BYJU'S Classes

BIOLOGY

STRUCTURAL ORGANISATION IN ANIMALS

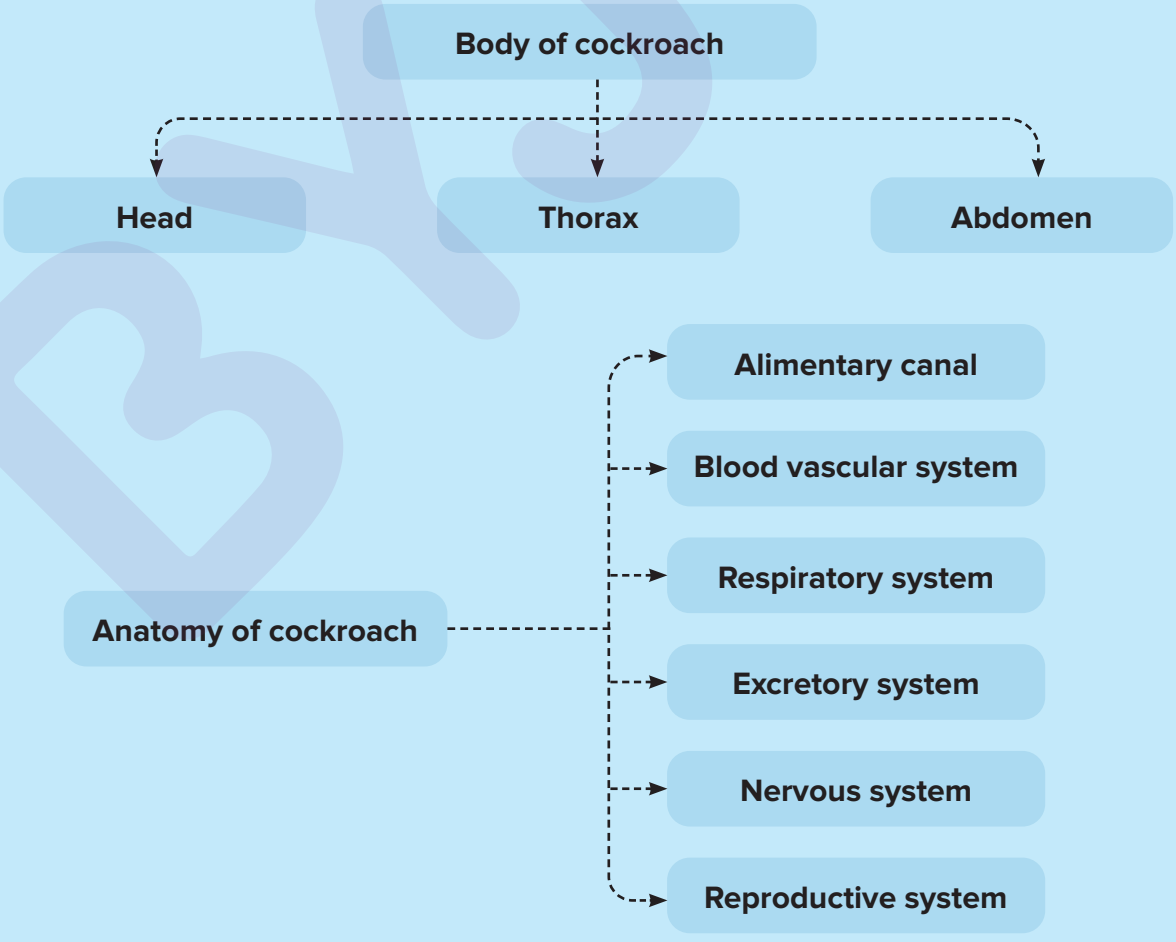
COCKROACH: PART 2 AND FROG: PART 1

NOTES

Key Takeaways

- Cockroach
  - Anatomy
    - Excretory system
    - Nervous system
    - Reproductive system
- Frog
  - Frog vs toad
  - *Rana tigrina*
    - Special characteristics
    - Habitat
    - Morphology

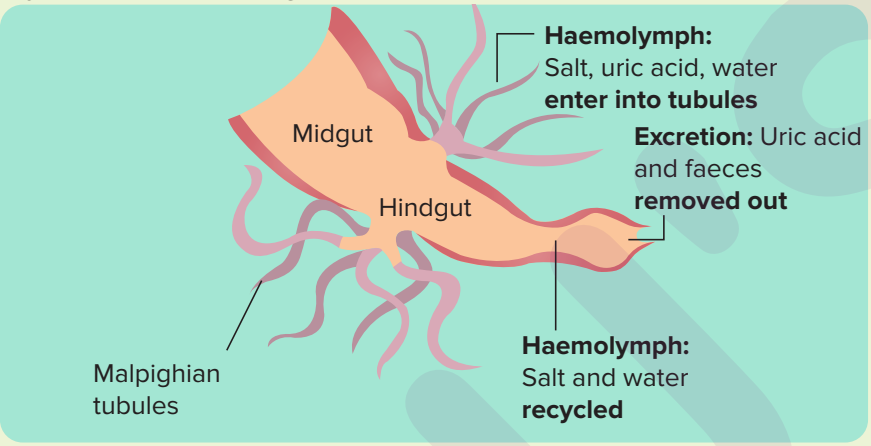
Prerequisites



Cockroach

Excretory System

- Excretion occurs through **malpighian tubules.**
- Malpighian tubules are lined by **glandular** and **ciliated cells**.
- They convert **nitrogenous wastes** into **uric acid** that are released into the hindgut.
- Fat body, nephrocytes, and urecose glands also help in excretion.



Excretory system showing malpighian tubules

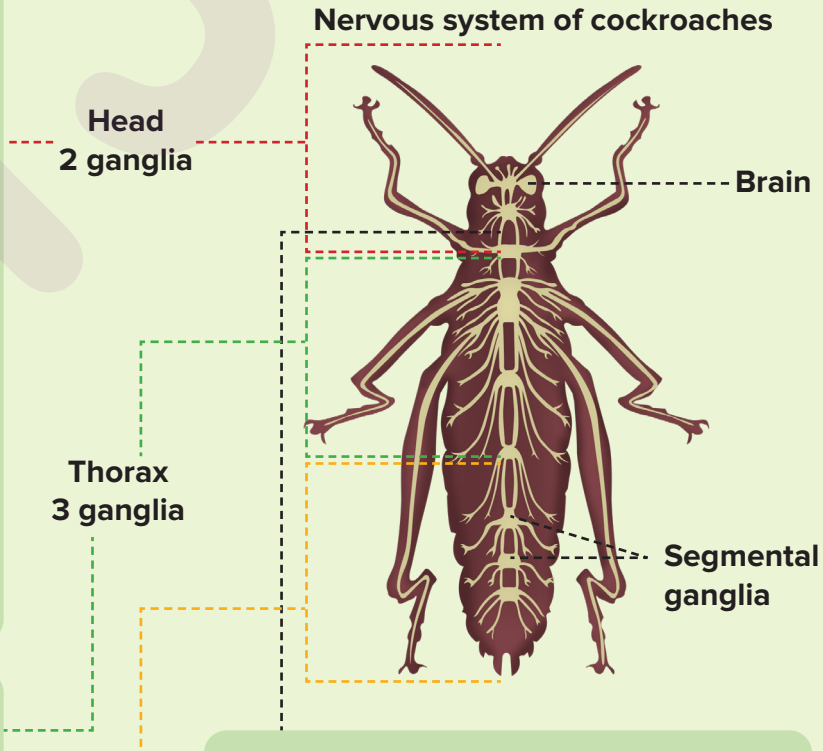
Nervous system

- It consists of a series of **fused ganglia** (groups of neuron cell bodies).

- **2 ganglia in the head**
  - **Supraoesophageal ganglion**
  - **Suboesophageal ganglion**
- **Supraoesophageal ganglion**
  - It is the **brain** and is present in the head
  - '**Supra**' means **above** and '**esophageal**' means of **oesophagus**. This refers to the position of the ganglion that is located **above the oesophagus**.
- It supplies nerves to **antennae** and **compound eyes**.

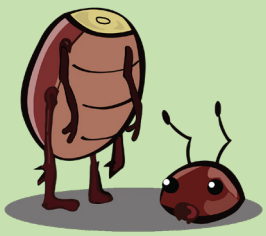
- The nerves from **thoracic ganglia** are supplied to **legs** and **wings**.

- The nerves from **abdominal ganglia** are supplied to various **parts** of the **abdomen**.



Ventral nerve cord

- The ganglia are connected to each other by a **double nerve cord**.
- The nerve cord is present at the ventral (belly) part of the body.



Headless cockroaches! Secrets revealed!

How do cockroaches survive without a head?

- The head portion of a cockroaches only holds a small part of the nervous system. The majority of the nervous system is located on the ventral side of the body.
- So, even if the head of the cockroach is cut off, it can still survive for as long as one week by performing basic actions like standing, reacting to touch, etc.

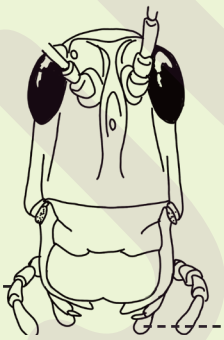
Sensory organs

(a) Antennae

- It is used to sense **taste (gustatory receptor), smell (olfactory receptor),** and **touch (tactile receptor)**.

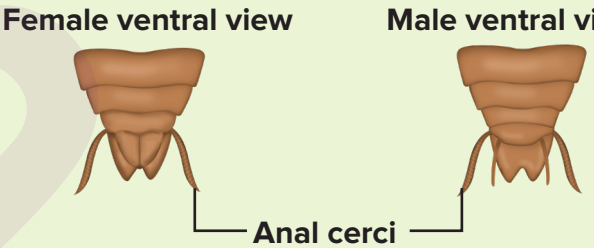
(b) Maxillary palps and labial palps

- They help in **tasting** the food.



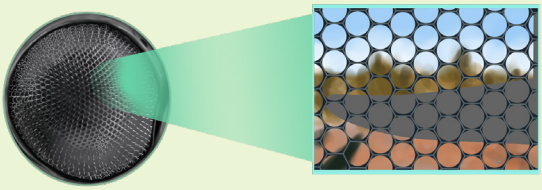
(c) Anal cerci

- They are **auditory or hearing receptors.**
- They help cockroaches respond to **air** or **earth-borne vibrations.**



(d) Compound eyes

- They are present at the **dorsal** side of the **head**.
- Each compound eye has **2000 functional units** known as **ommatidia (singular: ommatidium)**.
- Many ommatidia form several images of objects. This creates **mosaic vision** that has **more sensitivity** and **less resolution**.
- They help in **nocturnal vision**.



Compound eyes of cockroaches

Reproductive system

- Cockroaches exhibit **sexual dimorphism**. They have **distinct male** and **female** members.
- They have well-developed reproductive organs in both males and females.

Male reproductive system (parts)

- Testes
- Seminal vesicle
- Male gonopore
- Accessory glands
- Vas deferens
- Ejaculatory duct
- Gonapophysis/ Phallomeres

Testes

- There is a pair of trilobed testes.
- It is present from **4th to 6th** abdominal segments.

Vas deferens

- It arises from the testes and opens into the ejaculatory duct through seminal vesicles.

Seminal vesicles

- These are **sac-like** structures that stores the sperms.

Mushroom-shaped accessory glands

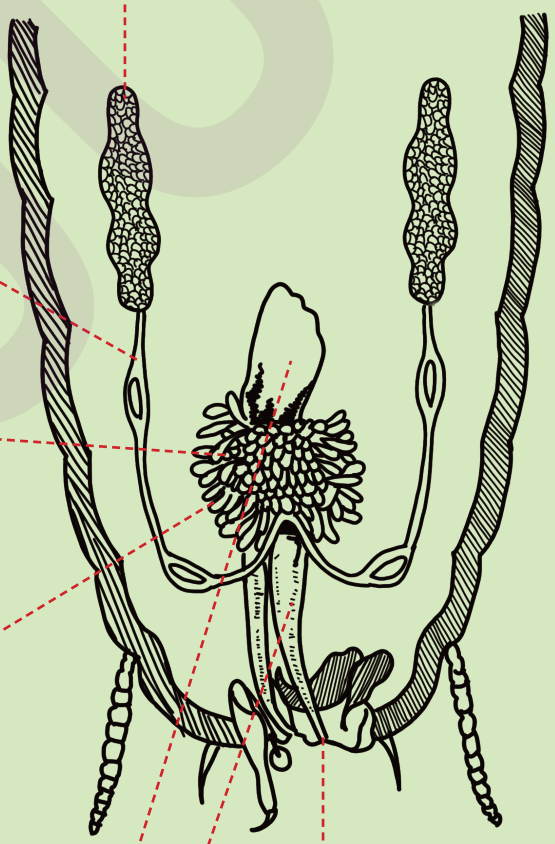
- They are present in the form of small and long tubules in the **6th** and **7th** segments.
- The secretions of these glands help in nourishing the sperms.

Phallic gland

- It helps in the formation of **spermatophores** (bundles containing sperms glued together).

Ejaculatory duct

- It carries sperms from the seminal vesicles into male gonopore.



Male gonopore

- A gonopore is a genital pore through which sperms pass into the vagina.

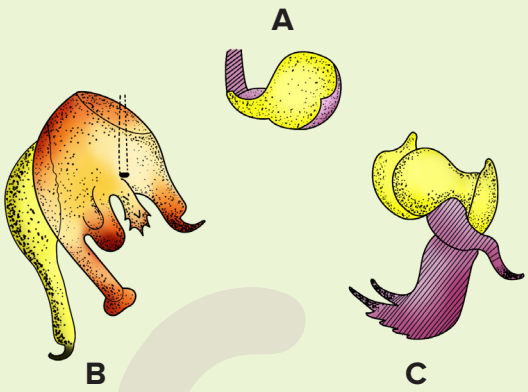
Male gonapophysis
The male external genitalia is represented by chitinous, asymmetrical structures that surround the male gonopore known as **male gonapophyses** or **phallomeres**.

There are three gonapophyses/phallomeres:

(A) Ventral phallomere

(B) Left phallomere

(C) Right phallomere



Male reproductive parts of cockroaches

Female reproductive system

- Ovaries
- Common oviduct
- Spermatheca
- Oviduct
- Genital chamber
- Collateral glands

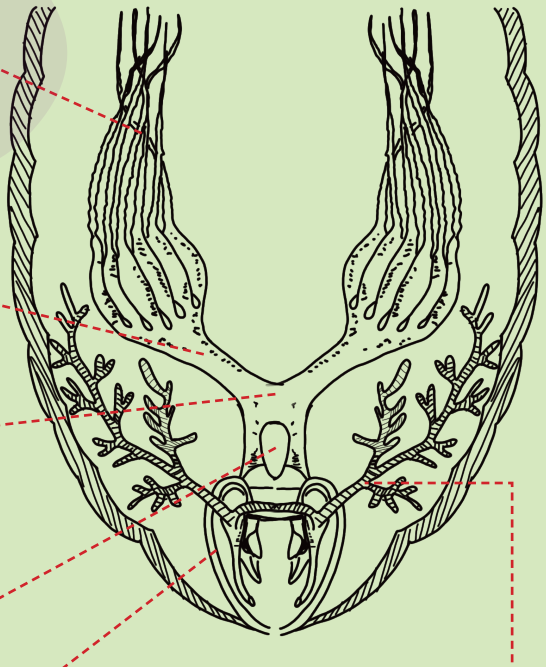
Ovaries
- A pair of large ovaries is present from **2nd to 6th** abdominal segments.
- Each ovary contains eight ovarian tubules (ovarioles) with a chain of developing ova.

Oviduct
- Each ovary leads into an **oviduct.**

Common oviduct
- Oviducts join to form a single median (common) oviduct or vagina.

Spermatheca
- One pair is present in the 6th abdominal segment
- It stores sperms that are received during copulation.

Genital chamber
- It is a chamber to pass ova and sperms.
- Vagina and spermatheca open into it.

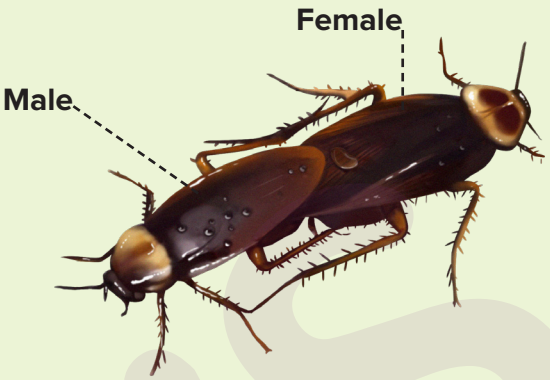


Female reproductive system

Collateral glands
- The secretion produced by these glands form the oothecal case of the ootheca (a case carrying the eggs).

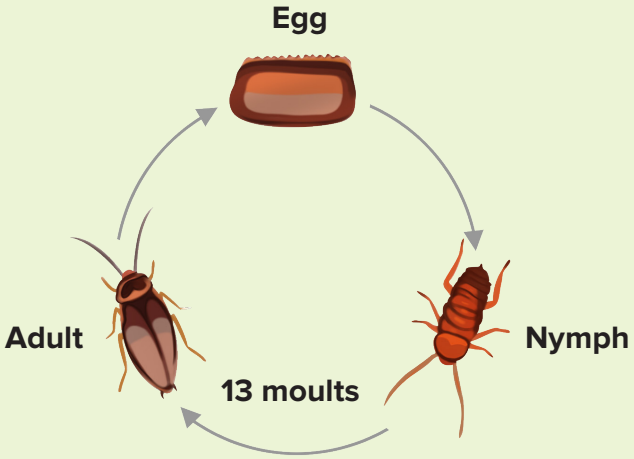
Fertilisation and development

- **Fertilisation**
  - The male cockroach **deposits** the **sperm** into the female by **backing** into its mate.
  - The **fusion** of **sperm** and **ova** takes place **inside** the **female body: internal fertilisation**.
  - Fertilisation takes place in the **genital chamber** of a female cockroach.
  - The **sperms** stored in **spermatheca** are released into the genital chamber.
  - **Ova** are also released into the **genital chamber**.
- **Oothecae (Egg case)**
  - Post fertilisation, the **fertilised eggs** are **encased** in **capsules** known as **egg cases (ootheca)**.
  - They are **dark reddish** to **blackish brown** in colour.
  - They are about ⅜ inches or 8 mm long.
  - Female cockroaches deposit ootheca at places of **high humidity** and one that is **next to a food source.**
  - A female lays around **9–10 ootheca**. Each ootheca has **14–16 fertilised eggs**.
- **Development of cockroach**
  - Development is **indirect**. The embryo develops into a mature individual through an intermediate sexually immature **larval stage**.
  - The mode of development in *P.americana* is known as **paurometabolous**.
  - **Paurometabolous** is one where there is a gradual metamorphosis from the juvenile to adult state without any sudden, radical change in the form of the body.
  - The **nymph moults** (casts/sheds a part of the body to make way for new growth) about **13 times** to reach the adult form.
  - The stage before the last nymphal stage has **wing pads** but only adult cockroaches have **wings**.



Fertilisation in cockroach


Oothecae of cockroaches



Development of cockroaches

Yucky cockroaches have their uses too!

- They release nitrogen through their faeces, which then gets into the soil and is used by plants.
- Extinction of cockroaches will have a big impact on forest as there will be less nitrogen available in the soil for plants to absorb. Therefore, that will indirectly affect all the species that depend on plants.

Frog

Frogs and toads . . . aren't they the same?

Frogs and toads are closely related animals.

Both of them are amphibians and are found on every continent on Earth, except Antarctica. However, even if they look very similar, there are some big differences between them.

Differences between frogs and toads

Toad

Frog

- **Lives on land** — **Lives in water**
- **Thick, dry skin with bumps, and usually brown** — **Thin, wet smooth skin that has more colour**
- **Stout body type** — **Slim body type**
- **Short legs** — **Very long legs**
- **Prefers to walk or use small hops** — **Prefers to jump**

- They both belong to the same order, **Anura**, but **different species** and **genus**.

	Toad	Frog
Kingdom	Animalia	Animalia
Phylum	Chordata	Chordata
Class	Amphibia	Amphibia
Order	Anura	Anura
Family	Bufonidae	Ranidae
Genus	*Bufo*	*Rana*
Species	*marinus*	*tigrina*

Frog: *Rana tigrina*

Characteristics

- They are commonly found in **India**.
- They are also known as the **Indian bullfrog**.
- They are **amphibians**. They can live both on land and in water. They need water or a moist environment to survive.
- They are **cold-blooded (poikilotherms)**, as they cannot regulate their body temperature according to their environment. Their body temperature varies considerably.
- They undergo **hibernation** (dormancy or inactive state of organisms due to low temperature) to prevent internal body damage due to low temperature.
- They also undergo **aestivation** (dormancy of organisms during high temperature) to prevent water loss and internal body damage due to high temperature.
- They have the ability to change the colour to hide them from their predators or prey **(camouflage)**.
- They **mimic** other animals to protect themselves from predators.
- **Mimicry** means imitating. It may evolve between different species or individuals of the same species.

***Epipedobates biliguis* (Poisonous)**

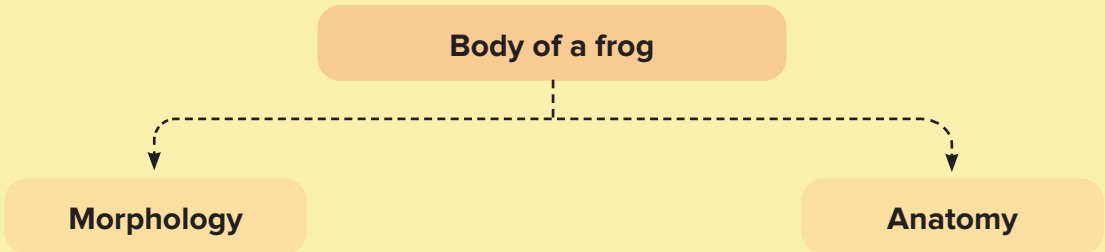
***Allobates zaparo* (Non-poisonous)**

Habitat

- They are found in **freshwater bodies** such as ponds, lakes, and marshes.

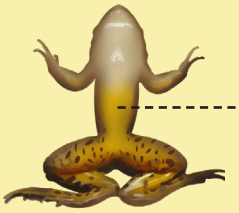
Did you know?

Frogs cannot live in saltwater as it will lead to dehydration and accumulation of salt inside their body to a poisonous level.



Morphology

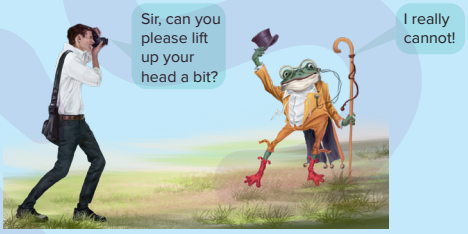
Dorsal side is **olive green** in colour.



Ventral side is **pale yellow** in colour.

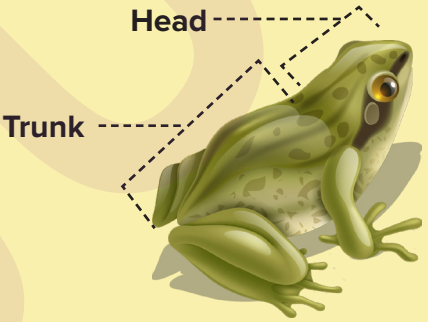
Did you know?

Frogs cannot turn their heads sideways. This is because they do not have necks. They cannot turn, lift, or lower their heads like humans and other animals.



(a) Body plan

- Their body is divided into head and trunk.
- Neck and tail are absent.



Body plan of frogs

(b) Skin

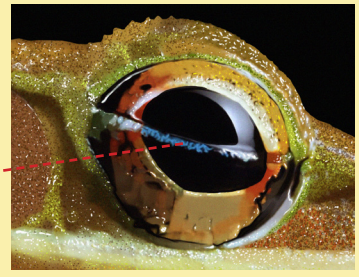
- They have **smooth** and **slippery** skin due to the presence of **mucus**.
- The mucus helps in keeping the skin **moist**.

Slippery skin

(c) Eyes

- A pair of **bulging eyes** is present in the skull.
- The bulging eyes of most of the **frogs** allow them to see
  - To the front
  - To the sides
  - Partially behind
- Eyes are **simple** in nature.

The eyes are protected by a **nictitating membrane**. It is a semi-transparent third eyelid that completely covers the eyes, allowing it to see underwater.



(d) Nostrils and tympanum

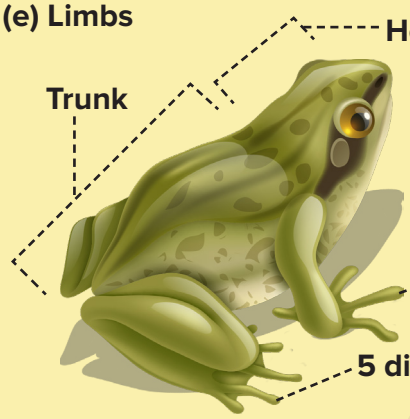
Nostrils

- A pair of nostrils is present above the mouth.

Tympanum

- A membranous **tympanum** is present on the either side of the eyes.
- It is an organ of **hearing** as well as **balancing**.
- It helps in hearing by **receiving sound signals**.
- Some frogs have small tympanum and in some, the tympanum is larger than the eyes.

(e) Limbs



Forelimbs

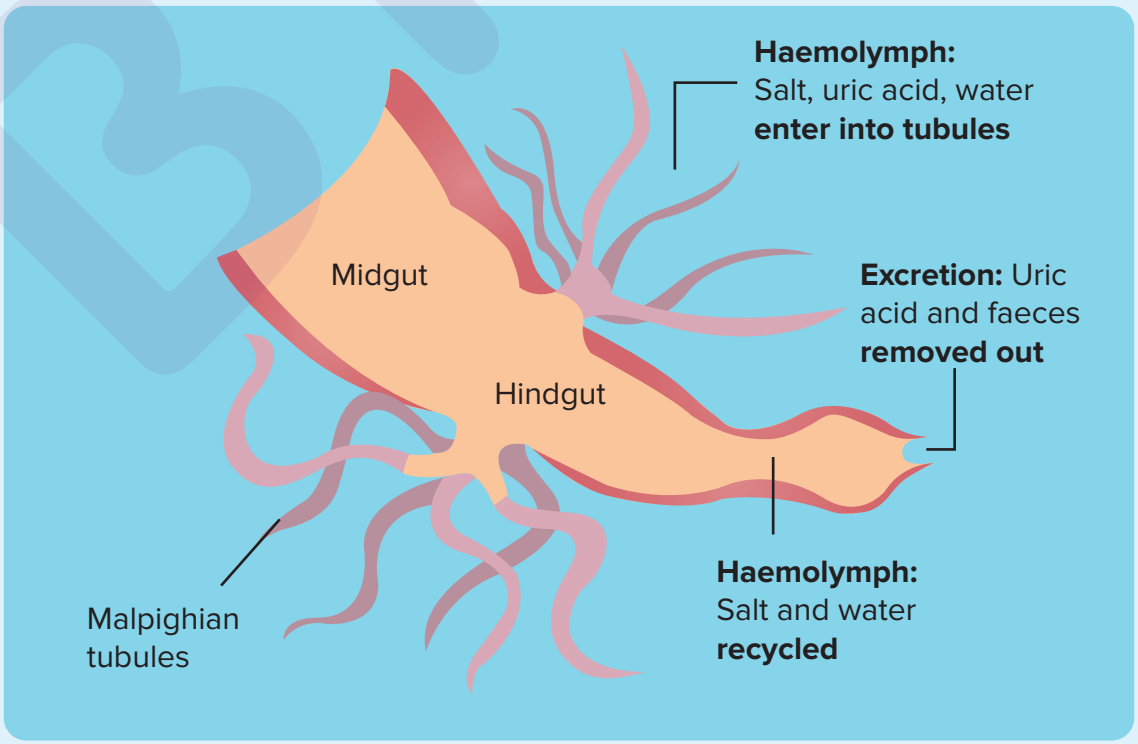
Hindlimbs

- Larger and muscular than forelimbs
- Webbed

Limbs help in

- Leaping
- Swimming
- Burrowing

Summary Sheet



Excretory system showing malpighian tubules

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- The nerves from **thoracic ganglia** are supplied to **legs** and **wings.**

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Ventral nerve cord

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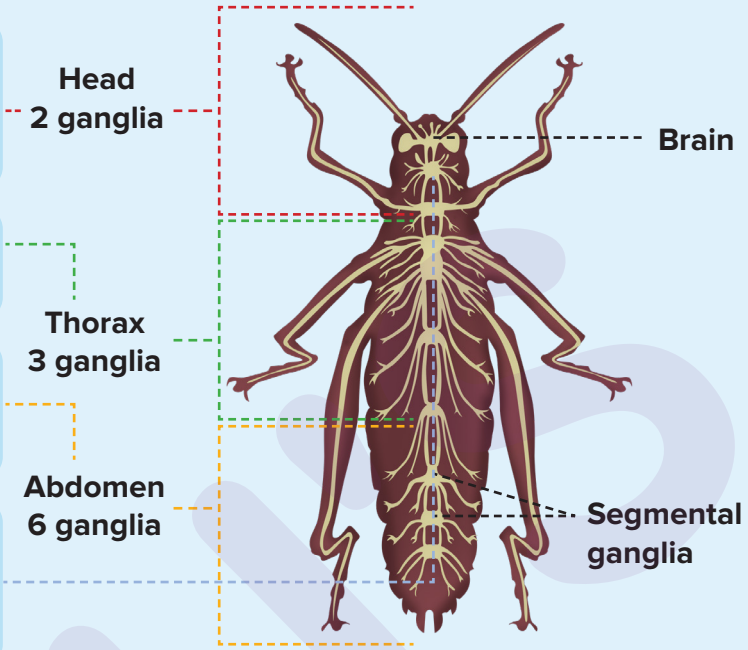


Nervous system of cockroaches

Testes: Trilobed

Vas deferens: Carries sperm from testes

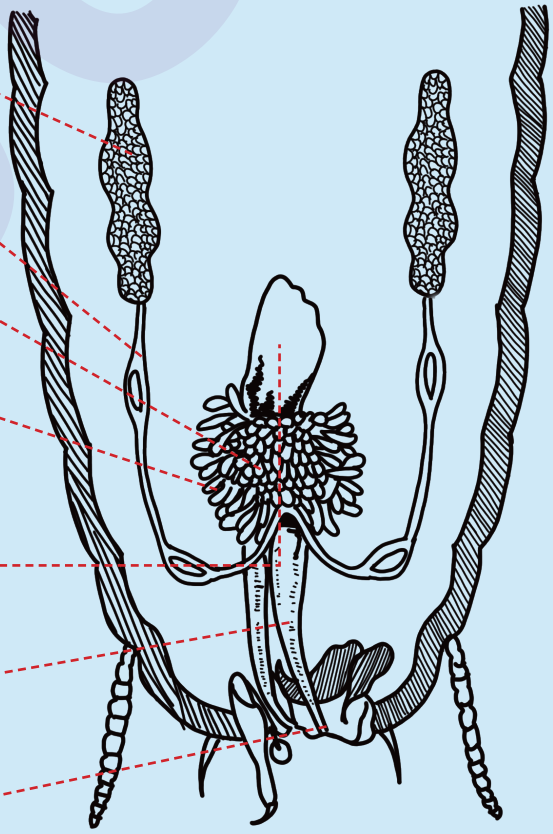
Seminal vesicles: Secrete fluid

Mushroom-shaped accessory glands: Have small and long tubules, help in nourishing the sperms

Phallic gland: Helps in the formation of spermatophores

Ejaculatory duct: Carries sperm from the seminal vesicles into **male gonopore**

Male gonopore: Genital pore



Male reproductive organs

Ovaries: Contain a chain of developing ova

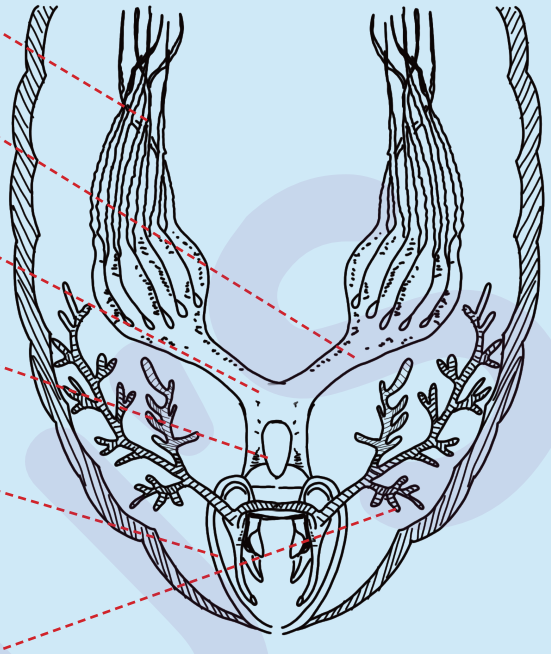
Oviduct: Each ovary leads into an oviduct.

Common oviduct: Oviducts join to form a **single median (common) oviduct** or **vagina**.

Spermatheca: Stores sperms

Genital chamber: It is a chamber to pass ova and sperms.

Collateral glands
The secretion produced by these glands form the oothecal case of the ootheca (a case carrying the eggs).



Female reproductive system

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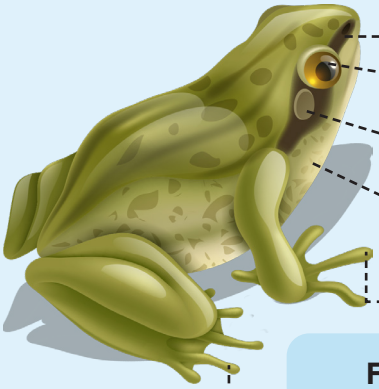
Toad

Frog



Nostrils: A pair of it is present above the mouth.

Eyes: A pair of bulging eyes

Tympanum: Helps in hearing by receiving sound signals

Skin: Have smooth and slippery skin

4 digits

Forelimbs

5 digits

Hindlimbs

- Larger and muscular than forelimbs
- Webbed

Limbs help in

- Leaping
- Swimming
- Burrowing

Morphology of frogs

Characteristics

Amphibians: Can live on land and in water

Cold-blooded: Cannot regulate their body temperature as per environment

Hibernation: Winter sleep

Aestivation: Summer sleep

Camouflage: Ability to change colour according to the environment

Mimicry: Imitating other animals