UG CBCS Semester-II (Chordata)
Mammalia

General Characters

1. Hair-clad, mostly terrestrial, air-breathing, warm-blooded, viviparous, tetrapod vertebrates.
2. Body distinctly divisible into head, neck, trunk and tail.
3. Limbs 2 pairs, pentadactyle, each with 5 or fewer digits and variously adapted for walking, running, climbing, burrowing, swimming or flying. Hind limbs absent in cetaceans and sirenians.
4. Exoskeleton includes lifeless, horny, epidermal hairs, spines, scales, claws, nails, hoofs, horns, bony dermal plates, etc.
5. Skin richly glandular containing sweat, sebaceous (oil) and sometimes scent glands in both the sexes. Females also have mammary glands with teats producing milk for suckling the young.
6. A muscular partition, called diaphragm, separates the anterior thoracic cavity from the posterior abdominal cavity.
7. Endoskeleton thoroughly ossified. Skull dicondylic, having 2 occipital condyles formed exclusively by the exoccipitals. Cranium large. A single zygomatic arch present. Pterygoids small, scale-like. Otic bones fused into periotic which forms tympanic bulla with tympanic. Absent bones of skull are prefrontal, postfrontal, quadratojugal, supraorbital and basipterygoids. Each half of lower jaw made of a single bone, the dentary, articulating with squamosal of skull. Vertebrae with terminal epiphyses and flat centre (acoelous). Cervical vertebrae usually 7. Ribs bicephalous. Coracoid vestigial.
8. Alimentary canal terminates by anus, there being no cloaca. Buccal cavity separated from nasal passage by a hard palate, formed by premaxillae, maxillae and palatines. Teeth are of several types (heterodont), borne in sockets (thecodont) and represented by two sets (diphyodont).
9. Respiration always by lungs (pulmonary). Glottis protected by a fleshy and cartilaginous epiglottis. Larynx contains vocal cords.
10. Heart, 4-chambered with double circulation. Only the left aortic arch present. Renal portal system absent. R.B.C. small, circular and non-nucleated. Body temperature regulated (homoiothermous).
11. Kidneys metanephric. Ureters open into a muscular urinary bladder. Excretion is ureotelic. Excretory fluid is urine.
12. Brain highly evolved. Both cerebrum and cerebellum large and convoluted. Optic lobes small and 4 in number called corpora quadrigemina. Corpus callosum present connecting both cerebral hemispheres. Cranial nerves 12 pairs.
13. Senses well developed. Eyes protected by lids, the upper of which is movable. External ear opening protected by a large fleshy and cartilaginous flap called pinna. Middle ear cavity with 3 ear ossicles—malleus, incus and stapes. Cochlea of internal ear spirally coiled.
14. Sexes separate. Sexual dimorphism generally well marked. Male has an erectile copulatory organ or penis. Testes commonly placed in a bag or scrotum outside abdomen. Eggs are small, with little yolk and no shells.
15. Fertilization internal, preceded by copulation.
16. Except egg-laying monotremes, mammals are viviparous, giving birth to living young ones.
17. Development uterine. Developing foetus attached to uterine wall of mother by a placenta for nutrition and respiration. Embryonic membranes (amnion, chorion and allantois) present.

18. After birth, young nourished by milk secreted from mammary glands of mother.
19. Parental care well developed reaching its climax in humans.
20. Mammals show greatest intelligence among all animals.

Classification

Mammals have been thoroughly described and adequately classified. They include approximately 5,000 living species (15,000 subspecies) and numerous fossil forms. Their classification differs with different authorities. The main characters forming the basis of their classification into orders include : (i) mode of caring for their young, (ii) nature of dentition, (iii) foot posture, (iv) nails, claws and hoofs, (v) complexity of nervous system, and (vi) systematics.

G. G. Simpson provided a complete review of the group in a publication entitled. "The Principles of Classification and a Classification of Mammals". He recognized 18 living and 14 extinct orders of mammals. For the purpose of this text, we shall refer to only 18 living orders of mammals which are first divided into 2 subclasses : *Prototheria* and *Theria.*

Subclass I. Prototheria (Gr., *protos,* first + *therios,* beast)

Primitive, reptile-like, oviparous or egg-laying mammals.

Order 1. Monotremata (Gr., *monos,* single + *trema,* opening).

Cloacai opening present. Confined to Australian region. Examples: Monotremes. Platypus or duckbill *(Ornithorhynchus)* Spiny anteater *(Tachyglossus = Echidna).*

Subclass II. Theria (Gr., *ther,* animal)

Modern or typical viviparous mammals that give birth to living young. Theria are subdivided into 2 living infraclasses:

Infraclass 1. Metatheria (Gr., *meta,* between or after)

Pouched and viviparous mammals without or with a rudimentary yolksac placenta. Confined mostly to Australian region.

Order 2. Marsupialia (Gr., *marsypion,* pouch). Born in a very immature state, and complete their development attached to teats or nipples in the abdominal pouch or marsupium. Usually 3 premolars and 4 molars in each jaw on either side. Vagina double. Examples: Marsupials. Opossum *(Didelphis),* kangaroo *(Macropus),* koala *(Phascolarctos).*

Infraclass 2. Eutheria (Gr., eu, true + *therios* + beast)

Higher viviparous, placental mammals without marsupium. Young born in a relatively advanced stage. Eutherians constitute the vast majority of living mammals arranged in 16 orders.

Order 3. Insectivora (L., *insectum,* insect + *vorare,* to eat). Small primitive mammals with long pointed snout. Feet plantigrade, usually 5-toed, with claws. Molars with pointed, peg-like cusps for insect feeding. Placenta discoidal. Nocturnal and terrestrial. Examples: Mole *(Talpa),* common shrew *(Sorex),* Solenodon *(Solenodon),* hedgehogs *(Erinaceus, Paraechinus).*

Order 4. Chiroptera (Gr., *Cheiros,* hand + *pteron,* wing).

Flying mammals or bats in which forelimbs are modified into wings (patagium). Hindiegs short and included in wing membrane. Teeth small, sharp, peg-like. Sternum provided with keel. Clavicles are stout and fused with scapula and sternum. Eyes are small with weak vision. Ear have large pinnae. Nocturnal, capable of true flight. Two suborders: *Megachiroptera* and *Microchiroptera*.

Order 5. Dermoptera (Gr., *derm,* skin + *pteron,* wing). Four equal-sized limbs and tail included in a lateral furry skin fold, the *patagium.* Incisor teeth 2/3. Nocturnal in trees. A gliding mammal called flying lemur, resembling a flying squirrel. Examples : One living genus *Cynocephalus (= Galaeopithecus)* with 2 species from Southeastern Asia (Fig. 1).

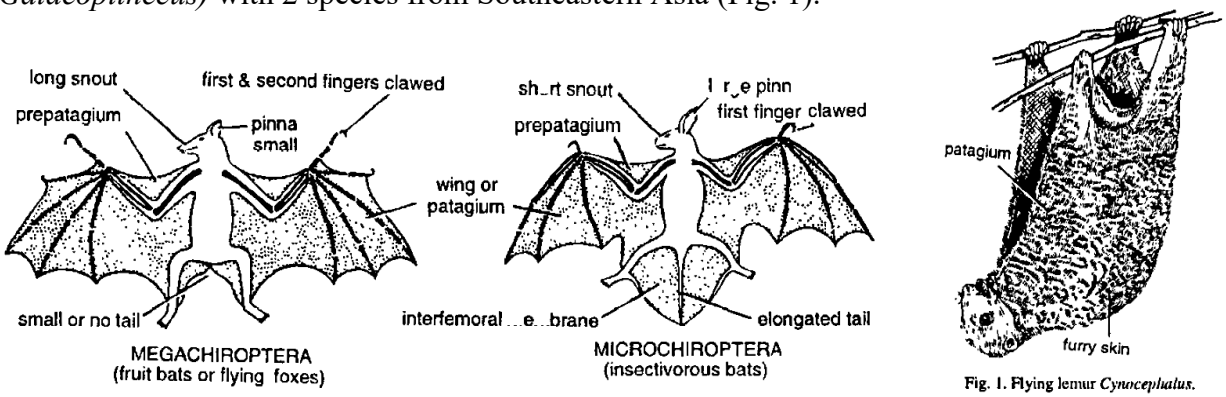

Fig. 1. Flying lemur *Cynocephalus.*

Order 6. Edentata (L,, *edentatus,* toothless),

Teeth absent or reduced to molars, without enamel. Toes with large, strong, curved claws. Testes are abdominal. Some times they are armoured. Examples: Giant anteater *(Mryrmecophaga),* armadillo *(Dasypus),* 3-toed sloth (*Bradypus).*

Order 7. Pholidota (Gr., *pholis,* a horny scale).

Body covered with large overlapping horny scales with sparse hair in between. No teeth. Tongue long and protrusible, used to capture insects. Examples: Single genus of scaly anteaters or pangolins *(Manis).*

Order 8. Tubulidentata (L,, *tubulus* tube-like + *dens,* tooth).

Tongue slender, protrusible. No incisors or canines. Each jaw with 4 to 5 teeth, lacking enamlel and perforated by- numerus fine tubules of pulp. Skin thick covered with hair. Ear are long, erect and pointed. Placenta is zonary. Examples: Single genus of pig-like aardvark or Cape anteater *(Orycteropus)* of South Africa.

Order 9. Primates (L., *primus,* of the first rank).

Generalized or primitive mammals except for the great development of brain. Flat nails on fingers and toes. First digit usually opposable, an adaptation for grasping. Eyes typically large and turned forward. Mostly arboreal. The Order Primates is divided into 3 suborders: *Lemuroidea, Tarsioidea,* and *Anthropoidea.* The suborder Anthropoidea is further subdivided into two divisionsor infraorders: *Platyrrhina* and *Catarrhina* (Figs. 2 & 3).

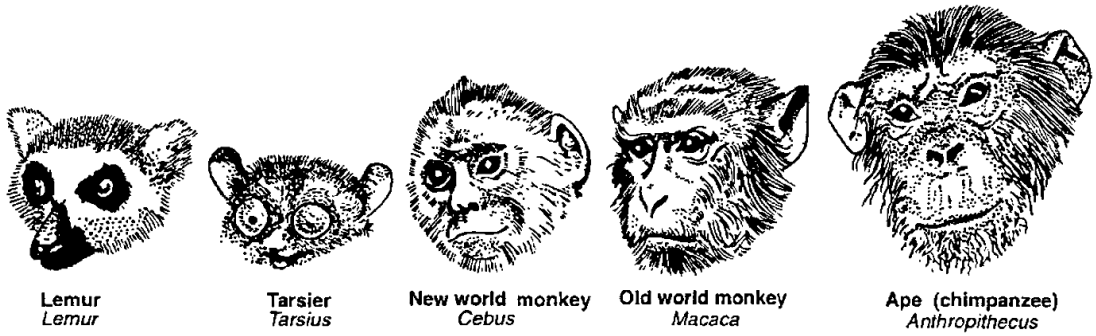

Fig. 2. Some modern Primates. Only heads.

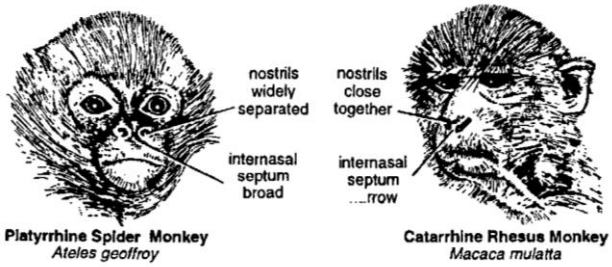

Fig. 3. Comparison between New World Monkeys (Platyrhina) and Old World Monkeys (Catarrhina).

Order 10. Rodentia (L,, *rodo,* gnaw).

Largest order including usually small gnawing mammals. Each jaw with one pair of long, rootless, chisel-like incisors growing throughout life. No canines. Digits provided with claws. Testes abdominal. Space between molars and canine present called diastema. Examples: Rat *(Rattus),* mouse *(Mus),* squirrel *(Funambulus),* guinea pig *(Caviaj,* beaver *(Castor),* porcupine *(Hystrix),* prairie dog *(Cynomys).*

Order 11. Lagomorpha (Gr., *logos,* hare + *morphe,* form).

With a second pair of small upper incisors behind first pair of large chisel-like incisors. No canines. Examples: Rabbit *(Oryctolagus),* hare *(Lepus),* pika *(Oehotona).*

Order 12. Cetacea (Gr., *ketos* or L., *cetus,* a whale).

Large, marine, fish-like mammals, well adapted for aquatic life. Hair on skin are reduced to a few bristles on the muzzle. Pectoral limbs modified into broad paddle-like flippers. Tail divided in two broad horizontal fleshy flukes with a notch, used in propulsion. No claws, no hind limbs and no external ears. Skull bones are spongy and contain oils. The living Cetacea are divided into two suborders: *Odontoceti* (toothed whales) and *Mysticeti* or *Mystacoceti* (whalebone whales).

Order 13. Sirenia (Gr., *siren,* sea nymph).

Large, clumsy, herbivorous, aquatic mammals with paddle-like forelimbs, no hind limbs and a flattened tail with horizontal lateral fleshy flukes with or without a notch. No external ears. Muzzle blunt. Hairs few. Stomach complex having several chambers. Clavicles absent. Testes are abdominal. Inhabit estuaries and coastal sea (Fig. 4). Examples: Manatee (*Trichechus),* dugong *(Dugong = Halicore),* recently extinct Steller's sea-cow *(Rhytina).*

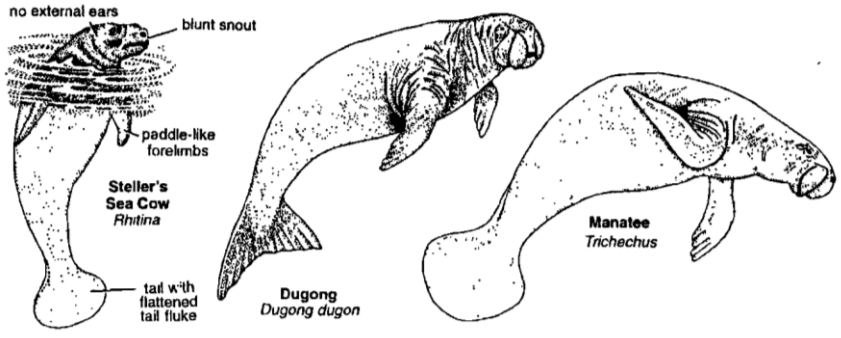

Fig. 4. Examples of Sirenia.

Order 14. Carnivora (L., *caro,* flesh + *vorare,* to eat).

Small to large predatory, flesh-eating mammals. Claws well developed. Incisors small, canines large, fang-like and molars of cutting type. Temporal fossa are open behind. Tympanic bulla are large and rounded. Clavicles are incomplete or reduced. Scaphoid and lunar bones of hand are always fused. Living carnivores are divided into 2 suborders: *Fissipedia* and *Pinnipedia.*

Suborder Fissipedia. Modern terrestrial carnivores whose feet contain separate toes. Feebly developed incisors and are always 6 in each jaw. Canines are strong and large. Last premolar in the lower jaw is called *carnassial* or *sctorial teeth.* Examples: Dog *(Canis familiaris),* wolf *(C. lupus),* jackal *(C. aureus),* red fox *(Vulpes),* otter *(Lutra),* badger *(Meles),* cheetah *(Acinonyx),* lion *(Panthera leo),* tiger *(Panthera tigris),* domestic cat *(Felis domesticus),* hyaena *(Hyaena),* mongoose *(Herpestes),* bear *(JJrsus),* racoon *(Procyon),* mink *(Mustela),* skunk *(Mephites),* panda *(Ailuropoda).*

Suborder Pinnipedia. Marine carnivores with streamlined, torpedo-shaped body, reduced tail, and limbs modified into flippers or paddles. Examples: Walrus *(Odobenus),* fur seal *(Callorhinus),* common seal *(Phoca).*

Order 15. Hyracoidea (Gr., *hyrax,* shrew + *eidos,* form). Small, guinea-pig like mammals, distantly related to elephants. Snout, ears and legs short. 4 toes on front foot, 3 on hindfoot, each with a flattened hoof-like nail. Incisors 1/2. No canines. Cheek teeth lophodont. Clavicles are absent. Dorsal gland is present. Testes abdominal. Mammae are six pairs, four pairs inguinal and two pairs axillary. Examples: Conies *(Hyrax = Prvcavia)* from S. Africa, Syria and Arabia (Fig. 5).

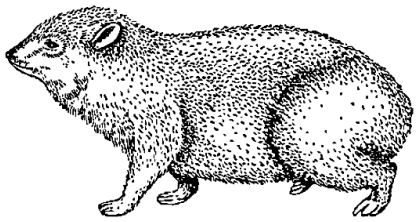

Fig. 5 Hyrax, *Procavia syriacus.*

Order 16. Proboscidea (Gr., *pro,* in front + *boskein,* to eat). Largest living land animals having large heads, massive ears, thick practically hairless skins (pachyderm), bulky straight legs and 3 to 5 toes with small, nail-like hoofs. Conspicuous feature is the nose and upper lip modified as an elongated flexible proboscis or trunk. 2 upper incisors elongated as ivory tusks. Cheek teeth lophodont. Examples : Indian or Asiatic elephant *(Elephas maximus),* African elephant *(Loxodonta ofricana),* pigmy african elephant *(Elephas cyclotis).* Extinct mammoths and mastodons.

Order 17. Perissodactyla (Gr., perissos, odd + dactylos, toes).

The odd-toed hoofed mammals or ungulates have an odd number of toes (1 to 3). Functional axis of foot passes through the middle or third digit. Incisors present in both jaws. Stomach simple. Examples: Horse *(Equus cabalus),* wild ass *(Equus asinus),* zebra *(Equus zebra),* tapir *(Tapirus),* rhino *(Rhinoceros = Diceros).*

Order 18. Artiodactyla (Gr., artios, even + dactylos, digit). The even-toed hoofed mammals having an even number of toes (2 or 4). Axis of support passes between third and fourth toes. All except pigs and peccaries ruminate or chew their cud. Incisors and canines in upper jaw usually lacking. Stomach 4-chambered. Many with antlers or horns. Examples: Pig *(Sus),* common hippopotamus *(Hippopotamus amphibius),* camel *(Camelus),* deer *(Carvus),* musk deer *(Moschus),* sheep *(Ovis),* goat *(Capra),* giraffe *(Giraffa),* blackbuck *(Antilope),* Ox *(Bos indicus),* water buffalo *(Bubalus bubalis).*

References:

Kotpal RL (2009-2110). Modern Text Book of Zoology: Vertebrates (Animal Diversity – II). Rastogi Publications, India.