

Renal Block

Histology Team

Histology of the Kidney

By:

Rana Al Ohaly
Mohammad Adel

Objectives:

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

1. The microscopic structure of the renal cortex and medulla.
2. The histology of renal corpuscle, proximal and distal tubules, loop of Henle, and collecting tubules & ducts.
3. The histological structure of juxtaglomerular apparatus.
4. The functional structures of the different parts of the kidney.

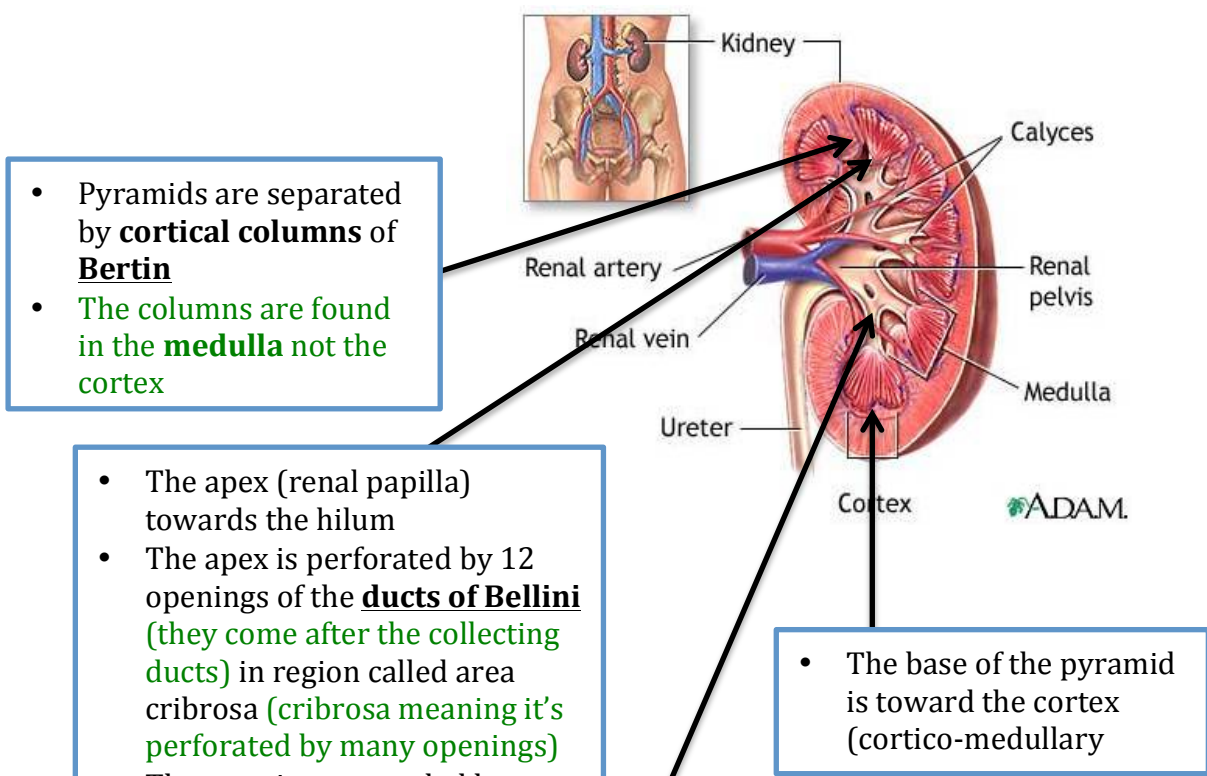
Black = Slides

Green = Additional notes

The work contains everything in the slides

432histologyteam@gmail.com

The Kidney	
Cortex	Medulla
Dark brown and granular -The granules are the corpuscles which are only found in the cortex -Superficial part -Rich in blood vessels giving it its darker colour	6-12 pyramid-shaped regions (renal pyramids) -Inner part (lighter colour) -Mainly collecting ducts

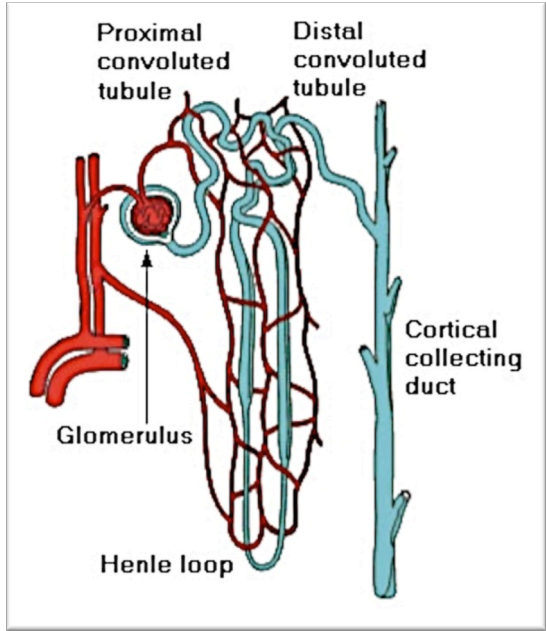


- Pyramids are separated by **cortical columns of Bertin**
- The columns are found in the **medulla** not the cortex

- The apex (renal papilla) towards the hilum
- The apex is perforated by 12 openings of the **ducts of Bellini** (they come after the collecting ducts) in region called area cribrosa (cribrosa meaning it's perforated by many openings)
- 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 which then forms the ureter

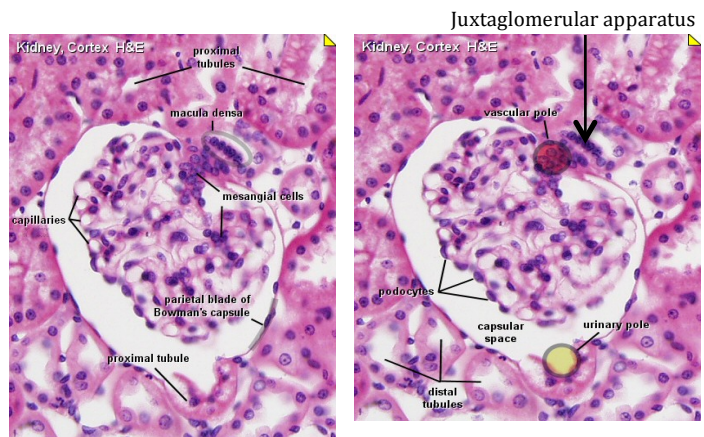
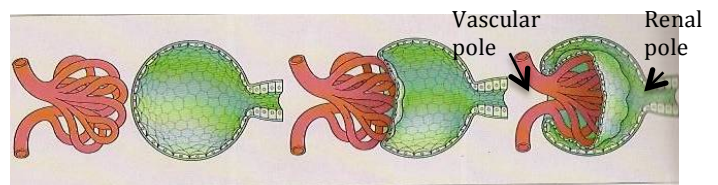
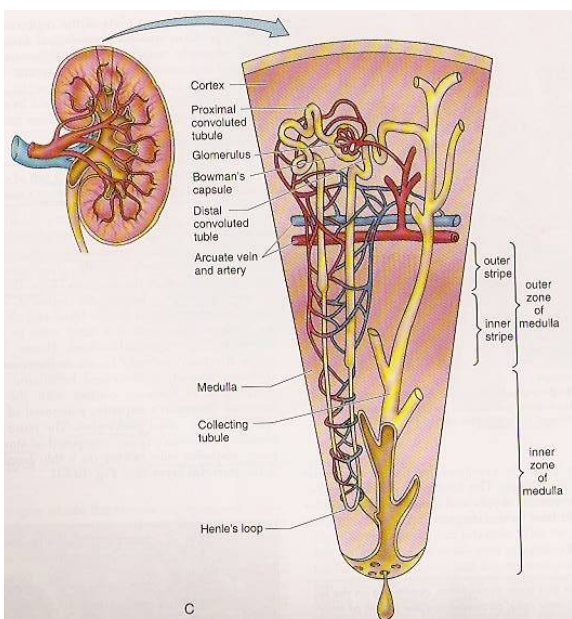
- The base of the pyramid is toward the cortex (cortico-medullary)



Urineriferous Tubules The functional unit of the kidney	
1-Nephron	2-Collecting tubule
<p>There are two types:</p> <ol style="list-style-type: none"> Cortical nephrons found just below the kidney capsule Juxtamedullary nephrons (<i>juxta = beside</i>) so it is beside the medulla but still in the cortex <p>It's formed of:</p> <ol style="list-style-type: none"> Renal corpuscle Proximal convoluted tubule Thin limbs of Henle's loop hairpin-shaped Distal convoluted tubule 	<ul style="list-style-type: none"> Are composed of simple cuboidal epithelium They aren't part of nephron They have 3 regions: <ol style="list-style-type: none"> <u>Cortical</u>: Simple cuboidal epithelium <u>Medullary</u>: Simple cuboidal epithelium <u>Papillary ducts (ducts of Bellini)</u>: Simple columnar epithelium They open in area cribrosa They are impermeable to water except in presence of ADH
<ul style="list-style-type: none"> The tubules are densely packed The tubules are separated by thin stroma and basal lamina 	

1. Renal Corpuscle

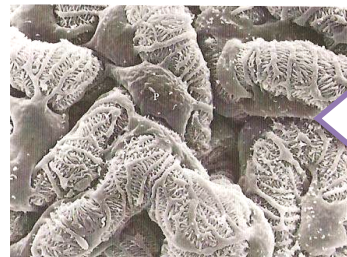
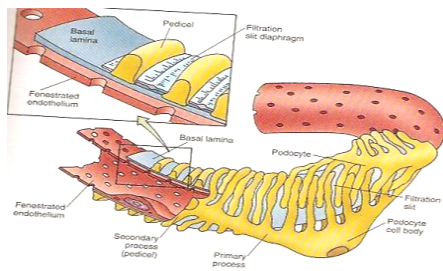
Glomerulus	Bowman's capsule	Mesangial cells
<p>Tufts of <u>fenestrated capillaries</u> without diaphragm for filtration</p> <p>-Between afferent and efferent arterioles (unlike normal capillary beds that are usually between an arteriole and venule)</p>	<p>-Parietal layer (<u>simple squamous epithelium</u>)</p> <p>-Urinary space</p> <p>-Visceral layer or podocytes (part of the glomerular filtration barrier)</p>	<p>Intra-glomerular cells</p> <p>The <u>mesangium</u> supports the glomerulus (between the tuft of capillaries)</p> <p>Mesangium= Mesangial cells + mesangial matrix</p>



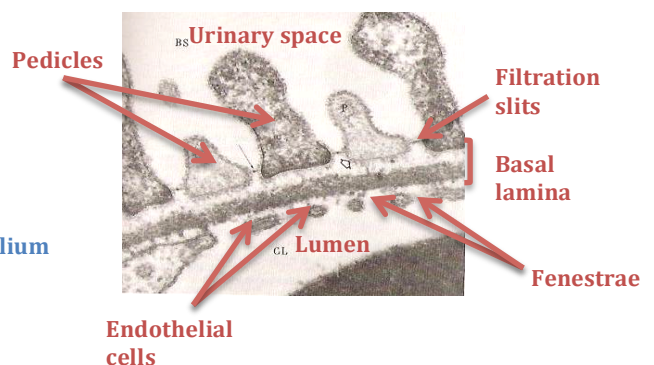
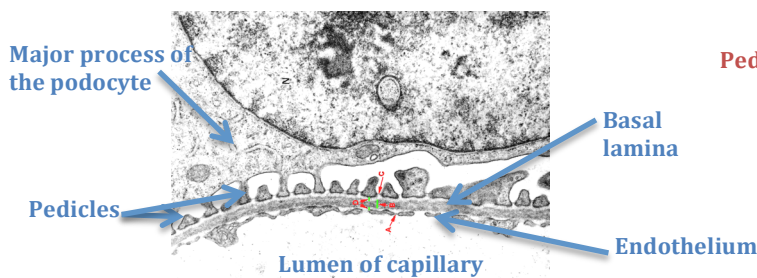
Glomerular Filtration Barrier

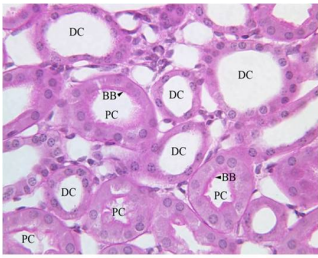
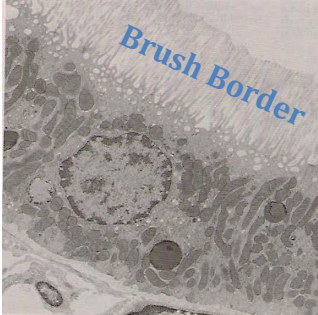
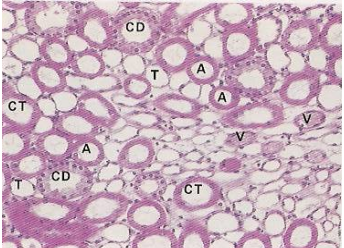


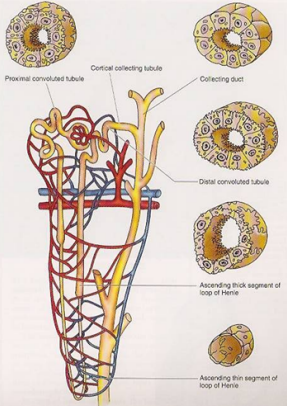
Barrier between the blood within the capillary and the renal space

- 1) **Endothelial wall** of the glomerular capillaries (formed of simple squamous endothelium)
- 2) **The glomerular basal lamina** It is the **thickest basal lamina in the body** (inner and outer laminae rarae (light) and middle lamina densa (dark)) appears to be formed of 3 layers
- 3) **Visceral layer of Bowman's capsule (podocytes)**
Podocytes have primary (major) processes and secondary (minor) processes (pedicles) they are basically modified (specialized squamous cells)
- 4) **Filtration slits** that have **filtration slit diaphragms**
These are between pedicles (on the surface of capillaries)



You cannot see the capillaries because the podocytes are covering them



Renal Tubules		
Proximal Convoluted Tubules	Thin Limbs of Henle's Loop	Distal Convoluted tubules
<ul style="list-style-type: none"> Composed of simple cuboidal epithelium with acidophilic cytoplasm The cells have striated or brush borders (formed of many microvilli to increase surface area) and lateral interdigitations (meaning the cell walls are irregular and fit together making it hard to see the lateral borders of the cells even with EM) They have well-defined basal lamina Reabsorption mainly happens in it Only found in cortex 	<p>Composed of simple squamous epithelium</p> <p>Has 3 regions:</p> <ol style="list-style-type: none"> Descending thin lumb Crest of Henle's loop Ascending thin limb <p>NB: It is longer in the juxtamedullary nephron than in cortical nephron</p>	<ul style="list-style-type: none"> It starts at the macula densa (tall columnar & narrow cells) Composed of low cuboidal epithelium so the lumen is wider than in proximal tubules Distal convoluted tubules drain into the collecting tubules <p>NB: Because distal convoluted tubules are much shorter that proximal convoluted tubules, any section of renal cortex presents many more sections of proximal convoluted tubules</p> <ul style="list-style-type: none"> Only found in cortex
 <p>DC - distal convoluted tubule PC - proximal convoluted tubule BB - brush border</p> 	 	 

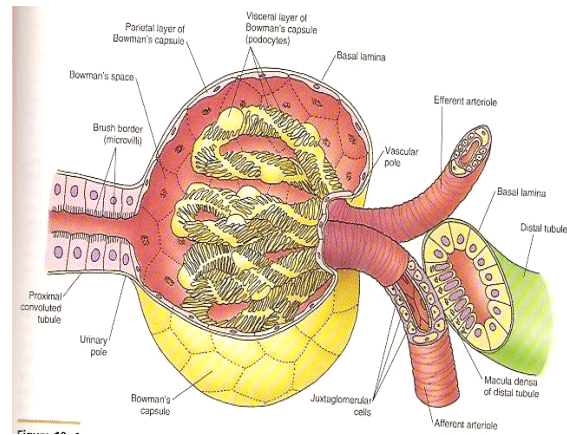
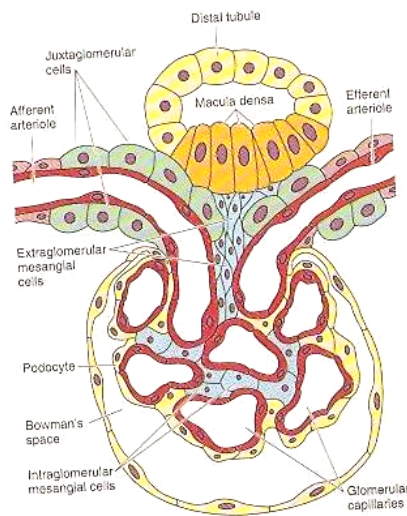
Note: Brush border is when there is a very large number of microvilli and that is only found in the small intestines and the proximal renal tubules

Juxtaglomerular Apparatus

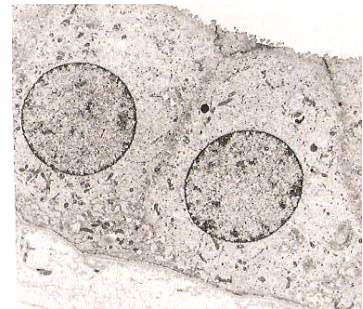
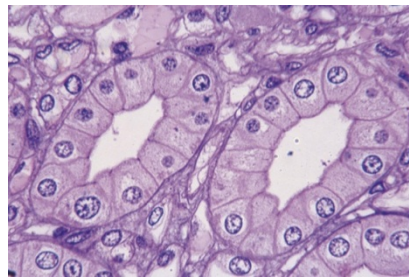
1) Macula Densa

2) Juxtaglomerular cells

3) Extra-glomerular mesangial cells



Collecting Tubules



Renal Interstitium

The stuffing between all the components mentioned above

- It is very flimsy
- Scant amount of loose connective tissue **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 (to balance the renin-angiotensin system)

Some useful links provided by Sahar Alharthi!

<http://www.getbodysmart.com/ap/urinarysystem/kidney/cortexhistology/tutorial.html>

<http://www.getbodysmart.com/ap/urinarysystem/kidney/medullahistology/tutorial.html>