# CHAPTER SEVEN
# Mammals
# Endothermic Amniotic Haired Vertebrates

## Mammals overview

Class Mammalia (Latin mamma=breast), Mammology is the science deals with the study of mammals. Class Mammalia includes all the forms on which the female possesses mammary glands for the production of milk with which they nourish their young. Besides, they are warm-blooded (endothermic) animal like birds, where all mammals have a hairy covering on their body. Even though they are apparently naked, whales and dolphins grow sensitive bristles on their snouts. These two fundamental characteristics (mammary glands and hair) are possessed by all mammals and unlike other living vertebrates.

## Variation in size

A wide variety of structure and form is present among the mammals. They range in size from that of a small shrew, the body of which is about 2.5 cm in length, and weighs about 2g. to that of a whale attaining a length of more than 30 meters, and weigh about 150 tons or more. Thailand hog-nosed bat is also about the same weight of smallest shrews.

## Distribution in all habitats

Because mammals are: i. endothermic animals and ii. many variations occur in their limb structure, they have been able to achieve a greater diversity of habitats. Some like moles entirely underground; whales are water dwelling; bats rival birds in their ability to fly; most monkeys are arboreal; but the majority of mammals walk or run on solid ground.

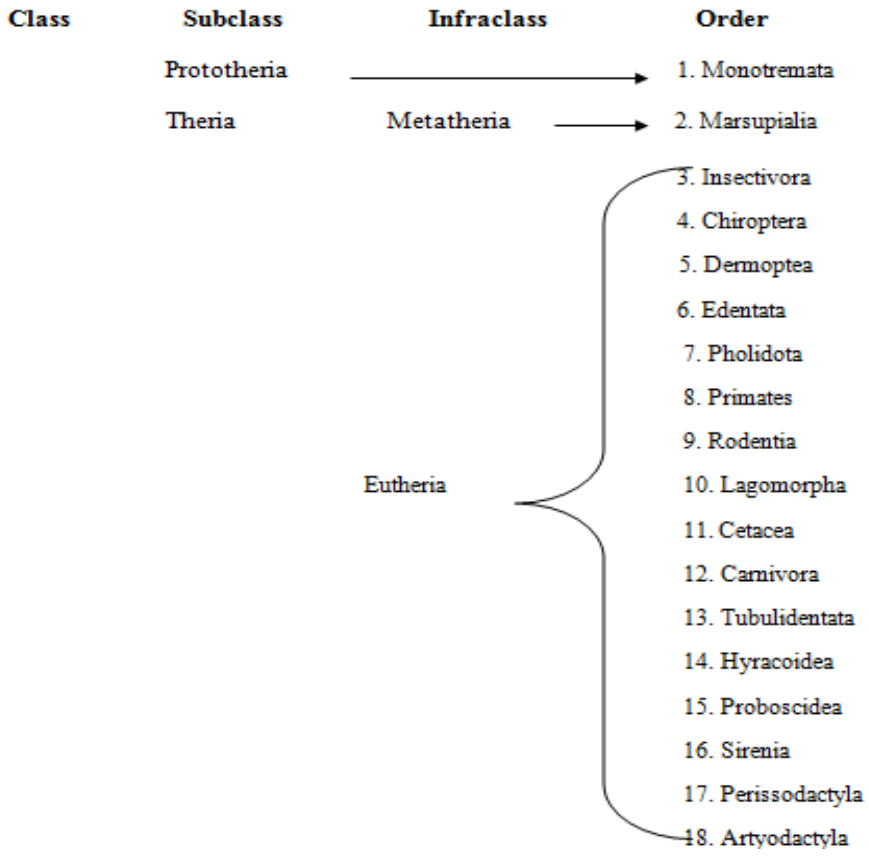
## Unique characteristics of Class Mammalia

1. Body is covered by epidermal hair or its modifications like wool, fur, bristles, quills and spines.
2. Mammary glands supply milk for the nourishment of suckling young.
3. Skin richly glandular, containing sweat (sudoriferous), sebaceous (oil) and sometimes scent gland in both the sexes.
4. External ear opening mostly protected by fleshy and cartilaginous sound collecting lobe called pinna accessory to the outer ear.
5. Brain is highly evolved. Both cerebrum and cerebellum large and convoluted, so they show the greatest intelligence among all animals.
6. Head of some species, like rhinos; sheep; cows, bears long horns and of deer and giraffe bears antlers.
7. Teeth are mostly heterodont (incisors, canines, premolars and molars.

8. Glottis protected by cartilaginous epiglottis.
9. A muscular diaphragm separates the thoracic and abdominal cavities.
10. Digits of the limbs are provided with either claw or nail or hoof.
11. Red blood corpuscles non-nucleated and mostly biconcave.
12. Alimentary canal terminates by anus, there being no cloaca except in monotremes and pikas (American rabbit).
13. Testes commonly placed in a bag or scrotum outside abdomen.
14. Egg with little yolk and no shell, except egg-laying monotremes. **Most** mammals are viviparous, where developing fetus attached to uterine wall of mother by a placenta for nutrition and respiration.

## Classification

Class Mammalia include approximately 5000 living species. A few mammals (six species) lay eggs and the rest give birth to living young, including marsupials and placental mammals. 95% of mammals are placentals. Accordingly, the class Mammalia has been divided into two subclasses and two infraclasses as in the following scheme:




**Subclass I. Prototheria**: Contain only the egg laying forms and has cloaca throughout life.

**Subclass II. Theria**: Therians which give birth to young.

Therians are subdivided into two infraclasses. Those that have a yolk sac or vitelline placenta belong to **Infraclass Metatheria**, and those that have a chorioallantoic placenta belong to **Infraclass Eutheria (Placentalia)**.

**Subclass I. Prototheria** (Gr., protos = first, therion = beast)

**Peculiar features of Prototheria represented by monotremes**

1. Females lay eggs (oviparous).
2. Mammary glands lack teats and nipples. The milk oozes onto the mother's hair, around the mammary gland openings, and the babies lap it off with their tongues.
3. Ear pinna absent.
4. Adults lack true teeth.
5. Cloaca receives the openings of urinary bladder, vas deferens and ureters.
6. Testes are abdominal (no scrotum).
7. Living species are included in a single order.

**Order Monotremata** (Gr., monos = single, trema = opening), where the term monotreme is literally means that they have one opening for excretion and reproduction. Their name (monotreme) mirrors the observation that the cloaca has a single opening to the exterior.

Only six species are found today for duck-billed platypus and echidna. The duck-bill is also known as the water mole or duck mole, and the echidna is also known as spiny ant-eater **(Fig.1).** Upper jaw is produced into depressed beak in platypus and pointed rostrum in echidna. The large sticky protrusible tongue in echidna is employed for ant-eating purpose. Hair on the dorsal side of the echidna's body is coarse or spine-like. All these monotremes are endemic to Australia or nearby Tasmania and New Guinea.

**Echidna *Tachyglossus sp*. Duck-billed platypus *Ornithorhynchus sp.***

**FIGURE 1:** Two primitive egg laying mammals (subclass prototheria).

**Subclass II: Theria** (Gr., therion = beast)
Includes Metatheria (marsupial) and Placentalia.

**Distinctive features in comparison with prototheria**

1. The females give birth to young ones (viviparous).
2. Mammary glands with nipples or teats.
3. Ear Pinna generally present but absent in some aquatic mammals.
4. Teeth generally present throughout the life period, heterodont dentition except aquatic mammals.
5. Possess anus except pikas, lagomorphs type.
6. Testes generally within the scrotal sac.
7. The ureter opens directly into the urinary bladder.
8. Living species are included in 17 orders.

**Mammary glands**

A mammary gland is an exocrine gland in mammals that produces milk to feed young offspring. Mammals get their name from the Latin word mamma, "**breast**". The mammary glands are arranged in organs such as the breasts in primates (for example, humans and chimpanzees), the **udder** in ruminants (for example, cows, goats, and deer), and the **dugs** of other animals (for example, dogs, pigs and cats). Mammary glands located: i. ventrally, on both sides of abdomen; ii. inguinal, in the root or base of the femurs of hind limb; iii. thoracic region; iv. Between the two forelimbs; v. sidely in the base of forelimb.

Subclass Theria is divided into two living infraclasses:

**Infraclass A. Metatheria** (Gr., Meta = next to)

**Unique characteristics**

1. Primitive animals next to only monotremes.
2. The young are born in an immature condition and undergo further development in the marsupium of females.
3. Mammary glands with nipples open into the marsupium.
4. Two epibubic bones of the pelvic girdle protects the marsupial sac.
5. Placenta is simple and of vitelline type (yolk sac placenta).
6. This infraclass includes single order.

**Order Marsupialia** (L., marsupium = a sac)

They are also primitive mammals next to only monotremes. They are the dominant group of mammals in Australia and the neighboring islands. Most of them are native only to Australia and New Guinea and some species in South America and one species in North America. They range from small forms like the marsupial mole, to the large kangaroos. Forelimbs are shorter than the hind limbs. Members

of this order show variation in the feeding habit; carnivorous herbivorous and omnivorous. **(Fig.2).**

**North American opossum *Didelphis sp.*** **Banded ant-eater *Myrmecobius sp.***

**Marsupial mole *Notoryctes sp.*** **Cuscus *Phalanger sp.***

**Wombat *Vombatus sp.*** **Common kangaroo *Macropus sp.***

**Koala *Phascolarctos sp.***

**FIGURE 2:** Some pouched mammals (marsupials).

## Eutherian's (Placentalian's) Orders

### Order 1. Insectivora (L., insect = insects, voro = to eat)

1. Small terrestrial and nocturnal insectivores.
2. Body is covered with hair, some members possess dorsal spines.

3. Testes are retained in the abdominal cavity, and they never descend fully into scrotal sac in any genera.
4. Mammary glands are many and are distributed all along the ventral surface.

**Examples: Shrews, Moles, Hedgehogs, Tenrecs, Moon rats (Fig.3).**

**Shrew** **Mole rat**

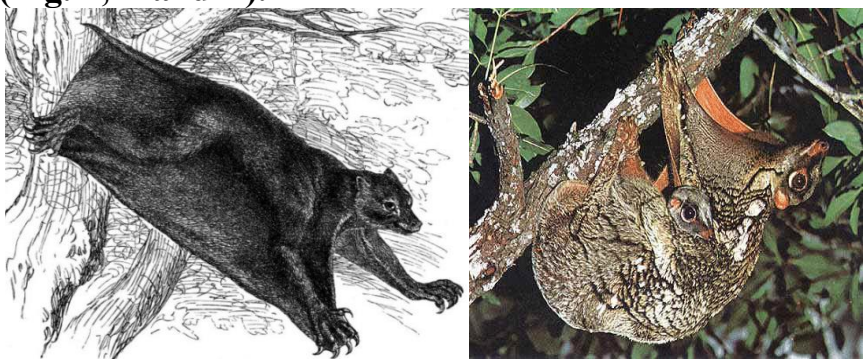
**Hedgehog**

**FIGURE 3:** Some insectivores.

**Order 2. Dermoptera** (L., derma = skin, pteron = wing)

1. Dermopterans are tree-living and their size is like that of a large squirrel or a cat.
2. Most important feature is the presence of broad folds of hairy skin (patagium) extending between the legs and onto the tail with which it glides long distances from one tree to another.
3. They are herbivorous.

**Examples: Colugo or flying lemur of East Indies and Colugo of Malay and Philippines (Fig. 4, A and B).**



**Colugo *Cynocephalus variegatus*** **Colugo *C. volans***

**FIGURE 4:** Two dermopteran species.

**Order 3. Chiroptera** (L., cheir = hand, pteron = wing)

1. Comprise large mammalian order. The only mammals which have mastered true flight like birds so their structure is modified **(Fig.5)**. They show variations in feeding **(Fig.6)**.
2. Pinna is well-developed.
3. Forelimbs modified to wings, and their bones are elongated, as are all the fingers, excepting the pollex, for the support of the patagium that runs between the forelimbs and hind limbs and include the tail if present.
4. First digit of the forelimb (pollex) is small, free from the wing and bears claw.
5. Hind limbs are rotated, so the knee is directed backward.
6. Sternum is carinate (keeled) like that of the flying birds and serves for the attachment of the strong pectoral muscles used in flight.

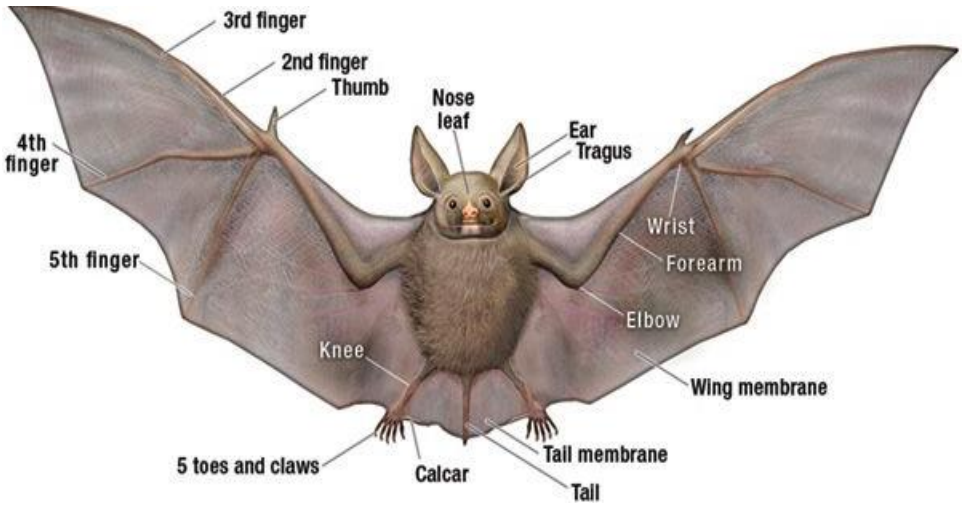



**FIGURE 5:** Bat, general anatomy.

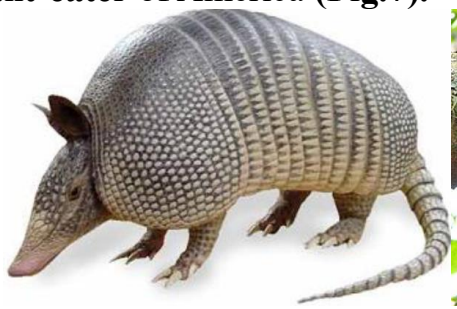
**A** **Sangunivorous bat** | **B** **Insectivorous bat** | **C** **Frugivorous bat (flying fox)**

**FIGURE 6:** Three types of bats, Microchiroptera (A and B) and C- Megachiroptera.

**Order 4. Edentata or Xenarthra** (L., edentates = toothless)

1. Teeth absent or reduced to molars, without enamel and root, but pulp cavity persistent.
2. A sticky tongue is present, they are mostly insectivorous.

**Examples: Armadillos** of central and South America, **Sloth** of North and South America, **Giant ant-eater** of America **(Fig.7).**



**Armadillo**

**Sloth**

**Ant-eater**

**FIGURE 7:** New World edentates mammals (Xenarthra).

**Order 5. Tubulidentata** (L., tubulus = small tube, dens = tooth)

4. Small mouth possesses long protrusible tongue. Ant-eaters in habit.
5. Incisors and canines are absent. The cheek teeth are 4 or 5 in number. Teeth pulp with numerous fine tubules hence the name of the order Tubulidentata.
3. Represented by 1 species, **Aardvark** of Africa, the sole representative of the order **(Fig.8).**

**Aardvark *Orycteropus afer***

**FIGURE 8:** Aardvark, the sole representative of the order Tubulidentata.

**Order 6. Pholidota** (Gr., Pholis = horny scales)

1. Body covered with large overlapping horny scales with sparse hair in between, ventral surface covered with hairs.
2. Facial part is prolonged to form a short muzzle.
3. Tongue is long, sticky and protrusible and is retained in a sac, used in captured insects.
4. Teeth are absent.

**Examples: The Indian pangolin** and the **Chinese Pangolin** inhabit Assam, eastern Himalayas, Myanmar, and South China **(Fig.9).**

**Pangolin *Manis sp.***

**FIGURE 9 :** Pangolin, its body covered with overlapping horny scales and can roll itself into an impenetrable ball.

**Order 7. Rodentia** (L., rodere = to gnow)

1. It is numerically the largest of all the mammalian groups.
2. Small terrestrial with exception. **Capybara** is the largest living rodents which are about the size of a pig of a South America form. Beavers, amongest the rodents, are aquatic.
3. Gnawing teeth of rodents are their most outstanding feature. These are two long curved incisors in front of both jaws.
4. Canines are absent, so there is **a diastema**, or a stretch of toothless jaw between the incisors and the first grinding teeth.
5. Testes are abdominal or inguinal in position.
6. Nipples of the females are abdominal. The rate of reproduction is rapid.
7. Rodents are cellulose eaters.
8. Represented by 1814 species. **(Fig.10).**

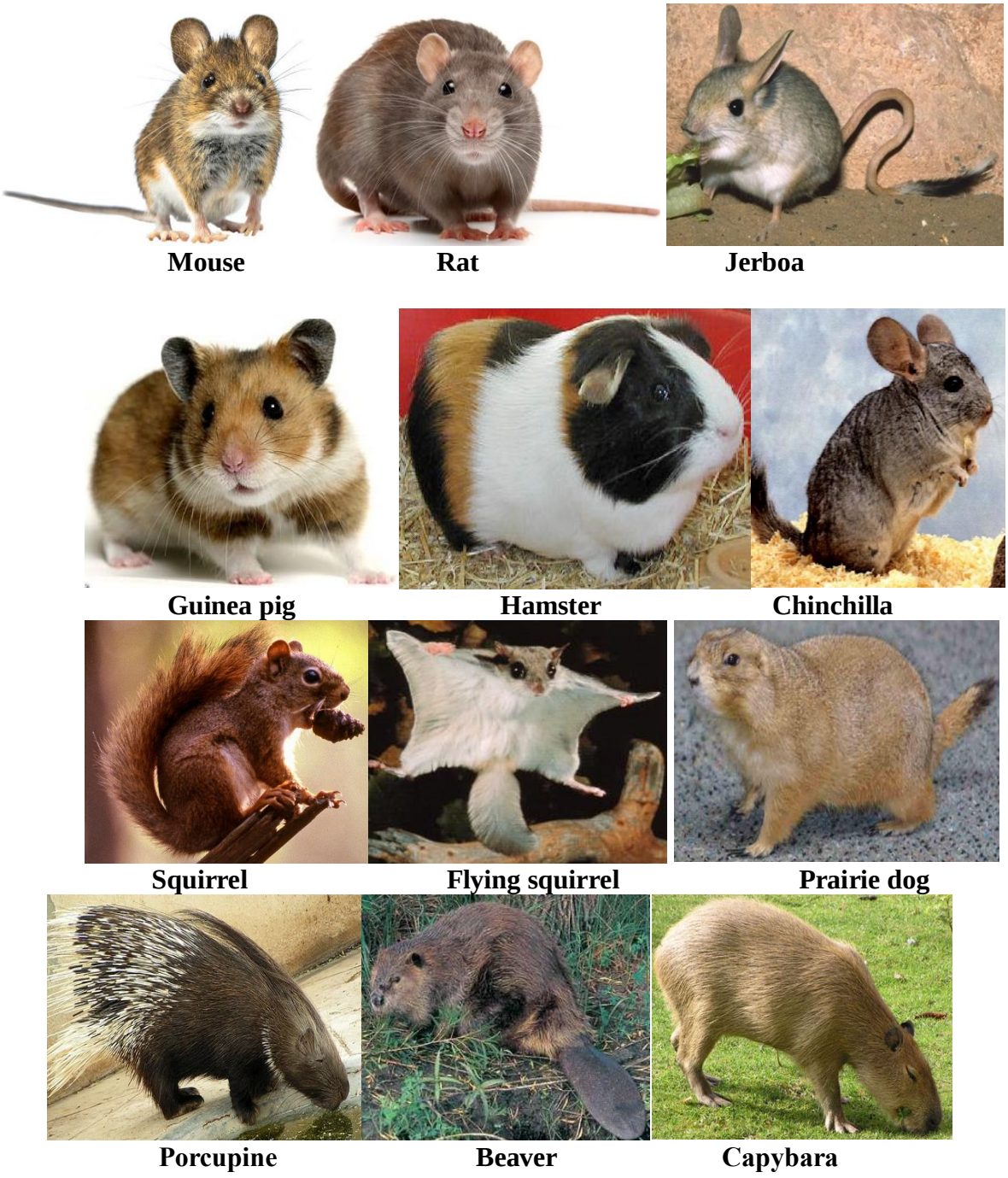



**FIGURE 10:** Different rodent species.

**Order 8. Lagomorpha** (L., lagos = hare)

1. Members belonging to this group are small herbivorous and gnawing forms.
2. There are two pairs of incisors in the upper jaw and one pair in the lower jaw. Incisors of upper jaw are of unequal size. A large pair lies in front and the smaller pair lies behind the front pair.
3. Canines are absent as such, diastema is present.

4. Upper lip is provided with a cleft in the middle.
5. Hind limbs are larger than the forelimbs. Digits end in claws.
6. Testes lie inside scrotum.
7. Nipples are abdominal in position.
8. Members of Lagomorpha were formerly classified belonging to the order Rodentia because of superficial similarities.
9. Represented by 63 species.

**Examples: Rabbits, Hares, Pikas (Fig.11).** Pika is famous for its occurrence of cloaca among eutherian mammals.

**Rabbit *Oryctolagus sp.*** **Hare *Lepus sp.*** **Pika *Ochotona sp.***

**FIGURE 11:** Lagomorohs, small herbivorous gnawing mammals.

**Order 9. Hyracoidea** (Gr., hyrax = shrew, eides = form)

1. They are small creatures, small and rabbit-like in size. With primitive and specialized features. Inhabit certain regions of Arabia, Syria and Africa.
2. Snout is splitted in some forms.
3. Pinna is short.
4. A single pair of large and curved upper incisors with persistent root is present. Lower jaw bears two pairs of incisors which are comb-like. Canines are absent. The upper incisor teeth, like those of rodents grow continuously. There is a diastema between canine and first premolar.
5. Tail is short.
6. There are four digits in the forelimb and the fifth one remains as a vestige.
7. Hind limbs are provided with three digits.
8. All digits are provided with hoof-like nails, with the exception of the inner digit on the hind foot has a claw.
9. Male hyraxes lack a scrotum and their testicles remain tucked up in their abdominal cavity next to the kidneys, the same as in elephants, manatees, and dugongs.
10. Female have a pair of teats in thoracic region near their armpits (axilla), as well as four teats in their groin (inguinal area).
11. Herbivorous in habit.
12. Represented by hyraxes **(Fig.12).**

**Hyrax *Procavia sp.***

**FIGURE 12:** Two genera for hyrax.

## Order 10. Cetacea (L., cetas = Whale)

1. Cetaceans are true mammals have undergone profound modifications in adapting themselves to aquatic, marine conditions.
2. Body is large, torpedo-shaped and devoid of hairs. A few sensory bristles are present around the snout. They are morphologically fish-like to allow them to easily move through the water.
3. Skull is dorsoventrally flattened and the facial part is elongated.
4. Pinna of ear and nail of the digits are absent.
5. Nasal openings located far back on the upper surface of the head.
7. Forelimbs are modified to form the flippers.
8. Hind limbs are mostly absent.
9. Tail terminates in a horizontal fin that moves up and dawn. Tail fin, called fluke, it is stiff and strong but contains no bone.
10. A fleshy dorsal fin is present on the dorsal side and acts as stabilizer.
11. Teeth may be present or absent. Accordingly, whales are separated into two groups. The **toothed whales** are usually smaller in size and include the dolphin and porpoise; both jaws bear homodont teeth. The **whalebone** whales or **baleen whales** have no teeth but possess great sheets of baleen whalebone which hang from the roof of the mouth. These plates are used in straining water the great numbers of microscopic plants and animals. Giant whales are members of this group.
12. Scrotum is absent and the testes lie inside the abdomen.
13. Two mammary glands are located in the inguinal area. Mammary glands are provided with muscles that help secretion of milk through two nipples, each lies in a soft pocket, where urinogenital slit located between them.
14. Copulation and birth both take place in water.

15. Breathe air by means of highly elastic and extensible lungs. Deep diving cetaceans store $O_2$ in the muscles and in the blood. Muscles of whales contain large quantities of myo-haemoglobin, a protein that attracts oxygen this help for the long submergence of the animal by storing $O_2$.
16. Toothed whales consume squids, octopi and different fish species. They generally prey below about 400 meters water depth. All toothed whales use the sonar system (echolocation) for navigation, communication and also in finding the prey in dark gloomy waters in the same way as bats.
17. Usual food of whalebone whales, with the exception of the grey whale, is a variety of zooplankton known as krill. The baleen plates act as strainer and these giant whales are filter feeder. They are not known to use echolocation or sonar-like phenomenon in finding their prey.
18. So-called spout of the whale is not a column of water, nor is it merely a condensation of moisture from the warm, exhaled air coming from the lungs. It is largely composed of a mixture of mucus, gas and emulsified oil that gathers in the lungs. This is expelled in the form of foam throughout the nostrils located on the top of the head. **(Fig.13).**

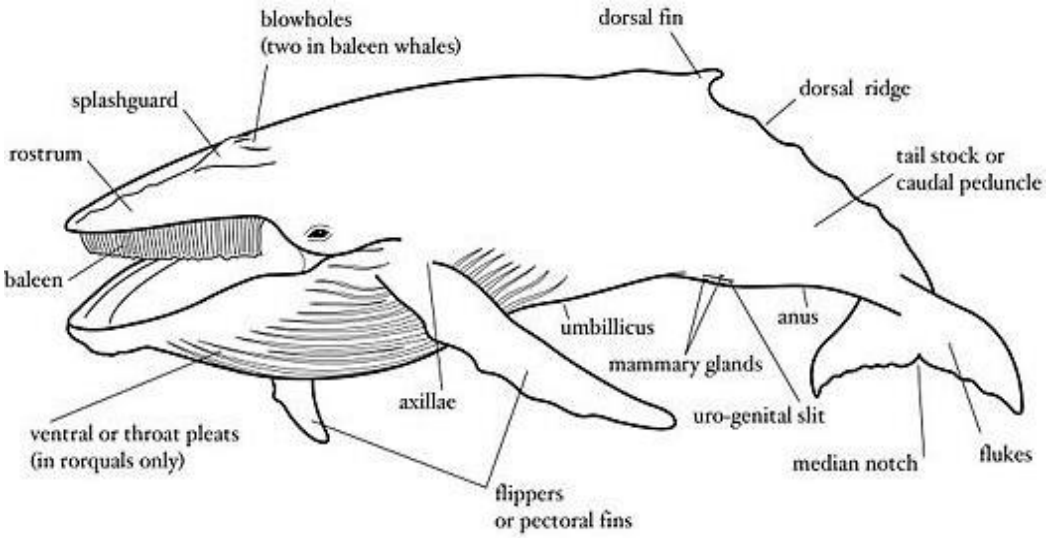


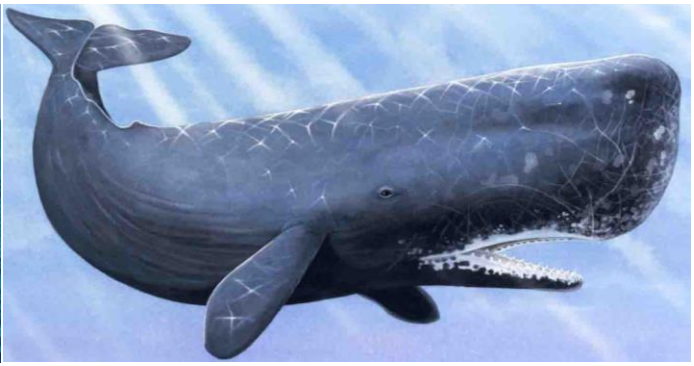

**FIGURE 13:** Morphology of typical whale.

## Suborder1. Odontoceti

It includes toothed whales. They mostly bear a fairly long beak with sharp homodont teeth on both jaws.

**Examples (Fig.14).**

Dolphin *Platanista sp.*



Sperm whale *Physester sp.*

Narwhal *Monodon sp.*

Killer whale *Orcinus sp.*

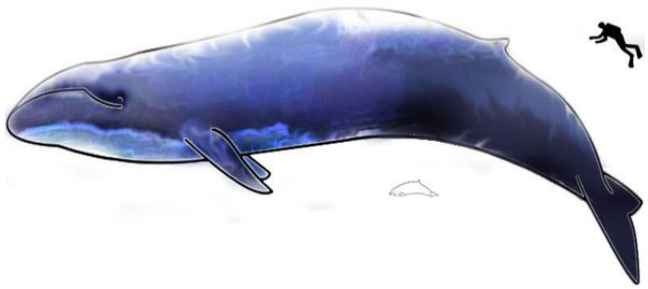
**FIGURE 14:** Some species of whales and dolphins, suborder: odontoceti.

The **narwhal**, or **narwhale** is a medium-sized toothed whale. It is also known as the "unicorn of the sea". The animal's most distinguishing characteristic—its 9-foot-long helical tusk (elongated upper left canine), which is found only in males. Unlike other whales narwhals do not have a dorsal fin.

## Suborder 2. Mysticeti (Baleen Whales)

Include whales which lack teeth in adult stage. Teeth are replaced by more than 300 triangular plates or baleen. The baleen is made up of horny structures and hangs from the roof of the mouth. The baleen is arranged in two rows on either side of the upper jaw. The tongue is muscular. The nostrils are paired.

**Examples: Blue whale (the largest animal in the existence), Humpbacked whale, Finner whale, Right whale (Fig.15).**



Blue whale *Balaenoptera*

**FIGURE 15:** Some species of baleen whales.

**Order 11. Sirenia** (Gr., siren = sea nymph)

1. Aquatic, freshwater or marine animals (sea cows). The body is large and stream lined, with few hair.
2. Aquatic adaptation gives their bodies many features that are similar to that of cetaceans.
3. Muzzle (snout) is round and the upper lip is protruding.
4. Neck is short.
5. Nostrils are on the snout.
6. Pinna is absent.
7. Eyes are small with muscular eyelids.
8. Jaws carry no teeth at the front, but have horny pads.
9. Forelimbs are large, the digits are jointed to form paddles, with a full pentadactyle structure.
10. There are no hind limbs and the pelvic girdle remains only as small rods.
11. Testes are abdominal.
12. young are born in water and nursed at pectoral nipples . One pair of mammary nipple located near the base of the paddles from outside.
13. Herbivorous in habit.
14. Represented by 4 species. While Manatees have large, paddle-shaped tails, dugongs have dolphin-like tail flukes.

**Examples: (Fig. 16).**

**Dugong *Halicore sp.*** **Manatee *Manatus sp.***

**FIGURE 16:** Two sirenians, cetaceans like animals, but their snouts are round. The upper lips are protruding and lack of dorsal fin. In third image the mother nurses her calf from a nipple located sidely at the base of the paddle.

### Paddles and flippers

Paddle is modification in forelimbs of turtles and sirenians. Flattened structures with movable joints, they help in swimming, while flippers are modification in forelimbs of cetaceans flattened stout structures with unjointed structure, which can be moved as a whole. They serve as balancer and provide stability during swimming.

### Order 12. Proboscidea (L., Proboskis = trunk)

1. These are **largest living land vertebrates** especially the African elephant.
2. The fusion and elongation of the nose and upper lip have resulted in the formation of a large prehensile **proboscis** called the **trunk**, with nostrils at its free end. Elephant trunk is very versatile and uses for numerous functions, such as, breathing, olfaction, touching, grasping, producing sound and suck up water to drink, or to spray on its body.
3. Eyes are small but pinna is large.
4. Only one pair of continually growing upper incisors forming the two enormous uncurved **tusks** used for offense and defense.
5. Tail is short and flat.
6. Pentadactyle limbs are pillar-like. Digits are **hoofed**.
7. Males **lack scrotum** and the testes abdominal in position and lie close to kidneys,
8. A pair of pectoral or thoracic nipples between their front legs.
9. Only one young is born at a time. Gestation period is 22 months.
10. Herbivorous (L. herba, green crop and vorous, to eat) in habit.
11. Represented by 2 species.

**Examples: Asian elephant, African elephant (Fig.17).**

**Asiatic elephant *Elephas Maximus***

**African elephant *Loxodonta Africana***

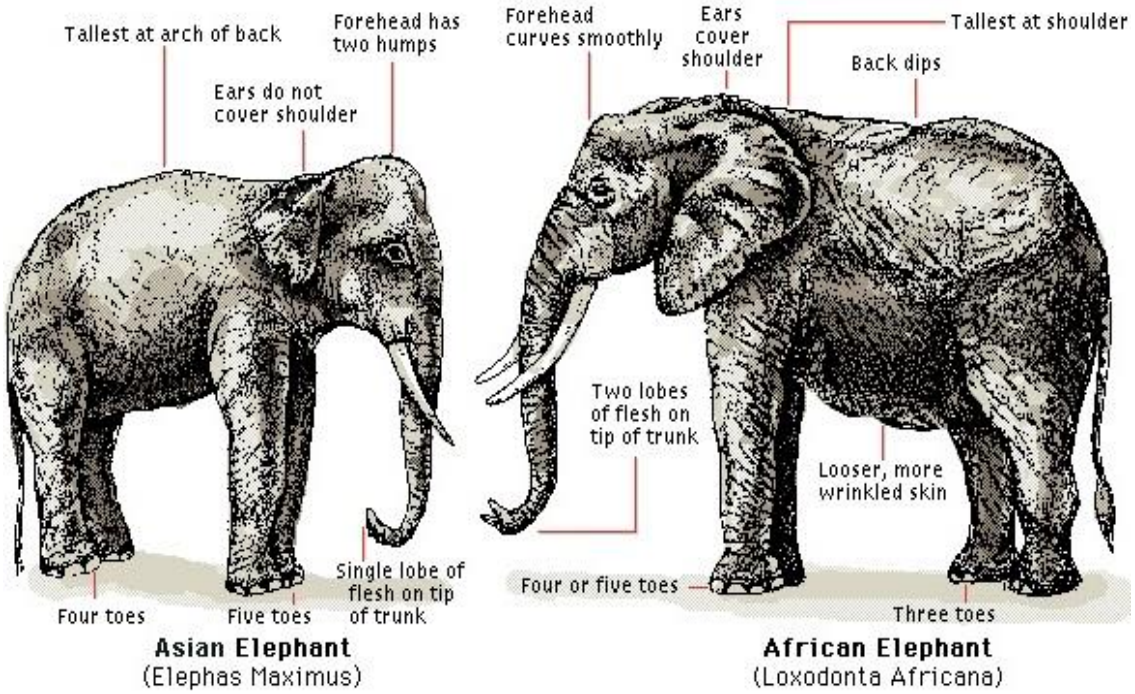



**FIGURE 17:** Two different elephant species, with their morphological variations.

**Order 13. Carnivora** (L., carno = flesh, voro or vorous = to eat)
The great majority of carnivores are terrestrial, but a few have become highly adapted to aquatic life. Hence the two suborders:

**Suborder I. Fissipedia** (In Latin fissipēs cleft-footed)
Carnivorous mammals that have separate toes, and terrestrial life, as bears, badgers, dogs, cats, and raccoons.

**General characteristics**

1. This order includes the strongest and most formidable of all terrestrial mammals, with highly developed brain and convoluted cerebral cortex.
3. Sense of smell is well developed.
4. Dentition is highly specialized. Each powerful jaw possesses three pairs of small incisors and one pair of large and sharp canine.
5. Numbers of digits in the limbs are usually five but never less than four. Digits end in sharp claws and claws may be retractile.
6. Testes are present in scrotal sac.
7. Nipples are abdominal in position.
8. Flesh eaters, for the most part, although some are omnivorous like bears.

There are currently seven families of fissipedes, including terrestrial individuals, in a few cases (e.g., otters), semiaquatic.

## Family 1. Canidae (dog family)

Limbs are long. Forelimbs are with 4 or 5 digits. Hind limbs are always with 4 digits. Pollex or hallux is reduced. Claws are non-retractile.

**Examples: (Fig.18).**

**Wolf *Canis lupus*** **Jackal *Canis aureus***

**Dog *Canis familiar*** **Fox *Vulpes sp.***

**FIGURE 18:** Some carnivore species, family Canidae.

## Family 2. Mustelidae (Weasel Family)

Members are slender bodied, long-necked but short-legged forms. Claws are non-retractile. In semi-aquatic otter, the digits are webbed.

**Examples: (Fig.19).**

**Otter *Lutra sp.*** **Badger *Meles sp.***

**Skunk *Mephitis sp.*** **Weasel *Mustella sp.***

**FIGURE 19:** Some carnivore species, family Mustelidae.

## Family 3. Ursidae (Bear family)

Members are large. Limbs are with five digits and digits are clawed. Tail is short. Members undergo hibernation. Omnivorous (L. omnis= all, voros= to eat, i.e. eat flesh and plants. Eat fruits and fishes).

**Examples: (Fig. 20).**

**Brown bear*Ursus arctos***

**Black bear**

**Polar bear *Thalarctos maritimus***

**Giant panda *Ailurapoda melanoluca***

**FIGURE 20:** Some carnivore species, family Ursidae.

## Family 4. Procyonidae (Racoon family)

The claws are not retractile .

**Examples: (Fig. 21).** Kinkajou is a carnivore with a long and prehensile tail.

**Kinkajou *Poto sp.***

**Racoon *Procyon sp.***

**FIGURE 21:** Two carnivore species, family Procyonidae.

## Family 5. Viveridae (Civet family)

Members possess short pinna and legs. Digits have non-retractile claws. Skull is large and dentition is typical.

**Examples: (Fig.22).**

**Civet *Viverra sp.***

**Mongoose *Herpestes sp.***

**Binturong *Arctictis sp.***

**Suricata *Suricata sp.***

**FIGURE 22:** Some carnivore species, family Viveridae.

## Family 6. Hyaenida (Hyena family)

The anterior part of the body is massive and slants posteriorly. The number of digits in each limb is four. Digits end in non-retractile claws.

**Examples: (Fig.23).**

**Striped hyena *Hyaena hyaena***

**Spotted hyena *Crocuta crocuta***

**FIGURE 23:** Some carnivore species, family hyaenidae.

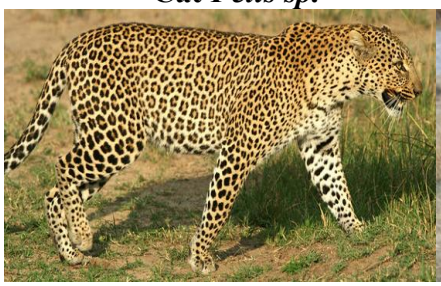
## Family 7. Felidae (Cat family)

Their members are very active predators. Tail is long. Digits end in retractile claws. Pads are present beneath the digits.

**Examples: (Fig.24).**

**Cat *Felis sp.***

**Wild cat (Lynx) *Lynx sp.***



**Leopard *Panthera pardus***

**Cheetah *Acinonyx jubatus***

**Tiger *Panthera tigris***

**Lion *Panthera leo***

**FIGURE 24:** Some carnivore species, family Felidae.

## Suborder II. Pinnipedia (In Latin, means fin-footed)

1. Aquatic carnivores. **Pinnipeds are commonly known as seals**, although it includes somewhat,morphologically, differ creature, which is the walrus.
2. Streamlined, torpedo-shaped body move about on land with difficulty.
3. They come up on land or ice to give birth to young and nurse their young.
4. Body of most species is covered with soft hairs.
5. Ear pinna developed or absent, with strong sense of hearing.
6. **Among adaptations for life in water are webbed paddle like limbs known as flippers.** Hind flippers are directed backwards.
7. **Digits are mostly enclosed within the distal end of the flipper and, unlike those of land-dwelling carnivores, they usually lack claws**.

8. Testes lie in scrotum.
9. Mammary glands or nipples one or two pairs. Folds of skin cover the genitalia and nipples.
10. They feed at sea on fish, squid, mollusks and crustaceans. This suborder includes three families, 34 species in 18 genera **(Fig.25).** .

**Fur seal *Callorhinus sp.*** **Common seal *Phoca sp.***

**Cow sea lion *Zalophus sp.*** **Male sea lion *Zalophus sp.***

**Male (bull) and female (cow) elephant seal *Mirounga sp.*** **Walrus *Odobenus sp.***

**FIGURE 25:** Different species of Suborder Pinnipedia.

## Order 14. Perissodactyla (Gr., Perissos = odd, daktylos = finger)

1. They walk on the hoofed tips of one toe, three or occasionally four toes, hence named odd-toed ungulates (mammals with hoofs). Tapirs and some rhinos have four toes on forefeet, and three on the hind feet.
2. The body weight is borne on a single digit because the functional axis of the leg passes through the middle toe (third one).
3. Horns are absent in most forms.
4. Testes lie in scrotum.
5. One pair of teats inguinal in position.

6. Herbivorous in habit.
7. Represented by 17 species.
This order includes three families:

## Family 1. Equidae

**Examples: (Fig. 26).**

**Horse *Eqqus cabalus***

**Mule**

**Ass *Eqqus asinus***

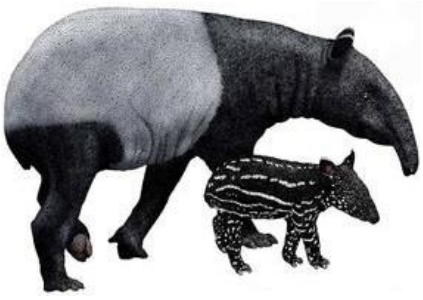
**Zebra *Eqqus zebra***

**FIGURE 26:** Odd-toed ungulates, family Equidae.

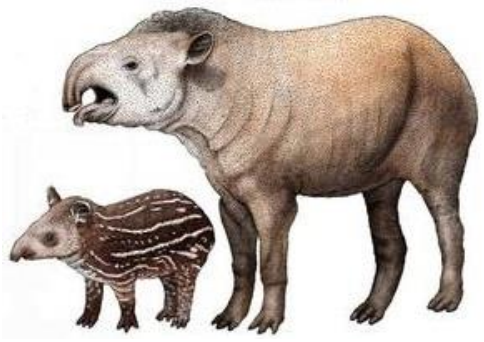
## Family 2. Tapiridae

Tapirs are nocturnal, herbivorous and heavy-bodied mammals. They have short legs with four hoofed toes on the forefeet and three on the hind feet. The upper lip and nose form a short flexible proboscis.

**Example: Tapir (Fig. 27).**



**Malayan tapir *Tapirus indicus***



**South American tapir *Tapirus terrestris***

**FIGURE 27:** Tapir, its upper lip and nose form a short flexible proboscis.

## Family 3. Rhinocerotidae

The horn on the nasal bone is very characteristic.
**Examples:** Rhinoceros **(Fig.28).**

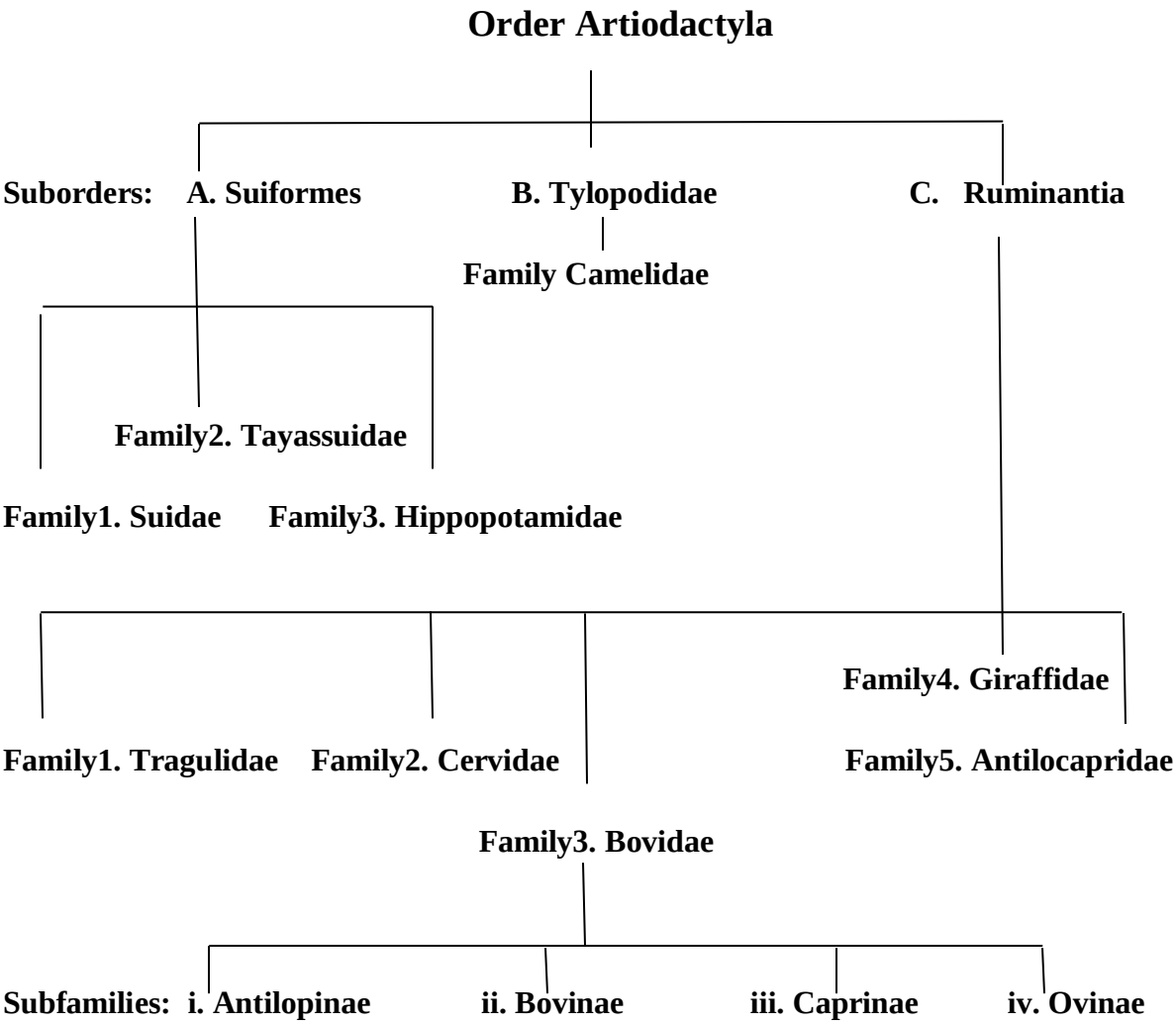
**One-horned rhinos *Rinoceros unicornis*** **Two-horned rhinos *R. Diceros***

**FIGURE 28:** Two rhino's species. Their horns located on the nasal bone.

## Order 15. Artiodactyla (Gr., artios = even, daktylos = finger)

1. Artiodactyles are usually called even-toed ungulates, where the number of functional digits is two or four in each limb.
2. Third and fourth digits are larger and bear hoof. The axis of the body passes between the middle of the 3rd and 4thdigits. This is a **paraxonic foot**.
3. Members usually possess a pair of epidermal horns. Horns may be hollow or solid and are located on the frontal bone.
4. Pinna is large.
5. Tongue is long, mobile and prehensile.
6. Upper incisors are absent and the space left by them is hard.
7. Testes lie in scrotum.
8. Teats are mostly inguinal, but in pigs abdominal in position and may be more than one pair.
9. Herbivorous in habit.
10. Represented by 213 species.

Members of this order show great variations and so is divided into 3 suborders in addition to families and subfamilies as shown in following scheme:




## Suborder A. Suiformes

Members belonging to this suborder differ from members of other two suborders in having one-chambered stomach. Teats are abdominal and arranged in series. Food is both plants and animals, but they do not ruminate. Like other artiodactyles, they have 4 toes on each foot, but only the 3$^{rd}$and 4$^{th}$ reach the ground.

This suborder is represented by 3 extant families are:

### Family 1. Suidae

**Examples: (Fig. 29).**

**Wild boar *Sus sp.***

**Wart-hog *Phacochoerus sp.***

**Babirusa *Babirousa babyrussa***

**FIGURE 29:** Three pigs, family suidae. Like other artiodactyles, only the 3rd and 4th toes reach the ground.

## Family 2. Tayassuidae

**Examples*:*** Peccary ***Tayassu*** **(Fig. 30).**

**Peccary *Tayassu sp.***

**FIGURE 30:** New World pig, family Tayassuidae.

## Family 3. Hippopotamidae

**Examples: Hippopotamus *Hippopotamus amphibious* (Fig.31).**

**Hippopotamus *Hippopotamus amphibius***

**FIGURE 31:** Hippopotamus. Its nostrils, eyes and pinnae are shifted toward the dorsal side of the head as an adaptation for aquatic life.

## Suborder B. Tylopodidae

## Family Camelidae

Stomach is three-chambered. Red blood cells are unnucleated and oval in outline. **Examples: One-humped Arabian camel *Camelus dromedaries*, Bactrian or two-humped camel *Camelus bacterianus,*** and the four very similar looking kinds of South American camelids or llamas which are: **Guanaco *Lama guanicoe*, Alpaca *Lama pacos*, Llama *Lama peruana*, Vicuna *vicugna vicugna* (Fig.32)**.

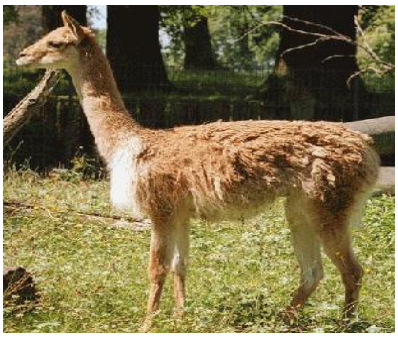
**Arabian camel *Camelus dormedarius***

**Bacterian camel *C. bacterianus***

**Guanaco *Lama guanicoe***

**Alpaca *L. pacos***

**Llama *L. peruana***



**Vicuna *Vicugna vicugna***

**FIGURE 32:** Camels and their relatives lamas. Lamas are without humps.

## Suborder C. Ruminantia (Selenodontia)

This diverse group is the most successful amongest the artiodactyles. Horns may be present in one or in both sexes. Stomach is of ruminant type and is made up of four chambers.

This suborder includes 5 extant families, they are:

### Family 1. Tragulidae

**Chevrotain *Tragulus tragulus*** and **mouse deer** are common names for any of the small ruminant mammals. *Tragos* refers to a male goat in Greek, while *–ulus* in Latin means 'tiny'. Not true deer in that they do not belong to the Cervidae family.

**Example: Mouse deer** commonly named **Chevortain *Tragulus Tragulus* (Fig. 33).**

**Chevortain *Tragulus tragulus***

**FIGURE 33:** Mouse deer. Smallest ungulates, resembles antelopes but lack horn.

## Family 2. Cervidae (Deer Family)

The characteristic feature of members of this family is the **antlers** in the form of branched horns but is solid bony outgrowths arising from frontal bone, shed and regenerated annually, **present in male only and rarely in both sexes as in caribou and many females of reindeer also have antler**.

**Examples: (Fig.34).**

**Red deer *Cervus elaphus***

**Reindeer *Rangifer tarandus***

**Moose *Alces alces***

**Male Musk deer *Moschus moschiferus***

**FIGURE 34:** Some species of deer family.

## Family 3. Bovidae

Includes 4subfamilies.They are:

### Subfamily i. Antilopinae

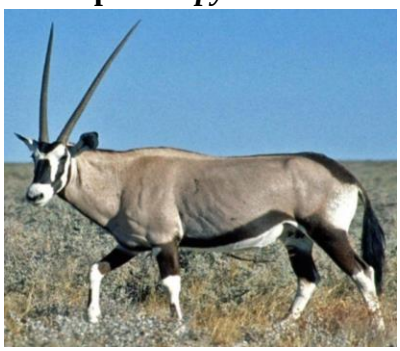
Differ **from** deers in possessing true, hollow, cornified permanent horns in both sexes or in male only.

**Examples: (Fig. 35).**

**Gazalle *Gazella***

**Impala *Aepyceros***

**Gnue *Connochaetes taurinus***



**Oryx *Oryx sp.***

**FIGURE 35:** Some antelope species. Differ from deers in possessing true, hollow and cornified permanent horns which may be present in both sexes or in male only.

## Subfamily ii. Bovinae

**Examples: (Fig. 36).**

The scientific name of **Musk ox** combines between the scientific name of sheep ***Ovis*** and the cow ***Bos*** because its head resembles the head of the cow while the body resembles that of the sheep.

**American buffalo *Bison bison***

**Bufallo *Syncerus (= Bos) sp.***

**Cow *Boss p.*** **Musk ox *Ovibos moschatus***

**FIGURE 36 :** Some bovine species.

## Subfamily iii.Caprinae

**Examlpes: Goats *Capra aegagrus,* Ibex*Capra ibe.* Ibex** with midform between goat and antelope, the male with very long horn arched backward and tuffted beard, while the female like the female of gazelle with short horn directed upward; **Chamios *Rupicapra rupicapra,* Serow *Capricornis cispus*, Tahr *Hemitragus jayakari* (Fig. 37).**

**Goat *Capra aegagrus*** **Ibex *Capra ibex***

**FIGURE 37:** Domestic goat and its relative, subfamily caprinae.

## Subfamily iv. Ovinae

**Examples: Sheeps Ovis (Fig. 38).**

**Sheep *Ovis sp.***

**FIGURE 38:** Sheep, an example of subfamily Ovinae.

## Family 4. Giraffidae

The okapi and the giraffe are the only living members of the family Giraffidae. Giraffes are the tallest animals on earth. Both sexes of **Giraffe *Giraffa*** bear small permanent antlers which remain covered by velvet.

Only male **Okapis *Okapia johnstoni*** have short, skin-covered antlers, but shorter than those of giraffe (**Fig. 39)**.

**Giraffe *Giraffa sp.*** **Okapi *Okapia johnstoni***

**FIGURE 39:** Giraffe and its relative, okapi.

## Family 5: Antilocapridae

**Example American antelope or called pronghorn *Antilocapra americana* of North America (Fig. 40).** Both sexes have impressive backward-curving horns. Each long horn splits to form forward facing prong, hence its name pronghorn.

**Pronghorn *Antilocapra Americana***

**FIGURE 40:** Male North American antelope, family antilocapridae.

**Order16. Primates** (L., primus = first, primate first in rank).

The order primate includes man, besides, lemurs, lorises, tarsiers, monkeys and apes. The order Primates is the third most diverse order of mammals, after Rodentia and Chiroptera. The number of living primate species exist today is not clear, but most estimates are in the range of 230-270.

**but know primates, except humans, are never lived in North America, Australia and most of the islands in the Pacific Ocean (Fig. 41).** The Barbary macaque scientifically known as *Macaca sylvanus*, which is the only species of macaque found outside Asia, and except for humans, it is the only primates found in Europe.

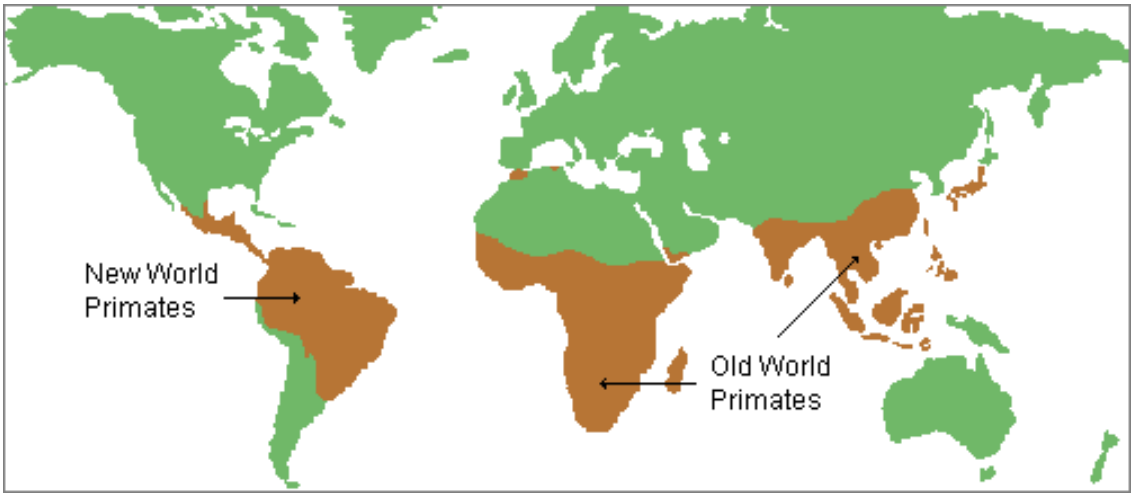



**FIGURE 41:** Natural range of non-human primates. North America, Australia and most Europe are devoid of primates except humans.

Following are general features of the primates:

## General characteristics

1. Highly developed large brain possesses much convoluted cerebral hemispheres. Cerebral hemispheres are larger than any other mammal.
2. Eyes are directed forward instead of laterally, and the vision is binocular, i.e. both eyes focus on one object (depth perception).
3. In many forms of primates, both Pollex or thumb, and hallux or big toe are smaller than other digits and are opposable. They can touch the tips of the other four fingers of the same hand (grasping hand). Although in man this characteristic applies only to the thumb.
4. At least some digits, of the pentadactyle limbs, have nails instead of claws.
5. Mostly one pair of nipples thoracic in position.

6. Testes lie in scrotal sac.
7. Represented by more than 200 species, including primitive primates and Anthropoidea. Primitive primates are: lemurs, lorises, aye-yes, indrises and tarsiers; while Anthropoidea are the bigger-brained monkeys and apes, including humans.

## Classification

**Order Primates**

**Suborder I. Prosimii** **SuborderII. Tarsioidae** **Suborder III. Anthropoidea**

**Figure (42)** shows the geographical distribution of animals of all non-human primate.

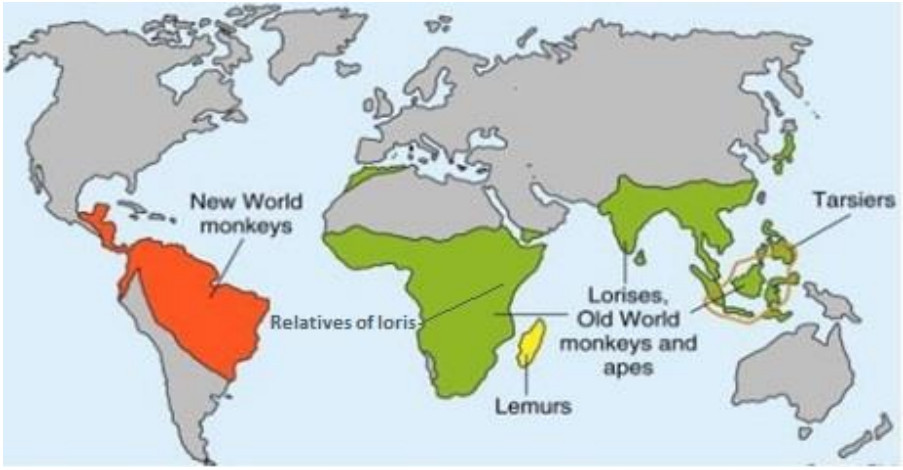



**FIGURE 42:** Geographical distribution of nonhuman primate members.

**Suborder I. Prosimii** (Gr. Pro= before + L. Simius or simia= ape)
Prosimians are true lemurs **Figure (43)**: (lemurs, indrids and aye-aye); lorises and their relatives, which are pottos, angwantibos, galagos or bush babies.

**Ringtail lemur**

**Indris *Indri indri***

**aye-aye *Daubentonia madagascariensis.***

**loris *Nycticebus pygmaeus***

**FIGURE 43:** Four **lemur** species.

## Suborder II. Tarsioidea

Tarsoids represented by tarsiers. Heel or tarsus of the hind limb is elongated and, hence, the name of the animals tarsiers **(Fig.44)**.

**FIGURE 44:** Three figures for tarsiers to show their morphological features: huge rounded eyes, long fingers and toes ended with pads, long tail, brown fur and the elongated heel (tarsus).

**Suborder III: Anthropoidea** (Gr., anthropos= man, oeides= resembling)
Anthropoids include New World monkeys, Old World monkeys, apes and human. **Figure (45). Monkeys** have tail and most species of New World monkeys have prehensile and long tail. None of the Old World monkeys has a prehensile tail, and

some have extremely short tails. All Old World monkeys are related to apes and humans.

**Apes** do not have a tail. This is an easy way to tell the difference between monkeys and apes. More or less upright posture. Great apes can recognize themselves in mirror. Anthropoid apes are closely resemble man. Gorillas, chimpanzees, bonobos and orangutans are four types of apes.

**Baboon *Papio sp.***

**Rhesus monkey *Macaca mulatta***

**Orangutan *Pongo pygmaeus***

**Gorilla**

**FIGURE 45:** Monkeys, apes and humans *Homo sapiens.*