

THE FRESH WATER PRAWN

Palaemon



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NATURAL HISTORY

HABITAT

- *Inhabits fresh water streams, rivers, lakes and ponds in Central and South India.*

HABITS

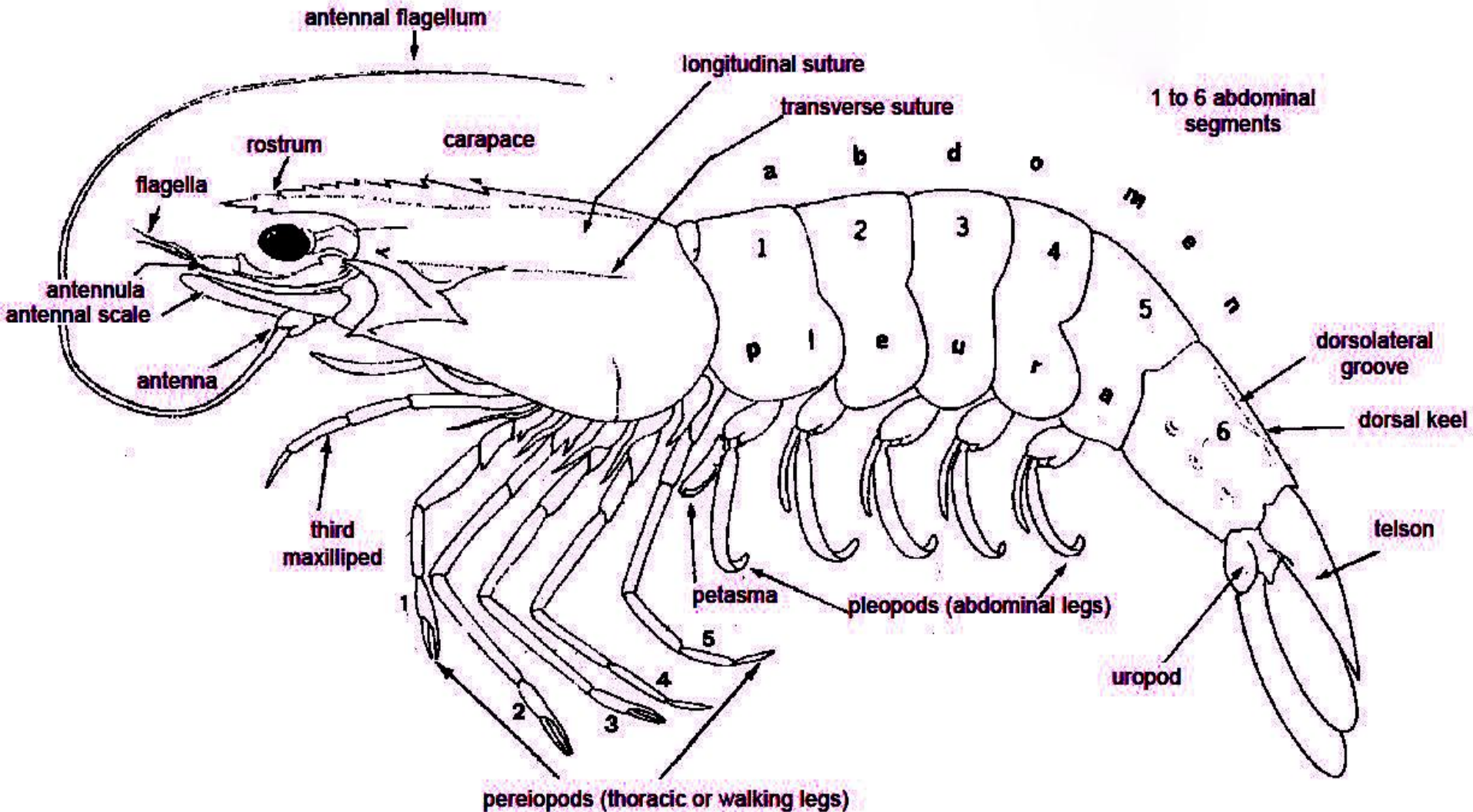
- *Nocturnal.*
- *Omnivorous (feed on small weeds, insects, algae).*
- *Respiration through gills.*
- *Sexual mode of Reproduction.*
- *Dual mode of locomotion:*
 - a. Walking*
 - b. Swimming*

Kingdom:	<u>Animalia</u>
Phylum:	<u>Arthropoda</u>
Subphylum:	<u>Crustacea</u>
Class:	<u>Malacostraca</u>
Order:	<u>Decapoda</u>
Family:	<u>Penaeidae</u>
Genus:	<i>Palaemon</i>

PRAWN.

TECHNICAL TERMS AND PRINCIPAL MEASUREMENTS USED

TECHNICAL TERMS



Entire body of prawn is covered by a calcareous shell or **exoskeleton**. The colour of the shell comes by the deposition of lime salts and sclerotin. It comprises of several hardened plates, called sclerites which are connected with each other by a thin soft uncalcified cuticle or the arthroial membrane, making the movement feasible.

(a) Cephalothoracic sclerites:

- All the cephalothoracic sclerites form a single large and continuous dorsal shield which extends over the head as a laterally compressed, serrated process called **rostrum**.
- At the base of rostrum a pair of orbital notch is found that lodged a stalked, movable, compound eye. Just behind the orbital notch there are two outgrowths, the anterior antennal spine and the posterior hepatic spine.
- The posterior region of dorsal shield is called carapace. On either side of thorax it hangs down freely as **branchiostegite** or **gill cover**.

(b) Abdominal sclerites:

- Each abdominal segment is covered by separate sclerites which are joined with each other by arthroial membrane . Each sclerite is composed dorsally by **tergum**, ventrally by narrow bar like plate **sternum** and the two flap like lateral plates **pleura**.
- Abdominal appendages are connected with pleuron by a small plate epimeron. Tergum and pleura of adjacent segments slightly overlap each other and this arrangement is called imbricate arrangement.
- Two adjacent abdominal segments articulate with each other by means of a pair of hinge joints. However, the hinge joints are lacking between the third and fourth segment.

A summary of the segments and the functions of each appendage

BODY SECTION	SOMITE	APPENDAGE NAMES (PAIRS)	FUNCTIONS OF APPENDAGES AND RELATED STRUCTURES
Cephalon (front portion of the cephalothorax)	1	embryonic segment (not visible in adults)	
	2	1st antennae	tactile and sensory perception (statocyst)
	3	2nd antennae	tactile
	4	mandibles	cutting and grinding food
	5	1st maxillae (maxillulae)	food handling
	6	2nd maxillae	food handling; water circulation through the gill chamber (scaphognathite)
Thorax (rear portion of the cephalothorax)	7	1st maxillipeds	feeding/food handling
	8	2nd maxillipeds	feeding/food handling
	9	3rd maxillipeds	feeding/food handling
	10	1st pereopods (chelipeds)	food capture
	11	2nd pereopods (chelipeds)	food capture; agonistic and mating behaviour
	12	3rd pereopods	walking; female gonophores between base of legs
	13	4th pereopods	walking
	14	5th pereopods	walking; male gonophores between base of legs
Abdomen	15	1st pleopods (swimmerets)	swimming
	16	2nd pleopods (swimmerets)	swimming; copulation in males
	17	3rd pleopods (swimmerets)	swimming
	18	4th pleopods (swimmerets)	swimming
	19	5th pleopods (swimmerets)	swimming
	20	uropods	propulsion, together with the central telson

BODY WALL

- **Cuticle**

- a. Epicuticle (thin outer layer).
- b. Procuticle (thick inner layer).

- **Epidermis**

Single layer of columnar cells with gland cells here and there.

- **Basement Membrane**

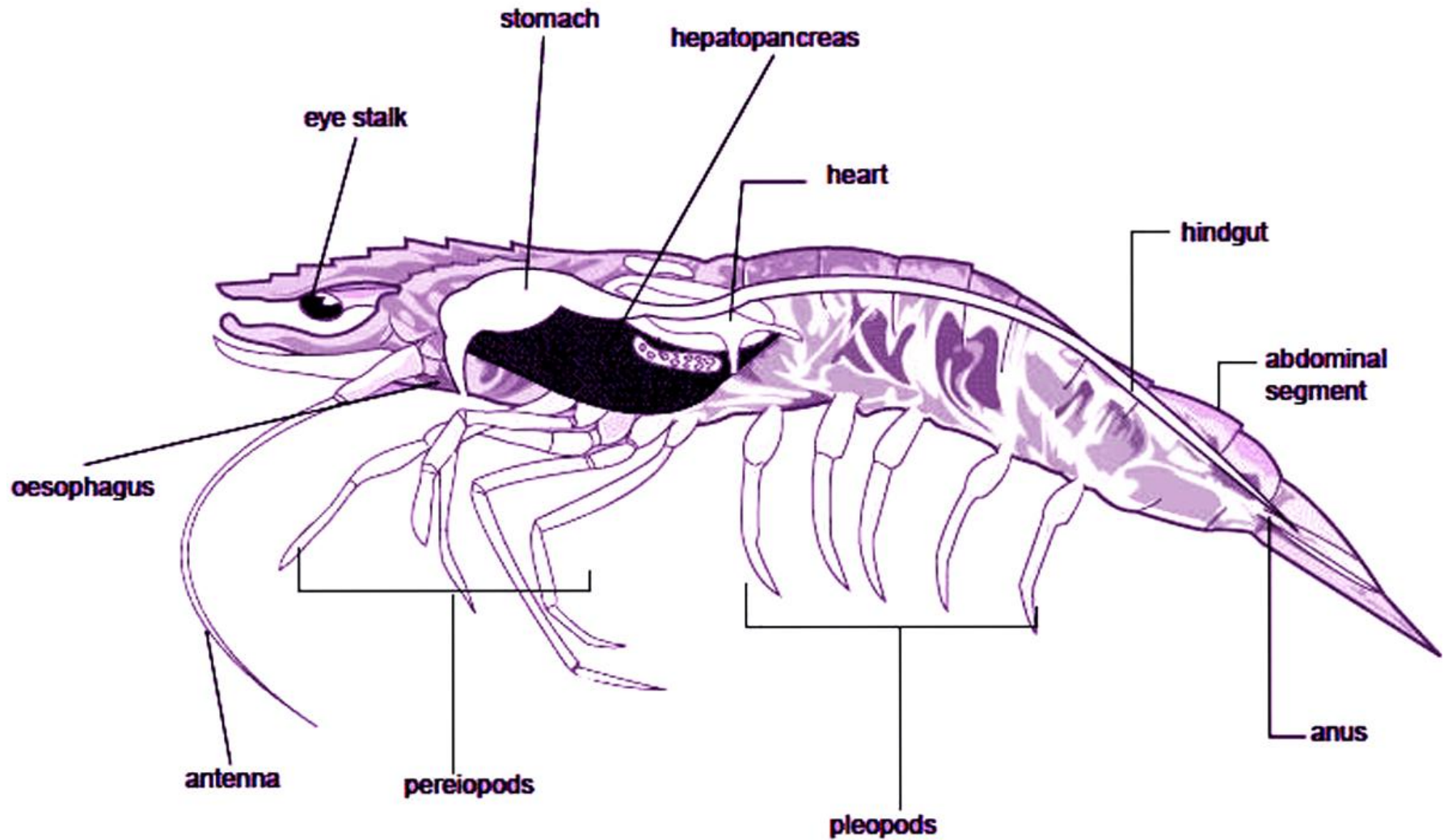
Single layer of flattened cells.

The body wall bears setae and spines.

FUNCTIONS

1. Maintain body form.
2. Check loss of water.
3. Protect delicate internal organs from injury, harmful chemicals and entry of microorganisms.
4. Helps in respiration.
5. Outgrowths forms sensory, defensive and feeding apparatus.

DIGESTIVE SYSTEM



DIGESTIVE SYSTEM

ALIMENTARY CANAL

The alimentary canal is a long tube, which extends from the mouth to the anus.

It is divisible into three regions.

Stomodaeum: Anterior region lined with chitin and consists of mouth, buccal cavity, oesophagus and stomach. The mouth lies on the ventral side of the cephalothorax, between the mandibles. It leads into a short buccal cavity which are connected by oesophagus. Stomach consists of an anterior larger cardiac and the posterior smaller pyloric stomach. The inner dorso-lateral folds of this region bear stout denticles which form the gastric armature or gastric mill for grinding the food.

Mesenteron: The pyloric stomach opens into the mesenteron which is not lined with chitin. The chitinous lining of the pyloric stomach forms one median dorsal, one median ventral and two lateral lippets or valvulae.

Proctodaeum: The proctodaeum is the posterior region of the alimentary canal. It is lined with chitin. It consists of the hindgut (or rectum) and the anus. The anus lies at the base of the telson ventrally.

DIGESTIVE GLAND

The digestive gland is large, orange red structure and is known as the hepatopancreas or liver which lies in the cephalothoracic region. It consists of two separate lobes called **hepatic caeca**. The digestive secretions of this gland reach the mesenteron by a pair of openings.

PHYSIOLOGY OF DIGESTION

Ingestion: Intake of food is aided by cephalothorax appendages. The mandibles cut the food into small pieces. The maxillae and maxillipeds aid in swallowing the food. In the buccal cavity food is masticated and then passes into the cardiac stomach through peristaltic movements of oesophagus.

Digestion: Digestive juice secreted by hepatopancreas met with masticated food in stomach. It contains amylolytic, lipolytic and proteolytic enzymes that digest the starches, fats and proteins respectively.

Absorption: Absorption takes place in the hepatopancreas and the intestine.

Egestion: The hindgut forms faecal pellets, which are then passed out through the muscular anus.

RESPIRATORY SYSTEM

Palaemon takes up oxygen dissolved in sea-water. Its respiratory organs are inner lining of branchiostegites, epipodites (mastigobranchiae) and branchiae (gills).

- **Branchiostegites:** The ventral extension of the carapace on either side of cephalothorax is known as branchiostegite. The space between the bodywall and branchiostegite is called gill chamber. The inner lining of branchiostegite is highly vascular. It is bathed in water where exchange of respiratory gases takes place.
- **Epipodites:** There are six pairs of epipodites. They are the outgrowth of coxae of the thoracic appendages, three pairs of maxillipeds and three pairs of chelate walking legs. They lie in the branchial chamber. They are bathed in water and richly supplied with blood. Here, exchange respiratory gases between water and blood takes place.
- **Branchiae or Gills:** Branchiae (gills) are the feather like (plumose) outgrowth of the lateral wall of the thorax and thoracic appendages. Each gill has a stem. Three longitudinal blood channels run through the stem. They are two lateral channels and one median channel. The two lateral channels are connected by many transverse channels. Many lateral flat gill plates arise from the stem. Marginal channels from the lateral channels penetrate into the gill plate and open into the median channel, The stem and gill plate are covered externally a thin layer of chitin. A single layer of epithelial cells lies beneath it. Epithelial layer encloses connective tissue and blood channels. This kind of gill is known as dendrobranchia.

MECHANISM OF RESPIRATION

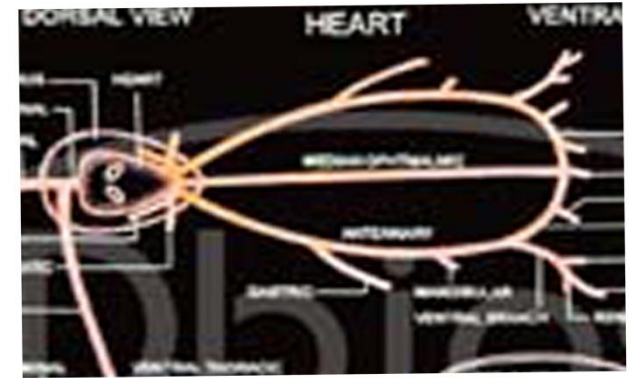
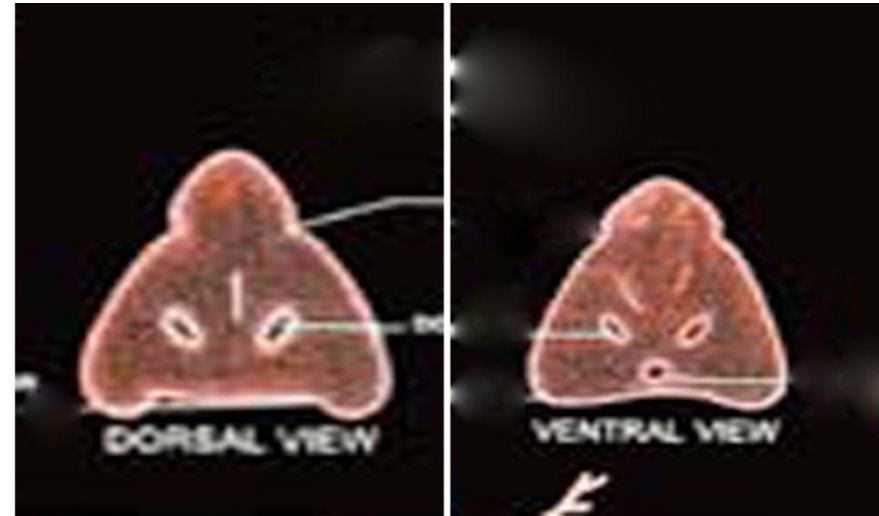
The scaphognathite of each maxilla lies anteriorly inside the gill chamber. By its constant vibrating movements it bales out water from the anterior open end of gill chamber. Action of scaphognathite is supplemented by the exopodites of maxillpedes. Fresh water enters the gill chamber from behind in the form of a current. This current of water flows over the lining of branchiostegite gills & epipodites which are richly supplied with blood so that exchange of gases takes place. The extremely delicate thin gill plates act as excellent permeable membrane for the passage of gases to & fro through diffusion. Oxygen dissolved in water is taken in by blood & CO₂ from blood diffuses out in the water.

CIRCULATORY SYSTEM

Circulatory system consists of heart, arteries, pericardial membrane, pericardial sinus, haemocoel, blood channels and blood or haemolymph.

HEART: The heart is a triangular chamber. It lies in the pericardial space. It is provided with paired openings called ostia.

ARTERIES: Arteries are the main tubes which arise from the anterior and posterior regions of the heart. These are ophthalmic artery, antennary arteries, hepatic arteries, sternointestinal artery



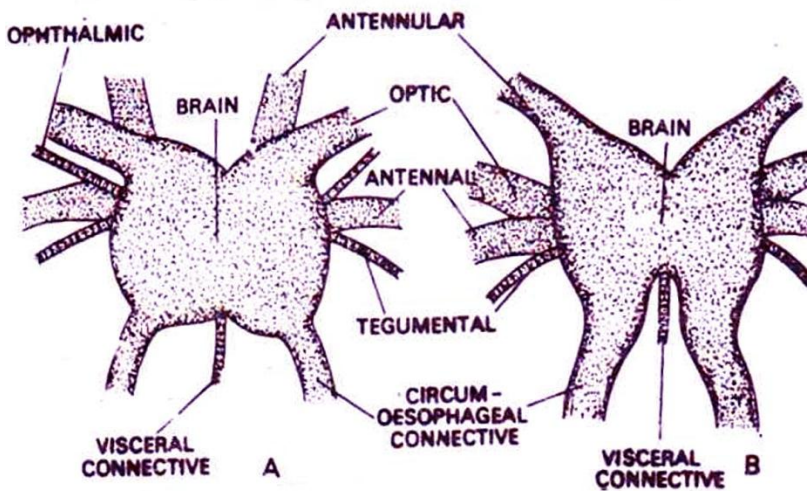
PERICARDIAL SINUS: It is a large space in the dorsal part of thorax and contains the heart in it.

HAEMOCOEL: The spaces between the visceral organs form the haemocoel. It contains blood or haemolymph. From the haemocoel blood goes to the gills through the blood channels. From the gills blood goes to the heart through blood channels. The blood contains plasma, haemocytes or blood cells and the respiratory pigment haemocyanin.

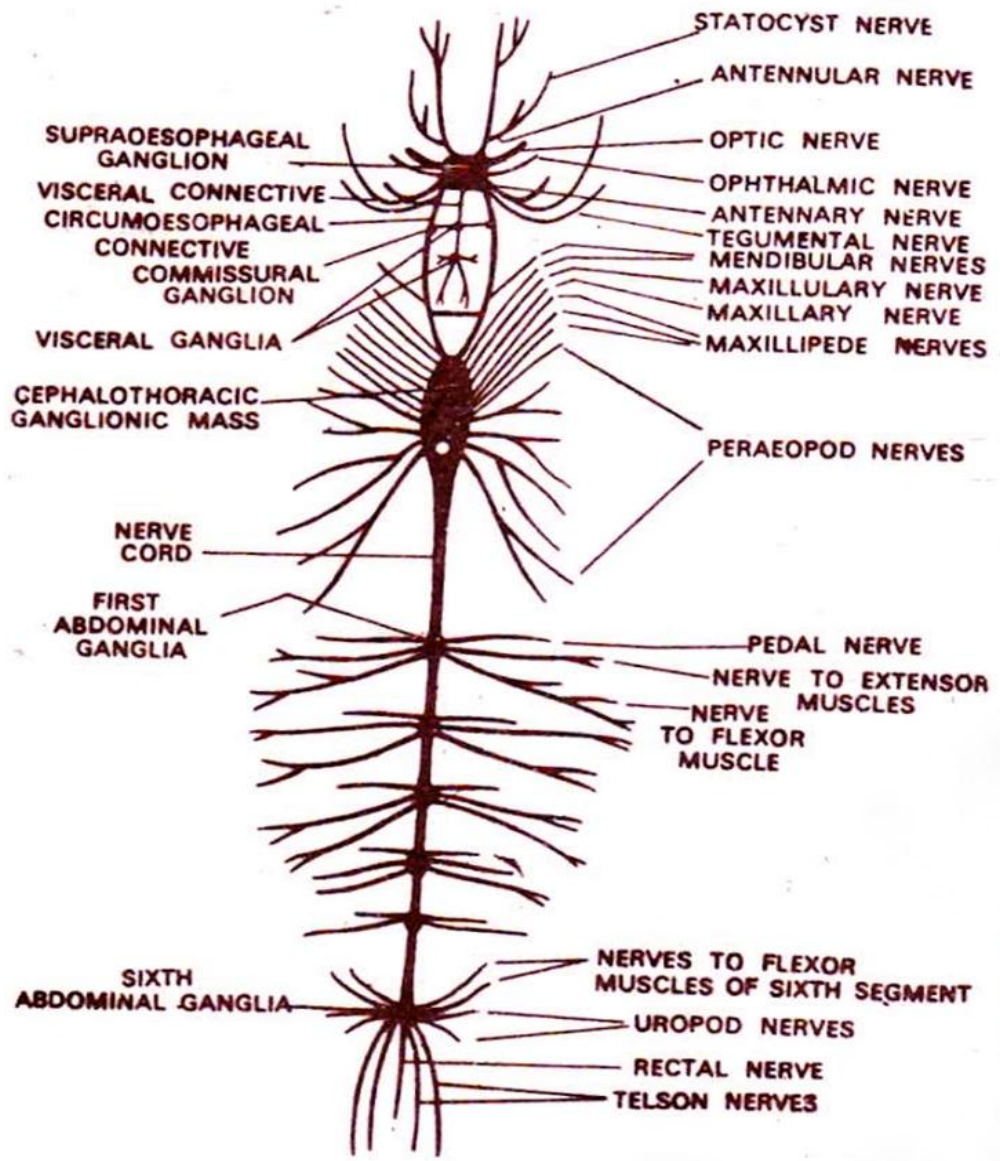
CIRCULATION OF HAEMOLYMPH

Haemolymph in the pericardial sinus enters the heart through the ostia. From the heart it reaches reaches the haemocoel through the arteries. Then it is collected by the afferent blood channels and returned to the pericardial sinus through the gills and efferent blood channels.

NERVOUS SYSTEM



BRAIN. A. Dorsal view. B. Ventral view



NERVOUS SYSTEM

1. CENTRAL NERVOUS SYSTEM

It consists of supraoesophageal ganglion or brain, circumoesophageal connectives and nerve cord.

- a. Supraoesophageal Ganglia: It lies under the base of the brain. The brain is a composite structure represents fused pair of ganglia.
- b. Circumoesophageal Connectives: They arise from lateral parts of brain and pass backward and downward round the oesophagus to meet the ventral nerve cord.
- c. Nerve cord: Nerve cord lies in midventral line of the body. It arises from the sub oesophageal ganglion and runs upto the end of the abdomen. It bears 17 pairs of ganglia, one belonging to each postoral segment. The anterior 11 pairs belong to cephalothorax. The posterior 6 pairs belong to abdomen.

2. PERIPHERAL NERVOUS SYSTEM

It consists of paired nerves that arise from various parts of central nervous system to innervate the body parts.

These are

- ❖ Optic nerves
- ❖ Ophthalmic nerves
- ❖ Antennular nerves
- ❖ Antennary nerves
- ❖ Tegumental nerves
- ❖ Mandibular nervess
- ❖ Maxillary nerves
- ❖ Pedal nerves

3. AUTONOMIC NERVOUS SYSTEM

It consist of nerve arise from hind end of brain and bears two small visceral ganglia. The anterior visceral ganglion is connected with the commissural ganglia borne by the circumoesophageal connectives by transverse connectives. The posterior visceral ganglia gives off two pairs of nerves to the muscles of wall of oesophagus and stomach.

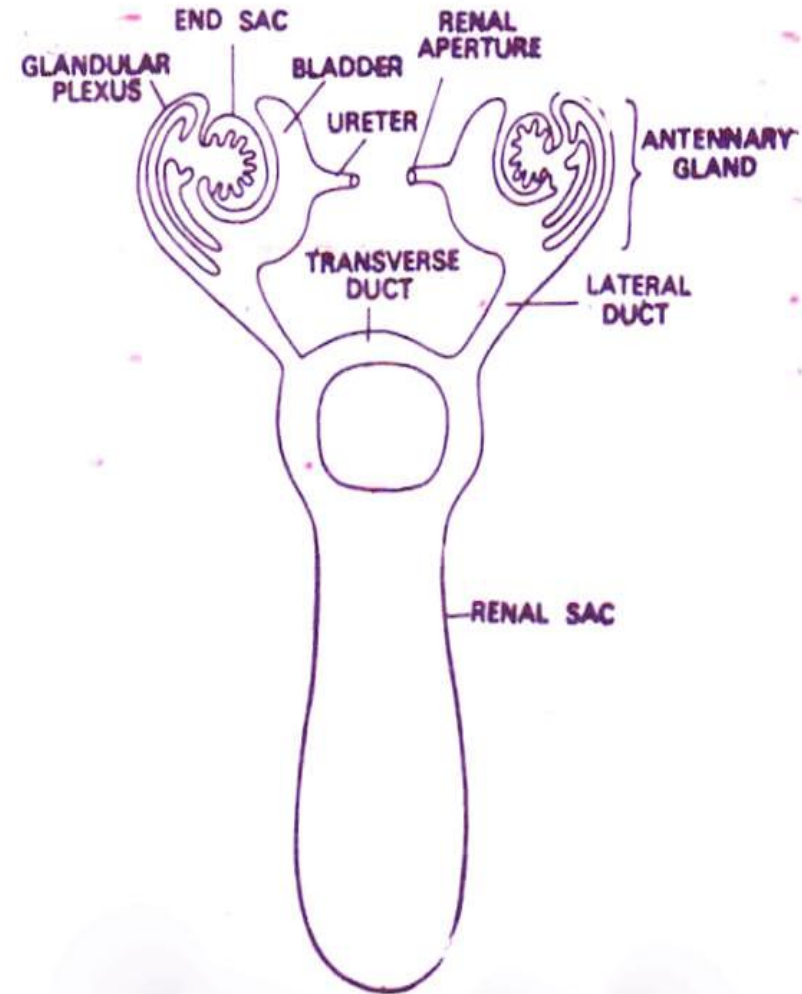
SENSE ORGANS

- **Compound eyes:** There are two compound eyes/ one on either side of the base of the rostrum. They are at the ends of movable stalks. Each eye is made up of many optical units called simple eyes or ommatidia. Each ommatidium consists of an outermost layer called cornea. It is formed by the transparent cuticle. Externally this layer is hexagonal and called a facet. Two types of images are formed. They are mosaic (apposition) and super-imposed (superposition) images.
- **Statocysts:** There is a pair of statocysts. They are organs of orientation and equilibrium. Each statocyst lies at the basal segment of the antennule. It is a sac-like structure filled with sand particles which function as statolith. The sand particles are surrounded by elongated delicate receptor setae. This sets up a nerve impulse which is conveyed to brain by nerve.
- **Tactile organs and setae :** Antennae are the important tactile sense organs. Many sensory setae are located over the body surface especially the appendages.
- **Olfactory setae:** They are present on the middle small feeler of each antennule.

EXCRETORY SYSTEM

The excretory system consists of

1. **Antennal glands:** There is a pair of antennal or green glands. Each lies enclosed in the proximal segment (coxa) of the antenna. Its parts are an end sac, a coiled tube and a bladder.
2. **Renal sac:** The renal sac is large, blind. It covers the cardiac stomach and reaches the gonads. Anteriorly, it communicates with the bladder. The tubular part is glandular and the bladder is thin-walled. The bladder opens to the exterior by the excretory pore.



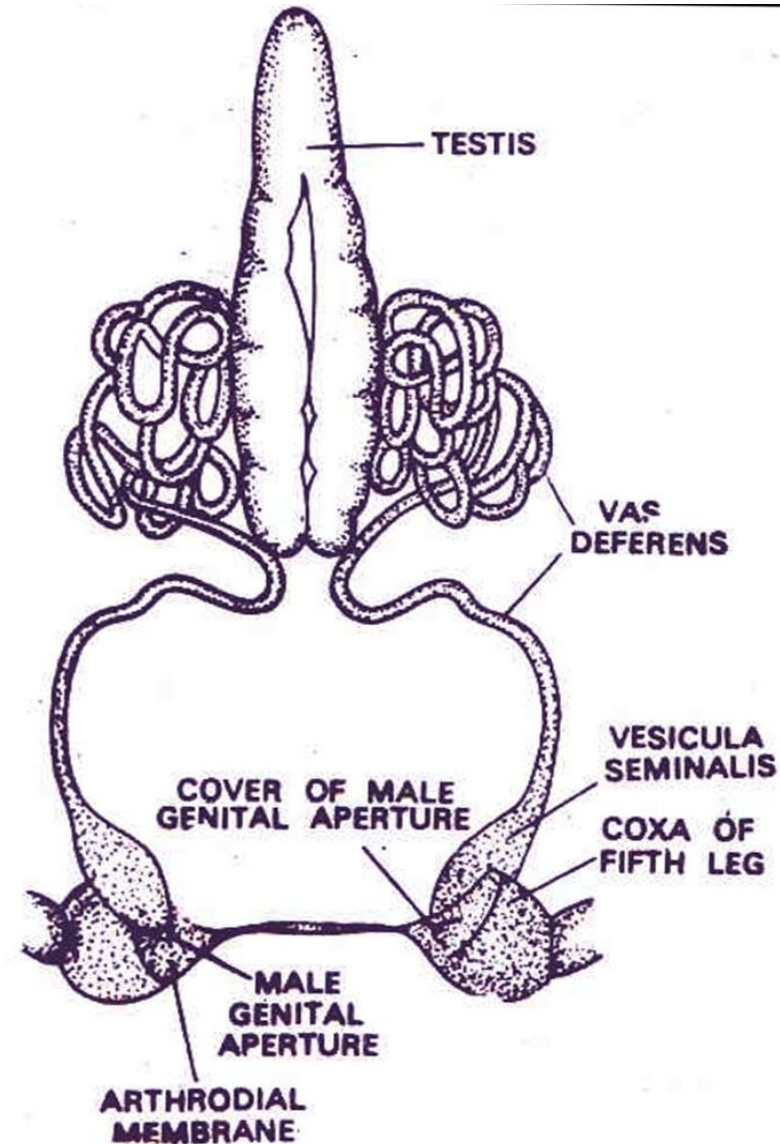
PHYSIOLOGY OF EXCRETION

- **EXCRETION**: The green glands have good blood supply from antennary arteries, by ultrafiltration, water and dissolved substances passing from surrounding blood into endsacs. The filtrate, called **primary urine** which passes into labyrinths. Here, selective resorption takes place where useful material pass into blood and remaining fluid is called **final urine** which flows into bladder. The urine is passed out through ureters and renal apertures and is wafted away in the currents set up by scaphognathites.
- **OSMORUGULATION**: Prawn blood is hypertonic to surrounding water. Therefore water diffuses into blood through highly permeable gills, that is why prawn passes out a large quantity of hypotonic urine to regulate internal fluid volume.

REPRODUCTIVE SYSTEM

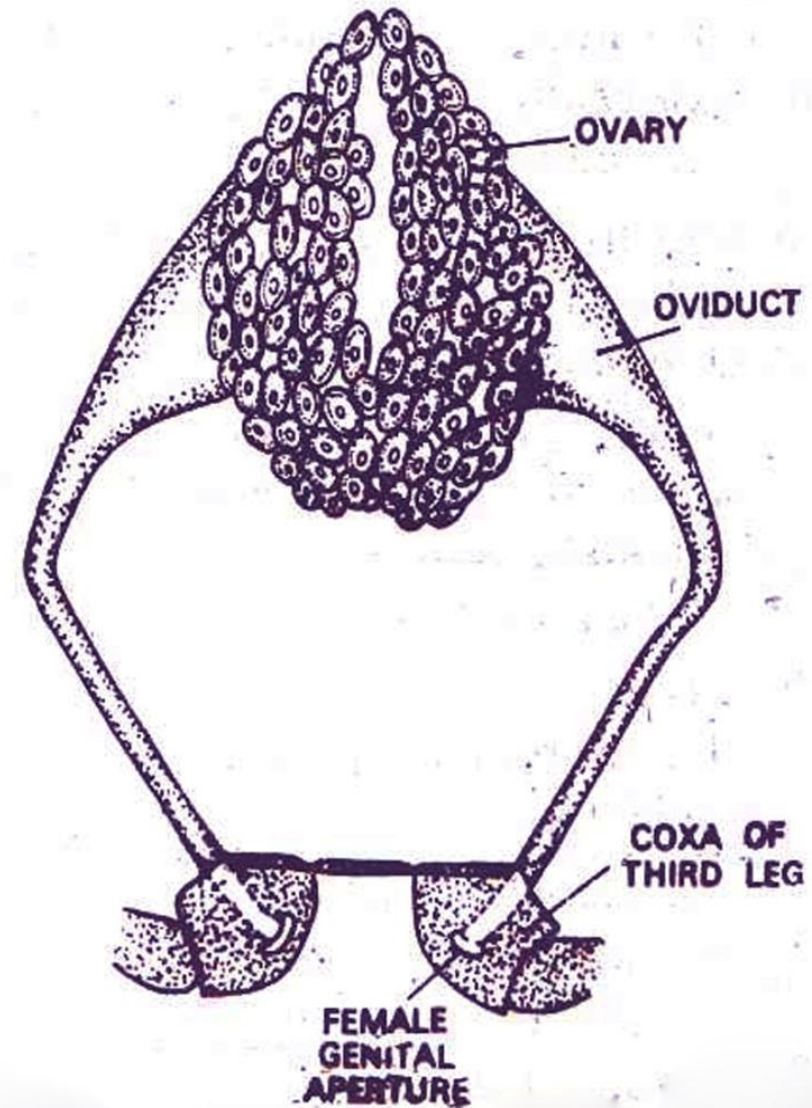
• Male Reproductive System:

1. **Testes:** There are two testis situated over posterior half of hepatopancreas and beneath heart. They extend upto renal sac in abdomen. Each testis is made up of large number of lobules held together by connective tissue. They are tubular and united in front. Many caecal diverticula arise from each testis.
2. **Vasa deferentia:** From the posterior region of each testis arises a tubular structure called vas deferens. It has a narrow anterior region, a swollen and convoluted middle region and a narrow posterior region.
3. **Vesiculae seminales:** These are club shaped posterior ends of the vasa deferentia. They store spermatozoa packed in spermatophores.
4. **Male genital openings:** The openings of the vesicula seminales to the exterior are called the male genital openings.

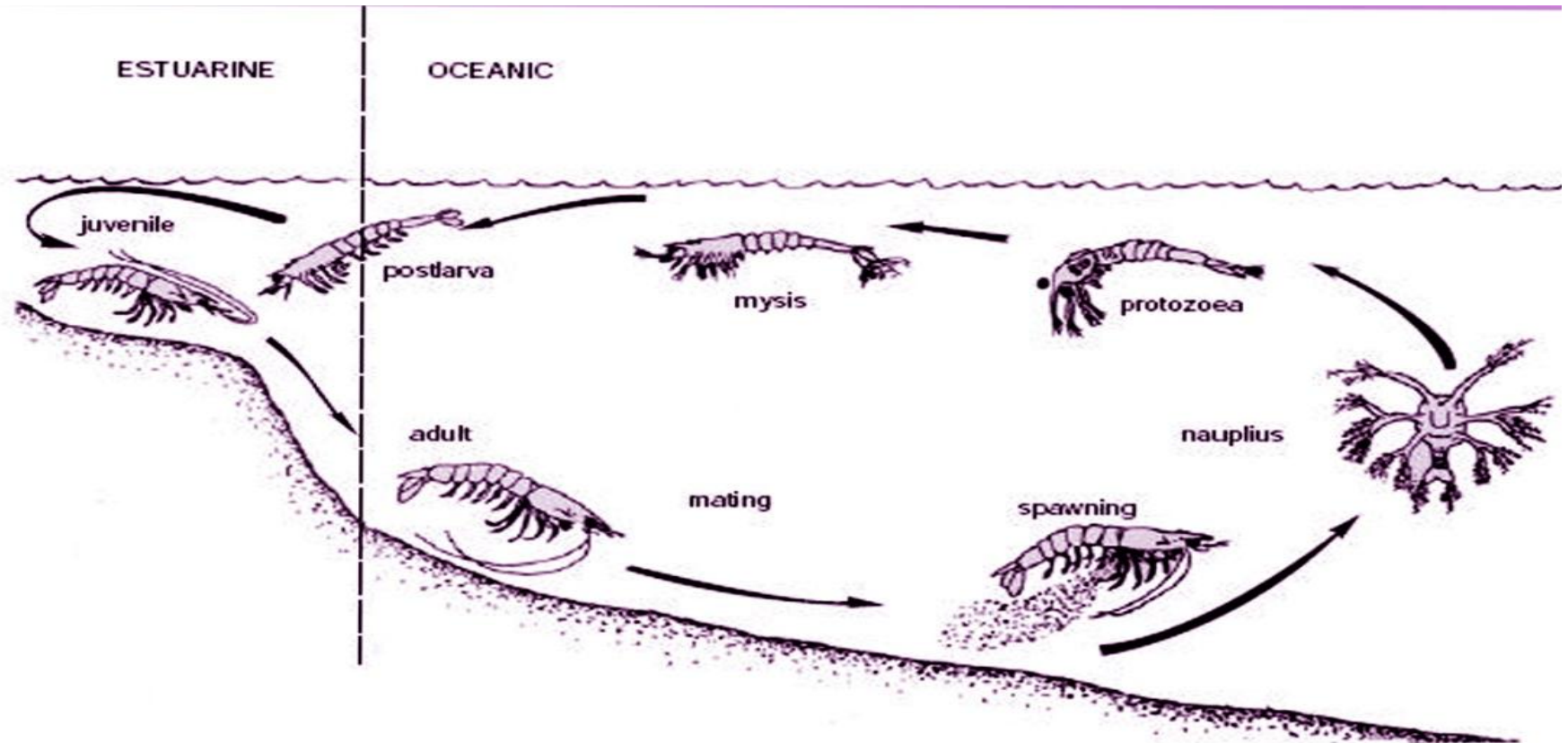


Female reproductive system:

1. **Ovaries:** There are two ovaries, one on either side of the middle line and they occupy the whole length of the thorax and abdomen. The right and left ovaries are united posteriorly and free anteriorly. Many distinct diverticula arise from the anterior region of the ovaries.
2. **Oviducts:** These are slender curved tubes with wide proximal ends. From the middle region of each ovary arises an oviduct.
3. **Female genital openings:** The two oviducts open to the exterior by the female genital openings.



LIFE HISTORY



The female releases the eggs in the water. *Nauplius larva* emerges from the egg. It passes the *metanauplius protozoa*, *mysis*, *postlarval*, *juvenile stages* and becomes the *adult*.

ECONOMIC IMPORTANCE

Fresh, and nutritious seafood is always the spirit for various delicious dishes. Either serving as live, fresh, boiled, steamed, chilled, fried, or baked, seafood is always the popular dishes in many restaurants. Prawns are the major high priced seafood.

The function of the marine creatures is not restricted to as seafood only, but many underlying uses are still remained to be discovered. In old ages, some have been used as a horn for recreational use. Some of the colorful species are collected as ornaments in containers. Some are used for jewelry, buttons and inlays. The shell of many molluscs can be sold for the manufacture of lime. Moreover, many crabs can serve as feed for fish cultures, for turtles and domestic birds and other animals. On duck farms, food mixed with crab powder not only stimulates growth and the fattening of ducks, but may also raise their spawning rate. Furthermore, dried seafood are on sale and widely used by Asian people as soup ingredients. Because they believe that seafood have potent medical contribution to good health.

IN CONCLUSION, IT IS UNDENIABLE THAT MARINE INVERTEBRATES ARE IMPORTANT, BOTH IN ITS DELICACY AS SEAFOOD AND ITS TREMENDOUS ECONOMIC VALUE.

THANKS