

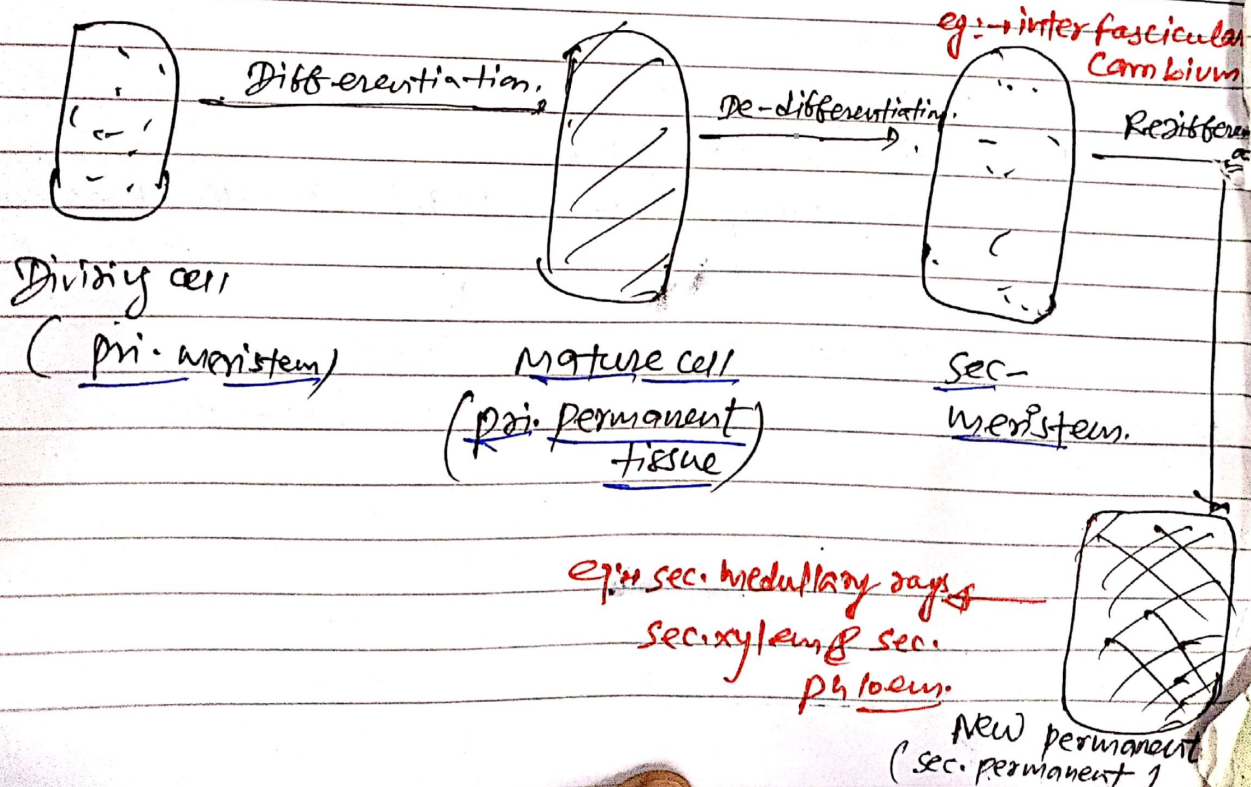
Plant - growth and development

Growth :- $\rightarrow$ It is irreversible increase in biomass
In plants :- $\rightarrow$ indeterminate $\rightarrow$ throughout life.
 Some parts $\rightarrow$ determinate.
 Localised $\rightarrow$ Meristems.
In animals :- $\rightarrow$ Determinate. (Limited time)
diffuses.

* Dormancy :- $\rightarrow$ It is suspension of growth due to internal factor. Ex: $\rightarrow$ immature embryo in seed causes delay in seed germination.

* Quiescence :- $\rightarrow$ It is suspension of growth due to unsuitable environmental conditions like poor moisture, low temp.

* Differentiation, Redifferentiation & Redifferentiation



Differentiation involves selective expression of gene and it results in specialised structure and function.

- * Dedifferentiation involves reversal of maturation and cell returns to active division cycle. It is possible in all living plant cells having nucleus.

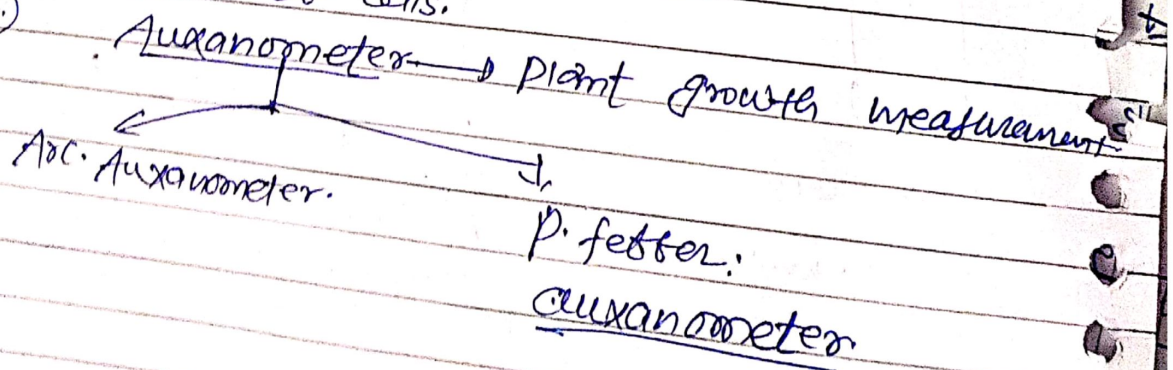
In Animals most cells do not show dedifferentiation like nerve cells and muscle cell. But Liver cells shows this property.

- ** Redifferentiation may form similar or different tissue.

- * development of roots in stem cutting involve dedifferentiation and redifferentiation.

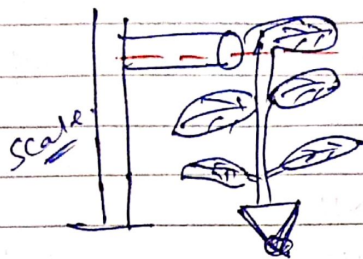
measurement of growth.

- (i) No. of cells.
- (ii) Volume of cells.
- (iii) Biomass of cells.
- (iv)



(V) Horizontal microscope.

→ plant height / growth measurement.



(vi) Crescograph.

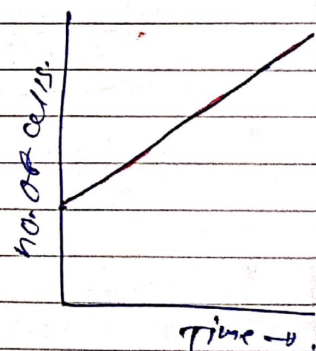
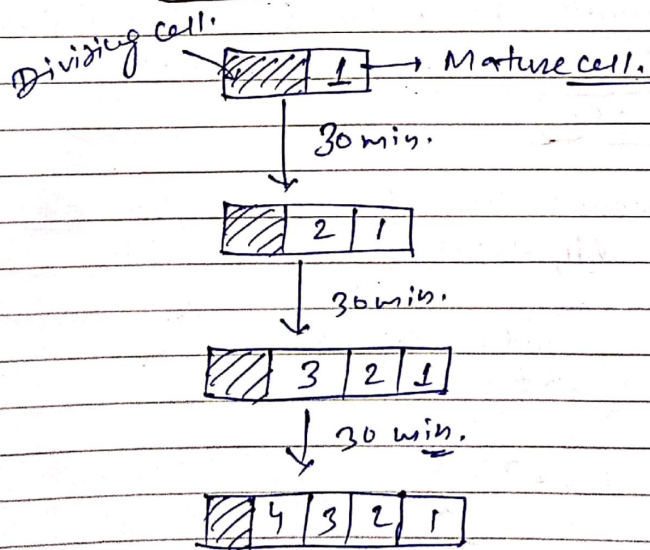
→ developed by J.C Bose. ^{10⁵ times}
→ magnifies growth. 10,000 times.

↓
Suitable for very small growth measurements.

types of growth.

① Arithmetic growth.

→ no. of dividing cell remain constant and remaining cell undergoes maturation.

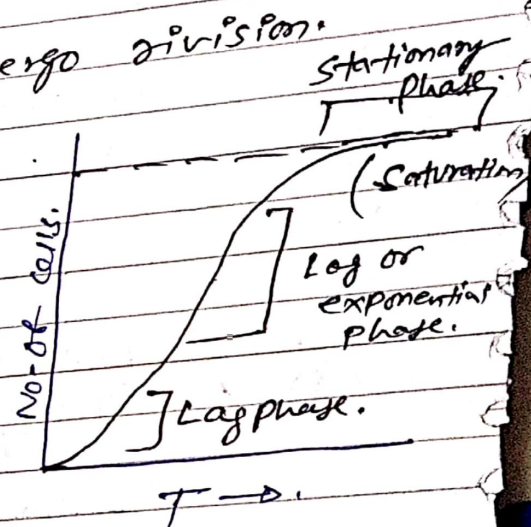
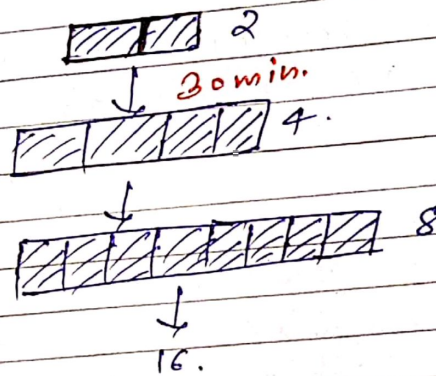


$$L_t = L_0 + \lambda t$$

- * The no. of new cells added with time remains same. and thus Linear Curve is obtained.
- * Arithmetic growth is observed at root tip and shoot apex.

(b) Geometric growth

↳ All available cells undergo division.



- * Geometric growth is followed by saturation, and the total growth behaviour gives sigmoid curve.

- * Saturation occurs due to maturation of organism or due to limitation of resources.

- * Geometric growth equation is
$$w_t = w_0 e^{rt}$$

or
$$N_t = N_0 e^{rt}$$

- * This equation explains geometric growth but does not explain saturation. This equation represents exponential growth.

$$\frac{5}{20} \times 100 = 25$$

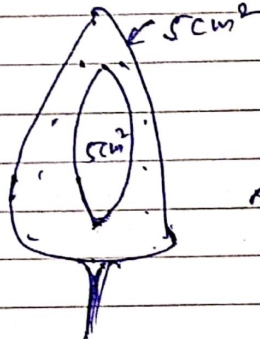
NOTE:- During Early Embryonic stage isometric growth is observed whereas arithmetic growth is observed at Later stage.

* Absolute growth :- is the actual growth in any plant part or complete plant.

Relative growth :- It is the percentage growth w.r.t the old size of plant part.

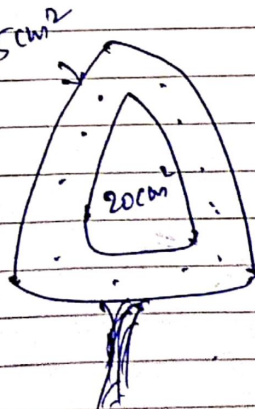
$$R.G = \frac{\text{New growth}}{\text{Old size of plant part}} \times 100$$

Ex:-



Absolute growth = 5 cm².
Relative " = 100%

Ex:-



$$A.G = 5 \text{ cm}^2$$

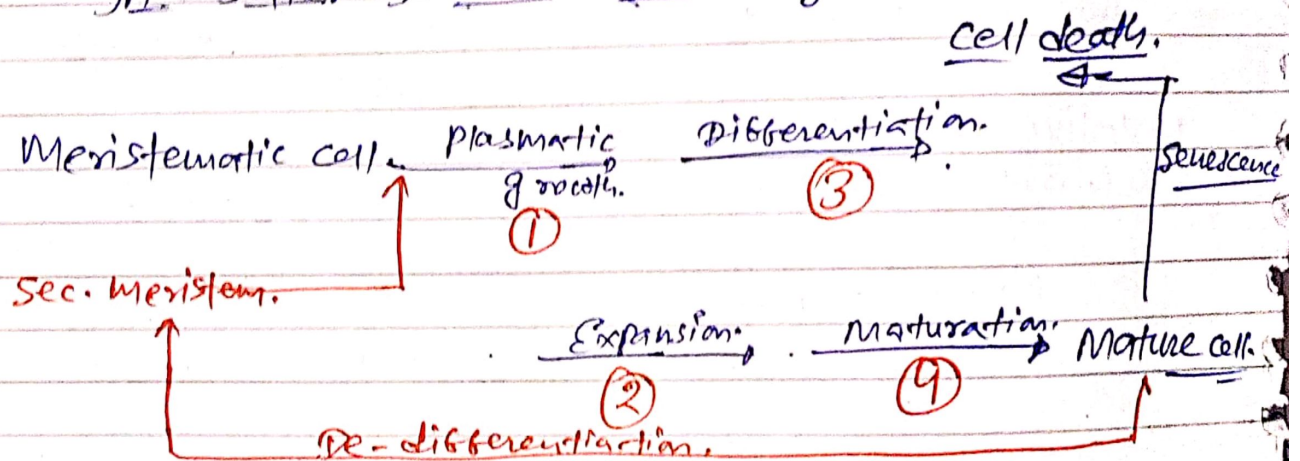
$$R.G = 25\% = \frac{5}{20} \times 100 = 25\%$$

Relative growth is higher in young parts of plant.

As absolute growth is same then relative growth may be different.

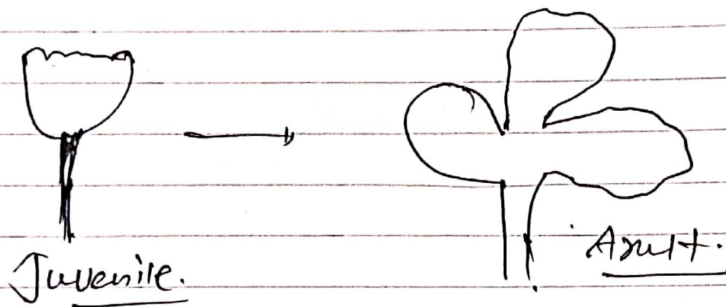
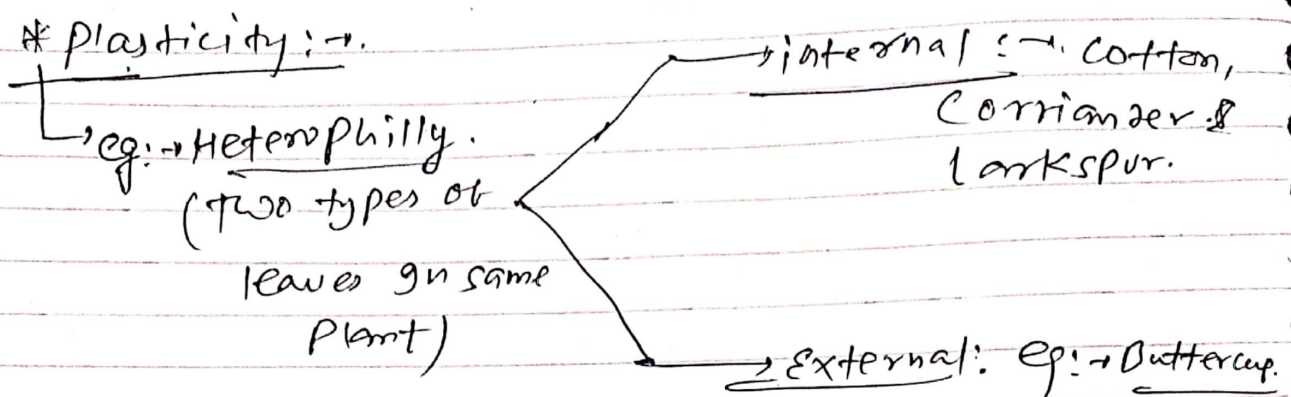
and it's vice-versa is also true.

* Development :- It involves growth, maturation and adaptations which help in better survival of organism.

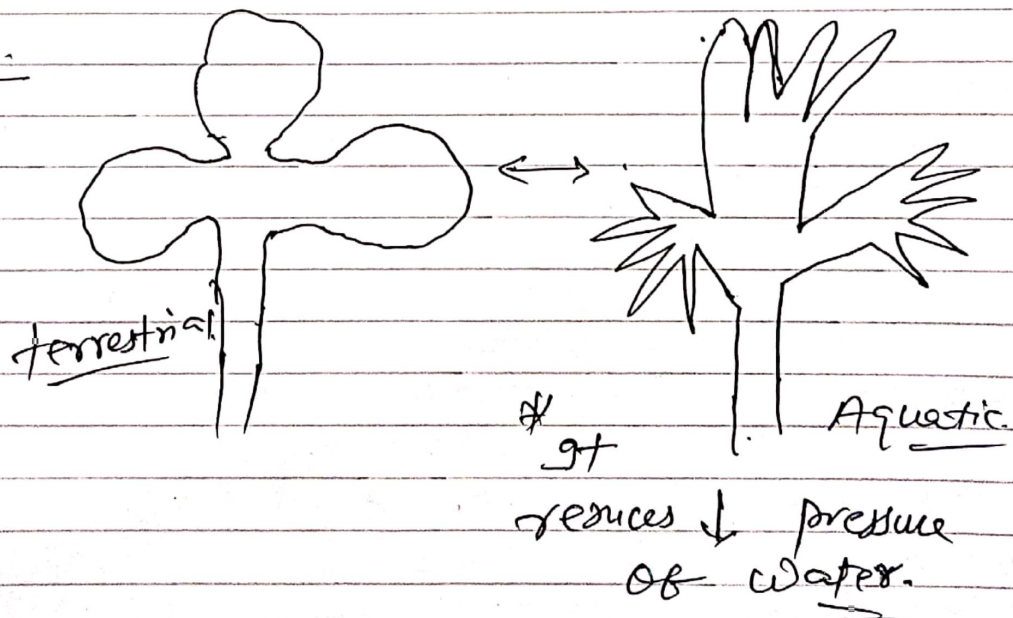


⊛ Senescence involves all changes from maturation to death.

* Plasticity :-



Buttercup.



Plant Growth Regulators (PGRs).

└─ Plant hormones.

└─ Growth promoters :-

Auxin, gibberellins, cytokinin

└─ Growth inhibitors :-

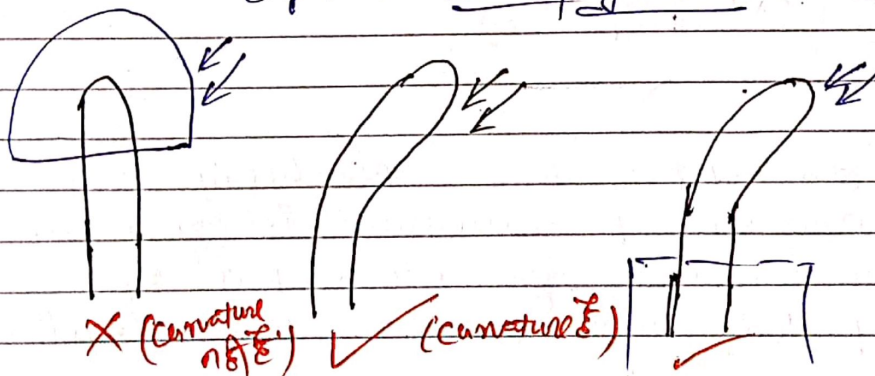
Ethylene & Abscissic acid.

Auxin :-

It was discovered as a plant hormone through a series of coleoptile curvature experiments.

* Darwin & Darwin.

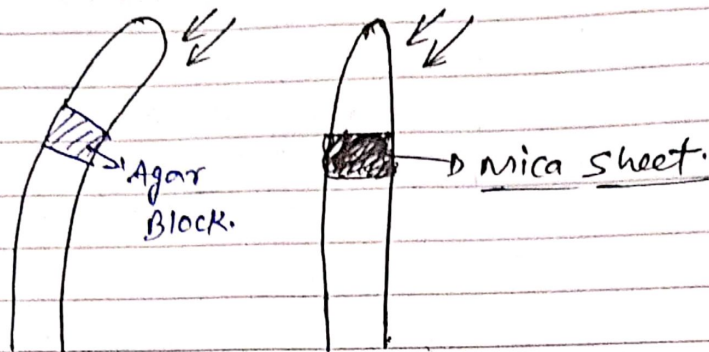
Exp. in Canary grass.



They observed that coleoptile shows curvature towards unilateral light. They concluded that some chemical synthesised in coleoptile tip is transmitted down to affect growth and it results in curvature.

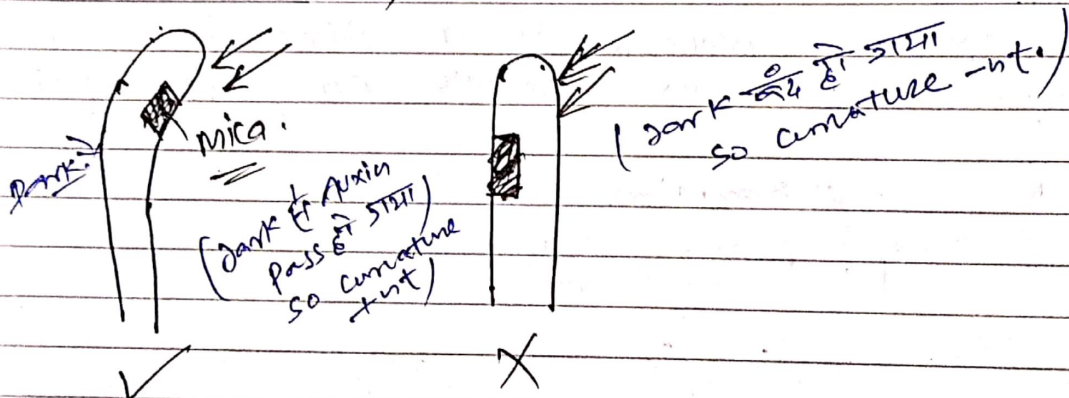
* In first block out of the two blocks
the one which is responsible is)

* Boysen & Jansen.



✓ (Tip se gita hoga
starch curvature
hoga.)

X (Tip se pass nahi ho gaya
so curvature -nt)



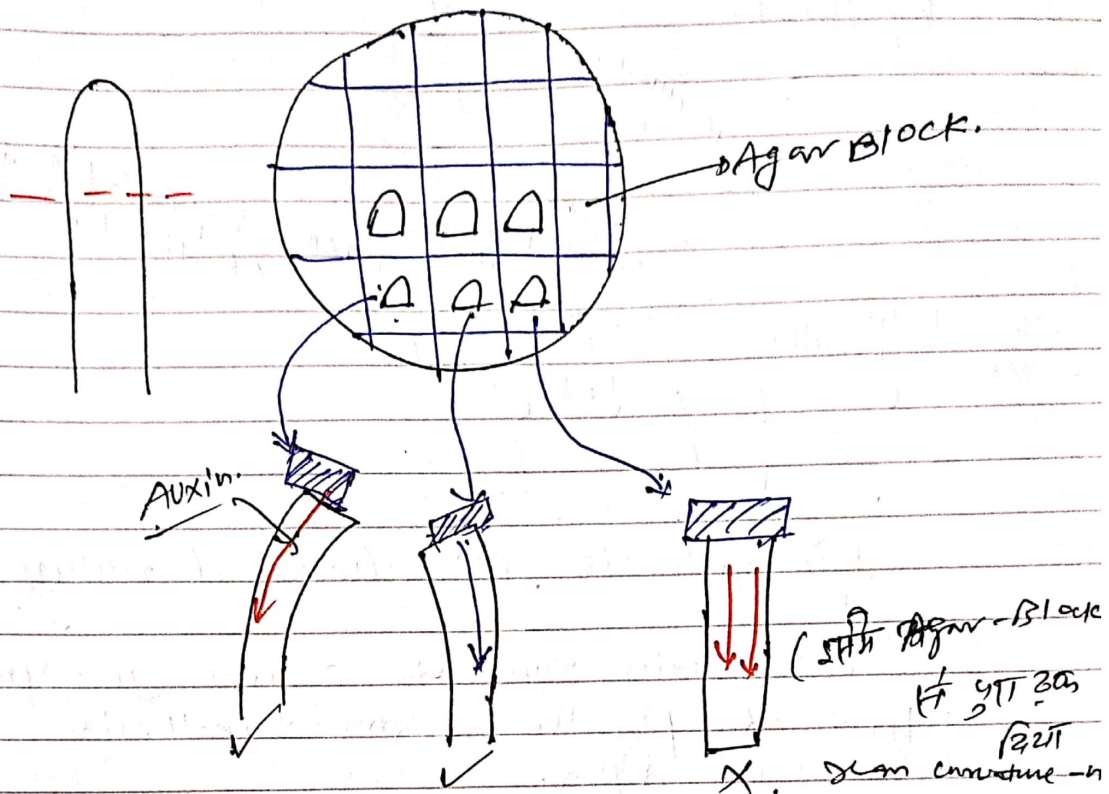
(Dark fr Axin
pass hoga
so curvature
+nt)

(Dark fr Axin
pass nahi hoga
so curvature -nt)

→ They concluded that the biochemical
responsible for curvature is able to
diffuse through Agar Block. But not
transported down through mica sheath.

→ They also found that this biochemical is
transported downwards through dark side
of coleoptile.

F.W. Went

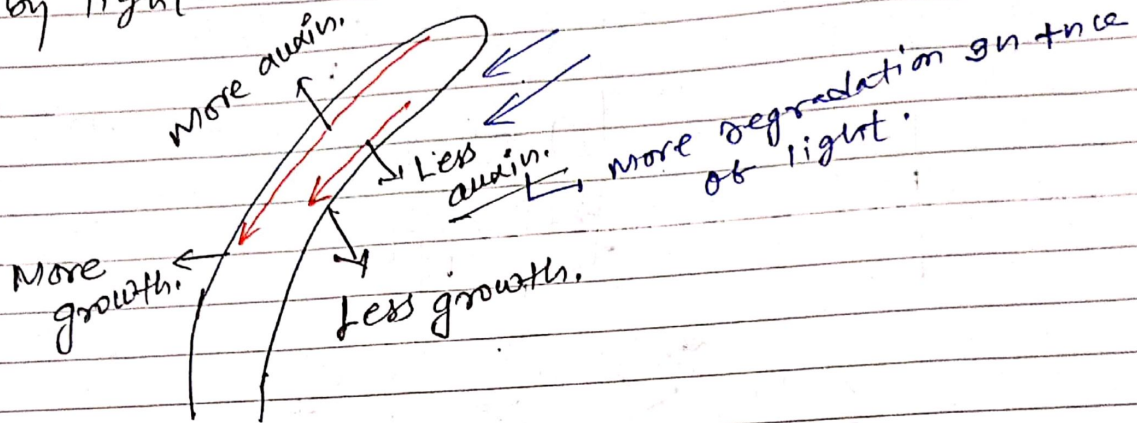


→ Went placed many coleoptile tips over agar-blocks. For a defined time period, and then used these agar blocks to observe curvature in decapitated coleoptiles.
(Tip remove)

→ Went isolated Auxin from *Avena* (oat) coleoptile and named auxin. (auxo. means growth) was also given by him.

* he further explain that darker sides of plant have more amount of Auxin than illuminated sides.
→ (More light is diff.)

It is b/c auxin degradation is promoted by light.

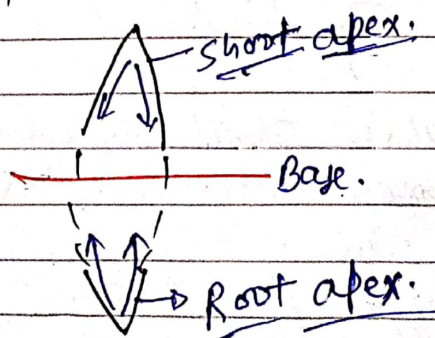


Biosynthesis and chemical nature.

↳ Auxin synthesis occurs in young parts of plants, maxm synthesis in shoot apex.

↳ Tryptophan amino acid acts as precursor for Auxin synthesis.
Essential comp.

→ Auxin transport is polar i.e from
1 terminal to another terminal.
and this transport is also basipetal.
i.e towards base.



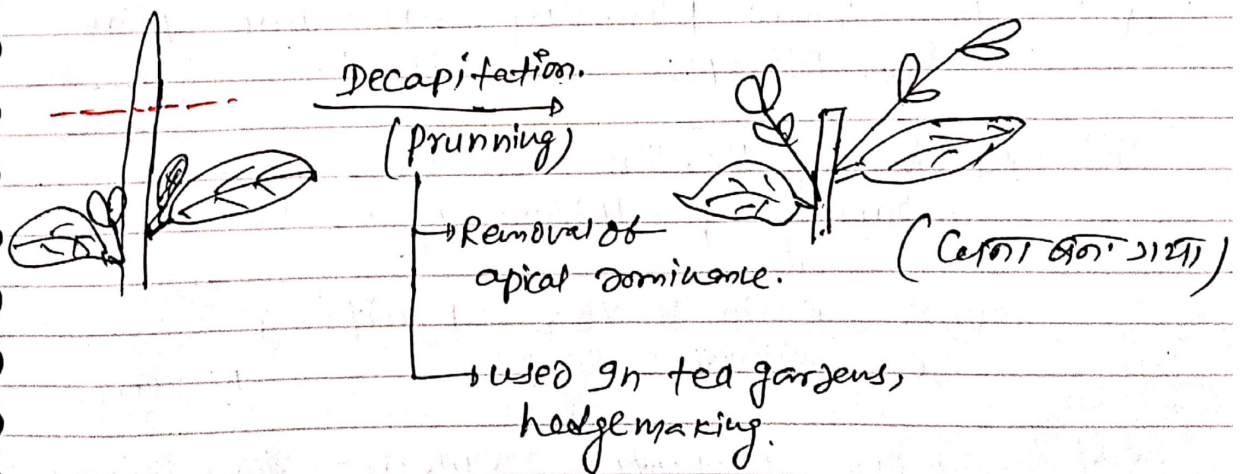
Most common natural auxin.

eg:- IAA. (Indole Acetic Acid) } Natural.
IBA. (" Butyric acid) }
2,4-D [2,4-Dichlorophenoxy acetic acid] }
2,4,5-T [2,4,5-Trichlorophenoxy acetic acid] }
NAA [Naphthalene Acetic Acid] } Synthetic.

Auxins are chemically weak organic acids.

* Physiological function and usages:-

(i) It is responsible for apical dominance.
i.e. It promotes growth of shoot apex
whereas growth of Lateral Buds is
suppressed.

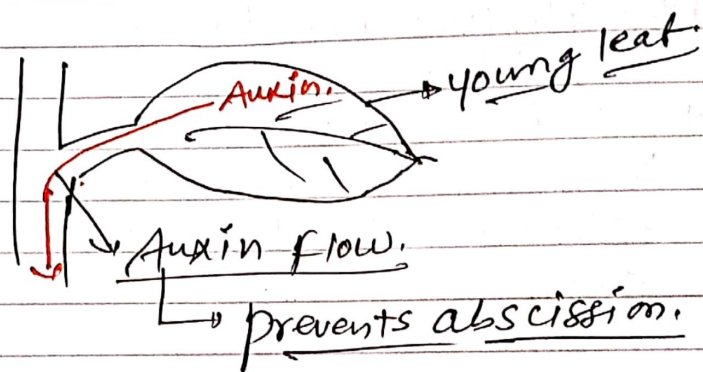


ii) Phototropism : $\rightarrow$ Auxin is responsible for phototropism - i.e. curvature of shoot towards light.

(iii) Auxin promotes root development ~~and~~ or new root formation.

Eg: $\rightarrow$ Stem cutting treated with auxin shows faster root formation.

*(iv) Auxin prevents fall of young leaves and fruits.



(v) It induces flowering in some plants like pineapple and Litchi.

(vi) Auxin application can be used for inducing parthenocarpy.

Ovary $\xrightarrow[\text{(without fertilization)}]{\text{Auxin spray}}$ fruit $\rightarrow$ NO seed.

(vii) Auxin promotes xylem differentiation.

(viii) It promotes growth mainly by

increasing cell size. (cell elongation)

ix) 2,4-D is used as a selective herbicide/weedicide. It highly increases activity of vascular Cambium insides roots of dicot. Due to which vascular bundles are Block and Broad Leaf or dicot weeds are killed.

(x) Agent orange :-
└ Mixture of 2,4-D & 2,4,5-T
└ high conc = Debilitation.
└ used by American Forces over vietnamese forests.

* Bioassay of Auxins

Bioassay is the qualitative and quantitative effect analysis of gonic compound in a Biological system.

└ Colopite curvature test in Avena is used as a standard bioassay of Auxin.

Gibberellin / gibberellic Acid :-

- ↳ Bakanae disease → foolish seedling disease in rice.
 - ↳ Excessive growth in rice seedlings & then they fall down.
- ↳ Kurosawa : This disease is due to a fungal infection by Gibberella fujikuroi.
 - ↳ First isolated gibberellin from extract of this Fungi.

→ Gibberellins are also weak organic acids and they belong to the category of terpenes.

→ Acetyl CoA acts as ^{starting compounds.} precursor for gibberellin synthesis.

→ Gibberellin synthesis occurs in young parts of shoot and in embryo.

→ Gibberellins are named as GA₁, GA₂, GA₃ -- and today more than 100 types of gibberellins are identified.

Most Common.

Physiological functions and usage:-

- (i) It promotes growth by cell elongation in Short.
- (ii) It increases plant height by internode elongation.

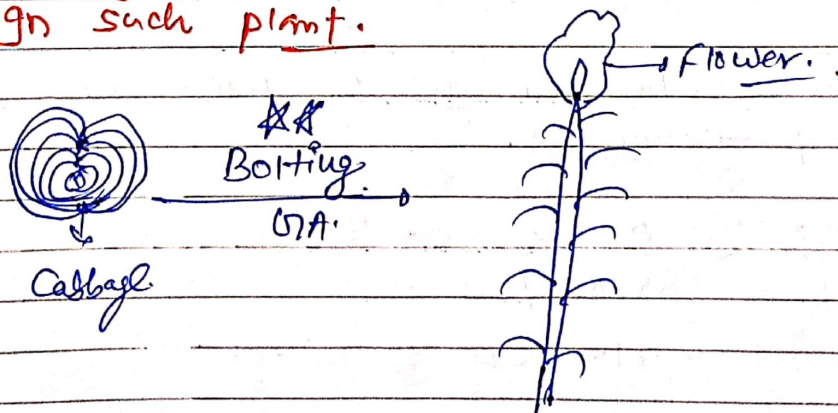
Dwarf pea $\xrightarrow{\text{GA}}$ Tall ~~Dwarf~~ pea plant.
↳ (No change in genotype)

- (iii) It can be used for increasing productivity of sugarcane.

- (iv) It can be used for increasing the size of grape Bunch.

- (v) Gibberlin is responsible for Bolting in rosette plants.
↳ (upward growth)
Eg: → spinach, Cabbage, Radish.

* Bolting is internode elongation before flowering in such plant.



(6) GA promotes seed germination or helps to break seed-dormancy by activating α -amylase, proteases and Lipases. These enzymes digest stored food in seed.

(7) Starch $\xrightarrow[\text{activation by GA}]{\text{maltin. } \alpha\text{-amylase}}$ Maltose.
Used in Brewing, or alcohol products industry.

(8) GA helps to delay the fall or abscission of mature fruits.

(9) Hastes : seed formation in conifers.
(makes fast)

(10) Pomalin = GA + cytokinin.
Increase fruit size.

(11) Gibberellin can also be used for inducing parthenocarpy.

Bioassay of Gibberellin : $\rightarrow$

$\rightarrow$ Dwarf pea test.

$\rightarrow$ Barley endosperm test.

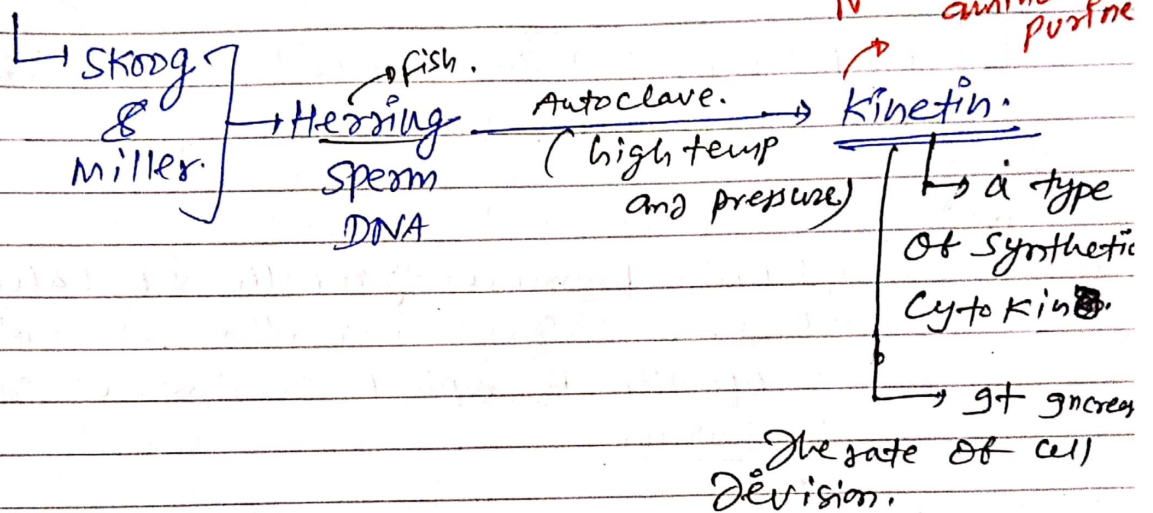
$\rightarrow$ related to the effect of GA.

Over breakdown of stored food in endosperm.

* Cytokinin :-

Cytokinins are the derivatives of adenine.
(N-Base).
and thus cytokinins are chemically
Basic.

→ cytokinin synthesis occurs in all young
parts of plant; max^m synthesis in
root apex.



* zeatin was the 1st natural cytokinin
isolated from Corn Kernel [maize = Zea mays]
(Z. mays)

* Physiological Functions and Usages :-

- (i.) it increases growth by promoting cell divisi.
- (ii.) cytokinin and Auxin together control
plant morphogenesis that is organ develop-
ment in plants.

Auxin and shoot start to grow and
But still shoot off and finally

Cytokinin $\uparrow$ + Auxin $\downarrow$ $\rightarrow$ Shoot formation/
development.

Cytokinin $\downarrow$ + Auxin $\uparrow$ $\rightarrow$ Root formation/development.

in Embryo development and
also used in tissue culture.

$\rightarrow$ BAP [Benzyl Amino purine] is commonly
used cytokinine in Laboratory.

19/Nov/2019.

$\rightarrow$ Cytokinin promotes growth of lateral
buds. and this formation is antagonistic
or opposite to apical dominance caused
by auxin.

$\Rightarrow$ Cytokinin is responsible for delay in
senescence by mobilising nutrients or
food, towards old part of plants.
this role is called. * Richmond-Lang effect *

NOTE:- Auxin and gibberellin also show delay in
senescence but ^{not prebance} cytokinin is the main
plant hormone related to this function.

Cytokinin application is used for increasing
the self-life of cut flowers and
vegetables. i.e. their degradation become
slow.

- It increases leaf size and also increases number of chloroplast inside leaf cells.
- Cytokinin and auxin are used for developing plantlets from callus in laboratory.

Bioassay of cytokinin

- ↳ Tobacco pith culture test.
- ↳ Cytokinin increases the rate of cell division by promoting cytokinesis.
- ↳ Cytokinins help in improving immune system in animals and coconut milk is rich source of cytokinin.

Ethylene.

- It is a gaseous plant hormone and thus it can diffuse from one plant to another plant.
- It is mainly synthesised in senescent parts of plant, maxm synthesis in ripening fruits.
- Methionine Amino acid acts as precursor for its biosynthesis.

* Physiological functions and usage:-v.

- (i) In most plants fruit ripening is carried out by ethylene, under such condition rate of respiration is increased and this called *climacteric or climactic respiration*,
NEET 2018.

Note:- Non-climacteric fruits: $\rightarrow$ Ethylene NOT responsible for ripening. Eg: $\rightarrow$ grapes.

☺ (Corgut out do the corgut is done it)

- (ii) Ethephon:- is a chemical compounds which breakdown to release ethylene and it is used for fruit ripening.

- (iii) Ethylene promotes root growth and formation of (new root hairs.)

- (iv) It helps to increase surface area for water absorption.

- (v) Ethylene promotes internode elongation and petiole elongation in deep-water rice. It helps in better survival of plant.

* In rice internode elongation $\rightarrow$ gibberellin.

* In rice $\rightarrow$ Ethylene.

- (vi) Ethylene promotes together synchronised flower formation in pineapple and mango.

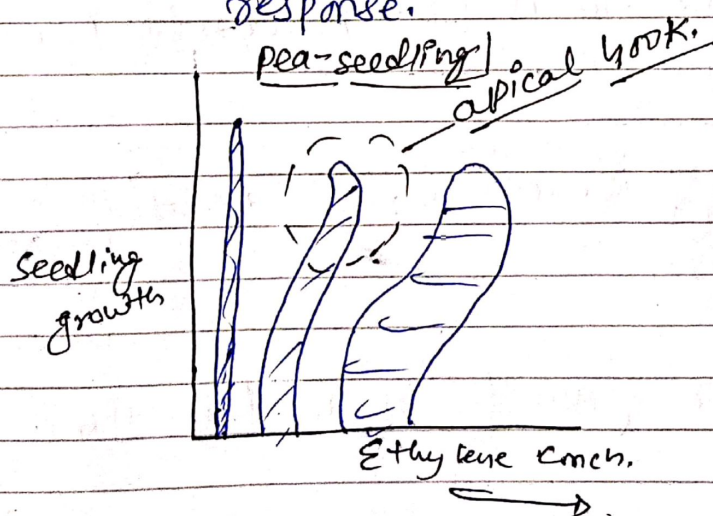
→ It helps to break dormancy in peanut seed and potato tubers i.e their germination is promoted.

* → It is responsible for thinning in cotton, Cherry and walnut. This function is related to maturation and separation of their fruits.

→ Ethylene promotes senescence and abscission in old plant parts.
 Yellowing and then dropping of leaves.

→ Ethylene inhibits vertical growth of stem, promotes horizontal growth of stem and also increases girth or thickness of stem.

These 3 effects are together called triple response.



→ these 3 responses help growing seedling to By-pass any hard ~~inside~~ object in soil.

→ Ethylene increases no. of female flowers in cucurbits, and it helps to increase productivity.

Bioassay of ethylene.

* Triple response test.

Abscissic Acid (ABA)

→ Initially identified as: →

Dormin,
Inhibitor-B
&
Abscission-II

→ Later found that these 3 compo are same → they named as Abscissic Acid.

→ violaxanthin is the precursor for ABA synthesis.

violaxanthin $\xrightarrow{\text{oxi}}$ Carotene $\xrightarrow{\text{oxi}}$ ABA] inside Chloroplast in Leaves.

→ It is major growth inhibitor in plants.

* Physiological functions:-

(i) GA induces closing of stomata under water stress or scarcity.

(ii) GA decreases rate of metabolism in case of nutrient stress or food scarcity.

Notes:-

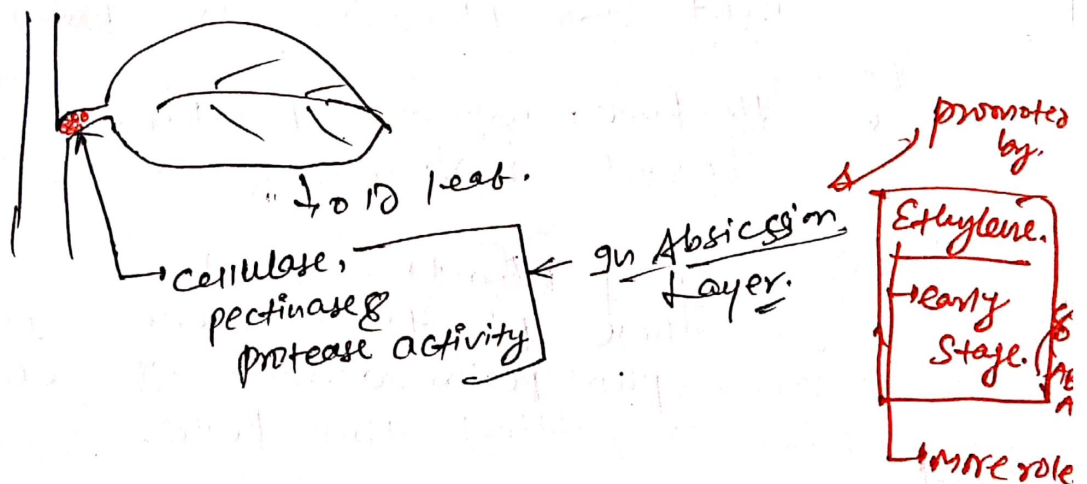
on the basis of above functions ABA is regarded as stress hormone in plants.

✓*

(iii) GA causes dormancy in buds and seed.
Seed dormancy helps to provide time period for embryo maturation.

(iv) ABA functions are antagonistic to GA.
Eg: → seed germination.

(v) GA promotes senescence and abscission in old parts of plant.



Photoperiodism → Phenomenon of Effect of duration of light or photoperiod over flowering in plants. This term was given by Warner & Allard.

↳ Photoperiodism was first study in a mutant variety of tobacco.

a) Long-day plant (LDPs) : →

In these plants flowering is induced when photoperiod is longer than a critical duration.

↳ Critical photoperiod is variable for different species.

↳ If their night period is interrupted by light then flowering is promoted.

Eg:- Henbane, wheat, Barley, cabbage, Spinach, radish.

b) Short day plants (SDPs)

In these plants flowering is induced when photoperiod duration is shorter than a critical time period.

→ Critical time period of light is variable.

→ If their night period is interrupted by light then flowering is inhibited.

i.e. New flowers are not form.

* SDP are Technically Long night plant as night period is critical for flowering in these plants.

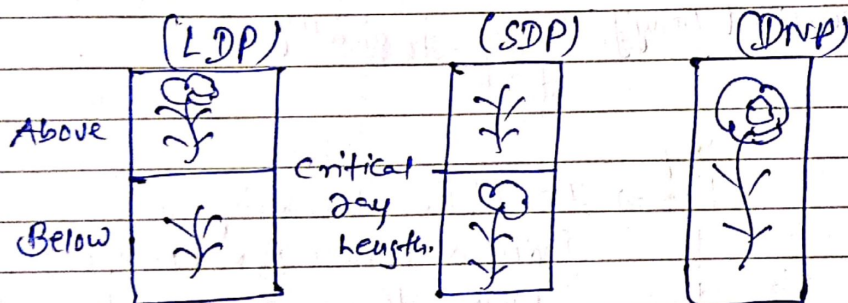
Eg: → Sugarcane, Dahlia, Tobacco, Cosmos,

Chrysanthemum, Rice.

* DNP (Day neutral plant)

In these plants flowering is induced when vegetative phase is completed and it is not dependent upon duration of light.

Eg: → Tomato, cucumber, Cotton, Sunflower.



* phytochrome : → It is a proteinaceous pigment present in leaves and it is responsible for receiving stimulus for photoperiodism.
[NEET-2019]

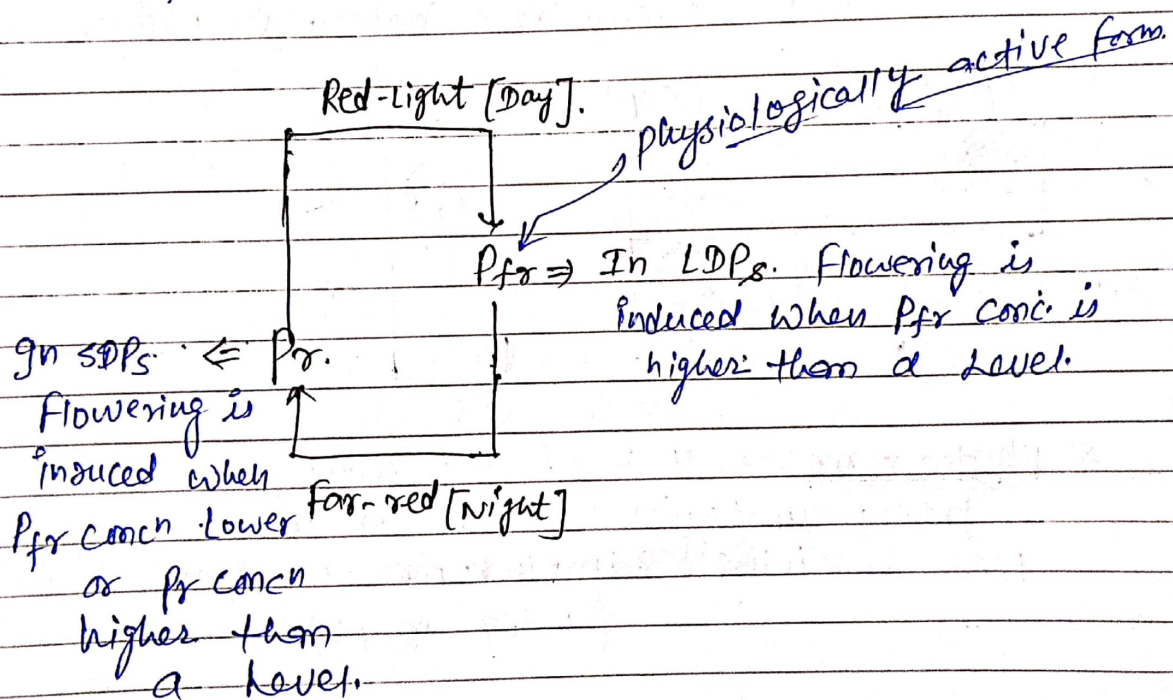
* → If all leaves are removed then flowering is inhibited in LDP's and HDP But not in DRP's.

→ Phytochrome is found in 2 forms which are interconvertible

⇒ P_r = absorbs red-light (660 nm)

max at red than slightly lower than
* nearest and lowest

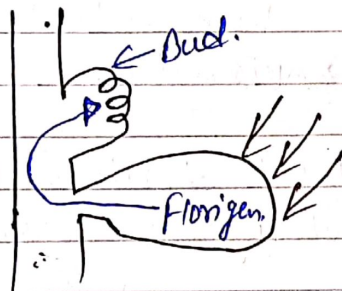
* P_{fr} → absorbs far-red light (730 nm)



* Relative amount of Pr and Pfr help to determine the duration of day and night time thus these concn act as a Biological clock.

→ This Biological clock also helps to regulate opening and closing of stomata.

→ florigen is a hypothetical hormone which carries message for flowering from leaves to Buds.



* In a LDP red light must be present for inducing flowering or generating the message for flowering.

* In SDP far red light must be present for generating the message for flowering.

→ $R + FR + R \rightarrow$ Flowering : LDP

→ $R + FR + R \rightarrow$ No " : SDP

→ $R + \underline{FR} \rightarrow$ flowering : SDP.

Inhibit → रोकना

Q:- In a plant Flowering is induced when 11 hr photoperiod is provided, but flowering is inhibited at 10 hr photoperiod then this plant must be

Ans: → LDP. ✓

Q:- In A plant flowering is induced by 13 hr photoperiod but inhibited by 13.5 hr then this plant must be:-

Ans: → SDP.

Vernalisation / yarovization:-

It is the low temp treatment required for inducing flowering in some plants.

↳ requirement.

- ↳ Low temp = $0 - 10^{\circ}\text{C}$.
- ↳ aerobic condition.
- ↳ good moisture.
- ↳ Low temp duration = variable.

* Vernalization $\left\{ \begin{array}{l} \text{Natural} \rightarrow \text{By winter season.} \\ \text{Artificial} \rightarrow \text{Cold treatment to seeds or other plant propagules.} \end{array} \right.$

$\Rightarrow$ Low temp treatment stimulus is received by meristems including embryo.

Wheat $\left\{ \begin{array}{l} \text{winter varieties} \rightarrow \text{Naturally vernalised by winter season.} \\ \text{Eg grown in summer season then seeds must be artificially vernalised.} \end{array} \right.$ Life cycle of wheat (C3) is C3.

Spring/Summer varieties $\rightarrow$

Vernalisation not required.

* In some Biennial plants Two Cold treatments are necessary for inducing flowering.

Eg: Cabbage, radish, Beet root.

Eg: Cabbage seed $\xrightarrow[\text{1st winter}]{\text{1st year}}$ Spring $\xrightarrow[\text{2nd winter}]{\text{2nd year}}$ Spring
Sowing in Oct. $\rightarrow$ NO Flowering $\rightarrow$ flowering

Eg: 1. Cabbage seeds artificially vernalised.

1st year	→ Spring
Winter	↓
2nd year	Flowering

1st cold.

Artificial + Natural Vernalisation.

* Under natural condition vernalisation prevents precocious (लघुमय से पहले) reproductive development.

- * Application of Artificial vernalisation helps to induce early flowering.

* Vernalisation affects both Quantity and Quality of Flowers.

* Vernalin is the hypothetical hormone produced by cold treatment.

Application of ribberetin can be used as an alternative of vernalisation.

Plant movements:-

* Tropic movements → curvature due to growth.

- phototropism: → due to Light.
- Chemotropism → eg: → pollen tube growth, affected by chemicals.
- Thigmotropism → due to touch.
↳ tendrils.

* Tactic movement: → due to locomotion.

- phototactic → Euglena.
- Chemotactic → Amoeboids.

* Nastic movements: →

- Stimulus does not determine direction.
- Hyponasty: → More growth on lower surface.
↳ eg: → closing of buds.
- epinasty: → More growth on upper surface.
↳ eg: → opening of buds.
- Seismonasty: → dropping of leaves
(in Mimosa pudica).
↳ decrease in TP in leaf base.

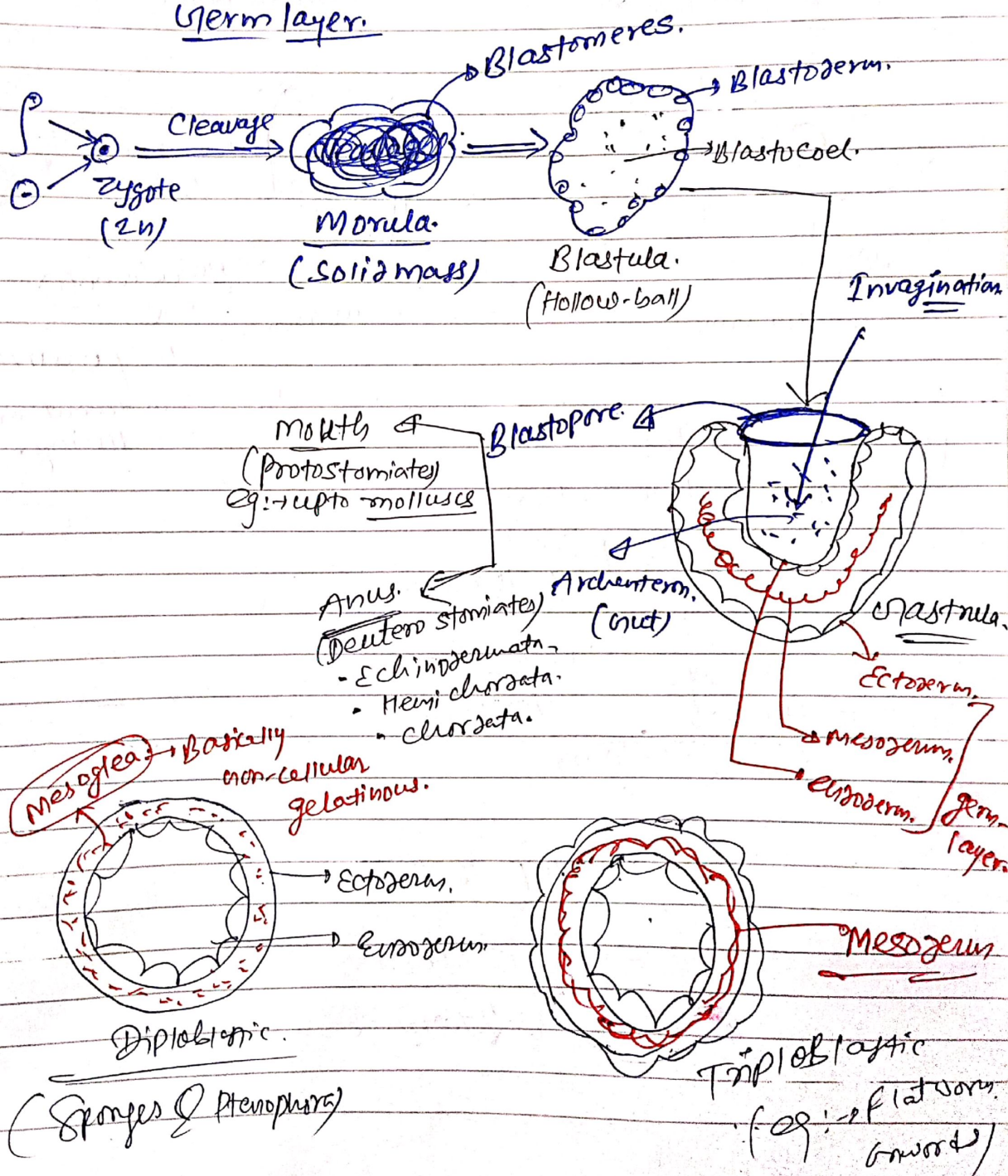
NEET KOTA JUANAD

Animal-Kingdom.

symmetry in
Symmetry → Asymmetry

* In general sponges are asymmetric.

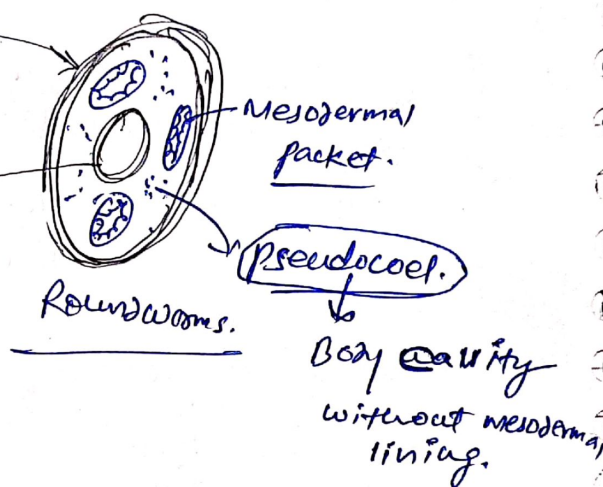
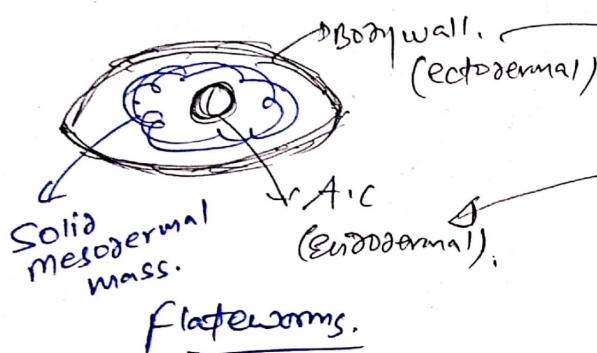
Germ layer.



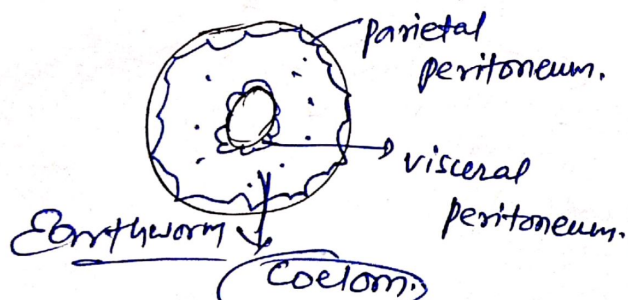
Body cavity or coelom. (Coelom = Body cavity + mesodermal epithelium (peritoneum))

(A) Acoelomate.
↓ without body cavity or coelom.
eg: → upto platyhelminthes.

(B) Pseudocoelomate.
(with false coelom)
eg: → nematodes.



(C) Coelomates.
(with true coelom)



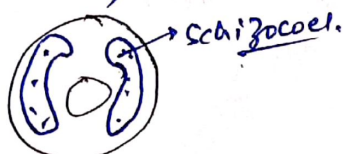
Coelomic fluid
↓
Shock absorber.
Actg as hydrostatic skeleton.

Types of Coelom.

Splitting

Schizocoel.

Coelom formed by
splitting of mesodermal
mass.



Arthropoda
Annelida
Mollusca.

fusion
Enterocoel.

formed by fusion
of gut or mesodermal
pouch.

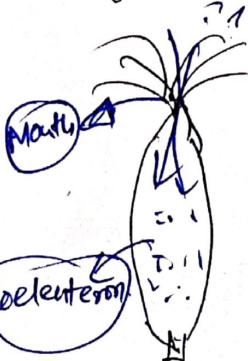


E.M.C

(5) Types of body plan (Body form)

(A) Cell aggregate
type

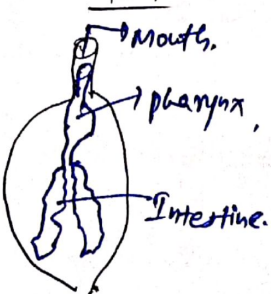
eg: + (sponges)



Coelenterata to Platyworms.

(B) Blind sac
type.

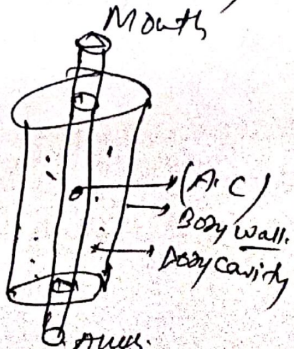
incomplete
digestive
tract



(C) Tube within Tube.

Complete digestive
tract.

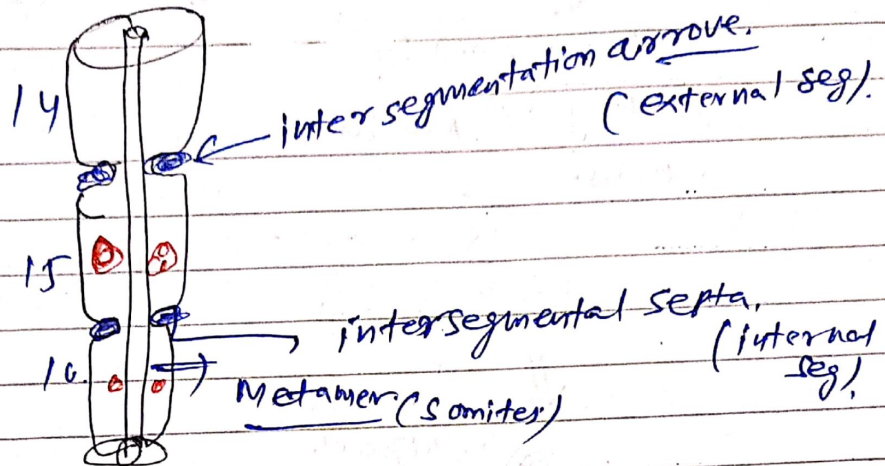
(Nematodes
onwards)



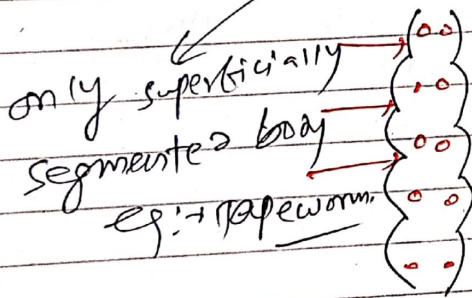
Segmentation.

- (A) metameric seg : →
- Annelida.
 - Arthropoda.
 - Chordata.

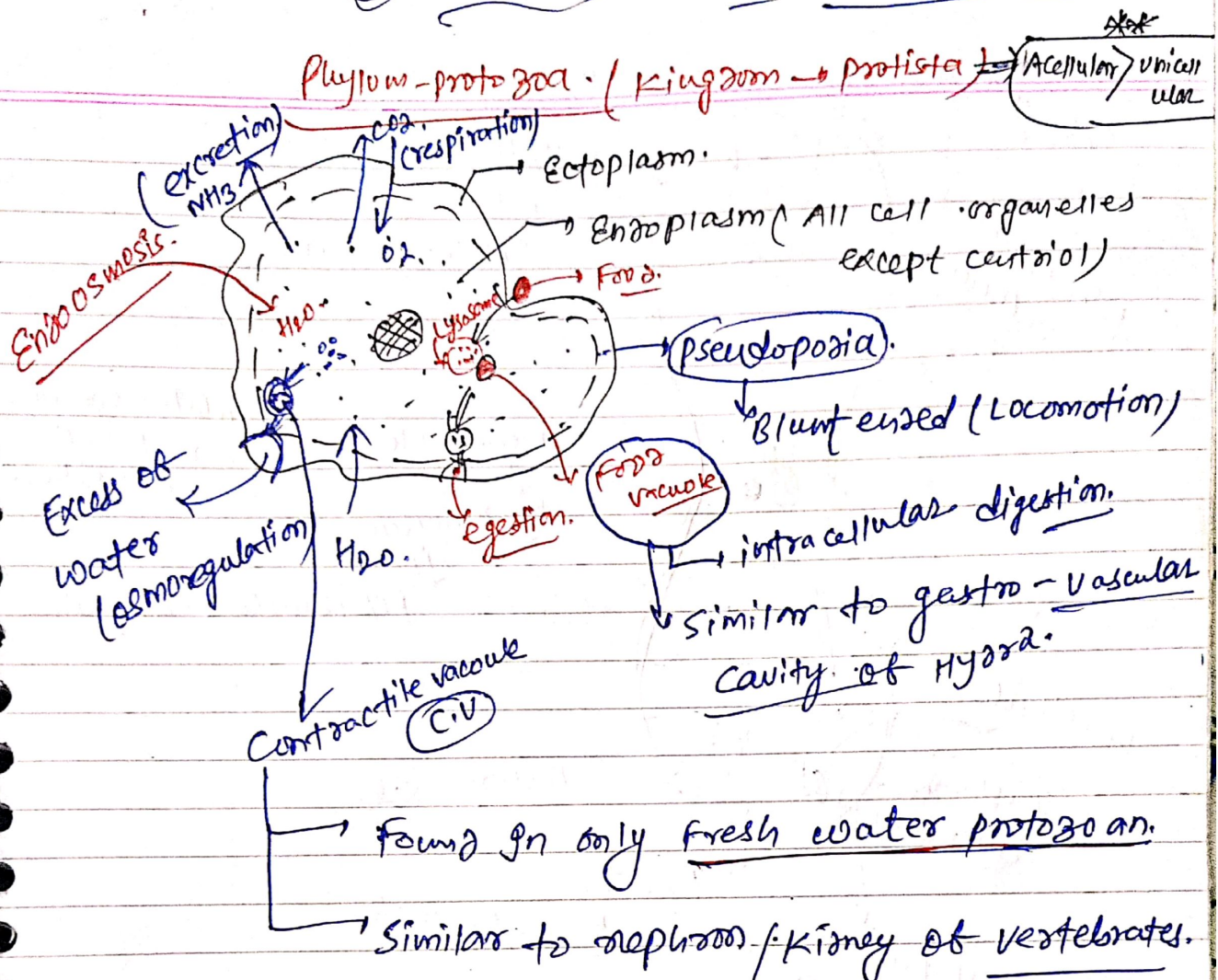
Text: SSA → 1
origin & Evolution.
seg → immunity
(cell div) Animal
tissue



- (B) Pseudometameric
(false) eg: → tapeworm.



④ Excretory system in platyhelminthes

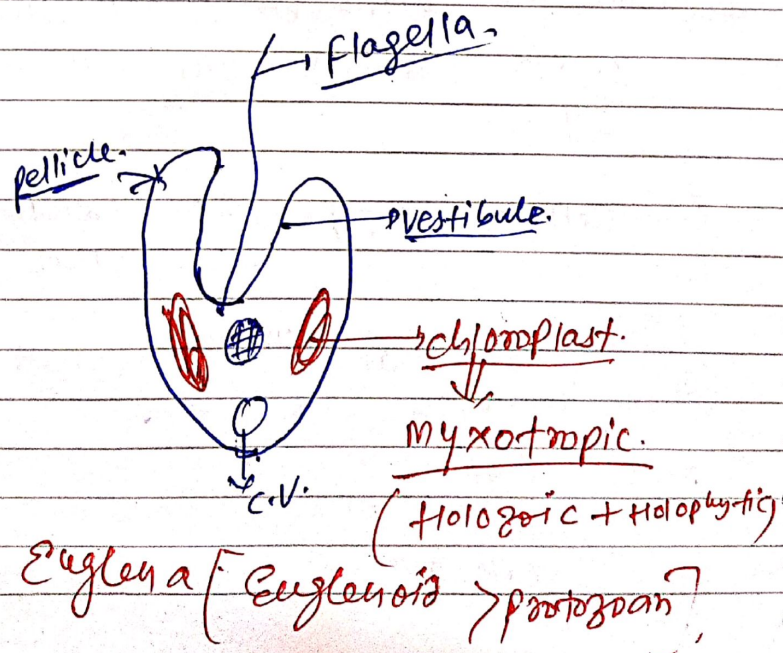
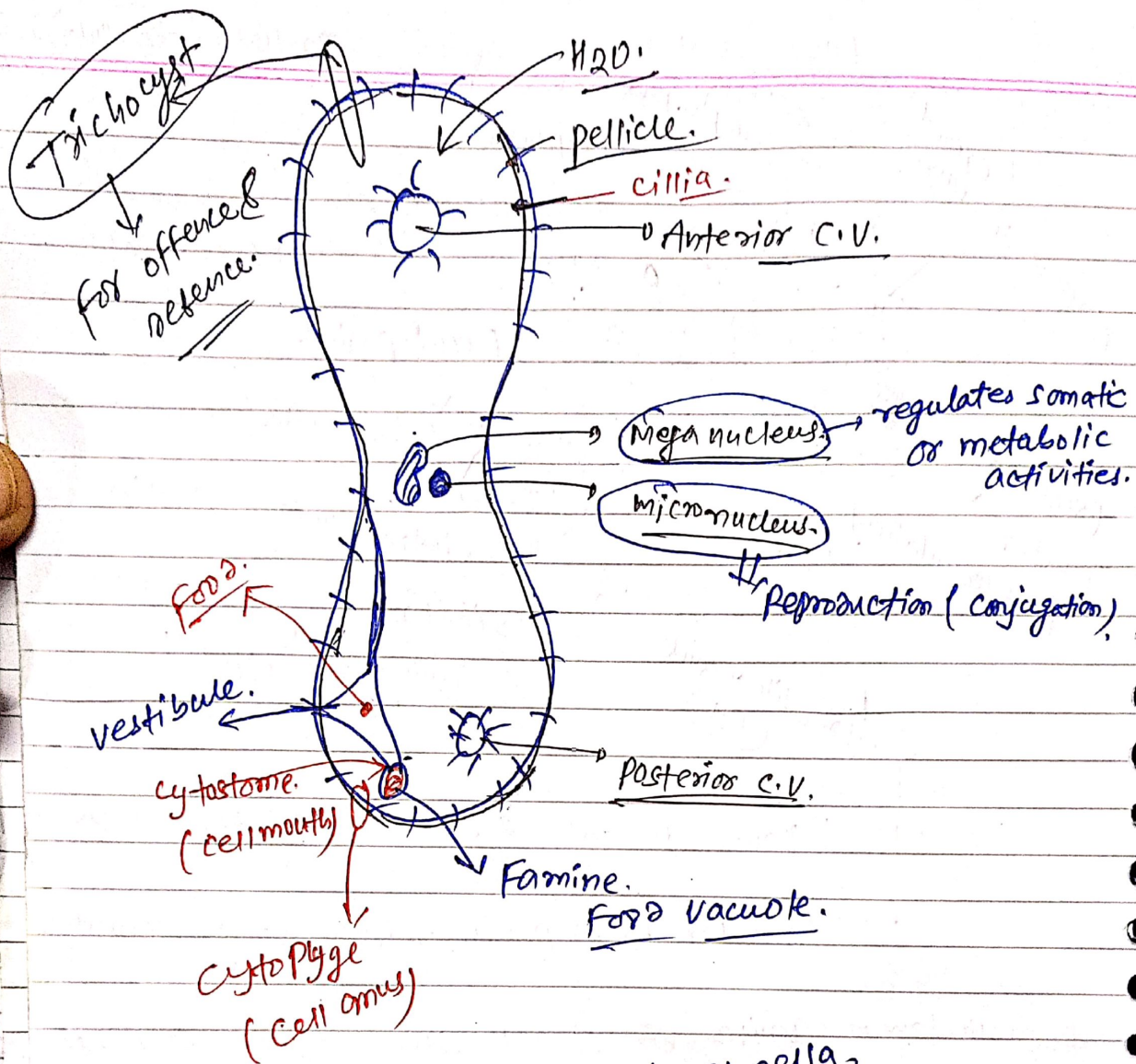


* Acellular → अकोशिका एका ही cell शरीर function कर रहा है।
जहाँ normally एक cell एक ही function करता है।

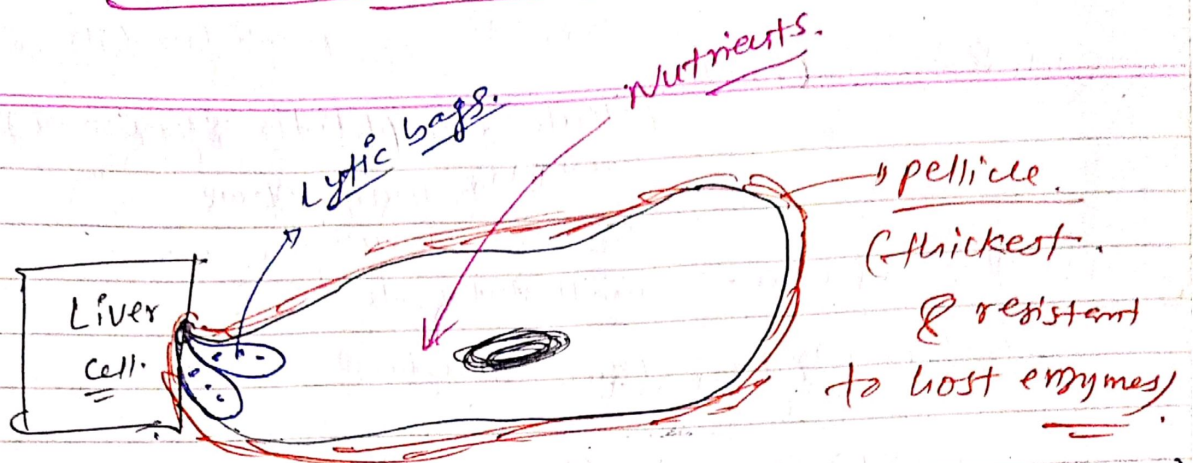
* Cell are independent exist- one ही होने में।
ment.

* Amoeba cell और distilled hypo Normal Hyper
cell are water potential में → disti > hypo > N > hyper.

8-10 AM
1st



* Name of disease = pathogen + iasis.



Sporozoite. (infective stage of Plasmodium)

[Protozoa] → Basis of locomotory organelles. Better adapted toward <u>parasitic</u>			
(1) Mastigophora. or Flagellata.	(2) Sarcodina.	(3) Ciliata.	(4) <u>Sporozoa</u> <u>more</u>
Free living & parasitic	Free living & parasitic	Free living & parasitic	Exclusively parasitic
* Flagellates.	→ pseudopodia	cilia.	<u>absent</u> .
* pellicle + nt	absent.	← 'present' →	
← Asexual rep. by binary fission.	← Asexual rep. by binary fission.	← Asexual rep. by binary fission.	Multiple fission.
← sex rep. absent.	← sex rep. absent.	← By conjugation.	← By Syngamy.

* Name of disease = most affected organ + itis.

encephalitis = hepatitis, ~~encephalitis~~ Bronchitis, meningitis.
(acute encephalitis syndrome)
↳ (चमकी बुखार
दिमागी)

Diarrhoea → small intestine.

Dysentery → large intestine.

① mastigophora.

eg. → ① Euglena → myxotrophic.

② Leishmania → Digenetic parasite.

Human
(1st host)

Kala-azar.

or
Leish-
mania
sis.

Small Fly
(carrier)

② Trypanosoma

Digenetic.

Human

African
Sleeping
Sickness.
or

Tsetse fly
(carrier)

Trypano-
somasis.

④ Giardia intestinalis.

↳ monogenetic - (Small intestine of human)
↳ Giardiasis or Diarrhoea.

↳ Infectⁿ by Contaminated H₂O.

⑤ Trichomonas vaginalis.

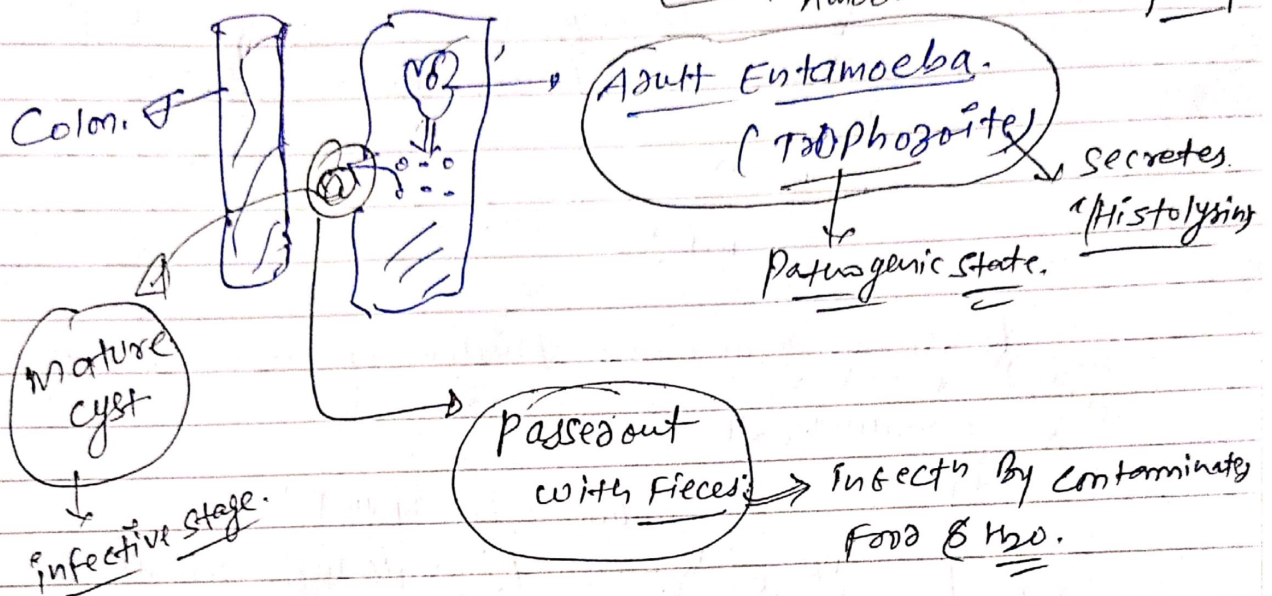
↳ monogenetic.

↳ Trichomoniasis or vaginitis or
Leucorrhoea Disease (STD)

(2) Sarcodina.

eg:- (1) Amoeba - "fresh water.
(2) Entamoeba histolytica.

↳ Monogenetic
↳ Amoebiasis or Amoebic dysentery.



(3) Ciliata.

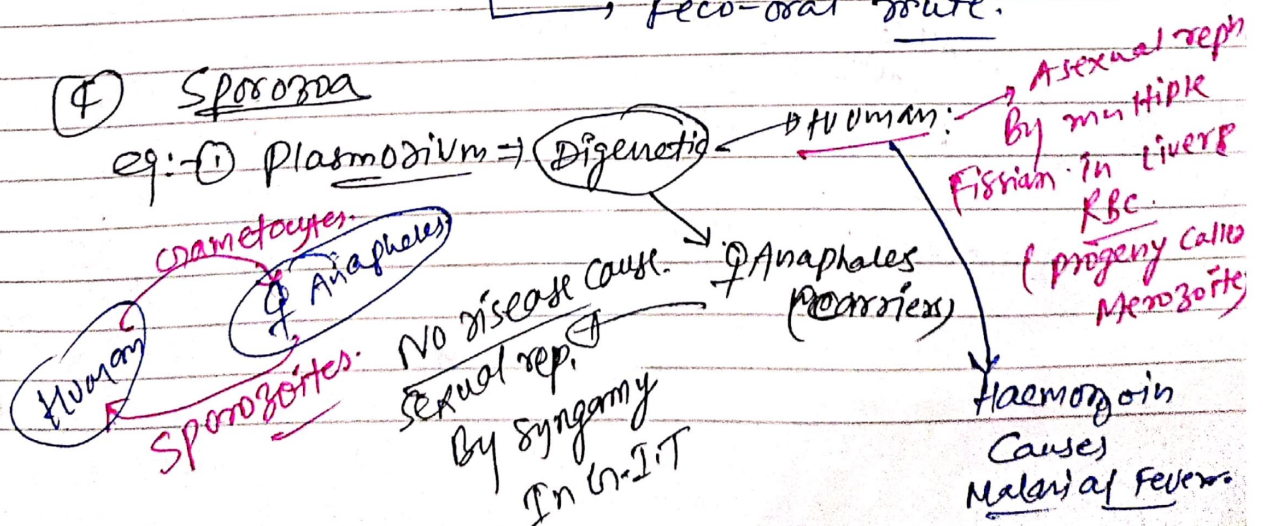
eg:- (1) Paramecium (Slipper animalcule).

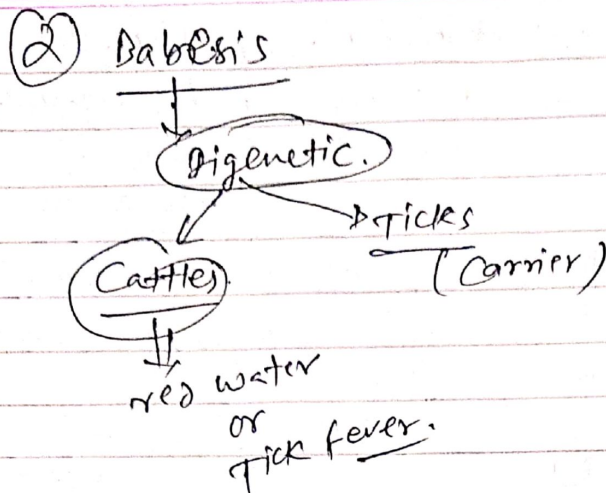
(2) Balantidium coli

↳ colon
↳ Balantidial dysentery.
↳ feco-oral route.

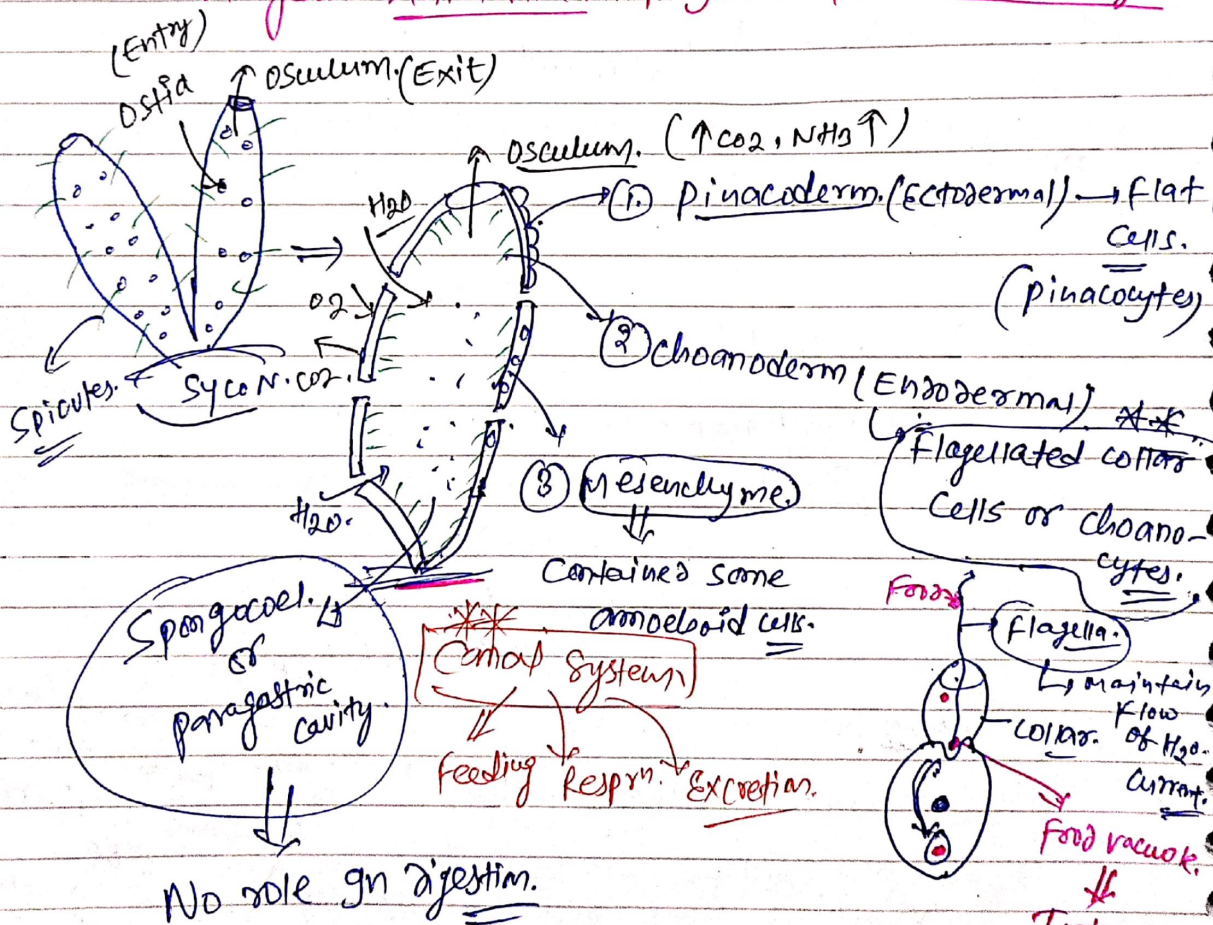
(4) Sporozoa

eg:- (1) Plasmodium ⇒ Digenetic

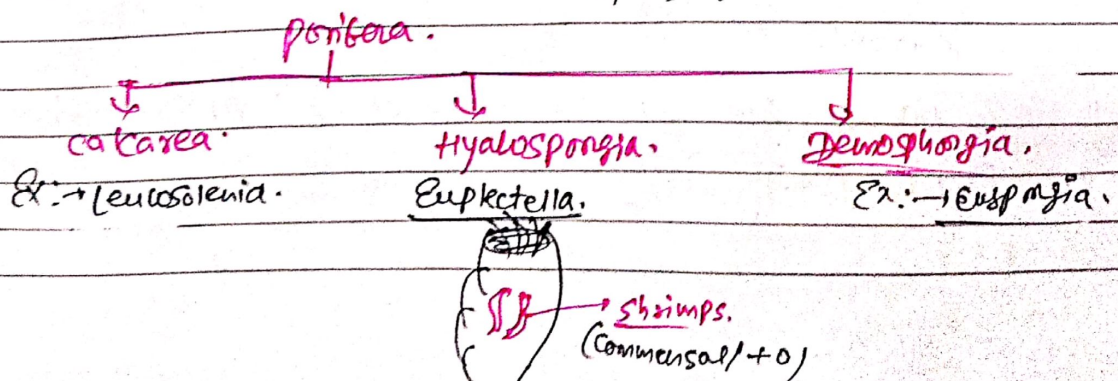
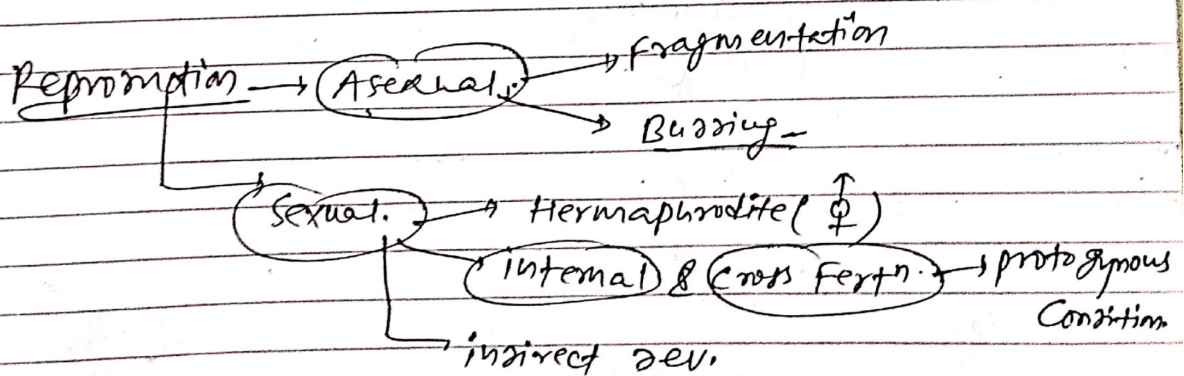
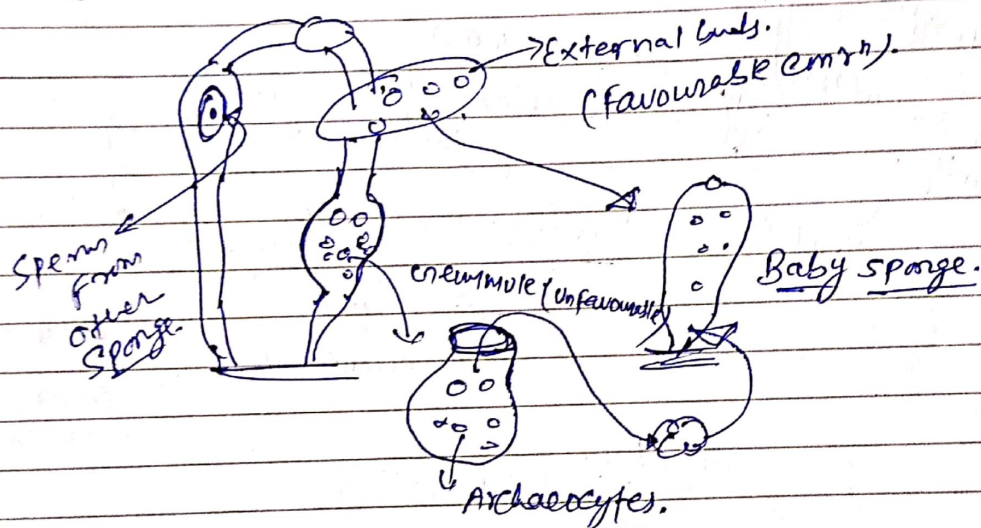


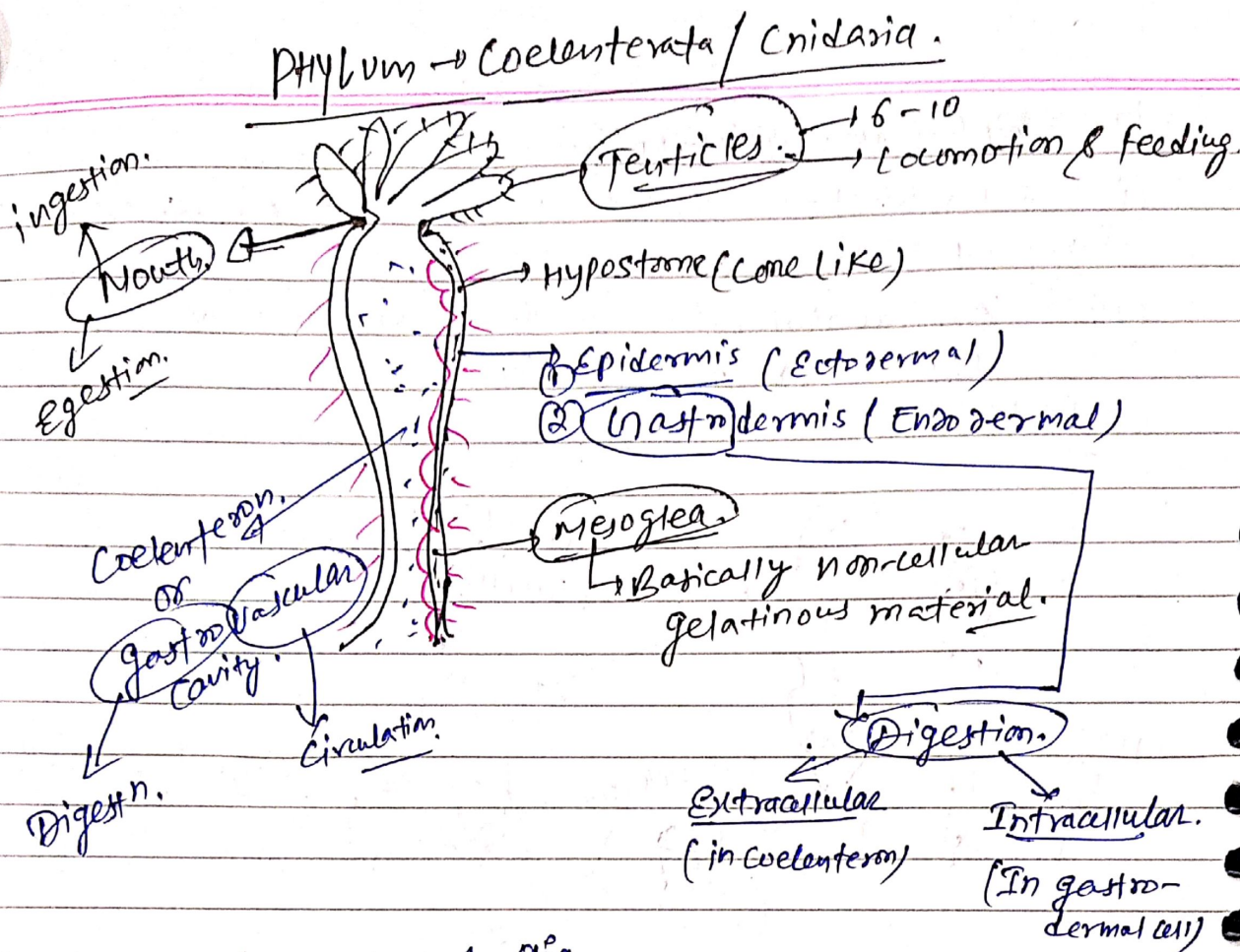


Kingdom - Animalia - phylum - porifera - sponges.

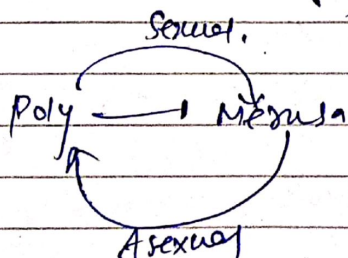
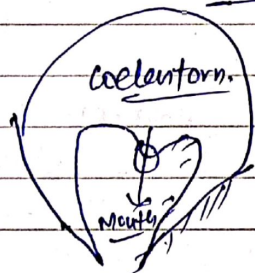


- (i) Trophoblast $\Rightarrow$ Distribution of nutrients.
(ii) Scleroblast $\Rightarrow$ skeleton formation (spicules or spongin fibres).
(iii) Archaeocytes $\rightarrow$ canete formation and high power of regeneration.
(Totipotent)

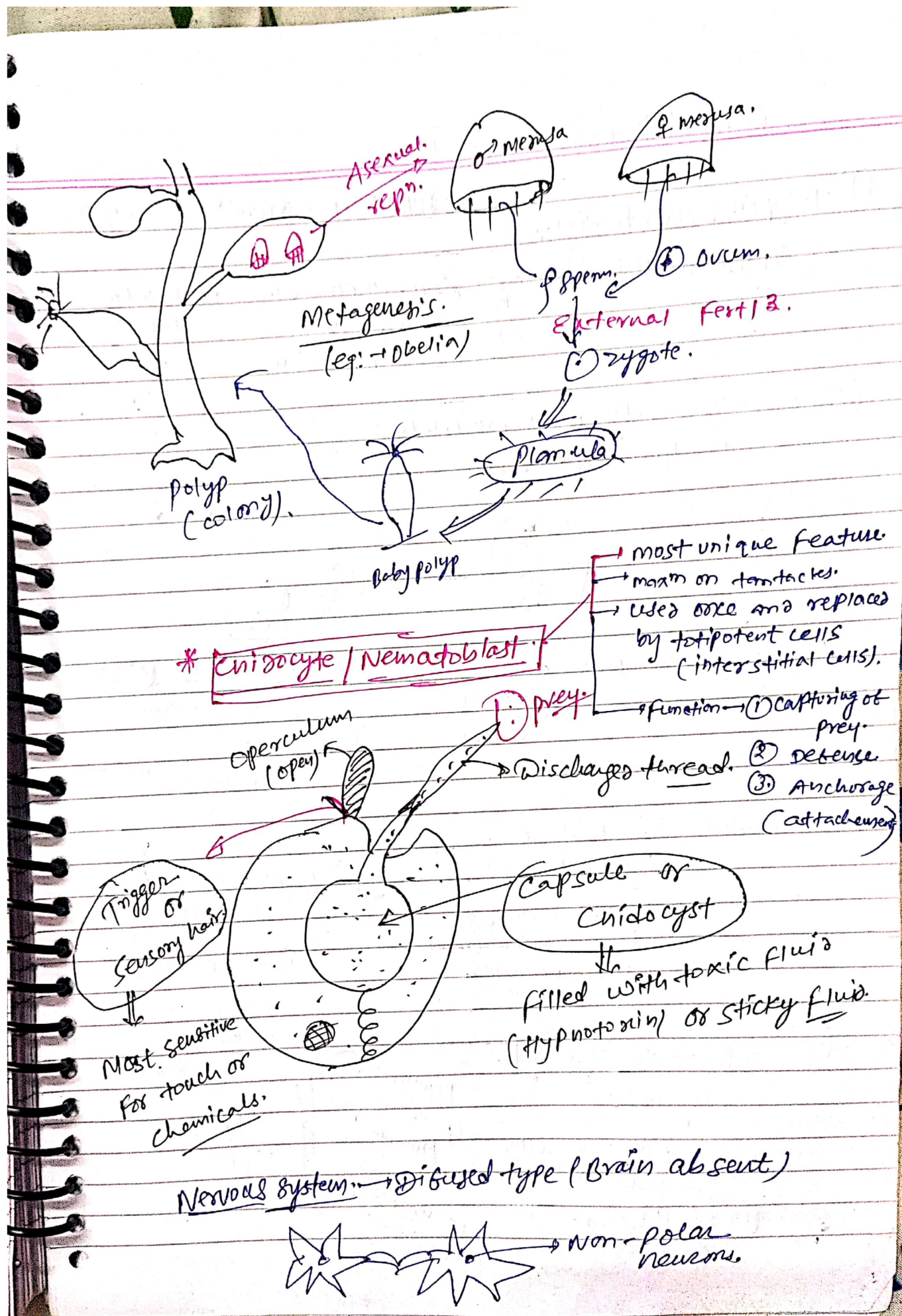




Aurelia (Jelly fish)

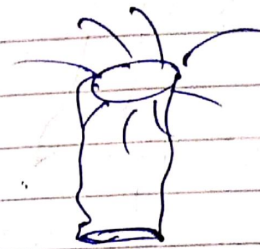


Aurelia में दोनो form चलना है लेकिन ये
बैदा 1 बार में 1 ही होगा कोई /

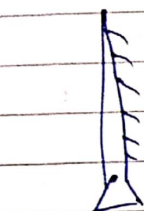


Classification: (3 classes)

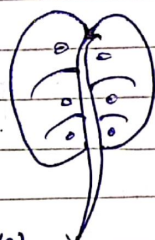
- (A) Polypoid coelenterates.
(mesusa absent)
- ① Hydra (fresh water Polyp.)
 - ② Sea-anemones. (Exoskeleton absent)
 - Anemone
 - Metridium.



- (B) Corals (Calcareous exoskeleton)
Death → Coral reefs.



(i) Pennatulid (sea pen)



(ii) Gorgonia
(Sea fan)

(iii)



Meandrina.
(Brain coral)

(iv)

Corallium
or Monga (Red-Coral)

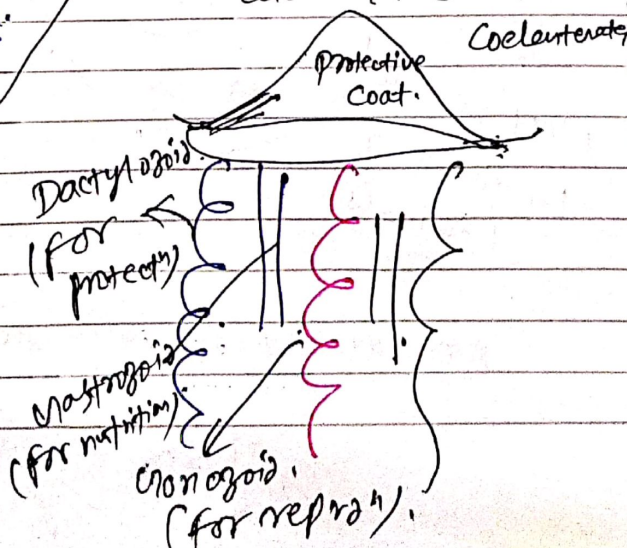
- (B) Medusoid coelenterates.
(Polyp absent)
eg: → Aurelia (Jelly fish)
↓
thickest Mesoglea.

(2)

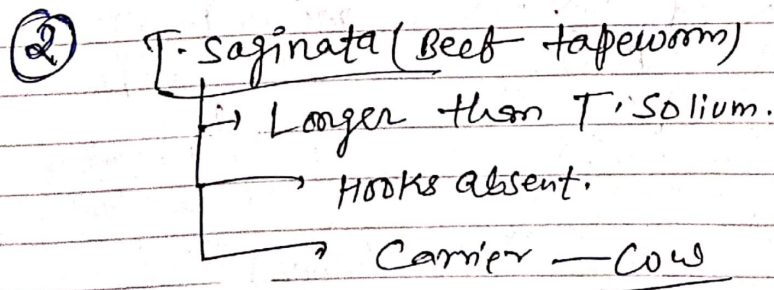
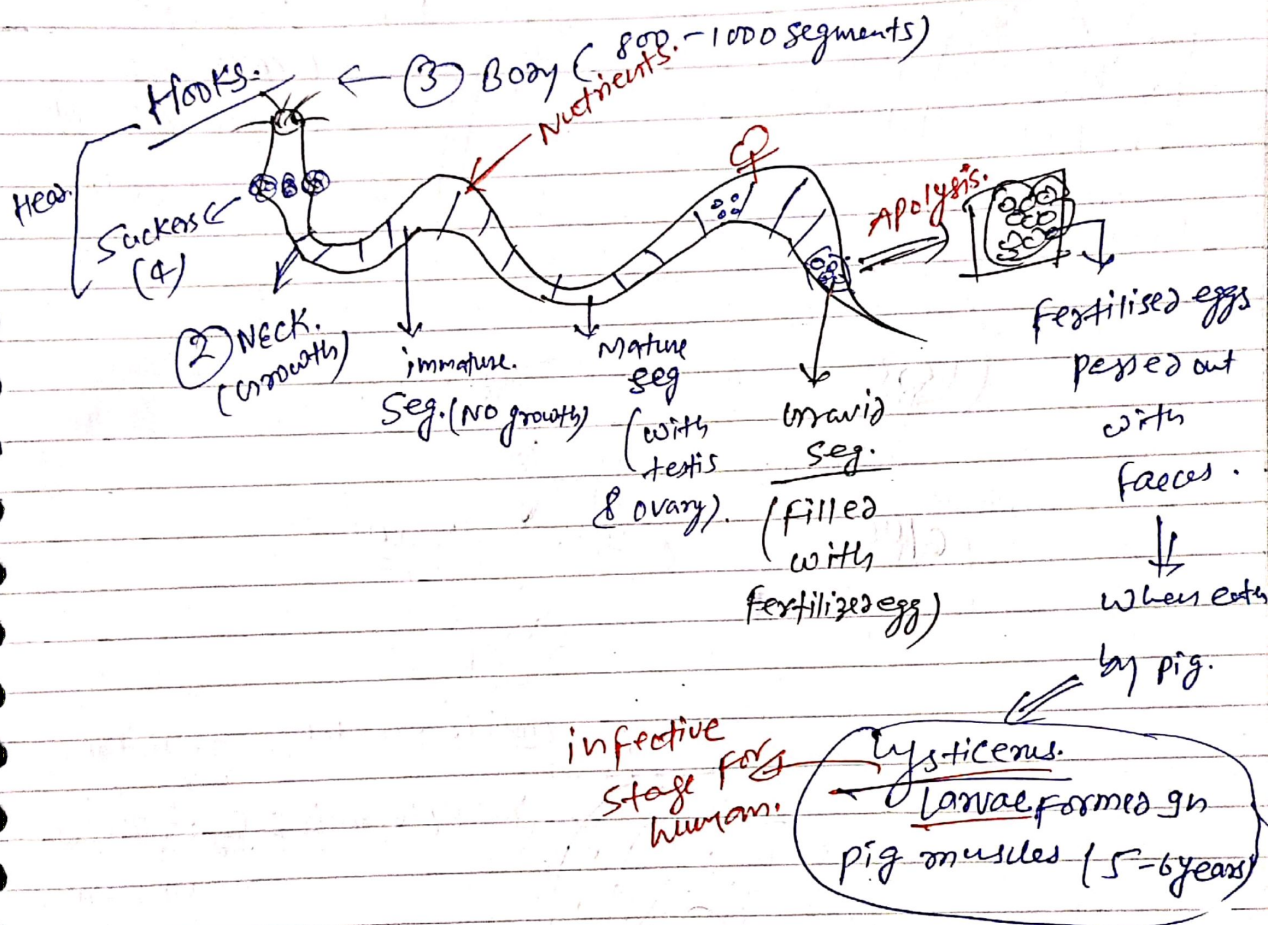
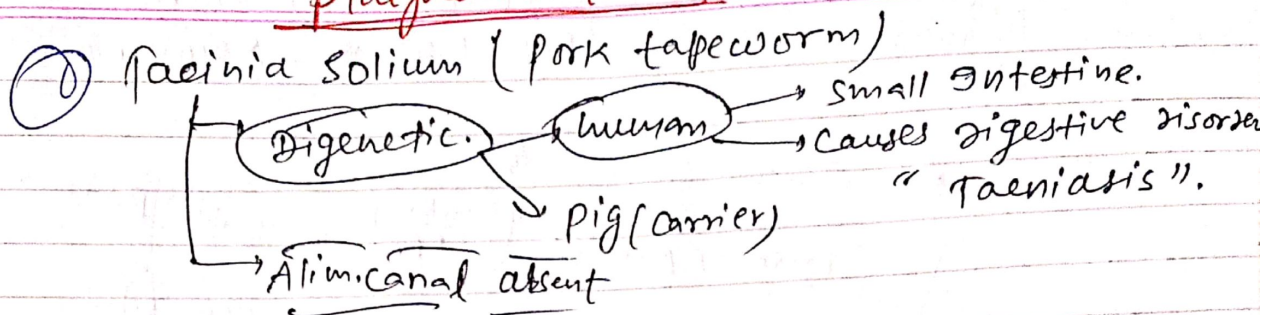
Physalia
(Portuguese man of war)
Colonial & polymorphic
Coelenterate.

- (C) Coelenterates showing Metagenesis.
(Both forms equally dominant)

eg: → ① Obelia (sea fan)
Colonial & marine
Coelenterates.



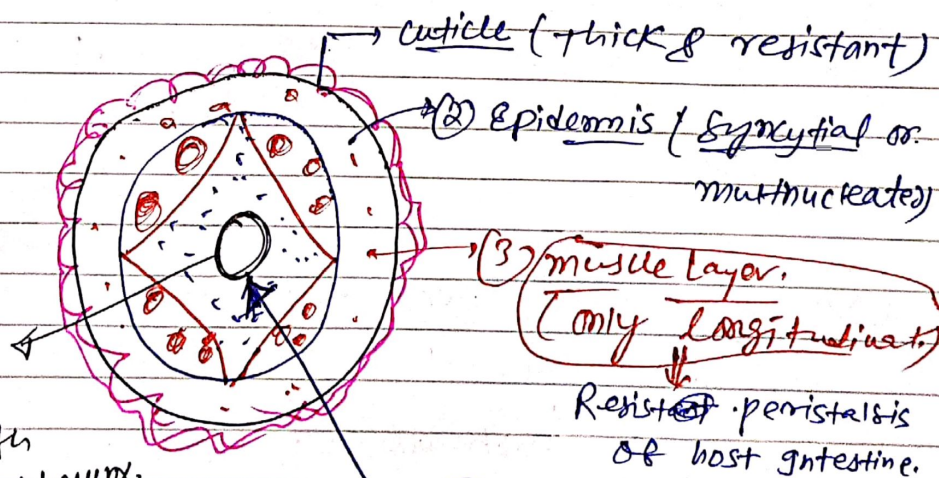
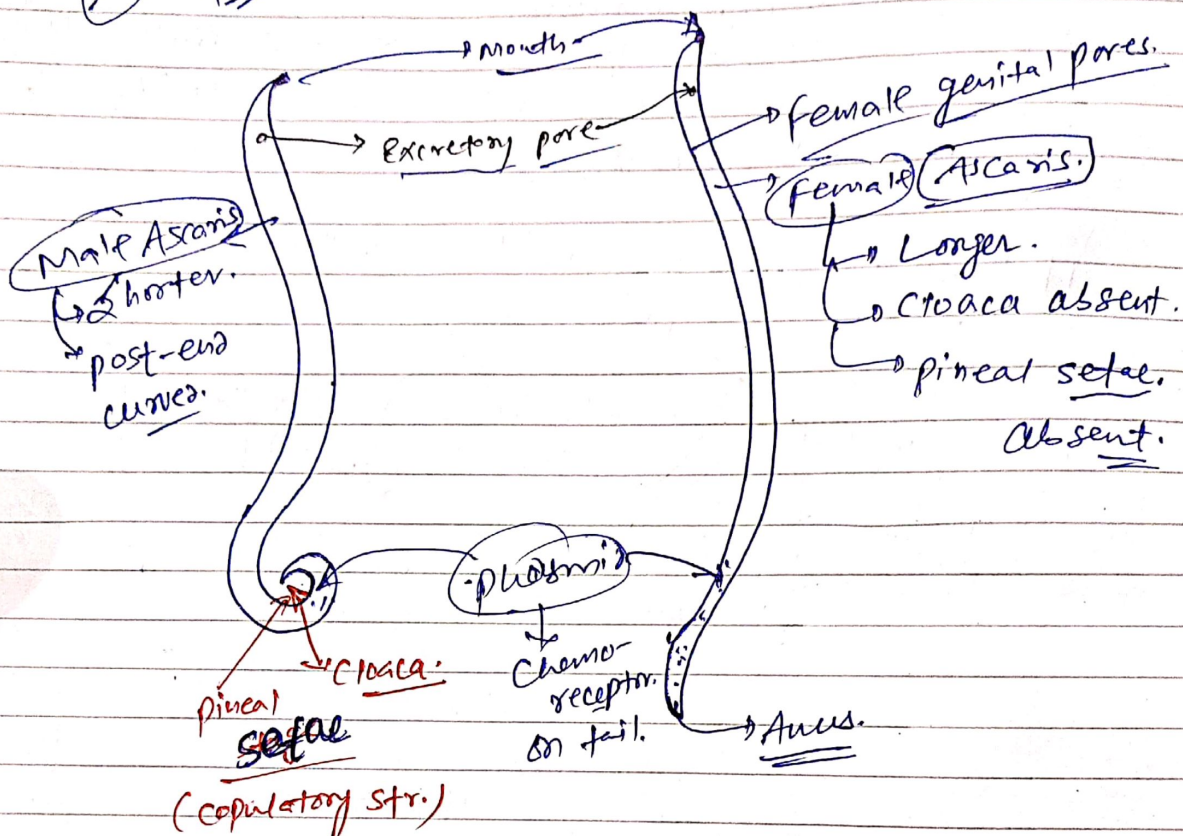
Platyhelminthes.



Roundworm
mollusc } Flatworm.
 } arthropod body wall & muscles develop good.

PHYLUM → Aschelminthes (or) Nematohelminthes
(Nematodes) (or) Roundworms

clitellous
teeth.



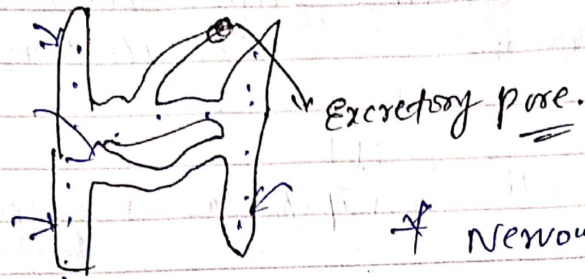
Complete with
muscular pharynx.
(for sucking liquid food).

Tube within tube body plan.

Pseudocoel

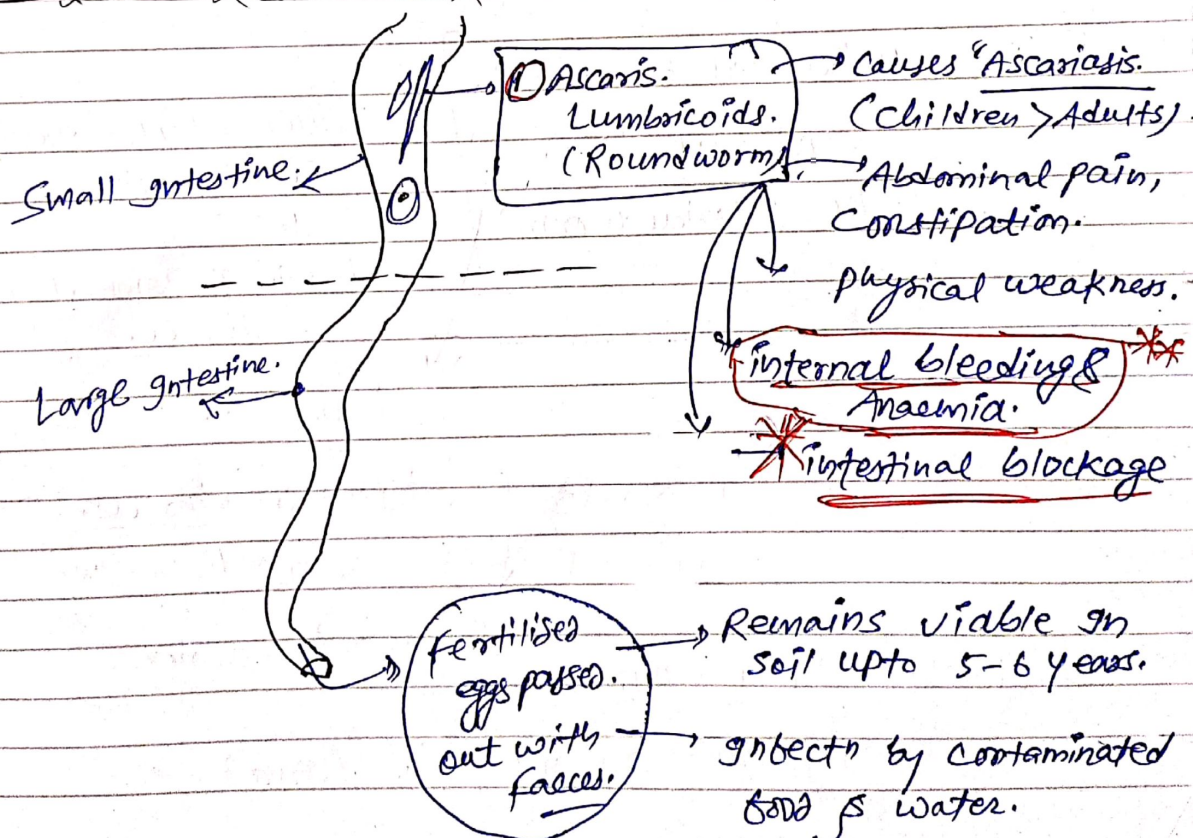
Body cavity without mesoderm lining.

* Excretory system :- H-shaped network of Excretory Canal or Renette cell



* Nervous system :- Nerve ring (Brain)
& Longitudinal nerve cords.

Rep'n :- Unisexual with sexual dimorphism.
(♀ > ♂)
↳ internal fert.
↳ Direct or Indirect dev'n.)



Acute (rapid and slow time) ^{lymph vessels} Filaria.

Chronic (slow and more time)

All intestinal protozoans & nematodes parasites are
Monogenetic.

(2) Ancylostoma deodenale $\Rightarrow$ Causes severe anaemia.
(Hook worm) "Ancylostomiasis".

(3) Trichinella spiralis $\rightarrow$ Viviparous $\rightarrow$ female
produce larvae.

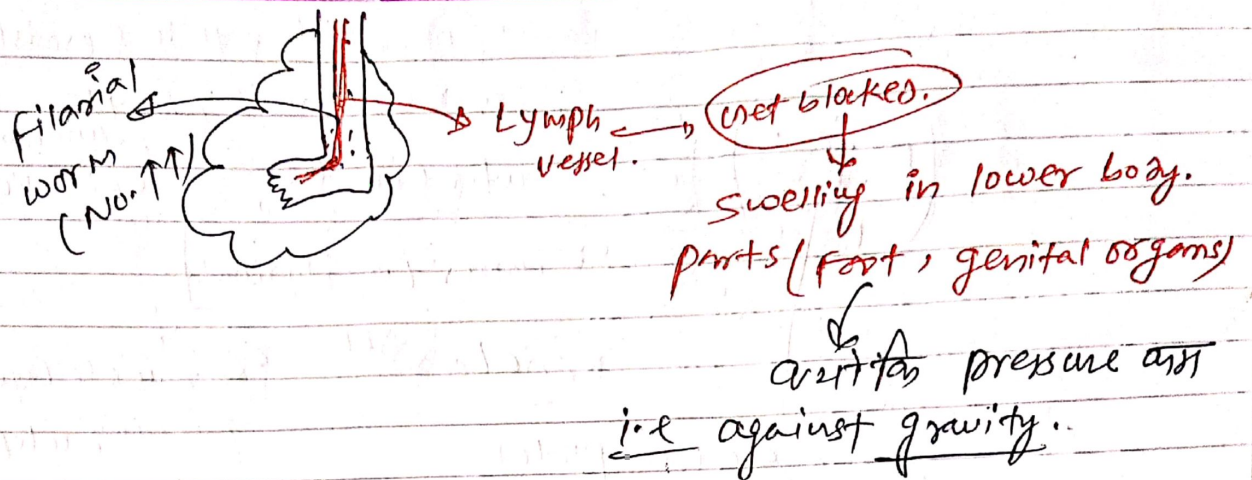
(4) Enterobius vermicularis.
(Pin worm) $\rightarrow$ Causes "Enterobiasis"
(Churche).
Deposited eggs causes anal
itching.

(5) Wuchereria bancrofti.
and W. Malayi.
(The Filarial worm) $\rightarrow$ Causes Elephantiasis
or Filaria.
 $\downarrow$
Chronic inflammatory
disease.

Digenetic.

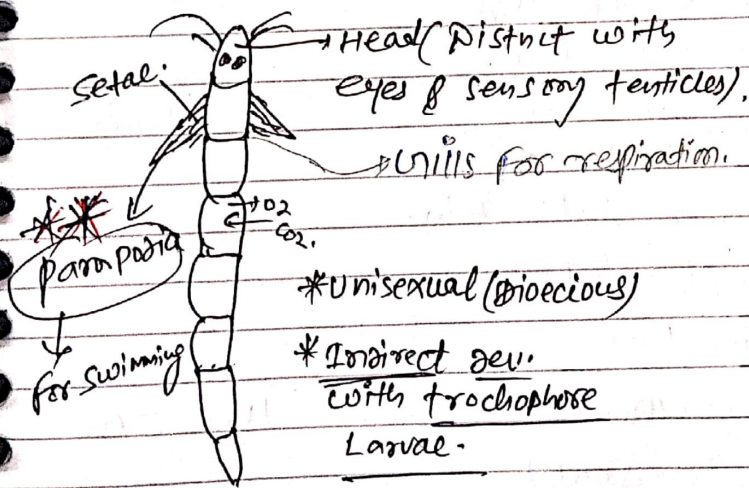
Human $\rightarrow$ infects.
Lymphatic tissue.

* females are viviparous.
(produces microfilariae larva).
Culex $\rightarrow$ carrier.

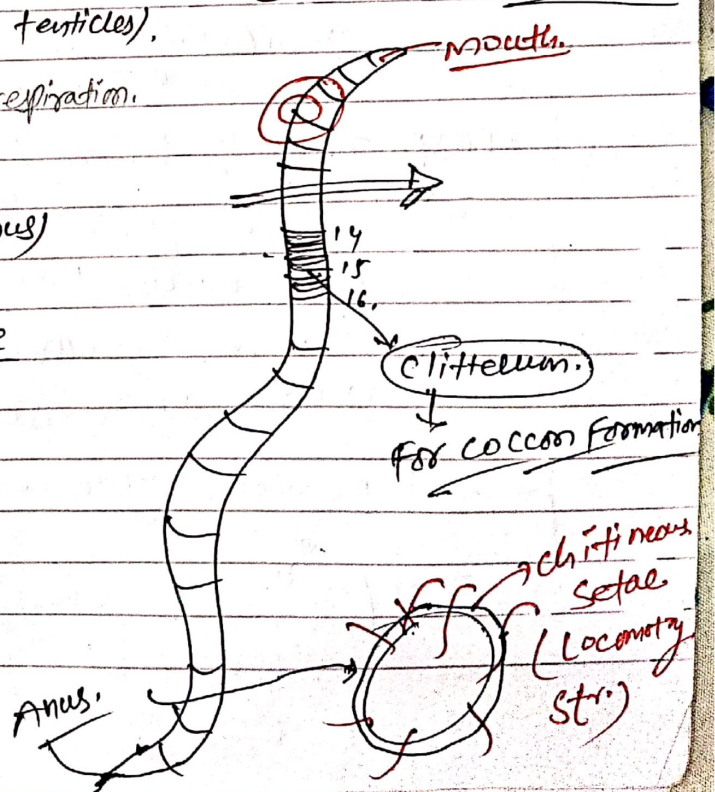


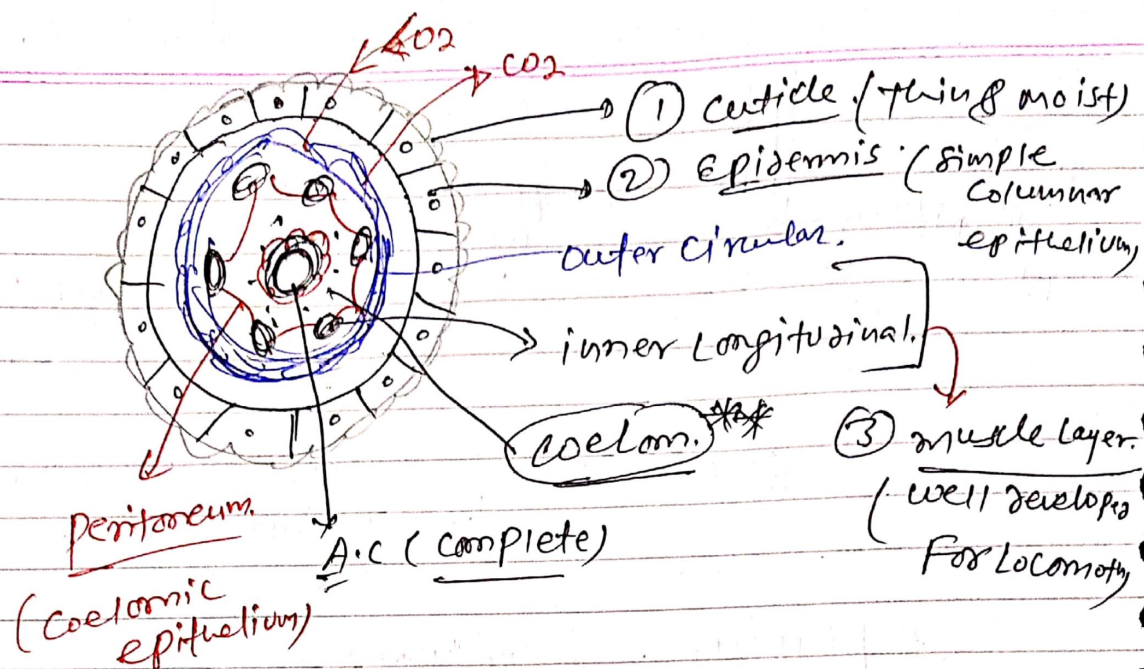
phylum → Annelida.
(or → Annuli → small rings) → metameric segmentation.

① Nereis (sand worm)
↳ Marine carnivores animals.



② Pheretima (earthworm)



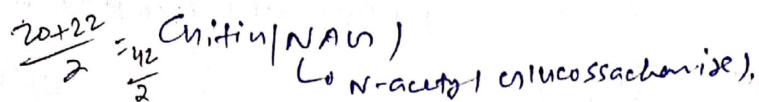


* Coelom.

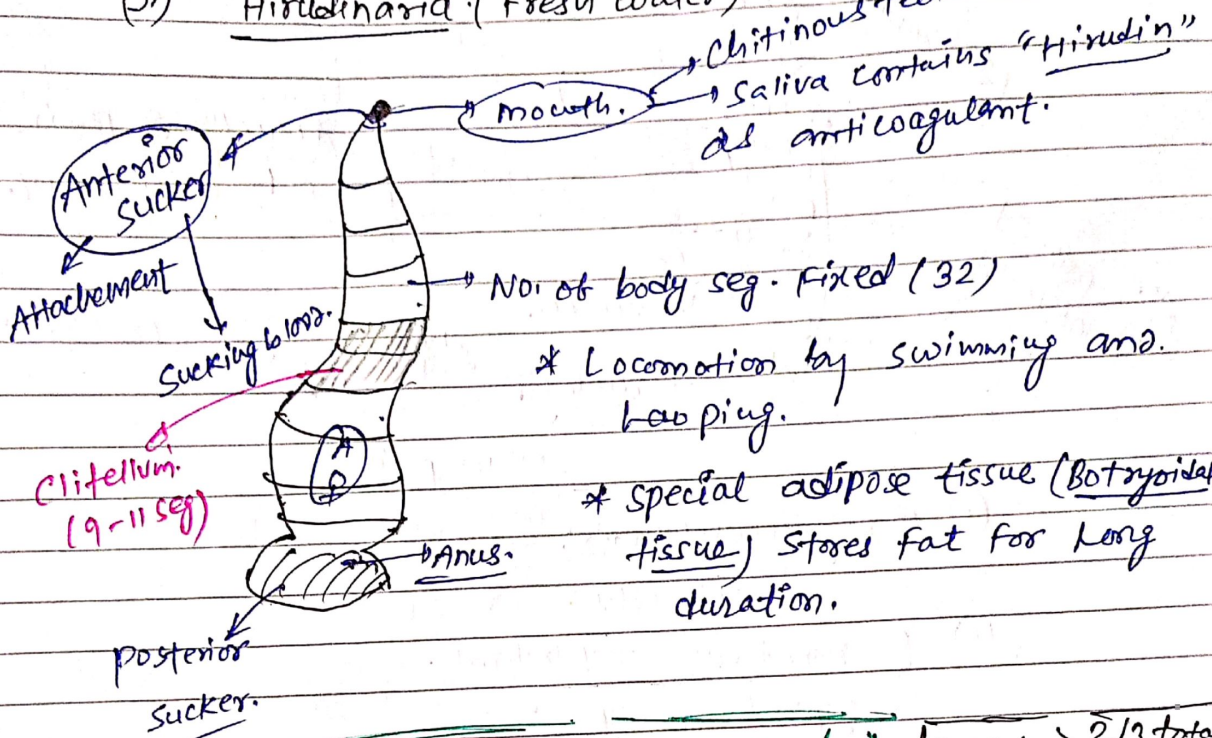
metameric segmentation.
Longitudinal muscle layer.
respiratory structure.
Circulatory system.

appeared 1st

- ↳ Resp mostly by moist skin.
- ↳ Excretion by nephridia.
- ↳ closed circulation.
- ↳ Blood red coloured. but Hb dissolved in plasma. (RBCs absent)
- ↳ Nervous system → nerve ring and ventral nerve cord.
- ↳ reproⁿ → unisexual or bisexual.
 - ↳ Ext fertⁿ.
 - ↳ Direct or indirect.



(3) Hirudinaria (fresh water) or Cattle Leech.



* Locomotion by swimming and looping.

* special adipose tissue (Botryoidal tissue) stores fat for long duration.

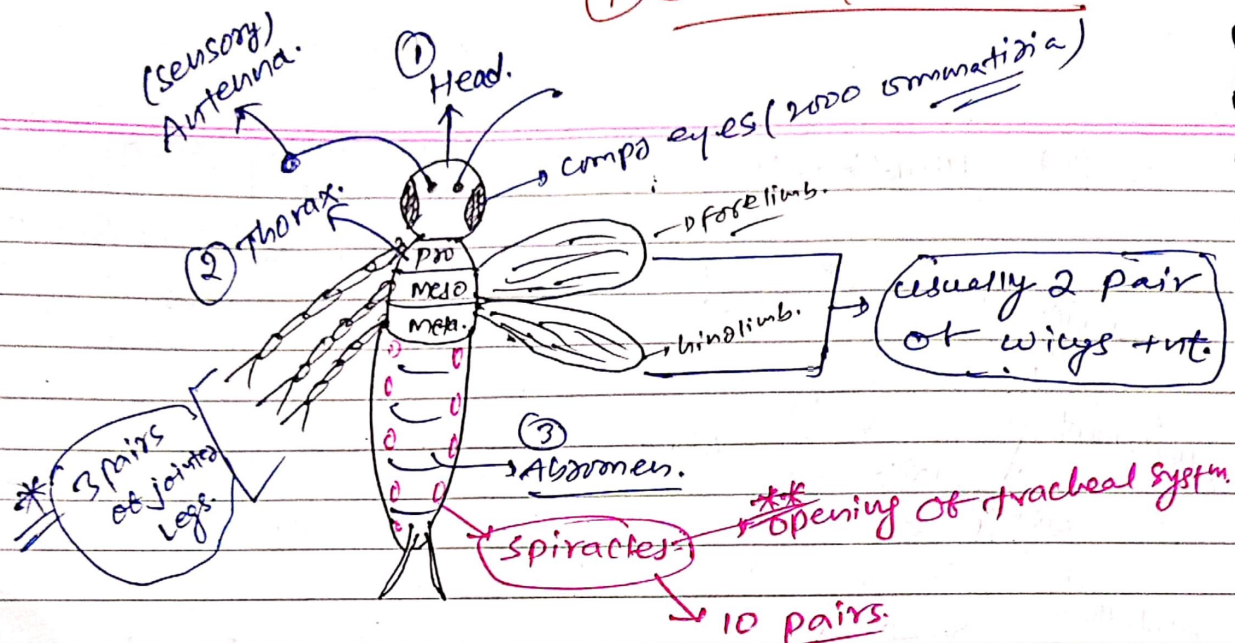
PHYLUM (Arthropoda) largest > 2/3 total known species

Cockroach or snake. moulting at 1201 :→ for growth. (10-10 moulting NA-NA growth)

Two unique and non-exceptional features :-

- (1) chitinous exoskeleton (shedding for growth-moulting)
- (2) Jointed appendages (for different function)

① Insects (Hexapods)



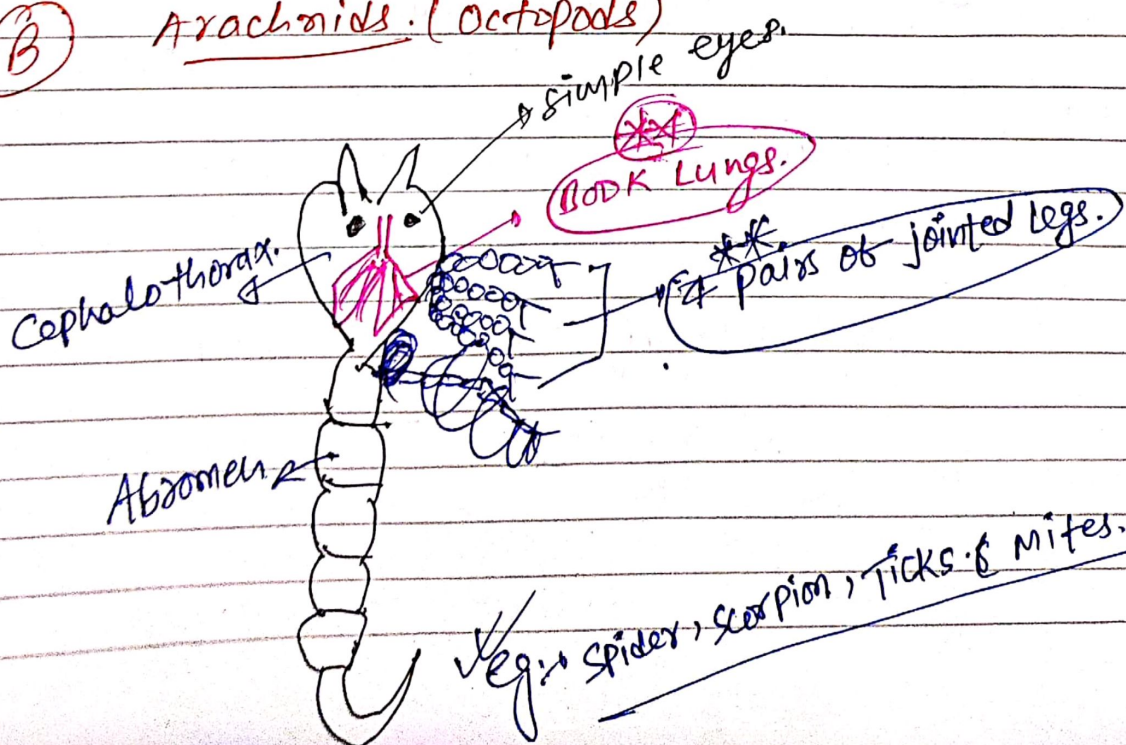
eg: (i) unreignous pests.
↳ Locusts.

(ii) Economically important.

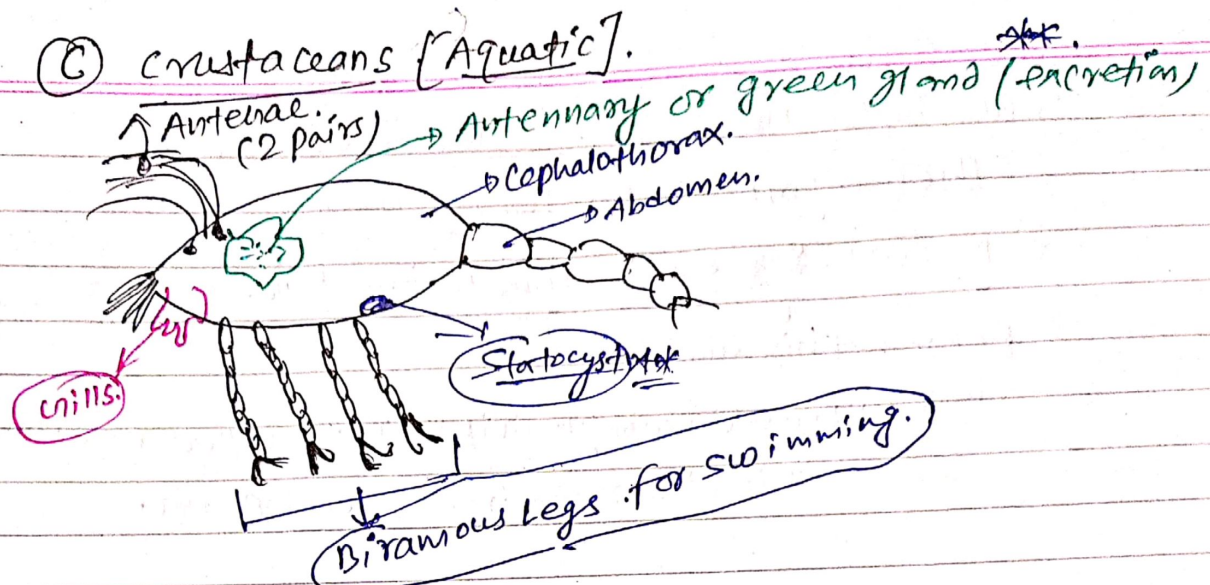
- Apis (Honey bee).
- Bombyx (Silk moth).
- Laccifer (Lac insect).

(iii) Vectors for diseases.

② Arachnids (Octopods)



(C) crustaceans [Aquatic].



Eg: Palemon (prawn)

• Cancer (Crop).

∴ Cyclops (Husband of 100 wives)

④ Limulus (King crab).

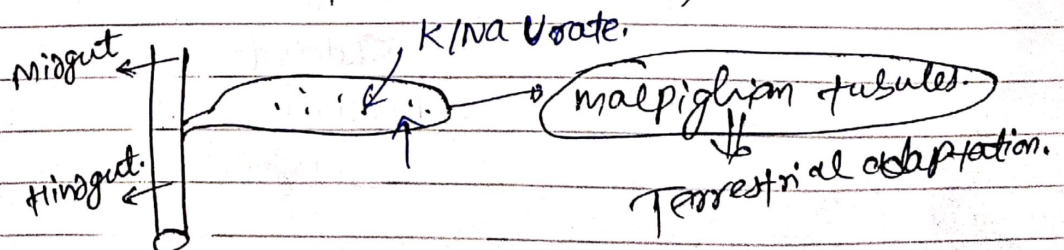
→ Living fossil *

→ Book gills (Resph)

(E) peripatus. (connecting link b/w annelida & arthropoda)
Nephridia (+nt)

(F) Scolopendra: → (Centipede or hundred legs).
↳ poisonous.

(9) Julus (millipede or thousand legger) - non-poisonous.



* Circulatory system $\rightarrow$ open (Haemocoel + nt)

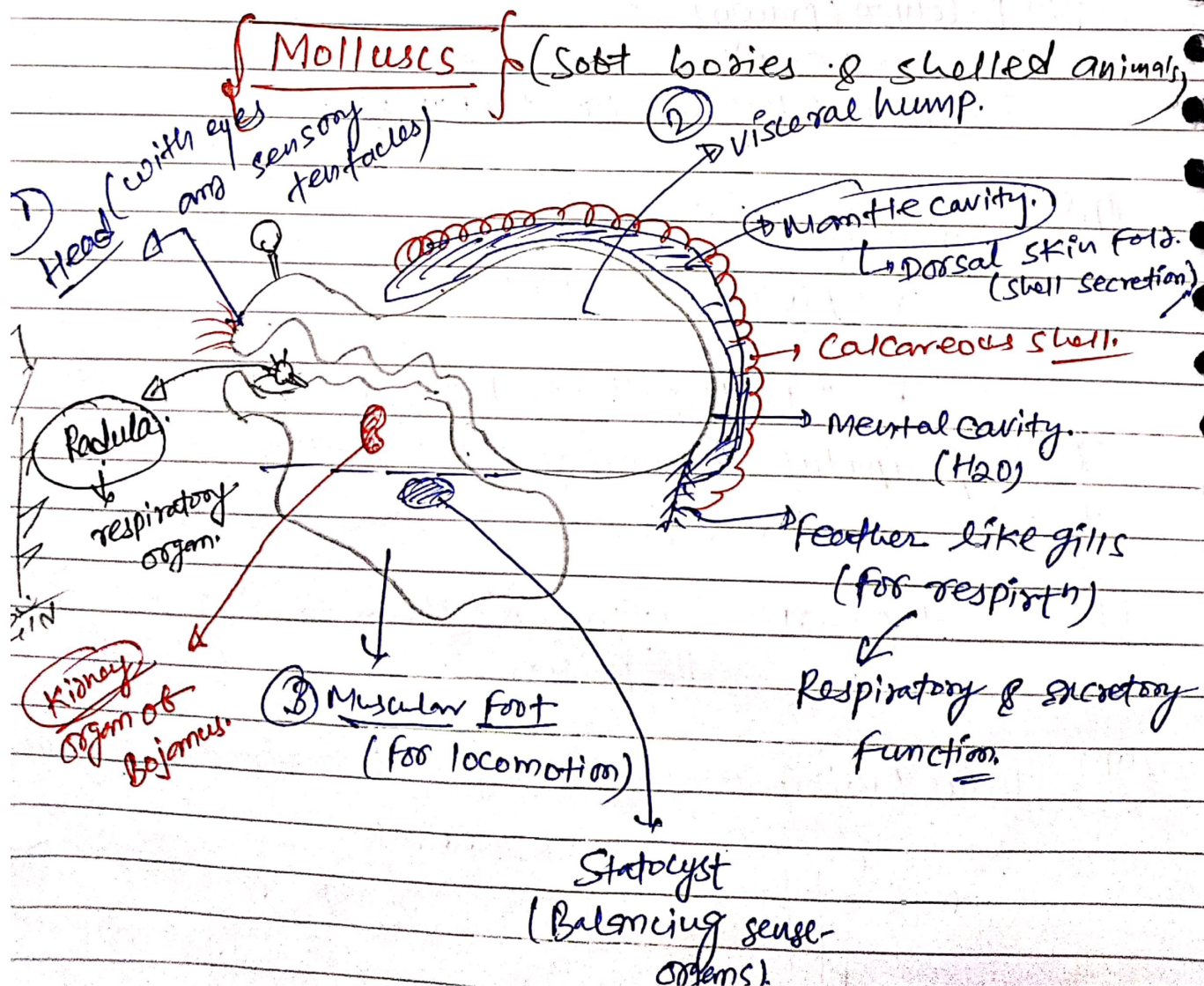
$\rightarrow$ Haemolymph (Blood) $\rightarrow$ colourless.

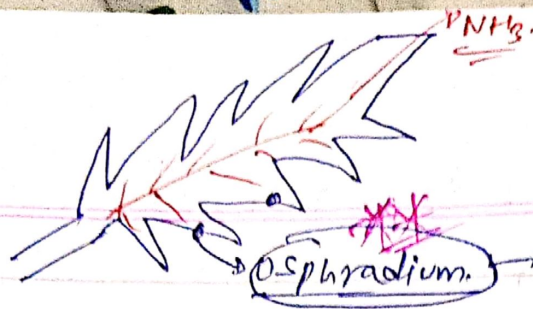
* Nervous system $\rightarrow$ Annelid type.

* Rep: $\rightarrow$ unisexual.

$\rightarrow$ female mostly oviparous (shelled eggs).

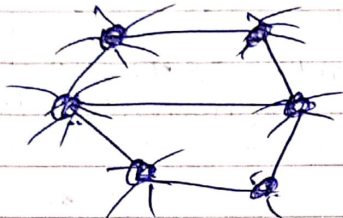
$\rightarrow$ Direct or indirect development.





- * Circulatory System : → open (except giant molluscs)
- Haemocoel (tnt)
 - Haemolymph contains "HC" (Blue or green colour)

- * Nervous System : → 3 or 4 pairs ganglia and connective nerves.



- * Rep'n : → Dioecious.

→ Females : mostly oviparous.

→ External fertilization.

→ Indirect dev. with trochophore, veliger (pila), velochidium Larva (Unio)

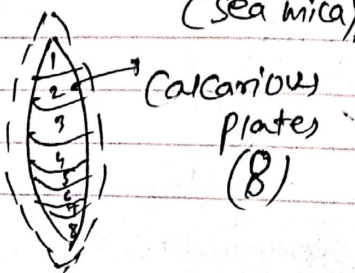
Examples : → (1) Neopilina (Living fossils) → connecting link b/w Annelida and mollusca → foot, mantle, shell etc.

→ Metameric Segm.

→ Nephridia.

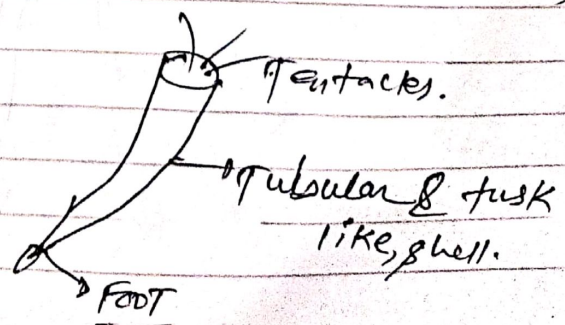
→ Trochophore larva.

(2) Chaetopleura
or chiton
(sea mica)



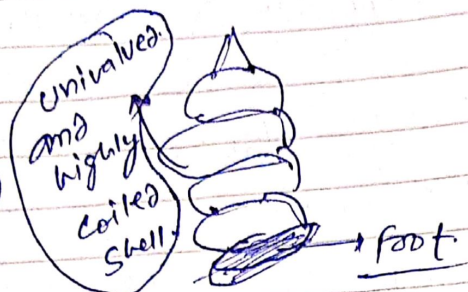
(3) Dentalium.

(Tusk shell animals)



④ Gastropoda (snails and slugs)

eg: → Pila
(Apple snail)



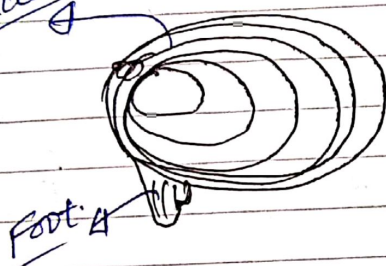
Aplysia
(sea-hare)

⑤ Pelecypoda

Mussels

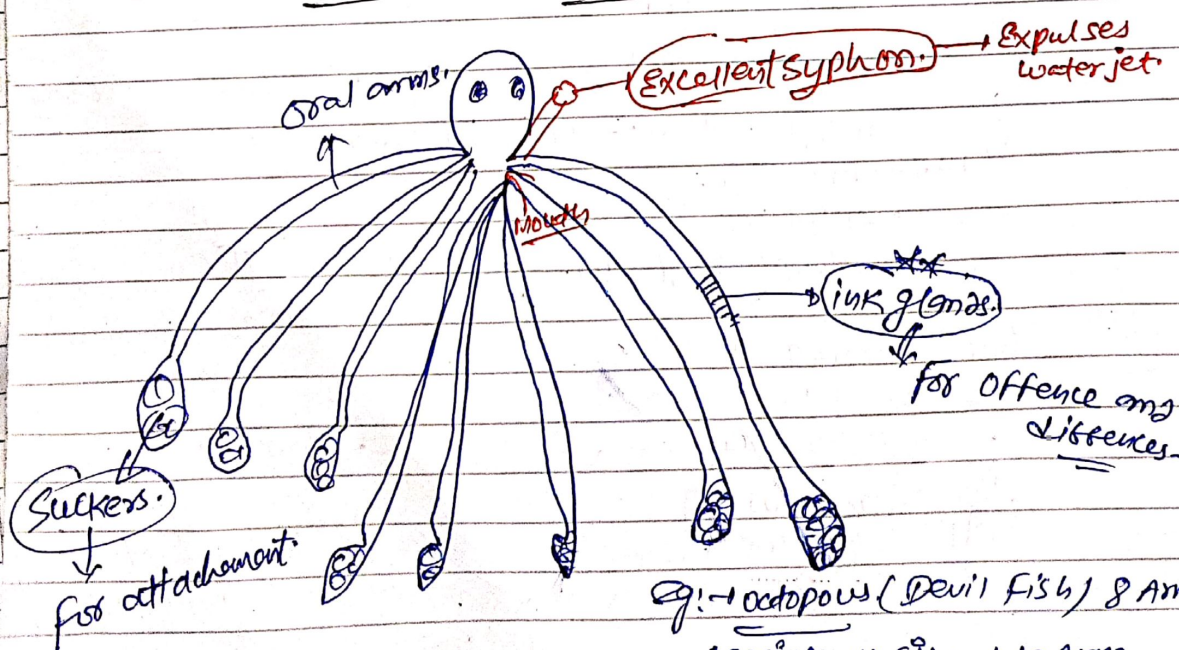
↓
Laterally compressed body and
bivalved shell

Tentacles



eg: → Unio (Fresh water mussel)
: Pinctada (pearl oyster)

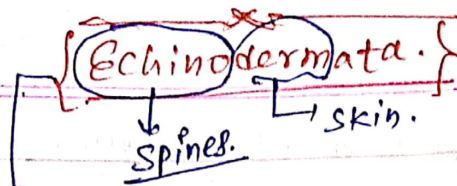
⑥ Cephalopoda (invertebrate molluscs)



eg: → Octopus (Devil fish) 8 Arms.
: Sepia (cuttle fish) 10 Arms.
: Loligo (squids) " " "

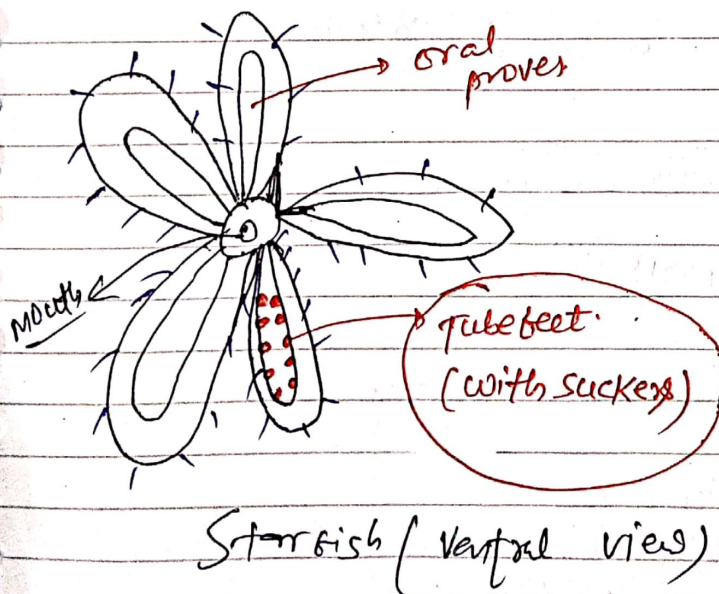
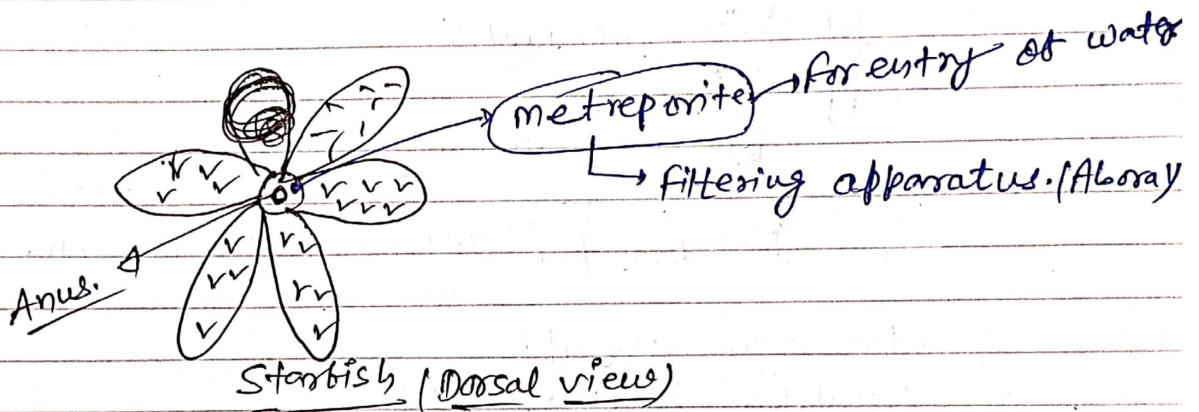
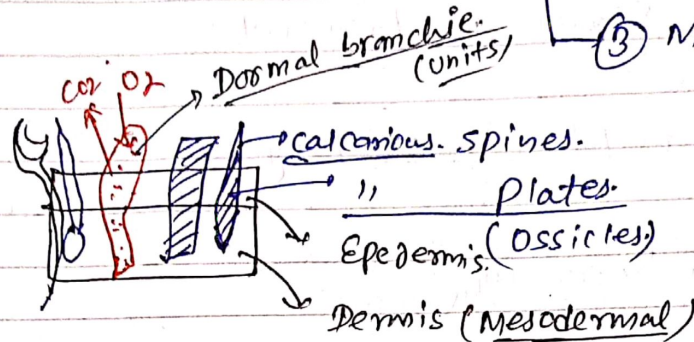
cutaneous → skin
branchial → gills & respn.

oral grooves → ventral surface
92



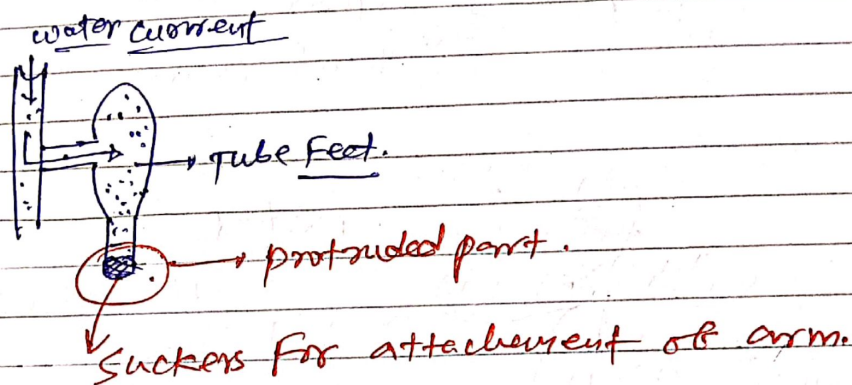
Chordate like characters

- ① enterocoel.
- ② Deutero-stomic dev.
- ③ mesodermal endo-skeleton.



✓* water vascular system:- most unique.

- (1) Mainly helps in locomotion (maintains shape of tube feet)
- (2) capturing of prey (3) respiration.
(4) Excretion.



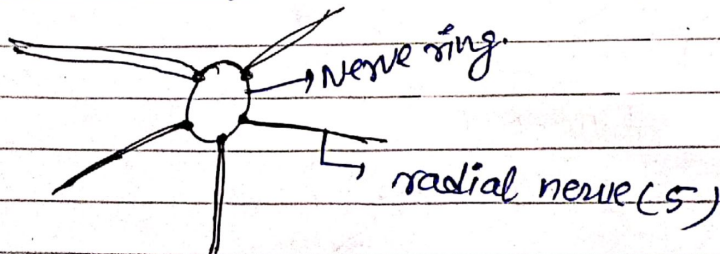
* Excretory organ absent.

* Circulatory system → open

* Heart absent and Blood colourless.

Nervous System:-

(Brain absent, nerve cord absent but nerve net)



* Reproduction:- Dioecious.

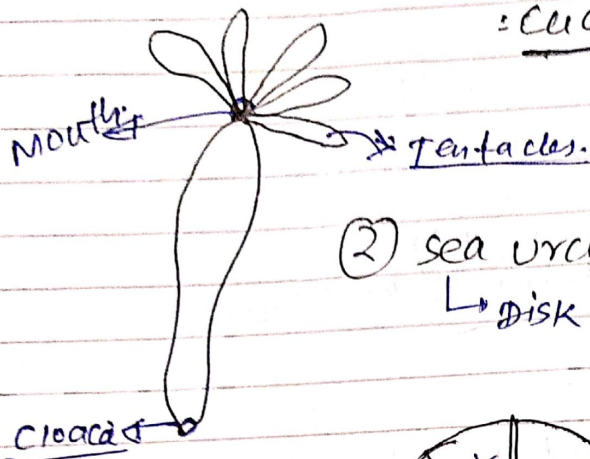
→ mostly oviparous.

→ External Fertilization.

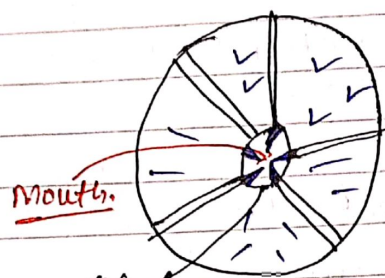
→ indirect devn. with Bipinnaria larva.

Examples:-

- (1) Sea cucumber (Holothuria)
: Cucumeria



- (2) sea urchins (e.g. :- Echinus)
↳ disk like body without arms.

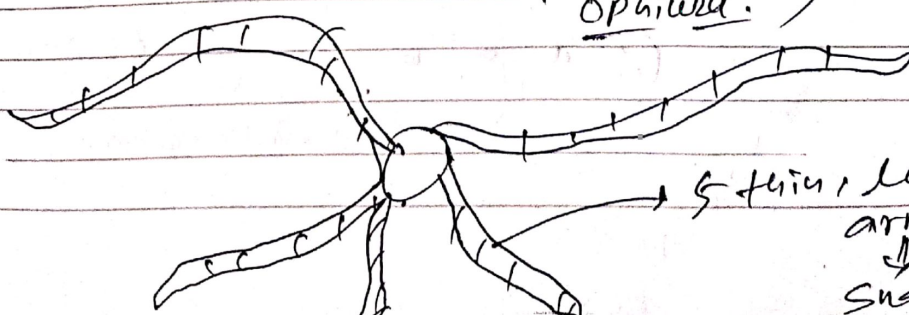


Aristotle lantern → Masticating app. with 5 teeth.

- (3) Star fishes (Asterias)

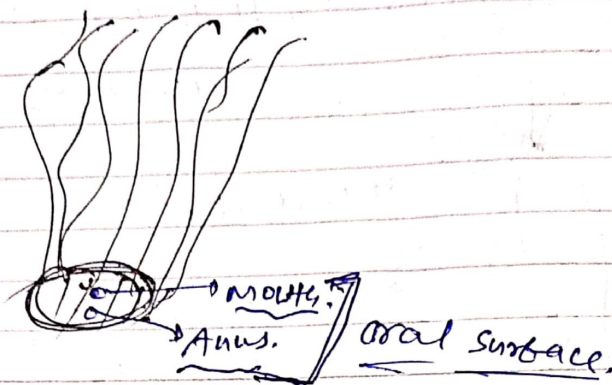
↳ Star like body with 5 thick & short arms.
↳ Shows autotomy for defence
↓
Stunt arm remove at joint

- (4) Brittle Star (e.g. :- Ophiotrix)
: Ophiura

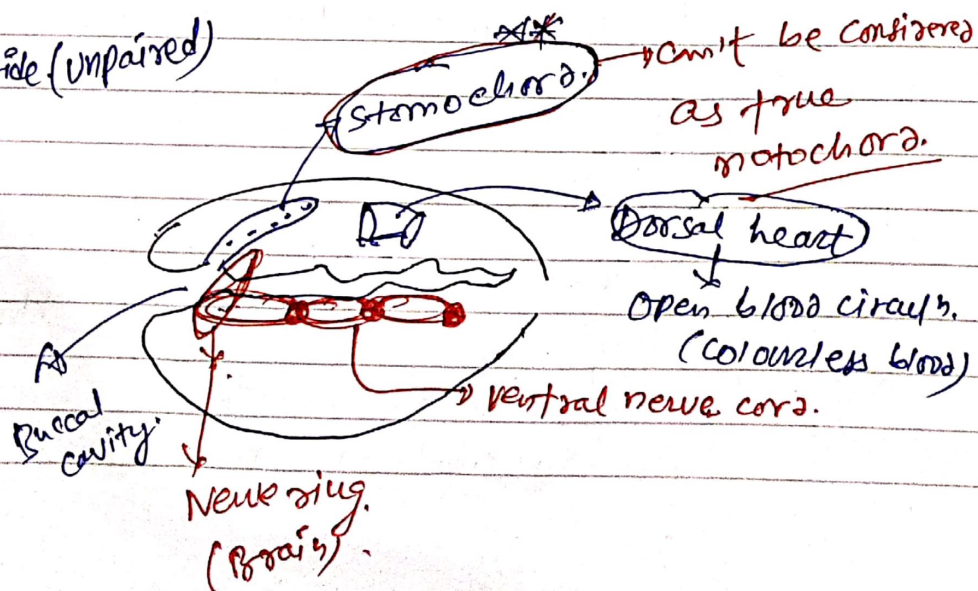
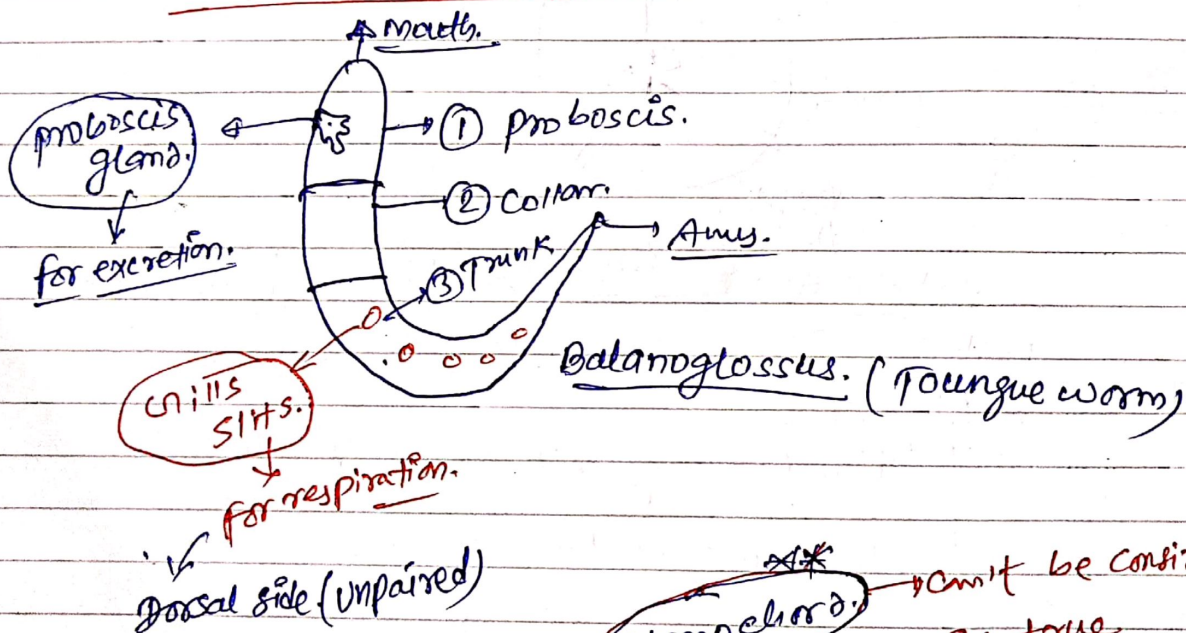


↳ 5 thin, long & fragile arms
↓
Snake tail like.

⑤ Sea-lilly (eg: → Antedon)
fixed.



PHYLUM → HEMI-CHORDATA.



- * Reprod: → Dioecious.
- mostly oviparous.
 - External fertilisation.
 - Indirect devn. with Trocharia Larva.

Chordata.

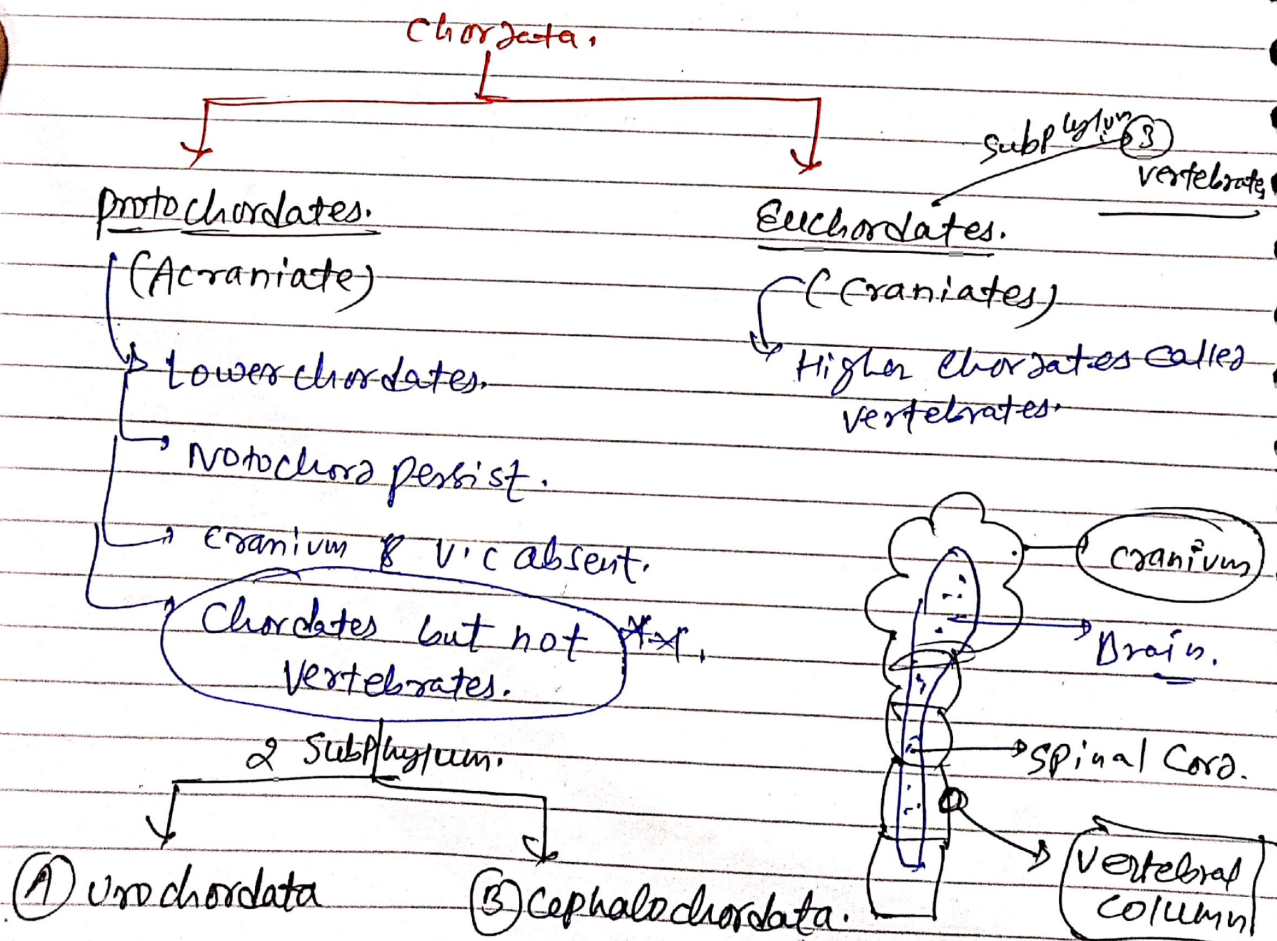
(1) Notochord :→ Solid rod like mesodermal str.
mid dorsal side (support).
replaced by v.c in vertebrates.

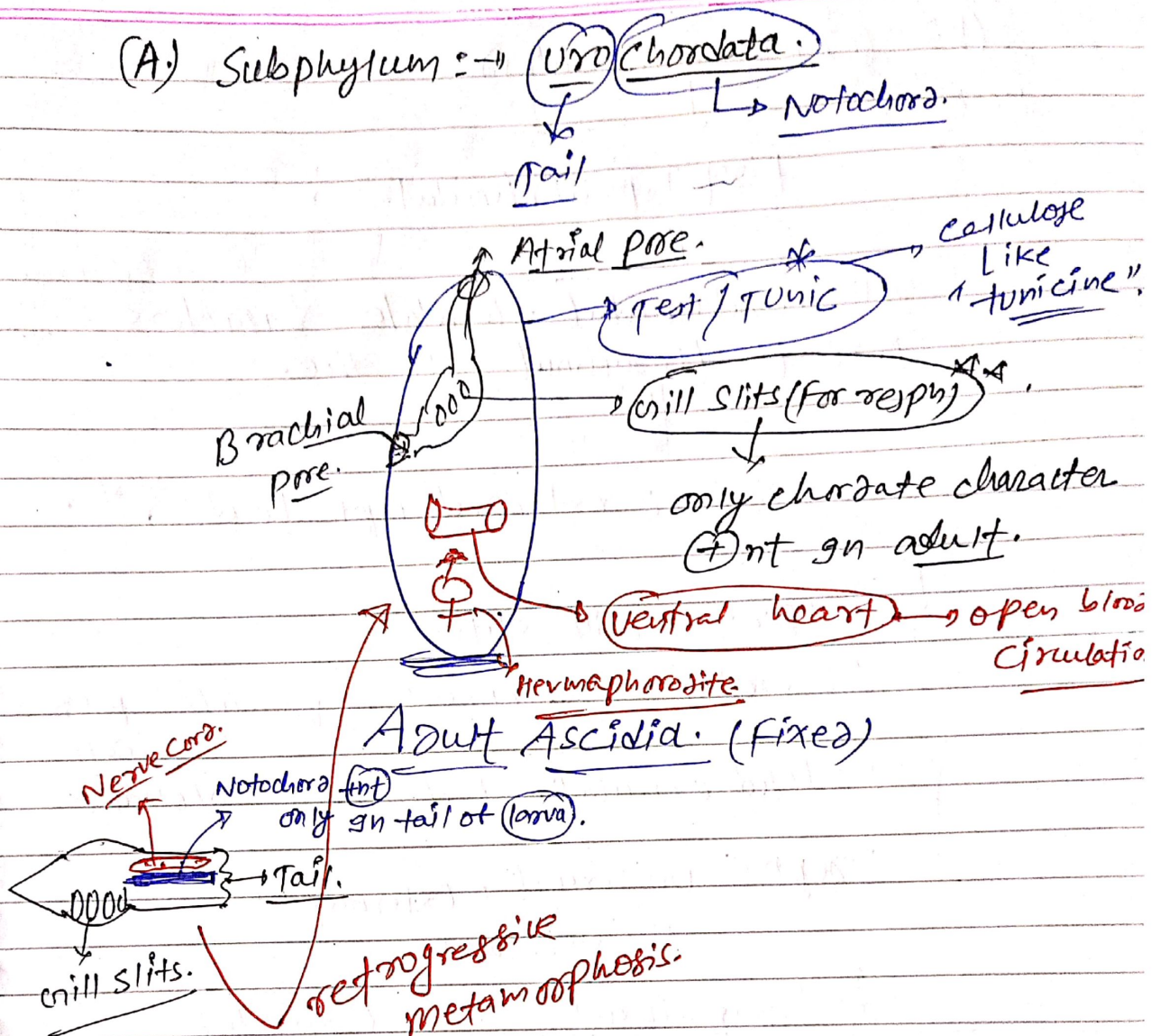
(2) Dorsal tubular Nerve cord.

(3) Lateral or paired pharyngeal gill slits.
(mainly for respⁿ)

(4) ventral heart. (g6 + int)

(5) post anal tail. (g6 + int).





* Excretion → Pyloric or Neural glands.

* Repn → Bisexual, External fertn, Indirect devn.

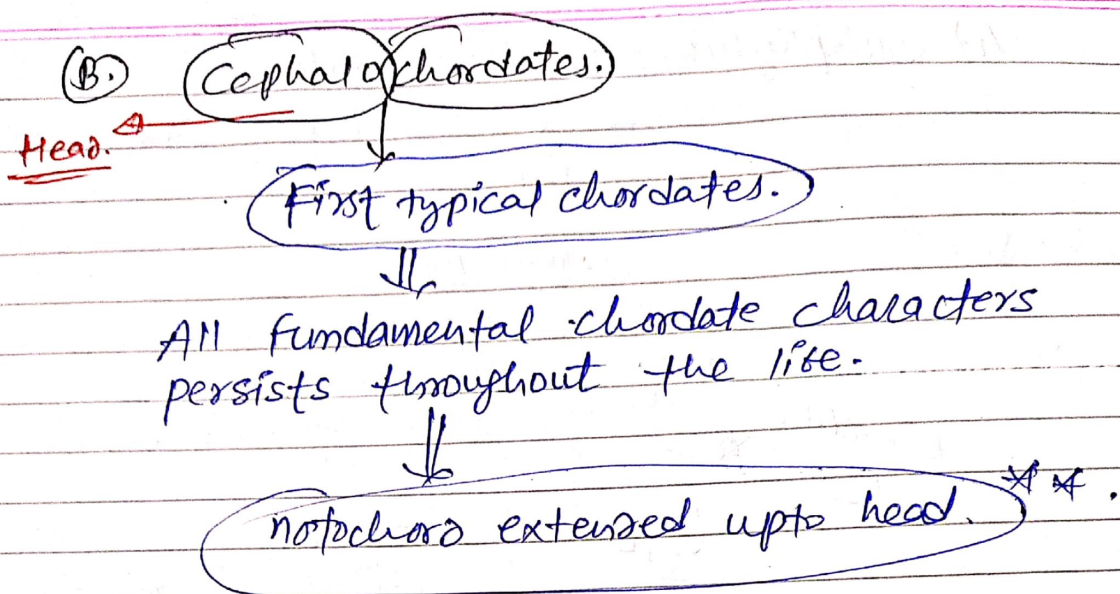
eg :- Ascidia.

Herdmania. (sea potato, sea squirt)

= Salpa.

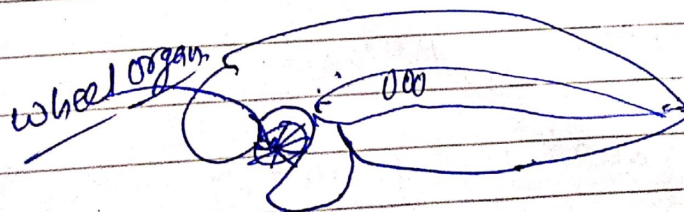
= Doliolum.

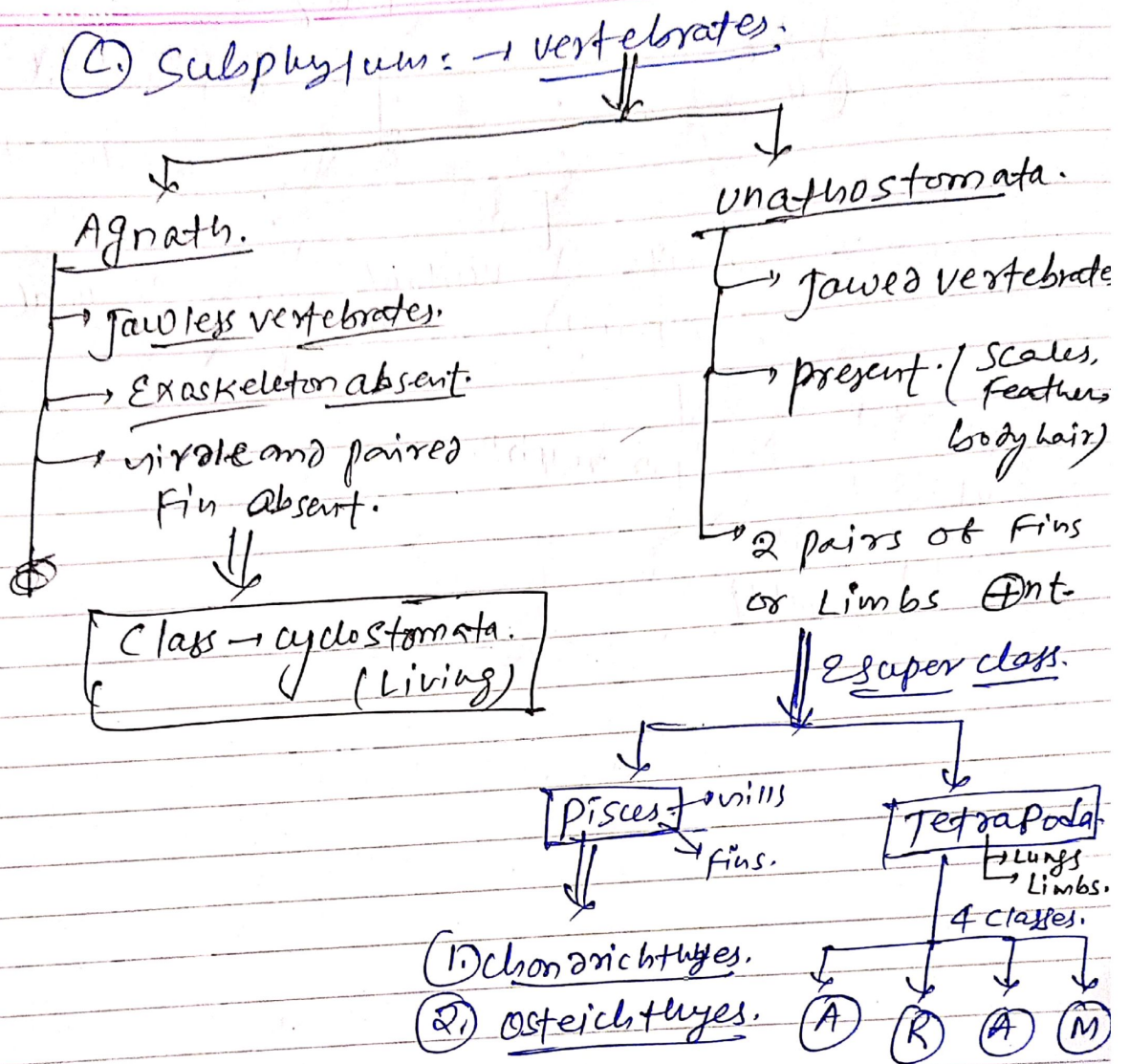
= Pyrosoma (Bioluminescence)



- ↳ respiration → gill slits
- ↳ Excretion → solenocytes. (vascular flame cells)
- ↳ Closed circulation but blood colourless.
- ↳ Repn → Unisexual, External fertilization & indirect devn.

Eg → Amphioxus. (The Lancelet)
(gill slit)

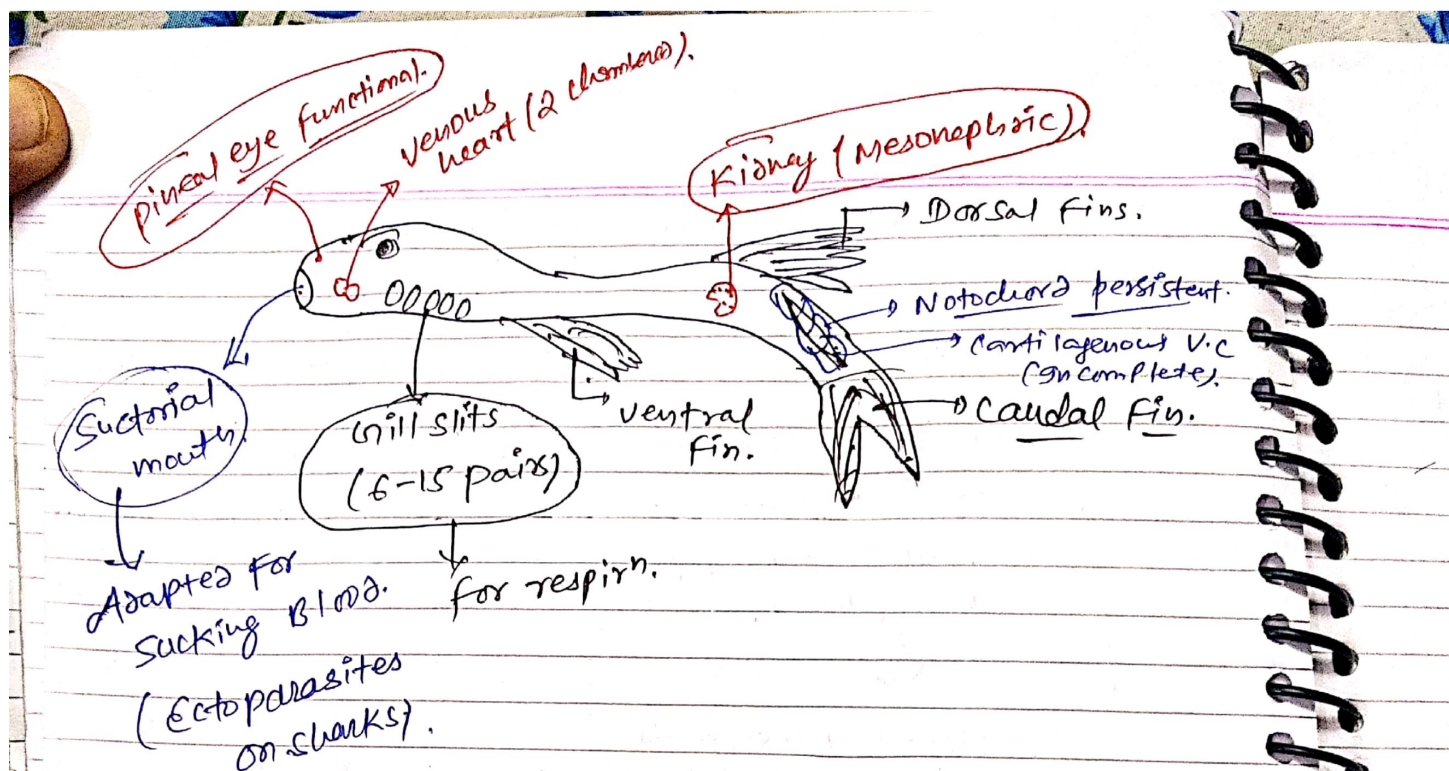




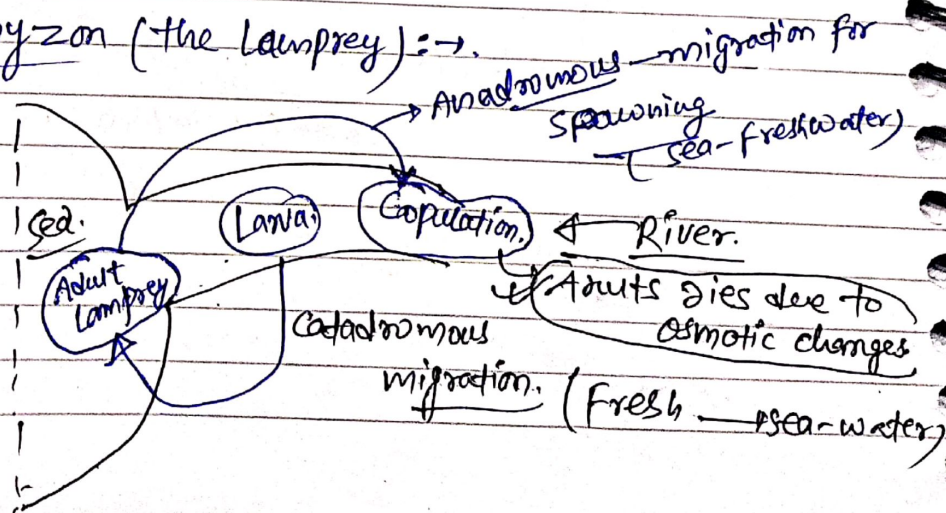
Class.
↳ Cyclostomata.

↳ Round mouthed / Jawless fishes
(False fishes)

Jaws, paired fins & scales absent



eg: → (1) Petromyzon (the Lamprey) :- →



Scales → impermeable to water and prevent from
Loss of water or osmosis in sea-water.

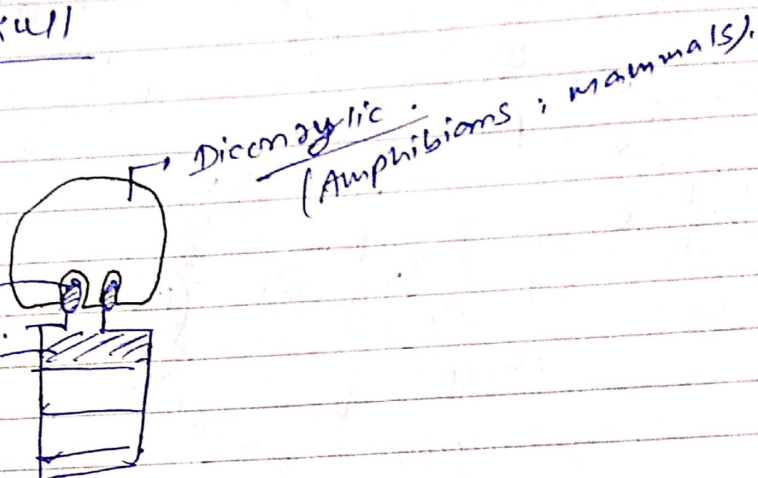
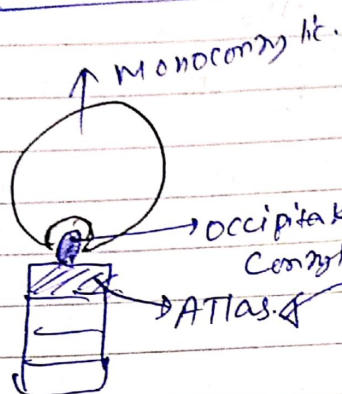
Mesonephric

Loop of henley - lt.
more dilute urine.

Metanephric

Loop of henley - lt.
more concn urine.

Types of skull



Cranial nerves. (fixed)

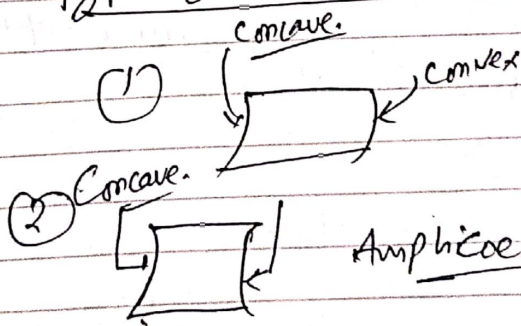
PA

10 pairs.

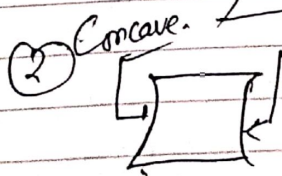
RAM.

12 pairs.

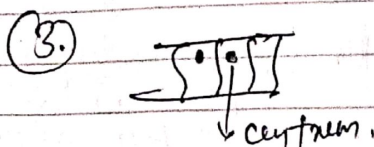
Types of vertebrae.



procoelous.
(eg: → AR)

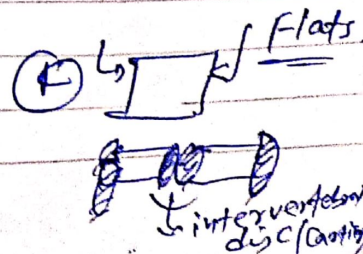


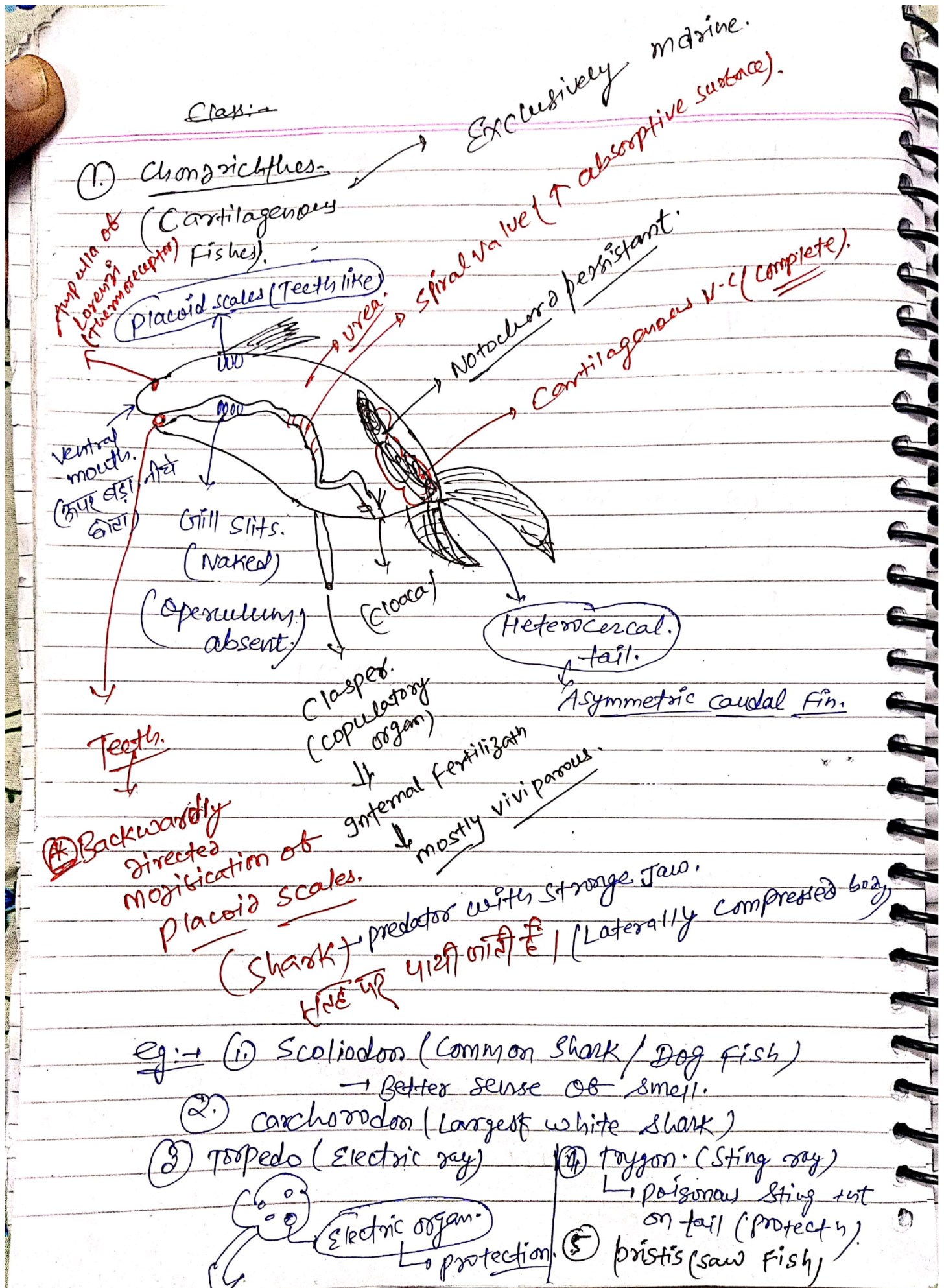
Amphicoelous. (modern fishes)



Heterocoelous.

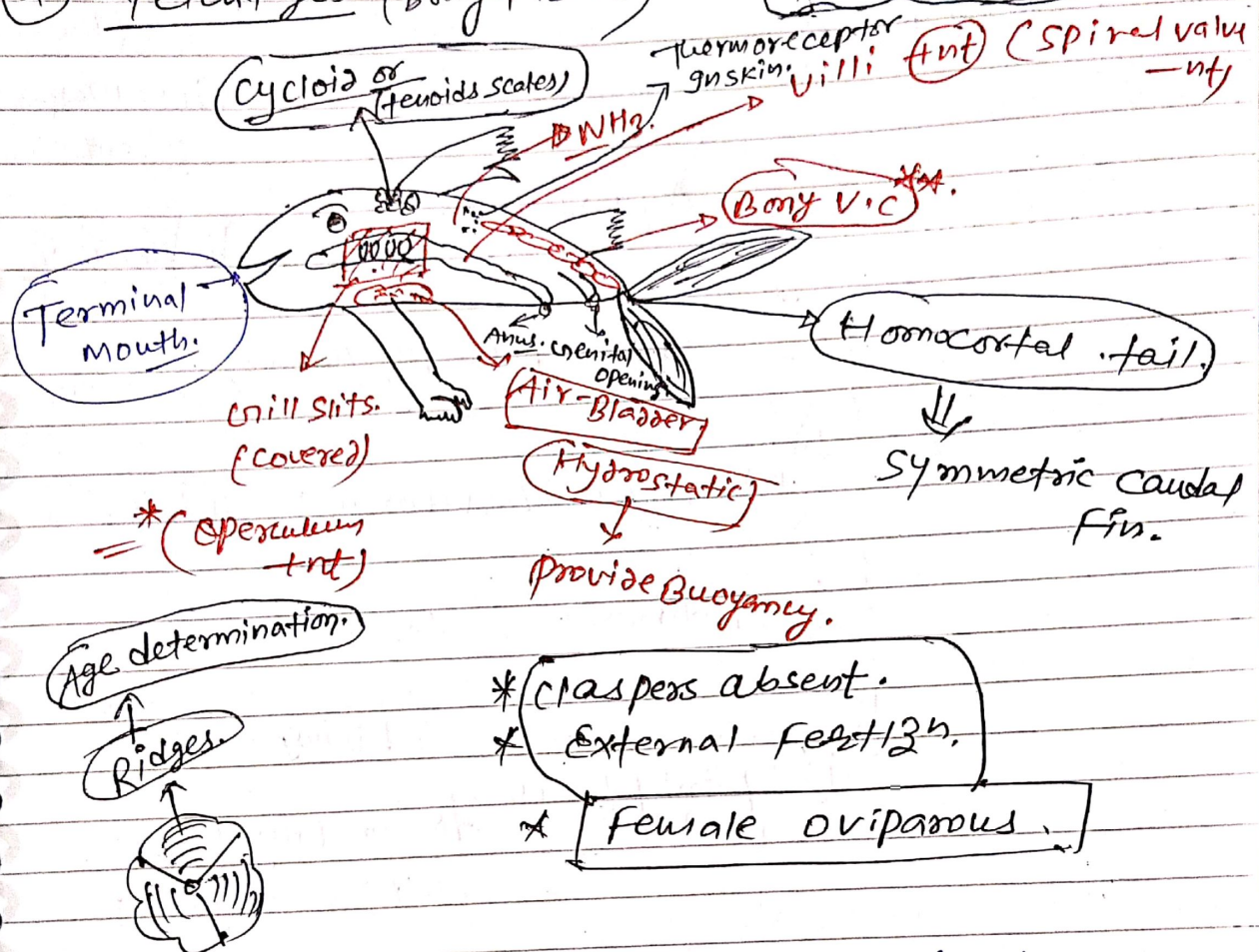
eg: → (birds)



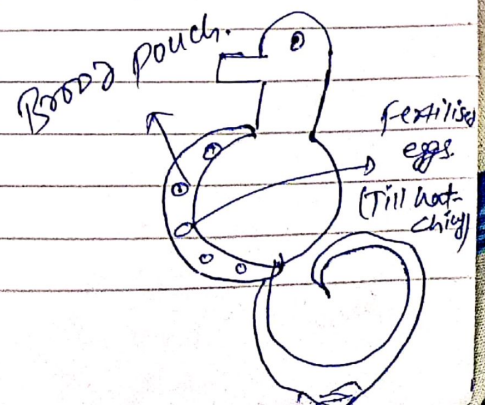


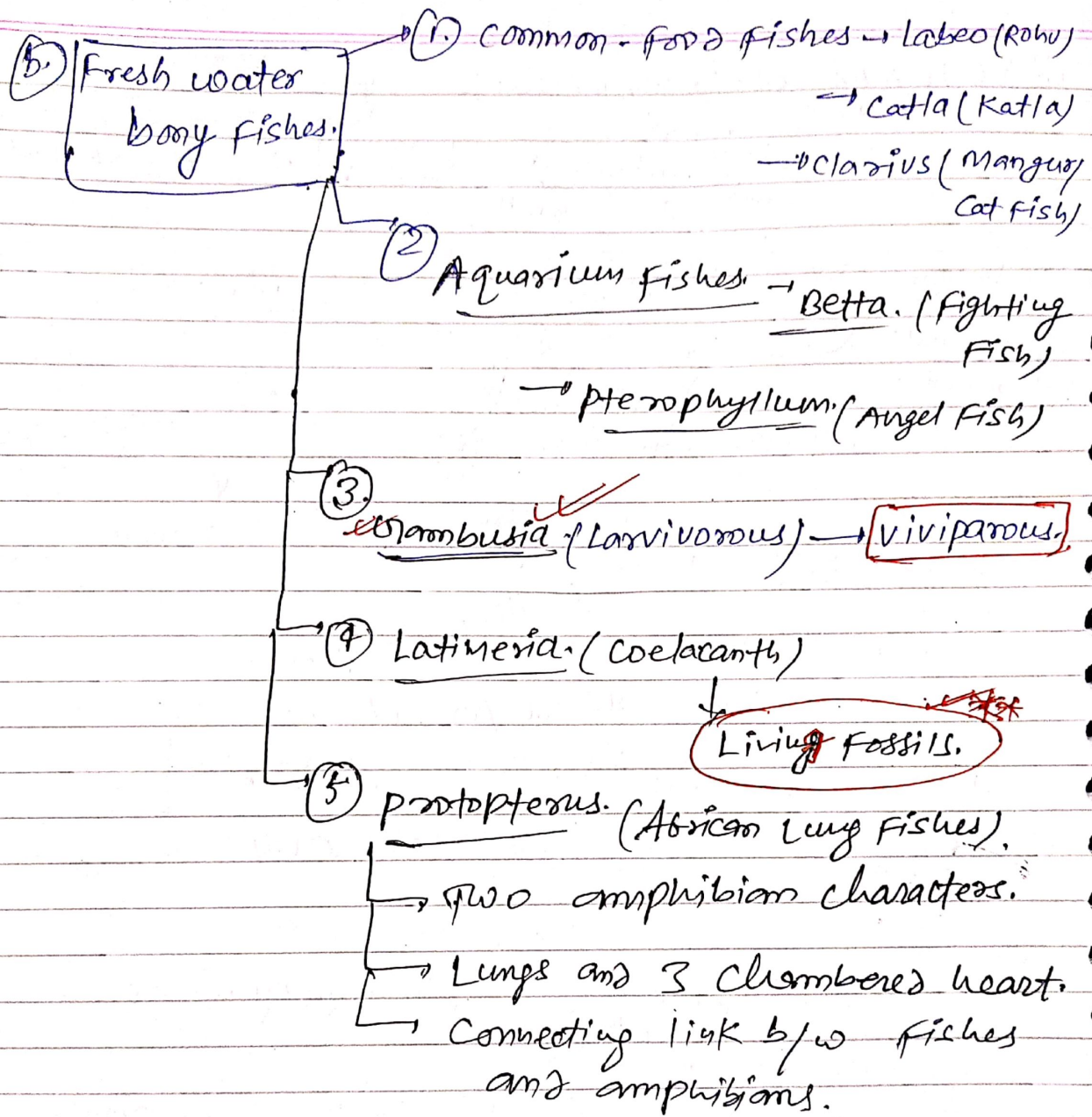
⑥ Chimera (Rat Fish) → connecting Link.
Operculum (+nt) & cloaca (+nt)

② Steichthyes (Bony Fishes) → Marine + fresh water



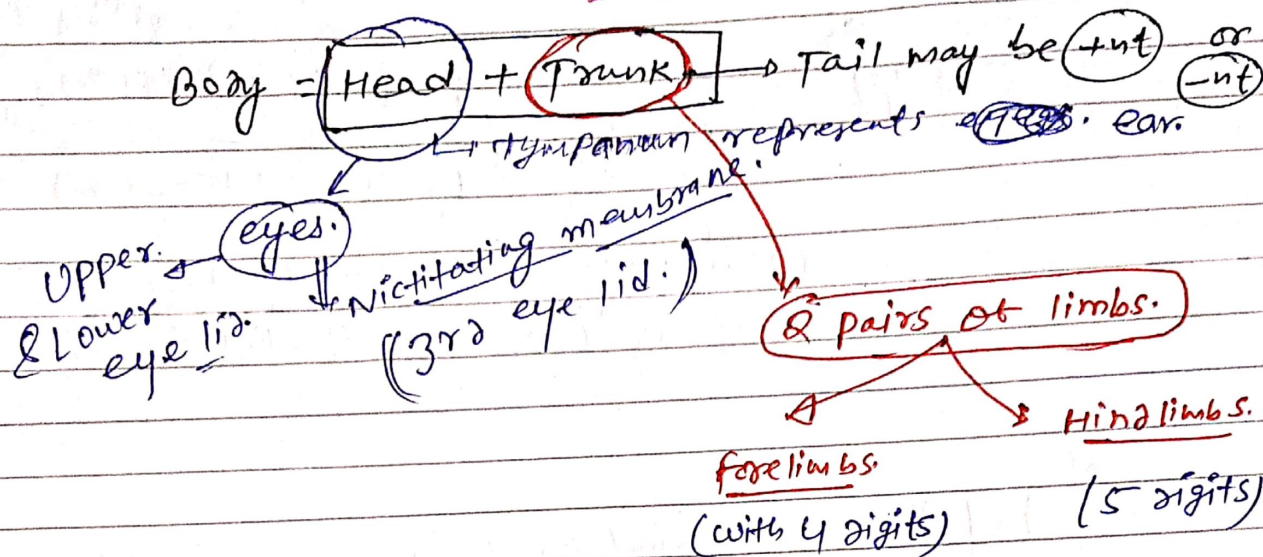
Ex: → ① Marine bony fishes → Hippocampus (sea horse or pregnant male)
→ Exocoetus (Flying Fish)
→ Glides through large pectoral fins.



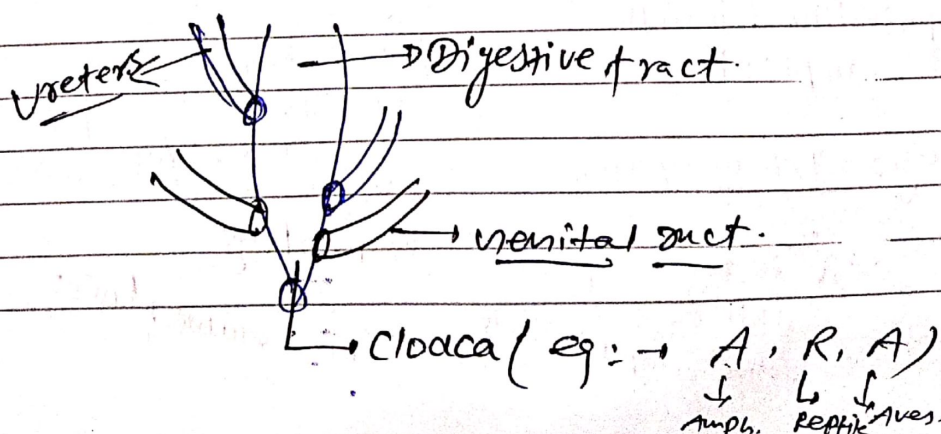
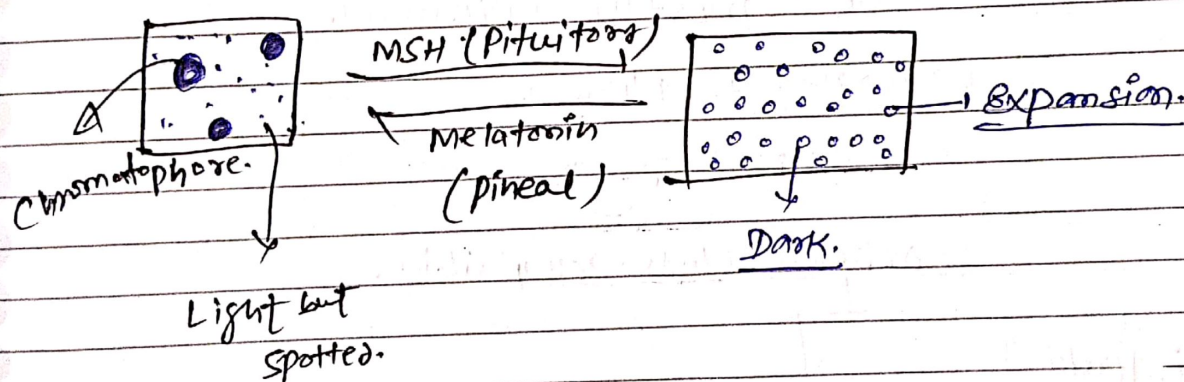


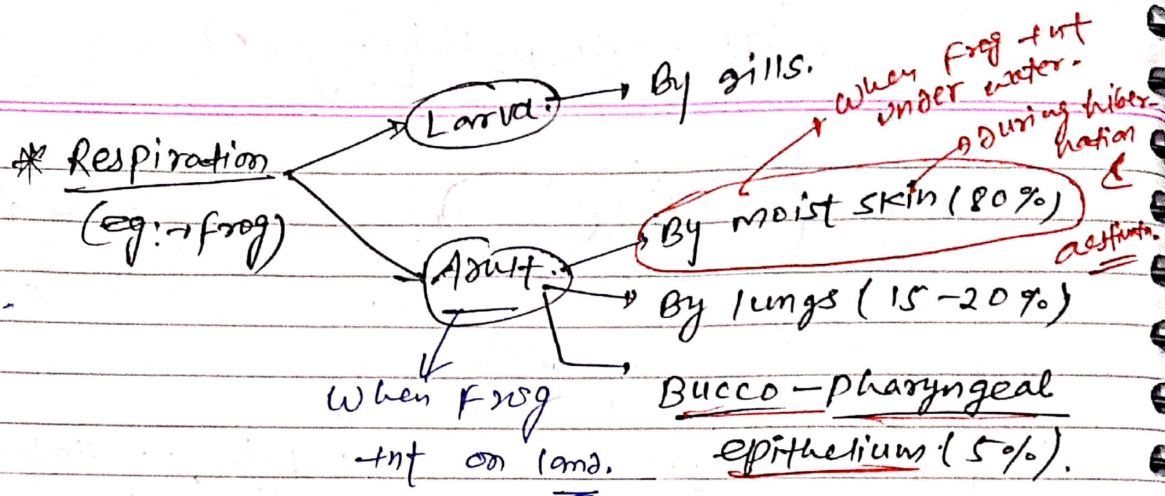
Metachrosis.
↓
chromatophore cell
↳ (Fore, body, skin tail)

Class → Amphibia → Land and water
life.
Dual.



* Skin → smooth, scales, moist/glandular (↑ mucus glands)
↳ Ability to colour of skin (metachrosis).





* Reprn: → Unisexual with sexual dimorphism.
(male has copulatory pads)

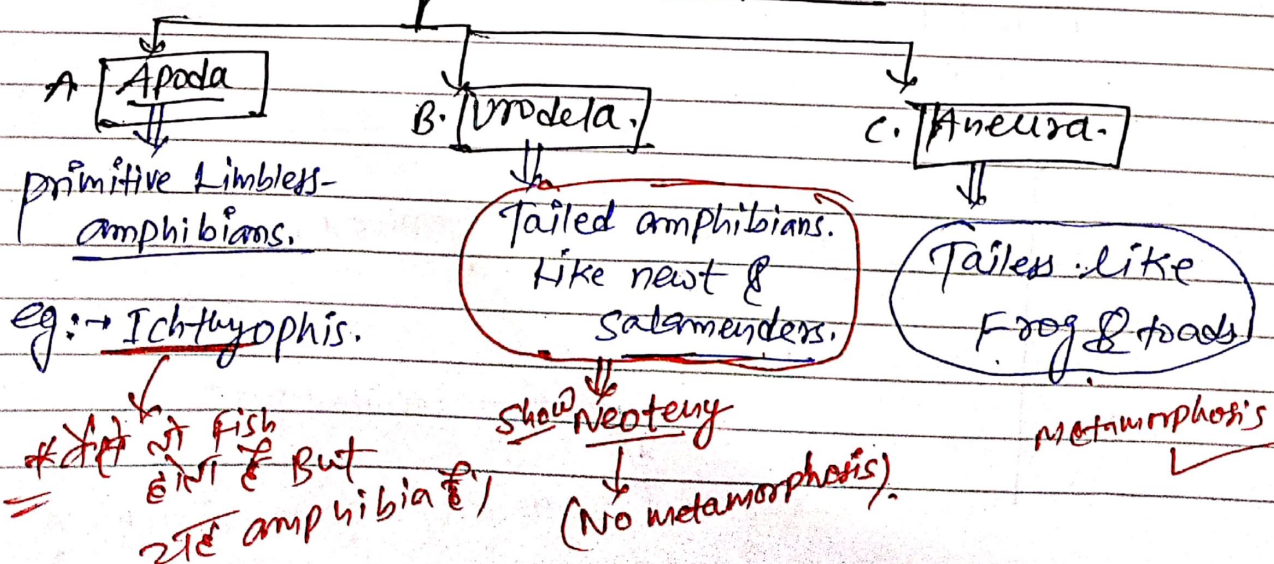
→ copulatory organs absent.
(Pseudocopulation)

→ Females. mostly oviparous.

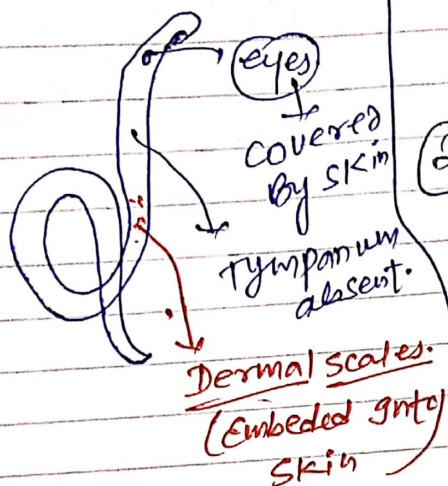
→ External fertilization.

→ Indirect devn.

3 order → class → Amphibia.



eg: - Ichthyophis
(Blind & deaf
worm)



(1) Salamanders
(Common Salamanders)
→ viviparous & internal
Fertilization.

(2) Ambystoma tigris
Salamander

(3) Amphiuma
(Congeel)
↳ Largest
RBC (75μ)

(1) Rana tigrina (Bull Frog) → large size.
→ Loud sound.

(2) Hyla (Tree-Frog)

(3) Rhacophorus (Flying Frog)

(4) Bufo (Common toad)
↳ Rough skin.
↳ mainly respiration by lungs.
↳ Skin contain poison glands (protection)

(5) Alytes (Midwife toad)

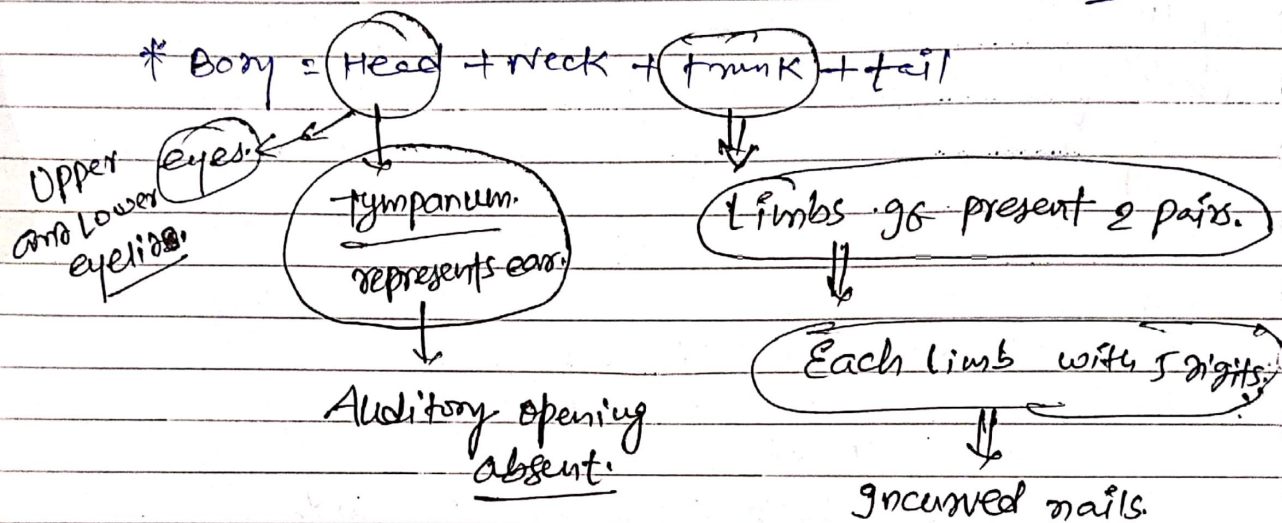
(6) Pipa (Singing toad)

good
tenor

Class - Reptilia (Creeping vertebrates)

First successful Land vertebrates.

- (1) Shelled Eggs.
- (2) Internal Fertilisation.
- (3) Development of Amnion.



* Skin → Dry, rough & non-glandular.
→ covered by Epidermal scales or bony plates.
→ Shedding as skin cast.

* repro → Unisexual
→ mostly oviparous.
→ Internal fertilization.
→ male has penis.
→ Direct Dev.

(A) Non-poisonous snakes:-

eg:- Python (A2gar) → Largest.

→ Eryx (sand boa / dhumahi)

(B) poisonous snake:-

→ Naja - Naja (common cobra or Black snake)

• N. bungarus (King cobra) → Largest poisonous

: Bungarus (Krait)

Neuro
toxic
venome

→ Hydrophis (sea snake)

→ most poisonous

Haemotoxic
↓
Haemolysis
(Hypoxia)

→ Vipera (viper)

Viviparous.

(C) crocodilia.

→ Largest / Heavies Living reptiles.

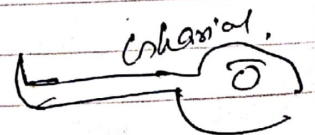
→ Body covered by bony plates & bony
Scales.

→ mammals like features.

→ 4 chambered heart.

→ Thecodont teeth.

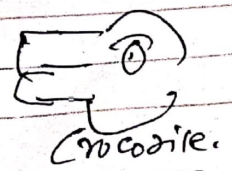
→ muscular diaphragm.



eg:- Crocodylus (Asian crocodile)

• Alligator (American crocodile)

• Crocodialis (Inharial)



4.2.11.6 Class - Aves

The characteristic features of Aves (birds) are the presence of **feathers** and most of them can fly except flightless birds (e.g., Ostrich). They possess **beak** (Figure 4.23). The forelimbs are modified into **wings**. The hind limbs generally have scales and are modified for walking, swimming or clasping the tree branches. Skin is dry without glands except the oil gland at the base of the tail. Endoskeleton is fully ossified (bony) and the long bones are hollow with **air cavities** (pneumatic). The digestive tract of birds has additional chambers, the crop and gizzard. Heart is completely four-chambered. They are warm-blooded (**homoiothermous**) animals, i.e., they are able to maintain a constant body temperature. Respiration is by

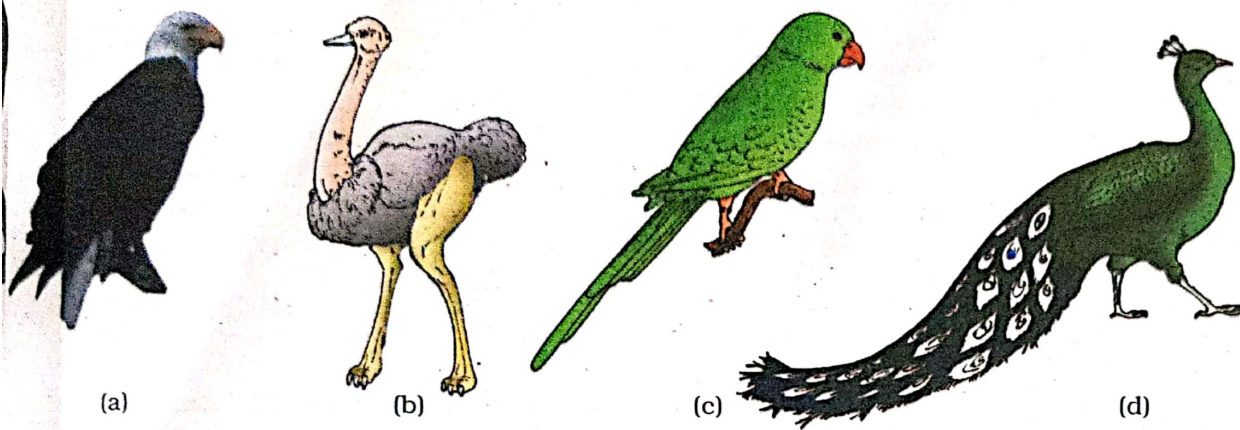


Figure 4.23 Some birds : (a) *Neophron* (b) *Struthio* (c) *Psittacula* (d) *Pavo*

lungs. Air sacs connected to lungs supplement respiration. Sexes are separate. Fertilisation is internal. They are oviparous and development is direct.

Examples : *Corvus* (Crow), *Columba* (Pigeon), *Psittacula* (Parrot), *Struthio* (Ostrich), *Pavo* (Peacock), *Aptenodytes* (Penguin), *Neophron* (Vulture).

4.2.11.7 Class – Mammalia

They are found in a variety of habitats – polar ice caps, deserts, mountains, forests, grasslands and dark caves. Some of them have adapted to fly or live in water. The most unique mammalian characteristic is the presence of milk producing glands (mammary glands) by which the young ones are nourished. They have two pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying (Figure 4.24). The skin of

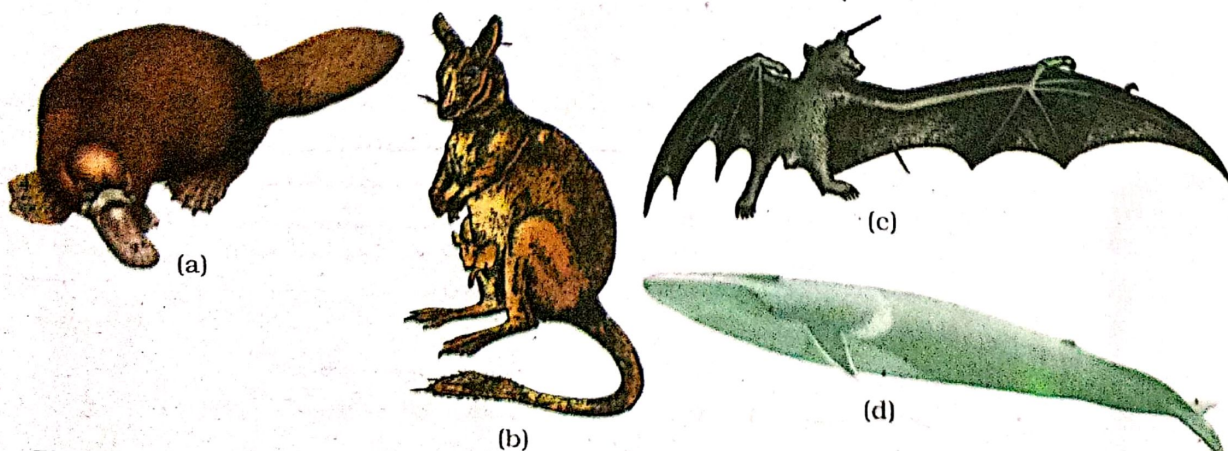


Figure 4.24 Some mammals : (a) *Ornithorhynchus* (b) *Macropus* (c) *Pteropus* (d) *Balaenoptera*

mammals is unique in possessing **hair**. External ears or **pinnae** are present. Different types of teeth are present in the jaw. Heart is four-chambered. They are homiothermous. Respiration is by lungs. Sexes are separate and fertilisation is internal. They are viviparous with few exceptions and development is direct.

Examples: Oviparous-Ornithorhynchus (Platypus); Viviparous - Macropus (Kangaroo), Pteropus (Flying fox), Camelus (Camel), Macaca (Monkey), Rattus (Rat), Canis (Dog), Felis (Cat), Elephas (Elephant), Equus (Horse), Delphinus (Common dolphin), Balaenoptera (Blue whale), Panthera tigris (Tiger), Panthera leo (Lion).

The salient distinguishing features of all phyla under animal kingdom is comprehensively given in the Table 4.2.

TABLE 4.2. Salient Features of Different Phyla in the Animal Kingdom

Phylum	Level of Organisation	Symmetry	Coelom	Segmentation	Digestive System	Circulatory System	Respiratory System	Distinctive Features
Porifera	Cellular	Various	Absent	Absent	Absent	Absent	Absent	Body with pores and canals in walls.
Coelenterata (Cnidaria)	Tissue	<u>Radial</u>	Absent	Absent	Incomplete	Absent	Absent	Cnidoblasts present.
Ctenophora	Tissue	<u>Radial</u>	Absent	Absent	Incomplete	Absent	Absent	Comb plates for locomotion.
Platyhelminthes	<u>Organ & Organ-system</u>	Bilateral	Absent	Absent	Incomplete	Absent	Absent	Flat body, suckers.
Aschelminthes	Organ-system	Bilateral	Pseudo coelomate	Absent	<u>Complete</u>	Absent	Absent	Often worm-shaped, elongated.
✓ Annelida	Organ-system	Bilateral	Coelomate	✓ Present	Complete	<u>Present</u>	Absent	Body segmentation like rings.
✓ Arthropoda	Organ-system	Bilateral	Coelomate	✓ Present	Complete	Present	<u>Present</u>	Exoskeleton of cuticle, jointed appendages.
Mollusca	Organ-system	Bilateral	Coelomate	Absent	Complete	Present	Present	External skeleton of shell usually present.
Echinodermata	Organ-system	<u>Radial</u> <i>Adult</i>	Coelomate	Absent	Complete	Present	Present	<u>Water vascular system</u> , radial symmetry.
Hemichordata	Organ-system	Bilateral	Coelomate	Absent	Complete	Present	Present	Worm-like with proboscis, <u>collar</u> and <u>trunk</u> .
✓ Chordata	Organ-system	Bilateral	Coelomate	✓ Present	Complete	Present	Present	Notochord, dorsal hollow nerve cord, gill slits with limbs or fins.