



Faculty of Biological Science and Technology
Zoology and Botanical Department
Practical Histology

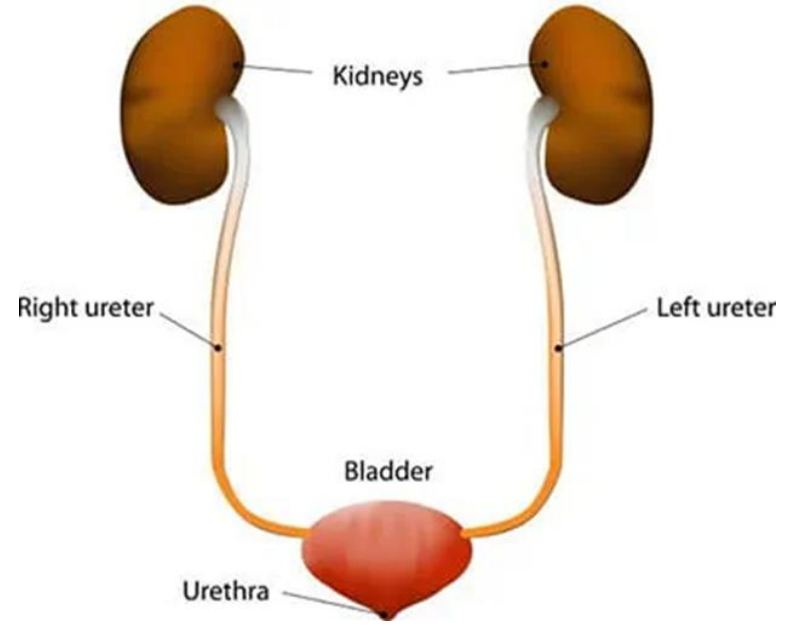
Urinary System

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Introduction

- ▶ The urinary system is composed of: kidney, ureters, urinary bladder and urethra
- ▶ There are a pair of bean-shaped kidney in vertebrate
- ▶ The ureters are a pair of narrow tubes which carry urine from each kidney
- ▶ The urinary bladder is a hollow, triangle-shaped organ which store urine
- ▶ The urethra is a single tube that allows urine to pass through body

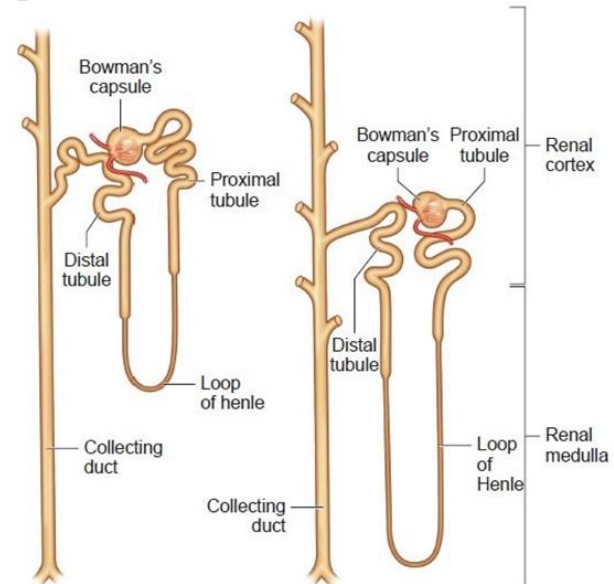


From: <https://www.cincinnatichildrens.org/health/u/urinary-system>.



Kidney

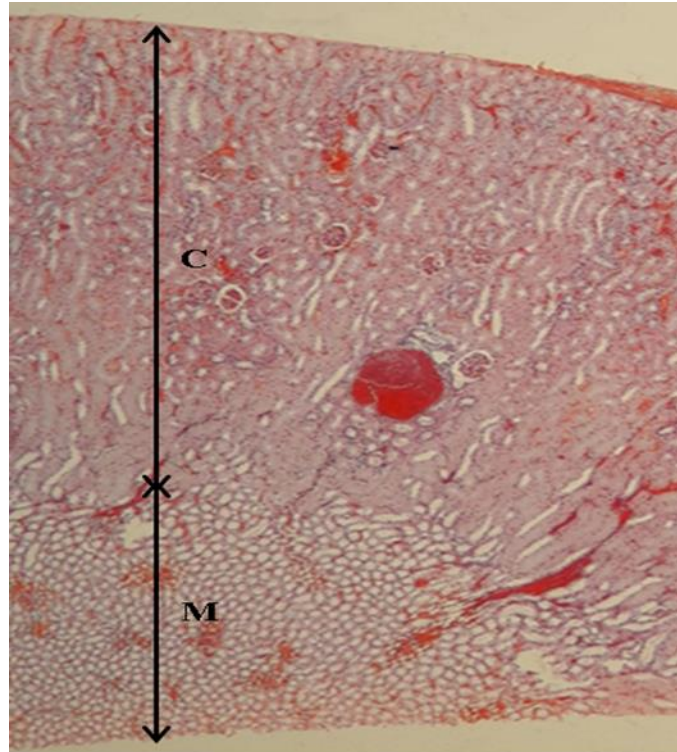
- ▶ Each kidney has a capsule that is made up of connective tissue (rich in collagen fibers) and smooth muscle cells
- ▶ Kidney parenchyma is consists of two parts: cortex and medulla. The medulla contains cone- shaped parts called renal pyramids. The base of each pyramid is towards the cortex and its rounded apex is towards the pelvis. The medulla looks striated in first glance
- ▶ These two parts composed of millions of uriniferous tubules, branches of arteries, veins, lymphatic vessels and nerves. The amount of connective tissue of kidney paranchyma is very little
- ▶ The uriniferous tubules is composed of nephrons and collecting tubules
- ▶ The nephron is the structural and functional unit of kidney. It is composed of:
 - ▶ Renal corpuscles
 - ▶ Proximal tubules
 - ▶ Henle's loop
 - ▶ Distal convoluted tubules



From: https://www.brainkart.com/article/Structure-of-a-nephron_33232/



Kidney

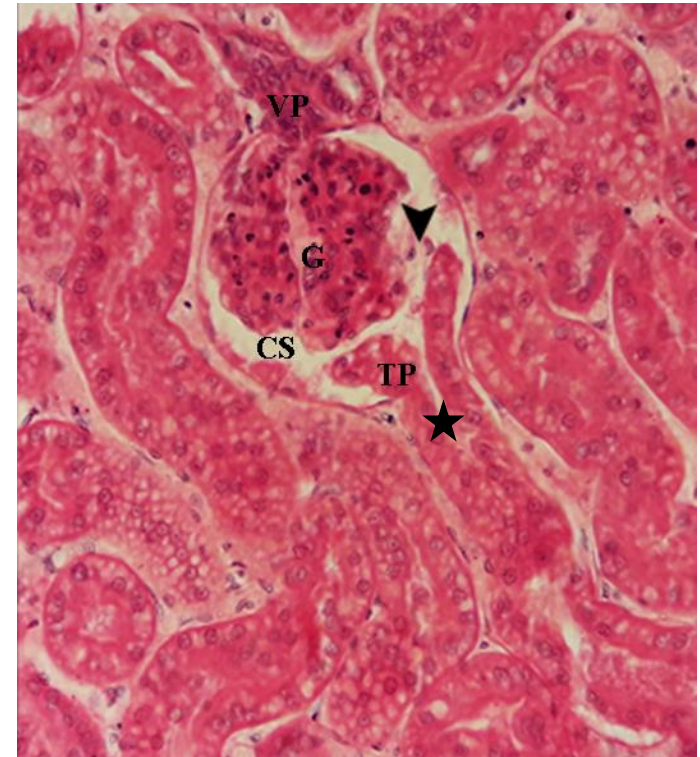


Kidney. Cortex (C) and medulla (M) is shown. The cortex is outer part and granular in appearance. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



Renal Corpuscles (Malpighi)

- ▶ Each renal corpuscle is spherical structure located in the renal cortex which is composed of two parts: glomerulus and Bowman's capsule
- ▶ The glomerulus is a convoluted network of fenestrated capillaries located into the Bowman's capsule
- ▶ Blood vessels enter and exit from glomerulus at the vascular pole, while the site where the Bowman's capsule open to proximal tubules is called urinary pole
- ▶ The Bowman's capsule surrounds the glomerulus and it is composed of two layers: inner visceral layer and outer parietal layer
- ▶ A cavity between these two layers is called Bowman's or urinary space
- ▶ The Visceral layer is made of special epithelial cells called podocytes, The parietal layer is made of simple squamous epithelium

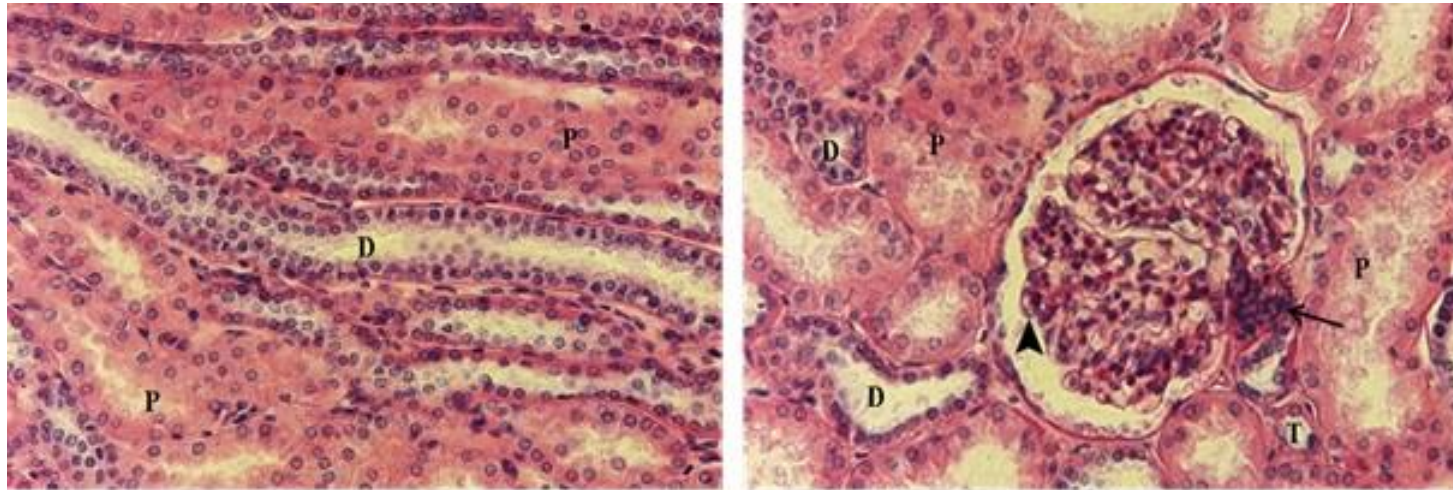


Renal corpuscles. Glomerulus is seen in the center surrounded by Bowman's capsule. Vascular pole (VP) is the entry and exit point of afferent and efferent arterioles. At the tubular point (TP), the Bowman's capsule is connected to proximal convoluted tubule. The lumen of proximal convoluted tubule (asterisk) is located along the Bowman's capsular space (CS). The nucleus of the podocytes cell (arrow head) is more external than to the glomerular capillaries and protrudes into the capsular space. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Proximal and distal convoluted tubule

- ▶ The proximal tubule wall is made of simple cuboidal epithelium with brush border. Their nucleus are spherical and located in the middle to basal part of the cells. The lumen is small and uneven
- ▶ The lining epithelium of distal convoluted tubule is tall simple cuboidal without brush border. Their nucleus are located near to apical surface of the cells. Distal convoluted tubules have larger lumen than proximal tubules

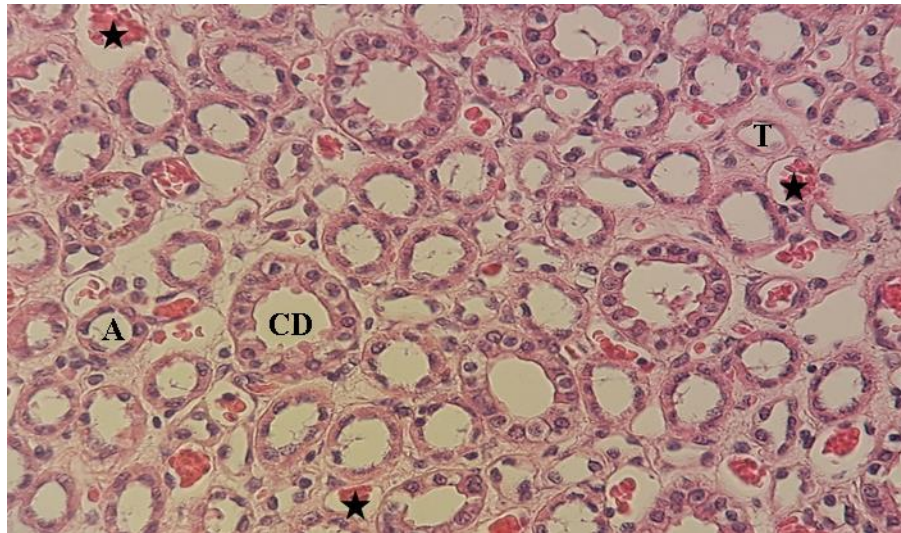


Proximal and distal tubules. Right: The proximal tubules (P) and the distal convoluted tubules (D) is seen in cross section of kidney. The proximal tubule epithelial cells are more eosinophilic than distal convoluted tubule. Due to presence of brush border the lumen of proximal tubule is narrower than distal convoluted tubule. The macula densa (arrow) is located in the vicinity of the vascular pole. A podocytes cell is also marked by arrow head. Left: Longitudinal and cross section of proximal (P) and distal (D) tubule. The epithelium lines both parts are simple cuboid, but the cells of distal convoluted tubule are larger. H&E, 40X These pictures are taken from histological slide in histology laboratory of Isfahan University



Henle's loops and connecting ducts

- ▶ The wall of thin ascending and descending limbs of Henle's loop have simple squamous epithelium. Their nuclei protrude into the lumen to a greater degree than the nuclei of the endothelial of adjacent capillaries
- ▶ The wall of thick ascending limb of Henle's loop has simple cuboidal epithelium with no brush border
- ▶ The wall of collecting ducts is made of simple cuboidal.
- ▶ Collecting ducts can be recognised by clear boundary between neighbouring epithelial cells



Cross section of renal medulla. The thin ascending and descending limbs of Henle's loop (T) is lining by simple squamous epithelium. The wall of thick ascending limbs of Henle's loops (A) and collecting ducts (CD) have simple cuboidal epithelium. The connective tissue is surrounded all these tubules and contains blood capillaries (asteriks). The lumen of capillaries are larger than thin ascending and descending limbs of Henle's loop. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Pelvis

- ▶ The wall of ureter is comprised of following layers from inside to out:
- ▶ 1) Mucosa layer - is made of transitional epithelium and underlying lamina propria
- ▶ 2) Muscularis layer- is composed of smooth muscle layers. It is thinner than muscular layer in urinary bladder
- ▶ 3) adventitia- is made of fibrous connective tissue

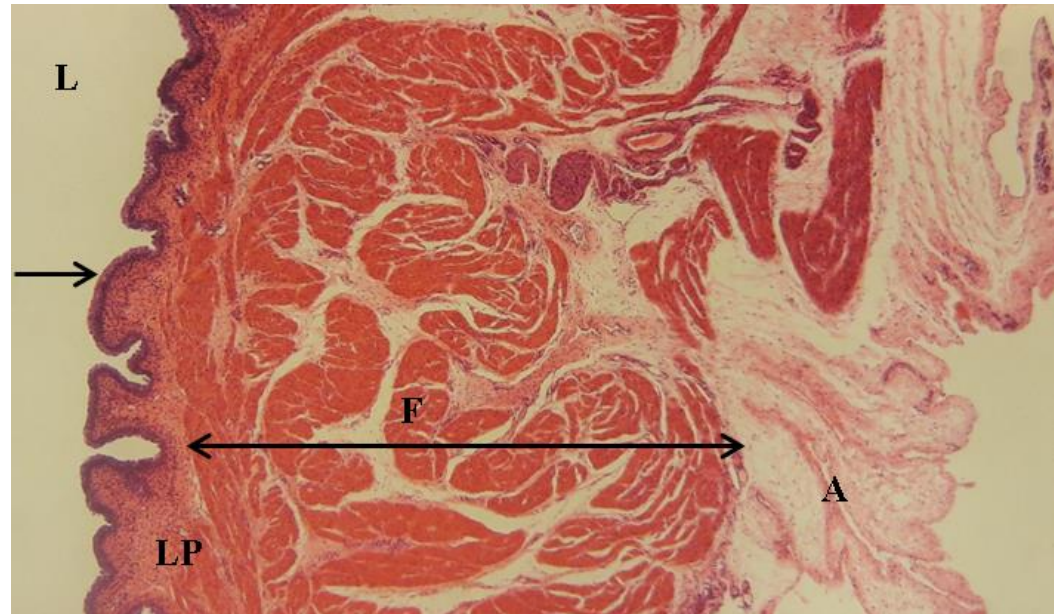


Cross section of a pelvis. Mucosa (M) is next to lumen which consists of transitional epithelium and lamina propria. The muscular layer (M) is thin. Adventitia (A) is located in outside. Renal capsule (C) surrounded all these layers. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



Urinary bladder

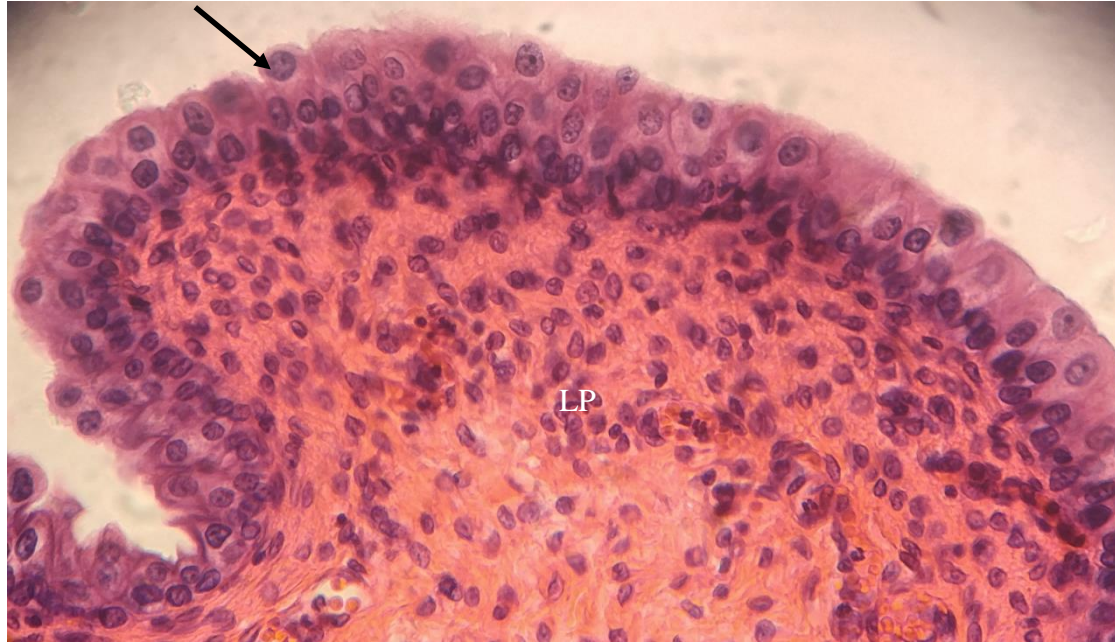
- ▶ Histologically, urinary bladder wall is made of three layers including (from inside to out): mucosa, muscular layer and adventitia
- ▶ The mucosa is made of transitional epithelium (urothelium) and underlying lamina propria. The mucosa is highly folded
- ▶ There are three layers of smooth muscle tissue: inner and outer longitudinal layer and middle circular layer. There is no distinct boundary between layers except for near bladder neck. The muscular layer is thick and collectively is called detrusor muscle
- ▶ adventitia is made of fibrous connective tissue



Cross section of urinary bladder. The mucosa of the urinary bladder consists of transitional epithelium (arrow) and lamina propria (LP). The muscular layer (F) is thick. Adventitia (A) is located in outside. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



Transitional or urinary epithelium



Cross section of urinary bladder mucosa. Transitional epithelium is seen in the surface. A dome cell is depicted by arrow. Lamina propria (LP) is made up of loose connective tissue. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University