

Class: Mammalia

INTRODUCTION:

Mammals are a well-known class of vertebrates, including many familiar domesticated species and pets, as well as our own species *Homo sapiens*. All mammals are warm-blooded, and all female mammals possess mammary glands (mammary), which are used to suckle the young with milk. Mammals are further distinguished by the possession of hair or fur, although this is limited to early developmental stages in the Cetacea (whales and dolphins). **The vast majority of mammals give birth to live young, the exception being the egg-laying Monotremata** (a small group of mammals including the duck-billed platypus and the echidnas or spiny anteaters). Monotremes are found exclusively in Australia and New Guinea. **Mammals are found in a wide variety of habitats, including terrestrial, freshwater, and marine systems.** They occur from the deserts to the dense forests, from the deep seas to the highest mountains, and from the tropics to the polar ice caps. Only one group of mammals, the Chiroptera (bats) is adapted to flight; other taxa such as flying squirrels or flying possums can glide effectively but are not capable of true flight.

GENERAL CHARACTERS:

1. Mammals are air breathing, warm blooded animals (homeotherms).
2. Most of them are **viviparous** (giving birth to young ones) with few exceptions being **oviparous** (prototherians).
3. Mammals are hair-clad organisms (skin covered by hair or fur) except Cetacea (whales and dolphins).
4. The skin has sudoriporous glands (i.e., sweat glands), sebaceous glands (oil) and sometimes scent glands.
5. **Females have mammary glands with teats (nipples) which secrete milk for the nourishment of young. Hence the name Mammalia.**
6. These have 2 pairs of limbs either with plantigrade or digitigrade or unguligrade of organization.
7. Each limb has 5 or fewer digits. (Cetaceans are hind-limbless).
8. **External ear pinnae are present to protect ear.**
9. Exoskeleton includes epidermal hair, horns, spines, scales, claws, nails, hoofs and bony dermal plates.
10. Endoskeleton (bones) completely ossified.
11. **Skull with two occipital condyles present. Skull is pretty reduced to make room for the large brain.**
12. The lower jaw is composed of single bone on each side.
13. **Ribs or bones of ribs are bicephalous i.e., with two heads.**
14. There is presence of prominent muscular diaphragm between the thoracic and abdominal cavities.
15. **Buccal cavity is separated from nasal passage** by a hard plate formed of premaxillae, maxillae and palatine bones

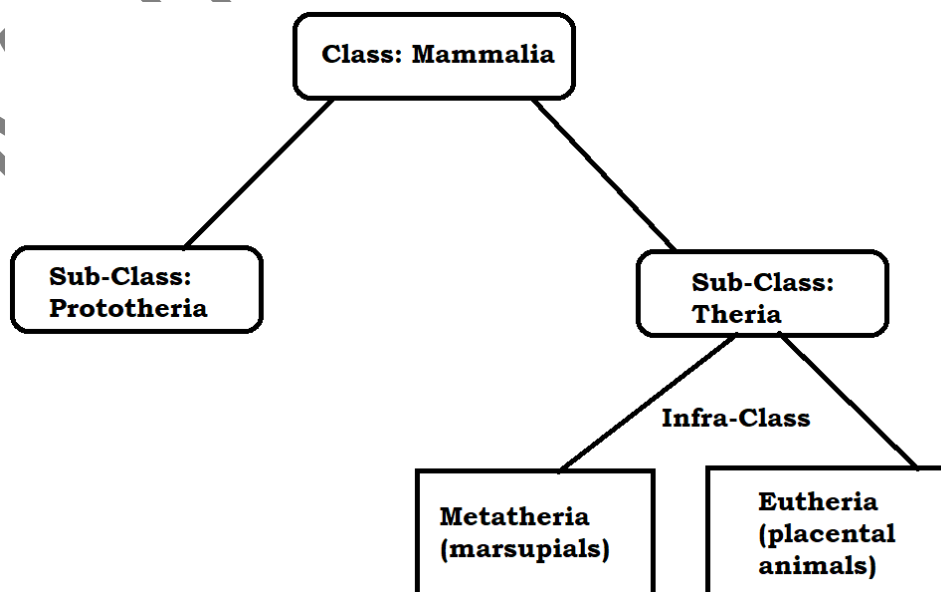
16. Dentition is **heterodont** (differentiated into incisors, canines and molars), **thecodont** (embedded in the alveolar pockets of jaw bone) and **diphyodont** (only two sets of teeth, a milk set replaced by permanent set).
17. Respiration by lungs (pulmonary respiration). Larynx has vocal cords.
18. **Heart is 4 chambered with only a left aortic arch.**
19. **Complete double circulation is striking character with no mixing of oxygenated and de-oxygenated blood.**
20. RBCs are small and non-nucleated or anucleate (except in Camel).
21. Brain has 4 optic lobes. Cerebrum and cerebellum are large and convoluted.
22. Presence of 12 pairs of cranial nerves.
23. A pair of **metanephros kidneys** present. Ureters open into urinary bladder.
24. Eyes are protected by lids and **upper eyelids are movable.**
25. Sexes are separate and **males have erectile penis.**
26. Eggs with very little yolk are seen.
27. Fertilization is always internal, after copulation.
28. **Young ones are born alive (except monotremes).**

CLASSIFICATION:

Mammals include about 5000-6000 living species and several fossil forms. Mammals are classified on the basis of;

- I. Mode of caring for their young,
- II. Dentition,
- III. Foot posture,
- IV. Exoskeleton,
- V. Complexity of brain,
- VI. Systematics (Taxonomical hierarchy).

Class mammalia is further divided into 2 Sub-classes taxonomically:



SUB-CLASS: Prototheria

- Protos= first, therios=beast.
- Commonly called as **egg laying mammals**.
- These are the animals with no pinna on the ear.
- Teeth are present only in young and adults have horny beak.
- Ribs have only a single head (mono-cephalous).
- Mammary glands without nipples (moist skin on the breast acts as nipple).
- Females are oviparous (egg laying).
- Example: ***Echidna (spiny ant eater) and Ornithorhynchus (Platypus)***.
- Found in Australia, Tasmania and New Guines.

SUB-CLASS: Theria

- Includes modern viviparous marsupials and placental mammals.
- Ear usually with ear pinna.
- Mammary glands with nipples or teats.
- Teeth are usually present in both young and adults.
- Testis usually in scrotal sack.
- Oviduct opens into a vagina.
- Sub-class Theria is further divided into two living infra-classes;
.01: Metatheria and
.02: Eutheria.

I. INFRACLASS: Metatheria

- Meta=between or after.
- Marsupium or brood pouch is present in the females.
- Mammary glands with nipples are sebaceous.
- They have strong tail bone which is usually helpful in defence or fight.
- Vagina and uterus are double (didelphic condition).
- Placenta is rudimentary yolk sac type.
- Young ones are born immature and develop in marsupium attached with nipples or teats.
- Examples: Kangaroo (*Macropus*), *Phascolarctos* (Koala), Tiger cat (*Dasyurus*).

II. INFRACLASS: Eutheria

- Eu=true, therios=beast.
- Higher viviparous placental mammals.
- Epipubic bones are present.
- Testes are usually contained in scrotal sacs.
- Vagina is single.
- The young always nourished for a considerable time in uterus by means of allontoic placenta and born in a relatively advanced state.
- Infraclass eutheria has 16 orders.
- Examples: rats, rodents, humans etc.

TYPE STUDY: Rat (genus *Rattus*)

MORPHOLOGY:

- ✓ Rats are generally slender with a pointed head, large eyes, and prominent, thinly furred ears.
- ✓ They have moderately long legs and long, sharp claws.
- ✓ The bald soles of their narrow hind feet possess fleshy pads of variable size, depending on species.
- ✓ The brown rat has a larger body than the house rat, and its tail is shorter relative to the body.
- ✓ The brown rat also has thicker fur and 12 pairs of mammae instead of 10.
- ✓ Tail length among rats ranges from shorter than body length to appreciably longer.
- ✓ The tail appears smooth and bald but is actually covered with very short, fine hairs.
- ✓ In a very few species, these hairs become longer toward the tip, which gives the tail a slightly tufted appearance.
- ✓ As with any large group of rodents, body size varies within the genus.
- ✓ Most species are about the size of *Hoffman's rat* (*R. hoffmanni*), native to the Indonesian island of Sulawesi and weighing 95 to 240 grams (3.4 to 8.5 ounces), with a body length of 17 to 21 cm (6.7 to 8.3 inches) and a tail about as long.
- ✓ One of the smaller species is *Osgood's rat* (*R. osgoodi*) of southern Vietnam, with a body 12 to 17 cm long and a somewhat shorter tail.
- ✓ At the larger extreme is the Sulawesian white-tailed rat (*R. xanthurus*), measuring 19 to 27 cm long with a tail of 26 to 34 cm.
- ✓ Sexual dimorphism is predominantly seen and females appear larger than males.



FEMALE RAT

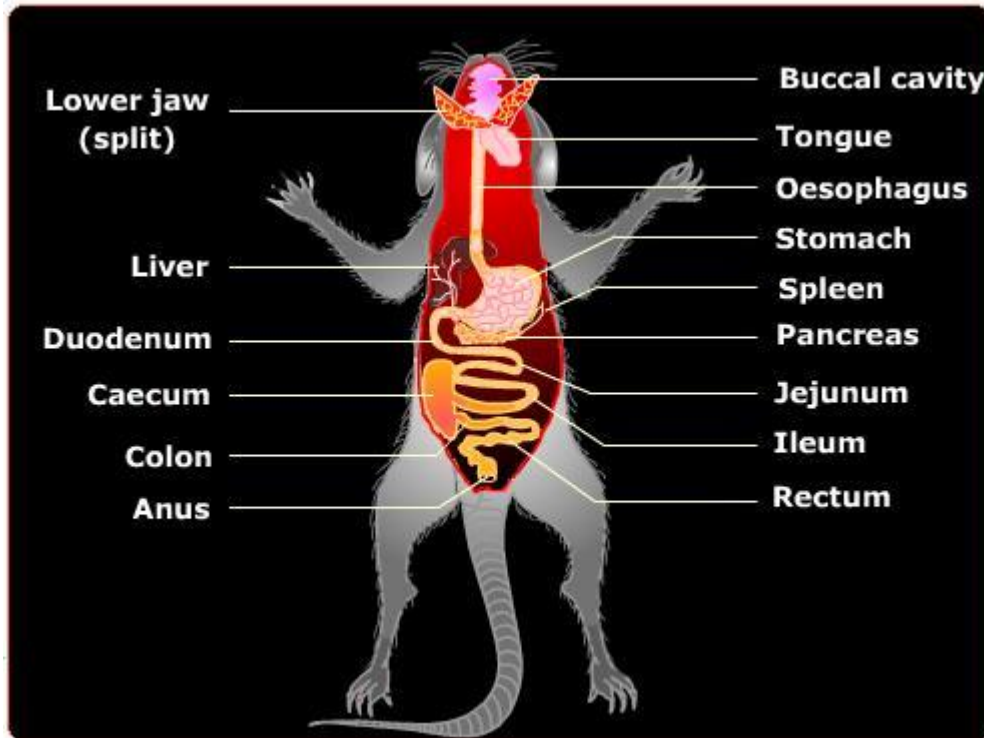


MALE RAT

(Size, presence of teats and shape of the body to be observed. **REFERENCE PURPOSE ONLY**)

DIGESTIVE SYSTEM OF RAT:

Digestion is the process in the alimentary canal by which food is broken up physically, as by the action of the teeth, and chemically, as by the action of enzymes, and converted into a substance suitable for absorption and assimilation into the body.



DIGESTIVE SYSTEM OF RAT

STRUCTURES IN DIGESTIVE SYSTEM:

1. **Mouth/Buccal Cavity-** These structures ingest the food. They mash up the food so that it can be easily swallowed. This is the first stage of digestion.
2. **Salivary Glands-** The Salivary Glands produce saliva. The saliva helps to moisten food. It also contains ptyalin (an enzyme) which helps to further break down food.
3. **Pharynx-** After the food has been mashed in the mouth, the food travels to the pharynx. The pharynx simply serves as a chamber to hold the food before it travels down the oesophagus.
4. **Oesophagus-** The oesophagus is a long muscular tube. It transports food down into the stomach for digestion. A majority of the actions the oesophagus performs are involuntary, but they are started with one voluntary action like a swallow.
5. **Stomach-** The stomach is a muscular sac that further breaks down food. The main functions are to store food, and break down food and protein. The stomach has a lesser curvature and a greater curvature. The stomach breaks down food into chyme.

6. **Pyloric Sphincter-** The Pyloric Sphincter separates the stomach and the small intestine. Its purpose is to open to allow food to enter when it is ready and to keep food from going where it is not wanted.
7. **Gastric Glands-** Gastric Glands are present in the inner lining of the stomach. They produce gastric juice which breaks down food and is very acidic.
8. **Small Intestine-** The small intestine receives food and absorbs the nutrients into the body.
9. The small intestine has 3 parts, **the duodenum, the ileum, and the jejunum**. The duodenum is divided into the ascending, transverse and descending limbs.
10. **Intestinal Glands-** These glands secrete alkaline enzymatic juices, intestinal juices, and mucous to help absorb and digest nutrients.
11. **Large Intestine-** Also called the colon. The Large Intestine is the final stage of digestion when the water is absorbed. There are a variety of bacteria present to help. **The colon also has 3 parts (ascending, transverse, and descending).**
12. **Caecum-** This is the point where the Small Intestine becomes the Large Intestine. It is a small pouch similar to the appendix where cellulose is digested
13. **Rectum-** The rectum is a structure towards the end of the Digestive System. It temporarily holds feces before they are expelled from the body.
14. **Anus-** The anus is the end of the Digestive System. It is the location from which feces are expelled.
15. **Spleen-** The spleen is often considered a part of the digestive system even though it does not produce any hormones. The spleen destroys old red blood cells.
16. **Liver-** The liver is a very large organ that secretes bile into the intestines. The bile helps to digest cholesterol.

PROCESS OF DIGESTION AND NUTRIENT ABSORPTION:

- a) Food is mashed up in mouth and mixed with saliva to break down starch.
- b) Then food travels down the oesophagus to the stomach.
- c) It is further digested with gastric juices which break the bonds holding cells together and kills bacteria.
- d) In the small intestine, nutrients are absorbed from the food and cellulose is digested in the Caecum.
- e) Any remaining water is removed in the large intestine before being stored in the rectum and expelled from the anus.
- f) The small intestine is lined with villi. The villi are present in the circular folds in the lining of the small intestine. The villi have microvilli that help to absorb nutrients.
- g) The villi absorb the carbohydrates, fats, and proteins in the chyme into the veins, arteries, and central lacteal.
- h) Fats are absorbed by the central lacteal and carbohydrates and proteins are absorbed via the vein and artery.

WASTE ELIMINATION:

- i. After the nutrients have been absorbed, water is removed in the colon.
- ii. As the waste travels farther through the colon, it becomes more solid.
- iii. At the end of the colon, the solid waste enters the rectum.
- iv. A few times a day, the muscles of the rectum contract and the urge to through metabolic wastes occur.
- v. The waste passes through the anus and out the body.

DIGESTIVE SYSTEM ADAPTATIONS:

- a) Epiglottis allows the respiratory and digestive systems to share the esophagus. This keeps the rat from choking on food and uses good space management.
- b) Rats have a long alimentary canal which lets the rat take advantage of as many of the nutrients as possible.
- c) They have a large caecum which allows them to digest cellulose. This allows them to eat many different foods, widening their diet and making their search for food easier.
- d) Rats have a **1:0:0:3** ratio of incisors to canines to premolars to molars. This supports a wider diet and makes hunting for food easier. A wider diet makes it easier for the rat to find food. An abundance of food allows for a greater population.