PRACHAND NEET

ONE SHOT

ZOOLOGY

Structural Organisation in Animals

By: Vipin Sharma Sir

Topics *to be covered*

1. Animal Tissues → gateway to physiology
2. Frog → ONLY TOPIC IN NCERT
3. Cockroach → NEET 2023 → 2 questions *
4. Questions and PYQs

Organisms

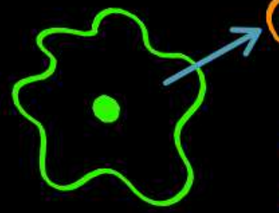
on the basis of no. of cells in organism's body

Unicellular

one

- Body consists of single cell

e.g., Bacteria, BGA, protozoan, yeast amoeba etc.



All functions like reproduction, digestion, respiration, excretion occur in same cell

Multicellular

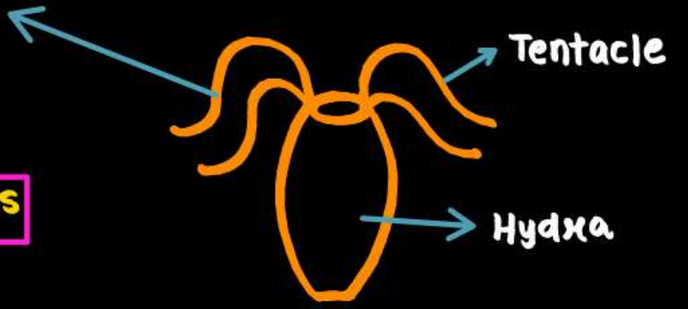
>1 cells

- Here, different group of cells takes care of diff. functions

1000's of cells

Human brain = Billions of cells

e.g., most fungi, plants, animals



Hierarchy in Living Systems

Cell

Tissues

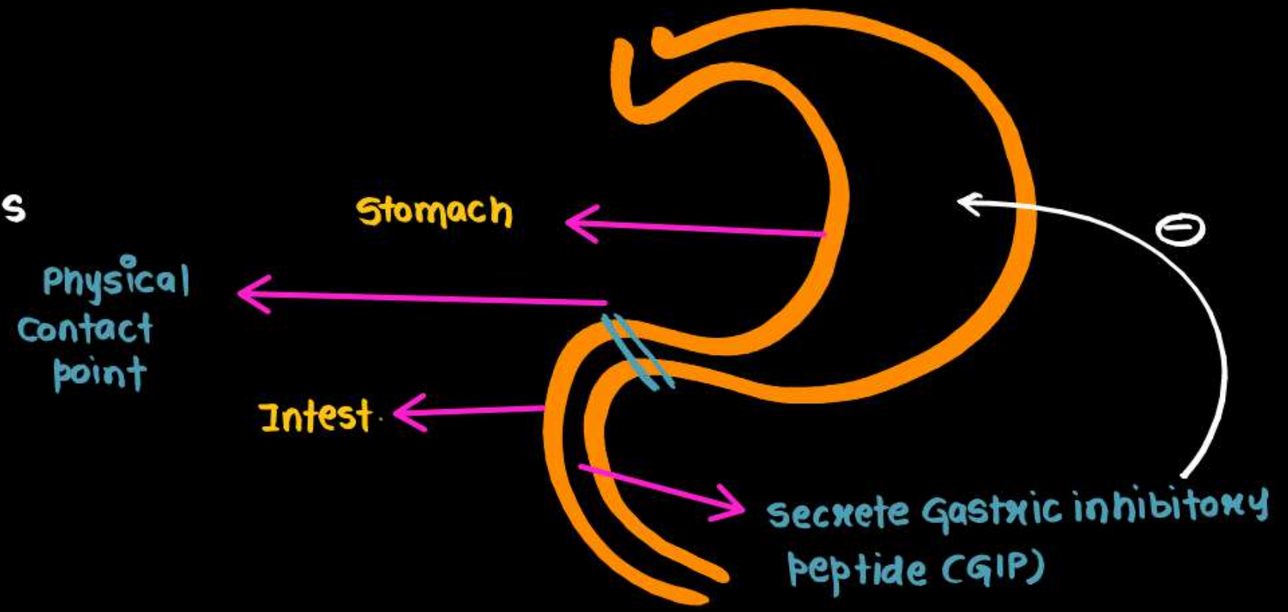
Tissues interacts in diff. proportions to make an organ

Organs

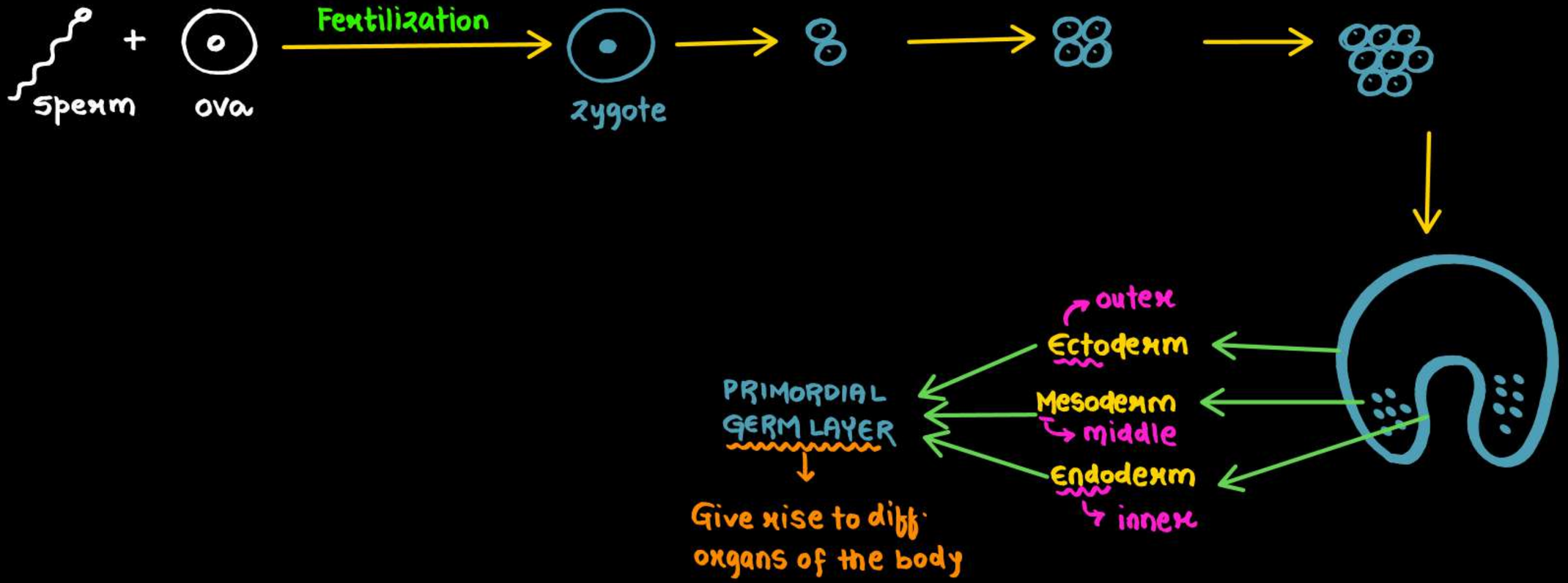
Interact physically & chemically

Organ System

Organism



Germ Layers


Sperm
+
ova
Fertilization
zygote
PRIMORDIAL GERM LAYER
Give rise to diff. organs of the body
outer
Ectoderm
Mesoderm
middle
Endoderm
inner

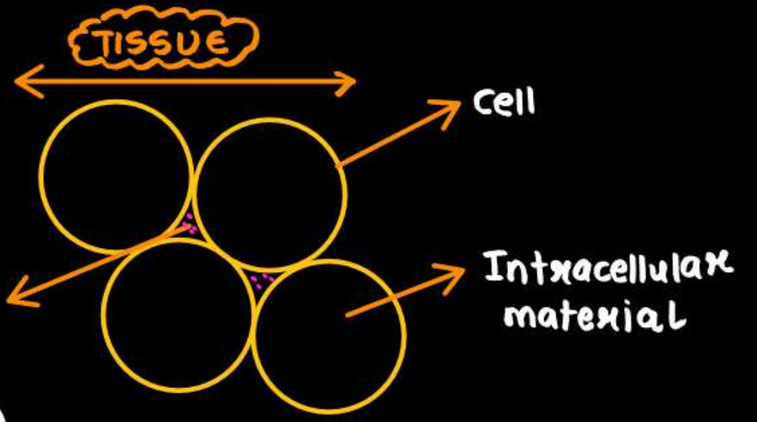
Definition of Tissue

- Group of cells ; similar in S, O, F → Function
  - Structure
  - Origin

Structure & Funct. can be diff. Origin is always same

e.g., Blood → Mesodermal in origin

Cells → RBC → Biconcave disc like → Transportation of gases
WBC → Amoeboid → defence
Platelet → Plate like → Clotting



Decides the quality of tissue
- Soft : Blood
- Hard : Bone

Glycoprotein , mucopolysaccharides

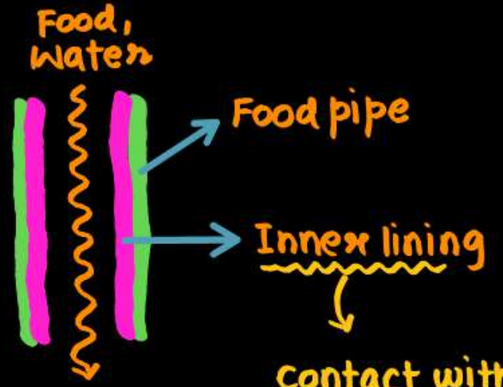
Types of Tissues

- The structure of the cells vary according to their function. Therefore, the tissues are different and are broadly classified into four types:

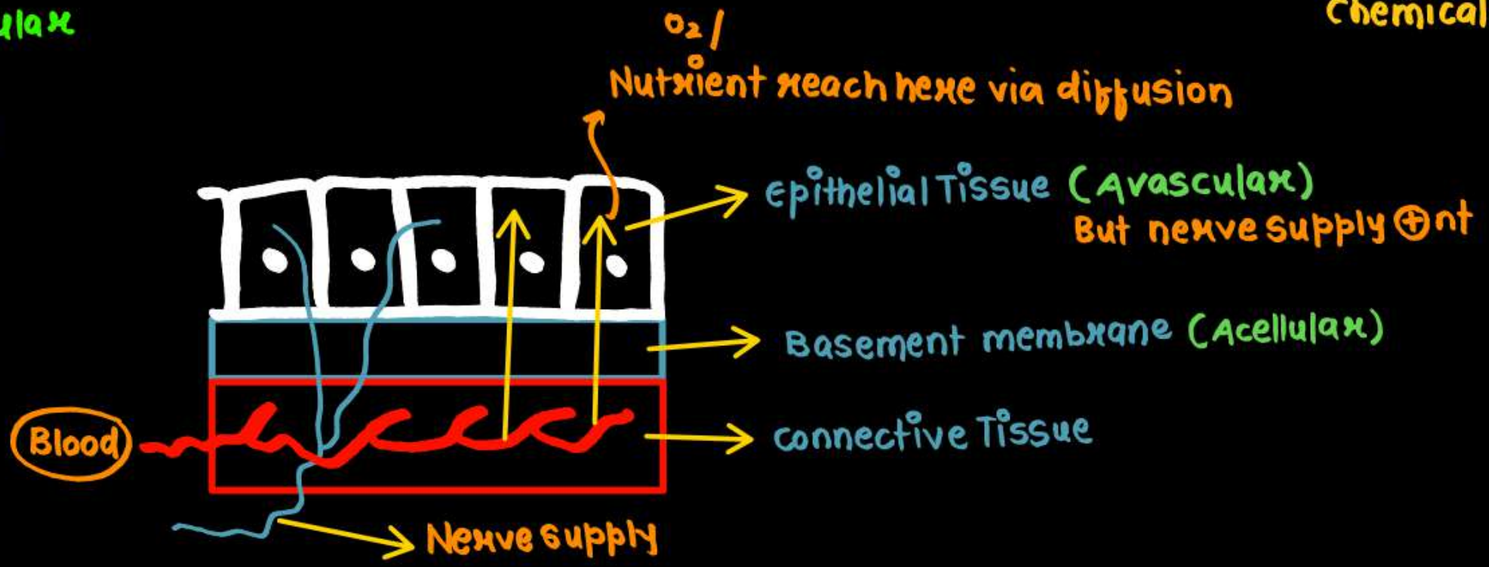
Type of Tissue/ Features	Epithelial Tissue	Connective Tissue	Muscular Tissue	Nervous Tissue
Origin	All: Ecto, Meso, Endo	• Mesoderm	Mesoderm	Ectodermal
Functions and special points	• Covering • lining	• Support, link & connect other tissues • Most abundant tissue	• Locomotion (change in location) • Movement	• Nervous control & coordination

Epithelial Tissue

- **Meaning:** Epithelial → upon rest → Rests on connective Tissue
- **Have free surface:** cover : contact with environment



- **Packing:** Tightly packed with little intexcellulax space
- **Basement membrane:**



Types of Epithelial Tissues

Depending on no. of layers of cells

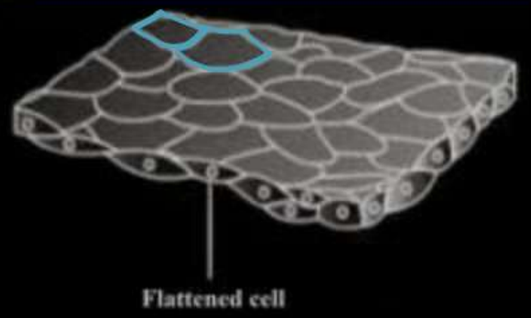
Simple

Unilayer

- Secretion, diffusion, filteration, absorption

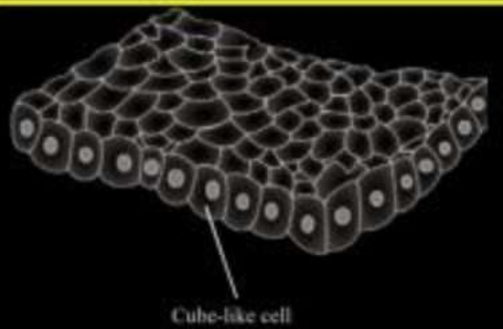
Simple Squamous

Tile like



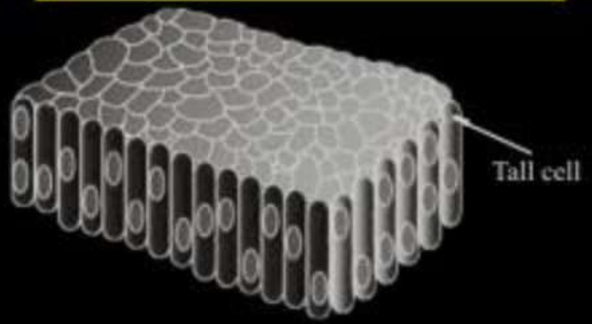
Simple Cuboidal

Cube like cell



Simple Columnar

Long, slender Column like



Compound

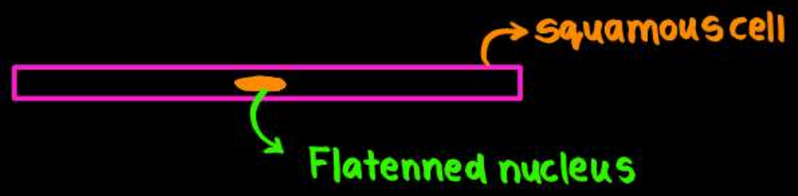
Many layers of cells

- Protection ↑

Simple Squamous Epithelium

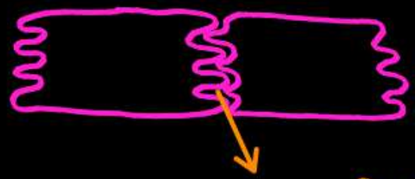
- The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries.

Tesselated epithelium



(Tile like)

Pavement Epithelium

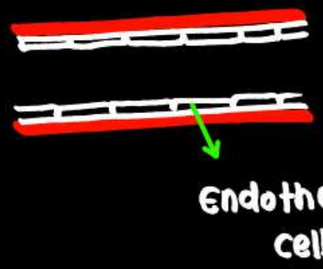


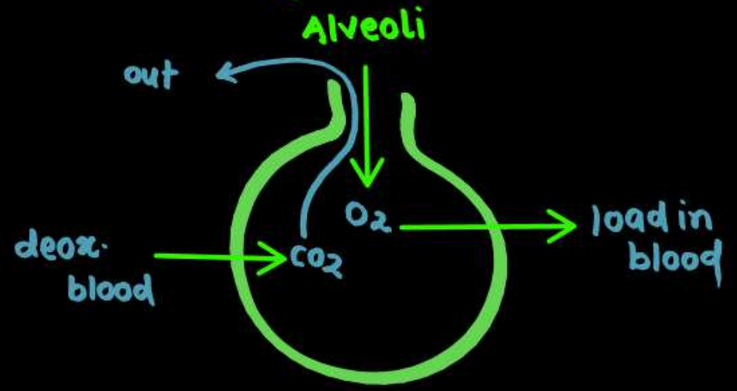
Association

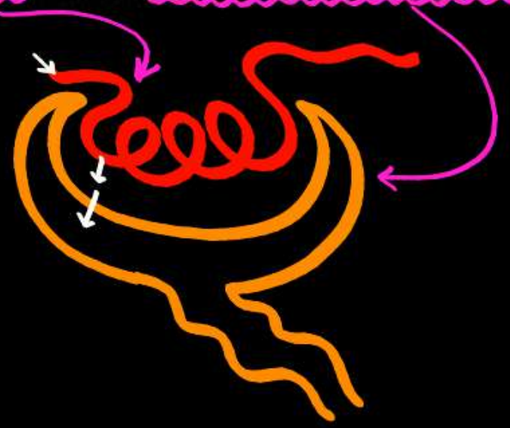
Ultrafiltera-tion

Endothelium

- They are found in the walls of blood vessels, air sacs of lungs and glomerulus and Bowman's capsule of nephron and are involved in functions like forming a diffusion boundary.

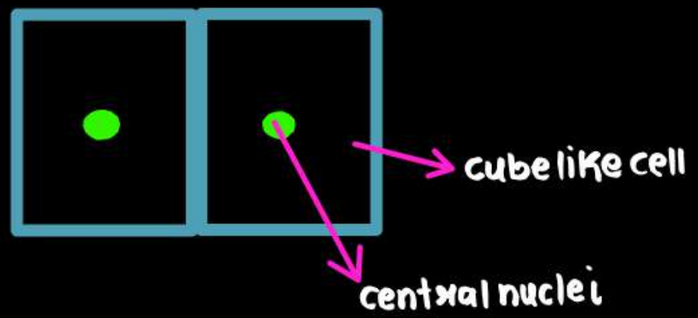


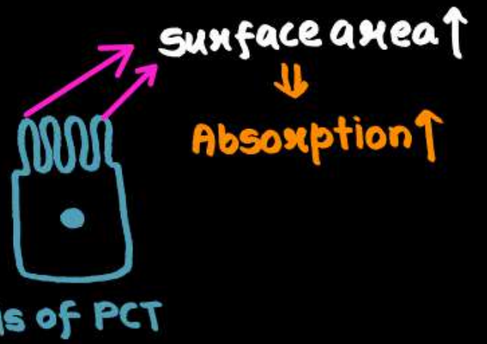




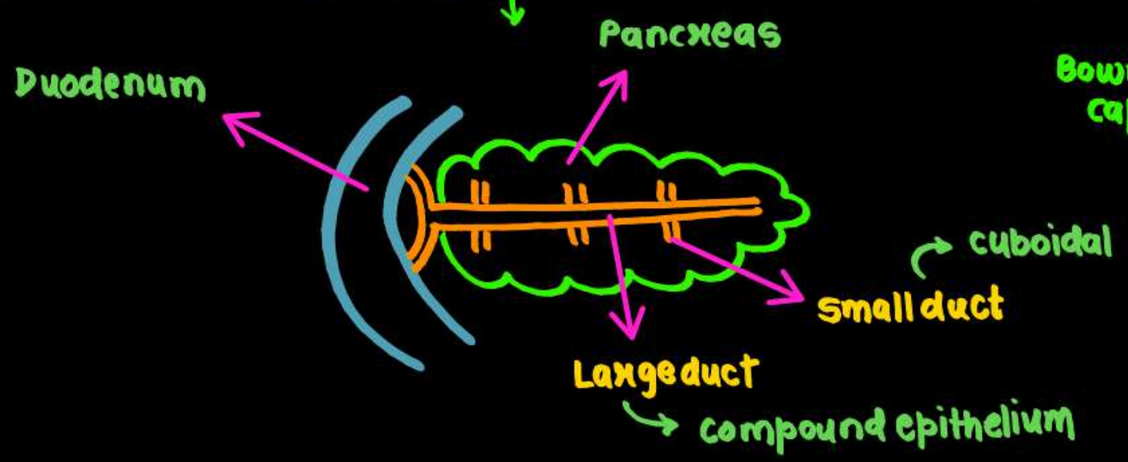
Simple Cuboidal Epithelium

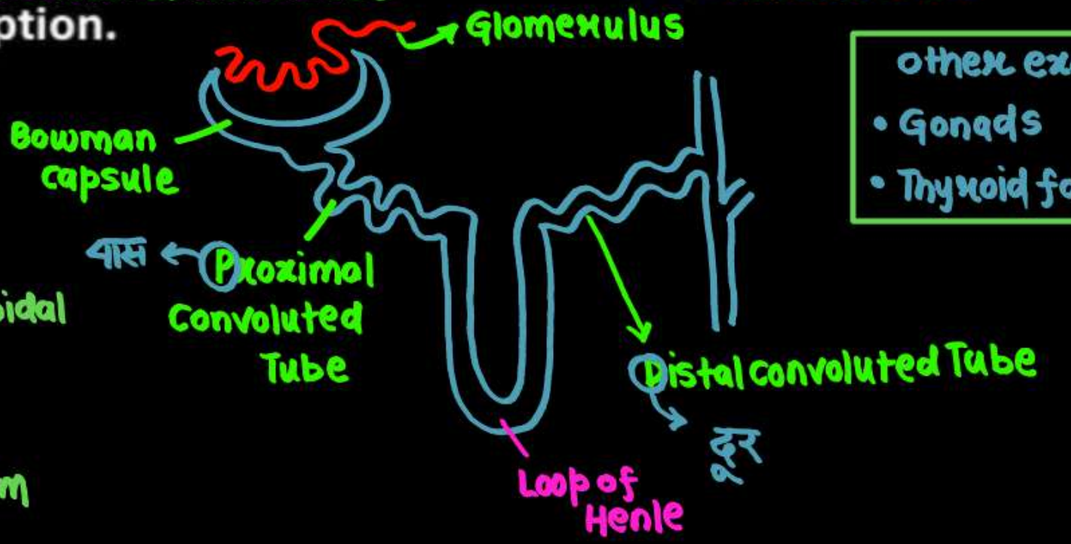
- The cuboidal epithelium is composed of a single layer of cube-like cells.





- This is commonly found in ducts of glands and tubular parts of nephrons in kidneys (brush bordered in PCT) and its main functions are secretion and absorption.

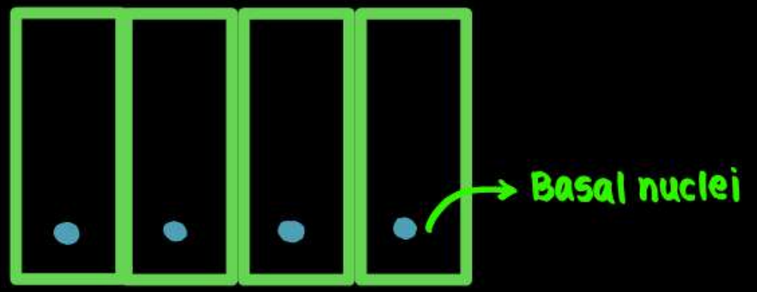




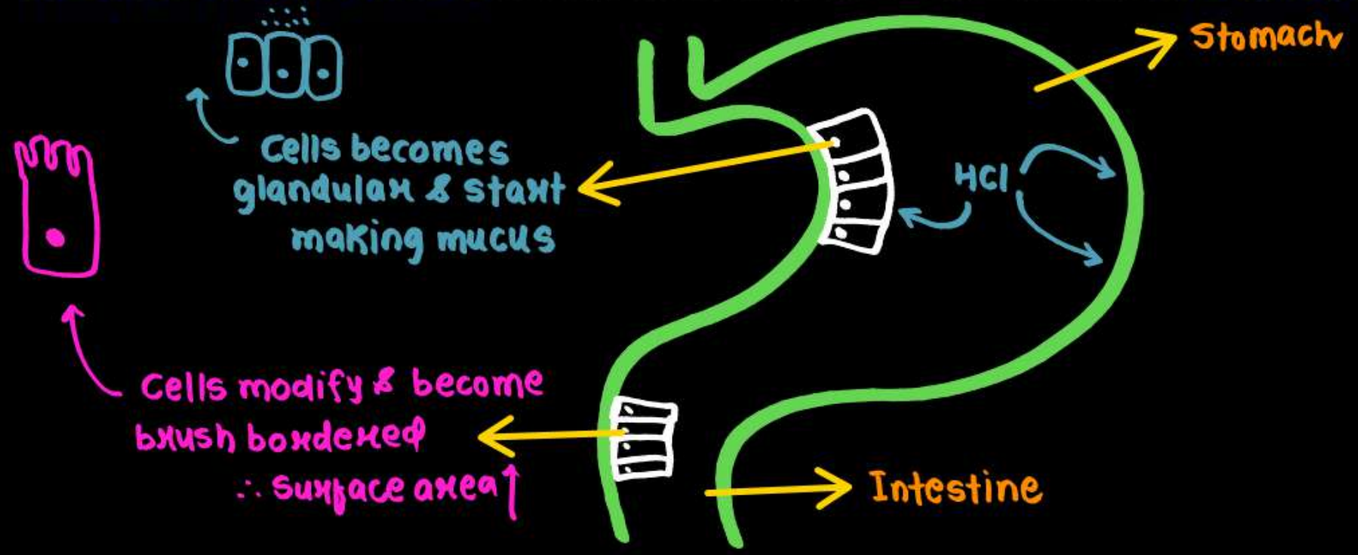
other examples *
- Gonads
- Thyroid follicles

Simple Columnar Epithelium

- The columnar epithelium is composed of a single layer of tall and slender cells.



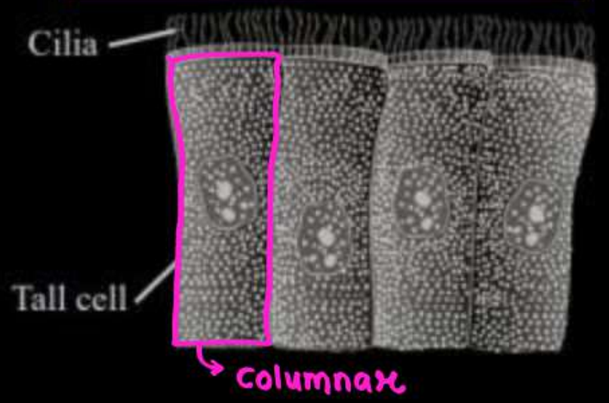
- They are found in the lining of stomach and intestine and help in secretion and absorption.



Modification of Cuboidal and Columnar Epithelium

No modification in squamous

Ciliated



- Help in movement of particles in a specific direction
- Bronchiole & Fallopian Tube (Columnar)
  - Small (Cuboidal)
  - Large (Columnar)

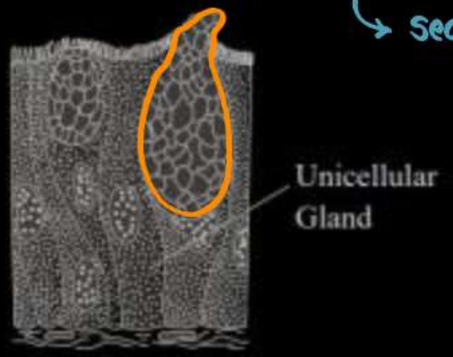
Glandular

Secrete various substances

- on the basis of no. of cells in glands

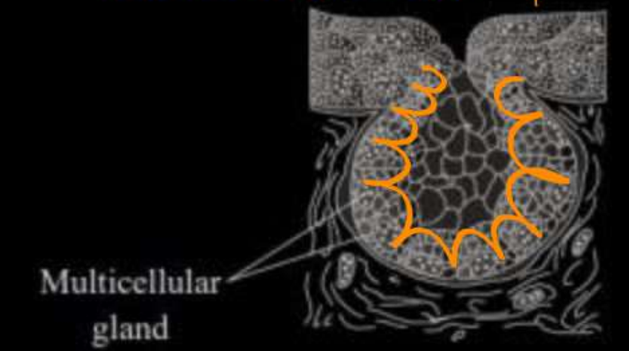
Unicellular

Goblet cell → Secretes mucus



Multicellular

Pancreas, Salivary gland



Glands

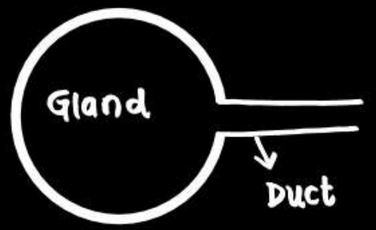
- Depending upon the mode of pouring secretion

Exocrine

⇓

They have ducts

- Secretion: Earwax, mucus, tears, oil, enzymes, milk ....

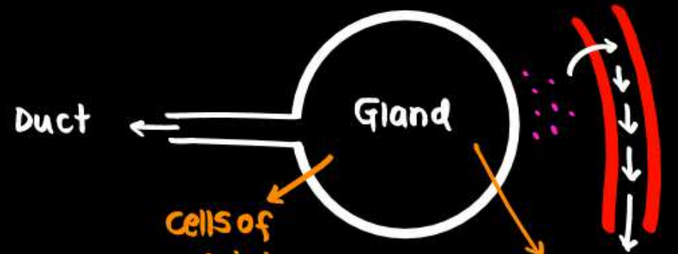


Endocrine

Hormones
(directly released in Blood)

Heterocrine/ Composite

also k/a Mixed gland
(Exo + Endo) e.g., Pancreas

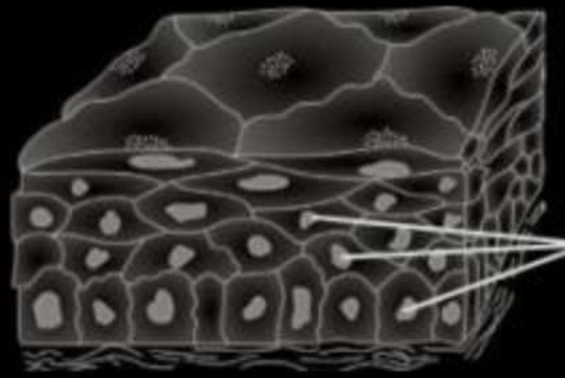


Cells of Acini
⇓
Exocrine

Islets of Langerhans
⇓
Endocrine

Compound Epithelium

- **Limited role in:** secretion & absorption
- **Main role:** Protection ↑↑
- **Found in:** skin ⇝ Keratinised
  - Large ducts of glands → Pancreas, Salivary gland
  - Moist surface of buccal cavity
  - Pharynx
  - Transition epithelium: urinary bladder (stretchable)



Cell-Cell Junctions

- Nearly ALL animal tissues have specialised junctions that provide structural and functional links between cells.

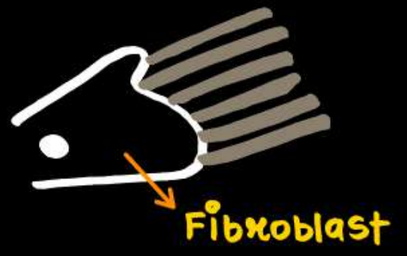
Tight Junction	Adhering Junction	Gap Junctions
• Prevent leakage across the tissue	• cementing cells together (चिपकाना)	Cytoplasms connected  • movement of ions, small molecule & SOMETIMES large molecules

Connective Tissues

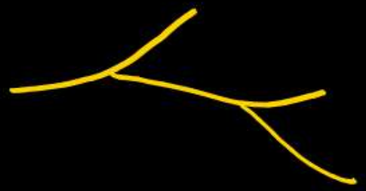
* blast: forming
clast: eating

- **Abundance:** most abundant & widely distributed
- **Main function:** To link, support & connect other tissues
- **Cells of connective tissue forms fibers (structural proteins):** (Except Blood & lymph)
  - S: Strength
  - E: Elasticity
  - F: Flexibility

  - Collagen: white fibers
    - Unbranched
    - Bundled



  - Elastin: yellow fibers
    - Branched
    - single



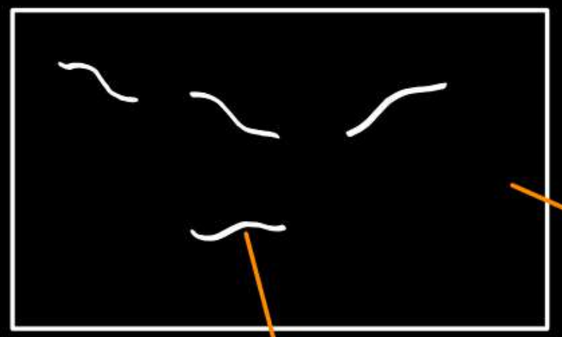
- **Cells of connective tissue secretes modified polysaccharides also:**

  which is called matrix: Glycoproteins + Mucopolysaccharides

  - Solid ⇓ Bone
  - liquid ⇓ Blood

Types of Connective Tissues

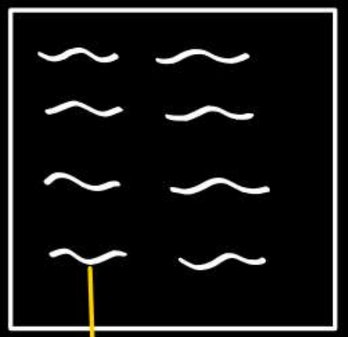
Loose CT



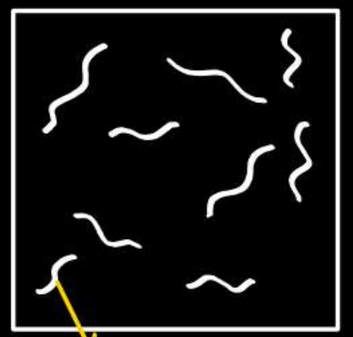
- Semifluid matrix↑
- Fibers↓

e.g.: Areolar tissue
Adipose tissue

Dense CT



- Fibers↑ (regular)
- Tendon
- Ligament



- Fibers↑ (irregularly)
- Skin

Specialised CT

- Skeletal
  - Bone
  - Cartilage
- Fluid (Fibers↑)
  - Blood
  - Lymph

• Adipose Tissue is also considered in Specialised C.T

Loose Connective Tissue

Areolar Tissue

e.g. : Beneath the skin
- Supporting framework for epithelium

Macrophage → Space↑ ; matrix↑
↳ Phagocytosis

Collagen

Elastin

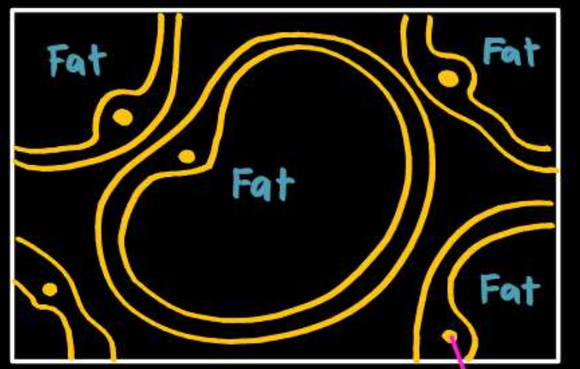
Fibro-
-blast
(secrete fibre)

Plasma cell
(Antibody form)

Mast cell → Histamine → vasodilator (BP↓)
Serotonin → vasoconstrictor (BP↑)
Heparin → Anticoagulant

Adipose Tissue

Beneath the skin
↓
Store excessive nutrient in form of fat
- Insulation layer

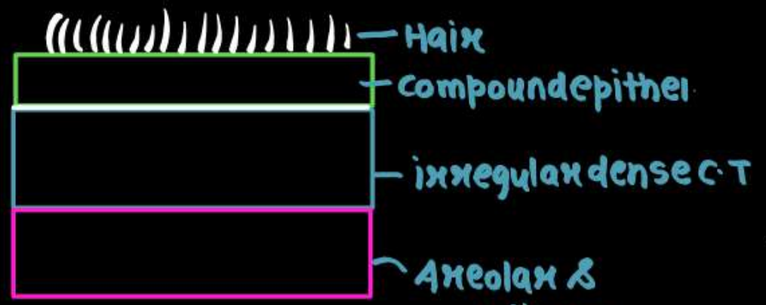


Dense Connective Tissue

Regular

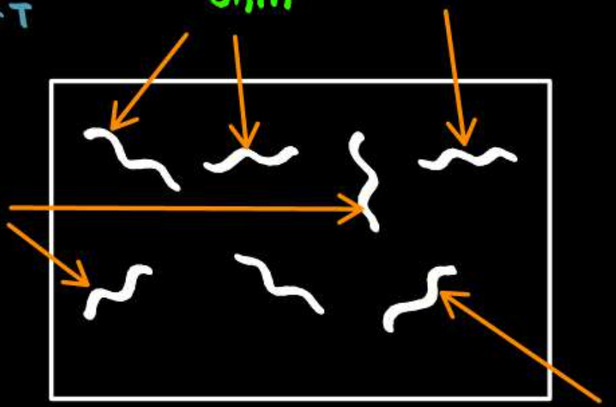
Tendon
↓
Bone with muscle

Ligament
(BaBLi)
↓
Bone to Bone



Irregular

Skin



Specialised Connective Tissue

Cartilage

- Chondroblast : Forming cells
  Chondroclast : eating cells
  Chondrocyte : cells
- Matrix : chondroitin SO_4^{2-}
  Hyaluronic acid (animal cement)
- Solid & pliable
- Most of the cartilage gets converted in bones in adults

  e.g., Nose tip & external ear joints
  B/w vertebrae
  in limbs

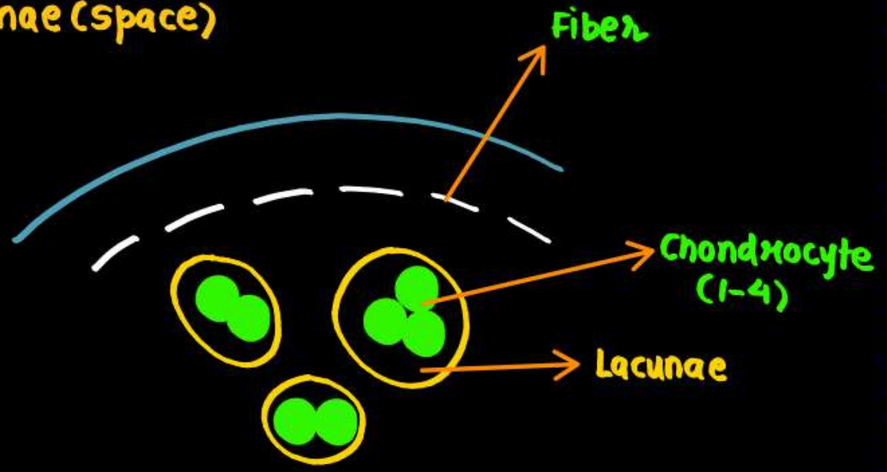
Bone

- Osteoblast : Forming cell
  osteoclast : eating cell
  osteocyte : Bone cell
- Solid & non-pliable
  ⇓
  Ca salts < PO_4^{3-}, $CaCO_3$
- Funct : Weight bearing funct : leg bones
  Provide frame
  Makes blood cells in Bone marrow

Specialised Connective Tissue

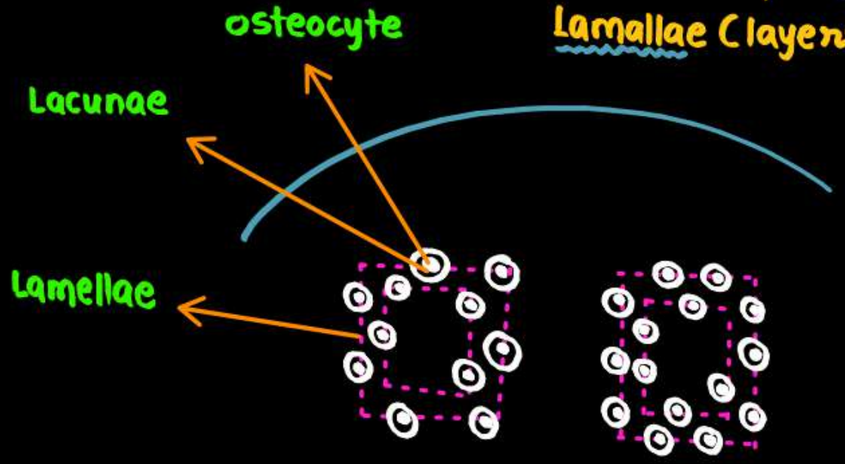
Cartilage

Lacunae (space)



Bone

Lacunae (space)
Lamallae (layers)



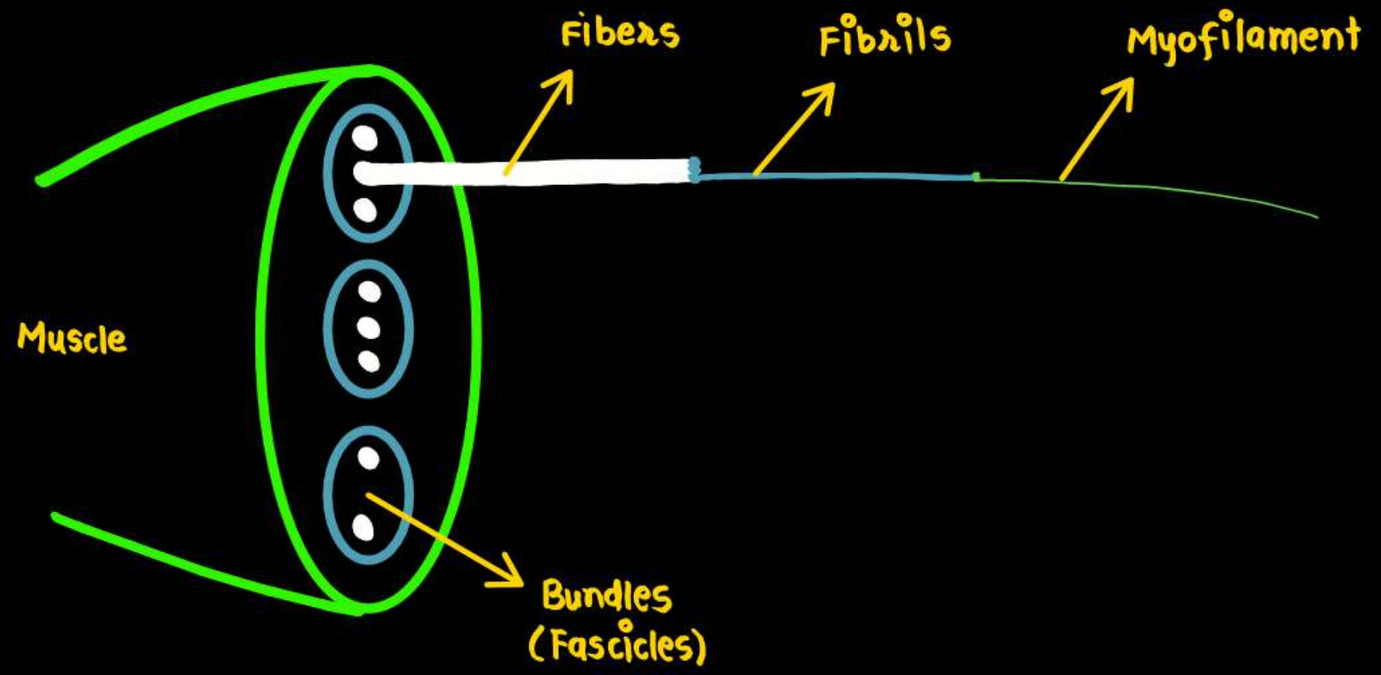
Blood (Specialised Connective Tissue)

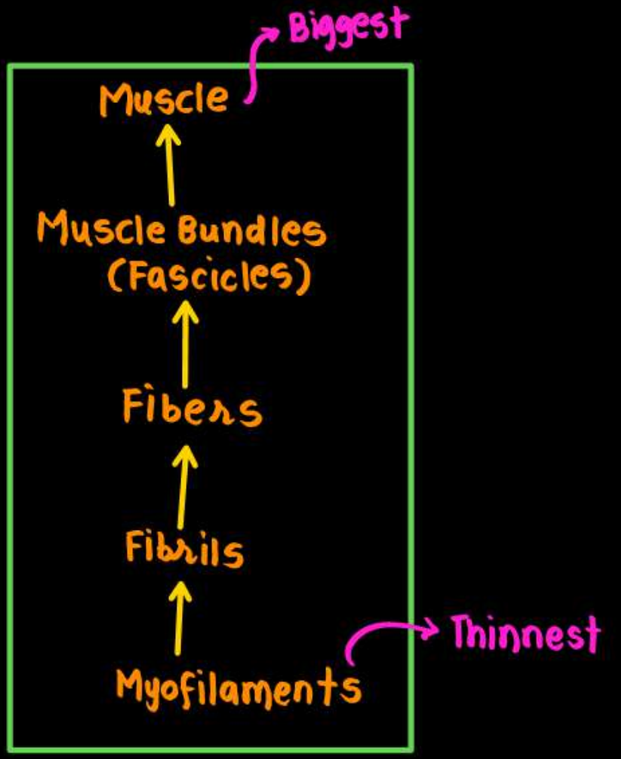
- Donot contain fibers
- Fluid connective Tissue

- Plasma
  - Mainly contain H_2O
- Formed elements
  - RBC
  - WBC
  - Platelet

Muscular Tissue

- **Functions:** Locomotion & movement; change in body posture
- **Structure of a typical muscle (skeletal):**

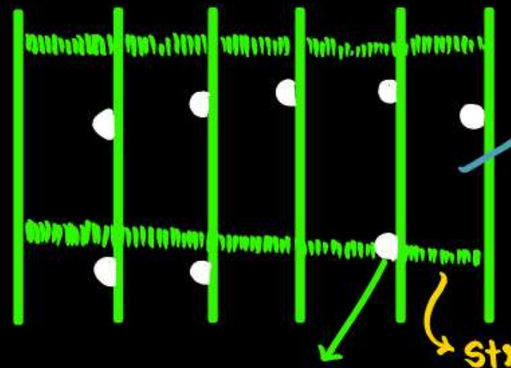




Types of Muscles

Skeletal Muscle

- Voluntary
- Covered by C.T Sheath
- Bicep, tricep



- No branching
- Striated / Striped
- Peripheral nuclei
  - Syncytium (>1 nucleus)

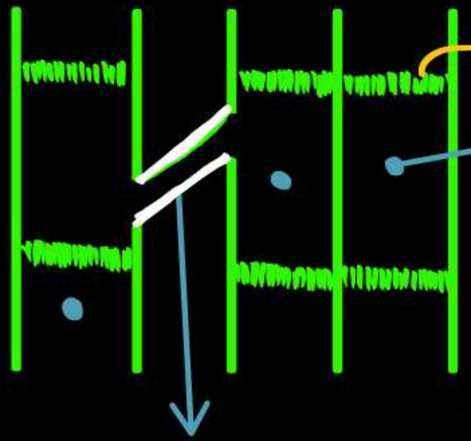
Smooth Muscle

- Involunt
- Bloodvessel Stomach
- Non-voluntary

- uni-nucleus
- Smooth (non-Striated)
- Gap junct.
- Tapered end
  - Fusiform

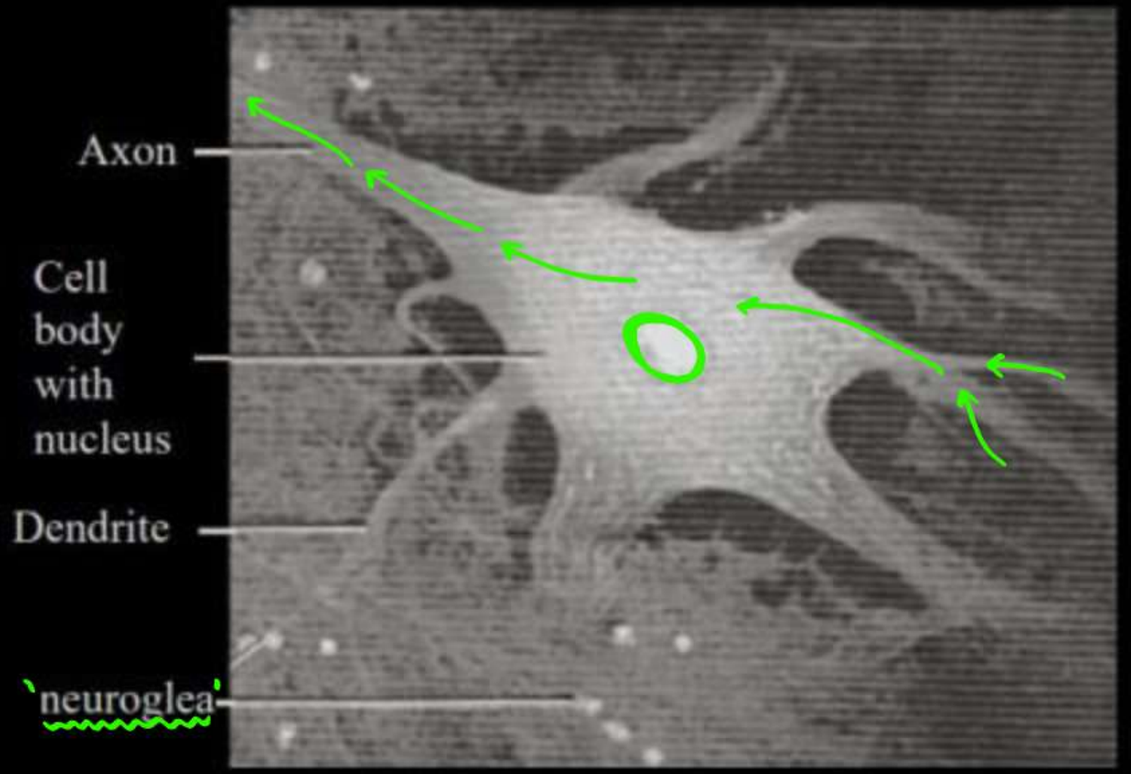
Cardiac Muscle

- e.g., Heart



- Striated
- Mono-nucleus
- heart can contract as a unit
- Branching ↑
- Gap junct. / intercalated disc (comm. junct.)

Neural Tissue



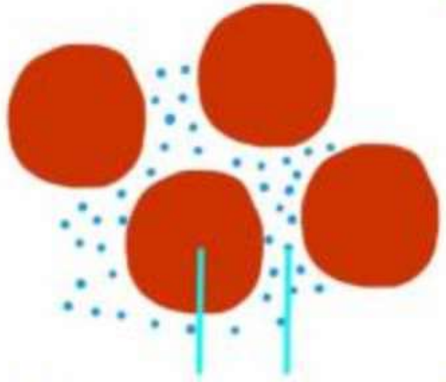
- Greatest control over body
- Neurons are special cells: excitable
  - D: Detect signal
  - R: Receive signal
  - T: Transmit signal
- Neuroglial Cells: consists (>50%) part of neural tissue
  - protect, nourish neurons
  - Support neurons
- Neuron can transmit various signals: promotary, inhibitory

Animal Tissues

Organisms

Unicellular
- Perform 'All' necessary funct.

Multicellular
- Diff. group of cells perform diff. functions
- No. of these cells can be thousands to millions
  - Hydra
  - Humans



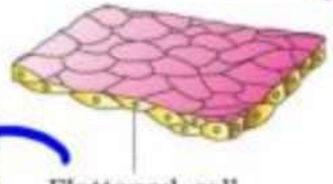
Similar cells — Intercellular substance

Tissue
- Similar structure, function and origin.
- All animals have only 4-types of tissues.
- Organised in specific proportion in diff. organs

Epithelial Tissue:
provide covering or lining
- Face outside environment
- Face body fluids

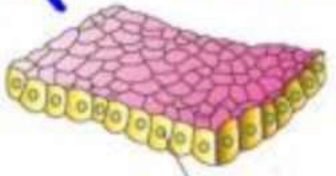
compactly packed with little intercellular space

Simple (single layer)
- lining of body cavities, ducts, tubes



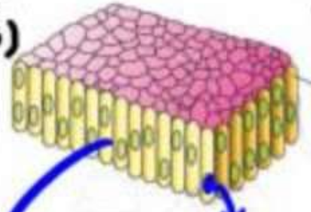
Found in endothelium & alveoli of lungs

Flattened cell (irregular boundaries)



Cube-like cell

Found in duct of glands & PCT (microvilli↑)
∴ Secretion & absorption

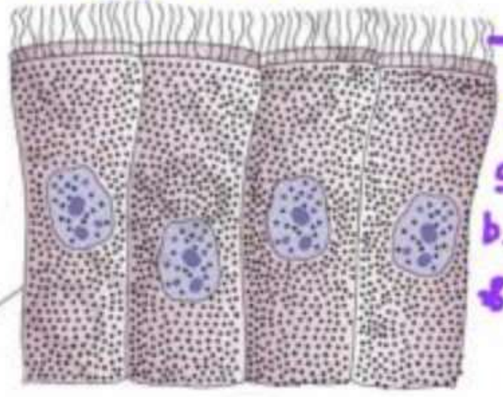


Tall cell

Nuclei at base

Found in lining of stomach & intestine
∴ Secretion & absorption

compound (multilayer)
- Protection (skin)

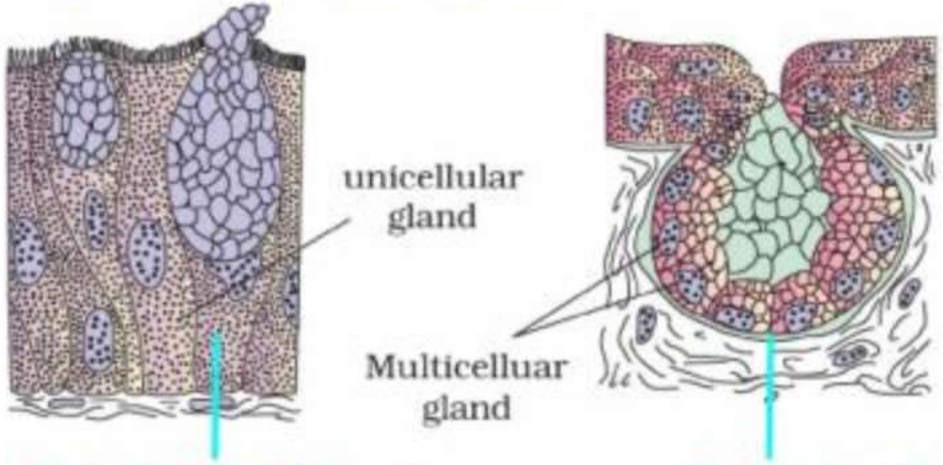


Inner surface of bronchioles & Fallopean Tube

Move particles, mucus in specific direction

Modifications of Epithelial Tissues

- Some cuboidal & columnar cells are specialised for SECRETION

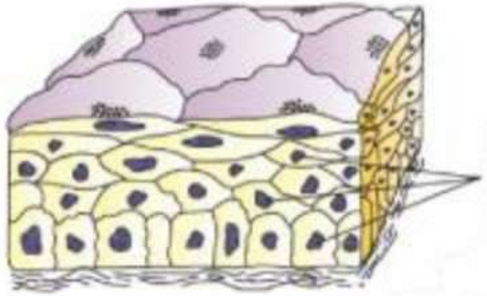


Goblet cells → Mucus

Salivary gland

- Endocrine (ductless): secrete hormones
- Exocrine (have duct): Mucus, saliva, earwax, oil, milk, enzymes etc.

■ Compound Epithelium: protection↑



• secretion & absorption↓

→ Moist surface of buccal cavity, pharynx, duct of pancreas & salivary gland

■ CELL JUNCTIONS → Provide str. & funct. links b/w individual cells

↳ Present in all types of tissues

Cell Junction	Features
Tight Junction	Stop substances from leaking across the tissue
Adhering Junction	Perform cementing and keep neighbouring cells together
Gap Junction	Cytoplasm of neighbouring cells connected for communication (rapid transfer of ions, small molecules and sometimes big molecules)

Connective Tissues

Loose C.T ↓ Fibers↓; matrix↑
- Areolar
- Adipose (Stores Fat) ↓ Beneath skin

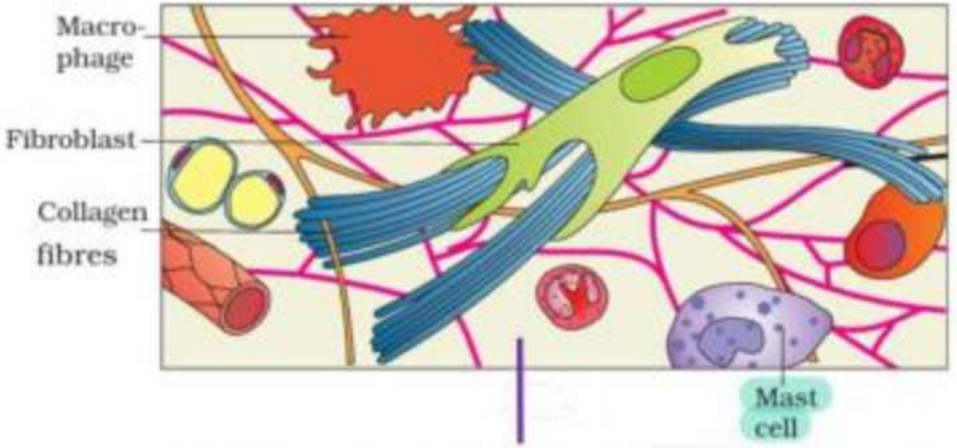
Dense C.T ↓ Fibers↑
- Regular
- Irregular

Specialised C.T
- Skeletal • Bone + cartil.
- Fluid ↓ Fibers ⊖nt
  - Lymph
  - \+
  - Blood (WBC + RBC + platelets + plasma)

CONNECTIVE TISSUE: most abundant tissue;

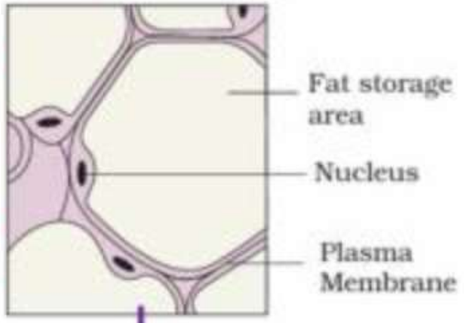
Support & link other tissues/organs

- They secrete fibers of str. proteins named elastin & collagen → provides strength + elasticity + flexibility



Areolar tissue (Support epithelium)

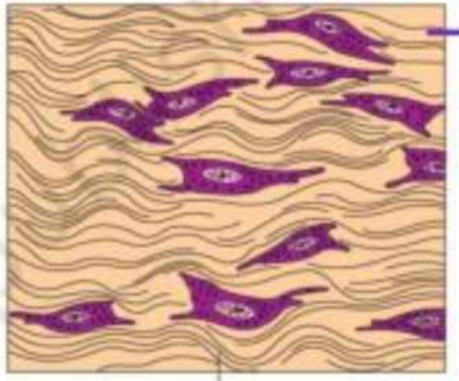
Beneath skin



Adipose tissue

Beneath skin

Dense Connective Tissue:

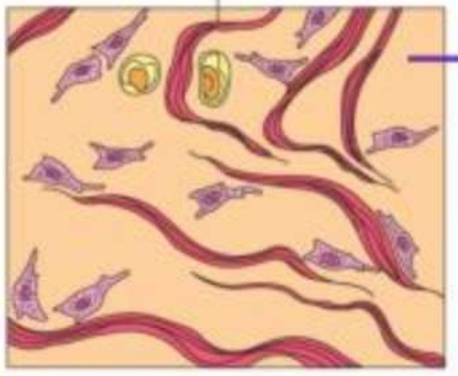


Regular

- Tenden: Bone to muscle

Ligament: Bone to Bone

Collagen fibre



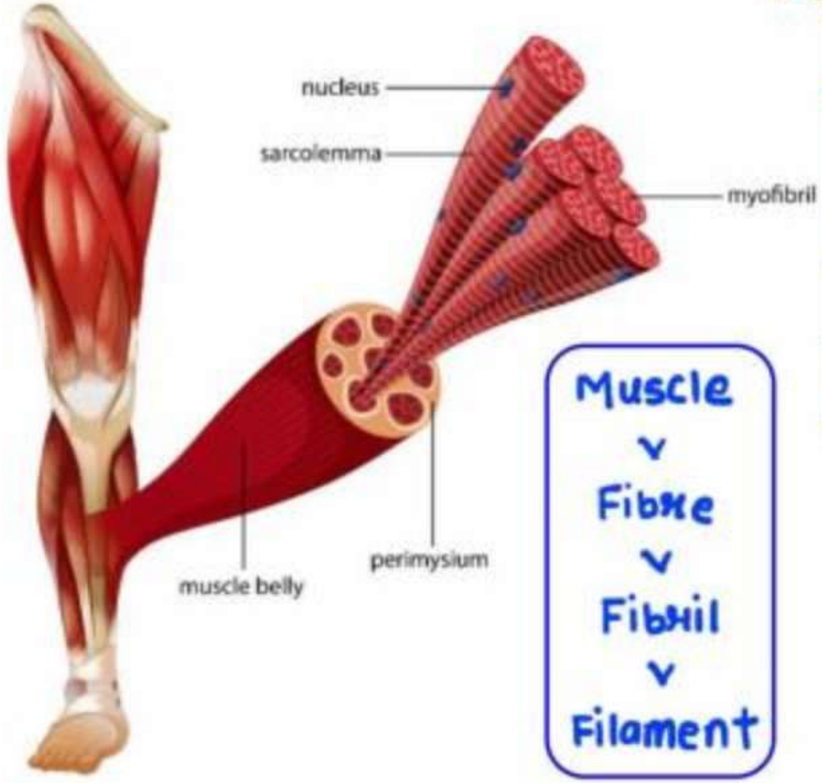
Irregular (Skin)

Specialised C.T (skeletal)

Cartilage	Bone
Solid and Pliable	Solid and Non-Pliable (rich in calcium salts and collagen)
Cells: Chondrocytes	Cells: Osteocytes
Most cartilages in vertebrate embryos are replaced by bones in adults (tip of nose, outer ear joints, adjacent bones of vertebral column, limbs and hands in adults)	Give frame to body; protect softer tissues and organs; locomotion and movement; produce blood cells (in long bones)
Lacunae present; lamellae absent	Both present

Muscular Tissues

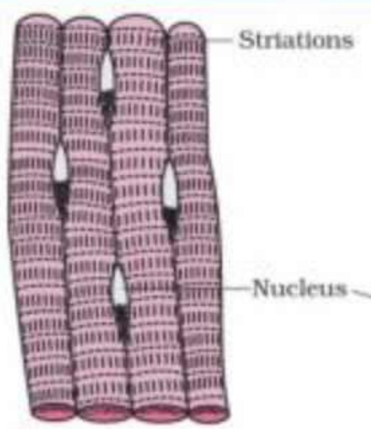
→ Shorten & lengthen to bring about movement

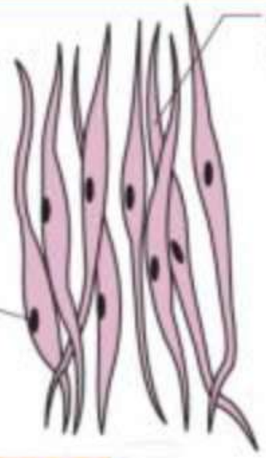


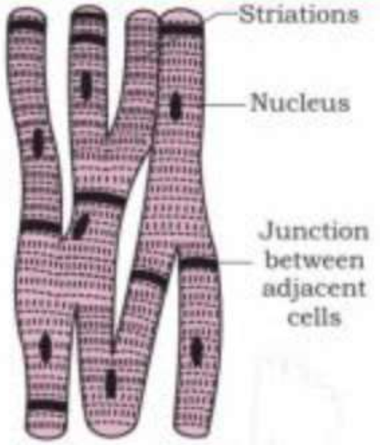
Muscle
v
Fibre
v
Fibril
v
Filament

Types of Muscular Tissues

Skeletal	Smooth	Cardiac
Closely attached to skeletal bones (bicep, tricep)	Internal walls of blood vessels, stomach, intestine	In heart (communication junctions or intercalated discs present)
Striated	Non-striated, fusiform	Striated
Voluntary	Involuntary	Involuntary

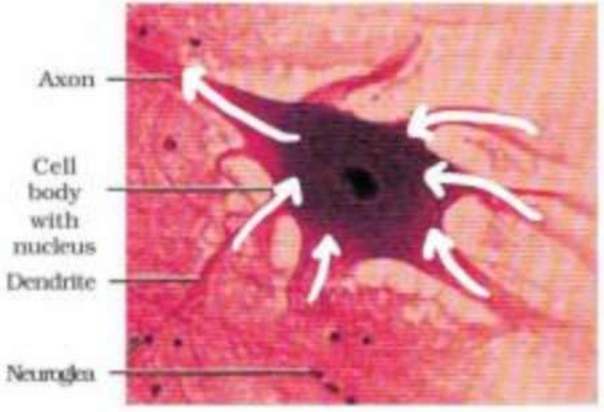






Neural Tissues

- Greatest control over body
- Str. & funct. unit: Neurons (excitable)
- Neuroglial cells: support & protect neurons
  - ↳ makes >50% part of nervous tissue



QUESTION (NEET PYQ EXAM 2024)

Which of the following statements is **correct** about the type of junction and their role in our body?

(1) Adhering junctions facilitate the cells to communicate with each other.

(2) Tight junctions help to stop substances from leaking across a tissue.

(3) Tight junctions help to perform cementing to keep neighbouring cells together.

(4) Gap junctions help to create gap between the cells and tissues.

QUESTION (NEET PYQ EXAM 2024)

In which of the following connective tissues, the cells secrete fibres of collagen or elastin?

A. Cartilage

B. Bone

C. Adipose tissue

D. Blood

E. Areolar tissue

Choose the **most appropriate** answer from the options given below :

(1) D, C, D and E only

(2) A, B, C and E only

(3) B, C and D only

(4) A, C and D only

QUESTION (NEET PYQ EXAM 2024)

Match List I with List II :

	List - I		List – II
A.	Squamous Epithelium	I.	Goblet cells of alimentary canal
B.	Ciliated Epithelium	II.	Inner lining of pancreatic ducts (large)
C.	Glandular Epithelium	III.	Walls of blood vessels
D.	Compound Epithelium	IV.	Inner surface of Fallopian tubes

Choose the correct answer from the options given below

(1) A-II, B-III, C-I, D-IV

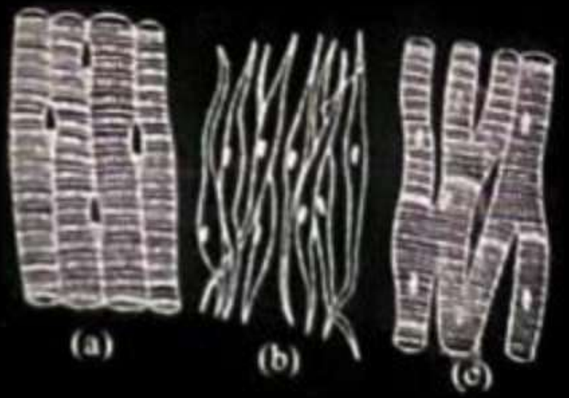
(2) A-II, B-IV, C-III, D-I

(3) A-III, B-I, C-II, D-IV

(4) A-III, B-IV, C-I, D-II

QUESTION (NEET PYQ EXAM 2024)

Three types of muscles are given as a, b and c. Identify the correct matching pair along with their location in human body:



Name of muscle/location

(1) (a) Smooth - Toes
(b) Skeletal – Legs
(c) Cardiac – Heart

(2) (a) Skeletal - Triceps
(b) Smooth – Stomach
(c) Cardiac – Heart

(3) (a) Skeletal - Biceps
(b) Involuntary – Intestine
(c) Smooth – Heart

(4) (a) Involuntary – Nose tip
(b) Skeletal – Bone
(c) Cardiac – Heart

QUESTION (NEET PYQ EXAM 2024)

Match List I with List II:

	List I		List II
A.	Unicellular glandular epithelium	I.	Salivary glands
B.	Compound epithelium	II.	Pancreas
C.	Multicellular glandular epithelium	III.	Goblet cells of alimentary canal
D.	Endocrine glandular epithelium	IV.	Moist surface of buccal cavity

Choose the correct answer from the options given below:

(1) A-II, B-I, C-III, D-IV

(2) A-IV, B-III, C-I, D-II

(3) A-III, B-IV, C-I, D-II

(4) A-II, B-I, C-IV, D-III

QUESTION (NEET PYQ EXAM 2023)

Given below are two statements. **(Manipur, 2023)**

Statement-I: Goblet cells are unicellular glands.

Statement-II: Earwax is the secretion of exocrine gland.

In the light of the above statements, choose the **correct** answer from the options given below;

(1) **Statement-I** is true but **Statement-II** is false.

(2) **Statement-I** is false but **Statement-II** is true.

(3) Both **Statement-I** and **Statement-II** are true.

(4) Both **Statement-I** and **Statement-II** are false.

QUESTION (NEET PYQ EXAM 2023)

Match **List-I** with **List-II**. **(Manipur, 2023)**

List-I		List-II	
A.	Columnar epithelium	P.	Ducts of glands
B.	Ciliated epithelium	Q.	Inner lining of stomach and intestine
C.	Squamous epithelium	R.	Inner lining of bronchioles
D.	Cuboidal epithelium	S.	Endothelium

Choose the **correct** answer from the options given below.

(1) A-(R); B-(Q); C-(P); D-(S)

(2) A-(R); B-(Q); C-(S); D-(P)

(3) A-(Q); B-(R); C-(P); D-(S)

(4) A-(Q); B-(R); C-(S); D-(P)

QUESTION (NEET PYQ EXAM 2023)

Match **List-I** with **List-II**. **(2023)**

List-I		List-II	
A.	Mast cells	P.	Ciliated epithelium
B.	Inner surface of bronchiole	Q.	Areolar connective tissue
C.	Blood	R.	Cuboidal epithelium
D.	Tubular parts of nephron	S.	Specialised connective tissue

Choose the **correct** answer from the options give below.

(1) A-(Q); B-(R); C-(P); D-(S)

(2) A-(Q); B-(P); C-(S); D-(R)

(3) A-(R); B-(S); C-(Q); D-(P)

(4) A-(P); B-(Q); C-(S); D-(R)

QUESTION (NEET PYQ EXAM 2023)

Given below are two statements. **(2023)**

Statement-I: Ligaments are dense irregular tissue.

Statement-II: Cartilage is dense regular tissue.

In the light of the above statements, choose the **correct** answer from the options given below.

(1) Both **Statement-I** and **Statement-II** are false.

(2) **Statement-I** is true but **Statement-II** is false.

(3) **Statement-I** is false but **Statement-II** is true.

(4) Both **Statement-I** and **Statement-II** are true.

QUESTION (NEET PYQ EXAM 2022)

Which of the following types of epithelium is present in the bronchioles and fallopian tubes? **(2022 II)**

(1) Stratified squamous epithelium

(2) Simple squamous epithelium

(3) Simple columnar epithelium

(4) Ciliated epithelium ✓

QUESTION (NEET PYQ EXAM 2022)

Choose the **correct** statement about a muscular tissue.

(1) Smooth muscles are multinucleated and involuntary.

(2) Skeletal muscle fibres are uninucleated and found in parallel bundles.

(3) Intercalated discs allow the cardiac muscle cells to contract as a unit.

(4) The walls of blood vessels are made up of columnar epithelium.

QUESTION (NEET PYQ EXAM 2022)

Choose the **correct** statements. (2022 II)

(a) Bones support and protect softer tissues and organs.

(b) Weight bearing function is served by limb bones.

(c) Ligament is the site of production of blood.

(d) Adipose tissue is specialised to store fats.

(e) Tendons attach one bone to another.

Choose the most appropriate answer from the options given below.

(1) (a), (b) and (e) only (2) (a), (b) and (d) only

(3) (b), (c) and (e) only (4) (a), (c) and (d) only

QUESTION (NEET PYQ EXAM 2022)

Which of the following is present between the adjacent bones of the vertebral column? **(2022)**

(1) Smooth muscle
(2) Intercalated discs
(3) Cartilage
(4) Areolar tissue

QUESTION (NEET PYQ EXAM 2022)

Which of the following is **not** a connective tissue?

(1) Neuroglia
(2) Blood
(3) Adipose tissue
(4) Cartilage

QUESTION (NEET PYQ EXAM 2022)

Match **List-I** with **List-II**. **(2022)**

List-I		List-II	
A.	Bronchioles	P.	Dense regular connective tissue
B.	Goblet cell	Q.	Loose connective tissue
C.	Tendons	R.	Glandular tissue
D.	Adipose tissue	S.	Ciliated epithelium

Choose the **correct** answer from the options given below.

(1) A-(Q); B-(P); C-(S); D-(R)

(2) A-(R); B-(S); C-(Q); D-(P)

(3) A-(S); B-(R); C-(P); D-(Q)

(4) A-(P); B-(Q); C-(R); D-(S)

QUESTION (NEET PYQ EXAM 2021)

Identify the types of cell junctions that help to stop the leakage of the substances across a tissue and facilitation of communication with neighbouring cells via rapid transfer of ions and molecules; **(2021)**

(1) Tight junctions and gap junctions, respectively
(2) Adhering junctions and tight junctions, respectively
(3) Adhering junctions and gap junctions, respectively
(4) Gap junctions and adhering junctions, respectively

QUESTION (NEET PYQ EXAM 2021)

Which of the following statement **wrongly** represents the nature of smooth muscle? **(2021)**

(1) They are involuntary muscles.

(2) Communication among the cells is performed by intercalated discs.

(3) These muscles are present in the wall of blood vessels.

(4) These muscle have no striations.

QUESTION (NEET PYQ EXAM 2020)

Cuboidal epithelium with brush border of microvilli is found in; **(2020)**

(1) ducts of salivary glands.

(2) proximal convoluted tubule of nephron.

(3) eustachian tube.

(4) lining of intestine.

QUESTION (NEET PYQ EXAM 2020)

Goblet cells of alimentary canal are modified from; **(2020)**

(1) Columnar epithelial cells ✓

(2) Chondrocytes ✗

(3) Compound epithelial cells ✗

(4) Squamous epithelial cells ✗

QUESTION (NEET PYQ EXAM 2020)

Select the **incorrectly** matched pair from following;

(2020 Covid)

(1) Neurons-Nerve cells ✓

(2) Fibroblast-Areolar tissue ✓

(3) Osteocytes-Bone cells ✓

(4) Chondrocytes-Smooth muscle cells ✗

QUESTION (NEET PYQ EXAM 2020)

Which one of the following is the most abundant protein in the animals? **(2020)**

(1) Haemoglobin
(2) Collagen
(3) Lectin
(4) Insulin

Frog

- **Kingdom:** Animalia → Multicellular, Eukaryotic, Heterotrophic, Holozoic mode of nutrition
  - Holozoic → First ingest then digest
- **Phylum:** Chordata → Notochord ⊕nt
- **Subphylum:** Vertebrata → Vertebral column ⊕nt
- **Division:** Gnathostomata → Jaw, Mouth
- **Superclass:** Tetrapoda (4) → limb
  - 2- Forelimbs → thin; → 4-digits
  - 2- Hindlimbs → Thick, muscular: → 5-digits → webbed for swimming
    - Swimming
    - Leaping (jump)
    - Burrowing
    - Walking
    - Consumed as a protein source
- **Class:** Amphibia → dual → Water, Terrestrial
- **Order:** Anura → Tail-less
- **Family:** Ranidae
- **Genus:** *Rana*
- **Species:** *tigrina* → Indian Bullfrog

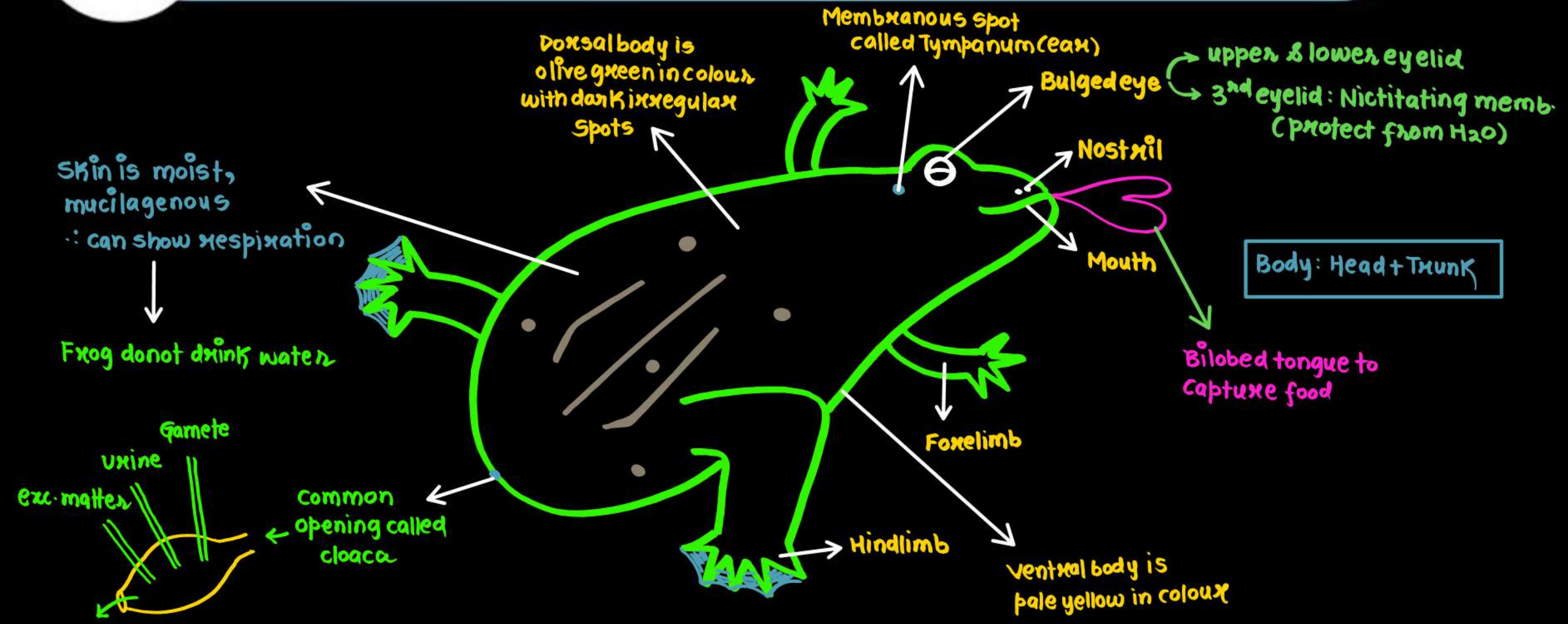
Body: Head + Trunk (neck & Tail ⊖nt)

Features of Frog

- **Poikilotherms:** cold blooded : their body temperature fluctuates acc. to external environment
  - Winter → Hibernation
  - Summer → Aestivation
- **Camouflage:** protective colouration
  - → Mimicry
- **Frog doesn't drink water:** as it gets H_2O through moist skin
- **Body is divisible into:** Head + Trunk (neck & Tail ⊖nt)
- **Sexual dimorphism:**
  - ♂
    - vocal sacs development
    - Nuptial pad/copulatory pad
  - ♀ → vocal sacs ↓ ⊖nt

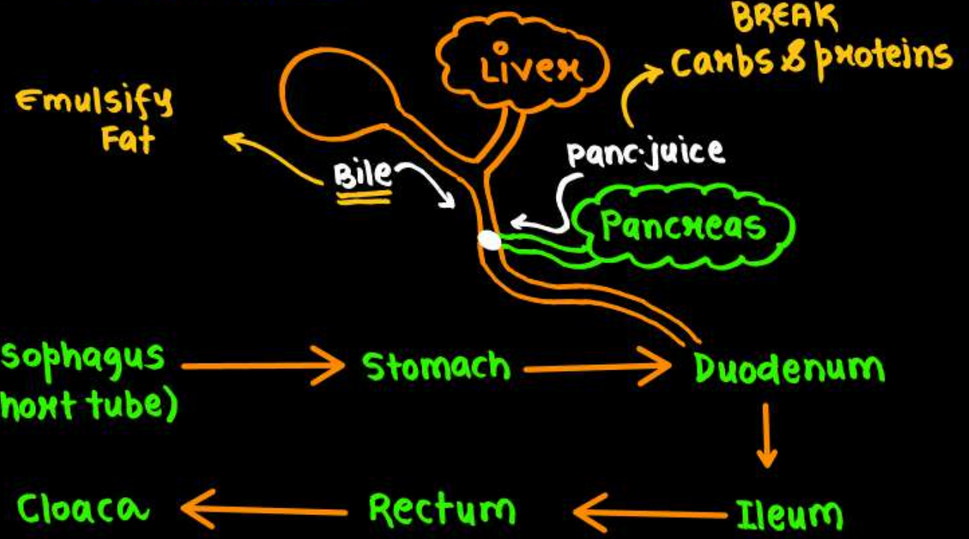
- **Economic Importance:**
  - Carnivore ∴ protects crops
  - A vital part of food chain

Morphology


Membranous spot called Tympanum (ear)
Dorsal body is olive green in colour with dark irregular spots
Bulged eye
upper & lower eyelid
3rd eyelid : Nictitating memb. (protect from H2O)
Nostril
Skin is moist, mucilagenous
∴ can show respiration
Frog donot drink water
Mouth
Body : Head + Trunk
Bilobed tongue to capture food
Gamete
Urine
Exc. matter
Common opening called cloaca
Forelimb
Hindlimb
Ventral body is pale yellow in colour

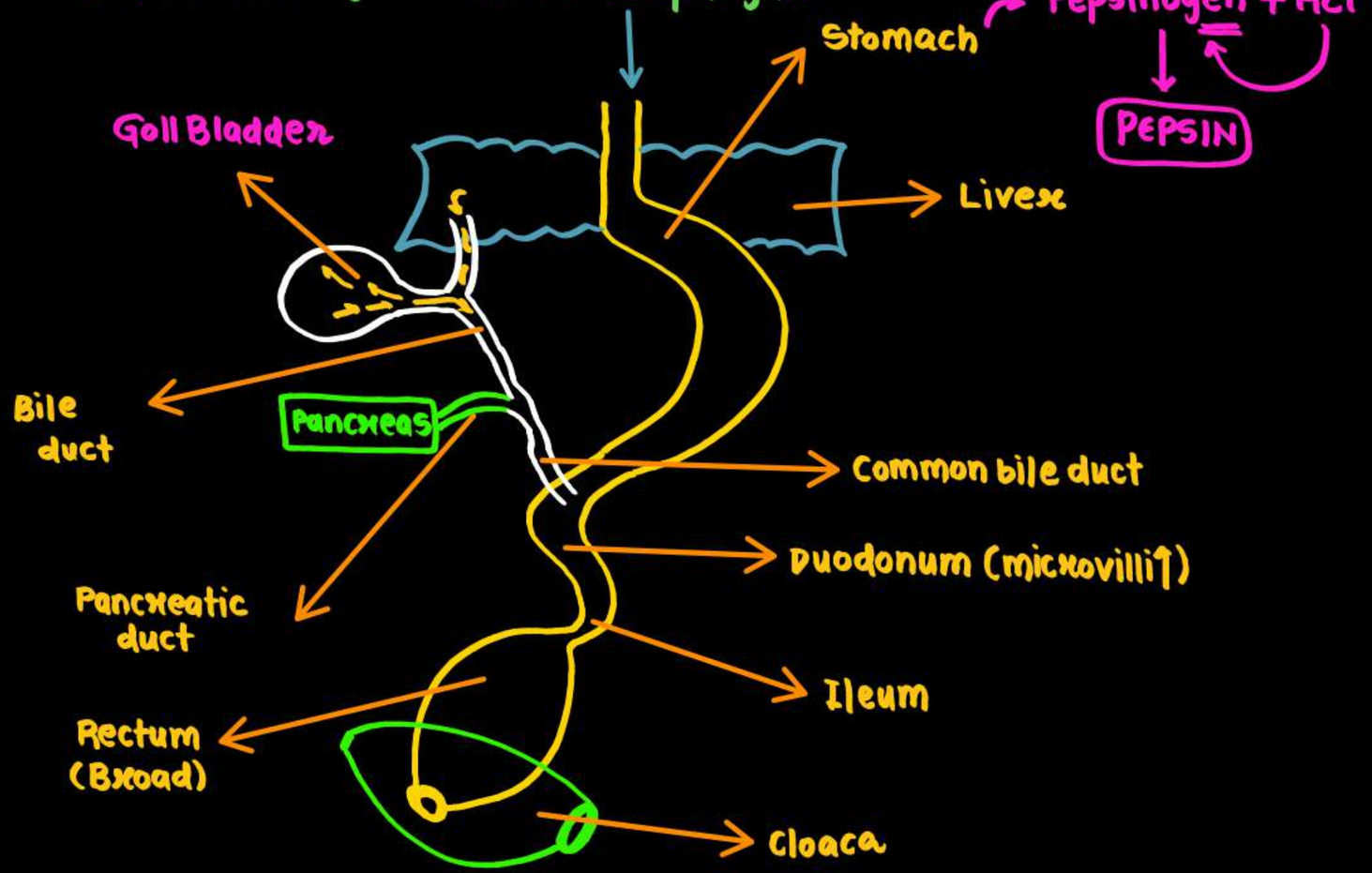
Digestive System

- **Includes:** Alimentary canal + Digestive glands
  - Alimentary canal → Small (∵ Frog is carnivore) → Mouth to cloaca
  - Digestive glands → Stomach → gastric juice; Liver → make Bile; Gall Bladder → store Bile juice; Pancreas → makes pancreatic juice
- **Alimentary canal is small:** ∵ frog is carnivore → it eats insects & their larva
- **Starts at:** Stomach → digests proteins
- **Ends at:** Small intestine
- **Path of Food:** Bilobed Tongue will capture food → Buccal cavity → Pharynx → oesophagus (short tube) → Stomach → Duodenum → Ileum → Rectum → Cloaca



Digestive System

Food captured by Bilobed Tongue → Mouth → Buccal cavity → Short oesophagus



Respiration

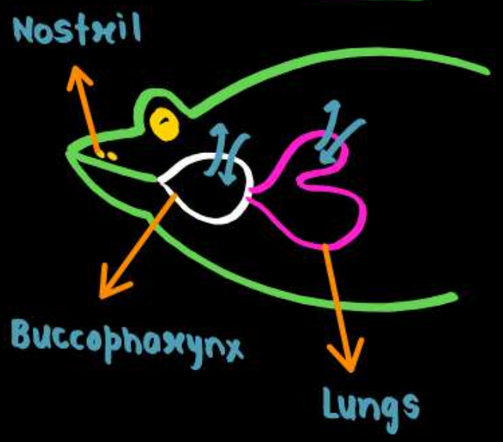
Cutaneous

Skin

- Hibernation
  Aestivation
  Aquatic

Bucco-pharyngeal

Least



Pulmonary

Most

- via Lungs

On land: all 3 respiration can work

Circulatory System

- well developed / closed

Blood Vascular System

1. Heart → 3-chambered = 2 Atria/auricle, 1 ventricle
2. Blood vessels
3. Blood
   - RBC → Nucleus
   - WBC
   - Platelet

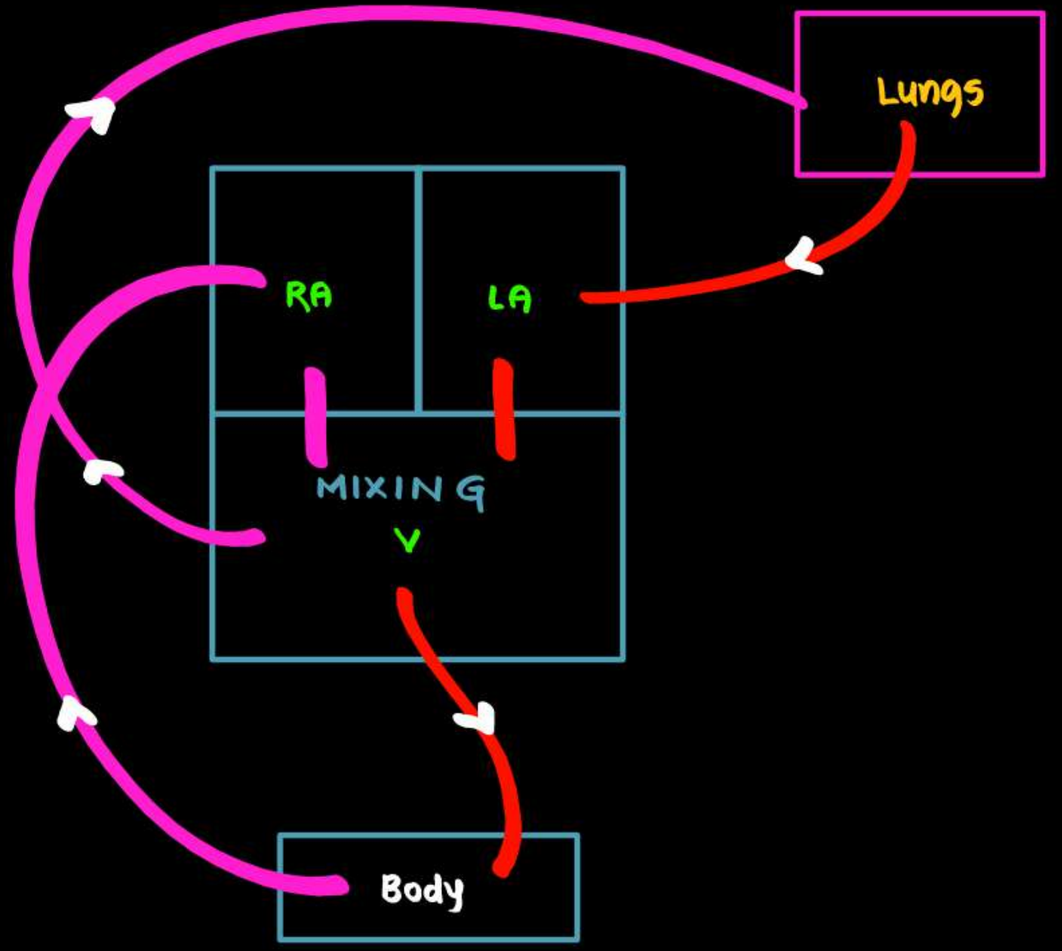
+2 additional Chambers

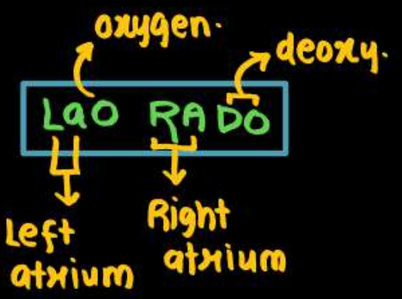
1. Sinus venosus → dorsal
2. Conus arteriosus → ventral

Lymphatic System

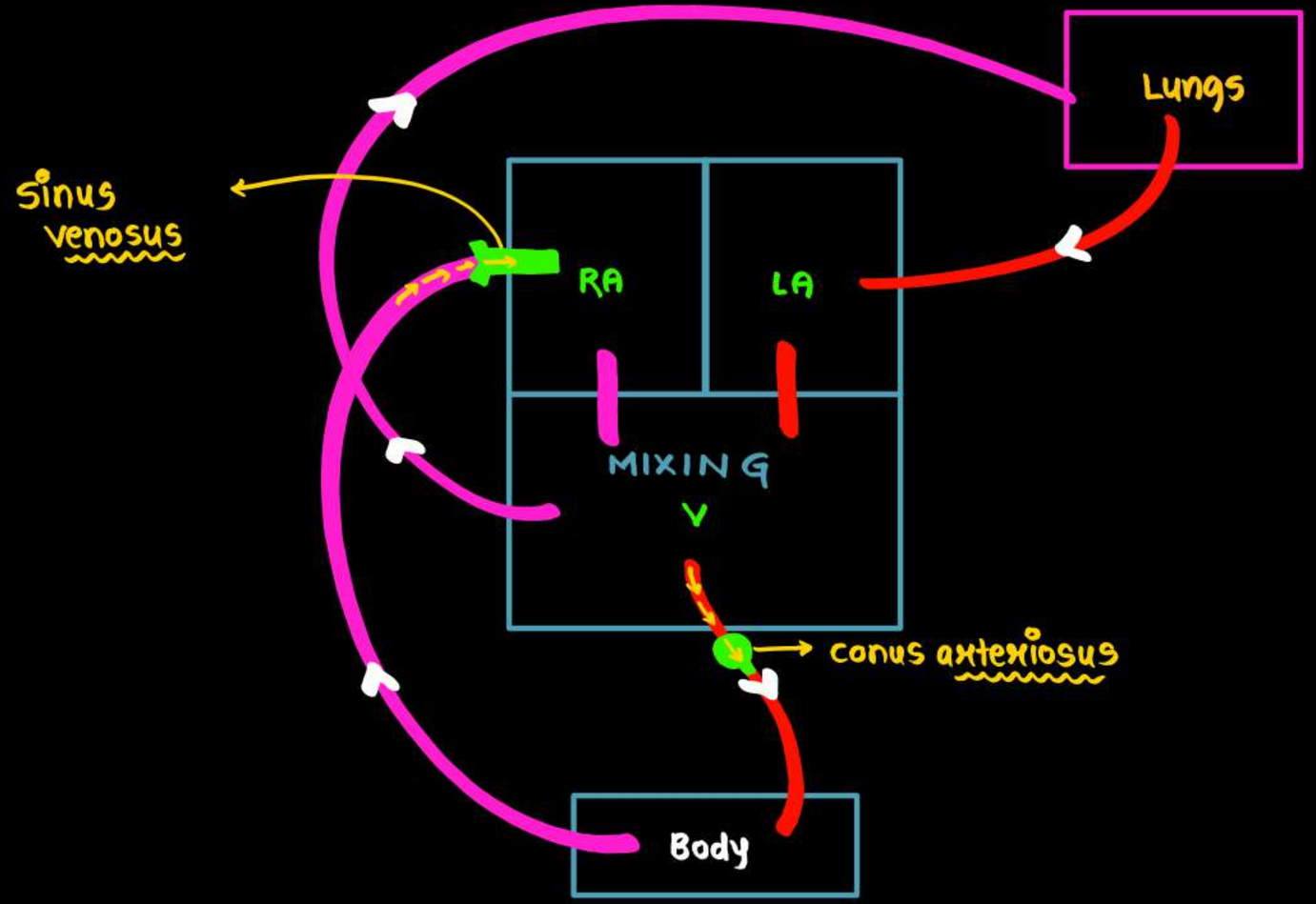
1. Lymph → Blood minus RBCs & large proteins
2. Lymph channels
3. Lymph nodes

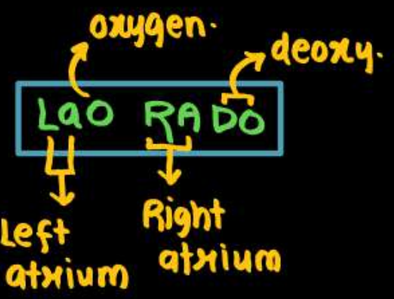
Circulatory System





Circulatory System





Portal Systems

Hepatic Portal System

Livex & intestine के बीच venous connection

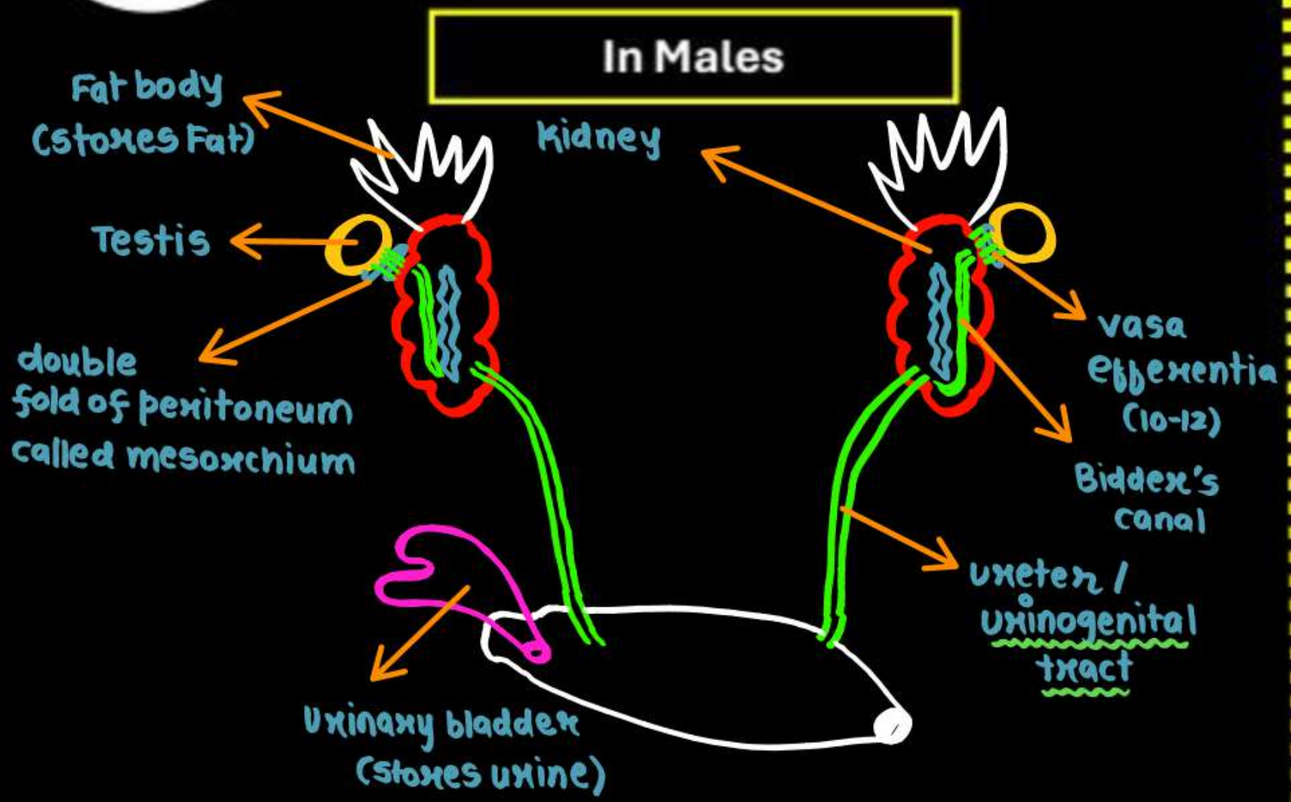
Renal Portal System

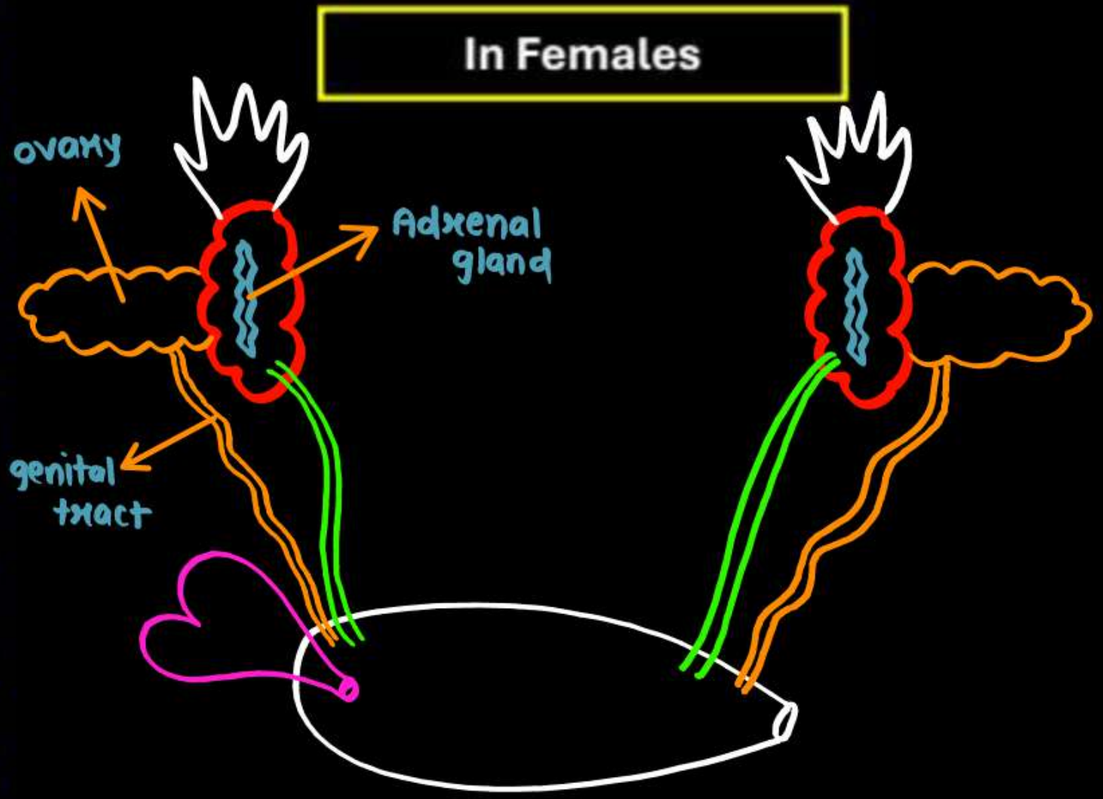
Kidney → For purification → Lower body parts

Excretory System

- **Nitrogenous waste:** Urea ∴ Ureotelic
- **Includes:** Kidneys, ureter, urinary bladder & Cloaca
- **Structural and Functional Unit is:** Nephron/ uriniferous Tubule

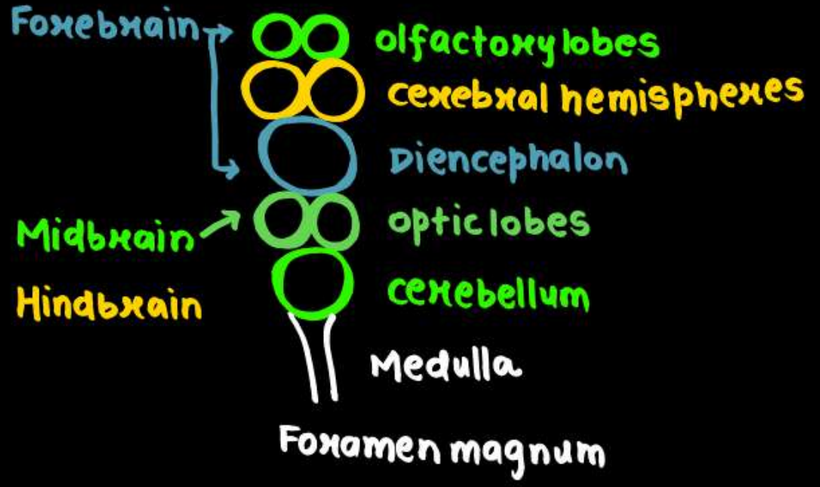
Excretory System





Control and Coordination

- Endocrine control
  - Pituitary gland
  - Thyroid gland
  - Adrenal gland
  - Pancreas
  - Testes
  - ovary
- Neural control
  - Central Nervous System (CNS)
    - Brain + Spinal cord



  - Peripheral nervous System (PNS)
    - Cranial nerve to pair
    - Spinal nerve to pair

Sense Organs

- **Sensory papillae:** for touch
- **Taste Buds:** for Taste
- **Nasal epithelium:** for Smell

others are cellular aggregations around nerve endings

- **Eyes:** for Vision

Most well developed

- **Tympanum and Inner Ear:** for Hearing and Balance (equilibrium)

Reproductive Systems

In Males

Sperm का Path

Testis → 10-12 vasa efferentia → Bidders canal → Urinogenital tract → Cloaca

In Females

ova का path:

ovary → genital tract → Cloaca (2000-3000 'ova' Release)

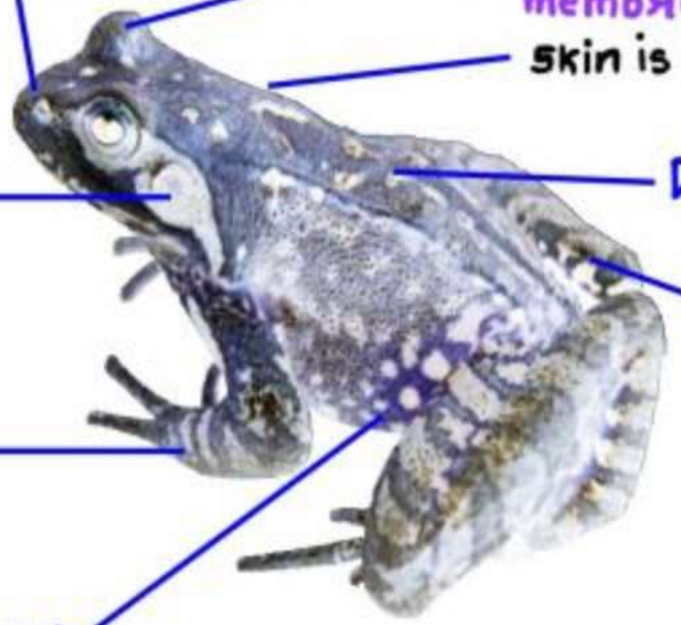
Sperms → Cloaca (2000-3000 'ova' Release)

Cloaca (2000-3000 'ova' Release) → External fertilisation (in water) → Tadpole larva → Metamorphosis → Adult frog

Frog (Amphibian)

- Can live on Land + Fresh H_2O; Chordate; Most common - Rana
- Poikilotherms; do camouflage; show aestivation & Hibernation

→ Body = Head + Trunk (neck & Tail ⊖nt)



Respiration in Frog

- In H_2O: Skin (Cutaneous) - by diffusion
- During aestivation & Hibernation: Skin
- At land: Skin + lungs + buccal cavity
  - lungs → Pink coloured sacs in upper thorax
  - buccal cavity → buccopharyngeal

Circulation in Frog

Closed type (advanced)

- Blood vascular + Lamphatic system
  - Heart + vessels + blood
  - Lymph + Channels + nodes

Heart = 3 chambered (2A + 1V) - surrounded by pericardium

- Dorsal side has triangular sinus venosus conn. to RA
  ∴ deox. blood → vena cava → Sinus venosus → RA
- Ventral side has sac like conus arteriosus conn. to ventricle ∴ ox. blood → ventricle → conus arteriosus → Body (mix.)

Circulation in Frog

LAO RADO

- Portal system: special venous system
  - Hepatic portal: b/w intestine & liver
  - Renal portal: b/w lower body parts & kidney
- Blood contains RBC + WBC + Platelets
  - nucleated
- Lymph: Blood minus RBC & some large proteins

Digestion in Frog

- Alimentary canal short :: carnivores
- Digestive system = Al. canal + glands

Bilobed tongue captures food

↓

Mouth → Buccal cavity

↓

Pharynx

↓

Short oesophagus

↓

Stomach → make HCl & gastric juice

↓

Duodenum

↓

Rectum

↓

Cloaca → Send out fecal matter, urine & gametes

Liver make bile

Gall Bladder Stores bile

Pancreas

Common bile duct

Digestion complete; has microvilli

Excretion in Frog

- Ureotelic: excretes urea
- System: Kidneys(2) + ureters + urinary bladder + cloaca
- Kidney: compact dark red, bean shaped; situated post. to body cavity on both sides of vert. column
- Unit: Nephrons/ uniferous tubules
- Ureter emerge from each kidney

in ♂ → carry urine + Sperms ∴ urinogenital

in ♀ → carry only urine

- Urinary bladder (thin) is present ventral to rectum that opens through cloaca

Control in Frog

Chemical (endocrine)
- Pituitary, thyroid, para-thyroid, thymus, pineal body, pancreatic islets, adrenal, gonads etc.

Neural
- Autonomic nervous system: Sympathetic and Parasympathetic
  - (Fight, Flight)
  - (Eat, sleep)
- Peripheral nervous system: Cranial nerves + Spinal nerves
  - (10 pairs)
  - (10 pairs)

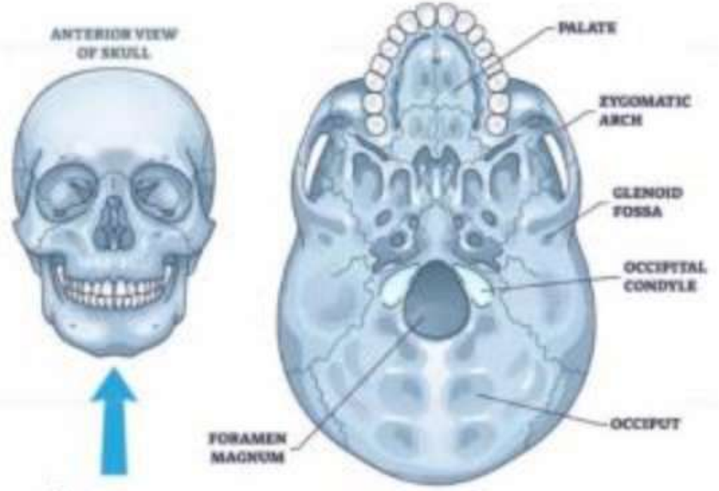
Central N.S: Brain + spinal cord
- enclosed in cranium
- enclosed in vertebral column

FORE
- olfactory lobes
- cerebral Hemispheres
- Diencephalon

MID
- Optic lobes

HIND
- Cerebellum
- Medulla oblongata

Pass through foramen magnum to continue into spinal cord



Sense Organs in Frog

- For touch: Sensory papilla
- For taste: Taste buds
- For smell: Olfactory epithelium

→ Cellular aggregation around nerve endings

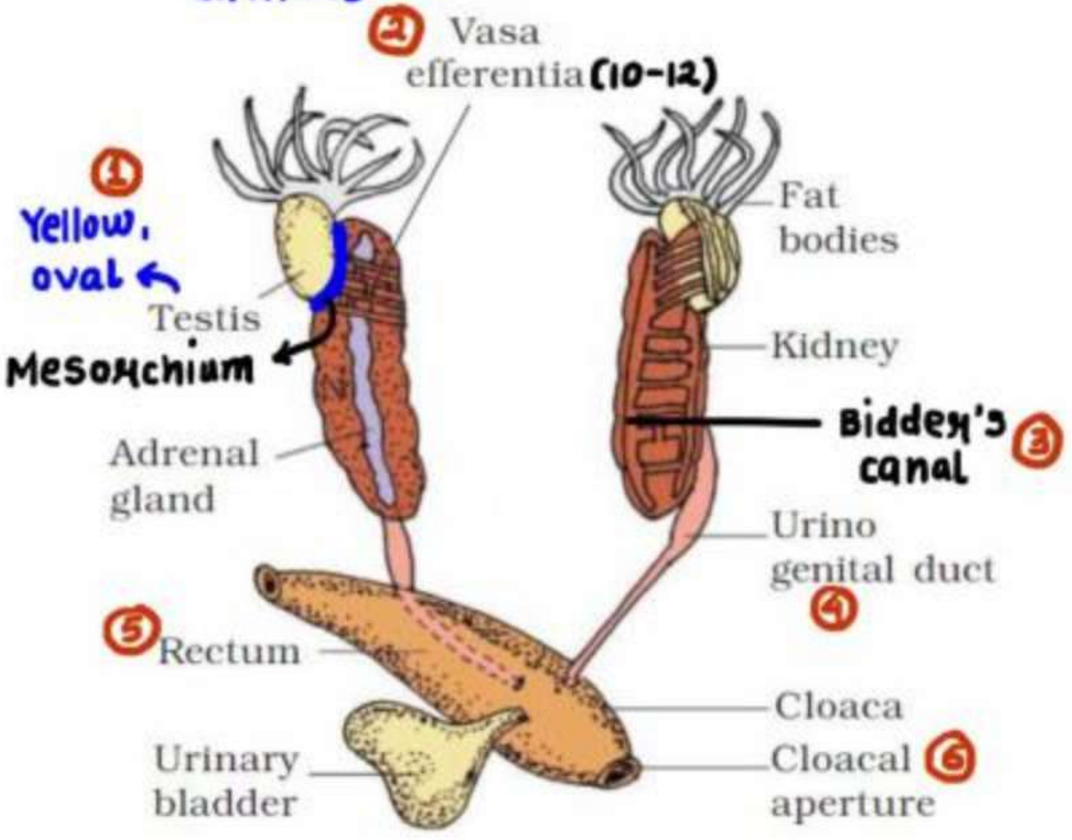
- For hearing & balance: tympanum with internal ear (ext. ear ⊖ nt)
- For vision: Simple eyes (present in orbit) → well developed

Economic Importance

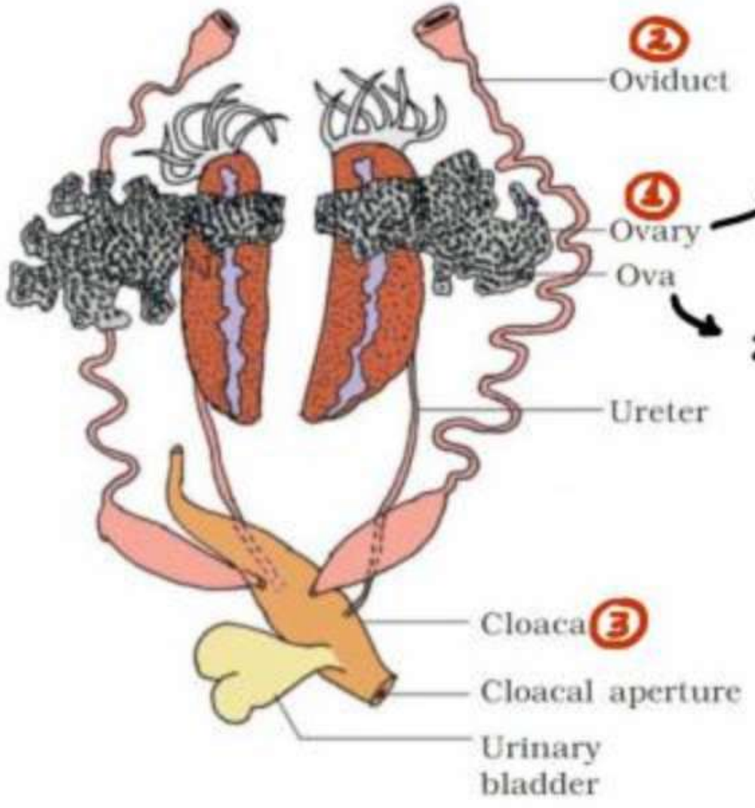
- Eat insects & protect crops
- Part of food cycle
- Muscular legs can be eaten ∴ Food

Reproduction in Frog

In males



In females



→ No funct. conn. with kidneys

2500-3000

Ext. fertilisation

↓

Tadpole Larva

↓ Metamorphosis

Adult

QUESTION (NEET PYQ EXAM 2017)

Select the **correct** route for the passage of sperms in male frogs; **(2017-Delhi)**

(1) Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca

(2) Testes → Vasa efferentia → Kidney → Seminal Vesicle → Urinogenital duct → Cloaca

(3) Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca

(4) Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca

QUESTION (NEET PYQ EXAM 2017)

Frog's heart when taken out of the body continues to beat for sometime. **(2017)**

Select the **best** option from the following statements.

(a) Frog is a poikilotherm.

(b) Frog does not have any coronary circulation.

(c) Heart is "myogenic" in nature:

(d) Heart is autoexcitable.

(1) (a) and (b)
(2) (c) and (d)
(3) Only (c)
(4) Only (d)

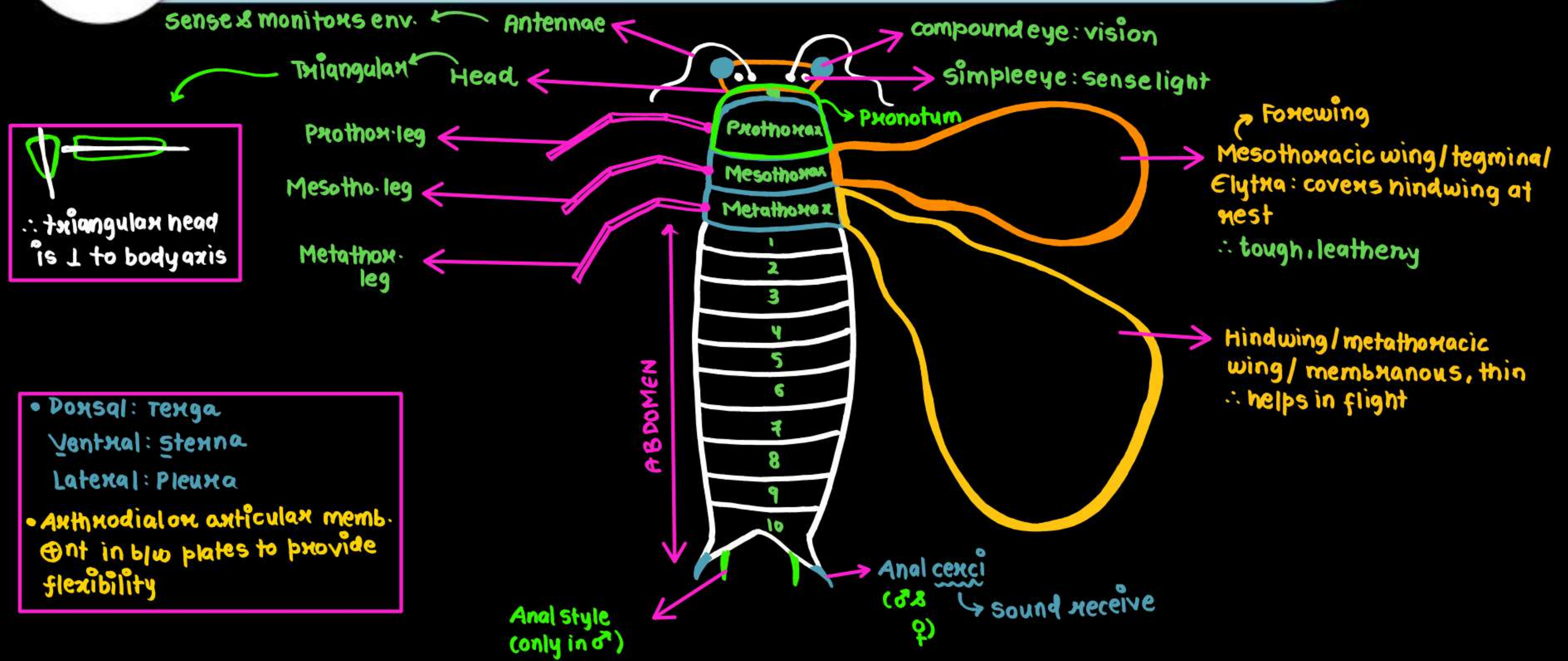
Cockroach

- **Kingdom:** Animalia
- **Phylum:** Arthropoda (Joint; Biggest phylum; appendages)
- **Class:** Insecta (Biggest class) → 3-pair of legs; Chitinous exoskeletal
- **Genus:** *Periplanata*
- **Species:** *americana*

- **Usual colour:** dark brown to black
- **Other colours:** yellow, green & red
- **Usual size:** ¼-3" or 0.6-7.6cm
- **Size of Adult Periplanata:** 34mm to 53mm
- **Found in regions:** Tropical
- **Usual features:** Omnivore, nocturnal (night), cursorial (Fast runner)
  (Herbi + carni)
- **Economic importance:** no importance

- **segmentation:** Head
  Thorax
  Abdomen

Morphology


Sense & monitors env.
Antennae
Triangular
Head
compound eye: vision
simple eye: sense light
Pronotum
Prothorax
Mesothorax
Metathorax
Prothor. leg
Mesotho. leg
Metathor. leg
Forewing
Mesothoracic wing / tegminal
Elytra: covers hindwing at rest
∴ tough, leathery
Hindwing / metathoracic wing / membranous, thin
∴ helps in flight
ABDOMEN
1
2
3
4
5
6
7
8
9
10
Anal cerci (♂ & ♀)
Sound receive
Anal style (only in ♂)
∴ triangular head is ⊥ to body axis
• Dorsal: Terga
Ventral: Sterna
Lateral: Pleura
• Arthrodial or articular memb. present in b/w plates to provide flexibility

Morphology

- **Head shape:** Triangular & it is ⊕nt perpendicular to body axis

- **Segmentation:** Head + thorax + abdomen

	Head	Thorax	Abdomen
Segment number in Embryonic Stage (20)	6	3	11
In Adults (14)	1	3	10

Mouth Parts

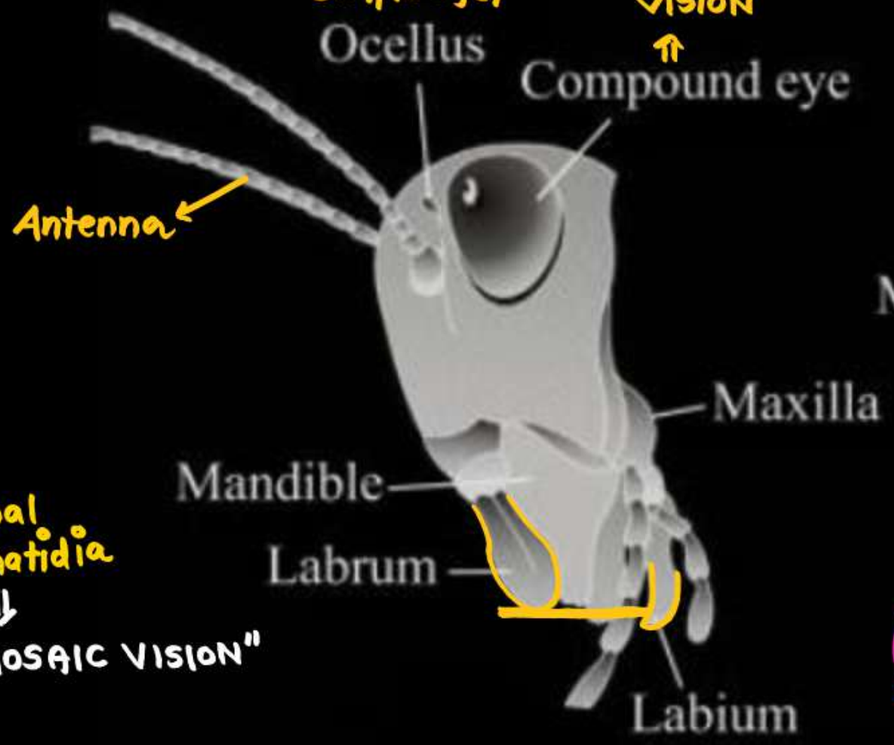
Biting & chewing type

Light sensit

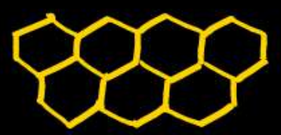
⇑

Simple eye/ Ocellus

VISION ⇑ Compound eye



Compound eye

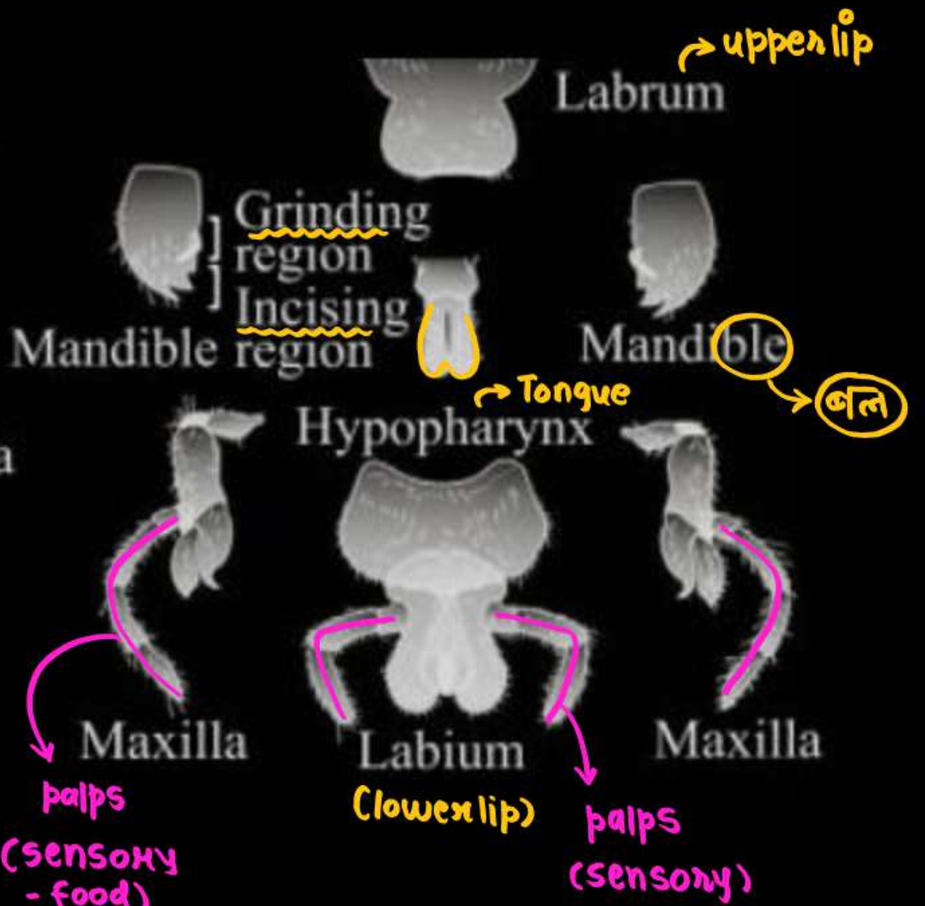


2000 hexagonal units K/a ommatidia

⇓

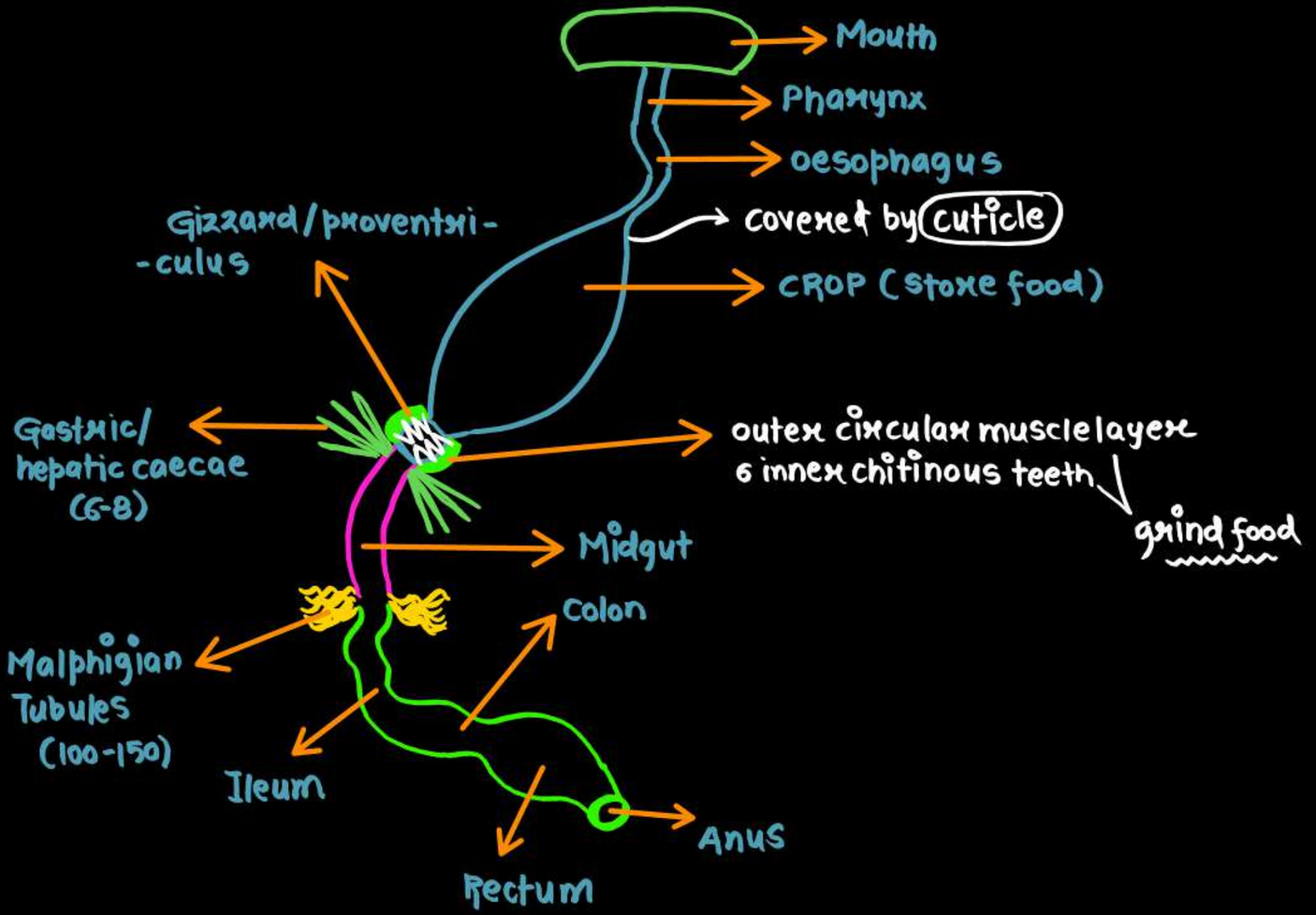
"MOSAIC VISION"

- ↑ sensitivity
- ↓ resolution



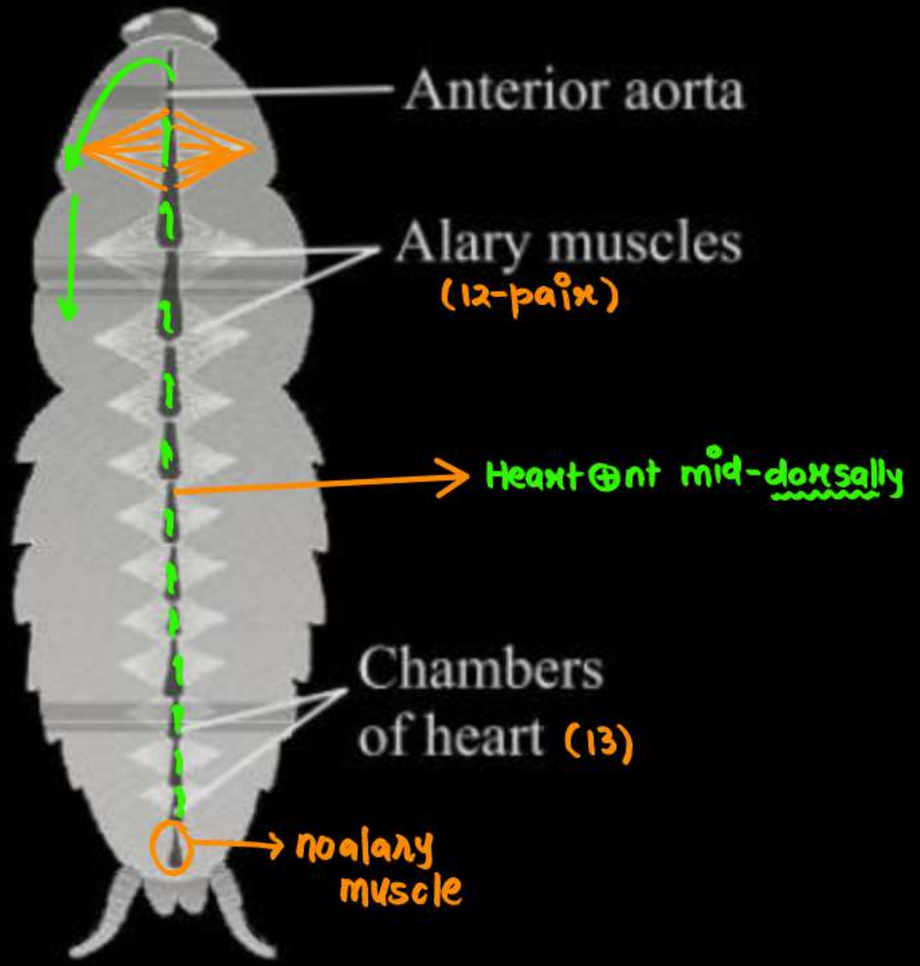
Digestive System

The alimentary canal present in the body cavity is divided into three regions: foregut, midgut and hindgut (Figure 7.16). The mouth opens into a short tubular pharynx, leading to a narrow tubular passage called oesophagus. This in turn opens into a sac like structure called crop used for storing of food. 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. A ring of 6-8 blind tubules called hepatic or gastric caeca is present at the junction of foregut and midgut, which secrete digestive juice. 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. The hindgut is broader than midgut and is differentiated into ileum, colon and rectum. The rectum opens out through anus.



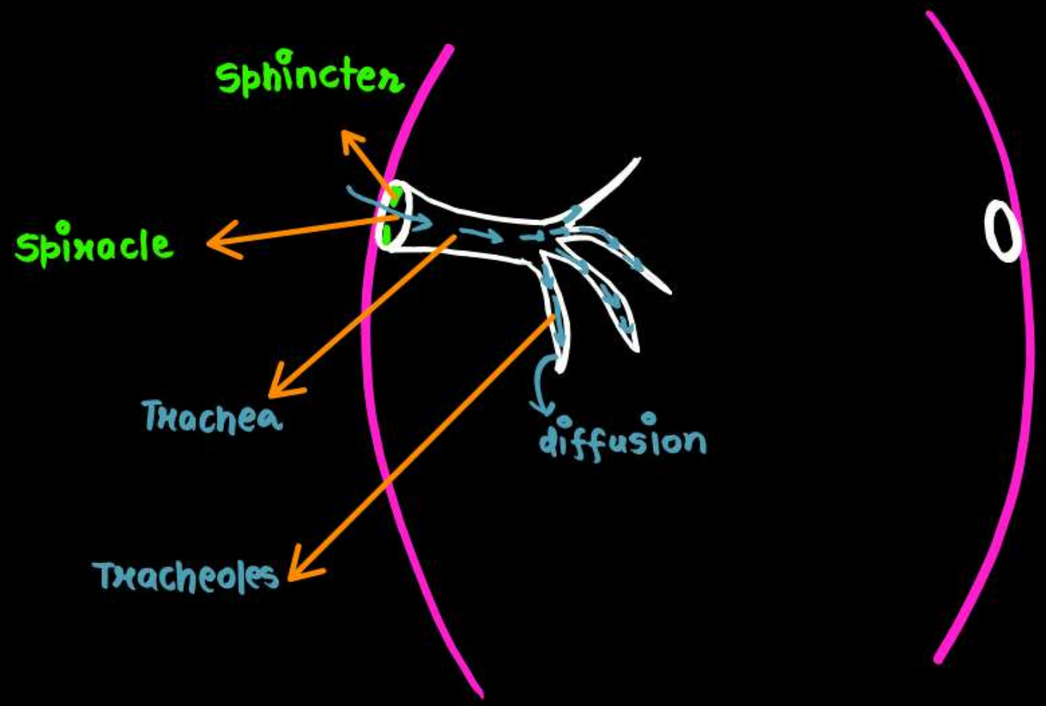
Circulatory System

- Heart → 13-chambered
- blood / Haemolymph (Colourless)
  ⇩
  Flows in haemocoel (open circulation)



Respiratory System

10 pair of spiracles + Trachea + Tracheoles



Excretory System

Excretion is performed by Malpighian tubules (main). 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.

nephrocytes → nephron

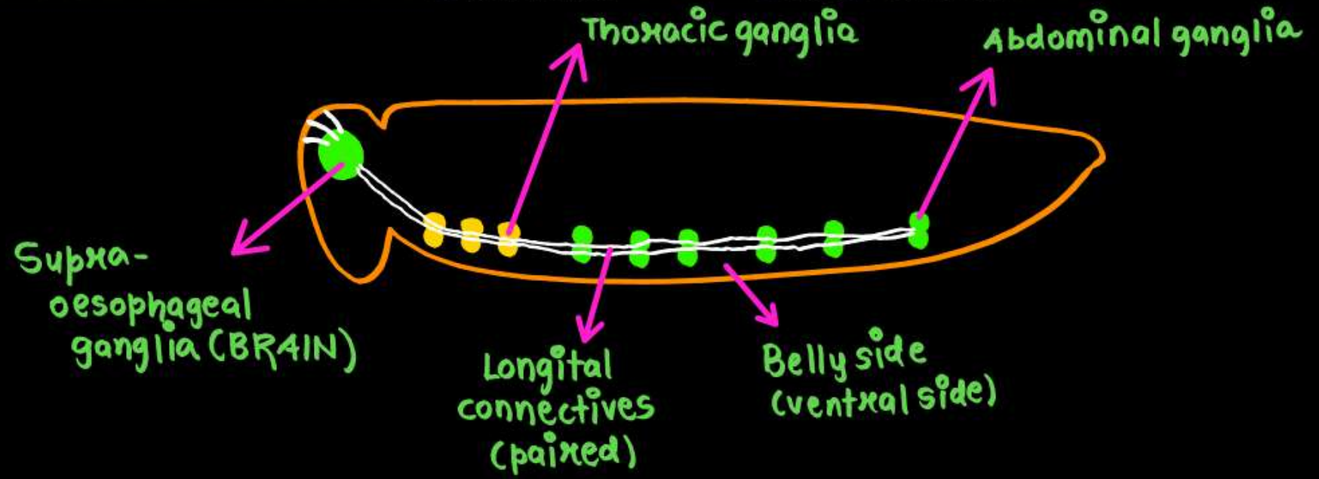
urecose → only in ♂

Malphigian Tubule
↓
Ileum
↓
Colon
↓
Rectum
↓
Anus

Ileum ↔ Rectum: Hindgut

Nervous System

The nervous system of cockroach consists of a series of fused, segmentally arranged ganglia joined by paired longitudinal connectives on the ventral side. Three ganglia lie in the thorax, and six in the abdomen. The nervous system of cockroach is spread throughout the body. The head holds a bit of a nervous system while the rest is situated along the ventral (belly-side) part of its body. So, now you understand that if the head of a cockroach is cut off, it will still live for as long as one week. In the head region, the brain is represented by supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.



Sense Organs

- **Simple eyes:** light
- **Compound eyes:** vision
- **Antennae:** monitor environment
- **Labial and Maxillary palps:** food intake
- **Anal Styles:** touch
  (♂)
- **Anal Cerci:** sound

Reproductive System

→ well developed!

- **Sexual Dimorphism:**

Male	Female
• Anal styles/caudal Styles ⊕nt	• Absent
• Wings extends beyond the tip of abdomen	• Wings are small

Male

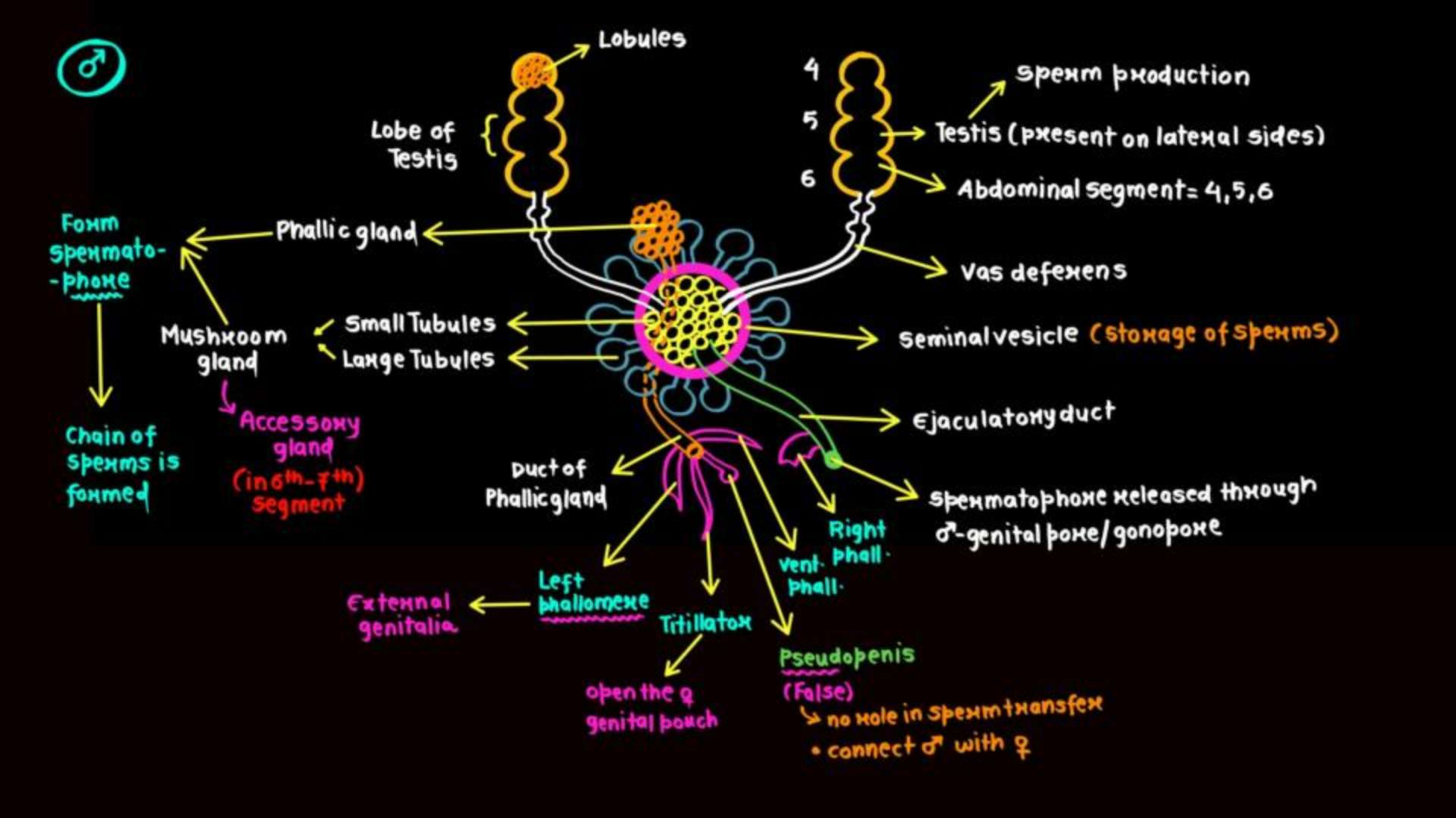
Mushroom-phall
- Mushroom/ Urecose gland
- Phallic gland
- Phallomere (♂ gonapophysis)
  - Left phallomere
  - Right phall.
  - Ventral phall.
  - → Assymetric Chitinous str.

- 8th 9th 10th
- 7th 8th 9th

Female

Female
- Fecol - Thick
  - Collateral glands
  - Theca
    - Sperma-theca (stores sperms)
    - ootheca

- 8th 9th 10th
  - → Anus open dorsally
  - → Sex-organs opens ventrally
- 7th sterna (Boat shaped) + 8th-9th sterna → Genital/Brood pouch


♂
Lobules
Lobe of Testis
4
5
6
Sperm production
Testis (present on lateral sides)
Abdominal segment = 4,5,6
Phallic gland
Form Spermato-phore
Vas deferens
Small Tubules
Large Tubules
Mushroom gland
Seminal vesicle (storage of sperms)
Chain of sperms is formed
Accessory gland (in 6th-7th) segment
Ejaculatory duct
Duct of Phallic gland
Spermatophore released through ♂-genital pore/gonopore
Right phall.
Vent. phall.
Left phallomere
External genitalia
Titillator
Pseudopenis (False)
open the ♀ genital pouch
no role in sperm transfer
• connect ♂ with ♀

♀

2-6th abdominal segment

ovary (present laterally)

ovarioles (8)

Size of ovary > Testis

oviduct

common oviduct (vagina)

Genital chamber

vestibulum

Genital pouch

Colleterial glands (branched)

Helps in formation of ootheca

Pair of Spermatheca (stores sperm) (6th segment)

ootheca

14-16 ova

darkened, brown, black

$\frac{3}{8}$" = 0·8mm

Fertilised eggs are dropped at safe place through ♀-gonopore

- 14-16 ova in one ootheca
- 9-10 ootheca produced by ♀ in lifetime
- Total eggs in lifetime of ♀

126-160 ova

Reproductive System

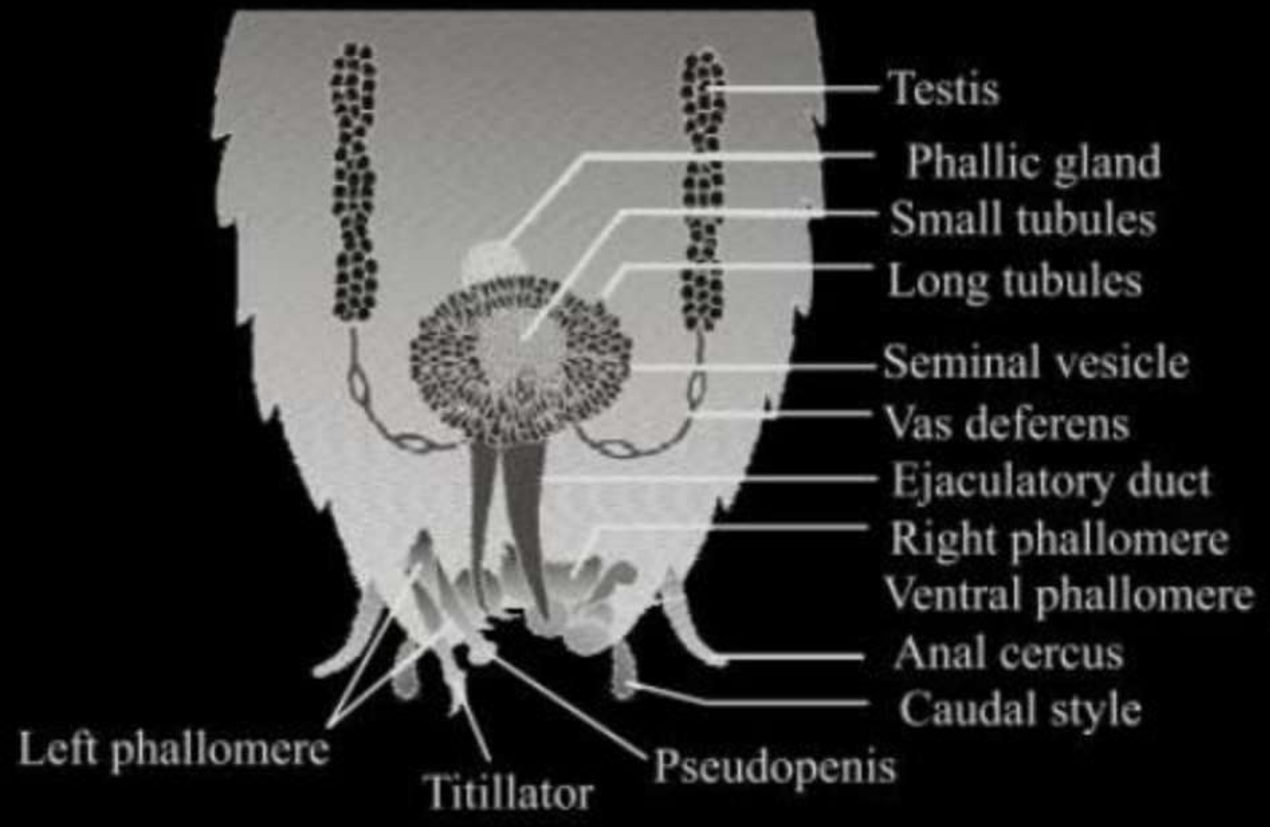
- Development in cockroach: **Paurometabolous**
- Fertilisation is internal
- Development is Direct (no larva)

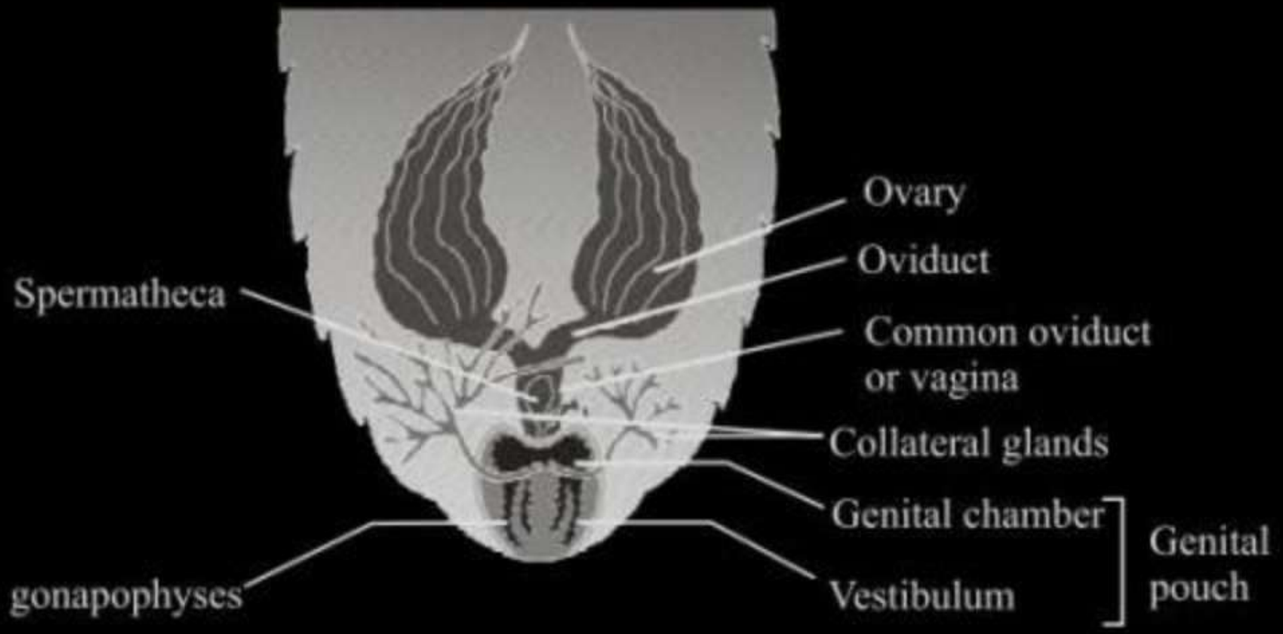
No larva but nymphal stages are ⊕nt

Shedding of skin

Total (13) moultings are needed to make adult

Reproductive System



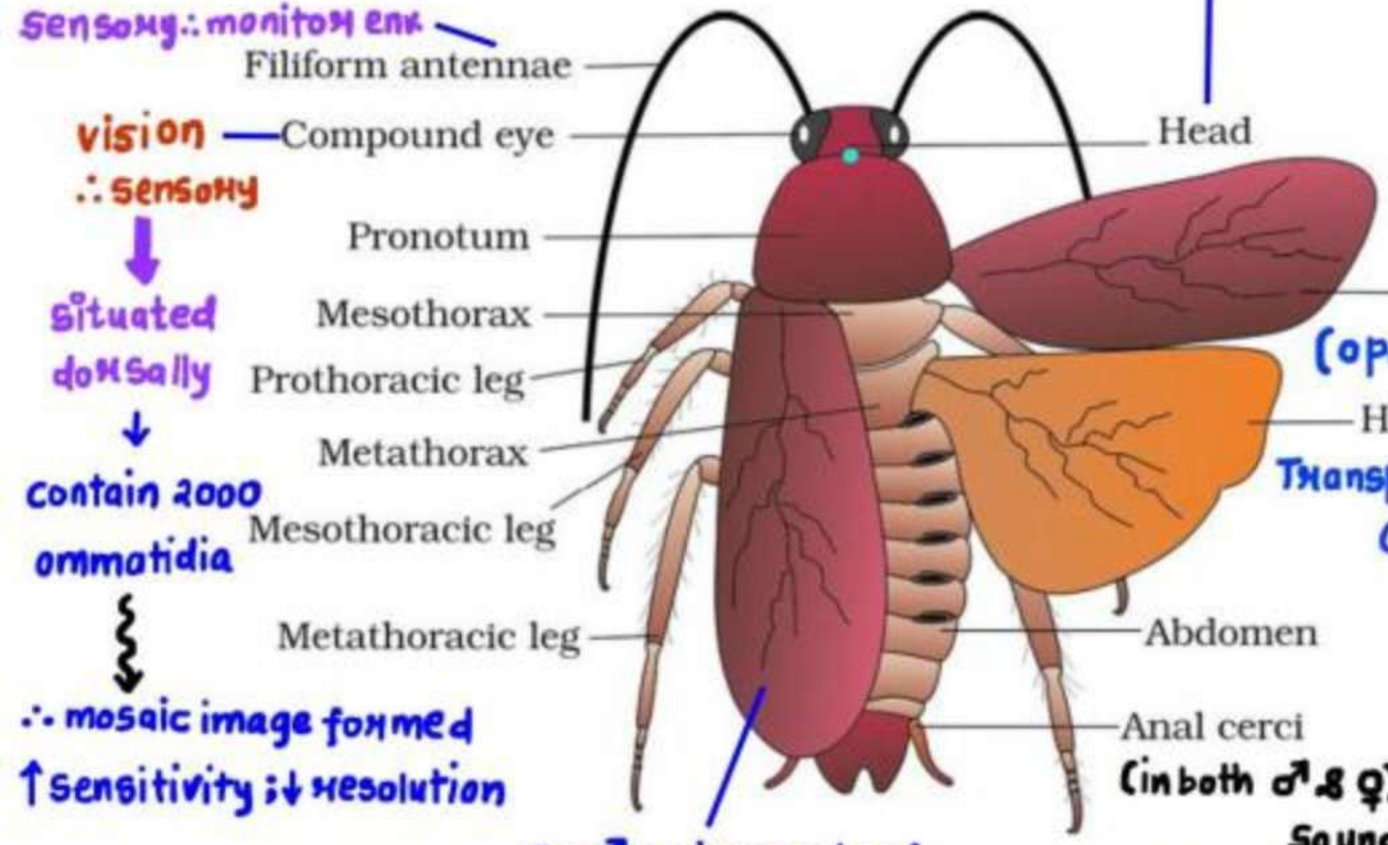


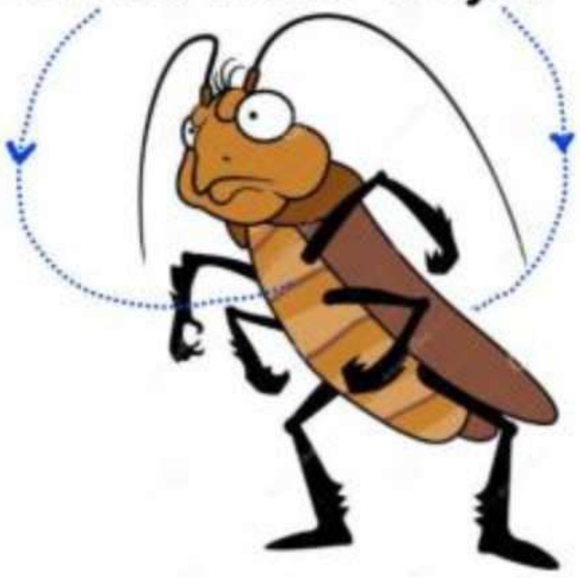
Cockroach (Arthropod)

- Periplanata americana
  - ↳ usually brown to black
  - Tropical regions: yellow, red, green
- Size: 1/4-3" or 0.6-7.6 cm
- Adult Periplanata: 34-53mm
- They are nocturnal omnivores

- Show great mobility due to flexible neck
- Neck is extention of prothorax

- Chitinous exoskeletal present
- Body = Head + Thorax + Abdomen
  - (Solo) (3-segm.) (10 segm.)
  - ↳ formed by fusion of 6-embryonic segments; triangular, lie perpendicular to longitud. body
- Exoskeletal has hard plates called sclerites
  - ventral- Sternite; Dorsal- Tergite

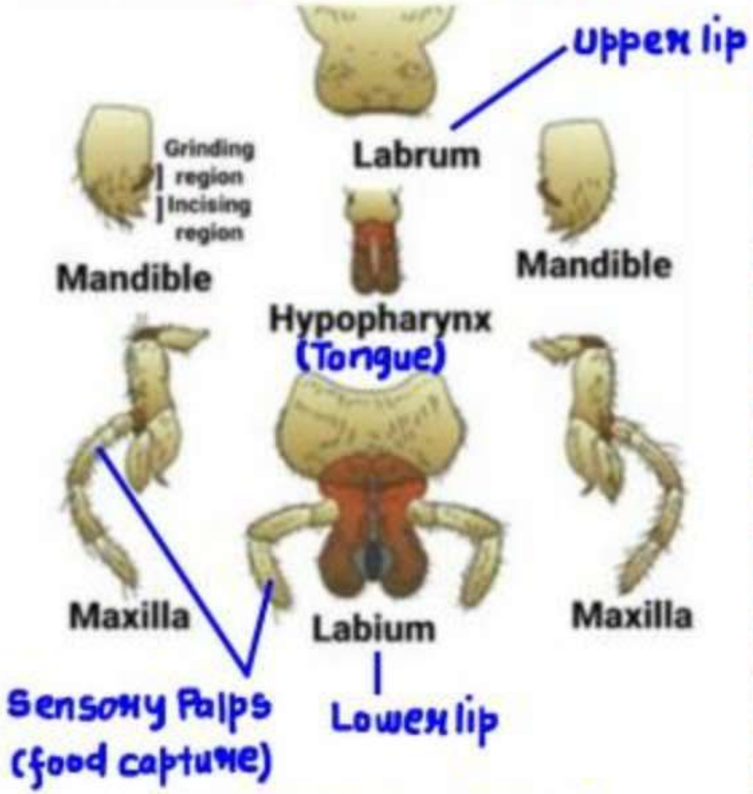




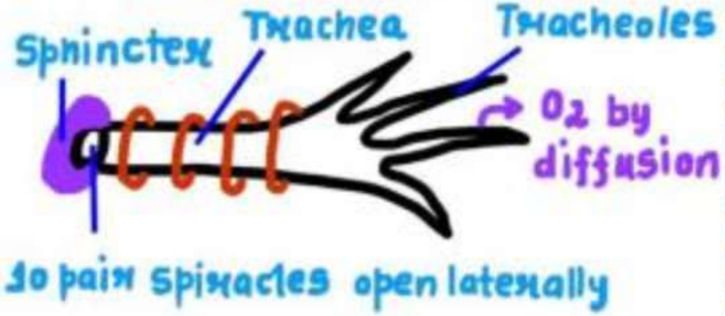
- These plates are conn. to each other by thin, flexible articular/arthrodial membrane

Mouth Parts

- Biting & chewing type

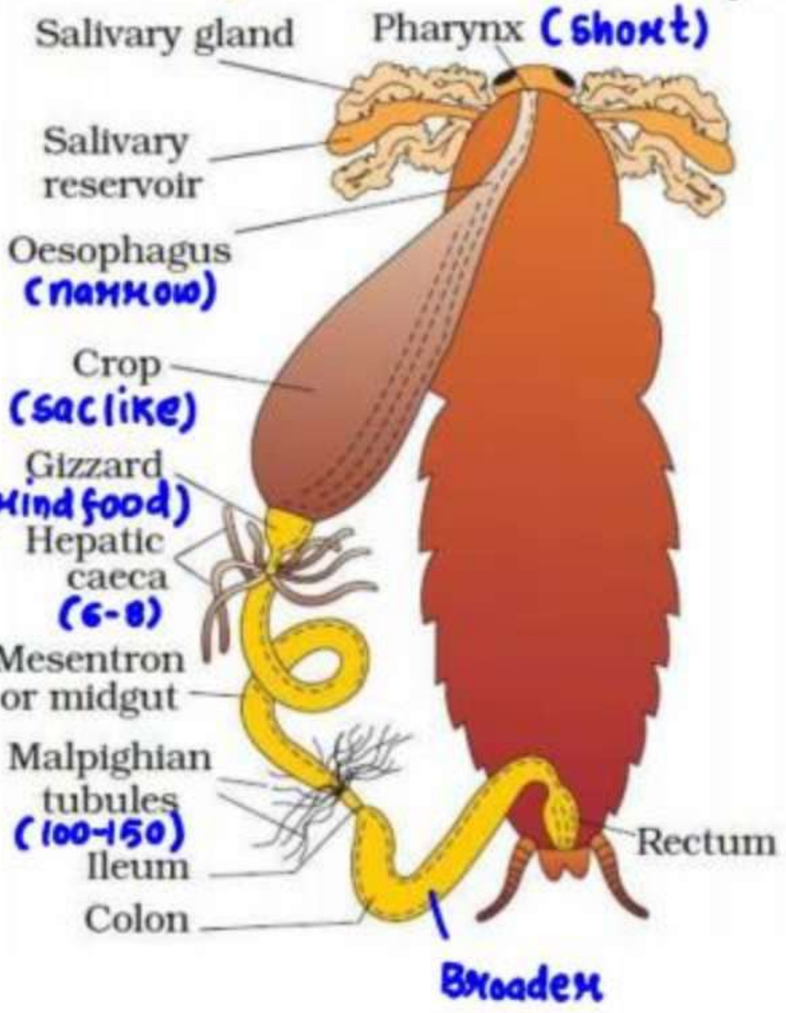


Respiration



Digestive System

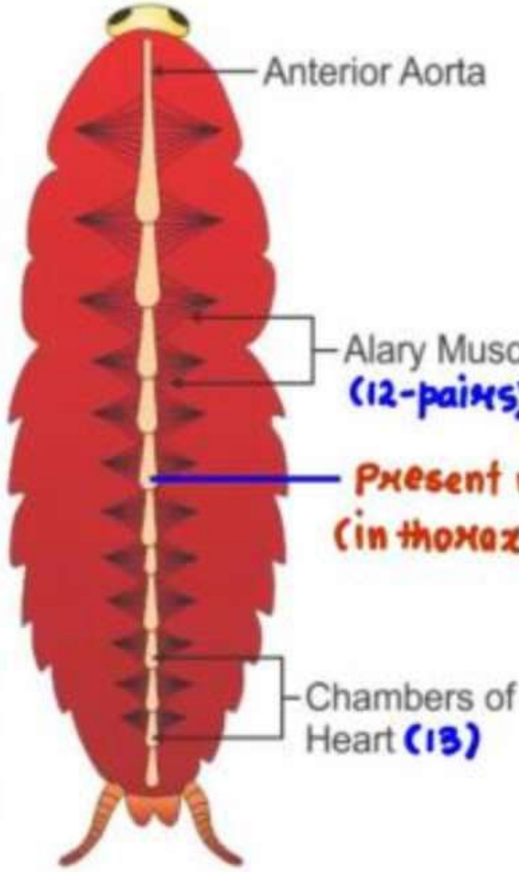
- Alimentary canal: Fore, mid, Hindgut



Crop: stores food; Gizzard/proventriculus has outer thick circular muscle layer and 6 inner chitinous teeth for grinding of food

Circulatory System

- Open type; haemolymph flow openly in haemocoel → Plasma + haemocytes (colourless)



Excretion

- Mainly by Malphigean Tubules
- They are lined by ciliated & glandular cells that convert N-waste to uric acid & send it to hindgut

∴ Uricotelic

- Other excretory structures

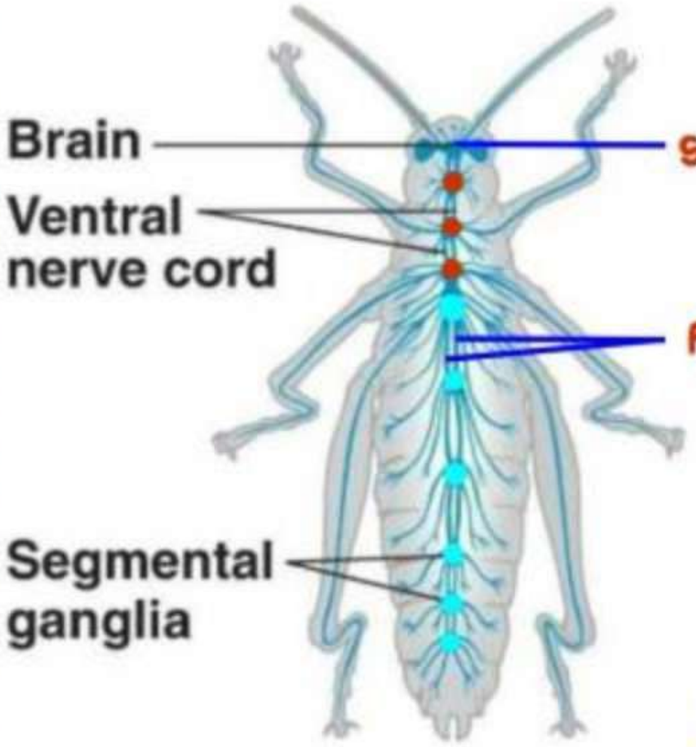
1. Fat bodies
2. Nephrocytes
3. Mushroom (urecose glands) - in ♂

Nervous System

- Consists of series of fused, segmentally arranged ganglia joined by paired longitudinal connectives on ventral side.

∴ Double, solid, ventral nerve cord

- Spread throughout body = 3 in thorax and 6 in abdomen



Supra-oesophageal ganglion
↳ Send nerves to eyes & antenna

Paired longitudinal connectives

Dimorphism

♂	♀
• Anal styles present • Wings extend beyond the tip of abdomen	• Absent • Wings small

Mushroom - Phall

↳ Mushroom/urecose gland

↳ Phallic gland
- Phallomeres
  - ↳ Left
  - Right
  - Ventral

∴ Assymetric

Fecol - Thick

♀ ↳ Colleterial gland

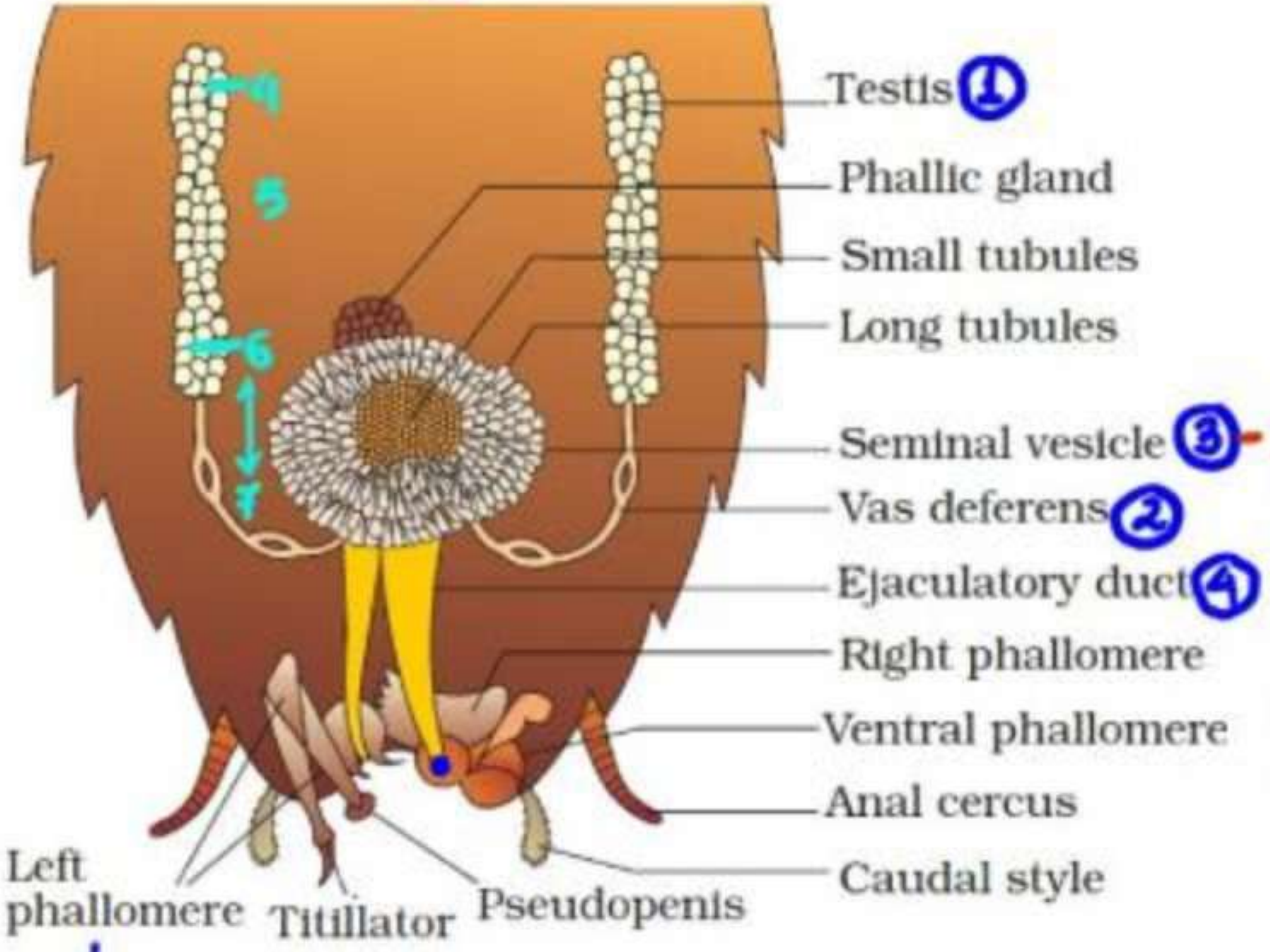
↳ Spermatheca
Ootheca

7th 8th 9th 10th

Blood/genital pouch ↳ 7th sterna - boat shaped + 8th + 9th

Reproductive System – dioecious / well developed

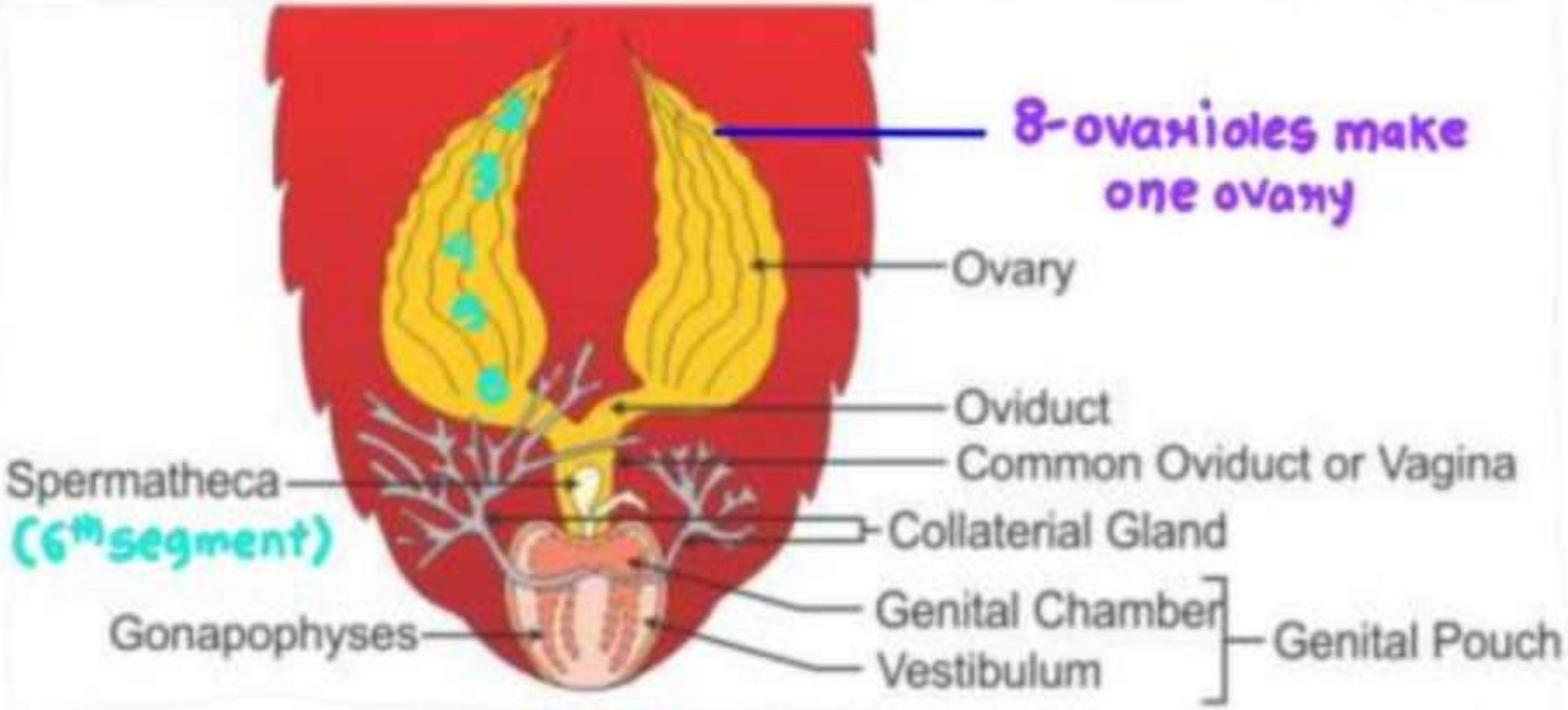
♂



③ - Store sperms & stick them → Spermatophore

Left phallomere ↓ Chitinous str. surrounding ♂-gonopore

♀



8-ovarioles make one ovary

ootheca: dark reddish to black brown capsule
↳ 3/8" or 8 mm → laid at proper place & contain 14-16 eggs

- Development is Paurometabolous: i.e., through nymphal stages
- 13-moultings to be done
- 2nd last nymph has wing pads but only adults have wings.

Economical Importance

- No ecological importance
- contaminate food: spread disease

QUESTION (NEET PYQ EXAM 2024)

In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on

(1) 5^{th} segment

(2) 10^{th} segment ✓

(3) 8^{th} and 9^{th} segment

(4) 11^{th} segment

QUESTION (NEET PYQ EXAM 2024)

Match List I with List II related to digestive system of cockroach.

	List I		List II
A.	The structures used for storing of food	I.	Gizzard
B.	Ring of 6-8 blind tubules at junction of foregut and midgut.	II.	Gastric Caeca
C.	Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut.	III.	Malpighian tubules
D.	The structures used for grinding the food.	IV.	Crop

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-III, D-I

(2) A-I, B-II, C-III, D-IV

(3) A-IV, B-III, C-II, D-I

(4) A-III, B-II, C-IV, D-I

QUESTION (NEET PYQ EXAM 2023)

Given below are two statements. **(Manipur 2023)**

Statement-I: In cockroach, the forewings are transparent and prothoracic in origin.

Statement-II: In cockroach, the hind wings are opaque, leathery and mesothoracic in origin.

In the light of the above statements, choose the **correct** answer from the options given below;

(1) **Statement-I** is correct but **Statement-II** is incorrect.

(2) **Statement-I** is incorrect but **Statement-II** is correct.

(3) Both **Statement-I** and **Statement-II** are correct.

(4) Both **Statement-I** and **Statement-II** are incorrect.

QUESTION (NEET PYQ EXAM 2023)

The Cockroach is; **(Manipur 2023)**

(1) Ammonotelic only
(2) Uricotelic only
(3) Ureotelic only
(4) Ureotelic and Uricotelic

QUESTION (NEET PYQ EXAM 2023)

Which of the following is characteristic feature of cockroach regarding sexual dimorphism? (2023)

(1) Presence of anal cerci ✗

(2) Dark brown body colour and anal cerci ✗

(3) Presence of anal styles ✓

(4) Presence of sclerites ✗

QUESTION (NEET PYQ EXAM 2023)

In cockroach, excretion is brought about by; **(2023)**

A. Phallic gland
B. Urecose gland
C. Nephrocytes
D. Fat body
E. Collaterial glands

Choose the **correct** answer from the options given below.

(1) B and D only
(2) A and E only
(3) A, B and E only
(4) B, C and D only

QUESTION (NEET PYQ EXAM 2022)

Excretion in cockroach is performed by all, **except;**

(2022 II)

(1) Hepatic caeca
(2) Urecose glands
(3) Malpighian tubules
(4) Fat body

QUESTION (NEET PYQ EXAM 2022)

Tegmina in cockroach, arises from; (2022)

(1) Prothorax and mesothorax

(2) Prothorax

(3) Mesothorax

(4) Metathorax

QUESTION (NEET PYQ EXAM 2021)

Which of the following characteristics is **incorrect** with respect to cockroach? **(2021)**

(1) Hypopharynx lies within the cavity enclosed by the mouth parts.

(2) In females, 7^{th}-9^{th} sterna together form a genital pouch.

(3) 10^{th} abdominal segment in both sexes, bears a pair of anal cerci.

(4) A ring of gastric caeca is present at the junction of midgut and hind gut.

QUESTION (NEET PYQ EXAM 2020)

If the head of cockroach is removed, it may live for few days because; **(2020)**

(1) The cockroach does not have nervous system.

(2) The head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

(3) The head holds a $1/3^{rd}$ of a nervous system while the rest is situated along the dorsal part of its body.

(4) The supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen.

QUESTION (NEET PYQ EXAM 2020)

In cockroach, identify the parts of the foregut in **correct** sequence; **(2020 Covid)**

(1) Mouth → Crop → Pharynx → Oesophagus → Gizzard

(2) Mouth → Gizzard → Crop → Pharynx → Oesophagus

(3) Mouth → Pharynx → Oesophagus → Crop → Gizzard ✓

(4) Mouth → Oesophagus → Pharynx → Crop → Gizzard

QUESTION (NEET PYQ EXAM 2020)

Match the following list with reference to cockroach and select the **correct** option. **(2020 Covid)**

List-I		List-II	
A.	Grinding of the food particles	P.	Hepatic caecae
B.	Secrete gastric juice	Q.	10^{th} segment
C.	10 pairs	R.	Proventriculus
D.	Anal cerci	S.	Spiracles

	A	B	C	D
(1)	(S)	(R)	(P)	(Q)
(2)	(P)	(S)	(R)	(Q)
(3)	(Q)	(R)	(P)	(S)
(4) ✓	(R)	(P)	(S)	(Q)

Homework

- Revise this Chapter from NCERT or Mindmap
- Participate in DPP Battleground
- Write Tararara or Tunik Tunik in comment section once done!!!!!!
- You can give feedbacks in comments and discuss doubts too!

FOR NOTES & DPP CHECK DESCRIPTION


VIPIN SIR
JOIN MY OFFICIAL TELEGRAM CHANNEL
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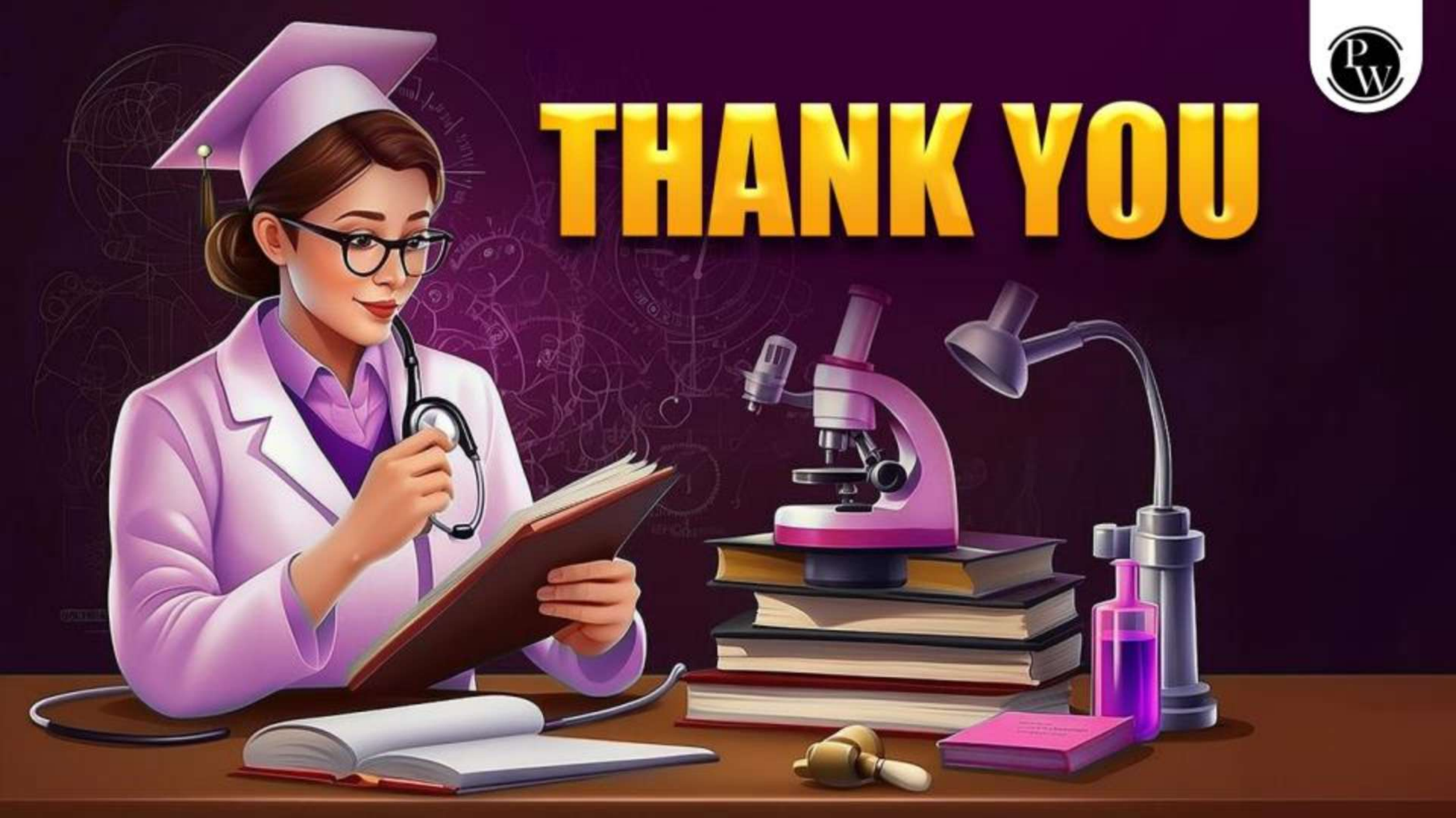
THANK YOU