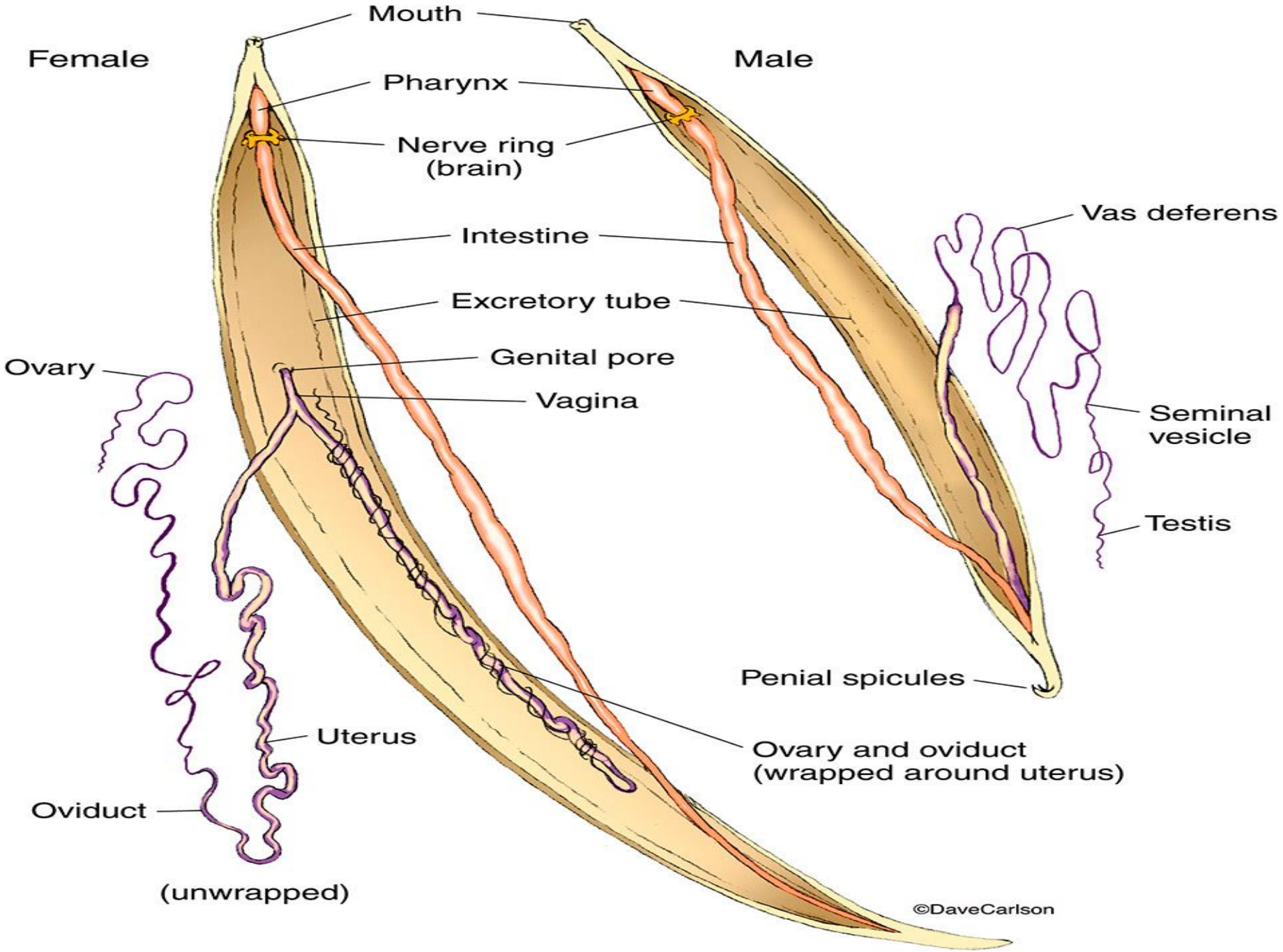

Male
Female

- The mouth lies at the anterior end of the body and the execratory pore lies on the ventral side, 2 mm behind the mouth.
- In females, the genital opening lies on the ventral side at the end of the first third of the body and the anus is located very close to the posterior extremity of the worm. In males, there is a cloacal opening (the genital duct joins with the hind gut) opens near the posterior end and two copulatory spicules project from the cloaca.


Female
Male
Mouth
Pharynx
Nerve ring
(brain)
Intestine
Excretory tube
Genital pore
Vagina
Ovary
Uterus
Oviduct
(unwrapped)
Ovary and oviduct
(wrapped around uterus)
Penial spicules
Vas deferens
Seminal
vesicle
Testis
©DaveCarlson

Digestive system

- The alimentary canal is straight, ribbon like and consists of three parts, a short stomodaeum, long midgut and a short proctodaeum.
- The stomodaeum is differentiated into a short buccal cavity followed by a long muscular oesophagus.
- The mouth is surrounded by three cuticular lips.
- Adult worms feed on semi-digested food and debris which are found in the intestine of the host.


Female
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Mouth
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(brain)
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Genital pore
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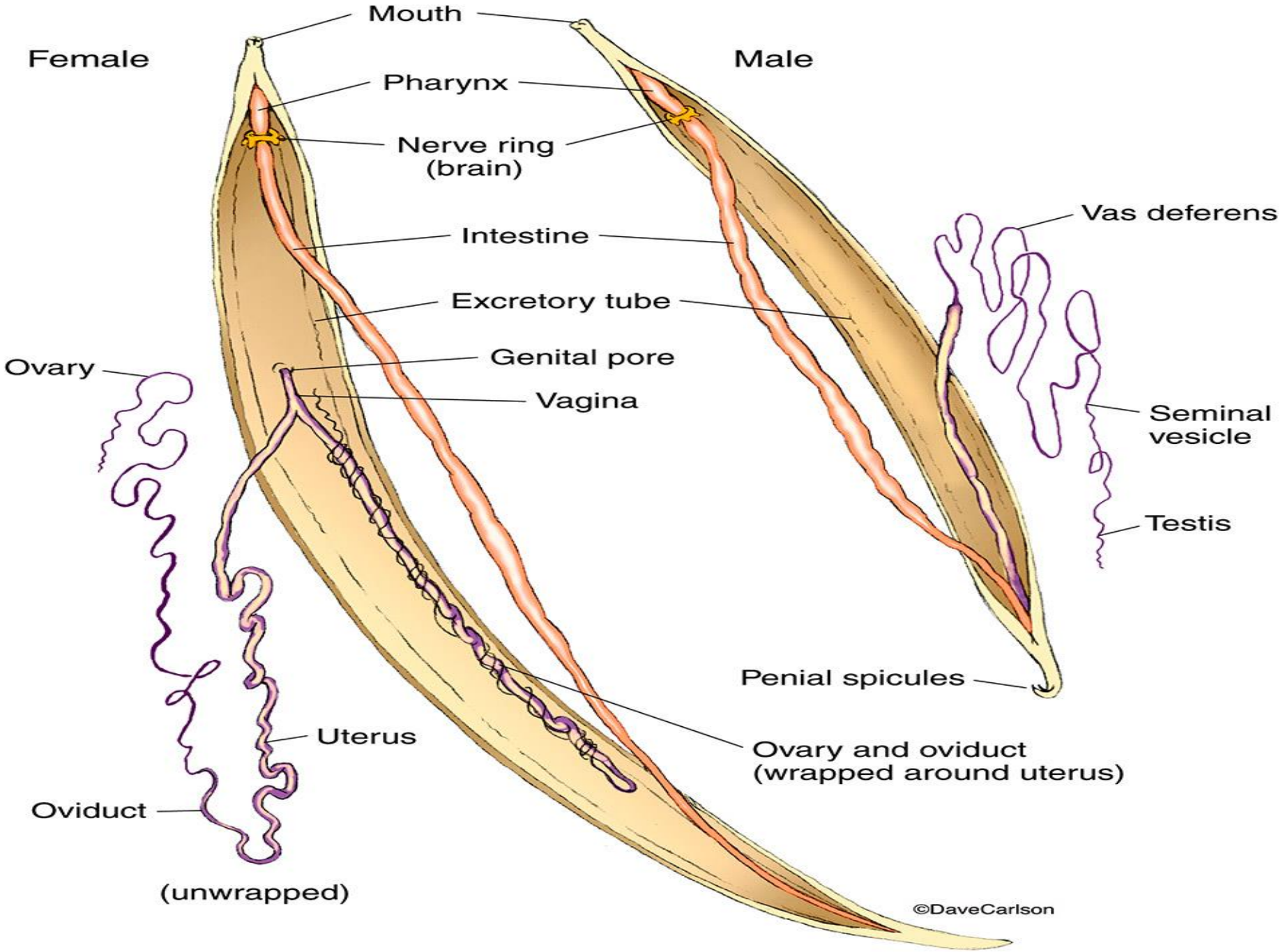
Ovary
Uterus
Oviduct
(unwrapped)
Ovary and oviduct
(wrapped around uterus)
Penial spicules
Vas deferens
Seminal
vesicle
Testis
©DaveCarlson

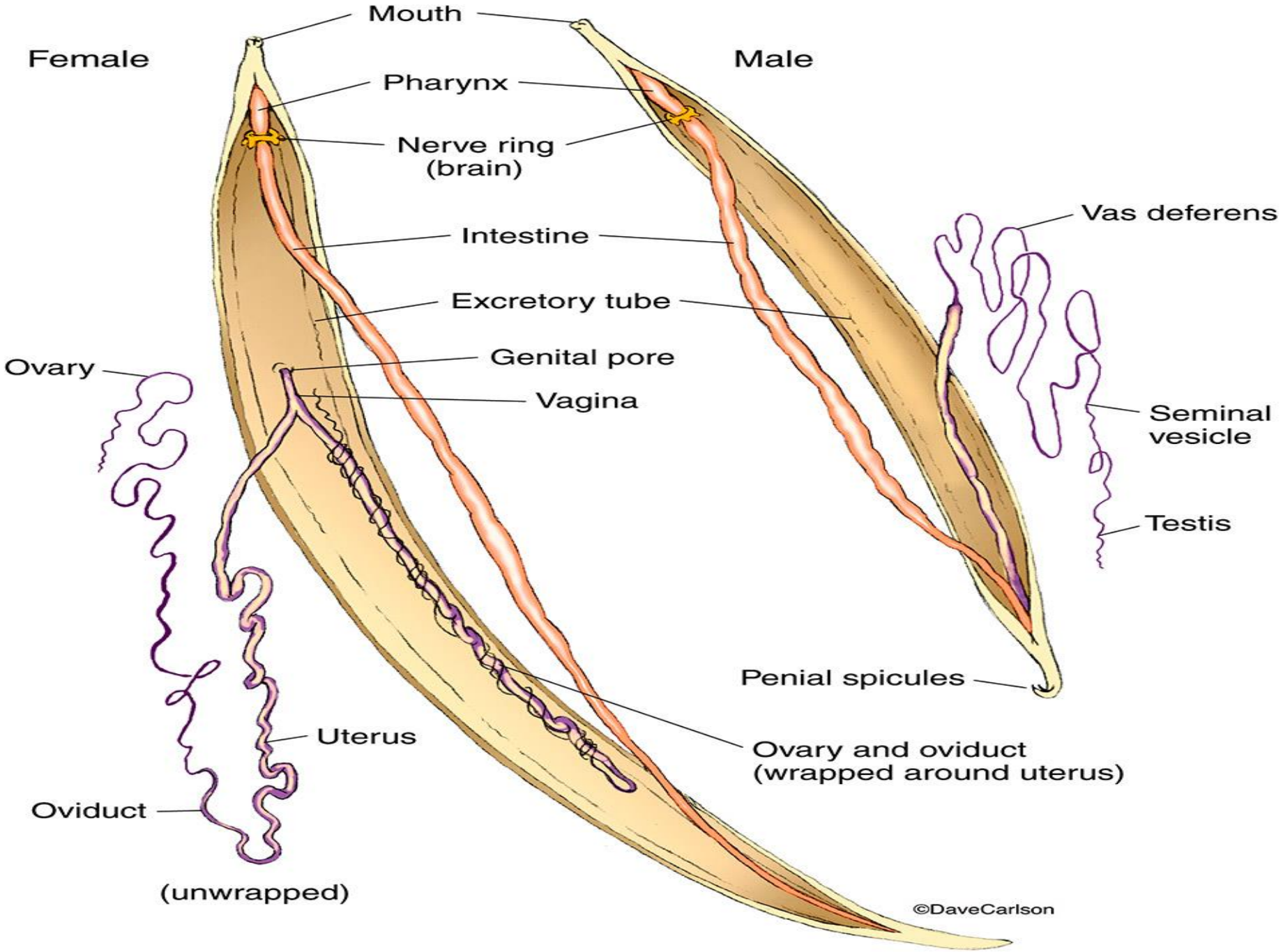
Male reproductive system

- The male genital system consists of a single thraed-like, much coiled testis. It leads to a coiled vas deferens which dilates into a wider vesicula seminalis. This opens with a short muscular ejaculatory duct into the hindgut, and to the outside by a cloaca.
- There are two copulatory spicules lying in the two small pouches dorsal to the ejaculatory duct.


Female
Male
Mouth
Pharynx
Nerve ring
(brain)
Intestine
Excretory tube
Genital pore
Vagina
Ovary
Uterus
Oviduct
(unwrapped)
Ovary and oviduct
(wrapped around uterus)
Penial spicules
Vas deferens
Seminal
vesicle
Testis
©DaveCarlson

Female reproductive system

- The female genital system consists of two thread-like coiled ovaries, one anterior and the other posterior. Each leads into a coiled oviduct. This leads into a wider uterus.
- The two uteri unite together and form a single vagina which tapers anteriorly and opens by the genital opening.


Female
Male
Mouth
Pharynx
Nerve ring
(brain)
Intestine
Excretory tube
Genital pore
Vagina
Ovary
Uterus
Oviduct
(unwrapped)
Ovary and oviduct
(wrapped around uterus)
Penial spicules
Vas deferens
Seminal
vesicle
Testis
©DaveCarlson

Subkingdom: Metazoa

Phylum: Annelida

General characters:

- These animals are found on land, in moist soil, freshwater or in the sea and they are free living or ectoparasites.
- They are triploblastic, coelomate and bilaterally symmetrical animals.
- They have an elongated and segmented body.
- The body covered with a thin non-chitinous cuticle and the body wall is muscular with circular and longitudinal muscles.

- They possess chaetae on the segments, some forms with parapodia.
- The alimentary canal is elongated and a tube like. It extends from the mouth to the anus.
- The respiration takes place through the external surface of the body.
- They have closed type of circulatory system, i.e., the blood flows in the blood vessels.
- The excretion takes place by tube-like organs, called nephridia. In each segment a pair or more nephridia are present.

- The nervous system consists of a pair of cerebral ganglia and double nerve cord, with pairs of lateral nerves in each segment.
- Sexes are separated or occur in the same body. Development may be direct or indirect through a trochophore larva. Regeneration is also common.

- **Classification:**

Class: Oligochaeta (e.g. *Allolobophora caliginosa*)

Class: Polychaeta (e.g. *Neries* sp.)

Class: Hirudinea (e.g. *Hirudo medicinalis*)

Class: Oligochaeta

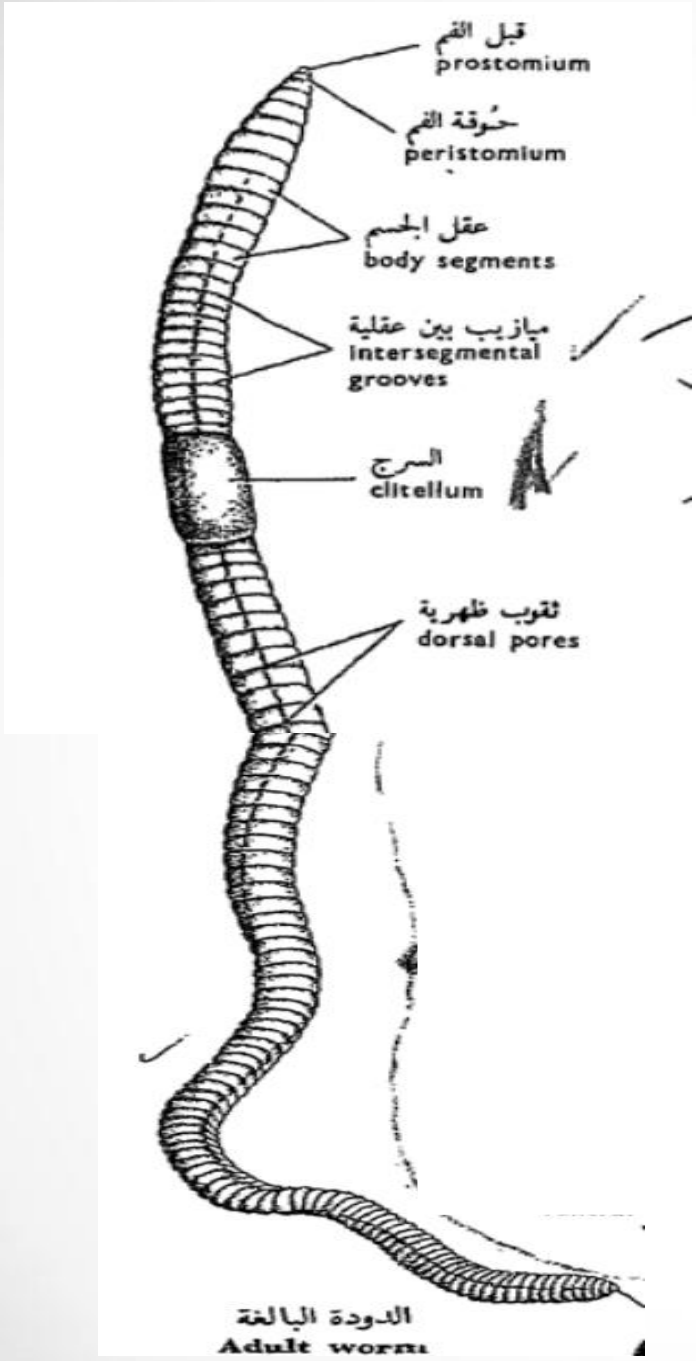
- They live in moist soil or in freshwater.
- They have numerous body segments, each carrying few chaetae.
- They are hermaphrodite and the development is direct.
- They include earthworms, e.g.: *Allolobophora caliginosa*.

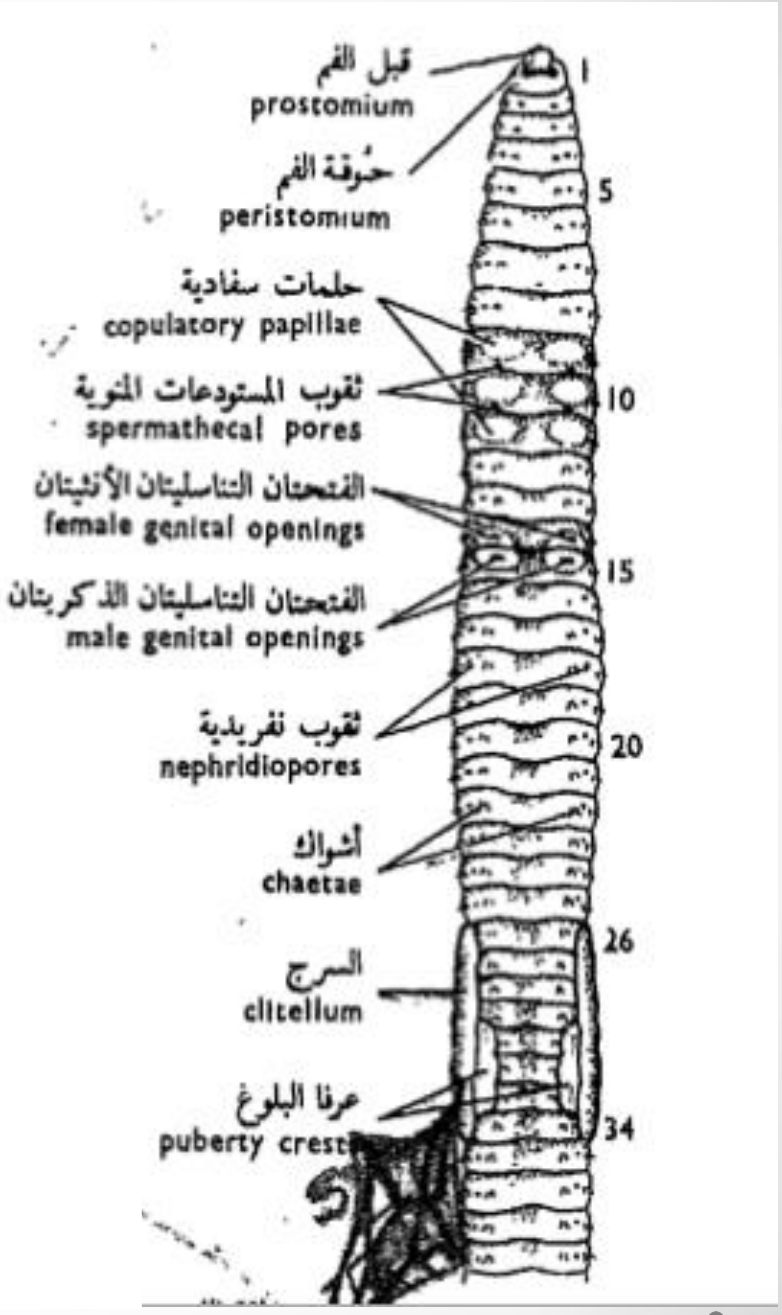
Allolobophora caliginosa

- The earthworms live in moist soil, build burrows and feed on organic matter.

General morphology:

- The body is cylindrical and divided into great number of segments (somites or metameres) separated by intersegmental grooves, pointed at the anterior end and flattened at the posterior end.
- The mouth and anus open at the anterior and posterior ends respectively.


قبل الفم
prostomium
حُوقة الفم
peristomium
عقل الجسم
body segments
مبازيب بين عقلية
intersegmental grooves
السرج
clitellum
ثقوب ظهرية
dorsal pores
الدودة البالغة
Adult worm

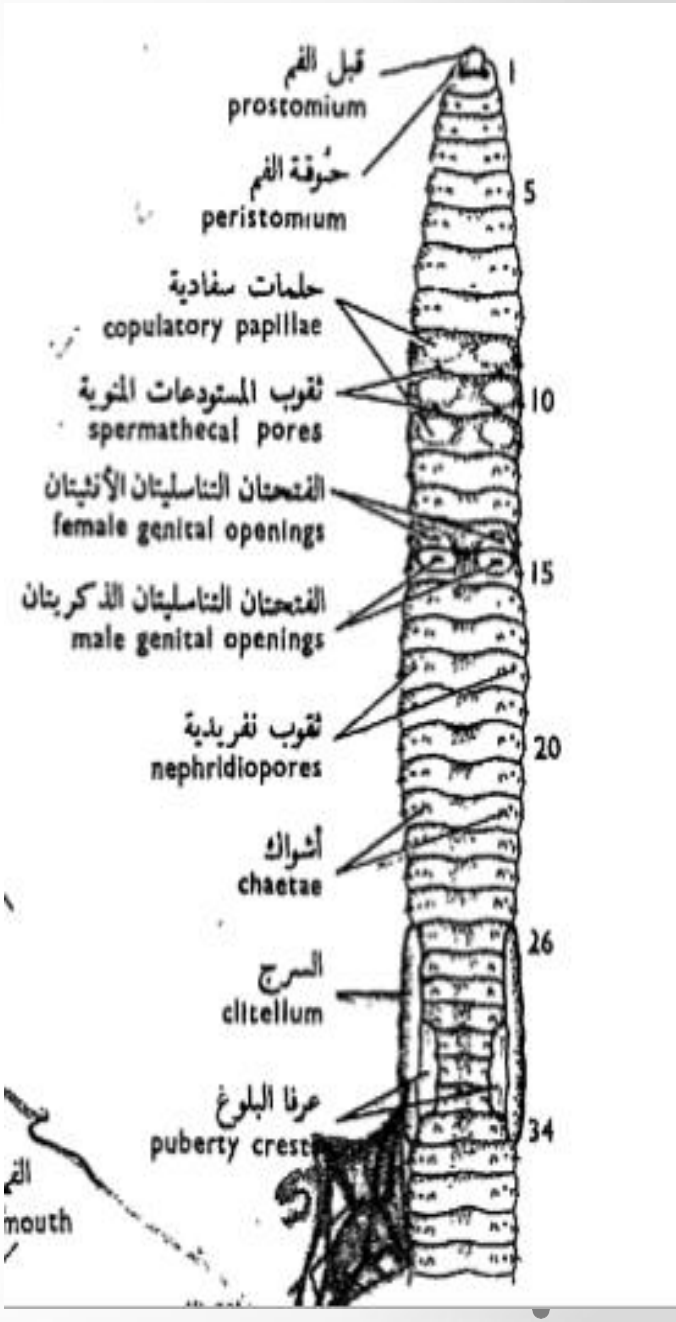

قبل الفم
prostomium
حُوقة الفم
peristomium
حلمات سفادية
copulatory papillae
ثقوب المستودعات المنوية
spermathecal pores
الفتحتان التناسليتان الأنثيتان
female genital openings
الفتحتان التناسليتان الذكريتان
male genital openings
ثقوب نفريدية
nephridiopores
أشواك
chaetae
السرج
clitellum
عرفا البلوغ
puberty crest
1
5
10
15
20
26
34

- The first segment in the body is called **peristomium** and a small club-shaped **prostomium** (which is not considered a true segment) projects above and in front of the mouth, and serves as upper lip.
- Every bodThe **clitellum** (secretes the cocoon) is the thickened skin of segments **26-34** and lies on the dorsal and lateral sides but theses segments are distinct on the ventral side. The edges of the clitellum are thickened on segments **31-33** forming the **puberty crests**.
- segment, except the first and the last, bears 4 pairs of **chaetae**, two ventral pairs and one pair on each lateral side.

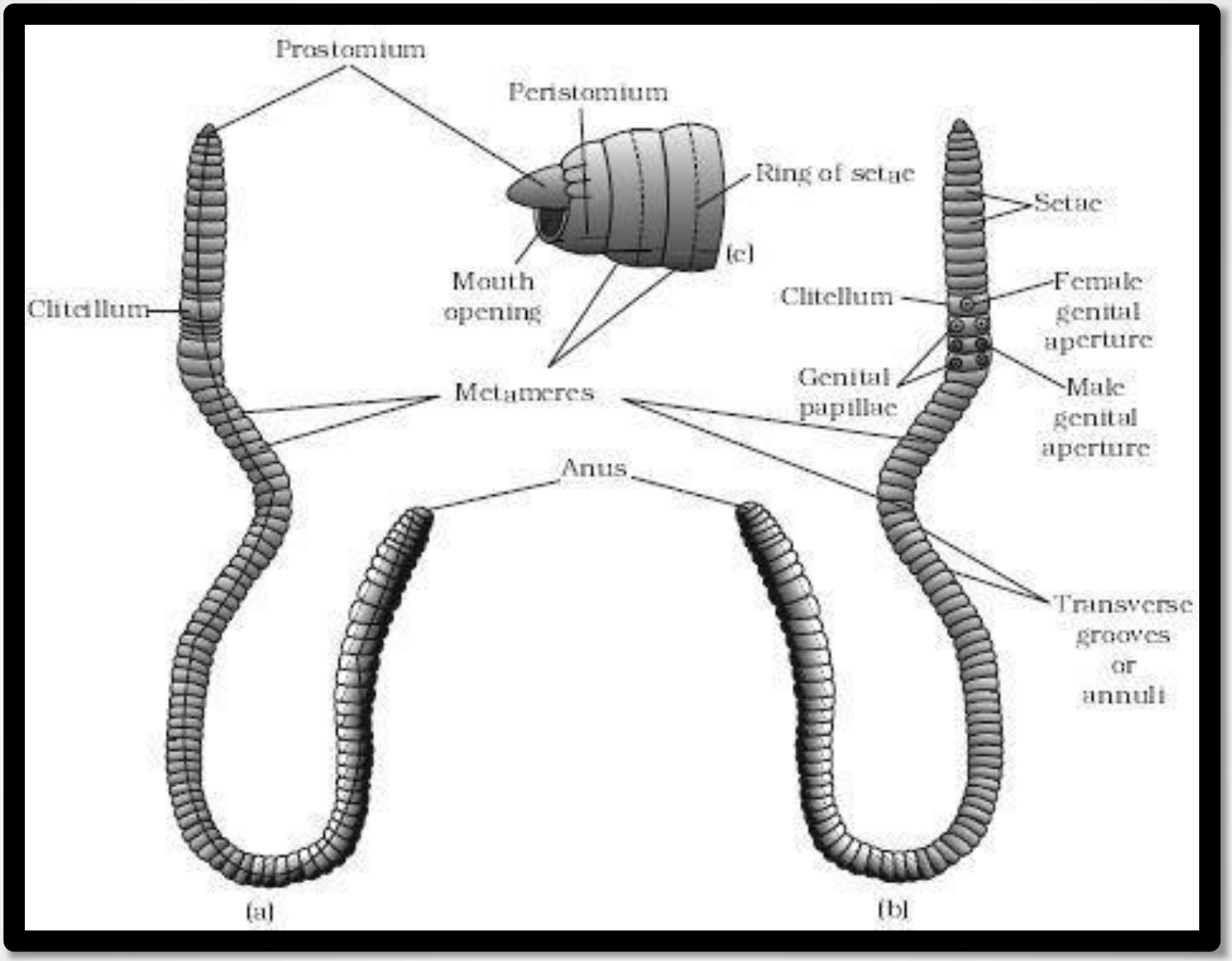
- **The external body openings:**
- The mouth on the first segment.
- The anus on the last segment.
- The female genital openings (2) on the ventro-lateral sides of

  segment 14.
- The male genital openings (2) on the

  ventro-lateral sides of segment 15.



- The **spermathecal pores** are 2 pairs lie in the intersegmental grooves between segments **9-10 and 10-11** and they are surrounded by three pairs of **copulatory papillae** on segments **9- 11**.
- **The dorsal (coelomatic) pores** lies mid-dorsaly on the grooves from **8-9** to the posterior end, connect the internal coelom with the external environment.
- **The excretory pores or nephridiopores** lie on the ventral side, a pair on each segment except the first three segments and the last segment.


Prostomium
Peristomium
Ring of setae
Setae
(c)
Mouth opening
Clitellum
Clitellum
Female genital aperture
Genital papillae
Male genital aperture
Metameres
Anus
Transverse grooves or annuli
(a)
(b)

Subkingdom: Metazoa
Phylum: Arthropoda

General characters:

- They are cosmopolitan in distribution, found as aquatic, terrestrial and aerial forms. Some are ectoparasites and vectors of diseases.
- They are triploblastic and bilaterally symmetrical animals.
- Body is segmented. Number of segments is less than those in Annelida and forms certain regions. It is divisible into head, thorax and abdomen.

NOTE: In some forms, body is divisible into cephalothorax (head and thorax are fused) and abdomen, or head and trunk.

- Body has jointed appendages or legs (which modified to different structures to perform different functions like jaws and walking legs).
- Body is covered with chitinous exoskeleton formed by epidermis. The exoskeleton forms internal projections useful for muscle attachment. The exoskeleton casts off periodically and a new one is secreted. That is called molting or ecdysis.
- True coelom is greatly reduced. It is represented only by the cavities of the reproductive and excretory organs. The general body cavity (haemocoel) is filled with blood.

- Digestive system is complete, straight and well developed. The mouth bears mouth parts for ingestion of food.
- Respiration takes place by general body surface or gills, trachea, booklungs or bookgills.
- Circulatory system is of opened type i.e. do not have blood vessels and the blood enters directly into the body chambers or (haemocoel), and returns back to the heart through ostia.
- Excretion takes place through Malphigian tubules (in terrestrial form) or green glands (in aquatic forms).

- Nervous system is of annelidian type, which consists of a brain and a ventral nerve cord.
- Sensory organs include antennae, sensory hairs for touch and chemoreceptor, simple and compound eyes, auditory organs (in insects) and statocysts (in crustaceans).
- Striated muscles are presented segmentary.

- Unisexual i.e. sexes are separated. Fertilization is internal or external. They are either oviparous or ovoviviparous. Development may be direct or indirect.
- Oviparous: lying eggs hatch out of the female body.
- Ovoviviparous: form eggs but still inside the female till hatching.

Classification:

- Subphylum: Branchiata
- Subphylum: Tracheata
- Subphylum: Chelicerata

Subphylum: Branchiata
Class: Crustacea

General characters:

- Mainly aquatic, few live in moist places. Few are parasitic forms.
- The body is divided into 3 regions: head, thorax (usually fused in one part : cephalothorax) and abdomen or head and trunk.
- The head contains 6 segments:

The first segment usually does not bear any appendages in adult.

The second bears the first antennae or (antennules).

The third bears the second antennae or (Antennae).

The fourth bears the Mandibles.

The fifth bears the first maxillae or (Maxillules).

The sixth bears the second maxillae or (Maxillae).

- The thoracic and abdominal segments differ from one crustacean animal to another, but generally each segment with a pair of appendages and sometimes disappear from abdomen.

- The digestive tract is almost straight. It consists of an anterior foregut and a posterior hindgut, both lined by chitin and separated by the unchitinised midgut which often gives rise to digestive glands.
- The opened circulatory system includes a contractile heart enclosed in pericardial cavity.
- Respiration takes place by general body surface or gills.
- Excretion takes place through coxal or antennal glands (green glands).
- The sexes are usually separated. Development is usually indirect forming (Nauplius larva).

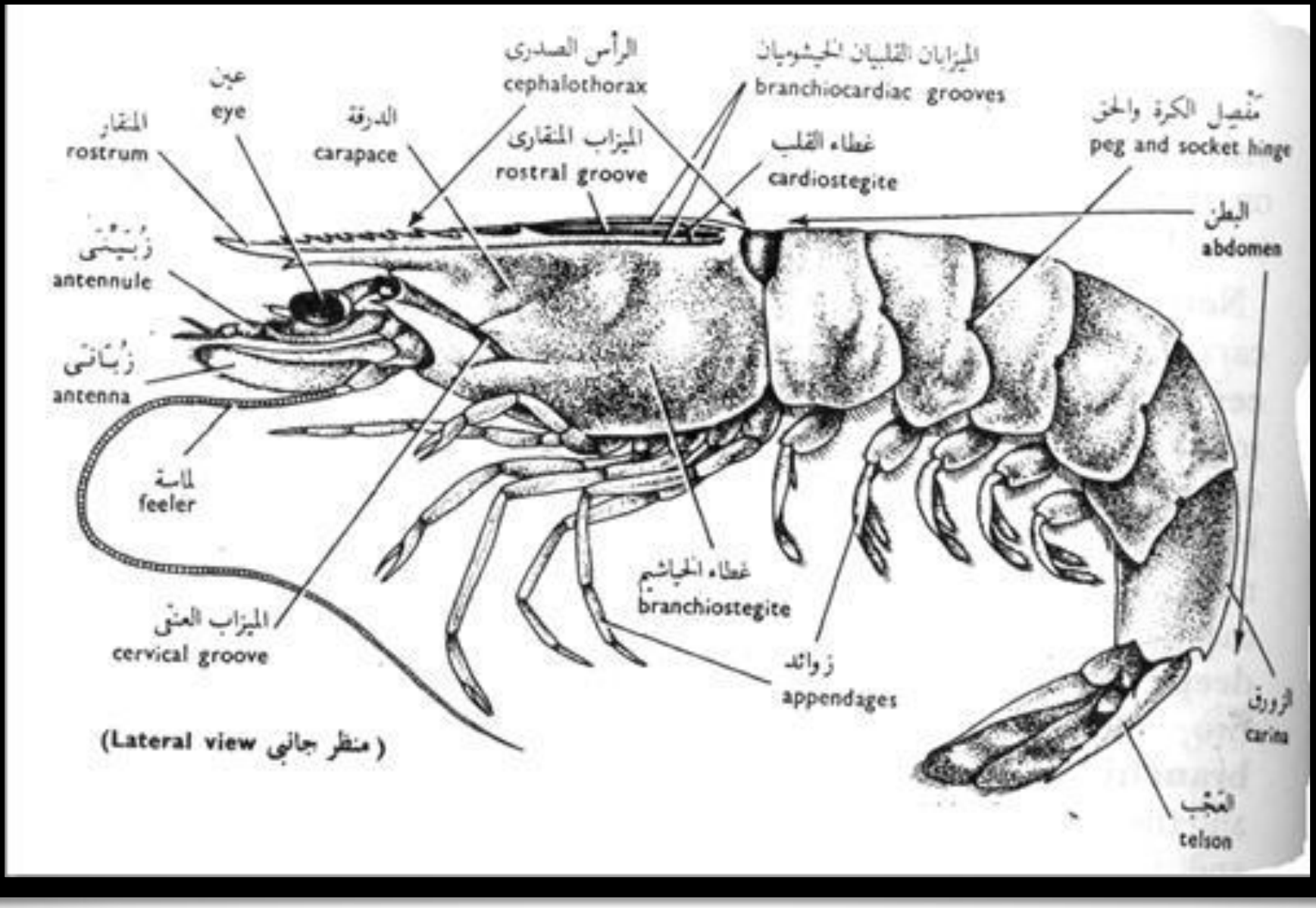
Penaeus Japonicus

General features :

- It is a prominent member of our marine fauna.
- The body is divided into an anterior cephalothorax and a posterior abdomen.
- The cephalothorax (6 cephalic + 8 thoracic segments) is covered on all sides except ventrally by carapace which extended anteriorly into a long serrated pointed rostrum.
- No external signs of segmentation on head and thorax.

- On each side of the carapace, a V-shaped cervical groove that demark between head and thorax. Also note 3 dorsal grooves two of these are branchiocardiac grooves and the third is the rostral groove.
- The dorsal part of carapace is called cardiostegite and the sides are called branchiostegite.
- On both sides of rostrum, two compound eyes are present carried on long stalks. Each eye made up of a large number of structural & functional units called ommatidia.

- The abdomen with (6) segments ended with a small telson and the anus opens on its ventral surface.
- The segments of abdomen can be moved upon one another according to the presence of the peg and socket hinges on each side.
- A pair of appendages arises on each segment of the body. So 19 pairs of appendages are present in adult animal.


المنقار
rostrum
عين
eye
الدرقة
carapace
الرأس الصدرى
cephalothorax
الميزابان القلبيان الخيشوميان
branchiocardiac grooves
الميزاب المنقارى
rostral groove
غطاء القلب
cardiostegite
مفصل الكرة والحق
peg and socket hinge
البطن
abdomen
زُبَيْنَى
antennule
زُبَانَى
antenna
لامسة
feeler
الميزاب العنقى
cervical groove
غطاء الخياشيم
branchiostegite
زوائد
appendages
الزورق
carina
المِخْبَ
telson
(Lateral view منظر جانبي)


© A. Barrère

Subphylum: Tracheata
Class: Myriapoda

General characters:

- All are terrestrial.
- The body is elongated with a head and a trunk consisting of many segments between 11-177 segments, each one bears one or two pairs of appendages.
- Each appendage with 7 segments and a claw.
- The head bears two antennae, two or three pairs of jaws and simple eyes.

- Respiration through spiracles which connected internally with the tracheal system.
- Excretion through Malpighian tubules which open in the hind-gut.
- Sexes are separated. Development is usually direct.

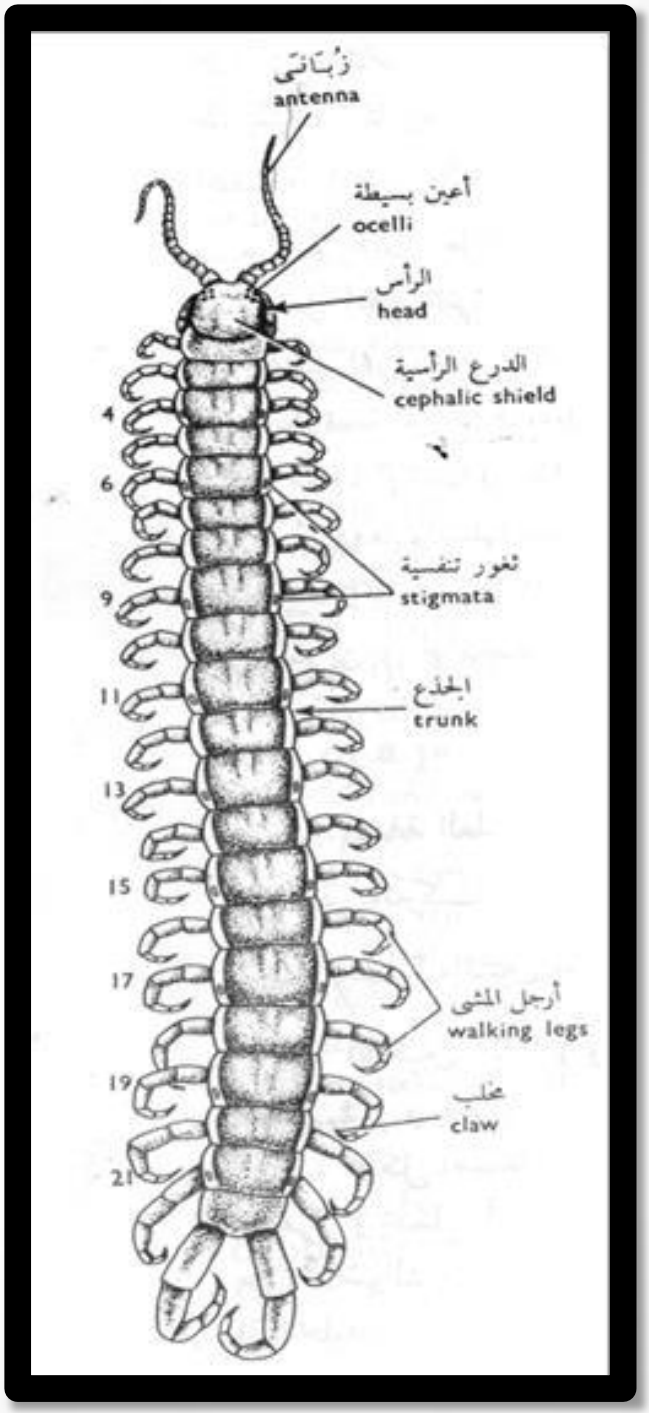
Scolopendra morsitans

General features :

- Hides by the day below stones or plant leaves and runs faster at night to prey insects and earthworms.
- The body is elongated, dorsoventrally flattened and divided into head and trunk.
- The head consists of 6 segments covered by a cephalic shield. There are two lateral groups of simple eyes (ocelli), each group of 4 ocelli. The head bears two segmented antennae (the main sensory organs).

- The trunk consists of 22 segments, each segment covered by a dorsal tergum, ventral sternum and 2 lateral pleura. The first segment has no separate tergum (maybe fused with the cephalic shield), this segment bears ventrally the maxillipeds or two poison claws, each ends in a sharp claw on which opens the poison gland.

- Each segment, beginning from 2 to 22 carries one pair of walking legs (which together with the 2 antennae make the 44 appendages). Each leg is built up of 7 segments named from the base: coxa, trochanter, femur, tibia and 3 tarsi ending in a claw.
- Paired respiratory openings or stigmata lie on the pleural shields of the segments 4, 6, 9, 11, 13, 15, 17, 19 and 21. Note that these segments longer than the other segments. The anus opens ventrally on the last segment.


زُبَانَى
antenna
أعين بسيطة
ocelli
الرأس
head
الدرع الرأسية
cephalic shield
4
6
ثغور تنفسية
stigmata
9
11
الجذع
trunk
13
15
17
أرجل المشى
walking legs
19
مخلب
claw
21

Subphylum: Chelicerata
Class: Arachnida

General characters:

- Most are terrestrial and some are aquatic.
- The body is divided into two regions: the prosoma and the opisthosoma. The prosoma includes head and thorax and in adult consists of 6 segments: the first bears a pair of chelicera, the second bears a pair of pedipalps and the 4 other segments with 4 pairs of walking legs. The opisthosoma consists of 12-13 segments and divided into mesosoma and metasoma (or not divided) and usually without any appendages.

- Respiration by lung-books, tracheae or by gill-books in aquatic forms.
- Excretion by coxal glands or Malpighian tubules.
- Open circulatory system.
- Sexes are separate and development is usually direct.
- The exoskeleton is strongly chitinized.

Buthus quinquestriatus

General features :

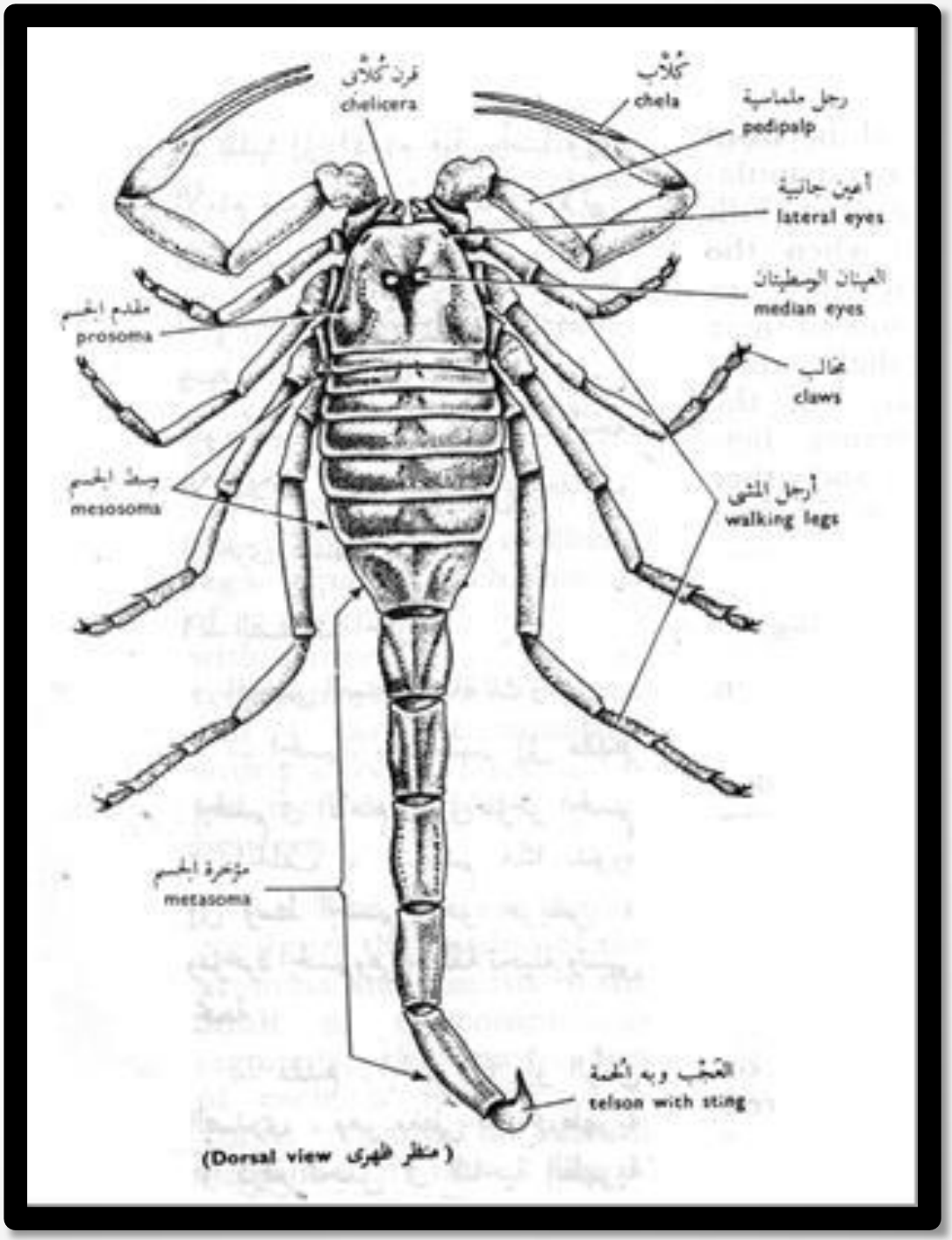
- It is a dangerous animal, spread in tropical and temperate regions.

  It is nocturnal (active at night), feeds on juice of insects and spiders.

- The body is divided into prosoma and opisthosoma which is subdivided to a broad mesosoma and a slender matasoma ends in a sting.

- The prosoma is covered by a dorsal shield (carapace) which carries dorsally a pair of median eyes and two groups each of 5 smaller lateral eyes (all are simple).
- The prosoma carries 6 pairs of appendages: the chelicerae (with a chela), the pedipalps (as feelers and with toothed pincers for offensive action) and 4 pairs of walking legs.

- The mesosoma in adult consists of 6 segments, the first segment carries on its ventral side a divided genital operculum covers the genital opening. The second segment carries a pair of comb-like structures (the pectens) act as tactile organs (longer in the male). The 4 other segments with 4 pairs of stigmata on their ventral side, lead internally into the lung-books.
- The metasoma consists of 6 narrow cylindrical segments jointed to one another. The last segment terminates with the telson which forms the sting. Two poison glands are found within the sting and open near the spine.


قرن كلاّبي
chelicera
كلاّب
chela
رجل ملمسية
pedipalp
أعين جانبية
lateral eyes
العينان الوسطيتان
median eyes
مقدم الجسم
prosoma
مخالب
claws
وسط الجسم
mesosoma
أرجل المشي
walking legs
مؤخرة الجسم
metasoma
العَجَب وبه الحمة
telson with sting
(منظر ظهري Dorsal view)


MINDEN
PICTURES
00770753 © Stephen Dalton / Minden Pictures

Subkingdom: Metazoa
Phylum: Mollusca

General characters:

- Lives in water (freshwater or marine) and some forms are terrestrial. Molluscs come in the second rank after arthropods according to the number of species.
- They are triploblastic, mostly bilaterally symmetrical except class: Gastropoda.
- The body is soft, unsegmented without any appendages and divided into: head, a ventral foot and a dorsal visceral hump (no head in class: Bivalvia).

- The visceral hump is covered by a thin, fleshy fold called mantle. Mantle secretes a calcareous shell, which may be external or internal or not present at all.
- Mantle also encloses an opened mantle cavity, within lie a pair of gills, the anus and renal openings.
- Coelom is reduced represented by the pericardial cavity, cavities of gonads and kidneys.
- Respiration by gills in aquatic forms and by lungs in terrestrial forms.

- The circulatory system is open (except class: Cephalopoda) consists of a heart enclosed in a pericardial cavity and extends into a haemocoel.
- The nervous system contains 3 doubled ganglia: the cerebral, pedal and lateral ganglia and maybe visceral ganglion in some forms. Sense organs are eyes, tentacles and statocyst.
- Locomotion takes place by ventral muscular foot.

- The digestive system with salivary and digestive glands. The mouth with a hard chitinous structure, called radula or odontophore (absent in class: Bivalvia).

- Sexes are usually separate and some are hermaphrodite. Development may be direct or indirect forming larvae.

Classification:

- Class: Placophora
- Class: Gastropoda
- Class: Pelecypoda
- Class: Cephalopoda

Class: Placophora

General characters:

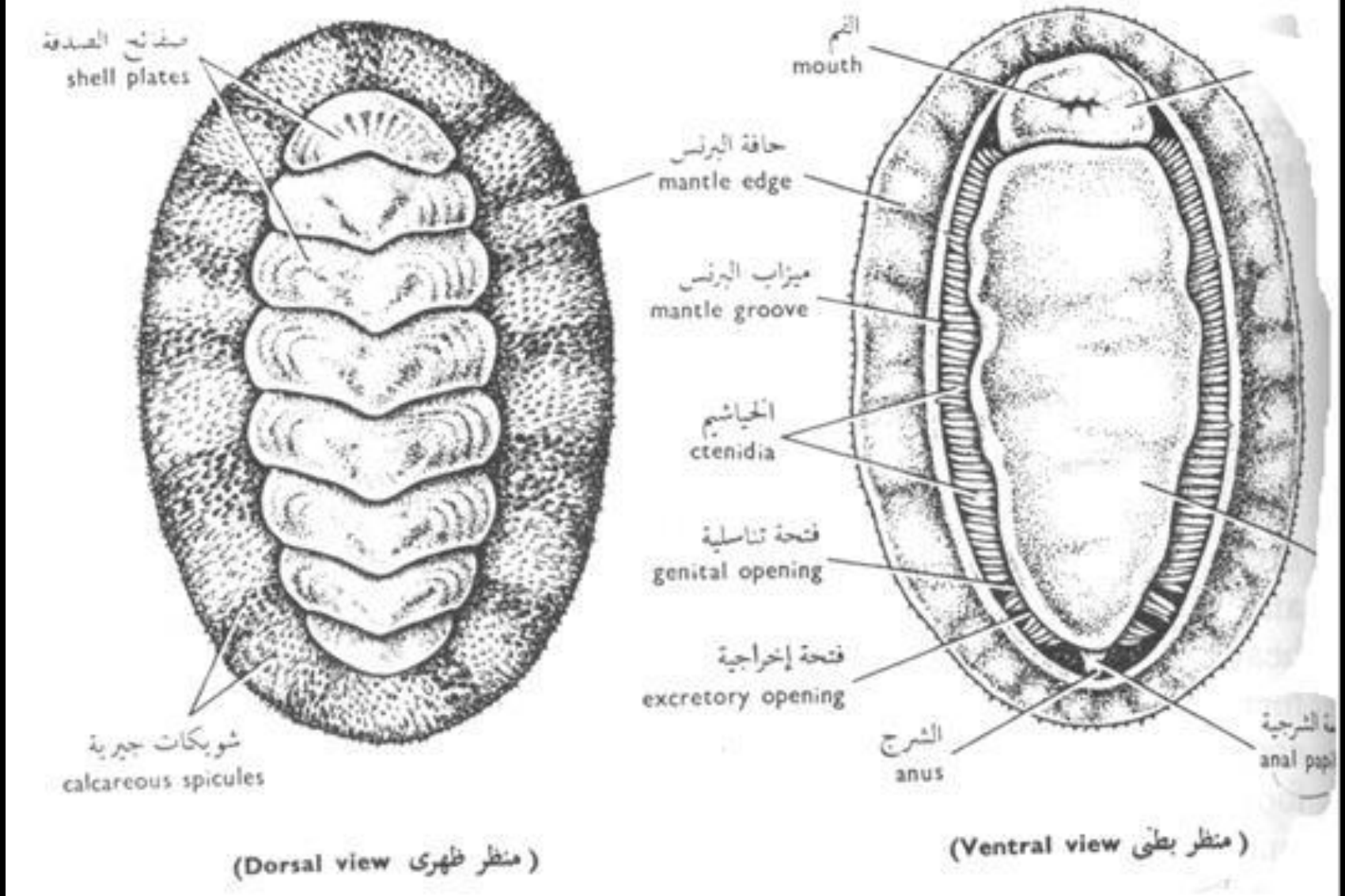
- All are marine, present in all depths and contains all chitons.
- Head is poorly developed without eyes or tentacles.
- Mantle covers all dorsal surface and secrets calcareous spicules and usually also a shell.
- Foot is flattened and large like a sucker.
- Feeds on aquatic plants and algae.
- Development includes larvae called: trochophore.

Acanthochiton spinigera

General features :

- It is common on our sea coasts, adhering to rocks, but when separated strongly from the rock, it rolls itself up to more or less spherical form like a ball.
- The body is elongated and oval in shape. The mantle secrets in the dorsal side a calcareous shell formed of 8 overlapped plates, enabling the animal to roll into a ball. The mantle edge contains calcareous spicules.

- In the ventral side, the head is small with only a mouth. The foot is large acts as a creeping organ and as a sucker.
- The mantle cavity is a groove between head-foot and the mantle edge, within found the gills on each side. The anus opens on a papilla projecting behind the foot. In front of anus on each side, an excretory pore and a genital opening are found.


صفائح الصدفة
shell plates
شويكات جيرية
calcareous spicules
(منظر ظهرى Dorsal view)
الفم
mouth
حافة البرنس
mantle edge
ميزاب البرنس
mantle groove
الخياشيم
ctenidia
فتحة تناسلية
genital opening
فتحة إخراجية
excretory opening
الشرج
anus
anal papi
(منظر بطنى Ventral view)


WiseGEEK

Class: Gastropoda

General characters:

- Gastropoda is the largest class of molluscs, lives in marine water, freshwater and on land.
- The head and foot are fused in one structure (the head-foot), this part is bilaterally symmetrical, but the visceral hump is asymmetrical, due to two processes happened in the embryonic stages called: the torsion and the spiral coiling.

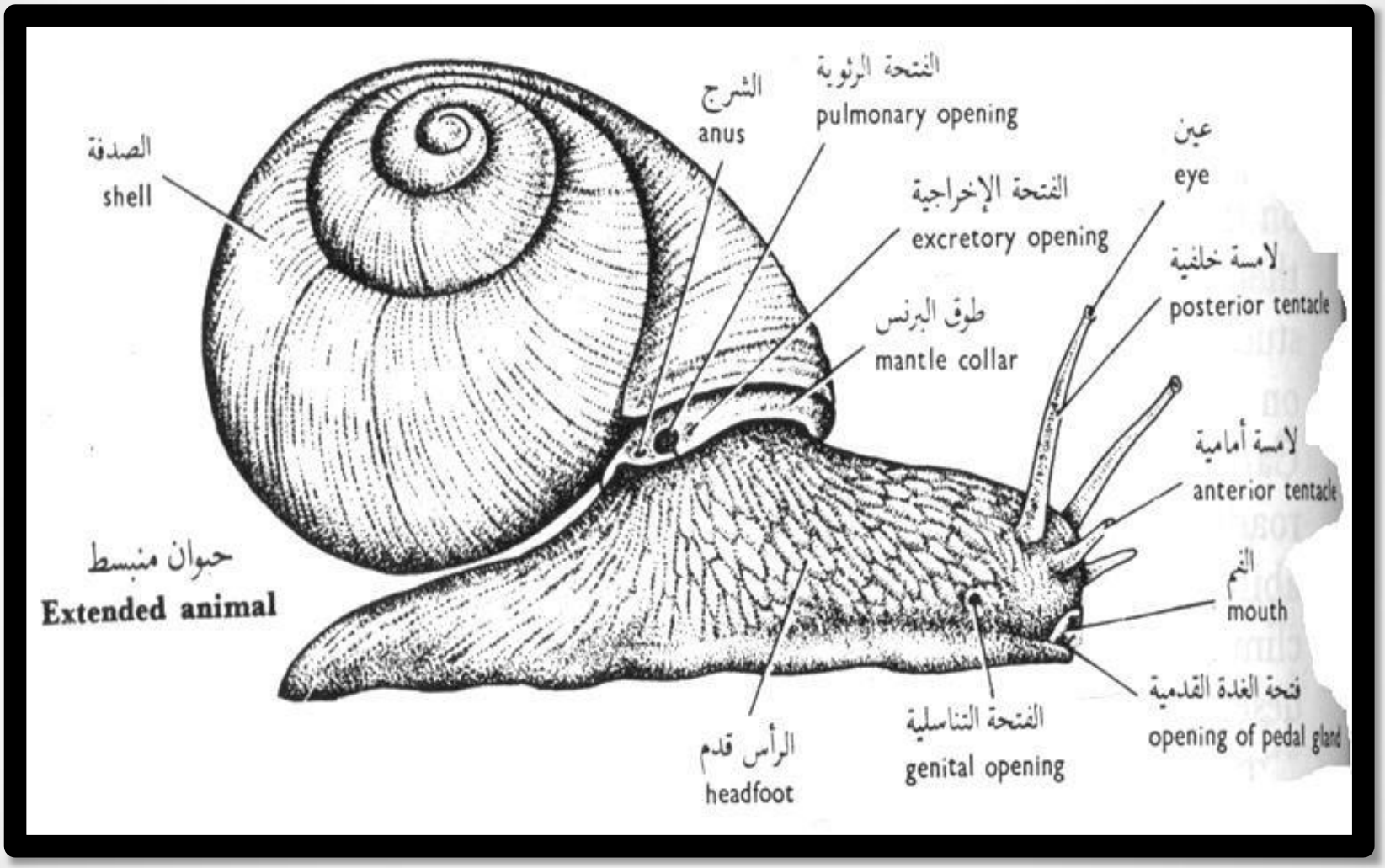
- The mantle forms a coiled shell with different colors but sometimes disappear from some forms like slugs.
- Development is direct.
- It is herbivorous, and some species are predators or parasitic.
- Some species act as intermediate hosts for some parasites like *Fasciola* and *Schistosoma*.

Eremina desertorum

General features :

- It is common in the Egyptian desert, feeds on leaves and stems of desert plants. It is nocturnal and hides in its shell during the day. It is active in winter.
- The head-foot mass bears anteriorly: the mouth, below it, an opening of a gland (the pedal gland) produces a slimy secretion. There are 2 pairs of tentacles: the anterior pair is short, but the posterior one is long with two black eyes. A single genital opening found on the right side of head.

- The visceral hump is spirally coiled and occupies the shell whorls. The mantle form a thick ring called the mantle collar, bears on the right side: the pulmonary opening which leads internally to a cavity rich with blood vessels and acts as a lung. Note also the anus and the execratory opening on the mantle collar.
- The shell with 4 whorls and it is dextral.


الصدفة
shell
الشرج
anus
الفتحة الرئوية
pulmonary opening
عين
eye
الفتحة الإخراجية
excretory opening
لامسة خلفية
posterior tentacle
طوق البرنس
mantle collar
لامسة أمامية
anterior tentacle
حيوان منبسط
Extended animal
الفم
mouth
فتحة الغدة القدمية
opening of pedal gland
الفتحة التناسلية
genital opening
الرأس قدم
headfoot


Oz Rittner
Eremina desertorum (Forsskal, 1775)
ברחול המדבר

Class: Pelecypoda

General characters:

- Most are marine and some are freshwater.
- The mantle consists of two lobes (right and left), so the shell is bivalve, the two valves hinged dorsally and jointed by a ligament.
- The head is reduced, only labial palps around the mouth. No radula because they are ciliary feeders.

- Moves very slowly by the foot, but mostly buried in the sand with its front.
- Sexes usually separated, but some are hermaphrodite. Development includes a larva called: veliger larva in marine forms.

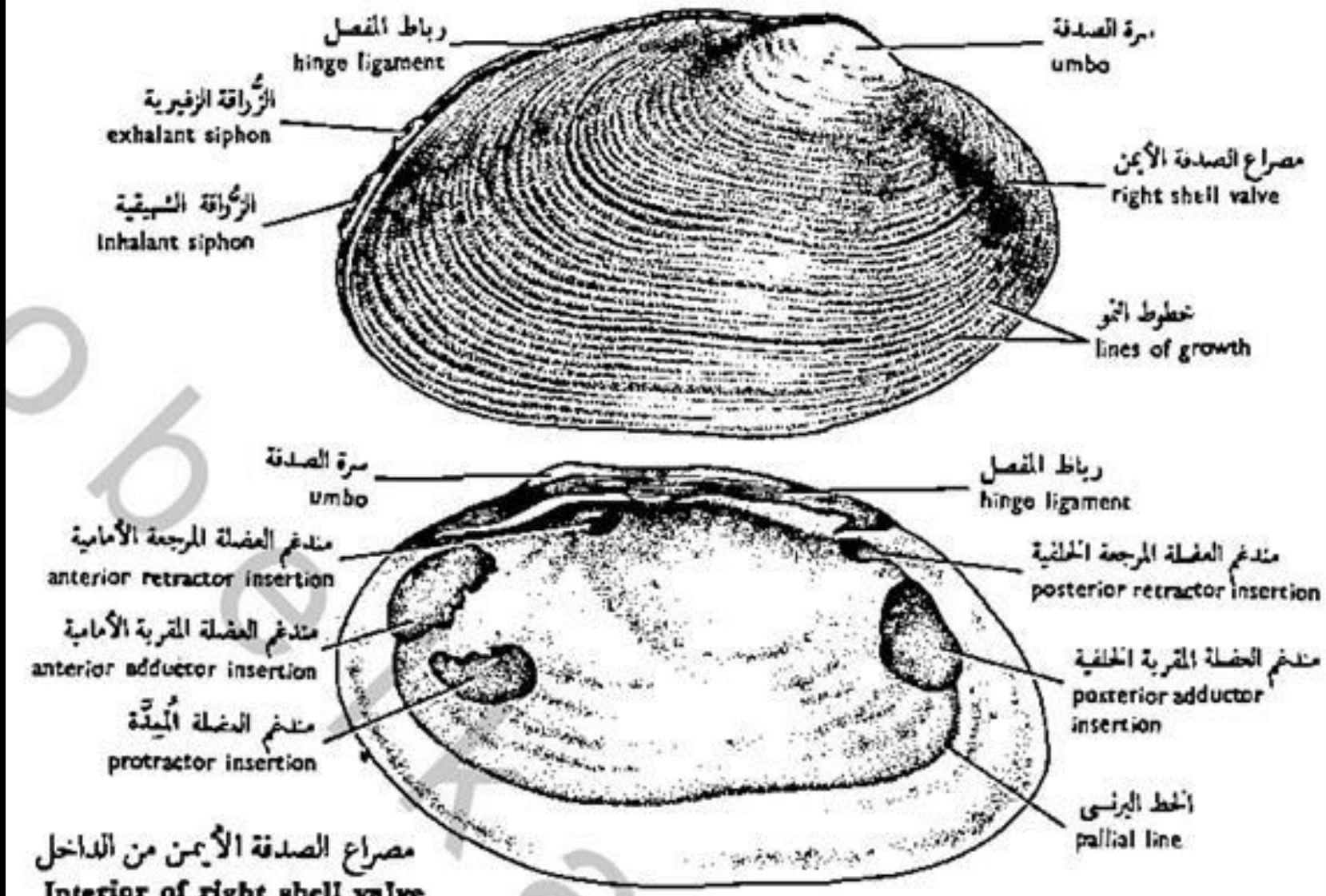
Anodonta rubens

General features :

- It lives on the bottom of the river.
- The shell with 2 lateral valves, hinged dorsally. The umbo is a swollen apex found near the anterior part. Note the parallel lines of growth on the outer surface.
- Internally, the mantle consists of 2 lobes, which united together posteriorly to form two tubes: the exhalent siphon (small and smooth-walled) and the inhalent siphon (wider and papillated edges for testing water).

- The visceral hump is the compressed mid-dorsal portion of the body.
- The foot is a large mass, which drags the animal very slowly in the bottom mud.
- The labial palps are 2 around the mouth carry cilia which drive food particles towards the mouth.
- The gills are 2 in number, very large and each one is formed of two plate-like folds.

- The muscles showing on the mantle surface are: the anterior and posterior adductor muscles which controlling the shell valves. The anterior and posterior retractor muscles which withdraw the foot are inside the shell. The protractor muscle which forcing the foot is outside the shell. Note the insertions of these muscles on the smooth inner surface of each valve.


رباط المفصل
hinge ligament
سرة الصدفة
umbo
الزُّراقة الزفيرية
exhalant siphon
مصراع الصدفة الأيمن
right shell valve
الزُّراقة الشهيقية
inhalant siphon
خطوط النمو
lines of growth
سرة الصدفة
umbo
رباط المفصل
hinge ligament
مندغم العضلة المرجعة الأمامية
anterior retractor insertion
مندغم العضلة المرجعة الخلفية
posterior retractor insertion
مندغم العضلة المقربة الأمامية
anterior adductor insertion
مندغم العضلة المقربة الخلفية
posterior adductor insertion
مندغم العضلة المُبعِّدة
protractor insertion
الخط البرنسي
pallial line
مصراع الصدفة الأيمن من الداخل
Interior of right shell valve

Class: Cephalopoda

General characters:

- All are marine; it is the highest molluscs in development.
- The shell present internally or absent.
- The head is well-developed, with large eyes (as vertebrates eyes). The head bears a number of tentacles and arms (8-10) with strong suckers to capture the prey. These arms maybe are the modified anterior part of foot, thus called: Cephalopoda (head-foot).

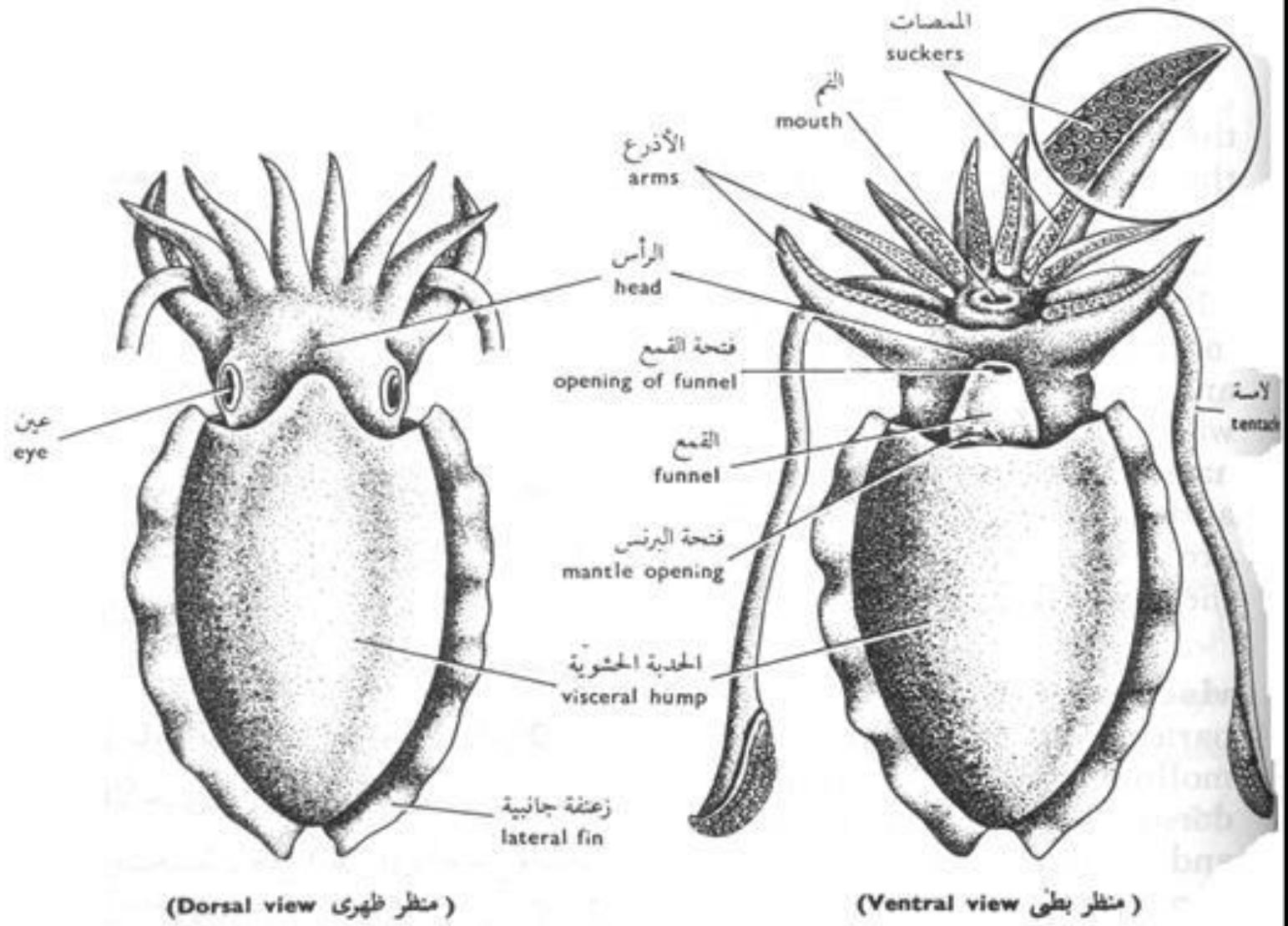
- They are predators, so the mouth contains the radula and two sharp horny claws.
- The mantle cavity present in the ventral side contains the gills, anus, excretory and genital openings, also a muscular funnel opens in the cavity (it is the posterior part of foot).
- The circulatory system is closed.

Sepia savignyi

General features :

- The body is divided into a head and a visceral hump.
- The head with 2 large eyes similar to those of vertebrates. Also bears the mouth which surrounded by 8 arms (each arm is provided with 4 rows of suckers) and two long tentacles. The tentacles are used in catching the prey and the arms for holding it during eating.

- A muscular funnel found in the ventral side of the head, it opens in the mantle cavity. The water from the mantle cavity is forced out through the funnel opening causing the animal jerk backwards and emits a cloud of ink to escape from enemies.
- The visceral hump with 2 lateral fins, by which the animal swim. An internal shell present in the dorsal side of the visceral hump beneath the integument. Ventrally, the mantle cavity opens with a wide anterior mantle opening.


المصات
suckers
الفم
mouth
الأذرع
arms
الرأس
head
فتحة القمع
opening of funnel
لامسة
tentacle
عين
eye
القمع
funnel
فتحة البرنس
mantle opening
الحدبة الحشوية
visceral hump
زعنفة جانبية
lateral fin
(منظر ظهرى Dorsal view)
(منظر بطنى Ventral view)

Subkingdom: Metazoa
Phylum: Echinodermata

General characters:

- All are marine, found in the shores to the great depths. Includes forms quite different from the preceding invertebrates.
- Some are free living and some are sessile.
- Adults are radially symmetrical while larvae are bilaterally symmetrical.
- The body is not divided, with different shapes (star, rounded or cylindrical).

- They possess a dermal skeleton consists of calcareous ossicles which may develop into short or long spines pushes out on the surface, thus the name: Echinodermata.
- The coelom divided into several divisions (perivisceral coelom, perihaemal cavity and a water vascular system characterizes this phylum).
- The water vascular system is connected to tube feet present on the outer body surface, these feet are the main locomotion organs but can also assist in sensation, respiration and food collection.

- Respiration by dermal gills, tube feet or respiratory tree in class: Holothuroidea .
- The nervous system with circumoral nerve ring and radial nerves in all body.
- The digestive system is usually complete but in some forms there is no anus.
- The circulatory system is very reduced.
- No special excretory organs.

- The sexes is usually separated and the development maybe direct or including larva formation.
- Show high power of regeneration.

Classification:

- Class: Asteroidea
- Class: Holothuroidea

Class: Asteroidea

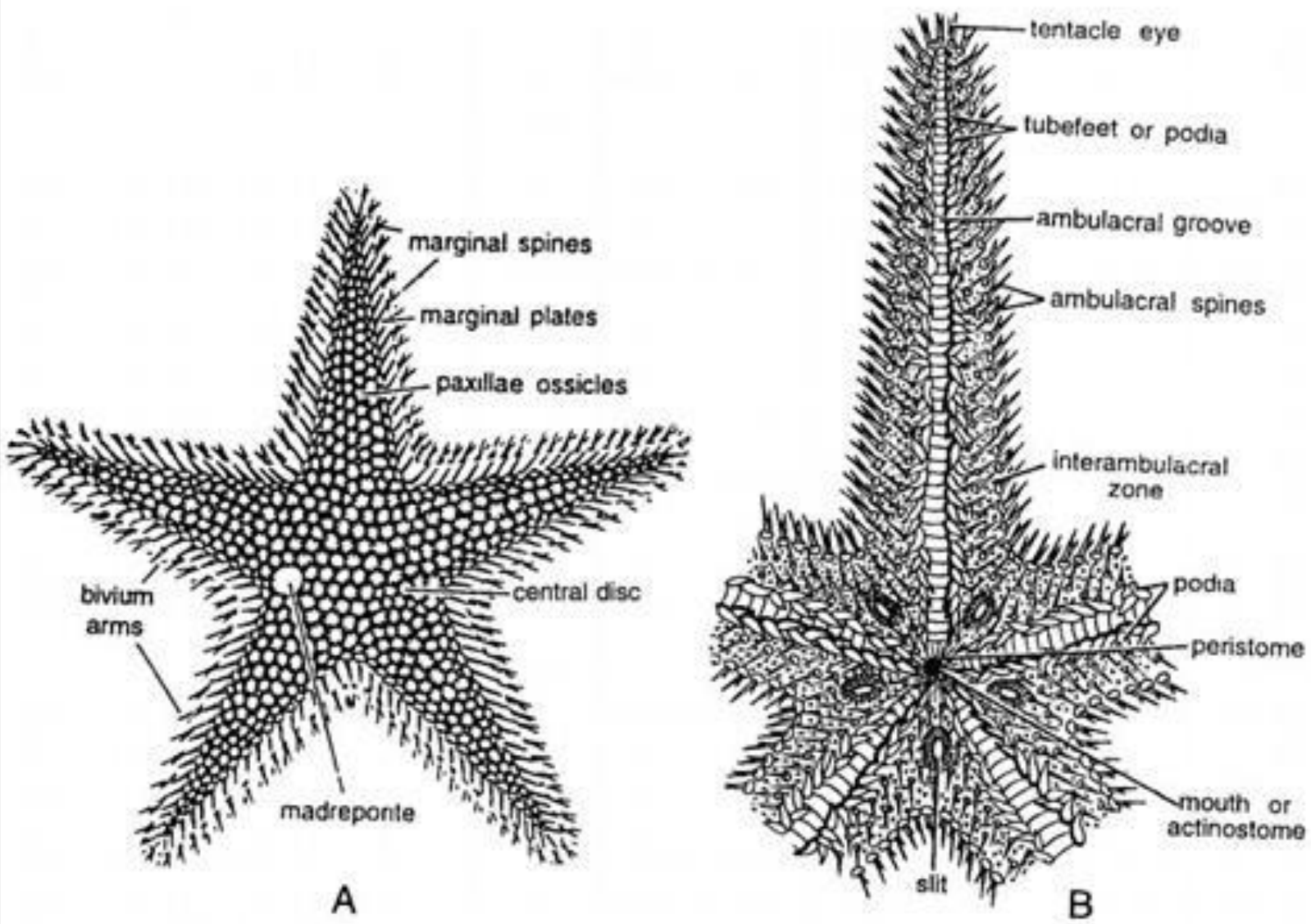
Astropecten relitaris

General features :

- It is common on our sea, creeps slowly on the bottom but in rest it lies buried in the sand except the central part.
- The body is star-shaped, consisting of a central disc prolonged into 5 arms. The body with two surfaces: a lower oral surface and an upper aboral surface.

- On the aboral surface, note the pointed spines on the edges of each arm and a blunt spines found in bundles called: the paxillae. Very minute dermal gills arise between the paxillae. Note also a plate with pores in the central disc, opposite to the angle between any two arms. This plate (the madreporite) leads into the water vascular system.

- On the oral surface, note the mouth in the centre, surrounded by a soft area (the peristome). Five ambulacral grooves extended out from the mouth along the entire length of each arm. Note, conical structures (the tube feet) project in 2 rows along each ambulacral groove. The terminal tube foot (called: the tentacle) has a pigmented spot (the eye) on its base. Note the different types of spines and the very small modified spines which known as pedicellariae, these small spines clean the body surface and the ambulacral grooves.



Astropecten. **A.** Aboral view, **B.** Oral view.

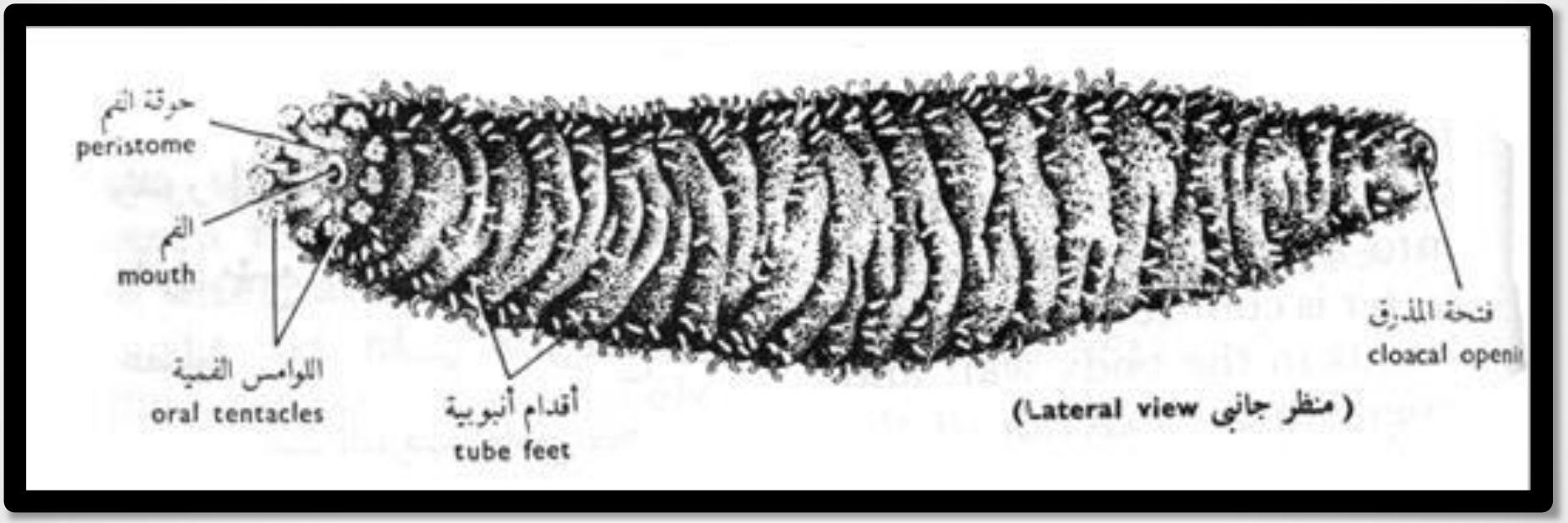
Class: Holothuroidea

Holothuria curiosa

General features :

- It is common on our sea, creeps slowly on the bottom but It is frequently seen near our sea coasts.
- It moves very slowly on the sea bottom by the muscular contractions of its body wall and with the help of its tube feet.
- The body is much elongated, cylindrical and soft. The mouth and the cloacal opening are located at opposite ends of the body.

- There are retractile locomotory tube feet, densely scattered all over the body surface.
- At the oral end, there is a large mouth opening, surrounded by a thin peristome. Around the edge of the peristome arises a circle of oral tentacles for food collecting purposes, and are considered as enlarged and greatly modified tube feet.


حوقة الفم
peristome
الفم
mouth
اللوامس الفمية
oral tentacles
أقدام أنبوبية
tube feet
فتحة المذرق
cloacal openi
(منظر جانبي Lateral view)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