AL MUSTAQBAL UNIVERSITY

College of Pharmacy / First Year

ANATOMY

(L7) Urinary System

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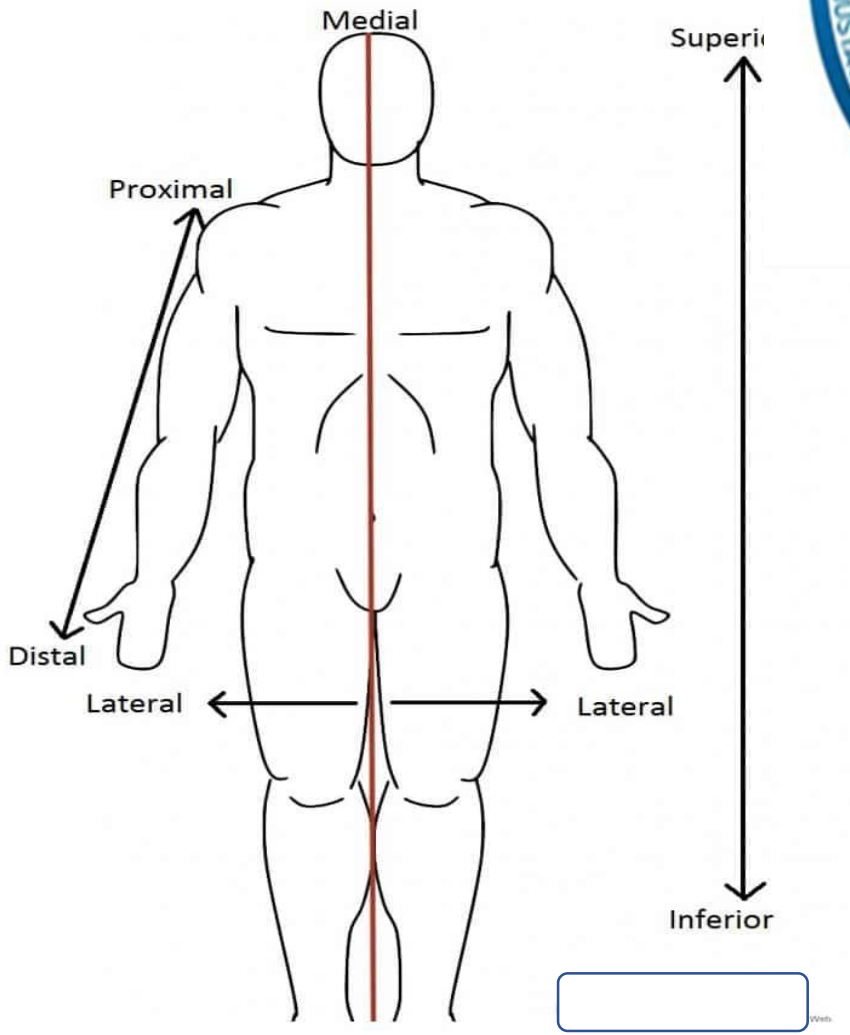
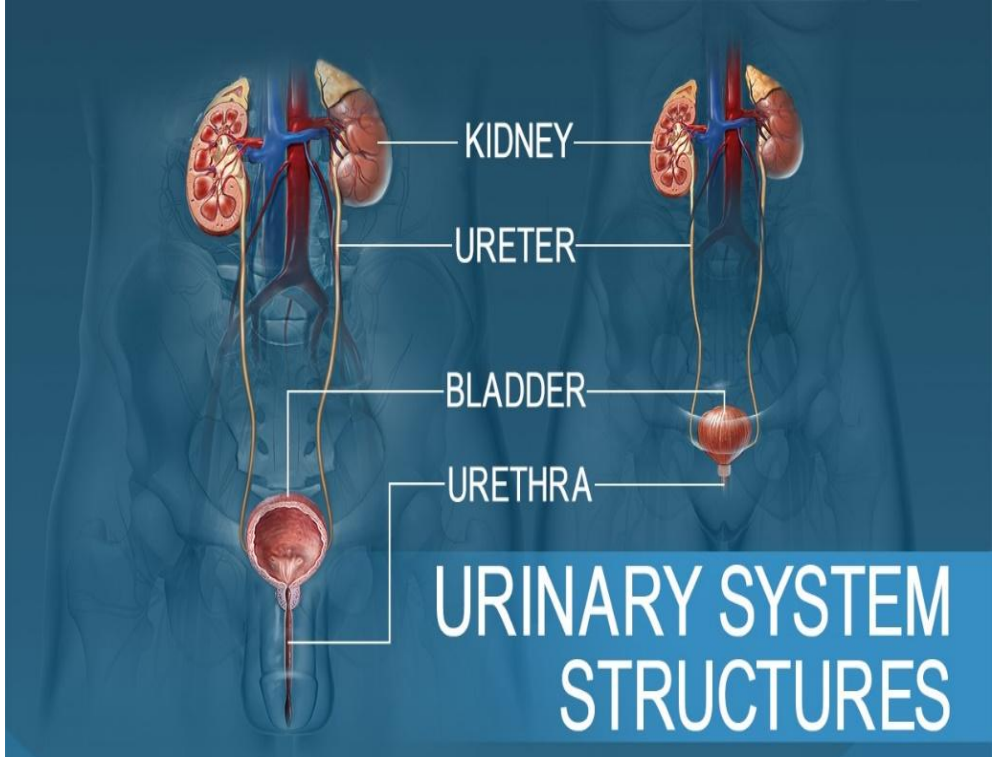


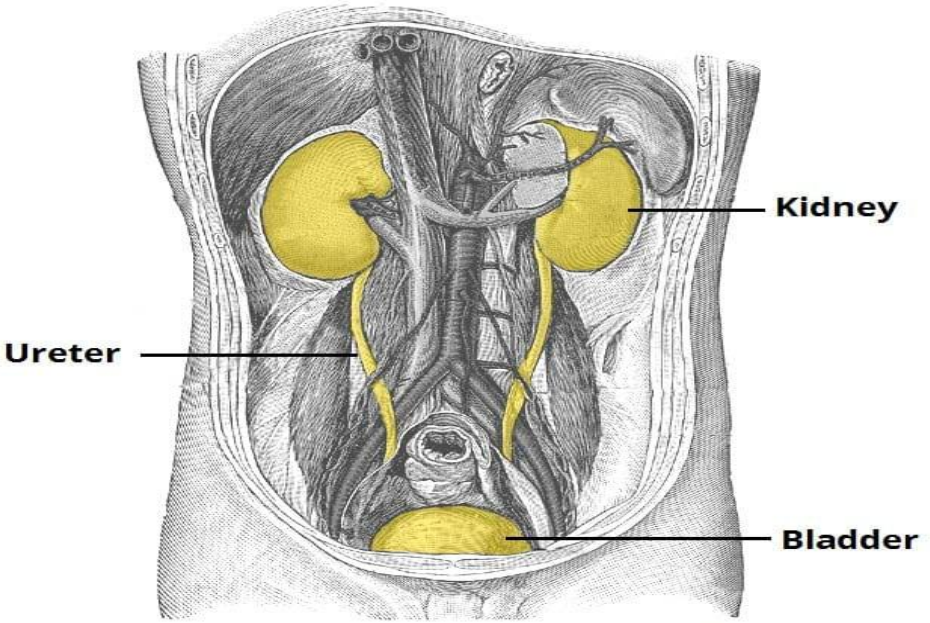
The Structures of the Urinary System

The urinary system, also known as the **renal system.** The urinary system refers to the structures that produce and conduct urine to the point of excretion**.**

2 kidneys, 2 ureters, 1 bladder, and 1 urethra are the primary structures of the urinary system.



The kidneys are bilateral bean-shaped organs, reddish-brown in colour and located in the posterior abdomen. Their main function is to filter and excrete waste products from the blood. They are also responsible for water and electrolyte balance in the body. Urine is transported from the kidneys to the bladder by the ureters. It leaves the body via the urethra.

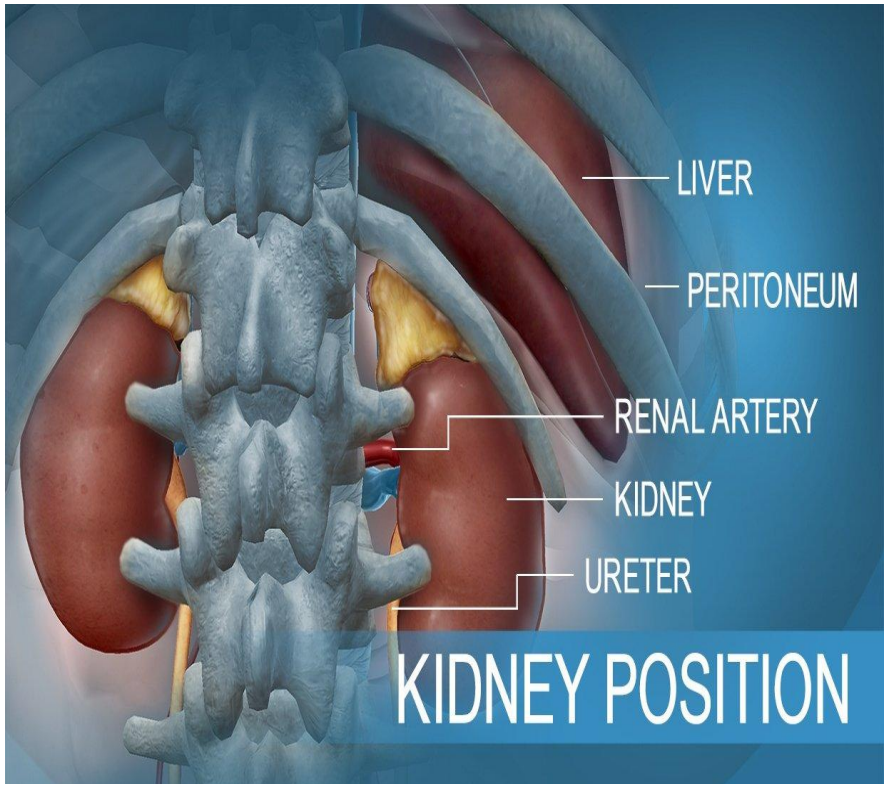


Anatomical Position

The kidneys lie **retroperitoneally** (behind the peritoneum) in the abdomen, on either side of the vertebral column.

They typically extend from **T12 to L3**, although the right kidney is often situated slightly lower due to the presence of the liver. Each kidney is approximately three vertebrae in length.

The adrenal glands sit immediately superior to the kidneys within a separate envelope of the **renal fascia**.

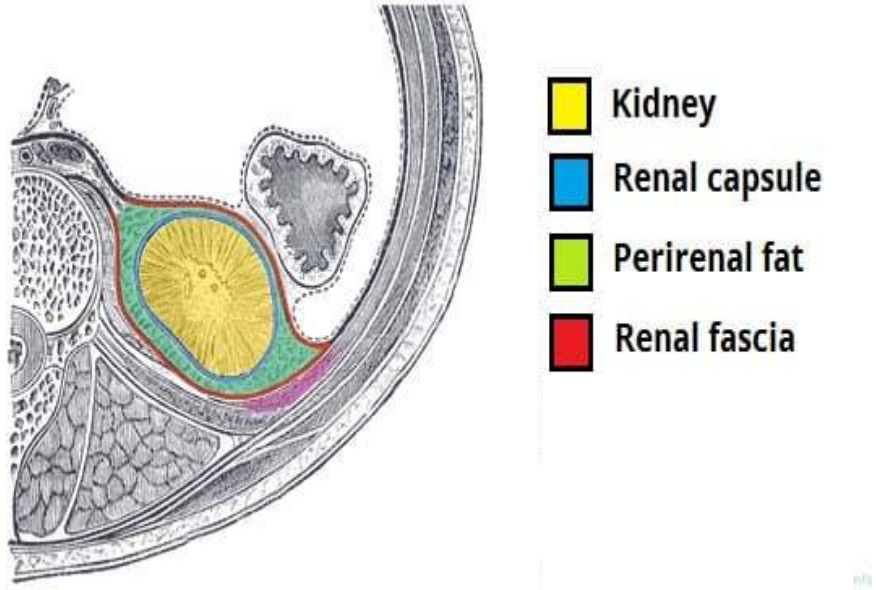


The kidneys are encased in complex layers of fascia and fat. They are arranged as follows (**deep to superficial**):

Renal capsule – tough fibrous capsule.

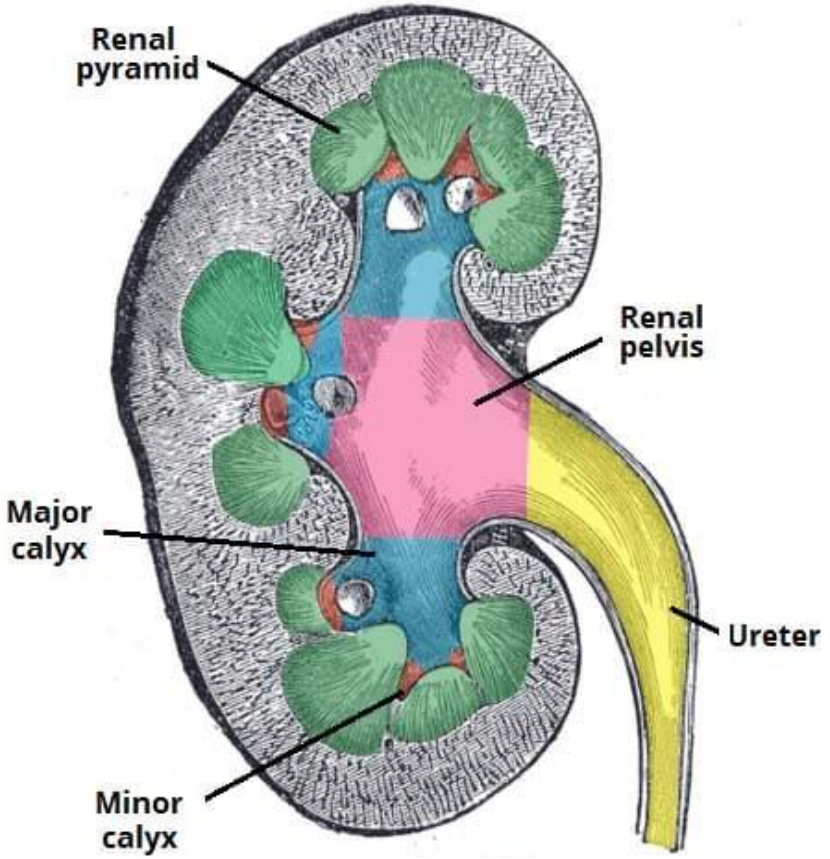
Perirenal fat – collection of extraperitoneal fat.

Renal fascia (also known as Gerota's fascia or perirenal fascia) – encloses the kidneys and the suprarenal glands.



Internally, the kidneys have an unique structure. The renal parenchyma can be divided into two main areas, the outer **cortex** and inner **medulla**. The cortex extends into the medulla, dividing it into triangular shapes, these are known as **renal pyramids**.

The apex of a renal pyramid is called a **renal papilla**. Each renal papilla is associated with a structure known as the **minor calyx**, which collects urine from the pyramids. Several minor calices merge to form a **major calyx**.



Urine passes through the major calices into the **renal pelvis**, a flattened and funnel-shaped structure. From the renal pelvis, urine drains into the ureter, which transports it to the bladder for storage.

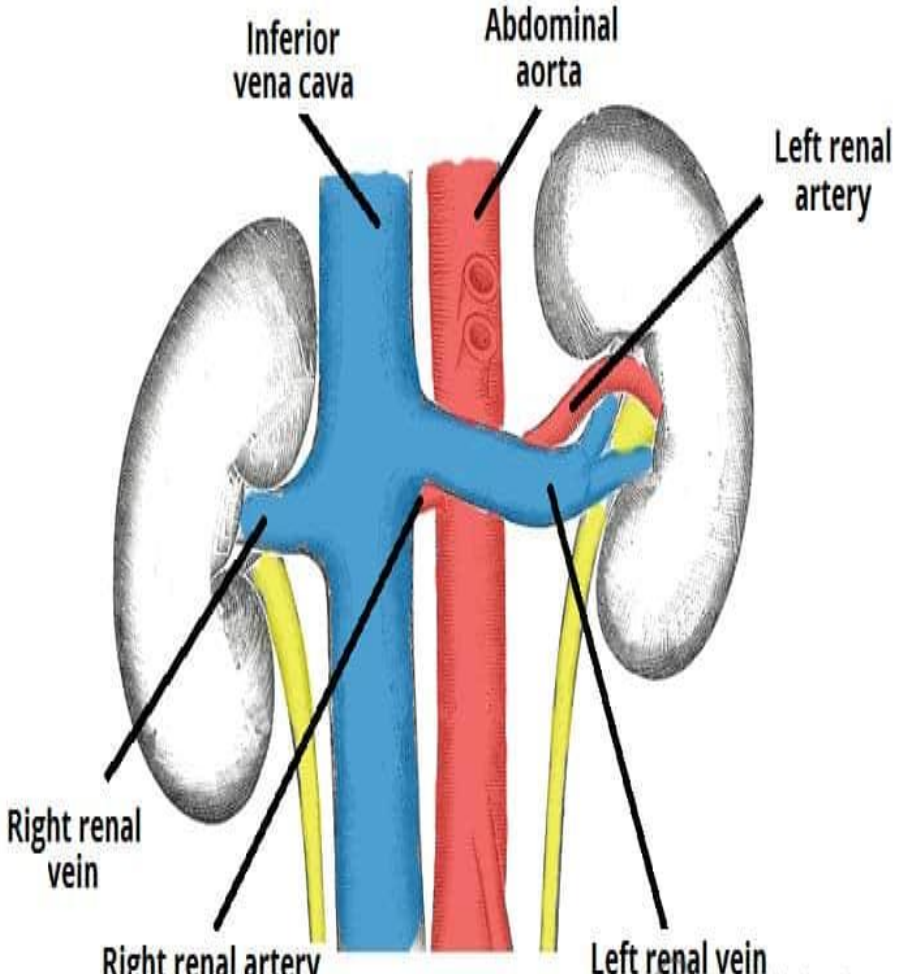
The medial margin of each kidney is marked by a deep fissure, known as the **renal hilum**. This acts as a gateway to the kidney, normally the renal vessels and ureter enter/exit the kidney via this structure.

Arterial Supply

The kidneys are supplied with blood via the **renal arteries**, which arise directly from the abdominal aorta, immediately distal to the origin of the superior mesenteric artery.

Due to the anatomical position of the abdominal aorta (slightly to the left of the midline), the right renal artery is longer, and crosses the vena cava posteriorly.

The renal artery enters the kidney via the renal hilum.



Venous Drainage

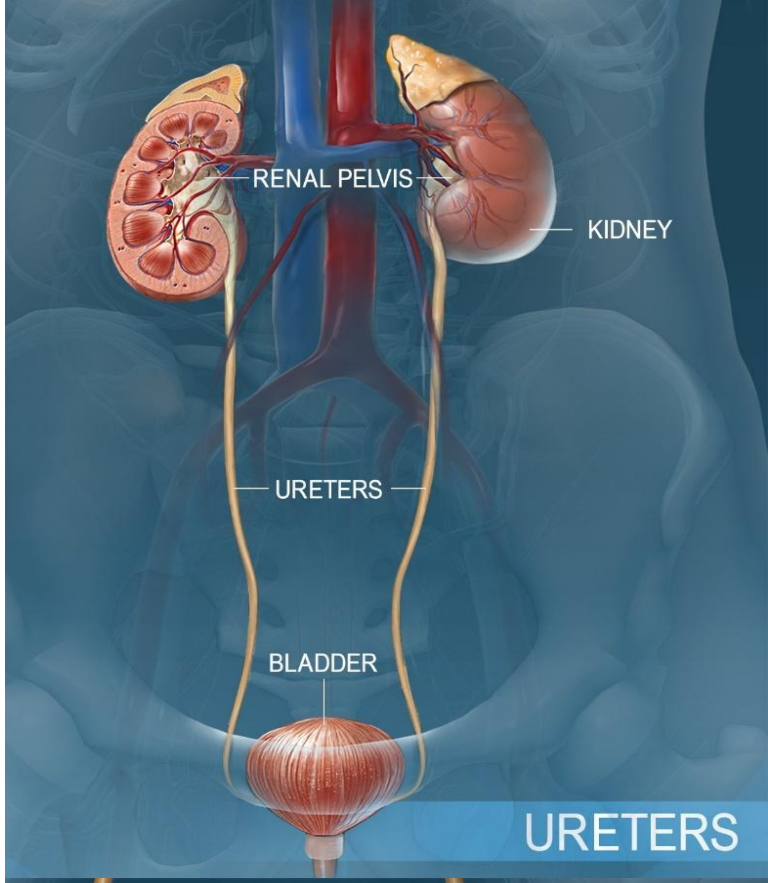
The kidneys are drained of venous blood by the left and right **renal veins**. They leave the renal hilum anteriorly to the renal arteries, and empty directly into the inferior vena cava.

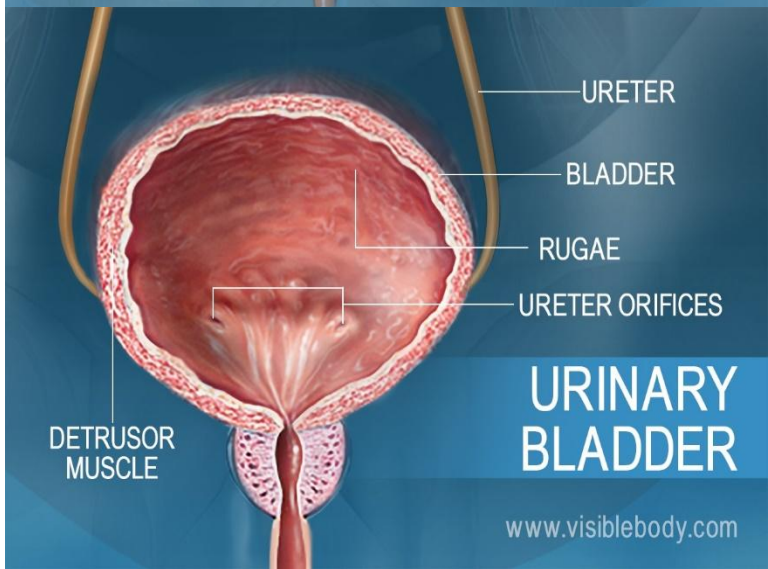
The Ureters Move Urine from the Kidneys to the Bladder

Urine drains from the renal pelvis of each kidney into the ureters. The ureters are long, thin tubes made of smooth muscle. Contractions of the smooth muscle push urine down through the ureters and into the bladder. In adults, the ureters are 25–30 cm long, about the length of a 12-inch ruler.

The Urinary Bladder Is a Reservoir for Urine

Urine flows through the ureters into the urinary bladder. **In women**, the bladder is located in front of the vagina and below the uterus. **In men,** the bladder sits in front of the rectum and above the prostate gland. The wall of the bladder contains folds called **rugae**, and a layer of smooth muscle called the **detrusor muscle**. An adult bladder is full at about half a liter, or about two cups.

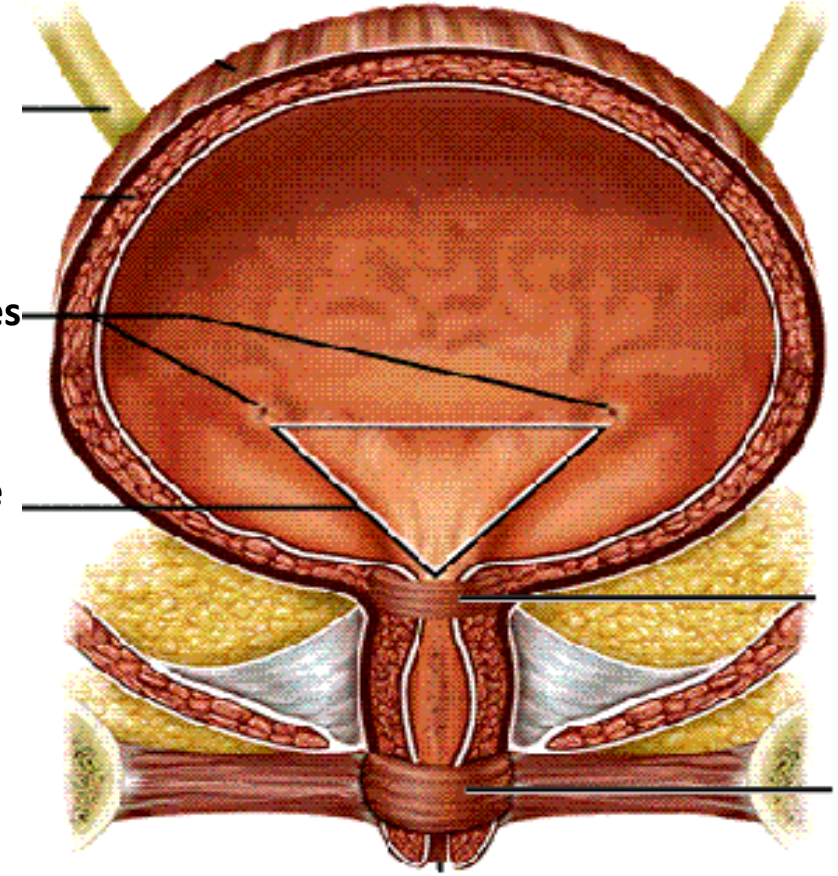




URETHRAL SPHINCTERS IN BOTH SEXES:

Internal Urethral Sphincter- under involuntary control of smooth muscle.-

External Urethral Sphincter - under voluntary control of skeletal muscle.-



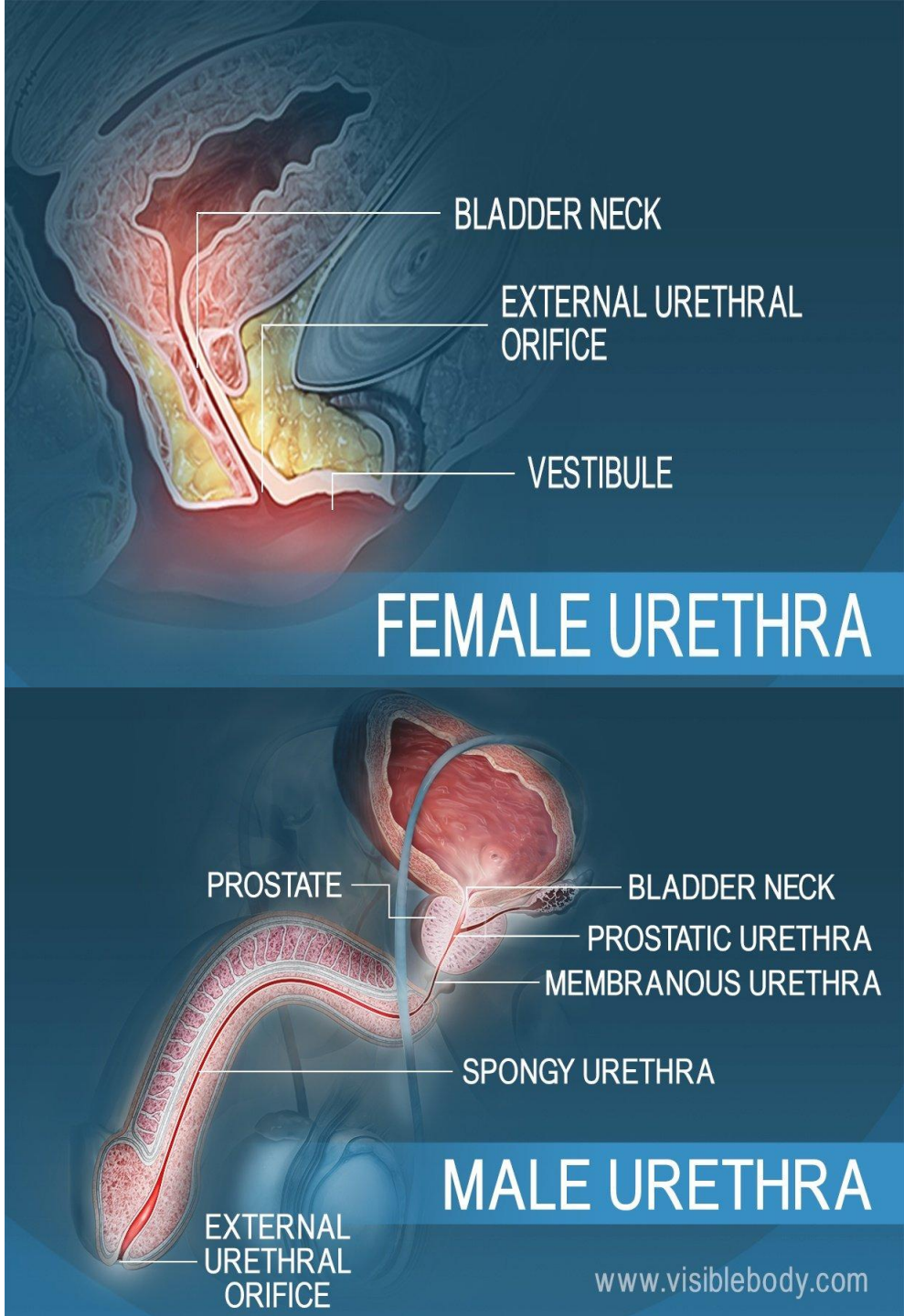
The openings of the two ureters and the urethra mark a triangular area called the trigone on the bladder floor.

The Female Urethra Is Shorter Than the Male Urethra

Urine produced in the kidneys passes through the ureters, collects in the bladder, and is then excreted through the urethra. In females, the urethra is narrow and about 4 cm long, significantly shorter than in males. It extends from the bladder neck to the external urethral orifice in the vestibule of the vagina.

The Male Urethra Is Divided into Three Sections

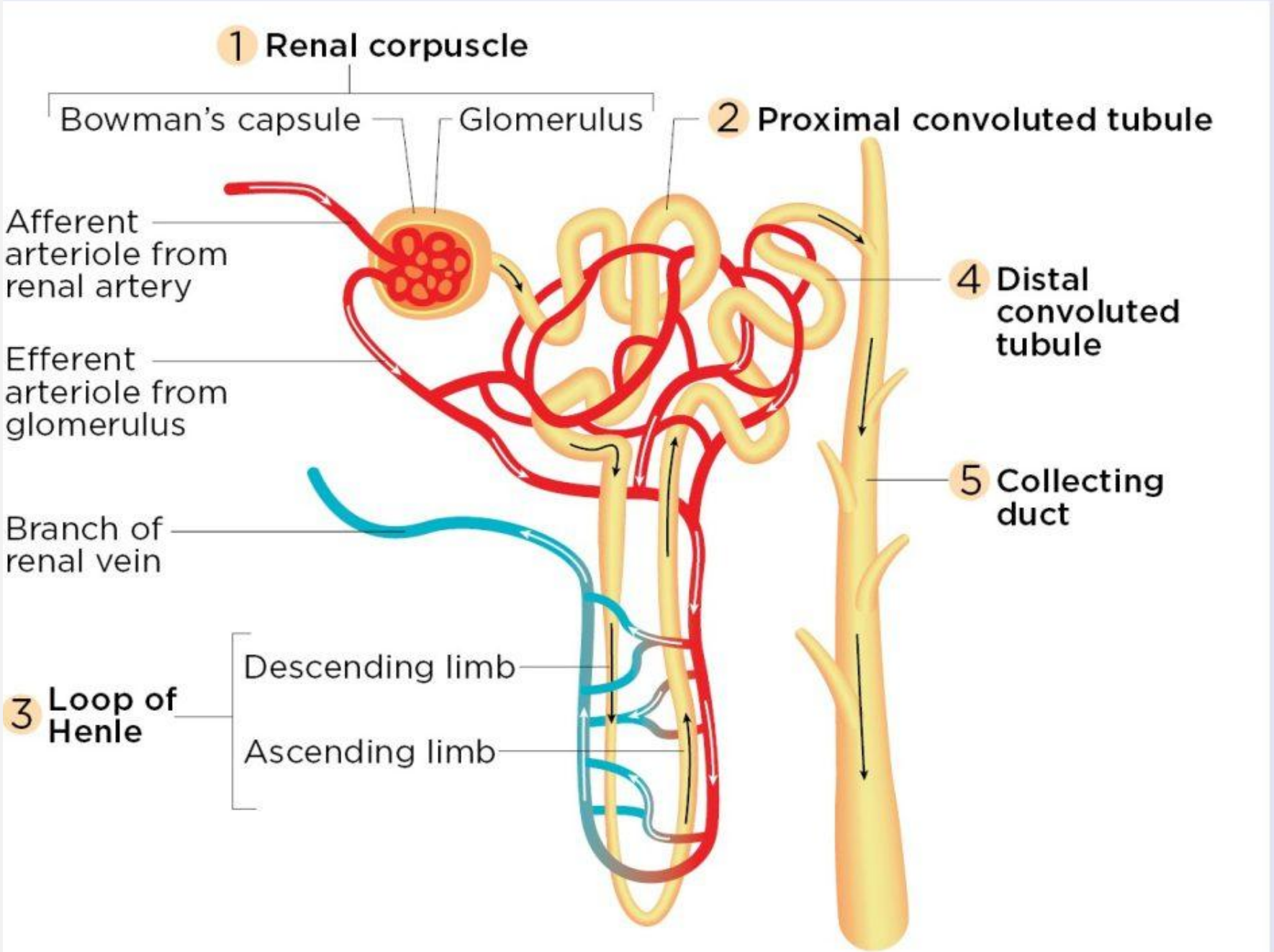
In males, the urethra is about 17.5–20 cm, four or five times as long as in females. The male urethra is divided into three sections: the **prostatic** urethra (the widest portion), the **membranous** urethra (the narrowest portion), and the **spongy** urethra (the longest portion). It extends from the bladder neck through the prostate and the penis to the external urethral orifice.



Nephrons are both the structural and functional units of the kidneys. Each human kidney contains about 1,200,000 nephrons, a number that does not increase after birth. In situations of compensatory hypertrophy, such as after nephrectomy, the increase in kidney size is due to an increase in the size of the nephron, but not the number.

The main components of the nephron are the glomerulus, the Bowman's capsule or **glomerular capsule**, the **proximal convoluted tubule**, the **loop of Henle**, and the **distal convoluted tubule** The glomerulus and the Bowman's capsule together are called **the renal corpuscle**, whereas the rest of the nephron is referred to as the **renal tubule**.

3. Anatomy of a nephron

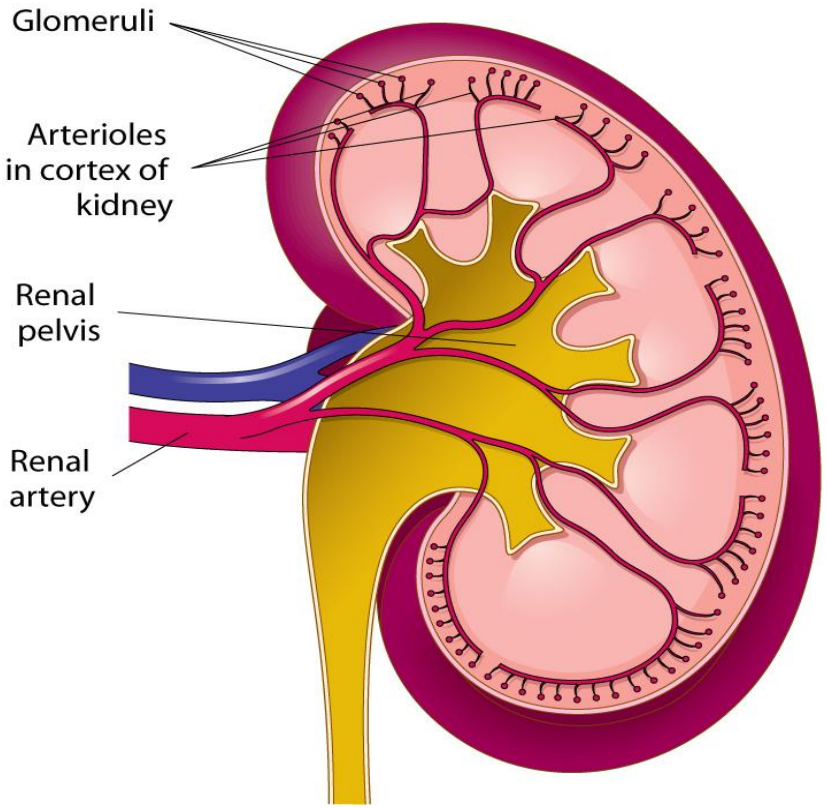


How Kidneys Produce Urine

Blood enters the kidneys through the right and left **renal arteries**

Arterioles carry blood to the **capillaries**

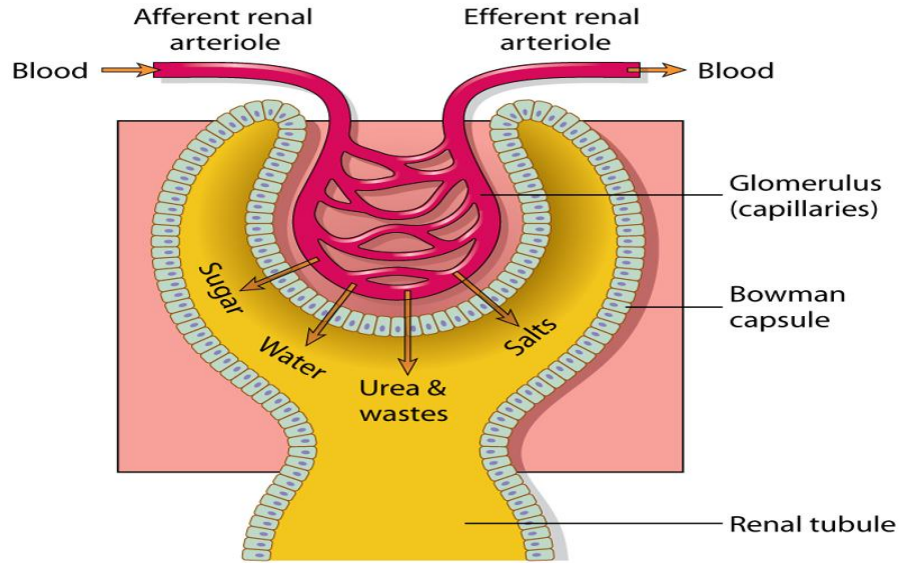
Glomeruli filter the blood.



Blood passes through the glomeruli

Glomerular (Bowman) capsule surrounds each glomerulus

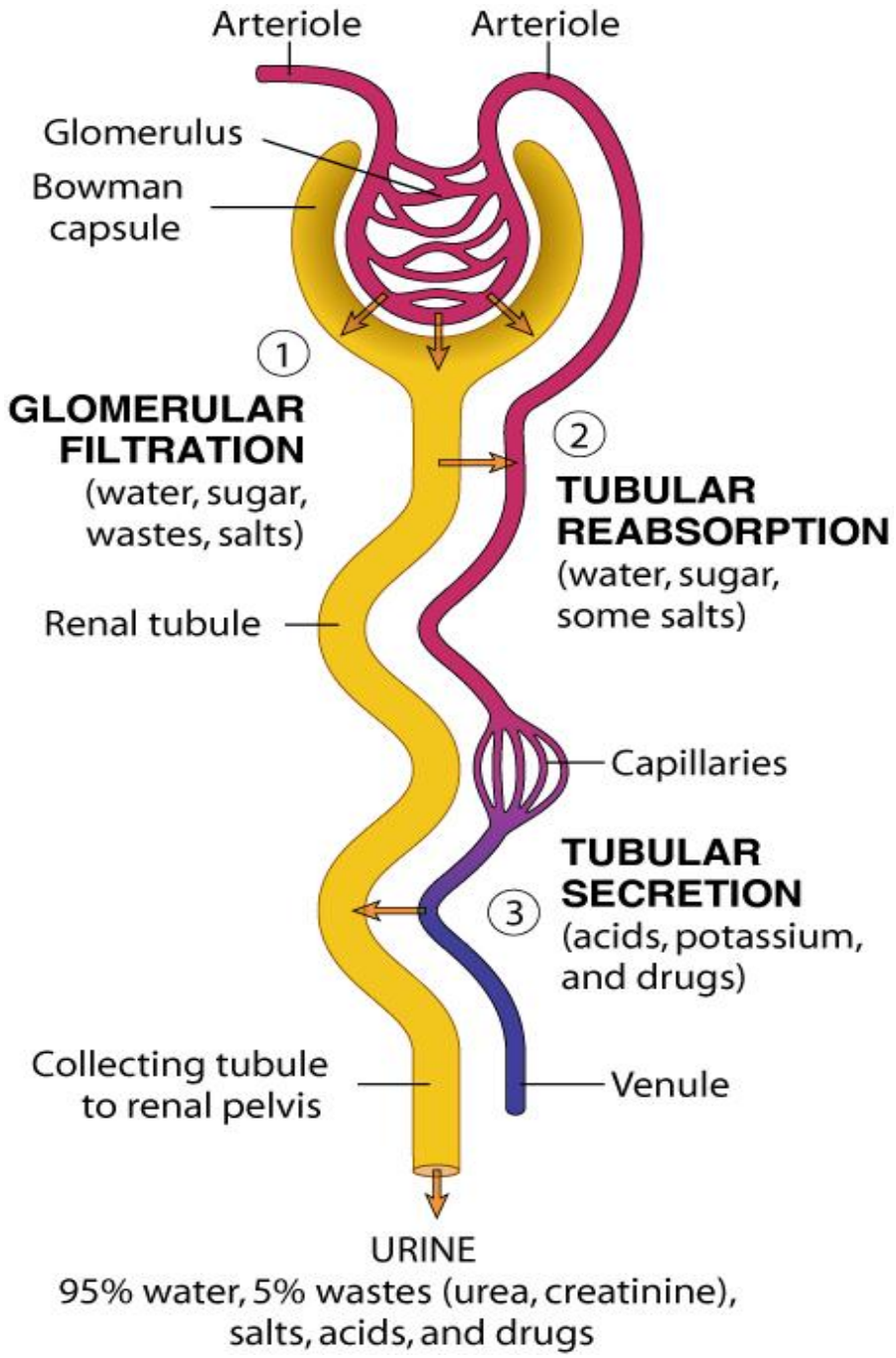
Renal tubule is attached to each Bowman capsule



Three steps in the formation of urine:

- Glomerular filtration
- Tubular reabsorption
- Tubular secretion

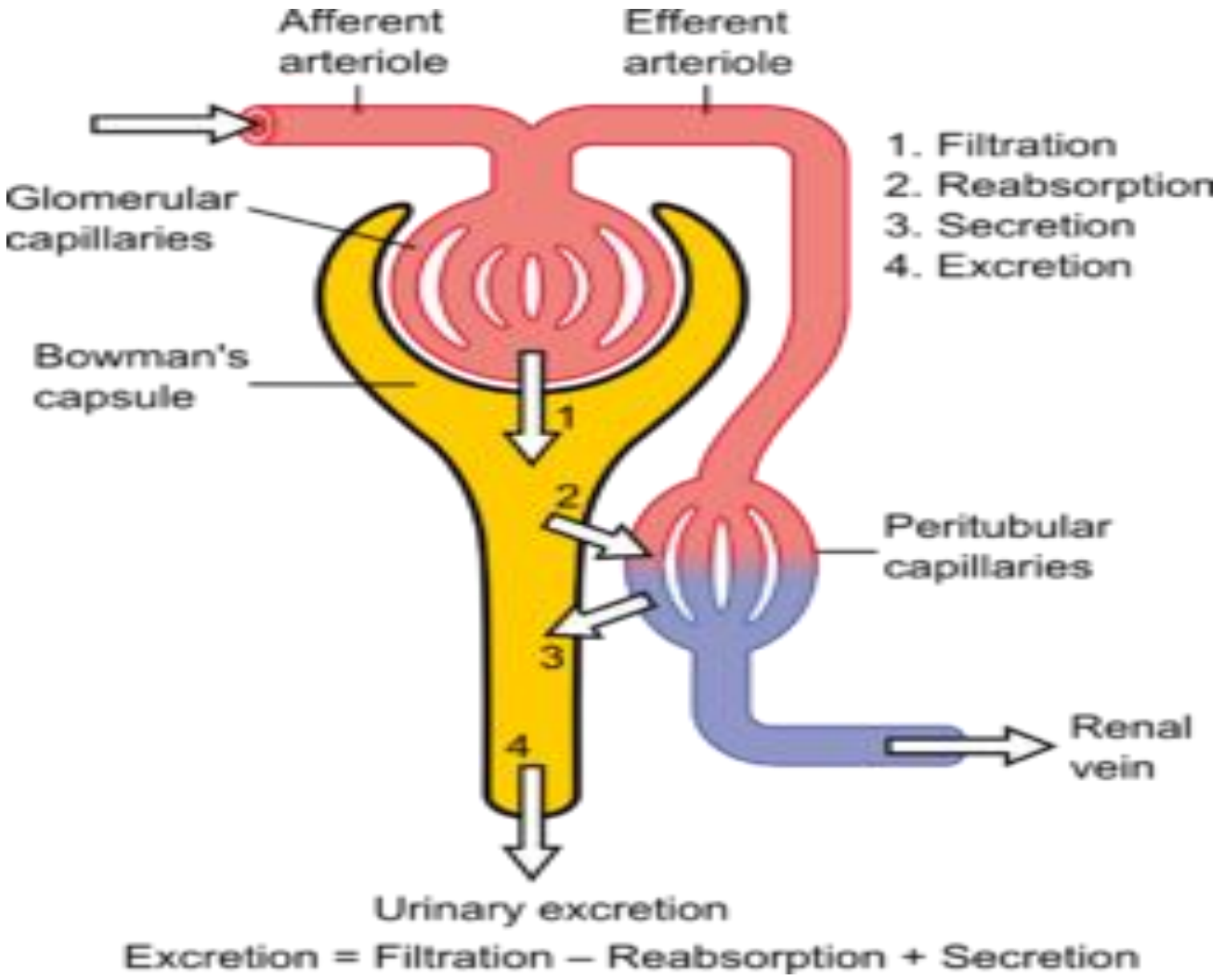
- The glomerulus and a renal tubule combine to form a unit called a **nephron**.



Blood enters the kidneys through **renal arteries**. These arteries branch into tiny capillaries that interact with urinary structures inside the kidneys (namely the **nephrons**).

Here the blood is **filtered**. Waste is removed and vital substances are reabsorbed back into the bloodstream. The filtered blood leaves through the renal veins.

All the blood in the body moves in and out of the kidneys hundreds of times each day—that's about 200 quarts of liquid to be filtered every 24 hours.



THANK YOU!