ANIMAL KINGDOM-2

Phylum – Chordata

(Gk. chorda = notochord or a string)

Definition and introduction

The term chordata is originated by the two words of Greek language the 'Chorda' and the 'Ata'. Meaning of 'Chorda' is 'a thick string' and meaning of 'ata' is 'to have' and over all meaning of chordata is animals having notochord.

Notochord supports the body of these animals so, chordates are the animals in which notochord is present in any stage of their life - span.

Animals, which do not have notochord, are called **non - chordates**. According to taxonomists, **90 - 95%** animals are non-chordates of the total animals present on earth, and rest of the 3 - **5% animals are chordates**.

In chordates, species of maximum live animals is in **Pisces group** and minimum live animals is in **Amphibia group**

Chordates are sharply distinguished from non-chordates by three fundamental characteristics

1. Notochord 2. Dorsal tubular central nervous system. 3. Pharyngeal gill clefts.

Characteristics

- **1. Notochord** It is a supporting axial endoskeletal rod, derived from embryonic mesoderm and extending in mid dorsal line (between nerve cord and alimentary canal).
- It persists throughout life in some primitive chordates (protochordates) but in majority, it occurs only during embryonic statges, as it is replaced in adult by a mesodermal, cartilaginous or bony vertebral column.
- 2. Dorsal tubular central nervous system Some higher non chordates (annelids and arthropods) possess a double and solid, midventral nerve cord beneath alimentary canal.
- Chordates, on the contrary, always possess a single and hollow, tube like nerve cord, extending along mid-dorsal line above alimentary canal and notochord.
- Nerve cord develops from embryonic ectoderm. Its cavity is called neurocoel.
- In most chordates, its anterior part enlarges to form a brain while the remaining part forms the spinal cord, both together forming the central nervous system (CNS).
- **3. Pharyngeal gill clefts -** Paired gill slits, called gill clefts, are present in lateral wall of embryonic pharynx in all chordates primarily for respiration.
- In lower, aquatic chordates, gill clefts persist for respiration throughout life.
- In higher, terrestrial chordates, they close during later part of embryonic development because main respiratory organ is lung in adults.

Resonate the Concept

 Above three fundamental characters are necessarily found in primary embryonic stages of chordates, but in adult stage, these are either absent or modified into other structures. Post anal tail is considered as fourth fundamental character of chordates.

Other general characters of phylum chordata

- 1. Habitat and habit These animals are aquatic, terrestrial or aerial & free living.
- **2. Body form** Metamerism or segmentation is found in the arrangement of muscles in embryonic stages and in adults, metamerism is found in the arrangement of vertebrae and ribs.
- 3. Germ layers and symmetry These are triploblastic and bilaterally symmetrical.
- 4. Body cavity True coelom is found in chordates which is enterocoelous type (Deuterostomous animals)

- 5. Digestive system
 - Alimentary canal is complete.
 - Digestive glands are present.
 - Digestion is extracellular.
- 6. Circulatory system Unlike non-chordates, chordates possess a distinct, muscular heart on the ventral side, mostly enclosed in a sac like pericardium.
 - **Closed blood vascular system** Blood flows in fixed direction within well-defined vessels. Chordates and some higher non-chordates, such as earthworms, possess a closed blood vascular system but in chordata, it is much better developed.
 - Red blood corpuscles (RBCs) A red respiratory pigment, haemoglobin is present in the blood of chordates and some non-chordates. In chordates, it is always present in special blood cells called Red blood corpuscles (RBCs) or erythrocytes, while in the non-chordates, it is dissolved in blood plasma.
 - **Hepatic portal system** Present in all chordates in which a hepatic portal vein collecting blood from alimentary canal, breaks up into capillaries within the liver, instead of running straight to the heart.
 - Renal portal system Present in all chordates except birds and mammals.
- 7. Skeleton system Normally exoskeleton is present, which is highly developed in most of the vertebrates.
 - In chordates, endoskeleton is found which is made up of cartilage and bones.
 - In embryonic stages of chordates, a muscular tail is found that is known as post anal tail. It is characterized by metameric segmentation and endoskeleton. It is primarily locomotory in function. In some chordates, this tail is reduced. e.g; man, apes.
- 8. Excretory system Proto, meso or metanephric kidneys are found in the form of excretory organs.
- 9. Reproduction Sexual reproduction is dominant.
 - Males and females are separate.
 - Development is direct with few exceptions.
- **10.** Chordates may be cold blooded (poikilothermal) e.g. fishes, amphibians and reptiles or warm blooded (homeothermal) e.g. birds and mammals.

Differences between chordates and non-chordates

	Chordates		Non-chordates		
1	A stiff and flexible rod of tissue, notochord is	1	Notochord is not present at any stage in the		
	present at some stage in the life cycle of		life of a non-chordate.		
	chordate.				
2	Hollow central nervous system is present on	2	Solid central nervous system lies on the		
	the dorsal side of the body.		ventral side of the body.		
3	Pharyngeal gill slits are present at some	3	Pharyngeal gill slits are absent.		
	stage in the life cycle of chordate.				
4	The post anal part of the body, the tail, is	4	Tail is absent.		
	present at some stage in the life cycle of				
	chordate.				
5	Heart is ventral.	5	Heart is dorsal.		
6	Blood vascular system is more developed.	6	Blood vascular system is less developed.		
	Blood flows in dorsal vessel in anterior -		Blood flows in dorsal vessel in posterior -		
	posterior direction.		anterior direction.		
7	If present, RBCs contain respiratory pigment	7	If haemoglobin or other respiratory pigment is		
	(haemoglobin).		present, it is found in the blood plasma. RBCs		
			are absent.		
8	Portal system is present.	8	Portal system is absent.		



Sub-Phylum – Urochordata or Tunicata

- 1. Habitat and habit There are about 200 species all marine, free swimming or attached with rocks.
 - Adults are mostly fixed or sessile while larva is free swimming.
- 2. Body form- Adults are microscopic to 30 cm in diameter; possess pharyngeal gill clefts. Free swimming larval stage, called tadpole, however possesses all the three distinctive chordate characters; its notochord is restricted to the tail and hence, the name of the subphylum (Gk uros = tail + chorda = notochord)
 - During metamorphosis, the larval tail gets disintegrated and notochord and major part of nerve cord also disappears with it. This is, therefore, a "retrogressive metamorphois" in which the advanced chordate characters are lost.
- **3.** Symmetry Adult body asymmetrical, sac like, enclosed in a leathery test or tunic formed of a self-secreted, cellulose like organic substance called tunicin (C₆H₁₀O₅). Tunicin is secreted by specific cells of mesoderm.
- 4. Digestive System Alimentary canal is V-shaped. Method of food intake is ciliary.
- **5. Respiratory system -** Pharynx large and sac like with several pairs of lateral gill clefts, opening into a large atrial cavity which surrounds the pharynx and opens out by a large atrial aperture.
- 6. Circulatory system- Blood vascular system is open type. Heart is situated at ventral surface of body. It is tubular and neurogenic in nature. Respiratory pigment is vanadium in blood which is stored in purple blood corpuscles known as vanadocytes.
- 7. Excretory system Excretion is by supra neural gland, pyloric gland and nephrocytes.
- 8. Nervous system Dorsal tubular nerve cord is found in nervous system, which is present only in larval stage. In adult stage, nerve cord is modified into a neural ganglion.

- 9. Reproduction Most of the animals are **bisexual**. Both **asexual (budding)** and sexual reproduction present. Each gonad contains testis and ovary portion (**ovo testis**) in it. Fertilization is **external** and mostly **cross fertilization**. Free swimming **tadpole larva** present.
- **10.** A ciliary glandular slit is present at the ventral surface of pharynx called **endostyle** which absorbs iodine from marine water (homologous to thyroid gland of mammals).
- **11. Classification -** Subphylum Urochordata is divided into three classes on the basis of test, location of mouth, atrial aperture, gill clefts and life cycle
 - I. Class Larvacea II. Class Thaliacea III. Class Ascidiacea
 - I. Class Larvacea Minute, tailed tunicates and pelagic.
 - These are **neotenic forms** i.e. larval forms which fail to metamorphose and attain sexual maturity. This condition is called **Neoteny** or **Paedogenesis**.
 - Since larval stage is permanent so these possess the three distinctive chordate structures (notochord, pharynageal gill clefts and dorsal tubular nerve cord) throughout life.
 - **Test ("house")** is thick, loose, jelly like, without cells and with an incurrent and an excurrent opening because sea water constantly flows through and is filtered in it.
 - Reproduction is only sexual.
 - e.g., *Oikopleura* shows **pseudomorphism** i.e. a gelatinous sheet envelops the animal which has emergency back door to escape.
 - Appendicularia
 - II. Class Thaliacea -
 - e.g. *Pyrosoma* **Bioluminiscence** is found (Strongest light among marine organisms) *Doliolum*– Barrel shaped.

Salpa

- III. Class Ascidiacea -
 - e.g, *Herdmania* Sea potato or sea squirts.
 Ascidia



Important Examples of Urochordata: Ascidia, Salpa, Doliolum

Sub-Phylum – Cephalochordata

(Gk. cephalos = head; chordata = notochord)

* General characters

- 1. Habitat and habit Found in shallow sea water. Animals form burrows in sand and are nocturnal.
- 2. Body form The notochord extends upto anterior end of the body & hence the name of the subphylum.
 - The notochord persists throughout life.
 - Body is laterally compressed like fish, and is segmented.
 - Head not distinct. Body divided into trunk and tail.
 - Paired appendages absent but median fins are present. The tail is present throughout life.
- 3. Germ layers and symmetry Triploblastic and bilateral symmetry.
- 4. Digestive System Alimentary canal is complete. Buccal opening is covered by oral hood from all the four sides. Just beneath it, "Wheel organ" or "Ciliated organ of Muller" present. This organ helps in the ingestion of food by producing circular currents in water.
 - Hatschecks pit is found on the wall of oral hood which secretes mucus.
 - These are ciliary feeders, which feed on diatoms and microbes. Oral cirri and velum is present.
- 5. Circulatory System Closed circulatory system is present. Respiratory pigment is absent.
 - Hepatic portal system is present.
- 6. Respiratory system Pharyngeal gill slits are more numerous and are better developed.
- **7.** Excretory system by protonephridia (flame cells or solenocytes). Hatschecks nephridium (single) is present which helps in excretion.
- 8. Reproduction These are unisexual animals. Fertilization is external with indirect development.
 - Fundamental chordate characters remain throughout life. Larva and adult both show chordate characters.
- 9. Members of this group are the first complete chordate animals.
- 10. It consists of only one class- Class leptocardii
 - e.g. Branchiostoma (Amphioxus)
 - Commonly called Lancelet
 - also called as typical chordate Assymetron

Resonate the Concept

Subphylum urochordata and cephalochordata collectively included in group **acraniata** (without cranium or brain box) or **protochordates** (primitive chordates).



Important Examples of Cephalochordata – Branchiostoma (Amphioxus or Lancelet).

	Test your Resonance with concept						
1.	The structure present, in all adult vertebrates, is(1) notochord(2) dorsal tubular nerve cord(3) pharyngeal gill slits(4) renal portal system						
2.	Which one of the follo (1) <i>Amphioxus</i>	wing does no (2) Dog fish	t have a sp	ecialised heart? (3) Chameleon	(4) S	caly ant eater	
3.	Balanoglossus belong (1) Platyhelminthes	gs to (2) Annelida		(3) Cephalochord	ata (4) H	emichordata	
4.	Which one of the following sets of organisms (1) Spider, Centipede, Cockroach (3) Cray fish, Cuttle fish, Hag fish			is mismatched? (2) Bat, Goat, Horse (4) Star fish, Sea cucumber, Sea urchin			
5.	A chordate character (1) gills (3) spiracles	is the presen	ce of	(2) post-anal tail(4) chitinous exos	keleton		
A	Answers						
	1. (2) 2. (1) 3.	(4)	4. (3)	5. (2)		

Sub-Phylum – Vertebrata

- 1. Sybphylum vertebrata are included in group **craniata** or **Euchordata** or **higher chordates** due to the presence of highly developed or advanced characters like **prominent head**, **vertebral column**, **jaws** and **cranium (brain box)** around brain.
- 2. Notochord is present in the embryonic stage only and is replaced by vertebral column (back bone) in the adult forms.
- 3. Body form Paired appendages
 - There is a very high degree of **cephalization** (formation of head).
- 4. Body cavity Coelom is well developed.
- 5. Body wall and musculo skeleton system It may bear an exoskeleton of scales or feathers or hair.
 - Three types of **muscles** i.e. **striped**, **unstriped** and **cardiac** are present.
 - The endoskeleton is formed of cartilage only or of cartilage and bone both.
- 6. Digestive System Digestive tract is complete.
- 7. Circulatory System There is closed circulatory system consisting of blood vascular and lymphatic systems.
 - Lymph is like blood but is colourless. Blood is with red and white blood corpuscles. Red blood corpuscles contain haemoglobin.
 - Heart is ventral. These is present hepatic portal system. In many vertebrates, renal portal system and hypothalamo hypophyseal portal system are also present.
- 8. Respiratory system Respiratory organs may be gills, skin, buccopharyngeal cavity and lungs.
- 9. Excretory system Excretion by a pair of Kidneys.

- **10. Nervous system** Consists of central nervous system (brain and spinal cord), peripheral nervous system (cranial and spinal nerves) and autonomic nervous system (sympathetic and parasympathetic nervous systems).
 - Sense organs are eyes, ears, tongue, nasal chambers and skin.
- 11. Endocrine system Endocrine glands are found in all vertebrates.
- **12. Reproduction -** Animals are **unisexual.** Gonads are paired and with gonoducts. Fertilization may be external or internal. Development is mostly direct but in some indirect development is present. Only sexual reproduction found.
- **13. Classification -** Subphylum vertebrata is divided into 2 divisions.
 - I. Agnatha– Jawless vertebrates
 - II. Gnathostomata- The jawed vertebrates.
 - I. Agnatha -
 - Consists of Jawless fishes (false fishes)
 - Most primitive of all craniates.
 - The mouth is **devoid of jaws** and hence the name Agnatha.
 - Notochord persists throughout life.
 - Vertebral column is ill developed.
 - 6-15 pair gill slits present.
 - Exoskeleton and paired appendages absent.
 - Have single nostril (monorhynous).
 - Internal ear has one or two semicircular canals.
 - Three eyes are found on head, one median pineal eye and two lateral eyes.
 - They are cold blooded.
 - Heart is two chambered called venous heart.
 - Animals are unisexual, fertilization is external. Larval stage is absent except **Petromyzon** which has **ammocoete larva**.
 - Group Agnatha is divided into 2 classes.
 - a. Ostracodermi and b. Cyclostomata
 - a. Ostracodermi
 - All members are **extinct**.
 - They were the first **vertebrates**.
 - e.g, **Cephalaspis, Drepanaspis**
 - b. Cyclostomata (The circular mouthed fishes) e.g., Petromyzon or Lamprey -

• a living fossil

- It is an ectoparasite (Sanguivorous) on true fishes.
- Many teeth are found in mouth and shows anadromous migration.
- Indirect development with Ammocoete larva which is the connecting link between cephalochordata and cyclostomata.
 Myxine or Hag fish
- has wrinkled lips just like an old woman.
- remains attached with gills of host (ectoparasite)
- has **archaeonephric kidney** in young ones i.e. which can filter blood and coelomic fluid.

Bdellostoma



Figure: A jawless vertebrate - Petromyzon

Important Examples of Vertebrata: Petromyzon (Lamprey) and Myxine (Hagfish).

II. Gnathostomata (The jawed vertebrates)

- They are advanced/developed vertebrates.
- Mouth is encircled by true jaws.
- Vertebral column well developed.
- Movement by paired fins or legs.
- Paired nostrils present (Dirhynous)
- 3 semi- circular canals are found in internal ear.
- Pineal eye is absent.
- Animals are unisexual
- Gonads are paired with genital ducts.
- Gnathostomata is divided into two super classes on the basis of locomotory organs, respiratory organs, heart and blood vascular system.
 - a. Superclass Pisces
 - b. Superclass Tetrapoda

SUPERCLASS PISCES

- It includes true fishes.
- Golden period of fishes Devonian period.
- Study of fishes Icthyology
- General characters
 - 1. Habitat All are aquatic.
 - 2. Body form Body is long, boat shaped and stream lined, which is divided into head, trunk and tail.
 - 3. Body wall -
 - Body is covered by **dermal scales** but **Cat fish**, **Torpedo** and **Wallagonia** fish are **scale less**.
 - Colour in fish is produced by iridocytes present in the dermis.
 - **4.** Locomotion Paired fins are present for swimming like pectoral and pelvic fins. Along with these unpaired fins are also found on the body like mid dorsal fin and caudal fin.
 - 5. Respiration One pair of external nares (Dirhynous condition).
 - Respiration by gills, gills are 4 to 7 pairs and naked or covered by operculum.
 - "Air bladder" helps in respiration in lung fishes (Group Dipnoi).
 - 6. Circulatory system Heart is two chambered known as "Venous heart", because it contains only impure blood, which goes to gills for purification from heart. Pure blood is then distributed to all parts of body directly from gills i.e. circulation of blood is **unicircuit.**
 - RBCs are nucleated. Sinus venosus, hepatic and renal portal system are found.
 - 7. Endoskeleton Endoskeleton is made up of cartilage or bones.
 - Vertebrae in fishes are amphicoelous, in which centrum is concave at both the surfaces.
 - In the **skull** of fishes only one occipital condyle is present, so their skull is called monocondylar type.
 - 8. Nervous system & sense organs Cranial nerves are 10 pairs.
 - External and middle ears are absent (No ossicles or tympanum). Only **internal ear** is present in which **three semi-circular canals** are present, which work as statoreceptors.
 - Eyes are without lids. Instead, each eye has a well-developed **nictitating membrane** called **third eyelid.**
 - Lateral line receptor system is present in the body of fishes, which includes many receptor organs which can detect vibrations (Rheoreceptor) and electric field.
 - 9. Excretory system Kidneys are mesonephric type.
 - Cartilaginous fishes excrete urea.

BIOLOGY FOR NEET

- Marine bony fishes excrete trimethylamine oxide.
- Fresh water fishes excrete ammonia.
- **10. Reproduction -** Fishes are **unisexual**.
 - Fertilization may be internal or external.
 - Eggs are mesolecithal or megalecithal type.
 - Extra embryonic membranes are absent in fishes so all the fishes are placed under group anamniota.
 - Metamorphosis or development is direct.
 - Small fishes or baby fishes are called **Fry** or **Hatchling**.
- 11. Fishes show a seasonal migration in a particular season.
 - i. Catadromous migration- Migration from fresh water to marine water. e.g. Anguila
 - ii. Anadromous migration- Migration from marine to fresh water. e.g, Salmon, Hilsa, Sturgeon.
 - iii. Potamodromous migration- Migration from fresh water to fresh water.
 - iv. Oceanodromous migration- Migration from marine to marine water.
- **12.** Fishes are of 2 types on the basis of salinity of water
 - i. Stenohaline- Tolerate a narrow range of Salinity in water.
 - ii. Euryhaline- Tolerate a wide range of salinity in water.
- **13.** They are **cold blooded (polikilothermal** or **ectothermal). Exceptions** Tuna fish and sword fish are endothermal.
- 14. Classification super pisces is classified into three classes
 - i. Placodermi
 - ii. Chondrichthyes
 - iii. Osteichthyes
 - i. Placodermi It includes the earliest fossil fishes which lived in fresh water.
 - Body had an external protective armour of bony scales or plates so called as "Armoured fishes".
 - Primitive jaws with teeth were present.
 - Skeleton was bony.
 - e.g. Climatius
 - ii. Chondrichthyes or Elasmobranchi They are marine animals with streamlined body and have cartilaginous endoskeleton.
 - Mouth is located ventrally.
 - Notochord is persistent throughout life.
 - They have 5-7 pairs of gills which are devoid of the operculum (gill cover).
 - The skin is tough containing minute placoid scales.
 - Teeth are modified placoid scales which are backwardly directed. Their jaws are very powerful. These animals are predaceous.
 - Due to the absence of air bladder, they have to swim constantly to avoid sinking.
 - Heart is two chambered.
 - Thermreceptors called "Ampulla of Lorenzini" present on the head of these fishes.
 - Some of them have electric organs e.g.- *Torpedo* and some possess poison sting. e.g. *Trygon*.
 - A **spiral valve** or **scroll valve** is found in intestine (to increase surface area). Liver is bilobed.
 - Sexes are separate.
 - **Cloacal aperture** is present. Genital ducts open into cloaca.
 - In males, pelvic fins bear **claspers** (copulatory organs).
 - They exhibit internal fertilization and many of them are viviparous.
 - e.g :- Scoliodon (Dog fish, Indian shark) ovoviviparous.

Pristis (saw fish)

Rhinobatus (guitar fish)

Sphyrna (hammer headed fish)

Trygon (sting ray)

Torpedo (electric ray)– Electric organ is modified muscles (can give 100 volts shock).

Carcharodon (great white shark)

Chimaera (Rat fish or king of herrings or Rabbit fish or Ghost fish) – Connecting link between cartilaginous and bony fishes. Operculum is present. *Rhineodon* (Whale shark) – Largest true fish. Its length is 13-14 metres.





Important Examples of Pisces: Scoliodon (Dog fish), Pristis (Saw fish), Carcharodon (Great white shark),

Poison sting: Trygon (Sting ray). Electric organs: Torpedo

- iii. Osteichthyes or Teleostomi In includes both marine and fresh water fishes with bony endoskeleton.
 - Mouth is usually terminal.
 - The exoskeleton is made up of scales, which may be cycloid or ctenoid type.
 - Respiration is by 4 pairs of gills. These gills are covered by operculum on each side of the body.
 - Air bladder is present which regulates buoyancy.
 - Scroll valve in intestine is absent. Liver is trilobed.
 - Cloaca is absent (in place of cloacal aperture, **anus** is present).
 - Ampulla of Lorenzini is absent.
 - · Genital ducts open outside the body through separate apertures.
 - Sexes are separate.
 - · Fertilization is external, claspers are absent in male fishes.
 - Fishes are oviparous but may be ovoviviparous or viviparous.
 - Development is direct.
 - e.g; Marine –*Hippocampus* (sea horse), *Exocoetus* (flying fish) Freshwater– *Catla* (katla), *Clarias* (magur), *Labeo* (rohu) Aquarium – *Betta* (fighting fish), *Pterophyllum* (angel fish)



Figure : Examples of Bony fishes : (a) Hippocampus (b) Catla

	Characteristics	Cartilaginous fishes	Bony fishes
1.	Habitat	Mostly marine	Marine and fresh water
2.	Mouth	Ventral	Anterior
3.	External nares	Ventral	Dorsal
4.	Scales	Placoid	Genoid, cycloid and ctenoid
5.	Operculum	Absent (except Chimaera)	Present
6.	Caudal fin	Heterocercal (asymmetrical)	Usually homocercal (symmetrical)
7.	Cloaca	Present (except Chimaera)	Absent
8.	Endoskeleton	Cartilaginous	Partly or completely bony
9.	Spiral (Scroll) valve	Present in the intestine	Usually absent in the intestine
10.	Gills	5-7 pairs	4 pairs
11.	Swim bladder	Absent	Present
12.	Excretory matter	Urea	Ammonia

Differences between cartilaginous and bony fishes

Dipnoi group

- Fishes of dipnoi group are called "Lung fishes" or "Uncle of amphibia" because their air bladder helps in respiration and acts as a lung. These are freshwater fishes.
- They have 3 chambered heart
- External and internal both the nares are present.
- Tail is heterocercal type. Scale is placoid type.
 - e.g, Protopterus (African lung fish)– a living fossil.
 Lepidosiren (South American lung fish)
 Neoceratodues (Australian lung fish).

Resonate the Concept

- 1. Shagreen is dried skin of cartilaginous fish.
- 2. **Isinglass** gelatinous substance derived from air bladder of certain fishes, used for making cement, jelly and for clarification of wine and beer.
- 3. Maltose cross Found in vertebra of shark for supporting vertebrae.
- 4. Mermaid's purse refers to egg capsule of shark.
- 5. Smallest fish- Mystichthyes (Goby fish/Pandaka) 8-10 mm size.
- 6. Cod liver oil is rich in vitamin D wheres shark liver oil is rich in vitamin A.

	Test your Resonance with concept						
1.	Bony plates/scutes occur in addition to scales in(1) sea horse(2) flying fish(3) eel(4) climbing perch						
2.	Association between (1) symbiosis	sucker fish <i>(Remora)</i> an (2) commensalism	d shark is (3) parasitism	(4) predation			
3.	Living fossil is a (1) dog fish (3) <i>Coelacanth (Latin</i>	neria)	(2) flying fish (4) <i>Dodo</i>				
4.	Which one is a true fi (1) Whale	sh? (2) Cuttle fish	(3) Silver fish	(4) Flying fish			
5.	Which one is a fish? (1) Sea cow	(2) Sea cucumber	(3) Sea horse	(4) Sea urchin			
	Answers 1. (1) 2. (2) 3. (3) 4. (4) 5. (3)						

SUPERCLASS - TETRAPODA

- Typically all tetrapods (Gk. Tetra = four + podos = foot) possess two pairs of limbs (pentadactylous limbs).
- Skin is adapted to withstand exposure to air (with scales, feathers or hair).
- They have **lungs** for aerial respiration.
- Their sensory organs are adapted for reception in air such as vision, hearing, smelling etc.
- Heart is three or four chambered and double circulation is found in them.
- Kidneys are mesonephric or metanephric type.
- Middle ear is present. Birds and mammals have external ears also.
- Tetrapoda is divided into four classes amphibia, reptilia, aves and mammalia.
- The **pisces** and **amphibia** are grouped as **anamniotes** (without amnion an embryonic membrane) whereas **reptilia**, **aves** and **mammalia** grouped as **amniotes** (with amnion).

	Pisces		Tetrapoda
1.	All fishes are aquatic	1.	Both aquatic and terrestrial from are present.
2.	Paired appendages in the form of pectoral and pelvic fins.	2.	Paired appendages in the form of pentadactylous limbs.
3.	Respiration by gills	3.	Respiration by lungs. Some amphibians also respiration by bucco-pharyngeal cavity, skin and gills.
4.	May possess an exoskeleton of dermal scales.	4.	May possess an exoskeleton of epidermal scales, feathers or hair.
5.	Do not have internal nares (except lung fishes)	5.	Have internal nares.
6.	Heart is 2 chambered (exception – lung fishes)	6.	Heart is 3 or 4 chambered.
7.	Have internal ear.	7.	Have internal and middle ear or internal, middle & external ear. Snakes lack ears.

Class - Amphibia (The vertebrates with dual life)

(Gk. Amphi = two or both; bios = life)

✤ General characters:

- 1. Habitat and Habit They were the first cold blooded vertebrates from evolution point of view, which came to the land but these were not able to live on land permanently. These depend on water for their reproduction because their eggs do not have protective covering to check the evaporation.
 - They are amphibious in nature i.e. they can live on land as well as in water. They are mostly found in warm climate.
 - They occur only in fresh water and on moist land. Amphibians are not found in sea water.
- 2. Body Form Body is divided into head, trunk and tail. Some amphibians lack tail. e.g. frog, toad etc.
- **3.** Body Wall The skin is smooth or rough containing glands to keep it moist. They are usually without scales but if present they are hidden beneath the skin e.g. **Caecilians** (blind worms).
 - Pigment cells are present called chromatophores for colouration. Few amphibians have ability to change colour by expansion and contraction of pigment cells. This phenomenon is known as **Metachrosis**.
- 4. Locomotion Paired fins are absent but unpaired fins may be present. Two pairs of limbs help in swimming in water or moving on land. Fore limbs have four fingers and hind limbs have five fingers. Their digits do not have nails or claws at all.
- 5. Respiratory system The gills are present atleast in the larval stage. Some adult forms also carry them in addition to lungs. e.g. *Necturus* (mud puppy)
 - The respiratory organs are lungs, buccopharyngeal cavity, skin and gills.
- 6. Circulatory system The heart is three chambered containing two atria and one ventricle. It contains sinus venosus and truncus arteriosus.
 - Both hepatic and renal portal systems are well developed.
 - RBCs are **biconvex**, **oval** and **nucleated**.
- 7. Endoskeleton Endoskeleton is made up of bones but cranium is cartilaginous.
 - Dicondylic skull.
 - Ribs mostly absent. If present, they are not attached with sternum.
 - Vertebrae are **procoelus type** in which centrum is **concave** from anterior side and **convex** from posterior side.
- 8. Nervous system & sense organs Ten pairs of cranial nerves are present.
 - Two nostrils are found (**dirhynous**). Ear consists of internal and middle ear. **Tympanum** (ear drum) covers the middle ear.
 - Lateral line sensory system is found during their embryonic development.
- **9.** Excretory system Kidneys (one pair) are mesonephric or opisthonephric type. Urinary bladder is present. Larvae and tailed amphibians (e.g. salamanders) are ammonotelic while frogs and toads are ureotelic.
- **10. Reproduction -** They are **unisexual**.
 - Males usually lack copulatory organs.
 - These animals return to water from land for their reproduction.
 - Fertilization is external and inside the water, but some animals show internal fertilization.
 - These are oviparous. Eggs are mesolecithal. Amnion is absent.
 - Cleavage is unequal and holoblastic.
 - Development is indirect i.e. metamorphosis present.
 - Tadpole larva in frog.

Axolotl larva – in salamander

- **11.** These animals undergo **hibernation** and **aestivation** to prevent themselves from extreme cold and heat and to overcome unfavourable conditions.
- **12. Classification -** Class amphibia is divided into three orders.
- i. Gymnophiona or apoda ii. Caudata or urodela iii. Anura or salientia
- i. Gymnophiona or Apoda
 - Also called **blind worms** or **caecilians**.
 - Primitive amphibians.
 - Worm like body, scales are present.
 - Limbless amphibians.
 - Eyes covered with opaque skin (blind).
 - Copulatory organ present in male.
 - Tail is ill developed or absent.
 - Fertilization is internal and parental care is found.
 - e.g. Icthyophis

ii. Caudata or urodela

- Tail is present.
- Two pairs of limbs are present. Sometimes hind limbs are absent.
- Skin is scaleless. Vertebrae are amphicoelous or opisthocoelous.
- External gills are present only in larval stage.
- Characteristic feature is **Neoteny** i.e. larva attains sexual maturity without undergoing metamorphosis and starts reproduction.
- e.g. Salamandra (Salamander) longest gestation period (36 months) *Ambystoma* (Tiger salamander) *Proteus* (Cave or blind salamander) *Necturus* (Water dog or mud puppy) *Amphiuma* (Congo eel)–Largest RBC present *Siren* (mud eel) *Triturus* (European large crested newt) *Cryptobranches* (Hell Bender) – Largest amphibian & fully aquatic.

iii. Order Anura or Salientia

- Tail is absent in adult stage. Includes all the frogs and toads.
- Skin is moist.
- 2 pairs of limbs are present. Fore limbs are short and hind limbs are long. Digits of hind limbs are **webbed** which help in swimming.
- Gills are absent in adults.
- Eyes with lids and tear glands are present (lower lid movable and upper immovable).
- Middle ear and tympanic membrane present.
- Well developed vocal sacs i.e. power of voice.
- Egg laying, fertilization and development is always in water. Fertilization is external.
- Development is indirect i.e. tadpole larva is present.
- Metamorphosis is complete.
 - e.g. *Rana tigrina* (Indian bull frog or common frog) *Rana goliath*–Largest frog *Hyla* (tree frog) *Rhacophorus* (Flying frog) *Alytes* (midwife frog) *Phyllobates*–smallest frog *Bufo* (Common toad) *Pipa* (Surinam toad) *Xenopus* (African toad) *Discoglossus* or *Bombinator* (Fire bellied toad)

Resonate the Concept

Many frogs and toads show Parental care. The male *Alytes* (midwife toad) carries the eggs around
its thighs till the tadpoles are ready to hatch. The female *Pipa* (Surinam toad) carries the tadpoles in
special pits on its back till they become little toads. In *Icthyophis* also, parental care is very well
developed. The female coils herself around the eggs to protect them.



Fig : Amphibians (a) European fire Salamander (Salamandra salamandra) ; (b) Rana

Important Examples of Amphibia: *Bufo* (Toad), *Rana* (Frog), *Hyla* (Tree frog), *Salamandra* (Salamander), *Ichthyophis* (Limbless amphibia).

	Test your Resonance with concept						
1.	Fire bellied toad is (1) <i>Amphiuma</i>	(2) Necturus		(3) Salamandra	(4) Bombinator		
2.	An amphibian lacking (1) <i>Necturus</i>	g limbs is (2) <i>Amphiuma</i>		(3) Salamandra	(4) Ichthyophis		
3.	A frog has (1) hands but no fing (3) eyes but no lids	ers		(2) ears but no pinna (4) jaws but no teeth	e		
4.	Frog has (1) five fingers and fo (3) five fingers and fin	our toes ve toes		(2) four fingers and fi (4) four fingers and f	ve toes our toes		
5. Which of the following is modified in toad to following is modified in toad to following (1) Sebaceous gland(3) Parotoid gland			oad to f	orm poison gland? (2) Pituitary gland (4) Submandibular g	land		
A	Answers 1. (4) 2. (4) 3. (2) 4. (2) 5. (3)						

Class Reptilia – The creeping vertebrates

(L. Reptare = to creep)

✤ General characters

- 1. Habitat These are normally terrestrial animals, but some animals are aquatic in nature also. They are cold blooded (ectothermic or poikilothermal).
- 2. Body form Body divided into head, neck, trunk and tail.
- **3.** Body wall Skin is dry, rough and without glands.
 - Exoskeleton is made of epidermal scales or bony plates.
- 4. Locomotion There are 2 pairs of pentadactyl limbs with claws / nails.
 - Some lizards and snakes do not have limbs e.g., *Ophiosaurus* lizard is a limbless lizard.
- 5. Respiration Respiration is by lungs throughout life but members of order chelonia respire through their cloaca also, known as "cloacal respiration".
- 6. Digestive system Tortoises feed almost entirely on vegetation. Some turtles are flesh eaters. All other reptiles are carnivorous or insectivorous.
 - A complete alimentary canal is found which opens into cloaca.
 - Teeth are acrodont, the codont or pleurodont type.
- 7. Circulatory system Heart consists of two atria and a partly divided ventricle.
 - In crocodilians, heart is four chambered (two atria and two ventricles).
 - Renal portal system is less developed.
 - Sinus venosus is ill developed and truncus arteriosus is absent.
 - **RBCs** are **oval** and **nucleated**.
- 8. Excretory system One pair of metanephric kidneys are present.
 - Urinary bladder may be present.
 - Crocodiles are ammonotelic.
 - Turtles and alligators are ureotelic.
 - Lizards and snakes are uricotelic.
- 9. Endoskeleton Skull is monocondylic i.e. with single occipital condyle.
 - Ribs are present in neck and thorax. Sternum is present.
 - Vertebrae are **procoelus** type.
- **10. Nervous system & sense organs –** Brain is well developed.
 - 12 pairs of cranial nerves present.
 - Each ear consists of three parts :- external, middle and internal. Snakes do not possess ears.
 - The lateral line system is completely absent.
- **11. Reproduction –** These are unisexual animals.
 - Genital aperture is not separate from anus. Ureters, genital ducts and alimentary canal open into a single cloacal chamber.
 - They are mostly oviparous. Some forms are ovoviviparous.
 - Development is direct.
 - Eggs are polylecithal and telolecithal.
 - Eggs are cledoic i.e. covered by a CaCO₃ shell. Cledoic eggs are an adaptation for terrestrial habitat.
 - Embryonic membranes (chorion, amnion, allantois and yolk sac) are formed during embryonic development so included in **amniota** group.
 - Cleavage is **discoidal** and **meroblastic**.
- **12. Classification –** Divided into 5 subclasses on the basis of presence or absence of temporal fossae and their number in the temporal region of skull.

- i. Anapsida
- ii Diapsida iii. Euryapsida (extinct)
- iv. Parapsida (extinct) v. Synapsida (extinct)

i. Subclass - Anapsida

- Temporal fossae are absent in the temporal region of the skull i.e. roof of skull is complete and solid.
- Includes two orders.
 - A. Order Cotylosauria- extinct
 - e.g. Seymouria- connecting link between amphibia and reptilia.

B. Order Chelonia

- includes terrestrial, marine and fresh water animals.
- Whole body is covered by firm bony shell. Exoskeleton of dorsal region of body is called carapace and skeleton of ventral region of body is called plastron. Bony plates of body called osteoderms.
- Sternum is absent.
- Digits are **webbed** for swimming
- Cloacal respiration also present.
- Animals are oviparous.
- e.g. *Testudo* Land tortoise
 - Chelone- Marine turtles

Trionyx- Fresh water terrapins (soft shelled turtles of Indian rivers - edible).

ii. Subclass Diapsida

- Two pairs of temporal fossae are present.
- Subclass diapsida is divided into four orders.

A. Order Rhynchocephalia

- Teeth are **acrodont** type.
- A functional **third eye** or **pineal eye** is found on the head.
- e.g. Sphenodon punctatum (tuatara) living fossil, found only in New Zealand.

B. Order squamata

- Largest number of species of reptiles found in this order in modern era.
- Includes all lizards and snakes.
- Limbs are clawed. Limbs absent in snakes and some lizards.
- Teeth are **pleurodont**.
- Order squamata is divided into 2 suborders.
- a. Suborder Lacertilia -
 - includes lizards.
 - Study of lizards is called "Saurology".
 - Eyelids are movable and **nictitating membrane** is found in eyes.
 - Auditory aperture and tympanic membrane is found in ears.
 - Phenomenon of **autotomy** is found.
 - e.g., Hemidactylus (Wall lizard)
 - *Calotes* (Garden lizard) *Varanus* (Goh, Monitor lizard)–Largest living lizard. *Ophiosaurus* (Glass snake)–limbless lizard. *Heloderma*–Only poisonous lizard.

b. Suborder ophidia

- includes snakes.
- Sudy of snakes is called **ophiology** or **serpentology**.
- Eyelids and nictitating membrane in eyes are absent.
- Auditory opening and tympanum are absent. No middle ear.
- Tongue thin, long and **bifid** and sensitive to odour and vibration.

e.g. *Python* (Azgar)–Largest snake (25 feet), non poisonous, rudimentary hind limbs present.

Naja (Indian cobra)-poisonous snake. Poison is neurotoxic.

Naja bungarus-Largest poisonous snake

Naja hannah (King cobra)-Head with one or two circular marks.

Bangarus (krait)- Poisonous snake (neurotoxic)

Vipera (Viper)– Poisonous (haemotoxic/Cardiotoxic) snake. Loreal pit is found which is a thermoreceptor. Largest viper is **Russel** viper (v mark on head).

Hydrophis (sea snake) - Poisonous snake. Tail is laterally compressed.

Resonate the Concept

- Characteristic features of poisonous snakes
 - **1.** Two teeth mark (v shaped in non-poisonous).
 - 2. Poisonous teeth (fangs) are modified maxillary teeth.
 - 3. Poisonous glands are modified labial glands (homologous to parotid gland of mammals).
 - 4. Small scales on hood or head while broad scales on ventral surface of body.
 - 5. Treatment by antivenom.

Antivenom in India produced at :-

- 1. Hoffkine Institute, Mumbai.
- 2. Central Research Institute, Kasauli, Shimla.
- Siggest serpentorium of India located in Chennai.
 - C. Order Crocodilia or Loricata
 - Includes crocodiles, alligators etc.
 - Amphibious in nature.
 - Largest modern reptiles.
 - Snout is long with external nares at distal end. Nares have cover.
 - Diaphragm is present in between thorax and abdomen.
 - Heart is completely four chambered.
 - Teeth are **thecodont type**.
 - Skin is covered by lines of bony scutes.
 - Sternum and **bifid ribs** are present.
 - e.g. *Crocodilus* (Crocodile) *Gavialis* (Gharial) – very long snout. *Alligator* (Mexican crocodile or Alligator)
 - D. Order Saurischia
 - Includes Dinosaurs (fossils)
 - e.g. Brontosaurus-Largest Dinosaur (herbivorous).

Resonate the Concept

- Four features make reptiles true land animals–
 - 1. Internal fertilization.
 - **2.** The amnion (an embryonic membrane) encloses the embryo and provides it with a watery environment during development, therefore the reptiles do not need water for laying eggs.
 - **3.** Shell around the egg to check dessication.
 - 4. Horny scales on the body check loss of water.



Fig : Reptiles : (a) Chameleon (b) Crocodilus (c) Chelone (d) Naja

Important Examples of Reptilia: Chelone (Turtle), Testudo (Tortoise), Chameleon (Tree lizard), Calotes (Garden lizard), Hemidactylus (Wall lizard), Crocodilus (Crocodile), Alligator (Alligator). Poisonous snakes – Naja (Cobra), Bangarus (Krait), Vipera (Viper).

	Test your Resonance with concept						
1.	A true terrestrial anim (1) tortoise	nal is (2) toad	(3) frog	(4) Necturus			
2.	Which of the following (1) Canine and Prem (3) Incisor and Canin	g teeth are lophodonts? olar e	(2) Premolar and Incisc (4) Premolar and Molar	or			
3.	Which one of the follo (1) <i>Python</i>	owing is a poisonous sna (2) <i>Typhlops</i>	ke? (3) <i>Eryx</i>	(4) Enhydrina			
4.	<i>Typhlops</i> is (1) sea snake	(2) grass snake	(3) glass snake	(4) blind snake			
Å	Answers 1. (1)	2. (4) 3. (4)	4. (4)				

Class Aves – The birds (L. Avis = Bird)

- Study of birds **Ornithology.**
- Arrangement of wings on the body of birds is known as **Pterylosis**.
- "Birdman of India" Dr. Salim Ali.
- Huxley stated that "Birds are glorified reptiles".

General characters

- 1. Birds are bipedal, feathered and **warm blooded** (endothermal, sternothermal or homoiothermal) animals. Their **forelimbs** are **modified into wings**.
- 2. Habitat Found on land as well as in water. There are about 9,000 species of birds.
- **3.** Body form and body wall-Body is boat shaped. It is divided into head, neck, trunk and tail. Neck is long and flexible.
 - A cover of soft feather (derivative of stratum corneum) present all over the body called as "plumage".
 - No skin gland is present (except **uropygial** or **oil gland** on the tail). Ostrich and parrot lack oil gland.

- 4. Locomotion Legs are modified for walking, hopping, grasping, perching, wading and swimming and usually bear four, sometimes three and rarely two toes. Legs (hind limbs) bear horny epidermal scales.
- 5. Digestive system The upper and lower jaws are modified into beak which lack teeth. An epidermal horny sheath is present on beak called as **ramphotheca**.
 - The alimentary canal has additional chambers, the **crop** and **gizzard** (modifications of oesophagus). The crop stores and softens the food whereas gizzard helps in crushing and churning the food.
 - **Pigeon milk** (crop product) is secreted by both sexes.
 - A three chambered **cloaca** and a **cloacal aperture** is present.
 - Gall bladder is absent in some seed eating (graminivorous) birds such as pigeons.
- 6. Respiratory system The lungs are spongy and inelastic.
 - Air sacs are connected with the lungs which help in flying.
 - The larynx does not act as a voice box. Voice is produced by a special organ called the Syrinx.

7. Circulatory system – Heart is four chambered.

- Hepatic portal system is well developed in birds, but renal portal system is ill developed.
- Sinus venosus is absent.
- RBCs are nucleated, oval and biconvex.
- 8. Endoskeleton The bones are pneumatic i.e. they have air cavities to reduce body weight. There is no bone marrow.
 - The skull is **monocondylic**.
 - Cervical vertebrae are from 11 to 25. Centrum of the vertebra is heterocoelous.
 - Sternum is usually large and with a median keel for the attachment of flight muscles.
 - Ribs are **bifid**.
 - Two bones, clavicle and interclavicle fuse to form V-shaped **furcula**, which acts as a spring between the two pectoral girdles. Furcula is absent in flightless birds.
- **9.** Excretory system The kidneys are metanephric (trilobbed) which drain the nitrogenous waste mature (chiefly uric acid) into cloaca through the ureters.
 - Urinary bladder is absent except in American Rhea and Ostrich.
 - They are uricotelic.
 - Excreta of marine birds is known as guano.
- **10. Nervous system and sense organs –** Brain is smooth and highly developed with well-developed cerebellum for aerial mode of life.
 - 12 pairs of cranial nerves are present.
 - Eyes are large and nictitating membrane is present. Vision is **monocular.**
 - A specific comb like structure **pecten** is found in the eyes of all birds **except Kiwi's eyes**. Pecten provides **acute vision** and **telescopic vision** to birds.
 - External ears are present but ear pinnae are absent. **Columella bone (stapes)** i.e. only one ossicle is found in middle ear. Cochlea (not coiled) is present in internal ear.
- **11. Reproduction –** Birds are **monodelphic** i.e. only left ovary and left oviduct is functional in females. Birds are oviparous vertebrates.
 - Birds are unisexual & sexual dimorphism is well marked.
 - Fertilization is internal.
 - Eggs are large, polylecithal, telolecithal and discoidal.
 - Embryonic development is **direct.** Included in amniota group

12. Classification – Divided into **two subclasses**.

- i. Subclass Archaeornithes.
 - All have become extinct.
 - Includes primitive "Lizard like birds".
 - Connecting link between reptiles and birds.
 - e.g. Archaeopteryx (lizard bird)

- Extinct in cretaceous period
- Fossil was discovered by Andreas Wagner from Bavaria (Gemany).
 Archaeornis
- ii. Subclass Neornithes Includes modern as well as extinct birds.
 - e.g. **Columba –** Pigeon,
 - Passer House sparrow

Corvus - Crow, Psittacula - Parrot



Fig : Some birds : (a) Neophron (b) Struthio (c) Psittacula (d) Pavo

Important Examples of Aves: *Corvus* (Crow), *Columba* (Pigeon), *Psittacula* (Parrot), *Struthio* (Ostrich), *Pavo* (Peacock), *Aptenodytes* (Penguin), *Neophron* (Vulture).

	Test your Resonance with concept					
1.	On which side of the (1) Left side (3) Both the sides	female birds ovary deve	lops? (2) Right side (4) Both the sides but without oviducts			
2.	The branch of science (1) Herpetology	e dealing with the study (2) Ornithology	of birds is (3) Oncology	(4) Anthropology		
3.	Both male and female (1) mammary glands	e pigeons secrete milk th (2) crop glands	nrough (3) salivary glands	(4) gizzard glands		
4.	Beak is toothed in (1) ostrich	(2) kiwi	(3) Archaeopteryx	(4) pelican		
5.	Birds have bipedal loo (1) reduces body weig (3) provides more sup	comotion as it ght oport to the body	(2) increases rate of lo(4) spares forelimbs fo	comotion r flight		
ļ	Answers 1. (1)	2. (2) 3. (2)	4. (3)	5. (4)		

Class – Mammalia

(L. Mamma = Breast)

✤ General characteristics

- 1. These animals are warm blooded, hairy and have mammary or milk producing glands.
- 2. Habitat Occur in all sort of habitats.
- 3. Body wall Sebaceous (oil) glands and sudoriferous (sweat) glands present in the skin.
- 4. Digestive system Teeth are heterodont, thecodont and diphyodont.
- 5. Circulatory system Heart is four chambered.
 - Sinus venosus is absent.
 - Renal portal system is absent.
 - RBCs are without nucleus except the members of family Camelidae (e.g., Camel).
- 6. Endoskeleton Have seven cervical (neck) vertebrae.
 - Skull is dicondylic.
- 7. Excretory system One pair of metanephric kidneys are present.
 - Cloaca is absent (except monotremes or egg laying mammals).
 - main excretory matter– Urea.
 - Urinary bladder is present.
- 8. Nervous system and sense organs Well developed brain with large cerebrum & cerebellum.
 - Optic lobes divided into 4 lobes called corpora quadrigemina.
 - Corpus Callosum connects the two cerebral hemispheres.
 - Each ear has 3 parts- external, middle and internal. Middle ear has 3 bony ossicles- malleus, incus and stapes. Internal ear has on organ of corti which is true organ of hearing.
 - 12 pairs of cranial nerves are present.
- 9. Reproduction Penis (male copulating organ) is always present.
 - Fertilization is internal.
 - They are viviparous (except monotremes).
 - There are present 4 embryonic membranes (except monotremes) Chorion, amnion, allantois & yolk sac.
 - A placenta is present (except monotermes)

Resonate the Concept

- i. A muscular diaphragm dividing trunk into thorax and abdomen is present.
- ii. Coelom is divided into 4 cavities- a pericardial cavity, 2 pleural cavities and a peritonial cavity.
- **10. Classification –** Divided into 2 subclasses.
 - a. Subclass Prototheria- egg laying.
 - **b. Subclass Theria** produce young ones.
 - (a) Subclass Prototheria Most primitive mammals restricted to Australia, Tasmania, New Guinea etc.
 - Lay eggs and have cloaca.
 - Includes one order Monotremata
 - e.g. Ornithorhynchus(Duck billed platypus), Echidna (Spiny ant eater).
 - (b) Subclass Theria Produce young ones. Divided into two infra classes.

(i) Infraclass Metatheria

- Mainly found in Australia, New guinea and South America.
- Females have a marsupium or brood pouch for rearing the young ones.
- Includes one order Marsupilia.
 e.g. *Macropus* (Kangroo), *Didelphis* (opossum) and *Phascolarctos* (Koala).
- (ii) Infraclass Eutheria

BIOLOGY FOR NEET

- Have true placenta so called placental mammals.
- Embryo is retained in uterus (womb) till an advanced stage.
 e.g., *Balaenoptera* (blue whale) *Camelus* (camel) *Canis* (dog) *Felis* (cat) *Delphinus* (Dolphin) *Equus* (horse) *Elephas* (Elephant) *Macaca* (monkey) *Panthera tigris* (tiger) *Panthera leo* (lion) *Pteropus* (flying fox) *Rattus* (rat)



Fig. Some Mammals : (a) Ornithorhynchus (b) Macropus (c) Pteropus (d) Balaenoptera

	Differences between three groups of mammals					
	Prototheria	Metatheria	Eutheria			
1	Oviparous	Viviparous	Viviparous			
2	No pinnae	Pinnae present	Pinnae usually present			
3	No Nipples (mammae)	Nipples abdominal	Nipples abdominal or thoracic			
4	No marsupial pouch	Marsupial pouch often	No marsupial pouch			
		present				
5	Digestive and urinogenital	Anus and urinogenital	Digestive and urinogenital tracts			
	tracts open into a cloaca,	apertrue open into a shallow	open out by seprate apertures.			
	cloaca aperture opens outside	cloaca surrounded by a				
	through cloacal aperture.	common sphincter				
6	Corpus callosum is feebly	Corpus callosum is feebly	Corpus callosum is well developed.			
	developed or absent	developed or absent	It, internally, connects two cerebral			
			hemisphere of the brain.			
7	Testes abdominal, no scrotum	Scrotum in front of penis	Scrotum behind penis			
8	No Placenta.	Placenta is less developed	Placenta is well developed			

Important Examples of Mammalia: Oviparous-Ornithorhynchus (Platypus); Viviparous - Macropus (Kangaroo), Pteropus (Flying fox), Camelus (Camel), Macaca (Monkey), Rattus (Rat), Canis (Dog), Felis (Cat), Elephas (Elephant), Equus (Horse), Delphinus (Common dolphin), Balaenoptera (Blue whale), Panthera tigris (Tiger), Panthera leo (Lion).

Test your Resonance with concept

1.	1. In which group, all the animals do not belong to same phylum?					
	(1) Man, Amphioxus and Panthera		(2) Earthworm, Hi	(2) Earthworm, Hirudo and Blatta		
	(3) star fish, brittle s	tar, sea urchin	(4) fish , frog and	crocodile		
2.	Which of the following	ng is the largest mar	imal?			
	(1) Elephant	(2) Dolphin	(3) Loxodonta	(4) Whale		
3.	The mammals usua	lly do not lay eggs, b	ut one of these lays			
	(1) spiny anteater	(2) scaly anteater	(3) hedge hog	(4) porcupine		
4.	Which one of the fo	lowing is an exclusiv	e character of class Man	nmalia?		
	(1) Presence of com	pletely 4-chambered	heart (2) Homoeothermi	ic		
	(3) Internal fertilizati	on	(4) Presence of a	muscular diaphragm		
5.	Odd numbered digit	s are not found in				
	(1) Rhinoceros	(2) Horse	(3) Camel	(4) Zebra		
	Answers					
	1. (2)	2. (4) 3.	(1) 4. (4)	5. (3)		