

Al-Mustaqbal University
College of Engineering and Technologies
Biomedical Engineering Department



Systemic Physiology I

Lecture: 7

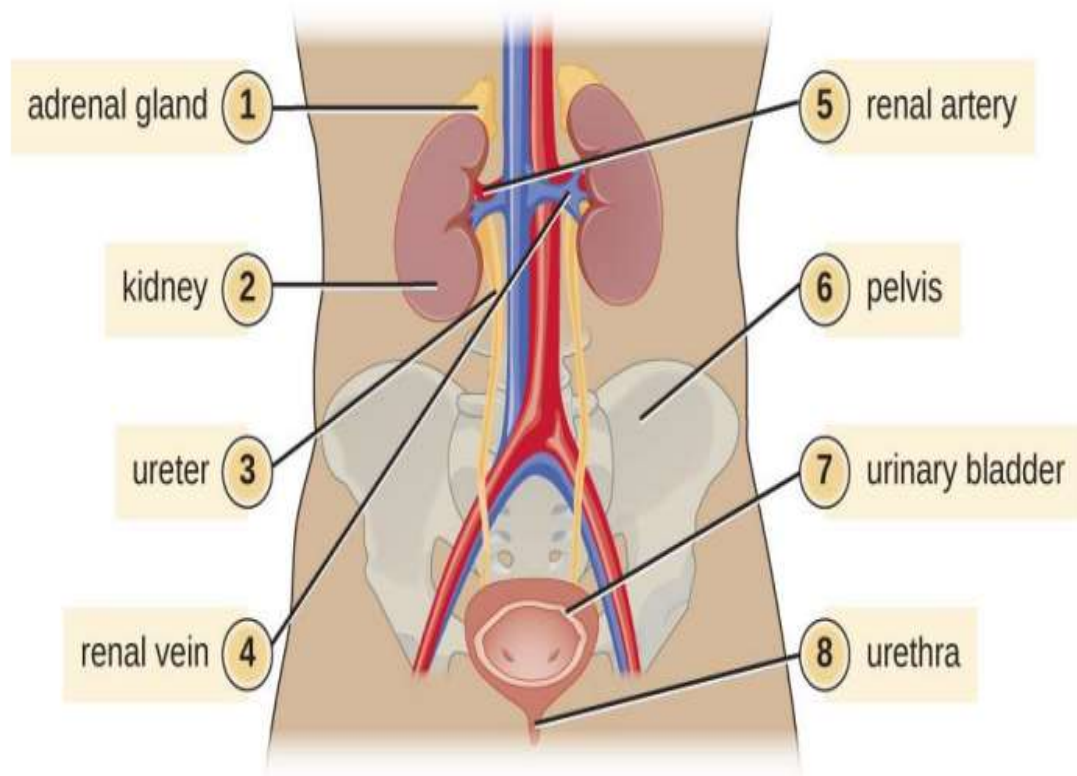
The Urinary System Physiology

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The Urinary System Physiology

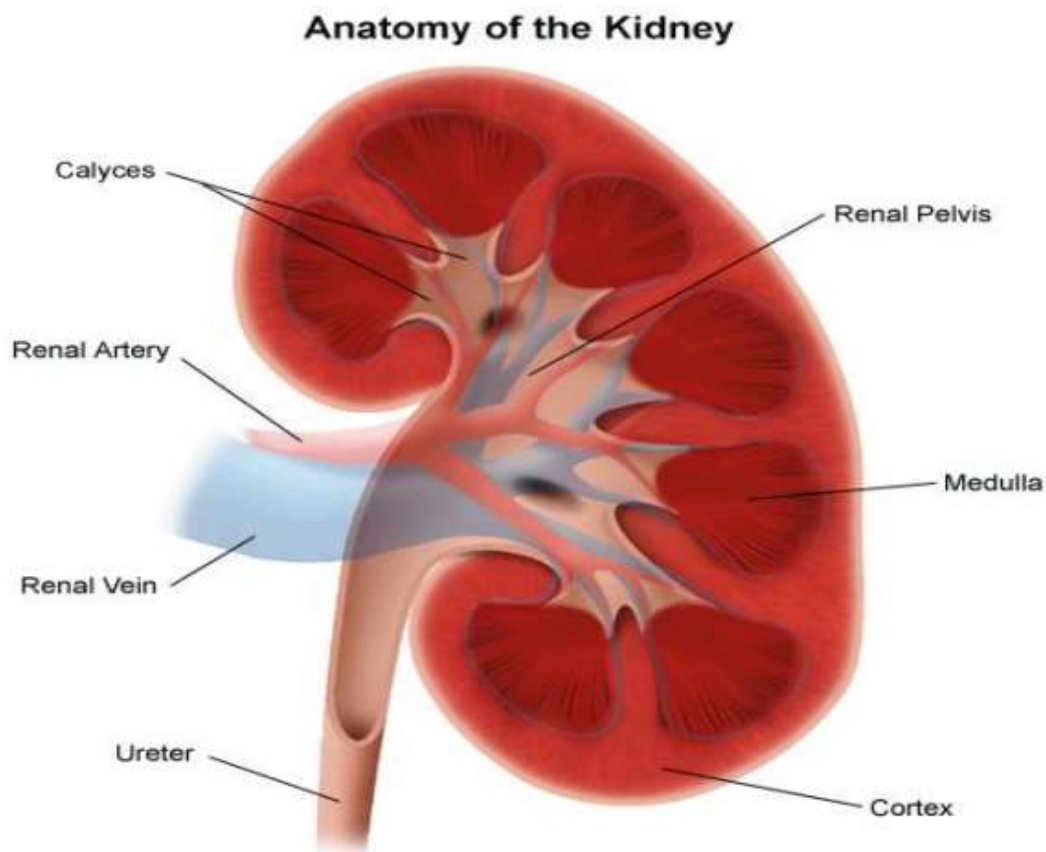
The urinary system's function is to filter blood and create urine as a waste by-product. The urinary system organs include the two kidneys, renal pelvis, two ureters, bladder, and urethra.



The Kidneys:

- The kidneys are solid, bean-shaped organs.
- Located below the ribs toward the middle of the back.
- The right kidney is positioned slightly lower than the left.
- Each of which is about 11 cm long, 6 cm wide, 3 cm thick.
- The average weight is 150 gm in male & 135 gm in female.
- Each kidney has a lateral convex & medial concave border.
- Each kidney has a fibrous capsule. On the concave, each kidney's medial side is called the hilus, which contains renal blood vessels and nerves.

- Medial to the hilum is the renal pelvis, a flat funnel-shaped structure that continues with the upper end of the ureter.
- The kidneys remove urea from the blood through tiny filtering units called nephrons. Each nephron consists of a ball formed of small blood capillaries, called a glomerulus, and a small tube called a renal tubule.



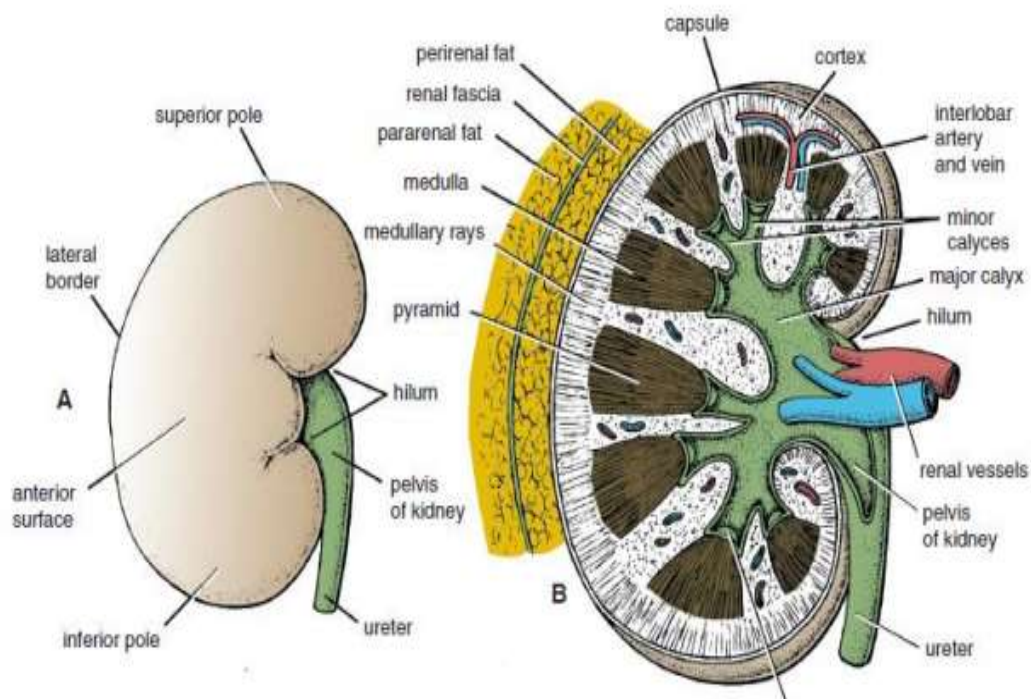
The function of the kidney

- Remove waste products and drugs from the body.
- Balance the body's fluids.
- Release hormones to regulate blood pressure.
- Control production of red blood cells.

Coverings of kidneys:

The kidneys have the following coverings:

1. **Fibrous capsule:** This surrounds the kidney and is closely applied to its outer surface.
2. **Perirenal fat:** This covers the fibrous capsule.
3. **Renal fascia:** This is a connective tissue that lies outside the perirenal fat and encloses the kidneys and suprarenal glands.
4. **Pararenal fat:** This lies external to the renal fascia and is often in large quantities.



When a kidney is cut lengthwise, 2- regions become apparent.

1. **Cortex:** The outer region, which is light in color.
2. **Medulla:** It is a darker reddish-brown area, deep to the cortex.

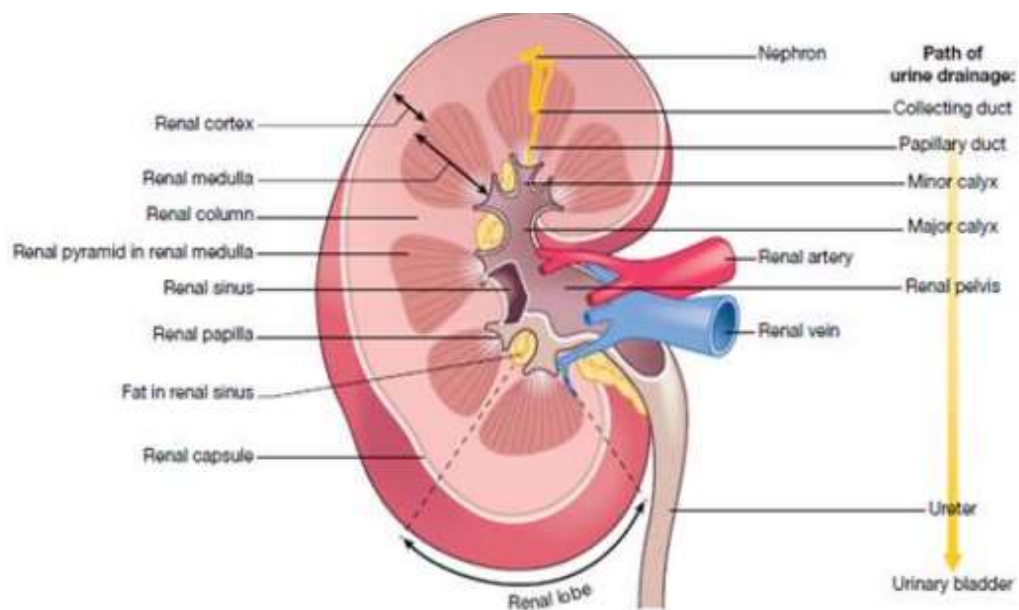
The parenchyma of the kidney consists of renal tubules.

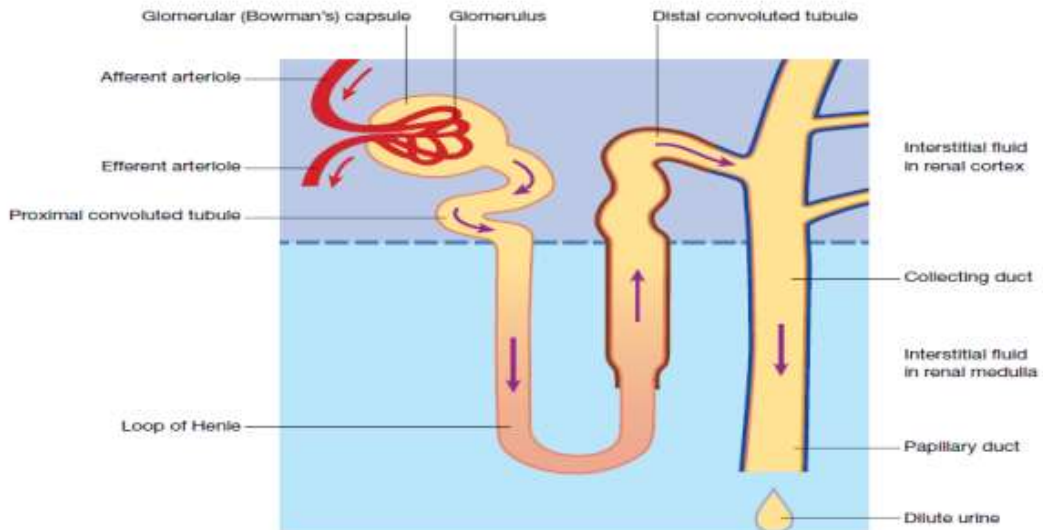
These renal tubules are consisting of:

1. **Secretory tubules (Nephron):** its function is the formation of urine.
2. **Excretory tubules:** These are ducts that collect urine and carry it to the pelvis.

- **Each nephron consists of:**

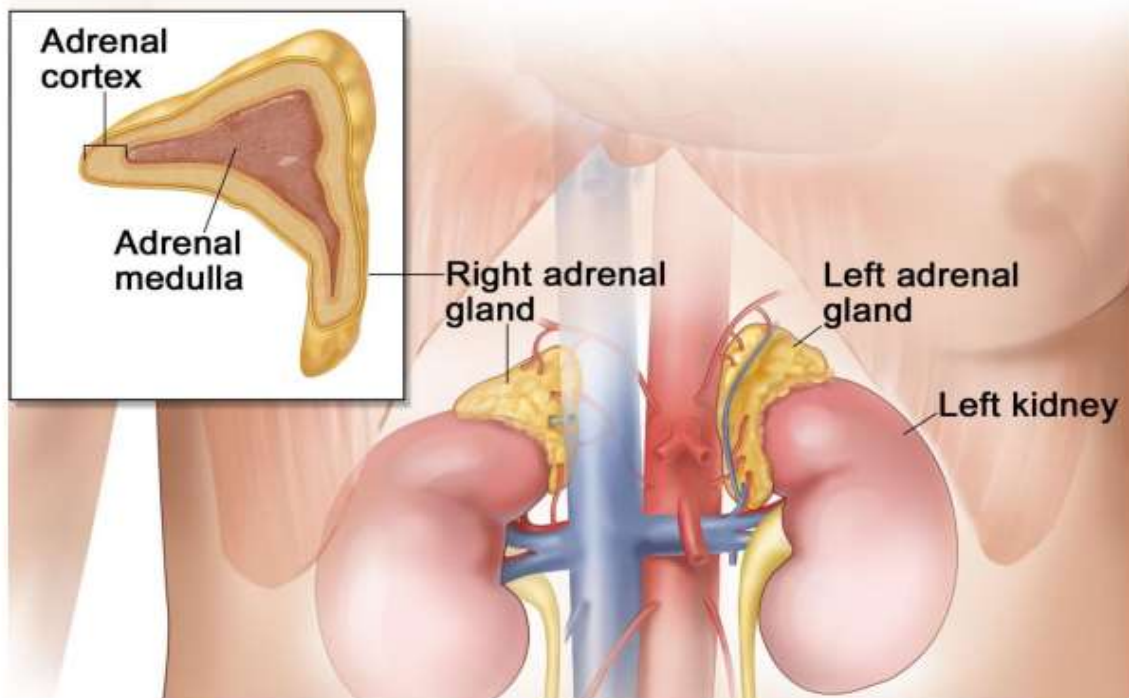
1. The renal corpuscle consists of two parts (Glomerulus, Bowman's capsule).
2. Proximal convoluted tubule.
3. Loop of Henle.
4. distal convoluted tubule.





The Suprarenal glands (Adrenal glands): The adrenal glands are small glands located on top of each kidney. They produce essential hormones, including sex hormones and cortisol.

Anatomy of the Adrenal Gland



The Ureter:

Narrow slender tubes carry urine from the kidneys to the bladder. The ureters are tubes, 25-30 cm long and 6 mm in diameter. Muscles in the ureter walls continually tighten and relax, forcing urine downward away from the kidneys. If urine backs up or is allowed to stand still, a kidney infection can develop. About every 10 to 15 seconds, small amounts of urine are emptied into the bladder from the ureters.

Functions: The ureters carry urine from the kidneys to the bladder.

Urinary Bladder:

It is a smooth, collapsible muscular sac that stores urine temporarily. Three openings are seen in the bladder- the two ureter openings and the single opening of the urethra, which drain the bladder.

- In males, the prostate gland surrounds the bladder's neck, where it empties into the urethra.
- The empty bladder is 5-7.5 cm long, while the full bladder is about 12.5cm long and holds about 500ml of urine, but it is capable of holding more than twice that amount (1500ml).
- It is the reservoir for urine received from the kidneys.
- Two sphincter muscles. These circular muscles help keep urine from leaking by closing tightly like a rubber band around the bladder's opening.
- Nerves in the bladder. The nerves alert a person when it is time to urinate or empty the bladder.

The Urethra:

The urethra is the canal transmission of the urine from the bladder to the outside. It differs between the two genders. The female urethra is short 4 cm long, while in the male, it is roughly 15-25 cm long in the adult. The external or urethral sphincter surrounds it.

The male urethra is a channel it has three parts:

1. Prostatic portion.
2. Perineal & membranous portion.
3. Penile or spongy portion.

