



Anatomy

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Anatomy

- **Anatomy** is the branch of biology concerned with the study of the structure of organisms and their parts.
- It is the scientific study of the structure of organisms including their systems, organs and tissues.
- It includes the appearance and position of the various parts, the materials from which they are composed, their locations and their relationships with other parts.

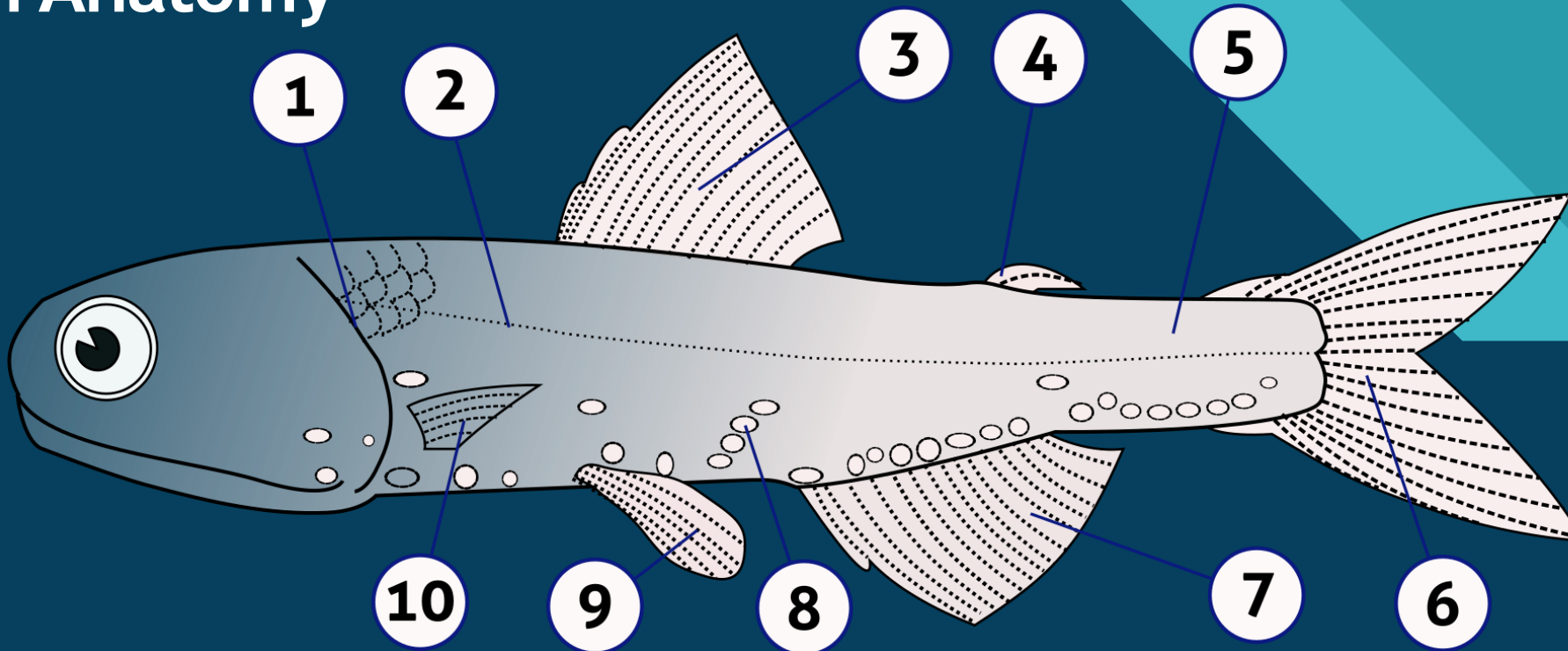
Classification

- The discipline of anatomy can be subdivided into
 - Gross or macroscopic anatomy and
 - Microscopic anatomy
- Gross Anatomy: It is the study of structures large enough to be seen with the naked eye such as the external and internal body organs.
- Microscopic Anatomy: It is the study of structures on a microscopic scale such as cells and tissues

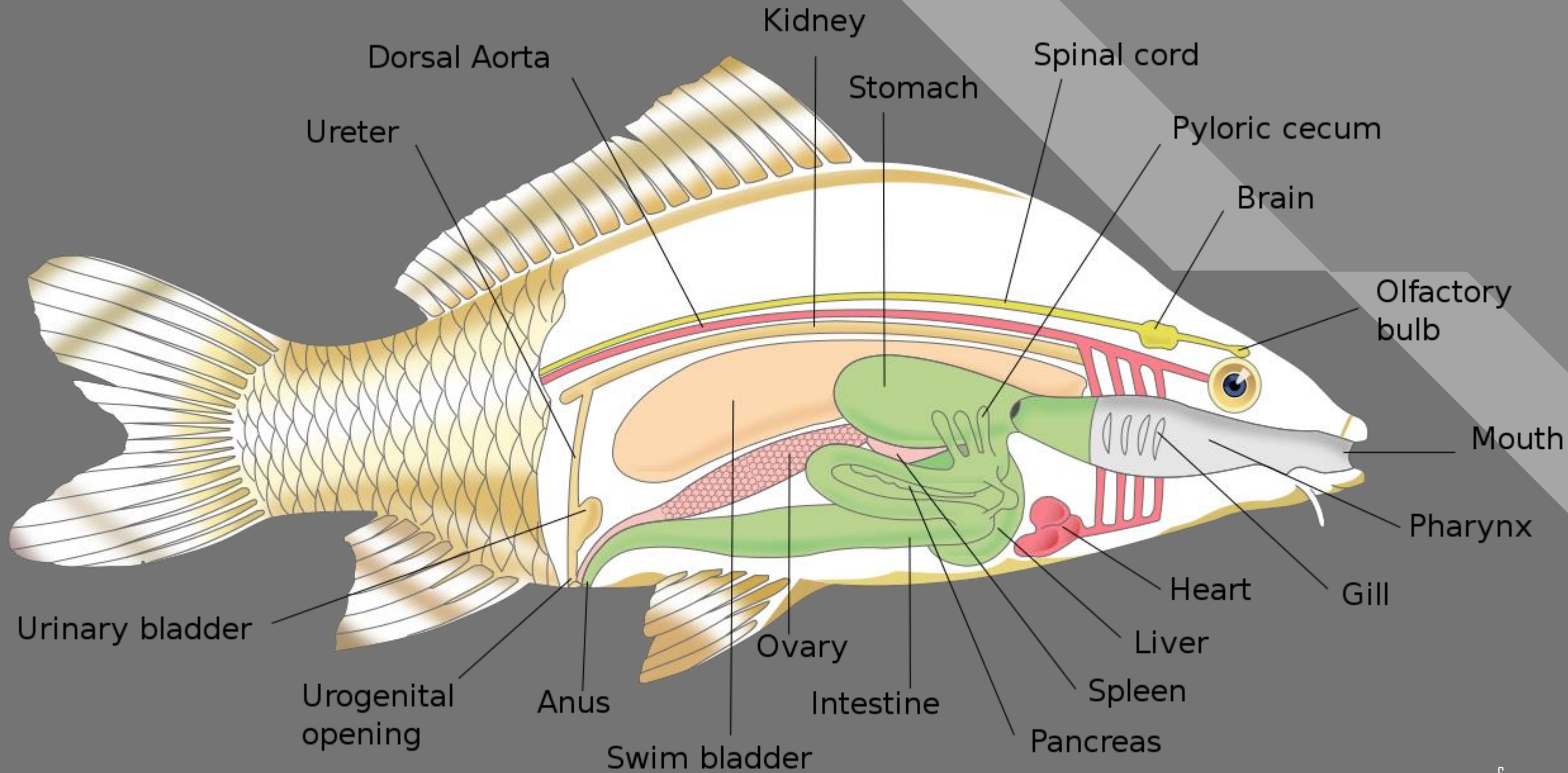
Gross anatomy and microscopic anatomy

- Gross anatomy is subdivided into
 - Surface anatomy or superficial anatomy (the external body without dissection)
 - Regional anatomy (specific external and internal regions of the body and how different systems work together in that region),
 - Systemic anatomy (specific organ systems such as respiratory or nervous system)
- Microscopic anatomy is subdivided into
 - Cytology (the study of cells) and
 - Histology (the study of tissues).

Fish Anatomy

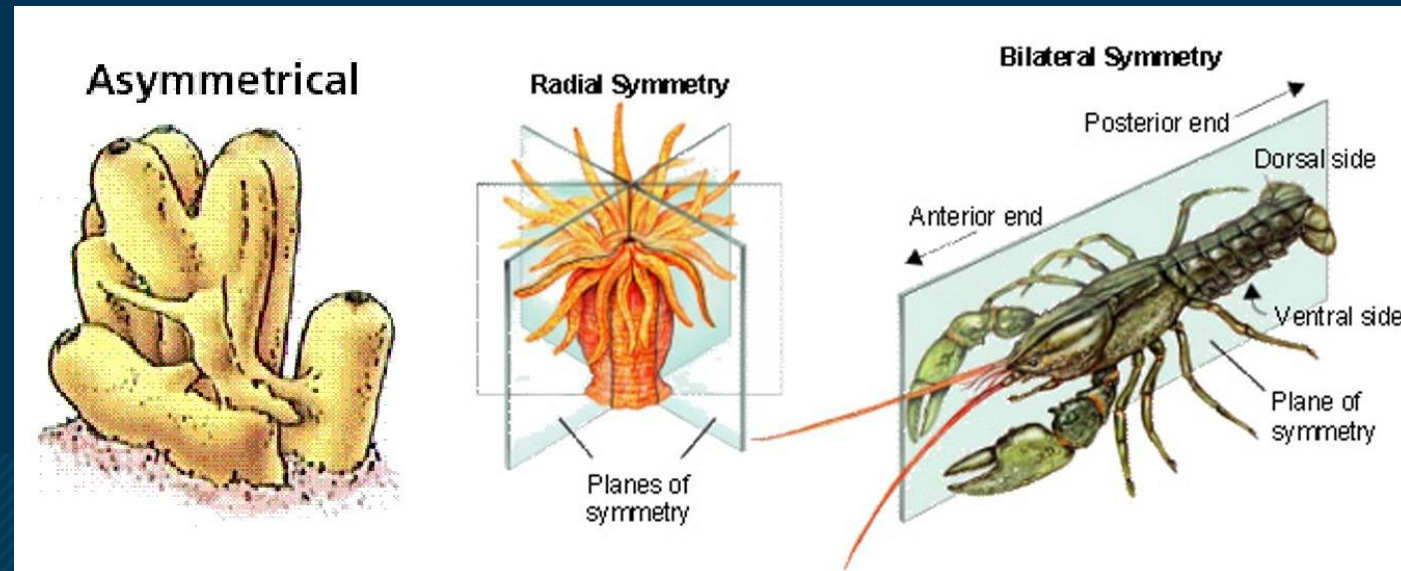


External anatomy of a bony fish: 1. operculum (gill cover), 2. lateral line, 3. dorsal fin, 4. adipose fin, 5. caudal peduncle, 6. caudal fin, 7. anal fin, 8. photophores, 9. pelvic fins (paired), 10. pectoral fins (paired)



Phylum Arthropoda

1. Bilaterally symmetrical animals with metameric body split in to tagmata
2. Body divisible into head, thorax and abdomen. The exoskeleton –chitin- functions in protection, attachment for muscles, locomotion and prevention of desiccation-moulting/ecdysis.



3. Appendages jointed and in some species (crab, lobsters and shrimps) appendages get specialized for walking, swimming and reproduction.

4. The muscular system complex with exoskeleton for attachment.

5. Reduced coelom and most of the body cavity consists of haemocoel filled with blood (Haemolymph).

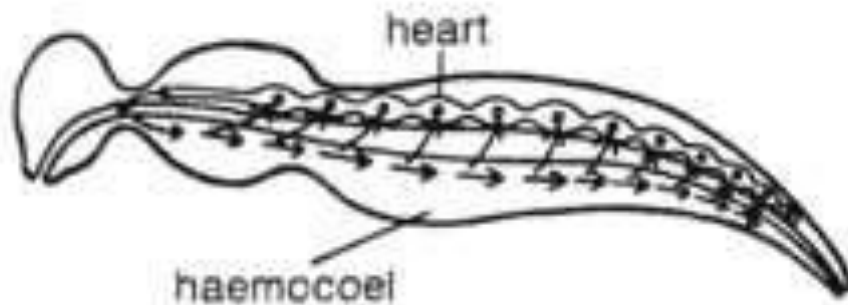
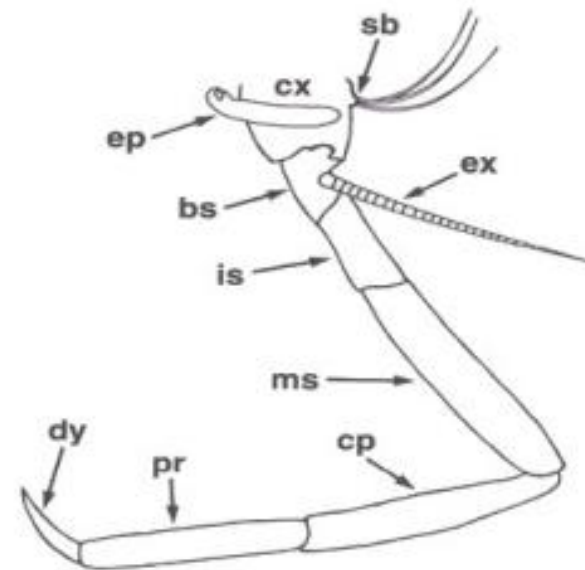
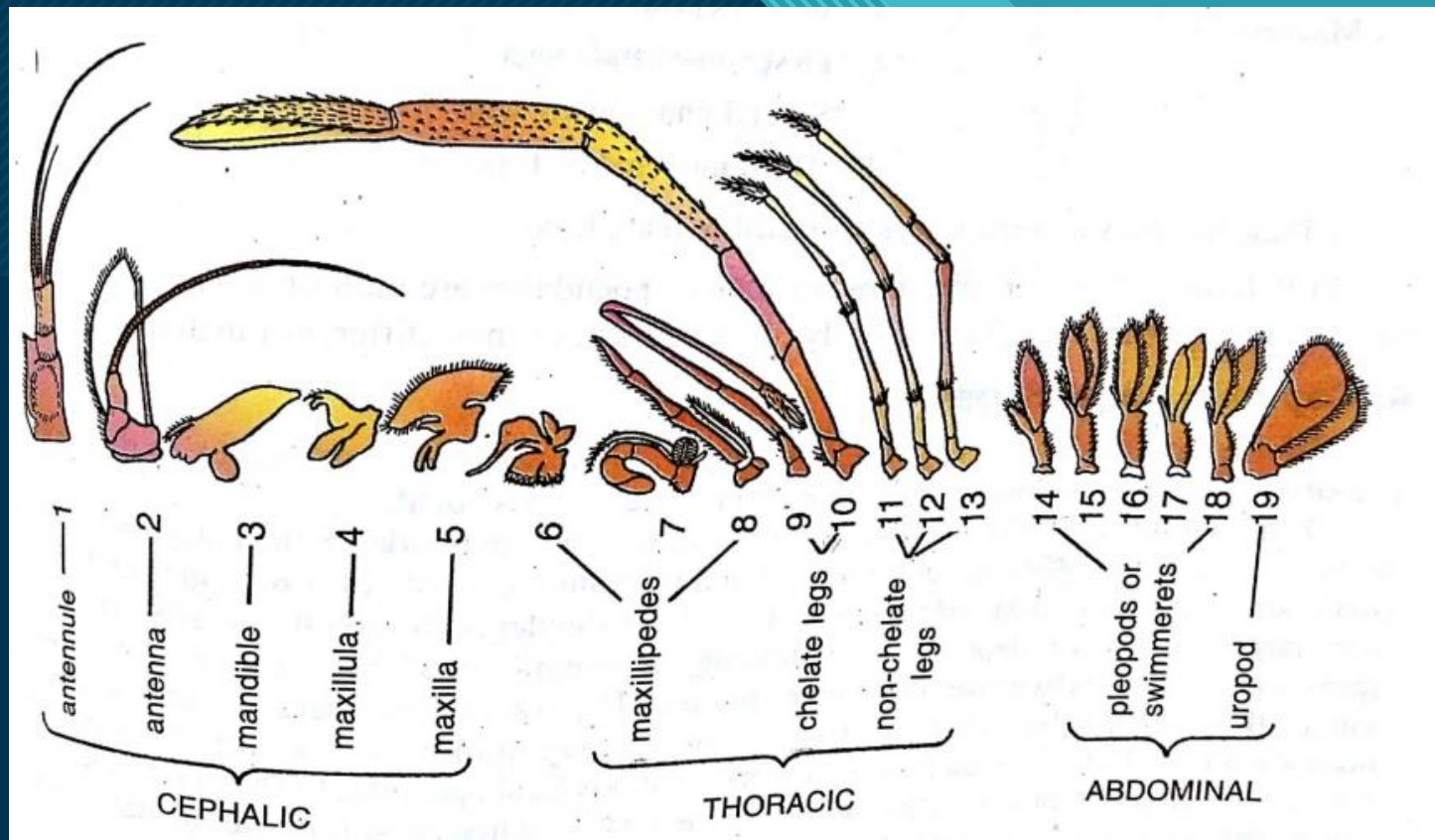


Fig. 186 Haemocoel.
Transverse section of an insect, showing the positions of the heart, haemocoel and blood flow.



Pereiopod structure
represented by a walking leg
bs=basis
cp=carpus
cx=coxa
dy=dactylus
ep=epipod
ex=exopod
is=ischium
ms=merus
pr=propodus
sb=setobranch



6. Appendages around the mouth get modified for different methods of feeding.

7. **Digestive system** complete with mouth, esophagus, stomach, intestine and rectum with associated glands for digestion.

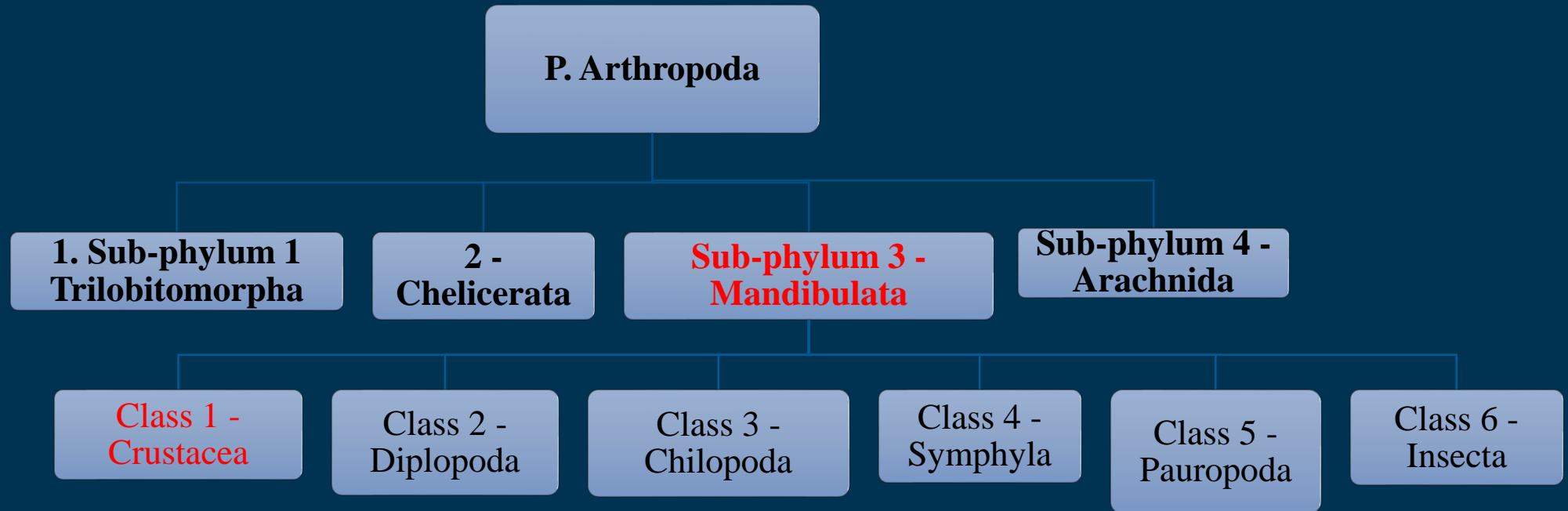
8. **Open circulatory system** with dorsal heart, arteries and haemocoel. Body cavity contains blood sinus and is a haemocoel, in which the different organs of the body lie bathed.

9. **Specialized respiratory system** having a variety of respiratory organs in accordance to the habitats of animals. Marine arthropods (**crabs, shrimps**) utilize vascularised gills for respiration. Terrestrial forms have **book lungs (e.g spiders)** or **trachea (e.g. insects)**.
10. **Paired excretory glands (green glands)** seen in aquatic crustaceans (shrimps and lobsters) while **terrestrial forms** have **malphigian tubules** as excretory organs.
11. A typical invertebrate nervous system with a brain connected to a **ventral solid nerve cord with ganglia**. Various sense organs are seen around the head region.
12. Sensory organs comprising **simple eyes (Ocelli)**, **compound eyes** (made up of a large number of individual units or Ommatidia), **chemoreceptors** and **tactile receptors**.

13. **Sexes separate** with internal fertilization, reproduction by oviparous or ovoviviparous; parthenogenesis seen in few forms.
14. During development, larval stages seen in most of the arthropods. The free swimming larva undergoes **metamorphosis** to become an adult.
15. **Moulting or ecdysis**, a common feature seen in arthropods. Moulting takes place from very young larval stages onwards. After the moult, the inner body increases in size and is able to adjust its expansion due to the softness of the cuticle.

P. Arthropoda-Classification

- 4 subphylum



Sub-phylum Crustacea

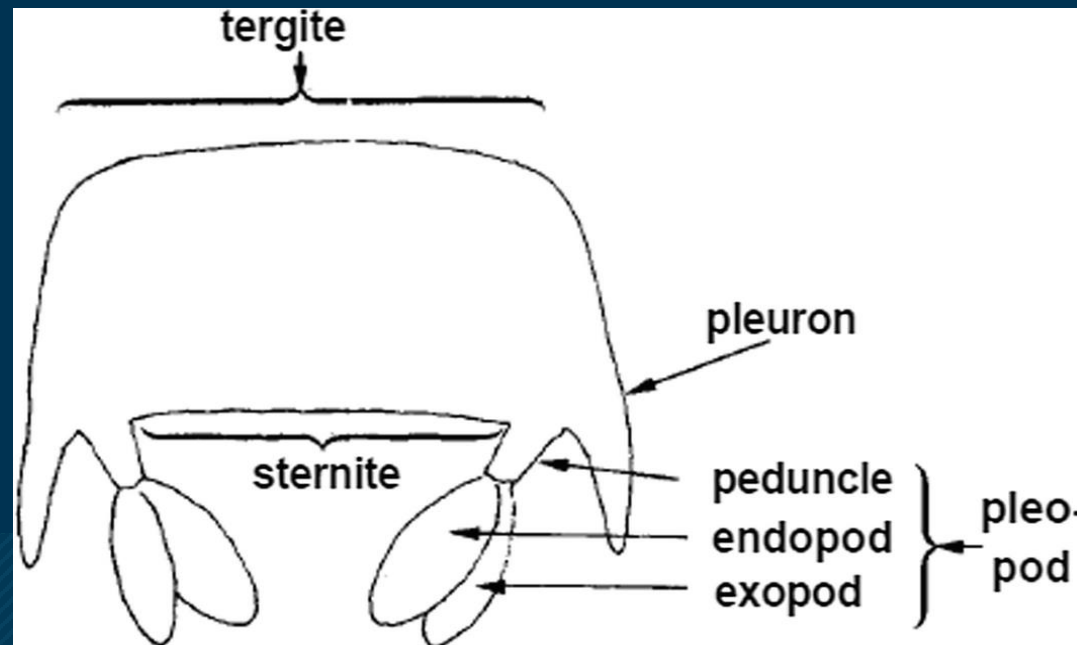
- Shrimps, prawns, lobsters, crabs, crayfish, barnacles, copepods etc., belong to this class
- Diverse group- very large Japanese spider crab, to the tiny planktonic water flea *Daphnia* sp
- Minute planktonic, some are active and nektonic while others are benthic living on sea-bed even up to a depth of 8000 m
- Parasitic crustaceans
- Habitat- Freshwater, brackish and marine

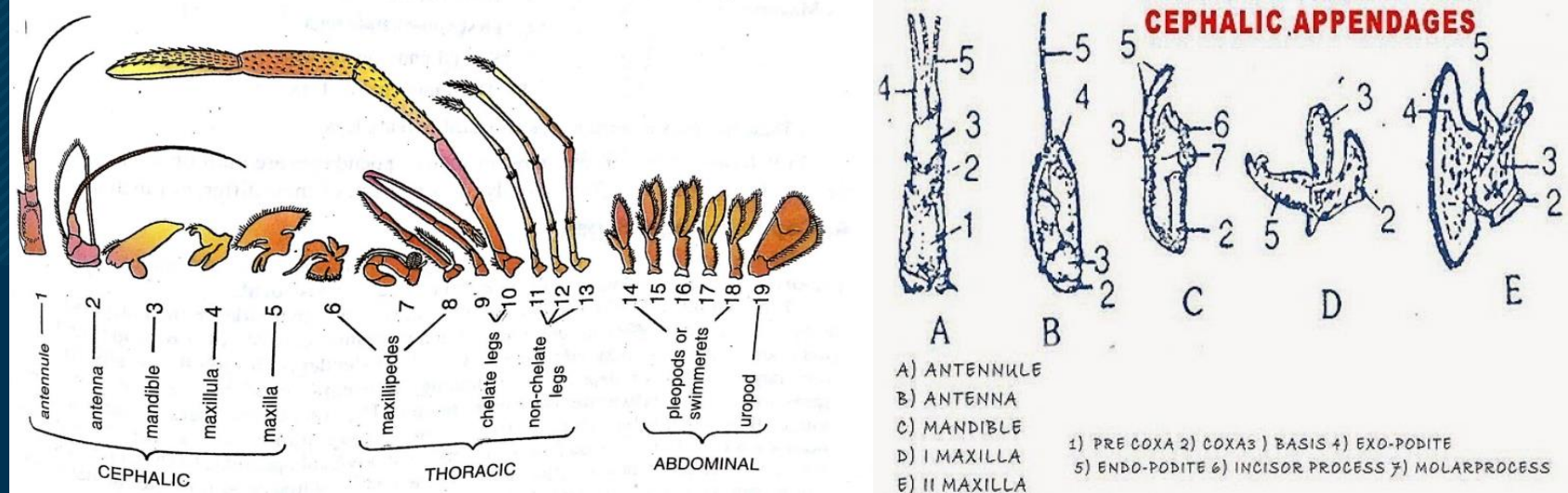
General characters (Sub-phylum Crustacea)

1. Crustaceans have **two pairs of antennae**, a **pair of mandibles**, a **pair of compound eyes** (usually on stalks) and **two pairs of maxillae** on their heads, followed by a **pair of appendages** on each body segment.
2. Body divided into **head, thorax** and **abdomen**; head and thorax fused to form **cephalothorax**.
3. Body segmented and covered by a **chitinous integument**, the **exoskeleton**.

4. Each segment has a ring of exoskeleton covering the adjacent rings being connected by thinner cuticle, the arthroidial membrane, making feasible the movement.

- The dorsal region of ring called the **tergite**, the ventral, the **sternite**. Each segment bears joined appendages. A pair of appendages found on the lateral sides of the sternite portion. The tergite may overhang freely over the sternites, called the **pleuron**.



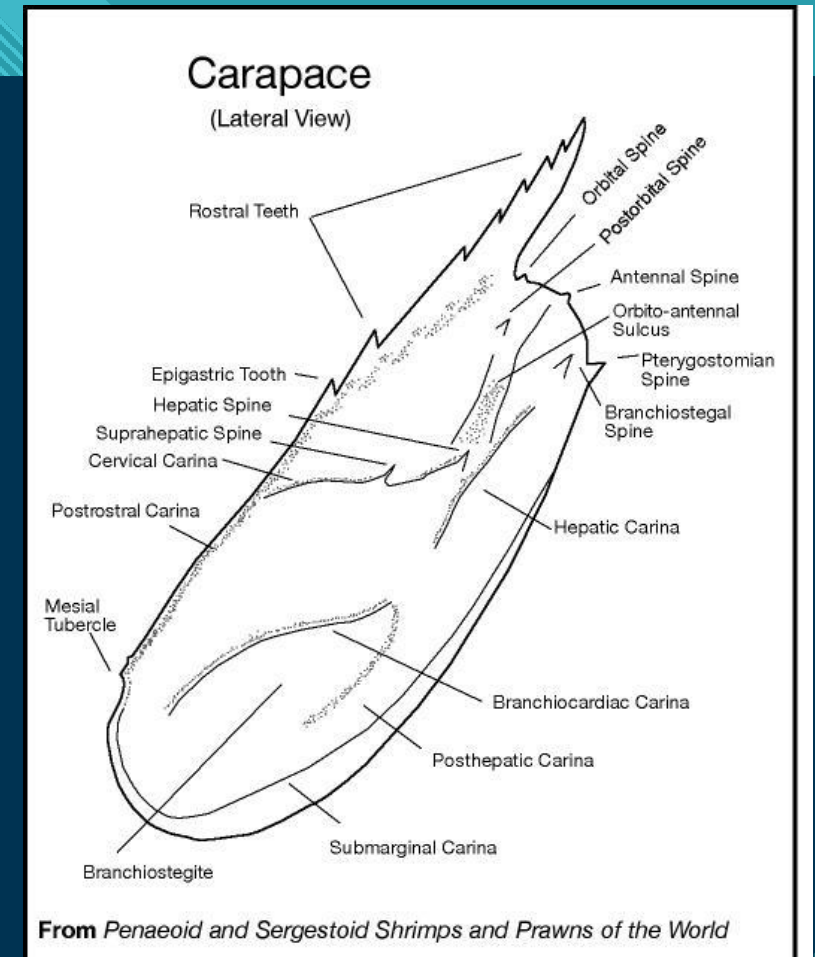


5. The thorax consists of a series of limb bearing segments, some of which may have become fused with head so that their appendages are **converted into mouth parts**.
6. The abdomen may or may not have appendages.
7. The appendages typically **biramous** having two branches, but become secondarily uniramous.
8. They have a calcified cuticle prior to moulting, the calcium gets reabsorbed and then deposited in the new cuticle.

9. On the posterior part of the cephalic region, a dorsal shield or carapace arises as an integumental fold-a shield or a mantle in the lower crustaceans.

10. In **Malacostraca (Sub class)**, the carapace fuses with some or all the tergites of other thoracic segments, the posterior extremity projecting freely at the sides to form branchial chambers.

- The anterior region may be produced into a toothed prolongation, the **rostrum**.

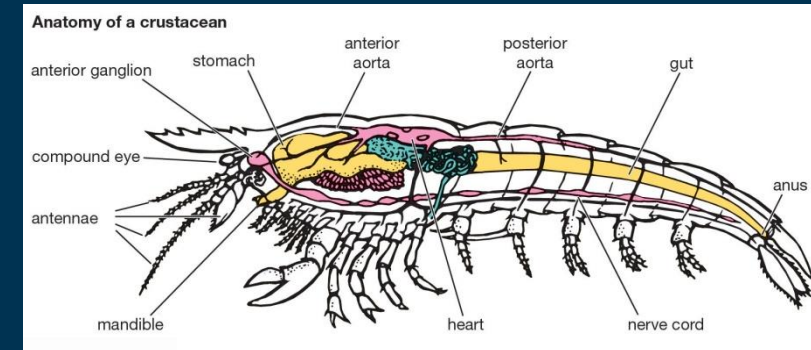
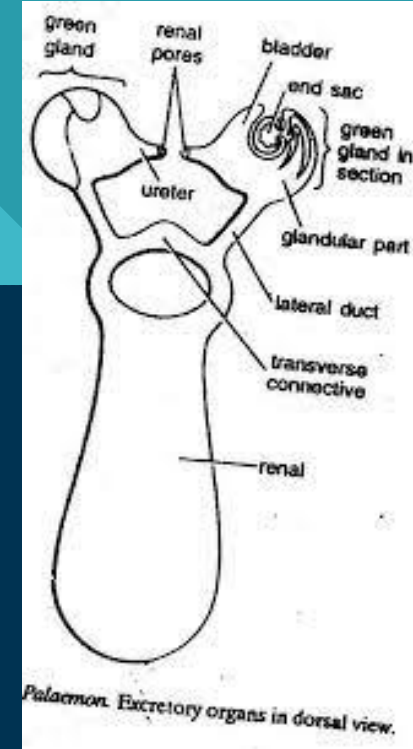


11. Respiration by the general **body surface** or by **gills**.

12. Excretion by modified **coelomoducts**, which may take the form either of **maxillary glands** or **antennary (green) glands**.

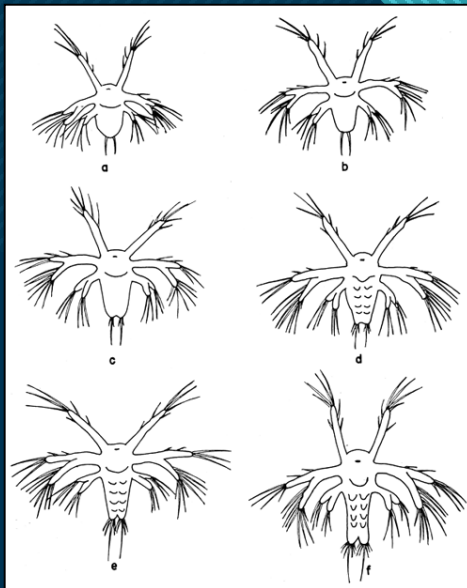
13. The development is **indirect**. Development includes **metamorphosis**, accompanied by a distinct embryonic or **free larval nauplius stage**.

14. **Digestive tract almost straight**. It comprises an anterior foregut, a posterior hind gut, both lined by chitin, and a middle unchitinised midgut.





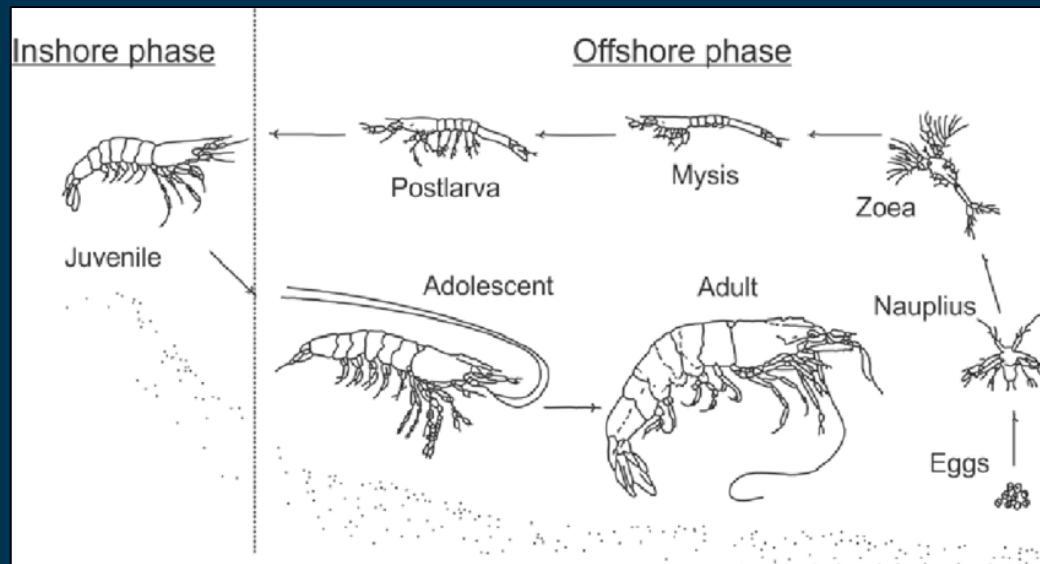
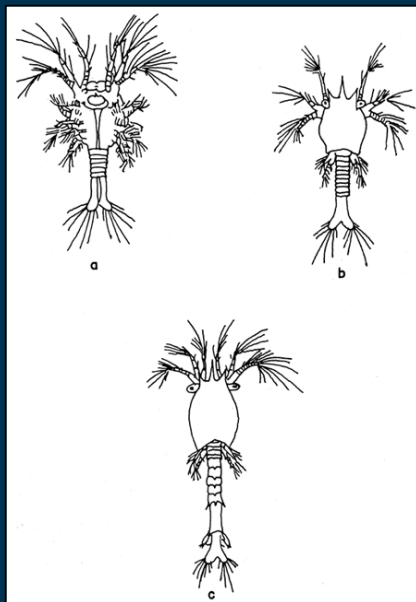
Nauplius



Mysis



Protozoa



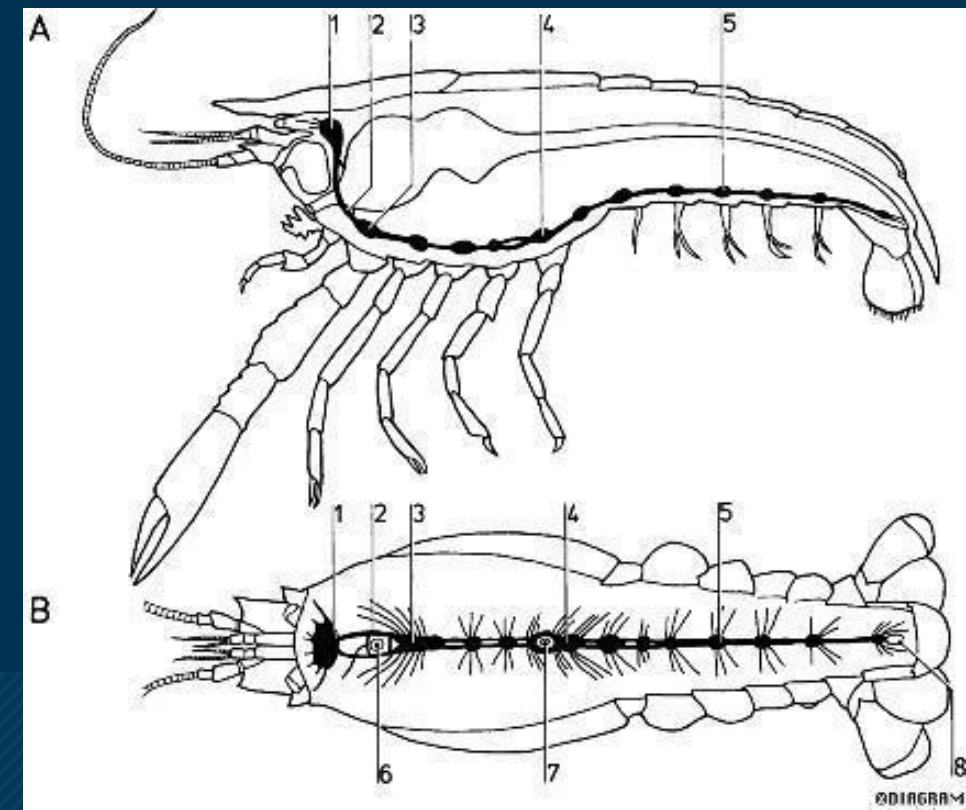
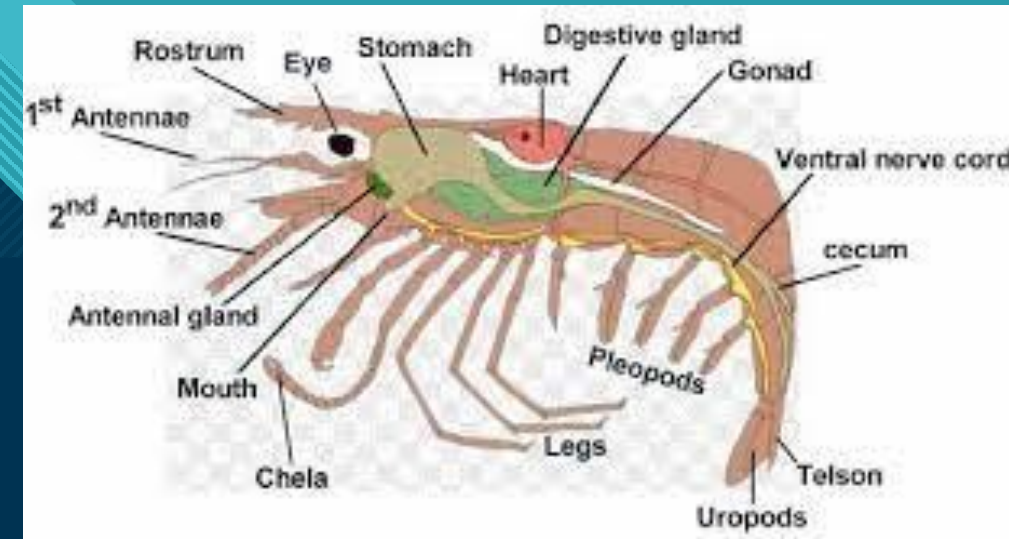
15. True coelom greatly reduced. The body cavity (haemocoel) is filled with blood (haemolymph).

16. **Blood vascular system** includes a dorsal contractile heart communicating by valvular ostia with a surrounding pericardial sinus.

17. **Nervous system** comprises the brain united by circumoesophageal connectives with a ventral nerve cord, formed of a double chain of ganglia joined together by connectives.

18. With the exception of many Cirripedia, the crustaceans are **unisexual**. Sexual dimorphism is common.

- Genital apertures are paired and anterior. Eggs are often carried by female.



19. Parthenogenesis frequently occurs among some of the Branchiopoda and ostracoda.

20. Body bilaterally symmetrical and triploblastic.



Thank You