

## Gymnosperm

- \* term gymnosperm was used by theophrastus in his book enquiry into plant and state plant with unprotected seed
- \* Acer to Goebel 1887 phanerogamous without ovary  
Gymno - naked  
sperm - seed
- \* That is naked seed bearing plant ie seed not inclosed within fruit
- \* The division spermatophyta ie seed bearing plant divided into 2 sub division
- \* Gymno form <sup>Gymnosperm</sup> linked b/w pterido & Angio
- \* Gymnosperm most simple and primitive gp of spermatophyta
- \* Gymnosperm most advanced than pteridophyta
- \* Most ancient gp than Angiosperm
- \* Also placed in embryophyta (form the embryo) including bryophyta, pteridophyta, gymnosperm, angiosperm
- \* Tracheophyta form xylem & phloem including pteridophyta gymnosperm, angiosperm also placed in archeogoniatae
- \* Also placed in archeogoniatae (form archegonia) including bryophyta, pteridophyta, and gymnosperm

They have following general characteristic

### Distribution

- \* World wide in distribution specially in eastern hemisphere
- \* Abundantly found in temperate and conifer forest as comparison to tropical region even in arctic region

There are near about 73 genera and 7000 species found all over the world out of which there 16 genera and 153 species found in India.

The gymnosperm originated in late paleozoic era and form dominant vegetation on earth in Jurassic and Cretaceous period of mesozoic era about 200 million years ago.

Distribution and Habitat During this period Lycadofilicales, Bennettitales, Cordaitales <sup>extinct & fossils</sup> mostly perennials mostly tree but some shrub as Ephedra and rarely herbs as *Zamia pygmaea*.

Habitat usually xerophytic as thick cuticle sunken stomata, waxy coating, xylem well developed. mesophyll tissue differentiated into upper palisade & lower spongy tissue and well developed sclerenchyma.

Size  
They range in size from cm to metre.

Smallest gymnosperm - *Zamia pygmaea* . 5cm

Largest gymnosperm - *Sequoia sempervirens* 366 feet in height. It is known as Coast Red wood of California.

*Sequoia dendron giganteum* 342 feet height. It is known as father of forest.

Massive gymnosperm is *Taxodium mexicanum* about 17 metres girth.

Internal structure

Main body sporophyte which is dominant independent autotrophic & long lived. Differentiated into root, stem and leaves.

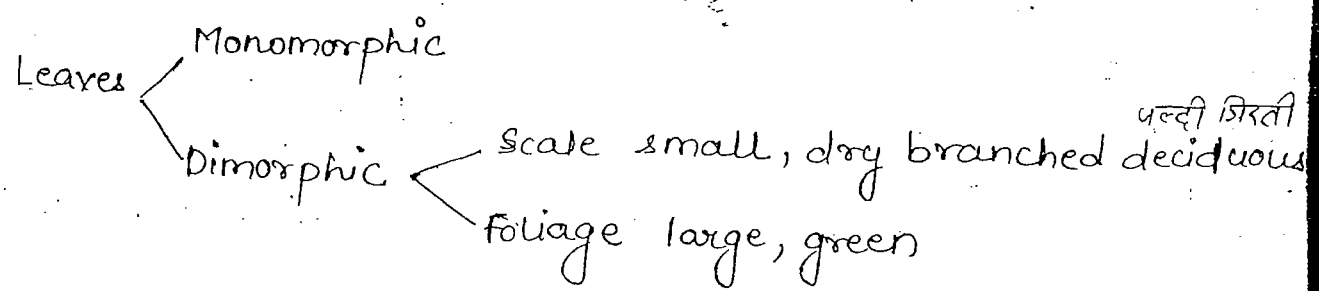
Root  
The ~~root~~ first root arise from the radical of seed and from which 2°, 3° root arises from tap root system.

- \* which grow deep and long some time associated with algae or fungi.
- \* The coralloid root of Cycas are Apogeotropic associated with algae as Nostoc Anabena & form
- \* Endophytic association In pinus, roots associated with fungi called mycorrhiza which is ectotrophic as pinus and Endotrophic as Aracaceae  
ऊपर की तरफ
- \* In Taxodium distichum pneumatophores are present

Stem

- \* Stem is aerial, erect सीधा but tubercle underground as Zamia pygmaea. woody with scars निम्न of leaves either unbranched as Cycas or branched as pinus
- \* In pinus & Ginkgo branching दो प्रकार Dimorphic long shoot & dwarf shoot
- \* Dwarf shoot arises from the axial of scale leaves of long shoot

Leaves



- \* leaves may be microphyllous (pinus) or megaphyllous. (Cycas) may be monomorphic (one type) either monomorphic or dimorphic.
- \* ~~Dimorphic~~ scale leaves which are small dry brown & deciduous
- \* foliage leaves are large & green may be simple as pinus.

or pinnately comp as Cycas. Either bifacial (dorsal ventral side) as Cycas or middle like as Pinus

Arrangement are phyllotaxy may be spiral as Cycas or opposite decussate as Gnetum or whorled as Adiantum

Veination may be reticulate as Gnetum or parallel as Welwitschia or Dicotomous as Ginkgo.

### Internal Character

Internally, Gymnosperm consist of xylem, phloem & cambium

Xylem made up of xylem parenchyma, xylem tracheids. Vessels are absent except Gnetum

Ephedra, Welwitschia

Tracheids consist are angular spirally & bordered with

phloem consist of seive cells phloem parenchyma, companion cells are absent. In place of companion

Albuminous cells may be present b/w xylem & phloem therefore secondary growth occurs

The VB are radial, exarch, diarch to polyarch in the root

In the cortex mucilage cell or resin canal in collaroid roots algal zone

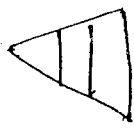
In the stem VB conjoint i.e. on the same radius

collateral (i.e. phloem external to xylem), endarch

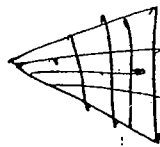
towards the periphery open (i.e. the cambium is present

b/w the xylem & phloem) & wood is 2 type

- \* Monoxyletic i.e. soft & loose as Cycas polyoxyletic i.e. compact & hard as Pinus
- \* On the basis of wood forms may be monoxyletic i.e. single cambium ring persist through out the life as Pinus but in Cycas many cambia are formed therefore wood is polyxyletic.
- \* Medullary rays may be linear i.e. monoseriate or fusiform or multiseriate



Monoseriate

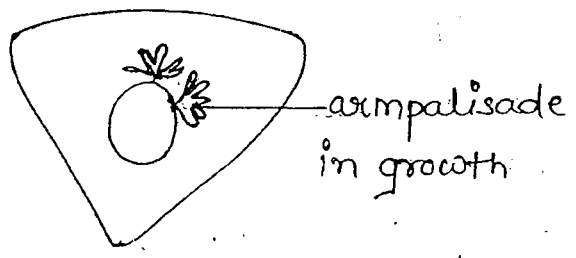
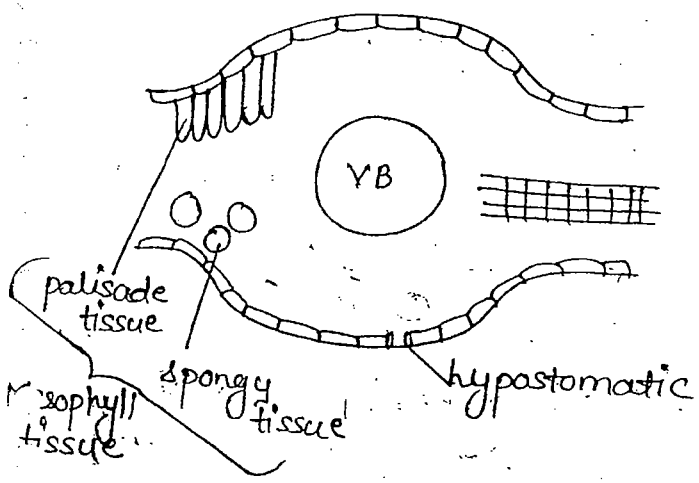


Multiseriate

- \* Secondary ray may be homogenous as Ginkgo or heterogenous as Pinus.

Leaves

- The leaves may be hypostomatic i.e. stomata on lower side as Cycas or amphistomatic i.e. stomata on both epidermis as Pinus.



Amphistomation

Stomata are 2 types

Haplocheilic

When guard cells arise from common mother cells & subsidiary cells are adjacent modified epidermal cells as

Cycas, pinus, Ginkgo, Taxus

### Syndetocheilic stomata

when both guard cells & subsidiary cells arise from common mother cells as

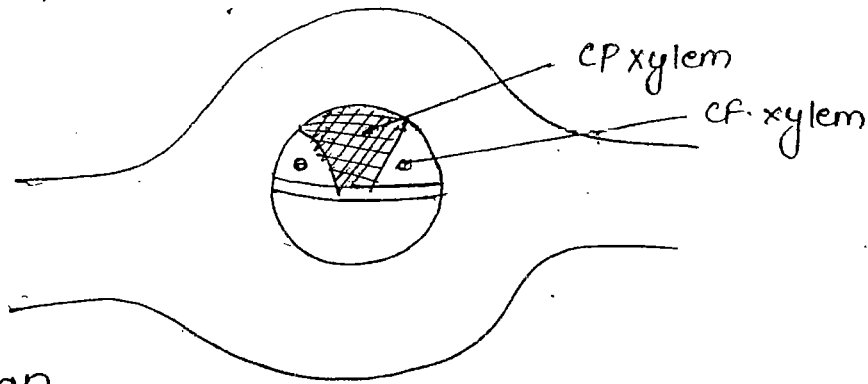
Gnetum, Welwitschia

Mesophyll tissue differentiated into upper palisade lower spongy tissue as Cycas, Taxus, Gnetum but in pinus & Ginkgo mesophyll tissue uniform

In pinus mesophyll cells folded inward called arm palisade usually lateral veins are absent in Gymnosperm

Therefore the transfusion tissue develop in the middle of pinus & midrib lamina region of leaf of Cycas. It translocate lateral side food

The vasculature of petiole & rachis consist of apoxylic xylem i.e. well developed centripetal xylem which is exarch & poorly developed centrifugal xylem i.e. endarch



### Reproduction

#### Vegetative

Gymnosperm may be rarely vegetative as by bulbils as Cycas

\* Gymnosperm are heterosporous i.e. produces 2 kinds of spores - small microspore produced within microsporangia which borne on the leaves, called microsporophyll. Microsporophyll compactly arranged to form male cone

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# Bryophyta

- \* Term used by Robert Braun 1864 including algae, fungi, lichen and mosses
- \* Term mosses used by Jussieu
- \* Study of bryophytes called Bryology
- \* Father of bryophytes Johanson Hedwig
- \* Father of Indian bryology K. S. Ram Kashyap
- \* Simplest and most primitive gp of land plants
- \* Most simplest and primitive gp of embryophyta  
embryo बनना शुरू
- \* placed in archegoniatae (Bryo, pteri, gymno)
- \* Oswald Tippo placed in Atracheata (ie v.B absent)  
X P absent)
- \* called non vascular cryptogamous OR  
<sup>hidden seed</sup>
- \* ~~Are~~ non vascular embryophyta
- \* Scott founded pteridophyte origin of bryophytes
- \* Bower founded origin of bryophyte from green thallophyte  

erect	}	heterotricous filamentous
prostrate		

  
(Algae)
- \* placed b/w thallophytes and pteridophytes on the basis of evolution
- \* More advanced than thallophytes

They have following general characteristics (features)

## Distribution (ecology of Bryophytes)

- \* Cosmopolitan ie world wide in distribution, where life sustained on moisture
- \* They occur (found) in tropical and subtropical region
- \* Upto ~~arctic~~ arctic and tundra region

- \* ~~prop~~ probably no found in sea marine, and Antarctic region
- \* There are near about 960 genera and 24000 species found all over the world
- \* In Mountain they occur at height 1800 feet to 20000 feet Aongstroema julacea occur max height 19800 feet
- \* In India, abundantly founded in eastern and western his himalyas and Niel giri hills
- \* Western himalyas is to be belived as Gold mines of the liver worts
- \* Oldest fossil hepaticites was 1<sup>st</sup> discribed by walter 1925 from upper carboniferous period of palaeozoic era and also in mesozoic era
- \* Oldest fossil obtained about 350 million years ago they form dominant vegetation of earth

Habit nature प्रकृति

- \* They may be annual or perennial, herbeccus

Habitat आवास

- \* Mostly terrestrial found in moist cool shaded places shad loving plant (sciophytes) but hence most simplest and primitive gp of 1<sup>st</sup> land plant but water is necessary for fertilization hence called amphibians of the plant kingdom

grow during the rainy season and form carpet & mat on the soil surface few are aquatic Riccia fluitans, Riccio corpus natans, sphagnum cotton moss.

Size

small in size ranges from 1mm upto 30 cm. Though small in size but much more developed & differentiated than heterotricous complex Algae.

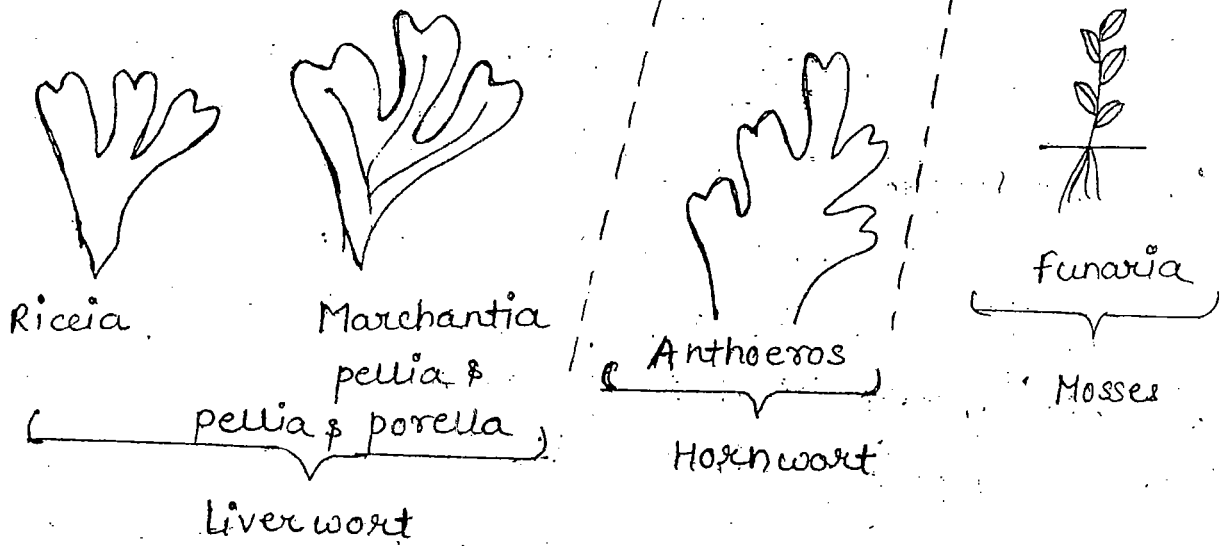
- \* Smallest Bryo - Zoopsis argentic 3
- \* largest Bryo - Dawsonia superba (40-70cm)  
Australian mosses  
found in Australia & Zealand
- \* longest Bryo - Fontinalis antipyretica (Brook mosses)

- \* few are aquatic Riccia fluitans, Riccia, Corpuscularia  
Sphagnum cotton mosses; turf moss peat moss, Bog moss  
great decompose mat
- \* Fontinalis antipyretica Brook moss.
- \* Riccia - completely adapted life in water.
- \* Mostly autotrophic but few are saprophytic Buxbaumia  
aphylla, Cryptothallus mirabilis, Minium hornum.
- \* few are epiphyllous Sadulla protensa (fern frond)
- \* few are epiphytic as Frullaria & Dendroceros
- \* few are xerophytic as Polytrichum juniperum (hair cap moss), Tortulla desertorium
- \* grow on dry rock Porella platyphyll

### External structure

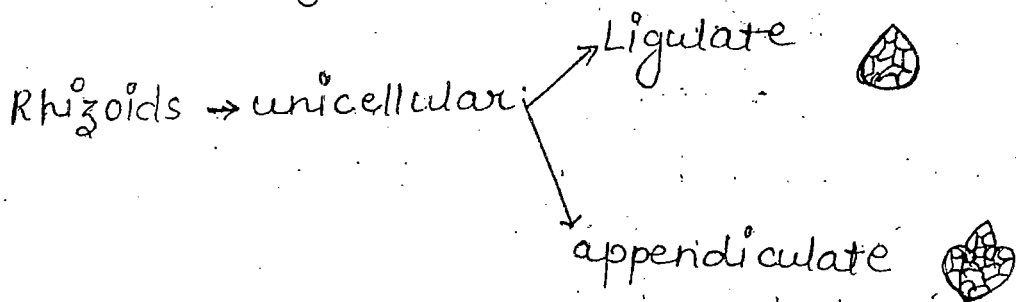
- \* Main body gametophyte (n) which is dominant long lived autotrophic; independent which may be  
Thallose or foliose (pseudo like) Autotrophic  $\left\{ \begin{array}{l} \text{chl a} \\ \text{chl b} \\ \text{starch} \end{array} \right.$   
Thallophyta like
- \* Thallose not differentiated into root stem and leaves  
Thallus is green flattened prostrate (प्रात) dorsiventral  
dicotomously branched but Anthoceros variously  
lobed each lobe has midrib on dorsal side
- \* single midrib but absent in anthoceros monoclea

\* dorsal surface smooth but ventral side rhizoid and scale.



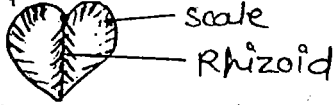
### Rhizoids

- \* Rhizoids occur on either side of midrib on the ventral side as Riceia & Marchantia, but in Anthoceros scattered rhizoids present.
- \* Unicellular unbranched, colourless smooth & tuberculate rhizoids. In tuberculate peg like or finger like outgrowth as Riceia & Marchantia. But in peltia & Anthoceros only smooth walled
- \* Main function fixation & absorption of some amount of water & mineral from the soil.
- \* They are analogous to the root of higher plant.

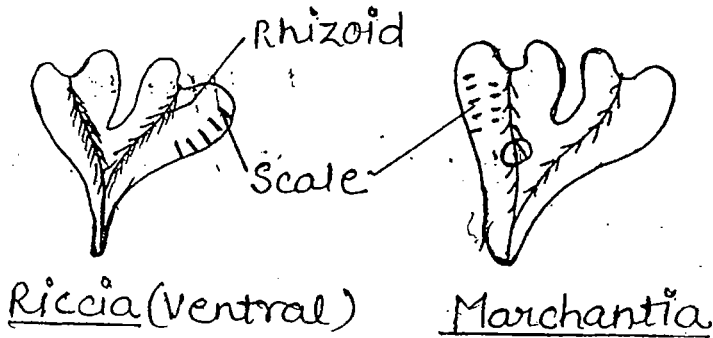


\* On the ventral side. In some liverworts like Riccia & Marchantia. scales occur

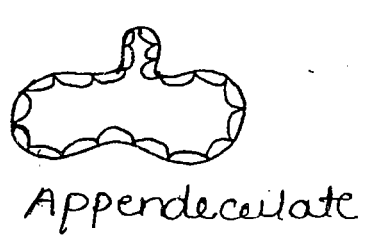
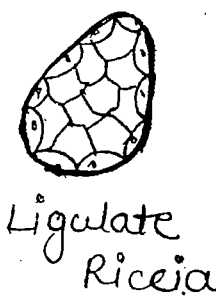
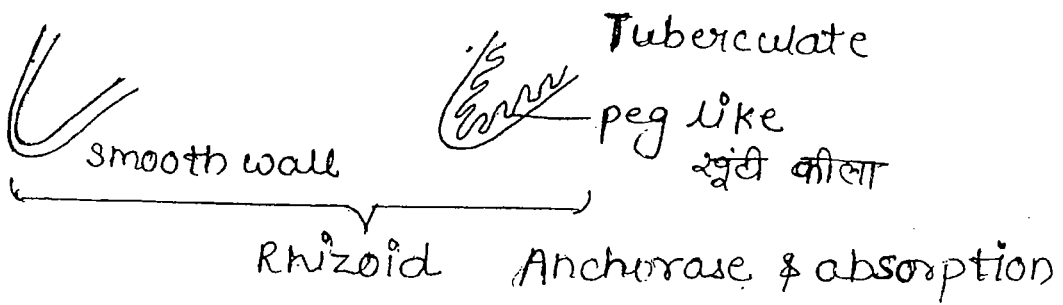
\* In Riccia on the margin usually single layer but In Marchantia 2-4 row on either side of midrib but in most of liverworts, Anthoceros.

scales are absent 

\* Multicellular one cell in thickening violet in colour. two type ligulate & appendiculate. appendiculate. Scale have appendix both are found in Marchantia but only ligulate in Riccia



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tree

\* dorsal surface smooth but ventral side rhizoid and scale.



Riccia



Marchantia

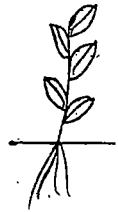
pellia &

pellia & porella



Anthoceros

Hornwort



Funaria

Mosses

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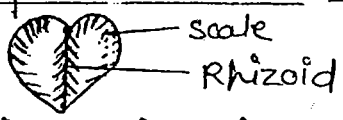
Marchantia & both ligulate  
appendiculate



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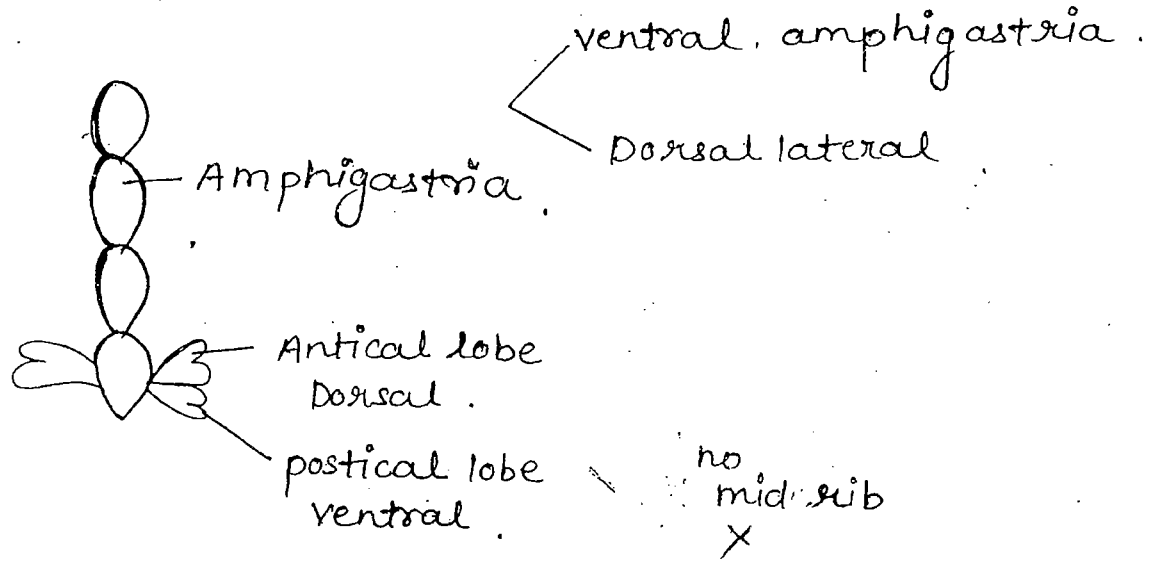
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\* Multicellular one cell in thickening violet in colour. two type ligulate & appendiculate. appendiculate. Scale have appendix both are found in Marchantia but only ligulate in Riccia

foliose

The foliose leaves bryophyte have axis which bear leave & rhizoids.



\* In foliose Jungermanniales leaves arranged in three rows one ventral lobe and 2 dorsal lobe

\* ventral row reduced very much in size of Amphigastrium

\* and two have dorsolateral row which have antical lobe Dorsal and postical lobe ventral  
But leaves without mid rib

\* In foliose mosses axis erect bears rhizoids & leaves.

### Rhizoids

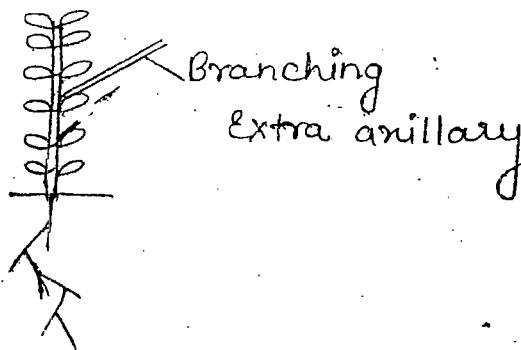
\* Rhizoids usually arise from the base of axis multicellular branched and colourless.

\* In funaria rhizoids with oblique septa  
leaves.

\* axis bears leaf like structure true leaves absent technically called phylloid arranged in spirally on the axis

\* Each leaf have usually single midrib, 2 midrib in hyphum absent. In fontinalis (Broom moss) & Andraeae (granite moss)

\* No venation in the leaves of funaria



### Acrocarpous

\* axis upright, feeble branching



70007.

MOLLUSCA / PROTOCHORDATA /  
HISTOLOGY / INTEGUMENTARY  
SYSTEM

Unio

"It is called fresh water mussel"

Other Bivalve Class → Lamellicidians.

Habit/Habitat - It lives in fresh water - Pond, lake, rivers, streams.

⇒ Usually it is found buried in sand or in b/w stone with its outer shell remains visible.

Morphology - Bivalvia

Both valve are joint from "Hinge joint"

i) Bivalve shell.

with anterior most whitish projected part called - Umbo.

which shows first region of shell growth.

Anterior adductor muscle.

Foot

Ant.

retractor muscle.

Anterior Protractor muscle.

Heart/Pericardium

Pallial line.

Exhalant siphon

Post adductor muscle.

muscle.

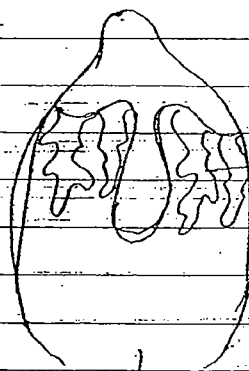
Inhalant Siphon

Post retractor muscle.

Gills.

ii) - Below Umbo there are many lines of growth.

iii) - Two valve of shell is attached to each other through a joint called - Hinge joint to which are attached - Hinge muscles.



Gills.

Siphon

There are 2- Big muscles - anterior adductor and Post. adductor muscles. Also present anterior, posterior protractor also present and posterior retractor muscles (No posterior protractor muscles). These muscles helps in keeping animal body inside shell.

Protractor and Retractor muscles - continues in foot and helps in forward and back-ward movement of foot.

iv) - There is line b/w 2- adductor muscles. called → Pallial line.

v) - Inner surface of shell is with rough margin called Hinge teeth.

### Structure of shell -

- 1) Periostracum
- ii) Ostracum or Prismatic layer
- iii) Hypostracum → Mother of Pearl

Periostracum - Thin membranous sheath made of hard organic material chonchiolin.

Ostracum - It has verticle plates of Calcium carbonate and chonchiolin.

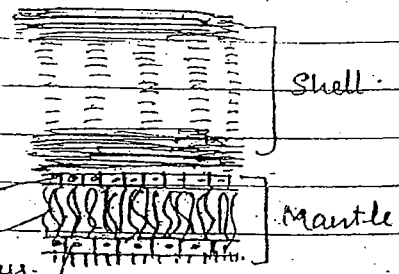
Epithelial layer.

Connective tissue layer.

ciliated epithelium

Hypostracum - Mother of Pearl,

Macres layer - Inner most layer of shell etc



which are used indigestion of food

Intestine - long coiled tube, comes out from stomach then running through gonads, enters in Pericardium. Its internal valves has foldings similar to Typhlosole of Earthworm. Hence it helps in absorption of nutrients.

Rectum - Posterior most part outside of Pericardium. finally opening through anus near post. adductor muscle.

Digestive Gland - One pair large gland present around stomach. Contains large no. of cells taking part in secretion of enzymes and absorption of some nutrients. Hence it helps in intracellular digestion of food and absorption of some nutrients. It is connected thro to stomach through duct.

Food and Feeding -

Food - microscopic, diatoms, Protozoans, Algal filaments etc.

Feeding - Called Ciliary feeding or filter feeding. Food comes through water current entering through Inhalent siphon and undigested food also moves out through Inhalent siphon.

Respiratory System -

Gill - Bipectinate type

## Respiratory Organs includes -

Gills and Mantle.

Gills - A pair of Gills, present on both side of foot hanging in mantle cavity attach to whole length of mantle excluding some posterior part.

→ Gills are attached to mantle through Ctenidial axis.

→ Gills are of Eulamellibranch type, Bipectinate i.e. laminae on both side or lamellae

### Structure -

- Each gill has two lamellae → outer and inner.

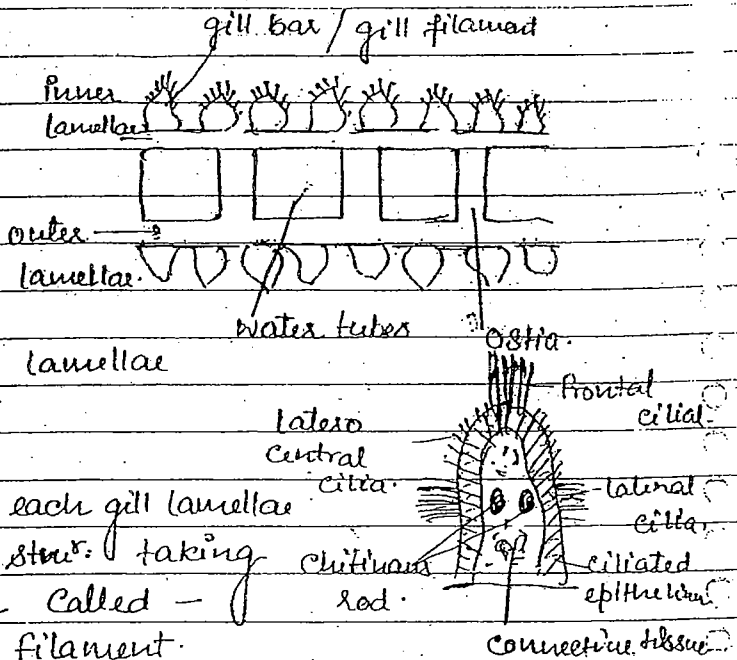
- Each lamellae has 2-lamellae outer and inner.

- Outer most surface of each gill lamellae has most important str. taking part in respiration called - Gill bar or Gill filament.

These gill filament makes 'V' or 'W' shaped structure.

- In b/w gill filaments or Ostial Pores which continues in water tubes present b/w gill lamellae.

- Space present above 2-gill laminae is called as - Suprabranchial chamber.



Body cavity → like Pila. (Schizocoelous. + Haemocoelous)

hang and different apertures are present.

→ Mantle By its folding forms → left and right mantle lobe which posteriorly develops opening called → inhalent and exhalent siphon.

## Physiology -

### I- Digestive System-

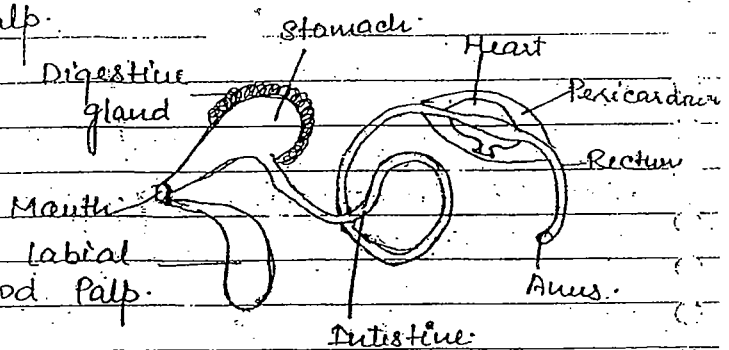
1) Mouth → labial Palp.

ii) Oesophagus

iii) - Stomach.

Mouth - Slit like with labial palp.

Giving movement of food Palp towards mouth.



Oesophagus - Short, a tube continues in stomach.

Stomach - Big, sac like well developed divided in anterior Cardiac stomach and Post. Pyloric Canal or Pyloric Caecum.

Pyloric Caecum has specific region called Style sac, secreting a solid stru<sup>n</sup> called - Crystalline style.

Crystalline style has concentric layers of some Proteins, including cellulose digesting and starch digesting enzymes.

When food moves through stomach crystalline style shows movement enrolling its enzymes layer.

with Parallel plates of  $\text{CaCO}_3$  and chonchiolin.

Mantle - It is covering around visceral mass and visible after removing shell. It takes part in secretion of shell.

If any foreign particle enters in mantle, it secretes concentric layers of chonchiolin and  $\text{CaCO}_3$  around that particle, resulting in Pearl formation.

Natural Pearl formation takes place in about 3-5 years and maximum in 7 years.

Mantle has outer columnar epithelium layer below which is connective tissue mass and inner most layer is with ciliated epithelial layer.

Head - It is absent, Hence no tentacles and eyes.

Foot - Muscular organ Projected out from shell.

It is unstriated smooth muscles. Involuntary in Action.

→ Group of muscles protractor and retractor innervates it.

→ It has a great contraction ability through which it takes part in locomotion.

Visceral Mass - All internal organs are present around mantle lobe forming visceral mass or Pallial complex.

Mantle Cavity - A Big mantle cavity is present towards posterior end in which large gills are present.

and the space b/w gill filaments is Infrabranchial chamber.

Histologically, Gill filament have inner core of connective tissue with Chitinous Rod and outer covering of ciliated epithelium. Cilia present on gill filaments are

- i) - frontal cilia - longest, Present at anterior end.
- ii) lateral cilia - smaller, present on sides of gill filament
- iii) fronto-lateral or latero central cilia - smallest, present b/w frontal and lateral cilia.

### Physiology of Respiration -

Water current in the form of food current is created rows of cilia present on gill filaments. Water is through inhaled siphon moves in gill filament <sup>supra</sup> infra branchial chamber and running through water tubes of gill lamellae goes in supra-branchial chamber. finally goes out through Ex-halant siphon.

Deoxygenated Blood from kidney goes in Gills. through afferent branchial vein and comes out through efferent branchial vein, during their course of circulation in gill, deoxygenated blood gets oxygenated

2) Mantle - It is like gill contains large no. of blood vessels and is always in contact of water. Oxygenated blood takes place additionally helping <sup>in</sup> in the process of respn.

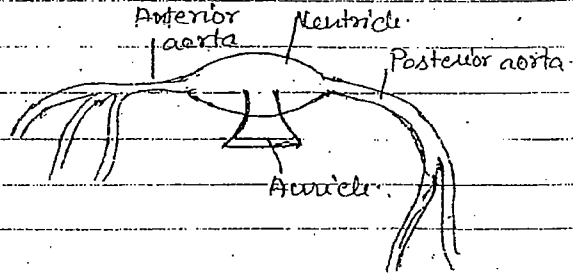
### Circulatory System

- i) Pericardium ii) Heart iii) Veins iv) Sinuses v) Arteries.

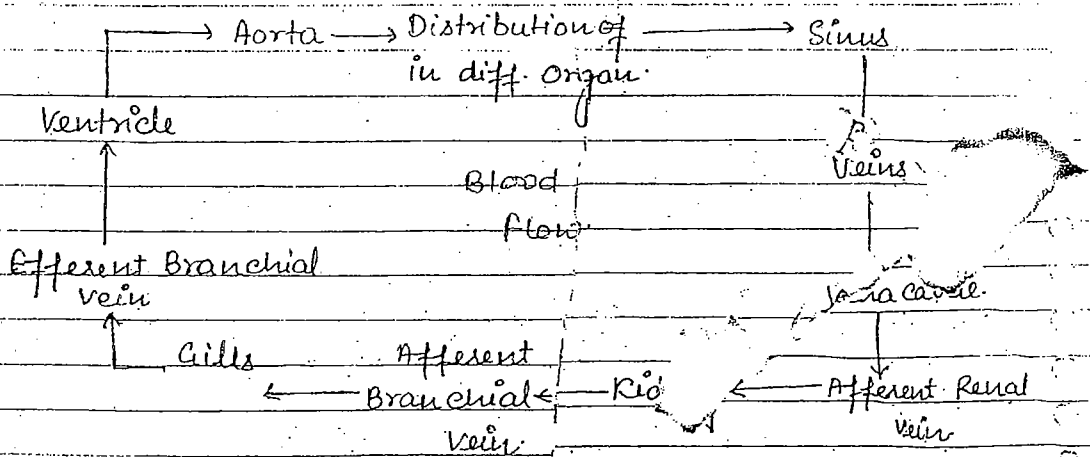
Circulation → <sup>Blood</sup> Open type. + Vascular System.

Heart → 3 chambered

- 1 - Ventricle and
- 2 - Auricle.



→ Blood is like Pila.



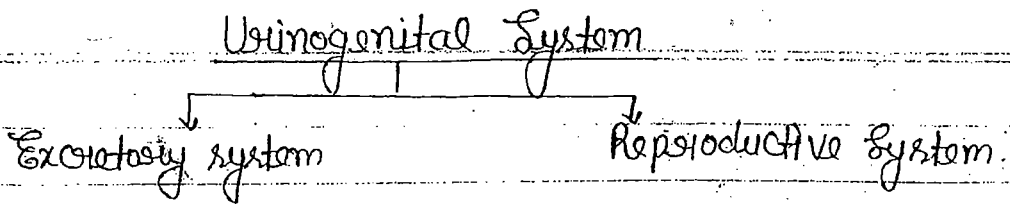
Components of blood vascular system →

i) Pericardium - Sac like covering around heart through which intestine goes out. Connected to kidney through Nephropericardial aperture.

ii) Heart - 3-chambered → One Primary large Ventricle to which all attached 2 - auricle.

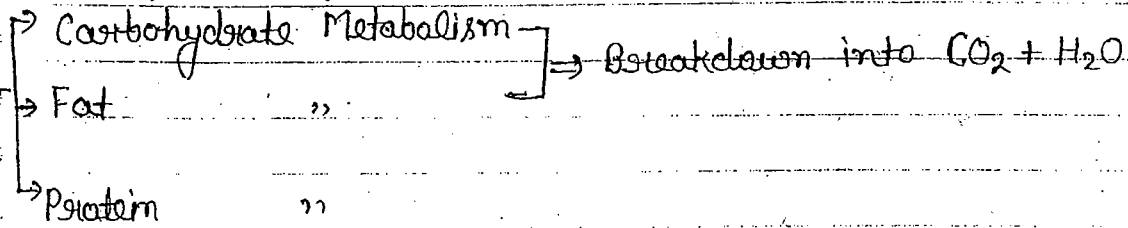
A valve called Auriculo ventricular valve is present b/w auricle and ventricle preventing back flow.





### Excretory System:-

"Excret" of harmful nitrogenous waste products.



### Products of Protein Metabolism:-

① Amino Acid — those animal which have amino acid, k/a Aminotelic.

② Ammonia — if amino acid excess in amount then it converts into ammonia, stored in liver but it is produced into water. Condit<sup>n</sup> is k/a Ammonotelic.

③ Urea — ammonia converted into Urea, k/a Ureotelic.  
+nt in mammals & human.

④ Uric Acid — Urea converted into uric acid, k/a Urictelic.  
+nt in Insect.

⑤ TMAO (Trimethyl Amine Oxide) — +nt in marine teleost fishes, it is special type of product.

### Other Excretory Products:-

① Uricine & Pyrimidine

2- Creatine / Creatinine

3- Hippuric acid

### Kidney :-

Origin - Mesodermal - develops from Coelomic pouch. These coelomic pouch k/a Nephrotome, develops from mesomere.

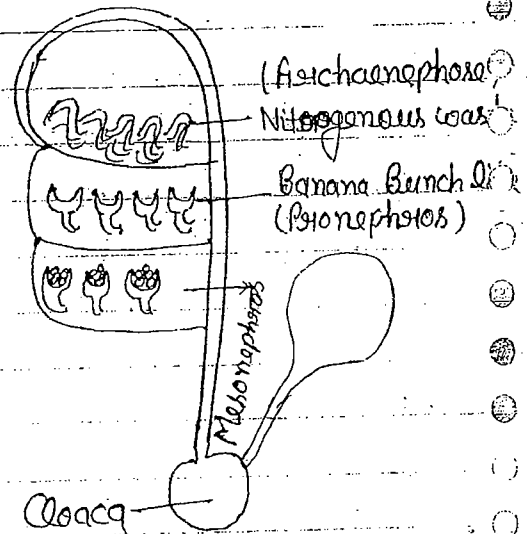
### Types of Kidney :-

(1) Archaenephros :- primitive kidney, also k/a hypothetical kidney.

\* - It is found only in embryonic <sup>condition</sup> of cyclostomes + <sup>some</sup> Myxine.

\* - Not found in adult animals, so it k/a hypothetical kidney.

- It has many protonephrostomal pouches with funnel nephrostome scattered in whole coelomic cavity. Hence, it also k/a Holonephros.



(2) Protonephros :- k/a Embryonic kidney.

- It is ~~not~~ in early embryonic stages. Later on replaced by Mesonephros.

- It is rarely ~~not~~ in some cyclostomes & some fishes.

- It develops towards ant. most end. Hence, k/a Head Kidney.

- It has nephridial tubule in the form of banana bunch.

Malpighian capsule is not developed.

- All tubule commonly opens in a duct, k/a Protonephric duct.

- Excretory material is absorbed from coelomic fluid, but glomerulus is not developed.

(3) Mesonephros: - It develops from middle part of coelomic pouch after "degeneration" of pronephros.

It develops malpighian corpuscles, having primitive glomerulus & Bowman's capsule.

- Excretory material are filtered from blood. Pronephric duct of pronephros, unites with mesonephric tubule, k/a mesonephric duct. It is also k/a Wolffian duct.

- It is +nt in Anamniotes (Fishes & Amphibian)

- In cartilaginous fishes & some limbless Amphibian - nephric tubule spread towards post. end of body. Such type of kidney is k/a Opisthonephros or posterior or Tail Kidney.

(4) Metanephros: - In amniotes mesodermal mesonephros also degenerate. Another kidney k/a metanephros develops from separate nephridial pouch.

- Mesonephridial <sup>or (Wolffian duct)</sup> duct in ♂ changes to Vas deference & in ♀ it degenerates disappear.

- It has well developed malpighian corpuscle & tubules. In mammals, tubules become longer due to development of loop of henley.

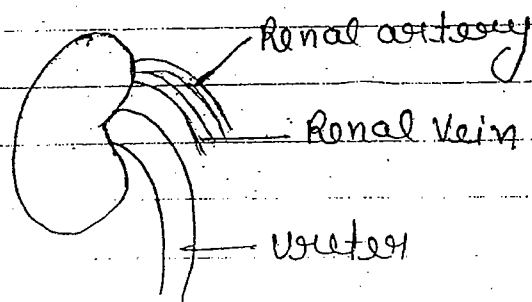
### Mammalian Excretory System: -

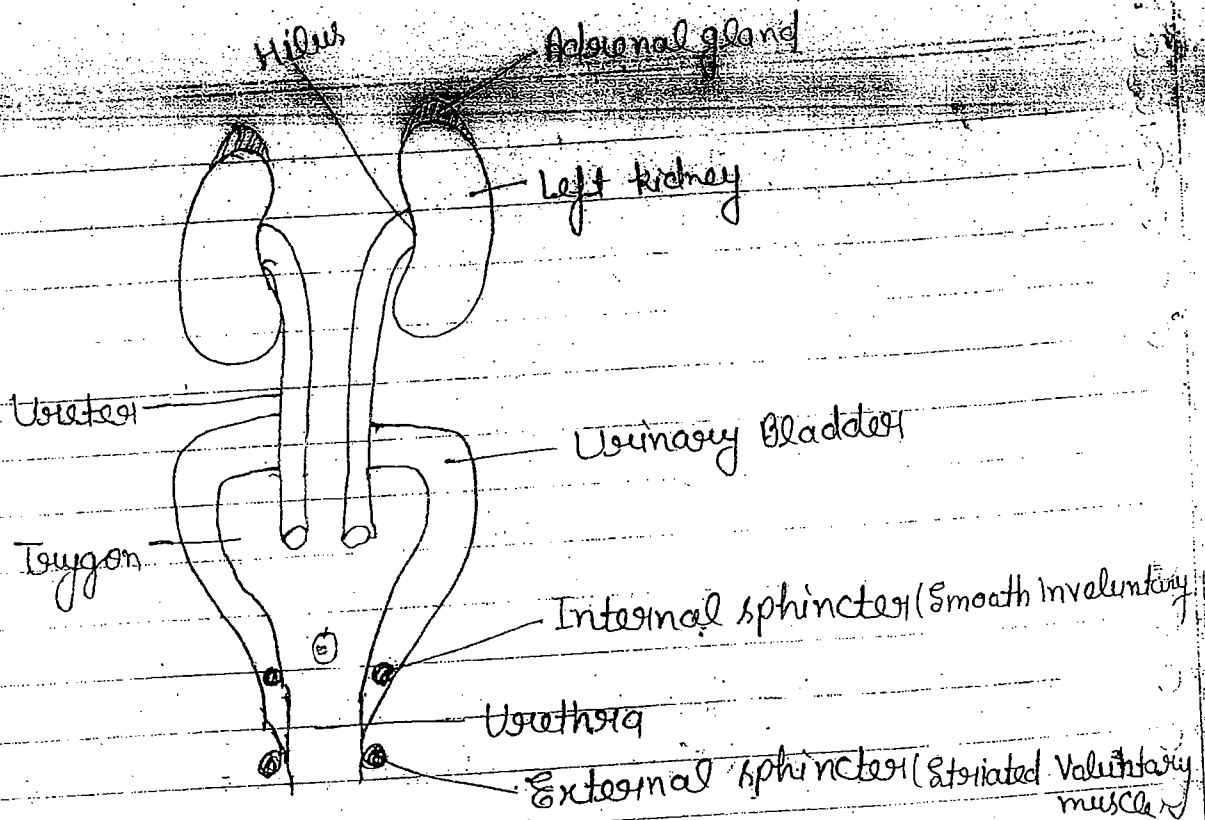
Kidney: - Bean shaped - +nt in retroperitoneal cavity

In human - 300-400 gm. in ♂, 300 gm. in ♀

12 cm. in size. Slightly smaller in ♀ than ♂

- Paired kidney in which





- Kidney are Retroperitoneal in posit<sup>n</sup>, attached to peritoneal wall on both side of spinal cord & dorsal aorta. Post.
- Post. most end a floating ribs covers it externally.

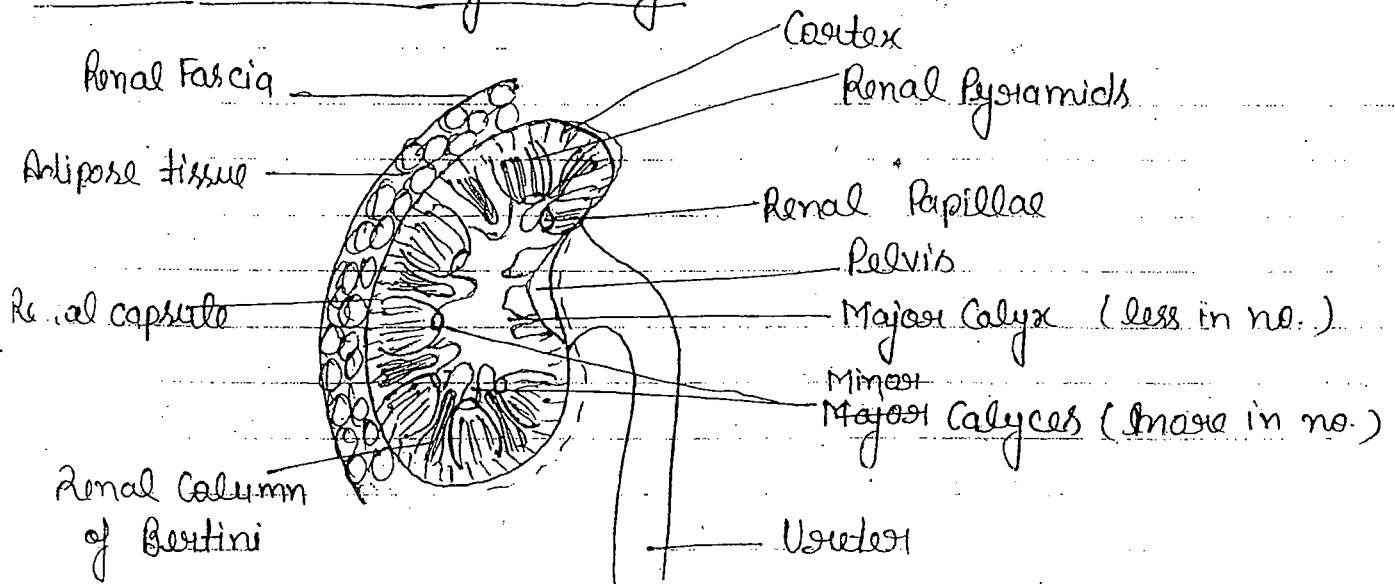
Morphology — Bear shaped with middle furrow, k/a Hilus. through which blood vessels & ureter comes out. Renal artery enters through it for distrib<sup>n</sup> of blood & renal vein comes out for suckering of blood.

- Ureter transfers urine, forms kidney. It is collected in urinary bladder in which 2 ureter opens. A long duct continues from urinary bladder, k/a Urethra, opening through excretory pore. — Common urinogenital aperture in ♂ & separate.

Triangular part of urinary bladder with 2 opening - 2 of Ureter & 1 is urethral opening.

- \* Urinary bladder has covering of transitional epithelium & labile detrusor muscle, providing maximum stretchability.
- \* Urethral tract with a sphincter - internal sphincter with smooth muscle - involuntary in funct<sup>n</sup>.
- External sphincter - with striated muscle, voluntary in funct<sup>n</sup>.

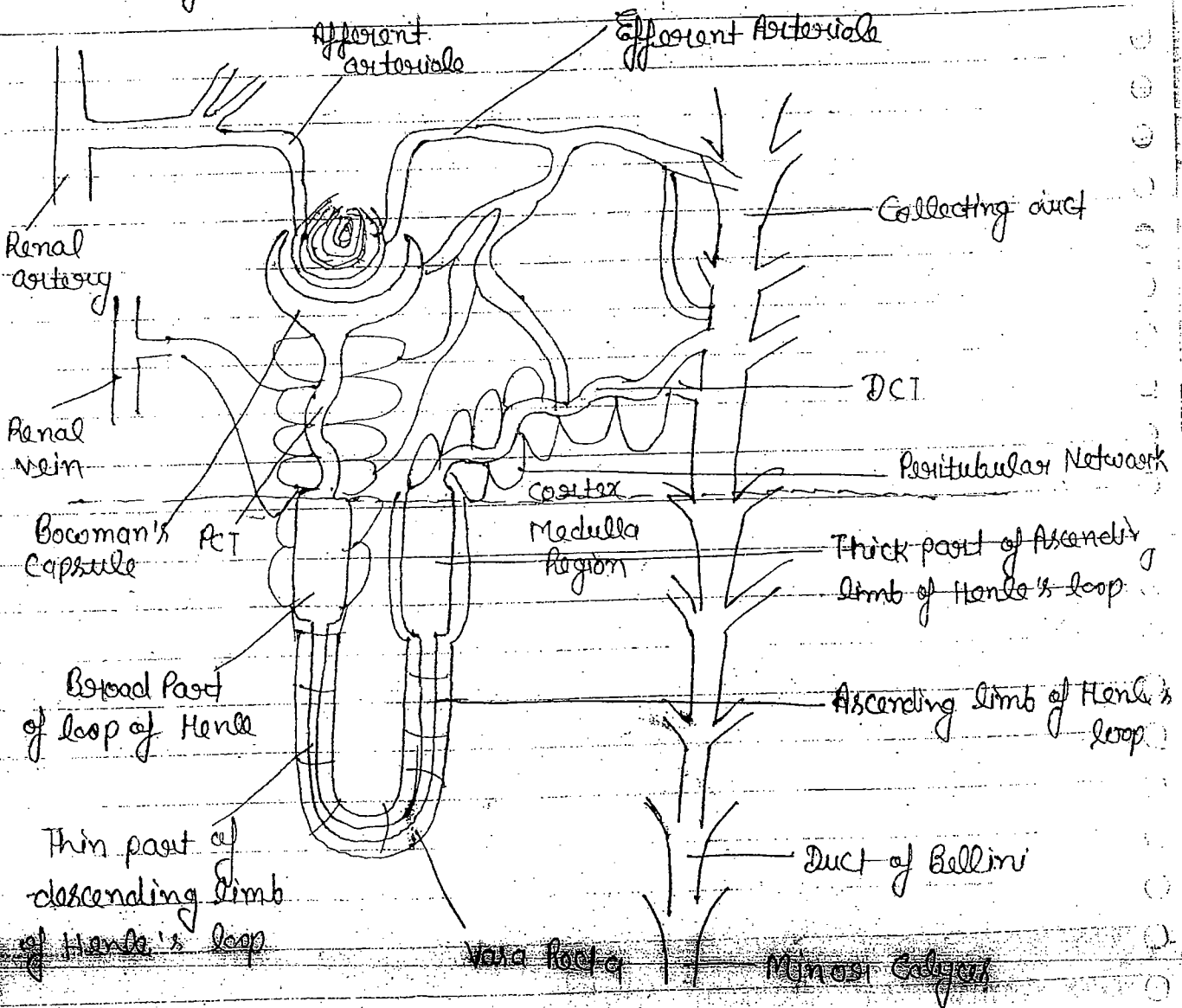
### Internal Structure of Kidney :-



- Externally, kidney has 2 regions :- outer cortical & inner medullary region.
- Medullary region is in the form of medullary pyramids & in b/w pyramids develops - Renal column of Bertini due to folding of cortical region in medullary region.
- But most part of medullary pyramid is k/a Renal papillae which opens in small spaces k/a Minor calyxes & these small spaces continues in larger spaces, k/a Major Calyxes.
- Finally, major calyx continues in funnel shaped str, k/a pelvis.
- Pelvis comes out through Ureter.
- Outermost cover of kidney is k/a Renal fascia.
- Renal capsule is ~~form~~ with fibrous connective tissue.

# Structure of Nephron / Uriniferous Tubules :-

- 1- Malpighian Capsule → Glomerulus  
→ Bowman's Capsule
- 2- Proximal Convoluted Tubule
- 3- Loop of Henle
- 4- Distal Convoluted Tubule
- 5- Collecting duct
- 6- Duct of Bellini - opens in Minor Calyx



- in cortical nephron - most part of Henle loop occurs in cortex region.

Medullary nephron - ~~less~~ most part of Henle loop occurs in medulla region.

1. Adiphaion Corpuscles:-

① Glomerulus:- Bunch of thin capillaries made by branching of afferent arteriole.

②  Bowman's Capsule:- Cup-like str. in which glomerulus is placed. Continues in PCT.

③ PCT:- Constricted tube like posteriorly continues in loop of Henle

Loop of Henle:- differentiated in descending & ascending limb of Henle's loop & both limb has thick & thin parts.

D.T:- Post. constricted duct which continues from thick part of ascending limb of Henle's loop.

Collecting Duct:- DCT opens in collecting duct which also has opening of many other nephrons.

- Many collecting duct then opens in broad duct, k/a duct of Bellini & many duct of Bellini finally opens in a small space towards inner side of kidney, k/a minor calyces.

- Minor calyces continues in major calyces & major calyces in pelvis.

Blood Supply to Nephron:- it is 2 types:-

1. Peritubular Network

2. Vasa Recta

1. Peritubular Network:- it is int in cortical nephron & smaller loop of Henle. Renal arto

branches in afferent arteriole & afferent arteriole forms capillaries & then efferent arteriole comes out from capillaries.

- Efferent arteriole then branches in thin blood vessels around parts of kidney tubule, nephron, PCT, DCT, Henle's loop & collecting duct.

- Finally, all thin capillaries opens in renal vein which comes out through kidney.

2- Vasa Recta :- it is +nt in medullary nephron, having long loop of Henle.

- Blood vessels branching out from efferent arteriole forms sun like vessels around long loop of Henle.

Types of Nephron :-

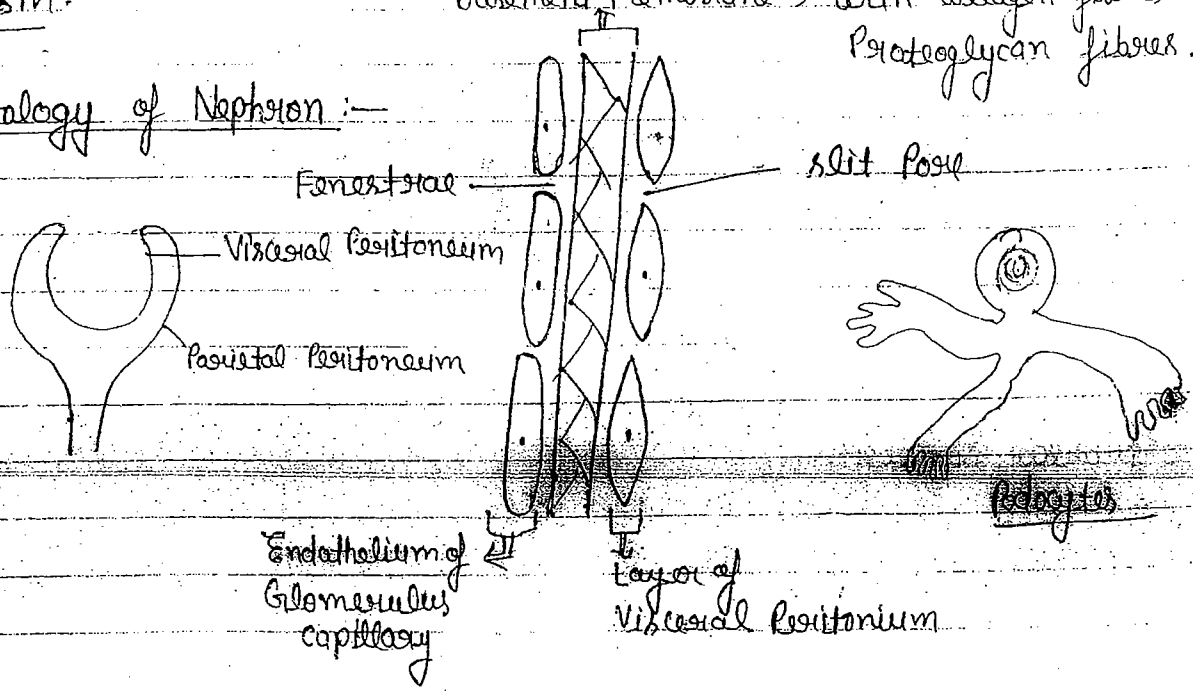
Cortical Nephron - maximum <sup>part</sup> of loop of Henle in cortical region about 85%.

\* Medullary Nephron (Juxtamedullary Nephron) - about 15%.

Juxtamedullary medullary with juxtamedullary cells, long loop of Henle, Vasa recta helps in counter current mechanism.

Basement Membrane  $\Rightarrow$  with collagen fibres & proteoglycan fibres.

Histology of Nephron :-





# ANIMAL NUTRITION

Nutrition And Nutriant -

Types of Nutrition →

1) Chemoautotrophs. (Chemosynthesiser)

2) Autotrophic / Holophytic

3) Holozoic

4) Saprobiotic → Saprophytic  
Saprozoidic

5) Parasitic

Holozoic Nutrition — 1) Herbivorous

2) Carnivorous

3) Omnivorous

## Alimentary Canal or Gastrointestinal tract and Associated Glands →

Alimentary Canal originates from

A pouch anterior to archenteron takes part in Gut development embryologically at anterior and posterior end. It has <sup>mouth</sup> ectodermal lining and in middle region Endodermal layer present. But in wall of Alimentary Canal all of 3-layer - Ectoderm, mesoderm and endoderm takes part in their form.

### Mammalian (Human) Alimentary Canal

1) - Mouth - Slit like structure. In mammals surrounded with lip. small in Man and larger in Rabbit. (Mouth) lip movement through - Orbicularis circularis muscles.

Human lips are large fleshy with glands at their inner surface. Lip are immovable in Platypus, in aquatic Cetacean whale.

In Rabbit at the side of mouth, corner of mouth hard bristles sensory for touch called Vibrissae are present. In Man Upper lip with mouth stretch and notch called ~~philtrum~~ philtrum is present.

2) - Vestibule - Space just behind mouth surrounded with Gum and teeth smaller in Man larger in Rabbit.

3) - Buccal cavity - Broad space behind vestibule in which or oral cavity following structures are present -

a) - Palate -

→ Hard Plate Palate

↳ Soft Palate

It makes the roof of buccal cavity. It is formed by bony processes of upper jaw bones (Premaxillary, Maxillary and Palatine Processes) in most mammals including rabbit but in man Premaxillary Processes are absent.

In b/w Bony Processes, soft tissue are present forming ridges and grooves on Palate called Palatine rugae which help in keeping food in buccal cavity during mastication. It is best developed in Carnivores.

In Rabbit and some other mammals a pair of Naso-Palatine duct is present b/w Nasal passage and buccal cavity. In which olfactory organ - Jacobson's organs are present. Best developed in Reptiles.

Posterior part of Palate is without bony processes contains soft tissue making soft Palate.

It posteriorly makes around in U-shape like structure called Uvula or Velum Palati. which reaches upto pharyngeal region dividing Pharynx in 3 regions.

- i) Naso-Pharynx
- ii) Oro-pharynx
- iii) Laryngo-Pharynx

b) - Tongue - Fix to Floor through a membrane called Lingualum - ~~Pharynx~~ and Posteriorly Franchum.

## Hyoid apparatus.

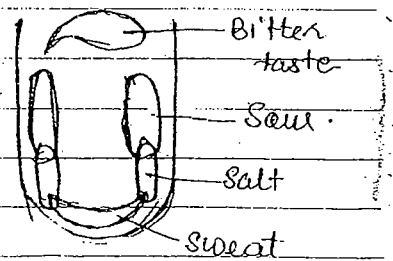
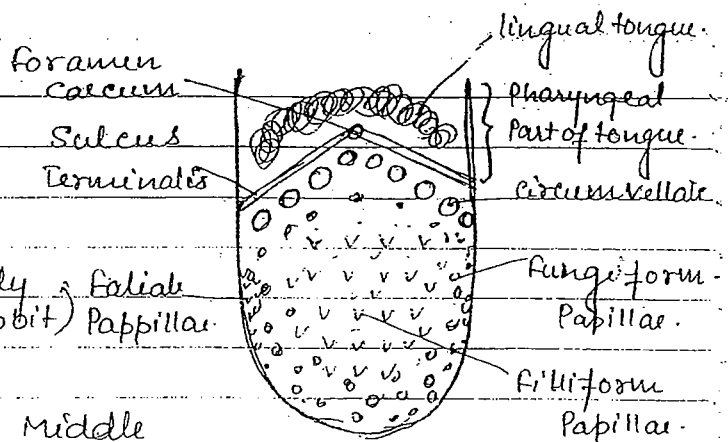
It is divided 2-parts → Terminatis Pharyngeal and lingual Part  
The latter a 'V' shaped (only in Rabbit) Pappillae.  
Septum called - Circ

Sulcus terminalis. In Middle of which a narrow Foramen Taste area. Caecum is present.

In embryonic Cond<sup>n</sup>. foramen caecum is a opening of a duct called - Thyroglossal duct.

In Pharyngeal Part of duct lingual Tonsil having lingual tissue is present.

In Oral part of tongue many Papillae are scattered having taste bud. These Papillae are -



- 1) Circum Vallate → largest in size Just below <sup>Sulcus</sup> Circum terminalis about 40 in no. ~~absent~~ and have taste bud.
- 2) Fungiform Papillae - Smaller in size, circular and ~~scat~~ scattered at the corner soft tongue and also have taste bud.
- 3) Filiform Papillae - Cone Shape, smallest in size present in Middle region. Most numerous but have no. taste bud.
- 4) Foliate Pappillae - Present in rabbit but absent in Man leaf like, present at corner and have taste bud

overlapping taste area - ~~Sweet~~ Salt

Overlapping b/w - Sweet and Sour.

## Teeth-

### Types of teeth-

(a) - On the basis of growth

- ① Hyodont - When teeth come to the surface they are replaced. other vertebrate
- ② Statodont - Stable teeth persist after growing upto surface.  
eg - Mammals.

(b) - On the basis of Pulp cavity opening -

(i) - Brachydont →

(ii) - Rooted teeth in which Pulp cavity closes on maturity hence growth is limited. eg - Most of teeth also in Man.

(iii) - Hypsodont - Rootless teeth with open Pulp cavity showing continuous growth.

eg - Incisor in Rabbit and Elephant, canine in Boer, Molar and Premolar in Horses.

(c) - On the basis of attachment with Jaws -

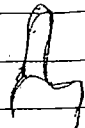
(1) - Acrodont - Teeth superficially attached to the surface of Jaw bone.

eg - Amphibian and fishes



(2) - Pleurodont - Teeth attached to the side of Jaw bone and attachment

is stronger. eg - Reptiles.



4) Thecodont - Teeth attached deeply in bony socket of Jaw bone. eg - Mammals.

Morphological type of teeth -



1) Homodont - Similar type of teeth.  
eg - Other vertebrate

2) Heterodont - More than one type.  
(4-types) eg - Mammals.

Types of teeth in mammals -

1) Incisor - Chisel shaped attached to Premaxilla bone of upper Jaw and dentary of lower Jaw.  
Function - Capturing of food.

2) Canine - Pointed with cutting edge & attached to Maxilla bone of upper Jaw and dentary of lower Jaw.  
Function - Tearing of food.

3) Premolar and Molar - Cheek teeth (Normal crown) to grinding food.

Types of Molar -

a) Bunodont - With normal cusp on crown. (Normal teeth)

b) Lophodont - Crown long with long cusp or called loph. eg - Elephant.

21.25

c) - Secodont - Crown with cutting edge modified for tearing of food. eg. carnivore

d) - Selenodon → Crown with crissent sharp cut. Fixed sheep and cows.

e) - Carnassial teeth - 1st upper molar and last lower premolar are with sharp cutting edge in carnivorous.

basis → Replacement.

- ① - Monophodont - ] → Mammals. 12 → Monophodont
- ② - Dipodont. ] → 20 → Dipodont.
- ③ - Polyphodont.

Dental formula -

$$\begin{array}{c} i, c, Pm, M. \\ \hline i, c, Pm, M. \end{array} \times 2$$

Note - In Bat and Guinea Pig - Milk teeth are lost before birth

2) - In Platypus - Toothed vein Sloth and Sirenean → Monophodont dentition.

3) - Armadilloes and Sloth have no enamel on teeth

1) Man →

Milk →	2102	= 20	Adult Platypus has Epidermal teeth which drops late on.
	2102		
Permanent -	2123	= 32	
	2123		

8 pm and 4 m → Monophodont.

Rabbit →

$$\frac{2033}{2023} = 20.$$

In Spiny Ant eater - Monotremes, Scaly Ant eater - some variety of whale are toothless.

In Platypus Ectodermal embryonic teeth are replaced by Horny Plates

In whale - fetal teeth are replaced and built by valvular Plates used for straining (filtering) of planktonic food.

Minimum teeth - Elephant.

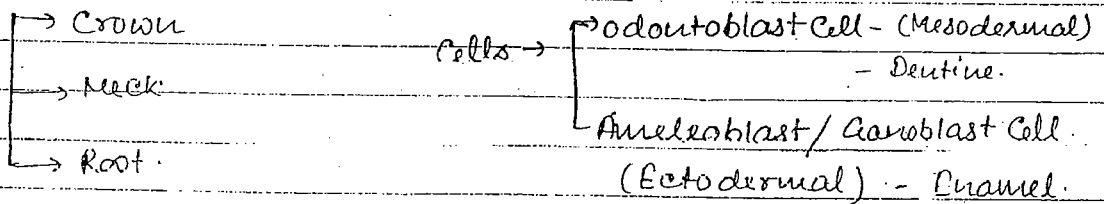
Max. teeth - oppossum, Horse.

In Man - 1st Milk teeth to appear - lower incisor

last milk teeth to appear - Molar.

1st and last Permanent teeth → Molars.

### Structure of Teeth - Origin - Ectomesodermal.



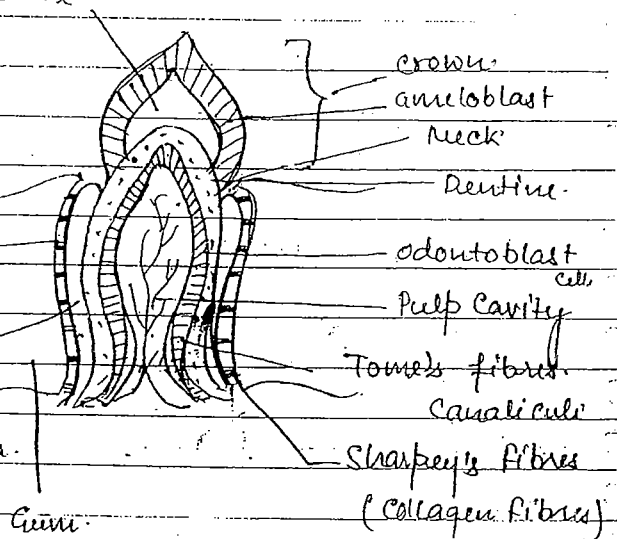
Dentine is hard material

70% in organic comp. enamel. secreted by odontoblast cell

It has thin tube called canaliculi. In which thin processes of odontoblast cells innervates alveolar and provides - membrane.

These fibres are called Tomes fibres.

Cement or crusta petrosa.



Cement or Crusta Petrosa

is around dentine in root region, acting as or behaving as glue for attachment of teeth in Jaw bone. A

membrane called alveolar membrane lines it.