Ch 7 Structural Organisation in Animals

Module 4

7.5 FROG

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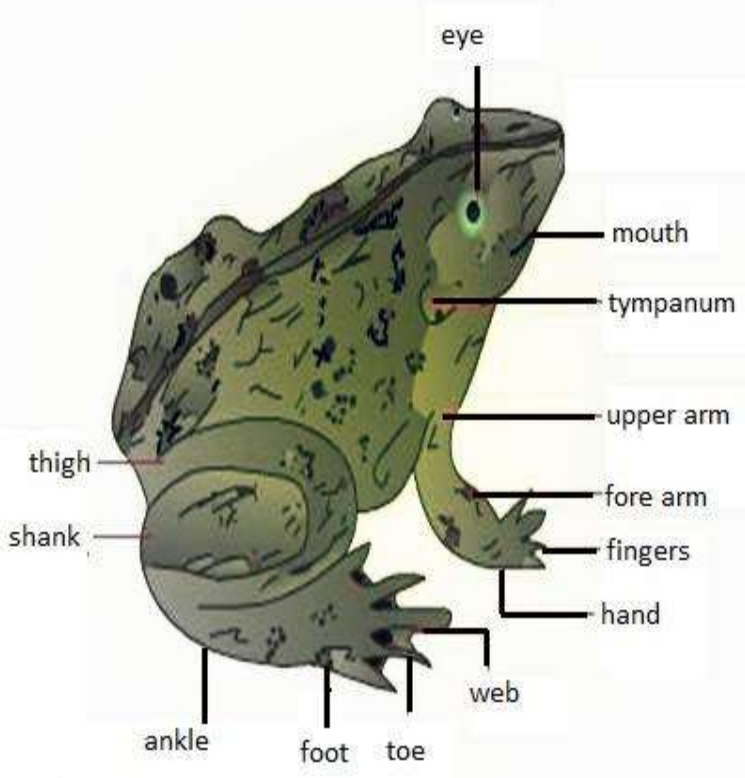
- Live both on land and in freshwater. So, Amphibious.
- Belong to class Amphibia of phylum Chordata. The most common species of frog found in India is *Rana tigrina.*
- No constant body temperature i.e., their body temperature varies with the temperature of the environment. Such animals are called **Cold Blooded or Poikilotherms**.
- We notice changes in the colour of the frogs while they are in grasses and on dry land. They have the ability to change the colour to hide them from their enemies (camouflage). This protective coloration is called **mimicry**.
- Frogs are not seen during peak summer and winter. During this period, they take shelter in deep burrows to protect them from extreme heat and cold. This is called as summer sleep (aestivation) and winter sleep (hibernation).

7.5.1 Morphology

i. S**kin:** smooth and slippery due to the presence of mucus. Always maintained in a moist condition.
Colour: dorsal side of body-generally olive green with dark irregular spots. ventral side- uniformly pale yellow.



- Frog never drinks water but absorb it through the skin.
- ii. **Body** of a frog is divisible into head and trunk.
- A <u>neck</u> and <u>tail</u> are <u>absent</u>.
- A pair of <u>nostrils</u> is present above the mouth.
- <u>Eyes</u> - bulged and covered by a nictitating membrane that protects them while in water.

- On either side of eyes, a membranous tympanum (ear) receives sound signals.
- Forelimbs and hind limbs help in swimming, walking, leaping and burrowing.
- Hind limbs end in five digits and they are larger and muscular than fore limbs that end in four digits.
- Feet have webbed digits that help in swimming.
- Frogs exhibit sexual dimorphism.

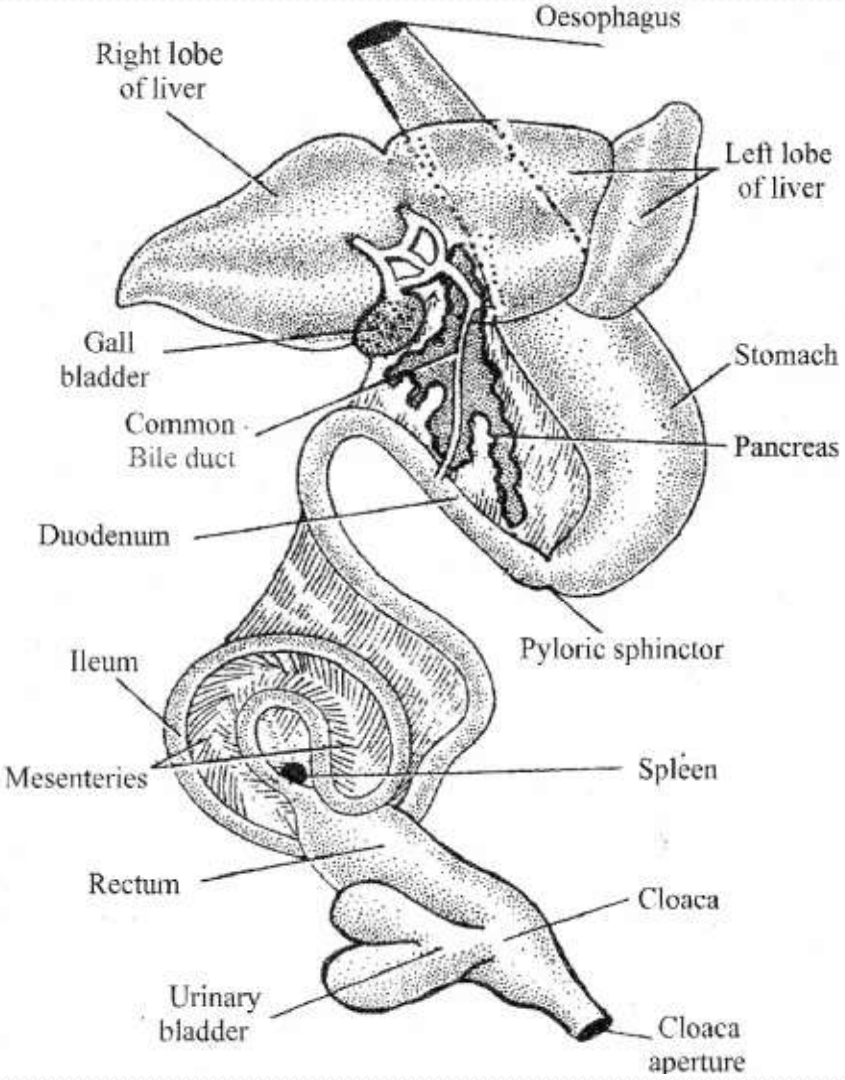
- Male frogs can be distinguished by –

i. presence of sound producing vocal sacs and

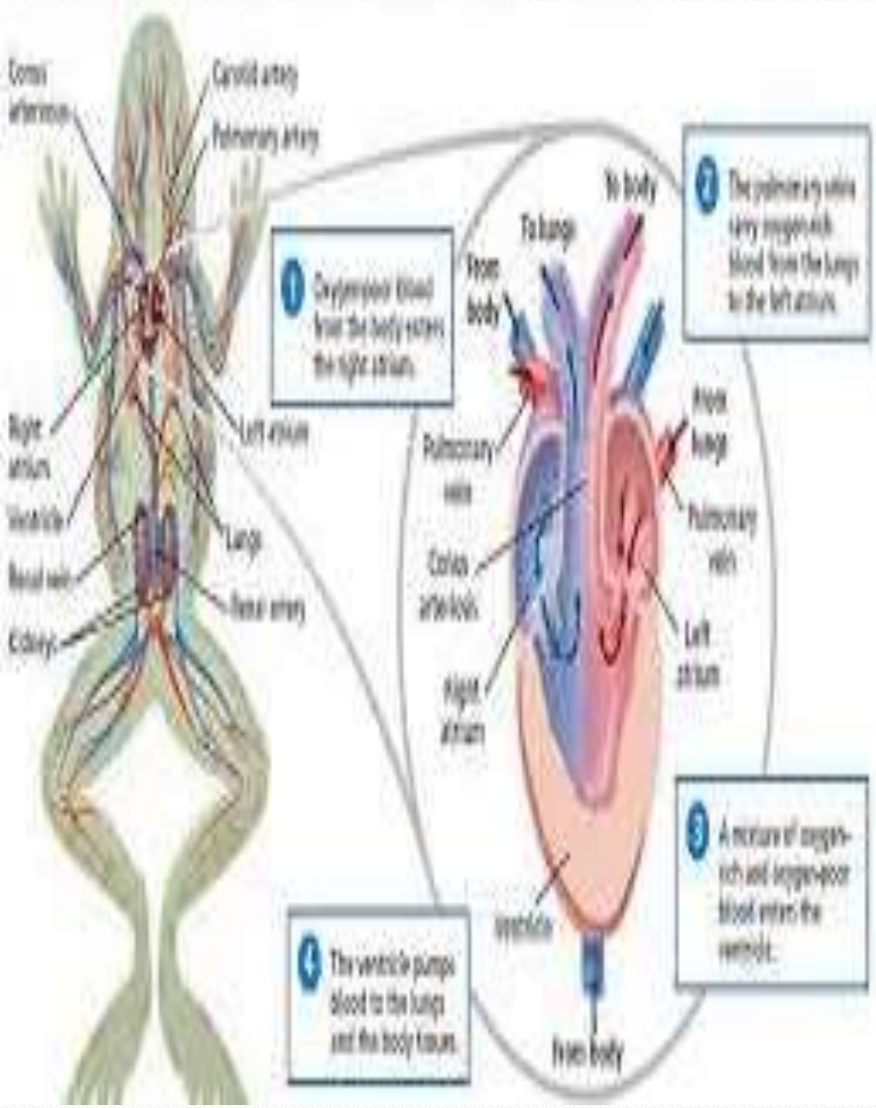
ii. a copulatory pad on the first digit of the fore limbs which are absent in female frogs.

7.5.2 Anatomy of Frog

- i. **Body cavity** of frogs accommodates different organ systems such as digestive, circulatory, respiratory, nervous, excretory and reproductive systems with well developed structures and functions.
- ii. **Digestive system** consists of alimentary canal and digestive glands.
- - Alimentary canal is short because frogs are carnivores and so the length of intestine is reduced.
  - Mouth opens into the buccal cavity that leads to the oesophagus through pharynx.



Frog: Digestive System



Frog: Blood Vascular System

- - Oesophagus is a short tube that opens into the stomach which in turn continues as the intestine, rectum and finally opens outside by the cloaca.
- Liver secretes bile that is stored in the gall bladder.
- Pancreas, a digestive gland produces pancreatic juice containing digestive enzymes.
- - Food is captured by the bilobed tongue.
- Digestion of food takes place by the action of HCl and gastric juices secreted from the walls of the stomach.
- Partially digested food called **chyme** is passed from stomach to the first part of the intestine, the duodenum.

- Duodenum receives bile from gall bladder and pancreatic juices from the pancreas through a common bile duct.
- Bile emulsifies fat and pancreatic juices digest carbohydrates and proteins.
- Final digestion takes place in the intestine.
- Digested food is absorbed by the many finger-like folds in the inner wall of intestine called villi and microvilli.
- The undigested solid waste moves into the rectum and passes out through cloaca.

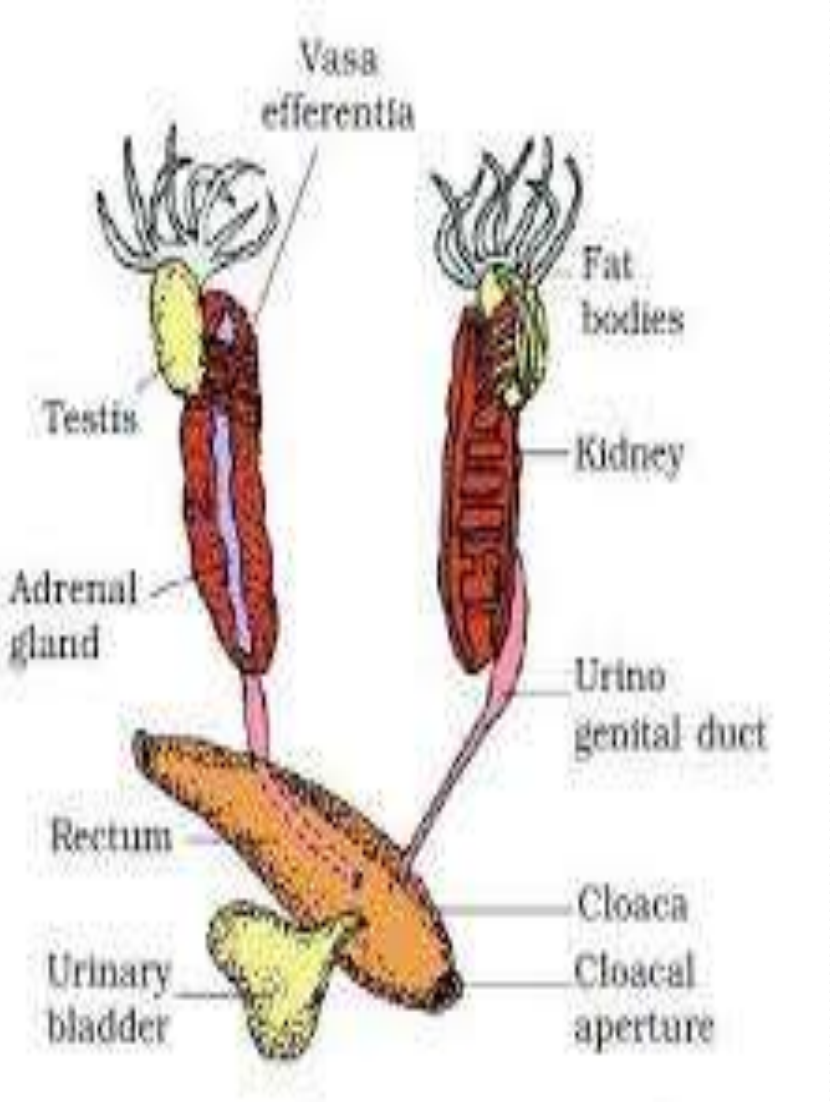
- iii. Frogs **respire** on land and in the water by two different methods.
  - i. In water, skin acts as aquatic respiratory organ (*cutaneous* respiration). Dissolved oxygen in the water is exchanged through the skin by diffusion.
  - ii. On land, the buccal cavity, skin and lungs act as the respiratory organs.
- The respiration by lungs is called pulmonary respiration.
- The lungs are a pair of elongated, pink coloured sac-like structures present in the upper part of the trunk region (thorax).
- Air enters through the nostrils into the buccal cavity and then to lungs.
- During aestivation and hibernation gaseous exchange takes place through skin.

- **iv. Blood vascular system** of frog is well-developed closed type. It involves heart, blood vessels and blood.
- **Heart** is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium.
- A triangular structure called sinus venosus joins the right atrium. It receives blood through the major veins called vena cava.
- The ventricle opens into a saclike *conus arteriosus* on the ventral side of the heart.
- The blood from the heart is carried to all parts of body by the arteries (arterial system).

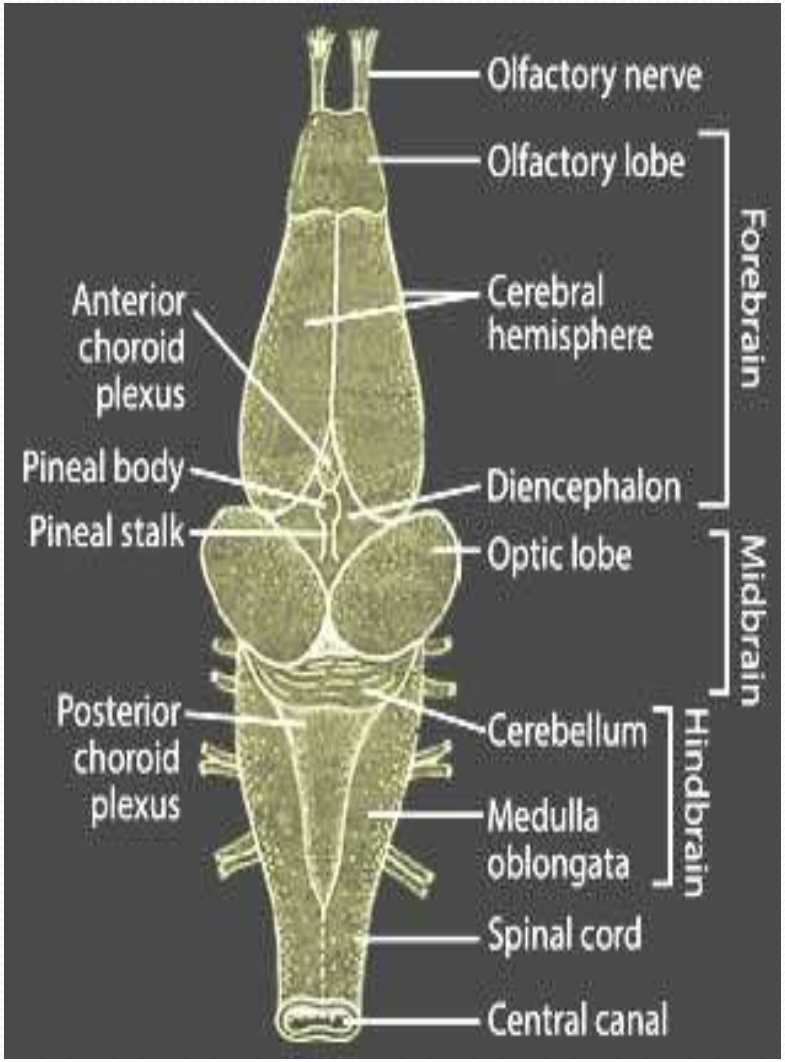
- The veins collect blood from different parts of body to the heart and form the venous system.
- Special venous connection are present in frogs between-
  - i. Liver and intestine, is called Hepatic Portal System &
  - ii. Kidney and lower parts of the body, is called Renal Portal System.
- The **blood** is composed of plasma and cells. The blood cells are RBC (red blood cells) or erythrocytes, WBC (white blood cells) or leucocytes and platelets.
- RBCs are nucleated and contain red coloured pigment namely haemoglobin. The blood carries nutrients, gases and water to the respective sites during the circulation.
- The circulation of blood is achieved by the pumping action of the muscular heart.

- v. Frogs have a **lymphatic system**. It consists of lymph, lymph channels and lymph nodes. The lymph is different from blood. It lacks few proteins and RBCs.
- vi. The elimination of nitrogenous wastes is carried out by a well developed **excretory system**.
- It consists of a pair of kidneys, ureters, cloaca and urinary bladder.
- Kidneys are compact, dark red and bean like structures situated a little posteriorly in the body cavity on both sides of vertebral column.
- Each kidney is composed of several structural and functional units called uriniferous tubules or nephrons.

- Two ureters emerge from the kidneys in the male frogs.
- The ureters act as urino-genital duct which opens into the cloaca.
- In females, the ureters and oviduct open separately in the cloaca.
- The thin-walled urinary bladder is present ventral to the rectum and opens in the cloaca.
- Frog excretes urea and thus is a **ureotelic** animal.
- Excretory wastes are carried by blood into the kidney where it is separated and excreted.



Frog: Excretory System



Frog: Brain (Dorsal view)

- vii. System for **control & coordination** is highly evolved in frog. It includes both neural system & endocrine glands.
- a. Chemical coordination of various organs of the body is achieved by hormones which are secreted by the endocrine glands.
- The prominent endocrine glands found in frog are pituitary, thyroid, parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads.
- b. Nervous system (NS) is organised into –

✓ Central NS (brain and spinal cord),

✓ Peripheral NS (cranial and spinal nerves) and

✓ Autonomic NS (sympathetic & parasympathetic).

- Ten pairs of cranial nerves arise from the brain.
- Brain is enclosed in a bony structure called brain box (*cranium*). The brain is divided into fore-brain, mid-brain and hind-brain.
- i. Forebrain includes olfactory lobes, paired cerebral hemispheres and unpaired diencephalon.
- ii. Midbrain is characterised by a pair of optic lobes.
- iii. Hind-brain consists of cerebellum and medulla oblongata. The medulla oblongata passes out through the *foramen magnum* and continues into spinal cord, which is enclosed in the vertebral column.

- viii. Frog has different types of **sense organs**, namely organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears).
- Out of these, eyes & internal ears are well-organised structures and the rest are cellular aggregations around nerve endings.
- **a. Eyes** in a frog are a pair of spherical structures situated in the orbit in skull. These are simple eyes (possessing only one unit).
- **b. External ear** is absent in frogs and only tympanum can be seen externally. The ear is an organ of hearing as well as balancing (equilibrium).

- ix. Frogs have well organised male and female **reproductive systems**.
- Male reproductive organs consist of

i. a pair of yellowish ovoid testes, which are found adhered to the upper part of kidneys by a double fold of peritoneum called mesorchium.

ii. Vasa efferentia are 10-12 in number that arise from testes. They enter the kidneys on their side and open into Bidder's canal.

iii. Finally it communicates with the urino-genital duct that comes out of the kidneys and opens into the cloaca.

iv. The cloaca is a small, median chamber that is used to pass faecal matter, urine and sperms to the exterior.

- Female reproductive organs include-

  i. a pair of ovaries- they are situated near kidneys and there is no functional connection with kidneys.

  ii. A pair of oviduct arising from the ovaries opens into the cloaca separately.
- A mature female can lay 2500 to 3000 ova at a time.
- Fertilisation is external and takes place in water.
- **Development** involves a larval stage called tadpole.
- Tadpole undergoes metamorphosis to form the adult.

- Frogs are **beneficial to mankind** because-

  i. They eat insects and protect the crop.

  ii. Frogs maintain ecological balance as they serve as an important link of food chain and food web in the ecosystem.

  iii. In some countries the muscular legs of frog are used as food by man.

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