

**MAMMALIA: GENERAL CHARACTER AND
CLASSIFICATION**

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General Characteristics of Class Mammalia

Definition of Mammals:

Among vertebrates, mammals became most fully suited for life on land. There are many species of mammals in which the process of life are carried on under conditions far remote from those in which life first arose.

The information in their DNA provides them with numerous special adaptive devices. The success of the mammals in maintaining life in strange environments is largely due to the remarkable powers they possess of keeping their own composition constant.

Besides the regulation of temperature, there is also regulation of nearly all components of the blood, which are kept constant within narrow limits. Therefore, the most characteristic features of the modern mammals are seen to be largely in their behaviour and soft structures.

Mammals can be defined as 'highly percipient and mobile animals, with large brains, spiral cochlea, warm blood, left aortic arch, and water-proof, usually hairy skin, whose young are born alive, and are nourished by milk.

1. These animals are warm blooded, hairy and have mammary or milk producing glands, (mammary glands). They are the only animals which nourish their young ones with milk. There are about 4,000 species of mammals found in the world.
2. They are homoiothermous (warm blooded).
3. Oil glands (sebaceous glands) and sweat glands (sudoriferous glands) are present in the skin.
4. Teeth are of different types (heterodont) and are embedded in the sockets of jaws (the codont). These are developed twice during the life-time of the animal (diphyodont), milk and permanent teeth.
5. Except a few, mammals possess seven cervical (neck) vertebrae.
6. The skull is dicondylic i.e., with two occipital condyles.
7. Respiration is by lungs.
8. They possess a muscular diaphragm dividing trunk into thorax and abdomen.

9. The coelom is divided into four cavities; a pericardial cavity lodging the heart, two pleural cavities each containing the lung and an adominal cavity having the rest of viscera.
10. The heart is four chambered. Sinus venosus is absent. The red blood corpuscles are without nucleus. Renal portal system is absent.
11. The brain has large cerebrum and cerebellum. Optic lobes are divided into four lobes called corpora quadrigemina. Corpus callosum connects the two cerebral hemispheres internally.
12. 12 pairs of cranial nerves are present.
13. Each ear consists of three parts: external, middle and internal. Pinna is a part of external ear. Middle ear has 3 bony ear ossicles (malleus— hammer shaped, incus-anvil shaped and stapes-stirrup shaped). Internal ear has organ of Corti, the actual hearing organ.
14. Except egg laying mammals they are viviparous. There are present four embryonic membranes: chorion, amnion, allantois and yolk sac. Except egg laying mammals a well developed placenta is present.
15. Mammals occur in all sorts of habitats. They are dominant animals and are capable to learn because of their better developed brain.

Another Character of Mammals

1. Body of mammals is covered by epidermal hair.
2. Integumentary glands are — sweat (sudoriferous), sebaceous (oil), scent (odoriferous) glands.
3. Mammary glands are present to supply milk for the nourishment of suckling young.
4. External fleshy pinna is present in mammals.
5. Eyes with upper and lower eyelids and often with eyelashes.
6. Nictitating membrane is translucent and hairless; it is vestigial in higher mammals.
7. A muscular diaphragm is present in between the thoracic and abdominal cavities.
8. Endo-thermal homoeotherm animals.
9. RBCs are non-nucleated, biconcave and usually circular in form.
10. The four-chambered heart is highly powerful.
11. Only left aortic arch is present in the arterial system.

12. Cerebral hemispheres are very large and highly convoluted.
13. Cerebellum is large, complex and solid in mammals.
14. There is a single urinary bladder in mammals.
15. Testes remain in scrotal sacs.
16. Small eggs are devoid of yolk. Fertilisation is internal.
17. Mammals are viviparous animals.
18. The skull has double occipital condyles. Quadrate absent.
19. A bony palate is formed by the union of premaxillae, maxillae and palatines that separates the nasal passage from the buccal cavity.
20. The lower jaw is composed of a pair of bones — the dentaries.
21. Vertebrae are acoelous type.
22. Ribs are double-headed — capitulum and tuberculum.
23. The teeth are heterodont, thecodont and diphyodont type.
24. Molars are tribosphenic (three-cusped).
25. Paired forelimbs and hind limbs are present in mammals.
26. The digits of the limbs are provided with either claw or nail or hoof.
27. Cranial nerves twelve pairs.
28. Kidneys are metanephric type.

Examples:

Oviparous – *Omithorhynchus* (Duck Billed Platypus), *Tachyglossus* = *Echidna* (Spiny Anteater).

Viviparous — *Macropus* (Kangaroo), *Pteropus* (Large bat), *Camelus* (Camel), *Macaca* (Monkey), *Rattus* (Rat), *Canis* (Dog), *Elephas* (Elephant), *Felis* (Cat), *Delphinus* (Common dolphin), *Equus* (Horse), *Balaenoptera* (Blue whale), *Panthera tigris* (Tiger), *Panthera leo* (Lion).

Classification of Mammals:

Like other chordates, the classification of mammals is a very controversial and complex matter. There are several schemes of classification that exist in different literatures. But none of the existing classifications is beyond criticism.

3. The cloaca receives the openings of urinary bladder, vas deferens and ureters.
4. Ribs possess single head.
5. The mammary glands lack teats.
6. External pinna absent.
7. In childhood, teeth are present but adults lack teeth.

This subclass includes four orders of which only Monotremata is the living group, others are extinct.

Order — Monotremata:

General Characters:

1. Body is covered over with soft hair. Hair on the dorsal side may be coarse or spine-like.
2. Webbed digits are ended in sharp claws.
3. Pinna is distinct but small.
4. In males, poison spur is present.
5. Brain lacks corpus callosum.
6. Tail may be present or absent.
7. Dental formula is $i = 0/5, c = 1/1, p = 2/2, m = 3/3$.
8. Body temperature varies in between 25° - 28° C.
9. Pectoral girdles resemble that of reptiles.
10. Eggs are large and undergo meroblastic cleavage.
11. Tongue is long and sticky.
12. Sutures are obliterated in the skull.

Examples:

Ornithorhynchus, Tachyglossus, Zaglossus, Echidna. The monotremes occupy a most interesting position among mammals, because of their distribution, anatomical peculiarities and systematic position. Both the reptilian and mammalian characters are present in monotremes, which lead to consider them as connecting link. Only three genera of monotremes are found in Australia, Tasmania and New Guinea.

Subclass — Theria (Greek: therion = beast):

General Characters:

1. Female members of this subclass do not lay eggs but give birth to young ones.

2. Mammary glands are provided with nipples or teats.
3. Pinna or external ear is present.
4. The ureters open directly into the urinary bladder.
5. At the end of the digestive tract an anus is present.
6. Teeth are present throughout the life period.

7. Testes are situated in the scrotum.
8. Ribs possess two heads for articulation with vertebrae.

This subclass includes three infraclasses, of which Pantotheria is extinct.

Infraclass — Metatheria (Greek: Meta = next to):

General Characters:

1. The youngs are born in an immature condition and undergo further development in the marsupium of females.
2. Mammary gland with teats opens into the marsupium.
3. Epipubic bone of the pelvic girdle protects the marsupial sac.
4. Placenta is chorioviteline type.

This infraclass includes single order.

Order — Marsupialia (Latin: Marsupium = a sac):

General Characters:

1. Body is covered with soft fur.
2. Pinna is well developed.
3. Most of the female members possess marsupium.
4. Tail is well-developed and helps in balancing.
5. The second and third toes of the hind-limb are slender and remain enclosed in a sheath of skin, i.e., syndactylous digits. The fourth toe is largest. All digits are clawed.

6. Forelimbs are shorter than the hind limbs.
7. Dental formula is $i = 5/4, c = 1/1, p = 3/3, m = 4/4$.
8. Caudal vertebrae are with chevron bone.
9. Atlas is incomplete and is provided with cartilage in the ventral incomplete side.

Examples:

Macropus (Kangaroo), Didelphis (Opossum), Thylacinus (Tasmanian wolf – the mystery marsupials), Myrmecobius (Banded ant-eater), Nottoryctes (Marsupial mole), Petaurus (Flying opossum), Phascolarctos (Koala bear), Vombatus (Wombat), etc.

Infraclass — Eutheria (Greek: eu = true):

General Characters:

1. The young are born as miniature adult and go through a considerable period of prenatal growth.
2. A highly-organised allantoic placenta attaches firmly with the uterine wall during developmental period.
3. Brain is highly-developed, cerebral hemispheres have well-developed neo-pallial region. The two hemispheres are connected by corpus callosum.
4. The anal and urinogenital apertures are separate.
5. The tympanic bone is ring-like and forms a tympanic bulla.
6. Dental formula is $i = 3/3$, $c = 1/1$, $pm = 4/4$, $m = 3/3$. In some forms there are modifications in dental formula, and in some cases teeth are absent.
7. Epipubic bone in the pelvis is absent.

Cohort — Unguiculata:

General Characters:

1. These eutherians possess nails or claws in their digits.

This Cohort contains eight orders, of which two are extinct.

Order — Insectivora (Latin: insecta= in sects; voro = to eat):

General Characters:

1. Body covered with hair. Some members possess dorsal spines which are modified hair.
2. Nocturnal animals with long snout are insectivorous.
3. Skull is constricted in the middle.
4. The zygomatic arch and bony palate are incomplete.
5. Teeth have sharp molar cusps.
6. Each limb possesses five digits with claws.
7. Locomotion is plantigrade type.

8. Caecum in the intestine is small or absent.
9. Scrotum is absent and the testes are internally situated.
10. Uterus is bicornuate type.
11. Mammary glands are many and are distributed all along the two milk-lines on the ventral surface.

Example:

Talpa (Mole), Tupaia (Tree-shrew), Erinaceus (Hedgehog), Sorex (Shrew), Desmana (Water mole), Chrysochloris (Golden mole), Neomys (Water shrew).

Order — Chiroptera (Latin: cheir = Hand; pteron = wing):

General Characters:

1. The forelimbs are modified to form wings.
2. The bones of the digits of the forelimbs are elongated except pollex. These bones support a membrane that runs between forelimbs and hind limbs. This membrane is called as patagium.
3. An inter-femoral membrane is present between the femurs. It is supported by a cartilaginous calcar of the ankle.
4. A short tail is often included in the inter-femoral membrane.
5. The wings are having direct arteriovenous connections.
6. Pollex is small, free from the wing and bears claw.
7. The hind limbs are weak, having five clawed-digits.
8. Pinna is well-developed.
9. These are nocturnal animals. They are able to fly and catch prey in the dark with the help of their special radar system. This capacity is called echolocation.
10. The sutures of the skull is obliterated.
11. The ribs are flat and fused with the vertebrae to become rigid during flight.
12. The hind limbs are rotated, so the knee is directed backward.
13. The testes are abdominal in position.
14. Only one young is born at a time.
15. The sternum is provided with a flat keel for the attachment of pectoral muscle.

Examples:

Pteropus (Fruit bat) (Fig. 1.129A and C), *Rhinolophus* (Horseshoe bats), *Desmodus* (Vampire bats) (Fig. 1.129B), *Vespertilio* (European bats) (Fig. 1.129D).

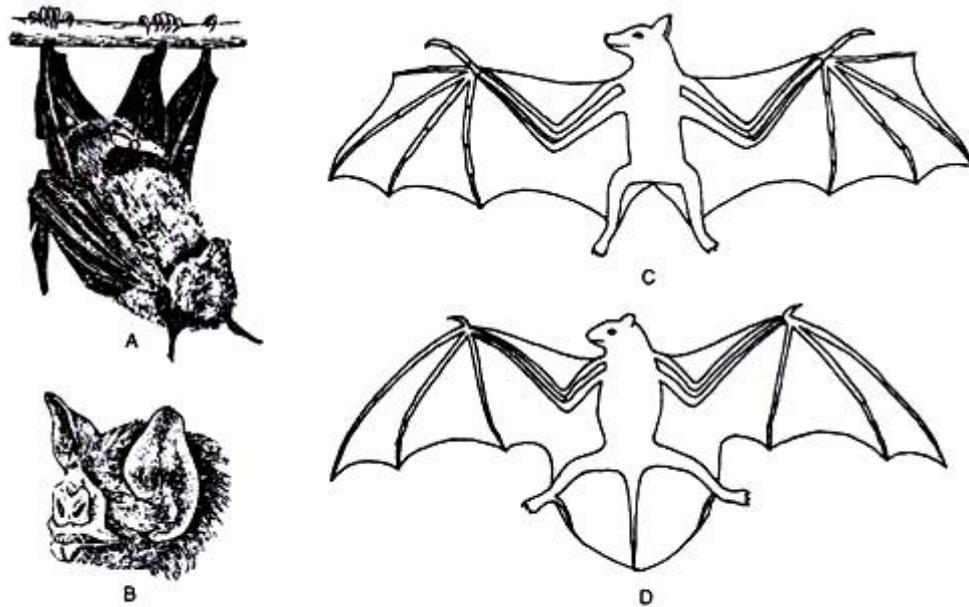


Fig. 1.129 : A. *Pteropus* (Fruit bat), B. Head of *Desmodus* (Vampire bat). C. & D. Diagrammatic figure of *Pteropus* and *Vespertilio*, respectively. Note the patagium between the hind limbs in two groups of bats and the presence of tail in the latter

Fruit bat (*Pteropus*) is the member of suborder Megachiroptera and others are member of suborder Microchiroptera. The chiropterans are the only mammals that truly fly, by flapping their wings, as distinct from the soaring of flying phalangers, colugos and others. In acquiring the power of flight they have evolved many features in parallel with birds.

The method of flight of many forms is specialised to give the great maneuverability needed for catching insects by echolocation at short distances rather than by vision. The wings vary greatly but are thin aero foils, often with high camber, giving high lift at low speed.

The evolutionary history of chiroptera is inadequately known. The first known bats are reported from the Eocene period. The bats are numerous and their distribution is worldwide.

Order — Dermoptera (Latin: Derma = skin; pteron = wing):

General Characters:

1. These are herbivorous, tree-living and their size is like that of a large squirrel.
2. The lower incisors are combed.

3. The tympanic ring forms the bulla and the lower margin of the external auditory meatus.
4. Brain is primitive and the optic lobes are not covered by cerebrum.
5. A broad fold of hairy skin extends between the legs and up to the tail, with which it glides long distances from one tree to another.
6. Fingers are not elongated to support the wings as in bats.

Example:

Cynocephalus (= Galeopithecus) (Flying lemur or colugo).

Order — Edentata (Latin: E/ex = without; dens = tooth):

General Characters:

1. Incisors and canines are absent but molars are long and similar in appearance.
2. Enamel and root of the teeth are absent but pulp cavity is persistent.
3. Tongue is sticky in nature.
4. Skull is small in comparison to body size.
5. The zygomatic arch is reduced or absent.
6. Olfactory lobe of the brain is well-developed.
7. In the pectoral girdle, clavicle is present but the coracoid and acromion are fused.
8. In the pelvic girdle, ischium is united with anterior caudal vertebrae.
9. Posterior thoracic and lumbar vertebrae are with additional pair of zygapophyses.

Example:

Dasybus (Nine banded armadillo), Myrmecophaga (Giant ant-eater),

Cyclopes (Two toed ant-eater), Bradypus (Three toed sloth), Choloepus (Two-toed sloth).

Order — Pholidota (Greek: pholis = scale):

General Characters:

1. Horny scales are present in an imbricated fashion. On the dorsal side of the head, body and tail. Few hair peep through these scales.
2. The ventral side of the body is covered with hair.
3. Eyes are small and pinna is ill-developed.
4. Tail is long and tapering.
5. The short and powerful limbs possess five clawed-digits in each.
6. The claws of the forelimbs are curved and sharp.

7. Locomotion by hind limb is plantigrade in nature.
8. The facial part is prolonged to form a short muzzle.
9. Tongue is long, sticky and protrusible and is retained in a sac.

10. Teeth are absent.
11. Skull is long and cylindrical.

Example:

Manis crassicaudata (Indian Pangolin), *M. pentadactyla* (Chinese Pangolin).

Order — Primates (Latin: primus = first; Primate = One first in rank):

General Characters:

1. Body is covered with thick hair except the palm, sole and some parts of the face.
2. Neck is short and mobile.
3. Forelimbs are shorter than hind limbs.
4. Pentadactyl limbs possess digits with flat nail.
5. The pollex or thumb, hallux or first toe are smaller than other digits and are opposable.
6. Locomotion is plantigrade type.
7. A tail is present.
8. Mammae are two and thoracic in position.
9. Testes lie in scrotal sac.
10. Highly developed brain possesses much convoluted cerebral hemispheres.
11. The eyes are directed forward and the vision is binocular and stereoscopic.
12. Teeth show reduction in number.
13. The skull is more inclined to the vertebral axis.
14. Zygomatic arch is complete.
15. Foramen magnum faces downward.

Example:

Homo sapiens (Man), *Gorilla*, *Presbytis* (Langur), *Macaca* (Rhesus monkey, Macaque), *Papio* (Babon), *Hylobates* (Gibbon), *Pongo* (Orangutan), *Pan* (Chimpanzee), *Callithrix* (= *Hapale*) (Marmoset), *Loris* (Slender loris), Lemur, etc.

The term 'primate' carries with it the implication that the animals in the group are not only the nearest to man but are also in some sense the first or most completely developed members of the animal world. But these are not so specialised as they are believed to be.

The primates have retained many primitive and generalized eutherian characters. They are primarily arboreal and return to land as a secondary condition. These are omnivorous in habit.

Cohort — Glires:

General Characters:

1. Teeth are specialized for gnawing.
2. Skull is long and low.
3. Temporal fossa widely opens to the orbit.
4. Brain is small with small cerebral hemispheres.
5. Limbs are pentadactyle.
6. Radius and ulna are separate.

This cohort is divided into two orders — Rodentia and Lagomorpha.

Order — Rodentia (Latin: rodere = to gnaw):

General Characters:

1. Body is covered with soft hair.
2. Eyes are small but pinna is well-developed.
3. Limbs are provided with blunt claws.
4. Forelimbs are smaller than the hind limbs.
5. Locomotion is plantigrade type.
6. Jaw muscles are well developed for gnawing. Intestine and caecum are large.
7. Testes are inguinal.
8. Prolifically reproducing animals. Females possess abdominal teats.
9. Single pair of large, chisel-shaped incisors are present both in upper and lower jaws.

10. Canine and anterior premolars are absent forming a diastema between incisors and cheek teeth.
11. There are two premolars in the upper jaw and one in lower jaw.
12. The scapula is provided with acromion process.

Example:

Sciurus (Squirrel), Petaurista (Flying squirrel), Rattus (Rat), Mus (House mouse), Hystrix (Porcupine), Cavia (Guinea-pig) (Fig. 1.130), Bathyergus (Mole-rat), Cricetus (Hamster), Mesocricetus (Golden hamster), Microtus (Vole), Dipus (Jerboa), Castor (Beaver), Geomys (Pocket gopher), Dipodomus (Kangaroo rat), Citellus (Ground squirrel), Marmota (Marmot, woodchuck).

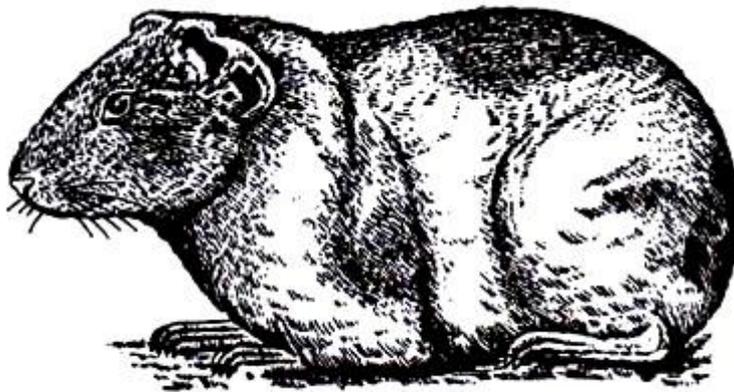


Fig. 1.130 : *Cavia* (Guineapig)

Order — Logomorpha (= Duplicidentata) (Latin: logos = hare; morph = form):

General Characters:

1. Body is covered with soft hair.
2. Eyes are large and pinna is long.
3. Pentadactyle limbs possess clawed digits.
4. Hind limbs are larger than forelimbs.
5. The upper lip is provided with a cleft in the middle.
6. Tail is almost vestigial.
7. Masseter muscles are enormously developed but temporal muscles are weak.
8. Testes lie inside the scrotum.
9. Mammary glands are abdominal in position.
10. Maxillae are laterally fenestrated.
11. There are two pairs of incisors in the upper jaw, while it is one pair in lower jaw.

12. The incisors of the upper jaw are unequal. A larger pair situated in front and smaller pair lie behind it.
13. Canine absent and diastema is present.
14. There are three premolars in upper jaw and two in lower jaw.
15. Scapula is with acromion and metacromion process.
16. Tibia and fibula are fused.

Example:

Lepus (Hare), Oryctolagus (Rabbit), Ochotona = Lagomys (Pika, Cony), Lepus nigricollis (Indian hare), Ochotona roylei (Himalayan mouse hare), Caprologus hispidus (Hispid hare of Himalaya).

Cohort — Mutica:

General Characters:

1. These animals lack vocal cords and are known as silent animals. But can emit sound for various purposes, which is called 'whale song'.
2. These animals are completely aquatic throughout their life cycle.

Order — Cetacea (Latin: cetas = whale):

General Characters:

1. The large, torpedo shaped body devoid of hair.
2. The skin is smooth and skin glands are absent.
3. The nictitating membrane of eye, pinna of ear and nail of the digits are absent.
4. Forelimbs are modified to form flippers, hind limbs are absent.
5. The nasal openings are asymmetrical, located far back on the upper surface of the head and can be closed by valves.
6. The tail terminates in a horizontal fin, called fluke. It is a neomorphic structure.
7. Dorsal fin is fleshy; it is also a neomorphic structure.
8. A thick subcutaneous fat layer, called blubber, is present.
9. The lungs are highly elastic and extensible.
10. Brain is highly developed but olfactory lobe is reduced.
11. Two mammary glands are located in the inguinal area.
12. Single, large, well-formed young is born at a time.
13. The cranium is dorsoventrally flattened and the facial part is elongated.
14. Cervical vertebrae are fused to form a bony mass.

15. Sacral vertebrae are absent.
16. Caudal vertebrae are with chevron bones.
17. Ribs lack heads.

18. Number of digits are either reduced to four or increased to more than five (hyperdactyly). Numbers of phalanges are more than the usual number in second and third digits (hyperphalangy).
19. Humerus is short, stout and its head moves freely in the glenoid cavity.

Example:

Platanista (Ganges dolphin), Physeter (Sperm whale), Delphinus (Dolphin), Phocaena (Porpoise), Balaenoptera (Blue whale), Balaena (Right whale).

Cohort — Ferungulata:

1. Modern carnivores and hoofed animals, all are members of this group.
2. From the fossil records it is evident that all of them arose from a common ancestral population in Palaeocene period.

The cohort Ferungulata is divided into five super orders for the convenience of classification.

Superorder — Ferae:

1. All the living members of this group are carnivorous.

Order — Carnivora (Latin: carno = flesh; voro = to eat):

General characters:

1. Pentadactyle limbs, with digits ending in sharp claws and claws may be retractile.
2. Locomotion is either digitigrade or plantigrade type.
3. Intelligence in the form of mental alertness and coordinated actions is evident.
4. Brain is highly developed.
5. Intestine is short and caecum is small or absent.
6. Testes are present in scrotal sac.
7. Mammae are abdominal in position.
8. Placenta is deciduate and zonary.
9. Uterus is bicornuate in shape.
10. Skull is short. Sagittal and lambdoidal crests are well-developed.
11. Zygomatic arch is strongly built.

12. Each jaw possesses three pairs of incisors. Canines are large, sharp and pointed.
13. The last upper premolar and first lower molar transformed into blades, and act as incisors — they are jointly known as carnassial teeth.
14. The atlas is large and is provided with wing like lateral processes.
15. Thoracolumbar vertebrae are 20 to 21 in number.
16. Sternum is long narrow and made up of 8 to 9 sternibrae. Sternal ribs are not calcified.

Examples:

Canis (Wolves, Dogs, Jackals etc.), Vulpes (Fox), Ursus (Bear), Procyon (Raccoon), Ailurus (Panda), Ailuropoda (Giant Panda), Viverra (Civet), Herpestes (Mongoose), Hyaena (Hyena), Felis (Cats, Pumas, Leopards, Lions, Tigers, Jaguars), Eumetopias (Sea lion), Odobenus (Walrus), Phoca (Seal), Mephitis (Shunk), etc.

Superorder — Protungulata:

All the members of this group are unguiligrade and herbivorous. This super order includes five orders, among which four are extinct.

Order — Tubulidentata (Latin: tubulus = small tube; dens = teeth):

General Characters:

1. Body is covered by a dull-grey skin with unevenly distributed hair.
2. Head is elongated to form a tubular snout.
3. Pinna is long in size.
4. Four toed forelimbs possess clawed digits. Hind limbs possess five toes with clawed digits. The limbs are powerful.
5. Small mouth possesses long, protrusible tongue.
6. The cheek teeth are 4 or 5 in number, which lack enamel but a coating of cement is present. Incisors and canines are absent.
7. These are ant-eater in habit.

Example:

There is only one representative species present till now. *Orycteropus* after (ardvark) living in Africa and known as cape ant-eater.

Superorder — Paenungulata:

General Characters:

1. They are all herbivorous animals.
 2. The legs are with long upper segments, ulna and fibula complete.
 3. They possess several digits, with nail but no well-marked hoofs.
 4. The incisors and canine become reduced to single pair of large tusks in each jaw and the molars are specialised for grinding, with development of cross-ridges.
- Simpson (1945) suggested the name paenungulata (= near ungulates).

Order — Hyracoidea (Greek: hyrax = shrew; eides = form):

General Characters:

1. These are rabbit-like animals, with short tail and short pinna.
2. Locomotion is plantigrade type.
3. Forelimbs possess four functional digits and fifth one remains as vestige.
4. There are three digits in each hind limb. First and third digits possess hoof while second digit is clawed.
5. The caecum has a pair of caecal pouches.
6. Abdominal testes are present.
7. Mammae are pectoral in position and two in number.
8. Uterus is paired; the placenta has an annular avascular allantois and haemochorial in nature.
9. Single pair of large and curved upper incisors with persistent root is present. Canines are absent.
10. The lower incisors are comb-like and four in number.
11. There is a diastema and seven grinding molariform teeth of bunoselenodont type, with transverse ridges.
12. Brain is of macro somatic type.

Example:

Procavia (= Hyrax), Dendrohyrax (Tree hyrax).

Order — Proboscidea:

General Characters:

1. These are largest living land vertebrates.
2. Thick skin with scanty hair.

3. An enormously elongated nose and upper lip, with appropriate muscles and sensitive grasping tip makes the proboscis.
4. Only one pair of continually growing upper incisors forming the two enormous un-curved tusks. These are composed of solid dentine except for a temporary cap of enamel at the tip.
5. Nostrils are situated at the tip of the trunk.
6. Eyes are small but pinna is large.
7. Pentadactyle limbs are pillar-like. Digits are hoofed.
8. The weight of the head is reduced by extensive development of air sinuses between the inner and outer tables of bones of the skull.
9. The immensely large hypsodont molars with numerous sharp transverse ridges are parts of the powerful grinding apparatus.
10. The skeleton shows typical graviportal features. The backbone is based on a 'single girder' plan, with twenty ribs and high thoracic neural spines.
11. The ilium is nearly vertical and expanded transversely for the attachment of large muscles.
12. Cerebral hemispheres are relatively small and leave the cerebellum uncovered.
13. Stomach and intestine are simple. There is no special chamber in stomach for fermentation of herbaceous food.
14. The caecum is long and sacculated and there is an ileocaecal sphincter.
15. Testes lie close to kidneys, no scrotal sac is present.
16. The two horns of the uterus remain separate, though united externally.
17. Only one young is born at a time. Gestation period 22 months.
18. Placenta have at the poles, areas of diffuse, non-deciduate structure, while in an annular zone round the middle there is much invasion of the trophoblast.

Example:

Elephas (Asian elephant), Loxodonta (African elephant).

Order — Sirenia (Greek: siren = sea nymph):

General Characters:

1. These are herbivorous animals, highly adapted for aquatic life.
2. They have a streamlined body form, with few hair and thick blubber.

3. The muzzle is round and the upper lip is protruding.
4. Nostrils are located on the upper surface of head and are provided with valves.
5. Neck is short and pinna is absent. Eyes are small with muscular eyelids.
6. There are no hind limbs and the pelvic girdle remains only as small rods.
7. The forelimbs are large; the digits are joined to form paddles, with a full pentadactyle structure.
8. Caudal vertebrae are well-developed.
9. A strong terminal horizontal fin is present.
10. Ribs are round and the diaphragm is oblique.
11. Lungs contain large air sacs.
12. Brain is small and the ventricles are exceptionally large.
13. The front parts of the jaw carry no teeth at the front, but have horny pads. The teeth form a series of pegs, with two transverse ridges.
14. Stomach is complex and intestine is very long.
15. Testes are abdominal. Uterus is bicornuate.
16. Placenta shows a zonary arrangement and haemochorial structure,
17. The young are born in water and nursed at pectoral teats.

Example:

Dugong (= Halicore) (Sea cow), Manatus (= Trichechus) (Manatee).

Superorder — Mesaxonia:

1. Axis of the limbs passes through the third digit (middle axis). This is called the mesaxonic condition. The remaining digits are reduced.

Order — Perissodactyla (Greek: perissos = odd; daktylos = finger):

General Characters:

1. These are large, herbivorous mammals having streamlined body.
2. The neck and facial parts are elongated.
3. Tail is with long tuft of hair.
4. The powerful limbs are suitable for fast movement.
5. The lower part of the limbs became elongated and the upper segments shortened.
6. One distal carpal, the capitate (magnum), become enlarged and interlocked with the proximal carpals.

7. Of the five digits, the first and fifth digits are lost. The second and fourth digits remain as splints. The middle or third digit is stout and is provided with hoof.
8. Stomach is simple and undivided.
9. Digestion of cellulose takes place by symbionts in the caecum and large intestine.
10. Brain is relatively small and macrosomatic type. Olfactory lobe is highly developed.
11. Skull is elongated.
12. The incisors are three in each quadrant of the jaws. The incisors having pit on the free surface.
13. The canine may be reduced or absent and there is often a diastema.
14. The molars have developed an elaborate grinding surface with the formation of a longitudinal ectoloph along the outer edge of the upper molar and parallel transverse ridges, the protoloph and metaloph.
15. Ulna and fibula are reduced.
16. The femur is provided with a prominent process on the other surface of the shaft. The process is called third trochanter.
17. Astragalus has a double-keeled pulley-shaped surface for articulation with tibia.
18. The third metatarsal of the hind limb is long and erect and is known as cannon bone.
19. Uterus is bicornuate. Placenta is of diffuse epitheliochorial type, with a large allantoic sac.
20. The yolk sac grows to a large size and forms a yolk sac placenta during the early part of the development.

Example:

Tapirus (Tapir), Rhinoceros (Rhinos — Indian and Javan), Dicerorhinus (Horses, Asses, Zebras).

Superorder — Paraxonia:

1. Axis of the limbs passes through the third and fourth digits.

Order — Artiodactyla (Greek: Artios = even; daktylos = finger):

General Characters:

1. These are even toed ungulates and latest mammalian herbivores.

2. Neck is elongated but tail is small.
3. Usually possess a pair of epidermal horns. Horns may be hollow or solid and are located on the frontal bone of the skull.
4. The characteristic of the limbs is the equal development of third and fourth digits, with reduction of the rest.
5. Gait is digitigrade type. Hoofs have developed on the toes.
6. The long metapodials have become united to make the cannon bone.
7. The presence of two digits has led to the retention of two bones in the distal row of carpals, the hamate (unciform) and fused magnum-trapezoid. These articulate in interlocking fashion with the three proximal carpals.
8. In the hind foot the two cuneiforms are fused to provide thrust upon the third digit, while the fourth sends its thrusts to the cuboid and the latter is fused with the navicular.
9. The eyes are large with horizontal pupil. Pinna is large with an acute sense of hearing.
10. Tongue is long, mobile, prehensile and pointed.
11. The upper incisors are lost, which crop up by means of the lower incisors biting against the hardened gum of the pre- maxilla.
12. The canine may form tusks.
13. Molars are of hypsodont and solenodont (moon-tooth) condition.
14. Stomach is complicated and divided into several chambers.
15. Intestine is short and a short caecum is present.
16. Mammae are abdominal or inguinal in position and may be more than one pair.
17. Brain is moderately developed. The olfactory organ and related parts of the brain are well-developed.
18. The uterus is bicornuate type.
19. Placenta of pig is of diffused epitheliochorial type. In ruminants there is a cotyledonary placenta, but the contact between maternal and foetal tissues is never very close (Syndesmochorial) and the allantois is usually large.

Examples:

Sus (Pig), Hippopotamus (Hippo), Camelus (Camel, dromedary — Asia), Moschus (Musk deer), Ceruus (Red deer), Dama (Fallow deer), Rangifer (Rein deer), Giraffa

(Giraffe), Gazella (Gazelles), Bos (Cattle, Yak), Bison (Buffalo), Capra (Goat), Ovis (Sheep).

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