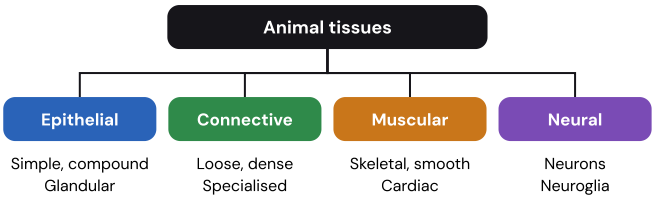
FREE NOTES · NCERT + NEET LEVEL

Structural Organisation in Animals

Animal tissues (epithelial, connective, muscular, neural), cell junctions, and the morphology and anatomy of the frog as a model organism.

01 Animal tissues: overview
02 Epithelial tissue
03 Connective tissue
04 Muscular and neural tissue
05 Frog: morphology
06 Frog: anatomy
07 Extra: more on animal tissues
08 Extra: Cockroach (old syllabus)
09 Important Q&A
10 Common mistakes
11 Practice (NEET style)
12 Quick revision

01 Animal tissues: overview



Four basic animal tissues

A tissue is a group of similar cells with intercellular material performing a specific function. Tissues form organs, organs form organ systems.

02 Epithelial tissue

Type	Shape / feature	Location
Squamous	Flat, single layer	Blood vessel walls, air sacs (alveoli)
Cuboidal	Cube-like; microvilli in PCT	Ducts of glands, kidney tubules
Columnar	Tall; may have microvilli/cilia	Stomach, intestine lining; ciliated: bronchioles, fallopian tubes
Compound	Many layers; protection	Skin, buccal cavity, pharynx, ducts of salivary glands

Glands: unicellular (goblet cells) or multicellular; **exocrine** (with ducts: saliva, milk, mucus) vs **endocrine** (ductless, hormones into blood). **Junctions**: tight (stop leakage), adhering (cementing), gap (cytoplasm connection for ions, molecules).

03 Connective tissue

- Most abundant tissue. Cells secrete collagen/elastin fibres and matrix (except blood).
- **Loose**: areolar (beneath skin; fibroblasts, macrophages, mast cells), adipose (fat storage, below skin).
- **Dense regular**: tendons (muscle–bone), ligaments (bone–bone). **Dense irregular**: skin.
- **Specialised**: cartilage (chondrocytes; tip of nose, outer ear, between vertebrae), bone (osteocytes in lacunae, calcium salts, bone marrow makes blood cells), blood (fluid: plasma, RBC, WBC, platelets).

04 Muscular and neural tissue

Muscle	Look	Control	Location
Skeletal	Striated, multinucleate, cylindrical	Voluntary	Biceps, attached to bones
Smooth	Non-striated, spindle, uninucleate	Involuntary	Gut wall, blood vessels
Cardiac	Striated, branched, intercalated discs	Involuntary	Heart only

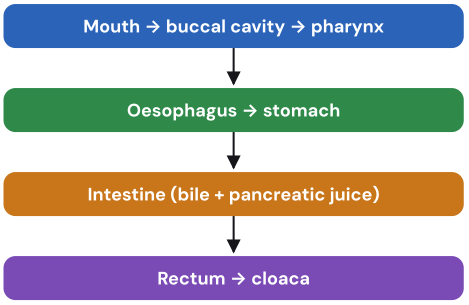
Neural tissue: neurons (excitable units) + **neuroglia** (make up more than half the volume; protect and support neurons).

05 Frog: morphology

- *Rana tigrina*; cold-blooded (poikilotherm), **camouflage** (mimicry of colour), aestivation (summer sleep) and hibernation (winter sleep).
- Skin moist and slimy (mucus); never drinks water, absorbs through skin.
- Body: head + trunk; no neck, no tail. Nictitating membrane protects eyes in water; tympanum receives sound.
- Forelimbs 4 digits, hind limbs 5 webbed digits. Male: vocal sacs and copulatory pad on first digit of forelimb.

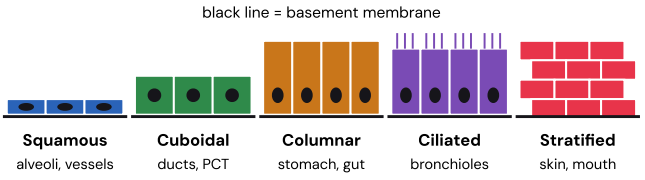
06 Frog: anatomy

- **Digestive**: short gut (carnivore), bilobed tongue; liver secretes bile stored in gall bladder; food digested in stomach and intestine; villi absorb.
- **Respiration**: skin (cutaneous, in water and during hibernation) and lungs (pulmonary, on land) and buccal cavity.
- **Circulation**: closed; 3-chambered heart (2 atria, 1 ventricle), sinus venosus, conus arteriosus; hepatic and renal portal systems. Lymph system present.
- **Excretion**: kidneys, ureters, cloaca; **ureotelic** (urea). In male, ureter = urinogenital duct.
- **Nervous**: 10 pairs cranial nerves; brain in cranium. Sense organs: eyes, tympanum (ears), nose, taste buds.
- **Reproduction**: external fertilisation in water; tadpole larva → metamorphosis.



Path of food in frog

07 Extra: more on animal tissues

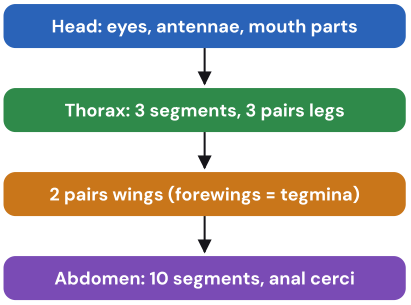


Types of simple and compound epithelium

- **Pseudostratified**: one layer but looks layered (trachea). **Transitional**: stretchable, urinary bladder and ureter. **Keratinised** stratified: skin; non-keratinised: buccal cavity, vagina.
- Glands by mode of secretion: **merocrine** (only secretion: salivary, sweat), **apocrine** (tip of cell lost: mammary), **holocrine** (whole cell: sebaceous).
- Junctions: tight (no leakage), gap (exchange), **desmosomes** (cell–cell anchor), **hemidesmosomes** (cell–basement membrane).
- Bone: Haversian canals (longitudinal) linked by Volkmann's canals; osteocytes in lacunae; red marrow (RBC formation), yellow marrow (fat).
- Neuroglia: astrocytes (blood–brain barrier), oligodendrocytes (CNS myelin), microglia (phagocytes), ependymal cells (line ventricles, CSF).
- Fat: white (stores fat, adults) vs **brown** (many mitochondria, heat: newborns, hibernating animals).

08 Extra: Cockroach (old syllabus)

- *Periplaneta americana*; nocturnal omnivore; body covered by chitinous exoskeleton with sclerites (tergites dorsal, sternites ventral).
- Digestive: mouth → pharynx → oesophagus → **crop** (storage) → **gizzard** (proventriculus, 6 chitinous teeth, grinding) → midgut with 6–8 **hepatic caecae** → hindgut (ileum, colon, rectum). **Malpighian tubules** (100–150) at junction of mid and hindgut: excretion (uricotelic).
- Circulation: open; 13-chambered tubular heart; haemolymph colourless.
- Respiration: 10 pairs of spiracles → tracheae.
- Nervous: ganglia; brain in head; most nervous system in ventral nerve cord; mosaic vision with compound eyes (~2000 ommatidia).
- Reproduction: dioecious; male mushroom gland, phallomeres; female spermathecae; eggs in **ootheca** (~9–10 per ootheca); paurometabolous development (nymph).



Body regions of cockroach

09 Important Q&A

Q1. Difference between tendon and ligament?

Tendon joins muscle to bone; ligament joins bone to bone. Both are dense regular connective tissue.

Q2. Why are cardiac muscles able to contract as a unit?

Intercalated discs (with gap junctions) let impulses pass quickly so cells contract together.

Q3. How does a frog respire in water?

Through its moist skin by diffusion (cutaneous respiration).

10 Common mistakes

- Calling blood a fluid without matrix (plasma is its matrix).
- Saying frog drinks water.
- Writing frog heart as 4-chambered (it is 3).
- Mixing exocrine (duct) and endocrine (ductless).

11 Practice (NEET style)

1. Tissue lining alveoli?
2. Junction that prevents leakage?
3. Frog excretes mainly?
4. Cells forming most of neural tissue volume?
5. Fat-storing tissue?

ANSWERS

1) Squamous epithelium · 2) Tight junction · 3) Urea (ureotelic) · 4) Neuroglia · 5) Adipose

12 Quick revision: 5 minutes before the exam

EPITHELIUM

- Squamous: alveoli
- Cuboidal: ducts, PCT
- Ciliated columnar: bronchioles

CONNECTIVE

- Tendon: muscle-bone
- Ligament: bone-bone
- Cartilage: nose, ear

MUSCLE

- Skeletal voluntary
- Smooth spindle
- Cardiac intercalated discs

FROG

- 3-chambered heart
- Skin + lung respiration
- Ureotelic, 10 cranial nerves

Have a doubt? Ask the AI Doubt Solver at padhaiadda.netlify.app, or take the mock test on this chapter.