



The urinary system II



HISTOLOGY

Semester 2, Year 3 •

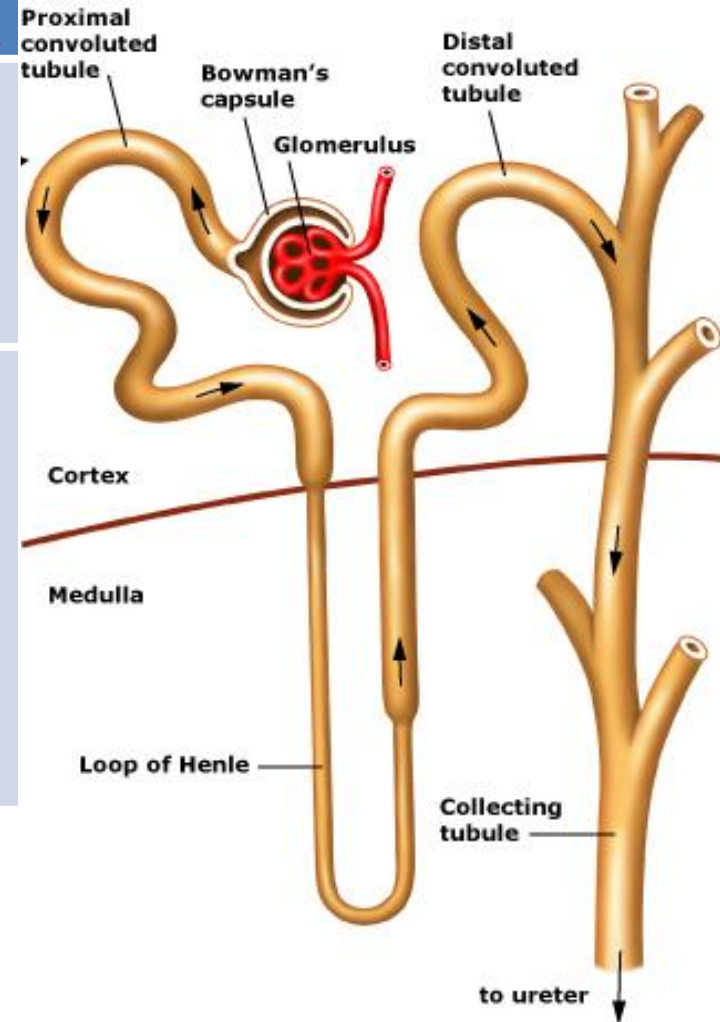
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Proximal convoluted tubule (PCT):

Distal convoluted tubule (DCT):

	<u>(PCT):</u>	<u>(DCT):</u>
Length:	About 15 mm	About 5 mm
Convolutions :	More convoluted	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):

Diameter:

– Large (60 μm)

Lumen:

– Narrow

Lining cells:

Number:

– 3-5 cells

Shape:

– Cubical shape

Nucleus:

– Basal and rounded



(DCT):

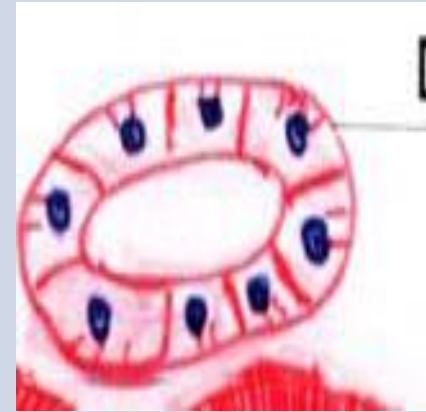
– Small (30-50 μm)

– Wide



– 5-8 cells

– Less cubical

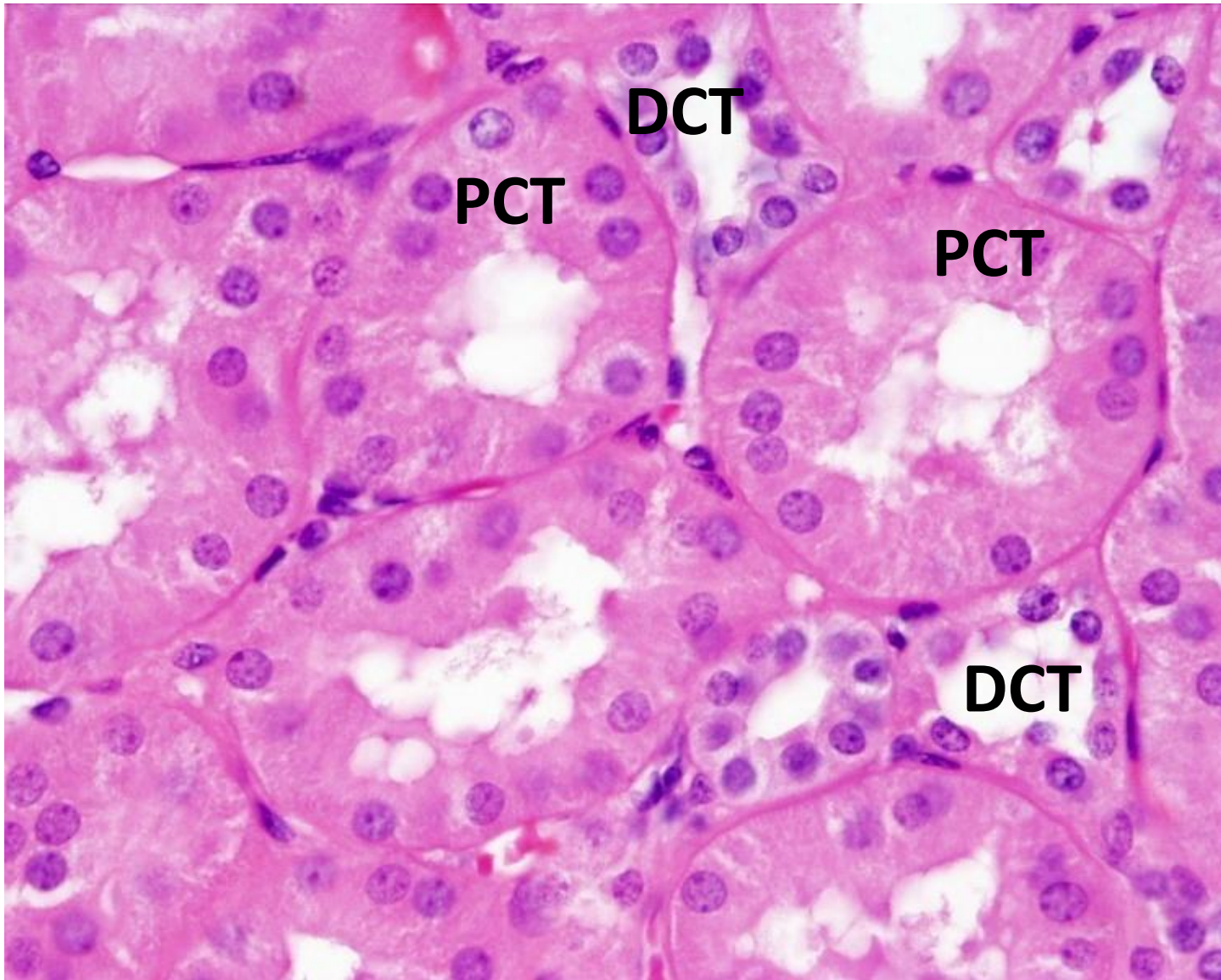
– Central & rounded

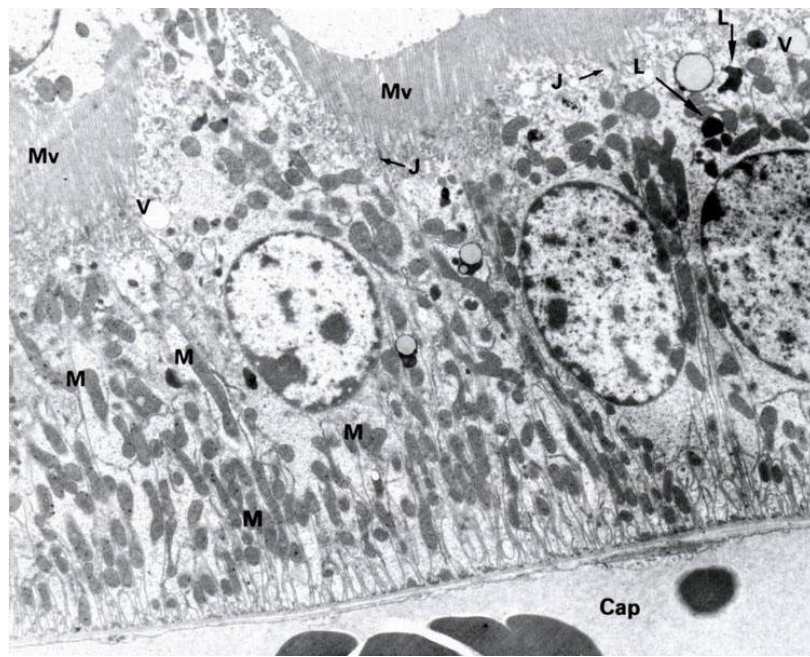


	P. C. T.	D. C. T.
<u>Lining cells:</u>		
<i>Side border:</i>	– not clear (due to interdigitation of the cell membranes)	– Clear
<i>Luminal border:</i>	– Shows brush appearance due to microvilli	– Microvilli are few and short
<i>Base of cell:</i>	– Shows basal mitochondrial striation due to rod shape mitochondria	Basal mitochondrial striation due to rod shape mitochondria

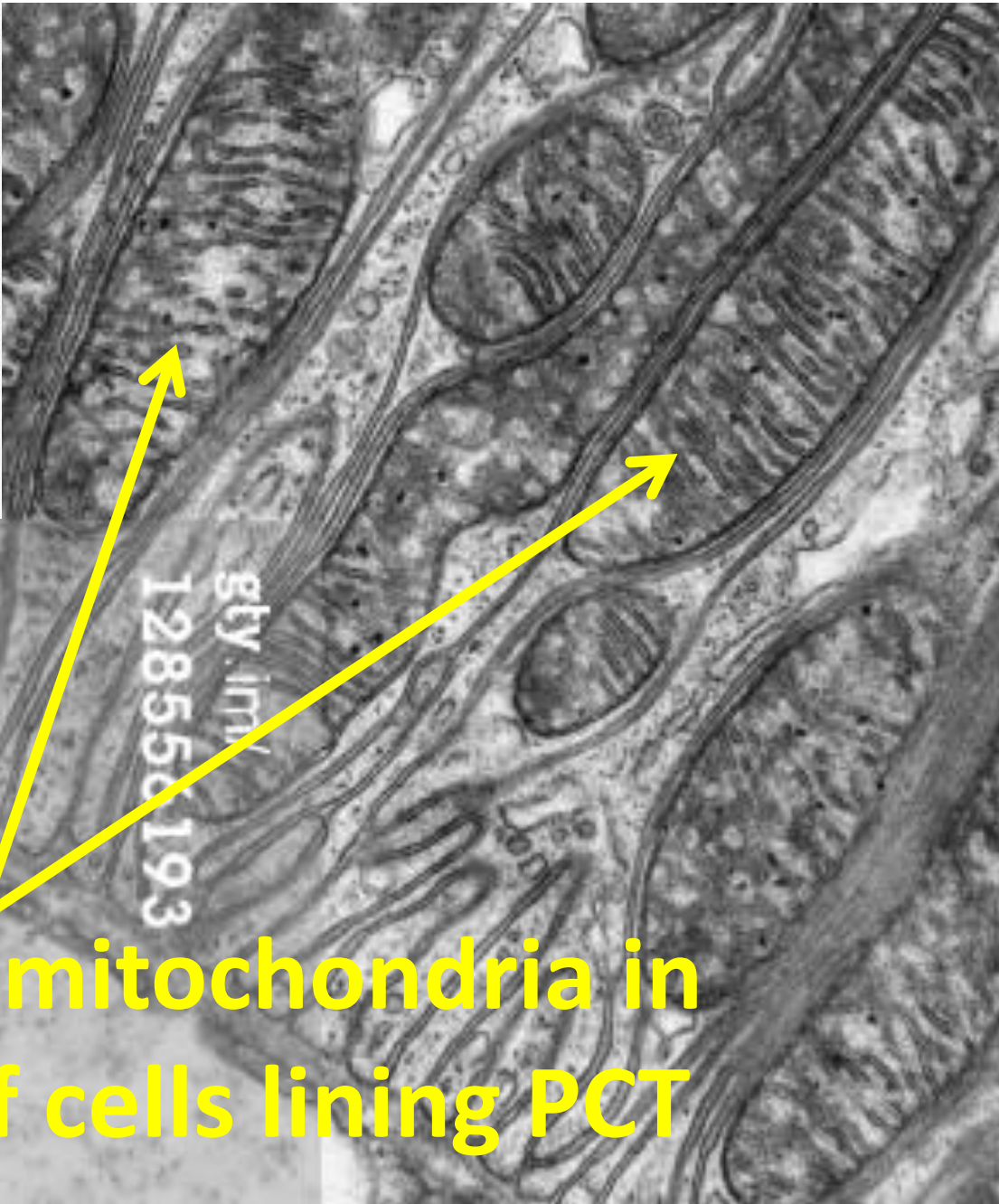
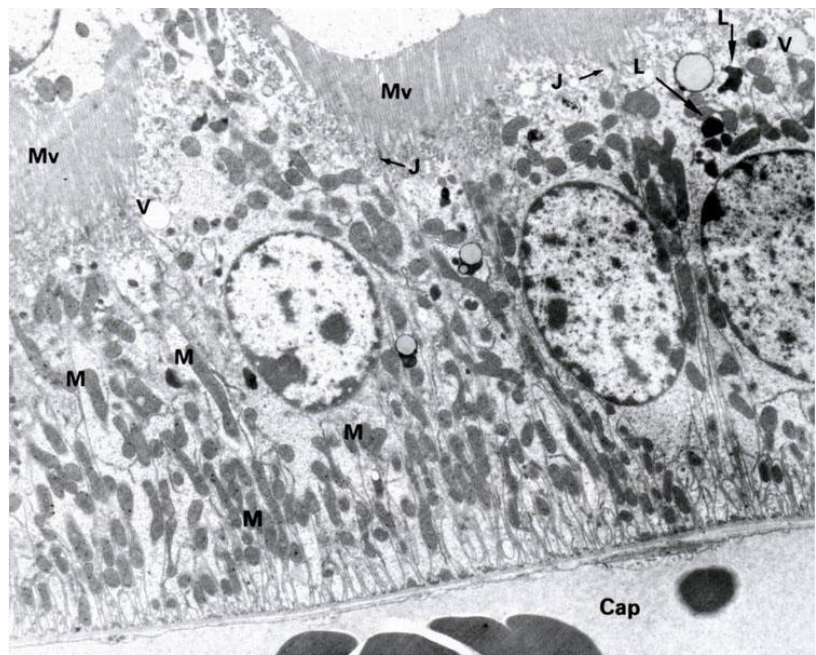
Cytoplasm:	<p>Deeply acidophilic and granular</p> 	<p>Pale acidophilic and non granular</p> 
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Section in the Kidney

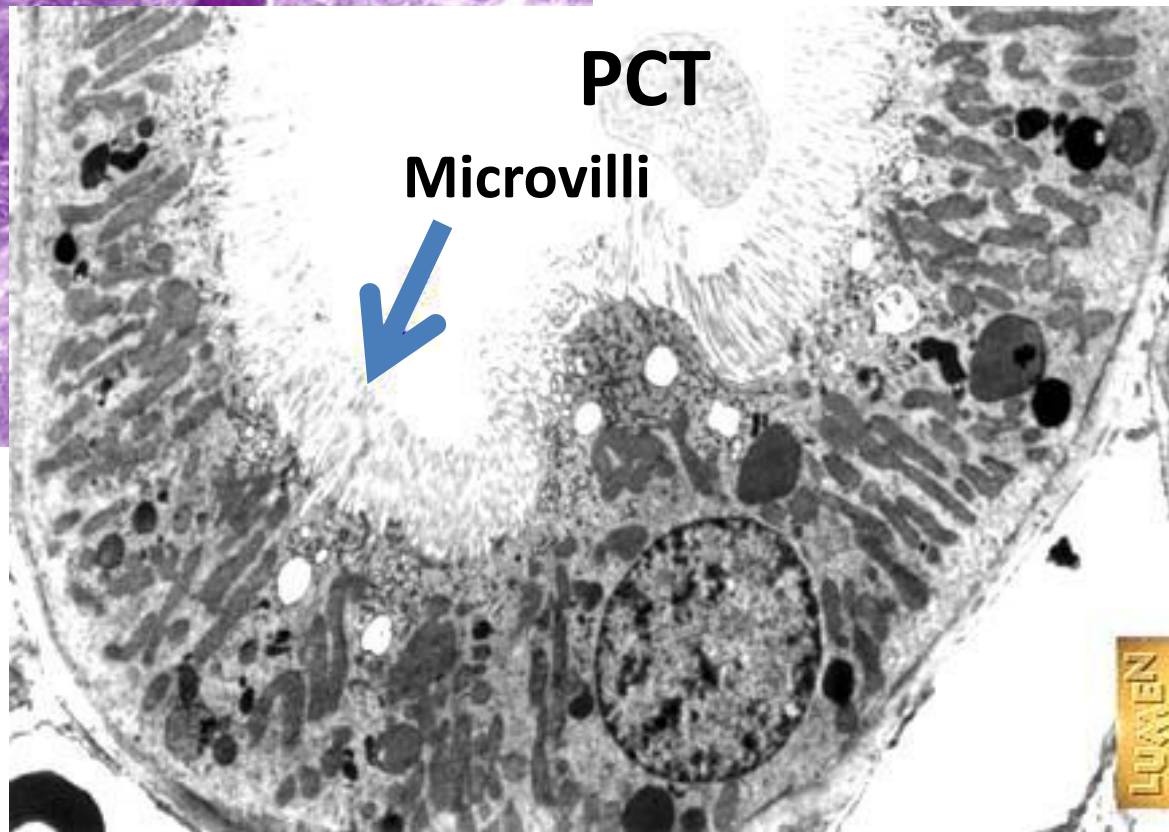
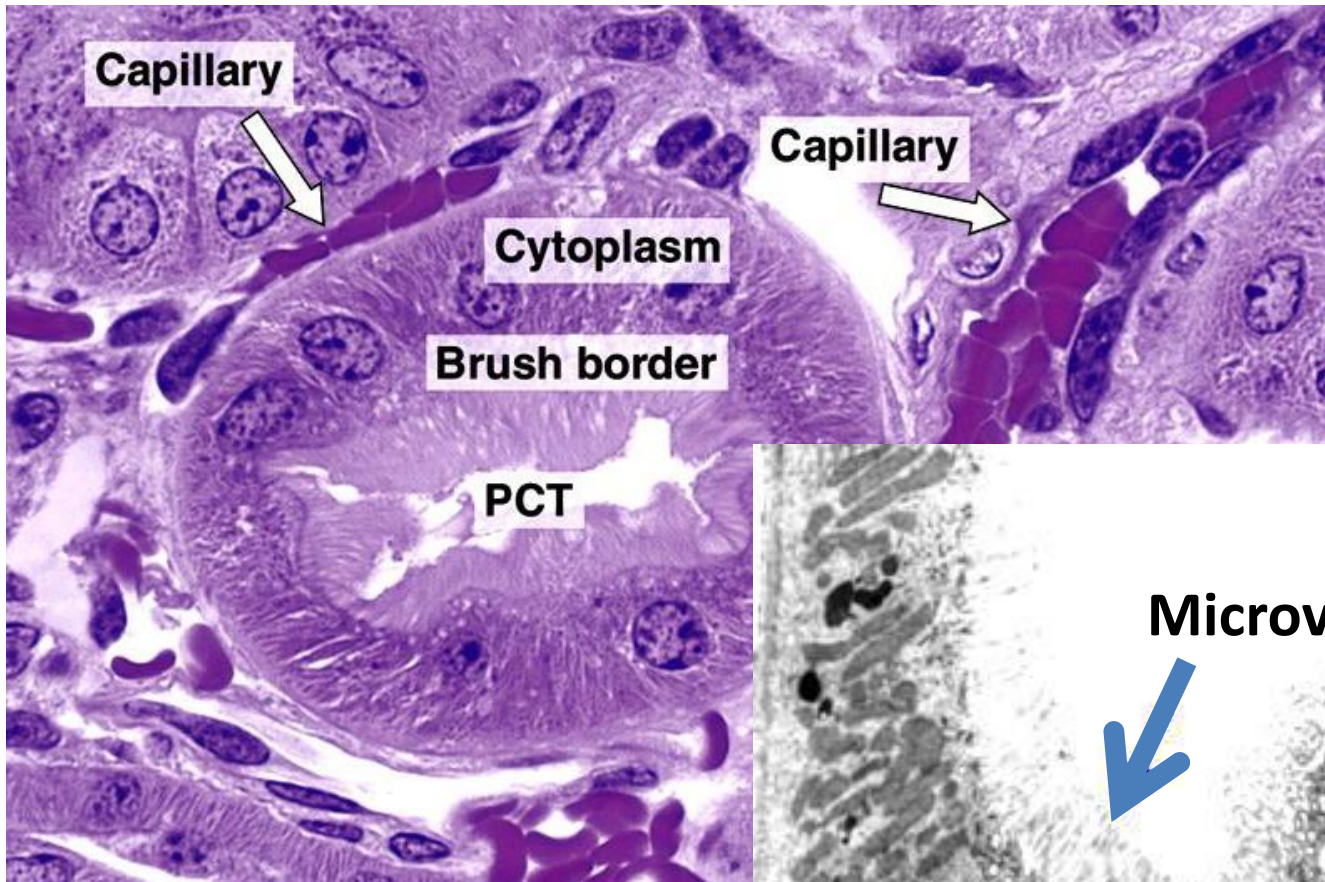




Rod-shaped mitochondria in basal part of cells lining PCT



Rod-shaped mitochondria in basal part of cells lining PCT



4- The Loop Of Henle

- U-shaped tube connecting P.C.T. & D.C.T.

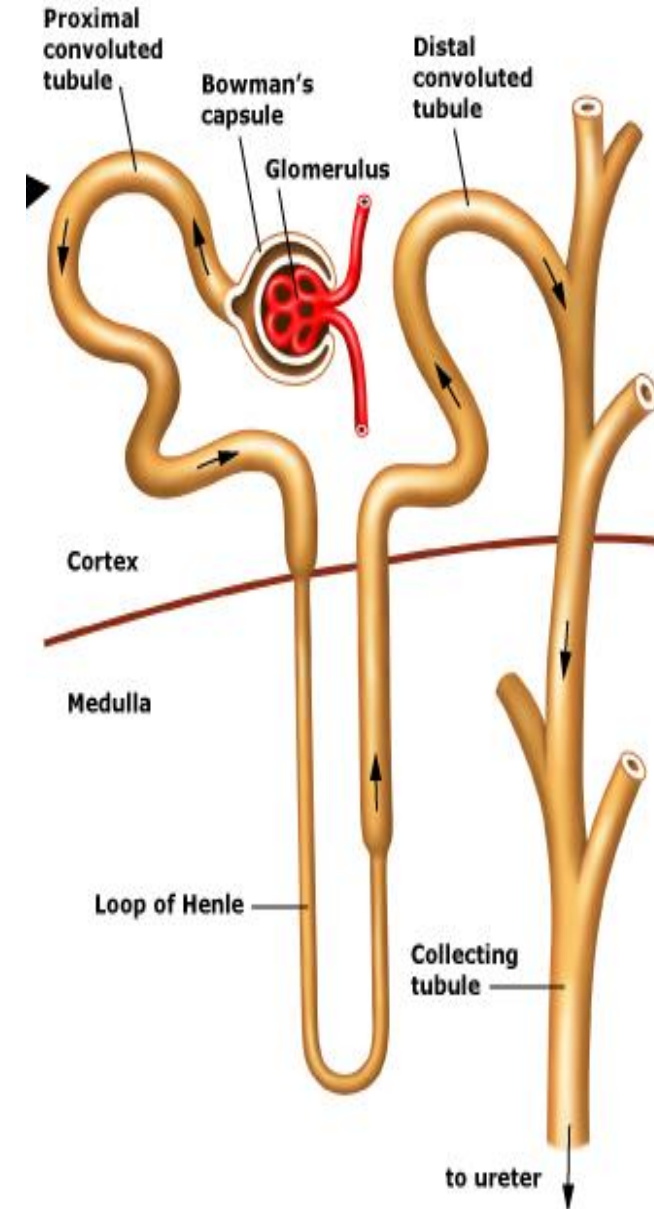
- The loop is formed of:

1-Descending limb:

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

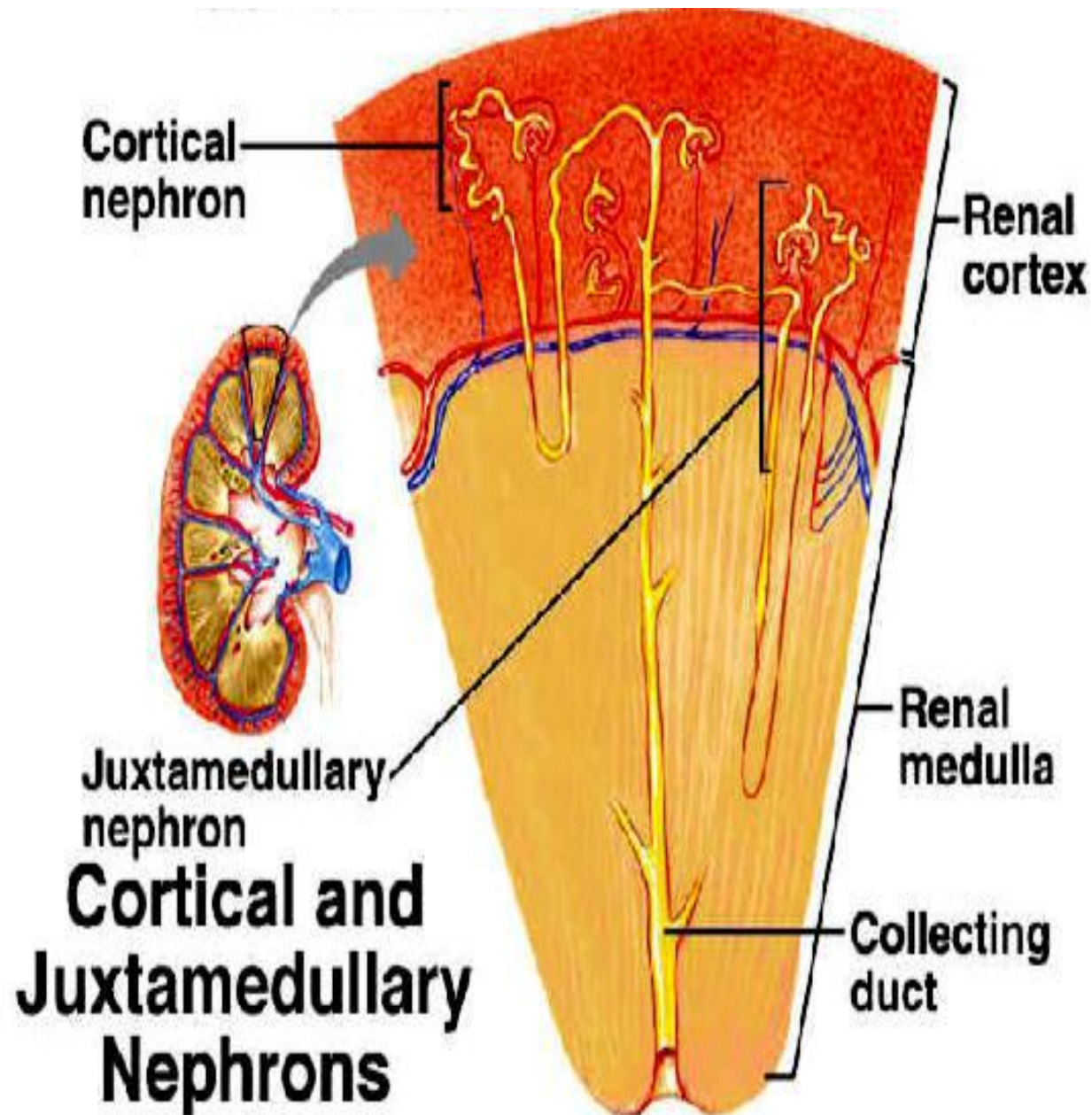
2-Ascending limb:

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



Types of Henle loop:

1. Long loops: Loops of juxtamedullary nephrons.
2. Short loops: Loops of cortical nephrons.



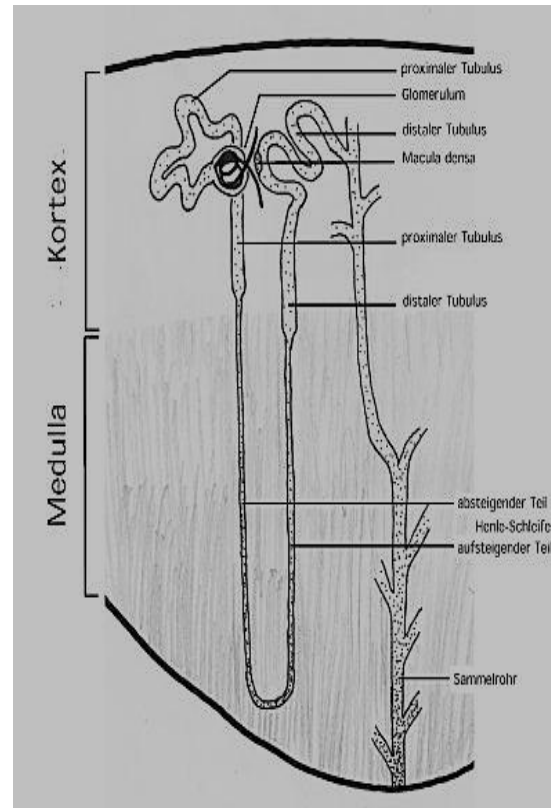


loop of Henle, thin segment

loop of Henle, ascending thick segment

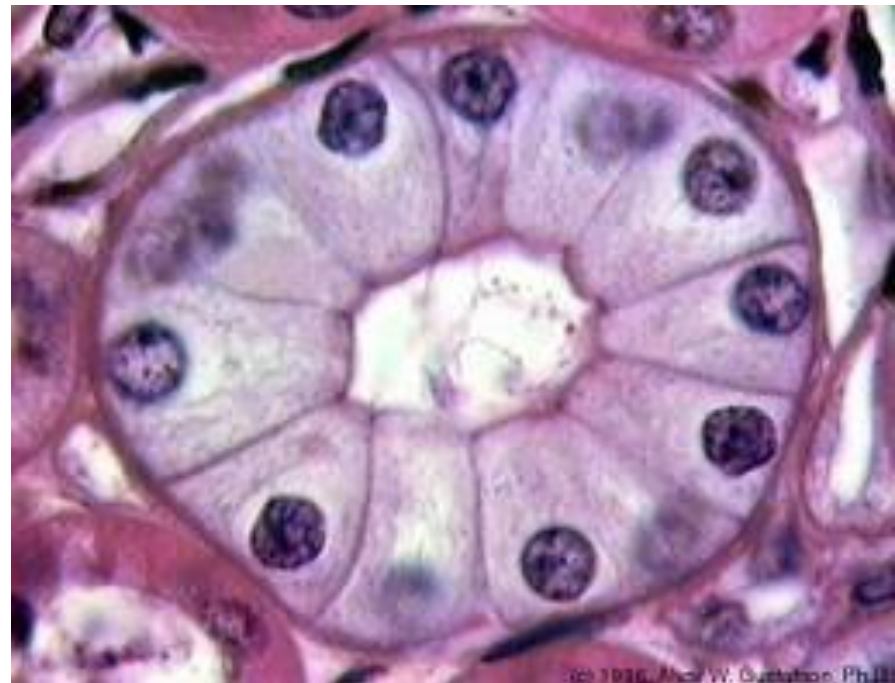
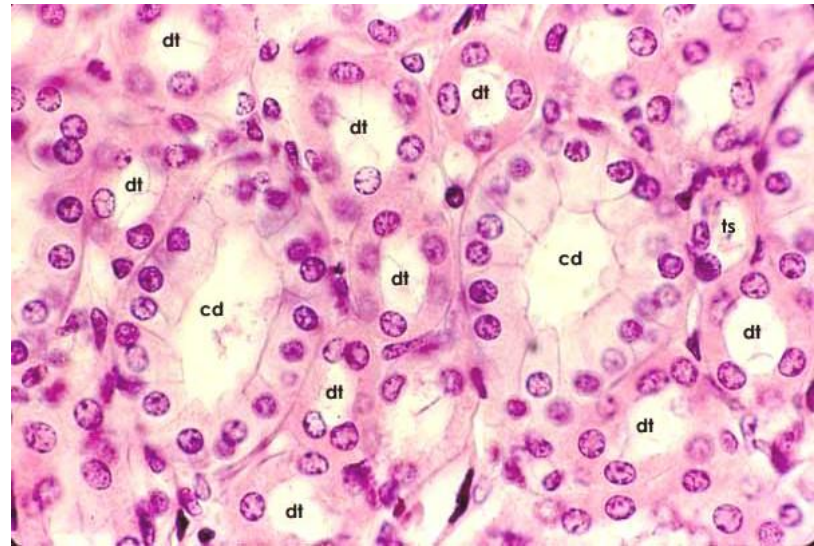
5- Collecting tubules

- 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 columnar cells with clear basophilic



The collecting ducts

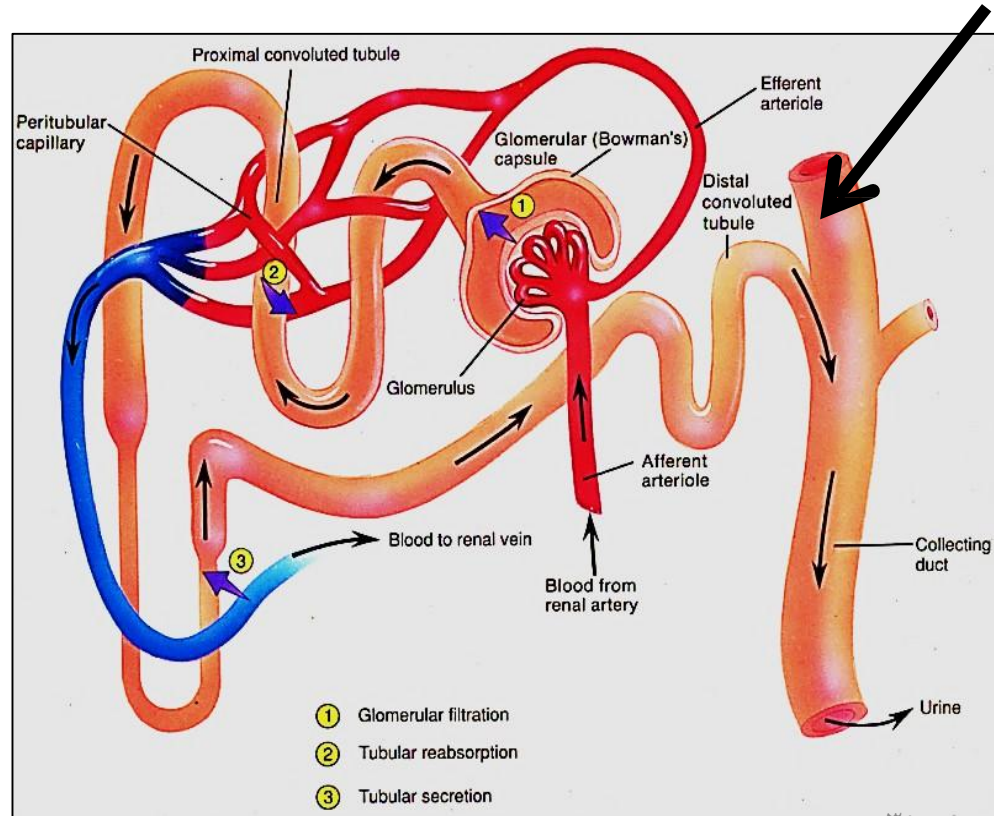
The excretory portion of renal tubules, under **ADH**

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

Numerous

→ **Very sensitive to ADH**

Responsible for the ability of collecting tubules to **concentrate urine**

Reabsorb water

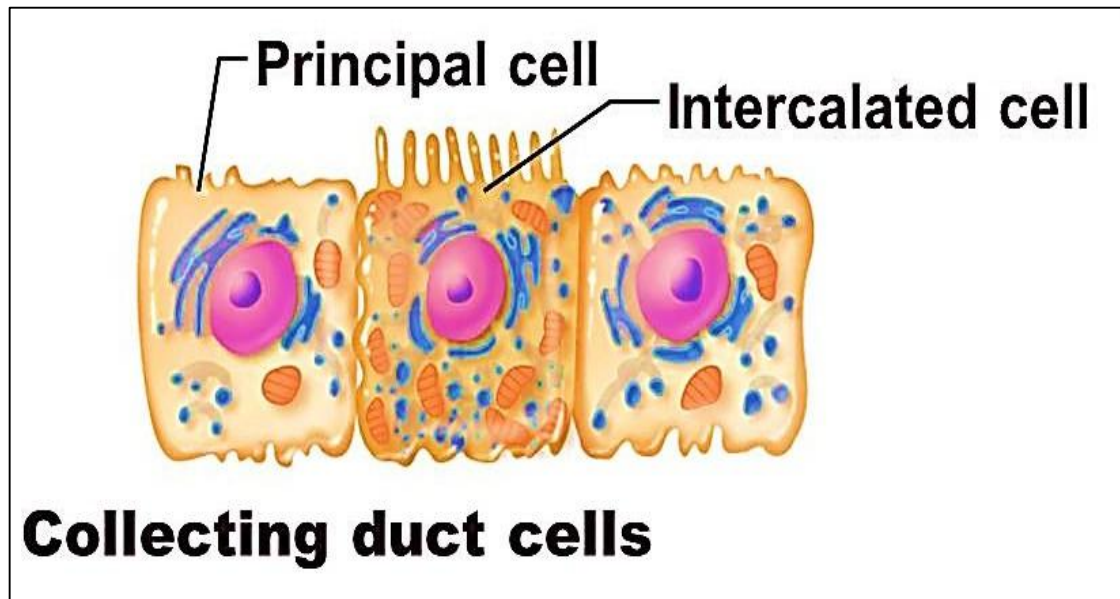
Reabsorb Na & secrete K

Intercalate cells

Few, have apical microfolds

types alpha & Beta 2

Regulate acid-base balance

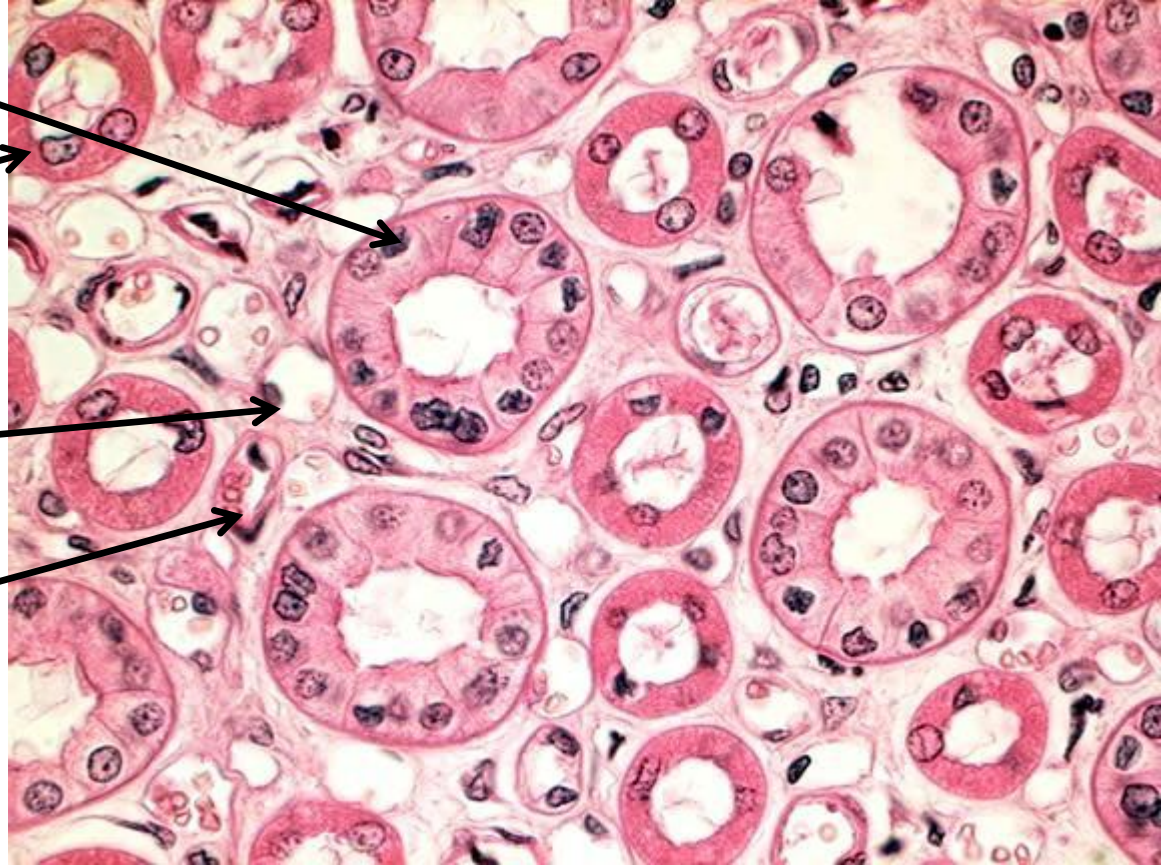


Collecting tubule

**Henle loop
(Thick segment)**

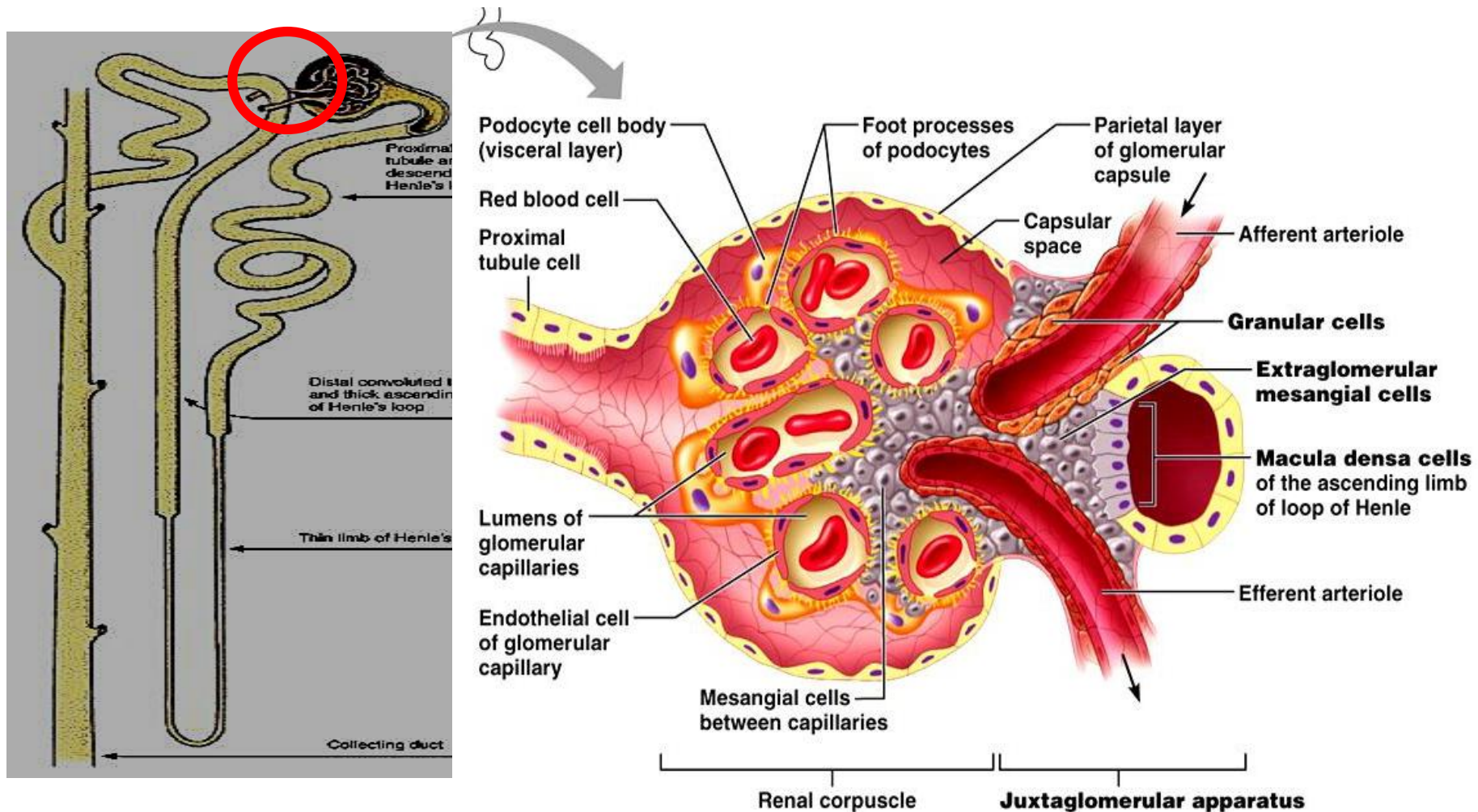
**Henle sloop
(thin segment)**

capillary.



The Juxtaglomerular Complex

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



Juxtaglomerular apparatus

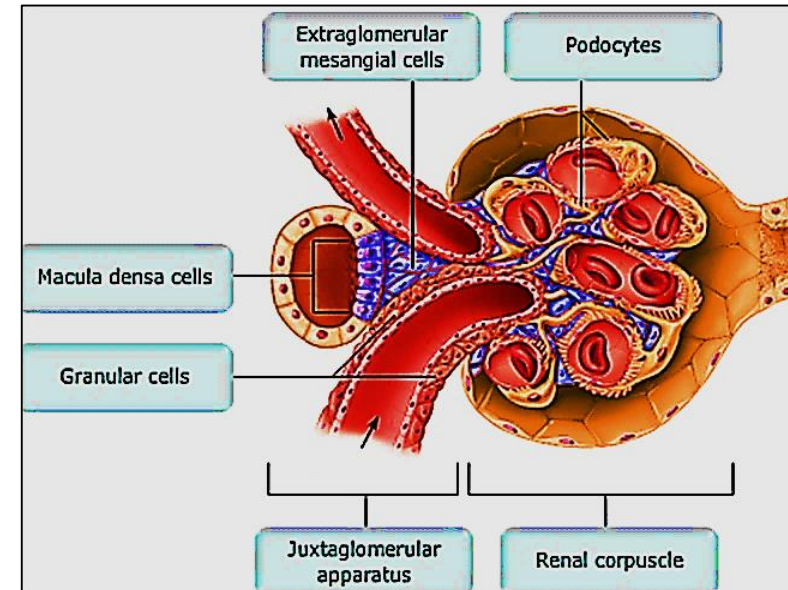
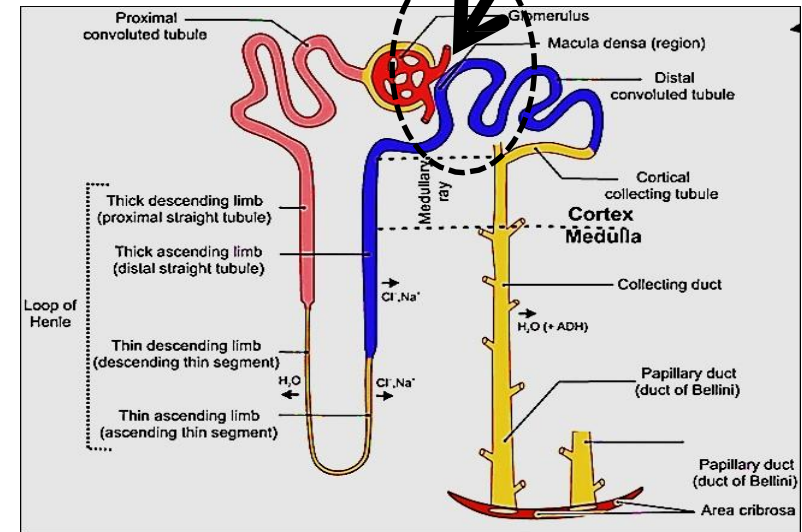
Located at the vascular end of renal corpuscle

:Consists of 3 components

Macula densa (.lining of distal convoluted T)

Granular (juxtaglomerular) cells
(wall of afferent arteriole)

Lacis cells (Extra-glomerular mesangial cells)

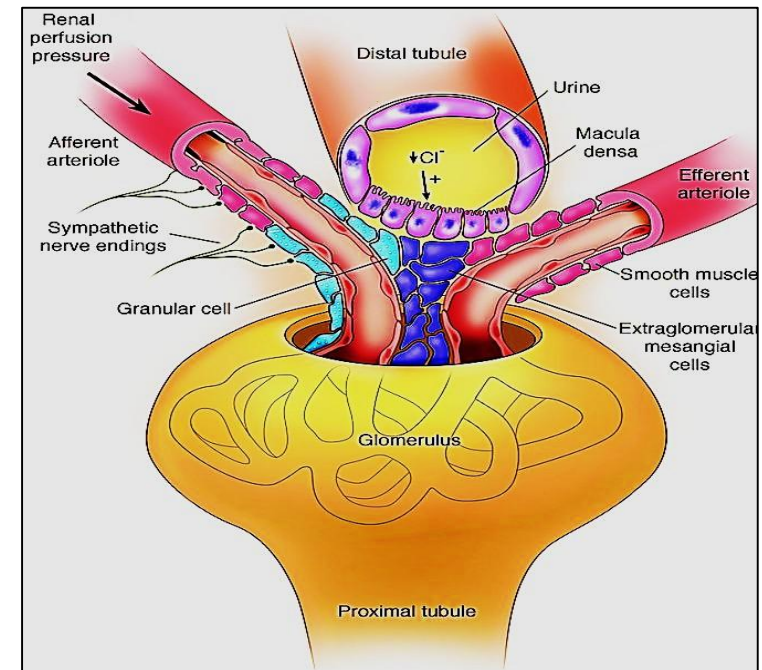
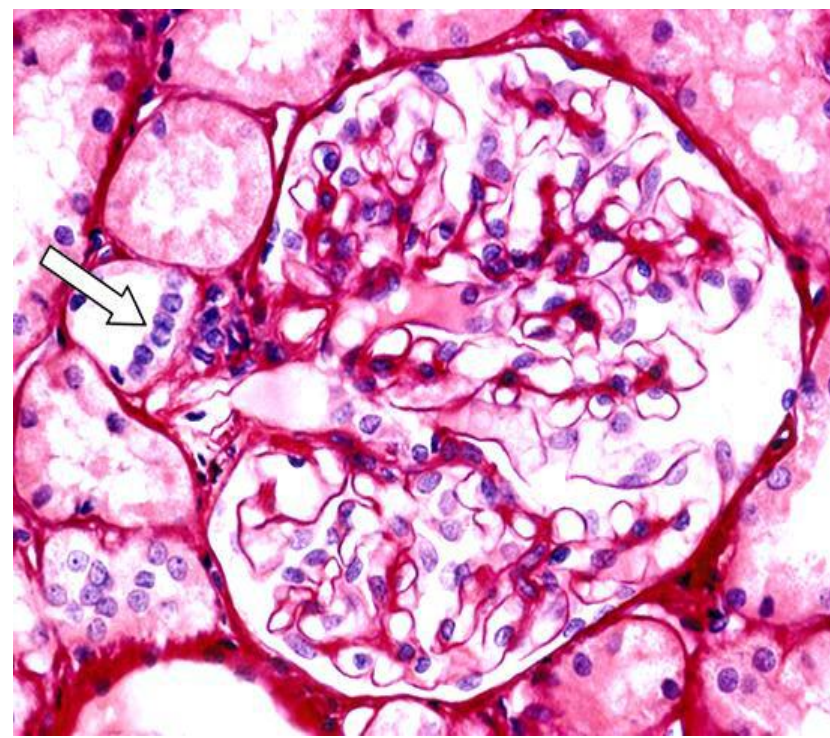


1. Macula densa:

-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

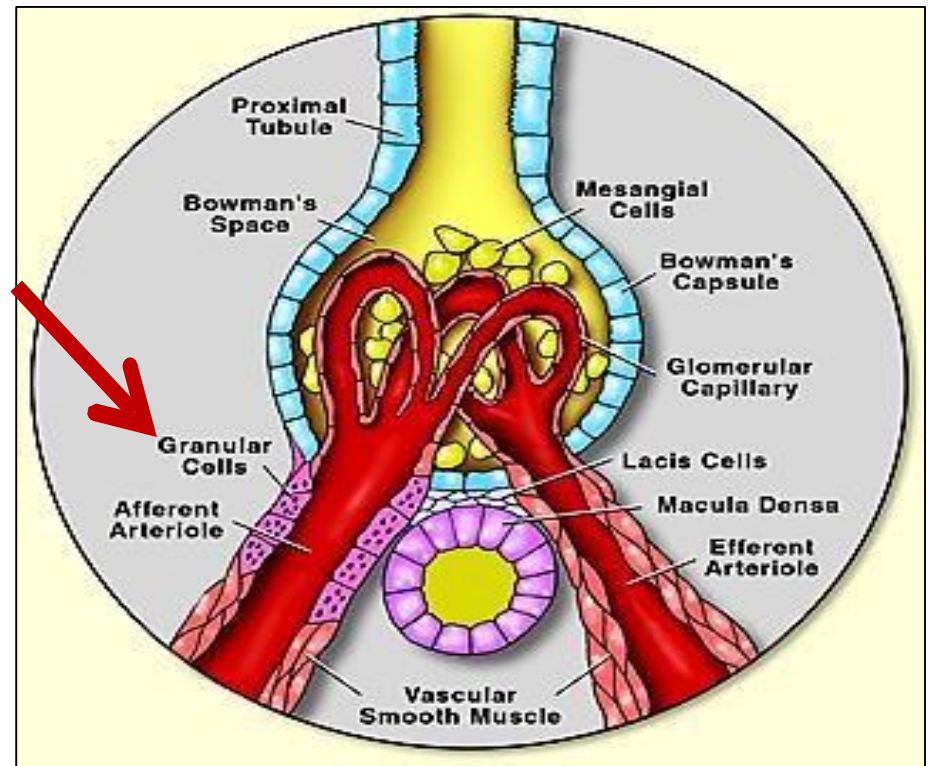
Act as osmoreceptors that monitor the level of Na⁺ ions of the filtrate in the lumen of DCT

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.

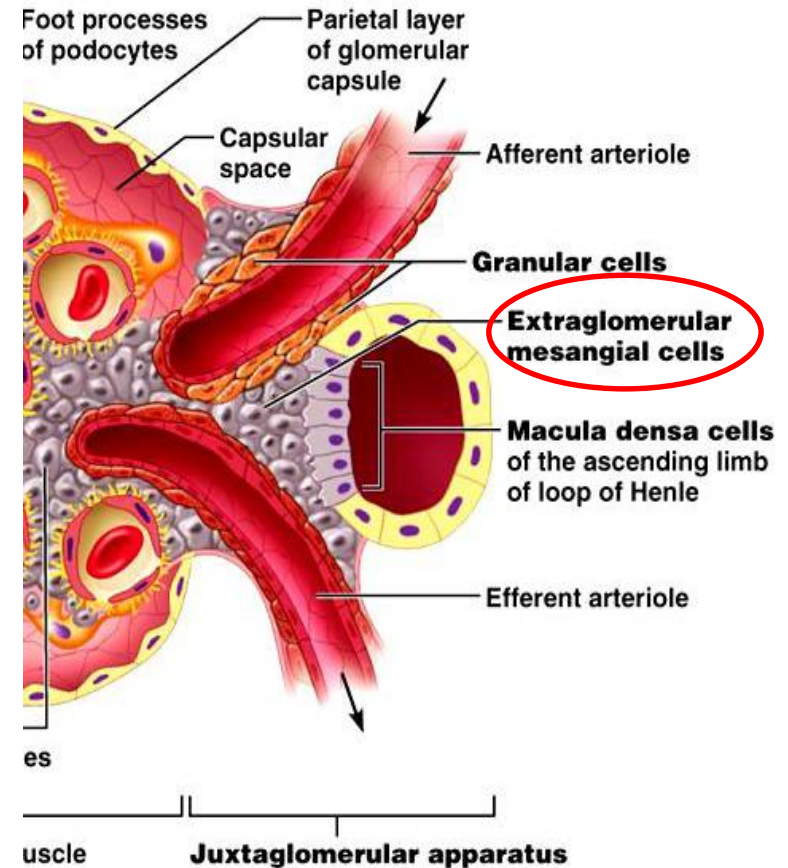
Function

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

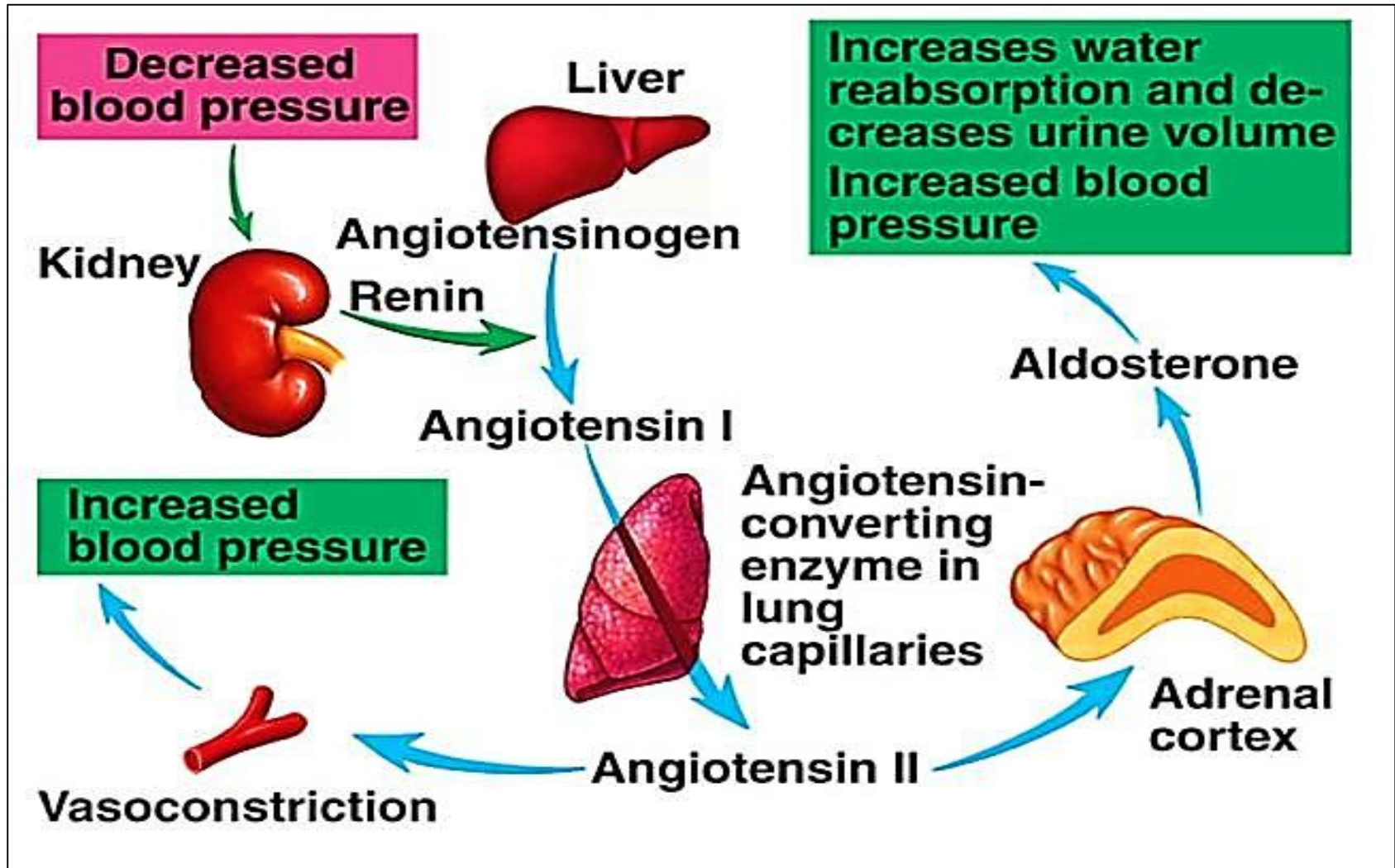


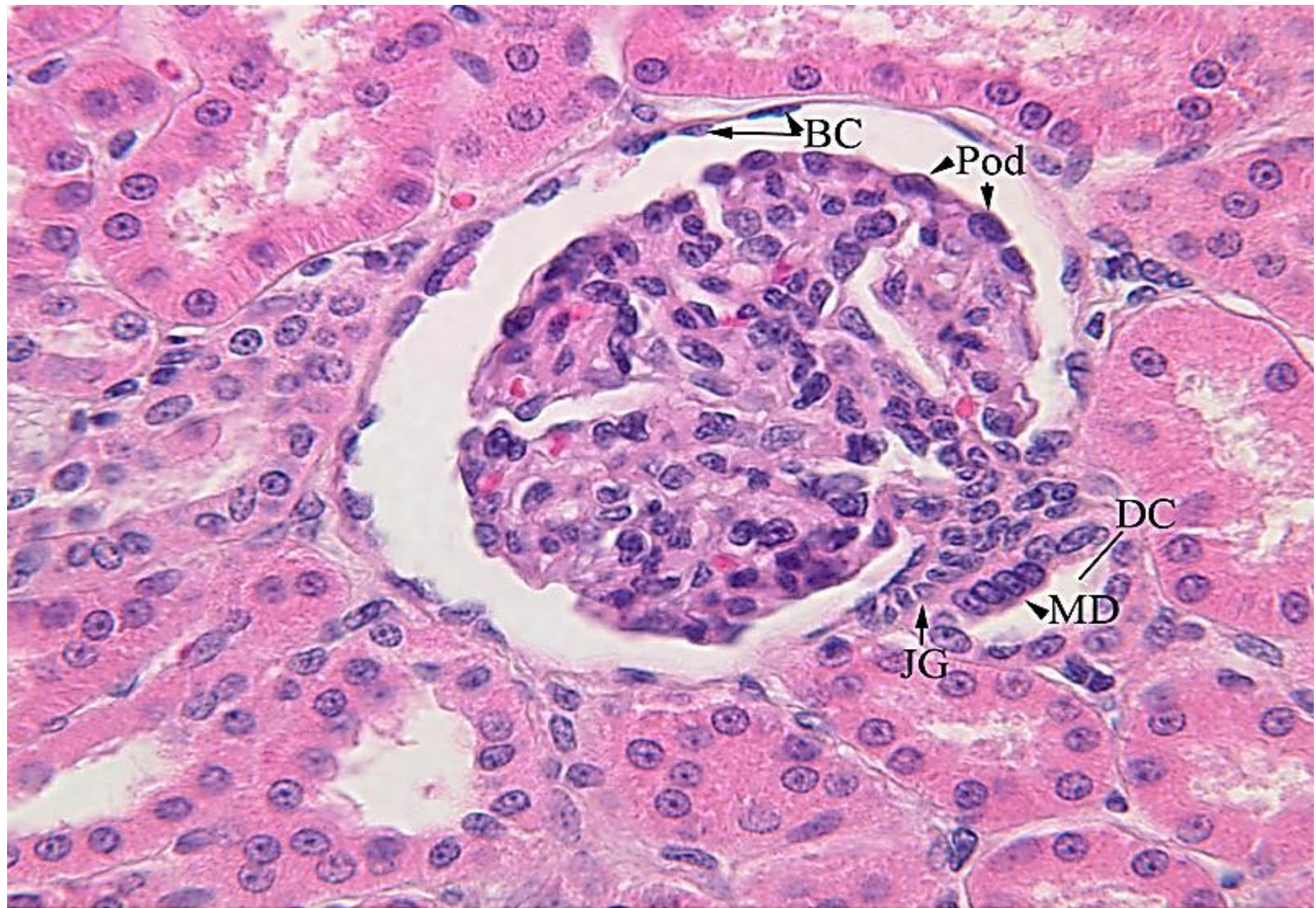
Functions of J. G. complex:

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

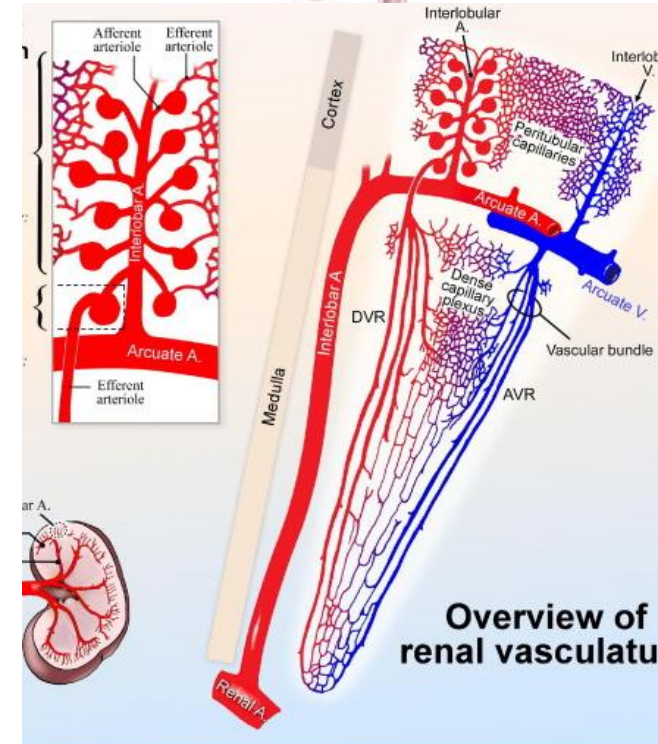
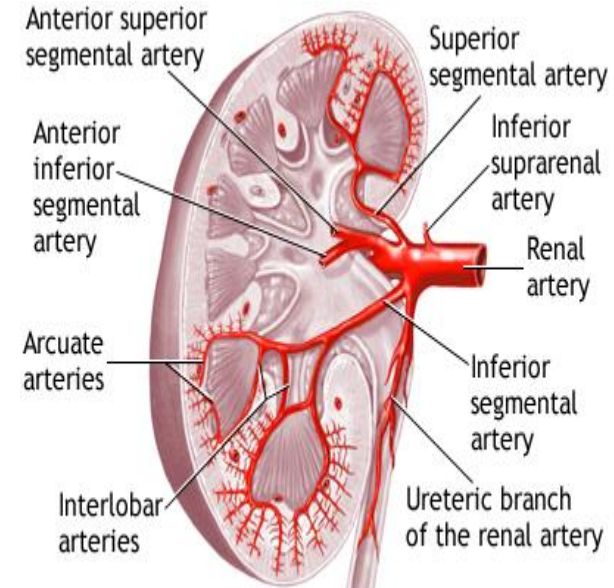




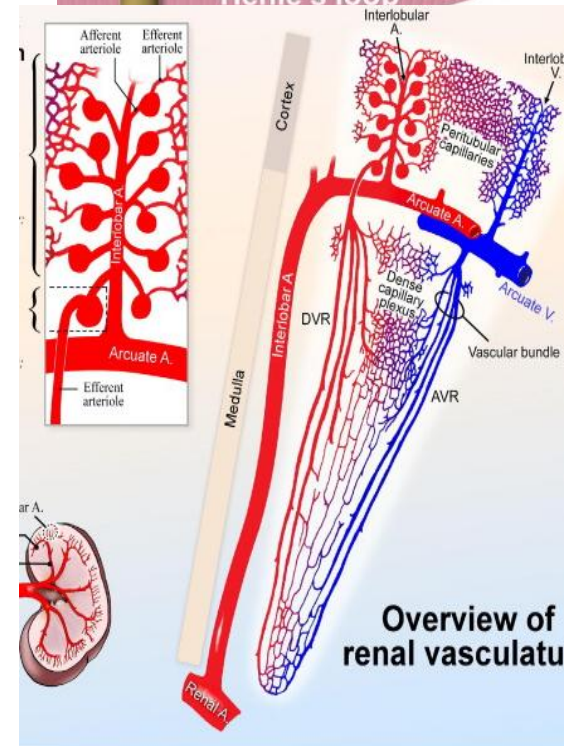
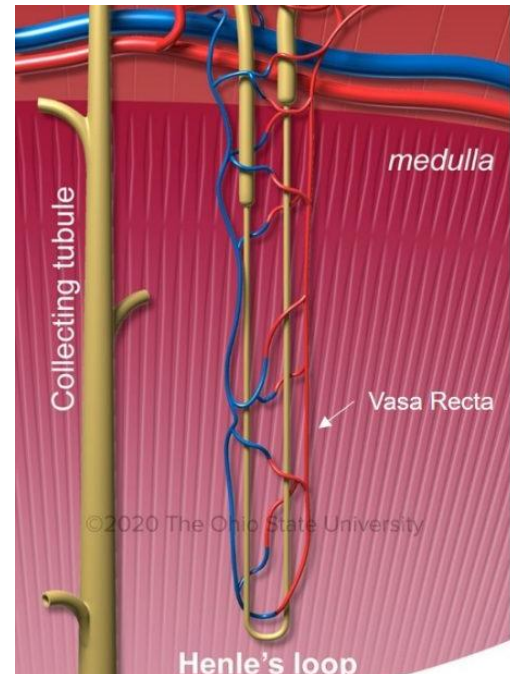
BC - Bowman's capsule (parietal layer) Pod - podocyte (visceral layer of Bowman's capsule)
MD - macula densa JG - juxtaglomerular cells DC - distal convoluted tubule

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).

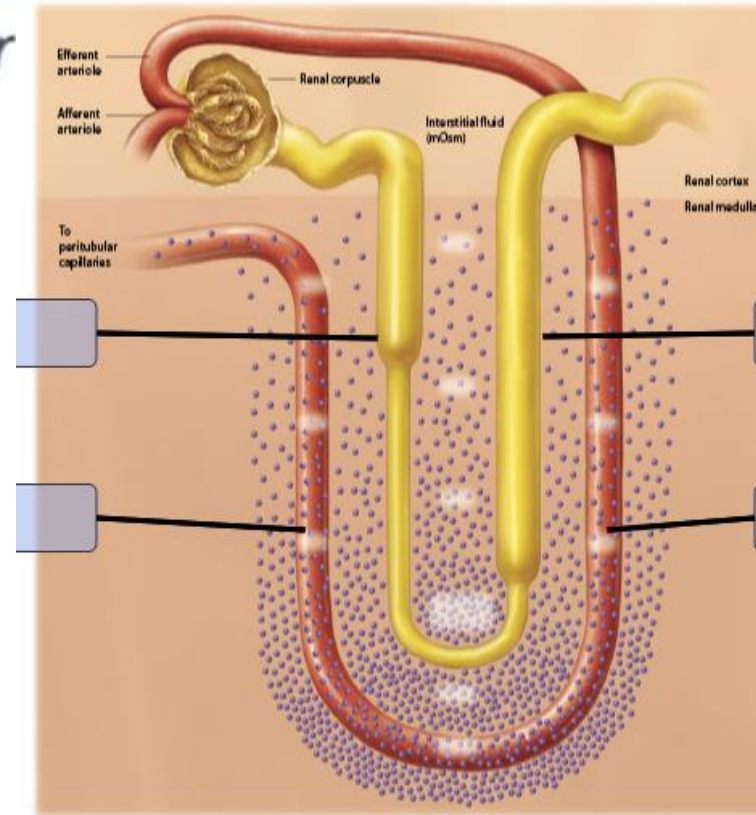


- **Arteria vasa recta:**(straight capillary loops) close and parallel to loop of Henle
- and collecting duct
- **Venous drainage:**
- Veins draining the cortical and medullary capillary beds accompany the interlobular arteries & vasa recta respectively and drain into arcuate veins.
- •Arcuate veins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



Function of vasa recta

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



URINARY BLADDER

Urinary bladder

I. Mucosa:

- **Transitional epithelium.**
- **Corium.**

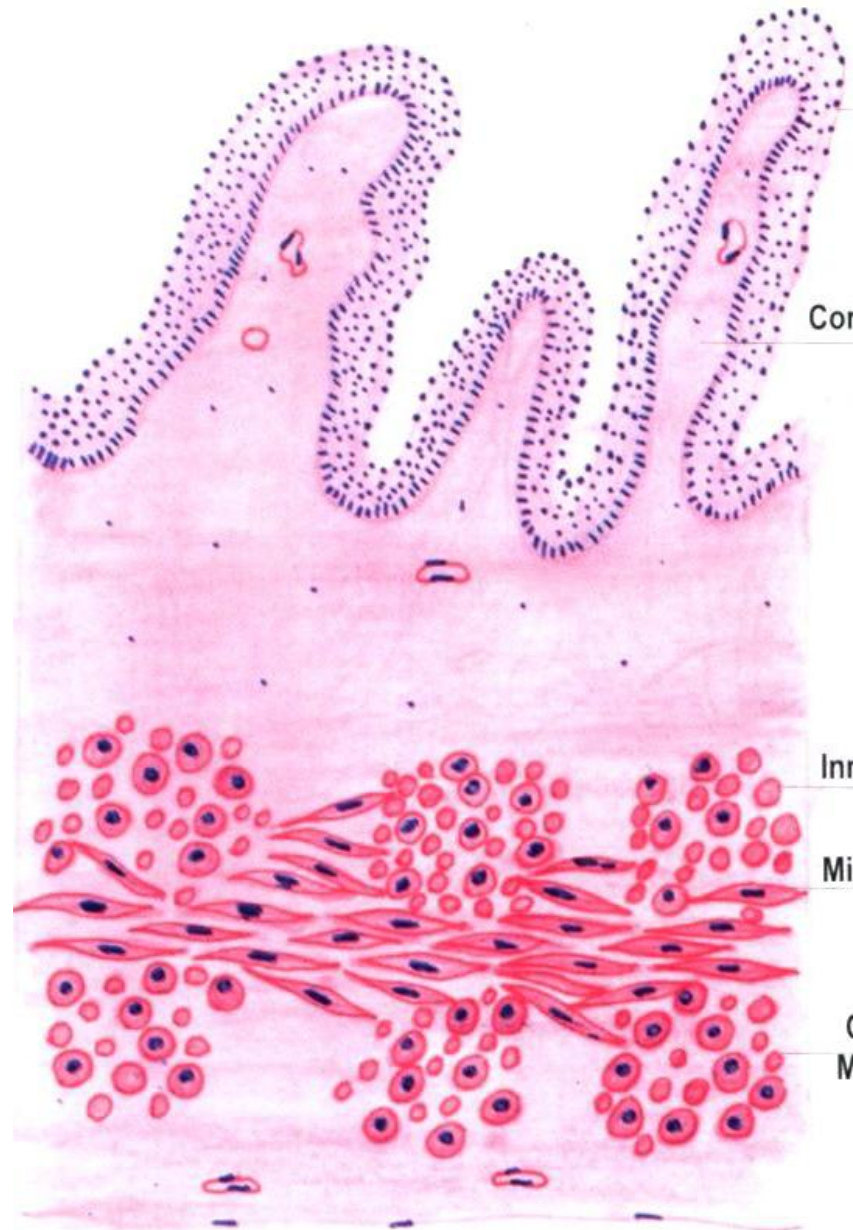
II. Muscle layer:

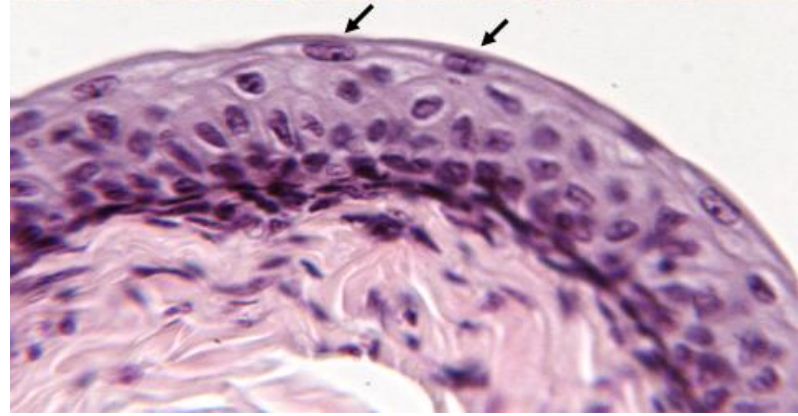
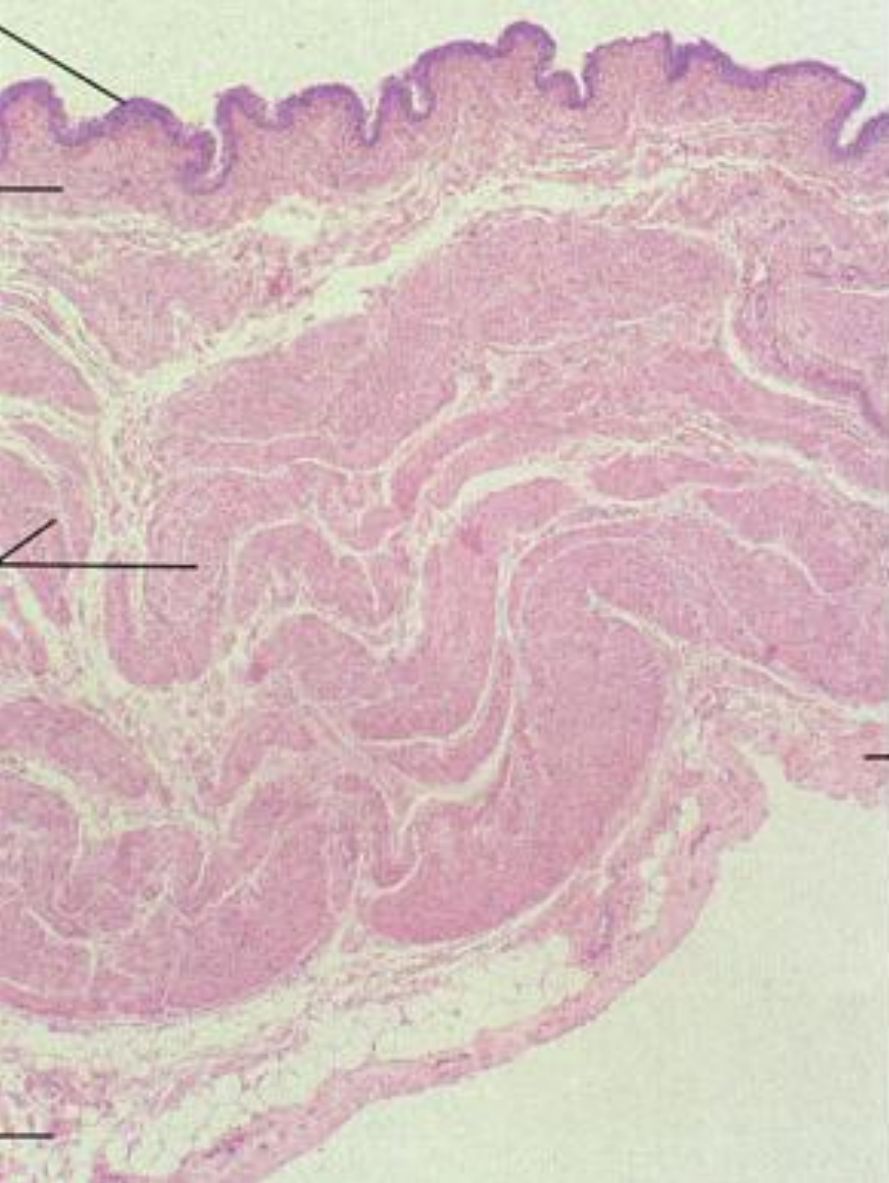
Widely separated smooth muscle fibers by loose C.T.

- **Inner longitudinal**
- **Middle circular**
- **Outer longitudinal**

III. Adventitia:

(Serosa in the fundus).





URETER

Ureter

similar to urinary bladder but:

1- **Lumen:** narrow.

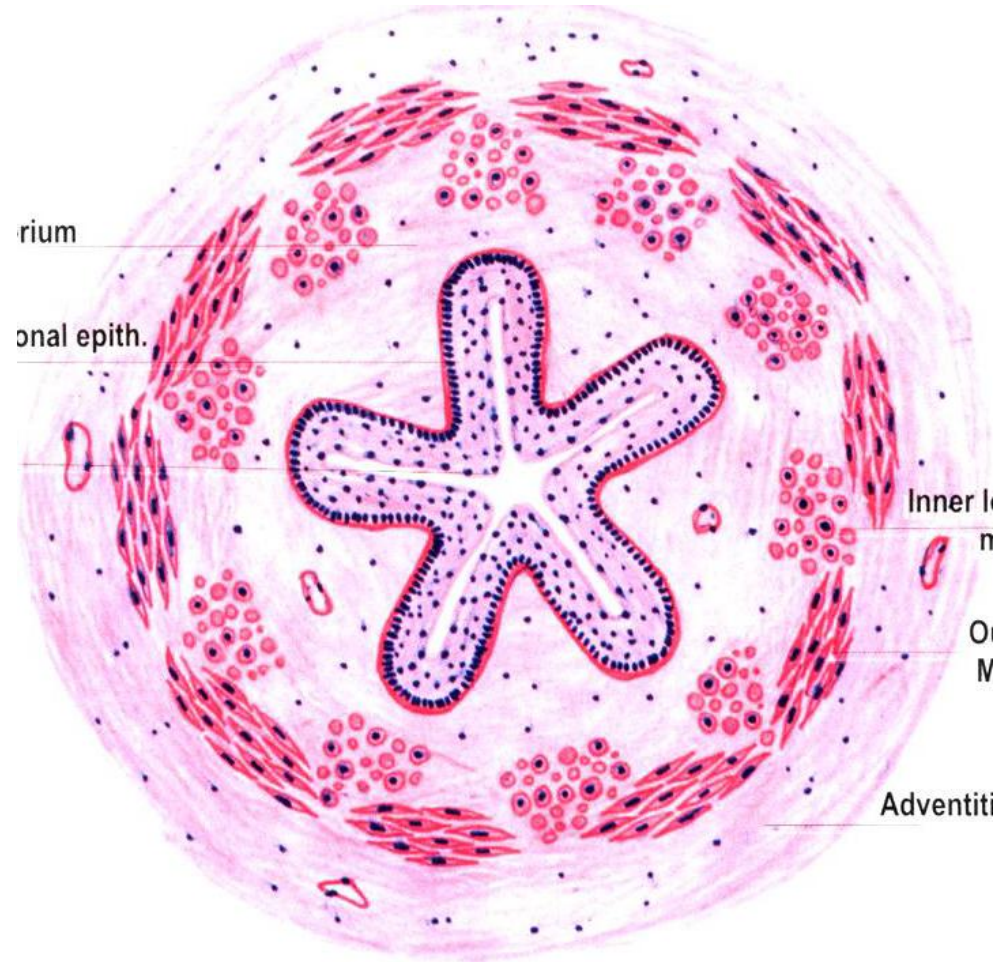
2- **Muscle layer:**

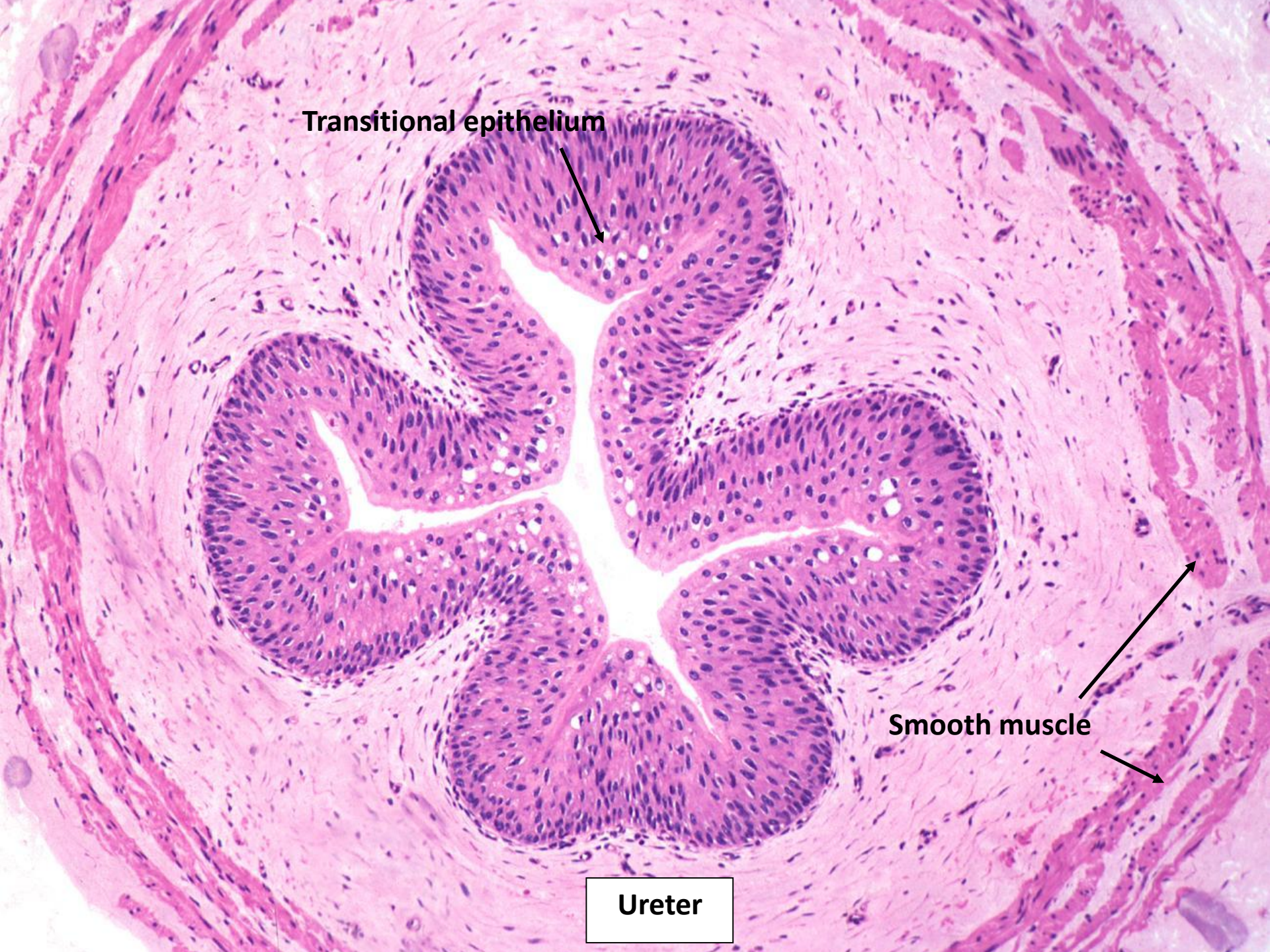
2 layers only •

Inner longitudinal

Outer circular

**Lower 1/3: similar •
to bladder (3 layers)**

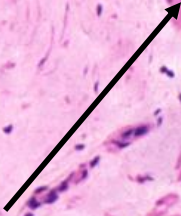




Transitional epithelium



Smooth muscle



Ureter

urethra

A-Male urethra

Prostatic – membranous – penile

Prostatic urethra

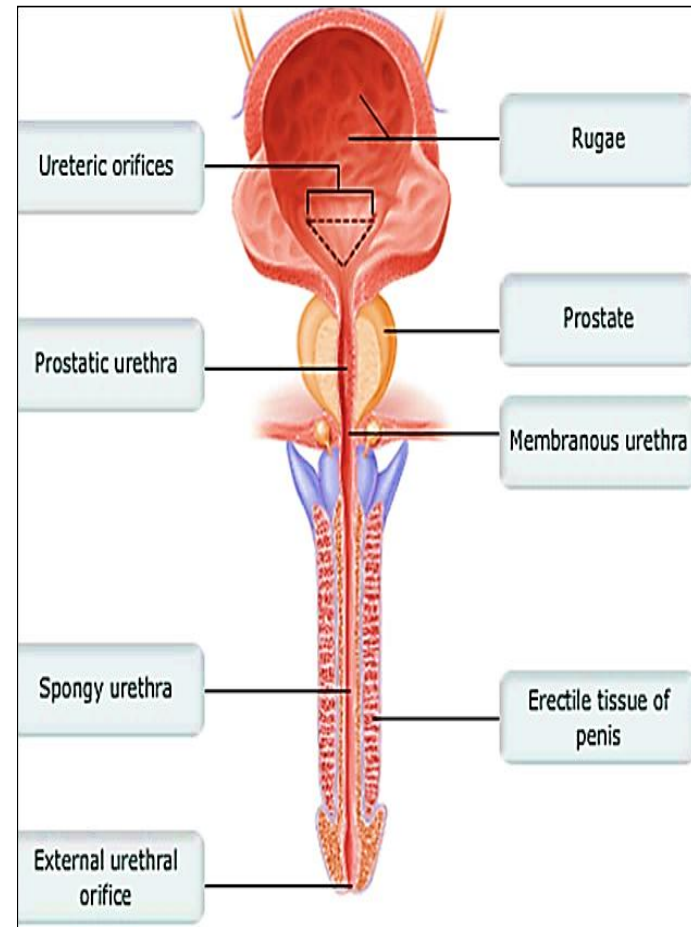
Lined e **transitional** epithelium

Membranous urethra

Lined e **stratified columnar** epithe

Penile urethra

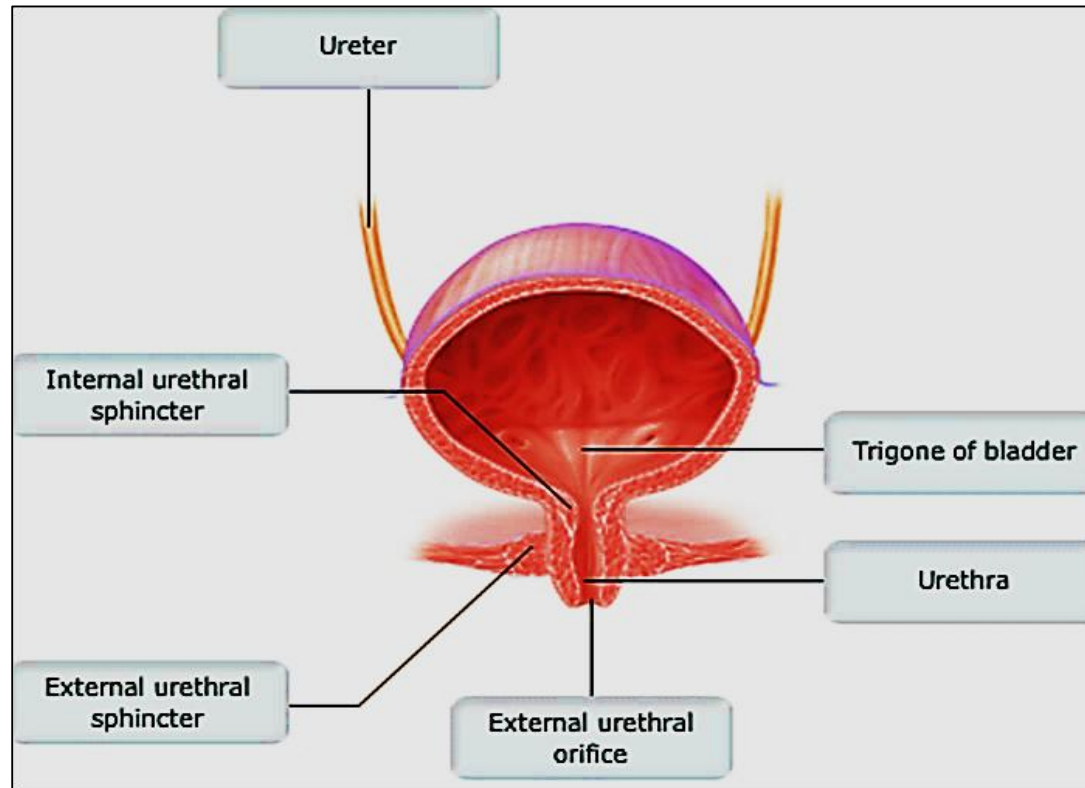
Lined e **stratified columnar** epith which → **stratified squamous** in its distal part (fossa navicularis)



B- Female urethra

Short straight tube

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





THANK
YOU