Classification of Mammals upto order

Paper V, Unit II
BZT 301, Animal Diversity II

Dr. Mrs. Savita P. Nalawade
Assistant Professor,
Department of Zoology,
D. P. Bhosale College,
Koregaon
drsavita73@hotmail.co.uk

Class Mammalia is the largest class in the animal world.

Mammals are vertebrates that possess hairs on body, mammary glands for feeding young. They also possess a four-chambered heart, a large cerebral cortex, three distinctive bones: incus, malleus and stapes in the middle ear, a diaphragm for breathing, heterodont and thecodont dentition, limbs attached under the body, dicondylic skull and acoelous vertebrae.

The class Mammalia is classified into three subclasses, 28 Orders, 161 Families, 747 Genera and 4939 Species

Characteristic Features of Mammals:

1. Endothermal homoeotherms.(Endotherms are animals that primarily produces its own heat. **Homeotherms** are animals that have a constant body temperature.)
2. The body is generally covered with epidermal hairs (except whales) as an insulating and thermal regulating material.
3. Integumentary glands are sweat (sudoriferous) glands, sebaceous (oil) glands and scent or odoriferous glands.
4. Mammary glands are present that supply milk for suckling the young.
5. The external fleshy pinna is present in most mammals (absent in the Monotremata, Cetacea and Sirenia).
6. Eyes with upper and lower eyelids and often eyelashes. The nictitating membrane is hairless and translucent which is vestigial in higher mammals.

B. Anatomical characters:

1. A muscular diaphragm is present in between the thoracic and abdominal cavities and functions chiefly in breathing.

2. The red blood corpuscles are non- nucleated, biconcave and usually circular in form except in the camel, in which most of them are elliptical.

3. The heart is completely four- chambered. Sinus venosus and conus are absent.

4. Cerebral hemispheres are very large and highly convoluted.

C. Skeletal features:

1. The skull has double exoccipital condyles.

2. The lower jaw or mandible is made up of a single piece of bone, called dentary.

3. The lower jaw (dentary) articulates with the upper jaw through the squamosal bone (squamosal articulation).

4. A bony palate is formed by the union of pre-maxillae, maxillae and palatines that separates the nasal passage from the buccal cavity.

5. Middle-ear contains three-ear ossicles—malleus, incus and stapes. Internal ear with spirally coiled cochlea (not coiled in monotremes). The ear ossicles conduct sound from the tympanic membrane to the inner ear.

D. Teeth:

6. Dentition heterodont, thecodont and diphyodont Heterodont dentition is marked by the presence of incisors, canines, premolars and molars.

Thecodont teeth (Each tooth is in alveolar socket of the jaw bone).

Diphyodont teeth, i.e., only two sets of teeth—first set is milk or lacteal teeth which is replaced by permanent teeth.

E. Development

7. Eggs are small, with little or no yolk (except in Monotremata).

8. Fertilization is always internal.

9. Part of the oviducts is dilated to form a uterus.

10. Allantoic (Chorio-allantoic) placenta is present in eutherian mammals (absent in monotremes and most marsupials). Placenta is the site of transfer of nutrients from maternal tissues to the embryo and of transfer of metabolic wastes from embryo to mother.

11. Viviparous, i.e., they give birth to alive youngs except in monotremes which are oviparous.

Different authors have classified Mammalia in different schemes. The scheme followed here is mainly based on G. G. Simpson (1945).

1. Subclass: Prototheria [Gk. Protos, first + therion = beast or a wild animal]

The monotremes differ from other mammals by having many peculiar characters, some of which are typically mammalian.

i) The females lay eggs and the mammary glands lack teats.

ii) The testes are abdominal.

iii) The ureters open into a urinogenital sinus (do not open into the urinary bladder).

iv) The cloaca receives the openings of urinary bladder, vas deferens and ureters.

v) It is now presumed that the Jurassic triconodonts are the ancestors of the extint prototherians.

This subclass includes three orders:

(i) Triconodonta

(ii) Symmetrodonta and

(iii) Monotremata.

Order 1. Triconodonta:

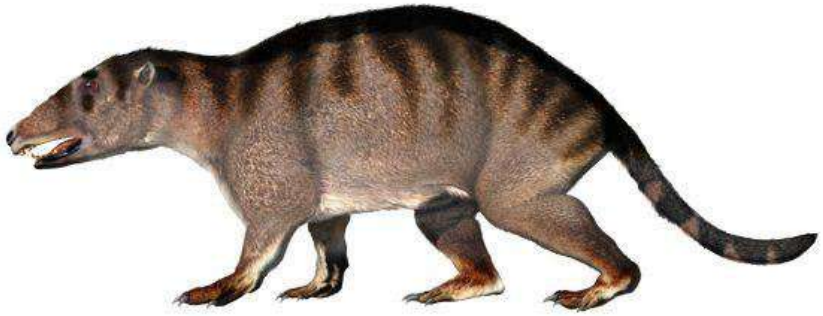
i) This was not bigger than present-day cats.

ii) The brain was small and primitive.

iii) jaws were elongated with four incisors, a single canine and nine post-canines.

iv) The molar teeth of the triconodonts had three cusps arranged in rows.

Examples: Amphilestes, Triconodon, Priacodon, Eozostrodon.



Triconodon

Eozostrodon

Order 2. Symmetrodonta

i) Each molar teeth when looked at in crown view presents three cusps arranged in a perfect symmetrical triangle.

ii) The lower jaw is without an angular process.

The members of this group ranged from the Jurassic to the Middle Cretaceous.

Examples: Spalacotherium, Peralestes.

Spalacotherium is a genus of extinct mammal from the Early Cretaceous of Europe.

Spalacotherium

Peralestes

Order 3. Monotremata

(Gk. monos = single + trematos = hole)

The monotremes occupy a most interesting position among mammals because of their distribution, anatomical peculiarities and systematic position. **The reptilian and mammalian characters present in the monotremes** lead one to thing that mammals have evolved from reptiles putting a step on the Monotremes.

Geographical distribution: Only three living genera including six species (Griffiths, 1978) are found today.

They are duck-billed platypus

spiny ant-eater

pro-echidna.

The duck-bill is also known as the water mole or duck mole. It is found in Australia, Tasmania and New Guinea.

The echidna or spiny ant-eater includes also a single species and ranges from New Guinea to Tasmania.

The proechidna is found only in New Guinea.

Duck billed platypus

Spiny ant eater

Proechidna

External morphology

1. Body is covered over with soft hairs (platypus). Hairs on the dorsal side may be coarse or spine-like (echidna).

2. Digits end in sharp claws and are webbed.

3. Mammary glands are devoid of teats.

4. Pinna is distinct but small.

5. Tail may be present or absent.

6. In males, poison-spur is present on the hind legs.

7. Nictitating membrane is present.

8. Lachrymal is absent.

9. Nasal and pre-maxilla are drawn out into a rostrum.

10. Pterygoid bone is present.

11. The malleus is large and the stapes is imperforate.

12. The mandible is slender with slightly marked coronoid process.

13. The scapular spine is placed at the anterior border.

14. Teeth are replaced by a horny pad in adults. Youngs possess teeth.

Dental formula in young stage is 0.1.2.3/5.1.2.3

15. Epiphysis is ill-developed.

16. Zygapophyses in cervical vertebrae are ill- developed.

17.Sternum: 'T'-shaped interclavicle is present in the sternum corresponding to that of reptiles.

18.Limbs: Humerus is flat having a little developed olecranon process. Femur is flat with prominent trochanter.

Internal organs:

1. Tongue is long and sticky.

2. Sweat and sebaceous glands are present.

3. The testes are abdominal in position, immediately behind the kidney.

4. The cerebrum of brain is smooth and does not cover the cerebellum. Corpus callosum is absent.

6. Eggs are provided with much yolk and the egg shell is leathery.

Peculiar features of Monotremata

1. Upper jaw is produced into depressed beak in Platypus (Ornithorhynchus) and pointed rostrum in Tachyglossus (Echidna).
2. Mammary glands are unspecialized and without nipples or teats, and some specialized hairs in place of them.
3. Temporary marsupial pouch (incubatorium) occurs in females during breeding season (only in Tachyglossus).
4. In Platypus only embryonic teeth are replaced by horny plates in adults. In Tachyglossus, teeth are absent in all stages of development.
6. There is a grooved erectile poison spine on the tarsus of

8. Egg-laying habits.

Specialized features:

Though they possess many primitive features they also show many specializations:

1. The clawed feet in Echidna are used for breaking the ant's nest.
2. The large tongue in Echidna is employed for ant-eating purposes.
3. Feet are used for walking, digging and swimming.
4. The male possesses a hollow tarsal spur.
5. Nostrils open on the dorsal side.
6. The platypus, Ornithorhynchus is highly adapted for aquatic life.

Order Monotremata comprises two families:

(i) Ornithorhynchidae and

(ii) Tachyglossidae.

Family Ornithorhynchidae:

i. The snout is flat, elongated and covered with a leathery skin.

ii. The body is without hairs and covered with a dense soft fur.

iii. The tail is short and dorsoventrally flat.

iv. The legs are short with long webbed- digits, used for paddling.

v. Nipples and teats are absent in both families.

e.g., Platypus (Ornithorhynchus).

Family Tachyglossidae:

i. The snout is elongated and tapered.

ii. The body is covered with spines and hairs.

iii. The tail is very short.

iv. The limbs are stout with clawed digits used for digging.

v. Temporary marsupial pouch is formed on the abdomen during breeding season.

e.g., Echidna (Tachyglossus), Pro-echidna (Zaglossus).

Affinities of Monotremata:

Reptilian Affinities

(1) Presence of ectopterygoid (Echidna pterygoid) in skull.

(2) At the posterior end of palate, a pair of bones are present. They represent some reptilian skull bone.

(3) Ribs are single headed (excepting cervical ribs).

(4) Cervical ribs are present.

(5) Coracoid is well developed and and epicoracoid is present.

(6) 'V- shaped interclavicle.

(10) Acetabulum is perforated.

(11) Absence of epiphysis in the vertebrae except in the tail region of platypus.

(12) Ventral abdominal vein is present.

(13) Body temperature is not constant.

(14) Cloaca is present and it is shallow.

(15) Testis is abdominal.

(16) Presence of different glands in the oviduct.

(17) No uterine gestation.

Presence of strong reptilian features in Monotremata speaks of its primitiveness. These primitive mammals have failed to cope up with many of the evolutionary transformations which culminated in the establishment of better characteristics in higher mammals.

Avian Affinities:

(1) Shape of the beak in platypus resembles birds.

(2) Teeth are absent.

(3) Presence of webbed feet.

(4) Sutures of the skull are obliterated.

(5) Presence of spur in the tarsal region.

(6) Presence of oil gland

Remark:

The relationship between monotremes and birds does not stand on a solid ground. The converging characters noticed in them are due more to the fact that both possess common reptilian ancestry.

Mammalian Affinities:

(1) Presence of hair, mammary glands, oil gland and sweat glands.

(2) Single jaw bone.

(3) Presence of palate.

(4) Sternum is segmented.

(6) Cervical vertebrae are seven.

(7) Circulatory system is typically mammalian.

(8) Diaphragm is present.

(9) Cochlea is slightly coiled.

(10) Cerebellum is well-developed.

(11) Fertilization is internal.

Though monotremes show affinity with non-mammalian groups, the above- mentioned characters unequivocally speak of close and firm affinity with mammals.

Affinities with Marsupials:

(1) Structure of skull.

(2) Presence of Marsupial bone.

(3) Mandibular inflection.

(4) General contour of brain.

(5) Bulbourethral gland.

(6) Resemblance between foetal monotreme and marsupial.

(7) Mode of milk secretion.

Considering the similarities, Gregory (1947) has proposed that monotremes originated from some pre-marsupial stock and their present features are due to degeneration, neoteny and specialization.

He has included both monotremes and marsupials in a subclass 'Marsupiontia'. But the most accepted view is that monotremes originated from the principal line of evolution of mammals.

Systematic position of Monotremes:

The fossils of monotremes are not known before Pleistocene. So to determine the systematic position of Monotremata becomes difficult for lack of palaeontoiogical evidences.

Regarding the systematic position many authors from time to time pass their opinions:

Newman (1939):

Monotremes represent the end product of a slender evolutionary line of mammalian evolution. They arose during Triassic from some different mammal-like reptile stock, along with the Multituberculata but were not derived from the fitter.

Howell (1907), Romer (1939), Kermack and Mussett (1956), and Grassae (1955):

Monotremata is a divergent branch of the mammalian line of descent separated in very early times or in Jurassic.

Carter (1967):

Monotremes are not ancestor to higher mammals but are believed to be a side branch of mammalian evolution, probably separated since Triassic times.

Colbert (1969):

Monotremes represent quite a separate line of descent from the mammal-like reptiles, containing in an isolated corner of the world.

Hopson and Crompton (1969), Mills (1971) and Simpson (1971):

Morganucodontidae, e.g., morganucodonts, a group of primitive mammals those arose back to early Cretaceous, may be the ancestral lineage of monotremes.

Parker and Haswell (1964):

Monotremes developed from an early stock (Triassic cynodonts) on the principal mammalian line of descent.

Hopson (1994) and Pough, Heiser and McFarland (1996):

Monotremes evolved from the 'holotheres' (a primitive mammalian group during the Jurrasic period) lineage.

Kardong (2002):

Monotremes derived early from the Theria, probably in the lower Jurassic period and ever since they are on their own course.

Phylogenetic consideration of Monotremes:

Two logical and reasonable views have been put forward to explain the phylogeny of Monotremes. In one view it has been expressed that the Monotremes evolved independently from the early mammal-like reptiles and continued to survive in isolation as basically primitive mammals marked with certain specializations.

The other view advocates that Monotremes have been derived from very early Marsupials and owe their peculiar characters to divergent specialisation. These specialisations are retention, degeneration and reversion of characters.

Among the mammals the Monotremes are very much controversial. They possess primitive, degenerated and specialised features. It is reasonable to conclude that Monotremes originated as a side line from the main line of mammalian evolution and have retained the characters through which ancestors of higher mammals have passed.

2. Subclass Allotheria:

Fossil forms of Allotheria have been found from the sediments of Jurassic age. The group was highly specialised. Teeth pattern showed that they were herbivorous.

Order Multituberculata:

i) Skull was heavy with massive lower jaw.

ii) Zygomatic arch was strongly built.

iii) Incisors were elongated.

iv) Diastema was present.

v) Upper and lower molars were with longitudinal rows of cusps.

vi) In primitive forms, two parallel rows of cusps were present in both upper and lower molars, but in later forms three rows of cusps appeared on the upper molars.

They ranged from early Jurassic to the Lower Eocene.

Example:

Ctenacodon, Plagiaulax.

3. Subclass Theria (Gk. therion = beast):

i) Mammals included in this subclass do not lay eggs but give birth to young ones.

ii) Mammary glands are provided with nipples or teats.

iii) The ureters open directly into a urinary bladder.

Table 42 shows the distinction between Prototheria and Theria.

The subclass is divided into three infraclasses of which one is extinct.

Infraclass A. Pantotheria (Trituberculata):

They are also known as trituberculates. Jaws were long and slender with differentiated cheek teeth. They persisted during the middle and upper Jurassic.

They were divided into two orders:

Order (1) Dryolestoidea:

i) They had four incisors, one canine, four premolars and seven molars on each half of their elongated upper and lower jaws.

ii) The upper molars were triangular in shape having a prominent cusp, called protocone, on the inner apex.

iii) The outer side of the molar was provided with many cusps and cuspules.

Example:

Amphitherium, Amblotherium, Melanodon.

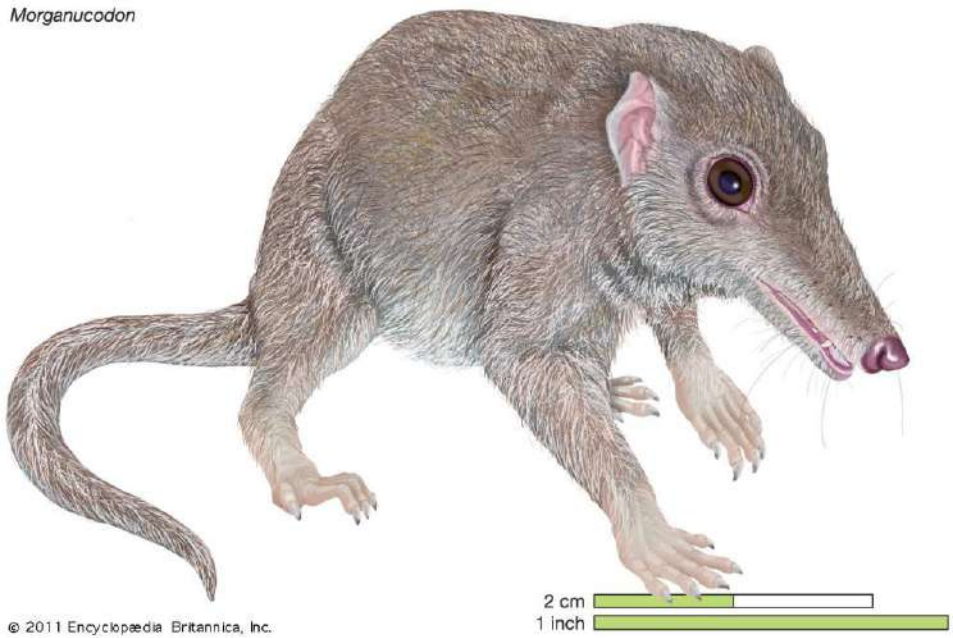
Order (2) Docodonta:

This group includes controversial fossils of Upper Jurassic period and shows resemblance with the Triconodonta. Molars in the upper jaw possess three roots but in the lower jaw they do not have these features. The inner cusp of the molars appears to be homologous with the Dryolestoidea.

Example:

Docodon, Morganucodon.

Docodon



Morganucodon

Infraclass B. Metatheria [Gk. meta = next to]:

1. The youngs are born in an immature condition and undergo further development in marsupium of the female.

2. Mammary glands with teats open into the marsupium.

3. Allantoic placenta is absent.

Order Marsupialia (L. marsupium = a sac) 242 species:

The marsupials form a distinct group for their anatomical peculiarities, distribution, adaptation and evolutionary history.

Distribution:

Past: Marsupials were universal in distribution during Cretaceous period and were in keen competition with the placentals. But, during Coenozoic era, the placentals increased in number at such a rapid rate that the marsupials failed in competition and consequently became exterminated from many parts of the globe.

In Coenozoic era, Australia and South America became separated from the main land mass. The separated lands contained marsupials as well as some placentals. Marsupials, defeated in competition with placental mammals in other parts of the world, flourished in these separated land masses of Australia and South America.

Later on, South America was invaded by placentals again and their influx led to the extinction of many marsupials there. Thus marsupials, like true placentals, explored all the possible niches but failed to survive in all the regions.

Present:

Today there are about 242 species of Metatheria, confined to Australasian, Neotropical and Nearctic region.

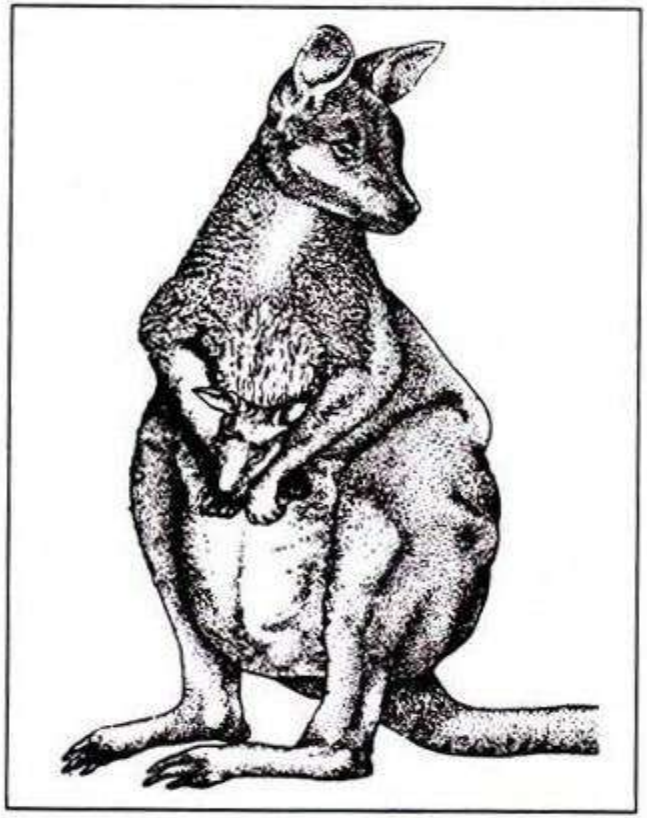


Fig. 10.50 : *Macropus* (Kangaroo) in sitting posture. Note that the young is placed in the marsupium.

Origin:

The Australian marsupial fauna is mono- phyletic and probably originated from microbiotheriid marsupials of S. America which migrated during Late "Cretaceous or early Tertiary.

External Morphology:

1. Body is covered over with soft fur.
2. Pinna is well-developed.
3. Most of the female members possess marsupium. The marsupium is supported by two epipubic or marsupial bones.
4. Mammary glands have teats.
5. Tail is well developed and helps in balancing.
6. A strange specialization is seen in the hind foot. The second and third toes are slender and remain enclosed in a sheath of skin. These two together are known as syndactylous digits which form a sort of two-pronged comb. The fourth toe is the largest. All digits end in claws.
7. Forelimbs are shorter than the hind limbs (Fig. 10.50).

Skull:

1. Skull is small with well-developed sagittal crest.
2. Sutures of the skull are present (Fig. 10.51 A).
3. Jugal takes part in the formation of glenoid fossa.
4. Tympanic bulla is partly formed by alisphenoid and is incompletely united with the skull.
5. Orbital and temporal fossae are confluent.
6. Zygomatic arch is complete.
7. Pterygoid is small.
8. Inward inflection of lower jaw is present
11. Dentition is heterodont, thecodont and monophyodont (excepting last premolars). Number of incisors vary. There are five upper incisors and four lower incisors. Dental formula is 5.1.3.4/4.1.3.4.

Vertebral Column:

1. Vertebral column is divided into five regions.
2. Cervical vertebrae are seven in number.
3. Thoracic vertebrae are about thirteen in number and are provided with ribs.
4. Lumbar vertebrae are seven in number and are devoid of ribs.
5. Cervical vertebrae are perforated and vertebral artery passes through the perforation.
6. Caudal vertebrae are with 'chevron bone' excepting in Koala and Wombat.
7. Atlas is incomplete (Fig. 10.51 C) and is provided with cartilage in the ventral incomplete side.

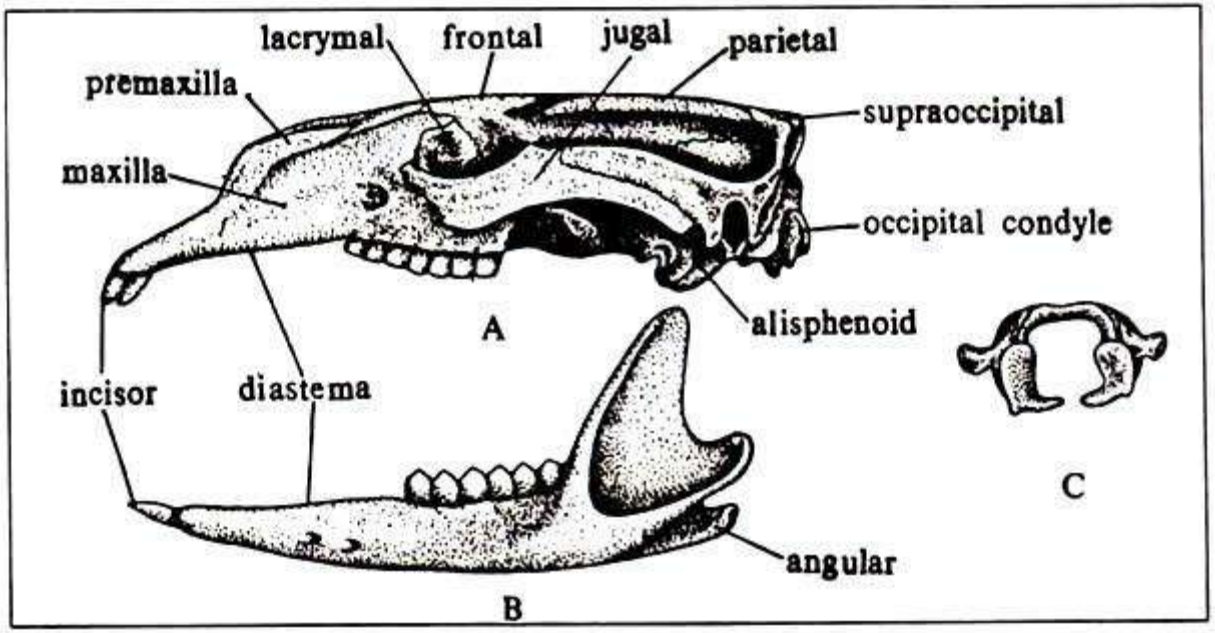


Fig. 10.51 : Skull (A), lower jaw (B) and Atlas (C) of *Macropus*.

Girdles and Limbs:

1. Coracoid is well developed in embryonic stage but becomes reduced into a rod-like structure in the adult.
2. Coracoscapular line of fusion persists for a long time.
3. Acromion, metacromion and scapular spine are present.
4. Clavicle is well-developed.
5. An epipubic bone for the support of the marsupium is present but it is not homologous to reptilian epipubic bone.
6. Humerus is with epicondylar foramen.
7. A parafibula bone in the form of a narrow rod may be present on the outer side of the fibula.
8. The 4th toe in the hind limb is the largest and serves as the axis of the foot.

Digestive System:

1. Teeth are heterodont, thecodont and monophyodont. The last premolar is an exception. Number of premolars may be 3/4 or 4/4. Molars bear three cusps; often an additional small cusp may be present.
2. Shape and size of the stomach is variable. In Kangaroos, the stomach is elongated and succulated.
3. The cardiac gland is present in Phascolarctos, Phascolomys.
4. A gall bladder is always present.
5. A large caecum is present in herbivorous forms.
6. Caecum is absent in carnivorous forms.

Circulatory System:

1. The fossa ovalis in the inter-auricular septum is absent.
2. There are two superior venae cavae and each superior vena cava receives an azygos vein.
3. Auriculoventricular valves are membranous and remain attached by chordae tendineae to the papillary muscles.

Urinogenital System:

1. Anal and urinogenital apertures are enclosed by a common sphincter muscle.
2. Ureters run between the genital ducts in both sexes.
3. Oviducts remain separate and uterus and vagina are paired
4. Testes are abdominal and lie in front of the penis.
5. The glans penis is bifurcated. The scrotum lies in front of the penis.

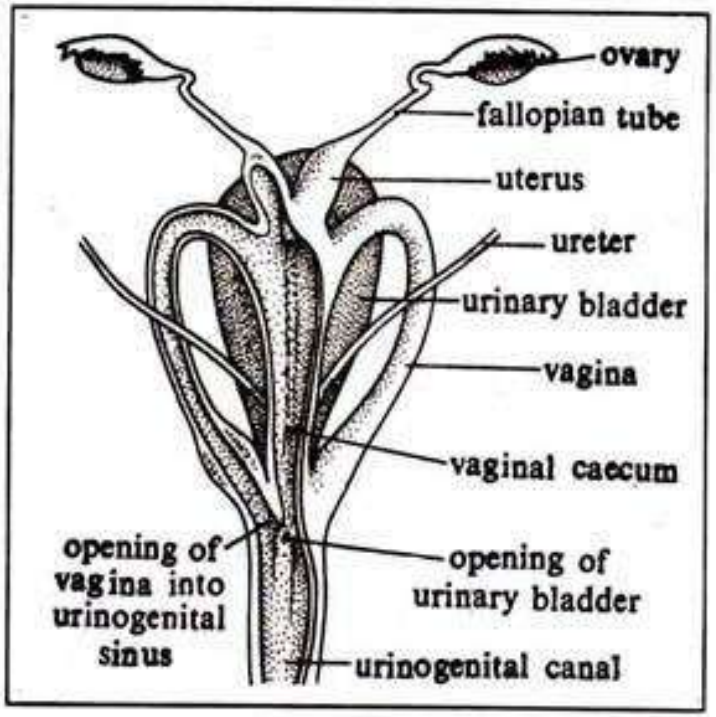


Fig. 10.52 : Female reproductive system of *Macropus*. Right uterus, vagina and vaginal caecum are exposed.

6. The anus and the opening of the urinogenital sinus are enclosed by a common sphincter.

7. Youngs are born alive in an immature state seven days after fertilization. Youngs are taken by the mother in her marsupium where the embryos remain attached to the nipples of the mother.

8. Yolk-sac placenta is common in all. But in Parameles, an allantoic placenta is present. It is structurally very simple and remains functional for a short period.

Nervous System:

1. The brain is small with little convolutions.

2. Olfactory lobes are comparatively large.

3. Corpus callosum is either absent or poorly developed.

4. Anterior commissure is very prominent.

Affinities of Marsupialia:

1. With Reptilia (with cynodont-like reptiles):

Similarities:

i) The skull of American opossum is nearer to the construction of the skull of Cynodont-like reptilia. ii) Presence of alisphenoid bulla. iii) Presence of epipubic bone and stapes like the columella of reptiles. iv) Small cerebral hemispheres and large olfactory bulbs.

Remark:

The dissimilarities are so numerous that the affinity towards the reptilia can be discarded.

2. With Prototheria (Monotremata):

Similarities:

i) Marsupial pouch in Tachyglossus of monotromes. ii) Brain without corpus callosum. iii) Cerebellum exposed and simple. iv) No fossa ovalis in the heart.

v) Common sphincter muscles surrounding the anus and urinogenital aperture.

vi) Oviducts separate, double uteri. vii) Marsupial mammary glands are more closely related to monotremes. viii) No true allanto-chorionic placenta except in Perameles (Bandicoot).

ix) Eggs yolky and segmentation meroblastic.

x) Incomplete tympanic bulla.

xi) Presence of epipubic bone.

xii) No cervical ribs.

xiii) Presence of chevrone bones.

Dissimilarities:

i) Absence of teats in monotremes. ii) Egg-laying habit in monotremes.

iii) Presence of uterine gestation in Marsupialia. iv) Absence of interclavicle and epicoracoid in marsupials. v) Vertebrae with epiphysis. vi) Body temperature varies between 25°C – 28°C in monotremes but constant in Marsupialia.

Remark:

Above affinities indicate that there is definitely some relationship between the marsupials and monotremes but they also differ from each other by specialised characters which suggest us to put marsupials separated from monotremes in subclass classification.

3. With Multituberculata (Subclass Allotheria):

In many multituberculates, the anterior lower cheek teeth were much enlarged and specialized in a manner analogous to that of some living marsupials, e.g., Rat Kangaroo (Bettongia).

iii) Testes in the male in the scrotal sac.

iv) Females produce living youngs.

v) Oviduct of the females are differentiated into upper Fallopian tube and lower uterine portion.

5. With Infraclass Eutheria:

Similarities:

i) Viviparous, though with a short uterine gestation in Marsupialia.

ii) Mammary glands are modified sebaceous glands in both groups.

iii) Testes are in scrotal sacs. iv) Development of placenta (Allantochorionic in Perameles). v) Non-nucleated R.B.C. vi) Dentition thecodont and heterodont.

vii) Skull with distinct sutures.

Dissimilarities:

i) Palate fenestrated in marsupials. ii) Incomplete tympanic bulla.

iii) Small cranium in marsupials. iv) Teeth monophyodont except last premolar.

v) Number of incisors are greater than eutherians

ix) Youngs are born in an immature condition and generally become fully matured within marsupium.

x) Vaginae are separate and has a separate opening into the urinogenital canal.

xi) Temperature regulation and other homeastic processes are not equal to that of eutherians.

It seems that they have diverged at an early stage from main mammalian stock and all other similarities are due to parallel evolution. So it is better to put them under the separate infraclass Metatheria.

Different views regarding systematic Position:

T. H. Huxley (1880) divided Mammalia into three groups — Proto, Meta and Eutheria, and considered the marsupials as intermediate in between Proto and Eutheria.

Beddard (1909) included Marsupialia as an order under the subclass Eutheria.

Simpson (1945) treated Marsupialia as an infraclass under the subclass Theria and retained the nomenclature of Huxley (1880) the Metatheria.

Modern authors like Carter (1957, 67), Parker and Haswell (1964), J. Z. Young (1981) have followed the scheme proposed by Simpson.

Hugh Tyndale Biscoe (1973) put forwarded that the marsupials and eutherians have probably evolved from Pantotheres by a dichotomy, now thought to be in the Cretaceous.

Sharmann (1970) and Lillegraven (1974) opined that Marsupialia (Metatheria) and Placental mammals (Eutheria) have evolved from a common ancestral stock. But Keast (1968), Muller (1969), Kirsch (1977) and Griffiths (1978) have rejected this view. According to them, the relationship between the marsupialia and placentalia are due to parallel evolution.

Classification of Marsupialia:

Formerly two different schemes, one on the basis of the character of teeth and the other on the basis of the features of toes in the hind limb, were made to classify the order Marsupialia.

As a scheme based on single character is insufficient to meet the demand of a perfect classification, Simpson has proposed a third scheme. His scheme has taken into consideration the six marsupial groups as independent units and he has placed them under six super families.

The three schemes are given below:

First scheme (on the basis of teeth):

Order Marsupialia

Division I. Polyprotodontia

Family (i) Didelphoidea

(ii) Dasyuroidea

Second scheme (on features of hind toes):

Order Marsupialia

Division I. Didactyla

Family (i) Didelphoidea (ii) Dasyuroidea (iii) Borhyaenoidea (iv) Caenolestoidea

Division II. Syndactyla

Family (i) Perameioidea (ii) Phalangeroidea

Simpson's scheme (1945):

Order Marsupialia

Superfamily I. Didelphoidea

Family (i) Didelphidae

Example:

Opossum

Superfamily II. Dasyuroidea

Family (i) Dasyuridae.

Example:

Tasmanian Devil, Tasmanian wolf

(ii) Notoryctidae.

Example:

Marsupial mole

Superfamily III. Borhyaenoidea

Family (i) Borhyaenidae.

Example:

Borhyaena

Superfamily IV. Perameioidea

Family (i) Peramelidae.

Example:

Perameles

Superfamily V. Caenolestoidea

Family (i) Caenolestidae

Example: Caenolestes

Superfamily VI. Phalangeroidea

Family (i) Phalangeridae

Example: Petaurus

(ii) Phascolomyidae

Example: Wombat

(iii) Macropodidae.

Example: Macropus (Kangaroo)

(iv) Diprotodontidae.

Example: Nototherium.

Biological account of some important families of Marsupialia:

Didelphidae:

This family includes 12 genera and 66 species. They are Neo-tropical and Nearctic in distribution. Didelphis marsupial is (opossum of United States), Marmosa, Chironectes belong to the family. The other species are found in Central and South America. The dental formula i5/4, c1/1 pm3/3, m4/4 = 50. The tail is scaly and prehensile. Up to 22 embryos of the size of honey bees are 'born' after a gestation period of 12 days. The embryos remain attached to the nipples for 50-60 days.

Caenolestidae:

This family includes 3 genera and 7 species and they are represented by Caenolestes, Orolestes and Rhyncholestes at present and known as the 'rat opossums' of western South America, Andes and adjoining coastal zones of Central Chile. The dental formula is: i4/3-4, c1/1 pm3/3, m4/4 = 46-48. The marsupium is either absent or very small with reduced epipubic bones. The lower incisor is large and horizontal in position. The canines of the male are larger than that of female.

Dasyuridae:

The family has 20 genera and 50 species. They are Australian in distribution. The dental formula is: i4/3, c1/1; pm2-4/2-4, m4/4 = 42-50. The hind-limbs and forelimbs are of same length. The members are carnivorous or insectivorous. The marsupium may be absent.

Examples:

Sminthopsis (small marsupial of mouse size), Thylacinus (Tasmanian wolf), Sarcophilus (Tasmanian devil), Dasyurops (tiger cat), Myrmecobius (marsupial ant-eater), etc.

Does the Tasmanian wolf still exist ?

Scientists still argue whether Tasmanian wolfs still exist or they became extinct a long ago. A curiosity still continues among the biologists. The animal is the largest of the carnivorous marsupials with the head of a wolf, stripes on the body of a tiger and a pouch much like a kangaroo.

Although unofficial sightings continue to be reported, the last known live Tasmanian wolf was trapped a few kilometres west of Mt. Field National Park, Australia in 1933. A year later the only remaining captive wolf died in an Australian zoo.

An intensive search is being made by scientists and WWF Australia, to find the animal in the forests of Tasmania using infra-red, automatically triggered still and movie cameras. A portable dark room has been built on the off-road vehicle for on-the spot film processing. Hundreds of photographs have been taken of other wild life but this timid animal continues to elude and mystify man.

Notoryctidae:

This family has only one genus and two species. Notoryctes (marsupial mole) is found in arid zones of North-western and South-central Australia. They are insectivorous and fossorial. The dental formula is: i4/3, c1/1, pm2/3, m4/4 = 44. The claws of the fore- limbs become enlarged for digging.

Phascolomyidae: The family includes 2 genera and 2 species of Australian realm. The wombats (Phascolomys) are stout marsupials which are adapted to fossorial life. They are adapted to fossorial life. They are adapted to herbivorous diet. The dental formula is: i1/1, c0/0, pm1/1, m4/4 = 24. The marsupium opens posteriorly and with a pair of mammae. Rodent-like incisors are separated from the premolars by a wide diastema.

Macropodidae: The wallabies, Wallaroos and Kangaroos of Australian realm are included in this family. There are 19 general and 47 species. The dental formula is: i3/1, c0/0, pm2/2, m4/4 = 32-34. The forelimbs are reduced. The hind legs are greatly enlarged and the powerful tail is long for ricochetal type of locomotion. The forelimbs have five digits.

The digits of the hind limbs are greatly modified. II and III digits are slender and syndactylous. Digits IV and V are elongated and clawed. The hallux is usually absent. They are mostly nocturnal, cursorial or arborial and herbivorous. Females usually bear one young annually.

Peramelidae: This family is represented by the bandicoots (e.g., Perameles, Thylacis, Thylacomys, Chaeropus) of Australian realm. There are 8 general and 22 species in this family. The dental formula is: i4-5/3, c1/1, pm3/3, m4/4 = 46 or 48. The marsupium opens downward and backward. The incisors are small but specialised. The placenta is of chorioallantoic type without villi. They are largely insectivorous and fossorial in habit.

Phalangeridae:

This family includes the phalangers, cuscuses, Phascolarctos (Koala) of Australia. There are 16 general and 46 species in this family. The marsupium opens posteriorly. The dental formula is: i2-3/1-3, c1/0, pm1-3/1-3, m3-4/3-4 = 24 – 42. They are arboreal and herbivorous in habit. The flying phalanger (Petarurus) is included in this family. The claws are sharply pointed and the hallux is opposable.

Adaptive radiation in Marsupials:

Marsupials have explored all possible ecological niches and have tried to master all available habitats. Because of their adaptation to diverse habitats, the different members have undergone through various anatomical modifications. A good degree of adaptive radiation is exhibited by different members of the groups.

They are discussed below:

Superfamily: Didelphoidea:

Members belonging to this superfamily are found in North and Central America and in Australia.

Most of the members are Arboreal, only one species is aquatic. They are small in size and insectivorous. They are characterized by the presence of an elongated muzzle, well-developed nail, less opposable hallux and a long prehensile tail. The aquatic forms have webbed feet. Marsupium is absent or incompletely formed. The American forms pretend to be dead when captured.

Example:

Opossum, Didelphis (Fig. 10.54), Chironectes.

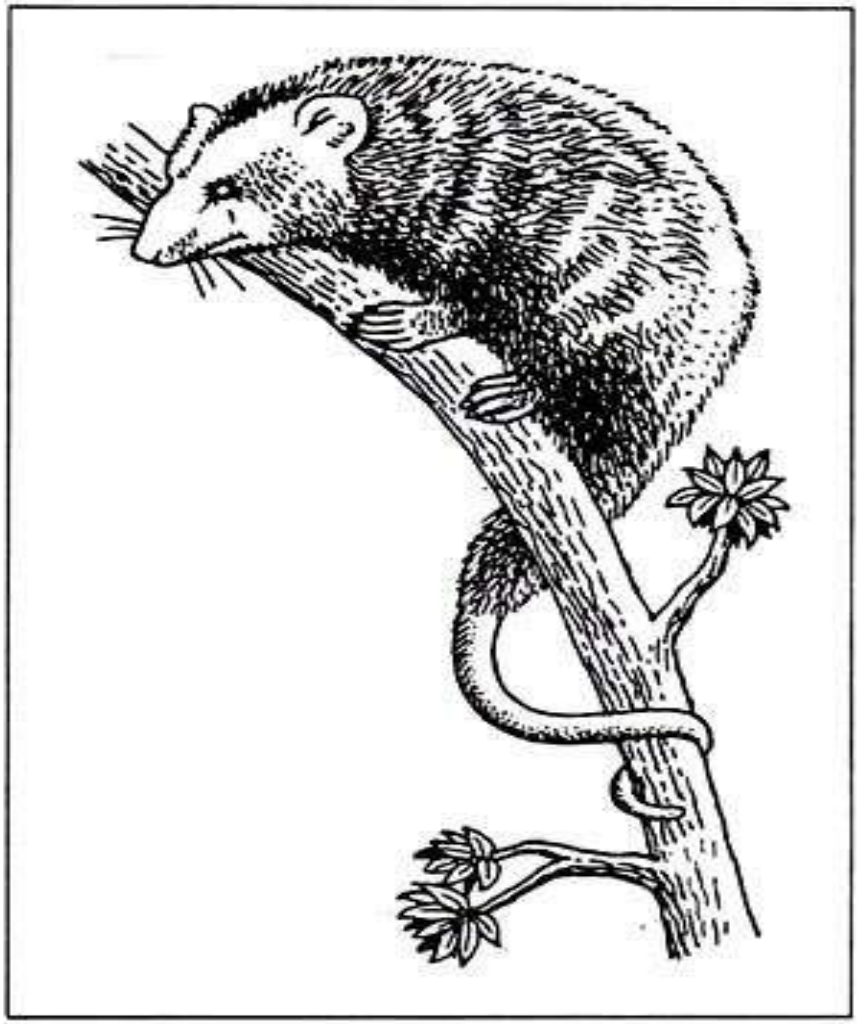


Fig. 10.54 : South America's opossum (*Didelphis*)

Superfamily: Borhyaenoidea:

Most of the members are extinct. They were distributed in South America. The members were bear-like in size, short legged, large headed and carnivorous in habit. Examples: Borhyaena, protohylacinus.

Superfamily: Dasyuroidea:

Members belonging to this superfamily are restricted in Australia. A diverse adaptation is encountered among the different members.

They are: (1) Carnivorous: Dasyuroidea include the members which are nocturnal and carnivorous. The teeth are modified for cutting flesh. These animals have rudimentary pollex and small, clawless hallux. Most members are terrestrial with well-developed four-toed feet and marsupium.

The tail is long and non-prehensile. They are represented by Tasmanian wolf, Thylacinus (Fig. 10.55 A), Tasmanian devil, SarcophiIus (Fig. 10.55 B), Tasmanian tiger cat, Dasyurus (Fig. 10.55 C) and Eastern native cat, Dasyuropus (Fig. 10.55 D). The Tasmanion wolf, at present extinct, has exhibited close parallelism with eutherian or wolfs in dentition and hunting habit.

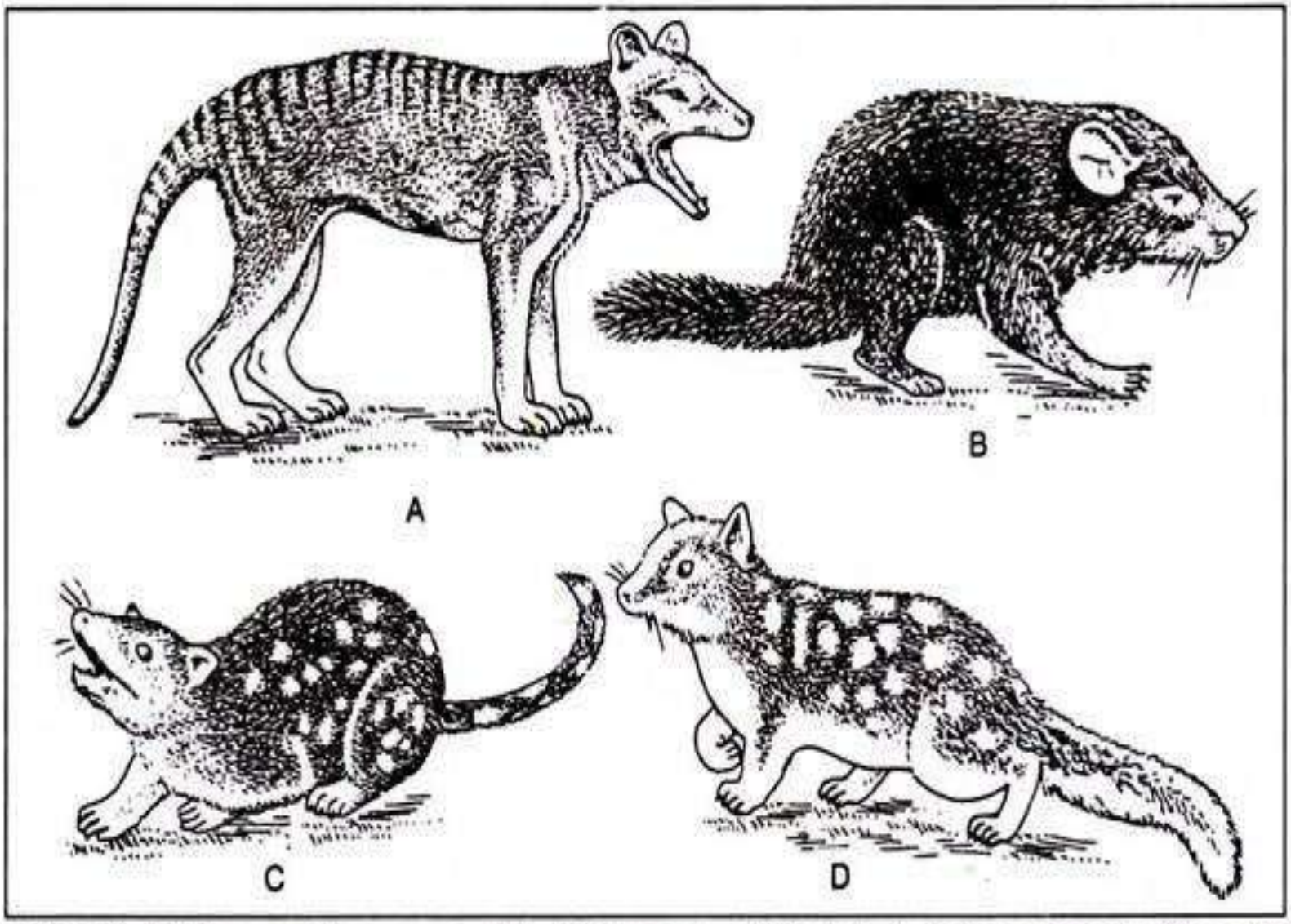


Fig. 10.55 (A–D) : Some carnivorous marsupials. A. Tasmanian wolf (*Thylacinus*), B. Tasmanian devil (*Sarcophilus*), C. Tasmanian tiger cat (*Dasyuropus*), D. Eastern native cat (*Dasyurus*)

Tasmanian devil is still common in Australia and the second largest of the living carnivorous marsupials after the thylacine and more ferocious than Native cats. It frequently hunts domestic poults. The Native cats (Dasyurus) are found in Australia, Tasmania and New Guinea. They are cat-like animals and prey on smaller marsupials such as pouched rats and mice as well as on birds.

(2) Semiarboreal:

Members are represented by Phascogale. These are slender bodied rat-like creatures with bushy tail.

(3) Ant-eater:

Members are represented by Myrmecobius (Fig. 10.56). These are pouch- less small rat-like animals characterized by the presence of black bands across the lumbar and sacral regions.

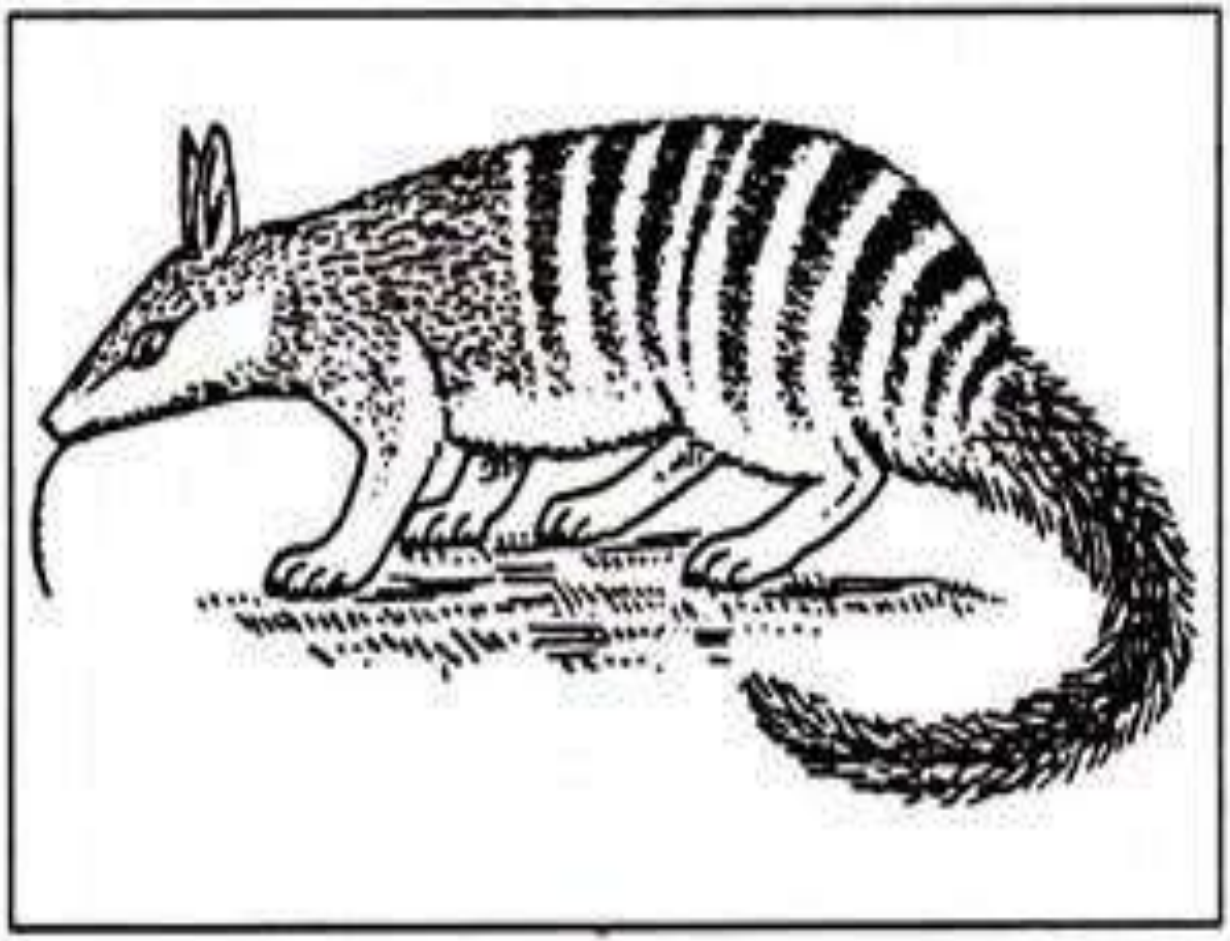


Fig. 10.56 : Banded ant-eater (*Myrmecobius*).

(4) Fossorial:

Members are represented by Notoryctes (Fig. 10.57). They are small in size with well-equipped body adaptation for burrowing. They live in sandy deserts. The limbs are short but powerful having five digits. Claws in the 3rd and 4th digits of the forelimbs are large, flat and triangular. Dorsal side of the head is provided with protective shield.

The tail is short and is covered by hairless horny skin. Pinna is absent and eyes are vestigial. Pouch is well-developed and the opening is directed backward. The pouched mice, Sminthopsis (Fig. 10.58), are small marsupials living in those niches, similar to that of shrews.

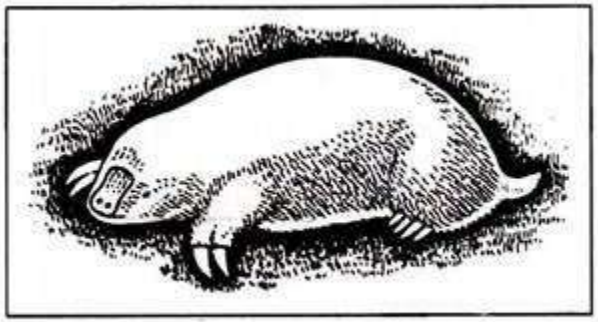


Fig. 10.57 : Marsupial mole (*Notoryctes*).

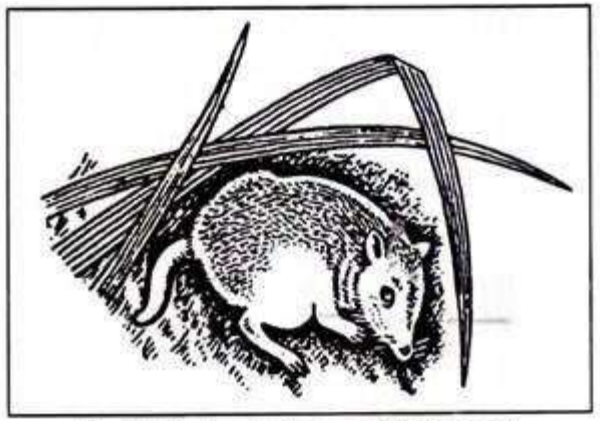


Fig. 10.58 : Pouched mouse (*Sminthopsis*).

Superfamily: Perameloidea:

Members belonging to this superfamily are restricted in Australia in its grassy lands. The animals are smaller than rabbit in size. The animals have elongated and pointed muzzle.

Pinna present in some and the tail is small. The 3rd and 5th digits are either vestigial or absent. In the hind limb the 4th toe is the largest, the 2nd and 3rd ones are small and webbed and the 1st toe is vestigial. The opening of the marsupium is directed backward.

Example:

Perameles (Bandicoot), Macrotis and Thylacomys. The last one is carnivorous and others are omnivorous.

Superfamily: Caenolestoidea:

The members are found in South America. They are small, rodent-like and terrestrial in habit. Enlargement of median pair of lower incisors is a characteristic feature.

Examples: Caenolestes (Opossum rat), Orolestes, Rhynocolestes

Superfamily: Phalangeroidea:

A high degree of adaptive radiation is exhibited by the members of this superfamily.

The type of adaptation and characteristics for each type of adaptation is given below: (1) Arboreal: Both the limbs and the tail are prehensile in the arboreal forms. The 2nd and 3rd toes of the hindlimb are slender and united by a fold of skin. The 4th and 5th toes are nearly equal. Hallux is nail less and opposable.

Example: Trichosurus.

(2) Arboreal and clinging: The members which are arboreal and clinging in habit are usually sluggish and timid. Tail in these forms, is vestigial but a cheek pouch is present. Caecum is very large and they lick instead of drinking. The lateral side of the pouch is extended to the flanks.

Example: Phascolarctos or Koala (Fig. 10.59). The special point about Koala is that they are monophagous, that is, they are adapted to feeding upon the leaves of certain eucalyptus trees and nothing else. The Cuscus, Phalanger (Fig. 10.60 B) eats leaves, insects and, sometimes eggs.

Fig. 10.59 : *Phascolarctos* (Koala). Note that mother carries the young on her back.

(3) Flying:

Example of flying marsupial is the flying phalangers or Petaurus (10.60 *A*). Presence of a lateral fold of skin between fore- and hind-limbs enables it to glide.

(4) Burrowing:

Example is the Phascolomys, or Wombat Vombatus (Fig. 10.60 *C*). These are relatively large sized and heavily built animals. They are vegetarian and nocturnal in habit. The head is short and flattened. Limbs are thick and short and end in strong claws excepting the hallux. The 2nd and 3rd toes of hindlimb are connected by skin. Tail is short or no tail.

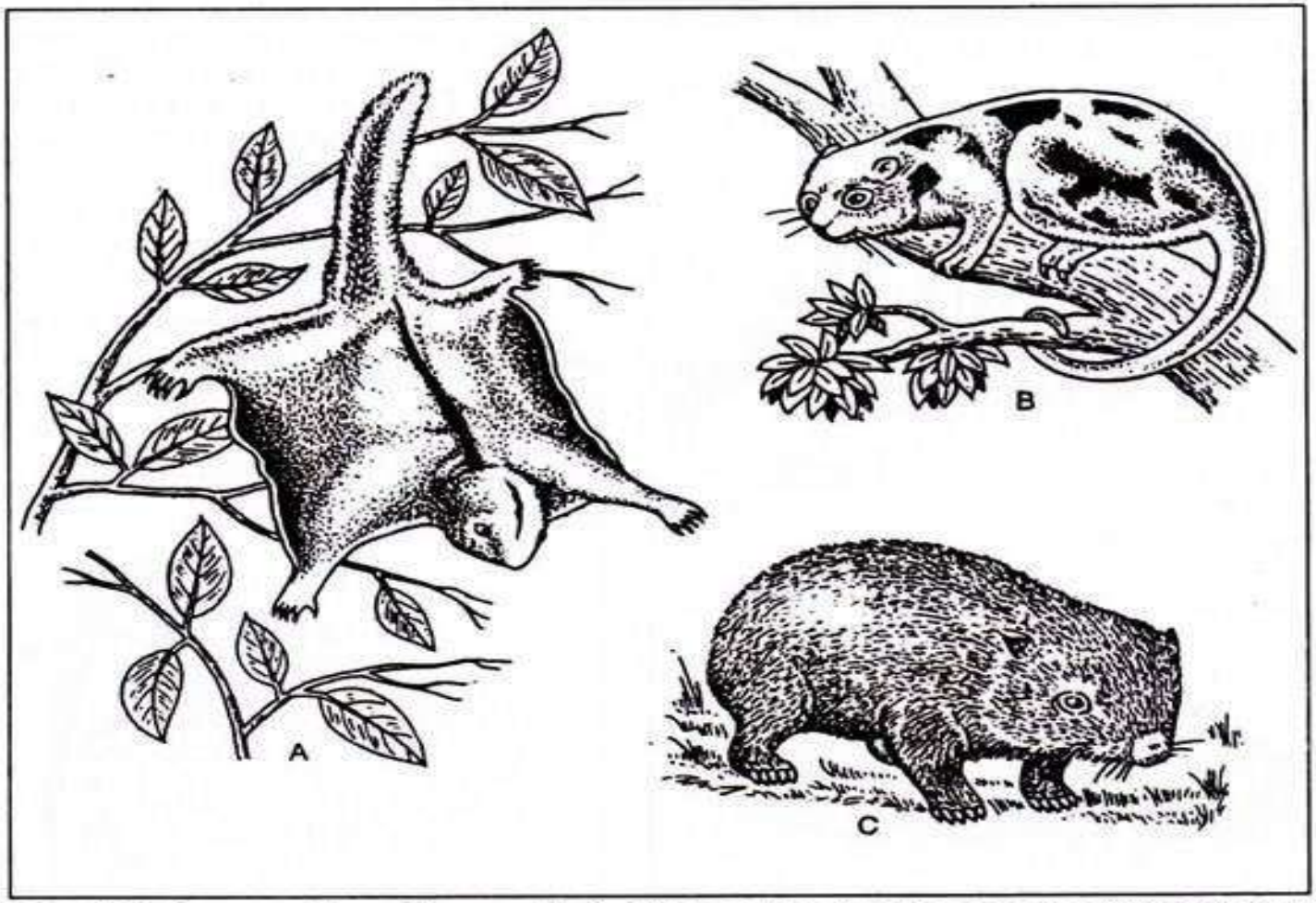


Fig. 10.60 : (A-C) Some members of the superfamily Phalangeroidea. A. Flying opposum (*Petaurus*), B. Cuscus (*Phalanger*), C. Wombat (*Vombatus*)

(5) Swift locomotion:

The members of the order Marsupialia that are well-known for their swift locomotion and browsing and grazing habits are the Kangaroos (Macropus) and Wallabies. They have small head and neck. The forelimbs are smaller than hindlimbs and are with five digits.

Hind limbs are long and powerful. The hallux is absent and syndactyly is present in the hind leg. Marsupium is large. The tail is stout and long and supports the body during rest. The Kangaroos sail across the landscape in graceful and prodigious leaps propelled by their powerful hind legs.

Rat kangaroos, Bettongia (Fig. 10.61) are rabbit-sized terrestrial marsupials. They are bipedal jumpers and have a prehensile tail.

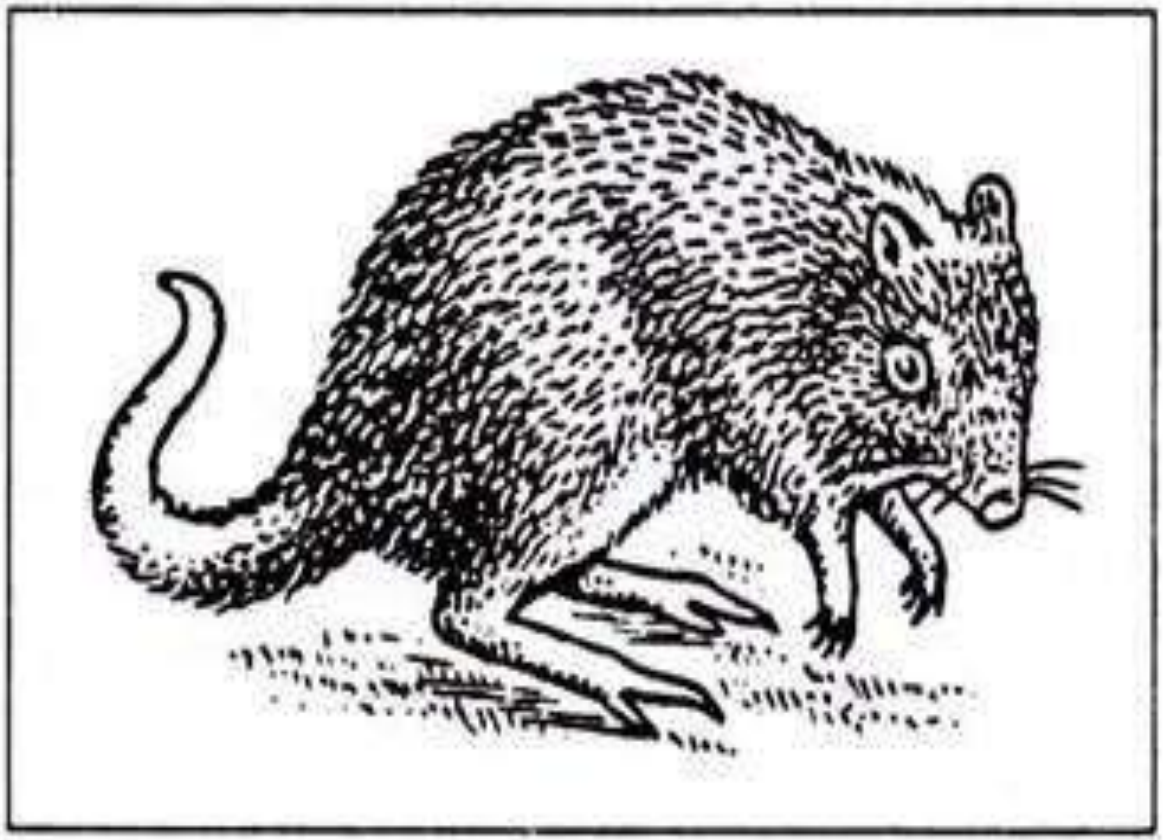


Fig. 10.61 : Rat kangaroo (*Bettongia*).

Infraclass (c) Eutheria or Placentalia [Gk. eu = true]:
(1) In Eutherians, the youngs go through a considerable period of prenatal growth and are born as miniature adults.
(2) A highly organised allantoic placenta is present.
(3) The brain is highly developed.
(4) Cerebral hemispheres and cerebellum are well-developed.
(5) The hemispheres have well-developed neopallial region.
(6) The two hemispheres are connected by corpus callosum.
(7) Anterior commissure is ill-developed.
(8) The ureters pass outside the genital duct in both the sexes.
(9) The uteri and vagina show a tendency of becoming single.
(10) The anal and urinogenital apertures are separate.
(11) Cloaca is absent except Pika.
(12) The osteological characters show that the brain case is large and the bony palate is solid.
(13) The angle of the lower jaw is not inflected.
(14) The tympanic bone is ring-like and forms a tympanic bulla.
(15) Alisphenoid is never associated with the bulla. The bulla is performed by the carotid canal.
(16) Dental formula, in general, is 3.1.4.3/3.1.4.3 but undergoes modifications in different groups and teeth are absent in some forms.

(17) In the post-cranial skeleton, there are seven cervical vertebrae.

(18) The thoracic series of vertebrae bear ribs.

(19) Ribs are lacking in the lumbar vertebrae.

(20) Epipubic bone of the pelvis is absent.

The structural differences between Metatheria and Eutheria are shown in Table 43.

Simpson (1945) recognizes 25 orders of placentals or eutherians.

Cohort A. Unguiculata:

It includes those placentals which possess nails or claws and are derived directly from primitive insectivores.

Order 1. Insectivora [L. insecta = insects + voro = to eat] 405 species:

Hedgehogs, Shrews, Moles, Tenrecs.

Insectivores are the earliest and primitive of all eutherians. They are believed to be ancestors of all other placental mammals and are persisting unchanged from Cretaceous period. They are distributed in Asia, Africa, Europe and North America.

These small, terrestrial and nocturnal insectivores are stamped with many primitive and some specialized characters:

(i) The primitive characters are exhibited by its typical dental formula which is 3.1.4.3/3.1.4.3.

(ii) The skull is constricted in the middle.

(iii) The zygomatic arch is incomplete,

(iv) The tympanic bulla is absent,

(v) The bony palate is incomplete,

(vi) Palatine is extended to meet the lacrymal.

(vii) Teeth have sharp molar cusps,

(xii) Locomotion is of plantigrade type.

(xiii) Body is covered with hairs. Hairs on the dorsal side are modified into spines (Hedgehog),

(xiv) Caecum is small or absent,

(xv) Scrotum is absent and the testes are internal in position,

(xvi) The uterus is of bicornuate type,

(xvii) A sphincter muscle is present around anus and urinogenital aperture,

(xviii) Mammary glands are many and are distributed all along the two milk lines on the ventral surface.

Remark:

The ordinal name Insectivora is somewhat misnomer since it implies that members of this taxon feed exclusively upon insects, while it is true that most members of the Insectivora feed upon invertebrates in soil litter, many of which are insects. Again some members of the group feed on fish, others on crustaceans and still others on small vertebrates (Eisenberg and Gould, 1984).

Marshall and Williams (1964) have splitted the order Insectivora into two separate order ranks — (i) Lipotyphla and (ii) Menotyphla. The order Lipotyphla was considered by Simpson as a suborder of the Order Insectivora which includes shrews, moles and hedgehogs.

The Order Menotyphla includes the elephant-shrews, Macroscelides of Africa and the tree-shrews, Tupaia (Fig. 10.62D) of Asia. The Tupaiidae were included by Simpson in the Primates and also Macroscelides were included under lipotyphla as the Insectivora.

The Order Insectivora includes diverse groups of mammals that share one common set of features the possession of skeletal plan and dentition, and many families of the Insectivora had rather independent origins is no longer disputed (Eisenberg, 1981),

Example:

Tenrecs, Tenrec, Hemicentes, Microgale, Oryzorictes (Madagascar); Otter shrew, Potamogale (West Africa); Golden mole, Chrysochloris (South Africa); Ground shrews, Sorex, Suncus (Fig. 10.62A), Crocidura, Nectogale, Soriculus (World-wide except Australasia and most of South America); Moles, Uropsilus, Talpa (Fig. 10.62B), (Holarctic and Oriental); Desman or Water mole, Desmana (South Europe); Alamiqui, Solenodon (West Indies); Elephant shrews, Macroscelides, Elephantulus (Africa); Moon rat, Echinosorex (= Gymnura) (South East Asia); Hedgehogs, Erinaceus, Hemiechinus, Paraechinus (Fig. 10.62C) (Europe, Asia and Africa); Tree-shrew, Tupaia (Asia) (Fig. 10.62D); Pen-tailed tree shrew, Ptilocercus (Asia).

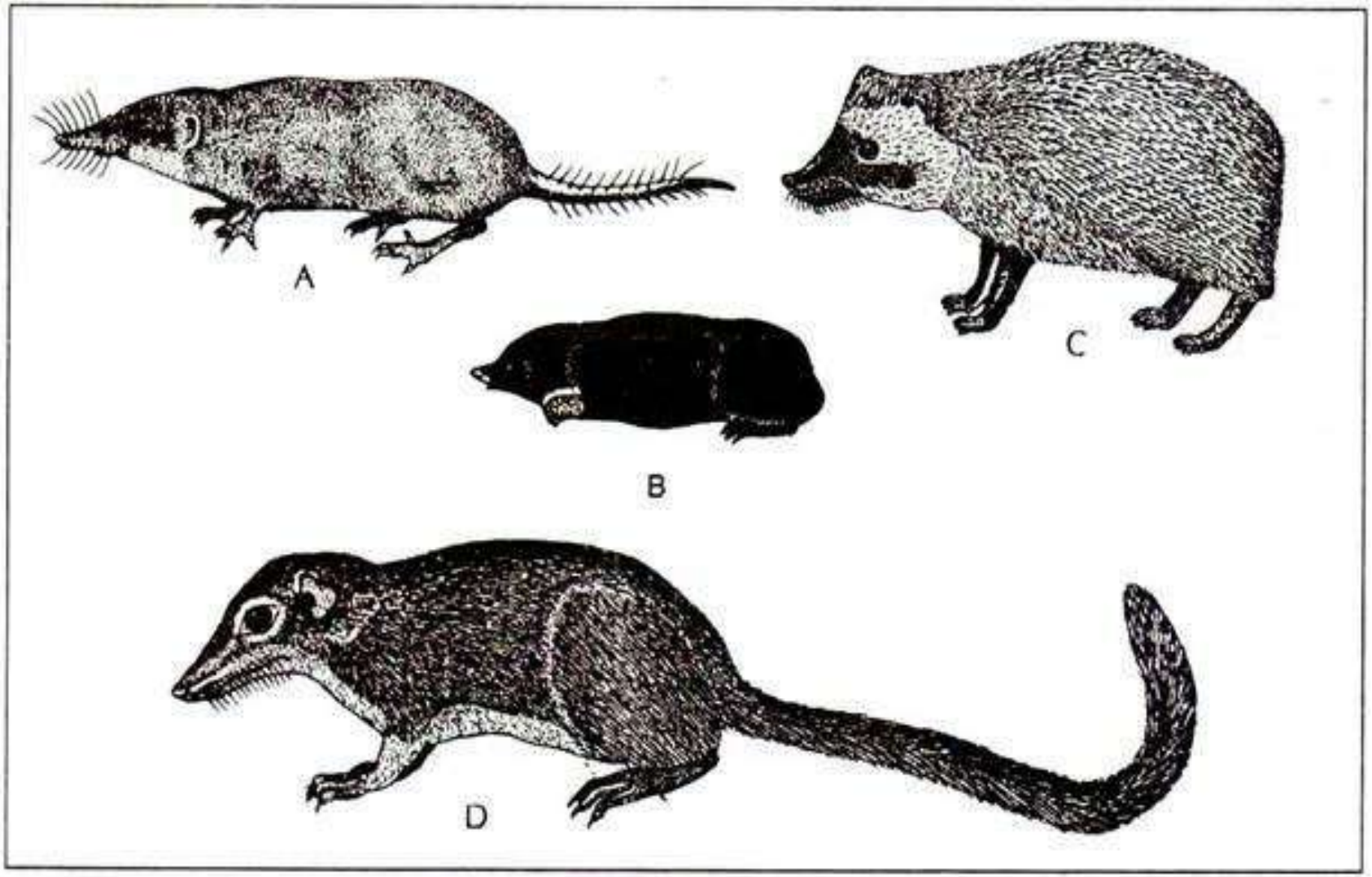


Fig. 10.62 : Some members of insectivores. A. Shrew (*Suncus*), B. Mole (*Talpa*), C. Hedgehog (*Paraechinus*), D. Tree shrew (*Tupaia*).

Order 2. Dermoptera [L. Derma = skin + pteron = wing], 2 species. Flying Lemurs: The Dermopterans evolved along a separate line from the primitive insectivores during Eocene. The present-day dermopterans are found in Malay, Philippines and East Indies.

1. They are herbivorous, tree-living and their size is like that of a large squirrel.
2. The tympanic ring forms the bulla and the lower margin of the external auditory meatus.
3. Lower incisors are combed.
4. The brain is primitive and the optic lobes are not covered by cerebrum.
5. The most important feature is the presence of broad folds of hairy skin extending between the legs and onto the tail with which it glides long distances from one tree to another.

Examples:

Colugo or Flying lemur, Cynocephalus (Caleopithecus) variegatus (Fig. 10.63) of East Indies and C. volans of Malay and Philippines

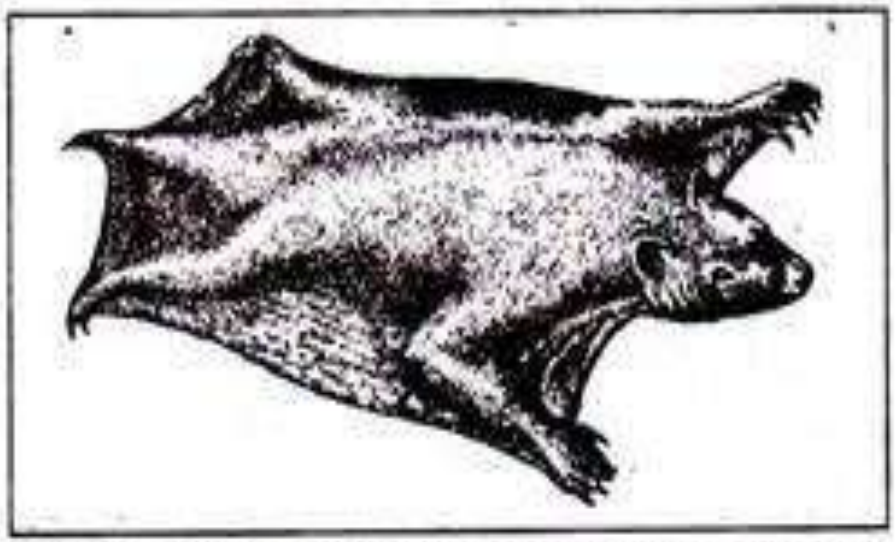


Fig. 10.63 :A flying lemur, *Cynocephalus* (= Galeopithecus).

Order 3. Chiroptera [L. Cheir, hand + pteron, wing], Bats, 980 species:

Members belonging to this order are the only mammals which have mastered true flight like birds. The evolutionary history of Chiroptera is inadequately known. It is believed that they have, at the beginning, undergone a very rapid evolutionary metamorphosis as the first known bats of Eocene age were little different from their modern relatives.

The bats are numerous and their distribution is worldwide.

1. In bats, the forelimbs are modified to form wings.
2. The forelimb bones are elongated, as are all the fingers excepting the pollex for the support of the membrane that runs between forelimbs and hindlimbs.
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 peculiar by having direct arterio-venous connections.

6. The first digit of the forelimb is small, free from the wing and bears a claw.

7. The hind limbs are weak, thus making the bats helpless on ground.

8. The foot has five-clawed digits and the bats hang upside down with the hind limbs.

9. Pinna is well-developed and, in many, complicated foliaceous nose folds, called auricular appendage, around the nose are present.

10. Bats are nocturnal but can pursue insects ignoring their own sense of vision.

11. The brain has smooth cerebral hemispheres which do not cover the cerebellum.

12. The olfactory region of the brain is ill-developed.

13. Only one young is born at a time.

14. The milk set of teeth of the young is hooked which aids in clinging to the body of the mother.

15. The testes are abdominal in position.

16. The sutures of the skull are obliterated.

17. The postorbital process of the frontal is well-developed.

18. Orbital and temporal fossae are confluent.

19. A lacrimal foramen is present outside the orbit,

20. Zygomatic arch is cylindrical.

21. Tympanic bulla is ill-developed.

22. Molars have cusps.

23. The ribs are flat and fused with the vertebrae to become rigid during flight.

24. The clavicle is stout and remains fused with the sternum and scapula.

25. The sternum is provided with a flat keel for the attachment of pectoral muscles.

26. The hind limbs are rotated so that the knee is directed backward.

27. The cavity of the acetabulum is dorsal in position.

The 19 Orders of Mammals

All animals with backbones, including humans, are chordates. That is, in the language of taxonomy, they belong to the phylum Chordata. Their subphylum is Vertebrata, meaning that their backbones are segmented. Mammals, members of the class Mammalia of vertebrate animals that includes humans, are the most highly advanced organisms on Earth. They are warm-blooded, hairy, have four-chambered hearts, relatively large brains, and they suckle their young.

There are 19 orders of mammals in the world. Ten of these live in North America. Some orders include a wide range of animals; for example, shrews, lemurs, marmosets, monkeys, apes, and humans are all primates, one order of the class of mammals. Other orders are made up of only one sort of creature; Order Chiroptera, or example, consists of 18 families of bats.

The Latin names of the orders of mammals given here are followed by their common names and the families that make up each order. Examples of the various types of animals included in each family also are given.

Order Artiodactyla (even-toed hoofed animals) of infra-order Ungulata – http://www.ultimateungulate.com/ Hoofed animals with an even number of toes include those that ruminate, or digest their food in four-chamber stomachs and chew cuds, and those that do not ruminate. Those that ruminate are the families Girrafidae (giraffes). Cervidae (deer, moose, reindeer, elk). Antilocapridae (pronghorn antelope), and Bovidae (cattle, bison, yaks, waterbucks, wildebeest, gazelles, springboks, sheep, musk oxen, goats). Nonruminators include the families Suidae (pigs), Tayassuidae (peccaries), Hippopotamidae (hippopotamuses), and Camelidae (camels, llamas).

Order Carnivora (meat-eaters) There are two suborders of these toe-footed creatures. They include the Canidae (wolves, dogs, jackals, foxes), Ursidae (bears, giant pandas), Procyonidae (coatis, raccoons, lesser pandas), and Mustelidae (martens, weasels, skunks, otters), all part of one superfamily that is characterized by long snouts and unretractable claws; and Felidae (cats, lions, cheetahs, leopards) Hyaenidae (hyenas), and Viverridae (mongooses, civets), all of which have retractable claws. There are between 240-270 recognized species in this order, depending on the source. Some of these species have so little information on them that they are discarded by some sources. The carnivores consist of between 7-12 living families (based on source) in two superfamilies, Canoidea (or Arctoidea), the dog-like carnivores, and Feloidea (or Aeluroidea), the cat-like carnivores.

Order Cetacea (whales and purpoises) Two suborders of Order Cetacea are the toothed whales, which have regular conical teeth, and the baleen, or whalebone, whales, which have irregular whalebone surfaces instead of teeth. Toothed whales include the families

Physeteridae (sperm whales), Monodontidae (narwhals, belugas), Phocoenidae (porpoises), and Delphinidae (dolphins, killer whales). Baleens are in the family Eschrichtiidae (gray whales), Balaenidae (right whales), or Balaenoptridae (fin-backed whales, hump-backed whales).

Order :Chiroptera (bats) There are two suborders of bats, the only mammals that can fly. Suborder Megachiroptera contains one family, the Pteropodidae (flying foxes, Old Worm fruit bats). Suborder Microchiroptera contains 17 families, including: Rhinopomatidae (mouse-tailed bats), Emballonuridae (sheath tailed bats), Craseonycteridae (hog-nosed or butterfly bats), Noctilionidae (bulldog or fisherman bats), Nycteridae (slit-faced bats), Megadermatidae (false vampire bats), and Rhinolophidae (horseshoe bats). 19 families, 178 genera, 926 species (the second largest mammalian order)

Order Dermoptera (colugos or flying lemurs) These gliding tree mammals from Asia do not fly and are not lemurs, but they are known as flying lemurs, or Family Cynocephalidae .

Order Edentata (toothless mammals) Three families of mammals get by without teeth: Dasypodidae (armadillos), Bradypodidae (sloths), and Myrmecophagidae (hairy anteaters).

Order Hyracoidae (hyraxes, dassies) Order Hyracoidae is one of three orders that has only one modern family remaining. Procavia capensis (the African rock hyrax) is one of nine living species in the Family Procaviidae .

Order Insectivora (insect-eaters) The three members are the families Talpidae (moles), Soricidae (shrews), and Erinaceidae (hedgehogs).

Order Lagomorpha (pikas, hares, and rabbits) Two families make up this order: Ochotonidae (pikas) and Leporidae (hares and rabbits of all sorts).

Order Marsupialia (pouched animals) Included among these are the families Caenolestidae (rat opossums), Diddeelphidae (true opossums), Dasyuridae (native cats, native mice), Notoryctidae (marsupial moles), Myrmecobiidae (numbats), Peramelidae (bandicoots), Phalangeridae (koalas), Vombatidae (wombats), and Macropodidae (kangaroos and wallabies).

Order Monotremata (egg-laying mammals) These more primitive mammals make up the families Tachyglossidae (echidnas, also called spiny anteaters) and Ornithorhynchidae (platypuses).

Order Perissodactyla (odd-toed hoofed animals) of infra-order Ungulata The two suborders, Hippomorpha and Ceratomorpha, include creatures that have an odd number of toes. Families in this order are the Equidae (horses, donkeys, zebras), the Tapiridae (tapirs), and the Rhinocerotidae (rhinoceroses).

Order Pholidata Family Manidae (pangolins) is the sole family in this order.

Order Pinnipedia (seals and walruses) In the fin-footed order there are Otariidae (eared seals, sea lions), Odobenidae (walruses), and Phocidae (earless seals).

Order Primates (primates) The order to which people belong is divided into two suborders: The Prosimii , who have longer snouts than their relatives, and the Anthropoidae . The first group includes the families Tupalidae (tree shrew), Lemuridae (lemurs), Daubentonlidae (aye-ayes), Lorisidae (lorises, pottos), and Tarsiidae (tarsiers). The anthropoids include the families Callitrichidae (marmosets), Cebidae (New World monkeys), Cercopithecidae (baboons, Old World monkeys), Hylobatidae (gibbons), Pongidae (gorillas, chimpanzees, orangutans), and Hominidae (human beings).

Order Proboscidea (elephants) Large enough to have an order all to itself is Family Elephantidae .

Order Rodentia (gnawing mammals) The most prolific mammals, Order Rodentia includes three suborders. It takes in the families Aplodontidae (mountain beavers), Sciuridae (chipmunks, squirrels, marmots), Cricetidae (field mice, lemmings, muskrats, hamsters, gerbils), Muridae (Old World mice, rats), Heteromyidae (New World mice), Geomyidae (gophers), and Dipodidae (jerboas). 1700 Species

Order Sirenia (dugongs and manatees) The families Trichechidae (manatees) and Dugongidae (dugongs and other sea cows) make up the Order Sirenia .

Order Tubulidentata (aardvarks) Another mammal in an order by itself is Family Orycteropodidae

Thank You

Dr. Mrs. Savita P. Nalawade