7- Phylum PLATYHELMINTHES-

Characteristics

1- Parasitic or free-living metazoan flatworms.

2- Bilaterally symmetrical.

3- Triploblastic, with well-developed organ systems.

4 -Excretory system generally of flame cells and ducts

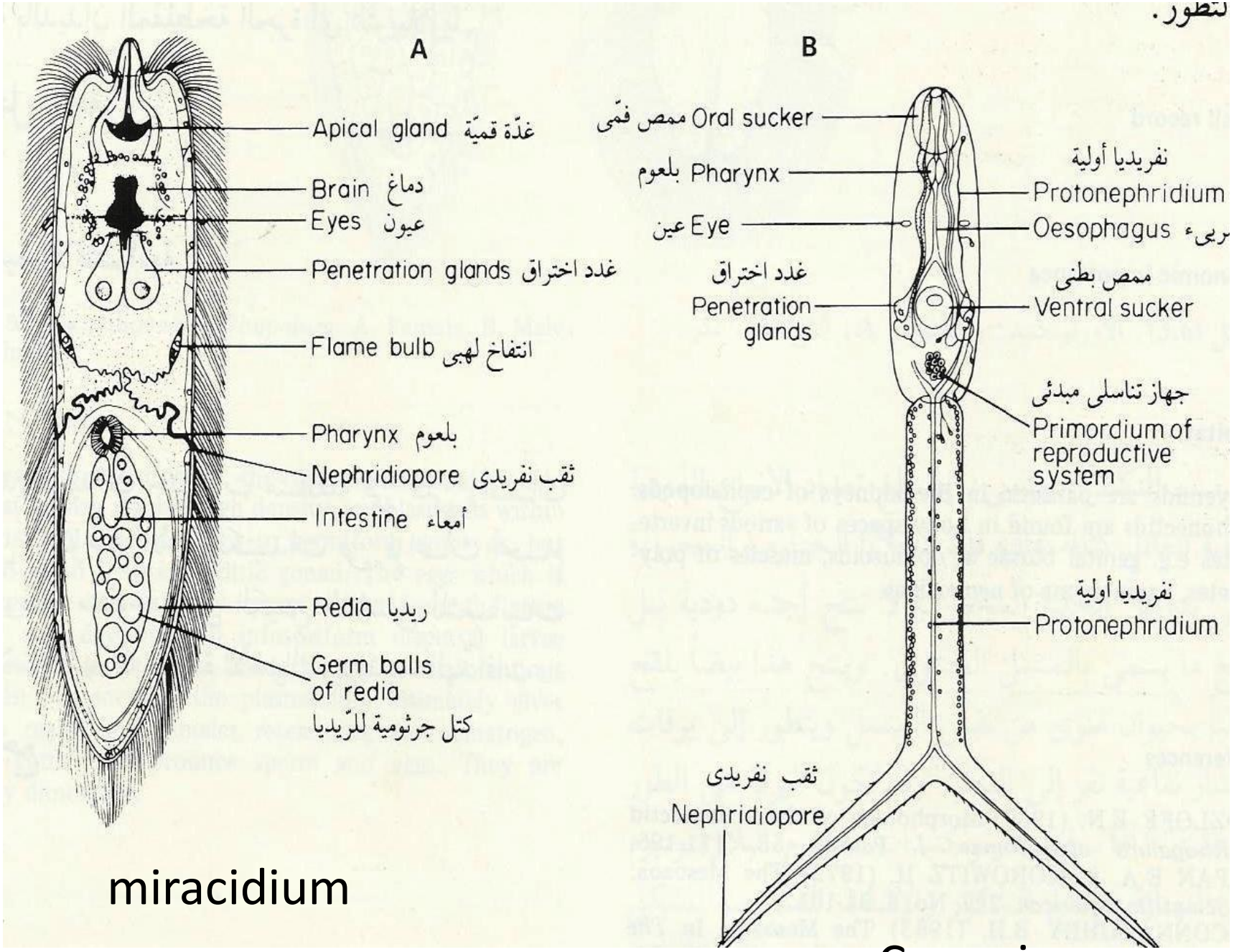
5-Nervous system includes a brain.

6-A coelom is lacking, the spaces between organs being filled with parenchyma.

7-Generally hermaphrodite except schistosomes. The ovary divided into a gonad producing ova, and a vitellarium producing yolk and shell-forming substance.

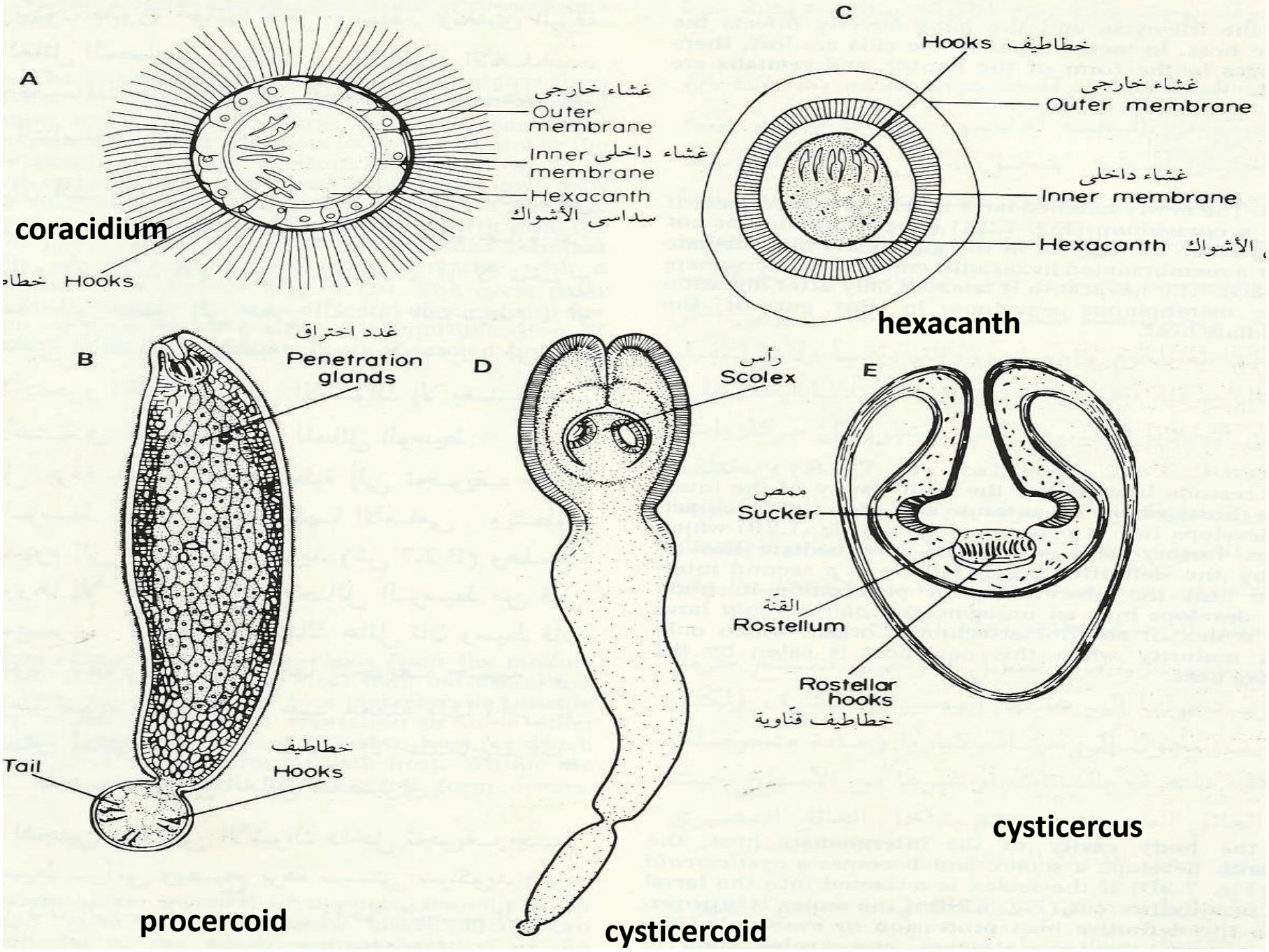
Larval form :

Class	types of larvae
Turbellaria	Muller's
Digenia	Miracidium,cercaria,sporocyst,redia,metacercaria
Aspidogastrea	cotylocidium
Monogenea	oncomiracidium
Cestoda	Coracidium,procercoid,plerocercoid,haxacanth,cysticercoid,cysticercus



miracidium

Cercaria


A
غشاء خارجي
Outer membrane
غشاء داخلي Inner membrane
Hexacanth سداسي الأشواك
coracidium
خطاف Hooks
C
Hooks خطاطيف
غشاء خارجي
Outer membrane
غشاء داخلي
Inner membrane
Hexacanth الأشواك
hexacanth
B
غدد اختراق
Penetration glands
Tail
خطاطيف
Hooks
procercoid
D
رأس
Scolex
cysticercoid
E
ممص
Sucker
القنة
Rostellum
Rostellar hooks
خطاطيف قناوية
cysticercus

Metamorphosis:

Class turbellaria : A Juvenile worm hatches from egg .

Class digenea: The miracidium hatches from the egg has locomotory cilia, eyes pots and an anterior penetration organ for entry into the molluscan intermediate host. After entry the larva loses its cilia develops into a sporocyst containing germinal cell balls which give rise another larval stage, the redia, with birth pore for escape of larval forms. The redia also contains germinal cell balls which develop into tailed cercariae with a digestive tract and suckers .

The free-swimming cercaria escapes from the molluscan host. Entry into the definitive host may be direct, or gives rise to a metacercaria (usually encysted), which lies on vegetation or some other surface until swallowed by the definitive host, or which may parasitise a second intermediate host. Within the definitive host development to the adult form occurs.

Class aspidogastrea. After invasion of the host, the ciliated or non-ciliated larva undergoes slow development to the adult.

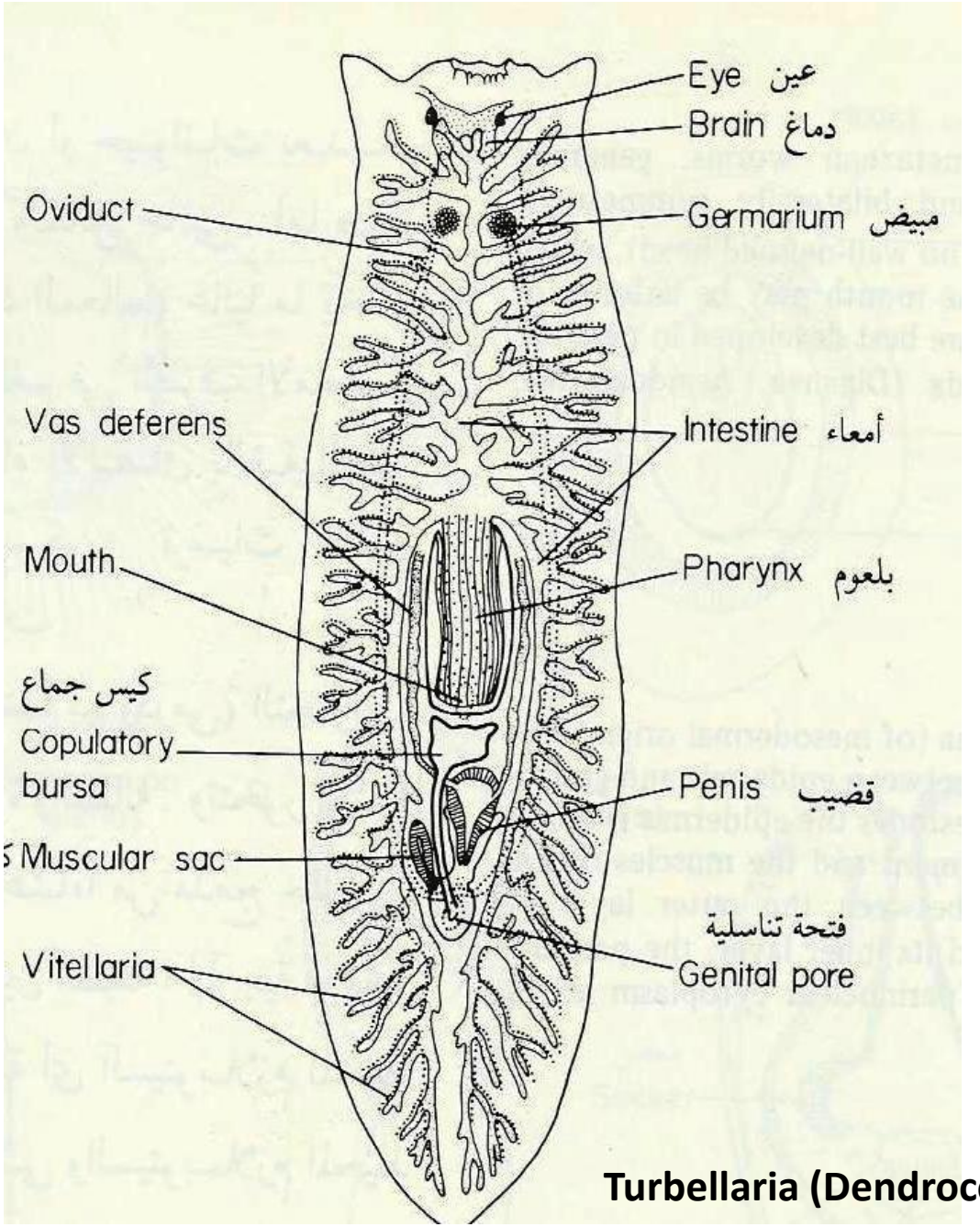
Class Monogenea.The oncomiracidium has cilia, eyes, a gut and a posterior hooked haptor. There is rarely an intermediate host.

Class cestoda :

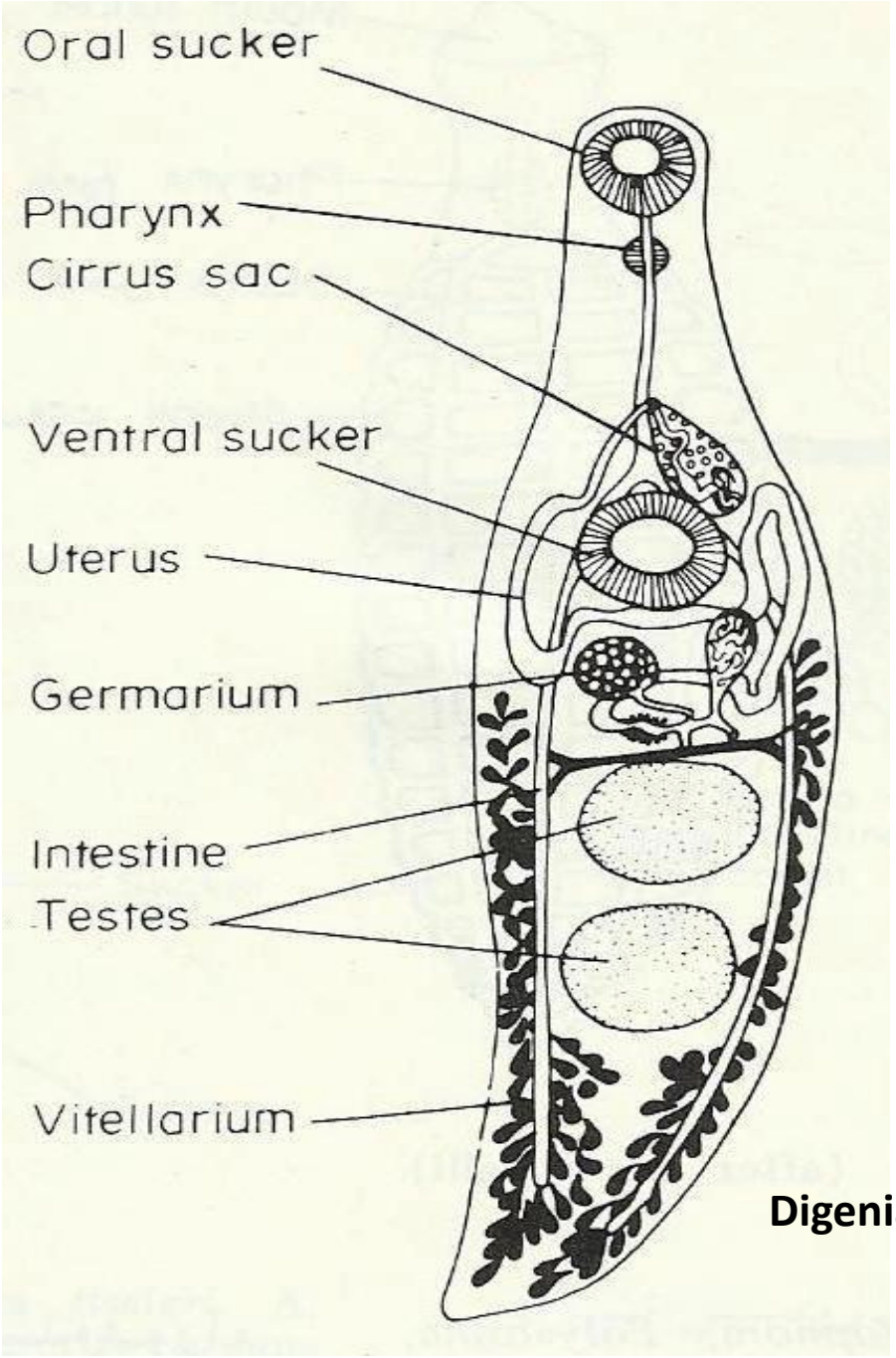
-Egg contain hexacanth embryo hatch to free swimming coracidium or egg ingested by the first intermediate host and hatch in and release coracidium which enters the body cavity of host to form procercoid which develop into plerocercoid when the first intermediate host eaten by second intermediate host then develop to adult when the latter host eaten by final host .

Adult body form:

The Platyhelminthes are metazoan worms, generally dorso-ventrally flattened, and bilaterally symmetrical. There is an anterior end which bears sense organs. The mouth may be anterior or ventral. Attachment organs (Suckers)are best developed in parasitic forms, as in Trematoda and Cestoda. In trematodes and cestodes the epidermis is modified to form a syncitial tegument.

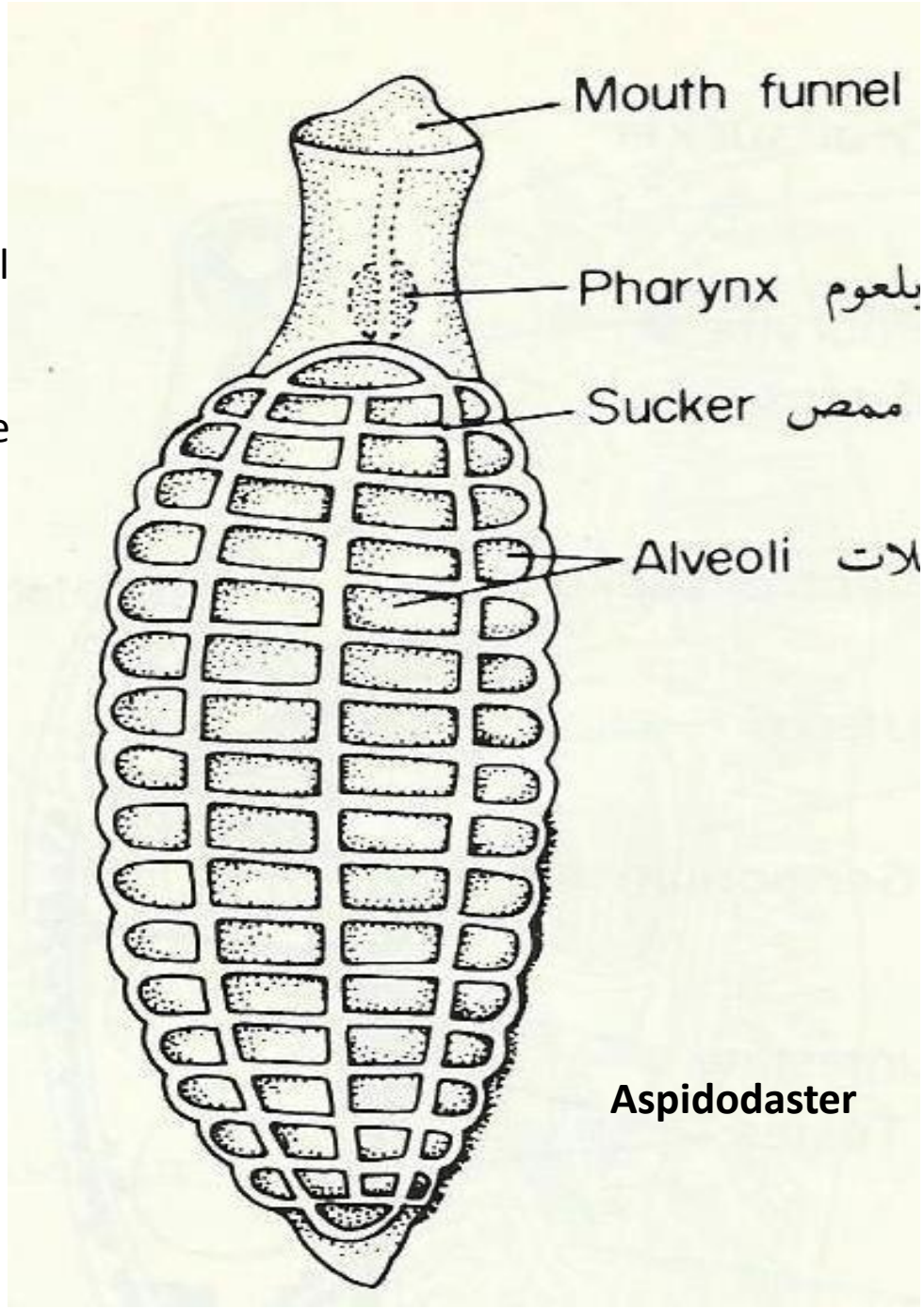


Turbellaria (Dendrocoelum sp.)



Digenia (Allocreadium sp.)

Without oral sucker and with large sucker in the ventral side



Aspidodaster

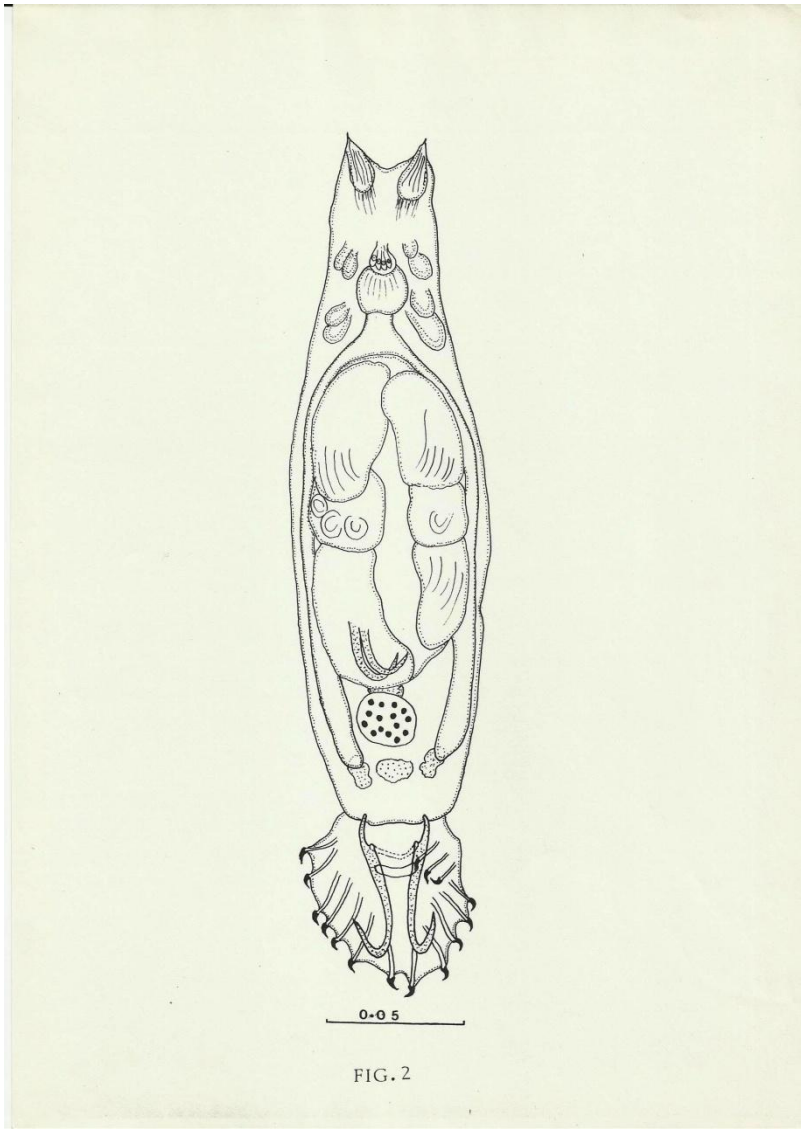
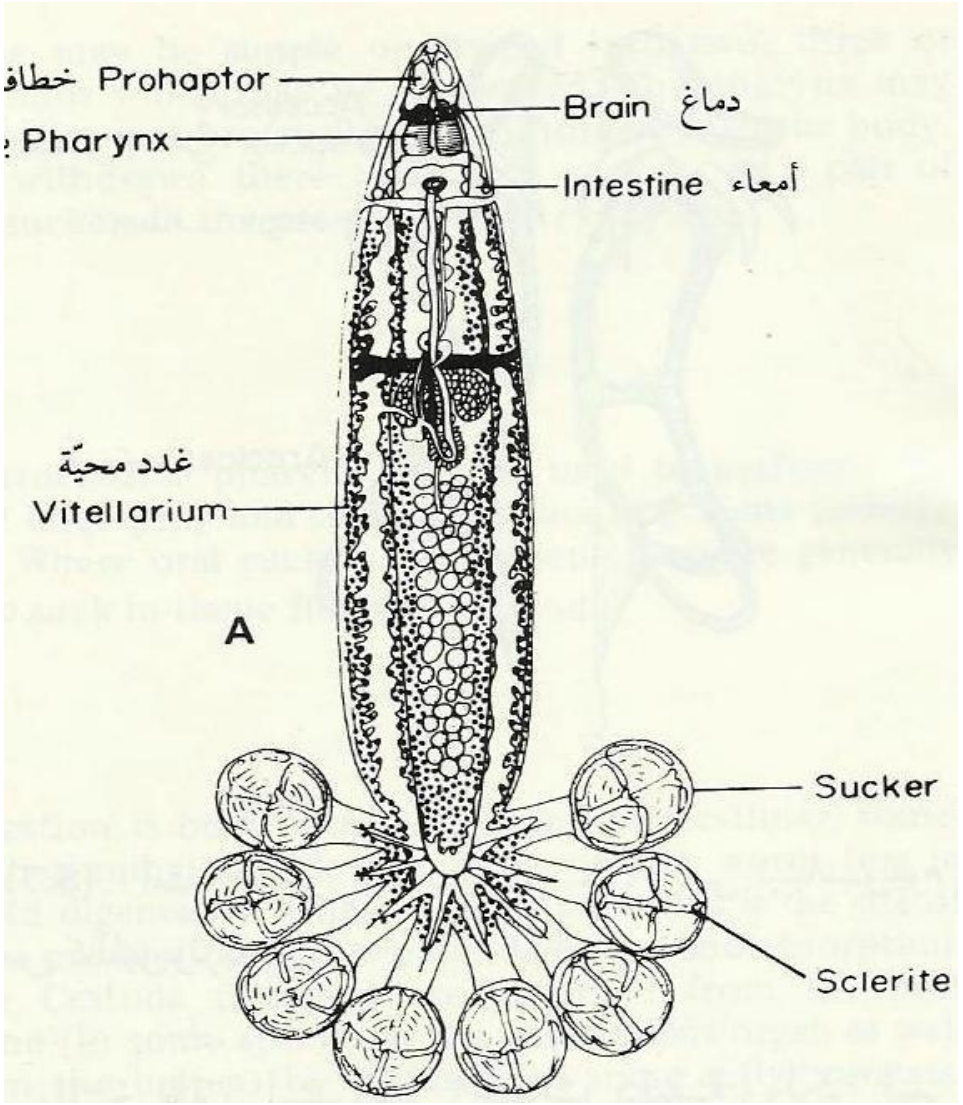
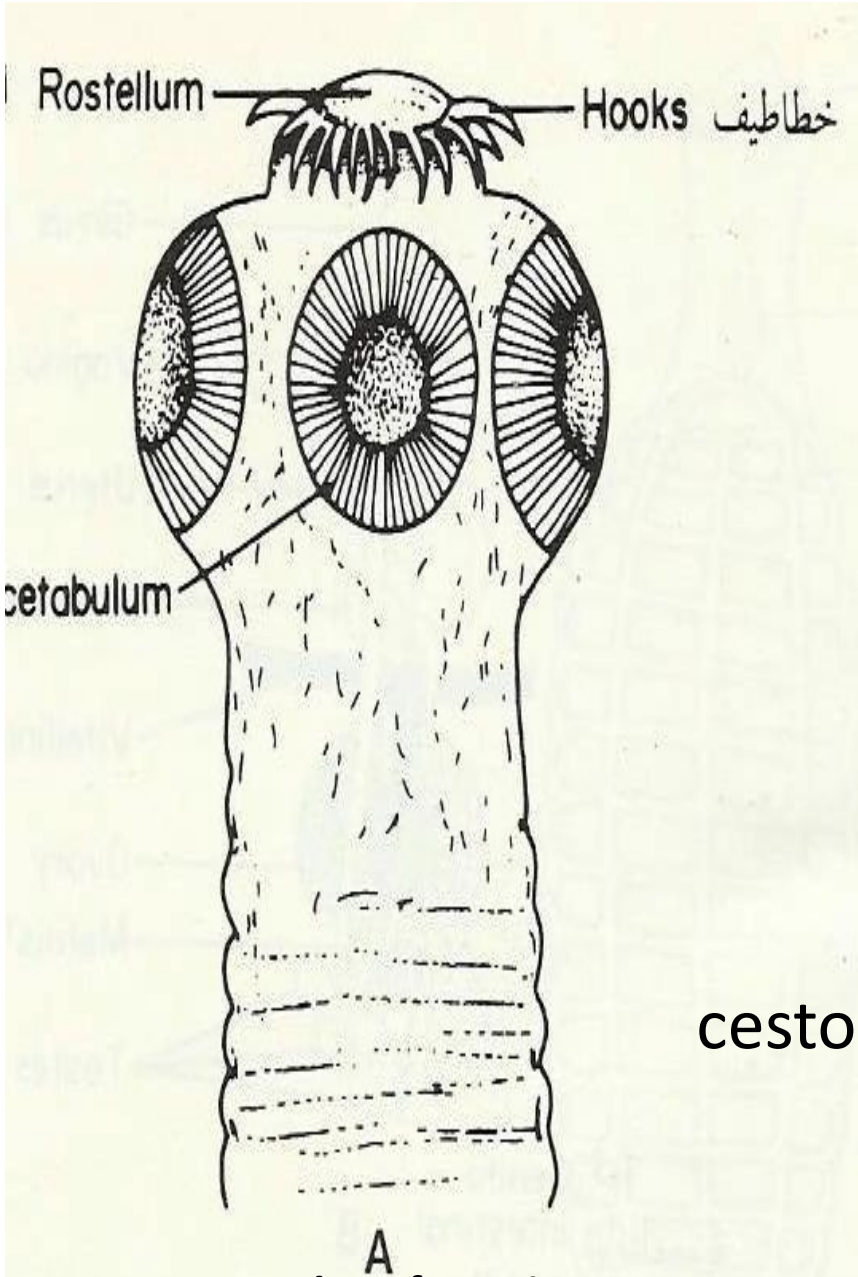


FIG. 2

Gyrodactylus

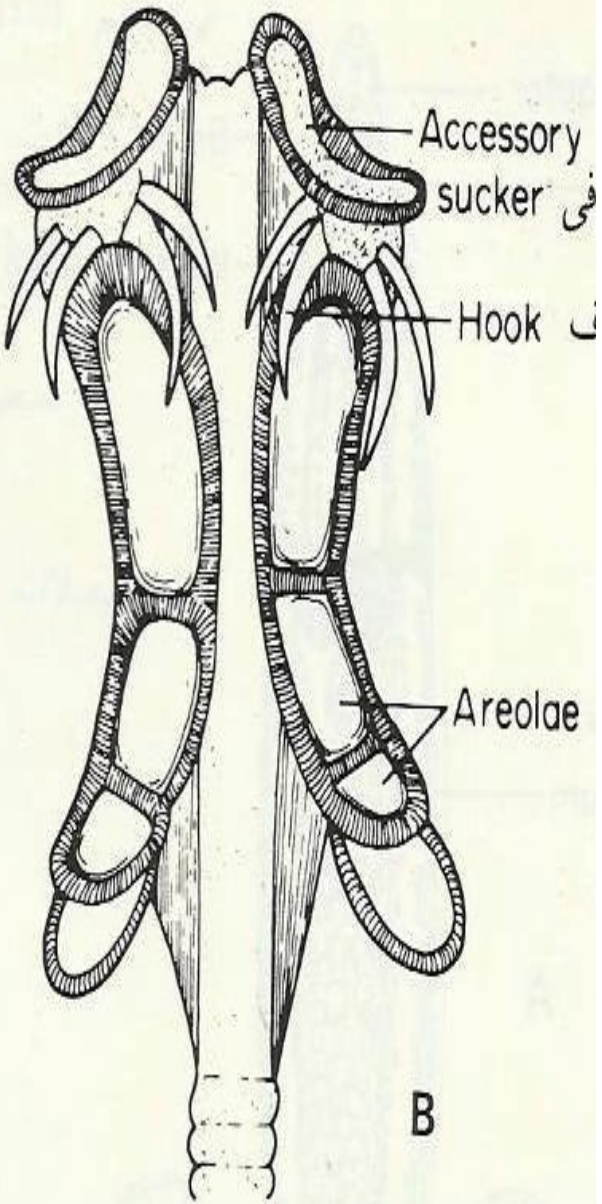


Monogenea (**Diclidophoropsis**)

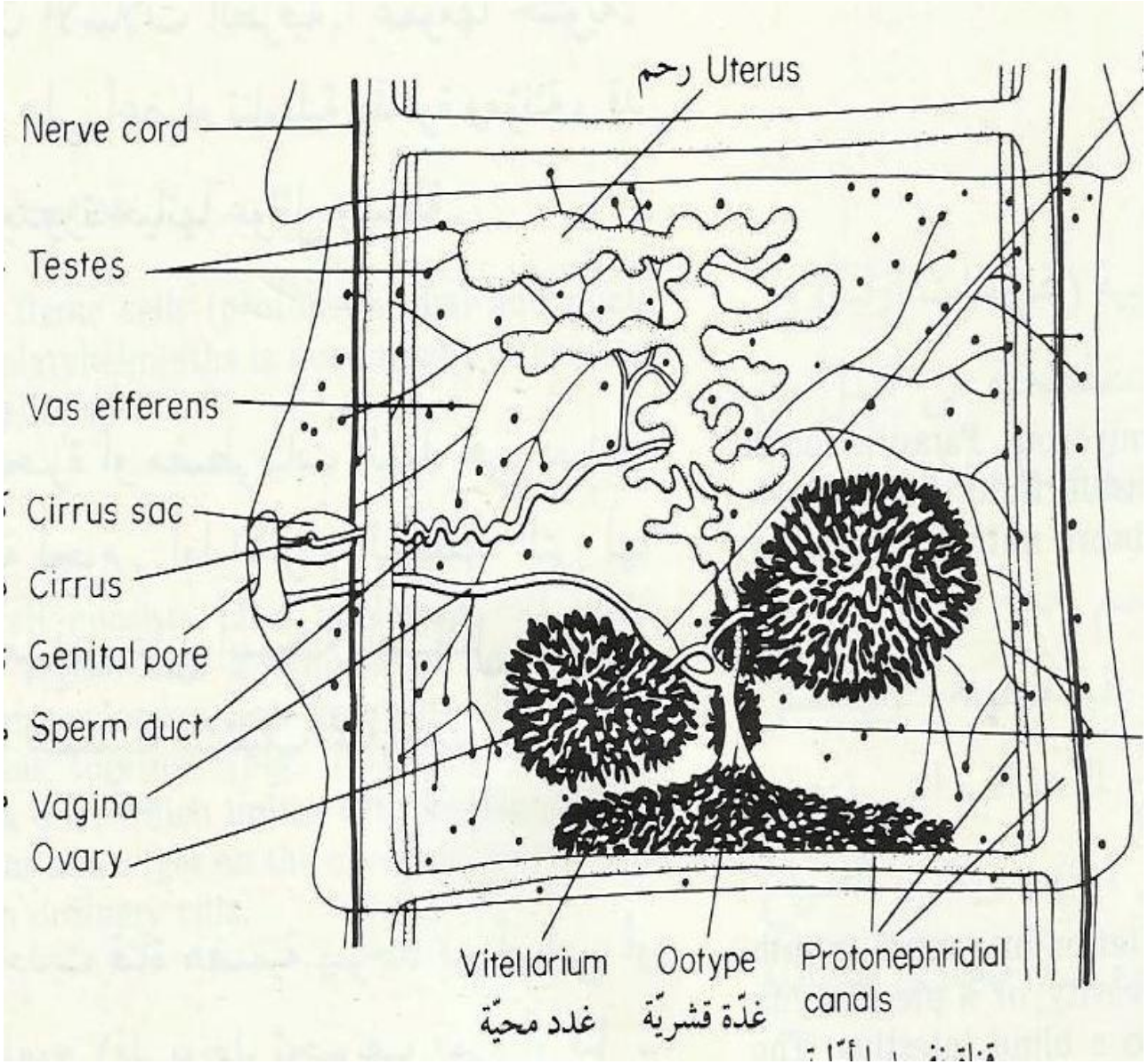


Scolex of Taenia

cestodes



Scolex of Calliobothrium



Mature segment

Feeding:

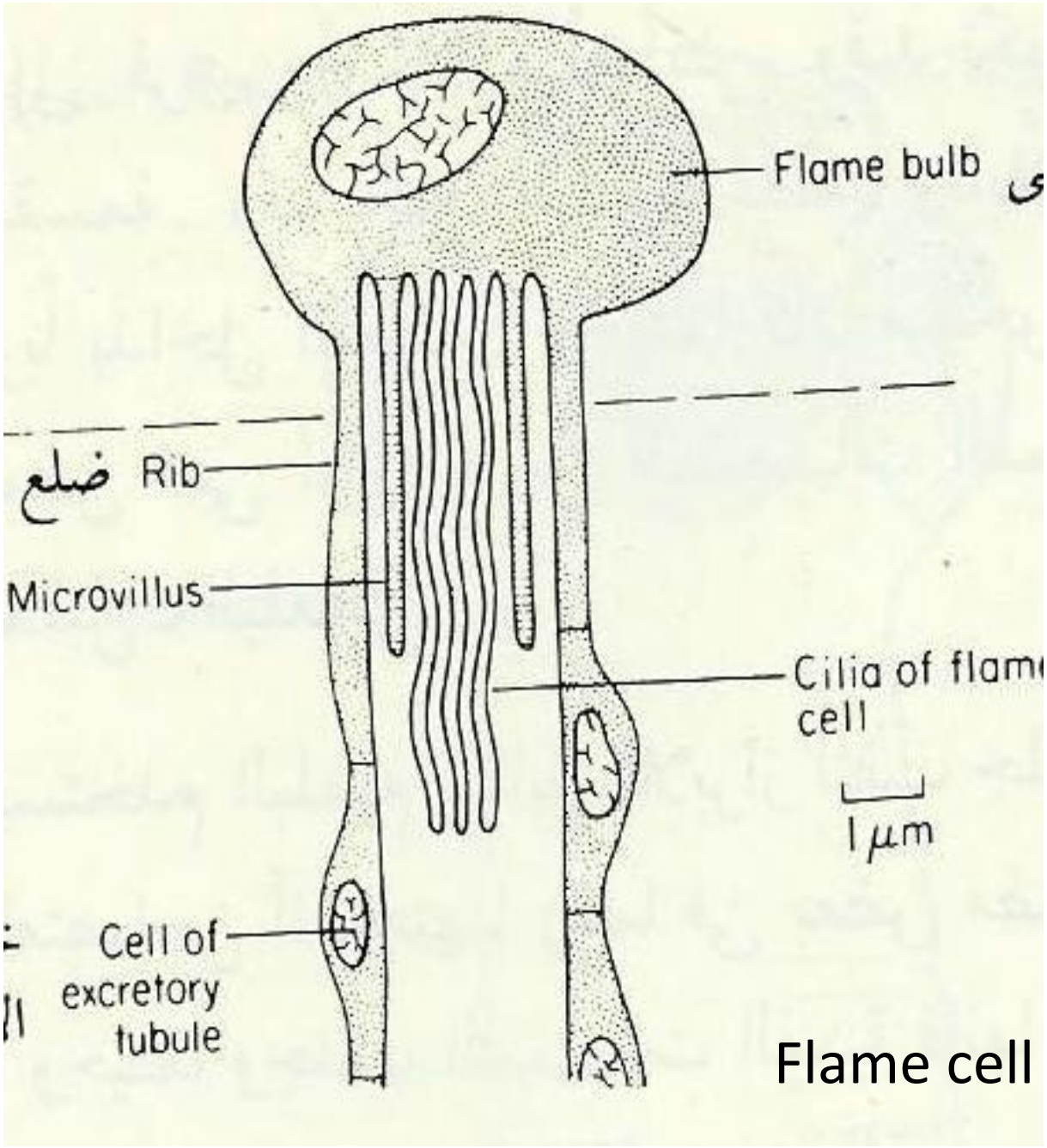
Free-living turbellarians are carnivorous. Parasitic trematodes as digenea with a gut feed on tissues and tissue fluids of the host. Ventral mouth opens into a pharynx which leads into a blind intestine. The intestine may be simple or divided into two, three or many limbs which may be subdivided. The pharynx may be muscular and protrusible or withdrawn into the body.

Where withdrawn there is an oral sucker, or a pair of buccal suckers in the pre-pharyngeal cavity. A protrusible pharynx and oral sucker used to suck out tissues and fluids and blood. Digestion is both extracellular and intracellular, sometimes beginning outside the body of the worm (e.g in strigeoid digeneans). Where a gut is present it is the site of release of enzyme production, digestion and absorption. In the Cestoda nutrients are absorbed from the host intestine or by diffusion or some active process.

Osmoregulation/excretion:

a -The system of flame cells (protonephridia) and ducts characteristic of platyhelminths is not present in turbellarians. Each flame cell consists of a nucleated cell body produced in one region into a cylinder or neck whose extracellular lumen encloses a large group of cilia, united so that they beat together . The lumen is continuous with a duct which unites with similar ones to form a system that open in the excretory pores. The ducts may contain ordinary cilia.

b- The system of flame cells and tubules is involved in osmoregulation especially in free-living freshwater forms and larvae of parasitic species. Mature flukes digenea and tapeworms appear to be normally depend on ismosis with the medium, and no powers of regulation. Where a gut is present materials may be ejected through the oral sucker. Additionally, the tegument of Turbellaria ,trematodes and cestodes may be involved in excretion. The main end products of nitrogen metabolism are ammonia, urea and uric acid.


Flame bulb
ضلع Rib
Microvillus
Cilia of flame cell
1 μm
Cell of excretory tubule

Flame cell

Movement:

a -Types of locomotion are swimming, gliding' or creeping, and leech-like movement.

b- In small aquatic forms (e.g. larvae, most turbellarians swimming by means of cilia; in larger forms (e.g. the polyclad turbellarian) muscular waves pass along the sides of the body. In cercariae the tail is used.

Creeping or gliding in small aquatic forms (e.g. turbellarians) may be due only to cilia and the larger ones achieved by a combination of ciliary beating and muscular waves. Leech-like progression is achieved by means of muscles and attachments organs (suckers and hooks).

Co-ordination:

a A central nervous system is present, with an anterior bilobed brain giving rise to a number of anterior branches and a variable number of paired posterior cords connected by commissures. The highest level of development occurring in free-living forms as turbellaria.

The peripheral nervous system consist of deep and superficial plexuses connecting with the CNS. Sense organs are best developed in free-living forms.

In the Turbellaria they include eyes, statocysts, specialized patches of sensory epithelium, scattered photoreceptors, tactile, chemoreceptors which are sensitive to water currents.

b -There is some evidence of wound hormones in turbellaria being active in regeneration. Cestodes may regulate proglottid shedding by specific chemicals. Neurosecretory cells have been reported in some group

Respiration:

There are no special organs.

Respiratory exchange occurs across the general body surface. Free-living and ectoparasitic forms show aerobic respiration. Adult parasitic digeneans are considered to be facultative anaerobes. In the Cestoda anaerobic metabolism is present but species so far examined experimentally, have been found to utilize oxygen when available.

Circulation/coelom:

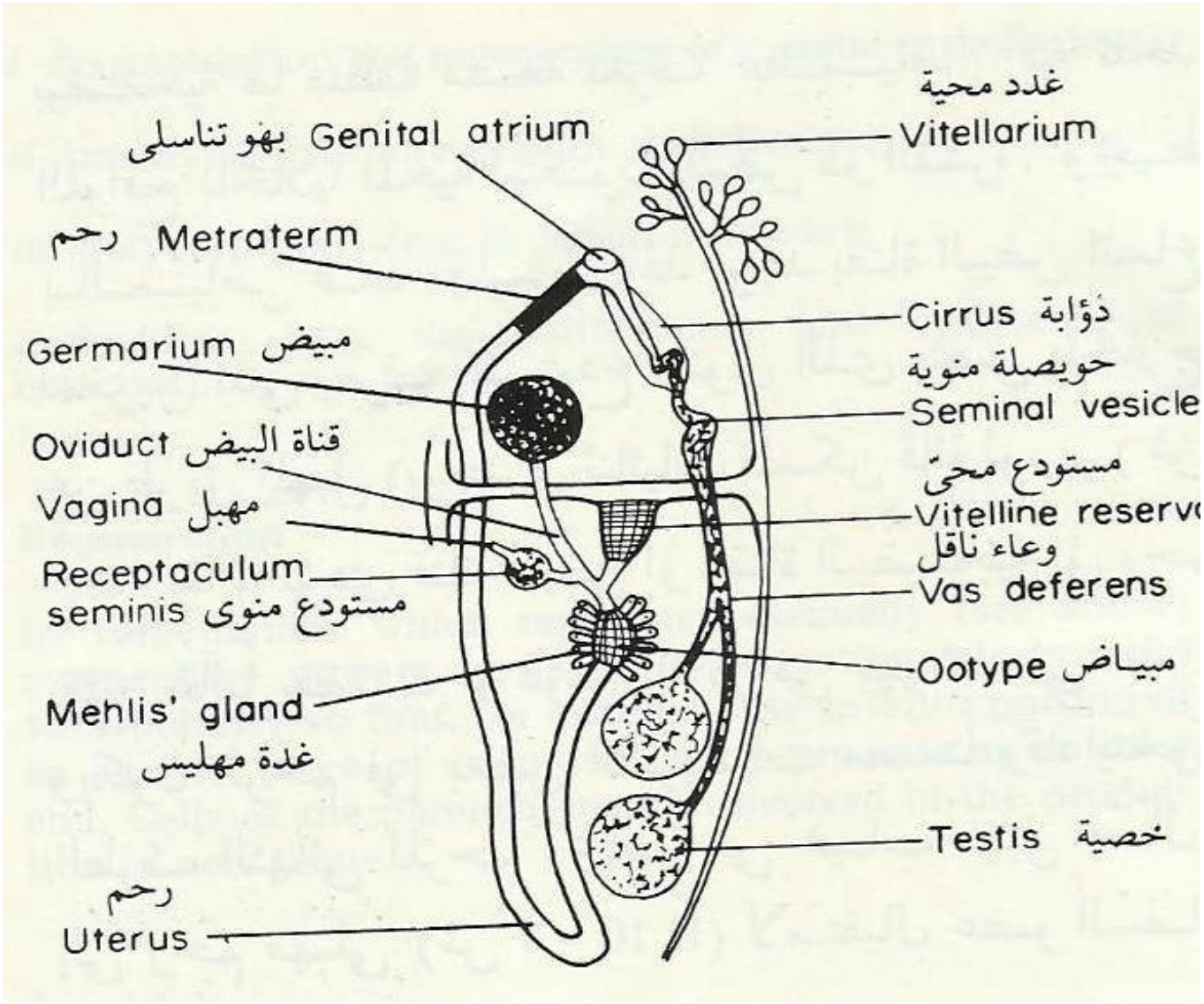
a- There is no circulatory system, haemocoel or coelom.

b- The transport of food and oxygen around the body occurs by diffusion, this process being aided by the flattened nature of the body, and in some forms, by the highly branched nature of the gut.

c- Haemoglobin and lymphatic system reported in some digenean species but its role is not known.

Reproduction:

a -Most platyhelminths are hermaphrodite as in below figure:



Hermaphroditic system

b- Sexual reproduction. Cross or self-fertilization may occur; in tapeworms self-fertilization of eggs is normal. The cirrus or penis is inserted into the metraterm or vagina or Laurer's canal. Spermatozoa are stored in the receptaculum seminis until required for fertilization of ova. Fertilized ova and vitelline cells are assembled into eggs in the ootype, and then the shelled eggs pass into the uterus, from which they are released. In tapeworms where the uterus has no external opening, ripe proglottids with gravid uteri are detached from the strobila and passed out with the host faeces. In some Turbellaria cleavage of the zygote is spiral, in other flatworms it is said to be irregular.

c- Asexual reproduction may occur by
i fragmentation and regeneration (e.g. some turbellarians);
ii transverse fission (e.g. some turbellarians);
iii polyembryony (e.g. in digenean larvae and some monogenea);
iv budding (e.g. in cysticercoids and cysticerci of cestodes as in *Echinococcus*).

Regeneration:

In turbellarians which reproduce asexually regenerative powers are high.

Parasitism:

The phylum Platyhelminthes contains important groups of animal parasites, with life-cycles ranging from simple, with a single host, to complex with one or more intermediate hosts and a final definitive host, which is nearly always a vertebrate.

Morphological adaptations of the parasitic life are the following :

1- penetration glands;

2- attachment organs, e.g. hooks and suckers;

3- increase proliferation of the reproductive capacity of the gonads.

4- the ability to employ self-fertilization .

5- the ability to produce resistant cysts, shelled eggs , metacercariae.

6- the possession of free-living, distributive larval stages as cercariae.

7-the ability to larval multiplication in some species.

8- the ability to resistant chemical attack by the host's digestive enzymes or immune system as nematoda.

Economic importance:

Major parasitic pests of concern to man include, among the Digenea:

Fasciola hepatica —liver fluke of sheep and cattle;

Dicrocoelium dendriticum — inhabiting bile duct of domestic animals and sometimes man;

Clonorchis sinensis — liver fluke of man, in S.E. Asia;

Paragonimus sp. — lung fluke of man;

Schistosoma spp. — blood flukes of man.

The schistosomes are the most notable digenean parasites of man, and cause the widespread tropical disease, schistosomiasis. The adult flukes live in the hepatic portal system, S. *mansoni* and S. *japonicum* in veins draining the intestine, S. *haematobium* in veins draining the bladder. However the disease is rarely fatal, it produces dangerus effect . Immunity to platyhelminth infections does not develop as in the case of Schistosoma spp. this may be due to the parasite have antigen identical similar to that of the host on their surface

The parasite would not stimuli the immune response of the host.

Cestode parasites of man and his domestic animals:

Diphyllobothrium latum — broad tapeworm of man;

Taenia solium — in pigs and man;

Taenia saginata — in cattle and man.

The presence of flukes in livestock and fish farms may cause disease; it also leads to the rejection of infected animals and also cause economic loss.

Habitat:

Free-living species may inhabit marine, fresh-water or moist terrestrial habitats. The remainder of the phylum are endo- or ecto-parasitic.