ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

path to success

PRE-MEDICAL

ZOOLOGY

ENTHUSIAST | LEADER | ACHIEVER

STUDY MATERIAL

Frog

ENGLISH MEDIUM

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FROG *(RANA TIGRINA)*

0.1 INTRODUCTION

- **Introduction**
- **Morphology**
- **Anatomy- Respiration, Digestion, Circulation, Nervous, Excretion and Reproductive system**

- **Classification :**

Phylum	–	Chordata
Sub-phylum	–	Vertebrata
Super class	–	Tetrapoda
Class	–	Amphibia
Genus	–	*Rana*
Species	–	*tigrina*

- ***Rana tigrina*** is the most common species of frog.
- Most common species of toad is ***Bufo melanostictus***

Toad have the poisonous gland in its skin but it is absent in frog.

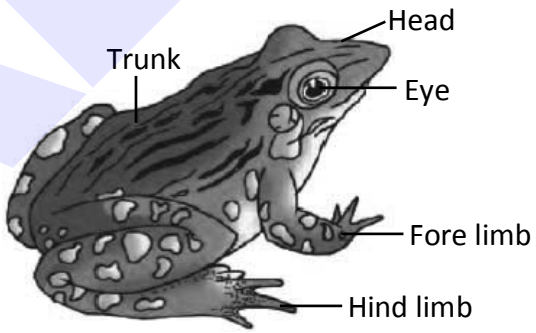
Frogs do not have constant body temperature i.e., their body temperature varies with the temperature of the environment. Such animals are called **cold blooded** or **poikilotherms.**

They have ability to change the colour to hide them from their enemies **(camouflage).** This protective coloration is called **mimicry**.

We also know that the frogs are not seen during 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).**

Size of frog :

Length	–	18 – 20 cm
Width	–	5 – 8 cm



External features of frog

NCERT XI Page No. 116, Figure No. 7.19

Colour of frog → Dorsal part is olive green and ventral part is uniformly pale yellow.

Body of frog is adapted for burrowing, jumping and swimming.

The frog never drinks water but absorb it through the skin.

02. MORPHOLOGY

Body of frog is divided into 2 parts :-

(1) Head (2) Trunk

Neck and tail are absent in it.

(1) HEAD

Head is triangular & its anterior conical part is called **snout**.

Head bears the following structures -

(i) Mouth

(ii) Nostrils – 1 pair

(iii) Eyes – 1 pair

(iv) Tympanic membrane – 1 pair

(v) Vocal sac – 1 pair

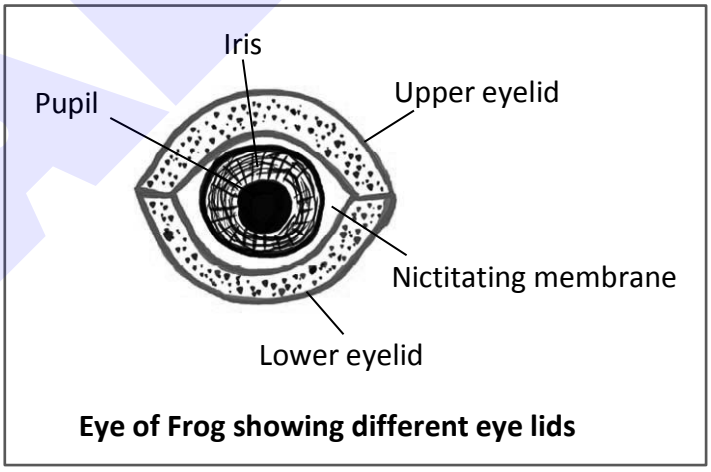
(vi) Brow spot – 1 at mid dorsal region

(A) Eyes – Each eye has 3 eyelids :-

(i) Upper eye lid – It is immovable

(ii) Lower eye lid – It is movable

(iii) Third eye lid – It is thin, transparent, freely movable membrane also called nictitating membrane. It protect the cornea from mud and dust.



Eye of Frog showing different eye lids

(B) Brow Spot: It is small, circular light coloured spot located mid-dorsal side in between the 2 eyes. It represents vestigial third eye or pineal eye.

(C) Tympanic Membrane/Eardrum : It is small, circular membranous Fold located just behind each eye. It receives the sound waves so it is related with hearing.

(D) Vocal Sac : It is a pair of balloon like elastic structures in throat of male frog. It acts as a resonater. It increases the pitch of croacking of male frog. At the time of breeding season, it is used to attract the female.

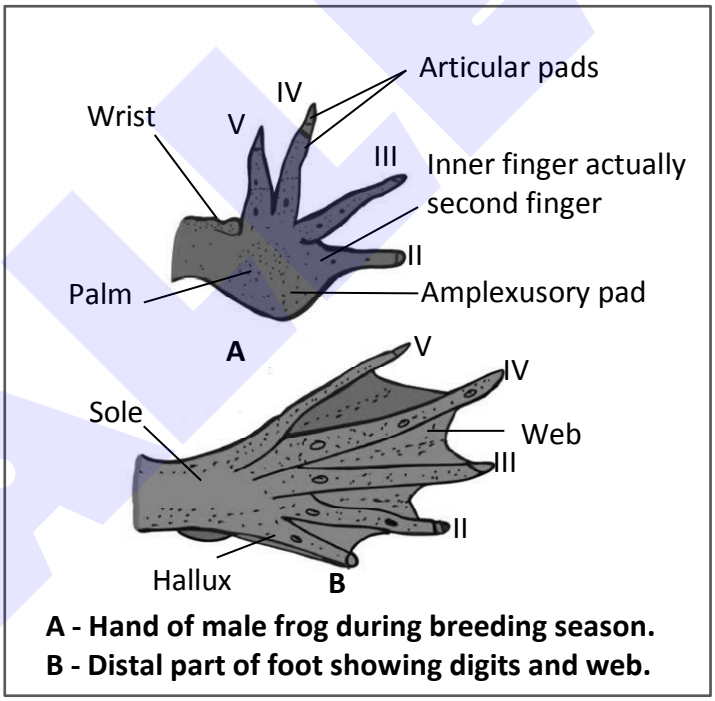
(2) TRUNK

Frog is a tetrapod animal. Four limbs are attached to its trunk. Longitudinal folds are present on the dorsal part of trunk that is called dermal fold or dermal plicae.

The forelimbs and hind limbs help in swimming, walking, leaping and burrowing. Fore limbs have four digits. Thumb is absent in fore limb.

The hind limbs are larger and muscular than fore limb. The hind limb end in five digits.

Hind feet have webbed digits that help in swimming.



A - Hand of male frog during breeding season.
B - Distal part of foot showing digits and web.

Frogs exhibit sexual dimorphism.

Male frogs can be distinguished by the presence of sound producing vocal sacs and also a copulatory pad on the first digit of the fore limbs which are absent in female frogs.

03. ANATOMY (INTERNAL MORPHOLOGY)

- Following systems are present in frog :-

(1) RESPIRATORY SYSTEM

- Exchange of gases from the environment is the function of its respiratory system.
- 3 types of respiration are present in frog.

(i) **Cutaneous respiration :** 35% cutaneous respiration is present in it. Skin contain the mucous gland which secrete the mucous on the surface to moist the skin that causes exchange of gases from the environment by diffusion.

(ii) **Pulmonary respiration :** 56% pulmonary respiration is present in it. Two pear shaped lungs are present in anterior part of trunk, which is responsible for pulmonary respiration.

(iii) **Buccal cavity respiration :** 9% buccal respiration is present in it. Large network of capillaries is present in its oral cavity that cause exchange of gases through diffusion.

(2) DIGESTIVE SYSTEM

Function of digestive system is ingestion of food, digestion & egestion of undigested food.

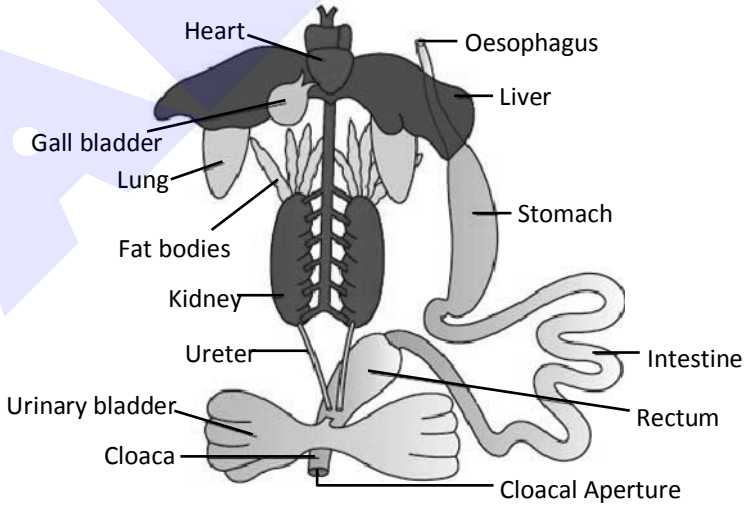
Digestive system is divided into 2 parts :-

The digestive system consists of alimentary canal and digestive glands. The alimentary canal is short because frog is carnivores and hence the length of intestine is reduced.

Digestive tract or food passage : In frog, passage of food is through

Mouth → Oral cavity → Oesophagus → Stomach → Intestine → Rectum → Cloaca → Cloacal aperture

Tongue : Tongue of frog is long, folded, sticky & bilobed at its anterior end. It is adapted for capturing the prey (insect).



Diagrammatic representation of internal organs of frog showing complete digestive system

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(A) Stomach :

It is a muscular bag. It contains HCl & proteolytic enzyme. HCl makes the acidic pH of food & it is bacteriolytic.

Digestion is completed in intestine.

Undigested food is excreted through cloacal aperture.

Digested food is absorbed by the numerous finger like folds in the inner wall of intestine called **villi** and **microvilli**.

(B) Digestive Glands :

Two digestive glands are present in it.

(i) Liver : It forms bile. Bile is stored in gall-bladder. Bile is secreted in intestine. Bile juice is an alkaline solution. It changes the pH of food from acidic to alkaline. It also causes emulsification of fat.

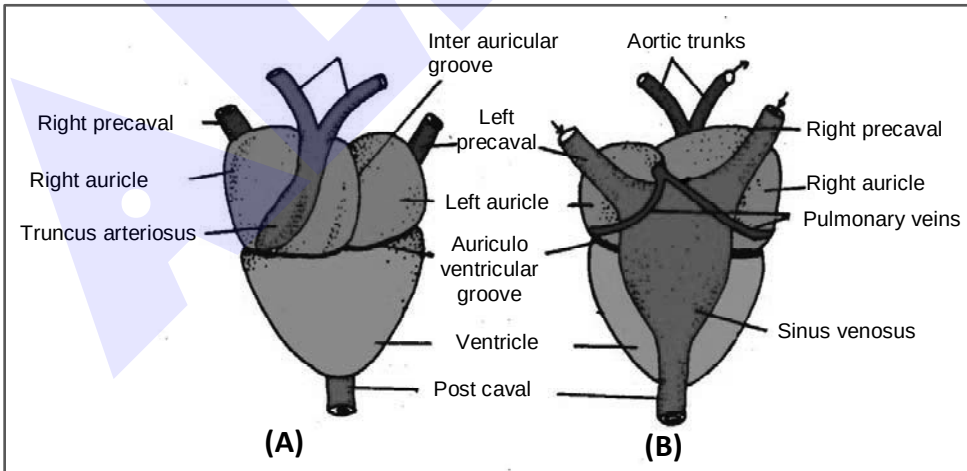
(ii) Pancreas : It secrete pancreatic juice in intestine. Pancreatic juice is called digestive juice as it is complete digestive juice.

(3) CIRCULATORY SYSTEM

Closed & incomplete double circulation is present in frog.

Function of circulatory system is to transport food, gases and hormones to various parts of the body. It consists of following structures

(A) Heart :



Heart of Frog (external structure) A-Ventral view, B-Dorsal view

Three chambered, muscular myogenic heart is present in it which have 2 Auricles & 1 ventricle. Auricles receive the blood. Ventricle pumps the blood to the various parts of the body.

Its heart rate is 64/min.

(B) Blood vessel : These are contractile tubes which distribute blood from the heart to the various parts of the body.

Blood : Three type of blood cells are present in it

(i) RBC – RBC are oval or biconvex in shape and nucleated. It contains haemoglobin which carry the oxygen.

(ii) WBC – These cells provide protection or immunity.

(iii) Thrombocytes : These cells prevent loss of blood by forming thrombus or clots on the bleeding site.

(4) NERVOUS SYSTEM

Function of nervous system is perception of sense & analysis of sense, reaction according to a sense & control and coordination of various parts of body.

It is divided into 3 parts

(A) Central Nervous System :

Central nervous system is made up of brain & spinal cord. It is involved in analysis of sense. Brain is enclosed in a bony structure called brain box (cranium). The brain is divided into fore-brain, mid-brain and hind-brain. Forebrain includes olfactory lobes, paired cerebral hemispheres and unpaired diencephalon. The midbrain is characterised by a pair of optic lobes. 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.

(B) Peripheral Nervous System :

It is made up of cranial nerves and spinal nerves. 10 pairs of cranial nerves & 10 pairs of spinal nerves are present in frog.

- (In ***Rana tigrina***, 9 pairs spinal nerves are present) 12 pairs cranial nerves & 31 pairs spinal nerves are present in human.
- 12 pairs cranial nerves & 33 pairs spinal nerves are present in rat.

(C) Autonomous Nervous System :

This controls the autonomous parts (automatic) of the body.

This system control the autonomic parts of the body like heart, lungs & intestine. Two type of nerves are present in it.

(i) Sympathetic Nerve : It increase the rate of autonomous organs.

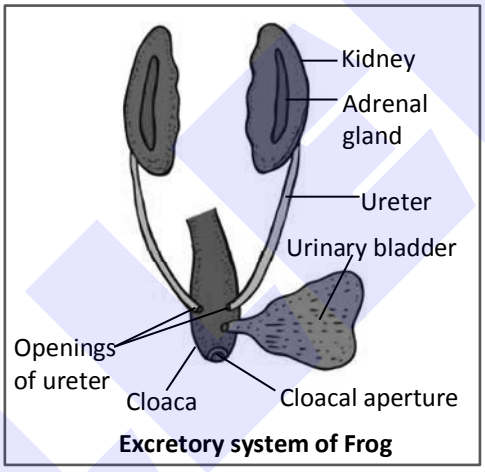
(ii) Parasympathetic nerve : It decrease the rate of autonomous organs.

(5) SENSE ORGANS IN FROG

- Organ of touch called sensory papillae.
- Organ of taste called taste buds.
- Organ of smell called nasal epithelium.
- Organ of vision called eyes (Possessing only one unit)
- Organ of hearing called tympanum with internal ears.
- Eyes and internal ears are well-organised structures and the rest are cellular aggregations around nerve endings

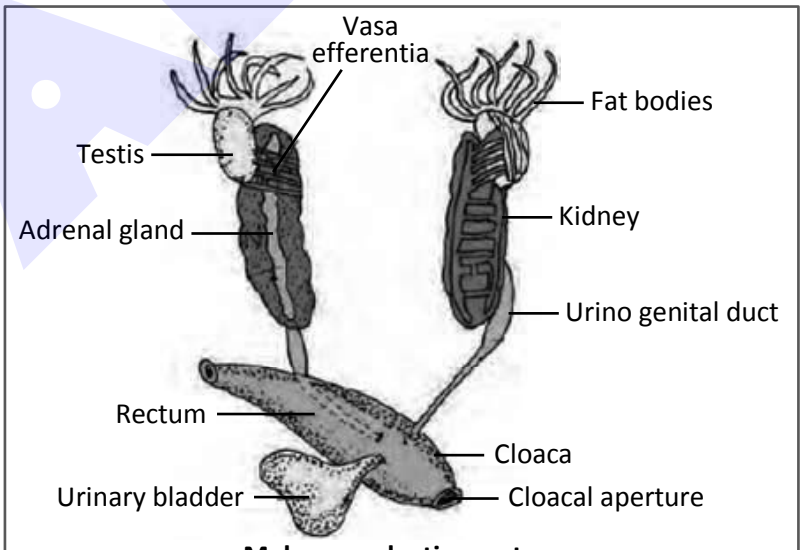
(6) EXCRETORY SYSTEM

One pair of kidney are present in it. Each kidney is made up of 2000 uriniferous tubules or nephrons. Kidney form urine which is stored in urinary bladder & excreted through cloacal aperture. The main excretory product in frog is urea, so it is a ureotelic animal.



Excretory system of Frog

(7) REPRODUCTIVE SYSTEM



Male reproductive system
NCERT XI Page No. 119, Figure No. 7.21

(A) Male Reproductive System :

One pair of testis are attached to the upper part of kidney by the help of membrane mesorchium. Sperms are formed in testis by spermatogenesis. At the time of copulation, these sperms enter into bidder's canal from the testis through 10 to 12 small ducts. These ducts are called Vasa efferentia. This bidder's canal opens into cloaca through the urinogenital duct. Sperms are ejected out through the cloacal aperture.

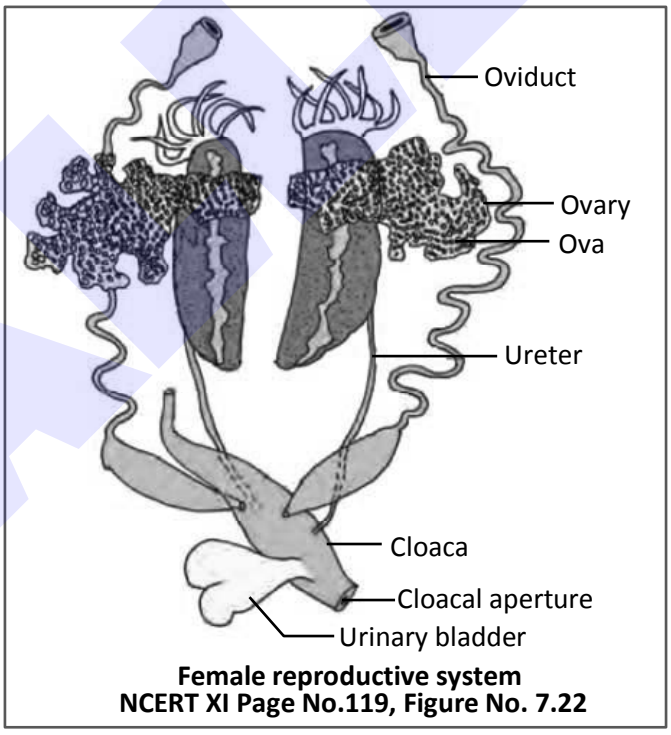
(B) Female Reproductive System :

One pair of ovaries are present on the upper pole of kidney and it opens into cloaca by a separate duct that is called oviduct, so there is no connection between the ovaries and kidney.

Mature female can lay 2500 – 3000 ova at a time.

At a time only one ovary eject ova. Fertilization is external and takes place in water. Its larva is called tadpole.

Tadpole undergoes metamorphosis to form the adult.



Female reproductive system
NCERT XI Page No.119, Figure No. 7.22

SPECIAL POINTS

- Sexual dimorphism is present in frog. **Nuptial pad** & **vocal sac** are present in **male frog** only.
- 10 vertebrae are present in frog.

ECONOMICAL IMPORTANCE OF FROG

Frogs are beneficial for mankind because they eat insects and protect the crop. Frogs maintain ecological balance because these serve as an important link of food chain and food web in the ecosystem. In some countries the muscular legs of frog are used as food by man.

★ Golden Key Points ★

- Frog belong to order - Anura.
- The capability of changing colour is known as metachrosis.
- The tadpole (larva) of frog - Hervivorous. So alimentary canal and intestine long.
- During tadpole kidney act as heamopoitic. Organ help in haemopoiesis process.
- The tadpole (larva) of frog respire with the help of gills.
- In frogs, teeth are absent on the lower jaw. While the upper jaw bears two type of teeth - maxillary and vomerine teeth.
- Teeth are homodont, polyphyodont and acrodont type.
- Sinus venosus of heart act as a pace maker in frog.
- In frog diaphragm absent.
- The digital formula for the fore limb of frog is 02233.
- The digital formula for the hind limb of frog is 22343.
- In frog kidney cortex, medulla and pyramid absent.
- Frog have anamniotes eggs.
- Neck is absent in frog. This helps frog in jumping on ground.
- Frog have single ear ossicle.
- Frog skull - dicondylic type.

BEGINNER'S BOX — MORPHOLOGY & ANATOMY

1. In male frog copulatory pad present on the :

(1) Second digit of the fore limbs (2) First digit of the hind limbs

(3) First digit of the fore limbs (4) Second digit of the hind limbs

2. The site for final digestion in frog is :

(1) Stomach (2) Rectum (3) Oesophagus (4) Intestine

3. Which of the following is not a character of frog's heart?

(1) Muscular structure (2) Three chambered structure

(3) Covered by pericardium (4) Non-muscular structure

4. How many pairs of cranial nerves arise from the brain of frog?

(1) 12 pairs (2) 10 pairs (3) 8 pairs (4) 9 pairs

5. In frog ureter act as urinogenital duct in :

(1) Male frog (2) Female frog

(3) In both male and female frog (4) None

6. Frogs are beneficial for mankind because :

(1) They eat crop and protect insect

(2) They eat insect and protect crop

(3) they eat both crop and insect

(4) They protect both crop and insect

7. Which of the following statement is not correct for Indian bull frog?

(1) Bidder's canal in male frog communicates with the urinogenital duct

(2) In female frog oviduct and ureter not open independently in cloaca

(3) There is no functional connection between ovary and kidney of frog

(4) Bidder's canal present in the kidney of male frog

8. Find out the correct classification of *Rana tigrina* :-

	Phylum	**Sub-Phylum**	**Class**	**Order**
(1)	Vertebrata	Chordata	Amphibia	Anura
(2)	Amphibia	Vertebrata	Anura	Chordata
(3)	Chordata	Vertebrata	Amphibia	Anura
(4)	Chordata	Vertebrata	Amphibia	Urodela

9. Match the column-I with column-II

Column-I		Column-II	
(A)	Hibernation	(i)	Winter sleep
(B)	Camouflage	(ii)	The ability to change the colour to hide them from their enemies
(C)	Poikilotherm	(iii)	Cold blooded
(D)	Aestivation	(iv)	Summer sleep

(1) A–iv B–ii C–iii D-i

(2) A–i B–ii C–iv D-iii

(3) A–i B–ii C–iii D-iv

(4) A–i B–iii C–iv D-ii

10. Given below is a list of some structure :

Diaphragm, Tail, Anus, Cloaca, Teeth on Upper jaw, Nictitating membrane and the cortex and medulla in kidney.

How many of the above structure are not found in *Rana tigrina*?

(1) 4 (2) 5 (3) 6 (4) 3

BEGINNER'S BOX — ANSWERS KEY

MORPHOLOGY AND ANATOMY

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**3**	**4**	**4**	**2**	**1**	**2**	**2**	**3**	**3**	**1**

- Common species of Frog found in India is *Rana tigrina*
- Cold blooded or poikilothermic
- Ability to change the colour of body (camouflage)
- Aestivation (summer sleep) and hibernation (winter sleep)

BODY OF FROG

Head

- Consist of eye,
  Either side of eye
  a membranous tympanum (ear) that received sound signals

Trunk

- Skin of frog is smooth and slippery due to presence of mucus.
- Dorsal side of body olive green colour and ventral side pale yellow.
- Neck and tail is absent.

DIGESTIVE SYSTEM

Alimentary canal
Short because carnivores
Mouth opens into buccal cavity
Salivary gland absent.

Digestive glands

Pancreas

Gastric gland

* Liver secretes bile store in gall bladder.

RESPIRATORY ORGANS OF FROG

- **Skin** (Cutaneous respiration)
- **Lungs** (Pulmonary respiration)
- **Bucco Pharyngeal** (Bucco pharyngeal respiration)

CIRCULATORY SYSTEM

- **Blood vascular system**
  - Heart
    - 3 chamber (2 atria & 1 ventricle) with additional chamber sinus venous and conus arteriosus
    - * Renal portal system is present
  - Blood vessels
  - Blood
    - Blood cells
      - R.B.C. (nucleated) with Hb
      - W.B.C.
      - Platelets
    - Plasma
- **Lymphatic system**

NERVOUS SYSTEM

- **Central Nervous System**
  - Brain
  - Spinal cord
- **Peripheral Nervous System**
  - Cranial nerve (10 pairs)
  - Spinal Nerve
- **Autonomic Nervous System**
  - Sympathetic
  - Parasympathetic

REPRODUCTIVE SYSTEM

Male reproductive system

- Testis (1 pair yellowish ovoid)
- Vasa efferentia (10-12 in number)
- Bidder's canal

Female reproductive system

- Ovary (1 pair)
- Mature female can lay 2500-3000 ova at a time
- Fertilization is external and takes place in water
- Larva of frog known as tadpole.