

Animal Kingdom

General features of animals :-

- All the animals belonging to animal kingdom are multicellular (many cells)
- They are eukaryotic
- They are motile (can move)
- They are heterotrophs (depend on other organisms)
- They reserve food energy in glycogen and fat.

Basis of classification :-

- Arrangement of cells (level of organisation)
- Body Symmetry
- Embryonic layer/germinal layer
- Body cavity/coelom
- Notochord
- Segmentation
- Cephalization
- Type of digestive, circulatory and reproductive system.

I Level of Organisation

- Cellular level of organisation
- Tissue level of organisation
- Organ level of organisation
- Organ system level of organisation

- i Cellular level :- They are arranged loose aggregates with some labour distribution.
- Each cell functions individually

Eg:- Coelenterata (Sponges)

ii Tissue level :-

- All with similar structure and function combine together to form tissue.
- Tissue performs body function

Eg:- Coelenterata, Ctenophora

iii Organ level :-

- Different type of tissue will form organ.
- organ perform body function.

Eg:- Platyhelminthes (flat worm).

iv Organ system level :-

- many organs interconnect to each other to carryout physiological functions.

Eg:- Aschelminthes, Annelida, Arthropoda, mollusca, Echinodermata, Hemichordata, chordata.

II Types of digestive system :-

2 types $\left\{ \begin{array}{l} \text{Complete digestive system} \\ \text{Incomplete digestive system} \end{array} \right.$

i Complete digestive system :-

The body of an organism having two different opening outside the body that is the mouth and anus (mouth - intake of food, anus - removal of digestive waste)

Eg:- Aschelminthes, Annelida, Arthropoda, mollusca, Echinodermata, Hemichordata.

ii Incomplete digestive system :-

The body of an organism having a common opening which serves both as mouth and anus.

Eg:- Platyhelminthes

Digestion in lower organisms might be intracellular or extracellular or intercellular.

Intracellular :- Digestion inside the cell

Extracellular :- Digestion outside the cell

Intercellular :- Digestion in middle of cell

Body plan :- 3 types

i Cell-aggregate :- cells are arranged as loose aggregates.

Eg :- Sponges

ii Blind sac :- The body having one opening

Eg :- Platyhelminthes

iii Tube within tube :- Body having two openings

Eg :- Arthropoda, chordata

Circulatory system :- Two types

i Open type :- When heart pumps the blood the blood flows in the open space (sinuses) where it reaches the cells and tissues directly or the blood is pumped out of the heart and the cells and tissues are directly bathed in it.

Eg :- Arthropoda, mollusca, Hemichordata

Note :- All the non-Chordates except Annelids

ii Closed type :- When heart pumps the blood, the blood is circulated through closed blood vessels of different diameter (arteries, veins and capillaries)

Eg:- Chordata, Annelida.

III Body Symmetry :- Arrangement of body parts along the central axis.

There are three types:-

i Asymmetrical:- Any plane passing through central axis will not divide organism into equal halves.

Eg:- Sponges

ii Radial:- Any plane passing through central axis will divide organism into two equal/identical halves.

Eg:- Coelenterata, Ctenophora, Adult Echinodermata

To know (NEET) :- Radial symmetry are of two types:-

1 Biradial:- If the organism is divided along the central axis in two plane giving identical halves.

Eg:- Adamsia (sea anemone)

2 Pentaradial:- If the organism is divided in five plane along central axis giving 5 identical halves.

Eg:- Asterias (star fish)

iii Bilateral symmetry:- If the animals are divided along the central axis in one plane giving identical left and right

Eg:- Annelida, Arthropoda, Chordata, Larva of Echinodermata.

V) Segmentation

In some animals body is externally and internally divided with repetition of atleast some organs.

To know (NEET) :-

- The body of animals are externally and internally divided into segments is known as segmentation.
- The segments with the serial repetition of organs is known as metameric segments and the process is known as metamerism.

Eg:- Annelida (earthworm), Arthropoda (external segments), Chordata (in the embryonic stage)

VII) Notochord

notochord is a mesodermally derived having rod like structure present in dorsal side developed during embryonic stage.

- The animals which possess the notochord are chordates and animals which do not possess notochord are non-chordates

To know (NEET) :-

- notochord is present between nerve chord and alimentary canal/gut (below nerve chord and above the gut)

VIII) Cephalization (NEET)

The animals with anterior head having some sense organs. (Annelida, Arthropoda, mollusca, chordata)

IX) Types of reproductive system

- The reproduction takes by sexual and asexual means.

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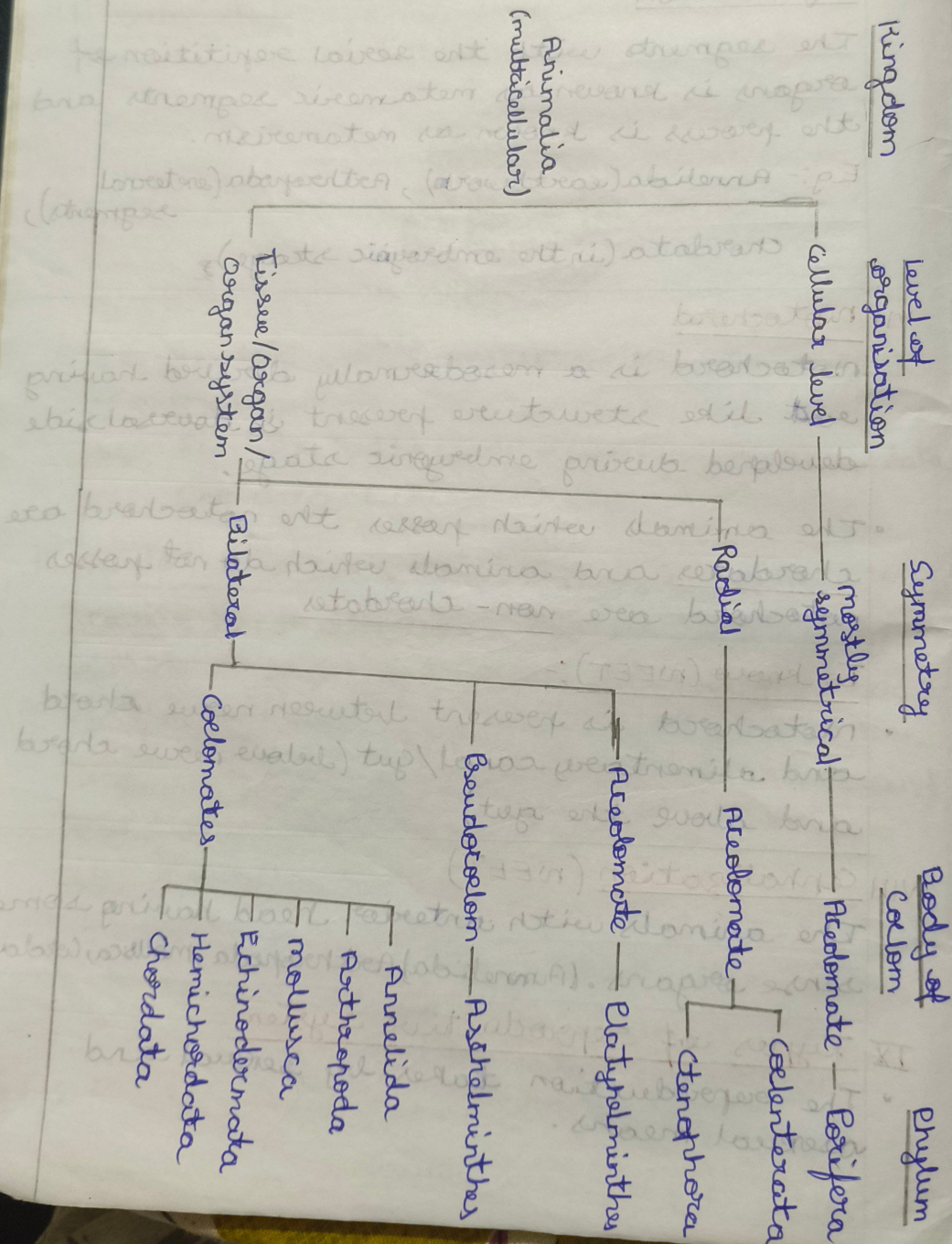
The animals with anterior head having some sense organs. (Annelida, Arthropoda, Mollusca, Chordata)

IX Types of reproductive system

- The reproduction takes by sexual and asexual means.

- In the lower organisms the sexes are not separate which is called as ~~as~~ Hermaphrodite, monoecious and bisexual. (that means the same individual will produce the sperm and ovum)
- In the higher organisms they exhibit ~~as~~ sexual dimorphism where male and female are different which is called as dioecious or unisexual.

The Classification of animals



1. Porifera

- generally called
- Pore bearing
- Habitat :- The
- Basic organisms

mostly asymmetrical
asymmetrical
They are called
Their body
i Ostia :- minute
helps in intake

ii asculum :- A
portion of the

- Body bears
- The transport system.
- The water enters into sponge given out.

It has three
i Food gathering
ii exchange of
iii Removal of

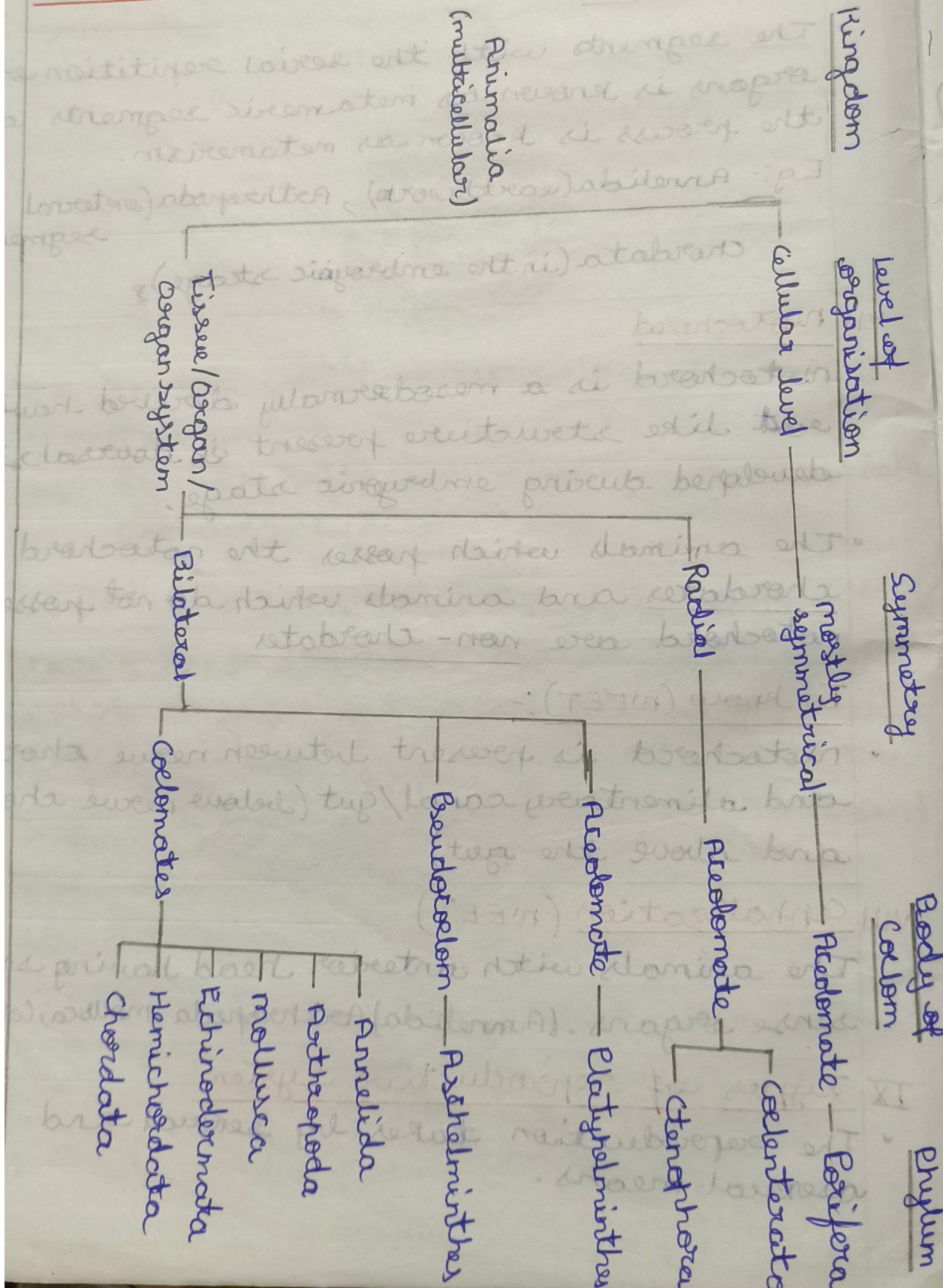
- The Body wall

i outer -> Pinacocytes
Pinacocytes
ii inner -> Choanocytes
called Pinacocytes

- Choanocytes lined by
- Digestion

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The Classification of animals



1 Porifera

- generally called sponges

- Pore bearing animals

- Habitat :- They are aquatic, some are marine, some are fresh water

- Basic organisation :- Cellular level of Organisation mostly asymmetrical (some are radially ~~sy~~ asymmetrical)

- They are coelomates.

- Their body bears two openings ~~osti~~ :-

- i Ostia :- minute pore present on the surface and helps in intake of water

- ii osculum :- A larger pore present in the anterior portion through which the water moves out.

- Body bears the central cavity called spongocoel

- The transport system in Poriferans are water canal system.

- The water enters through Ostia which moves into spongocoel and through osculum it is given out.

~~It~~ It has three main functions :- (3 marks)

- i Food gathering

- ii exchange of gases

- iii Removal of waste

- The Body wall has two layers :-

- i outer -> Pinnaeoelom -> lined by ~~cells~~ cells called Pinnaocytes.

- ii Inner -> Choanoderm -> lined by flagellated cells called Pinnaoderm

- choanocytes/collar cells helps in digestion and lined by spongocoel.

- Digestion is Intracellular

Lo Know (NEET) :-

Between Pinacoderm and choanoderm the layer present is known as mesohyl layer which has wandering amoebocytes and Archeocytes.

- Body :- Body is supported by Endoskeleton which is made up of Calcareous/Siliceous spicules or Proteinaceous Spongin fibre.
- They show power of regeneration
- Reproduction :- It is both sexual and asexual reproduction.
- Asexual reproduction includes Budding, Fragmentation and germinal formation (internal bud)
- Fertilization :- Development is indirect.
- Fertilization is internal with larval stage which is morphologically different from the adult

Eg :- Sycon (Sclerite), Euspongia (Bath sponge),
Spongila (fresh water sponge)

2 Coelenterata (Cnidaria)

- Coelenteron are Gastro Vascular cavity
- Specialized structure cnidoblast / Cnidocyst
- Habitat :- They are aquatic which include marine and fresh water.
- They are Sessile or motile
- They are Colonial or solitary
- Basic Organisation :-
- They are radially symmetrical, diploblastic and Acoelomates
- Body Wall :-
- The body wall has two layer called outer Ectoderm and inner gastroderm

- They have specialized structure in their ectoderm and tentacles called Cnidoblast or Cnidocytes which contain stinging capsule or nematocyst.

Function of Cnidoblast

- Defence
- Capture the prey
- Anchorage
- Some of coelenterates like corals has Exoskeleton that is made up of Calcium carbonate (calcareous)

- The body has a central gastrovascular cavity which opens into mouth, the mouth is located on the hypostome.
- Digestion is extracellular and intracellular.
- It is the first phylum to have network of nerve fibres.

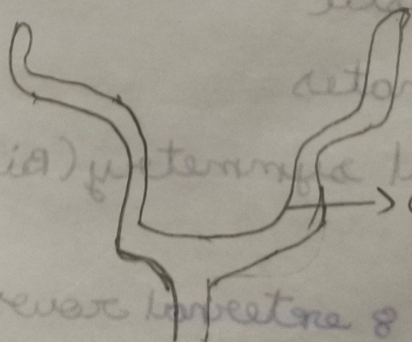
To know (N.E.E.T):-

- The mouth helps intake of food and removal of waste showing incomplete digestion and blind sac body form.
- Coelenterates Exhibits 2 basic body forms called :-

i) Polyp :-

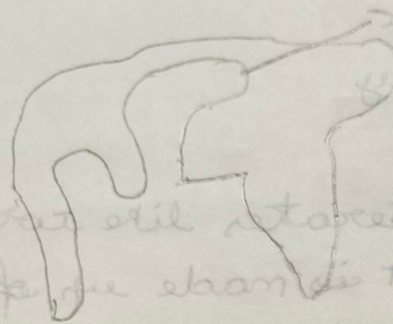
- It is sessile and cylindrical form which generally reproduce asexually.

Eg:- Hydra, Adamsia



Gastro Vascular
Cavity

- ii Medusae :-
- It is free swimming, umbrella shaped which reproduce sexually
- Eg:- Aurelia / Jellyfish



- In some coelenterates like Obelia exhibits both the body form that is polyp asexually produce medusae and medusae sexually produce polyp showing alternation in generation which is called as metagenesis

Eg of Coelenterata

Physalia (Portuguese man of war)

Adamsia (Sea Anemone) * Biradial symmetry

Pennatula (sea pen), Gorgonia (sea fan)

Meandrina (Brain coral), Obelia, Hydra

Aurelia

3 Ctenophora

- Commonly called sea walnut or comb jellies

Habitat :- They are exclusively marine.

Basic Organisation :-

- They have tissue level of organisation
- They are diploblastic
- They are acoelomates
- They have radial symmetry (Biradial)

Body :-

- Their body bears 8 external rows of ciliated comb plates that helps in locomotion.

- They bear one pair of retractile tentacles which has the cells called colloblasts, lossocells, adhesion which helps in capturing the prey.

* Digestion:- It is both intracellular and extracellular.

Unique features:-

- Bioluminescence:- Property of living organisms to emit light.

Reproduction:-

- They are hermaphrodite where sexes are ~~not~~ ^{not} separate.
- Reproduction takes by sexual means.
- Fertilization is external (fusion of gametes takes place outside the body).
- Development is indirect with cydippid larva.

Eg:-

Phlebobranchia and Ctenophora

4 Platyhelminthes

- The meaning of helminthes is worms.
- Study of worms is called Helminthology.
- They have dorso ventrally flattened.

Basic Organisation:-

- They have organ level of organisation.
- They have bilateral symmetry.
- They are acoelomates.
- They are triploblastic.

Body:-

- Their body is covered by thick cuticle called teguments.
- They have hook and sucker in Endoparasit.
- Their body shows Pseudosegment.

Habitat:-

- They are Endoparasitic

Digestion:-

- They have incomplete type of digestive system
- Some absorb food through their body surface.

Respiration:-

- Respiration takes place through the process of diffusion through body surface.

Excretion:-

- Excretory organs are Protonephridia or flame cells (cilia). They are also termed as solenocytes (flagella)

Nervous System:-

- They have ladder like nerve ~~cord~~ system with brain ring connected to a nerve chord

Regeneration:-

- The living organism capable of growing the lost part is called regeneration.
- Planaria has high power of regeneration.

Reproduction:-

- Sexes are not separate
- Fertilization is internal
- Development is indirect to many larval stage

To Know:-

- The distinct head begins from this phylum (cephalization).
- They are largest phylum of coelomates.

Eg Taenia (tape worm)

Eosciola (Liver Fluke)

5 Aschelminthes :-

- It is also called nematode.
- Commonly called round worms. (cross section appears to be round).
- It appears like thread.
- They are non-segmented.

Habitat :-

- They are parasite or free living.
- They are parasite on both plants and animals.

Basic Organisation :-

- They have organ system level of organisation.
- They have bilateral symmetry.
- They have pseudocoelom.
- They are triploblastic.

Body :-

- They have elongated, cylindrical body with tapering ends.
- Their body is covered by thick cuticle that protects the parasites.
- Epidermis is syncytial.

Digestive system :-

- They have complete digestive system with the muscular pharynx.
- Alimentary canal is well developed.

Respiratory system :-

- It takes place through body surface, this process is known as diffusion.

Circulatory system :-

- It is absent.

Excretory system :-

- It is H shaped and consists of glands or the protonephridial cells called Renette cells.

Nervous system:-

- They have a pole like nervous system.

Reproduction:-

- They are dioecious (unisexual).
- Sexes are separate.
- They exhibit sexual dimorphism.
- Generally females are longer than male.
- The posterior end of male is curved and female is bludge.
- Male has Penial seta (copulatory organ).
- Fertilization is internal.
- Development may be direct or indirect.

Eg Ascaris (round worm), Wuchereria (Filarial worm),
Ancylostoma (Hookworm)

6 Annelida:-

- Anneli is a Latin word called little ring.

Habitat:-

- They are both terrestrial and aquatic.

Basic Organisation:-

- They have Organ system level of organisation.
- They are coelomates.
- They are triploblastic.
- They have Bilateral symmetry.

Body:-

- Body is elongated, cylindrical body with segments called metamere.
- They exhibit metamerism.
- In terrestrial annelids they have longitudinal and circular muscles or Setae which helps in locomotion.
- Aquatic annelids like Nereis.

appendages called parapodia which helps in swimming and respiration.

Digestive system:-

- It has complete digestive system with mouth and anus

Respiratory system:-

- In terrestrial Annelids they respire through moist skin.

Circulatory System:-

- Imp- It has closed type of circulatory system
- Blood is red in colour as Haemoglobin is dissolved in plasma.

Nervous system:-

- It consists of paired ganglia connected by lateral nerves to a double ventral nerve chord

Excretion:-

- They have Nephridia that helps in excretion and osmo regulation.

Reproduction:-

- It is by sexual means
- Nereis are dioecious but earthworms are monoecious.

Eg Nereis, Pheretima (Earthworm),
Hirudinaria (Blood sucking leech) open type

Imp- Arthropoda

- They have jointed appendages
- It is 1st largest phylum of Animal Kingdom which consists of $\frac{2}{3}$ rd of named species.

Habitat:-

- They are aquatic

- They are terrestrial
- They are airtal
- They are colonial
- They show parental care

To know :- (NEET)

- They exhibit parthenogenesis (reproduction by unfertilized egg)

Basic organisation :-

- organ system level of organisation
- bilateral symmetry
- Triploblastic
- They are coelomates (Himocoel)

Body :-

- Body is generally divided into 3 parts :-
 i Head
 ii Thorax
 iii Abdomen

- Body bears sense organs called Antennae, Eyes (simple/compound)
- Body bears balancing organ called Statocyst (It is also found in Ctenophora)
- Body is externally covered by Exoskeleton made up of Chitin (Chitinous)

Digestive System :-

- They have complete digestive system

Respiratory System :-

- They respire through :-

Gills → Prawns

Book gills → King Crab

Book lungs → spider, scorpion

Trachea → All insects.

Circulatory system :-

- They have open type of circulatory system
- Their blood is colourless

Excretory System :-

- They have malpighian tubules - Insect
- Green gland / Antennal gland - Prawns
- Coel gland - Spider and Scorpion

Nervous system :-

- They have pair of ganglia connected by lateral nerve to double ventral nerve chord

Reproduction :-

- They are dioecious
- Fertilization is internal
- They are oviparous
- Development may be direct or indirect. (Development is indirect through many nymph stage)

Eg :- Economically important insects

- Apis (Honey bee), Silkworm / Bombyx, Lacifer (lac insect)

Gregarious pests :-

- Locusta, Vectors ; Anopheles, Aedes, Culex

Living fossil

- Limulus (King frog)

8 Mollusca

- mollusca are soft bodied animals

Habitat :-

- They are terrestrial or aquatic some are marine and fresh water

Basic Organisation :-

- They have organ system level of organisation
- They have bilateral symmetry
- They are triploblastic
- They are acoelomates

Body :-

- They have unsegmented body
- Body is divided into 3 parts
 - i Head
 - ii Visceral mass or hump
 - iii muscular foot
- Head is provides sensory organs like eyes and antennal
- mouth of mollusca file like rasping organs radula
- Visceral mass or hump collection of all organs
- Visceral mass is covered by soft spongy tissue layer called mantle (Pallium).
- The space between mantle and visceral mass is known as mantle cavity
- mantle cavity is provided feather like gills (Respiration and excretion)
- muscular foot is made up of muscle which helps in locomotion.

Digestive system :-

- It has complete type of digestive system.

Circulatory system :-

- Open type of circulatory system (Blood is blue in colour due to presence of copper of containing pigment called Haemocyanin)

Reproduction:-

- They are dioecious
- They are oviparous
- They show indirect development with the larval stage.

Eg:-

Pila (Apple snail), Pinctada (Pearl Oyster),
Sepia (Cuttle fish), Loligo (Squid),
Octopus (Devil fish), Aplysia (sea slug),
Dentalium (Tooth shell), Chactopleura (Chiton)

note:- mollusca is a second largest animal phylum.

9 Echinodermata

- They are spiny skinned animals

Habitat:-

- They are exclusively marine

Basic organisation:-

- They have organ system level of organisation
- Adult Echinodermata are radially symmetry
- Larva " have bilateral symmetry
- They are triploblastic
- They are coelomates

Body:-

- Body is externally covered by spines and Pedicellaria (Keeps body clean)

Digestive system:-

- It has complete type of digestive system
- Mouth is found in the ventral side or

- Anus is located in dorsal side (upper) or aboral surface.
- They have specialized system in their body called water vascular system (ambulacral).
- Functions of water vascular system:-
 - i Capturing of food
 - ii Respiration
 - iii Locomotion.
- Body has tube feet which also helps in locomotion.

Excretory System:-

- It is absent
- They have movable spicules called Endoskeleton
- They exhibit autotomy ability of losing its own body part in danger

Reproduction:-

- It is through sexual means
- Development is indirect with free swimming larva.
- Fertilization is external.

Eg:- Asterias (Star fish), Echinus (Sea Urchin)
Antedon (sea lily), Cucumaria (Sea cucumber)
Ophiura (Brittle star)

10 Hemichordata

- It is the connecting link between the chordates and non-chordates.
- Earlier Hemichordata was mistaken to be sub phylum under chordata because Hemichordates had structure called stomachord which is similar to notochord.

- Stomochord is also known as buccal diverticulum.

Habitat:-

- They are exclusively marine.
- They have organ system level of organisation
- They are coelomates
- They are triploblastic
- They have bilateral symmetry

Body :-

- They have worm like body
- The body is divided into 3 region :-

1 Proboscis

2 Collar

3 Trunk

- Proboscis has proboscis gland which helps in excretion.

Digestive system:-

- They have a complete digestive system

Respi

- They respire through gills (gill slits)

Reproduction:-

- Sexes are separate
- Fertilization is external
- Development is indirect

Eg:- Balanoglossus, Saccoglossus

Circulation:-

- Circulation is open type
- Blood is colourless
- Heart is situated dorsally

Note:-

- Stomochord is a structure which occurs in the mouth and extends upto collar.

Chordata

- Presence of notochord
- Presence of dorsal, hollow, nerve chord (ring)
- They have pharyngeal gill slits
- Presence of postanal tail
- The heart is located in the ventral side

Difference between chordates and non chordates

<u>Chordata</u>	<u>Non-chordata</u>
• notochord is present • Central nervous system is dorsal and single • Pharynx perforated by gill slits • Heart is in ventral side • Postanal tail is present	• notochord is absent • Central nervous system is ventral solid & double • gill slits are absent • Heart is in dorsal side • Postanal tail is absent
• They have organ system level • They are coelomates • They have bilateral symmetry • They are triploblastic	

Chordata

Urochordata

Cephalochordata

Vertebrates

- Urochordates and cephalochordates are together called protochordates and they are Acraniata
- Vertebrates are called Craniata

1 Urochordata:-

- notochord is present in tail part of larvae.
- larval stage is more advanced than adult. so it is called metamorphosis (retrogressive metamorphosis).

Habitat:-

- They are exclusively marine

To know:-

- Urochordata is also called Tunicata because its body is made up of Tunicin

Eg:- Ascidia , Salpa , Doliolum

2 Cephalochordata:-

- notochord will extend from head to tail throughout their life.

Habitat:-

- They are exclusively marine

Eg:- Branchiostoma (Amphioxus / lancelet)

3 Vertebrata:-

- They come under Craniata
- notochord is formed during embryonic stage and is replaced by Bony or Cartilaginous vertebral column.
- All the vertebrates are Chordates but not all Chordates are vertebrates.

Digestive system:-

- They have a complete digestive system.

Respiration:-

- Either by gills, moist skin or lungs

Circulatory system:-

- They have closed type of circulatory system
- They have a well developed muscular Heart with 2/3/4 chambers.

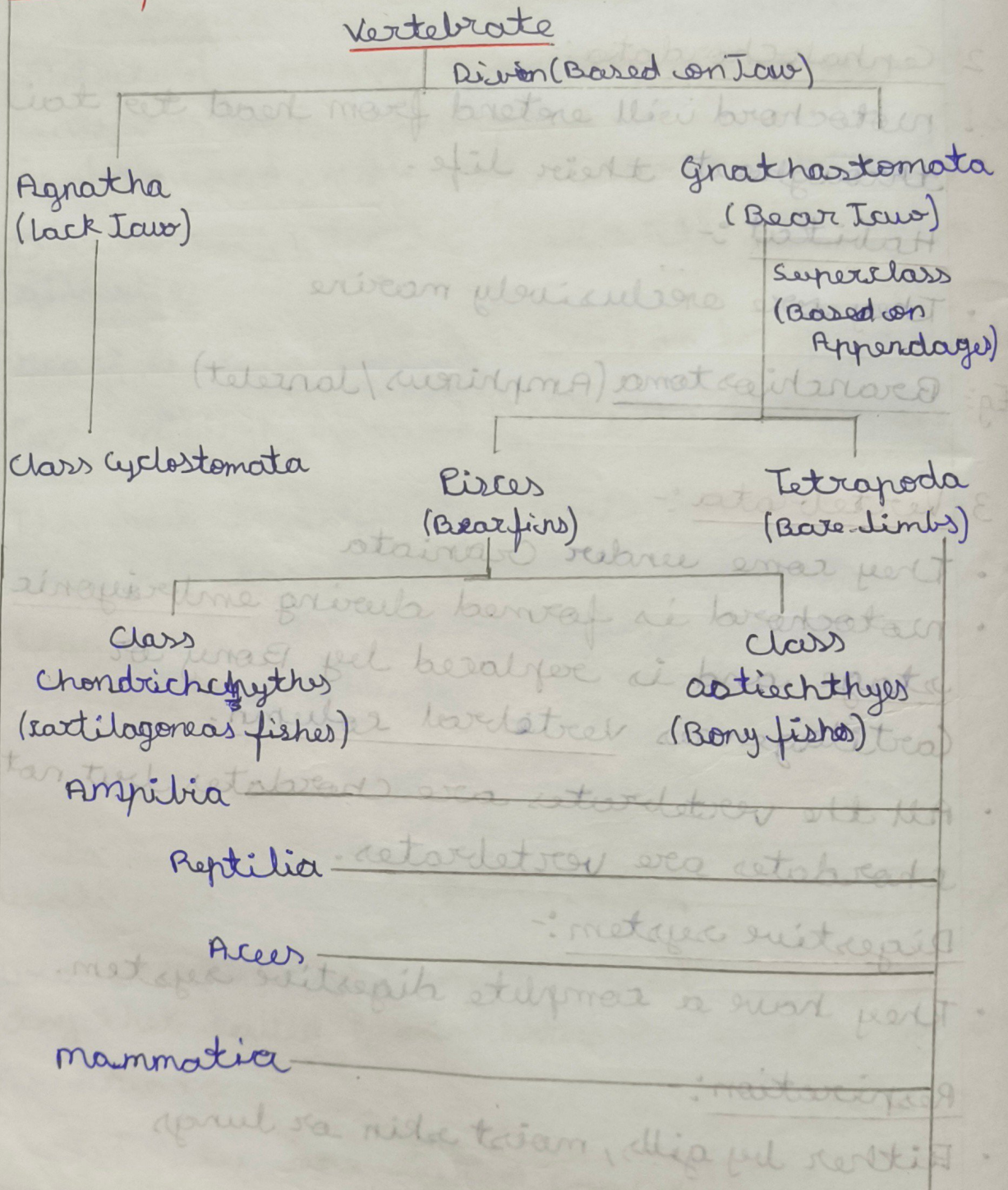
Excretion:-

- They have a pair of Kidneys for excretion and osmoregulation.

Appendages:-

- Vertebrates have limbs or wings or fins that helps in locomotion.

Classification of Vertebrate:-



1 Class Cyclostomata :-

- They belong to phylum Chordata
- They belong to subphylum Vertebrata
- They belong to division Agnatha
- They have circular mouth.

Habitat:

- They are ectoparasites on larger fishes for the purpose of food ~~or~~ ~~and~~ and locomotion

Body :-

- They have a ~~elongated~~ body with circular suctorial mouth

NOTE

- The body is devoid of scales & and paired fins (The body do not have scales, the body has unpaired fins)

- They are scavengers

Digestion :-

- They have a complete digestive system

Reproduction :

Respiration - 6-15

pair of gill
slits

- Animals are unisexual

- Reproduction is external

- Larval stage is ^{present} absent (development is ⁱⁿ direct)

- After spawning within a few day they die their larvae after metamorphosis return to the ocean (after larval stage is absent the adult migrate to fresh water for the purpose of spawning (to give birth to young one))

2 Gnathostomata :-

- Mouth is encircled by true jaws.

- These are developed vertebrate.

- Vertebral column are well developed

Eg: Petromyzon (Lamprey), Myxine (Hagfish)

i Chondrichthyes :-

- This class includes cartilaginous fishes
- These are normally marine ~~(and few inhabit tropical river)~~ (super class fishes)
- Endoskeleton is made up of cartilage
- Exoskeleton over the skin is made up of placoid scales. These scales are like denticles and are originated by dermis of skin.
- In these fishes 5-7 pairs of gills are present which open directly outside the body by gill slits. operculum is normally absent in these fishes.

Eg Squalodon (dog fish), Bristle (saw fish),
Carcharodon (great white shark), Trygon (sting ray)

ii Class Osteichthyes :-

- This class includes bony fish
- These are found in fresh water as well as in marine water.
- Endoskeleton of these fishes is made up of bones, so these fishes are called bony fishes.
- Their exoskeleton is made up of scales which may be cycloid or stenoid or ganoid type
- Placoid scales are absent.
- Respiration by four pairs of gills. These gills are covered by operculum at each side of the body.
- Mouth is normally terminal or subterminal, teeth are found in jaws

Eg:- Ereocetus (Flying fish), Hippocampus (sea horse)

Brackish water:-

Labeo (Rohu), Catla (Katla), Clarias (magur)

Aquarium:-

Betta (Fighting fish), Pterophyllum (Angel fish)

i Class Chondrichthyes continue

- notochord persist throughout their life.
- They have a streamlined body
- They bear fins
- Their body is externally covered by placoid scales.
- mouth is ventral in position
- They have a Heterocercal caudal fin (unequal fin).
- Digestive system is of complete type.

Respiratory system:-

- They have 5-7 pair gill slits without operculum

Circulation:-

- They are poikilotherms (body is cold blooded)
- They lack the capacity to regulate the body temperature.
- They have a 2 chambered heart (Atricle and ventricle)
- They are predaceous (danger)
- In mouth, the teeth is modified placoid scales and they have powerful jaw.
- They lack air bladder, they have to swim continuously from avoid sinking

Reproduction:-

- They are viviparous
- Fertilization is internal
- male bears claspers in their pelvic fin.
- Claspers which help in deposition of sperm.

- Some have electric organ

Eg Torpedo

- Some possess poison string

Eg Trigon

ii) Class Osteichthyes continue :-

- They belongs to chordates, sub phylum vertebrate, division Gnathostomata, super class spines.
- They have a streamlined body and they bear fins.
- They have homocircal dorsal fin.
- They have complete digestive system
- Circulation on poikilothermas (cold blooded) with 2 chambered heart.

Respiration :-

- They have 4 pairs of gills
- Gills are covered by operculum
- They are non predaceous.
- They bear ~~to~~ air bladder that helps to maintain buoyancy.
- Claspers are absent in males.
- Fertilization is external.
- They are oviparous with direct development

- Some have electric organ

Eg Torpedo

- Some possess poison string

Eg Trigon

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- They belongs to chordates, sub phylum vertebrate, division Gnathostomata, super class spines.
- They have a streamlined body and they bear fins.
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Respiration :-

- They have 4 pairs of gills
- Gills are covered by operculum
- They are non predaceous.
- They bear ~~to~~ air bladder that helps to maintain buoyancy.
- Claspers are absent in males.
- Fertilization is external.
- They are oviparous with direct development

Chondrichthyes

- mouth is located in ventral side.
- It is predaceous.
- Air bladder is absent.
- They have 5-7 pair of gills.
- Fertilization is internal.
- They are viviparous.
- They have Heterocercal caudal fin.
- Endoskeleton is made up of cartilage.
- They have externally covered placoid scales.

Eg: *Bristis* (saw fish)

- They are normally marine.
- Claspers in males are present.

Actinopterygii

- mouth is located in terminal side.
- It is non-predaceous.
- Air bladder is present.
- They have 4 pair of gills.
- Fertilization is external.
- They are oviparous.
- They have homocercal caudal fin.
- Endoskeleton is made up of bones.
- They have cycloid or ctenoid scales.

Eg: *Betta* (fighting fish)

- They are marine as well as fresh water.
- Claspers are absent.

iii Class Amphibia

- It belongs to chordates and subphylum vertebrates, Division Gnathostomata, super class Tetrapoda and class amphibia.
- Since they live in both land and water, they have dual life.

Body :-

- Body is divided into head and trunk.
- Tail may be present or absent.
- Body is covered by moist and glandular skin. (mucus gland)
- Head consists of sense organs like pair of eyes, eyes are provided with eyelids.
- Their eyes also has a membrane for protection called nictitating membrane.

Respiration :-

- They have a pair of nostrils.
- Ear is represented by Tympanum.
- Mouth is provided with bifurcating tongue.
- Trunk bears two pairs of limbs, 1 pair of forelimb and 1 pair of hindlimb.
- The limbs are provided with digits.

Digestive system :-

- It contains alimentary canal which helps in carrying digestive waste.

Reproductive tract :-

- They contain Egg / sperms.

Urinary tract :-

- They help in nitrogenous waste.

Circulation :-

Reproduction :-

- Sexes are separate.
- They are oviparous.
- They show indirect development.
- Fertilization is external.

Respiration :-

- They respire through gills, moist skin and also through lungs.

Circulation :-

- They have 3 chambered heart (2 auricles and 1 ventricle) and they show incomplete circulation.
- They are Poikilotherms or cold blooded animals.

Eg:- Bufo (Toad), Rana (Frog), Hyla (Tree frog),
Salamandra, Ichthyophis (Limbless amphibia)

iv Class Reptilia :-

- It belongs to chordates and sub-phylum vertebrates; Division Gnathostomata super class tetrapoda and class Reptilia.

- Latin - Repere or reptum is (known as creep (or Crawl.) *reptans*), (*reptil* *reptans*) *reptans*
- They are called Reptiles because of their creeping or crawling mode of locomotion.
- They are mostly terrestrial, some live both in land and water.

Body :- Body is

Body is divided into :-

~~Head~~ Head, neck, trunk and tail may be present or absent.

- Body is externally covered by dry cornified skin with epidermal scales or scutes.
- Snakes and lizard shed their skin at regular interval called skin casting.
- Head is provided with pair of eyes and eyes are provided with eye lids.
- Ears is represented by thin tympanum.
- They have a bifurcating tongue.

Digestive system :-

- They have complete digestive system.

Circulation :-

- They have 3 chambered heart and incomplete type of circulation.
- They have poikilothermus ~~are~~ except crocodile. Crocodile has 4 chambered heart and are warm blooded animals.

The trunk ~~tail~~ bear 2 pair of limbs.

Reproduction :-

Sexes are separate

Fertilization is internal

They are oviparous

They have direct development.

Eg: Chelone (Turtle), Testudo (Tortoise), Chameleon (Tree lizard), Calotes (Garden lizard), Chameleon (Tree lizard), Crocodilus (crocodile), Alligator (Alligator), Hemidactylus (Wall lizard), Poisonous snake:- Naja (Cobra), Bungarus (Krait), Vipera (Viper)

Imp ✓ Aves:-

- It belongs to chordates and subphylum vertebrates, Division Gnathostomata, super class Tetrapoda and class Aves.

External features:-

- Body is covered by colourfull feathers.
- They can fly except flightless birds like ostrich.
- Mouth is modified into toothless beak like kiwi.
- Forelimbs are modified into wings, helps in flying.

Body:-

- Body is divided into:-
 - Head:- Round head, pair of eyes mouth has beak
 - Neck:- Helps in movement of head
 - Trunk:- 2 pairs of limbs, Forelimbs modified into wings, Hind limbs are covered by dry scales
- Beak digits provided with claws.
- Clasping tree branch.
- Tail:- It is covered by dry skin without oil glands, oil gland is present only in tail.
- The endoskeleton is fully ossified (made of bone)
- The long bones are hollow with air cavities called pneumatic bones.

Digestive system:-

- It has complete type of digestive system.
- Alimentary canal is provided with additional chambers called crop and gizzard (crop store the food, gizzard crush food).

Respiration:-

- It takes place by lungs.
- Air sac connected to lungs will support the respiration.

Circulation:-

- They have closed type with 4 chambered heart.
- They are warm blooded or Homeotherms.
- They regulate their body temperature.

Excretion:-

- They have kidneys for excretion.
- They excrete uric acid.

Reproduction:-

- Sexes are separate.
- Fertilization is internal.
- They are oviparous.
- Development is direct.

Eg:- Corvus (Crow), Columba (Pigeon), Cathartus (Vulture),
Struthio (Ostrich), Pavo (Peacock), Antenodytes
(Penguin), Neophron (Vulture)

VI Mammalia:-

- It belongs to chordates, subphylum vertebrates, Division Gnathostomata, super class Tetrapoda.
- The most unique mammalian feature is presence of milk producing gland called mammary glands which is used to nourish the young one.

Note:-

- Mammary gland is a modified sweat gland.

Habitat:-

- Polar eyes cap. $\rightarrow$ Polar bear
- Desert $\rightarrow$ Kangaroo
- mountains
- Forest, grassland and dark caves
- Some can fly and some live in water (walrus)
- The body is divided into head, neck, trunk and tail.
- The entire body is covered by skin which posses hair
- Head consist of pair of eyes, nose, mouth (mouth consists of different type of teeth. Heterodont type of teeth)
- Teeth is located in the socket and presence of jaw.

- Ear is provided with external ear or pinna

Digestive system:-

- It has complete type of digestive system

Respiration:-

- It is through lungs

Circulation:-

- It is closed type with 4 chambered heart
- They are homeothermal

Excretion:-

- They have a pair of kidneys

Reproduction:-

- Sexes are separate $\neq$
- Fertilization is internal
- Development is direct.
- most of them are viviparous except egg laying mammal called amithorhynchus (Platypus)

Eg

macropus (Kangaroo), Pteropus (Flying fox)
Camelus (Camel), macaca (monkey), Rattus (Rat)

Habitat:-

- Polar eyes cap. $\rightarrow$ Polar bear
- Desert $\rightarrow$ Kangaroo
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Eg

Macropus (Kangaroo), Pteropus (Flying fox),
Camelus (Camel), macaca (monkey), Rattus (Rat)

Canis (Dog), Felis (Cat), Elephas (Elephant),
Equus (Horse), Delphinus (Common Dolphin),
Calaloptera (Blue whale), Panthera ~~Tiger~~ (Tiger)
Panthera lea (lion)