

Done by:-

احمد الدريهم

محمد الحربي

سلطان الجريسي

رائد فرج

Special thanks to:-

Histics team 428

PART ELEVEN: URINARY SYSTEM

هذه المذكرة عبارة عن ترتيب سلايدات الدكتور مع بعض الاضافات في المربعات الزرقاء وبنهاية المذكرة جداول من طالب رفض ذكر اسمه نرجو الدعاء له

Overview

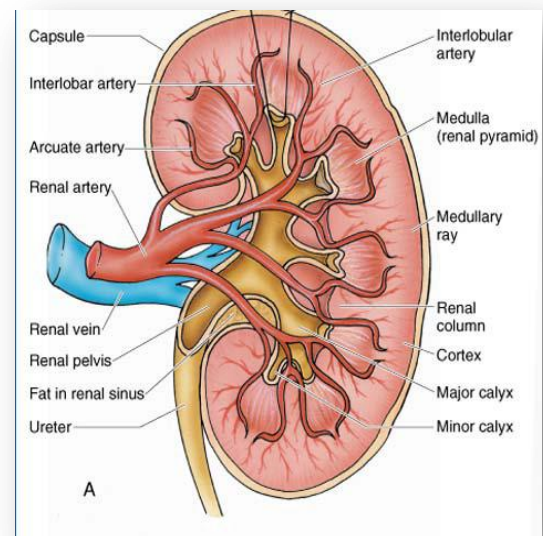
Urinary system consists of:-

- Two kidneys.
- Two ureters.
- Urinary bladder.
- Urethra

The Kidney

From outside to inside the kidney consists of:

- 1- **Cortex**: Dark brown and granular.
- 2- **Medulla**: 6-12 pyramid-shape regions (renal pyramids).
 - The **base** of pyramid is toward the cortex (corticomedullary border) and the **apex** (renal papilla) toward the hilum that is perforated by 12 openings of the ducts of Bellini in region called **area cribrosa**. The apex is surrounded by a minor calyx.
 - Pyramids are separated by cortical columns of **Bertin**.
 - **3 or 4 minor calyces** join to form **3 or 4 major calyces** that form renal pelvis.



Notes

- Juxt: near the Glomerulus "the first part of the nephron (renal corpuscle)"
- Papillary duct we also call it (duct of bellini).
- From minor calyx until initial part of urethra is lined with one type of epithelium is **transitional epithelium** and it is the only place of the body that contain it.
- Only the papillary duct is lined by simple columnar epithelium but all of the collecting tubules is lined by simple cuboidal epithelium.

Cortical arch

- The portion of the cortex overlying the base of each pyramid

- Macroscopically, three types of substances may be observed in the cortex:

Renal corpuscles (red dots).

Convoluting tubules (cortical labyrinth).

Medullary rays (cortical continuation of pyramids).

N.B. Lobe of the kidney is formed of :

- Renal pyramid.
- Cortical columns.
- Cortical arch

Each medullary ray with part of the cortical labyrinth surrounding it form kidney lobule.

Uriniferous tubule

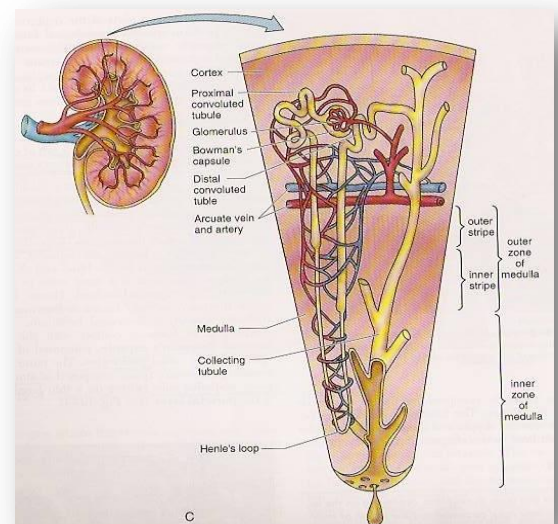
Is the functional unit of the kidney.

Is formed of different embryological origin:

- 1- **Nephron.**
- 2- **Collecting tubule.**

They are densely packed.

They are separated by thin stroma and basal lamina.



Nephron:

There are 2 types depending on the location of their renal corpuscles and the length of their Henle's loop:

- A. **Cortical nephrons.**
- B. **Juxtamedullary nephrons.**

It is formed of :

1- **Renal corpuscle:**

- **Glomerulus** (tuft of fenestrated capillaries)
- **Bowman's capsule** (Parietal layer, urinary or glomerular space and visceral layer or podocytes).
- **Mesangial cells** (intraglomerular & extraglomerular).

Notes

The glomerulus filters the fluid expressed from the bloodstream. The subsequent tubular portions of the nephron (i.e., the proximal tubule, the thin limbs of Henle's loop, and the distal tubule) modify the filtrate (FINE TUNING) to form urine

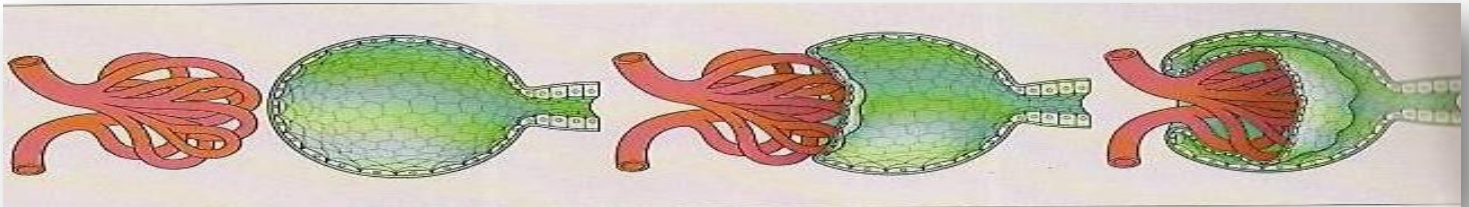
Bowman capsule is consists of two layer:

- 1- the outer is simple squames epithelium "praital layer of Bowman capsule"
- 2- the "inner" Visceral layer of Bowman capsule "podocytes or glomular epithelium" modified simple squamous.

The capillary of the glomular is fenestrated without diaphragm

The glomerulus is in intimate contact with the **visceral layer of Bowman's capsule, composed of modified epithelial cells called podocytes**

The outer wall surrounding Bowman's space, composed of simple squamous epithelial cells (sitting on a thin basal lamina), is the **parietal layer**



Glomerular Filtration Barrier:

- **Endothelial** wall of the capillaries.
- **The basal lamina** (inner and outer laminae rarae and middle lamina densa).
- **Visceral layer of Bowman's capsule (podocytes)**

Podocytes have primary (major) processes and secondary (minor) processes (pedicles).

Between pedicles (on the surface of capillaries) there are **filtration slits** that have slit diaphragms.

Notes

The basal lamina is the thickness in the glomerular.

Most of the glomerular membrane is formed by the podocytes.

2- Proximal convoluted tubule:

It is composed of simple cuboidal epithelium with acidophilic cytoplasm. The cells have striated or brush border and lateral interdigitations. They have well-defined basal lamina.

Notes

- **Mesangial Cells:** Located between the endothelium & the basal lamina of the glomerular capillaries.
- **Macula densa:** cells of DCT in contact with juxtaglomerular cells without a basal lamina.
- The proximal tubule is much longer than the distal tubule.
- The proximal lumen is narrower than the distal lumen.

3- Thin limbs of Henle's loop:

It has 3 regions:

- 1- Descending thin limb.
- 2- Henle's loop.
- 3- Ascending thin limb.

NB. It is longer in juxtamedullary nephron than in cortical nephron.

* It is composed of simple squamous epithelium.

4- Distal convoluted tubule

- It starts at the macula densa.
- **Macula densa** (tall & narrow cells).
- The Distal convoluted tubule is formed of low cuboidal epithelium.

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

- Distal tubules drain into collecting tubules.

Juxtaglomerular apparatus

It has 3 components:

- A. **The macula densa** of distal tubule.
- B. **Juxtaglomerular cells** of afferent glomerular arteriole (modified smooth muscle of tunica media). They secrete renin, and angiotensin.
- C. The extraglomerular **mesangial cells**.

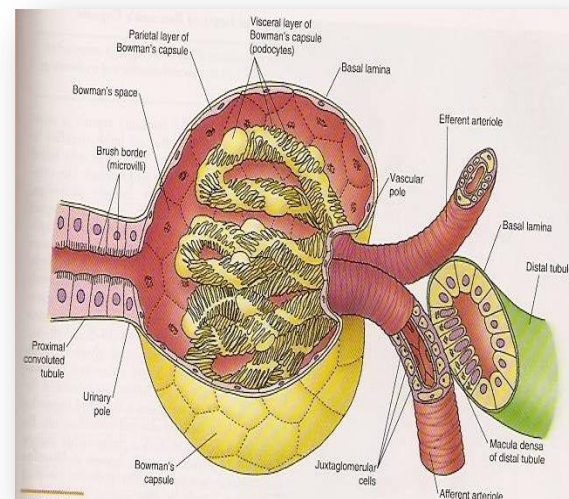
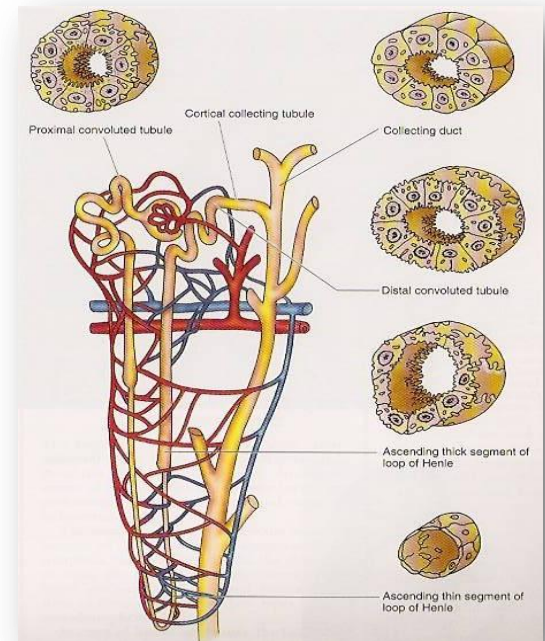
Collecting tubules:

Are composed of simple cuboidal epithelium.

They aren't part of nephron.

They have 3 regions:

- 1- **Cortical**: S. Cuboidal Epithelium.
- 2- **Medullary**: S. Cuboidal Epithelium.



3- Papillary ducts (ducts of Bellini): S. Columnar Epithelium they open in area cribrosa.

They are impermeable to water except in presence of A.D. hormone.

Renal interstitium

It is a very flimsy, scant amount of CT 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.

Renal Calyces

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

They are lined with transitional epithelium, lamina propria and smooth muscle.

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

Major calyces open into renal pelvis.

The Ureter

From the inner layer to the outer layer the ureter is consist of:

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.
 - It is formed of 3 layers of smooth muscle in the lower 1/3:
 - a. Inner longitudinal.
 - b. Middle circular.
 - c. Outer longitudinal.
3. **Adventitia:** fibrous C.T. covering.

N.B. No serosa.

Notes

The ureter is retroperitoneum so the outer layer is not covered by visceral layer "no serosa".

Urinary Bladder

- It has the same structure as the ureter.
- Superficial layer of transitional epithelium has dome-shaped cells (in empty bladder).
- It has 3 layers of smooth muscle: inner and outer longitudinal (thin) and middle circular (thick) layers.
- Its outer covering is adventitia or serosa.

The Urethra

Female Urethra

Female urethra is short and lined by :

a. Epithelium:

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

b. Subepithelial fibroelastic Connective Tissue that contains glands of Littre (mucus-secreting glands).

c. Smooth muscle: inner longitudinal and outer circular layers.

Male Urethra

It is long and is divided into 3 regions:

1. **Prostatic urethra:** is lined with transitional epithelium.
2. **Membranous urethra:** is lined with Stratified columnar epithelium with patches of pseudostratified columnar epithelium.
3. **Penile (spongy) urethra:** is lined with Stratified columnar epithelium with patches of pseudostratified columnar epithelium.

N.B. In navicular fossa: Stratified squamous non-keratinized epithelium.

Its lamina propria contains mucus-secreting glands of Littre.

Summary

part	epithelium	basal lamina	Smooth muscle.	outer covering
kidney - proximal convoluted tubule	Simple cuboidal, with microvilli	well-defined		
kidney - thin limb of Henle's loop	Simple squamous			
kidney - distal convoluted tubule	low cuboidal epith., without microvilli			
kidney - collecting duct in general	Simple cuboidal			
1-Cortical:	Simple cuboidal			
2-Medullary	Simple cuboidal			
3-Papillary ducts (ducts of Bellini):	Simple Columnar			
Renal Calyces	Transitional	lamina propria	Smooth muscle.	
renal pelvis	Transitional			
ureter	Transitional (mucosa)	lamina propria (mucosa)	Muscularis (muscular coat) 2 layers of the upper 2/3: A-Inner longitudinal. B-Outer circular.	fibrous C.T. covering. (adventitia) No serosa
urinary bladder	Transitional		3 layers in the lower 1/3: A-Inner longitudinal. B-Middle circular.(thick) C-Outer longitudinal.(thin)	adventitia or serosa
prostatic urethra	Transitional			

Summary

<i>part</i>	<i>epithelium</i>	<i>basal lamina</i>	<i>Smooth muscle.</i>	<i>outer covering</i>
membranous urethra	Stratified columnar epith. With patches of pseudustratified columnar epithelium.	Its lamina propria contains mucus-secreting glands of Littre.		
Penile (spongy) urethra	Stratified columnar epith. With patches of pseudustratified columnar epithelium.			
Navicular fossa	Stratified squamous non-keratinized epith.			
Female Urethra	1-Transitional epith. Near the bladder. 2- Pseudostratified columnar epith. 3- Stratified squamous non-keratinized epith.		Smooth muscle: inner longitudinal and outer circular layers. Subepithelial fibroelastic CT that contains glands of Littre (mucus-secreting glands).	