

الانبار	الجامعة
العلوم	الكلية
علوم الحياة	القسم
الثانية	المرحلة
اللافقریات	اسم المادة باللغة العربية
Invertebrates	اسم المادة باللغة الانكليزية
ابراهيم عبد النبي شبيب	اسم التدريسي
القشريات	عنوان المحاضرة باللغة العربية
Mandibulata	عنوان المحاضرة باللغة الإنكليزية
8	رقم المحاضرة

Lec. 8: Subphylum Mandibulata

A- Class: Crustacea

- Body divided into cephalothorax (head+thorax) and abdomen.
- The length of crustacea ranged from less than a millimetre to 4 metres.
- Crustaceans are the only arthropods with **two pairs of antennae**.
- A pair of mandibles and two pairs of maxillae on the head, followed by a pair of appendages on each body segment or somite. All appendages, except the first antennae, are primitively **biramous** (two main branches)
- Respiration by **gills or body surface**.

Example *Astacus* (Crayfish)

External features

The body of Crayfish consist of **two well defined regions**: the anterior **cephalothorax** and posterior **abdomen**.

Cephalothorax segments consists of (5 cephalic segments + 8 thoracic segments) and covered by a hardened **carapace**, and it has a projection to the front of the head called **rostrum**, this structure have eye stalks on both sides of it, these stalks bears a compound eye (Figure 6). The portion of carapace covering the head region is separated from that covering the thoracic region by the dorsal cervical groove. On the lateral side of the carapace, the branchiostegite (dorsal and lateral branchial region of carapace), covers the gills.

Abdomen: The abdomen is composed of **six segments** and modified posterior extension, the telson which may or may not be considered a true segment (Figure 6).

Openings: Several openings may be seen on the ventral side such as (Figure 7):

- Mouth: mouth is in the head region and is surrounded by the jaws and other mouthparts.
- Anus: the anus is in the telson.
- Opening of the oviducts are at the base of the **third** pairs of walking legs.
- Openings from vas deference are at the base of the **fifth** walking legs.

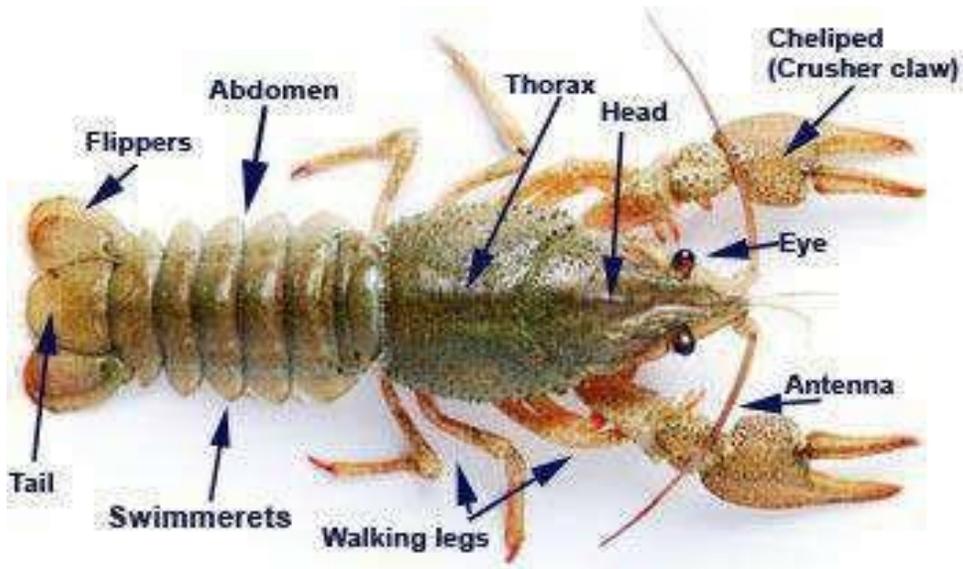


Figure (6): External feature of *Astacus*.

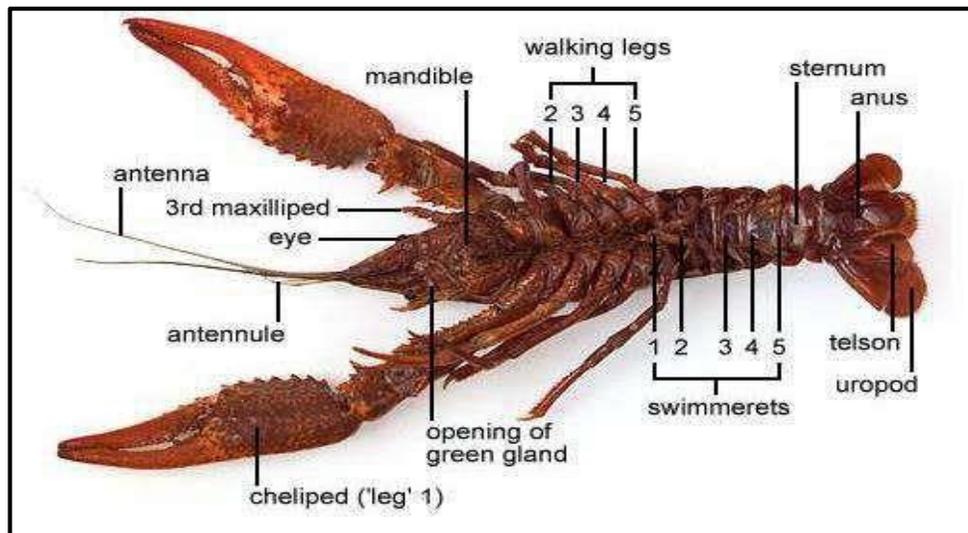
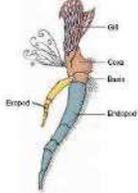
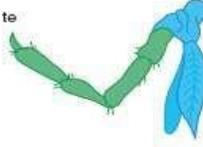


Figure (7): The ventral side of *Astacus*

Appendages: there are three types of appendages in *Astacus*

<p>1- Biramous: The basal portion, bears a lateral exopod and a medial endopod. ex: swimmerets and antennules.</p>	
<p>2- Follicaceous: its segment modified to leaf-like structure ex:second maxillae.</p>	 <p>Second maxilla</p>
<p>3- Uniramous: having a single branch only (endopod) ex: walking legs.</p>	 <p>Walking leg (peritopod, 5 pairs)</p>

Appendages of Crayfish (Figure 8):

1- Cephalic Appendages:	The function
<ul style="list-style-type: none"> • Antennae(1st & 2nd) 	Touch , taste
<ul style="list-style-type: none"> • Mandibles 	Crushing food
<ul style="list-style-type: none"> • 1st ,2nd Maxillae 	Food handling and bailing water from gill chamber.
2- Thoracic Appendages	The function
<ul style="list-style-type: none"> • 1st , 2nd & 3rd Maxillipeds 	Touch , test and food handling
<ul style="list-style-type: none"> • 1st walking leg (Cheliped) 	Offense and defense
<ul style="list-style-type: none"> • 2nd & 3rd walking legs 	Walking & prehension
<ul style="list-style-type: none"> • 4th & 5th Walking legs 	Walking
3- Abdominal Appendages	The function
<ul style="list-style-type: none"> • 1st swimmeret 	In female protopod reduced or absent in male modified to transfer sperm to female.
<ul style="list-style-type: none"> • 2nd swimmeret Male Female 	Transfer sperm to female Creating water currents ; carrying eggs and young.
<ul style="list-style-type: none"> • 3rd , 4th and 5th swimmeret 	Creating water currents; in female carrying eggs and young.
<ul style="list-style-type: none"> • Uropod 	Swimming; egg protection in female.

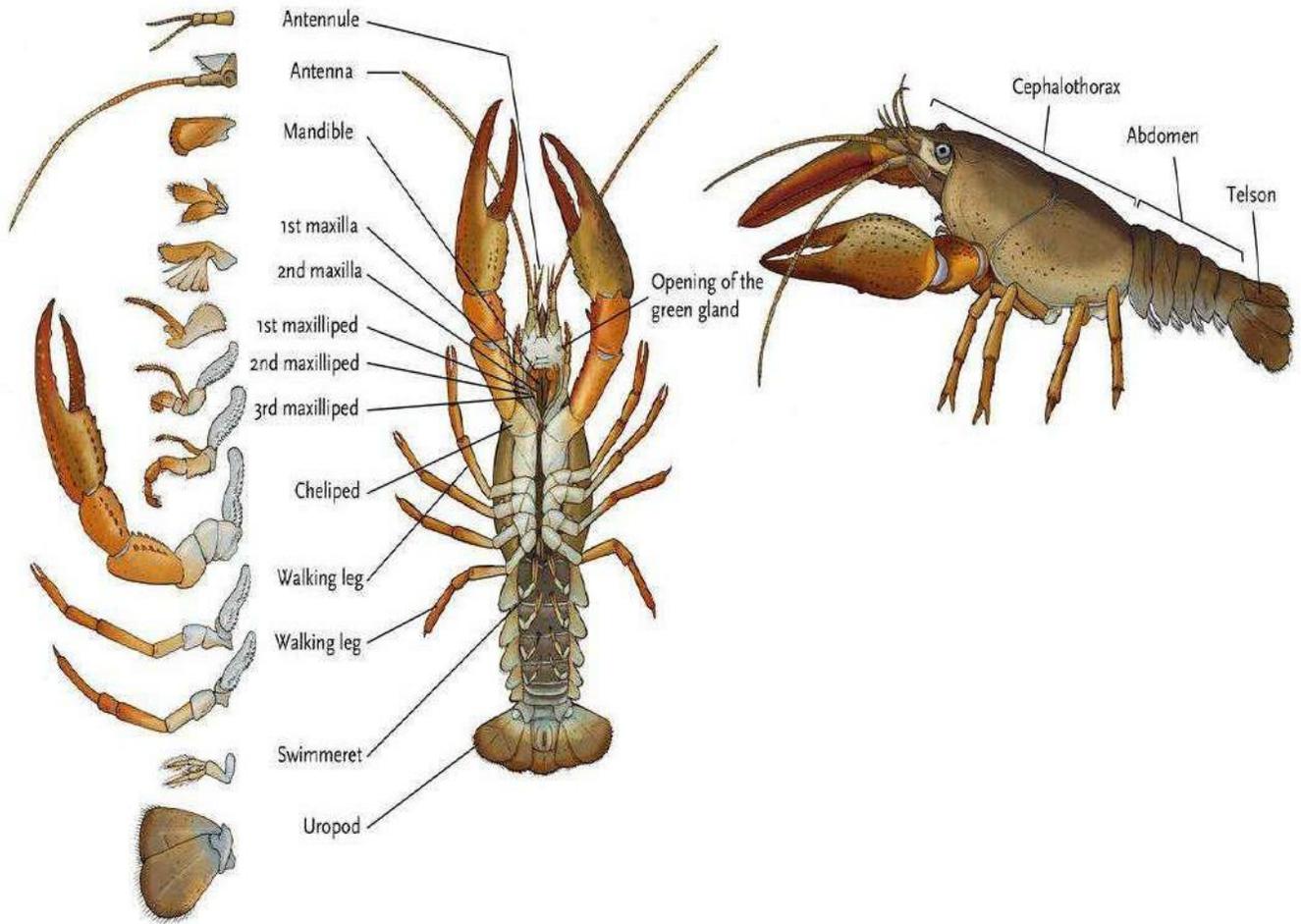


Figure (8): Types of appendages in *Astacus*

Internal Anatomy:

Digestive System:

Digestive tract divided into three main regions:

1- Foregut

2- Midgut

3- Hindgut

1- Foregut: the **mouth**, which opens between the jaws on the ventral surface, leads into the short **esophagus** and then into the stomach. The stomach is divided into **two main parts**: the **cardiac stomach** and the **pyloric stomach**. The cardiac stomach is a large sac-like structure in which food is stored, while the digestion occurs in a pyloric stomach. Digestive glands (liver) are located on each side of pyloric stomach which produce digestive enzymes. Undigested material passes into the hindgut (rectum) that opens into anus.

2- Midgut: the digestion and absorption of food occur in the midgut. This portion of the digestive tract consist of short intestine to which are connected large digestive diverticula, these are complex in both structure and function. Two diverticula are lateral in position and one is dorsal. the two lateral ones are often termed "**livers**" their secretion is both **proteolytic and lipolytic**.

3- Hindgut: the hindgut consists of the long straight intestine which broadens into the short rectum just before the anus (figure 9).

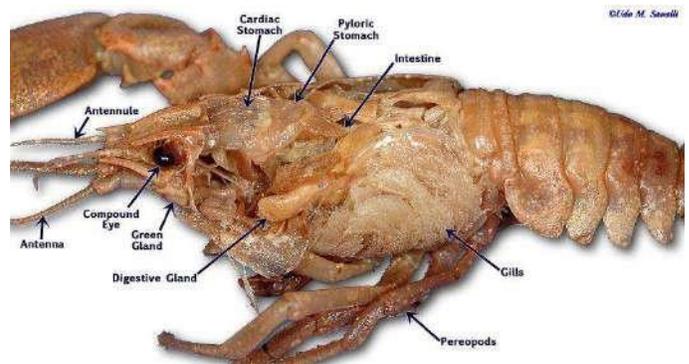
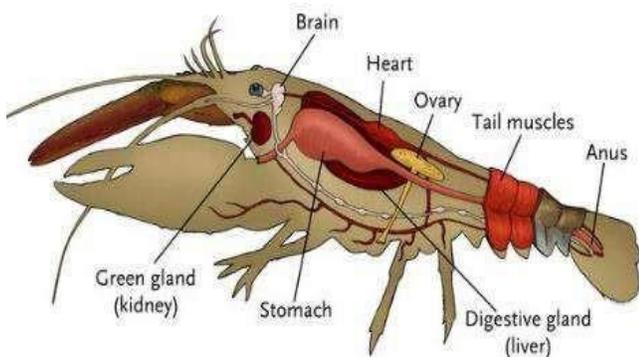


Figure (9): Digestive system in *Astacus*

Nervous Systems The nervous systems of crustaceans and annelids have much in common, although those of crustaceans have more fusion of ganglia. The brain is a pair of **supraesophageal ganglia** that supplies nerves to the eyes and two pairs of antennae. A fusion of at least five pairs of ganglia that supply nerves to the mouth, appendages, esophagus, and antennal glands. The double ventral nerve cord has a pair of ganglia for each somite and nerves serving the appendages, muscles, and other parts (figure 10).

Circulatory System: heart is a single-chambered sac of striated muscle located in the dorsal portion of the thoracic region, blood enters the heart through three pairs of ostia. Crayfish has open circulatory system (no veins), the abdominal aorta (toward the posterior, and anterior dorsal aorta (toward the anterior). Blood flows from the dorsal arteries to capillaries and then into tissue spaces called sinuses which function as veins. The blood flows over the gills before returning to the heart.

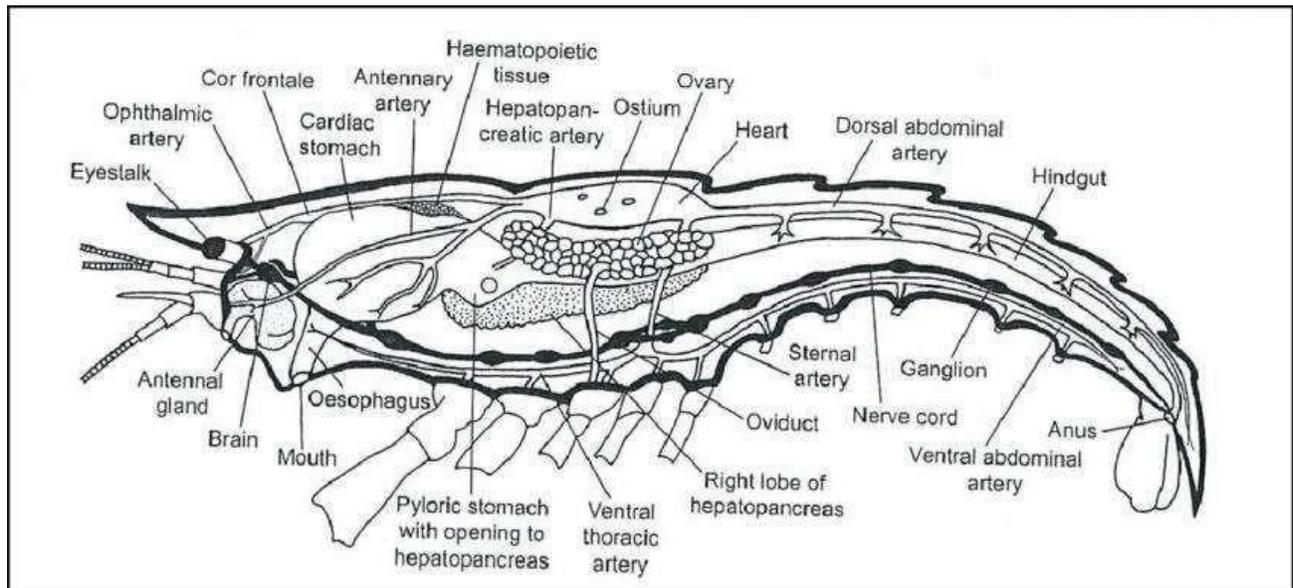
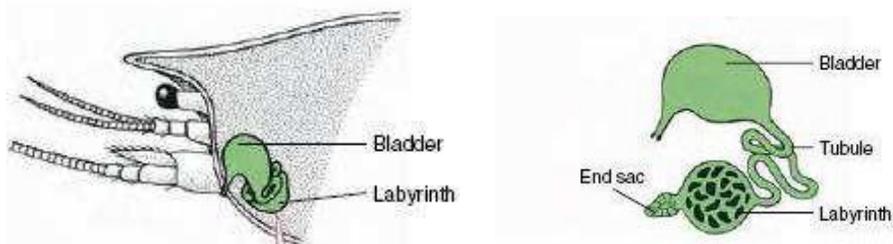


Figure (10): Internal anatomy of *Astacus*

Excretory System: The excretory system consist of a pair of green gland lying in the head region, each organ possesses end sac, glandular region (labyrinth) for waste removal and bladder. The labyrinth connects by an excretory tubule to a dorsal bladder, which opens to the exterior by a pore



on the ventral surface of the basal antennal segment (figure 11).

Figure (11) Excretory system in crayfish

Respiratory system: 17 pairs of gills located in the bronchial chamber on the lateral side between carapace and the body. These gills are attached to the chelipeds and walking legs. The blood passes through the gills where the carbon dioxide releases and oxygen picks up (figure 12).

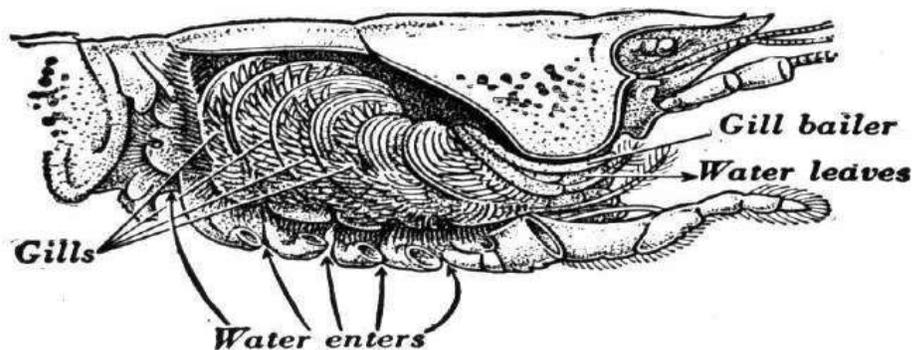


Figure (12): Respiratory system in crayfish

Reproductive system: the gonads lie in the **cephalothorax** beneath the **pericardium** and above the **gut**.

The ovaries and the testes are similar in shape and each consist of hollow, three-lobed, two sac laying anteriorly and one posteriorly.

The oviducts are short, thin walled, and almost straight, passing vertically downwards to their openings on the **3rd** walking legs (figure 13-A).

The vasa deferentia are long, and coiled, the straighter, terminal, muscular portions leading downwards to open on the **5th** walking legs (figure 13-B).

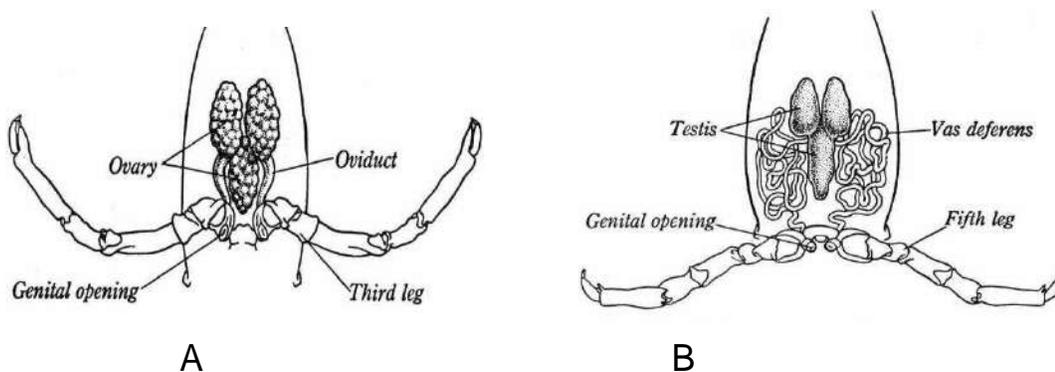


Figure (13): reproductive system in *Astacus*;

A- female reproductive system, B- Male reproductive system

Regeneration & Autotomy: crayfish are able to regenerate broken or lost appendages. For example, if an entire eye is removed, it is replaced by antenna like structure.

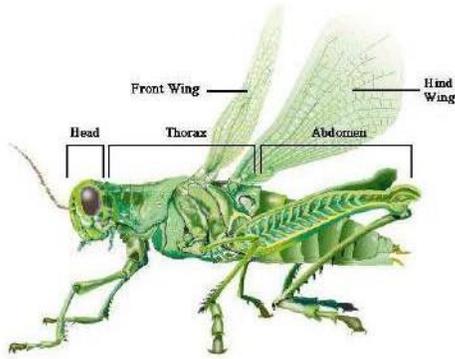
If walking legs is injured, the crayfish is able to cast it off in a process known as autotomy.

B- Class: Insecta (Hexapoda)

Insecta are the most diverse and abundant of all groups of arthropods. The general characteristic of insect are:

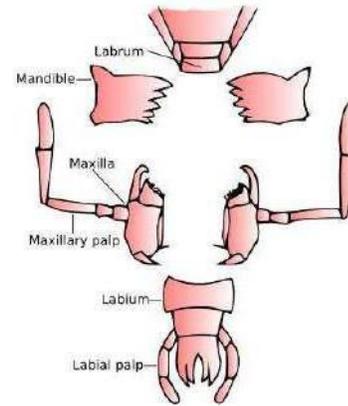
- The body is divided into three regions :**head , thorax and abdomen** . **three pairs of legs** are present on the thorax, and often there are one or **two pairs of wing** (figure 14-A).

- The mouth parts consist of: **the labrum, the mandibles, maxillae, labium and hypopharynx** (figure 14-B).
- Most forms respire by **trachea**; only some aquatic forms possess **gills**.
- The insects are well supplies with sense organ.



A

Figure 14: A- Body regions in insects



B

B- Mouth parts in insects

C- Class: Chilopoda(Centipeds)

Chilopoda (ki-lop_o-da) (Gr. *cheilos*,margin, lip, *_pous, podos*, foot), or centipedes, are land forms with somewhat flattened bodies that may contain from a few to 177 somites.

- Body is dorso-ventrally depressed.
- Antennae are long and many jointed
- Mandibles are toothed and cutting.
- Two pairs of maxillae.
- First pair of legs(maxillepeds) form poison claws
- The genital opening is situated at the hind end of the body
- Carnivorous.

Example: Scolopendra

- Body is elongated, dark greenish brown in color and dorsoventrally flattened with numerous of segment.
- Body is divided into head and trunk.
- Head is distinct and bears a pair of antennae, a pair of mandibles and two pairs of maxillae.
- Trunk segment are 22 in number and nearly all alike
- First pair of trunk appendages or maxillipeds bears a sharp claw connected with poison gland.
- Sex are separated, genital opening situated in the last segment.
- Carnivorous, feeding on insect spiders and worms (figure 15).

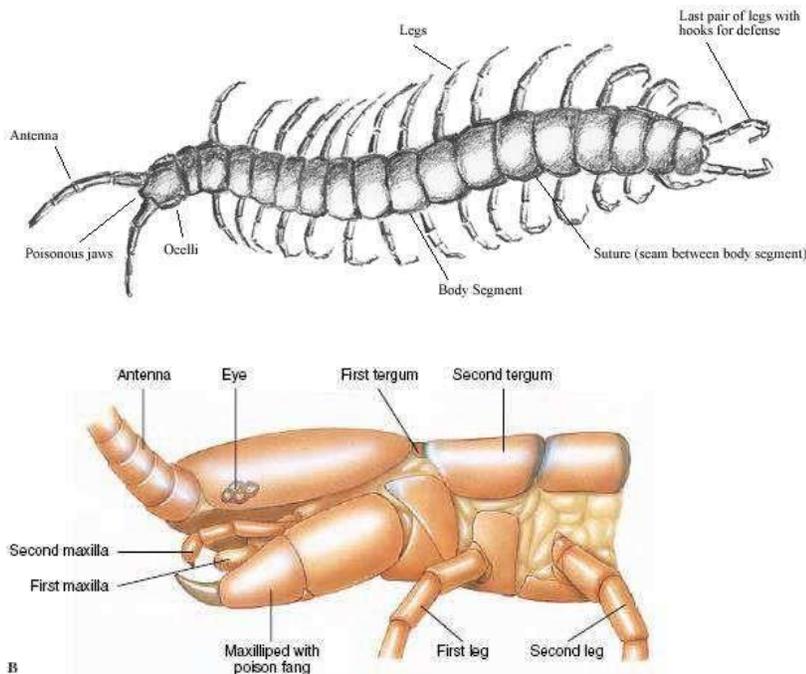


Figure (15): External feature of *Scolopendra*

D- Class: Diplopoda(Millipedes)

The Diplopoda (Gr. *diploo*, double, two _ *pous, podos*, foot) are commonly called millipedes, which literally means "thousand feet".

- Body is cylindrical or sub cylindrical.
- Antennae are short with fewer segments
- Mandible are broad and masticating
- One pair of maxillae
- Each trunk segment bears two pairs of legs mid-ventrally.
- Poison claws are absent
- The genital opening is situated at the anterior end of the body.
- Herbivorous.

Example : *Julus* (خاتم سليمان)

- *Julus* is commonly called millipede or wire worm.
- Body is elongated and cylindrical, consist of large number of segments.
- Body is divided into head, thorax and abdomen.
- Head consists of five segments, thorax of four segments and abdomen of 20-100 segments.
- Head bears a pair of short antennae, a pair of mandibles and a pair of maxillae.
- Thoracic segments with one pair of legs in each , while abdominal segments bear two pairs of legs.
- Poison claws are absent.
- Stink glands present along the sides of the body , secreting noxious substance.
- Sex are separated (figure 16).

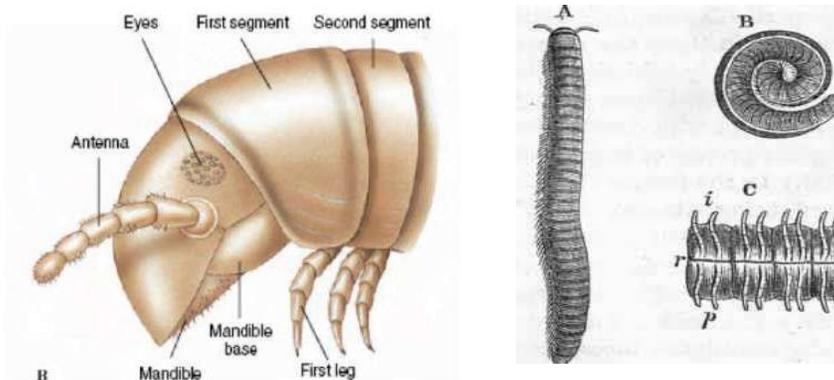


Figure (16): External feature of *Julus*.

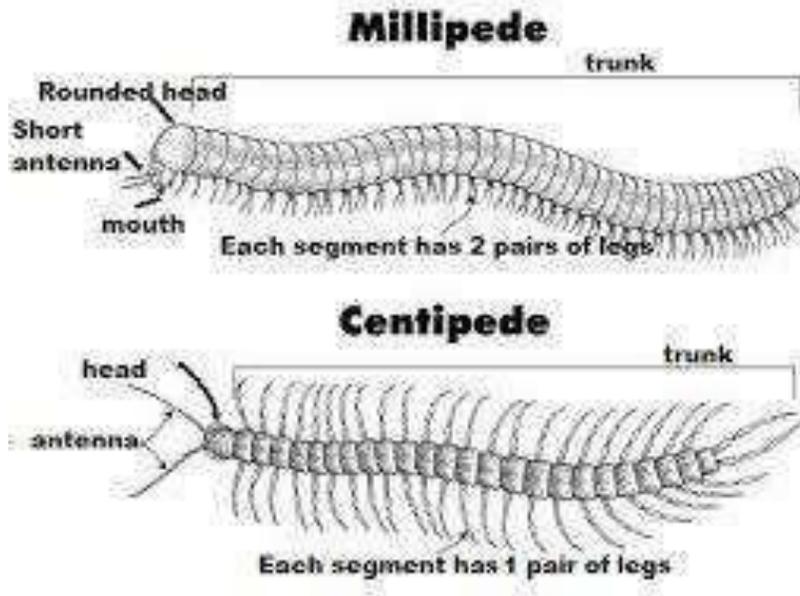


Figure (17): Difference between class: Millipede and class: Centipede

E- Class: Pauropoda

Pauropoda (Gr. *pauros*, small, *pous*, *podos*, foot)

- Pauropoda are a group of minute (2 mm or less), soft-bodied myriapods, numbering almost 500 species.
- They have a small head with branched antennae and no eyes, but they have a pair of sense organs that resemble eyes.
- Their 12 trunk segments usually bear nine pairs of legs (none on the first or the last two segments).
- They have only one tergal plate covering each two segments.
- Tracheae, spiracles, and circulatory system are lacking (figure 17). Ex: *Pauropus*

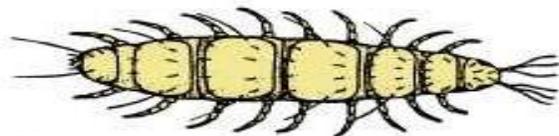


Figure (18): External feature of *Pauropus*

Article I. F- Class: Symphyla

- Are small (2 to 10 mm) and have centipede-like bodies.
- They live in humus, leaf mold, and debris.
- They are soft bodied, with 14 segments, 12 of which bear legs and one a pair of spinnerets.
- The antennae are long and unbranched.
- Only 160 species have been described.

