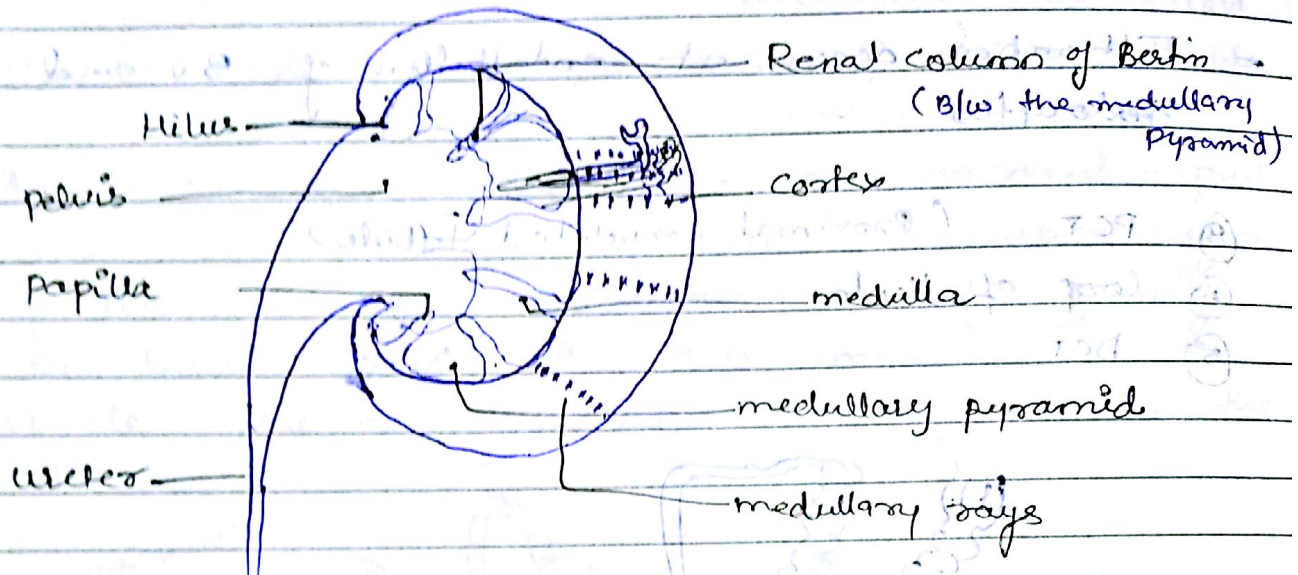


Excretory System

Kidney - Bean-shaped structure

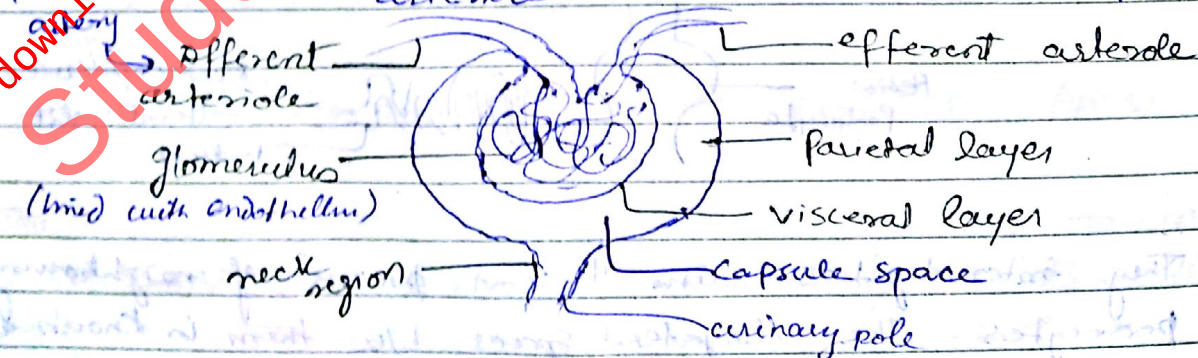


Kidney is an uriniferous tubule. This tubule has 2 parts - nephrons (structural and absorption unit of kidney) and collecting duct.

Nephron

- ① Bowman's capsule (double wall cup-shaped) with outer parietal layer & visceral layer

- ② Glomerulus → tufts of capillaries which arise from the afferent arteriole $\xrightarrow{\text{break}}$ Glomerulus $\xrightarrow{\text{region}}$ efferent arteriole

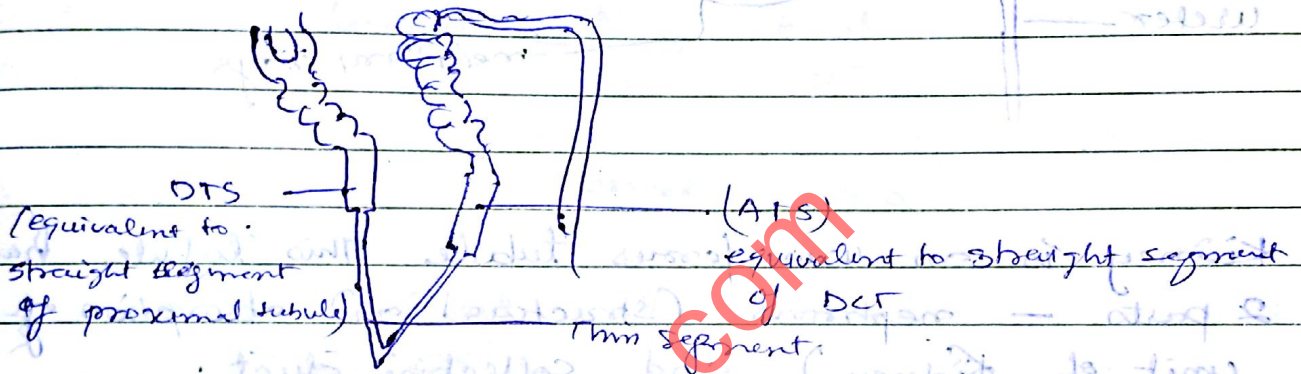


- Afferent arteriole is bigger than that of lumen of efferent arteriole

- cells of visceral layer are modified to form podocytes which have filtration slits through which the blood is filtered.

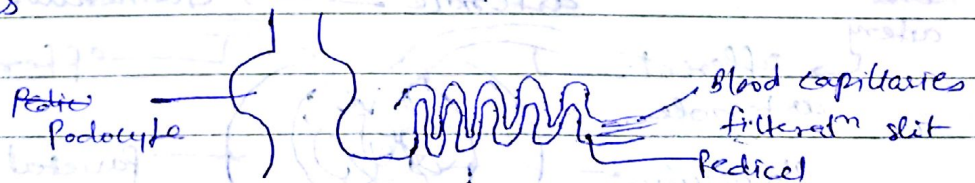
- Filtration occurs at endothelium of B.V and podocytes.

- (3) PCT (Proximal convoluted tubule)
- (4) Loop of Henle
- (5) DCT



PCT —

Podocytes :- The visceral layer closely the glomerulus capillary it has modified ep^l cells known as podocytes. which have numerous process which in turn contain 2° processes or foot processes or pedicels.

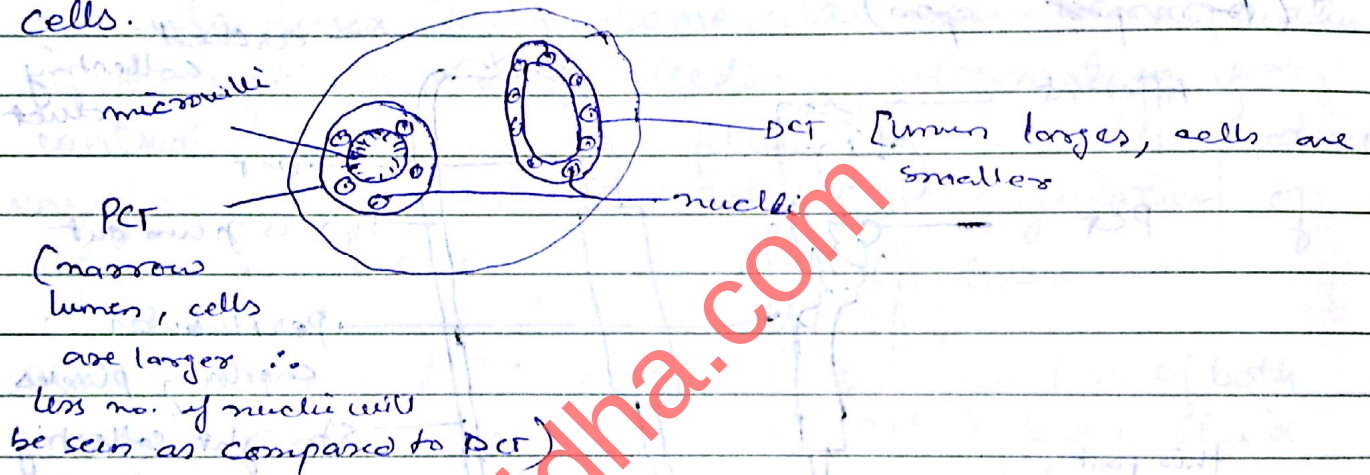


They inter-digitate with the foot processes of neighbouring podocytes. The elongated space b/w them is known as filtration slit through which the blood is filtered.

In addⁿ, to endothelial cells the capillaries have supporting and phagocytic cells c/d mesangials.

Proximal tubule : It has a convoluted tubule and straight portion. [Straight portion of proximal tubule

It lies in the cortical region near to renal capsule lined with cuboidal ep^l cells. The apical region of the cells have numerous microvilli forming the brush border. The cell margins ^{b/w the cell.} are not visible due to abundant inter-digitalⁿ b/w the cells.



- Loop of Henle :

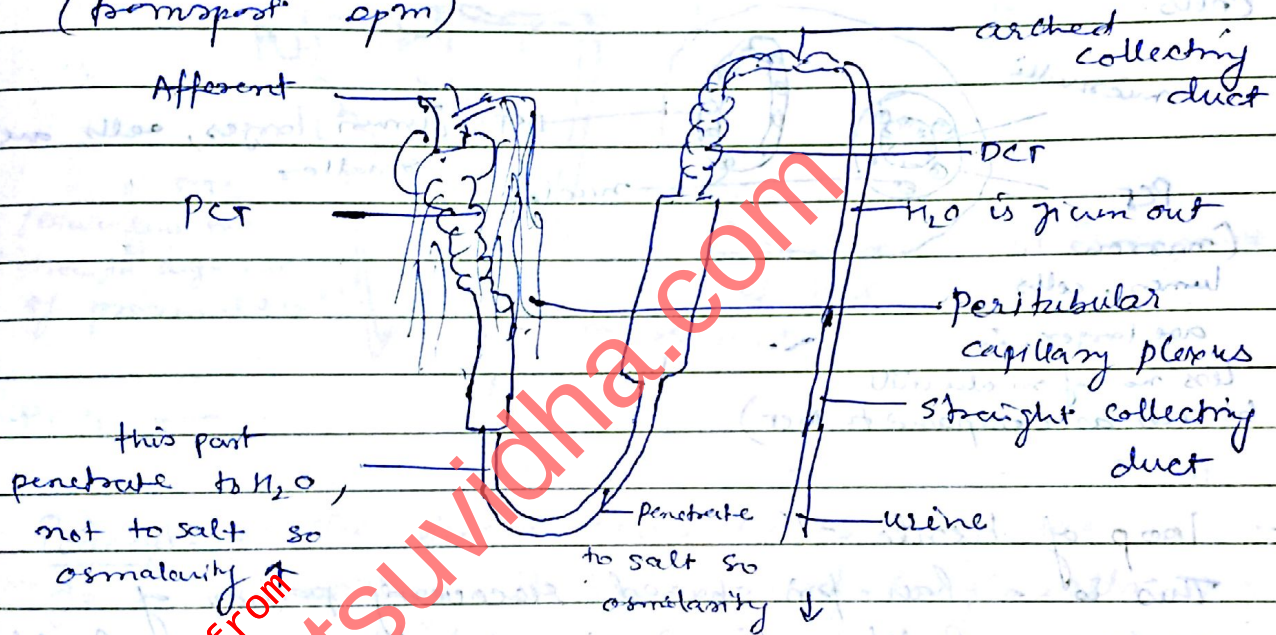
This is a hair-pin shaped recovery portion of nephron. Partly lined in the cortex and partly in medulla. It has 3 segments -

- ① Descending thick segment (DTS)
- ② Thin segment
- ③ and the ascending thick segment (ATS)

Thin segment is lined by simple sq. ep^l in long loops the turn occurs always in the thin part and it dips deep in the medulla.

In short loops turn occur in thick segment and lie ~~to~~ high in medulla. most of the thin portion is descending and most of the thick portion is ascending. In ~~Juxta~~ Juxta medullary nephrons, the thin segments is substantially longer. The thin segment is lined with simple squamous epm and lumen is wide.

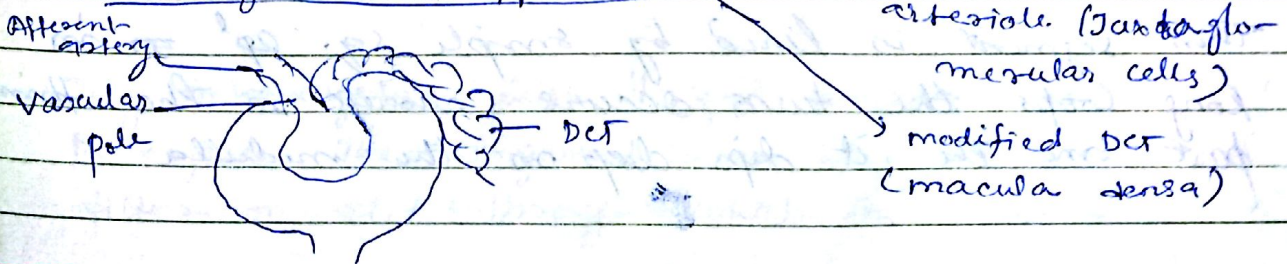
Distal tubule has ascending thick straight portion forming ascending limb of loop of henle and penetrates cortex, lined with cuboidal epm (transposed epm)



Vasa recta - straight blood vessel coming out of juxta medullary nephron.

Counter current multiplier system

Juxta glomerular apparatus



Juxtaglomerular apparatus (JGA)

↓
Renin-Angiotensin-Aldosterone system

Along its path in cortex DCT establishes contact with the vascular pole of Renal corpuscles of its own nephron closed to the afferent arteriole. Some of the cells of afferent arteriole at this pt are modified and are known as juxtaglomerular cells. In distal tubule of this cells usually become columnar and nuclei appear to be closely packed and this part is known as macula densa. Juxta glomerular cells. JGA apparatus is thought to provide feedback information for control of glomerular filtration. JG cells produce enzyme renin which is active in regulation of blood pressure.

↓
diarrhoea

Blood volume ↓
& Blood Pressure (BP)
(in afferent arteriole)

← excessive loss of both
salt & body fluid

↓ major wound
not affect ADH
as osmolality is
not changed.

JGA

↓

Renin

↓

Liver
↓
Angiotensinogen
(protein)

→ Angiotensin I (decapeptide)

↓ ACE (Angiotensin converting enzyme)
(in vascular epithelium in lungs)

Angiotensin II

↓ Adrenal gland

↓ Aldosterone

↓ Distal tubule

↓ $\text{Na}^+ + \text{H}_2\text{O}$

reabsorption ↑

Arteriole constriction

→ blood flow
to capillaries ↓
(Kidney)

Blood volume ↑

RP ↑

Antidiuretic hormone (ADH) (Vasopressin)

- works on principle of blood osmolality.

Excessive H₂O loss or inadequate H₂O intake

Blood osmolality ↑
(> 300 mOsmolal/litre)

Ingesting salty food

Osmoreceptor cells in hypo

feedback

ADH release ↑

Kidney Distal convoluted tubule + collecting tubules

(aquaporin protein)

epithelium permeability to H₂O ↑

H₂O Reabsorption ↑

urine concentrates

urine volume ↓

osmolality ↓

ADH influence H₂O uptake in kidney by regulating H₂O selective channels formed by protein aquaporin. ADH binding to the receptor molecule ↑ the no. of aquaporin molecules in the membrane. This ↑ the H₂O absorption reducing urine volume.

Osmoregulation

Nitrogenous waste

- NH_3 or NH_4^+ → toxic, highly soluble in H_2O (fishes)
- urea → less toxic, require low amt of H_2O for excretion. [e.g mammals, few reptiles & amphibians]
- uric acid - non-toxic, require no water for excretion. [Birds, some insects & some reptiles]

uricotelic

expends energy in converting NH_3 to urea

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