CHAPTER FOUR
Amphibians
Primitive terrestrial anamniotic tetrapods

Three divergent groups: caecilian, salamanders, toads and frogs, are included in class Amphibia. The Class Amphibia is composed of tetrapods in which the transition from aquatic to terrestrial life is clearly indicated. The name of the class in Greek amphibious meaning "double or dual life," (Gr., amphi = double, bios = life). Amphibians are first vertebrate to live on **moist** land, although they lay their unshelled eggs in water or in moist situation. Development occurs within the egg capsule, some species give birth to live young, others with indirect development. Marsupial frogs are so called because they carry their eggs in a pouch on their backs.

Larvae if present with integumentary external gill are water-breathing. Upon metamorphosis, among other changes, the gills are usually lost and lung developed supplementing the vascular skin as organs of respiration. Some salamanders never develop lung even though they lose their gills. Most species of lungless salamanders (family Plethodontidae), the largest salamander family.

Amphibians are ecological indicators, and in recent decades there has been a dramatic decline in amphibian populations around the global. Many species are now threatened or extinct. Batrachology is a subdiscipline of herpetology concerned with the study of amphibians alone.

Classification

Three living amphibian orders are: Apoda, Urodela and Anura, as shown in the following scheme, all comprise more than 5400 species.

Class	Subclass	Orders
Amphibia	Lissamphibia	Urodela or Caudata
		Apoda or Gymnophiona
		Anura or Salientia

General characteristics of amphibians

1. Aquatic or semi-aquatic (fresh water), air and water breathing, carnivorous, ectothermic (cold-blooded) tetrapod vertebrates, where the body temperature varies with environment.
2. Skin is naked, soft, moist and glandular. Pigment cells (chromatophores) present.
3. Mouth large mostly upper or both jaws with small homodont teeth, tongue often protrusible and less immobile in aquatic forms, alimentray canal terminates into cloaca.
4. The tympanic membrane or tympanum is absent in urodeles, apodans but is prominent in most anurans, which have middle ear with a single bone.
5. Head with a pair of nostrils leading into buccal cavity.
6. Limbs usually two pairs (tetrapods) some are limbless.
7. Some aquatic adults with lateral line system.
8. Respiration by lungs, skin and mouth lining. Larvae possess external gills which may persist in some aquatic adults.
9. Sexes separate. Male is without copulatory organ, fertilization mostly external.

Subclass Lissamphibia (Gr., lissos = smooth), mostly without exoskeleton

Their members have scaleless smooth skin (smooth amphibians). Possess numerous glands. Include 3 orders:

Order 1. Apoda (also known as Gymnophiona or Caecilia). (Gr., gymnos = naked, ophioneos = serpent-like) or (Gr., A = without, podos = foot).

Members of this order living today are found only in India, Africa and tropical America. They include the caecilians which are burrowing forms. They are to be about 160 species.

External features

1. Snake-like body lack girdles (pectoral and pelvic), limbs and sternum, possesses 250 vertebrae.
2. Reduced eyes are covered by the skin or bones.
3. Body smooth, slimy and externally segmented by a series of annular grooves with which small dermal scales are embedded.
4. A peculiar conical flap-like, protrusible sensory tentacle in between nostril and eye is present to help detect the presence of prey in undergorund.
5. Both tympanums and tympanic cavity are absent.
6. Teeth are present.
7. Tongue is fused with floor of the mouth cavity.

8. Adult lack gills and gill slits.
9. Cloaca is almost terminal.
10. A single median protrusible copulatory organ (phallodeum) in male can protruded through the cloaca, an indication of **internal fertilization**.
11. Terrestrial species lay large yolky eggs, and in some species, female guards them until they hatch. **The larval stages if present pass in the egg envelope**. Several aquatic genera are **ovoviviparous**.

Example: This order includes about 55 species or more. Indian types are: ***Ichthyophis sp., Uraeotyphls malabaricus, Gegenophis sp., Indotyphlus sp.,*** **(Fig.1).**

A-*Ichthyophis sp.* **B- *Indotyphlus sp.***

FIGURE 1: A and B are two Indian caecilians, with snake –like body.

Order 2. Urodela or Caudata (Gr.,oura = tail, delos = visible, : L., cauda = tail, ata= bearing)

Amphibian urodeles include salamanders, sirens and newts. Newts and sirens are really salamanders. Sirens are aquatic salamanders, which have no hind limbs **(Figs.2-4).** Salamander is a common name for all members of this order. The majority of salamanders are carnivorous. Most of them breathe with lungs, but a large part of their oxygen is absorbed through their moist skin.

External features

1. Lizard-like in appearance, with a well-developed permanent tail.
3. Absence of the external ear opening and tympanum, the columella in the middle ear is absent. Salamanders are able to perceive the sound.
4. Teeth may or may not be present.

5. There are two pairs of weak limbs (hind limbs absent in sirenidae) which are almost equal.
6. Many species have grooves on the side of the body.
7. Gills permanent or lost in adult.
8. Skin devoid of scales.
9. Includes more than 300 species.

Ambystoma sp.

FIGURE 2: Adult urodele possesses larval gills (neotonic form).

Salamander *Salamandra sp.*

FIGURE 3: Adult newt *Salamandra sp.* Possesses lungs and lack gills.

Mud eel *Siren sp.*

FIGURE 4: Eel-like salamanders possess 3 pairs of external gills, and lack hind limbs.

Relationship of urodeles with fishes

Urodeles exhibit the following piscine features:

1. Presence of immovable fixed tongue.
2. Lateral line sense organ present.
3. Gills may be remain in adult.
4. Tympanum is absent.

Order 3. Salientia or Anura (L., saliens = leaping) or (Gr. an = without, oura = tail).

Frog and toads, which can under this category lack tail in the adult stage. Head and trunk are fused, and there is no neck region. Anurans as a group are better fitted for terrestrial existence than other amphibians. Certain species even inhabit desert region, where they spend dry season in a state of estivation (summer sleeping).

External features

1. Hind limbs are longer than fore limbs and webbed adapted for leaping and swimming.
2. Adult without gills or gill openings.
3. Eyelids well-formed. Tympanum present.
4. Mandible (lower jaw) toothless.
5. Frogs and toads are the first vertebrate to have vocal cord for sound production.
6. Fertilization always external.
7. Fully metamorphosed.

About 2200 species of frogs and toads in many families, three of them are the most common. These are:

Family 1. Bufonidae

The most representative toads are belong to this family and are referred as true or common toad, most of which belong to genus ***Bufo*** which includes about 300 species. They occur in all continents except Australia.

They feed on worms, snails and especially insect trapping them with their sticky tongue as frogs do. They have no teeth on either jaws. Harsh warty skin and an

elevated poison secreting parotid gland behind each tympanum. They have short hind limbs **(Fig.5)**.

Bufo viridis ***Bufo terrestrus*** ***Bufo americanus***

FIGURE 5: Three toad species, belong to genus *Bufo*.

Family 2. Hylidae

Tree toads are tree frogs (arboreal frog), genus ***Hyla*** belongs to this family. It is a large genus containing 350 species spread throughout the world and adapted for living in trees. ***Hyla arborea*** is 5-8 cm long and green in colour terminal bones of digits are claw-shaped and swollen basally into glandular **adhesive disk** which enables them to climb trees **(Fig.6)**.

Hyla arborea ***Hyla andersonii*** ***Hyla sineri***

FIGURE 6: Three frogs species belong to genus *Hyla.*

Family 3. Ranidae

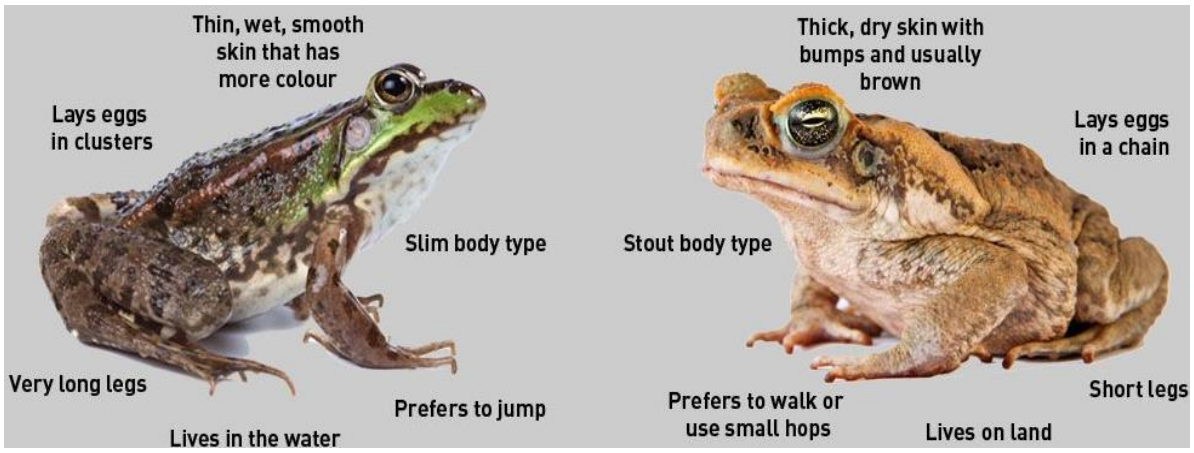
Long-legged, slender-bodied frogs are in this family **(Fig.7)**. Smooth slimy skin. Toothed upper jaw. Usually biffed tongue. Most have aquatic tadpoles. Include about 700 species. Cosmopolitan except some region of the world.

Rana catesbeiana ***Rana ridibunda***

FIGURE 7: Two frogs species belong to genu *Rana*.

How you tell a frog from a toad?

A toad is thick or stout frog, while frogs have thin or slim body. Toads have thicker and more warty skin compared to the smoother skin of most frogs. Toads more adapted to drier conditions than frogs, although they spend much of their time burrowed into moist soil when the humidity is low. Snout of toad is blunt while of frogs is pointed. Toads have shorter hind legs than frogs and move in short hops instead of making long leaps **(Fig.8)**.



A B

FIGURE 8: Differences between (A). frog and (B). toad.

Strange frog species

There are some species with a strange shape, for example the genera: ***Rhacophorus sp., Astylosternus sp., Eleutherodactylus Iberia (*Fig. 9).**

Rhacophorus is a common genus of tree frogs inhabiting Africa and South Eastern Asia. It is designated flying frog since it can glide due to the large webs developed in between the much elongated digits.

Astylosternus is the African hairy frog, where the male has extensive vascular filamentous or hair like cutaneous papillae, on groins, flanks and thighs. The filaments develop especially during breeding season where the need for oxygen is greater.

Eleutherodactylus iberia is the smallest frog in the world. Discovered only in two areas of Cuba mountains in1996, and only females have been found that are only 8.5 millimeters long. Very little is known about this sweet little frog, and does not have a common name yet.

Flying frog *Rhacophorus sp.* ***Eleutherodactylus Iberia sp.*** **Hairy frog *Astylosternu***

FIGURE 9: Three strange species of frogs.

Suggested questions

1. Amphibians are:
A. ectothermic anamniotes
B. ectothermic amniotes
C. endothermic amniotes
D. endothermic anamniotes

2. All these characteristic are common to both lungfishes and most salamanders, in a period of their lives, except
A. air breathing B. gill breathing C. internal nares D. dermal scales
E. lateral line

3. All Iraqi amphibians are attributed to
A. one order only B. two orders C. three orders D. Four orders E. no amphibians in Iraq

4. Give the common name for the animals belong to the following taxa?
Apoda, Salientia, Urodela, Caudata, Anura, Gymnophiona.

5. Give the Greek or Latin meaning for the following terms?
Amphibia, Urodela, Caudata, Anura, Gymnophiona.

6. Write the genus of a toad and two frogs?

7. Write two strange characteristics some salamanders have?

8. Give the differences between frogs and toads?

9. The science deals with the study of amphibian is called……..

10. Why skin of amphibians is smooth, thin, moist and highly vascular?