Unit II Ch 7: Structural Organisation in Animals

Module 3

7.4 Cockroaches

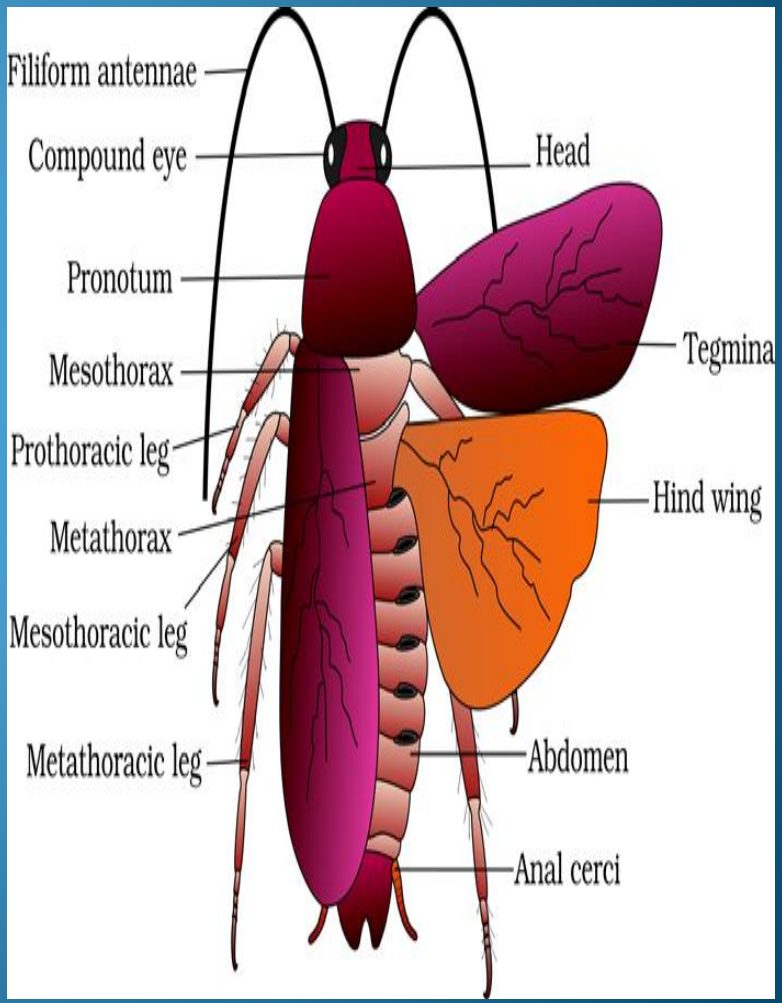
(*Periplaneta americana*)

Cockroaches (*Periplaneta americana*)

- Brown or black bodied animals that are included in class Insecta of Phylum Arthropoda.
- Also reported as Bright yellow, red & green coloured in tropical regions.
- Size ranges from ¼ inches to 3 inches (0.6-7.6 cm)
- have long antenna, legs and flat extension of the upper body wall that conceals head.
- Nocturnal omnivores that live in damp places throughout the world. They have become residents of human homes & thus are serious pests & vectors of several diseases.

7.4.1 Morphology

- Adults of the common species of cockroach, *Periplaneta americana* are about 34-53 mm long with wings that extend beyond the tip of the abdomen in males.
- The body of the cockroach is segmented and divisible into three distinct regions - head, thorax and abdomen.



7.4.1 Morphology

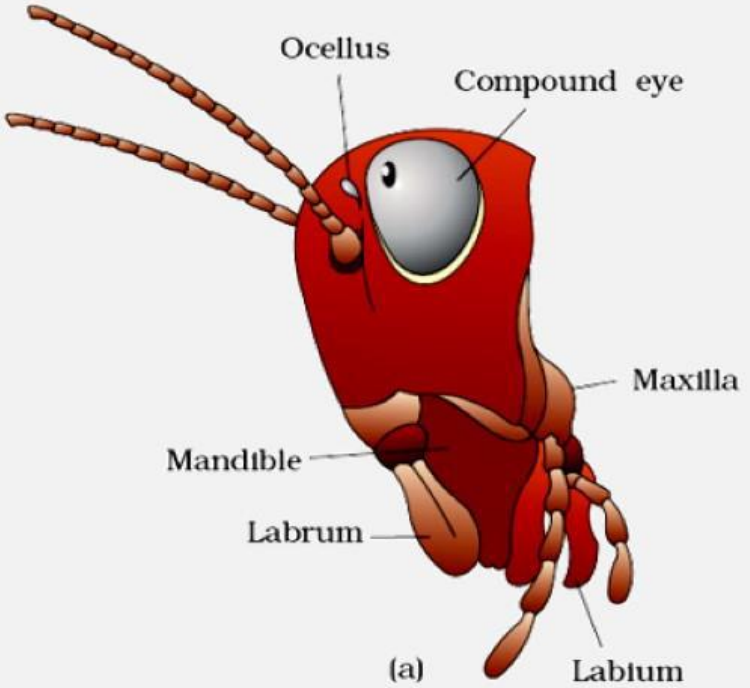
- **Head** is triangular in shape and lies anteriorly at right angles to the longitudinal body axis. It is formed by the fusion of six segments and shows great mobility in all directions due to flexible neck.
- Head capsule bears a pair of **compound eyes**.
- A pair of thread like **antennae** arises from membranous sockets lying in front of eyes. Antennae have sensory receptors that help in monitoring the environment.
- Anterior end of the head bears appendages forming biting and chewing type of **mouth parts**. The mouthparts consisting of a labrum (upper lip), a pair each of mandibles & maxillae & a labium (lower lip).

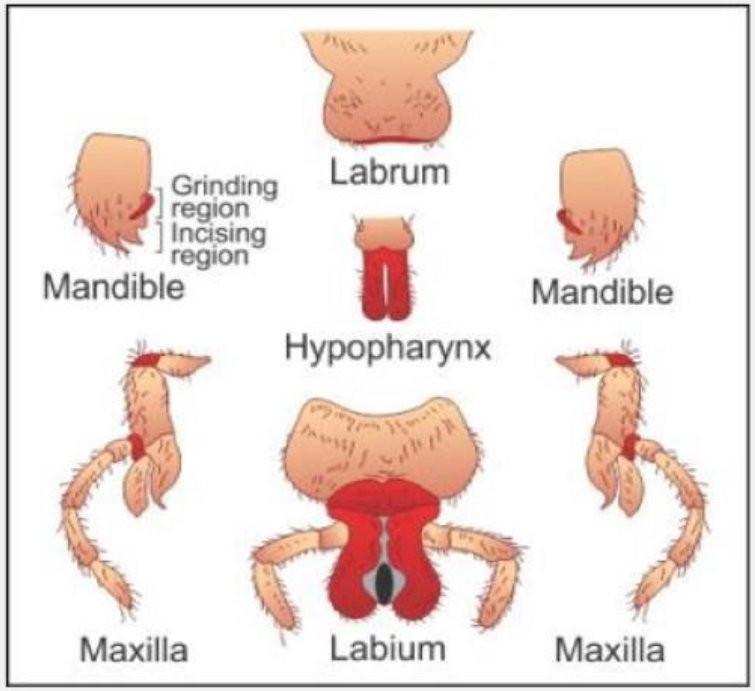
MORPHOLOGY

1. Head

Mouth parts

- A labrum (upper lip)
- 2 mandibles
- 2 maxillae
- Hypopharynx (tongue)
- A labium (lower lip)





7.4.1 Morphology

- A median flexible lobe, acting as tongue (hypopharynx), lies within the cavity enclosed by the mouthparts.
- **Thorax** consists of three parts ñ prothorax, mesothorax and metathorax. The head is connected with thorax by a short extension of the prothorax known as the neck.
- Each thoracic segment bears a pair of **walking legs**.
-The first pair of **wings** arises from mesothorax & the second pair from metathorax. Forewings (mesothoracic) called tegmina are opaque dark and leathery and cover the hind wings when at rest. The hind wings are transparent, membranous & are used in flight.
-The **abdomen** in both males & females consists of 10 segments.

7.4.1 Morphology

- a. In **females**, the 7th sternum is boat shaped and together with the 8th & 9th sterna forms a brood or genital pouch whose anterior part contains female gonopore, spermathecal pores & collateral glands.

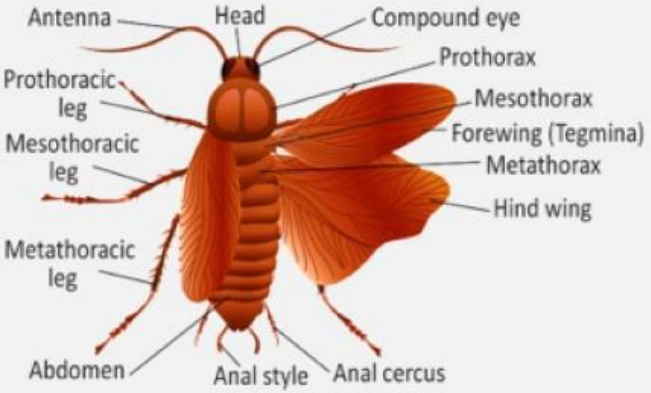
- b. In **males**, genital pouch or chamber lies at the hind end of abdomen bounded dorsally by 9th & 10th terga and ventrally by the 9th sternum. It contains dorsal anus, ventral male genital pore & gonapophysis. Males bear a pair of short, thread like anal styles which are absent in females.
- In both sexes, the 10th segment bears a pair of jointed filamentous structures called anal cerci.

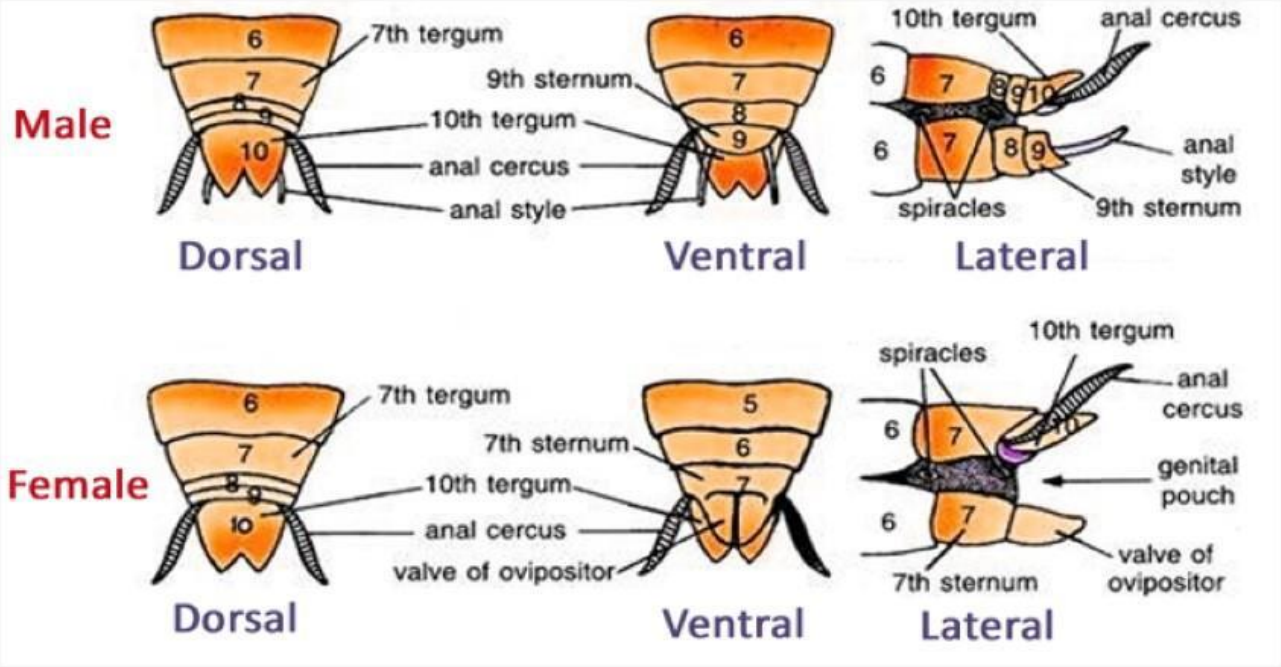
MORPHOLOGY

3. Abdomen

- It consists of **10 segments.**
- In females, 7th (boat shaped), 8th & 9th sterna form a **brood (genital) pouch.**

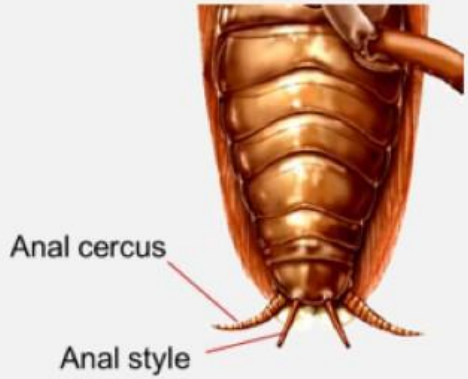
  It contains **female gonopore, spermathecal pores & collateral glands.**





MORPHOLOGY

Differences between male and female cockroach



Male

- Larger size
- Wings extend beyond the tip of the abdomen
- Narrow abdomen
- Anal styles present
- Brood pouch absent

Female

- Smaller size
- Do not extend beyond the tip of the abdomen
- Broad abdomen
- Absent
- Present

7.4.2 Anatomy

- The **alimentary canal** present in the body cavity is divided into three regions: foregut, midgut & hindgut.

i. The **mouth** opens into a short tubular pharynx, leading to a narrow tubular passage called oesophagus.

ii. This in turn opens into a sac like structure called **crop** used for storing of food.

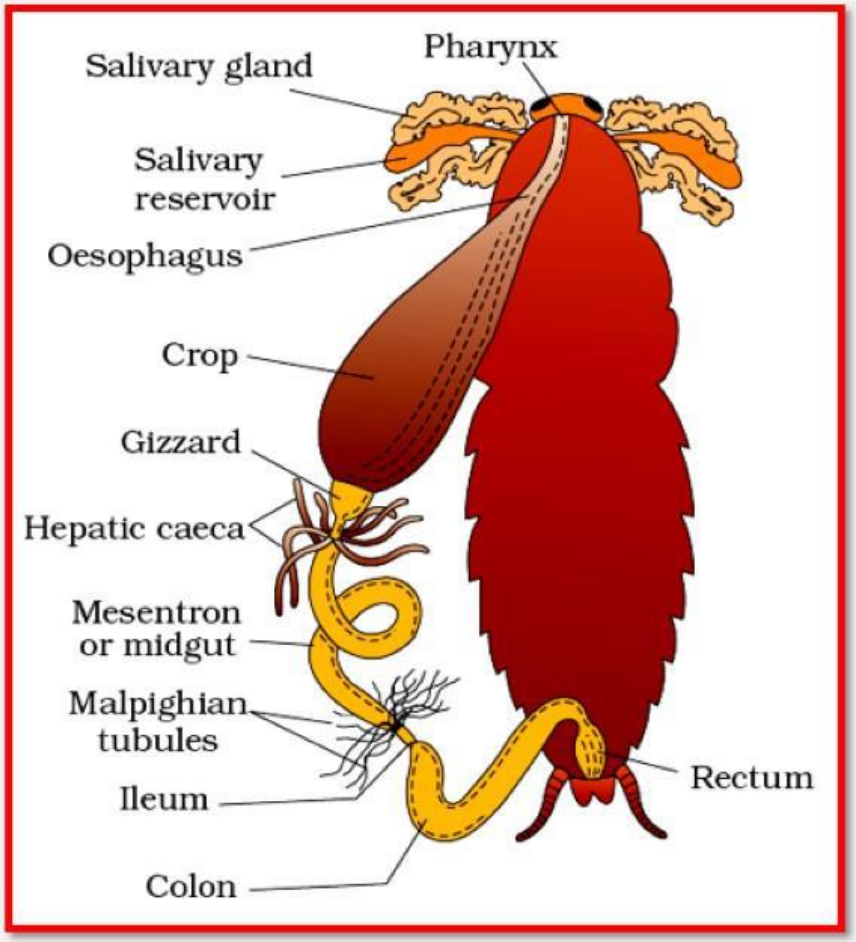
iii. The crop is followed by **gizzard** or **proventriculus**. It has an outer layer of thick circular muscles and thick inner cuticle forming six highly chitinous plate called teeth. Gizzard helps in grinding the food particles. The entire foregut is lined by cuticle.

ANATOMY

Digestive system

Alimentary canal has 3 parts:

- **Foregut**
- **Mid gut**
- **Hindgut**

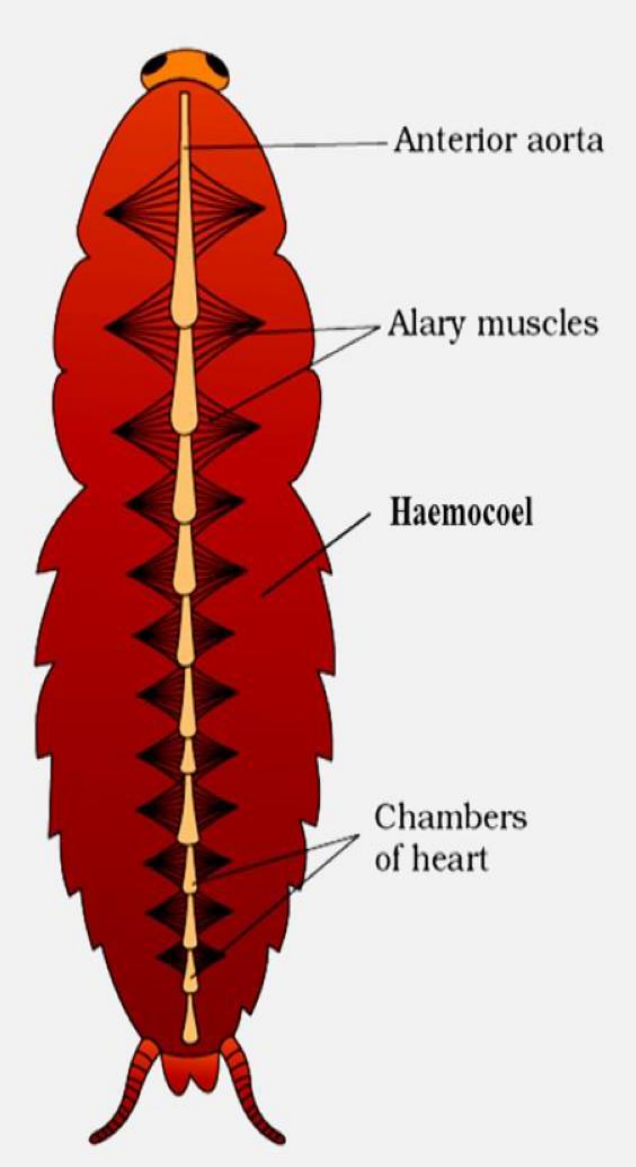


7.4.2 Anatomy

- iv. A ring of 6-8 blind tubules called hepatic or gastric caecae is present at the junction of foregut and midgut, which secrete digestive juice.
v. At the junction of midgut and hindgut is present another ring of 100-150 yellow coloured thin filamentous **Malpighian tubules**. They help in removal of excretory products from haemolymph.
vi. The hindgut is broader than midgut and is differentiated into ileum, colon and rectum.
vii. The rectum opens out through anus.

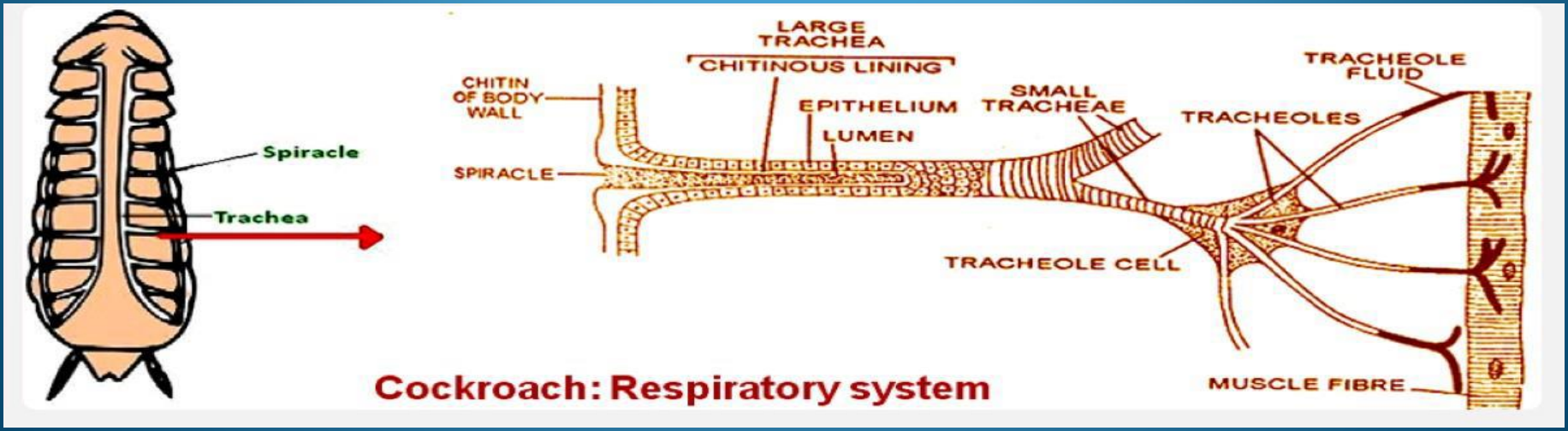
Blood Vascular System

- an open type.
- Blood vessels are poorly developed and open into space (haemocoel).
- Visceral organs located in the haemocoel are bathed in blood (haemolymph). The haemolymph is composed of colourless plasma and haemocytes.
- Heart of cockroach consists of elongated muscular tube lying along mid dorsal line of thorax and abdomen. It is differentiated into funnel shaped chambers with ostia on either side.
- Blood from sinuses enter heart through ostia & is pumped anteriorly to sinuses again.



Respiratory System

- consists of a network of trachea, that open through 10 pairs of small holes called spiracles present on the lateral side of the body.
- Thin branching tubes (tracheal tubes subdivided into tracheoles) carry oxygen from the air to all the parts.
- The opening of the spiracles is regulated by the sphincters.
- Exchange of gases take place at the tracheoles by diffusion.



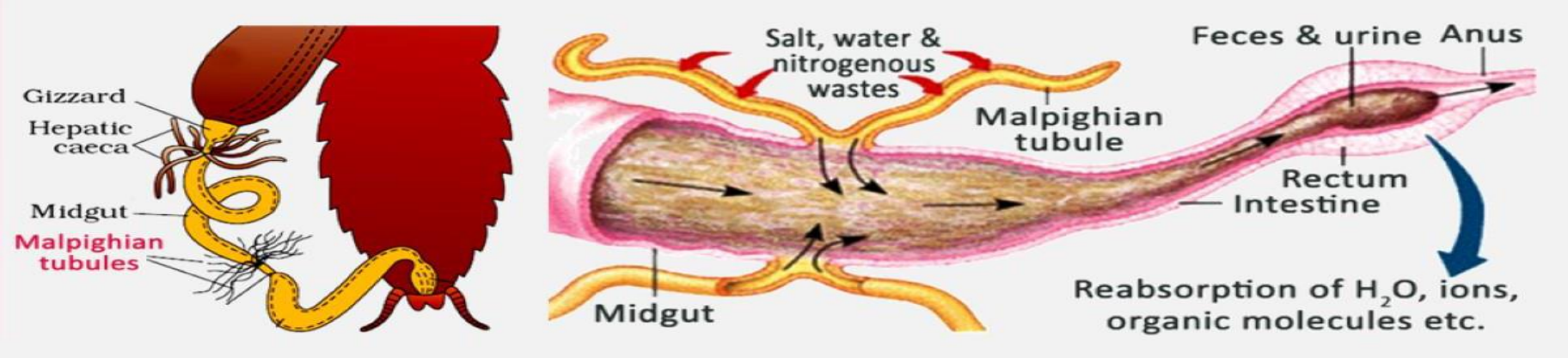
Excretion

- is performed by Malpighian tubules.

- Each tubule is lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into uric acid which is excreted out through the hindgut.

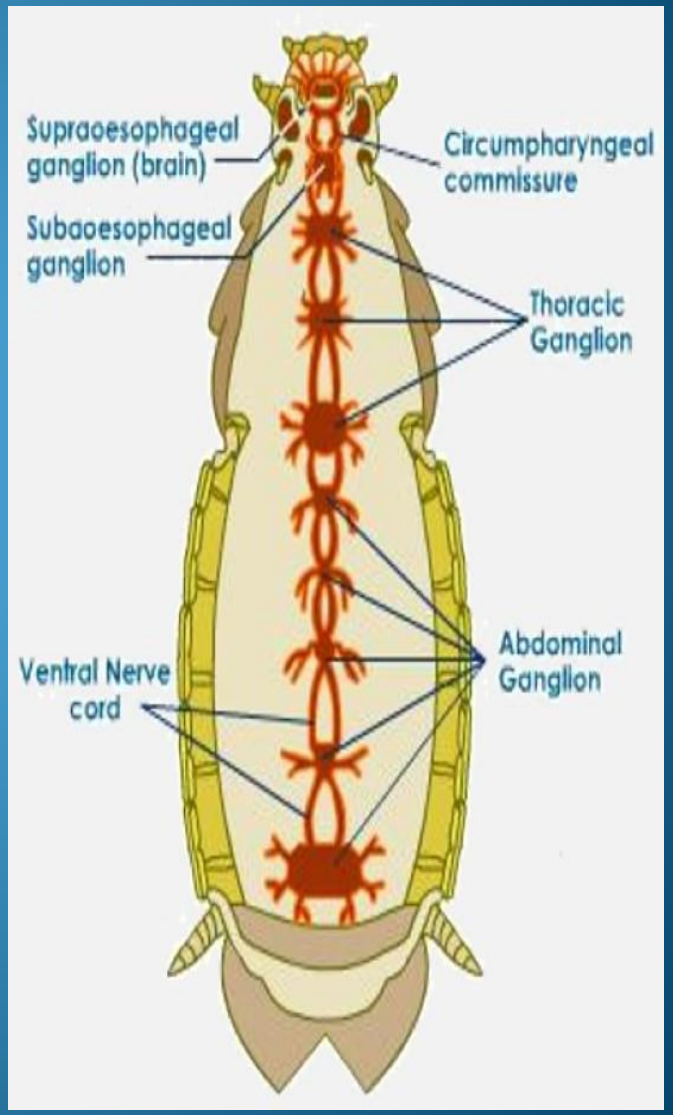
- Therefore, this insect is called **uricotelic**.

- In addition, the fat body, nephrocytes and urecose glands also help in excretion.



Nervous system (NS)

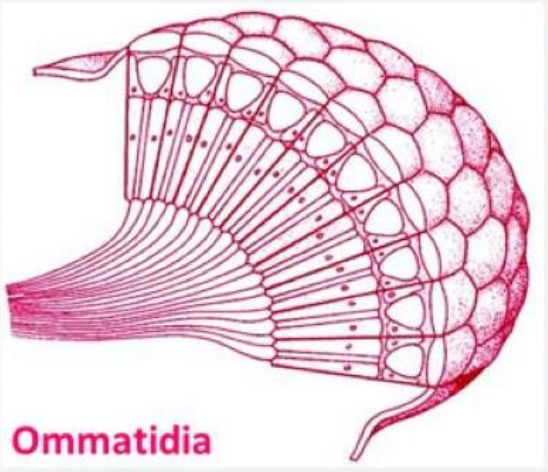
- spread throughout the body & consists of a series of fused, segmentally arranged ganglia joined by paired longitudinal connectives on the ventral side.
-Three ganglia lie in the thorax, & six in the abdomen.
- Head holds a bit of a nervous system while the rest is situated along the ventral (belly-side) part of its body.
- In the head region, the brain is represented by supra-oesophageal ganglion which supplies nerves to antennae & compound eyes.

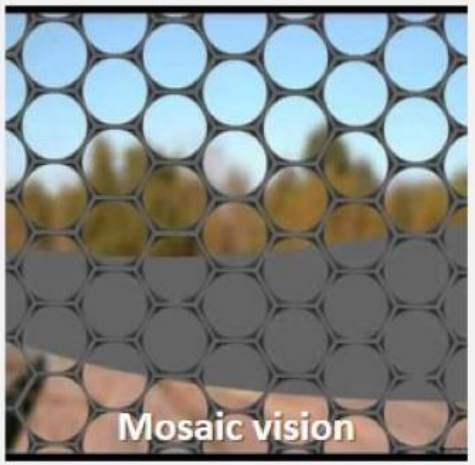


Sense Organs

- antennae, eyes, maxillary palps, labial palps, anal cerci, etc.

- Compound eyes are situated at the dorsal surface of the head. Each eye consists of about 2000 hexagonal ommatidia (sing.: *ommatidium*). With the help of several ommatidia, a cockroach can receive several images of an object. This vision is known as mosaic vision with more sensitivity but less resolution, being common during night (hence called *nocturnal vision*).





Reproductive System

- Cockroaches are dioecious and both sexes have well developed **reproductive organs**.

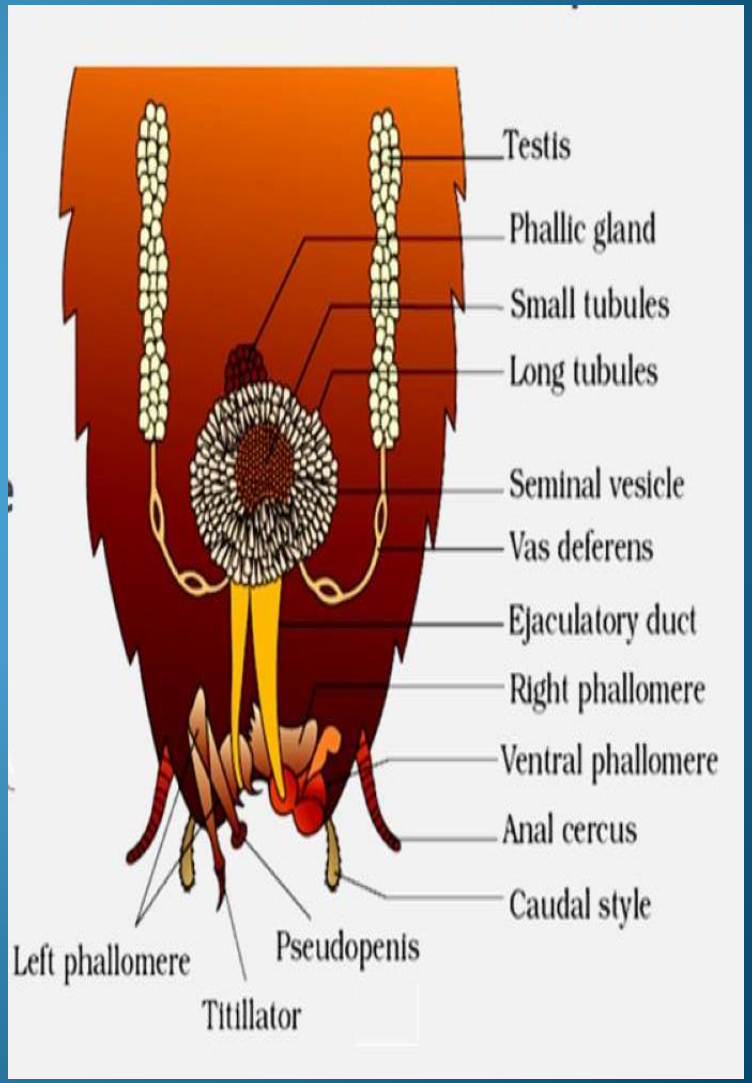
a. Male consists of a pair of testes one lying on each lateral side in the 4^{th} -6^{th} abdominal segments. From each testis arises a thin vas deferens, which opens into ejaculatory duct through seminal vesicle.

- The ejaculatory duct opens into male gonopore situated ventral to anus. A characteristic mushroom shaped gland is present in the 6th-7th abdominal segments which functions as an accessory reproductive gland.

Reproductive System

-External genitalia are represented by male gonapophysis or phallomere (chitinous asymmetrical structures, surrounding the male gonopore).

-The sperms are stored in the seminal vesicles and are glued together in the form of bundles called spermatophores which are discharged during copulation.



Reproductive System

b. **Female RS** consists of two large ovaries, lying laterally in the 2nd to 6th abdominal segments.

- Each ovary is formed of a group of eight ovarian tubules or ovarioles, containing a chain of developing ova.
- Oviducts of each ovary unite into a single median oviduct (also called vagina) which opens into the genital chamber.
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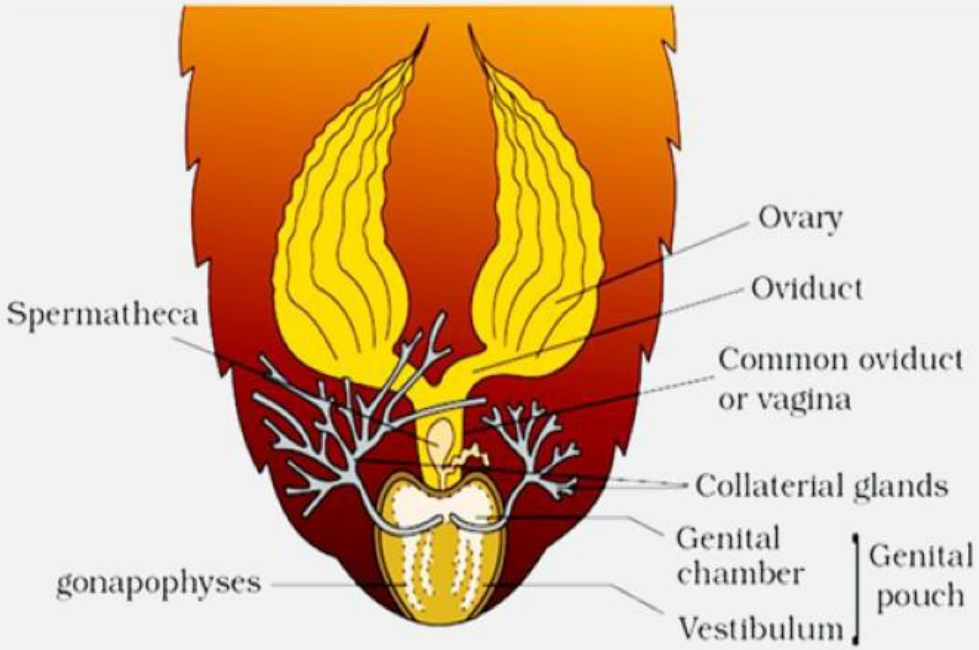
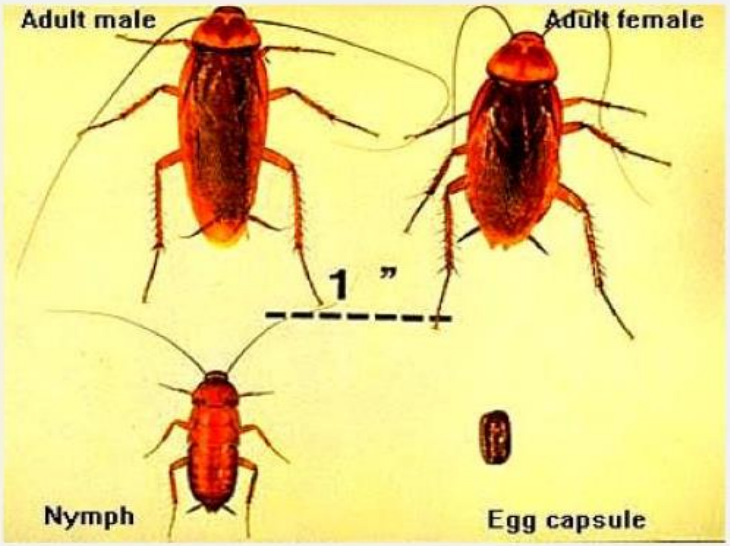
Female Reproductive System

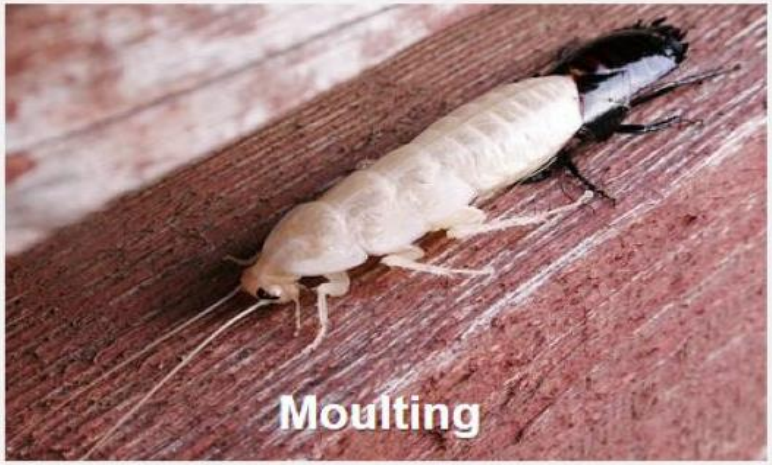


- A pair of spermatheca is present in the 6th segment which opens into the genital chamber.
- Sperms are transferred through spermatophores. Their fertilised eggs are encased oothecae.
- Ootheca is dark reddish to blackish brown capsule, 8 mm long.
- Females lay 9-10 oothecae, each contain 14-16 eggs.

Development of *P. americana*-

- Development of *P. americana* is paurometabolous (development through nymphal stage).
- Nymphs look like adults. They moult 13 times to reach the adult form.
- The next to last nymphal stage has wing pads.
- Only adult cockroaches have wings.





Economic Importance

* Many species of cockroaches are wild and are of no economic importance.

- A few species thrive in and around human habitat.

- They are **pests** because they destroy food and contaminate it with their smelly excreta.

-They can transmit a variety of bacterial diseases (Cholera, Typhoid, Tuberculosis) by contaminating food material.

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