UG CBCS Semester-II (Chordata)
Amphibia

The greatest event in the phylogenetic history was a transition from aquatic to terrestrial mode of life, and Amphibia were the first animals to attempt this transition. But they are not fully terrestrially adapted and hover between aquatic and land environments. The name of the class also indicates this double life (Gr., *amphi.* dual, double + *bios*, life). Structurally, Amphibia are between the fish on one hand, and the reptiles on the other.

General Characters

1. Aquatic or semiaquatic (freshwater), air and water breathing, carnivorous, cold-blooded, oviparous, tetrapod vertebrates.
2. Head distinct, trunk elongated. Neck and tail may be present or absent.
3. Limbs usually 2 pairs (tetrapod), some limbless. Toes 4-5 (pentadactyle) or less. Paired fins absent. Median fins, if present, without fin rays.
4. Skin soft, moist and glandular. Pigment cells (chromatophores) present.
5. Exoskeleton absent. Digits clawless. Some with concealed dermal scales.
6. Endoskeleton mostly bony. Notochord does not persist. Skull with 2 occipital condyles.
7. Mouth large. Upper or both jaws with small homodont teeth. Tongue often protrusible. Alimentary canal terminates into cloaca.
8. Respiration by lungs, skin and mouth lining. Larvae with external gills which may persist in some aquatic adults.
9. Heart 3-chambered (2 auricles+1 ventricle). Sinus venosus present. Aortic arches 1-3 pairs. Renal and hepatic portal systems well developed. Erythrocytes large, oval and nucleated. Body temperature variable (poikilothermous).
10. Kidneys mesonephric. Urinary bladder large. Urinary ducts open into cloaca. Excretion ureotelic. Brain poorly developed. Cranial nerves 10 pairs,
11. Nostrils connected to buccal cavity. Middle ear with a single rod-like ossicle, columella. Larval forms and some aquatic adults with lateral line system.
12. Sexes separate. Male without copulatory organ. Gonoducts open into cloaca. Fertilization mostly external. Females mostly oviparous.
13. Development indirect. Cleavage holoblastic but unequal. No extra-embryonic membranes. Larva a tadpole which metamorphoses into adult.

Classification of Amphibia

The living amphibians are represented by about 2,500 species, a very much smaller number than that of other principal classes of vertebrates. However, these represent a mere shadow of the great amphibian radiations of the past, ranging from mid-Palaeozoic (Devonian) to early Mesozoic (Triassic). They dominated the World during Carboniferous, but most of them have become extinct since long. About 10 orders of extinct Amphibia are known only by fossil remains. The classification most generally followed now-a-days was provided by G, Kingslev Noble (1924). He recognized 3 orders of extinct and 3 orders of living amphibians. In the past, all extinct groups of Amphibia were placed under a single subclass *Stegocephalia* (Adam Sedgwick) and all living groups in another subclass *Lissamphibia.* This arrangement has been followed in this text for the convenience of our young readers.

Subclass I. Stegocephalia (Extinct)

Limbs pentadactyle. Skin with scales and bony plates. Skull with a solid bony roof, leaving openings for eyes and nostrils. Permian to Triassic.

Order 1. Labyrinthodontia

Oldest known tetrapods called stem Amphibia. Freshwater or land forms. Salamander or crocodile like. Teeth large with characteristically much folded dentine similar to their crossopterygian ancestors. Carboniferous to Triassic.

Example: *Eryops* (Fig. 1).

Order 2. Phyllospondyli

Small salamander-like. Head large, flat. Vertebrae tubular. Notochord and spinal cord housed in common cavity. Believed to be ancestors of modern Salientia and Urodela. Carboniferous to Permian.

Example: *Branchiosaurs (Ichthyostega).*

Order 3. Lepospondvli

Small salamander or eel-like. Vertebrae cylindrical, each made of a single piece. Neural arch and centrum continuous. Ribs articulating intervertebrally. Regarded ancestral to modern caecilians (Gymnophiona). Carboniferous to Permian.

Examples: *Diplocaulus, Lysomphus.*

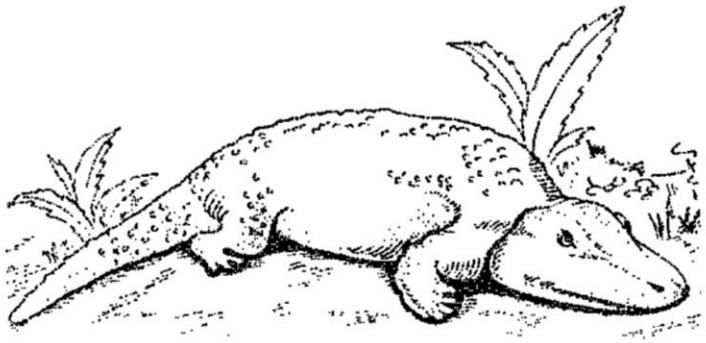

Fig. 1. *Eryops*, a fossil labyrinthodont.

Subclass 11. Lissamphibia (living)

Modern Amphibia lacking dermal bony skeleton. Teeth small, simple.

Order I. Gymnophiona or Apoda (Gr. *gvmnos,* naked + *ophioneos,* serpent-like) or (Gr., *a*, without + *podos,* foot)

Limbless, blind, elongated worm like, burrowing tropical forms known as caecilians. Tail short or absent, cloaca terminal. In some dermal scales embedded in skin which is transversely wrinkled. Skull compact, roofed with bone. Limb gridles absent. Males have protrusible copulatory organs.

Examples: About 55 species. *Ichthyophis, Uroaeotyphlus* (Fig. 2).

Order II. Urodela or Caudata (Gr., *Una,* tail + *debs,* visible) or (L., *cauda, tail)*

Lizard-like amphibians with a distinct tail. Limbs 2 pairs, usually weak, almost equal. Skin devoid of scales and tympanum. Gills permanent or lost in adult. Males without copulatory organs. Larvae aquatic, adult-like, with teeth. About 300 species in 5 suborders.

Suborder I. Cryptobranchoidea

Most primitive. Permanently aquatic. Adults without evehds and gills. Angular and prearticular separate. Premaxillary spine short. Fertilization external.

Examples: *Cryptobranchus, Mtgalobatmchus,*

Suborder 2, Ambystomatoidea

Adults are terrestrial with eyelids. Angular fused with prearticular. Premaxillary spine large. Vertebrae amphicoelous. Fertilization tnurnal.

Example: *Ambystoma.*

Suborder 3. Salamandroidea

Vertebrae opisthocueious. Teeth on palate and panomers. Three sets of cloacai glands. Fertilization internal.

Examples: *Triton* and *Triturus* (newts), *Salamandra* (salamander), *Desmognathus, Amphiuma* (congo eel), *Plethodon.*

Suborder 4. Proteidae

Aquatic bottom dwellers representing permanent larval forms, without eyelids. Adults with 3 pairs of external gills and 2 pairs of gill slits. Skull cartilaginous, without maxillae. Jaws with teeth.

Examples: *Proteus* (olm), *Necturus* (mud-puppy).

Suborder 5. Meantes

Aquatic representing permanent larvae. Forelimbs small, hind limbs absent. Three pairs of external gills. No eyelids, no cloacal glands. Jaws with horny covering.

Examples: *Siren* (mud eel), *Pseudobranchus.*

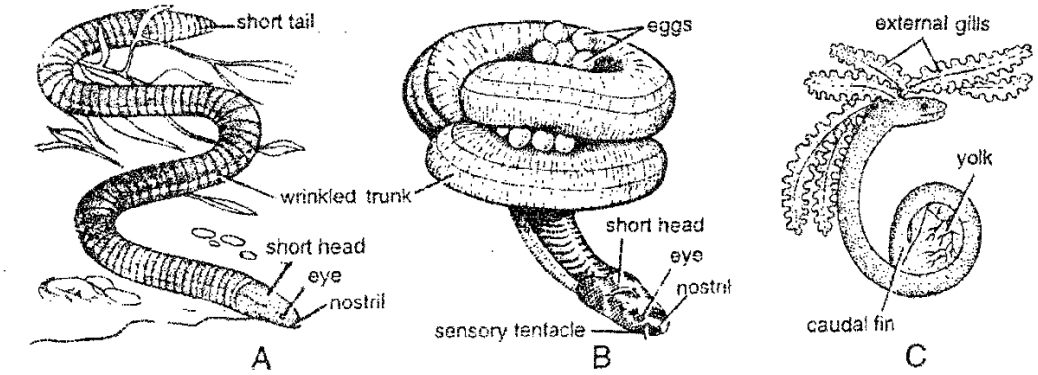

Fig. 2. *Ichthyophis glutinosa.* A—Male, B—Female guarding her eggs. C—Gilled larva.

Order III. Salientia or Anura (L., *saliens,* leaping) or (Gr., *an,* without + *aura, tail)*

Specialized Amphibia without tail in adults. Hind limbs usually adapted for leaping and swimming. Adults without gills or gill openings. Eyelids well-formed. Tympanum present. Skin loosely-fitting, scaleless; Mandible toothless. Pectoral girdle bony. Ribs absent or reduced. Vertebral column very small of 5-9 presacral vertebrae and a slender urostyle. Fertilization always external. Fully metamorphosed without neotenic forms. About 2,200 species of frogs and toads in 5 suborders.

Suborder 1. Amphicoela

Vertebrae amphicoelous. Presacral 9. Free ribs and 2 relict tail muscles. Fertilization internal.

Examples: *Leupelma, Ascaphus.*

Suborder 2. Opisthocoela

Vertebrae optsthococlous. Scapula small. Ribs free in adult or larva.

Examples: *Alytes* (midwife toad), *Bombinator, Discogiossus, Pipa, Xenopus.*

Suborder 3. Anomocoela

Vertebrae procoelous or amphicoelous. Free ossified ribs absent. Upper jaw with teeth.

Examples: *Pelobates, Scaphiopus,*

Suborder 4. Procoela

Vertebrae procoelous. Presacral 5-8. Urostyle with 2 condyles. No free ribs.

Examples: *Bufo* (common toad), *Rhinoderma, Dendrobates, Hyla* (tree toad), *Gastrotheca* (marsupial frog).

Suborder 5. Diplasiocoela

First 7 vertebrae procoelous, 8th vertebra amphicoelous, sacral or 9th vertebra convex anteriorly and bears 2 condyles posteriorly. Pectoral girdle usually fused to sternum (firmisternal). Ribs absent.

Examples: *Rana* (common frog), *Palypedates* or *Rhacophorus* (tree frog).

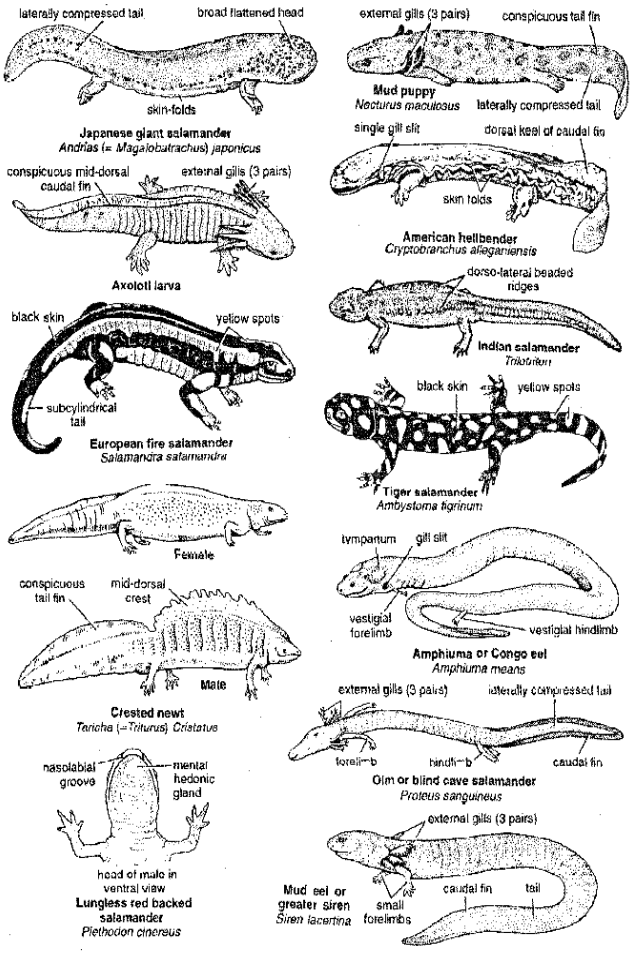

Fig. 4. Some urodele amphibians. Salamanders and newts.

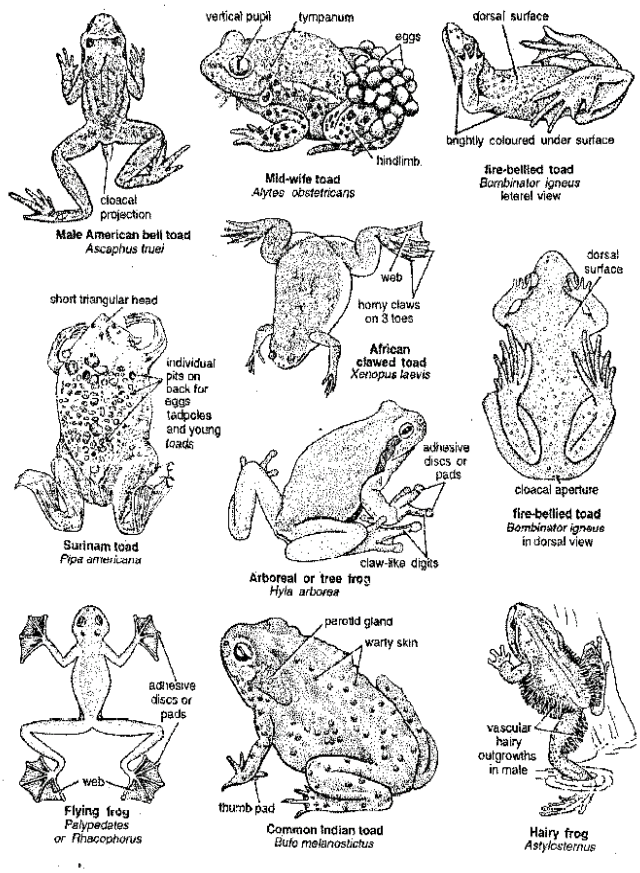

Fig. 5. Some anuran amphibians. Frogs and toads.

References:

Kotpal RL (2009-2110). Modern Text Book of Zoology: Vertebrates (Animal Diversity – II). Rastogi Publications, India.