

→ Animal Kingdom is a part of 5-kingdom classification structure proposed by R.H. Whittaker.

→ The classification of various organisms into 5 Kingdom was done by R.H. Whittaker in 1969

The main criteria of classification

- (i) Cell type / cell structure
- (ii) Body Organisation
- (iii) Cell wall
- (iv) Nuclear membrane
- (v) Mode of Nutrition
- (vi) Reproduction
- (vii) Phylogenetic relationship.

→ Animal Kingdom includes all the multicellular organism

Animal Kingdom

Non-chordata

Chordata

- On the basis of presence or absence of notochord - rod like
 - Present on the dorsal side
 - It is mesodermal in origin

Other basis of classification -

1. Level of Organisation -

- (a) Cellular - aggregation of independent cells
eg: porifera

x (b) Tissue - eg: coelenterata
 ctenophora

(c) Organ - eg: platyhelminthes

(d) Organ system - eg: Aschelminthes

- Annelida

- Arthropoda

- Mollusca

- Echinodermata

- Hemichordata

- Chordata

Example of Organ system -

(1) Digestive system -

• Incomplete - only one opening

eg: Coelenterata

ctenophora

platyhelminthes

- anus is absent.

- ingestion and egestion from same opening

• Complete - Both mouth and anus are present

eg: Aschelminthes - chordata

(2) circulatory system -

• Open - no blood vessel or poorly developed blood vessel

- Blood flows in body cavity - Sinus

• Closed - well developed blood vessel are present.

Q. Do porifera has nervous system?
 → No, as they do not have organ system level of organisation and neurons are not developed in porifera.

Q. Which phylum are exclusively marine?
 → (i) Ctenophora
 (ii) Echinodermata
 (iii) Hemichordata

2. Asymmetrical -

(1) Asymmetrical - Any plane that passes through the centre does not divide them into equal halves. eg: sponges, porifera

(2) radial symmetry - When any plane passing through the central axis of the body divides the organism into two identical halves. eg: Coelenterata, Ctenophora, Adult Echinoderm

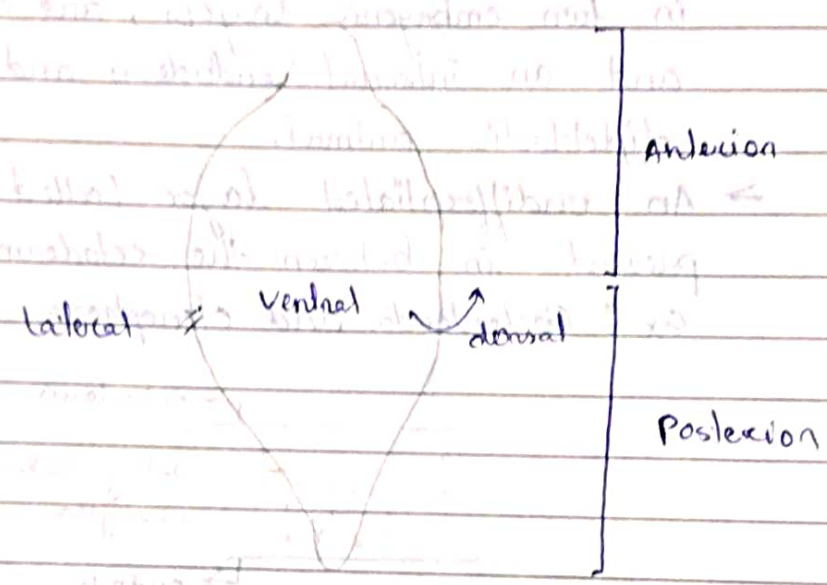
* This symmetry is beneficial for aquatic, mostly sessile (sedentary) organism because it allows them to capture food coming with water current from all direction.

* This symmetry has two surface oral (ventral) and aboral (dorsal)

(3) Bilateral symmetry :- Animals like plathyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca

where body can be divided into identical left and right halves in only one plane. exhibit bilateral symmetry under one p

→ It is the advance symmetry having the following surfaces -



- Cephalization is the characteristic of bilateral symmetry. (Cephalic - head)
- Cephalization is the development of head and sensory organ on the anterior part of the body.

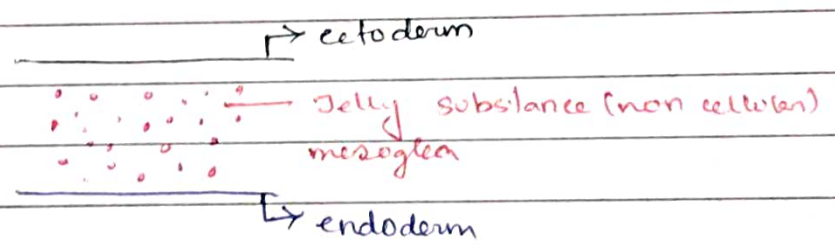
Q. Which phylum first shows the bilateral symmetry?
→ Platyhelminthes.

Q. Which organism first shows the cephalization?
→ Platyhelminthes.

(3) Germ layer : (Diploblastic and triploblastic)

- It is a tissue layer
- develops in the embryo
- gives rise to organs.

- Diploblastic : Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm and are called diploblastic animal.
 - An undifferentiated layer called mesoglea is present in between the ectoderm and endoderm.
 - Ex : Coelenterata and ctenophora



- Triploblastic : Animals in which the developing embryo has three ^{3rd} germ layers i.e., mesoderm in between ectoderm and endoderm.
eg : plathelminthes to chordata.

4. Coelom (Body cavity) :

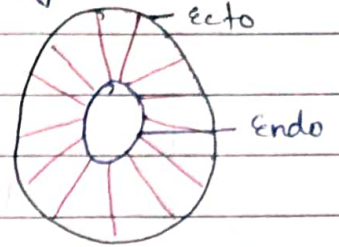
(*) Significance : It helps in accommodating the organs inside the body.

→ Coelomic fluid helps in locomotion in some organism. eg : leech

① Acoelom - The animal in which body cavity is absent are acoelomates.

→ Mesoderm is solid.

→ eg: Platyhelminthes



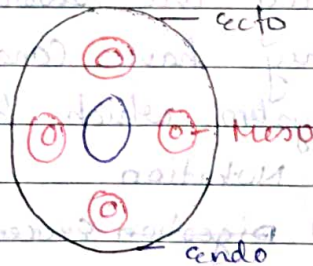
Q. which organism being triploblastic is acoelomic in nature?

→ Platyhelminthes

Q. In which organism mesoderm is solid.

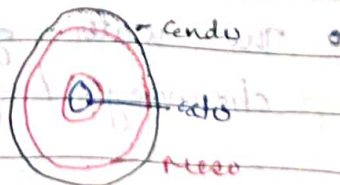
→ Platyhelminthes

② Pseudocoelom - Body cavity when not lined by mesoderm, instead mesoderm is present as scattered patch in between ectoderm and endoderm. eg: Aschelminthes.



③ Eucoelom/coelom: Body cavity which is lined by mesoderm on both the sides.

→ It can be defined as presence or absence of a cavity between the body wall and gut wall. eg: Annelida to chordata



4. Segmentation : linear repetition of body parts

(a) External + Internal → eg: Earthworm

(b) External → eg: Arthropods

(c) Internal → eg: chordata

* through Segmentation is also known as metamerism

1. Phylum - porifera

→ Mostly marine, some are fresh water.

-eg: Spongilla (freshwater sponge)

→ Mostly asymmetrical.

→ Cellular level of organisation.

→ They are sessile organism (sedimentary).

→ They have canal system or water transport system which has the following function

(i) Nutrition

(ii) Digestion Excretion

(iii) Respiration

(iv) Reproduction.

• Water enters through the minute pores in the called ostia in the body wall, circulated in the central cavity called the spongocoel and water moves out through osculum

• The water gets circulated in the spongocoel cheanocyte / flagellated cell / collar cell

- Digestion is intracellular.
- The skeletal part of the body is made up of spongin fibres and spicules.
- They are Hermaphrodite / Bisexual / Monoecious.
- Sponges reproduce asexually by fragmentation and sexually by forming gametes.
- Fertilisation - internal and development
- Development is indirect.
 (Amphiblastula and parenchymula larva)
- Example: Euspongia (Bath sponge), Spongilla (fresh-water sponge) and Sycon (Scypha)

Note -
 Intra - Inside
 Extra - Outside

2. Phylum - Cnidocera

- They are aquatic and mostly marine, few are freshwater. eg: Hydra
- They are sessile or free swimming

The sessile form is polyp.
 free swimming point medusa.

→ They are known as Cnidaria because of the presence of stinging cells called Cnidioblast / Cnidocyte / nematoblast which contain stinging

Note: Blast - mother cell
 clast - destructive cell
 cyte - matured cell

Capsule named nematocyst.

→ Mechanical stimulus leads to increase in osmotic pressure causing the opening of operculum, ejecting out the thread tube

- Tissue level of Organisation
- Diploblastic germ layer.
- Digestion - extracellular + intracellular.
- Mouth is located on hypostome
- Mouth leads to a central gastrovascular cavity and mouth is the only opening.
- Some of the have a skeleton composed of CaCO₃. for eg: Coral
- They exhibit polymorphism

- Polyp
- 2n
- asexual
- cylindrical
- sessile
- eg: Hydra
Adamsia



- Medusa
- 2n
- sexual
- umbrella
- free swimming
- eg: Aurelia



→ Alternation of generation occurs in Cnidarians having both the forms i.e., both polyp and medusa and is called metagenesis

eg: Obelia

→ Fertilisation by budding (asexual) and sexually by the process of external fertilisation

→ Development is indirect.

→ They are Dioecious / unisexual / sexual dimorphism

ex: Hydra (polyp), Adamsia (sea anemone)

[P+M], Physalia (Portuguese Man-of-war)

[P+M], Pentastula (sea pen) [P],

Gorgonia (sea fan) [P], Obelia (sea pen)

[P+M], Meandryna (Brain coral) [P],

Aurelia (jelly fish) [M].

3. Ctenophora (Sea Walnut / Comb jellies)

- Exclusively marine.
- Radial symmetry
- Diploblastic in nature
- Tissue level of organisation.
- Digestion - Extracellular + Intracellular
- Body bears 8 external rows of ciliated
- Comb plates which help in locomotion
- They exhibit bioluminescence (the property of living organism to emit light)
- They are Hermaphrodite.
- They have only Sexual reproduction
- Fertilisation is external in nature.
- Development is indirect (eg: Pleurobrachia)
 - Sea gooseberry

- ctenoplana (sea walnut)

4. Phylum - Platyhelminthes (Flat worms)

- dorso-ventrally flattened.
- Organ level of organisation.
- Triploblastic in nature.
- Bilateral symmetry.
- Acoelom
- Mostly endoparasitic
- For parasitic adaptation hooks and suckers are developed
- Specialised cell called flame cells are used for osmoregulation and excretion.
- Sexes are not separate / Hermaphrodite / Monoecious / Bisexual

- Fertilisation internal
- Development is indirect with many larval stage.
- Q. → Some members like planaria possess high regeneration capacity.
- Example: Taenia (Tape worm), Fasciola (liver fluke)

* Some larval forms are -

- Miracidium (ciliated)
- Radula
- Cysticercus
- Cercaria (tailed)
- Metacercaria

Phylum 5 - Aschelminthes (Round worm)

- Q. → The body of Aschelminthes is circular in cross section, hence named as round worm
- They may be free living, both Aquatic and terrestrial or parasitic.
- Organ system level of organisation.
- Triploblastic germ layer
- Pseudocoelomate
- Bilateral symmetry
- Alimentary canal is complete with well developed muscular pharynx.
- Muscular pharynx which helps in efficient intake of food.
- For excretion, an excretory tube is present which removes the body waste through excretory pore.

(Renette cell, a giant cell form their excretory organ)

→ They are Dioecious
 Female [♀]

Male [♂]



- longer
- straight

- short
- J-shaped with curved tail

• Perial setae is ^{Absent} present in male female

• Perial setae is ^{Present} absent in female male.

→ Fertilisation is internal

→ Development may be direct or indirect.

eg: Ascaris (round worm) causes Ascariasis

- 11th juvenile stage present in soil

(iii) *Brugia malayi* (Filarial worm) causes filariasis

- Vector - Culex mosquito

(iv) *Ancylostoma* (Hookworm) causes Ancylostomiasis

- enters through cut and injury.

Q. How some plathelminthes absorb nutrients from the host?

Ans = Directly through body surface.

This kind of plathelminthes do not have even incomplete digestive canal and hence remains in the host-intestine and absorb their completely digested food.

Q. In Animal Kingdom which organism have sperm without tail?

OR

Q. In which organism sperms are amoeboid in nature?
 Ans = Aschelminthes.

Phylum - 6 - Annelida

→ The word Annelida is derived from the word 'Annulus' meaning rings

→ It may be aquatic (Marine, freshwater) or terrestrial

eg: Marine - Nereis (clam worm / Rug worm / sand worm)
fresh water - Hirudinaria (leech)

Terrestrial - Pheretima (earthworm)

→ Organ system level of organisation

→ Triploblastic germ layer.

→ eucoelomate

→ Bilateral symmetry

→ Their body surface are distinctly marked out into segments or metameres i.e., metamericly segmented

→ For locomotion, they have longitudinal and circular muscle.

Aquatic annelid, Nereis has

fleshy appendage called parapodia that has dual function -

- locomotion

- Respiration

→ Circulatory system is closed

→ Nephridia helps in osmoregulation and excretion.

→ Their nervous system consist of

(1) paired ganglia (mass of neurons)

(2) The ganglia's are connected by lateral nerves to a double ventral nerve cord.

→ (3) They are monoecious / bisexual
exception - Nereis (Dioecious)

- Fertilisation is external
- Development is direct.
- * Blood Sucking nature - Sanguivorous.

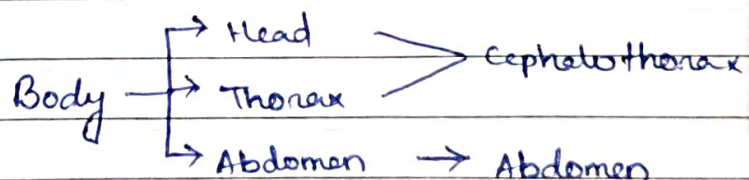
Q. Statement - Aschelminthes are parasitic in plants and animals.
Give example :

Ans : example :

Meloidogyne incognita is a nematod that infect tobacco plant.

Phylum - 7 Arthropoda -

- First largest phylum
- Arthro means joints and poda means appendages
- Q. → over 2/3 of all named species on earth are arthropods.
- Organ system level of Organisation.
- Triploblastic germ layer
- Eucelomate / Coelomate
- Bilateral symmetry
- They are metamericly segmented.
- Body is covered by chitinous exoskeleton.
- Body consist of head, thorax and abdomen



- They have jointed appendages
- Respiratory organs are -
 - (a) Gills . eg: Prawn
 - (b) Book gills - eg: Limulus (king crab)

(c) Book lung . eg: Spider
Scorpion

(d) Tracheal system eg: Cockroach

→ Sense organ includes -

- (a) Antennae
- (b) Compound eye
- (c) Simple eye

→ Excretory system consist of -

- (a) Malpighian tubules. eg: Cockroach
- (b) Antennal gland / green gland
eg: prawn
- (c) Coxal gland : eg: Scorpion
Spider

- for balancing organ they have Statocyst.
- They are dioec mostly dioecious
- fertilisation is usually internal
- Mostly oviparous
- Development may be direct or indirect.

eg: 1. Economically important -

- Apis (Honeybee)
- Bombyx (silkworm)
- Laccifera (Lac insect)

2. Vectors

- Anopheles (Malaria)
- Cules (filariasis)
- Aedes (Dengue)

3. Circogonous pest - locust (C)

- Locusta

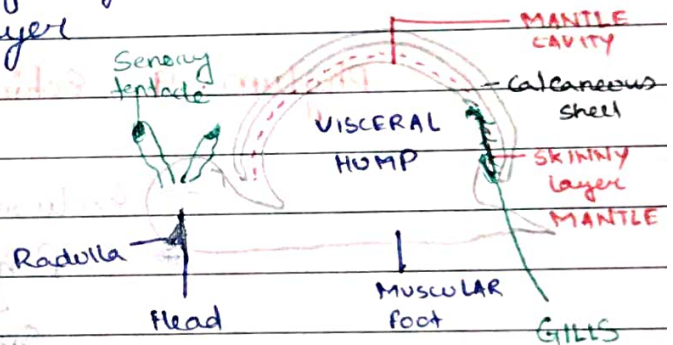
4. Living fossil

- Limulus (king crab)

* Organism surviving with primitive characters and all its closed relatives got extinct is called living fossil.

Phylum - 8, Mollusca.

- Second largest phylum.
- Both terrestrial or aquatic (marine or freshwater)
- Organ system level of organisation
- Triploblastic germ layer
- Eucoelomate
- Bilateral symmetry.
- Non-segmented



- Sensory tentacle (ommatophore)
- Gills (ctenidium)
- Rasping → chewing.

- Body is covered by calcareous shell.
- Body is with head, muscular foot and visceral hump.
- A soft and spongy layer of skin forms a MANTLE over the visceral hump
- The space between the hump and the mantle is called mantle cavity in which feathery like gills are present
- Their gills have dual function -

(a) Respiration

(b) Excretion

- The anterior head region has sensory tentacles
- Mouth contain a file of rasping organ called radula
- They are usually dioecious, and oviparous.
- Development is indirect
- eg: pila (Apple snail), Pinctada (pearl producing oyster), Loligo (Squid), Sepia (cuttle fish), Octopus (Devil fish), Aplysia (Sea hare), Chaetopleura (chiton), Dentalium (Tusk shell)
- Mollusca - 'Mollis' - Soft bodied

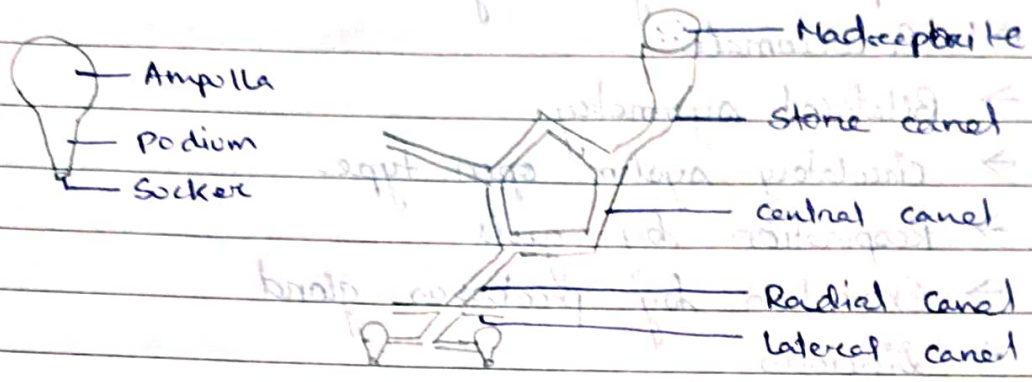
Phylum - 9. Echinodermata -

- Exclusively marine.

Echina	derm
↓	↓
Spine	Skin

- They are Spiny bodied organism
- They have calcareous endoskeleton. (Similar characters that it shares with chordates.
- Organ system level of Organisation
- Triploblastic germ layer.
- Adult - radially symmetrical
larva - bilaterally symmetrical.
- Euceelomate
- Digestive system - Complete. with mouth on the lower ventral side and Anus on the upper dorsal side

→ They have water vascular system / Ambulacral system



→ The most important function of water vascular system are —

- (a) Locomotion
- (b) Capture and transport of food
- (c) Respiration
- (d) Excretion

→ Specialised excretory system is absent in Echinodermata

→ Dioecious

→ Fertilisation is usually external

→ Development indirect with free swimming larvae.

- eg: Asteroias (star fish), Echinus (Sea urchin),
- Anemon (Sea lily), cucumaria (Sea cucumber)
- Ophiura (Brittle star)

Phylum - 10 Hemichordata.

→ It is exclusively marine.

→ Body is divided into proboscis, collar and trunk.

→ They are tailless organism

→ A bucal cavity / diverticulum called stomochead, a rudimentary structure similar to notochord is

present in the collar region.

- Organ system level of organisation.
- Triploblastic germ layers.
- Eutocoelomate
- Bilateral symmetry.
- Circulatory system open type.
- Respiration by gills
- Excretion by proboscis gland
- Dioecious
- External fertilisation
- Indirect development
- eg: Balanoglossus and Saccoglossus
 known as Tongue worm / Acorn worm.

Q. Which larva of echinodermata is hypothetically considered as the ancestor of chordata

Ans: Dipleura larvae.

Q. Distinguish between non-chordate and chordates

non-chordate	chordate
1. notochord absent	1. Notochord present
2. Central nervous system is ventral, solid and double.	2. CNS is dorsal, hollow and single.
3. Gill slits are absent	3. pharynx perforated by gill slits
4. Heart is dorsal	4. Heart is ventral
5. post-anal tail is absent	5. Post-anal tail is present

Q. Post anal tail is present in which Organism -

(i) Aplysa

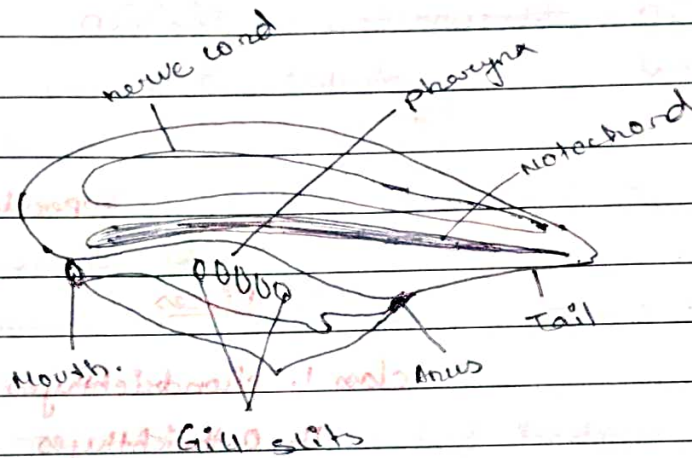
(iii) Adamsia

(ii) Limulus

(iv) Naja

Ans: (iv) Naja (cobra)

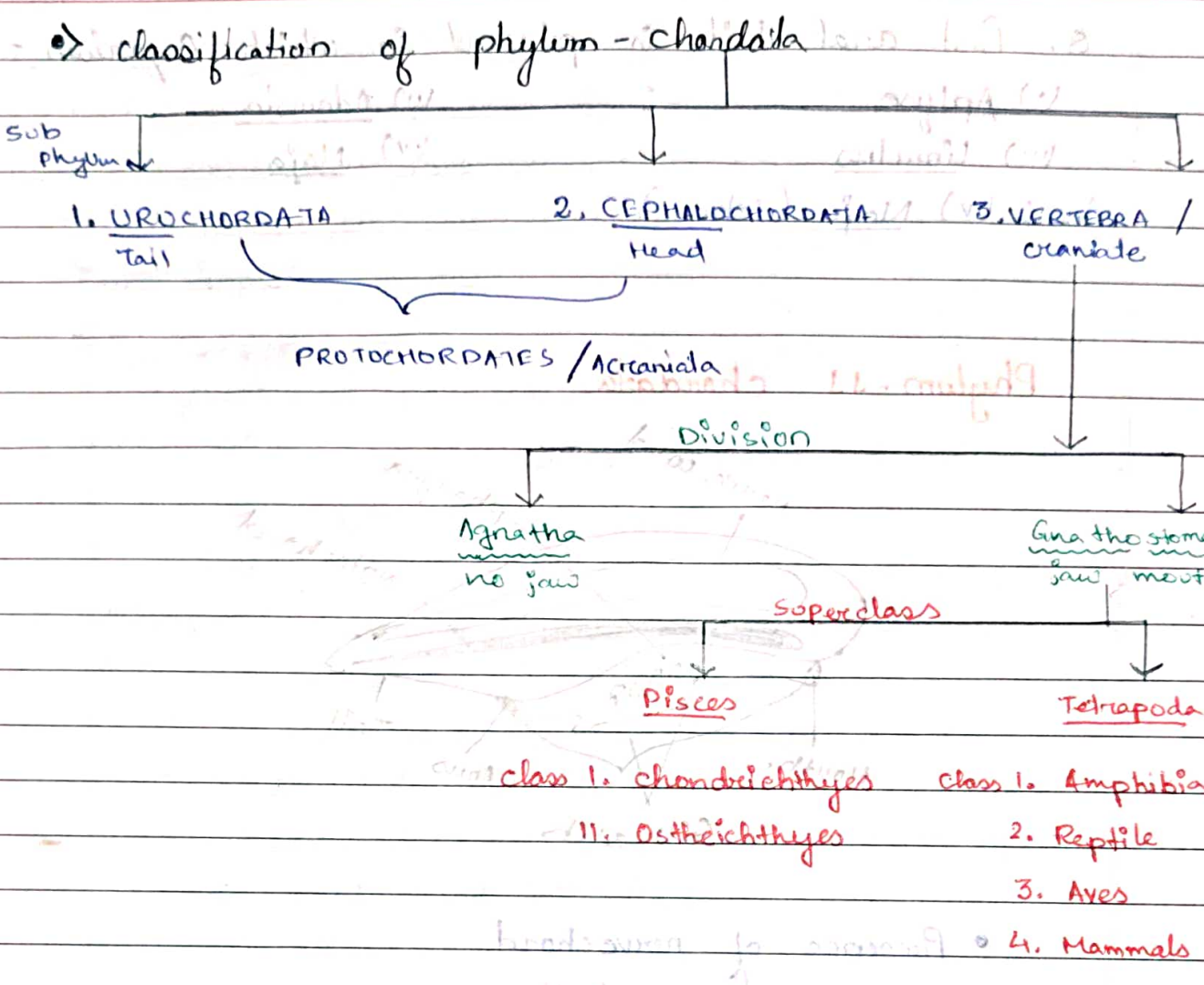
Phylum - 1.1 Chordata



- Presence of nerve chord
 - hollow
 - ectodermal in origin
- Presence of notochord
 - solid central
 - mesodermal
- Presence of pharyngeal gill-slits
- Presence of post-anal tail - balancing

Other features are -

- Organ system level of organism
- Triploblastic germ layers
- Eucoelomate
- Circulatory system closed.



- Sub-phylum 1 - Urochordata -
 - Exclusively marine
 - Notochord present only in tail region of larvae
 - During metamorphosis, the larvae loses it's notochord and hence the metamorphosis is Retrogressive
 - eg: Ascidia, Salpa, Doliolum, known as sea Borel.

Q. Which non-choardate have excretory structure similar to kidney.

Ans: Mollusca, it has organ of Bojanus a paired structure similar to kidney.

Super-class - PISCES

Class J: CHONDRICTYES

- Gill slits are separate and without operculum
- They are exclusively marine
- They have a streamline body
- Cartilagenous endoskeleton (chonda-cartilage)

→ Mouth is on the ventral side

→ Body is covered by minute scale called placoid.

Q. → Their teeth is backwardly directed, and it is a modified of placoid scales

→ Jaws are very powerful, hence they are predaceous.

→ Swim bladder is absent, therefore they need to swim constantly or else they will sink down to the bottom.

→ Heart is two chambered - Auricle and ventricle.

→ They are cold blooded (Poikilothermic - they lack the capacity to regulate their body temperature.)

→ Sexes are separate (dioecious)

→ In male, pelvic fin is modified as clasper

→ Fertilisation is internal

→ Many of them are viviparous.

Eg. Scoliodon (Dog fish), Pristis (saw fish),

Carcharodon (Great white shark), Torpedo (Electric ray)

Trygon (Sting ray)

- In Trygon Dorsal fin is modified as sting
- Notochord Persists throughout the life.

Q. In which organism external temperature influences the internal temperature of the body.

- (i) Cold blooded
- (ii) Warm blooded
- (iii) Poikilothermic
- (iv) Homeothermic

Ans - (iii) Poikilothermic

• class Osteichthyes

- Osteo-bony, Ichthyes-fish.
- Both marine and freshwater.
- Bony endoskeleton.
- Body streamline.
- Mouth is on the terminal side.
- Gills 4-pairs covered by operculum.
- Skin is covered with scales which may be cycloid or ctenoid.
- Swim bladder is present which regulate buoyancy.
- Heart is two chambered.
- They are cold blooded / Poikilothermic.
- Dioecious
- External fertilisation.
- Mostly oviparous.
- Development is direct.

e.g. : Marine -

• Exocoelus (flying fish)
Pectoral fin modified as wing.

• Flippocampus (sea horse)
Male has Brood Pouch to nurture the young one

ii. Freshwater

- Rohu (Labeo)
- Catla
- Mrigal (Magur)

iii. Aquarium

- Betta (fighting fish)
- Pterophyllum (Angel fish)

class - Amphibia

- Amphi - Dual
- bia - bios i.e., life

- Amphibia can live in aquatic as well as terrestrial habitat.
- Body divisible into head and trunk. (neck absent)
- Tail may be present in some
- → Skin is moist (without scale) - Skin is glandular
- Eyelids are present (lower eyelid movable)
- Tympanum represent their ear.
- Alimentary canal, excretory and reproductive track opens into a common chamber called cloaca.
- Respiration by (a) Gills (Branchial respiration)
 (b) Lungs (Pulmonary respiration)
 (c) Skin (cutaneous)
- Heart three chambered - Two auricle and one ventricle
- Cold blooded (Poikilothermic)
- Dioecious
- Fertilisation is external

→ Oviparous

→ Development is indirect.

E.g: Bufo (toad)

- Rana (Frog)
- Hyla (tree frog)
- Salamandra (Salamander) - tailed amphibia
- Necturus (Mud puppy)
- They have external gills
- Ambystoma (limbless amphibia)
- Alytes (Mid-wife toad).

Class - Reptila

→ It is derived from a tal latin word Repere or Reptum which means to creep or to crawl with the help of the chest

- They are mostly terrestrial.
- They perform pulmonary respiration
- Body is covered by dry and cornified skin, epidermal scales or scutes.
- Skin is non-glandular
- They do not have external ear opening but Tympanum represent ear.
- by limbs when present are 2-pairs
- Heart three chambered but four chamber in crocodiles.
- Cold blooded / Poikilothermic
- Snakes and lizard shed their scales as skin cast.
- Dioecious - Sexes are separate.
- Fertilisation is internal.
- Development direct

• Extra :

What makes reptile successfully terrestrial?

Ans: (i) cleidoic egg / shelled egg
 (ii) Amnion (Amniotes), which contains Amniotic fluid which (develops amnion with A. fluid) that protects the baby from getting dry.

* Pisces and Amphibia are anamniotes.

Example: Phrynosoma (Horned toad), Chelone (Turtle), Testudo (Tortoise), Chamaeleon (Tree lizard) [viviparous in nature], Calotes (Garden lizard), Geococillus (crocodile), Alligator, Hemidactylus (wall lizard), Naja (cobra), Bangarus (Krait), Vipera (Viper)

class - Aves

- They are glorified reptiles.
- Body is covered with feathers.
- Scales are present on the hind limb
- Forelimbs are modified as wings.
- Most of them can fly except flightless bird.
- Skin is non-glandular, dry except Oil gland / preen glands / uropygial gland present at the base of the tail.
- Endoskeleton is fully ossified (bony) and the long bones are hollow with air cavities (pneumatic) are

s. Digestive tract of birds have additional chambered

called crop and gizzard.

Q. Which Organism other than birds have crop and gizzard.

(i) Mammal

(ii) Earthworm

(iii) Cockroach

(iv) frog

Ans: (iii) Cockroach

→ Heart four chambered

→ Warm blooded / Homeothermic i.e. they are able to maintain constant body temperature

→ Pulmonary respiration

→ Air sacs are connected to lungs to Supplement respiration

→ Dioecious

→ Fertilisation - Internal

→ Oviparous

→ Development - direct

Example: Cornus (crow), Pavo (peacock), Psittacula (parrot)
^{Q.} Aptenodytes (penguin), Struthio (ostrich), Columba (pigeon), ^{Q.} Neophron (vulture)

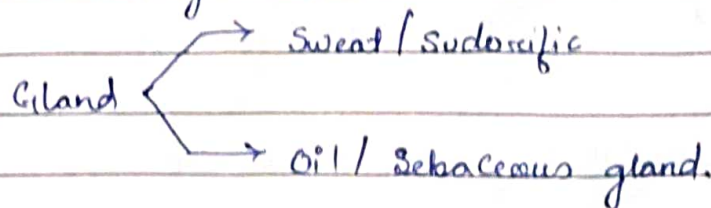
class Mammalia:

→ Pinna is present

→ Skin is covered with hair.

→ Mammary gland present which is modified from sweat gland.

→ Skin is glandular.



- Teeth - heterodont
- thecodont
- Liver contains Glisson's capsule
Kupffer's cell (phagocytic cell)
- Diaphragm present (muscular partition between upper thorax and lower thorax)
- RBC is non-nucleated
- corpus callosum present (Nerve tract) i.e. connects two sides of the brain.

Example: I. Egg laying Mammals (Prototherians)

- Ornithorhynchus (duck billed platypus)
- Echidna (spiny ant-eater)

II. Metatherian (Marsupials)

- Macropus (Kangaroo)

III. Placental Mammals

- Equus (Horse), Balenoptera (Blue whale),
Dolphin, Panthera, Canis, felis, elephas,
Camelus, Rattus, Macaca (Monkey)

→ They have 7 cervical vertebrae (neck).