



## Learning outcome:

Develop understanding on the diversity of life with regard to chordates.

- Group animals on the basis of their morphological characteristics/ structures.
- Develop critical understanding how morphological change due to change in environment helps drive evolution over a long period of time.

## Table of contents

	MAMMALS
1	Introduction
2	General characters of mammals
3	Classification of mammals
4	Adaptive radiation in mammals

## Introduction

Mammals form the highest group in animal kingdom and they show great diversity. Hair clad ,air breathing warmblooded, viviparous tetrapod vertebrates are mammals

### General features of Mammals:

- Body having different shape and divisible into head, neck, trunk and tail.
- Skin covered with horny epidermal exoskeleton of hair. Skin is thick , glandular having sebaceous and sudorific (sweat) gland.
- Mammary glands are present which secret milk for nourishment of the young.

Two pairs of pentadactyle limbs variously adapted for walking, running, burrowing, swimming or flying. Each foot bears 5 (or fewer) toes provided with horny claws, nails or hoofs

- Skull has large cranial cavity. The lower jaw is reduced to a single dentary bone. Teeth are heterodont, thecodont and diphyodont.
- Vertebrae are gastrocentrous. Neck contains 7 vertebrae.

- Buccal cavity contains true salivary glands, tongue mobile, alimentary canal leads into anus and cloaca is absent.
- Lungs are respiratory organs. Larynx contains well developed vocal cords for sound production. Glottis is guarded by epiglottis.
- Heart is 4 chambered having two auricles and two ventricles. Only left systemic arch is present.
- A muscular diaphragm completely separates thoracic cavity from an abdominal cavity.
- Kidneys are metanephric, ureters open into the urinary bladder.
- Brain is highly developed. Corpus callosum connects the two halves of cerebrum. 12 pairs of cranial nerves are present.
- Eyes have movable lids. Ear has a large external pinna, middle ear has ear ossicles, an internal ear has membranous labyrinth with spirally coiled cochlea.
- Sexes are separate and paired gonads. Fertilization is internal and mammals are viviparous.
- Embryo develops within the uterus except monotremes. Embryo has amnion, chorion and allantois. Placenta fixes the embryo to uterine wall for nourishment, respiration and excretion.
- Mammals are homiothermic animals.

## CLASSIFICATION OF MAMMALS UPTO ORDERS

- The class Mammalia is divided into two subclasses, Prototheria and Theria.

### Subclass 1. Prototheria:

- These are primitive, egg-laying mammals which are connecting link between reptiles and mammals.
- After hatching young ones are nourished on milk from mammary glands.
- Pectoral girdle has separate precoracoid, coracoid and interclavicle.
- Testes are abdominal. Cloaca is present. Teeth occur only in young, the adult having bony beak.
- Brain is small, corpus callosum is absent. Skeleton is reptilian.

- The subclass Prototheria includes only one order called Monotremata.

Order- Monotremata:

- This order has all the characters of the subclass Pototheria.
- Ex: Spiny ant eater, Ornithorhynchus (Duck billed platypus).



Subclass 2. Theria

- They do not lay eggs but they give birth to young ones.
- Mammary glands are provided with teats.
- Ear has external pinna. Brain is mostly with corpus callosum.
- Vertebrae bear epiphyses, coracoid is reduced.
- Cloaca is absent, digestive and urino-genital system opens out by separate apertures.
- Teeth occur in both the young and the adults.
- The subclass Theria is divided into infra classes.

Infraclass 1. Metatheria

- They are called pouched mammals.
- Epipubic bone is present.

- Female has ventral pouch called marsupium.
- The young ones are born in an extremely immature condition and undergo further development in a marsupium.
- Uteri and vaginae of the two sides remain separate.
- They are monophyodont with only one set of teeth.

#### Order- Marsupialia

- Characters same as infraclass- Metatheria.
- Ex. Didelphis (Opossum), Macropus (Kangaroo).



#### Infra-class-2. Eutheria:

- They are called placental mammals.
- They have allantoic placenta. Yolk sac is present but without yolk.
- Uteri generally and vagina always united into one.
- Young ones have prolonged intrauterine development.
  - Brain is highly developed. There is no cloaca.
  - The infraclass Eutheria is divided into 16 orders.

#### Order 1: Insectivora

- They are small, primitive mammals.
- Food mainly insects clawed digits. The locomotion is plantigrade.

- Many teats and multiple births. Testes internal.
- They have elongated snout, skin covered by soft fur or with spines.

Ex: Sorex, Eranaceus



#### Order 2. Chiroptera:

- They are flying mammals. Forelimbs are modified with lateral fold of skin called patagia or wings.
- Hind limbs are short and weak. All five digits of hind limbs and first two digits of forelimbs bear claw used for hanging.
- Bones are slender. Sense of touch and hearing remarkably developed.
- They are nocturnal gregarious. Two mammae present on thorax.
- Ex: Pteropus (Flying fox).



#### Order 3. Dermoptera:



- A thin, wide, hairy fold of skin the patagium extends along either side of the body.
- All the four limbs are of equal size.
- They are flying mammals, nocturnal and arboreal, but they only glide.

Ex: Galeopithecus (Flying lemur)



Order 4. Edentata:

- Dentition incomplete, only molars present.
- Limbs have sharp claws on the digits.
- Tongue is long and protrusible.
- Ex: Dasypus.



Order 5. Pholidota:

- Body elongated, pointed head and long prehensile tail.
- Limbs are armed with strong curved claws. Tongue is very long, sticky and protrusible.
- Jaw lack teeth, eyes small. Insectivorous.

- Ex: Manis (Scaly ant-eater).



#### Order 6. Rodentia:

- Small mammals , herbivorous in diet.
- Dentition is modified for gnawing and chewing. Single pair of incisors, long sharp.
- Digits have claws.
- Skin covered with fur. Spines in porcupine.
- They are pentigrade or semipentigrade.
- They are prolific breeders and produce several young ones at a time.
- They have many mammae. Ex: Hystrix (Porcupine) Rattus.



#### Order 7. Lagomorpha:

- They have two pairs of incisors in upper jaw.
- Pinnae are long. Hindlimbs are long and tail is short.
- They are herbivorous, burrowing animals.
- Ex: Rabbit, Lepus.





#### Order 8. Primates:’

- They are most intelligent animals. Highly developed brain.
- Pentadactyl and long limbs each having five digits with nails. They are arboreal animals.
- Eyes directed forwards to give binocular vision. Single pair of teats in female.
- Birth is given to single young one.
- They show parental care. Ex: Loris, Chimpanzee.



#### Order 9. Cetacea:

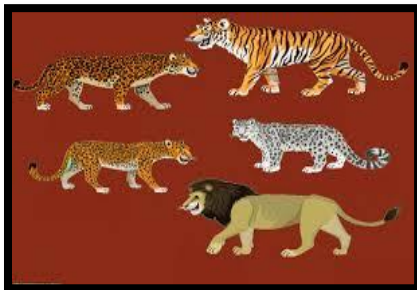
- They are adapted for aquatic life.
- Body is fish like, covered with smooth skin .
- Forelimbs modified into paddle-like flippers. Hindlimbs absent.

- Tail is dorsoventrally flattened, ends into flaps and flukes. Tail useful for swimming
- Eyes are small without nictitating membrane.
- Teeth homodont, lack enamel. Females have only two mammae, they are carnivorous.
- Ex: Balaenoptera (blue whale), Dolphin.



#### Order 10. Carnivora:

- They are very agile, bold and ferocious mammals.
- They feed on flesh. Few are omnivorous or herbivorous.
- Teeth sharp canines, premolars have cutting edges and two molars are crushing teeth.
- Jaws are powerful, useful for capture, kill and tear the prey.
- Senses are very keen, cerebrum is well convoluted.
- They are mostly terrestrial but some are aquatic. Ex: Panthera, Bear.



#### Order 11. Tubulidentata:

- They have stout, somewhat pig-like sparsely hair on body with long snout and pinnae.
- Mouth tubular, slender protrusible sticky tongue. Toes have heavy claws.
- Ex: Orycterpus.



#### Order 12. Hyrocoida:

- Small mammals like guinea pigs.
- Pinnae and tail are short. Four digits on forelimbs and three on hindlimbs.
- Ex: Procavi (Haryx).



#### Order 13. Proboscidea:

- They are largest terrestrial mammals.
- Head large, neck short, eyes small, broad fan-like ears, huge trunk, thick pillar like legs and small tail.
- The snout and upper lip are prolonged into long, muscular, prehensile proboscis or trunk.
- Skin thick, with scanty hair.

- Upper jaw bear only two incisors.
- Skull is very large. Limbs pentadactyle with nail like hoof. Ex: Elephas, Laxodonta.



#### Order 14. Sirenia:

- They are large, aquatic, hairless mammals. Body spindle shaped, forelimbs modified into paddles, hindlimbs absent.
- Tail bears fin or fluke. Head has blunt mizzle, small mouth, fleshy lips eyes small.
- Ex: Dugong.



#### Order 15: Perissodactyla:

- Terrestrial and herbivorous mammals.
- Limbs are long adapted for swift running.
- They have odd number of digits enclosed in cornified hoofs.
- Locomotion is unguligrade, i.e. animal walks on the tips of the digits with the heels raised from the ground.
- There are no horns. Ex: Tapir, Equs.



### Order 16.: Artiodactyla:

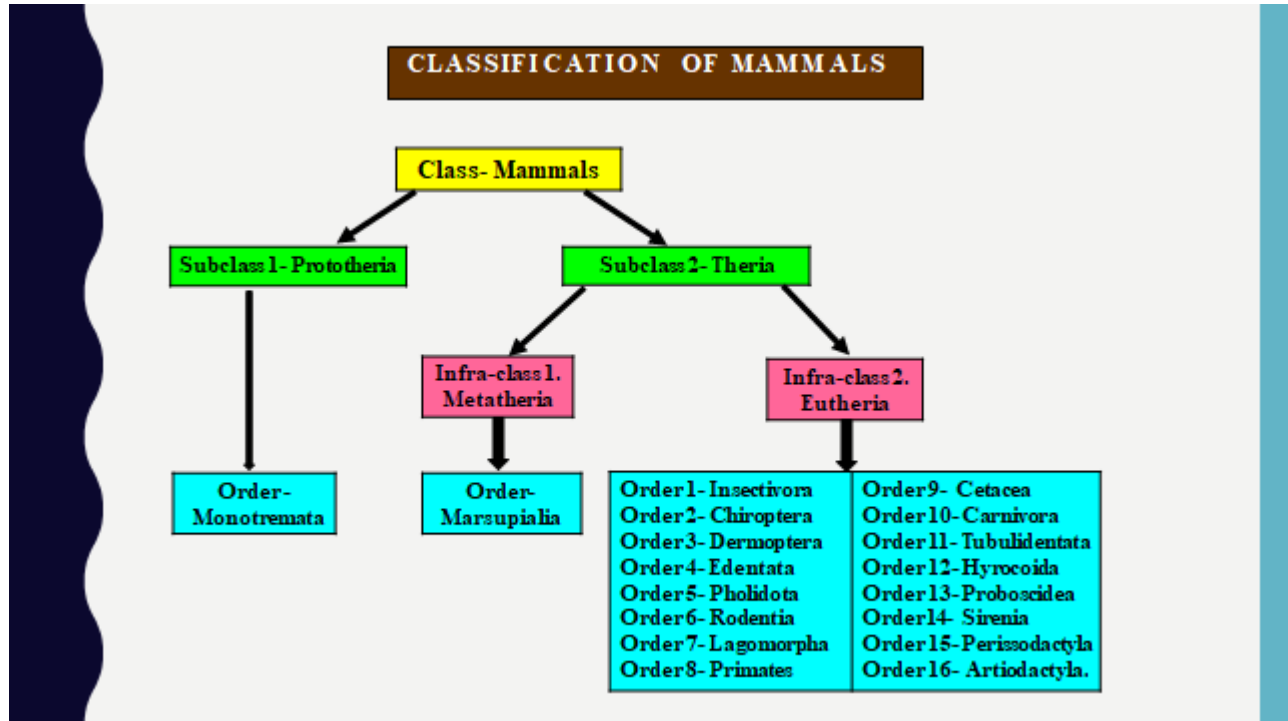
Terrestrial and herbivorous mammals. Limbs are long, adapted for fast running

- Each limb has only two functional digits. Each digit is enclosed in a cornified hoof.
- Locomotion is unguligrade.
- Neck is elongated. Many forms have horns or antlers on head. Incisors and canines are absent.
- Eyes are large, with horizontal pupil, pinnae are long and hearing is acute.
- Mammae are abdominal, they have teats.
- Scent glands are present for marking territory and for sexual and social life.

Ex: Hippopotamus, Lama



Summary



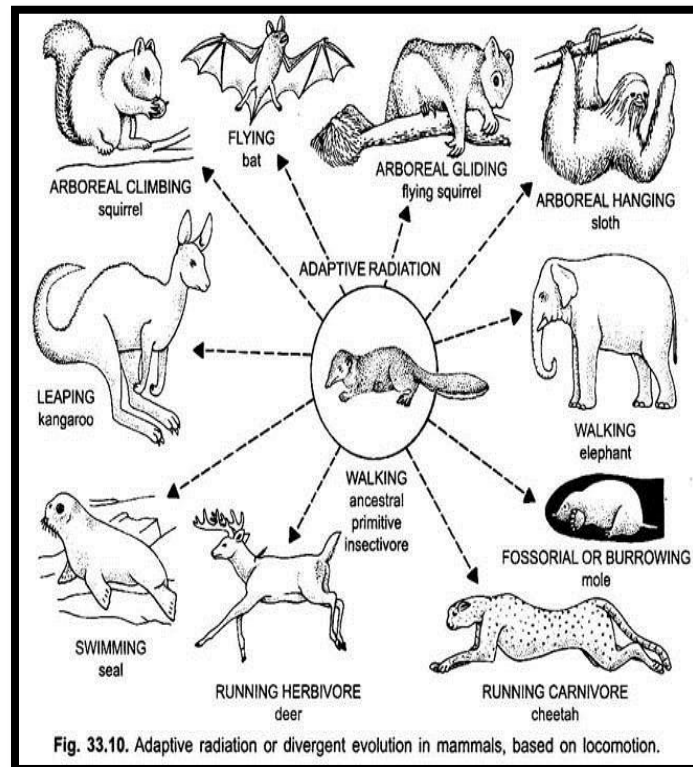
## Adaptive radiation in mammals

- Adaptive radiation can be defined as “ the evolution from a single ancestral species to a variety of forms which occupy different habitats”.
- Osborn H. F. in 1898 developed the concept of adaptive radiation in evolution.
- The mammals originated during Eocene and Oligocene period moved into the habitats and ecological niches. Thus the mammals are showing variety of forms and different habitats.
- In evolutionary biology, adaptive radiation is a process in which organisms diversify rapidly from an ancestral species into a multitude of new forms, particularly when a change in the environment makes new resources available, creates new challenges, or opens new environmental niches.



### Adaptive radiation in mammals based on locomotion:

- The primitive common ancestor mammals were terrestrial, 5 toed plantigrade limbs with no particular specialization.
- From this ancestor stem various types of modern mammals have evolved by the modification of limbs and other structures adapted to a wide variety of habitats.
- Mammals show five basic patterns of locomotion like running (cheetah horses, Zebras), burrowing (Rat, Shrew), tree climbing (Monkeys, Koala, Squirrels) flying (Bat, Flying Squirrels) and swimming (Whales, Dolphins).
- Their other modifications are walking (Elephant, Man), leaping (Kangaroos), graviportal (Elephants, Hippopotamuses, and Rhinoceroses).



Links:

<https://docs.google.com/presentation/d/1Cln9ZqYrtaPzTfNgLdyg8JiFfBKmYgxi/edit#slide=id.p1>

[https://www.youtube.com/watch?v=2VfCnn\\_HZ0I](https://www.youtube.com/watch?v=2VfCnn_HZ0I)

**Explore more:**

- Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
- Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press
- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.

**Assessment**

Units	Out-of –class activity Details of Activity	In-class activity Details of Activity	Assessment
1.1	Students should observe the specimens	Discussion on the topic Check the level of understanding through Question – answer session	Question – answer session
1.2	Students should classify the specimen Students should observe characters and identify mammals	Discussion on the topic Check the level of understanding through Question – answer session Help students to apply the knowledge	Question to write in detail classification with examples