



HISTOLOGY OF THE KIDNEY AND URINARY PASSAGE

(Lectures 1 & 2)

Color index:
Slides.. **Important** ..**Notes** ..Extra..

Revised by

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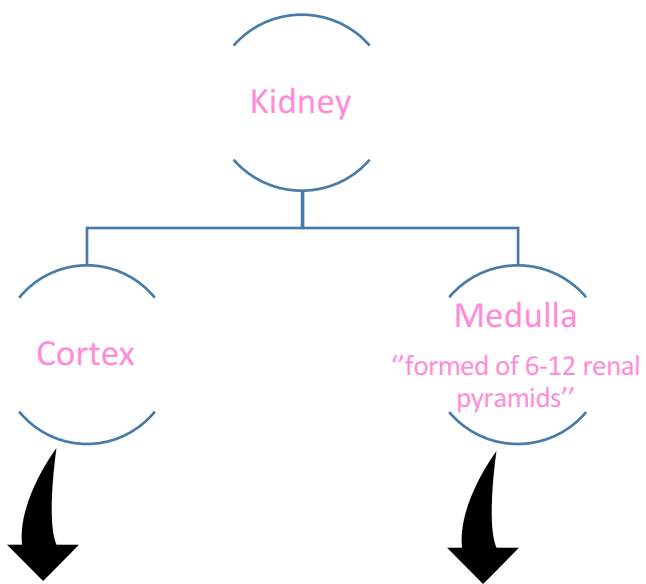
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Objectives:

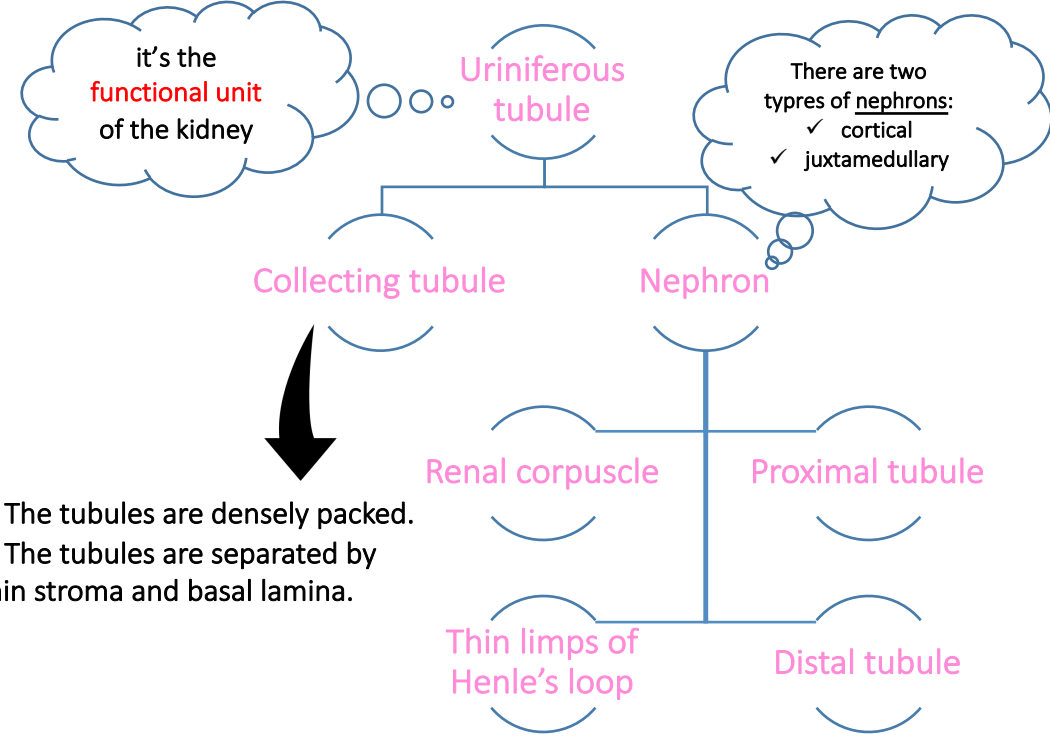
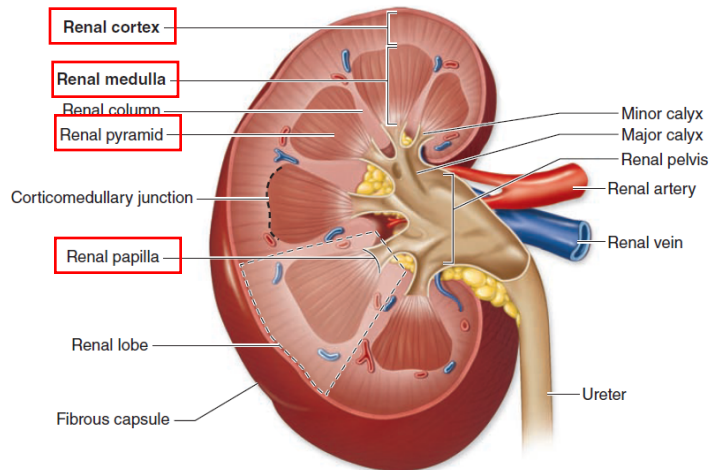
By the end of this lecture, the student should be able to describe:

- ✓ The microscopic structure of the renal cortex and medulla.
- ✓ The histology of renal corpuscle, proximal and distal tubules, loop of Henle, and collecting tubules & ducts.
- ✓ The histological structure of juxtaglomerular apparatus.
- ✓ The functional structures of the different parts of the kidney.
- ✓ The microscopic structure of the Renal pelvis and ureter.
- ✓ The microscopic structure of the urinary bladder and male and female urethra

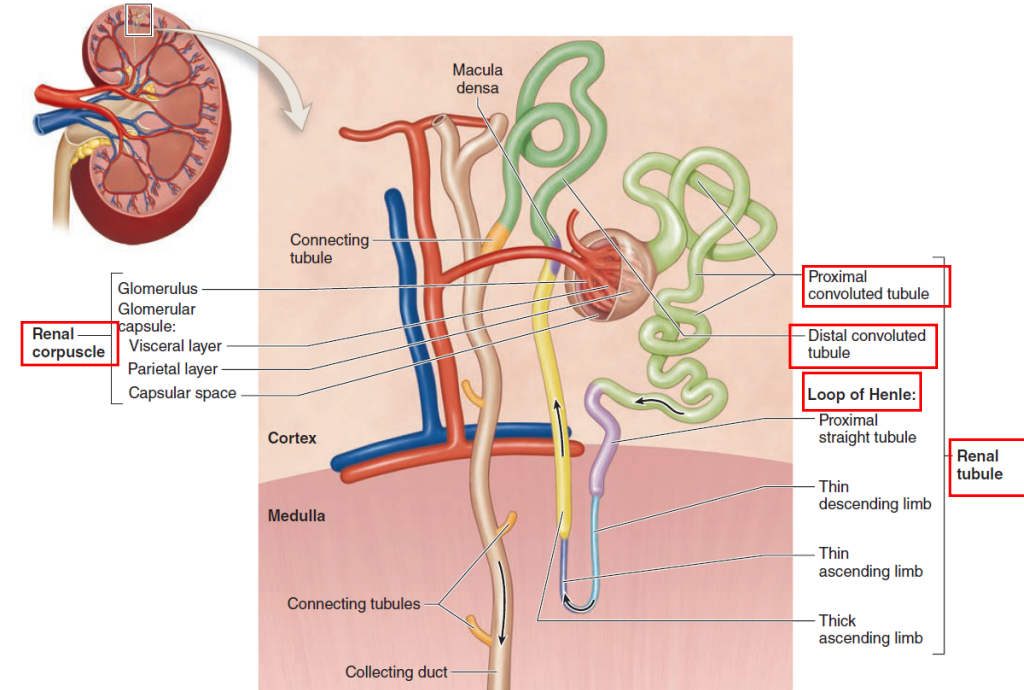
KIDENY



- ✓ Dark brown and granular.
- ✓ The **base** of pyramid is **toward the cortex** (cortico-medullary border)
- ✓ The **apex (renal papilla)** toward **the hilum**, it is perforated by 12 openings of the **ducts of Bellini** in region called **area cribrosa**.
- ✓ The apex is surrounded by a **minor calyx**.
- ✓ **3 or 4 minor calyces** join to form 3 or 4 major calyces that form renal pelvis.
- ✓ Pyramids are separated by cortical columns of **Bertin**.



- ✓ The tubules are densely packed.
- ✓ The tubules are separated by thin stroma and basal lamina.



Renal Corpuscle

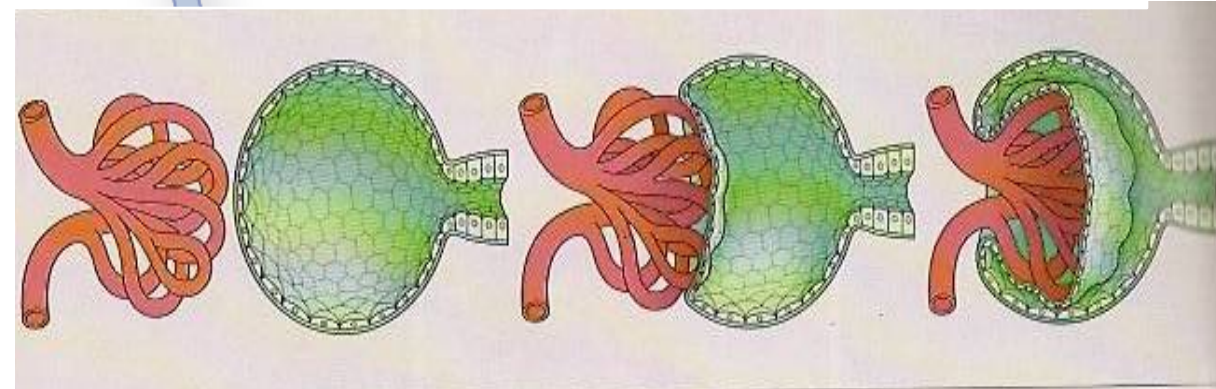
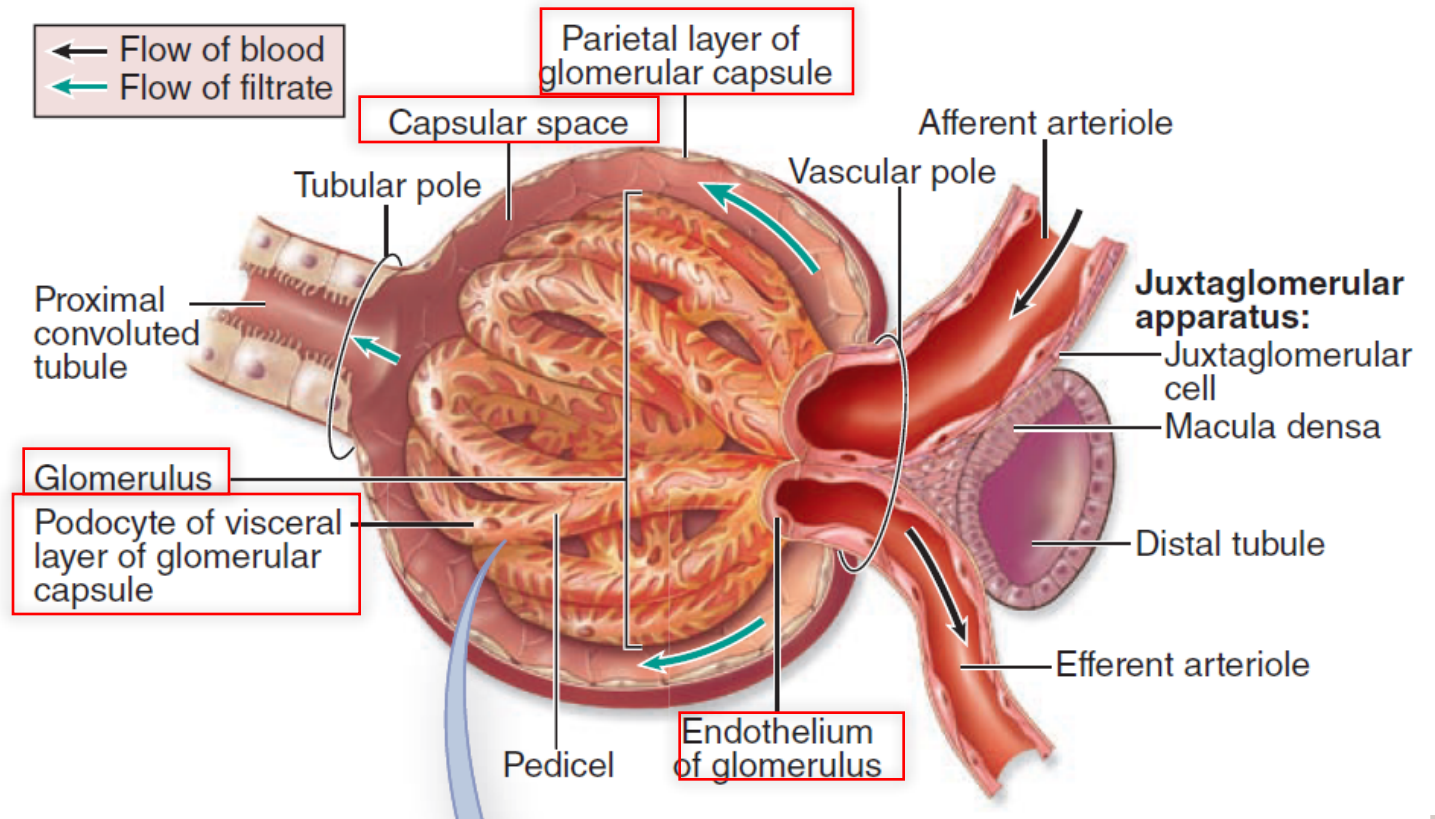
Renal Corpuscle

Contains:

Glomerulus : tuft (collection) of fenestrated capillaries "without diaphragm".
Partially covered by visceral layer of **Bowman's capsule**.

Bowman's capsule : (Parietal layer, urinary space, and visceral layer or **podocytes**).
Visceral layer: near to glomerulus and cover some parts of it.
Parietal layer: layer which is far from glomerulus.

Mesangial cells : (intra-glomerular cells).
Mesangial cells with its matrix called **mesangium** which support the glomerulus



Glomerular Filtration Barrier

Glomerular Filtration Barrier

Composed of:

More Information:

1- **Endothelial** wall of the glomerular capillaries.

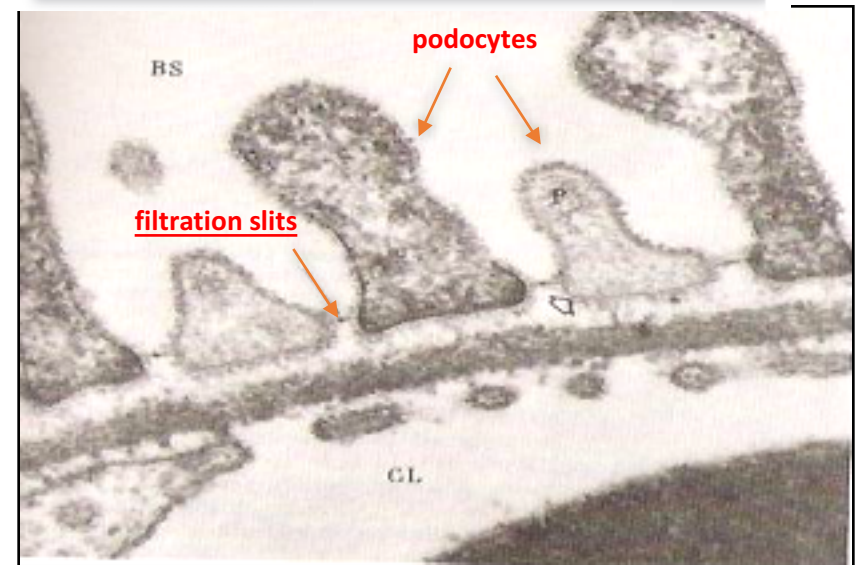
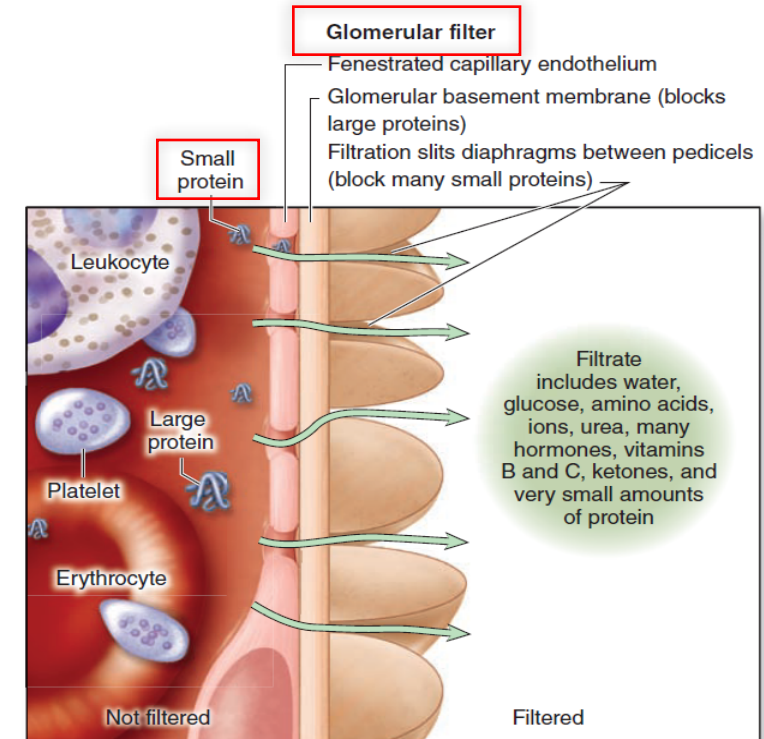
Also called glomerular endothelium.

2- The **glomerular basal lamina** (inner and outer laminae rarae and middle lamina densa).

Mainly composed of podocytes and partially composed of Glomerular Endothelium.

3- Visceral layer of Bowman's capsule (**podocytes**).

Glomerular Epithelium. Podocytes have primary (major) processes and secondary (minor) processes (pedicles). Between pedicles (on the surface of capillaries) there are filtration slits that have filtration slit diaphragms.



- Most of tubules are in the cortex
- Loop of henle and tubules extend to medulla

Renal Tubules

It's longer in Juxta-medullary nephron than in cortical nephron

Because distal convoluted tubules are much shorter than proximal convoluted tubules, any section of renal cortex presents many more sections of proximal convoluted tubules.

Proximal convoluted tubule

Composed of **simple cuboidal epithelium**

Acidophilic cytoplasm

Have **brush borders** (microvilli) and lateral interdigitations

Well-defined basal lamina

It's full with Microvilli because it is the place where most of the reabsorption process take place

- Proximal is the longest one that's why its convoluted.
- Proximal is more than distal in the cortex.

Thin limb of Henle's loop

Composed of **simple squamous epithelium**

It has 3 regions:

Descending thin limb

Crest of Henle's loop

Ascending thin limb

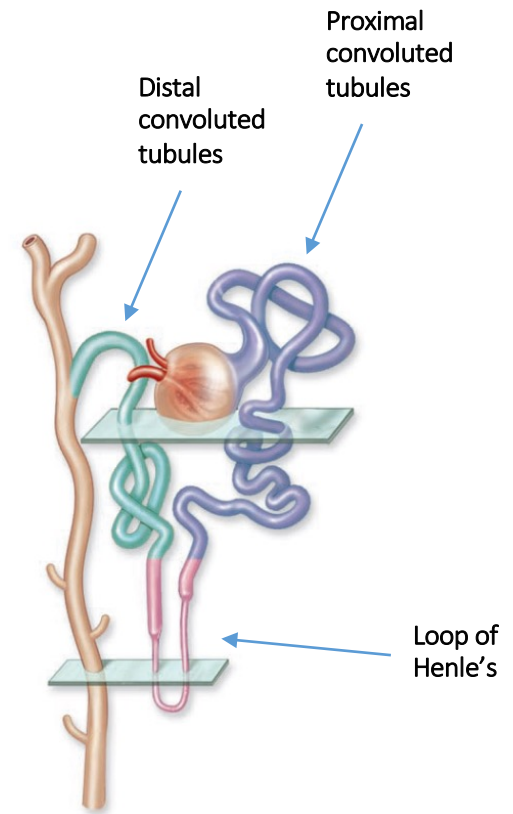
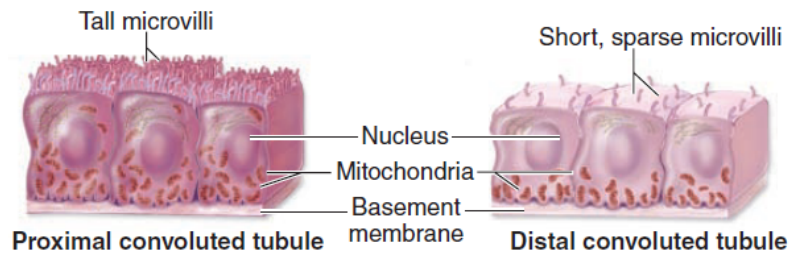
Distal Convoluted tubule

Formed of **low cuboidal epithelium**

Drains into the collecting tubules

Starts at the **macula densa**

The macula densa is a group of tall columnar narrow cells in the juxtaglomerular apparatus –of the distal tubule- (close to the afferent arteriole)



Collecting tubules

- Are composed of Simple Cuboidal Epithelium.

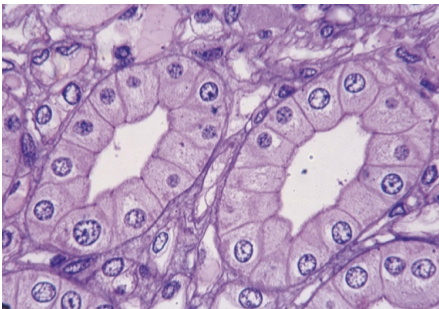
The lateral border is well defined because there isn't lateral interdigitation.

All parts of the collecting tubules (Cortex & medulla) excepts the last part (papillary ducts) are laying with **simple cuboidal epithelium**.

- They have 3 regions:

- **Cortical:** simple cuboidal epithelium
- **Medullary:** simple cuboidal epithelium
- **Papillary ducts (ducts of Bellini):** Simple **Columnar** Epith. (it must be lays with **S. Columnar Epith** because it's the biggest part)

- They aren't part of nephron.
- They open in area cribrosa. (لأنها مخرمه)
- They are impermeable to water except in presence of ADH.

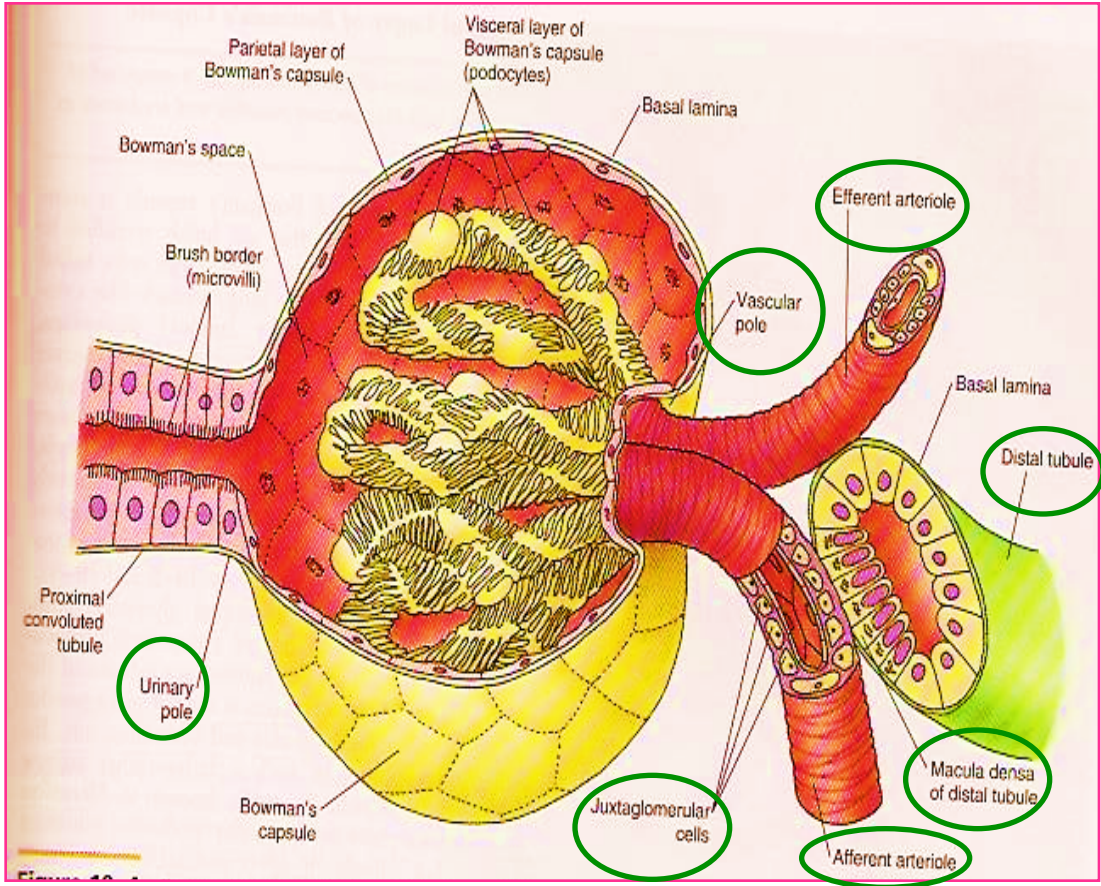


Renal interstitium

- It is a very flimsy, scant amount of loose CT that contains:

- 1-Fibroblasts.
- 2-Macrophages.
- 3-Interstitial cells:

They secrete medullipin I, which is converted in the liver into medullipin II, that lowers blood pressure.



DR Raesa's Explanation:

The renal corpuscle has two poles

- 1- vascular pole
 - 2- urinary pole for the passage of what will give me urine later.
- The vascular pole is for the blood entry and exit of arterioles:
(Afferent + Efferent)

The blood enters the afferent arteriole and goes out when its filtered through efferent arteriole.

In the space between the two arterioles there is distal tubule, part of it is adherent to the arterioles.

So the triangle of **Juxtaglomerular apparatus** is formed of 3 things::
 part of afferent, part of efferent, part of distal tubule and in between there is extra mesangial cells.

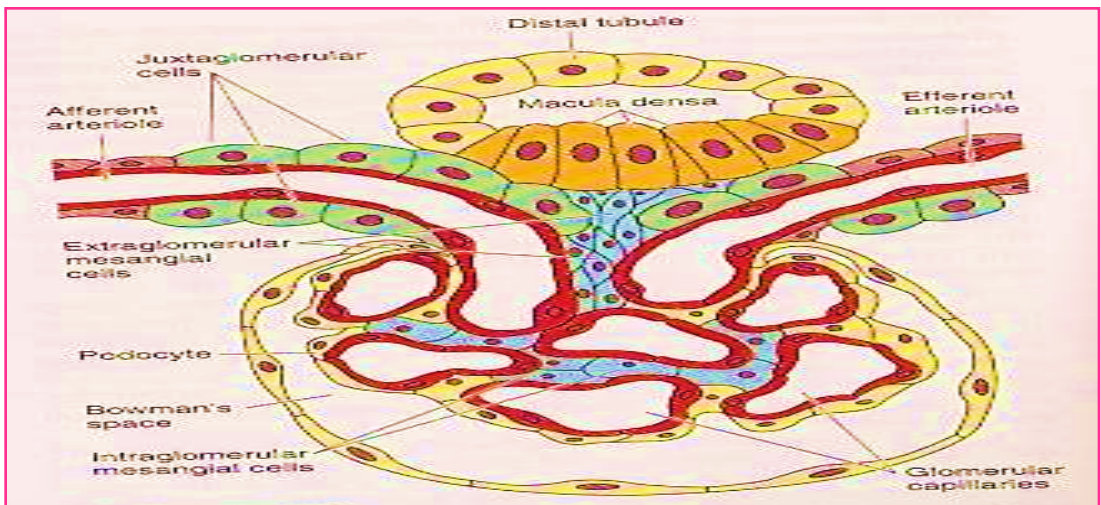
There are changes only in the cells of distal tubule adherent to the afferent arterioles:

The changes:

- 1- Columnar epithelium with oval nuclei
- 2- The number of cells increase
- 3- There is macula dense

There are changes in the arterioles in the part adherent to the distal tubule.
 the changes:

- 1- Modification in the tunica media (smooth muscle), so instead of spindle shaped cell it will be cuboidal cell. After modification it called **Juxtaglomerular cells** which is responsible for **renin secretion**.



Juxtaglomerular Apparatus

It has 3 components:

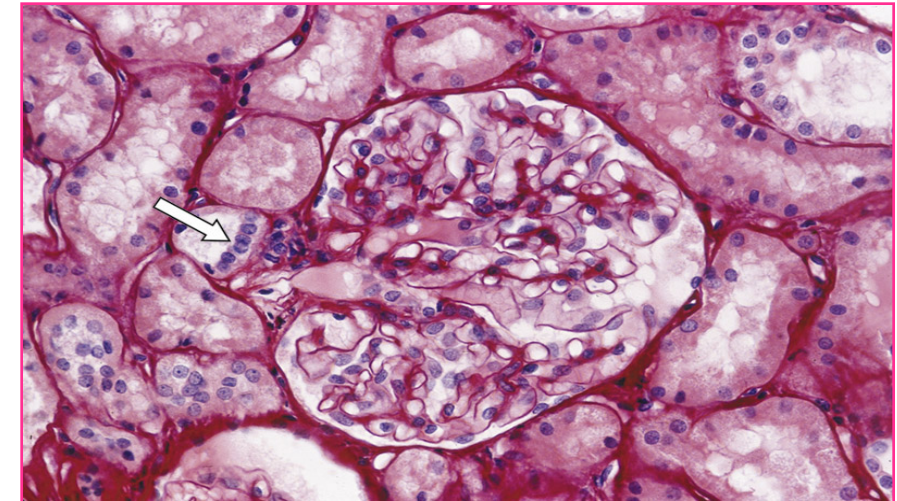
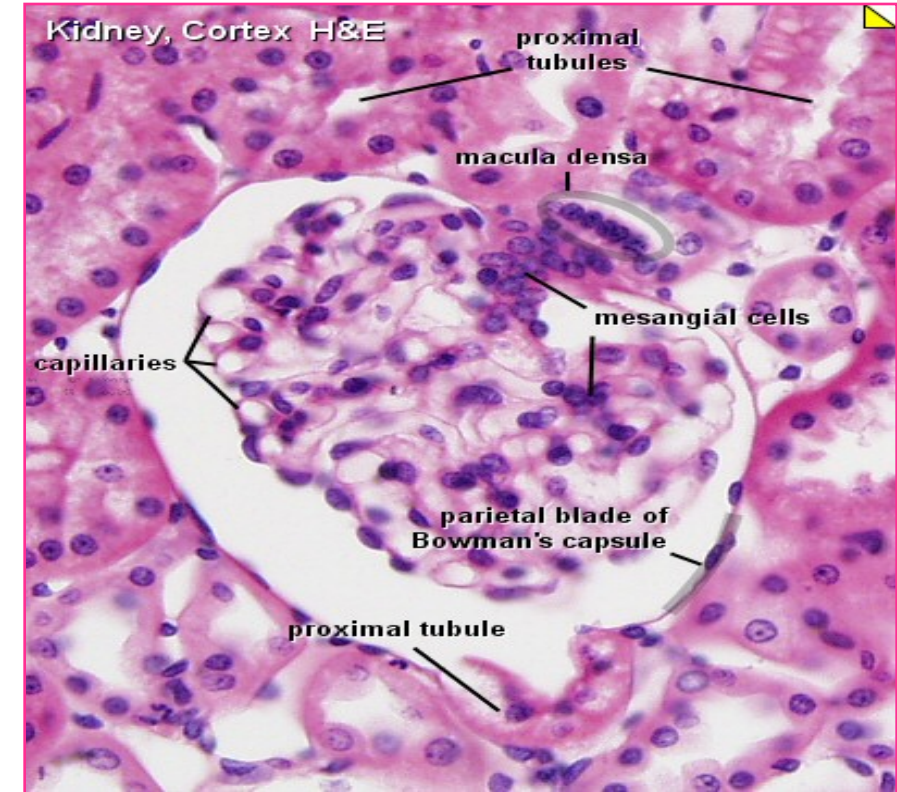
A- The macula densa of distal tubule

- Tall cells
- centrally-placed nuclei

B- Juxtaglomerular cells of afferent glomerular arteriole

- modified smooth muscle of tunica media.
- Nuclei are **round** with granular cytoplasm.
- They secrete **renin**.

C- The extraglomerular mesangial cells



Renal Calyces

Each papilla has minor Calyces in region called area cribrosa and the urine drop from here to major Calyces.

Each calyx accepts urine from the renal papilla of a renal pyramid.

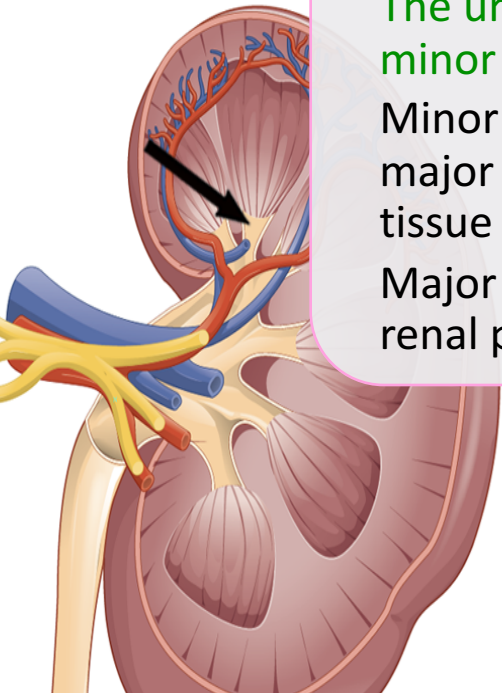
They are lined with:

- 1- Transitional epithelium
- 2- Lamina propria
- 3- Smooth muscle

The urinary track stars from minor calyces

Minor calyces merge to form major calyces (with same lining tissue as minor calyces).

Major calyces open into the renal pelvis.



Ureter

Composed of three layers:

1- Mucosa:

Is formed of transitional epithelium and lamina propria.

2- Muscularis (muscular coat):

Is formed of 2 layers of smooth muscle in the upper 2/3:

- A- Inner longitudinal.
- B- Outer circular.

2 layer like pelvis as it's continuation of it.

Is formed of 3 layers of smooth muscle in the lower 1/3:

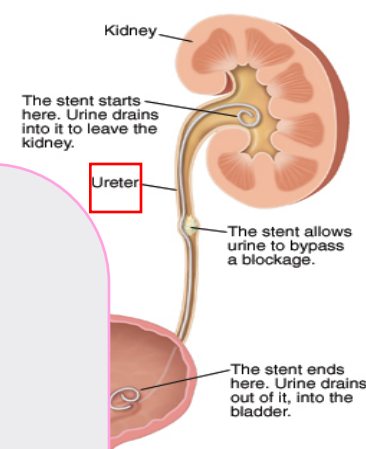
- A- Inner longitudinal .
- B- Middle circular.
- C- Outer longitudinal.

3 layer like urinary bladder as it's continuation of it.

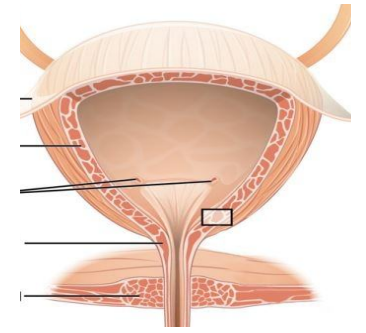
3- Adventitia:

Fibrous C.T. covering.

N.B. No serosa because the ureter isn't covered by peritoneum as we take in anatomy.



Urinary Bladder



It has the same structure as the lower third of ureter.

1- Mucosa:

Superficial layer of transitional epithelium has dome-shaped cells (in empty bladder).

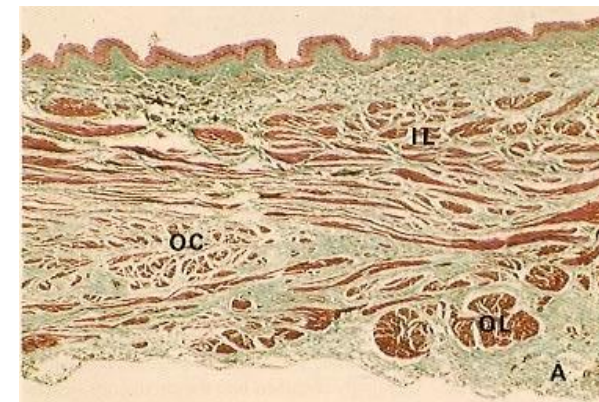
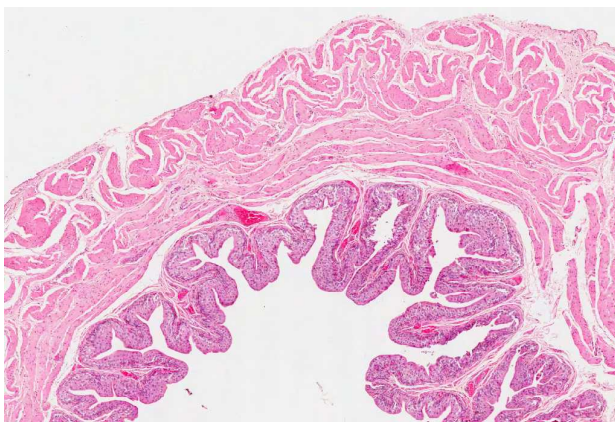
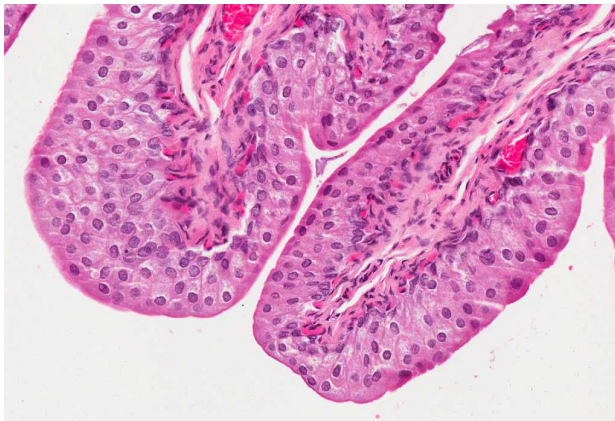
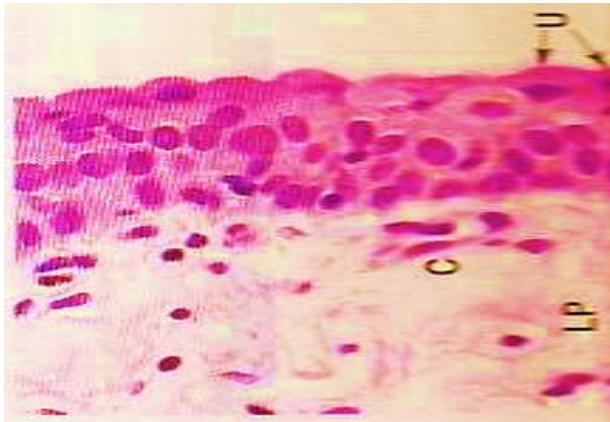
2- Muscularis (muscular coat):

It has 3 layers of smooth muscle: inner and outer longitudinal (thin) and middle circular (thick) layers.

3- Adventitia:

Its outer covering is adventitia or serosa.

It is similar the lower 1/3 of the ureter except that it has serosa



Female Urethra

Female urethra is short & lined by:

- **A- Epithelium:**

- 1- Transitional epithelium near the bladder.
- 2- Pseudostratified columnar epithelium.
- 3- Stratified squamous non-keratinized epith.

Before the opening, But in the opening it will be keratinized like skin

- **B- Sub-epithelial fibroelastic CT**

that contains glands of Littre (mucus-secreting glands).

- **C- Smooth muscle:**

inner longitudinal and outer circular layers.

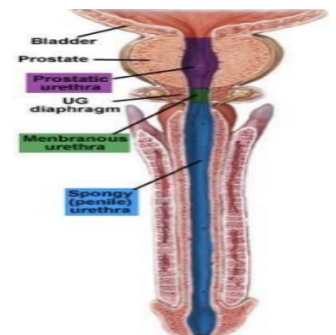
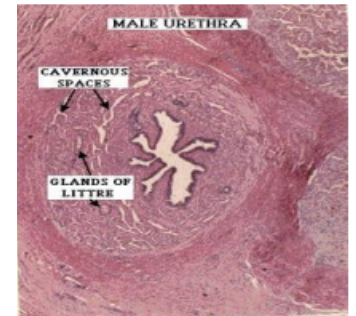
Very thin and ill-defined يعني تناتيف وشيء بسيط مو طبقة محترمة زي اليوريتز

Male Urethra

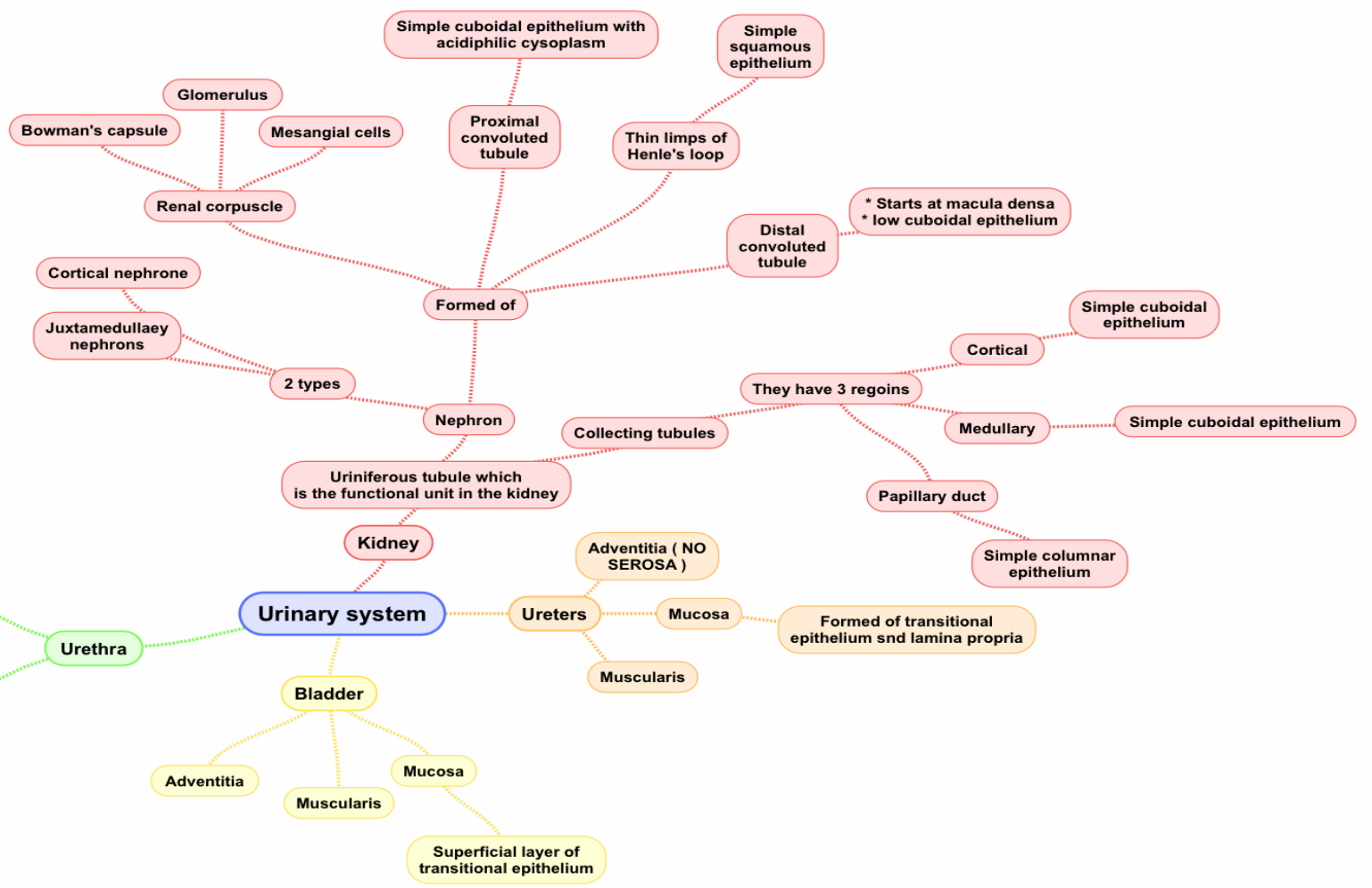
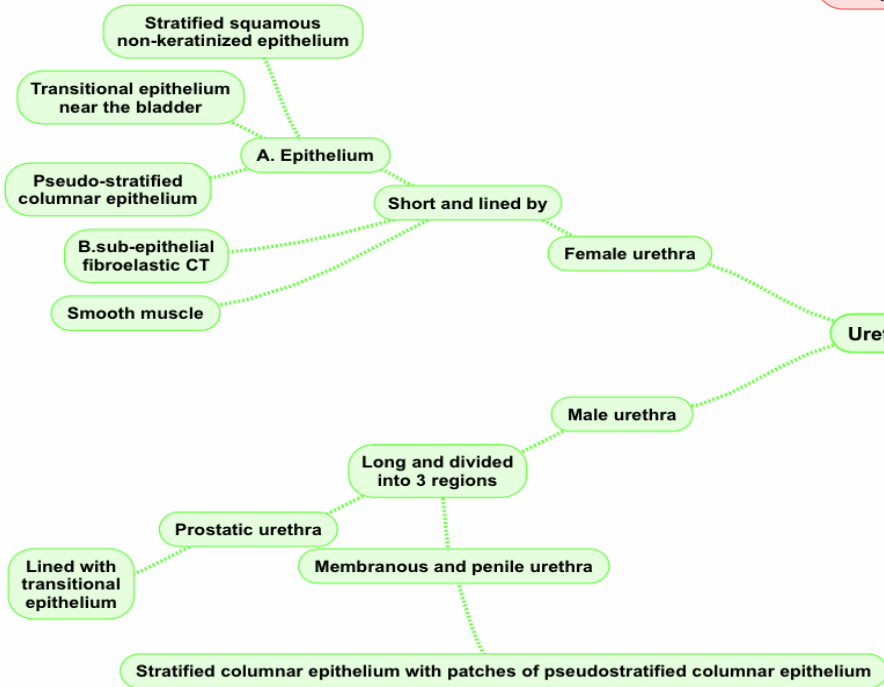
It is long and is divided into **3 regions**:

- **1- Prostatic urethra:** is lined with transitional epithelium.
- **2- Membranous urethra** and
- **3- Penile (spongy) urethra** (the longest part): are both lined with Stratified columnar epithelium With patches of pseudostratified columnar epithelium.
- N.B. In **navicular fossa (enlarged terminal portion)**: Stratified squamous non-keratinized epithelium.
- N.B. **The lamina propria** contains mucus secreting glands of Littre.

EXTRA pictures:



In both male and female there are glands of Littre in lamina propria
Its secretory gland that secret mucus to maintain the epithelium wet.



MCQ's

- Which of the following is a feature of urinary bladder?
 - The adventitia has no serosa
 - The adventitia has serosa
 - The structure is the same as upper third of ureter
 - The inner and outer longitudinal muscle layers are thick
- Which part of the renal system secretes renin?
 - Juxtaglomerular cells of afferent glomerular arteriole
 - Juxtaglomerular cells of efferent glomerular arteriole
 - Mesangial cells
 - Macula densa
- What is the correct passage of urine out of these sequences?
 - Renal pyramid > major calyces > minor calyces > renal pelvis
 - Major calyces > minor calyces > renal pyramid > renal pelvis
 - Renal pyramid > minor calyces > major calyces > renal pelvis
 - Renal pelvis > major calyces > minor calyces > renal pyramid
- What are the layers of muscles found in the ureter?
 - 2 layers; Inner longitudinal and Outer circular.
 - 3 layers; inner and outer longitudinal, middle circular
 - Both types, upper has 2 layers and lower has 3 layers
 - Ureter has no smooth muscles
- What are the type of cells found in macula densa?
 - Simple squamous cells
 - Simple cuboidal cells
 - Tall columnar cells
 - Transitional epithelium
- Which part of the male urethra has NO patches of pseudostratified columnar epithelium?
 - Membranous urethra
 - Penile urethra
 - Prostatic urethra
 - All of them have the patches
- What is the main lining epithelium found in the urethra ?
 - Simple squamous cells
 - Simple cuboidal cells
 - Tall columnar cells
 - Transitional epithelium

7-D
6-C
5-C
4-C
3-C
2-A
1-B



MCQ's

9. Which one of the following is a compartment of renal corpuscle?

- A- Glomerulus B- Bowman's capsule
C- Mesangial cells D- All the above

10. Which one is considered as a layer from glomerular filtration barrier?

- A- Parietal layer of Bowman's capsule B- Mesangial cells
C- Podocytes D- Henle's loop

11. If we take section of renal cortex which one will be most prominent?

- A- Distal convoluted tubule B- Proximal convoluted tubule
C- neither A nor B D- Both A and B

12. Which one of the following contains simple columnar epithelium?

- A- Ducts of Bellini B- Cortical collecting tubules
C- Proximal convoluted D- Medullary collecting tubules

13. Thin limbs of Henle's loop are longer in which of the following?

- A- Cortical nephron B- Juxtamedullary nephron
C- Renal corpuscle D- All the above

13-B
12-A
11-B
10-C
9-D



Thank you & good luck

- Histology team

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