The urinary system II

HISTOLOGY

Semester 2, Year 3

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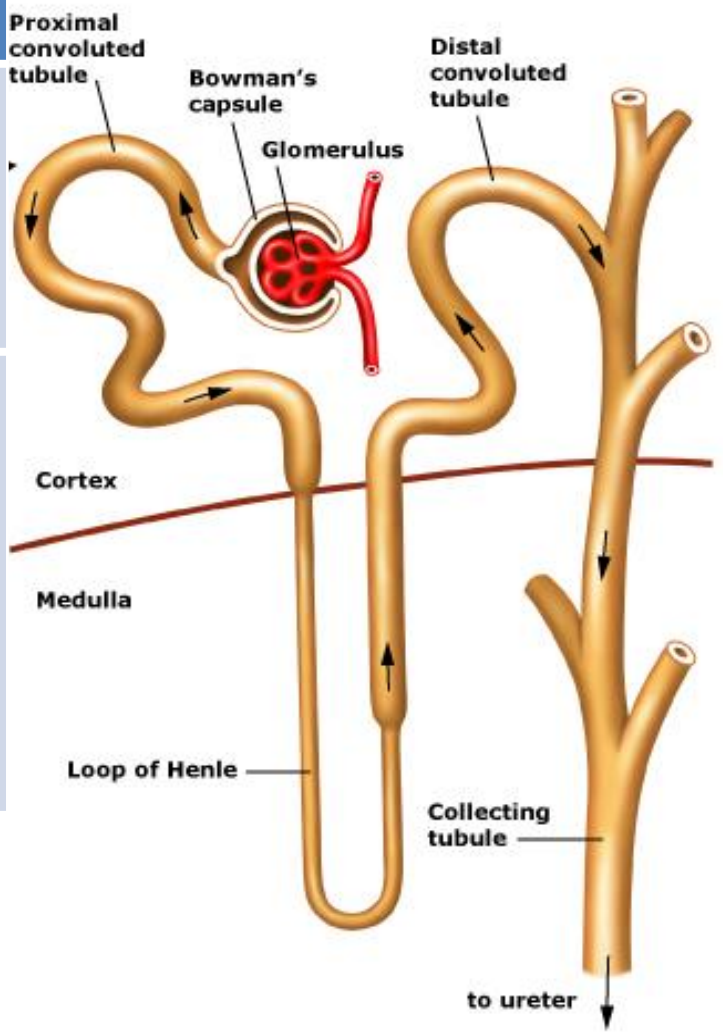
Proximal convoluted tubule (PCT):

Distal convoluted tubule (DCT):

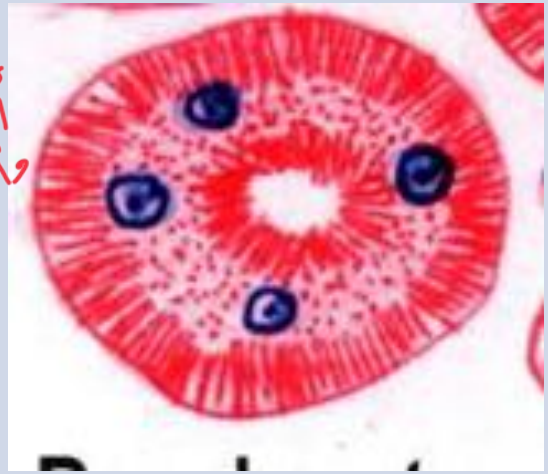
	(PCT):	(DCT):
Length: Convolutions:	About 15 mm longer More convoluted	About 5 mm shorter Less convoluted
function	**Reabsorption** of water (Na^+ pump), sugar , amino acids **Secrtion** of some metabolites (penicillin , dyes, ammonia)	Reabsorption of water under effect of Aldosterone

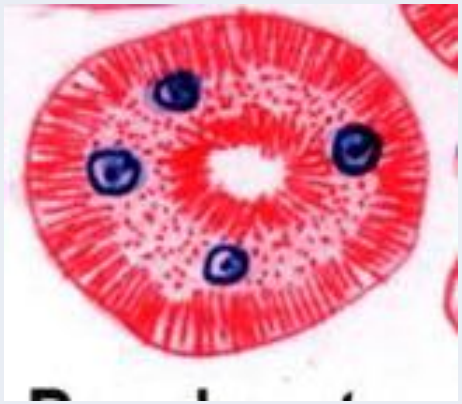
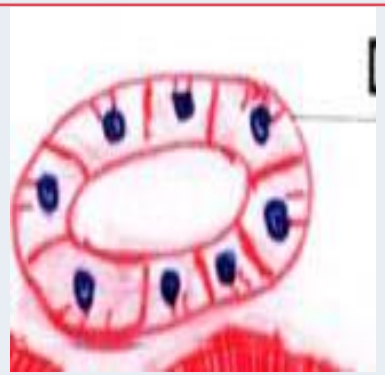


	(PCT):	(DCT):
Diameter:	– Large (60 µm)	– Small (30-50 µm)
Lumen:	– Narrow	– Wide
Lining cells:		
Number:	– 3-5 cells	– 5-8 cells
Shape:	– Cubical shape	– Less cubical
Nucleus:	– Basal and rounded	– Central & rounded

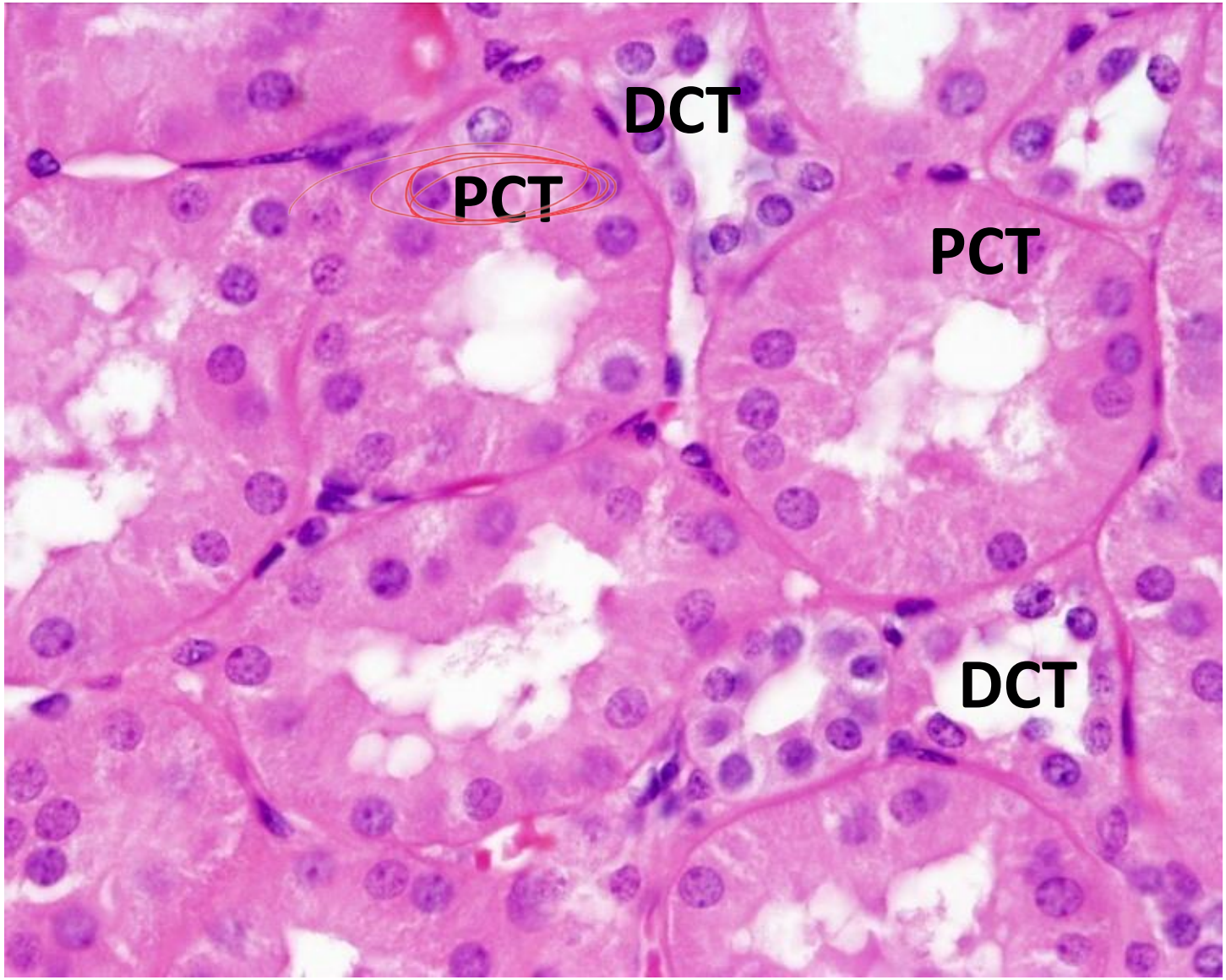
ليش اختفت ال cell bounderies تعوضها مش جيدة؟؟
Lateral inter digitation

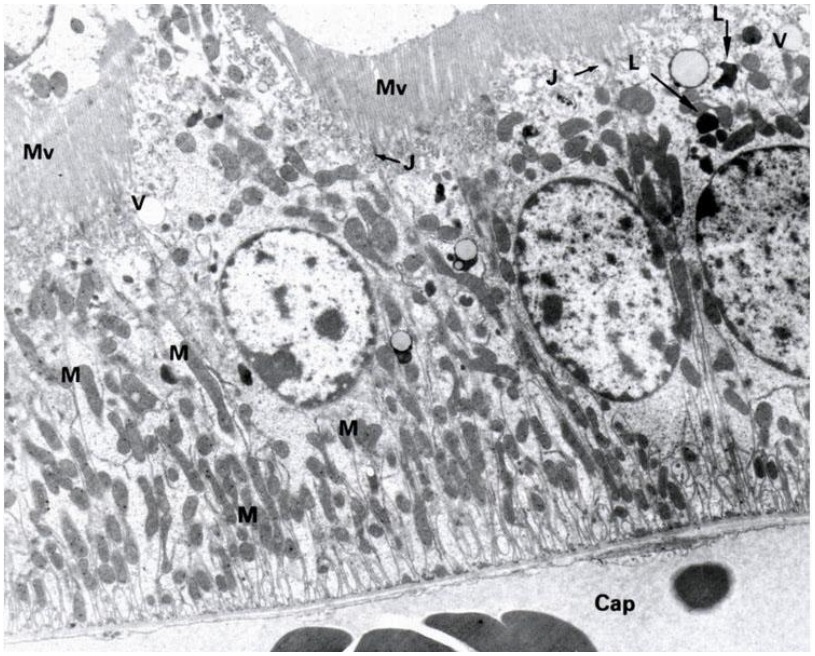
أكبر وأضيق



	P. C. T.	D. C. T.
Lining cells:		
Side border:	– not clear (due to interdigitation of the cell membranes)	– Clear
Luminal border:	– Shows brush appearance due to microvilli	– Microvilli are few and short
Base of cell:	– Shows basal striation due to rod shape mitochondria	Basal mitochondrial striation due to rod shape mitochondria
Cytoplasm:	Deeply acidophilic and granular 	Pale acidophilic and non granular 

Section in the Kidney





Rod-shaped mitochondria in basal part of cells lining PCT

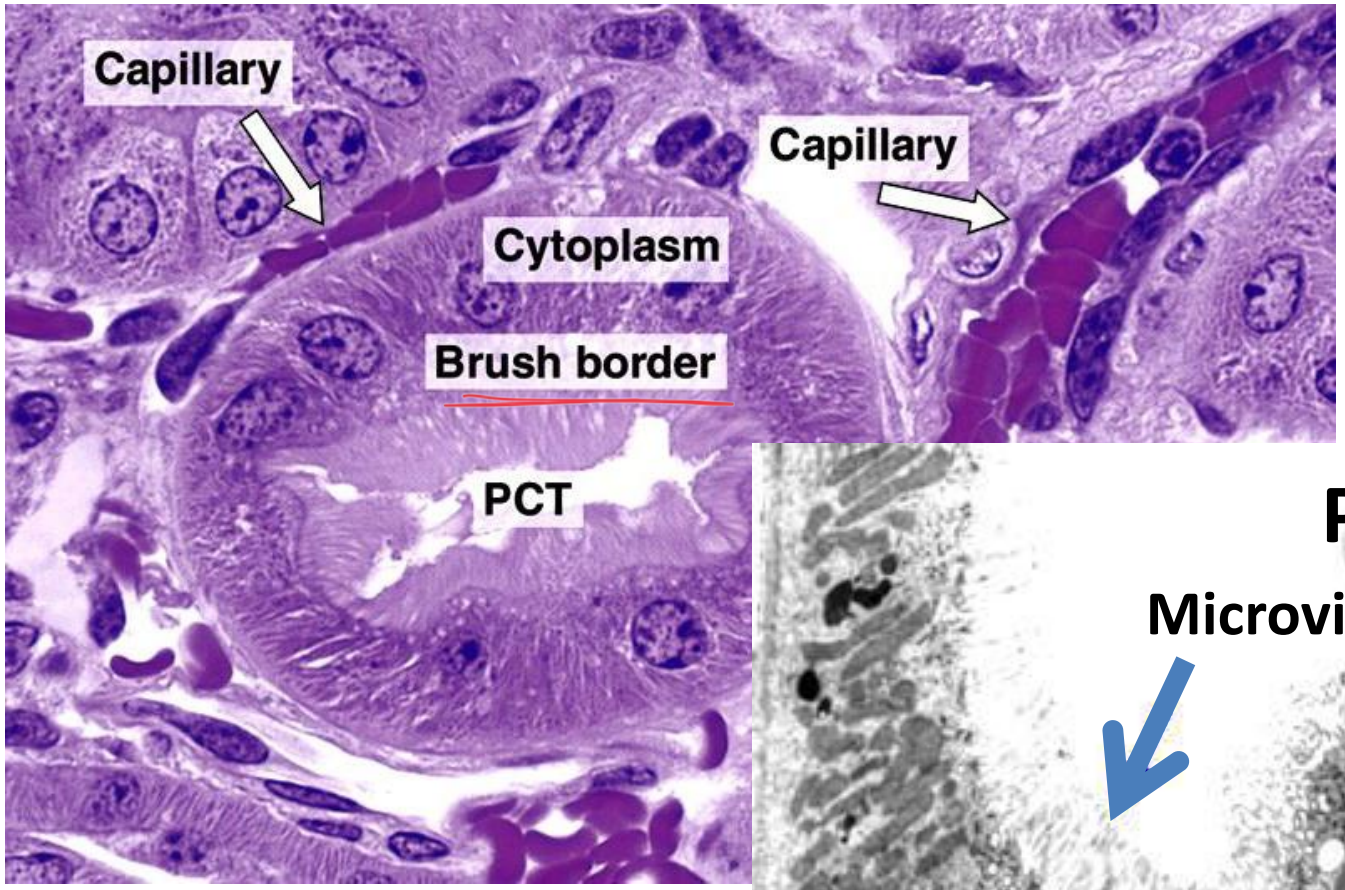
Iron transporting cell

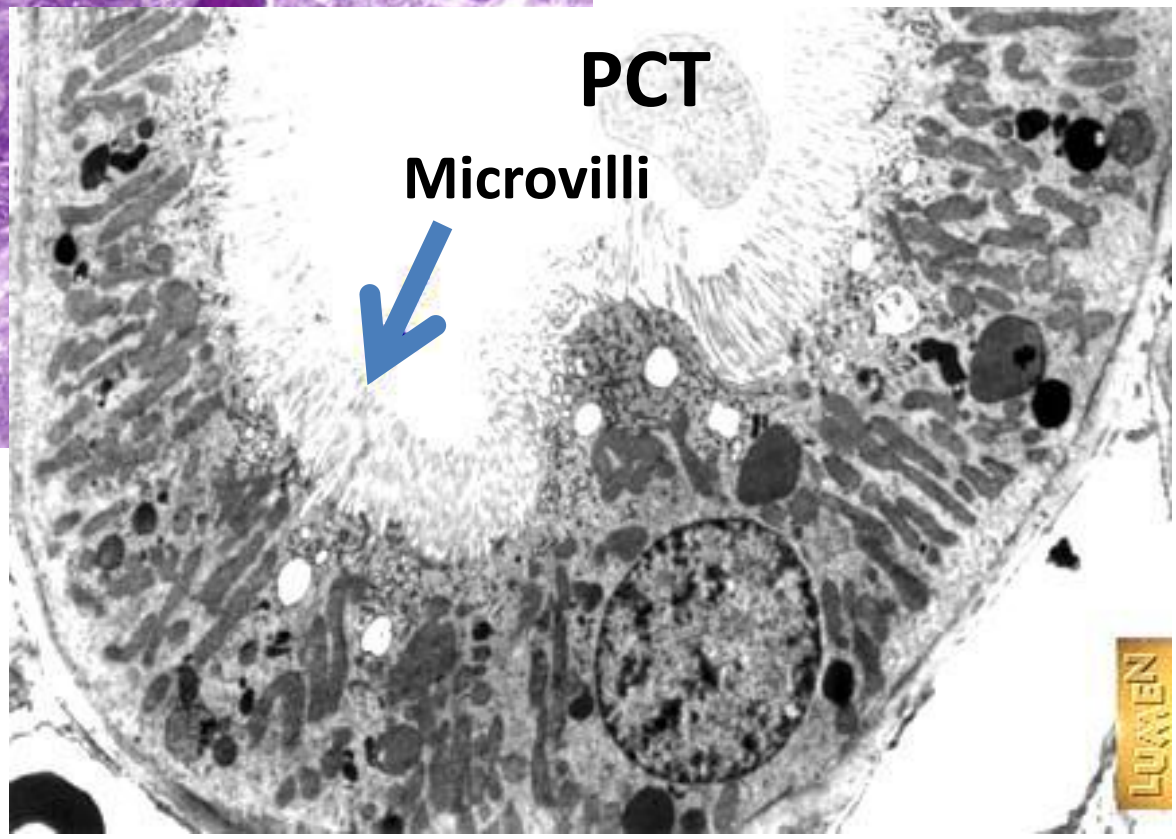
Microvilli = Brush Border

By Don W Fawcett

gty.im/ 128559193

Rod-shaped mitochondria in basal part of cells lining PCT


Capillary
Capillary
Cytoplasm
Brush border
PCT


PCT
Microvilli
LUMEN

4- The Loop Of Henle

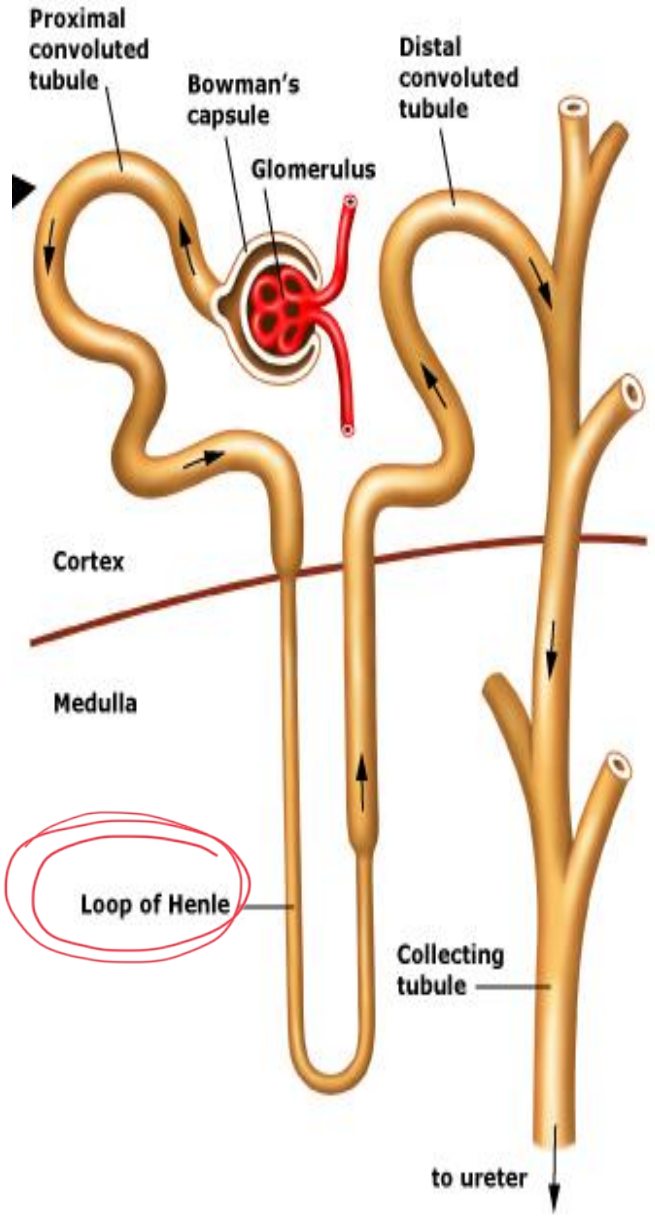
- U-shaped tube connecting P.C.T. & D.C.T.
- The loop is formed of:

1-Descending limb:

A. Thick part (as P.C.T.)
B. Thin part (simple squamous epithelium).

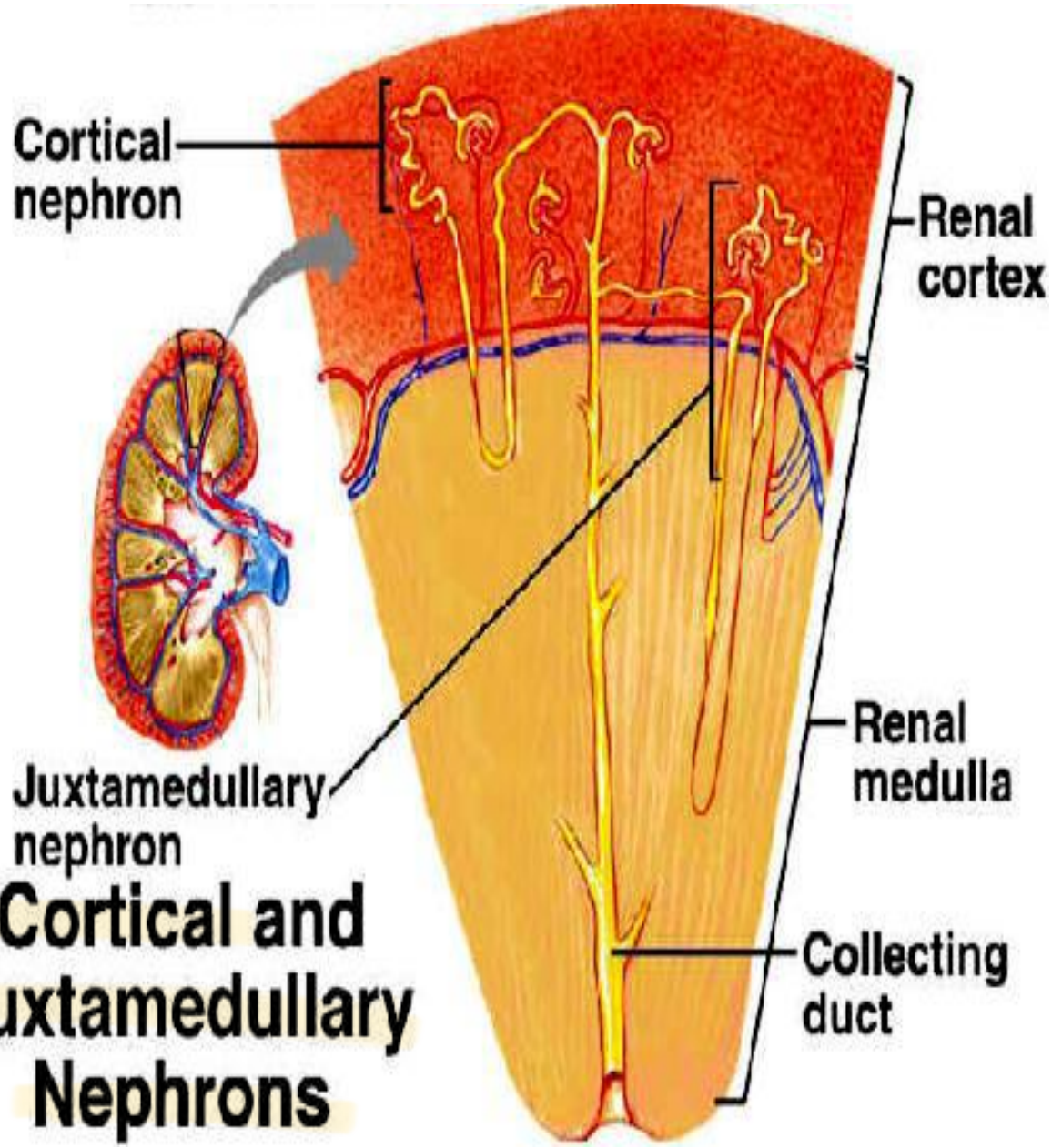
2-Ascending limb:

A. Thick part (as D.C.T.)
B. Thin part (simple squamous epithelium).



Types of Henle loop:

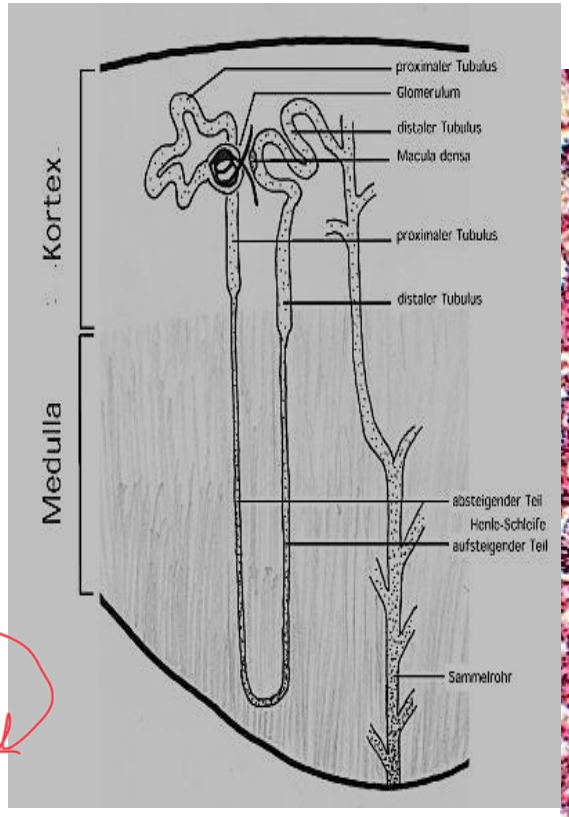
1. **Long loops:** Loops of juxta-medullary nephrons.
2. **Short loops:** Loops of cortical nephrons.

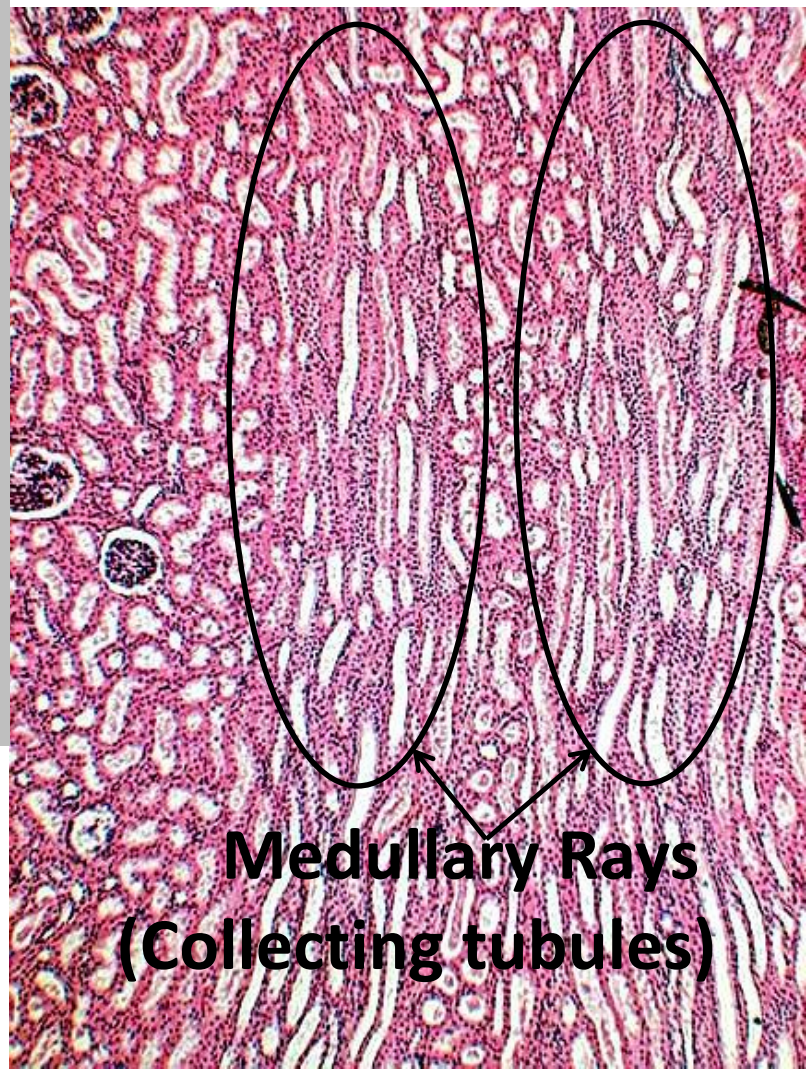



loop of Henle, thin segment
loop of Henle, ascending thick segment

5- Collecting tubules

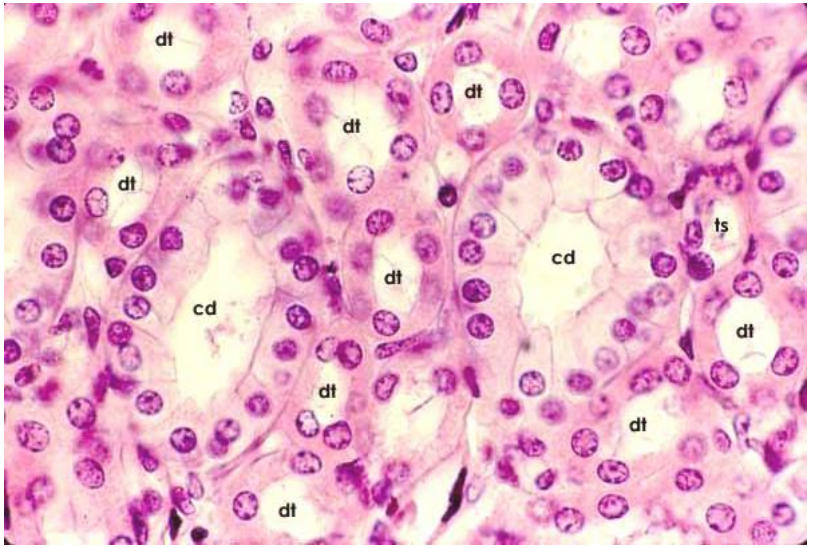
- Present in medullary rays.
- Each collecting tubule drains 5-10 nephrons.
- 6-8 collecting tubules open into a large duct called duct of Bellini which opens in medullary pyramid.





Collecting tubule is lined with cubical cells with clear pale basophilic cytoplasm.

Duct of Bellini is lined with simple columnar cells with clear basophilic



The collecting ducts

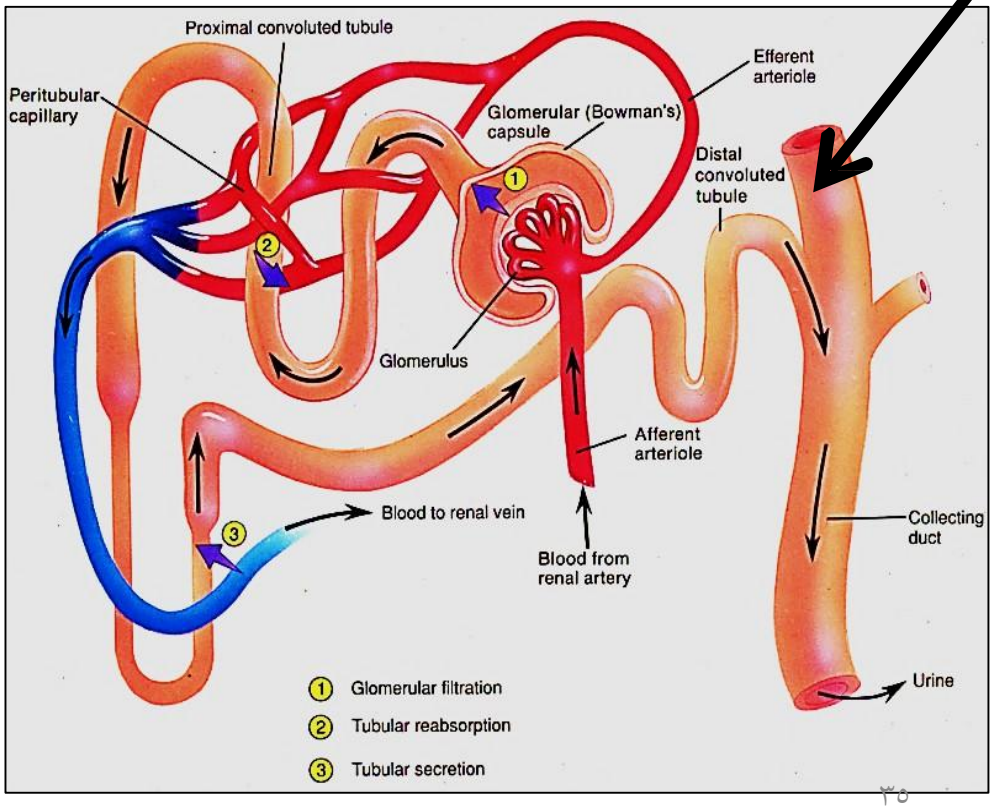
The excretory portion of renal tubules, under **ADH**

Lined with simple cuboidal epithelium. Each 6-8 collecting ducts drain into →tips of medullary pyramid

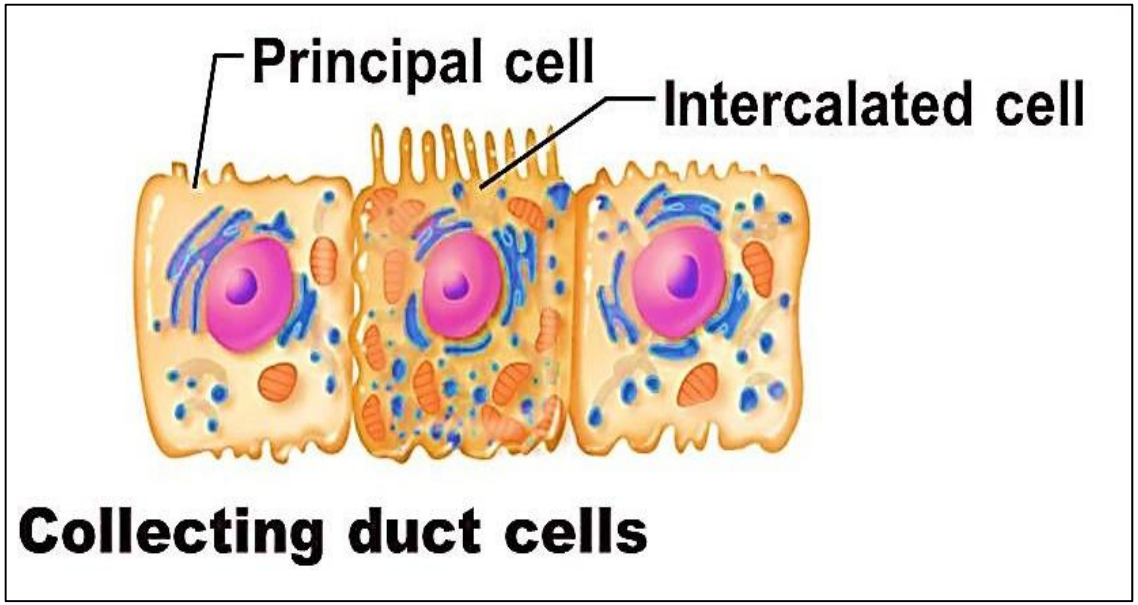
2 types of cells line collecting tubules

Principle cells

Intercalated cells



Principle cells	Intercalate cells
Numerous	Few, have apical microfolds
→ **Very sensitive to ADH**	types alpha & Beta 2
Responsible for the ability of collecting tubules to **concentrate urine**	**Regulate acid- base balance**
Reabsorbe water	
Reabsorb Na & secrete K	

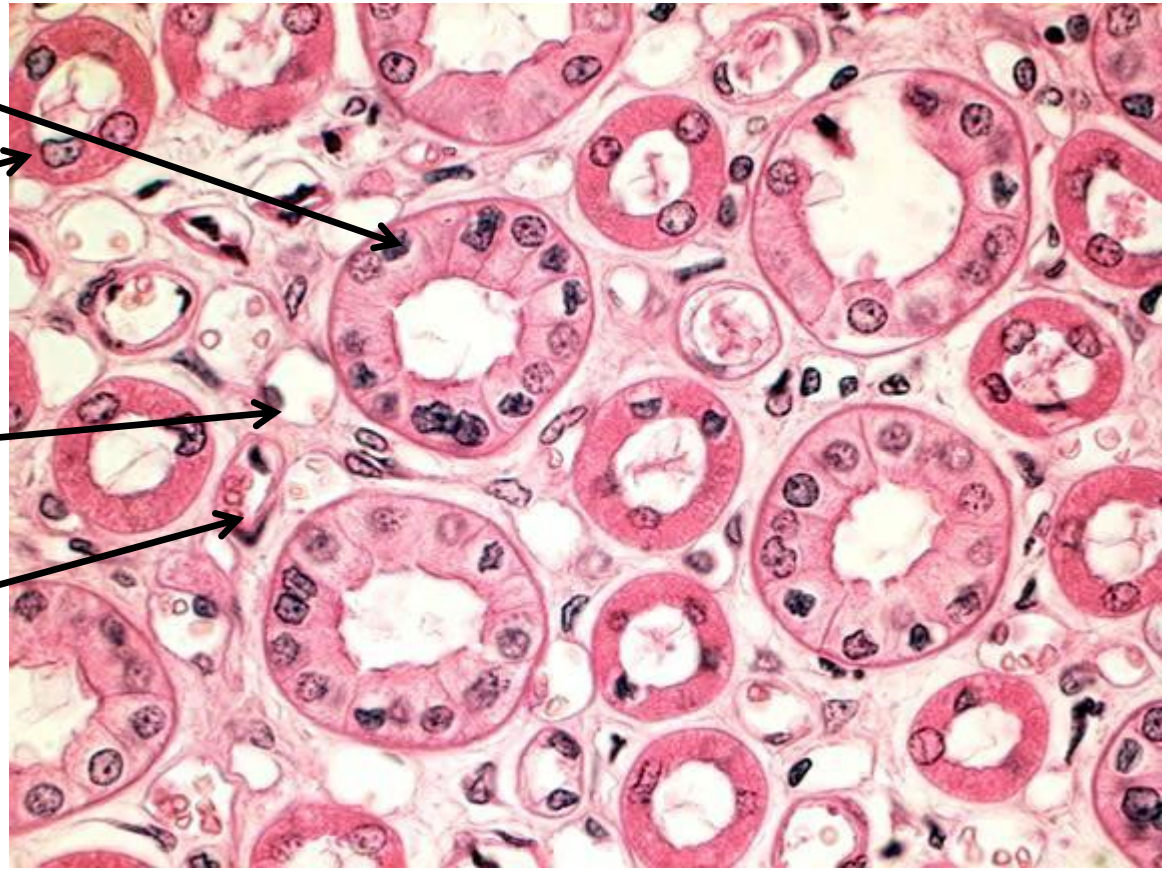


Collecting tubule

Henle loop
(Thick segment)

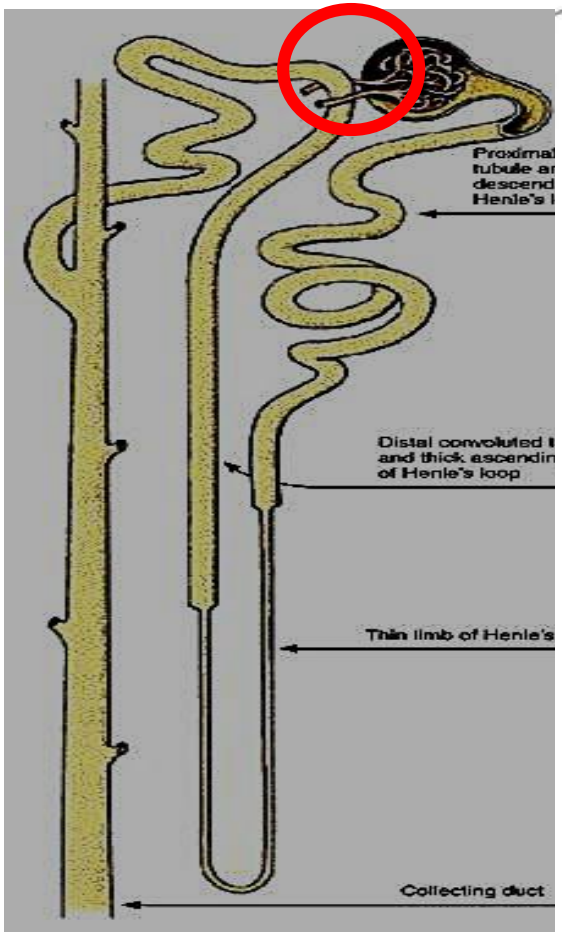
Henle sloop
(thin segment)

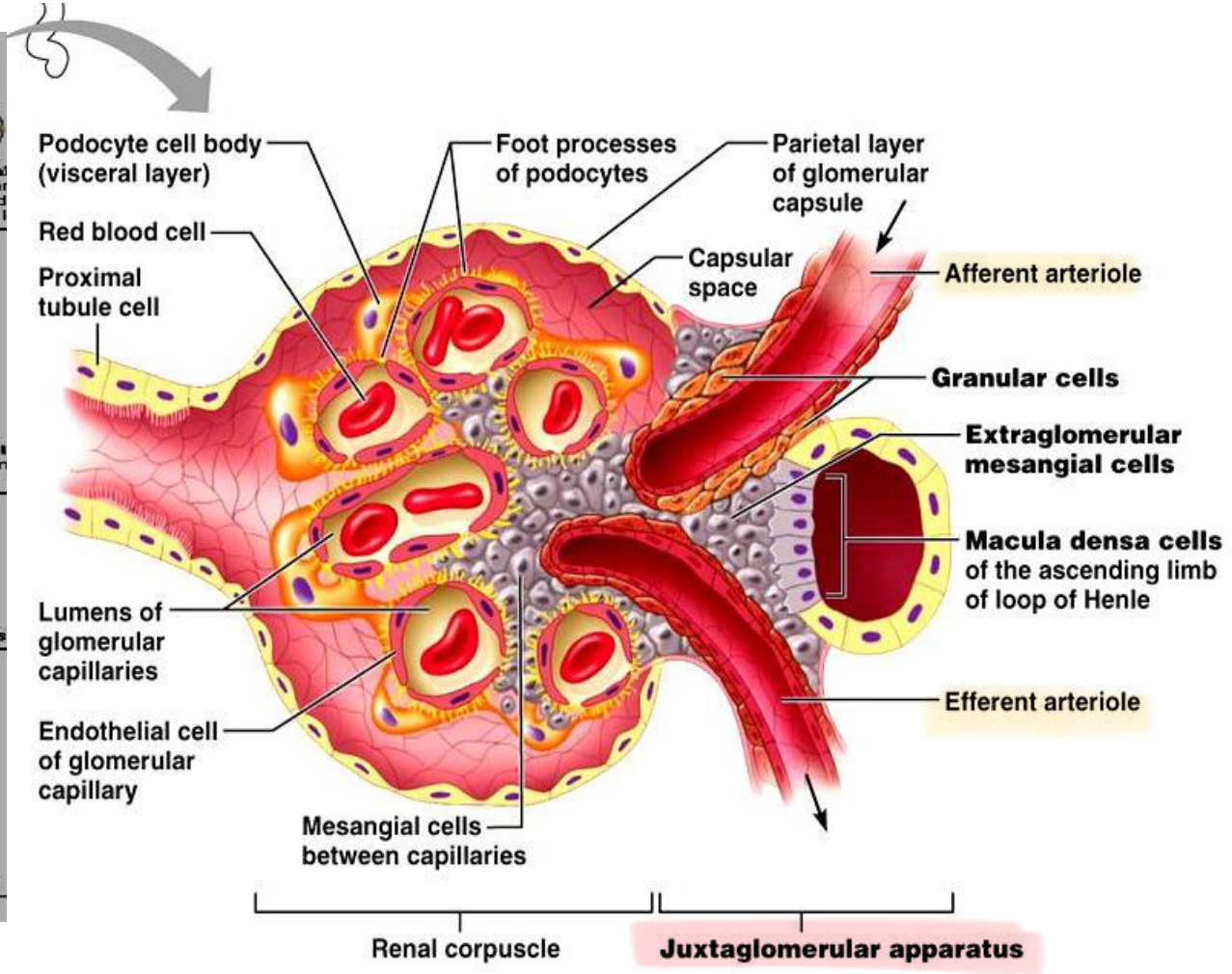
capillary.



The Juxtaglomerular Complex

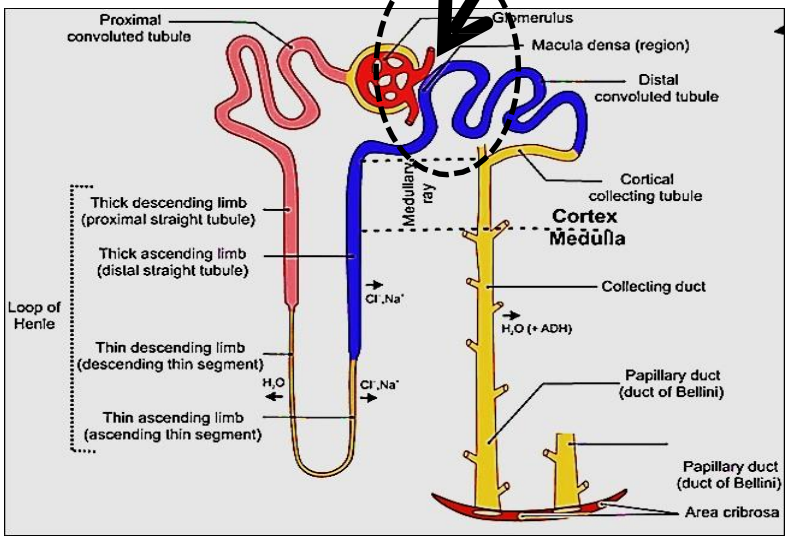
- Secretory complex at the vascular pole of renal corpuscle.
- Formed of 3 components:





Juxtaglomerular apparatus

Located at the vascular end of renal corpuscle

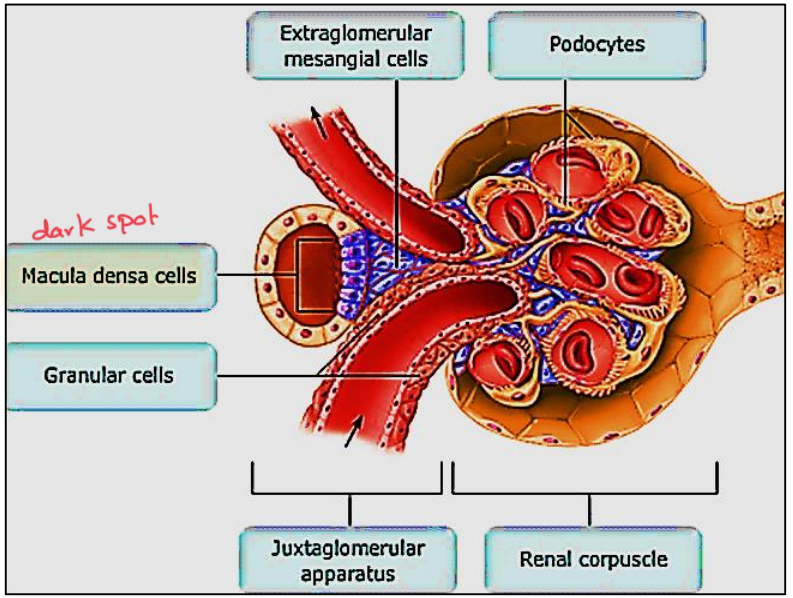


:Consists of 3 components

1. *Macula densa (.lining of distal convoluted T)*

2. *Granular (juxtaglomerular)cells (wall of afferent arteriole)*

3. *Lacis cells* (Extra-glomerular mesangial cells*)*

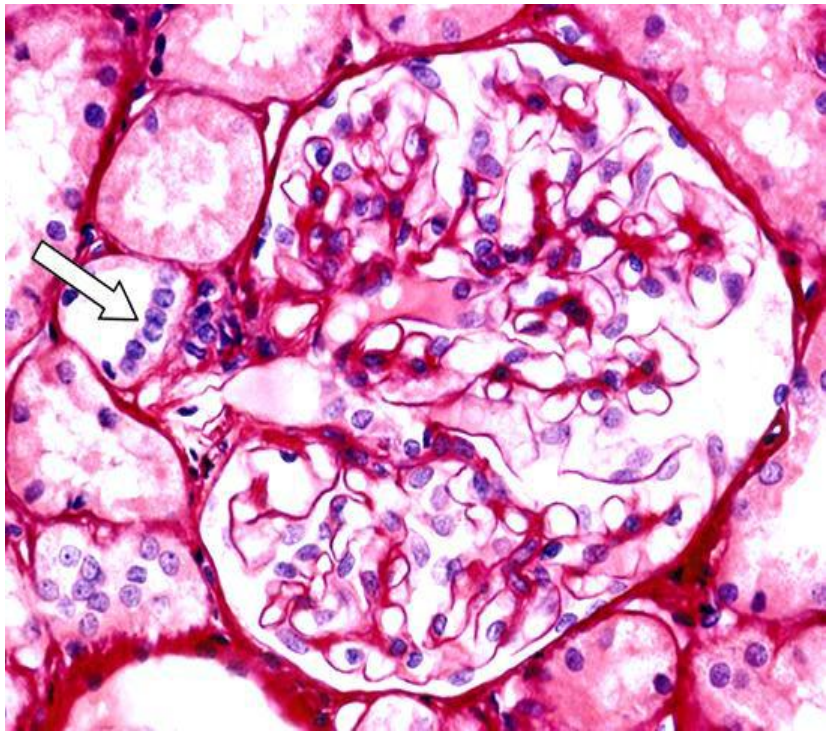


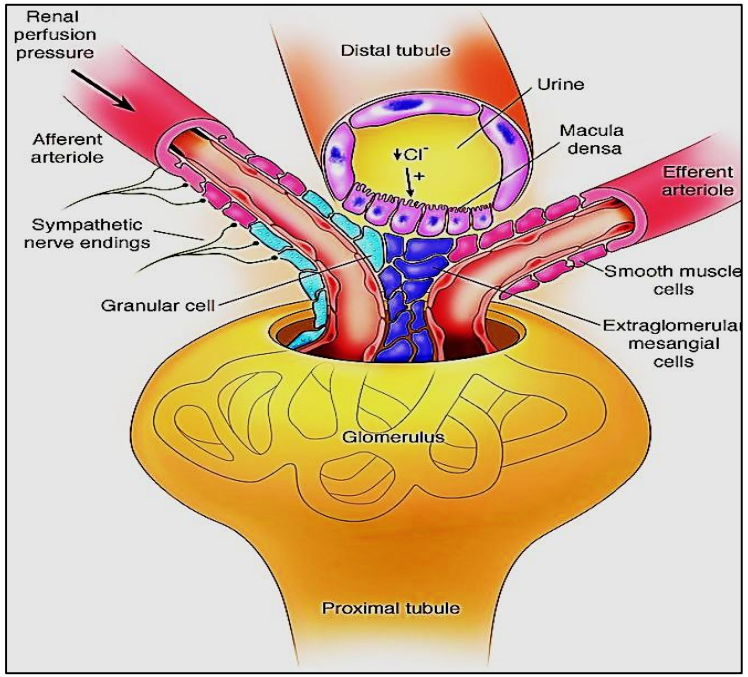
1.Macula densa:

-Cells lining part of D.C.T. fitting between afferent arteriole (A.A.) & efferent arteriole (E.A.).

- Cells:

1. Are increased in NO & crowded.
2. Become columnar.
3. Nuclei are deeply stained
4. Their BM is lost.
5. Golgi apparatus is present between the nucleus and base of the cell.





Function

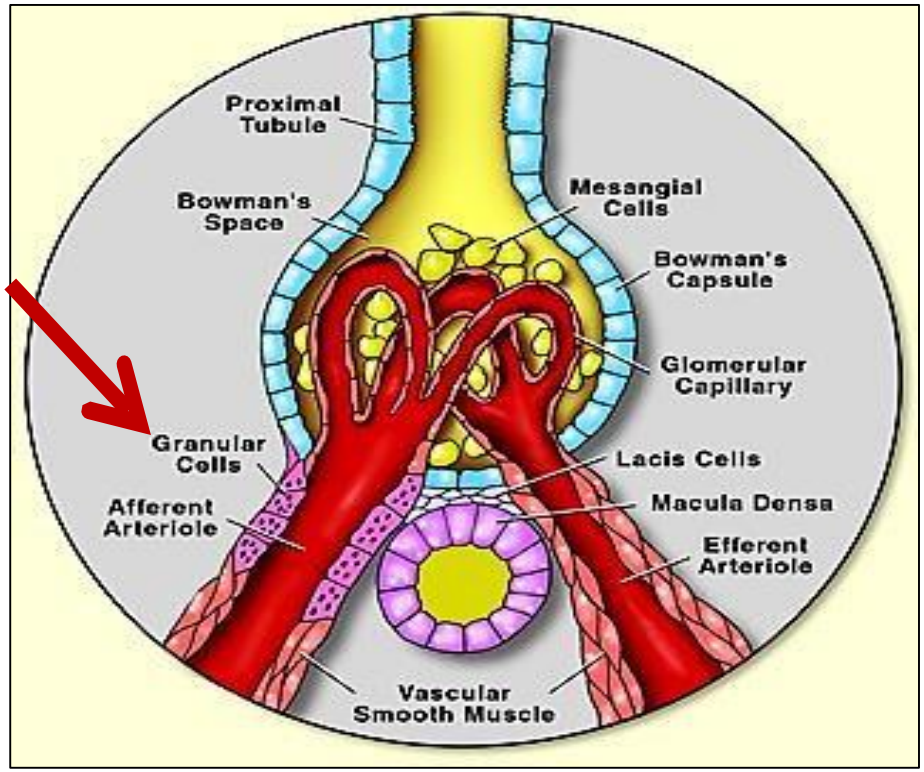
Act as osmoreceptors that monitor the level of Na^+ ions of the filtrate in the lumen of DCT

2. The juxtaglomerular cells: (J.G. C)

- Modified smooth muscles.
- In the media of afferent arteriole.
- They are large with rounded nuclei.
- The cytoplasm contains secretory granules (renin hormone) stained with PAS.

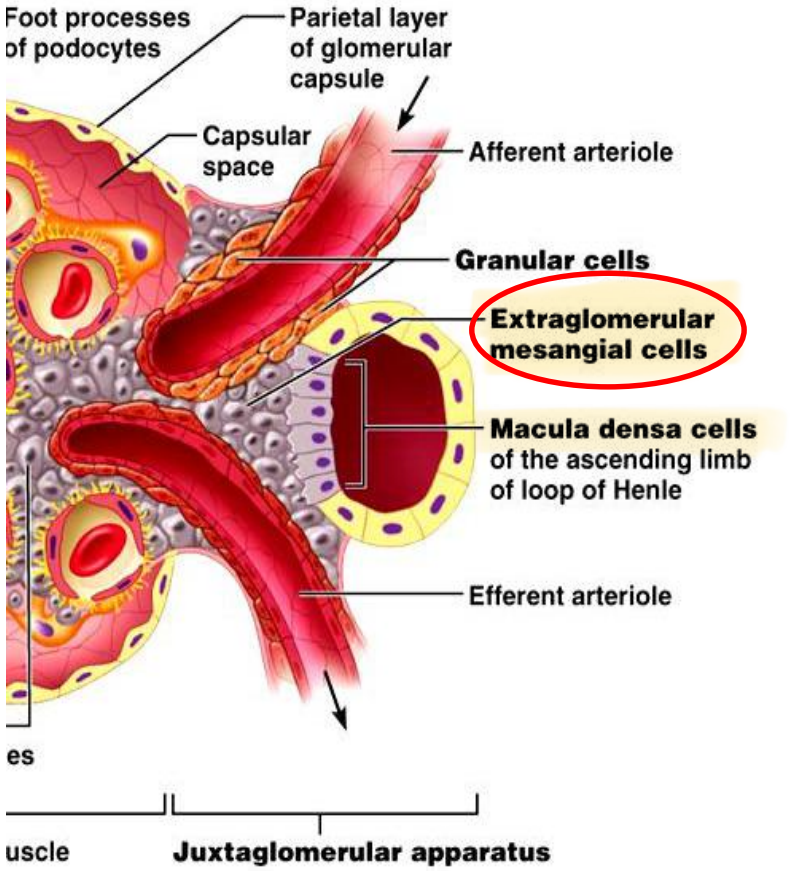
Function

Secrete renin and erythropoitin



3. Lacis cells (polar cushion):

- **Groups of small cubical cells, with pale nuclei.**
- **Present between A.A., E.A. & macula densa.**
- **Function**
  - Supportive
  - Transmit signals from macula densa → glomerulus → vasoconstriction of blood vessels

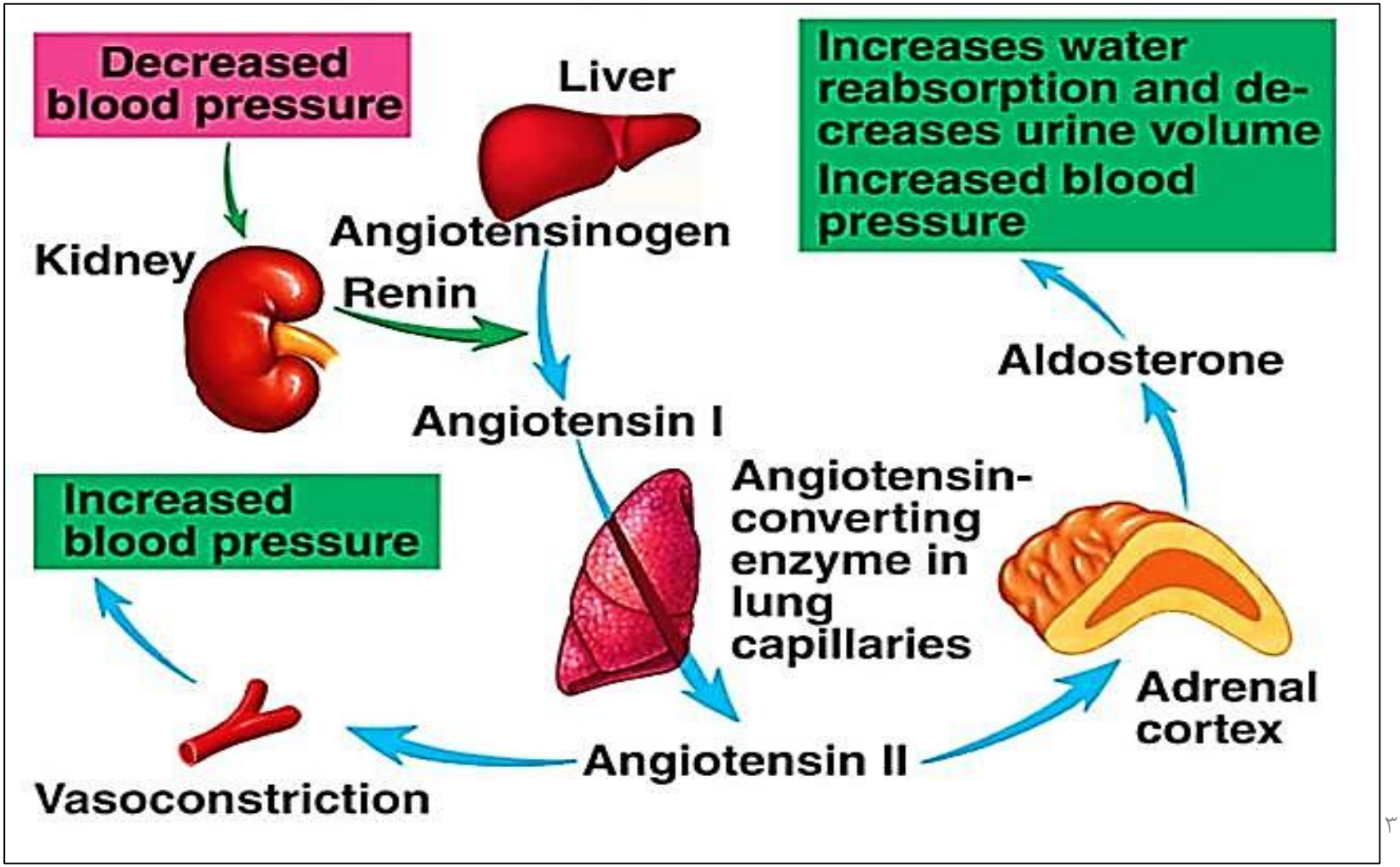


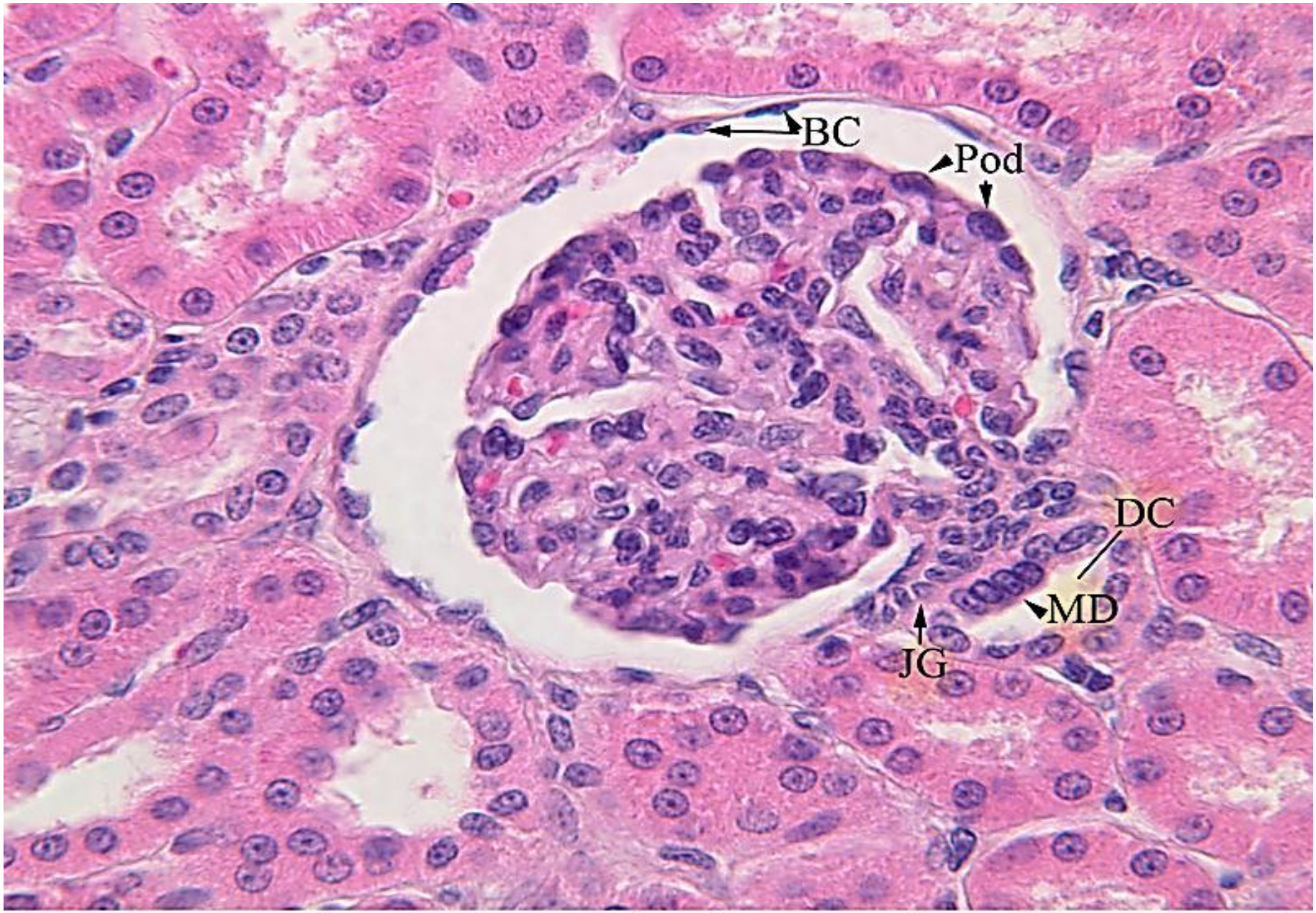
Functions of J. G. complex:

1. Regulation of bl. pressure: J.G. cells secrete renin
2. Secretion of erythropoietin which stimulates development of RBCs in the bone marrow. (erythropoietin secretion mainly from renal interstitial

:Function of Juxtaglomerular apparatus

Regulation of glomerular filtrate rate & blood pressure through the Renin- angiotensin – Aldosterone system .





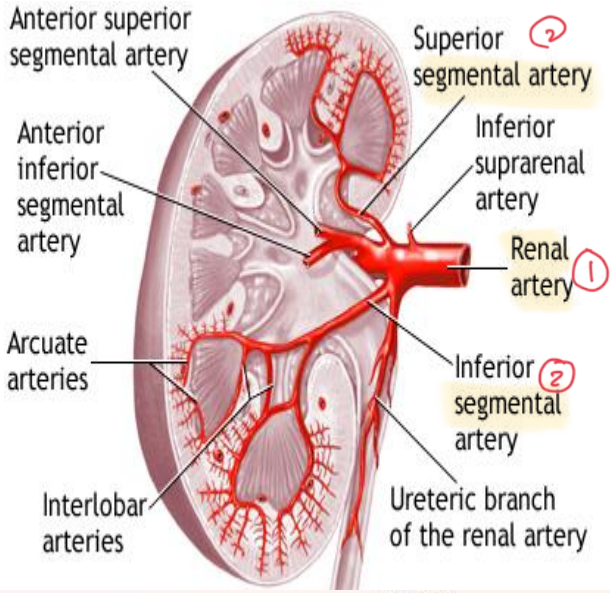
BC - Bowman's capsule (parietal layer) Pod - podocyte (visceral layer of Bowman's capsule)
MD - macula densa JG - juxtaglomerular cells DC - distal convoluted tubule

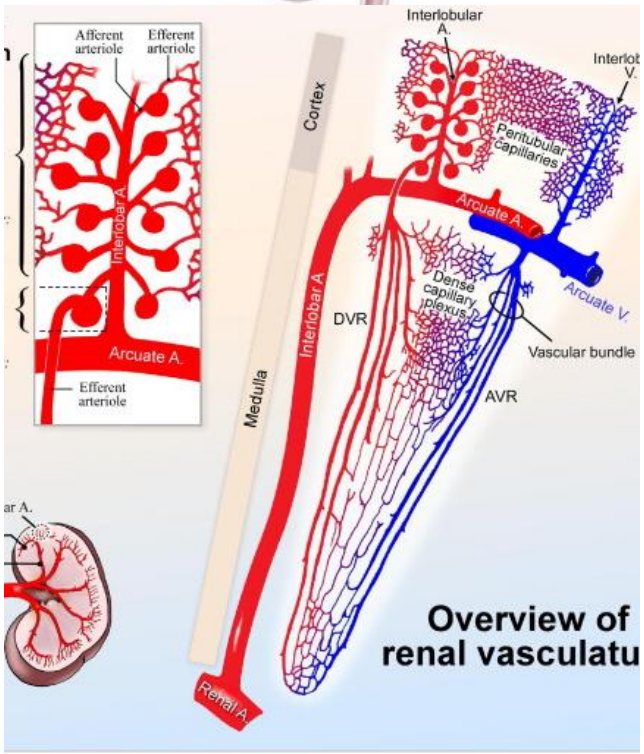
Blood Supply of the Kidney:

- **Arterial supply:**
- **Renal artery →segmental arteries → interlobar A.(pass between the medullary pyramids) → arcuate arteries (at the corticomedullary junction). arch around the bases of the pyramids → interlobular A (found in the cortex between the lobules→ afferent arterioles → renal glomerulus → efferent arterioles (EA).**

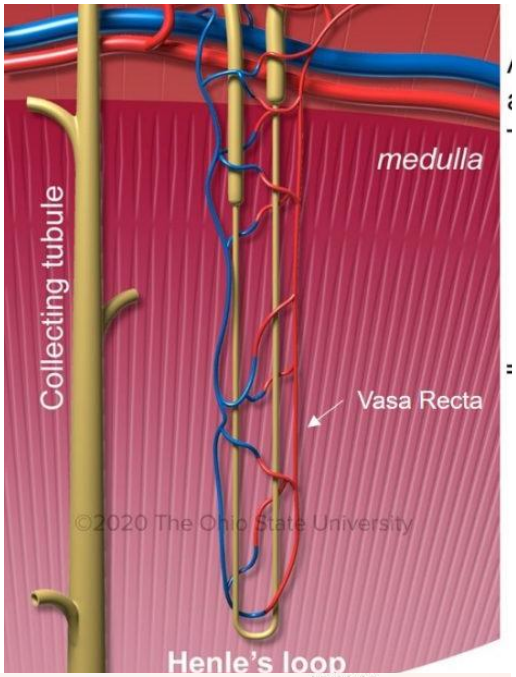
- **efferent arterioles of the cortical corpuscles: → peritubular capillary plexus (in the cortex) to supply the cortical tubules (filtered blood).**

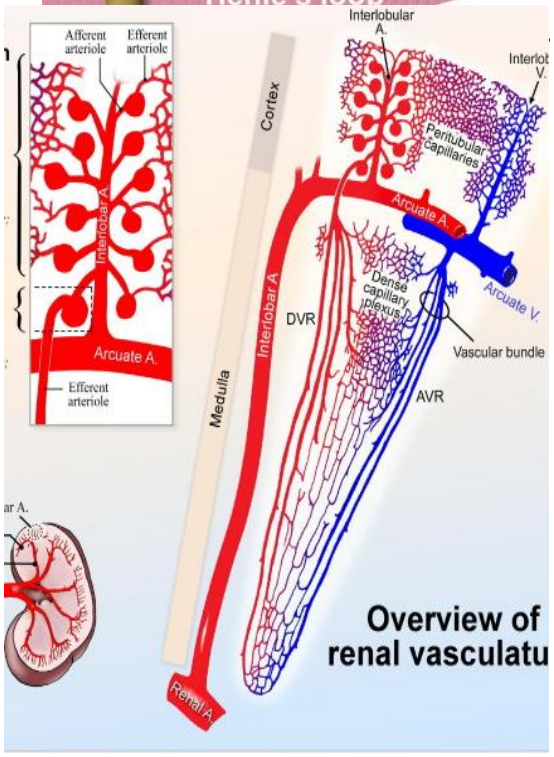
- **efferent arterioles of the juxta medullary corpuscles: → give rise to vasa recta to supply the medulla with blood (filtered blood).**





- **Arteria vasa recta:(**straight capillary loops) close and parallel to loop of **Henle**
- and collecting duct
- **Venous drainage:**
- **Veins draining the cortical and medullary capillary beds accompany the interlobular arteries & vasa recta respectively and drain into arcuate veins.**
- **•Arcuate veins unite to form interlobar veins which form the renal vein.**



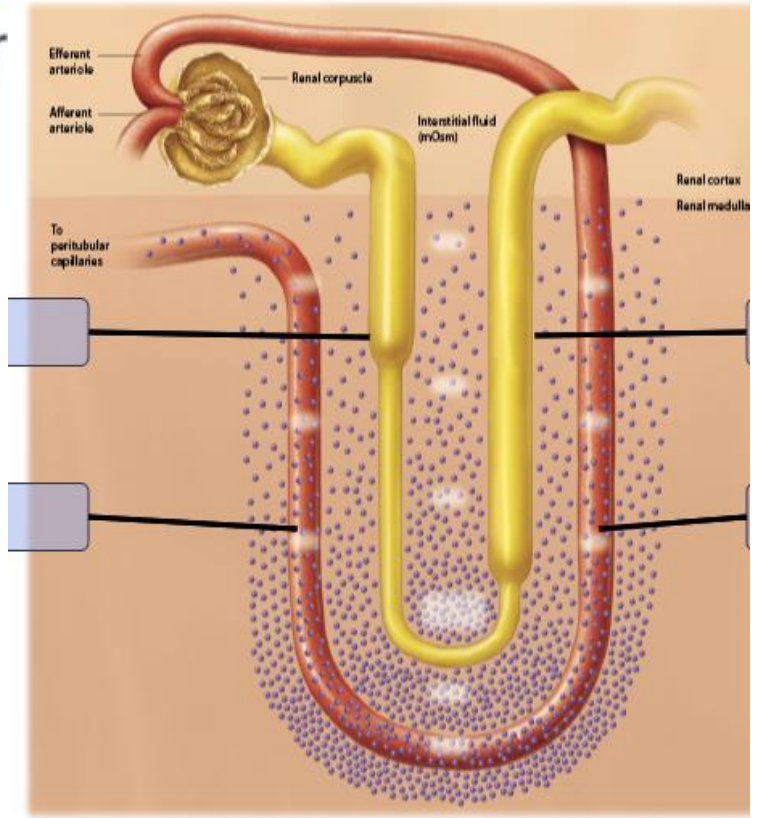


Function of vasa recta

اتجاه الـ urine عكس اتجاه الـ flow of blood عشان صح بنسميه counter current

- Together with Loop of Henle: *Counter current multiplier mechanism*.
- Function: concentration of urine.
  - Loop of Henle: *create* hperosmolar interstitium in the medulla.
  - Vasa recta: *maintain* this hyperosmolarity.

يسحب الماء ويرجعها الـ tissue



URINARY BLADDER

Urinary bladder

I. Mucosa:

- Transitional epithelium.
- Corium.

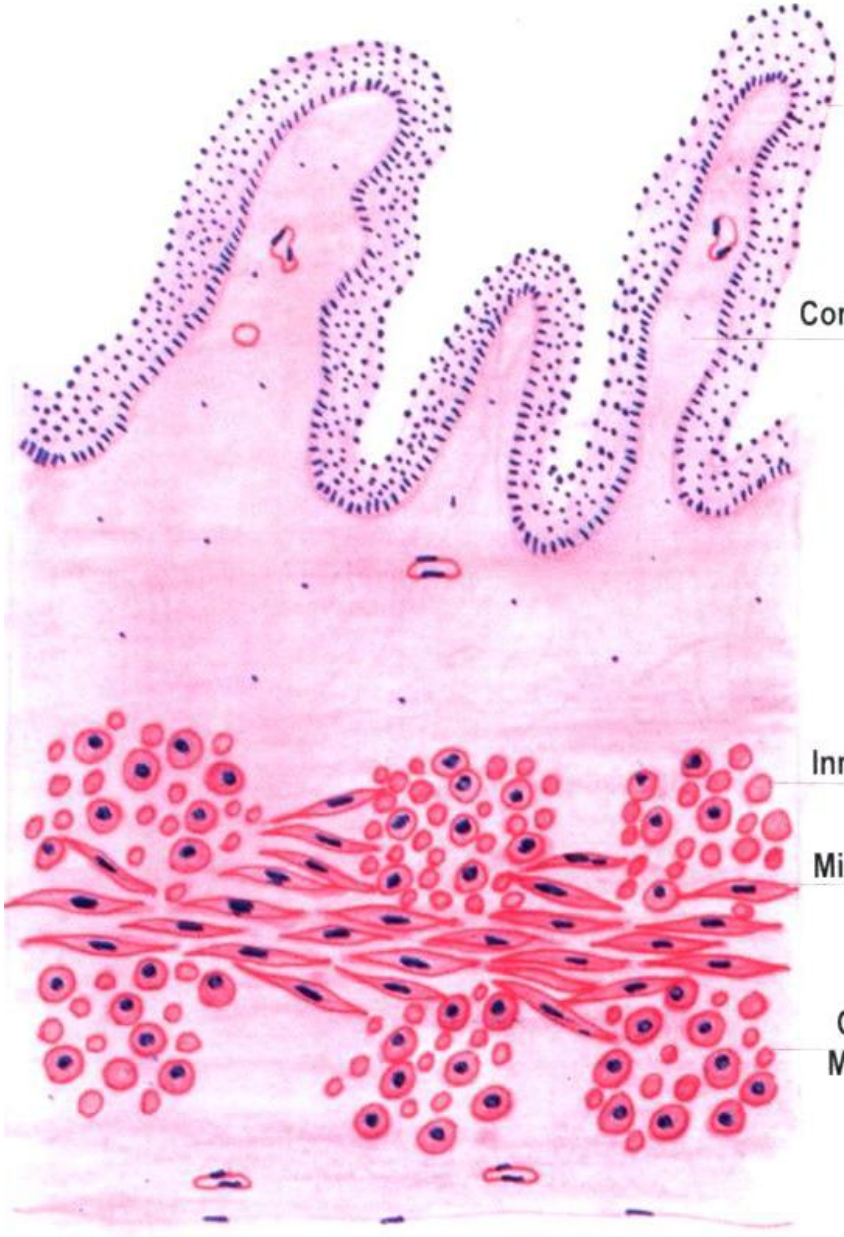
II. Muscle layer:

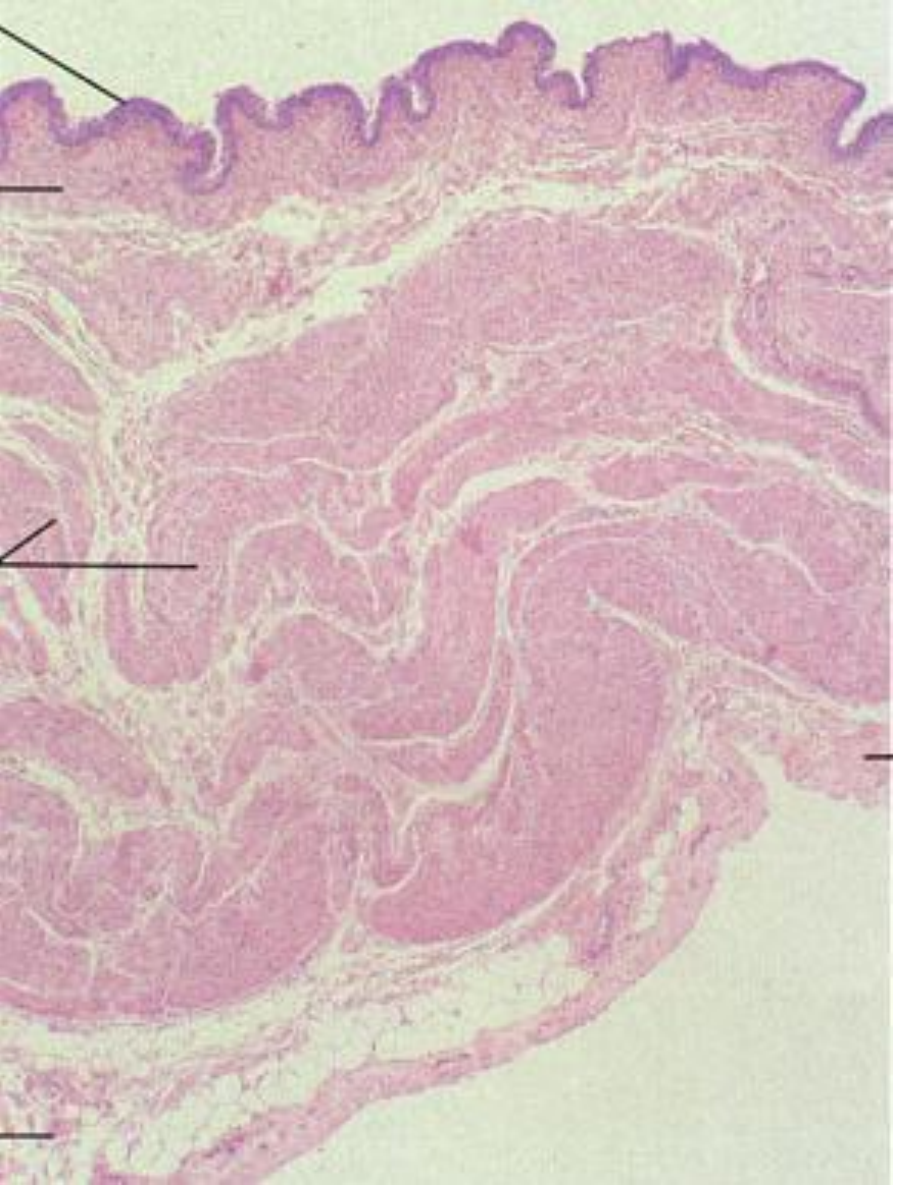
Widely separated smooth muscle fibers by loose C.T.

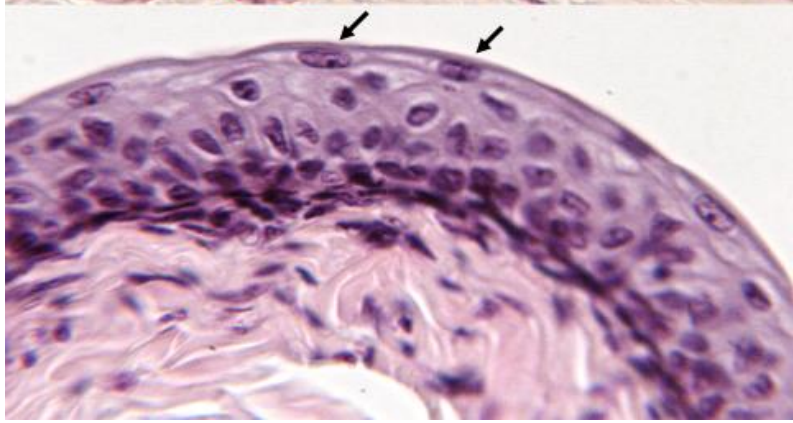
- Inner longitudinal
- Middle circular
- Outer longitudinal

III. Adventitia:

(Serosa in the fundus).








Transitional
epithelium

URETER

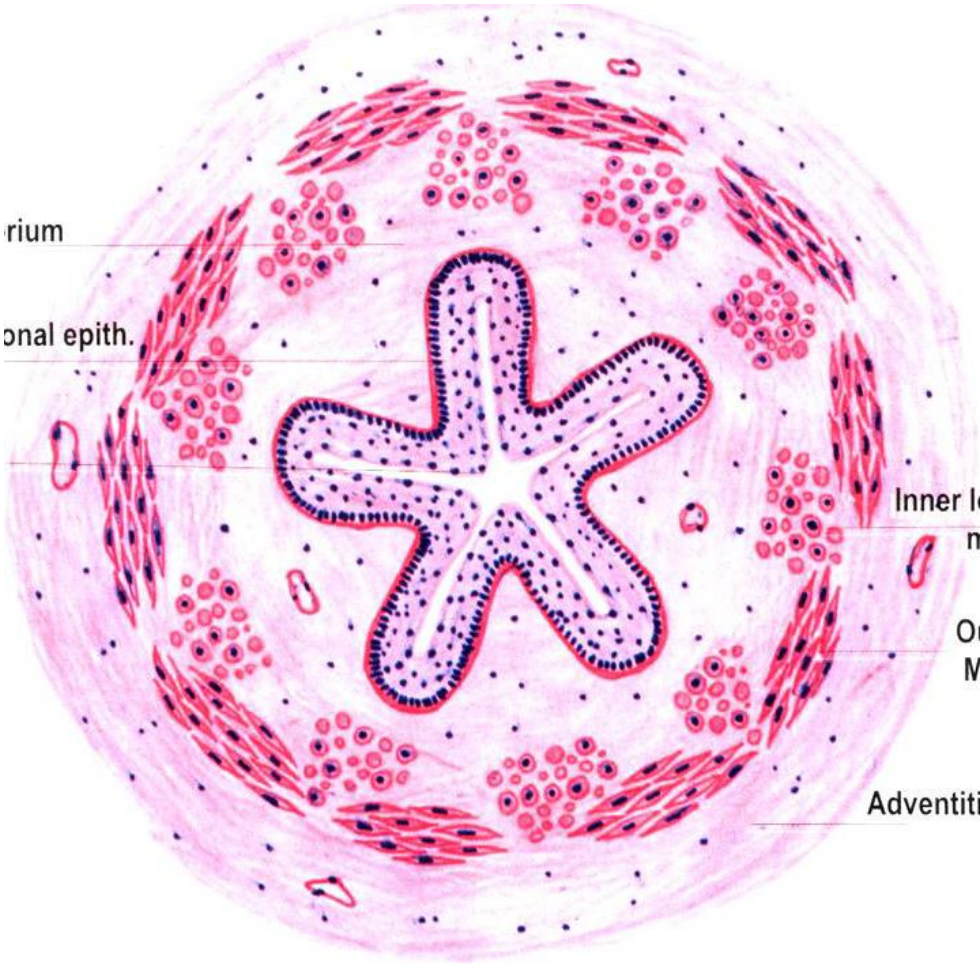
Ureter

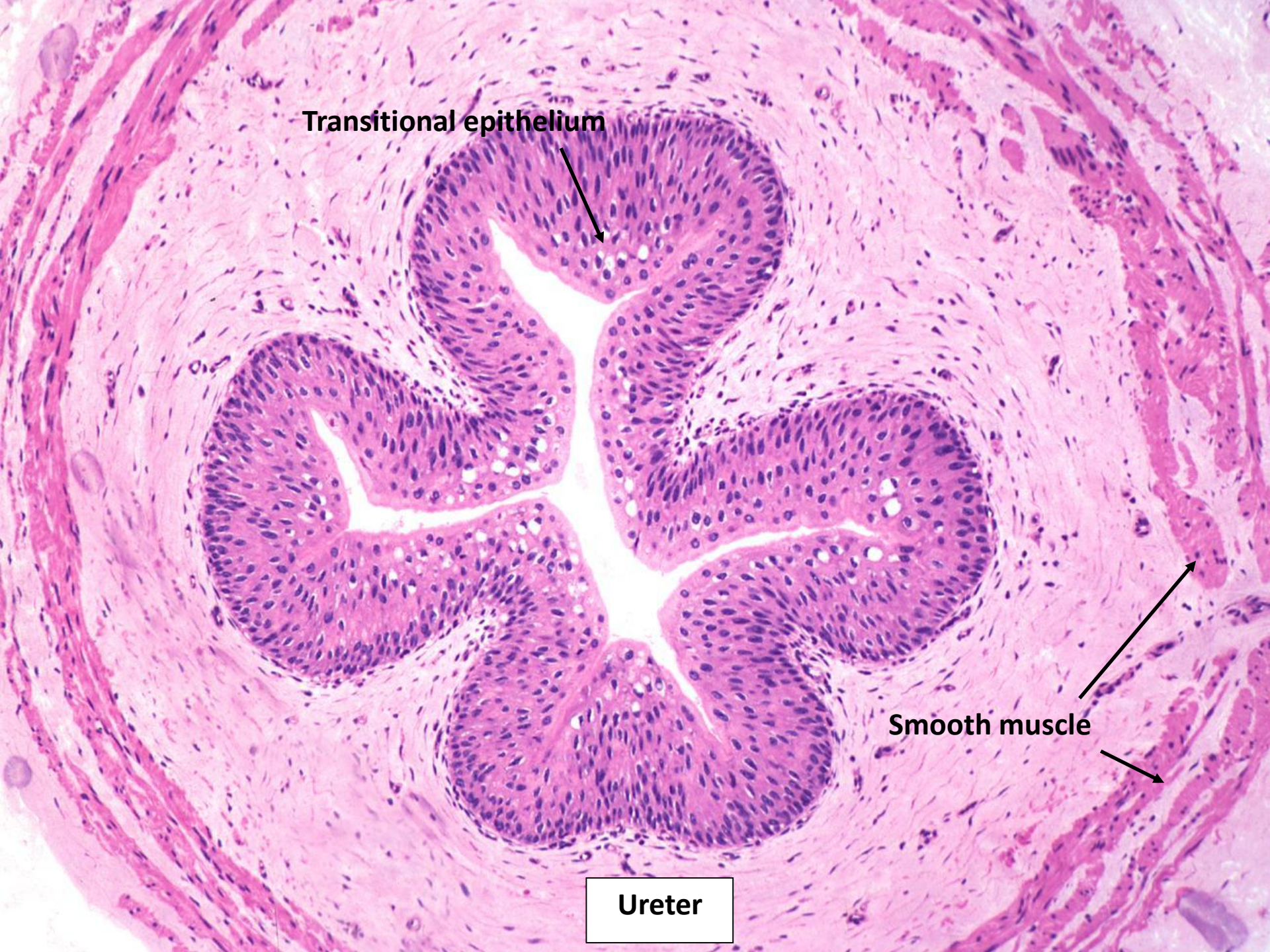
similar to urinary bladder **but**:

1- **Lumen:** narrow.

2- **Muscle layer:**

- **2 layers only**
  - Inner longitudinal
  - Outer circular
- **Lower 1/3**: similar to bladder (3 layers)

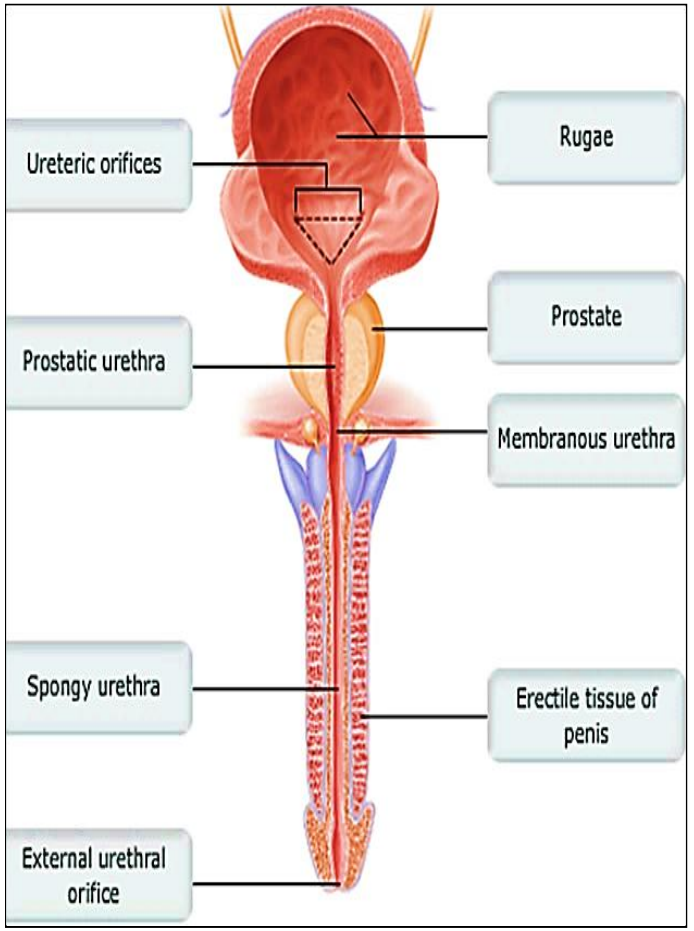



Transitional epithelium
Smooth muscle
Ureter

urethra

A-Male urethra

Prostatic – membranous – penile



Prostatic urethra

Lined e **transitional** epithelium

Membranous urethra

Lined e **stratified columnar** epithe

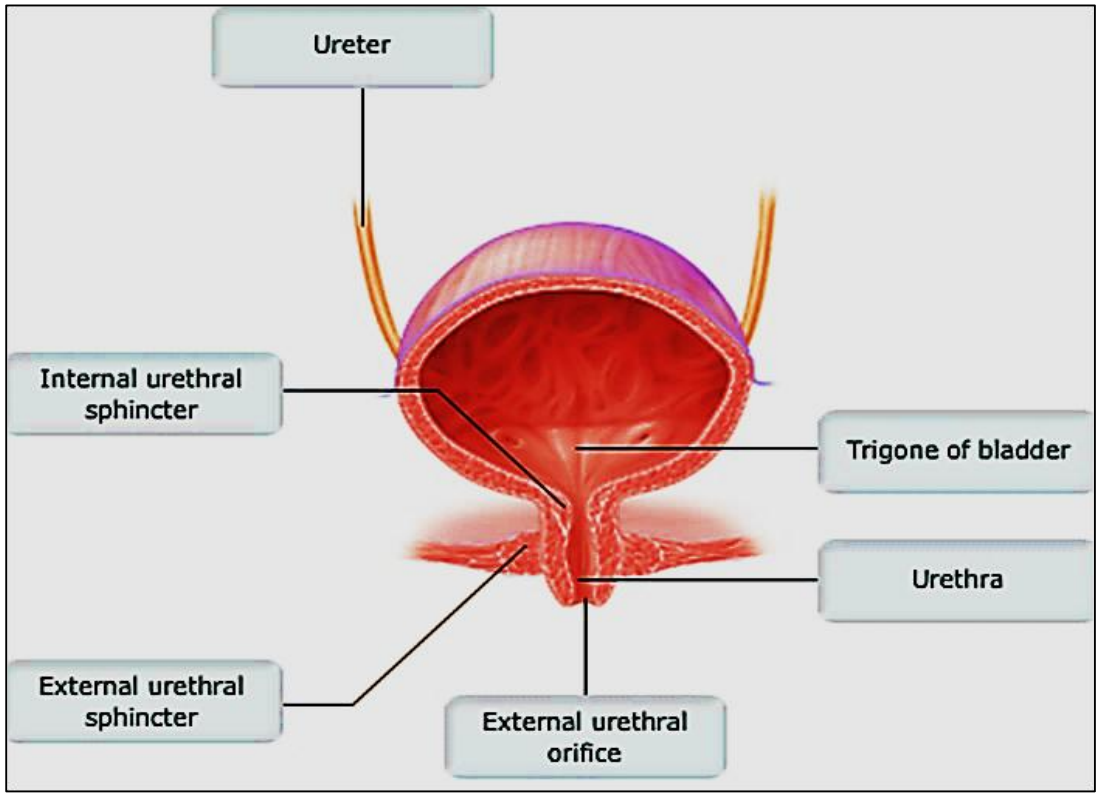
Penile urethra

Lined e **stratified columnar** epith which → **stratified squamous** in its distal part (fossa navicularis)

B- Female urethra

Short straight tube

Lined with **transitional** epithelium, then **stratified squamous** at its distal part



THANK YOU