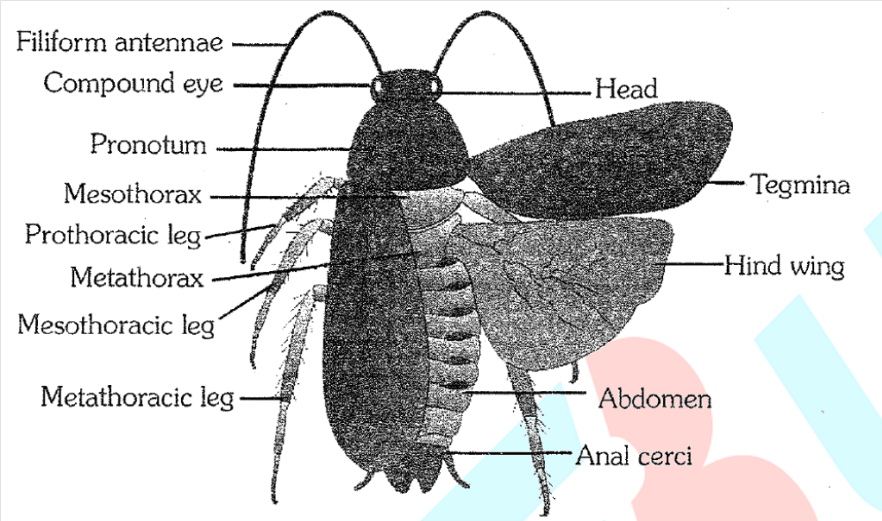
PERIPLANETA (COCKROACH)

Taxonomic status :-

- Phylum -Arthropoda (Jointed appendages and chitinous exoskeleton)
- Class - Insecta (3 pairs of jointed legs)
- Order- Dictyoptera/Orthoptera (Disimilar wings)
- Genus - Periplaneta
- Species – Americana



External features of cockroach

Introduction :-

- It is also known as "American or common cockroach or ship cockroach".
- Size is about 34-53 mm long with wings that extends beyond the abdomen of males.
- Cockroach of genus - Blatta has small wings in males but vestigeal in females.
- It is omnivorous, nocturnal and cursorial (fast runner) animal.
- Cockroach can run 130 cm/sec at 25°C.
- Number of chromosomes = 34
- It also exhibit cannabalism, feeds on their fellows 6cassionally.

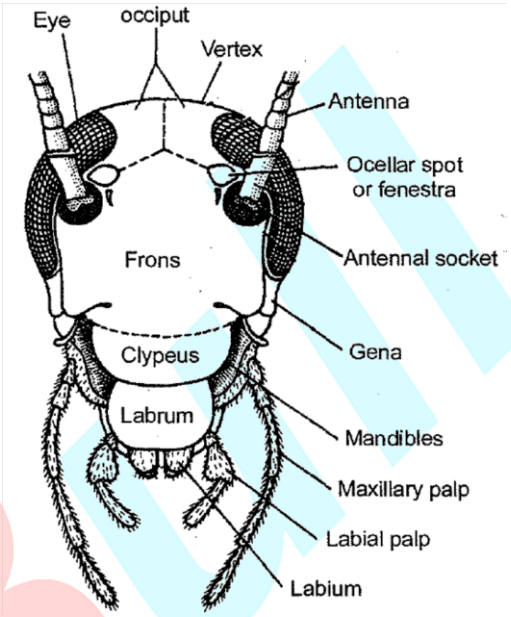
Morphology :- Body is divisible into 3 parts

Body	=	Head	+	Thborax	+	Abdomen		
	=	6	+	3	+	11	=	20 segments in embryo
	=	1	+	3	+	10	=	14 segments in embryo

- The entire body is covered by a hard chitinous exoskeleton (Brown in colour).
- Exoskeleton of each segment consists of Chitin plate called "sclerites ".
  Sderites joined each other by a flexible membrane called "articular or arthrodial membrane".
  Sclerites of dorsal side - tergum or tergite
  Sclerites of ventral side - - sternum or sternite
  Sclerites of lateral side - - pleurons or pleurites.

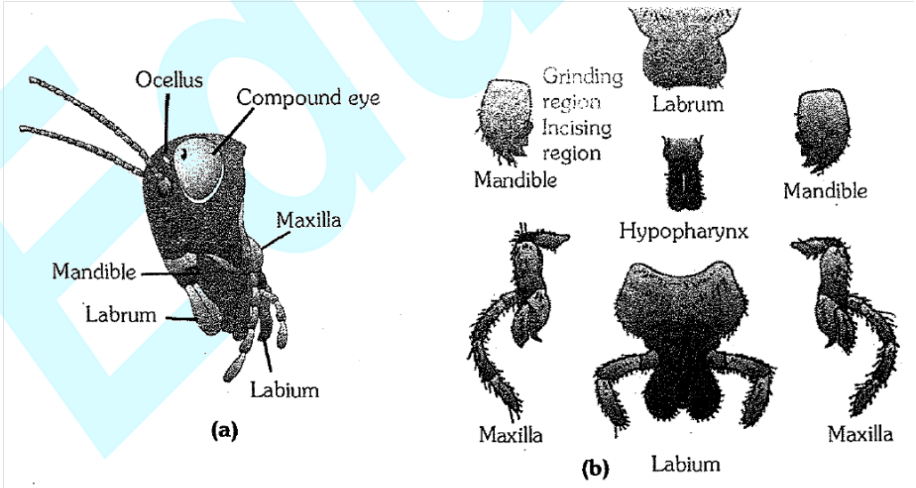
1. HEAD

- It is triangular and "Hypognathus", bent downwards at an angle of 90° from the long axis of body.
- sclerites of the head joined fully and form head capsule.
- Top part of Head is called "Vertex" and on the vertex a chitin plate present called "Occiput".
- On the lateral side of head apex 1 pair of compound eye
- Each compound eye made up of 2000 units called "ommatidia"
- A small light coloured spot called fenestra or ocellar spot is located upon dorsal surface close to each eye. In insect it function as a photoreceptor organ but in Cockroach, it is inactive and called "Vestigial simple eye".



Antennae:- Lateral side of head apex, 1 pair of antennae are present, acts as, main receptor of touch, temperature and vibration in cockroach.

- All these sensory receptors present on antenna help in monitoring the environment. Each antenna extending forwards from an antenna! socket located dorsally upon head capsule near the compound eye of its side. These are long, filamentous, unbranched and free moving.
- A big chitin plate situated below the vertex called frons or forehead .
- Two long flattened chitin plates situated on lateral side called "gena" or "cheek"
- A big chitin plate present in anterior part of frons called "Clypeus". a movable chitin plate joined with anterior part of clypeus known as "labrum" or "Upper lip".
- A mouth situated in the anterior side of head which is surrounded by many chitinous structure called "mouth parts".



Head region of cockroach : (a) parts of head region (b) mouth parts

Mouth Parts of Cockroach :-

- "Biting and chewing type"
- A cavity formed due to mouth parts called "Preoral cavity" or "cibarium ".

(1) **Labrum or upper lip:-** Broad, flattened and movable sclerite of the dorsal side of head capsule. It dorsally overhangs the mouth and hence referred to as "upper lip".

(2) **Mandibles** or Jaw

- 1-pair of triangular structure with Chitinous teeth on inner surface.
- They form the lateral wall of preoral cavity and moves horizontally (Grinding)

(3) **First maxillae :-**

- One-pair and form lateral wall of preoral cavity.
- With the help of maxillary palp cockroach pickup its food and put it in preoral cavity for chewing.
- Maxillary palps also used as brush to clean antenna and wing.

(4) **"Labium"or lower lip (Fused 2nd maxillae)**

- Form floor of preoral cavity {Ventral side) and provides a platform for food materials.

(5) **Hypopharynx :-** or "lingua"

- Small, non-chitinous flexible structure that lies on the floor of preoral cavity.
- It bears several sensory setae at its free end, and the common salivary duct opens at the base of hypopharynx, threrefore it is also considered as tongue of cockroach.

BEGINNER'S BOX-1

1. Cockroach belong's to phylum :
(1) Annelida (2) Arthropoda
(3) Porifera (4) Mollusca

2. Which of following tegmata of cockroach fused in adult stage ?
(1) Head (2)Abdomen (3) Thorax (4) (1) or (2)

3. How many segment found in adult cockroach :-
(1) 12 (2) 15 (3) 20 (4) 14

4. Which movable chitineous plate joined with dorsal part of head :-
(1) Labrum (2) Clypeus (3) Labium (4) Forhead or frons

5. Which is the correct location of mandibles in mouth of cockroach :-
(1) Upper side (2) Lateral side (3) Lower side (4) Anterior side

6. Function of arthroidial membrane is
(1) Circulation (2) Respiration
(3) Joining/ Articulation (4) Excretion

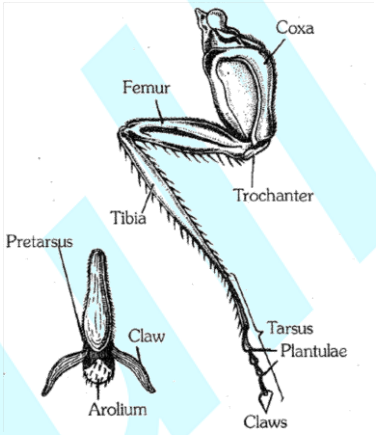
2. THORAX

- Head is connected with thorax by a short extension of prothorax known as neck.

- It has 3 segments - Pro thorax, Meso thorax and Metathorax.

Legs :- One-pair of legs are present on each segment of thorax. (Total 3 pairs)

- Each leg has 5 segments -
  (1) segment- "Coxa": broadest segment
  (2) segment-trochanter : small segment
  (3) long segment - femur
  (4) tibia- longest segment
  (5) tarsus - tarsus made up of five segments called tarsomeres and the last one is called "pretarsus"



- Each pretarsus bears one pair of Claws and large adhessive pads Arolium or Pulvilus.
- Cockroach move on the smooth surface by the help of "arolium" and on rough surface with the help of claws. (In Blatta- arolium is absent).
- Small adhessive pads present at the junction of tarsomeres are called "Plantuli"
- Cockroach climb on the wall by-the help of plantuli and Arolium.
- Tactile setae are present on each segment of legs.

"Wings" :- 2-pairs

(1) fore wings	**(2) Hind wing**
↓	↓
On mesothorax	On Metathorax
↓	↓
Long, narrow, opaque, dark and leathery	small broad, transparent, membranous and fan like
↓	↓
Fore wings are so long so cover full abdomen and hind wings when at rest.	these wings help in flight

- These are called Elytra or Tegmina.
- A network of fine tubules called "nervures" is present in the inner side of wings.

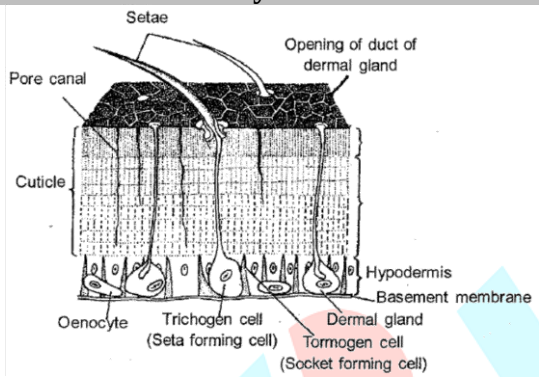
3. ABDOMEN

(1) Consists of 10 segments
(2) 9 segment in male
(3) 7 segment in female
} Clearly distnct while remaining segments get modified or reduced.

- All characters of sexual dimorphism in cockroach present in abdomen.
- Exoskeleton of each body segment consists of 4 chitinous plates or sclerites one tergum, one sternum and two pleurons.
- 7^{th} tergum largest in male and female and covers 8^{th} and 9^{th} tergite
- Stink gland present in between 5^{th} and 6^{th} tergum
  Smell- repel the enemies.
- 10^{th} tergum- bowl shaped and bifurcated. 10^{th} tergum bears 1 pair of "anal cerci"
- Each "anal cerci"- "15 segmented", These are main sound receptor.

- Sternum - In male - 9 sternum
  In female - 7 sternum
- Projected one-pairs of spine like structure from 9th sternum of male called "anal styles". These are nonsegmented and help in copulation.
- 7th sternum of female - broad and boat shaped.
  Free end - divided in to two plates called gynovalvular plates that surounds oothecal pore.

"Body Wall"



Made up of three layers :-

1. Outermost- thick cuticle. A waxy layer occurs on cuticle.
   Cuticle is made up of alternate layer of protein and chitin.
2. **Hypodermis :** Made up of columnar epithelium
3. **Basement Layer:** Simple squamous epithelium

Body cavity or Haemocoel

- Haemocoel is not true coelom. It is a large blood sinus. In embryonic stage several small blood sinuses fuse and form a Large Blood sinus.
- All arthropods are True coelomate but coelom is highly reduced and found only in the form of cavity of gonads known as gonocoel.
- Large fat bodies are present in Haemocoel of cockroach which are analogous to liver of higher animals.

BEGINNER'S BOX-2

1. How many segments present in thorax ?
(1) 2 (2) 4 (3) 1 (4) 3

2. Coxa is the __ of the leg of cockroach:
(1) Small segment (2) Long segment
(3) Broadest segment (4) Longest segment

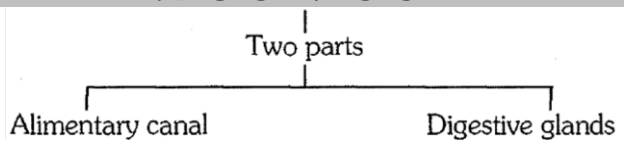
3. Cockroach moves on the rough surface by __.
(1) Arolium (2) Pulvilus (3) Claw (4) Plantulae

4. Which is the structure act as sound receptor in cockroach :-
(1) Anal style (2) Anal cerci (3) Antenna (4) Both (2) and (3)

5. What will happened when mandibles remove from mouth part's of cockroach ?
(1) Only grinding of food will be affected

(2) Only incisor of food will be affected
(3) No incisor and grinding of food take place
(4) No effect on Biting & chewing of food

4. DIGESTIVE SYSTEM

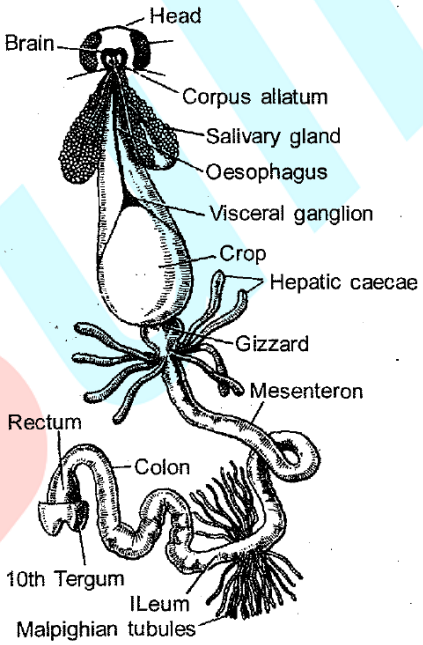


ALIMENTARY CANAL :

- It has 3-parts :-

(1) **Fore gut or stomodaeum :-** Ectodermal", Formed by the invagination of body wall. Cuticle present in inner side of foregut.

- Mouth to - gizzard is foregut
- Mouth open in the small buccal cavity
- Buccal Cavity - opens in tubular pharynx.
- ' Pharynx - open in to short tubular" oesophagus".
- In thorax oesophagus expand and called "crop". It opens into thick walled gizzard.
- Gizzard- "circular muscle layer" well developed.
- Six cuticular teeth occur in cavity which are used for fine grinding of food
- Cuticular hairs present in the posterior part of gizzard these form "sieve".
- Gizzard- grinding in upper part- filteration in lower part.



(2) **"Mesenteron" or" Mid gut" (endodermal)**

- Gizzard open in mesenteron by "stomodial valve".
- 6-8 small and tubular, finger like blind tubules called hepatic caeca (gastric caecae) project freely into the heamocoel from the anterior part of mesenteron.
- They secrete "digestive juice"
- Wall of mesenteron is muscular.

(3) **"Hind gut or Proctodaeum" (ectodermal)**

- Thin tubules attached at the junction of hind gut and mid gut called "Malpighian tubules". these are excretory organ.
- Hind gut- first part- Ileum Its wall is thin and internally folded. Its cuticle bears minute spines, which serve to break the peritrophic membrane.
- Colon - longest and broader part
- Rectum -last part, oval shaped and internally folded wall.
  Its wall - 6 folds - called rectal papillae. These absorb water
- **Anus:-** at the end of 10^{th} abdominal segment.

DIGESTIVE GlANDS :

Salivary gland :-

- 1-pair and attached with oesophagus.
- Two parts of each salivary gland.
  (1) Reservoir part :-cylindrical and storage of saliva.
  (2) glandular part :-leaf like, synthesis of saliva occurs in this part.
- Common efferent salivary duct arises from both salivary gland.
- This duct open in preoral cavity at base of hypopharynx.
- Saliva contains "Carbohydrate - digestive enzymes". eg. : Amylase, Cellulase, Chitinase etc.

Food- "Omnivorous"

(a) Bread, food grain, vegetable, wood, clothes, insects (dead), nymph, moulted exoskeleton.
(b) Identification of food by the help of antenna.

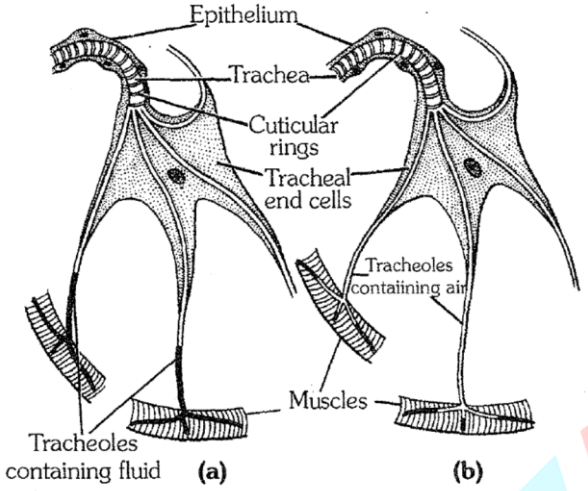
Digestion:-

- Start from preoral cavity
- saliva - Enzymes of saliva act upon the food till it reaches the crop. Digestion of carbohydrate takes place.
- In crop :- Hepatic caeca - Complete digestive juice release in crop. Most of digestion occur in the crop.
- Gizzard :- Food throughly grinded into a paste by the thick and sharp edged cuticle of internal folds and grooves.
- Grinded food enter in to the midgut through stomodial value.
- Wall of mesenteron secretes a membrane around the food called peritrophic membrane. It serves to protect the wall of midgut from friction with hard food particles.
- This membrane is permeable to digestive enzyme and digestive food. Bacteria and symbiotic protozoans are present in midgut which are helpful in digestion of cellulose.
- Digestion completes in the anterior part of midgut.
- Absorpiton of digested food mainly occurs in the posterior part of mid gut.
- Distribution of digested food :- by "heamocoelomic fluid"
- Peritrophic membrane and undigested food enter into the Ileum .
- Spines of ileum break the peritrophic membrane, so undigested substance release in ileum.
- Maximum absorption of H_2O occured in rectum by rectal papilla.

5. RESPIRATION

- Respiratory organ- "respiratory tubules" or Tracheal system.
- Network of respiratory tubules in body.
- This network open out side the body by the "spiracles"
- 10- pair spiracles , 2-pair on thorax and 8 pairs on abdomen.
- The spiracles are located on "Pleurone" (Lateral side of body) each spiracles is guarded by a value and bears cilia like bristles for filtering the incoming air.
- Value absent in 1^{st} pair of spiracles of thorax and abdomen both.
  So they remain always open.
- Each spiracle open into a large chamber called "atrium" or tracheal chamber.
- The tracheal chambers are connected with several main tracheal trunks which repeatedely branch in to a diffuse network of small trachea.
- Last branches of trachea called "Tracheal Capillaries" or "tracheoles"

- Tracheal capillaries develops as cytoplasmic processes of tracheal end cells.
- These process deeply merge in tissues of body
- Each cell of body is directly in contact with processes. Blood is not related with respiration in blood respiratory pigment is absent.
- Exchange of gases take place between the tracheoles and tissues by simple diffusion



Tracheoles
(a) Filled with fluid in resting cockroach
(b) Filled with air in active cockroach

Breathing :-

- Several tergo - sternal muscles extend between the tergites and sternites of all abdominal segments.
- When the abdomen expands, atmospheric air gets filled in the tracheal system through spiracles. This is inspiration.
- When the abdomen contracts, the air is forced out. This is expiration. Expiration takes place through first pairs of spiracles of thorax and first pairs spiracles of abdomen.
- The spiracular valves control and regulate the in and out passages of the air and abdomen.

BEGINNER'S BOX-3

1. In cockroach salivary glands attached with:-
(1) Oesophagus (2) Pharynx
(3) Crop (4) Gizzard

2. Which of the main function of tergosternal muscle ?
(1) Respiration (2) Blood circulation
(3) Excretion (4) Chewing

3. Grinded food enters into the midgut through:-
(1) Sieve (2) Stomodial valve (3) Gizzard (4) Crop

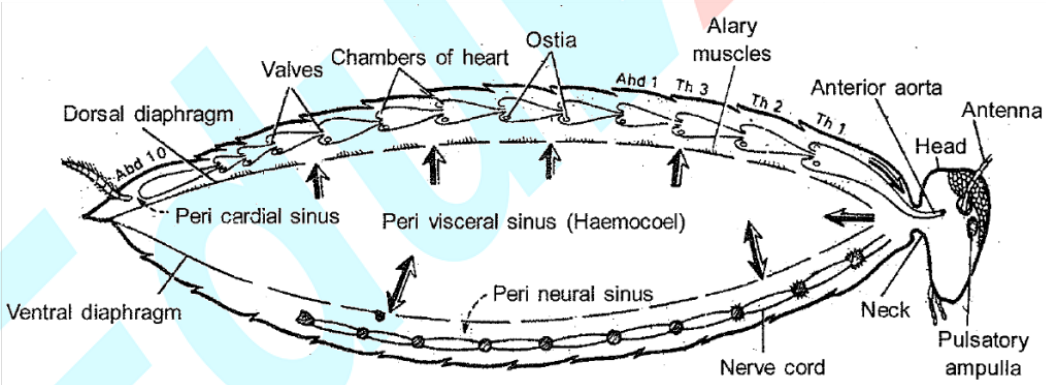
4. Gastric caeca are present at __.
(1) Junction of fore gut and midgut (2) Foregut
(3) Hindgut (4) Junction of midgut and Hindgut

5. In cockroach which of the following help in exchange of gasas?
(1) Spiracles (2) Respiratory tubule
(3) Tracheoles (4) Abdomen

6. Cockroach can digest __.
(1) Protein (2) Carbohydrate (3) Fat (4) All of them

6. BLOOD VASCULAR SYSTEM

- "Open types" or "lacunar types" in which blood remain filled in tissue spaces or blood sinuses .
- Blood vessel are poorly developed and open into tissue space or haemocoel.
- Visceral organs located in the haemocoel are bathed in blood .
- Largest blood sinus - "haemocoel"
- Blood of cockroach – "haemolymph" ⌐ Colourless – plasma
  └ Blood corpuscles(haematocytes)
- "Haematocytes" -
  (i) Phagocytosis of bacteria (Protection)
  (ii) related with blood clotting.
- Blood is not related with respiration, because respiratory pigment absent but it helps in transportation of food, hormones and excretory materials.
- Two horizontal septa are present in body cavity.
  (1) Dorsal diaphragm ⌐ Both have min tue pores called "fenestrae"/ sphincters
  (2) Ventral diaphragm ┘



Diaphragms divides the haemocoel in three chambers i.e.
(1) Dorsal sinus - Pericardial Sinus - It contains heart.
(2) Middle sinus - Perivisceral sinus has alimentary canal and fat body.
(3) Ventral chamber - Perineural sinus has nerve cord.

Heart of Cockroach :-

- It consists of elongated muscular tube lying along the mid - dorsal line of thorax and abdomen.
- Dorsal, tubular and 13 chambered.
- It is differentiated into funnel shaped chambers with ostia on either side. These pores act as value.

- Blood enters from pericardial sinus to heart through ostia when heart chamber relaxes (Diastole)
- Each Posterior chamber of heart connected/related with anterior chamber by a valve like pore.
- Each heart chamber pumps blood into anterior chamber when it contracts (systole), and thus blood reaches into head sinus.
- Special type of cells attached with heart wall are called "nephrocytes". They probably helps in regulation of HBR (49 beats/minute) and excretion.
- First chamber of heart opens into head sinus through a long tubule called "anterior aorta"
- 12-pair fan like muscles present in pericardia! sinus called alary muscles. One end which, is attached to tergum and other end is connected to dorsal diaphragm. These are also fused with heart wall and help in maintaining "blood circulation".
- Tergosternal muscle also help in blood circulation.
- "Pulsatile ampulla" are present at base of each antennae and wings. These help in blood circulation in antennae and wings.

7. EXCRETORY SYSTEM

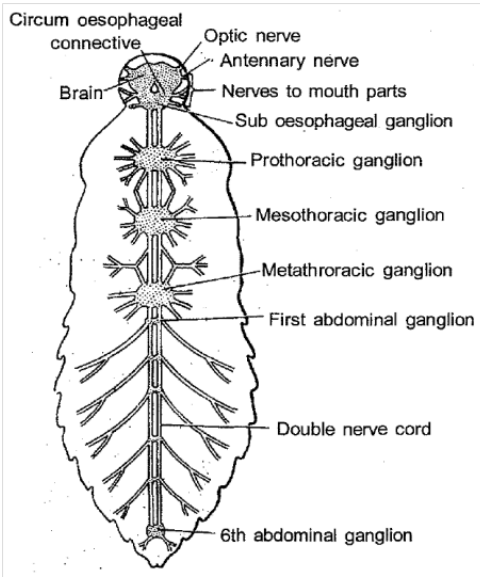
- Main excretory organ - Malpighian tubules
- These are yellow coloured, thin, filamentous, blind tubules located at the junction of midgut and hind gut.
- Number of malpighian tubules - 100-150
- They are lined by glandular and ciliated epithelium.
- They help in removal of excretory substance from heamolymph.
- Excretory substance mainly in the form of "potassium Urate"
- Potassium urate is converted into "Uric Acid" and potassium bicarbonate and uric acid is finally relased into alimentary canal by malpighian tubules.
- Water absorbed by hind gut and excretory materials along with undigested food is released outside.
- They are enteronephric and also help in osmoregulation (Water conservation)

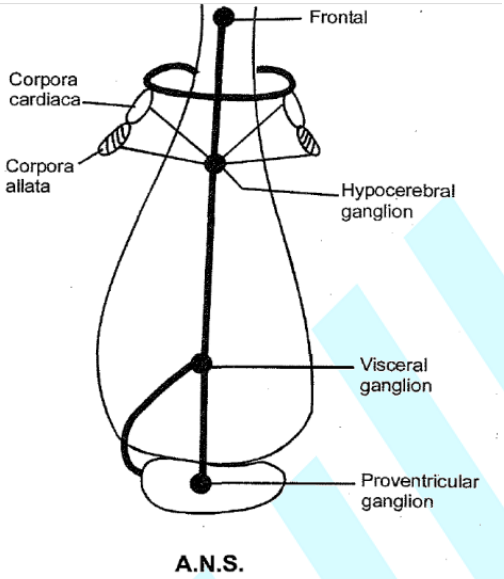
(i) Fat bodies (Urate cells)
(ii) Nephrocytes
(iii) Body wall
} Also helps in excretion (Storage excretion)

(iv) Uricose glands – These help in excretion in male cockroach only.

- Body wall absorbs excretory materials from Haemocoel and store in cuticle. Then at the time of moulting excretory substances and cuticle separate out from body.

8. NERVOUS SYSTEM





A.N.S.

(1) Central Nervous system:-

It consists of brain (Nerve ring) and ventral nerve cord with segmentally arranged paired ganglia.

(a) Brain :- It is represented by Supra-oesophageal ganglia in head region and their nerve supplies to antenna and compound eyes.

- Sub-oesophageal ganglion on ventral side of oesophagous remain connected with Supraoesophageal ganglia by circumoesophageal connectives.

(b) Nerve Cord :- paired, longitudinal, solid nerve cord is located on ventral side of body

- Nerve cord has nine segmental ganglia. i.e. Three large ganglia in thorax and six in abdomen. Last ganglion is located in 7^{th} abdominal segment.
- All ganglia formed in embryo stage by the fusion of 1 pair of ganglia. Last segmental ganglion formed by fusion of many ganglia.

(2) "Peripheral Nervous System"

- Several nerves arises from CNS (Nerve ring and Nerve cord) and innervate different part of body.
- All these nerves are mixed nerves
  - motor nerve fibres.
  - sensory nerve fibres.

(3) "Autonomous System" (ANS)

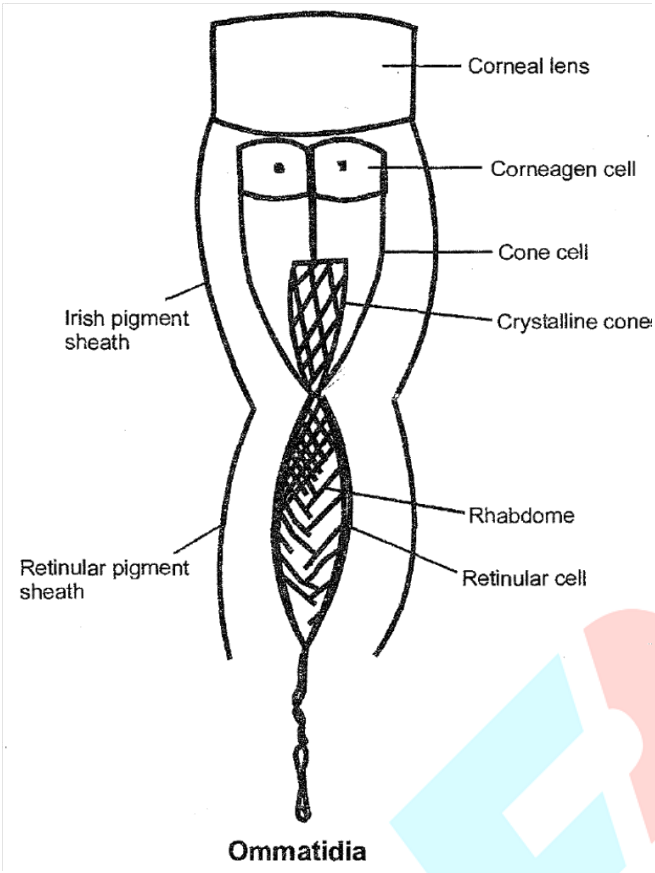
- It consists of 5 ganglia located on different parts of foregut and are inter-connected by nerves. It regulo.tes peristalsis movement in foregut (involuntary activity)

GOLDEN KEY POINTS

- The nervous system of cockroach is spread throughout the body. The head holds a bit of nervous system while the rest is situated along the ventral (belly side) part of the body. So, now you understand that if the head of cockroach is cut off, it will still live for as long as one week.
- In cockroach, the sense organs are antennae, eyes, maxillary palps, labial palps, anal cerci etc.

9. COMPOUND EYES

- Each compound eye made up of 2000 units called ommatidia.

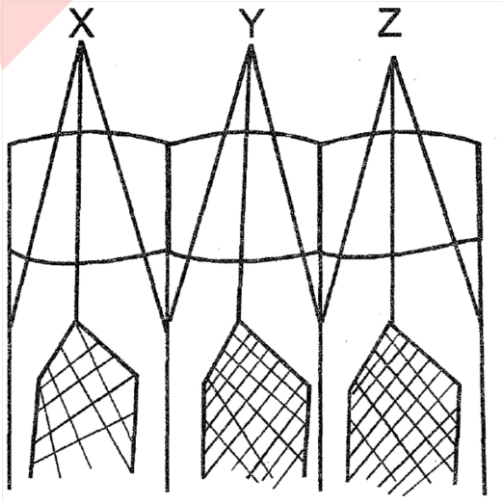


Ommatidia

Mechanism :- two types of vision are found in insects.

(1) Apposition or mosaic vision:-

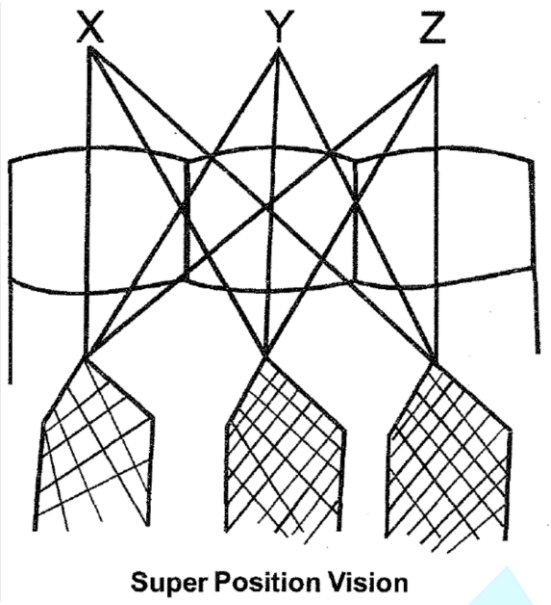
- Apposition vision form in bright light
- Ommatidia fully covered by pigmented membrane. The light rays reflected from an object enter into a number of ommatidia.
- Only straight light ray enters into an ommatidium and reaches into its receptor region and forms the image of corresponding part of the object, while cross light rays get absorbed.
- Thus several images (Pieces) of an object are received and assembled by brain, thus whole object becomes visible.



Apposition or Mosaic Vision

(2) "Superposition vision" :-

- In dim light in nocturnal insects.
- In the night, the pigment sheath of ommatidia contracts and shrinks to their bases, hence the light rays can easily cross over from one ommatidium to adjacent ommatidia
- Complete images are formed in all ommatidia. This results in the formation of blurred superpostion of the objects.



Super Position Vision

GOLDEN KEY POINTS

- In cockroach only mosaic or apposition images are formed throughout the day and night because there is no power of contraction in pigmented sheath.
- Cockroach is a nocturnal insect, but in it mosaic vision forms during night and therefore it has more sensitivity but less resolution.

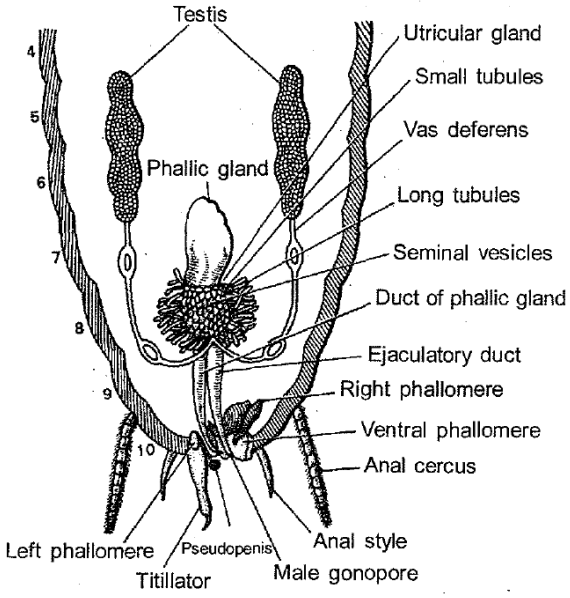
10. REPRODUCTIVE SYSTEM

Cockroach- is dioecious (Unisexual) and have well developed reproductive organs.

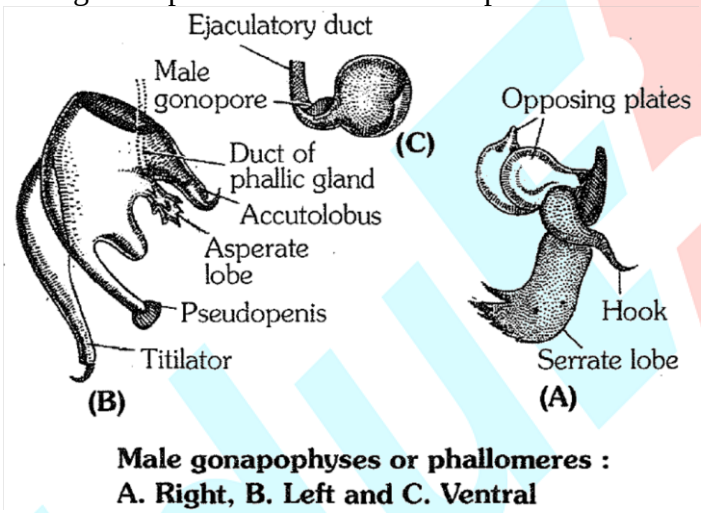
Male reproduction system:-

- Consists of 1-pair of testis located on lateral side in "4-6" abdominal segments.
  Each testis formed of "3 or 4 lobes" and each lobe divided into many lobules that produces sperms.
- Vasa deferentia -A vasa deferense arises from each testis, these open in an ejaculatory duct through seminal vesicle.
- Ejaculatory duct opens ou.tside by male genital pore situated ventral to anus.
- Seminal vesicles are numerous sac like structures located at the junction of vas-deferens and ejaculatory duct.
- A gland associated with seminal vesicles called mushroom gland or utricular gland having two types of tubules, (i) small tubules on inner side - utriculi brevivores.
  (ii) Long tubules outside - utriculi majores
- Tips of these long tubules are also called "Uricose gland" These absorb excretory material from haemocoel.
- A gland located on mushroom gland called phallic gland or congloblate gland. It opens out side by a seperate duct.
- Three irregular shaped Chitinous structures associated with and male genital pore are called "phallomeres" or male gonapophyses."
- Phallomeres
  - (i) Left phallomere
  - (ii) Right phallomere
  - (iii) Ventral phallomere

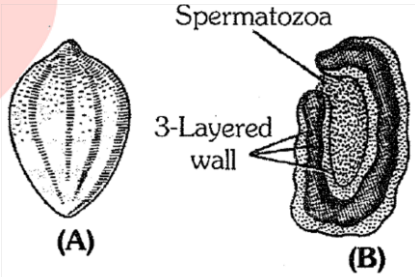
- Phallic aperture present on left phallomeres



- Male genital pore situated on Ventral phellomeres.



Male gonapophyses or phallomeres : A. Right, B. Left and C. Ventral



A spermatophore (A) and its L.S. (B)

(i) Left phallomere :- (Largest)

- Made up of a flat chitinous plate
- It bears Titilator (lobe with a hook), Pseudopenis (long with bulging tip, Acute and asperate lobe with spiny surface.

(ii) "Right phallomere" Two large hooks present at apex and a hook present on base of right phellomeres.

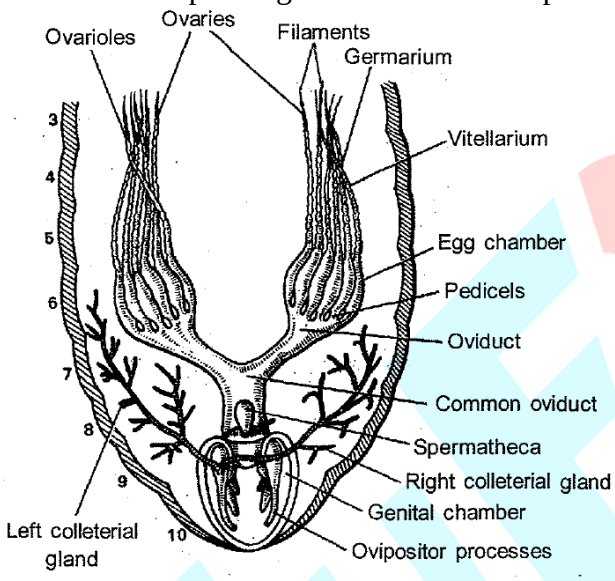
(iii) Ventral - phallomere : Smallest chitinous plate without hooks.

- Hooks help in opening of ootheca pore of female.
- Sperm produced in testes are stored in Seminal vesicle.
- All sperms released from seminal vesicles glued together to form a ball called "sperm ball"
- Long tubules of mushroom gland secrete a membrane around sperm ball called spermatophore
- Small tubules :- secrete a nutritive fluid in spermatophore.
- At the time of copulation spermatophore enters into ejaculatory duct.
- Ejaculaotry duct secrete another coat on spermatophore and hence it becomes double layered.

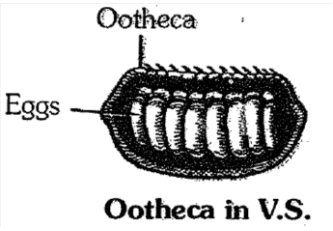
- When it is released outside from male genital pore then phallic gland secretes another layer, so spermatophore becomes three layered. They are finally discharged during copulation.

Female reproductive system

- 1-pair of large ovaries are situated on lateral side in "2nd to 6th segment of abdomen".
- Each ovary is made up of 8-long tubules called "Ovarioles", Containing a chain of developing ova.
- Only one egg in each ovariole. It means 16 ova are matured at a time in cockroach.
- Both the oviduct of ovaries fused to form "vagina". Which opens into the genital chamber.
- Genital chamber formed by fusion of 3 abdominal sternum.
- The 7 sternum is boat shaped and together with the 8 and 9 sterna forms brood or genital pouch whose anteriar part is genital chamber and posterior oothecal chamber.



- A pair of unequal sized "Spermatheca" are associated with genital chamber.
- Genital chamber contains female genopore, spermathecal pore and collaterial glands.
- 1-pair of collaterial glands associated with genital chamber. These are branched tubular gland, left collaterial gland is more branched.
- Both glands open in genital chamber by a common pore
- Three pairs of chitinous processes hanging from the roof of genital chamber into its cavity are the external ganitalia of female cockroach. These are called ovipositor or female gonapophyses because these serve to arrange the ova in a newly formed ootheca, and possibly help in giving proper shape to the oothecae.



Ootheca in V.S.

Copulation

- "Breeding season:- from March to September
- The females secrete a highly odousous and volatile "sex attracting scent from their scent glands called pheromones or ectohormones.
- Male perceive the smell of this scent with the help of olfactory sensillae located upon their antennae.

- Male cockroach opens the ootheca pore with the help of hooks.
- The male insert whole of its phallomeres into the female's gential pouch then it inserts its pseudopenis into the female gonopore for firm anchorage.
- Sperms are transferred through spermatophores.
- Copulation time $\Rightarrow$ one hour
- The spermatophore remains inside the body of the female for about 20 hours during this period all its sperms escape out and fill in the two spermathecae of the female, then the female drops out the case of empty spermatophore.
- Sixteen ova, one from each ovariole of the two ovaries, are discharged at a time into the genital pouch where these are arranged by the gonapophyses into two parallel row.
- Simultaneously, sperms stored in the spermathecae are also discharged into the genital pouch to fertilize the ova.

Fertilization :-

- Fertilization is internal and their fertilised are encased in capsules called ootbe.cae.
- After fertilization the left collaterial gland secretes a soluble "milky protein" while the right one secrete dihydroxyphenol. Both secretions mix to form a brownish scleroprotein.
- Sclera protein forms a common egg case, called ootheca.
- Ootheca is a dark reddish to blackish brown capsule, about 3/8"(8mm) long.
- They are dropped or glued to a suitable surface, usually in crack or crevice of high relative humidity near a food source.

Development :-

- On an average. female produces 9-10 ootheca, each containing 14-16 eggs.
- Development of egg takes place inside ootheca
- Development is Paurometabolous, meaning there is development through nymphal stage.
- Development time- "4 to 8" weeks
- The nymphs look very much like adults, the nymph grows by moulting about 13 times to reach the adult form.
- The next to last nymphal stage has wing pads but only adult cockroach have wings.
- Nymph changes into an adult in - 1 year
- Time interval between two moulting called "stadium.
- In between moulting nymph called "instar".

GOLDEN KEY POINTS

- Some of the CO_2 leaves the body through tracheae and spiracles. But major part of CO_2 leaves through cuticular covering of body because CO_2 can diffuse more readily through chitin than O_2.
- If the head of a cockroach is cut off, it still survives for as long as one week or more.
- It is because their head holds a bit of a nervous system, while rest of it lies in, i.e., ventral part of the body, i.e, in belly region. Also their brain does not control breathing and blood does not carry oxygen throughout the body rather the spiracles supply air directly to the tissues through a set of tubes (called trachea) in each segment separately. They are cold-blooded as blood flows in open spaces. i.e., sinuses, so they need much less food which is also one of the reasons for its survival. Without the brain, their body can still perform some functions in terms of very simple reactions.

- Their body ultimately dies due to the dehydration or starvation or from infection of bacteria, viruses etc.

BEGINNER'S BOX-4

1. In cockroach, ootheca is produced by secretion of-
(1) Conglobate gland (2) Prothoracic gland
(3) Gonapophyses (4) Collaterial gland

2. Mark the incorrect match w.r.t. function-
(1) Seminal vesicle - Storage of sperm
(2) Phallic gland - Covering of spermatophore
(3) Colleterial gland - Oothecal covering
(4) Phallomeres - Nourishing sperms

3. Heart of cockroach consists of elongated muscular tube lying along-
(1) Mid ventral line of thorax (2) Mid ventral line of abdomen
(3) Lateral to the alimentary canal (4) Mid dorsal line of thorax and abdomen

4. If the head of cockroach is cut-off, it will still live for as long as one week, because
(1) Head holds a large mass of nervous system
(2) Most of the Nervous system is present in ventral part of its body
(3) Nervous system present only in abdominal part
(4) No control of brain. over the body

5. Find out the incorrect pair w.r.t. cockroach
(1) A pair of testis - 4^{th} - 6^{th} abdominal segmental
(2) Mushroom gland - 6^{th} - 7^{th} abdominal segmental
(3) Titillator - Left phallomere
(4) Innermost layer of spermatophore - Utriculi brevivores

6. Nymph differs from adult cockroach in-
(1) Absence of wings
(2) Smaller in size
(3) Absence of mature reproductive organs
(4) All of these

7. In cockroach which of the following features is not asc:ociated with conservation of water?
(1) Wall of rectum is prouided with six rectal paoillae
(2) Uricotelism
(3) Presence of waxy layer above the epicuticle
(4) Presence of thin and transparent chitinous membrane on the inner linning of mesenteron

8. One of the following muscles deal with respiration of cockroach-
(1) Alary muscles (2) Sternotergal muscles
(3) Intercostal muscles (4) Adductor muscles

9. During metamorphosis, under the ecodysone hormone moulting occurs __ times in Periplaneta-
(1) 3-5 (2) 15-20 (3) 13 (4) 1-2

10. In male cockroach, outermost layer of spematophore is secreted by-
(1) Ejaculatory duct, during copulation (2) Phallic gland, during copulation
(3) Mushroom gland, during copulation (4) Conglobate gland, after copulation

ANSWER KEY

BEGINNER'S BOX-1

1.	(2)	**2.**	(1)	**3.**	(4)	**4.**	(1)	**5.**	(2)	**6.**	(3)		

BEGINNER'S BOX-2

1.	(4)	**2.**	(3)	**3.**	(3)	**4.**	(4)	**5.**	(3)

BEGINNER'S BOX-3

1.	(1)	**2.**	(1)	**3.**	(2)	**4.**	(1)	**5.**	(3)	**6.**	(4)		

BEGINNER'S BOX-4

1.	(4)	**2.**	(4)	**3.**	(4)	**4.**	(2)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(2)	**9.**	(3)	**10.**	(2)								