

# YAKEEN NEET 2.0

2026

STRUCTURAL ORGANISATION IN ANIMALS

ZOOLOGY

Revision-02

By- SAMAPTI MAM



## FROG:

- The most common species of frog found in India: Rana tigrina

### GENERAL CHARACTERISTICS:

- They belong to Class Amphibia  
dual bios life

They live on Land (terrestrial)  
as well as H<sub>2</sub>O (FRESH)

- These are POIKILOTHERM / COLD BLOOD animals

- ED.  
They do not have a fixed/  
CONSTANT body temperature, it changes with change in temp. outside.

### Classification

Kingdom: Animalia  
Phylum: Chordata  
Subphylum: Vertebrata  
SuperClass: Tetrapoda  
Class : Amphibia

3. During PEAK SUMMER and PEAK WINTER they make deep burrows & live inside as they go into SUMMER SLEEP (ESTIVATION) and winter SLEEP (HIBERNATION)\*
4. When they are ON LAND or ON GRASS, they can change their color (CAMOUFLAGE) according to the Background and this Protective Coloration is k/a MIMICRY  

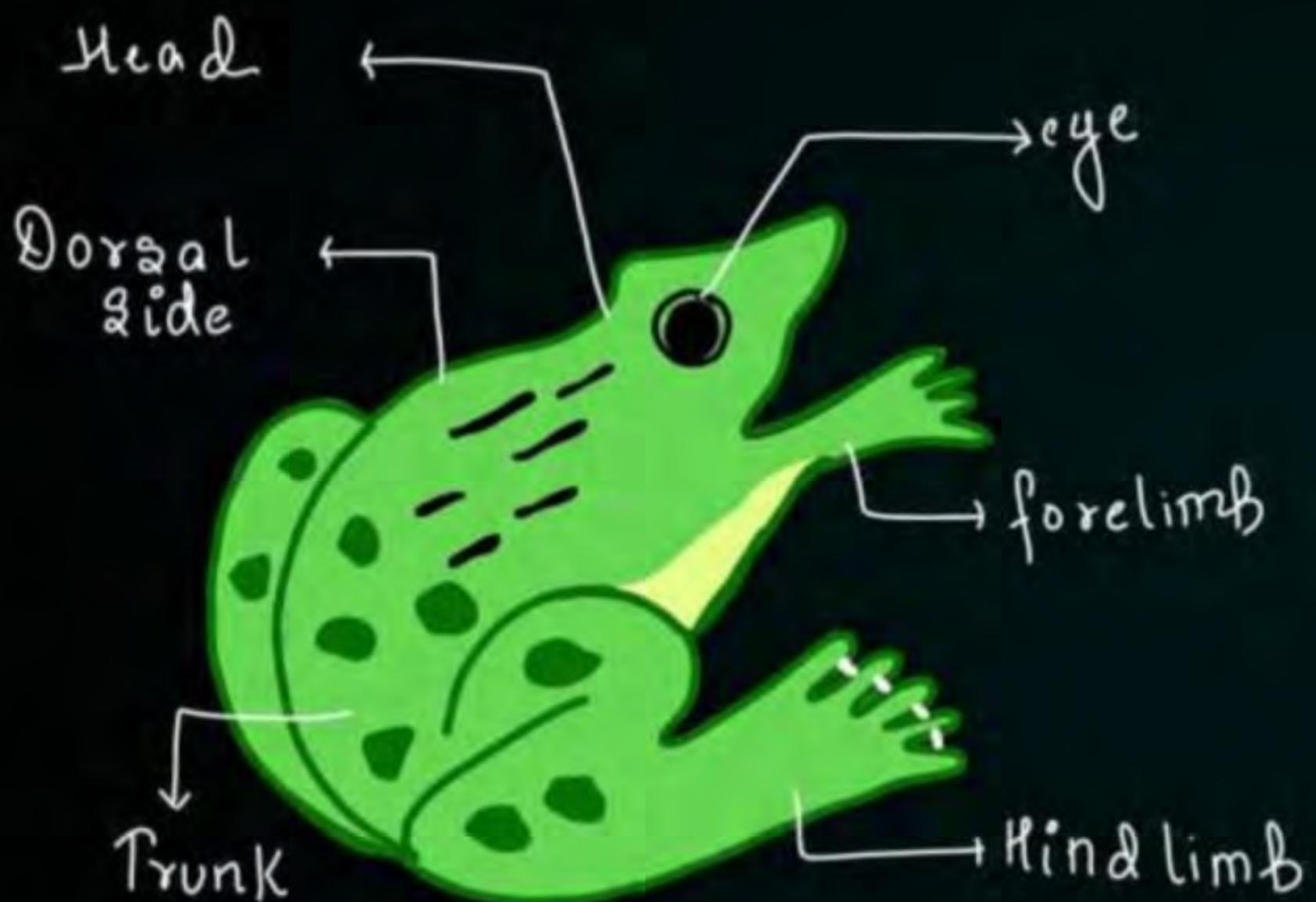
↓

 Protection from enemies, also to capture Prey (FIGHTER)

## MORPHOLOGY:

1. SKIN: Smooth & Slippery due to the presence of a lot of MUCUS
  - Always MOIST
  - Frog Never drinks water but absorbs through Skin.

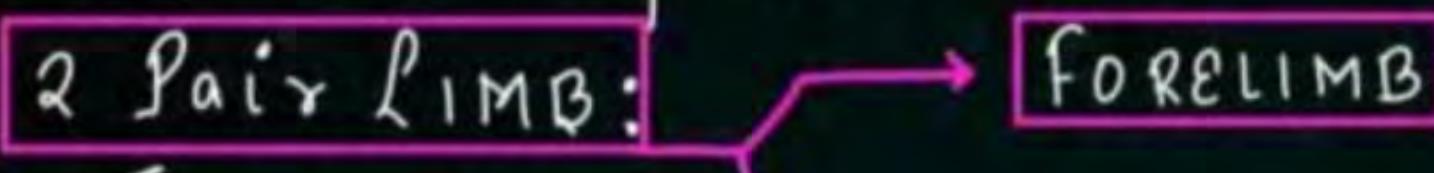




- Body divisible into
  - Head
  - Trunk
- Dorsal side → OLIVE GREEN
  - Dark, irregular spots
- Ventral side → PALE YELLOW
- A pair of simple eye: BULGED out, present in ORBIT of SKULL
- A NICTITATING MEMBRANE, covers the eye to protect it under water

- Ear finna is Absent, a fold of Skin Kla 'TYMPANUM' receives the sound vibrations present near eye.

- A pair of Nostril present above mouth.

- frog: **2 Pair LIMB:** 

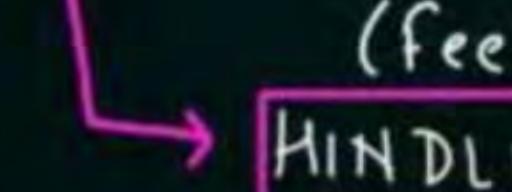
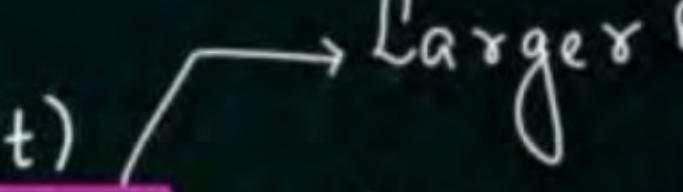
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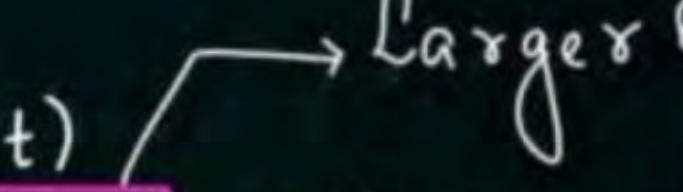
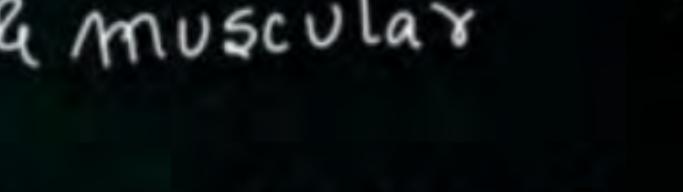
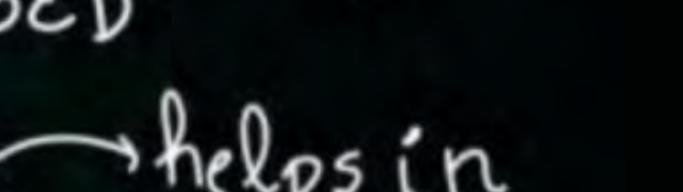
Leaping, walking,  
Burrowing, Swimming

**FORELIMB** → Ends with 4 Digits

**HINDLIMB** → Ends with 5 Digits & is 'WEBBED'



(feet)   eaten in some countries

Larger & muscular    
webbed feet  helps in swimming 

## Sexual Dimorphism:

- A ♂ frog can be distinguished from a ♀ frog hence frog shows Sexual dimorphism.

\*\* ♂ frog has:

- Sound producing **VOCAL SACS** to produce a sound especially during Breeding season to attract the ♀ frog.
- Male frog has **COPULATORY Pad** on the first digit of forelimb



helps in holding the ♀ during COPULATION

♂ releasing sperm  
♀ " egg

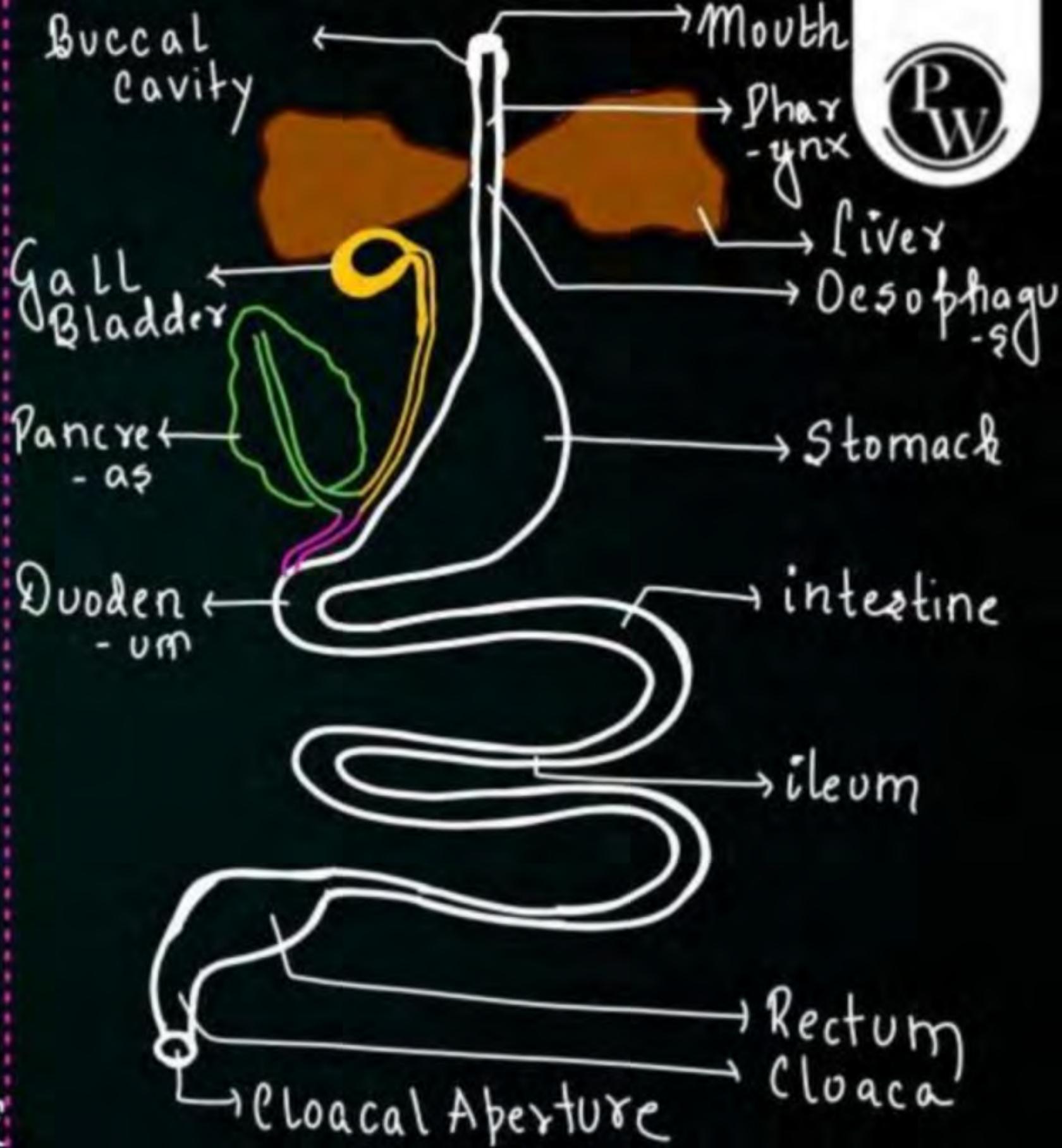
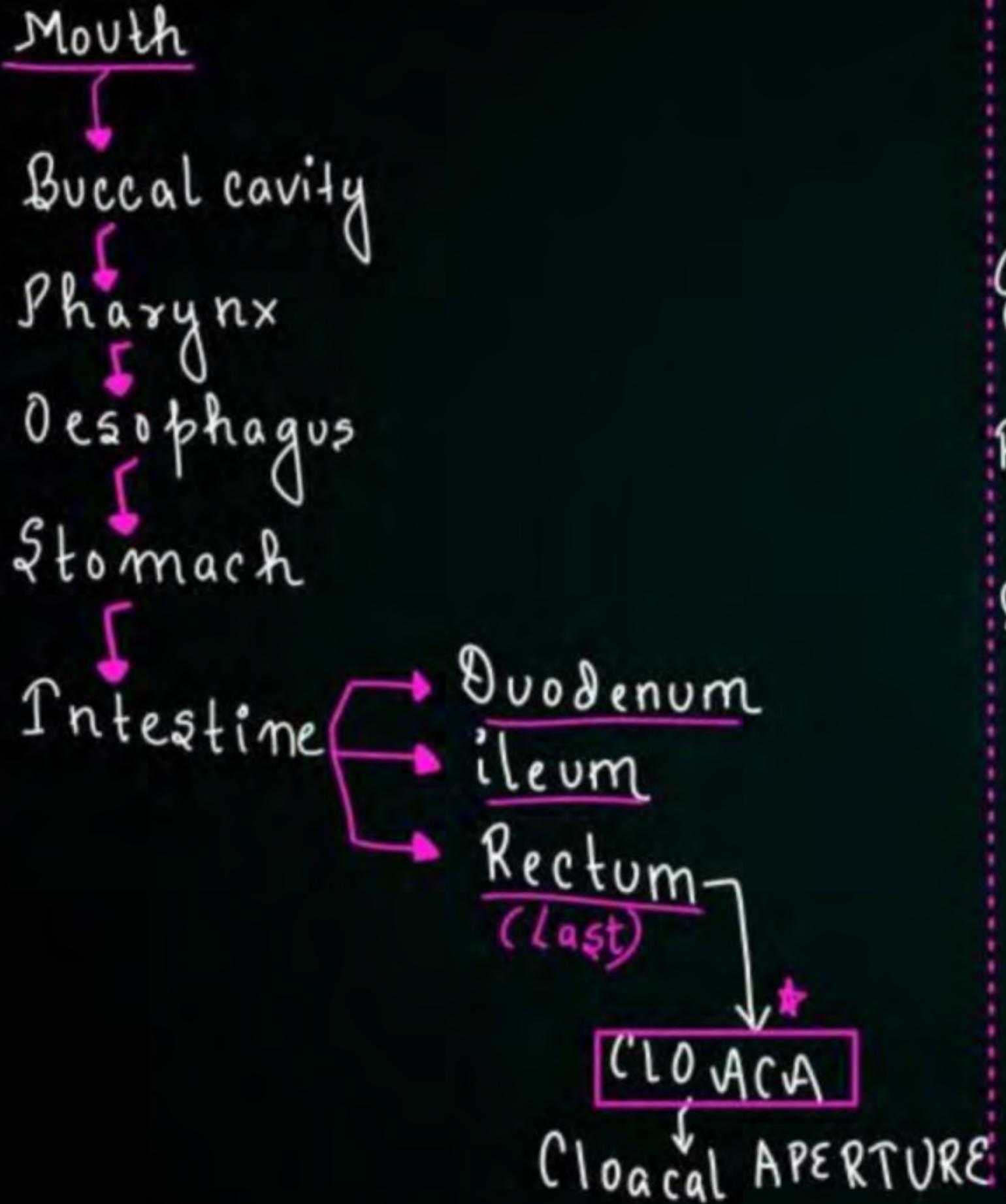
# Anatomy (Internal)



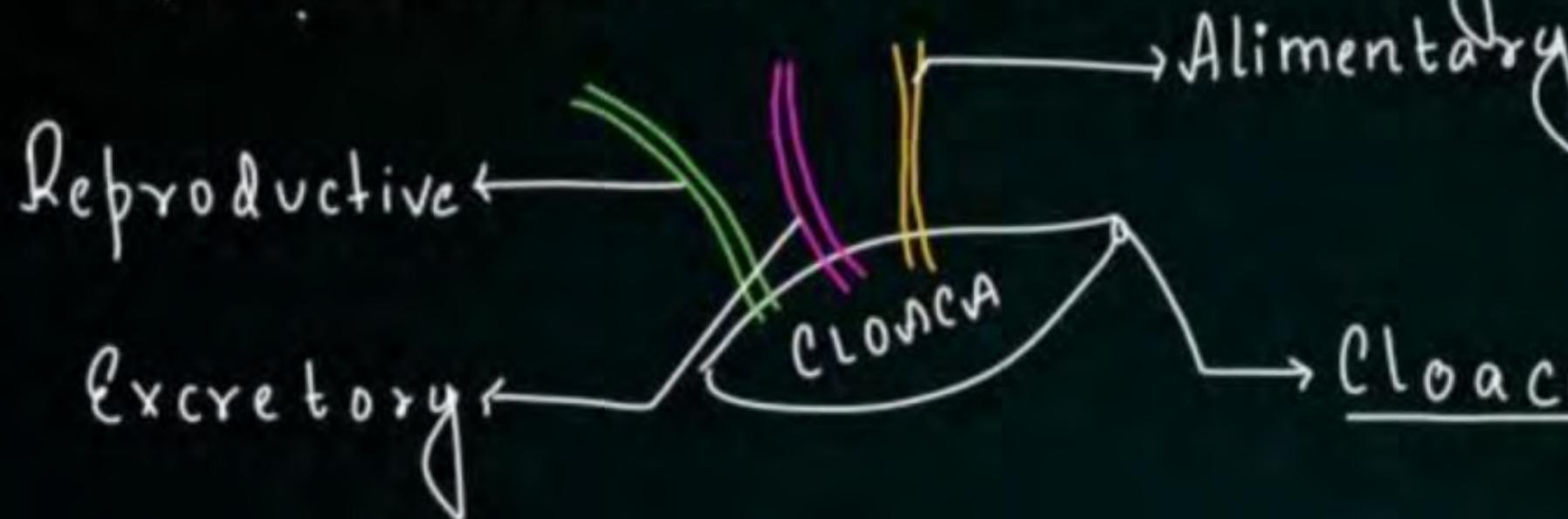
① DIGESTIVE SYSTEM: Alimentary canal + glands  
(tract)

- frog has 'SHORT' alimentary canal , length of the 'INTESTINE' is reduced because they are 'CARNIVORES' (Meat)

Parts of Alimentary Canal



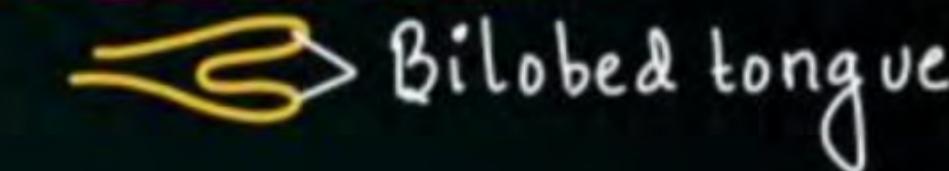
**Cloaca** It is a COMMON CHAMBER where the alimentary canal, reproductive canal and the excretory canal opens.



Cloacal aperture: Cloaca opens outside via this.

## Mechanism of Digestion:

Food is gathered with the help of the **BILOBED TONGUE**



oesophagus

STOMACH

INTESTINE

: GASTRIC JUICE + HCL → food mixes with this

together **"CHYME"**

Digestion is COMPLETED here

In the Duodenum, BILE & Pancreatic juice  
comes via COMMON BILE DUCT

BILE: emulsification of fats

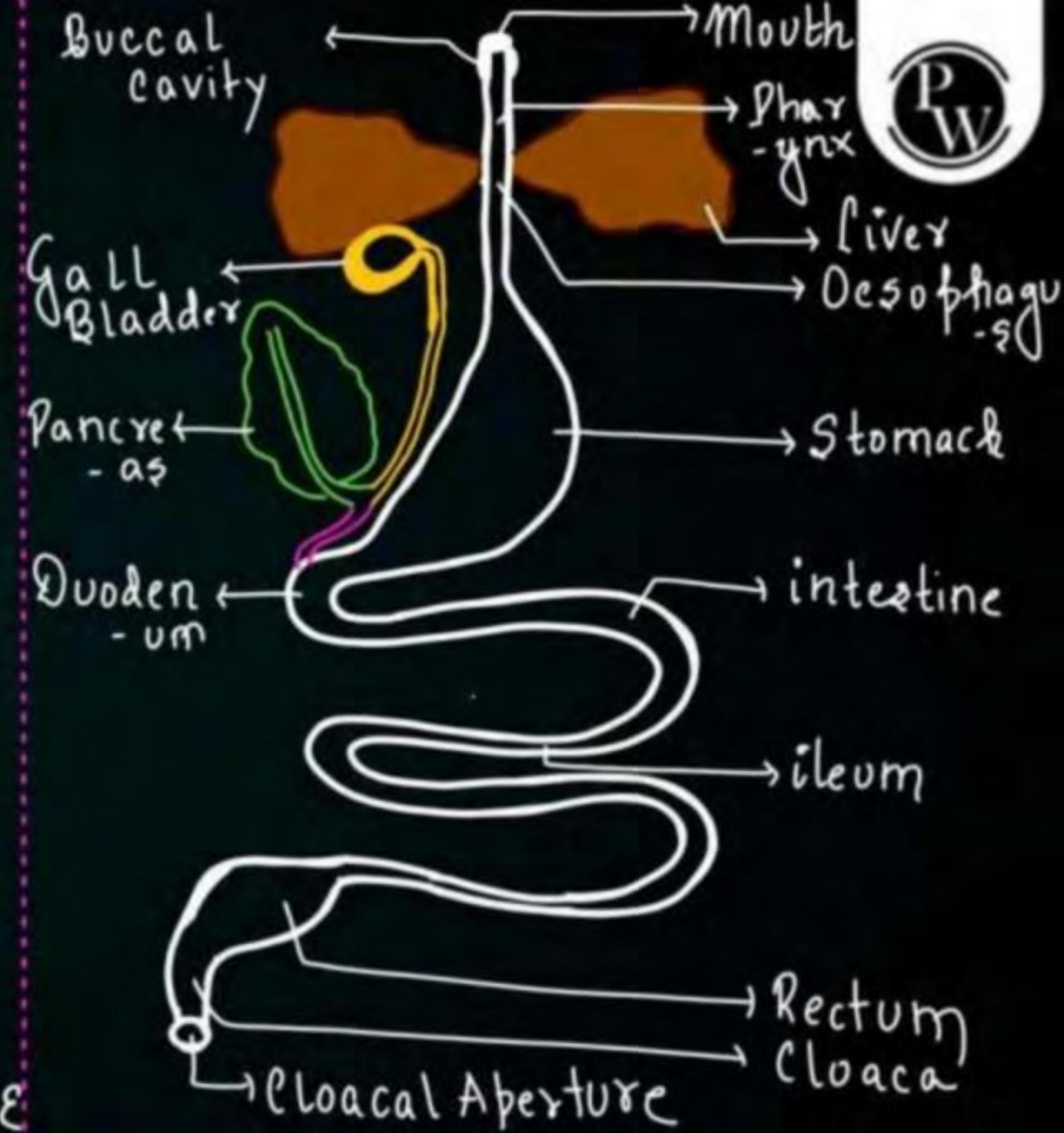
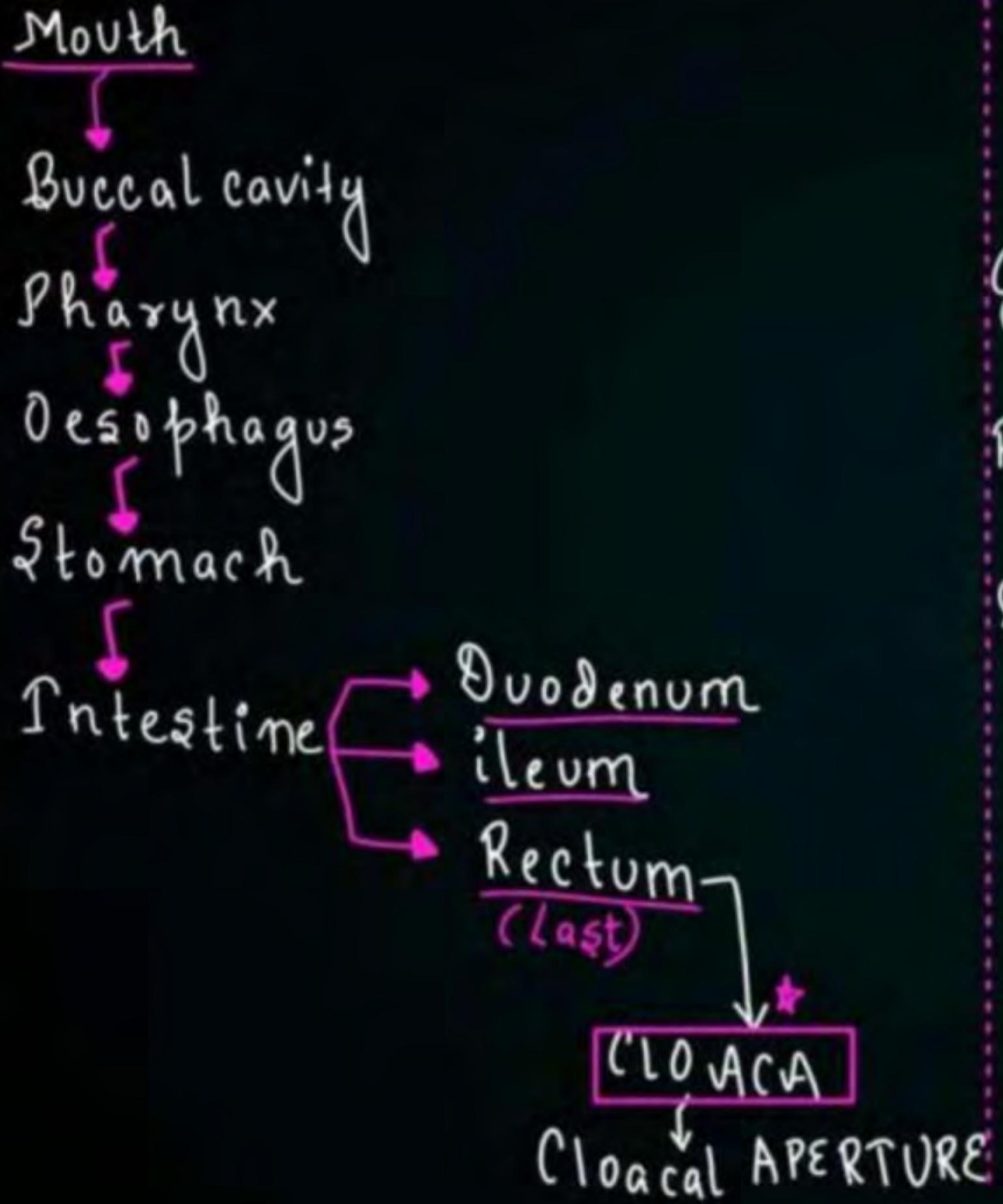
Pancreatic: PROTEINS &  
JUICE CARBOHYDRATE DIGESTION

Note

Liver: BILE JUICE SYNTHESIS

Gall Bladder: BILE STORAGE

PW



## Mechanism of Digestion:

food is gathered → Bilobed tongue



Stomach: Food + GJ + HCL



• Protein Digestion occurs (Digestion begins)  
CHYME

Intestine → Digestion completed here

Intestine → Duodenum → Bile + Pancreatic juice

emulsification of  
fats

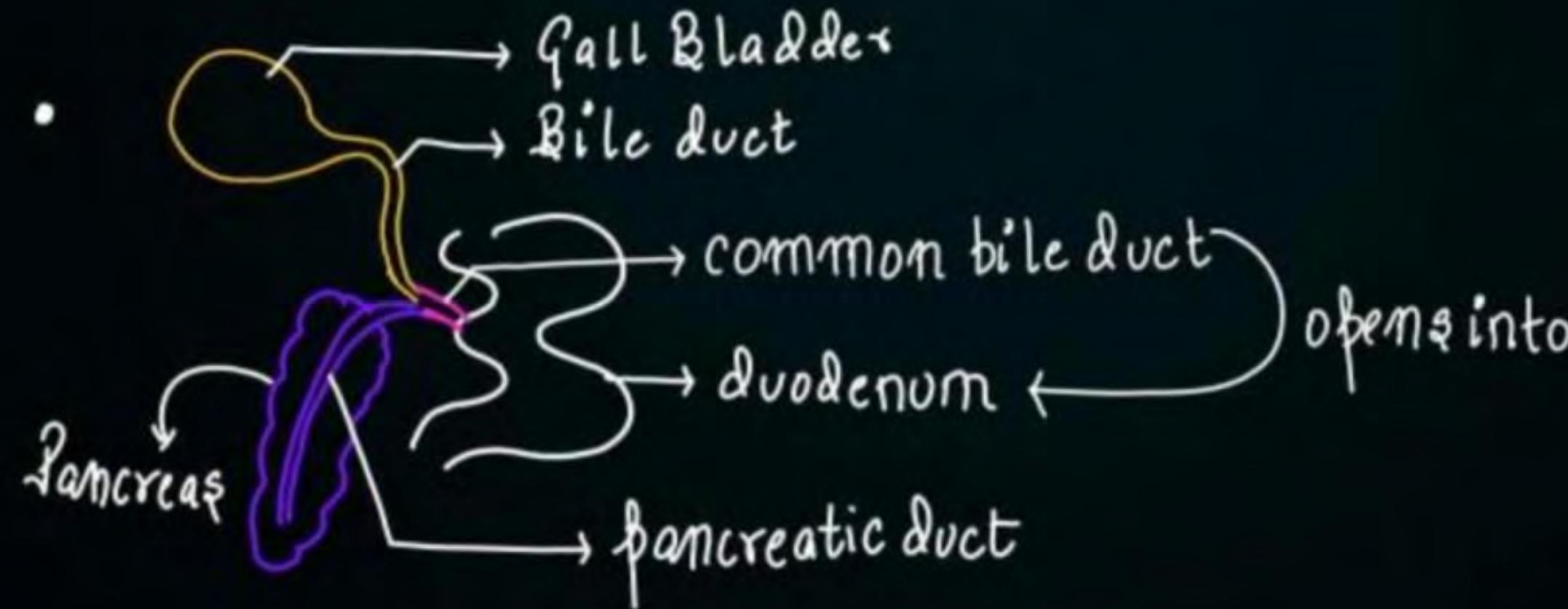
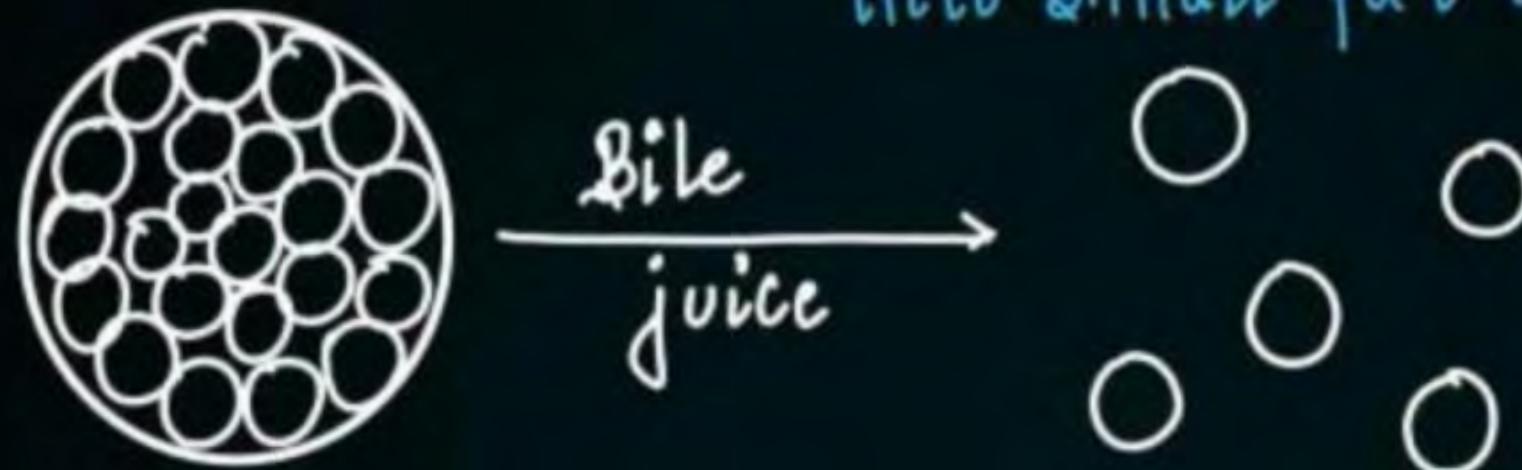
Protein + Carbohydrate  
digestion



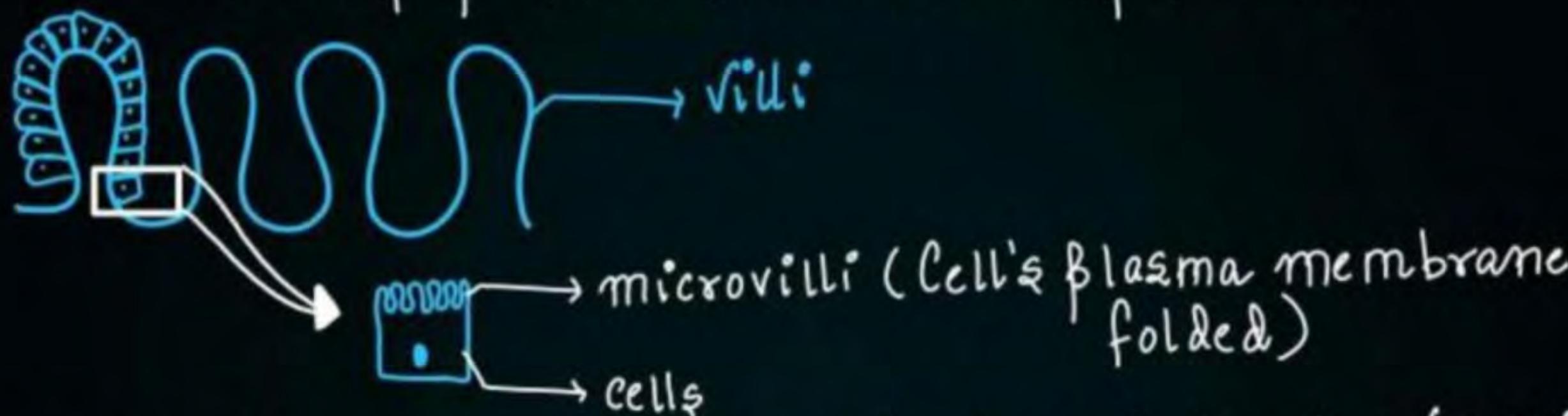
Note

P  
W

Emulsification of fats: BILE: Large fat droplets separated & converted  
into small fat droplets



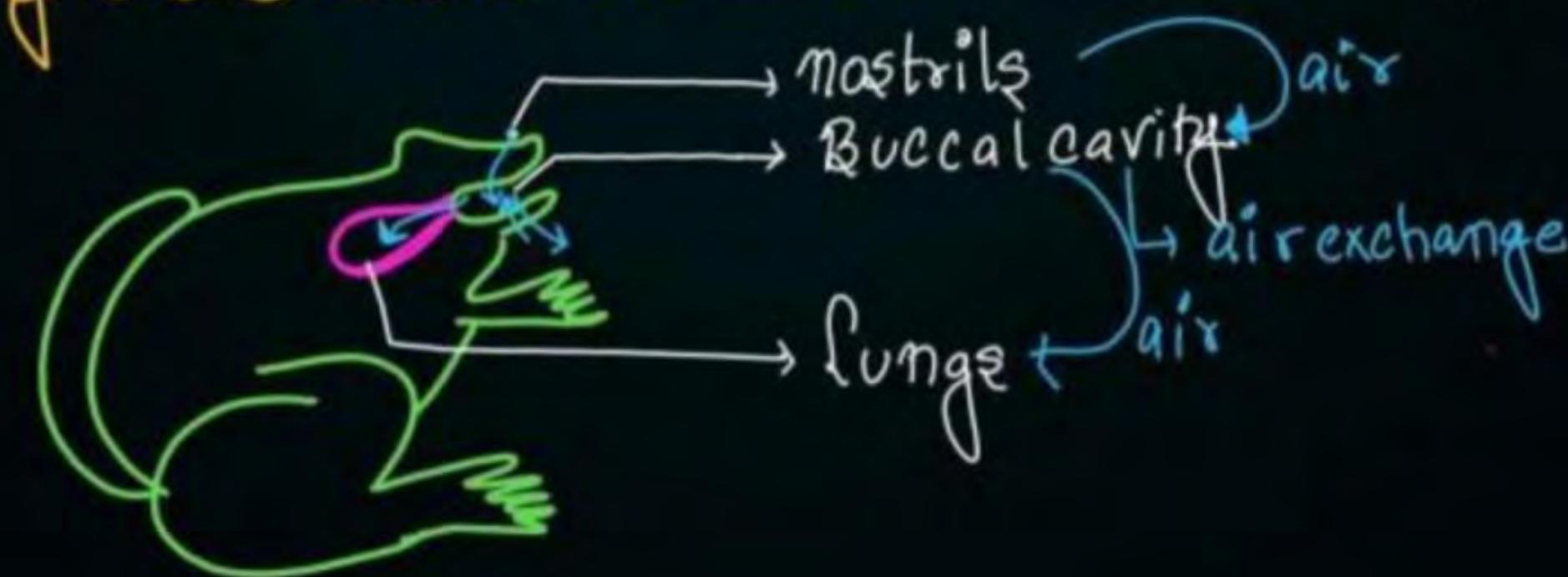
Absorption: The end product of Digestion is finally absorbed with the help of VILLI & MICROVILLI of intestine.



Egestion: After utilisation of end product of digestion (assimilation), the undigested, unabsorbed FAECAL MATTER is removed via RECTUM → CLOACA → CLOACAL APERTURE → outside.

## Respiration:

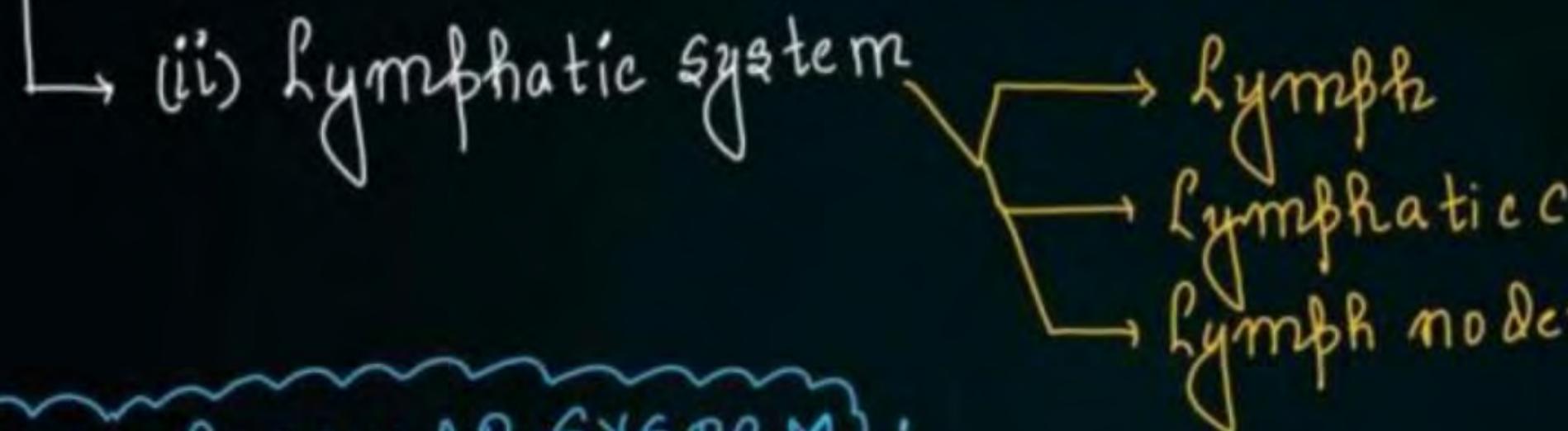
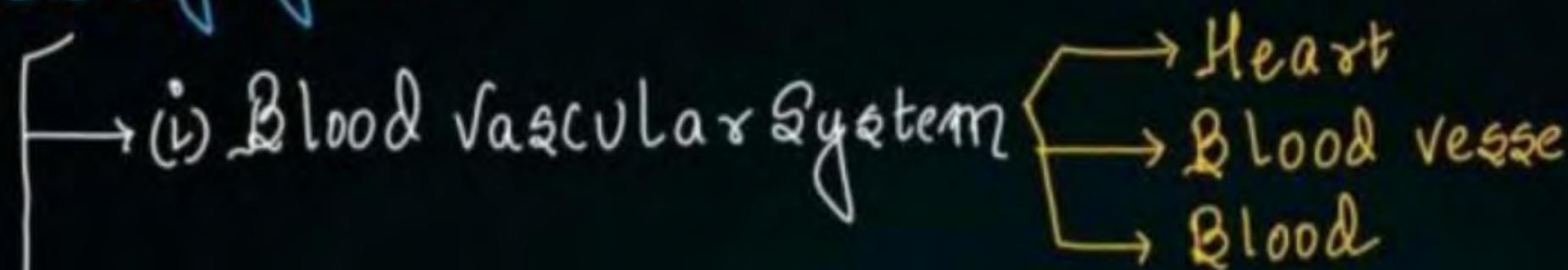
- ✓ → In water: Cutaneous respiration → Respirations through SKIN, dissolved O<sub>2</sub> in water is utilized by simple diffusion.
- On land
  - Cutaneous respiration
  - Pulmonary " → Using lungs → sac like 1 pair pinkish, present in upper part of trunk
  - Buccopharyngeal → Using Buccal cavity
- During hibernation & Aestivation: Cutaneous respiration



Note Tadpole Larva uses 'GILLS' for respiration.



## Circulatory system:



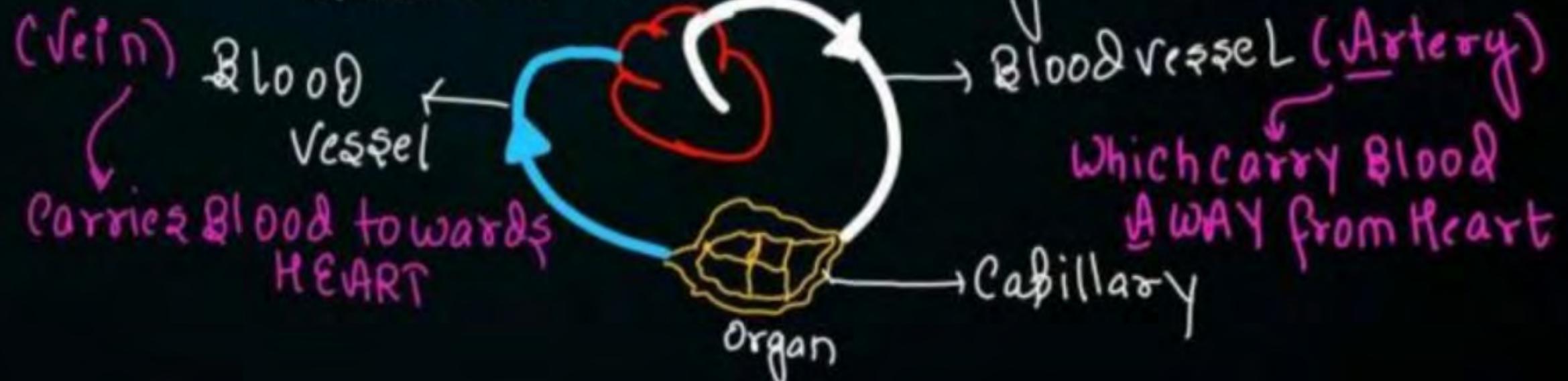
## Blood VASCULAR SYSTEM:

### 'Closed Circulatory system'

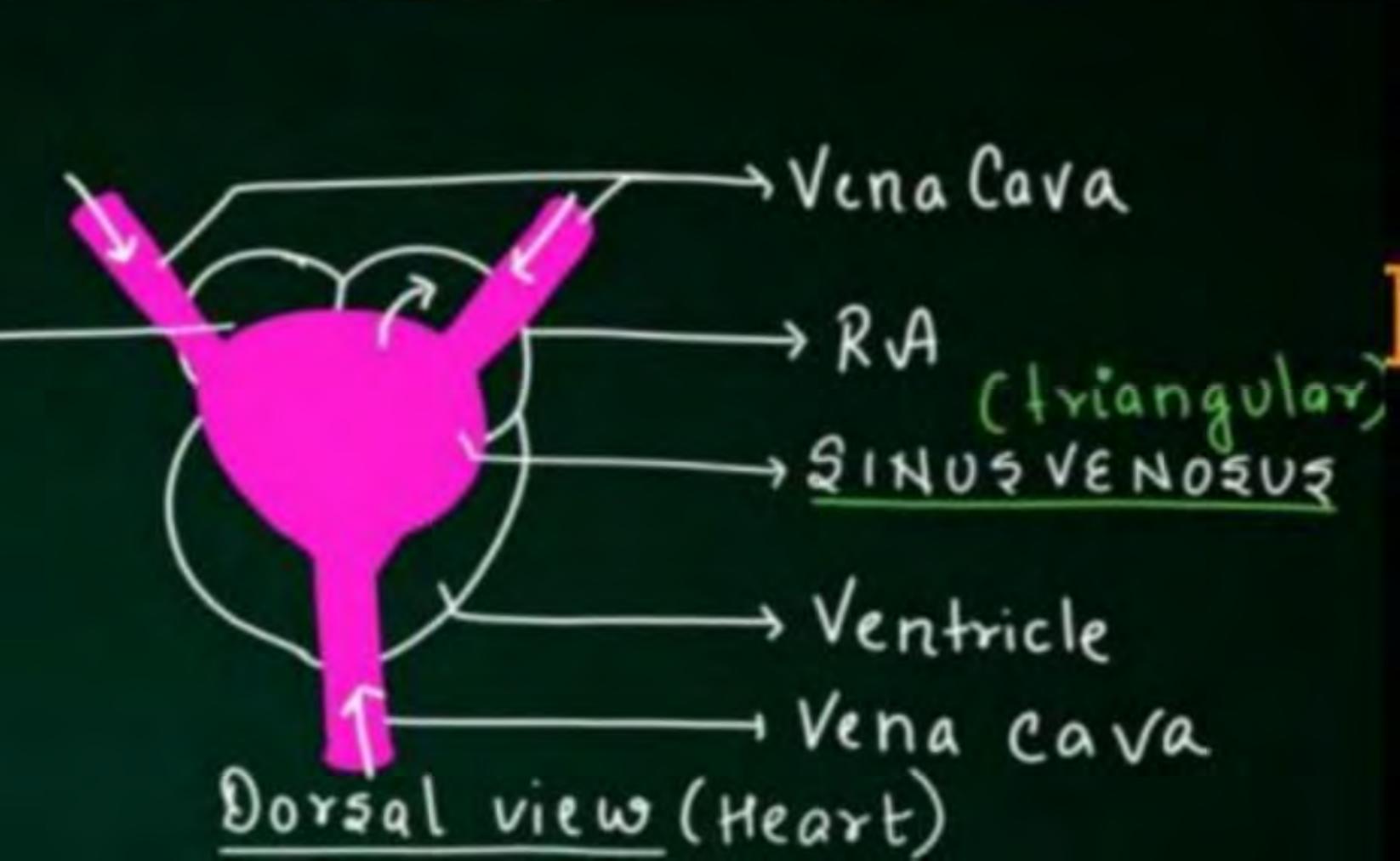
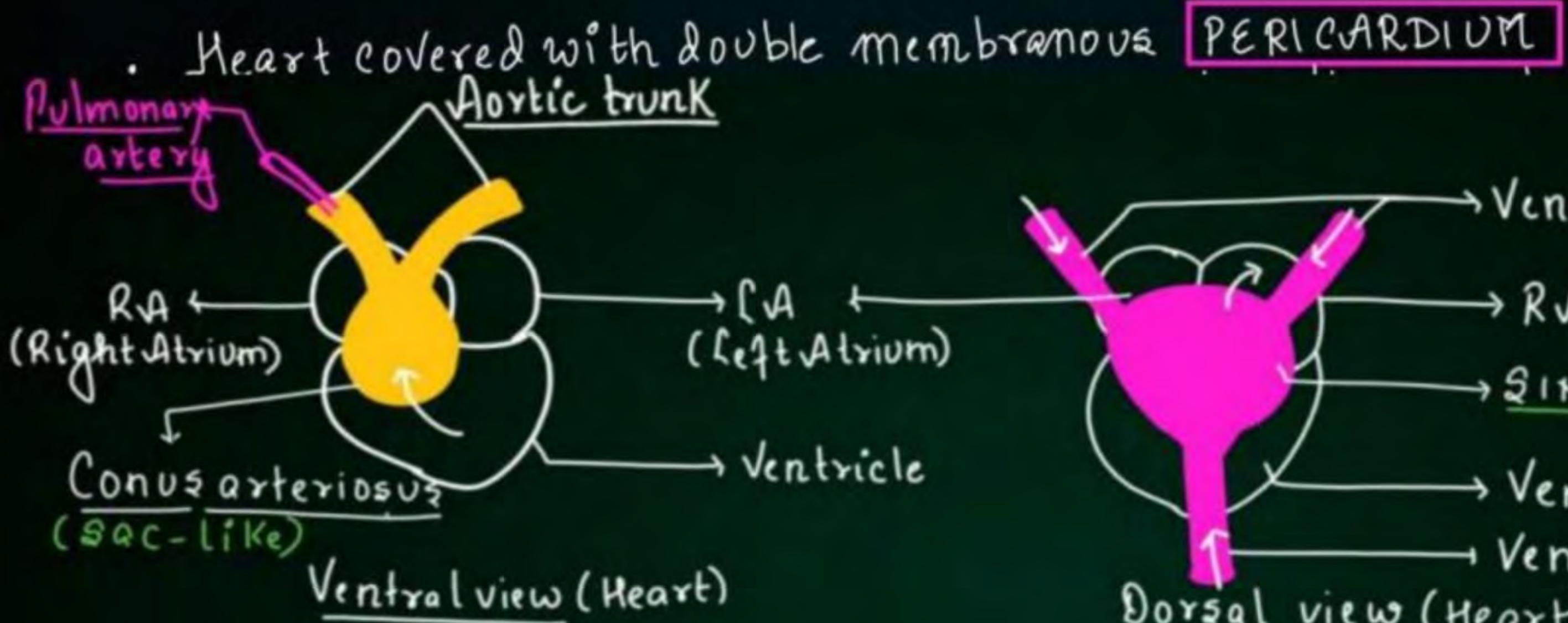
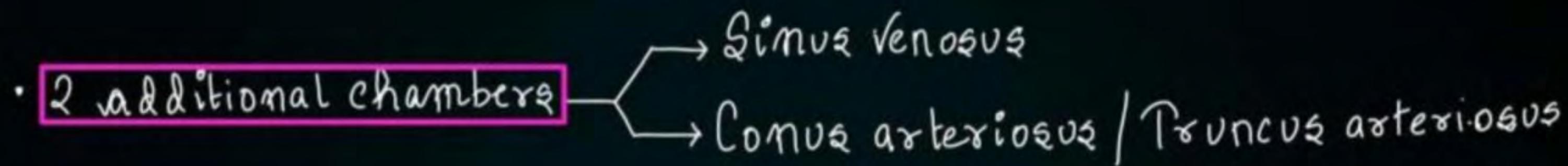
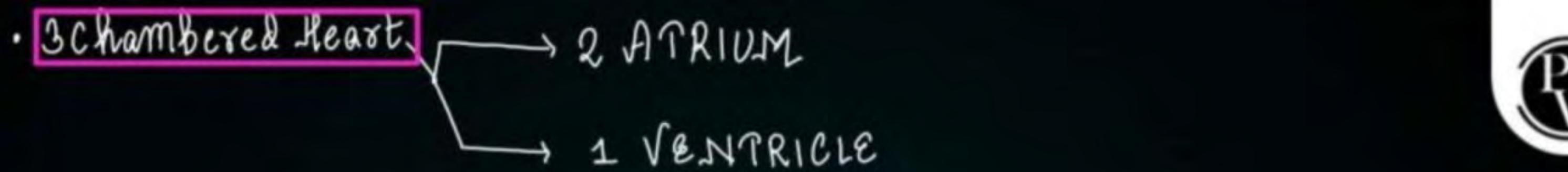
↳ blood vessels are bounded by network of capillaries

Heart

- muscular, well developed.



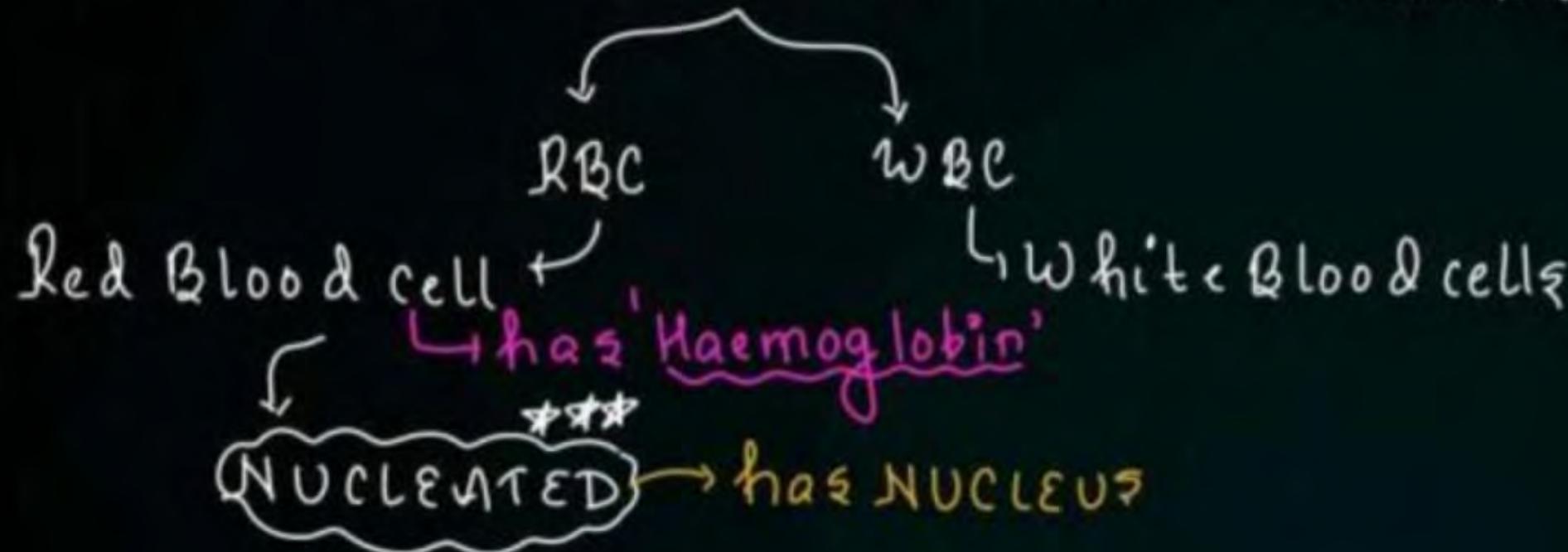
Which carry blood AWAY from Heart



'FROG' shows MIXED CIRCULATION OR INCOMPLETE DOUBLE CIRCULATION.



→ Blood = Blood cell + Platelets + plasma



→ Blood will help in transport of gases, nutrients etc.

Lymphatic system: It has:

- Lymph
- Lymph nodes
- Lymphatic channel

It is a colorless fluid formed by filtration of Blood with NO RBC & Less Proteins as compared to Blood

Note

Portal Circulation

Hepatic Portal

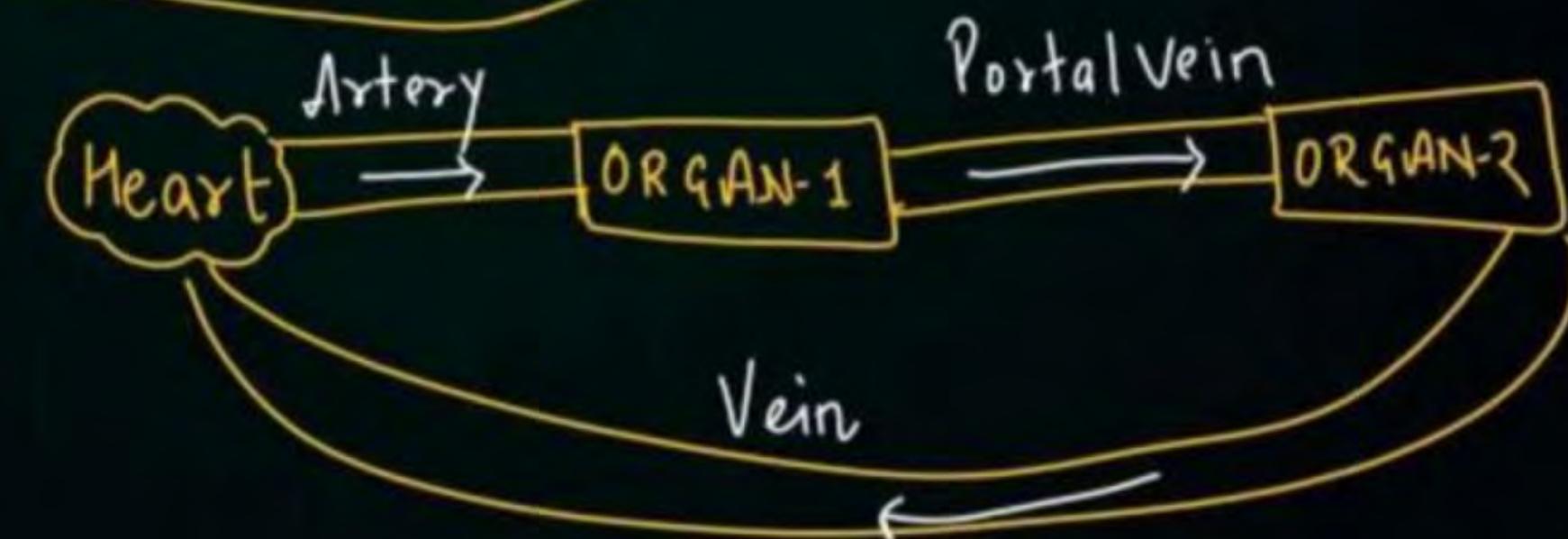
Renal Portal Circulation



Normal Circulation



Portal Circulation

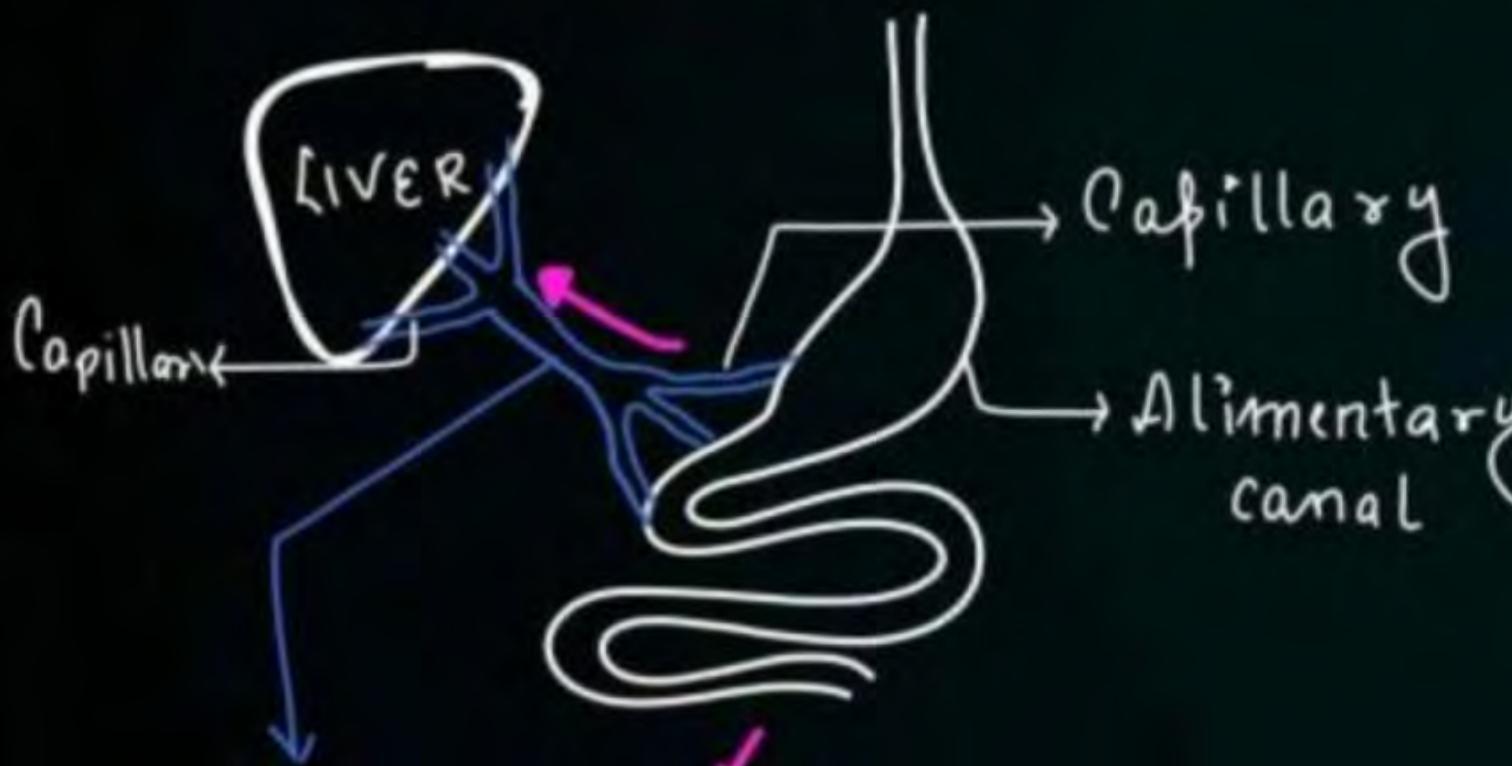


## Portal Circulation:

Special Venous connection b/w 2 organs which starts with Capillaries and end with Capillaries.

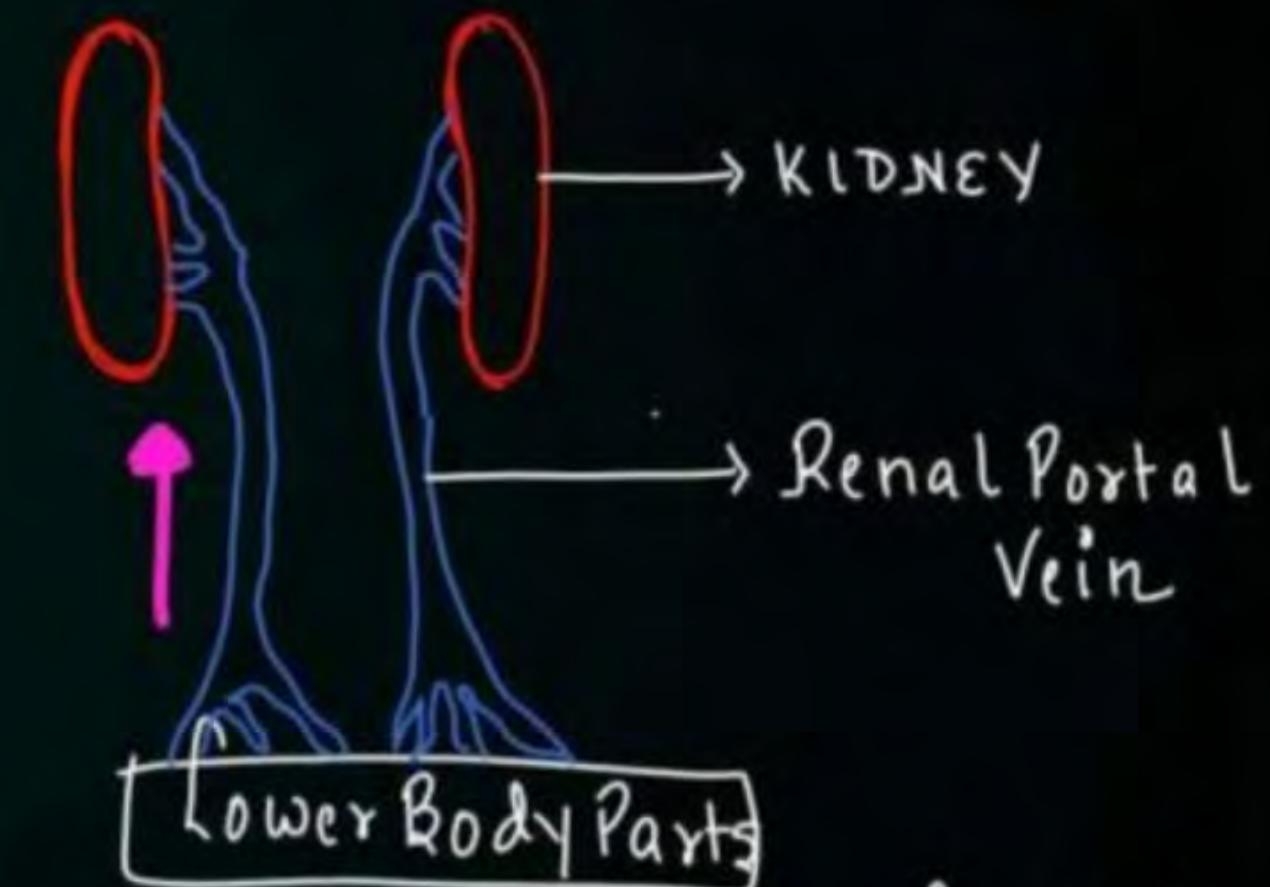


### HEPATIC PORTAL CIRCULATION



Hepatic Portal Vein: Connects the alimentary canal to carry blood from the canal to the Liver.

### RENAL PORTAL CIRCULATION



- Renal Portal Vein connects Lower Body parts to carry Blood from there to KIDNEY

## Excretory System:

Excretory system consists of :

- A pair of KIDNEY
- A pair of Ureter
- A Urinary Bladder
- A Cloaca

→ Frog → UREOTELIC  
Animals

→ Daphnia Larva

↓  
Ammonotelic  
↓  
'Ammonia'

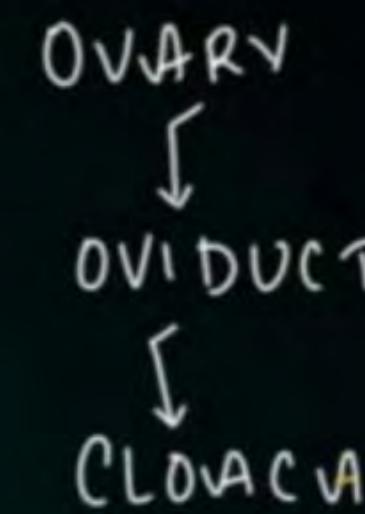
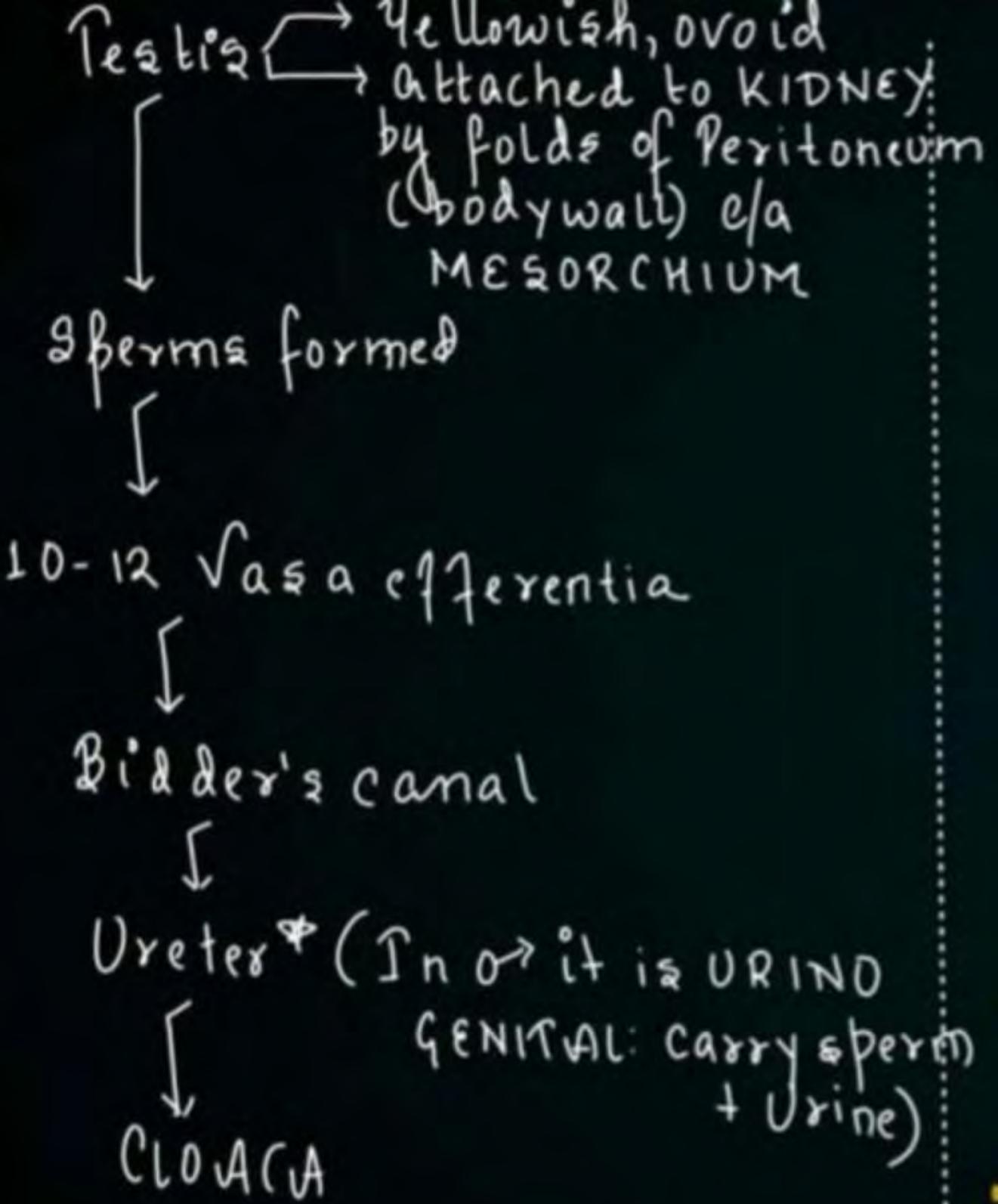


KIDNEY: Dark reddish

- 1 pair located posteriorly on either side of vertebral column
- 'Uriniferous tubule | Nephron' are the structural & functional unit of kidney  
↳ Urine formation

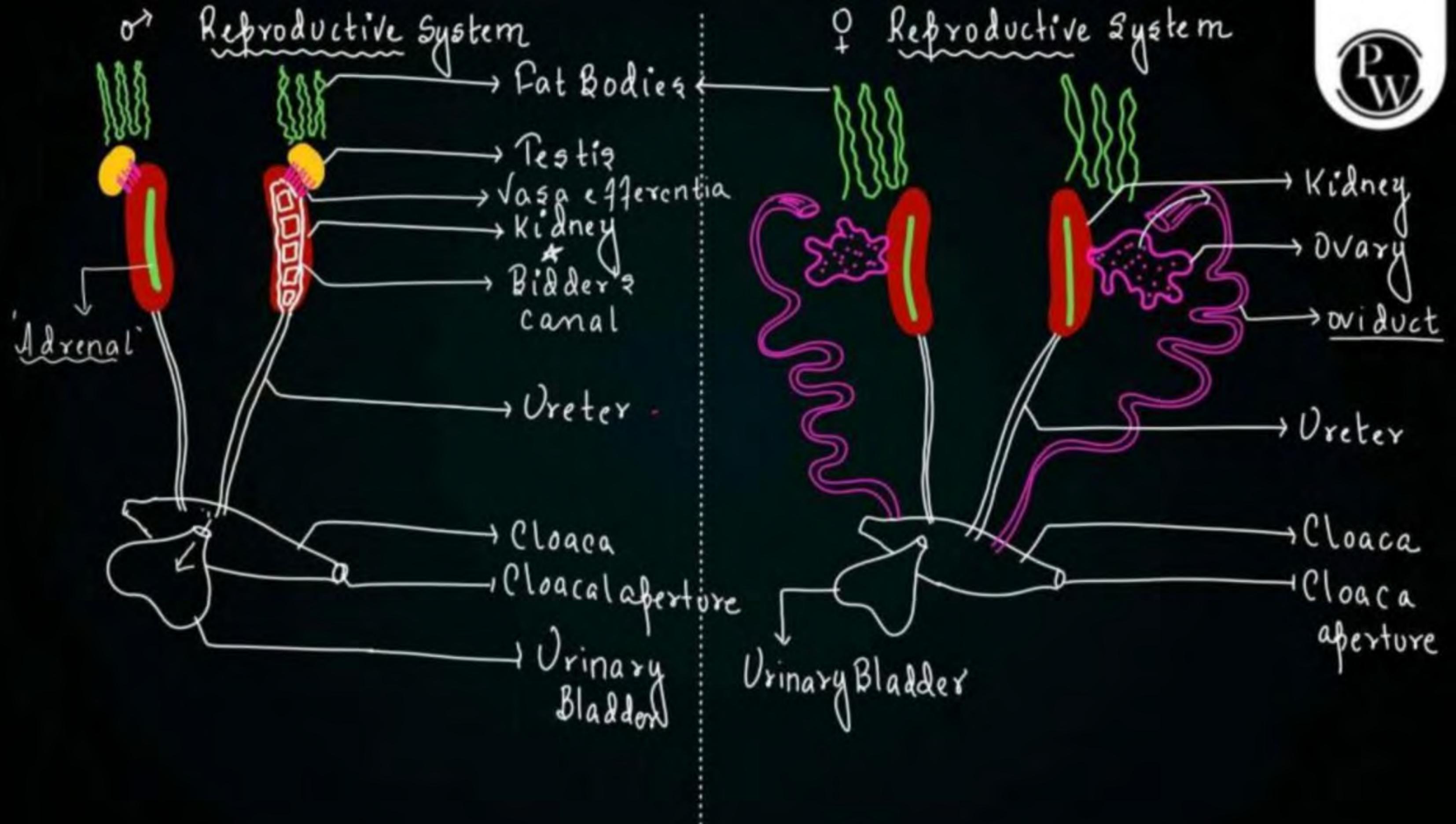


Reproductive System



**Note** In ♂ there is a functional  
 connection b/w Testis & KIDNEY

- In ♀ there is NO FUNCTIONAL CONNECTION b/w OVARY & KIDNEY
- Adrenal gland: Located mid ventrally (1 pair)
- Urinary Bladder Located ventrally to Rectum.



## Fertilisation and development:

- A ♀ Lays approx 2500 to 3000 ova at a time
- fertilization (fusion of sperm and ova) occurs outside the body hence it is EXTERNAL FERTILISATION (In Water)
- Development: Indirect development
  - Tadpole Larva undergoes METAMORPHOSIS (change in morphology) to convert into Adult frog.

# Control and Coordination:



→ 'well developed' → Neural system + Endocrine system

## CONTROL & COORDINATION

### (i) NEURAL / NERVOUS SYSTEM

#### 1) CNS

Central  
Nervous  
System

#### 2) PNS

Peripheral  
Nervous  
System

#### 3) ANS

Autonomic  
Nervous  
System

Cranial  
Nerves  
(10 pair)

Spinal Nerves  
(10 pair)

Sympathetic  
Nervous system

Parasympathetic  
Nervous

### (ii) ENDOCRINE SYSTEM

- They have well developed glands like: Pituitary, Pineal, Thyroid, Parathyroid, Thymus, Adrenal, Pancreatic islets (Endocrine), Gonads (Ovary & testis)

• These gland produce Hormone.

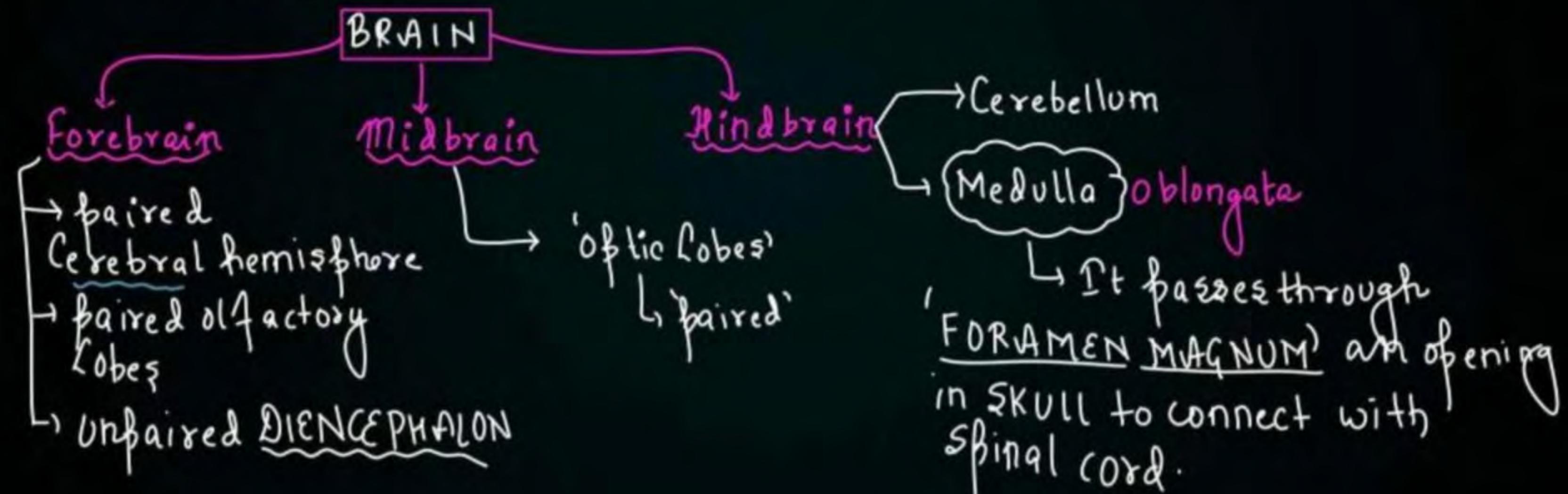
CNS

## BRAIN

- Brain is protected inside BRAIN
- BOX: 'CRANIUM'

## SPINAL CORD

- Protected inside Vertebral column.



## Sensory Structures

- 1) Touch: Sensory papillae
  - 2) Taste: Taste buds
  - 3) Smell: Olfactory epithelium
  - 4) Vision: Simple eye
  - 5) Hearing & Balancing: Tympanum & Internal ear
- Less developed: Cellular aggregation around nerve endings

## ECONOMIC IMPORTANCE OF FROG

- Used as a food in some countries (muscular legs)
- Important component of food chain & food web
- Protect our crops as it eats Insect

# COCKROACH



## Classification:

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Genus: Periplaneta  
Species: americana

## General Characteristics:

- Usually cockroaches are Black or Brown but in some regions BRIGHT YELLOW/ORANGE greenish cockroaches are also observed whose size ranges from ( $\frac{1}{4}$  inch upto 3 inch) (0.6 - 7.6 cm)
- Nocturnal animal (active during NIGHT)
- Omnivores (eat everything)
- Cursorial (fast runners)
- Usually found at Damp (dīlī) & warm places.
- P. americana, blackish-brownish, size is 34 mm - 53 mm.

## MORPHOLOGY:

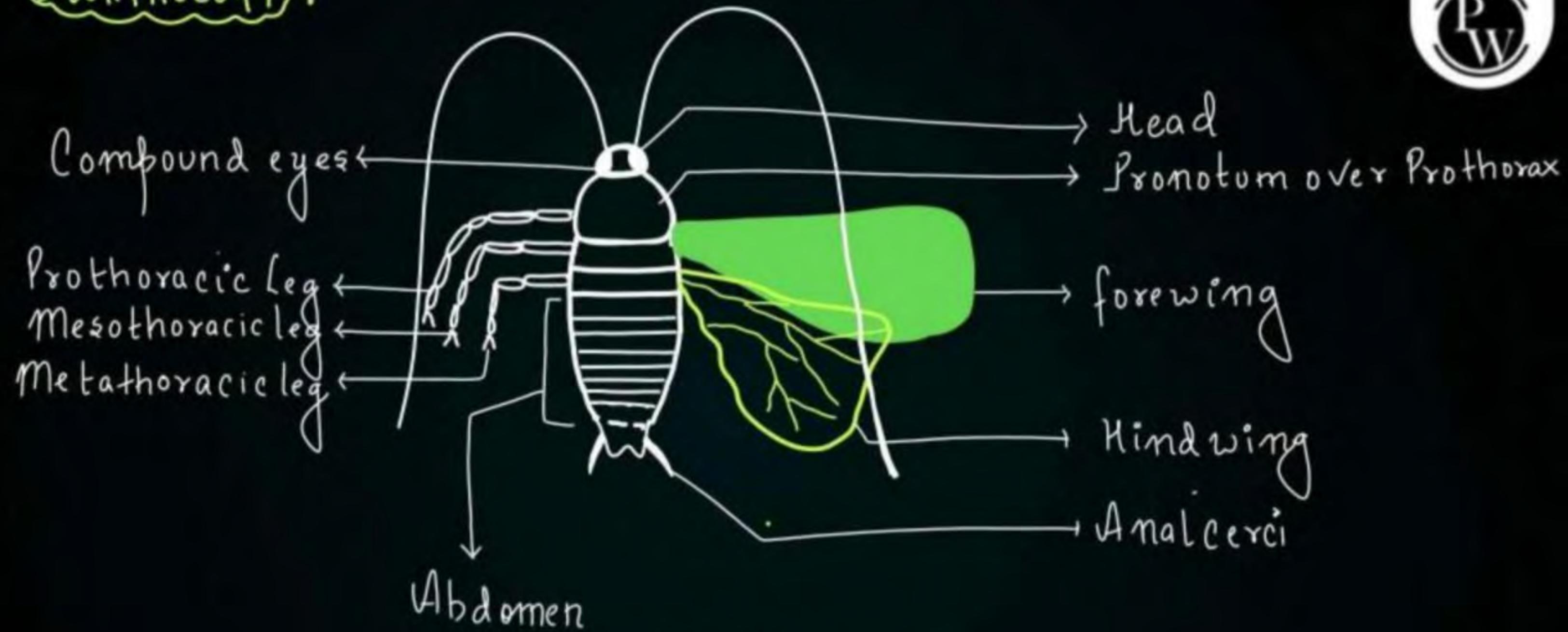


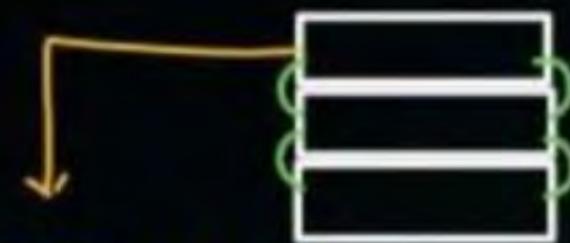
fig: Cockroach

## **COCKROACH**

### (MORPHOLOGY)



- Cockroach belongs to Arthropod,  
jointed appendages.
- Body is Divisible into → Head  
→ thorax  
→ Abdomen
- They have a very hard 'CHITINOUS EXOSKELETON'  
↳ made up of Chitin
- Their SEGMENTS are called  
METAMERIC SEGMENTS or  
METAMERES & each segments  
Cover is known as 'SCUTERITE'



Each segment  
is k/a 'METAMERE'

Each metamere's  
hard covering is  
k/a 'SCLERITE'

Each 'sclerite' further has

Dorsal

Ventral

Lateral

Dorsal  
sclerite is  
k/a 'TERGUM'  
or 'TERGA'

Ventral  
sclerite is  
k/a 'STERNUM'  
or 'STERNA'

Laterally it is  
k/a 'PLEURA'

1 Sclerite = 1 Tergum + 1 Sternum + 2 Pleura

Note : Each sclerite further connected via a flexible Arthrodial Membrane.

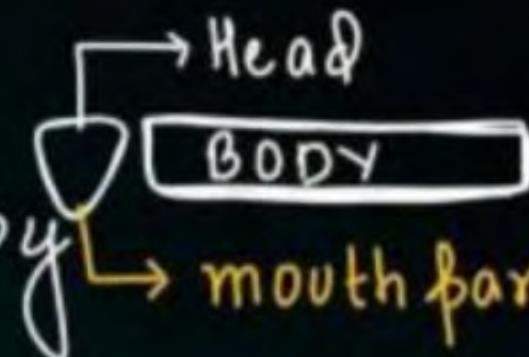
### Segments

	Head	Thorax	Abdomen	
1. Nymph	6	3	11	(20)
2. Adult Cockroach	1	3	10	(14)

Baby  
Cockroach

## ① Head

- It is a triangular structure formed by the fusion of 6 segments



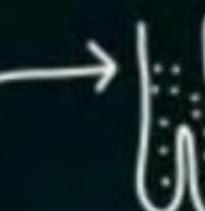
- Head is perpendicular to the Body
- Head: HYPOGNATHOUS (अधिकारी ग्यान)  
Below mouth parts  
mouth parts facing ground.
- Head has the 'BITING and CHEWING' type of mouth parts

## Mouth parts



1) Labrum: (1), upper lip → 

2) Labium: (1), lower lip → 

3) Hyphopharynx: (1), Tongue → 

4) Maxillae: (2) →  maxillary palps (sensory)

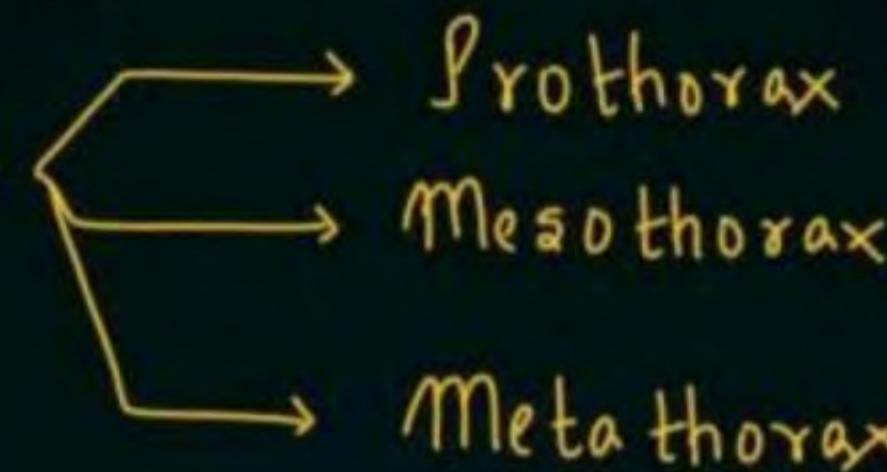
5) Mandibles\*: (2), it has incision region inside to cut the food particles. 

incision region → Grinding region

- Head also consists of Antennae, Compound eyes (functional), simple eye (Ocellus/Ocelli).

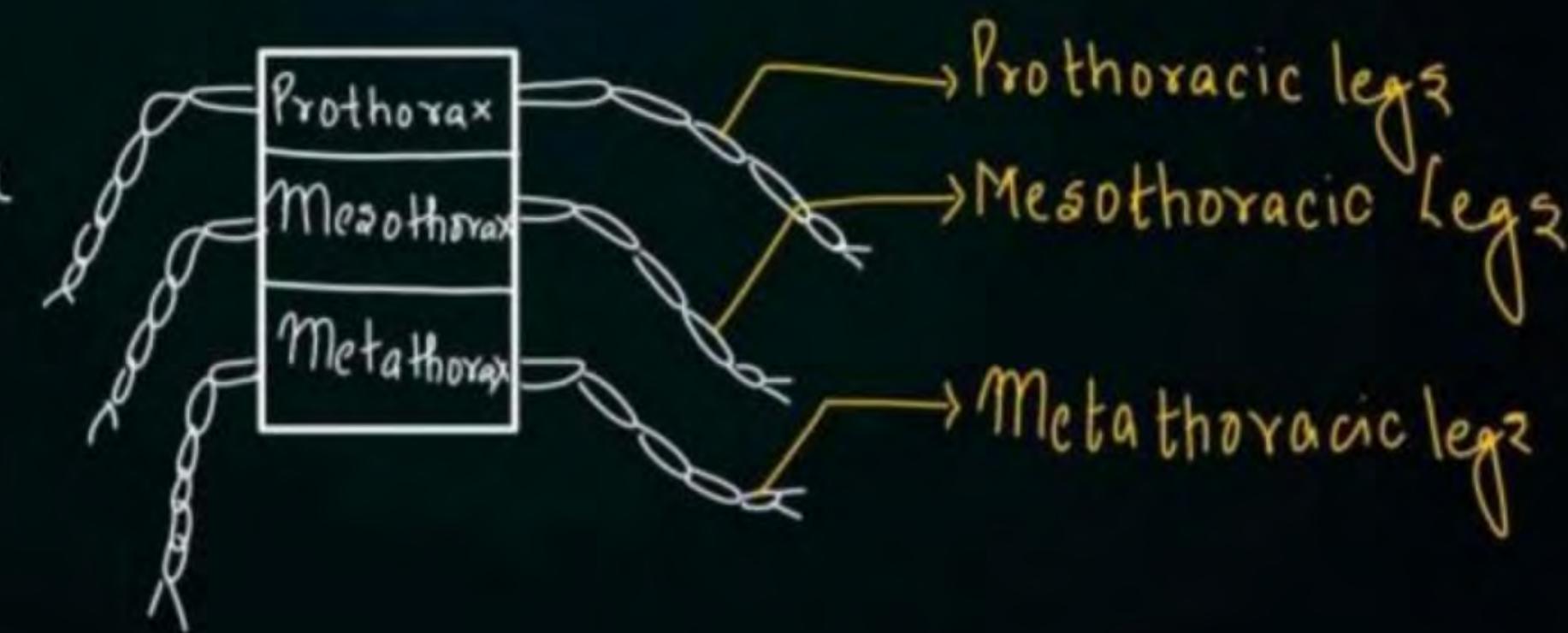


2) Thorax : 3 Segment



### (i) Legs:

- 3 pair
- 1 pair arising from each thoracic segment



(ii) Wings: 2 pair



→ Forewings

- Arises from mesothorax hence also k/a 'MESOTHORACIC WINGS'
- It is also k/a 'TEGMINA' or 'ELYTRA'
- Dark, opaque, leathery
- Only protects the hindwings at REST

→ Hindwings

- Arises from METATHORAX, hence k/a 'METATHORACIC WINGS'
- Transparent, membranous.
- Used for FLIGHT.

**Note** : A Large Chitinous plate like 'Pronotum' covers the Prothorax and also conceals (छुपाना) some part of head.



- A flexible neck which is nothing but the extension of Prothorax connects to the head.

③ Abdomen: 10 Segments

- In both ♂ and ♀ Cockroach abdomen consists of 'GENITAL POUCH'

### ♂ Genital pouch

- formed by the fusion of 9<sup>th</sup>, 10<sup>th</sup> Tergum along with 9<sup>th</sup> sternum

will explain later

- It has openings: Dorsal anus, ventral male gonopore & gonapophyses.

### ♀ Genital pouch

- It is formed by fusion of 7<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup> sternum (sternum is Boat shaped)
- It has opening of: female gonopore, spermathecal pore, opening of collateral glands.

• \* Sexual dimorphism is observed in Cockroach

P  
W

Male & female can be distinguished

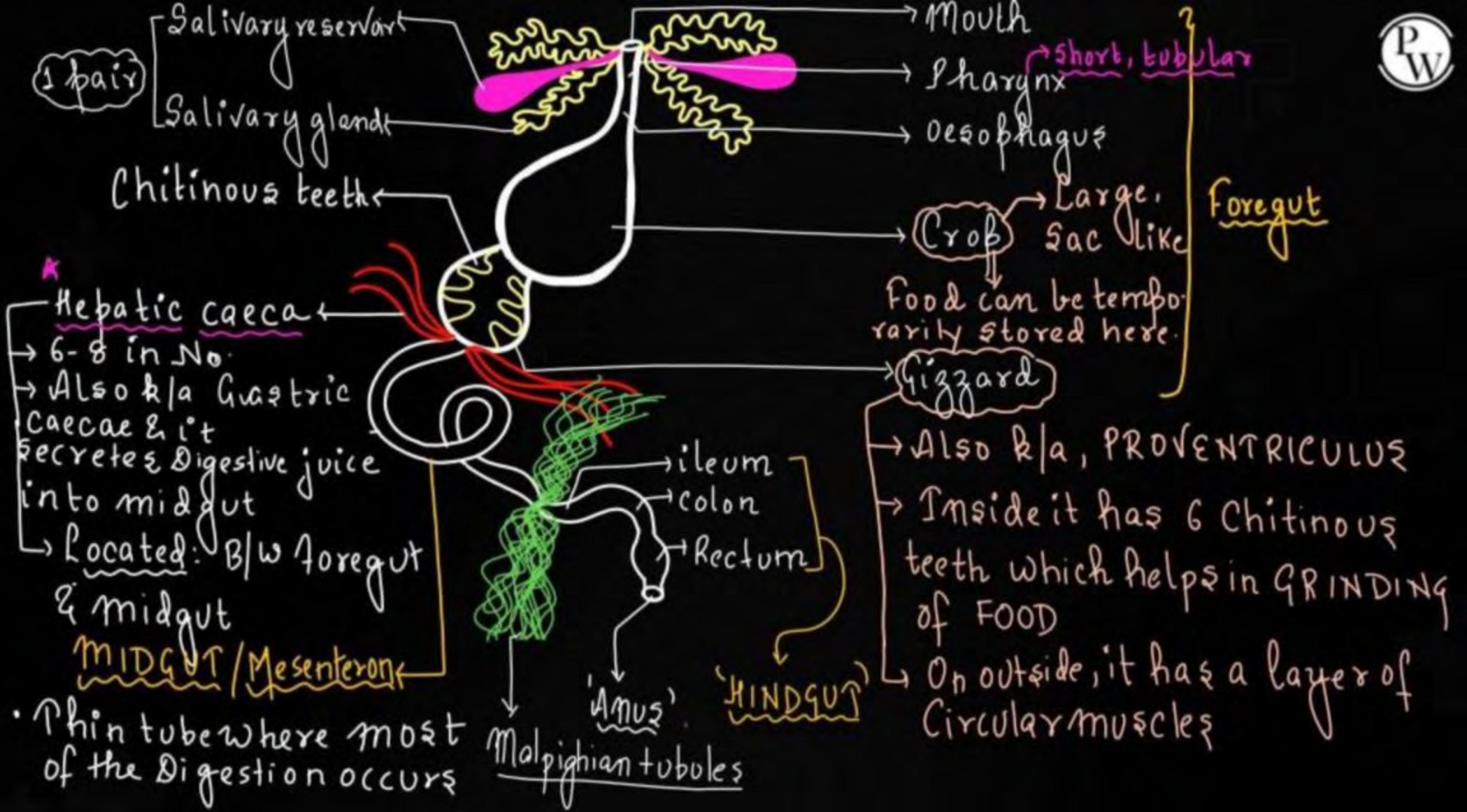
gmk

$\text{♂}$	$\text{♀}$
<ul style="list-style-type: none"><li>• A male has <u>Anal cerci</u> (10<sup>th</sup> tergum) as well as <u>anal styles</u> (9<sup>th</sup> sternum)</li><li>• Wings extends beyond abdomen</li></ul>	<ul style="list-style-type: none"><li>• A female only has <u>anal cerci</u> (10<sup>th</sup> tergum)</li></ul>

Anatomy:

Digestive system:





★★

## Malpighian tubules

- 100-150 in no.
- These are yellow, at the junction of mid & hindgut.
- Excretory in Nature
- Hindgut opens outside via Anus
  - ↓  
Undigested food passes out via this.
- Foregut on inside is lined by cuticle.
- Hepatic caeca: BLIND: One opening only in the tube.
- Hindgut is broader than midgut.

## ② Respiratory system:

- It is known as 'PRACHEAL SYSTEM'
- Blood has NO ROLE in transport of gases.
- Pracheal system consists of:

- 1) → SPIRACLES ↗ 10 pair  
→ openings present on the lateral side of the body for entry of air & guarded by SPHINCTERS
- 2) → Trachea  
↳ Air moves from spiracles to trachea
- 3) → Tracheoles → Air moves from trachea to tracheoles which is in contact with tissue from where simple diffusions of gases occurs.

## ⑤ Circulatory System:

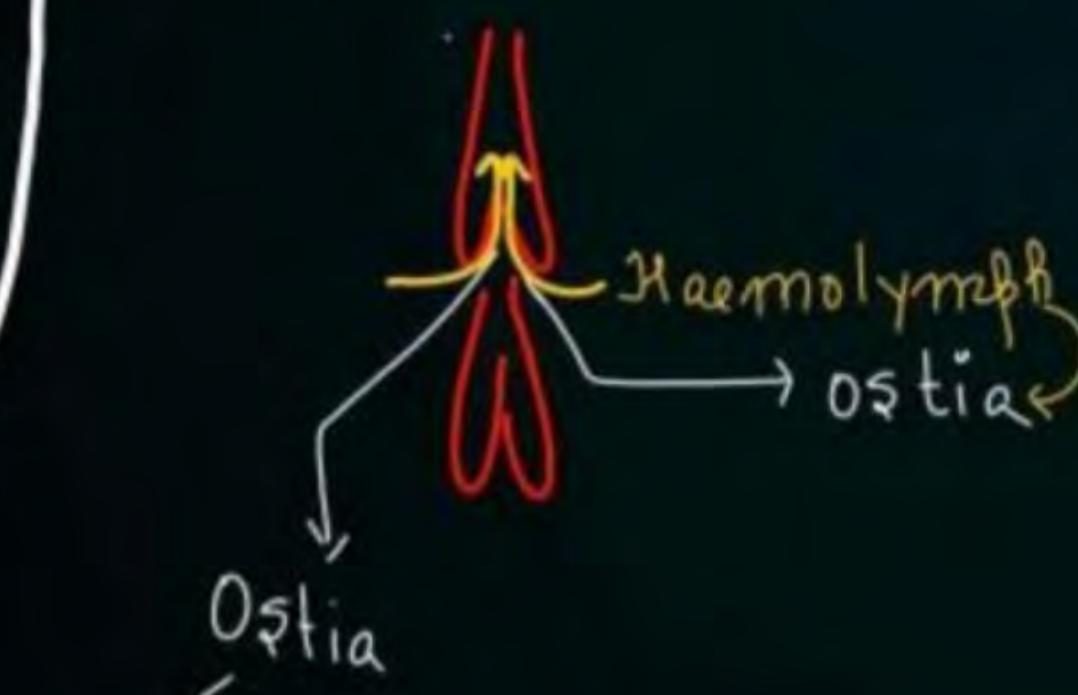
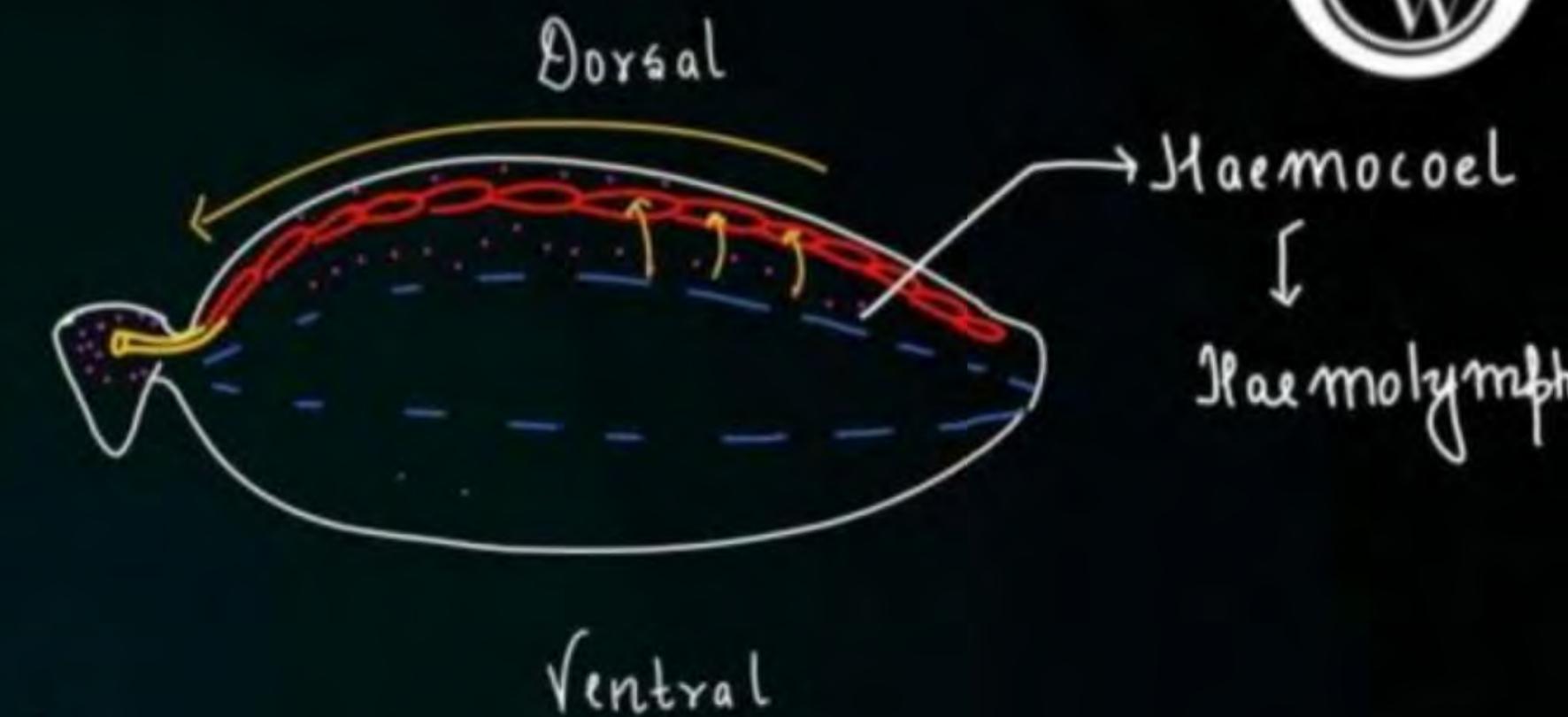
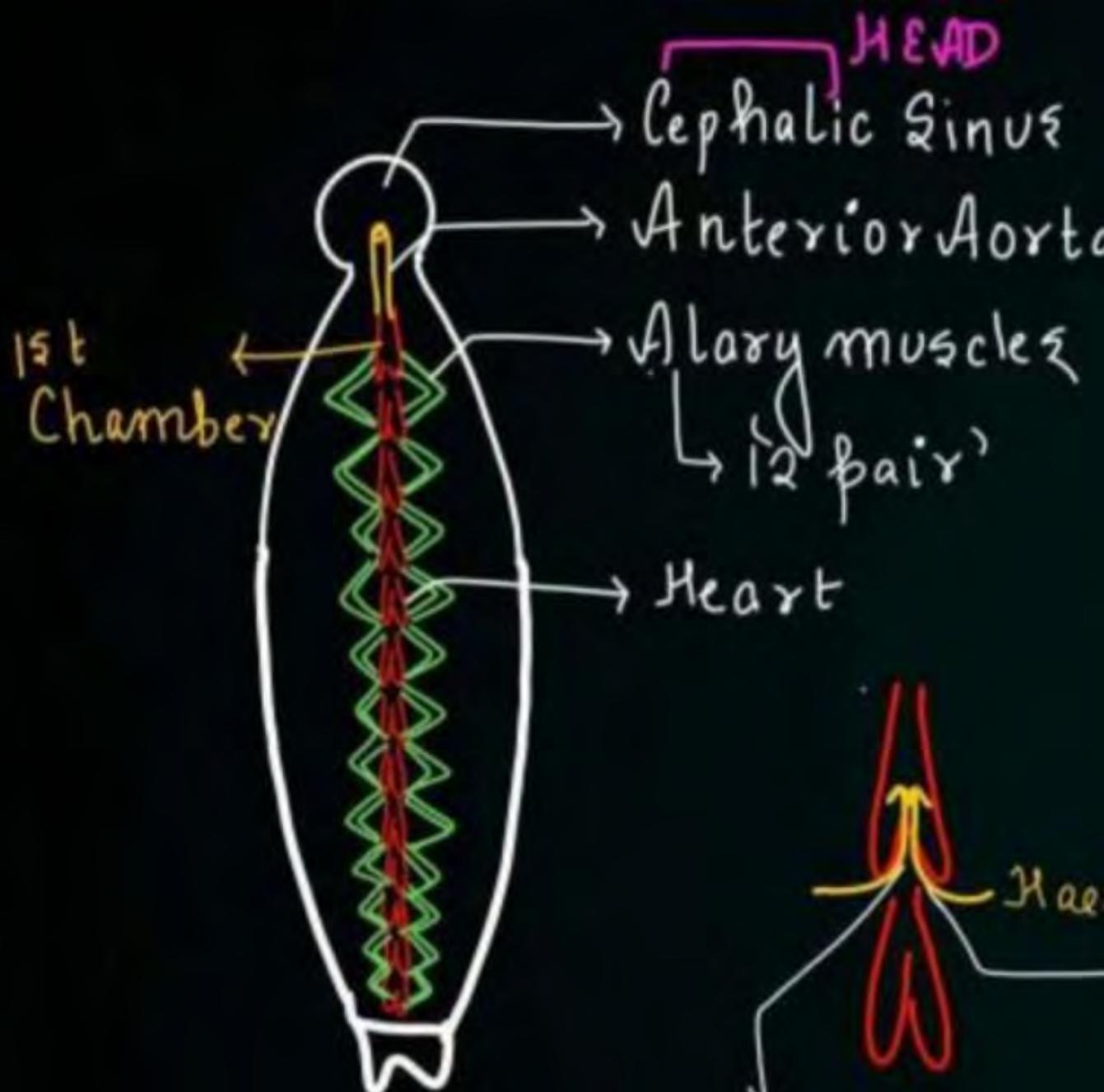
- Open-type: Blood vessel not bounded by capillary network.
- Blood-vascular system
  - Heart: 1 chambered heart, Located mid-dorsally
  - Blood / Haemolymph: Colorless Blood.
  - Haemocoel: open spaces also known as SINUSES in which haemolymph is present.

## Circulatory system :-



- Heart: 13 chambered. mid-dorsally
- Haemolymph: Colorless Blood
  - Plasma
  - Haemocytes (Blood cell)
    - ↳ No RBC, No Hb → Haemoglobin
- Haemocoel: open spaces also known as SINUSES in which haemolymph present
  - Anterior aorta:

P  
W



The heart's chamber's has  
openings on the lateral side called OSTIA

**Note** - Alary muscles (fan-shaped) regulates the entry of haemolymph into the heart via OSTIA.

- Alary muscles regulate entry of haemolymph from Sinus to heart via OSTIA.
- Haemolymph always moves from Posterior to Anterior direction in Heart
- Haemolymph → Heart → Anterior aorta → Cephalic sinus.

## Excretory system:

→ Excretory structures are:

1) Malpighian tubules

2) Fat bodies

3) Nephrocytes

4) Drectose glands: Only in ♂

Excretory Product: URIC-ACID

Animals which eliminate  
the Nitrogenous wastes Oric  
acid are URICOTELIC Animals



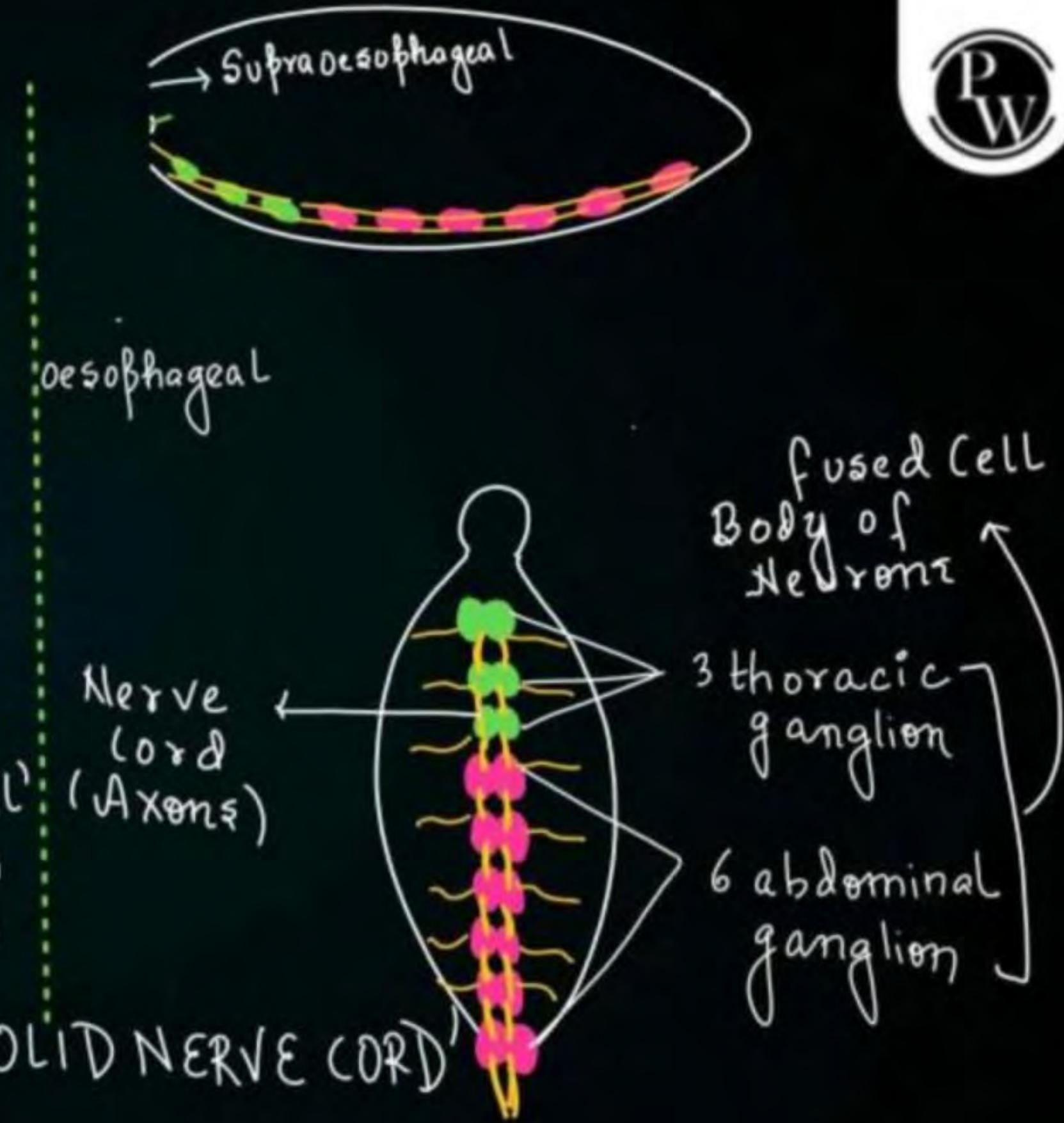
- Epithelial cells of Malpighian tubules
- Ciliated & GLANDULAR

**Note:** Excretory waste is dissolved in haemolymph as potassium urate  
moves into Malpighian tubule  
convert into URIC ACID  
eliminated through Anus.



## Nervous system:

- It consists of segmentally arranged series of fused GANGLIA
- 3 ganglia: Thorax
- 6 ganglia: Abdomen
- They have a 'SUPRA-OESOPHAGEAL' GANGLION which represents brain of Cockroach.
- \* They have DOUBLE VENTRAL SOLID NERVE CORD





- Most of the Nervous system is located along the belly region & head holds only a bit of it.
- Subpharyngeal ganglia which is located above the oesophagus has nerves arising from it controlling only the antennae, eyes & some mouth parts. Hence even if we cut the head of Cockroach it can still survive for as good as 1 week.



## Sensory structures

- Antennae
- Labial palps
- Maxillary palps
- Anal cerci
- Compound eyes  
↳ Dorsal Surface

## Compound eyes

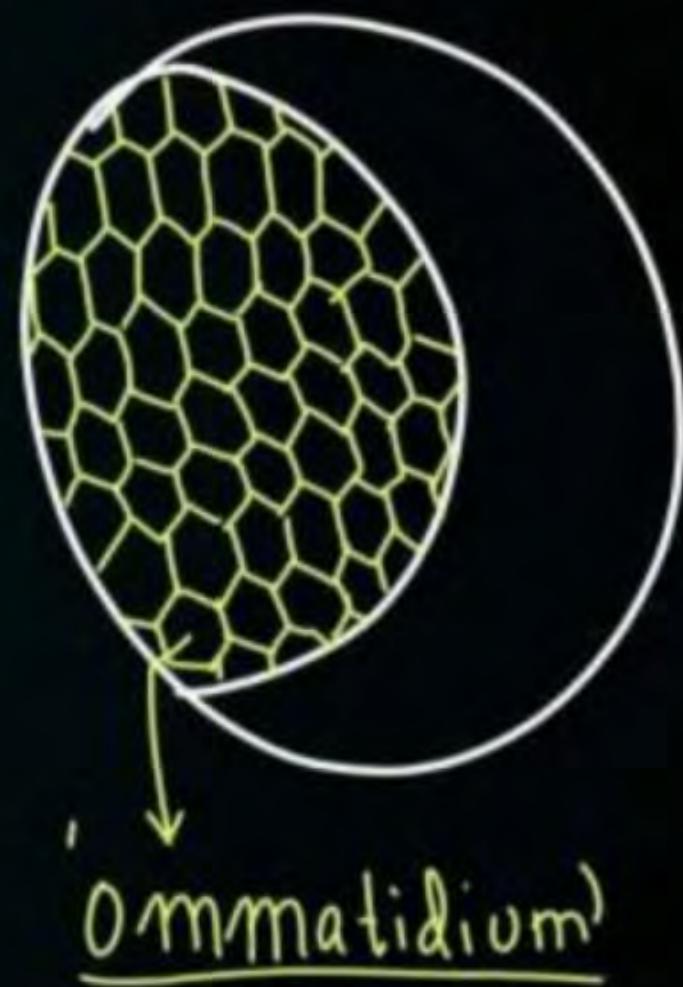
- Used for VISION
- Each compound eye consists of 2000 hexagonal structures called **OMMATIDIUM/OMMATICIDIA**

**Vision**

Mosaic Vision

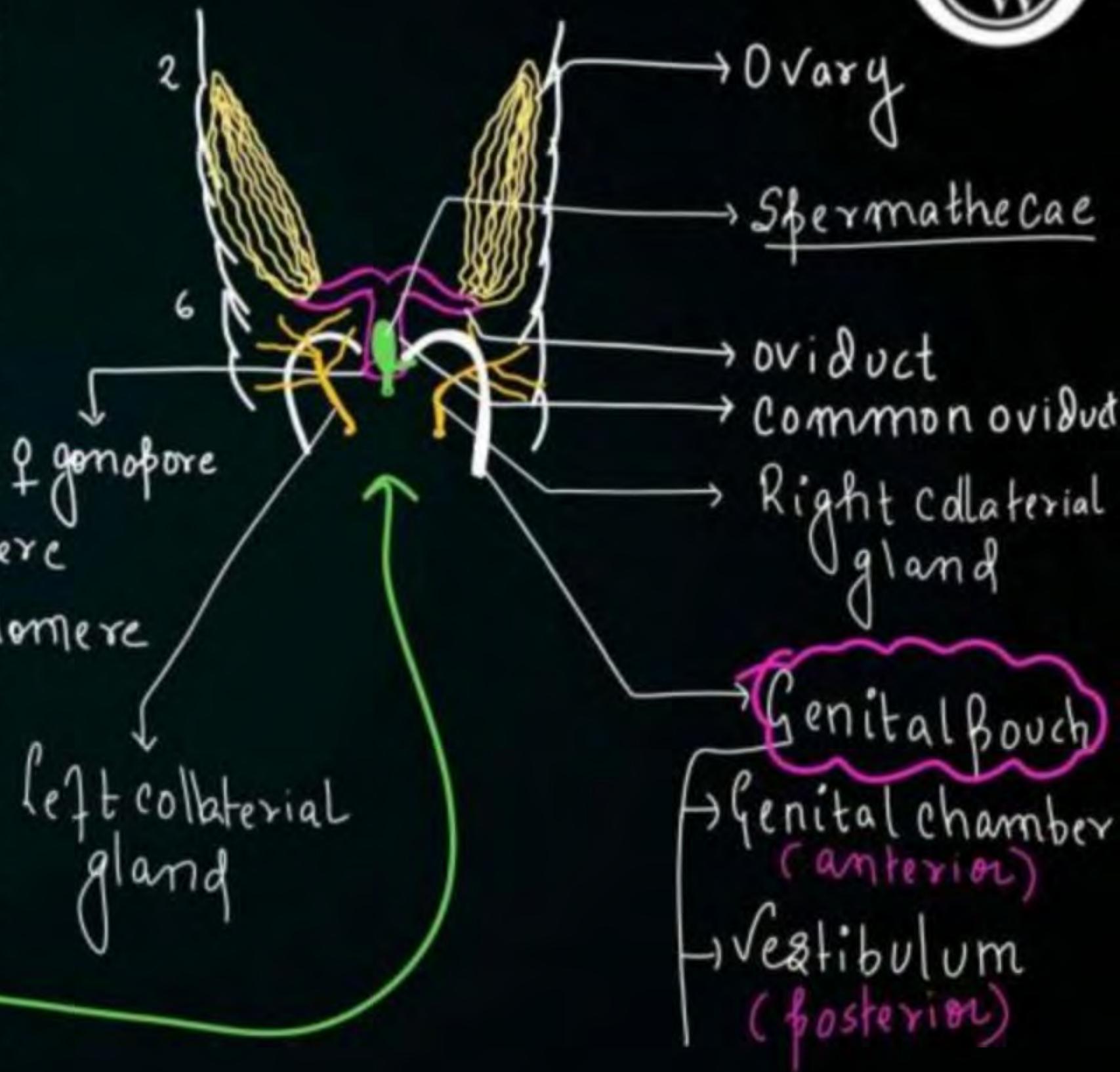
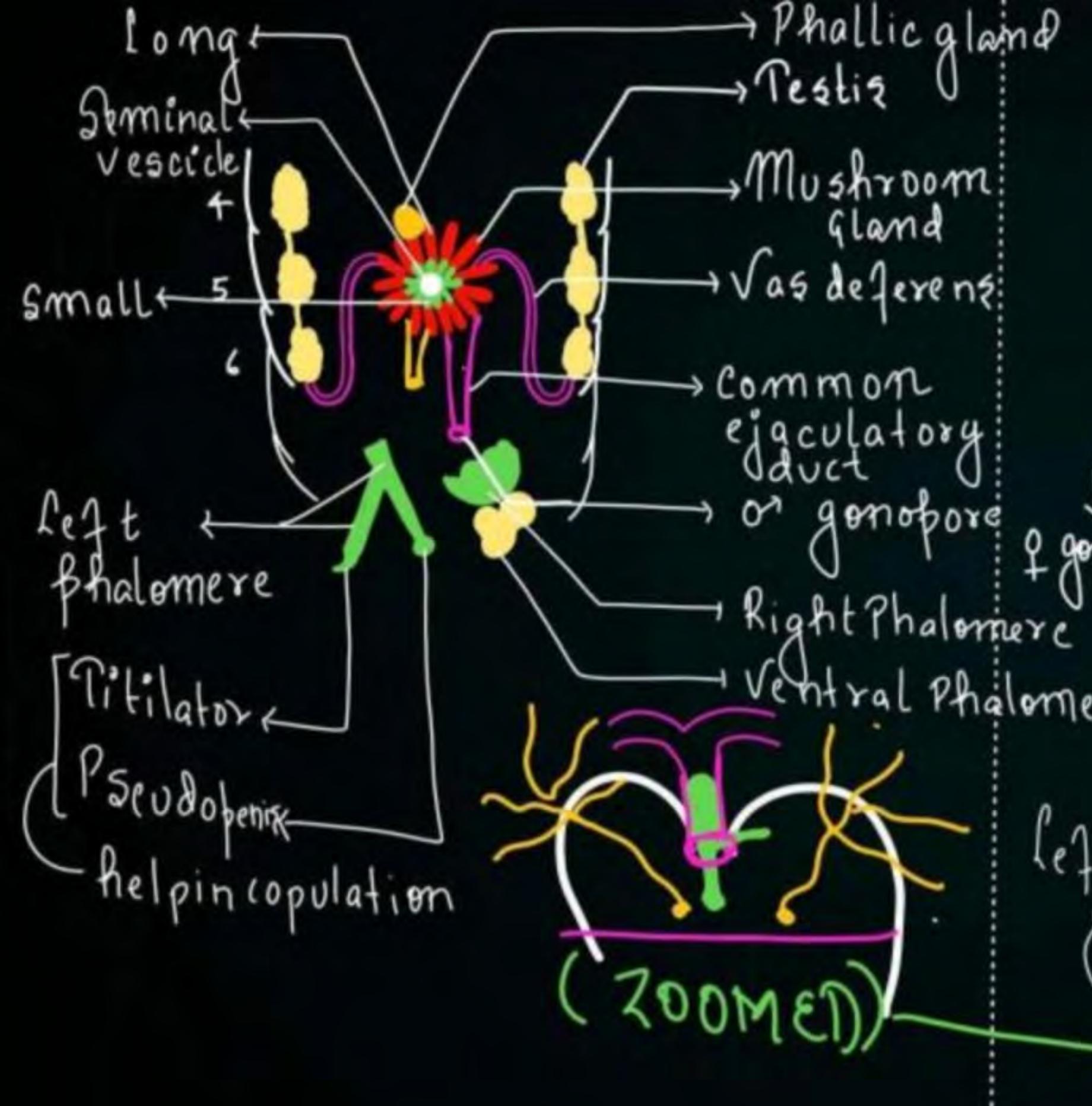
They see the image in BITS & PIECES

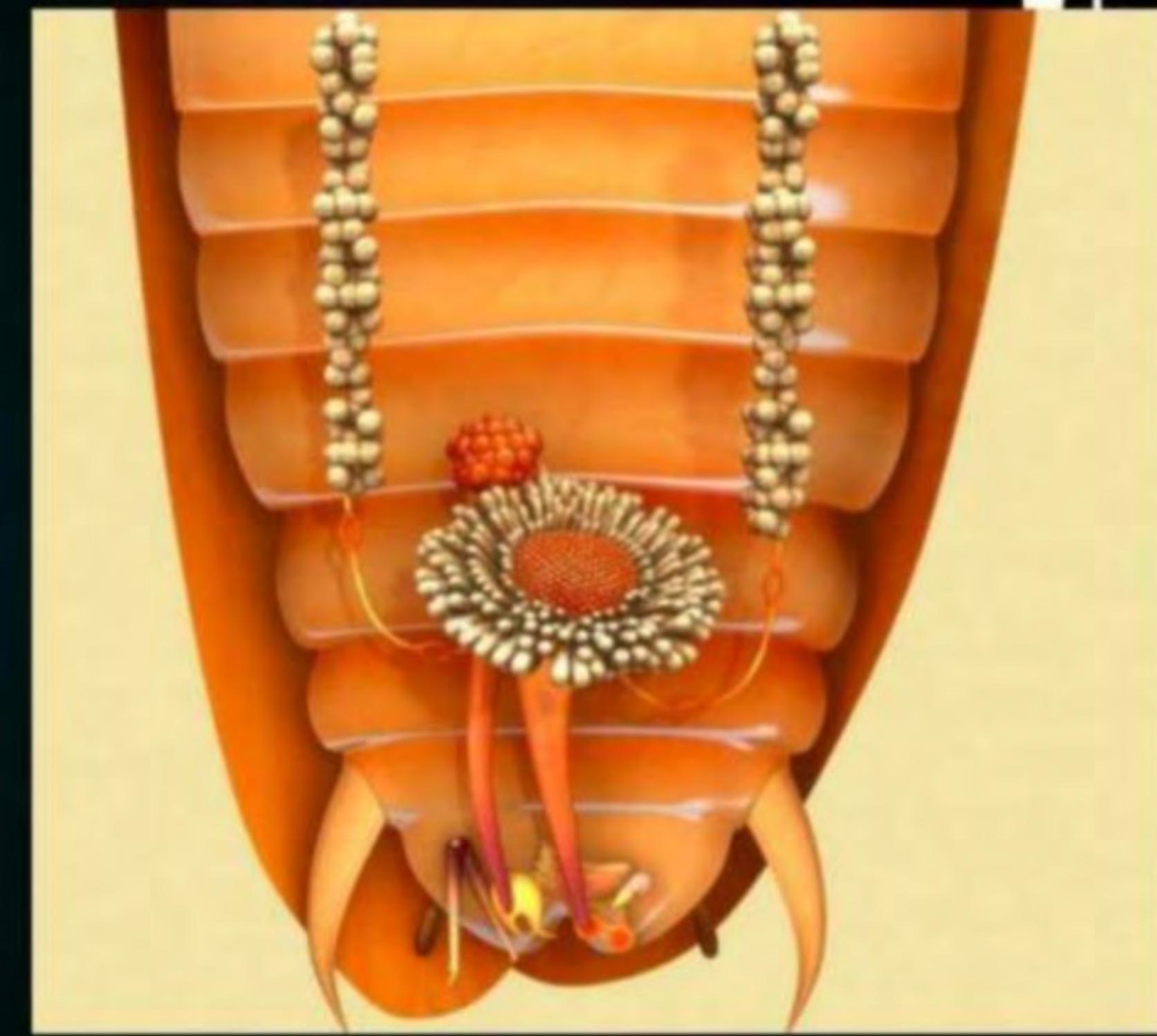
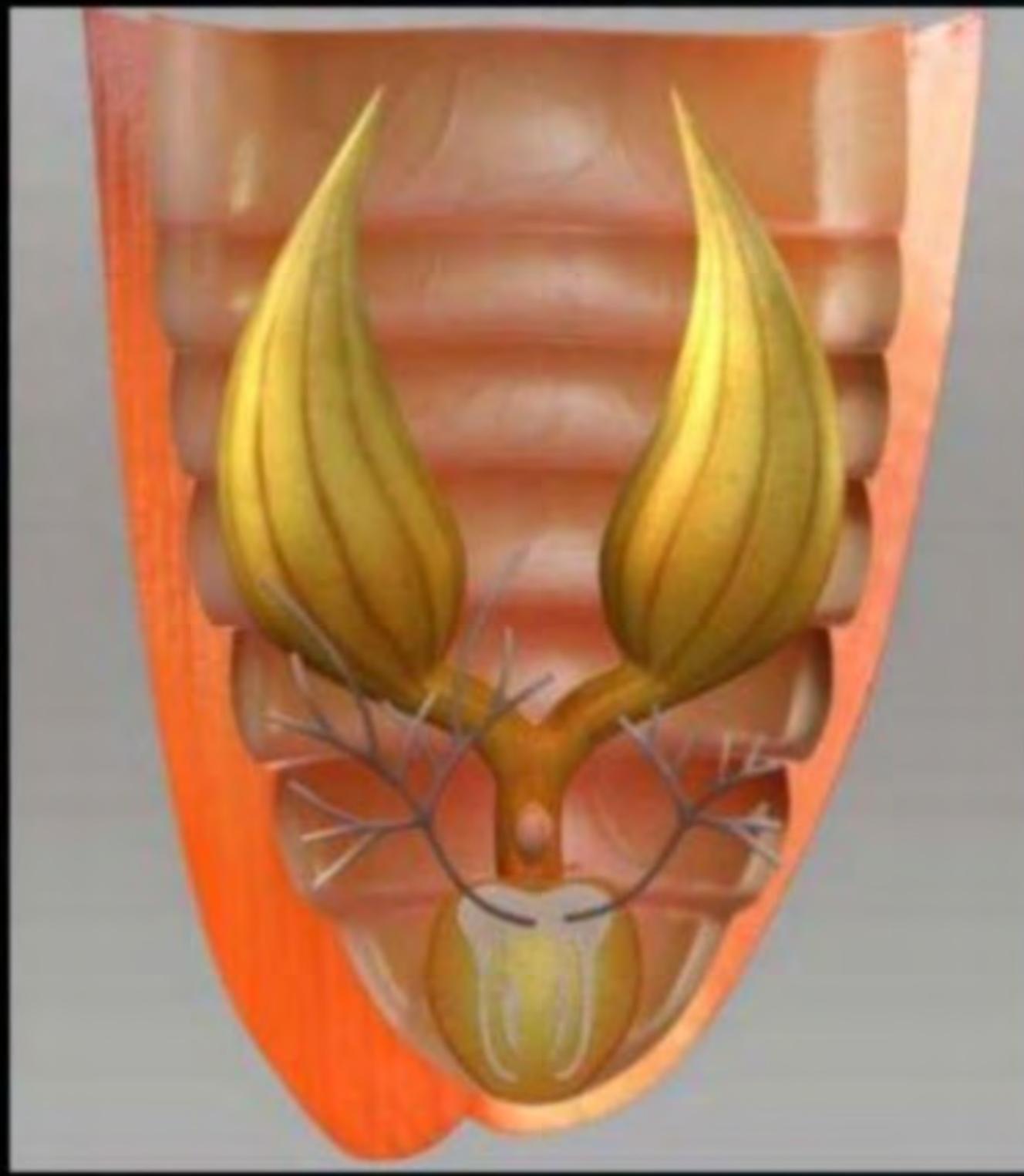
- Sensitivity ↑ }
- Resolution LOW } Nocturnal
- ↓ / POOR     [ Vision  
    ' Clarity        ' NIGHT ]





# Reproductive System of Cockroach





## ♂ Reproductive System:

### ① Testis: 1 pair.

- Location: 4<sup>th</sup>-6<sup>th</sup> Abdominal segment
- Each testis: TRICLOBULAR  
3 lobes
- Testis involved in sperm formation.

### ② Vas deferens: 1 pair.

- Vas deferens arises from each testis to carry sperm

### ③ Ejaculatory duct: Both Vas deferens fuses to form a

COMMON EJACULATORY DUCT whose opening is called MALE GONOPORE.

### ④ Mushroom gland/Utricular gland:

- ♂ accessory gland
- Location: 6<sup>th</sup>-7<sup>th</sup> abdominal segment
- Function: Nourishment of sperm
- small tubules: Inside (Kla Utricular Brevior)
- Long tubules: Outside (Kla Utricular major)

### ⑤ Seminal vesicle: \* white shiny structures which helps in storage of sperms.

- Sperms are glued together (जुड़ती) inside this Kla 'SPERMATOPHORE'

### ⑥ Phallic gland/Conglobate gland:

Another gland in Cockroach



7) Male genital pouch ( H.w)

8) Gonapophyses / Phalomeres / External genitalia

- Hard chitinous structure that are visible from outside
- Helps in Copulation (Sexual intercourse)

## ♀ Reproductive System:

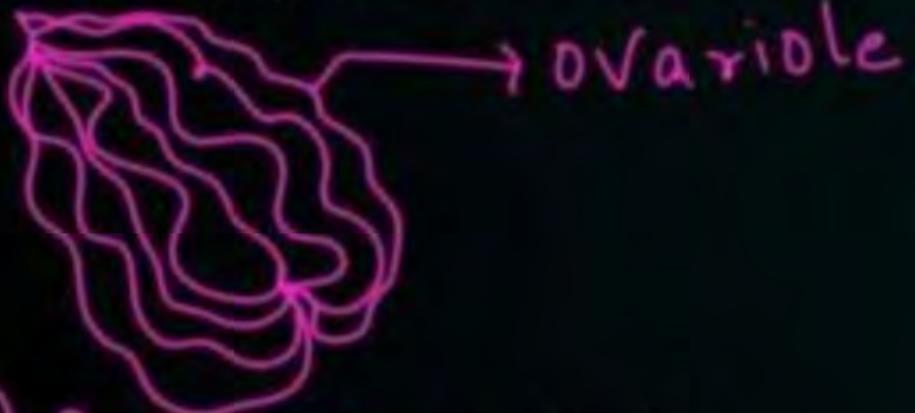
① Ovary: 1 pair

• Location: 2-6<sup>th</sup> Abdominal segment

• Each ovary has units called OVARIOLAE with ova developing at different stage

• 1 Ovary = 8 Ovarioles

• 1 Ovariole = 1 mature ovum



② Oviduct: 1 pair

• From each ovary arises 1 oviduct

which carries Ova/egg

③ COMMON OVIDUCT / VAGINA:

Both oviduct fuses to form common oviduct whose opening is called GONOPORE

④ Collateral gland

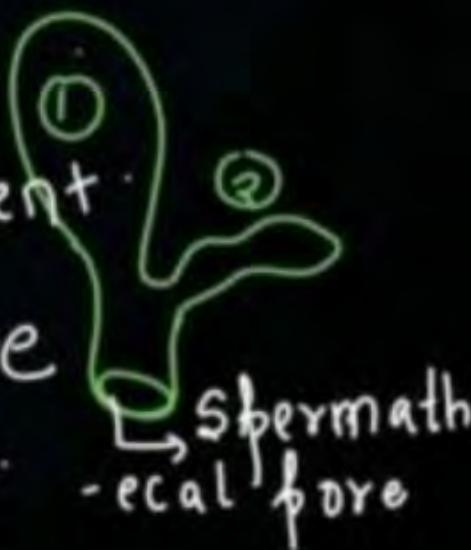
• Left & Right Collateral gland present

• Its secretion forms: OOTHECA  
the Egg Case around the fertilised egg of Cockroach

⑤ Spermathecae: 1 pair

• Location: 6 Abdominal segment

• Stores the Spermatophore received during Copulation



6) ♀ genital pouch: Hw

- Genital chamber is the upper part where all the opening is seen
- Vestibulum: Lower part

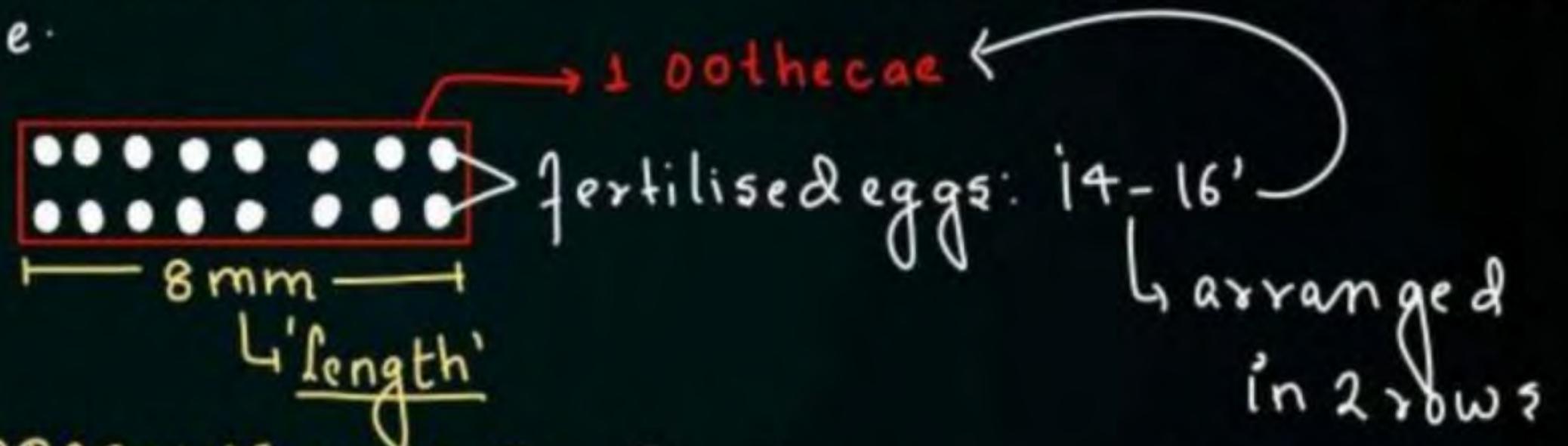
7) Gonapophysis/Phalomeres: Hard chitinous structure

Note Cockroach: UNISEXUAL / DIOECIOUS  
, ↓  
Sexes separate

## Fertilisation & Development

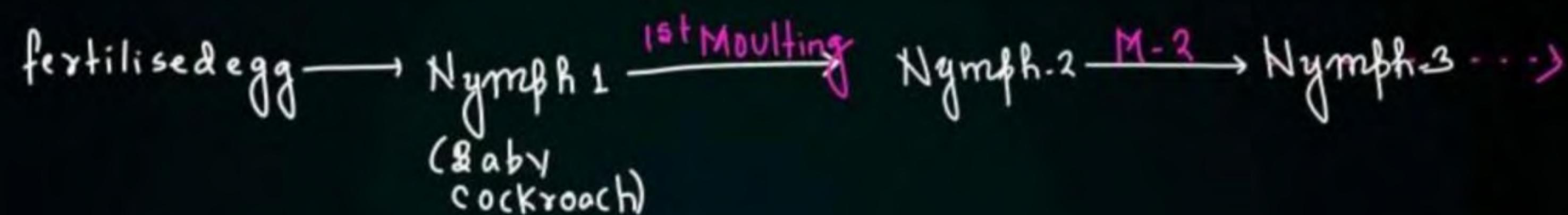


- Spermatophores are released within Body  
 → Fertilization occurs inside  
 Over the fertilised eggs, Collateral gland forms Egg case [OOTHeca]  
 At one time, female releases 9-10 oothecae.  
 ↳ Dark reddish brown



- Development: \* PAUROMETABOLUS INSECT: It shows gradual metamorphosis (moultting) i.e. it sheds off its exoskeleton & undergoes moultting for 3 times to form an Adult cockroach from Nymph
- Metamorphosis: Change in morphology

- Nymph looks very much like Adults. Nymph does not have wings but adult has wings.



Note

Next to Last Nymphal stage has wing pads but adult has wings

↳ Search on your own

**THANK  
YOU**