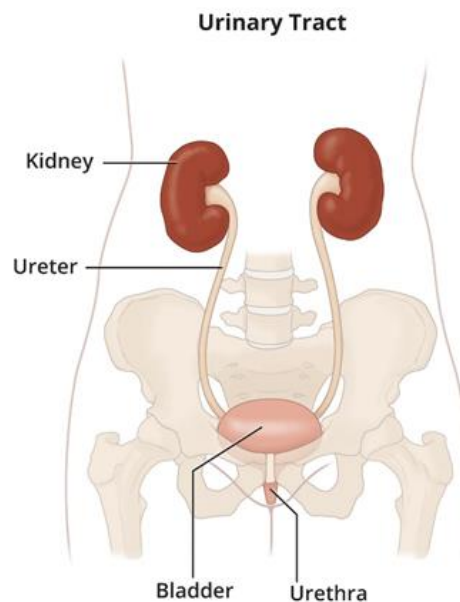


Urinary Tract Parts and Function

Two kidneys. This pair of purplish-brown organs is located below the ribs toward the middle of the back. Their function is to:

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

The kidneys remove urea from the blood through tiny filtering units called **nephrons**. Urea, together with water and other waste substances, forms the urine as it passes through the nephrons and down the renal tubules of the kidney.



Nephrons

A nephron is the basic structural and functional unit of the kidney. The name nephron comes from the Greek word (**nephrons**) meaning kidney.

Its chief function is to regulate water and soluble substances by filtering the blood, reabsorbing what is needed and excreting their rest as urine.

Nephrons eliminate wastes from the body, regulate blood volume and pressure, control levels of electrolytes and metabolites, and regulate blood pH. Its functions are vital to life and are regulated by the endocrine system by hormones such as anti-diuretic hormone, aldosterone, and parathyroid hormone.

Each nephron is composed of an initial filtering component (**the renal corpuscle**) and a tubule specialized for reabsorption and secretion (**the renal tubule**).

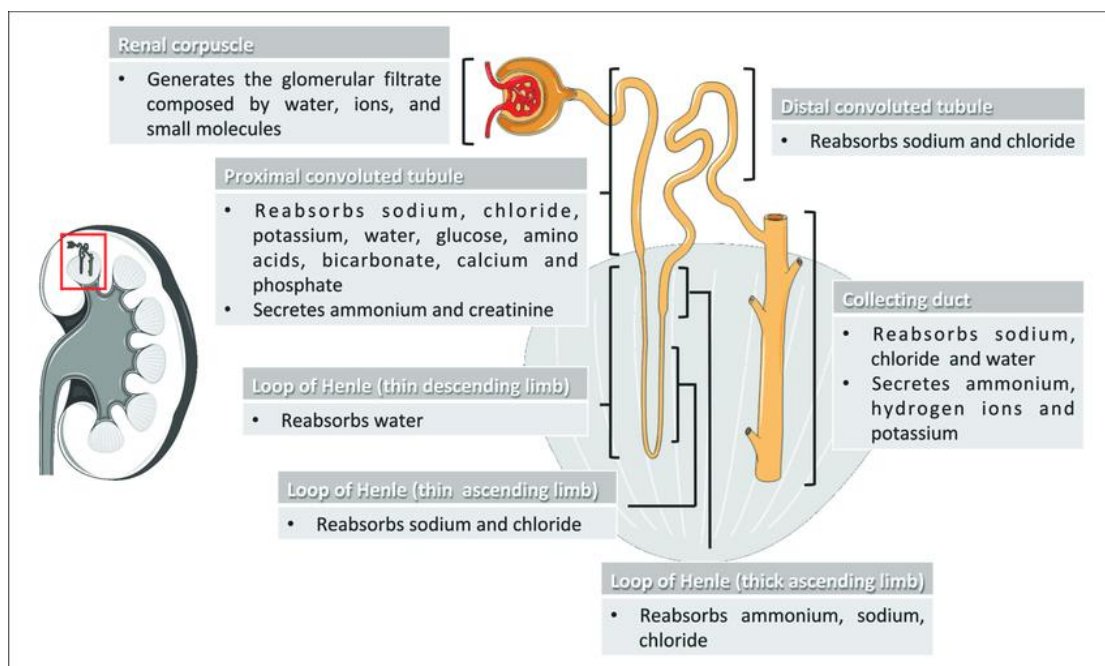
The **renal corpuscle** consists of Bowman's capsule and glomerular capillaries, responsible for plasma filtration.

1- Glomerulus

- Network of capillaries that invaginate into Bowman's capsule.

2- Bowman's capsule

- Forms the distended end of the renal tubule.



The renal tubule is a long and convoluted structure that emerges from the glomerulus and can be divided into three parts based on function.

- The first part is called **the proximal convoluted tubule (PCT)** due to its proximity to the glomerulus.
- The second part is called **the loop of Henle**, or nephritic loop because it forms a loop (with descending and ascending limbs).
- The third part of the renal tubule is called the **distal convoluted tubule (DCT)**.

Two ureters: These narrow tubes carry urine from the kidneys to the bladder. Smooth muscles in the ureter walls continually tighten and relax forcing urine downward, away from the kidneys. At the entrance to the bladder, the ureters have sphincters that prevent the backflow of urine. 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.

The walls of the ureters are composed of multiple layers of different types of tissues.

- 1- The innermost layer is a special type of epithelium, called **transitional epithelium**. it is capable of stretching and does not produce mucus. Transitional epithelium allows these organs to stretch and expand as they fill with urine or allow urine to pass through.
- 2- The next layer of the ureter walls is made up of **loose connective tissue** containing elastic fibers, nerves, and blood and lymphatic vessels.
- 3- After this layer are two layers of **smooth muscles**. The smooth muscle layers can contract in waves of peristalsis to propel urine down the ureters from the kidneys to the urinary bladder.
- 4- The outermost layer of the ureter walls consists of **fibrous tissue**.

Urinary Bladder: This triangle-shaped, hollow organ is located in the lower abdomen. The bladder's walls relax and expand to store urine, and contract and flatten to empty urine through the urethra. Urine leaves the bladder through a sphincter called the internal **urethral sphincter**. When the sphincter relaxes and opens, it allows urine to flow out of the bladder and into the urethra.

Like the ureters, the bladder is lined with **transitional epithelium**, which can flatten out and stretch as needed as the bladder fills with urine. The next layer (**lamina propria**) is a layer of loose connective tissue, nerves, and blood and lymphatic vessels. This is followed by a **submucosa layer**, which connects the lining of the bladder with the detrusor muscle in the walls of the bladder. The outer covering of the bladder is **peritoneum**.

Urethra. This tube allows urine to pass outside the body. The brain signals the bladder muscles to tighten, which squeezes urine out of the bladder. At the same time, the brain signals the sphincter muscles to relax to let urine exit the bladder through the urethra. When all the signals occur in the correct order, normal urination occurs.

In males, the urethra carries semen (as well as urine), but in females, it carries only urine. Like the ureters and bladder, the proximal (closer to the bladder) two-thirds of the urethra are lined with **transitional epithelium**. The distal (farther from the bladder) third of the urethra is lined with **mucus-secreting epithelium**. The mucus helps protect the epithelium from urine, which is corrosive.