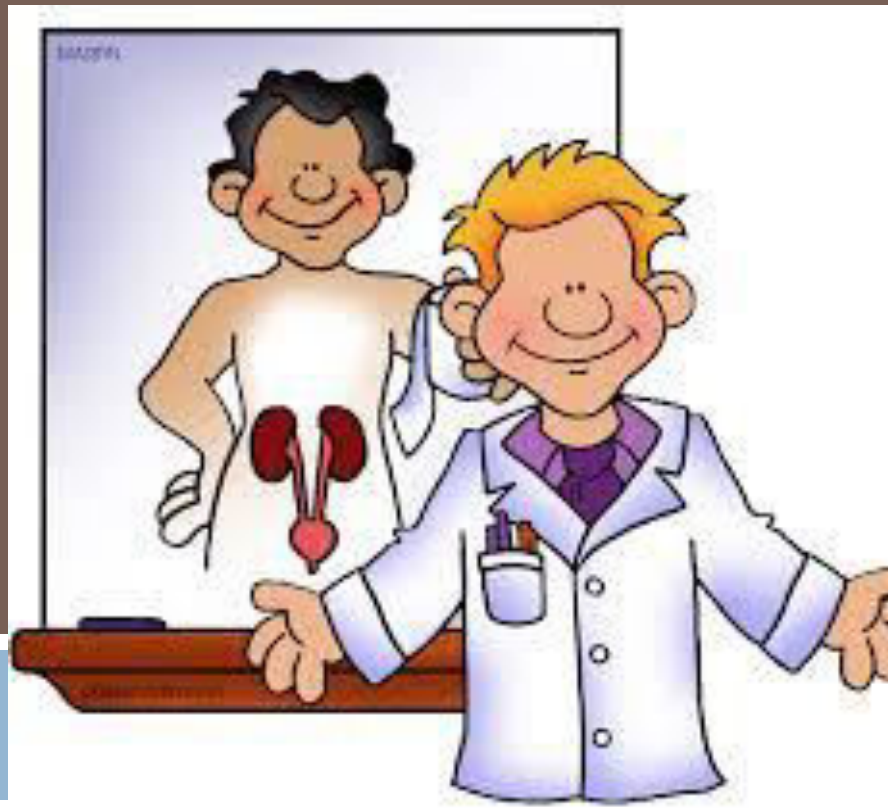
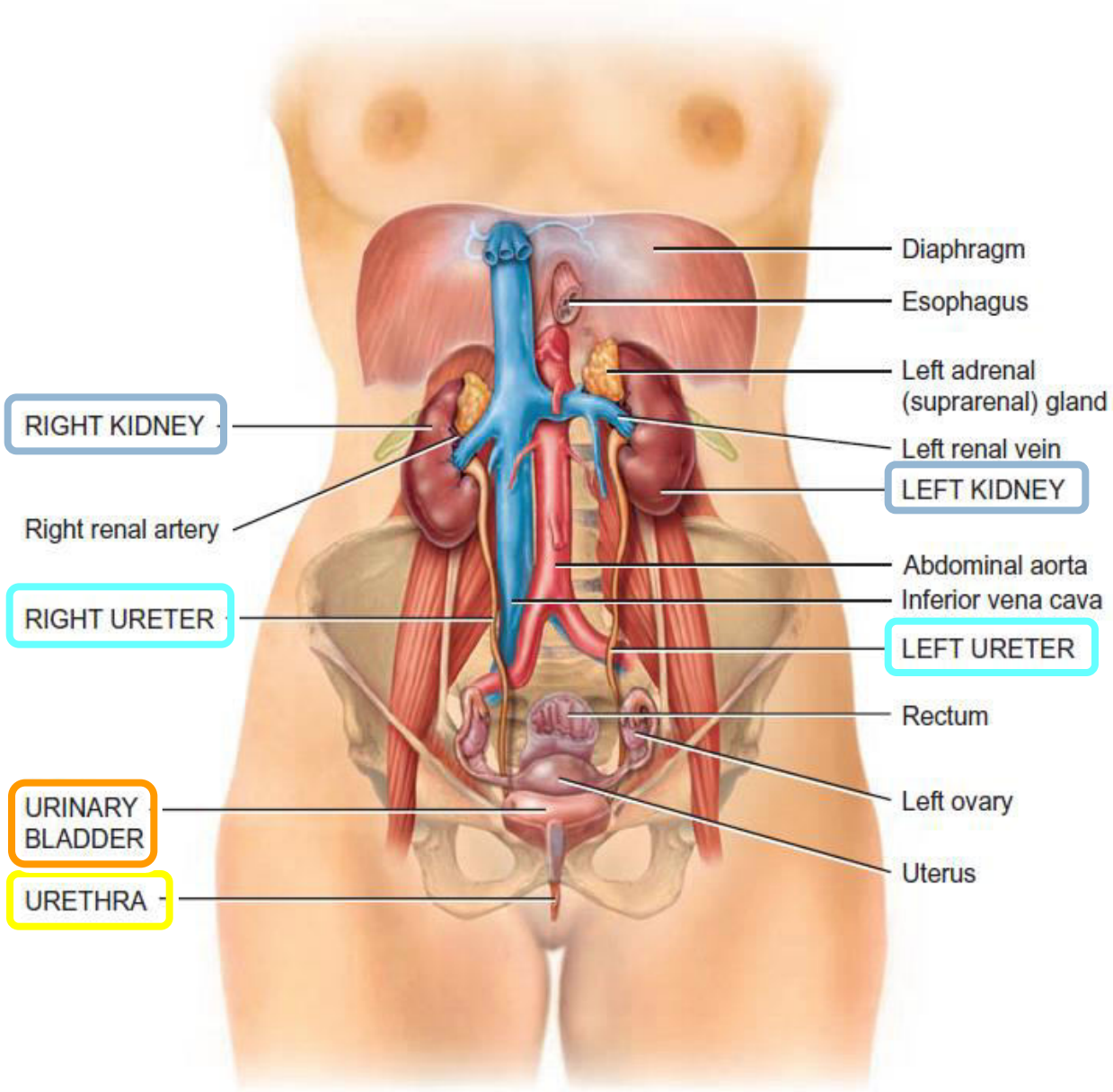
THE URINARY SYSTEM

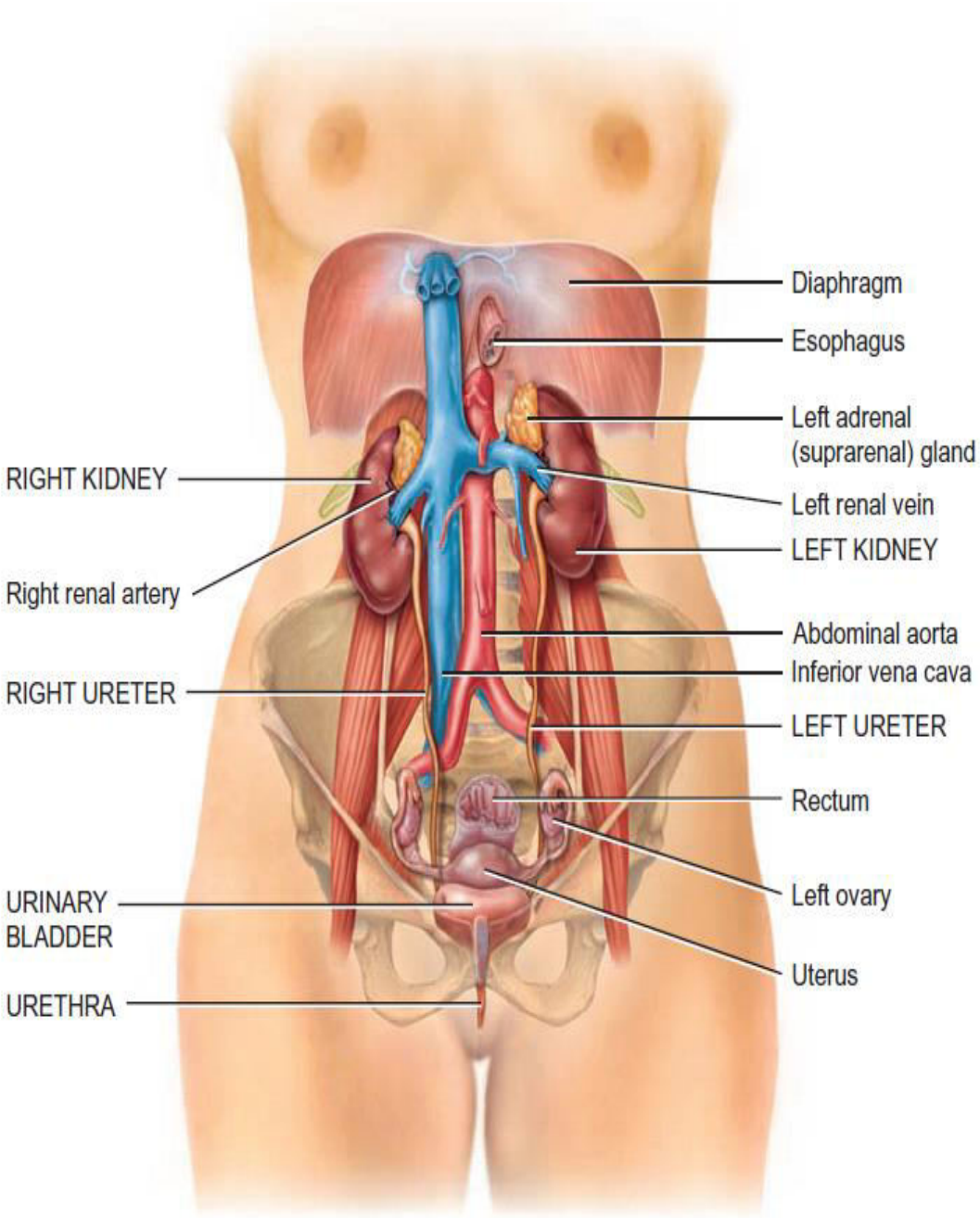


Dr. Wafaa Shunnaq



The **urinary system** consists of:

- ✓ two **kidneys,**
- ✓ two **ureters,**
- ✓ one **urinary bladder,** and
- ✓ one **urethra**

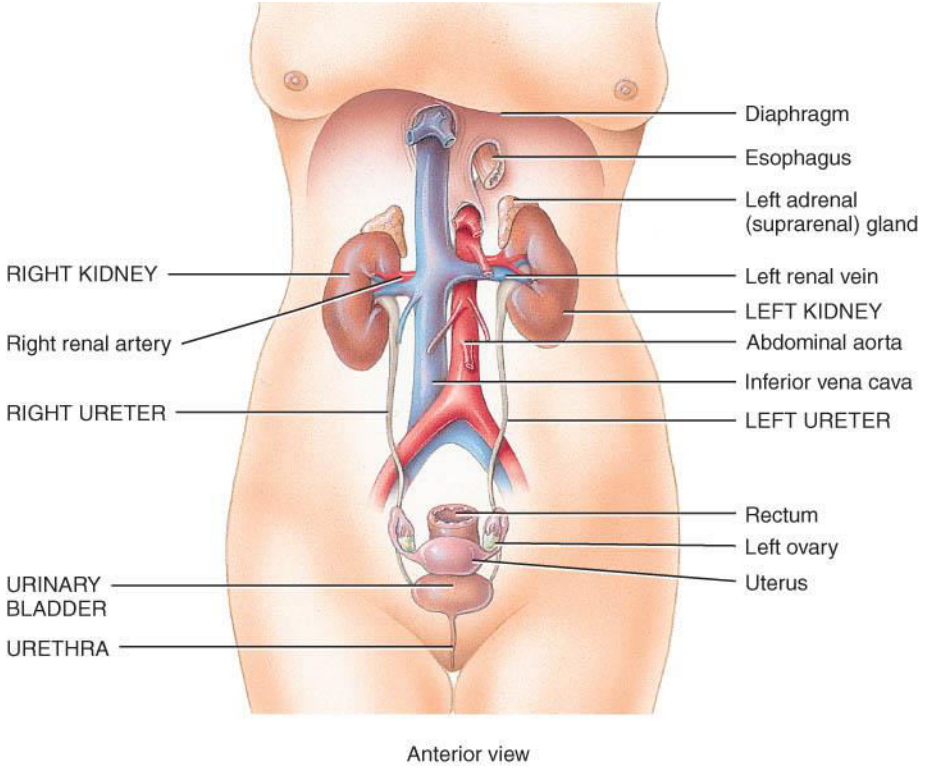


FUNCTIONS OF THE URINARY SYSTEM

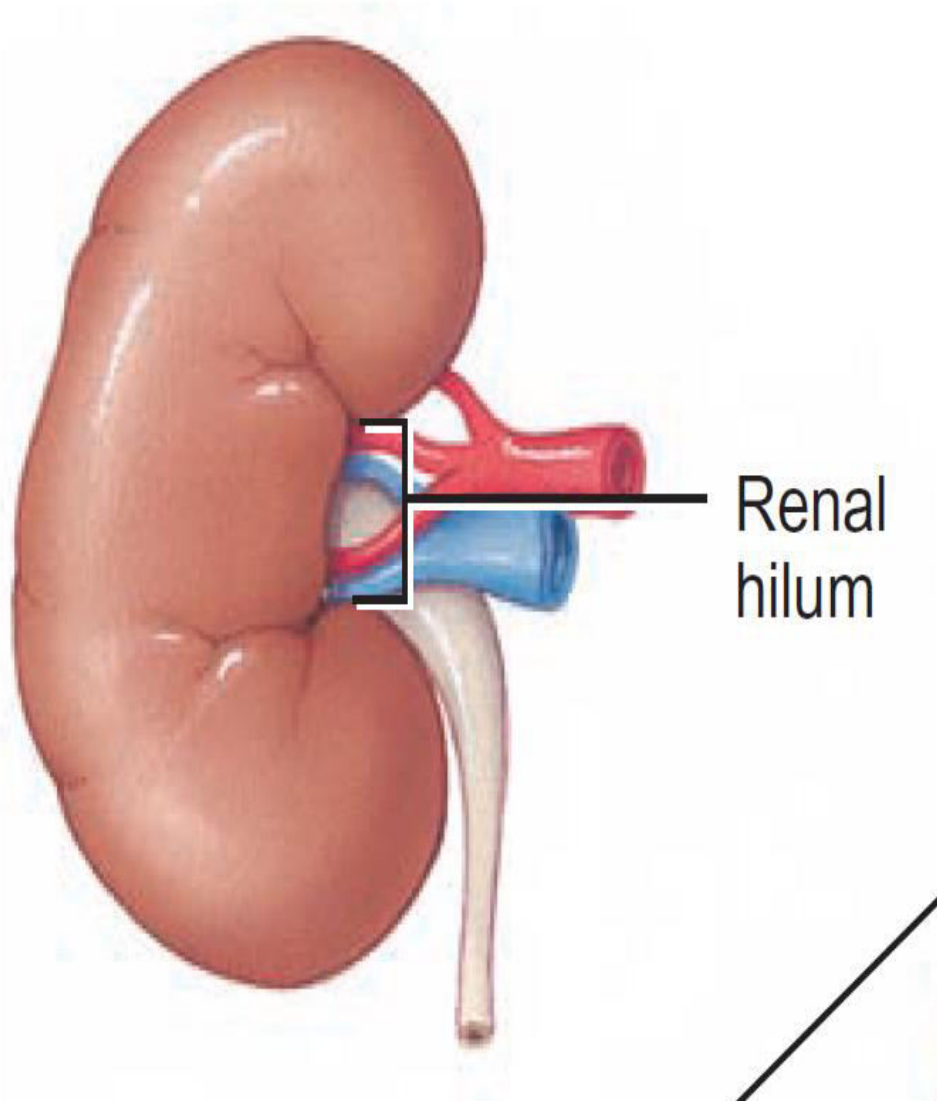
1. The kidneys regulate blood volume and composition; help regulate blood pressure, pH, and glucose levels; produce two hormones (calcitriol and erythropoietin); and excrete wastes in the urine.
2. The ureters transport urine from the kidneys to the urinary bladder.
3. The urinary bladder stores urine and expels it into the urethra.
4. The urethra discharges urine from the body.

External Anatomy of Kidney

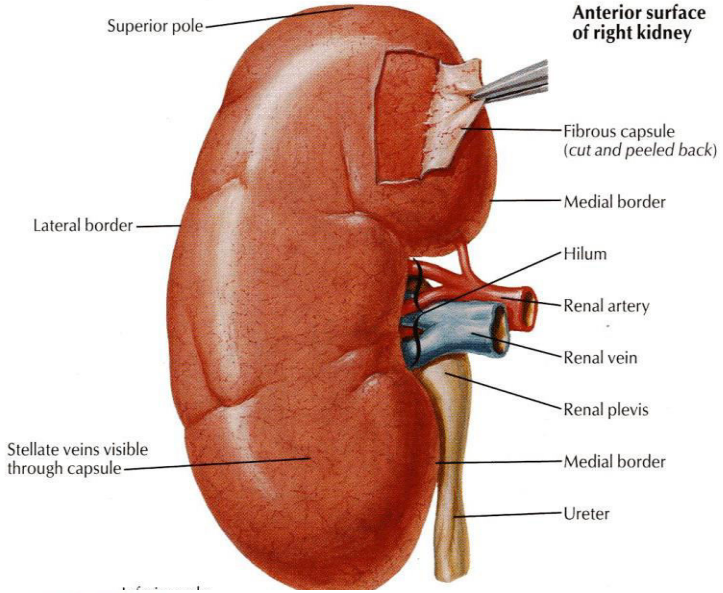
- Paired kidney-bean-shaped organ
- The paired *kidneys* are retroperitoneal organ.
- Found just above the waist between the peritoneum & posterior wall of abdomen
  - retroperitoneal (along with adrenal glands & ureters)
- Protected by 11th & 12th ribs with right kidney lower



Kidneys

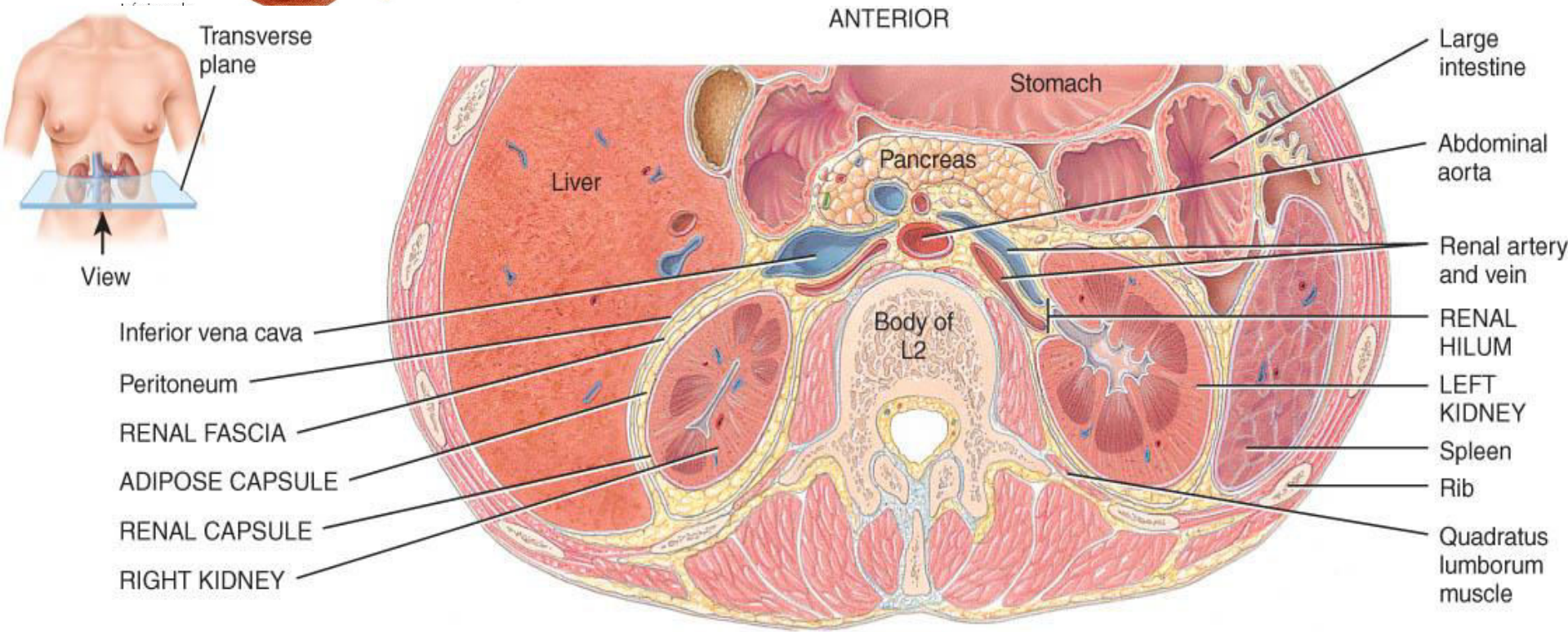


- An adult kidney is about 12 cm long, 6 cm wide, and 3 cm thick.
- It is convex laterally and has a medial indentation called the **renal hilum.**
- Several structures, including the ureters, the renal blood vessels, and nerves, enter or exit the kidney at the hilum.

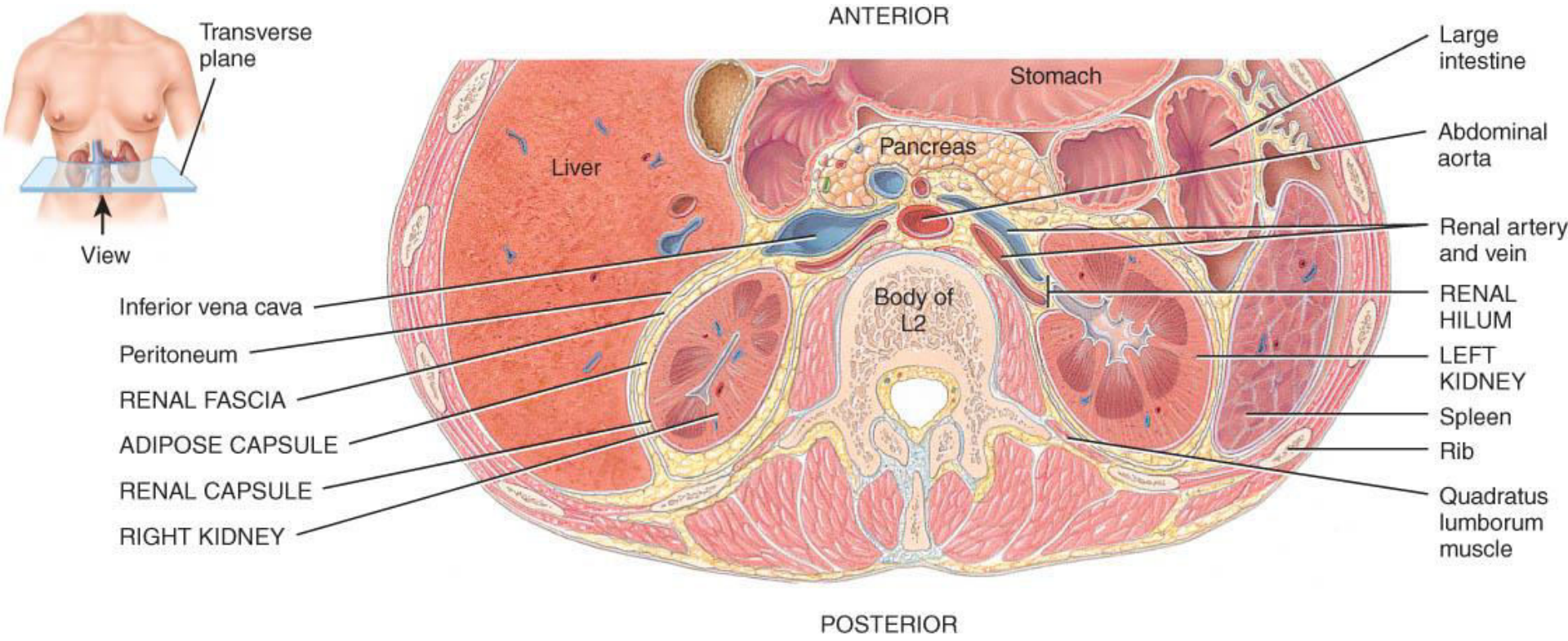


- Three layers of tissue surround each kidney.

1. Deep layer, **renal capsule.**
2. The middle layer, the **adipose capsule**, is a fatty mass which surrounds each kidney and helps hold it in place.
3. The superficial layer, the **renal fascia,** is that anchors the kidney to the surrounding structures.



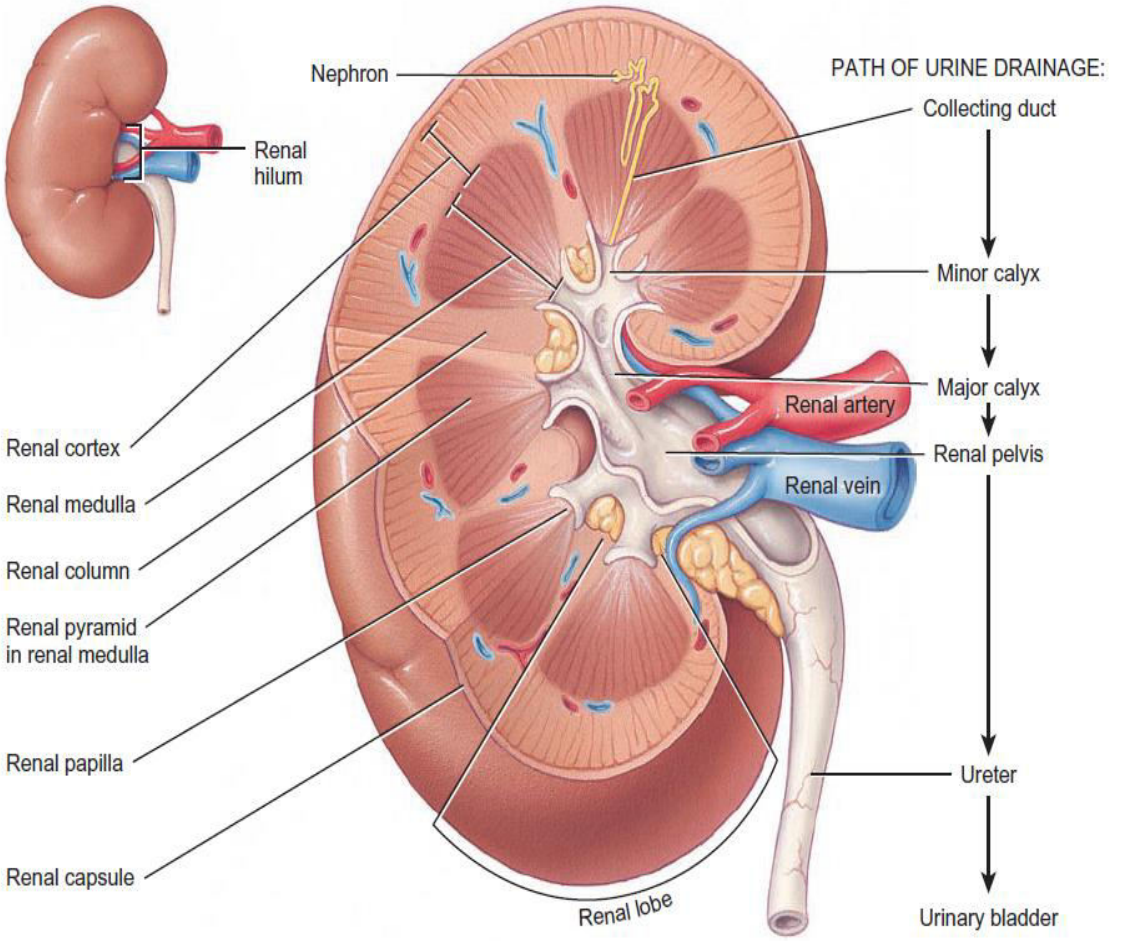
External Anatomy of Kidney



- Blood vessels & ureter enter hilus of kidney
- Renal capsule = transparent membrane maintains organ shape
- Adipose capsule that helps protect from trauma
- Renal fascia = dense, irregular connective tissue that holds against back body wall

Internal anatomy of Kidneys

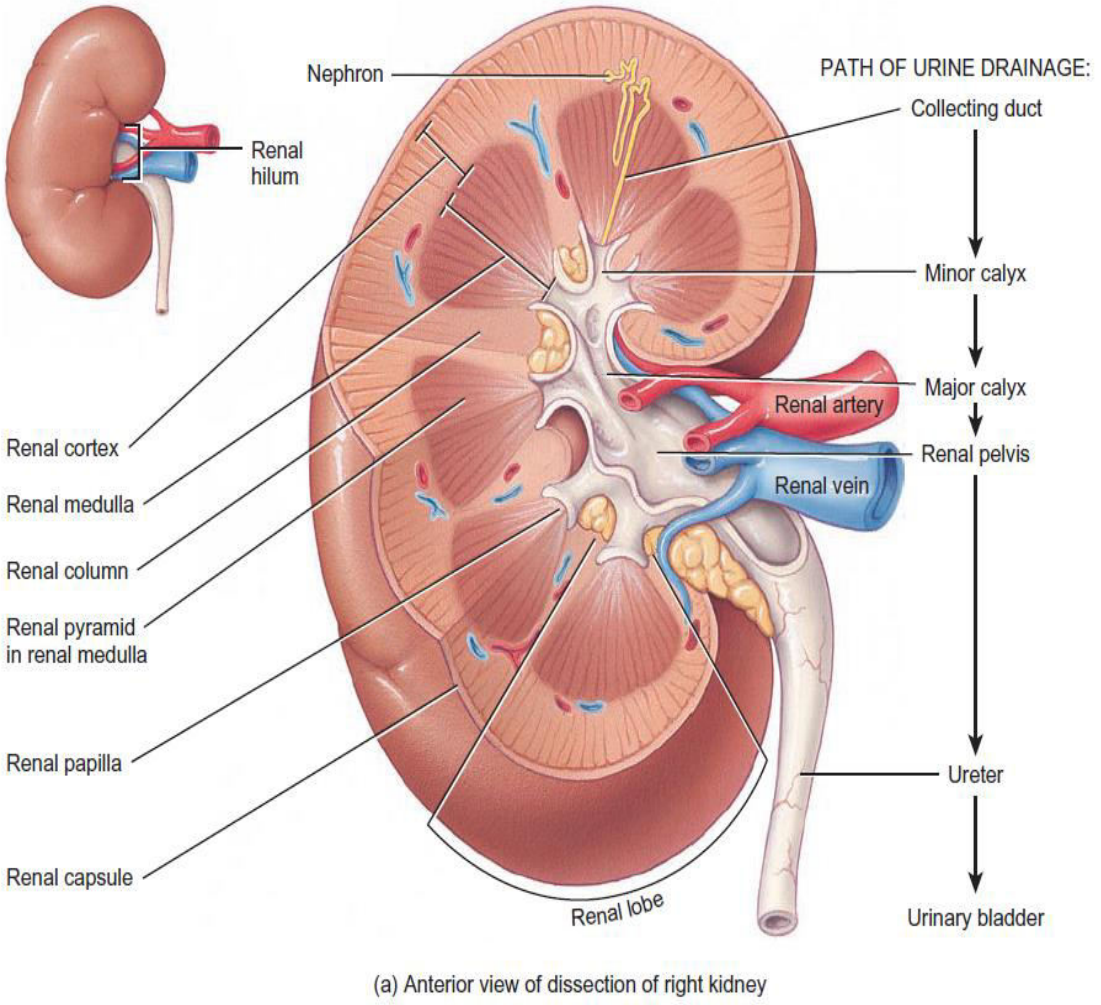
- two distinct regions:
- a superficial, light red area called the **renal cortex** and
- a deep, darker red-brown region called the **renal medulla.**
- The renal medulla consists of several cone-shaped **renal pyramids.**
- **The base** of each pyramid faces the renal cortex, and its **apex,** called a **renal papilla,** points toward the renal hilum.
- Those portions of the renal cortex that extend between renal pyramids are called **renal columns.**



(a) Anterior view of dissection of right kidney

Internal anatomy of Kidneys

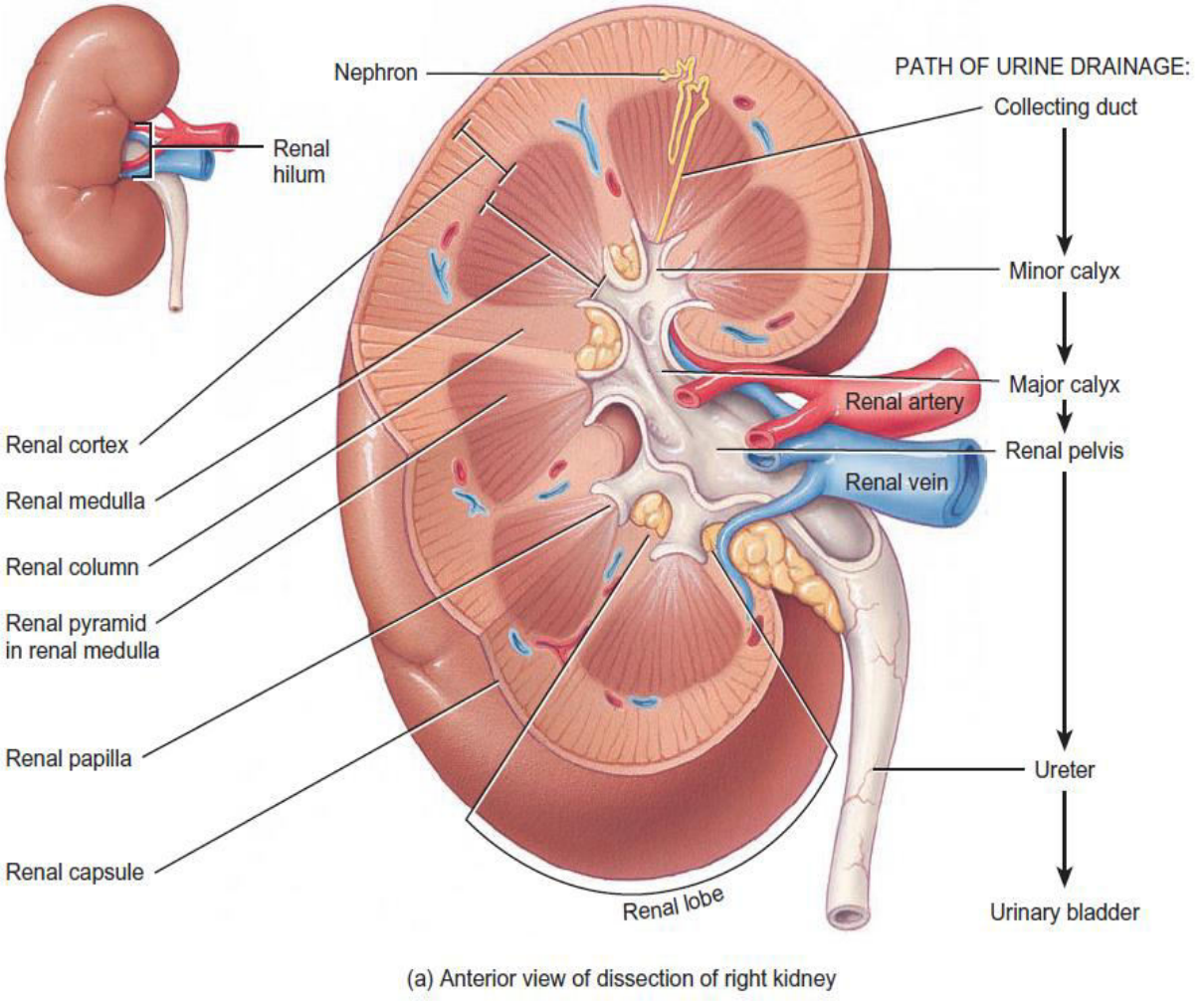
- The renal cortex and renal pyramids of the renal medulla constitute the **parenchyma** or functional portion of the kidney.
- Within the parenchyma are the functional units of the kidney—about 1 million microscopic structures called **nephrons.**



(a) Anterior view of dissection of right kidney

Internal anatomy of Kidneys

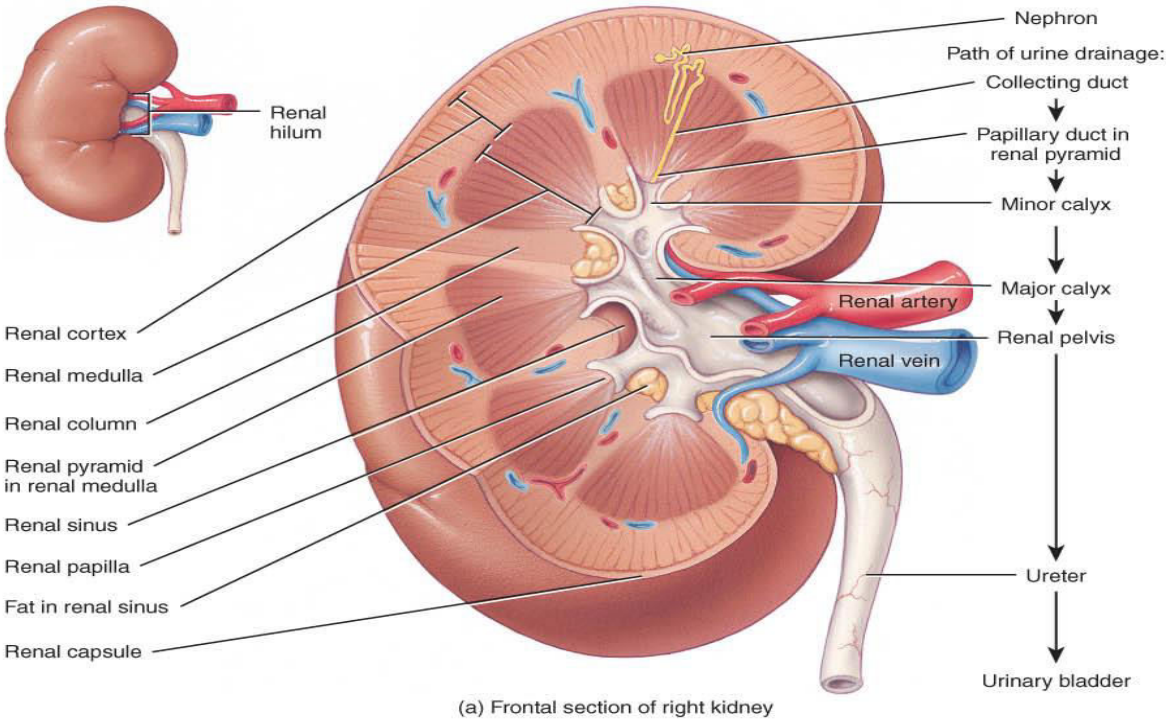
- Filtrate (filtered fluid) formed by the nephrons drains into large **collecting ducts,** which extend through the renal papillae of the pyramids.
- The papillary ducts drain into cuplike structures called **minor calyces** then to **major calyces.**
- From the major calyces, urine drains into a single large cavity called the **renal pelvis** and then out through the **ureter** to the **urinary bladder.**



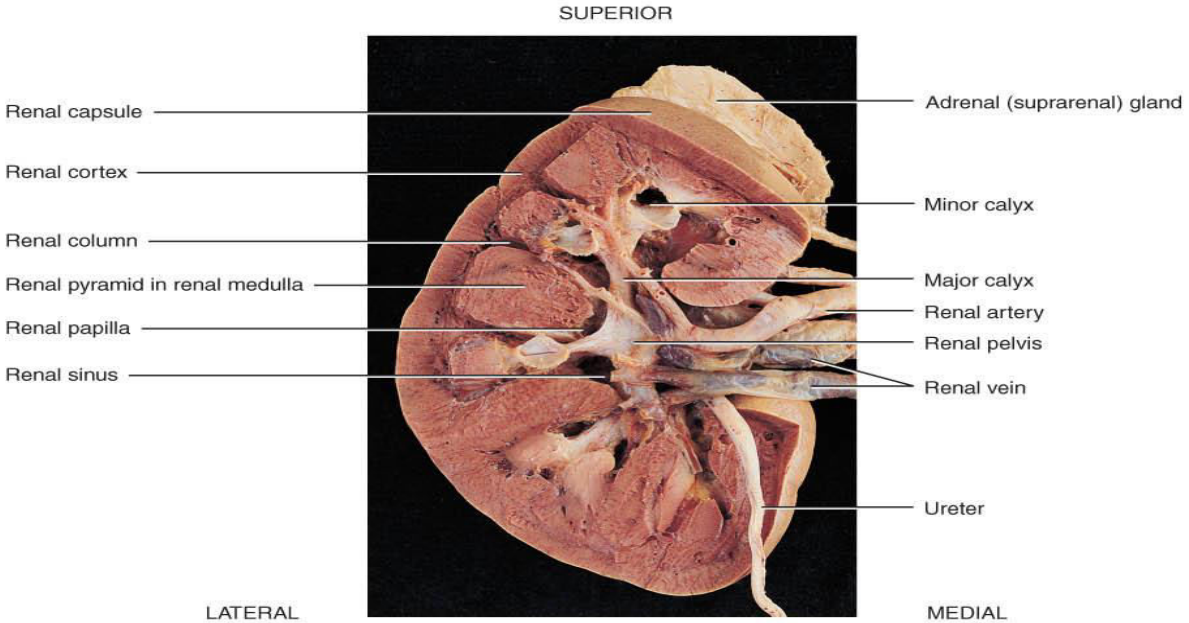
(a) Anterior view of dissection of right kidney

Internal Anatomy of the Kidneys

- Parenchyma of kidney
  1. renal cortex = superficial layer of kidney
  2. renal medulla
     - inner portion consisting of 8-18 cone-shaped renal pyramids separated by renal columns
     - **renal papilla** point toward center of kidney
- Path of urine drainage:
  - cuplike structure (minor calyces) collect urine from the papillary ducts of the papilla
  - minor empty into major calyces which empty into the renal pelvis which empties into the ureter



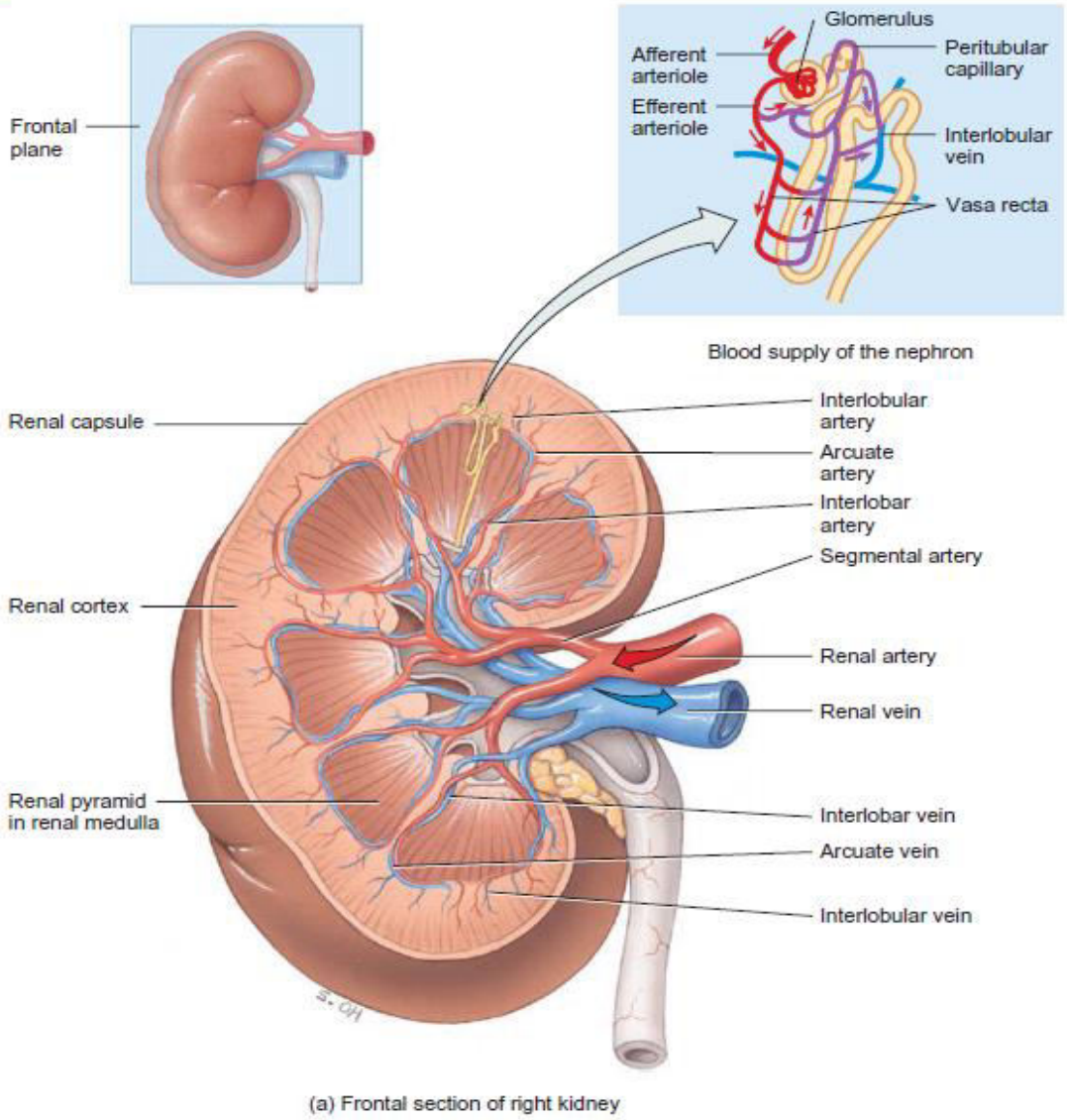
(a) Frontal section of right kidney



(b) Frontal section of right kidney

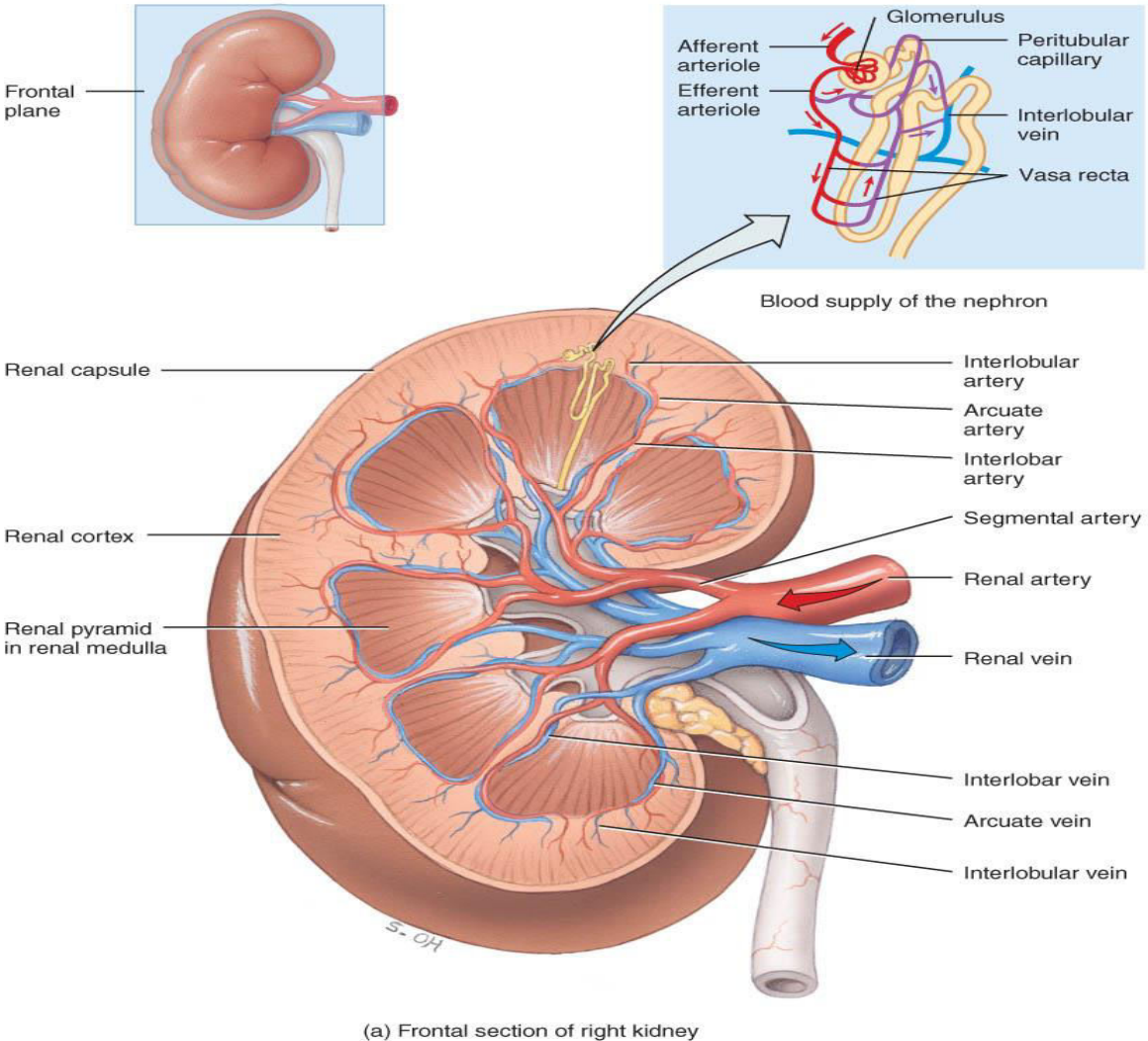
BLOOD SUPPLY OF THE KIDNEYS

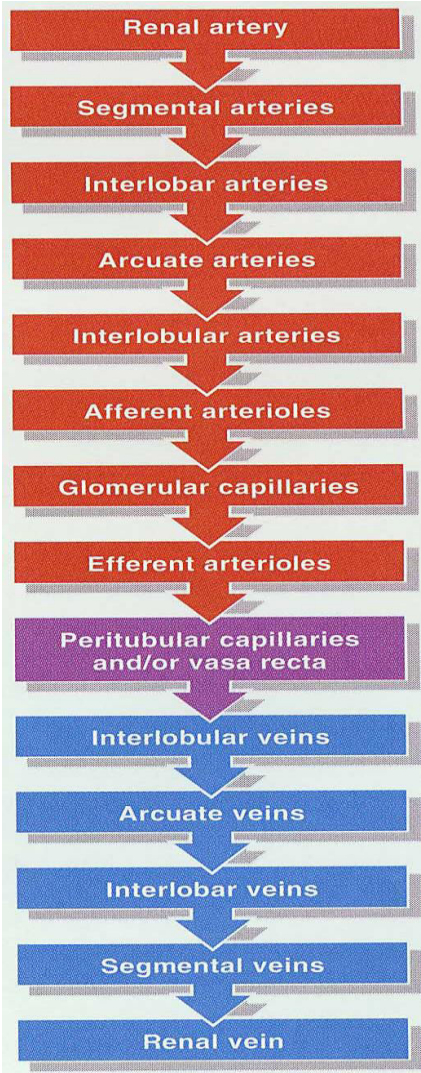
- Within the kidney, the **renal artery** divides into several **segmental arteries**.
- Each segmental artery gives off several branches that enter the parenchyma and pass through the renal columns between the lobes of the kidneys as the **interlobar arteries.**
- At the bases of the renal pyramids, the interlobar arteries arch between the renal medulla and cortex; here they are known as the **arcuate arteries.**
- Divisions of the arcuate arteries produce a series of **interlobular arteries.**



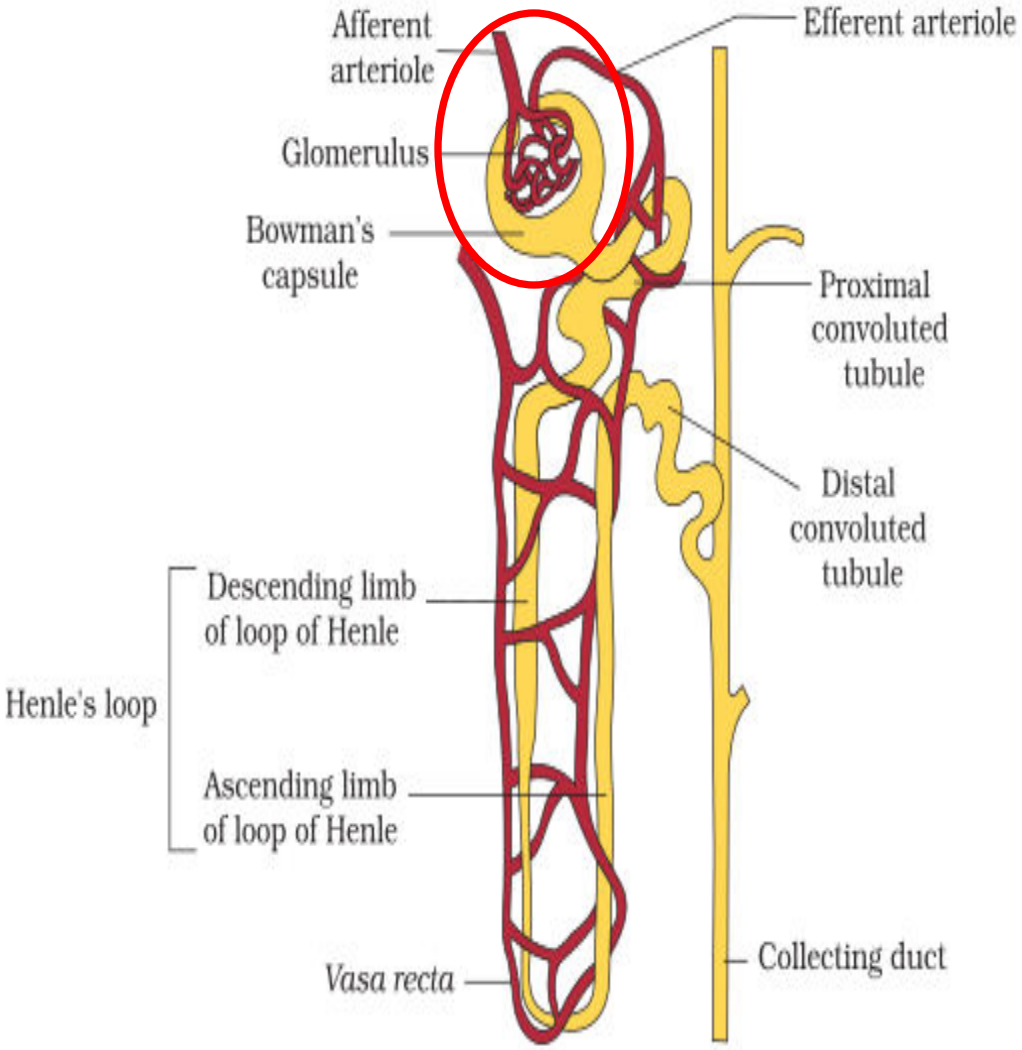
Blood Supply of the Kidneys

- Blood enters the kidney through the renal artery and exits via the renal vein.





The Nephron



Kidney has over 1 million nephrons composed of a corpuscle and tubule

Renal corpuscle = site of plasma filtration

- glomerulus is capillaries where filtration occurs
- glomerular (Bowman's) capsule is cup that collects filtrate

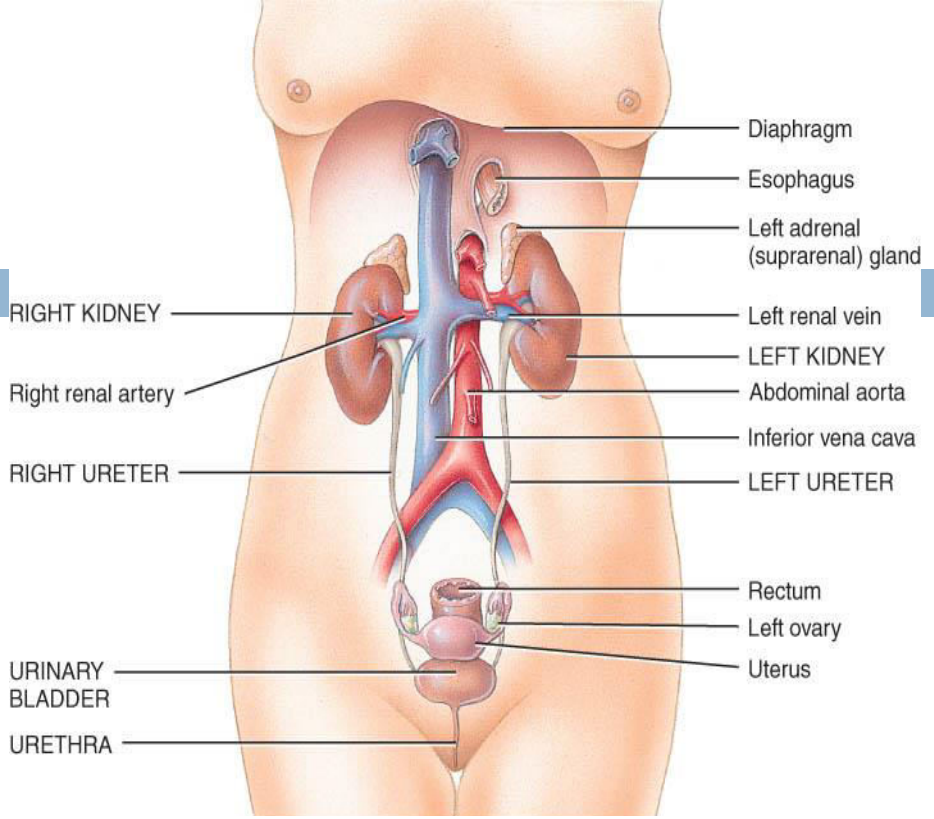
Renal tubule

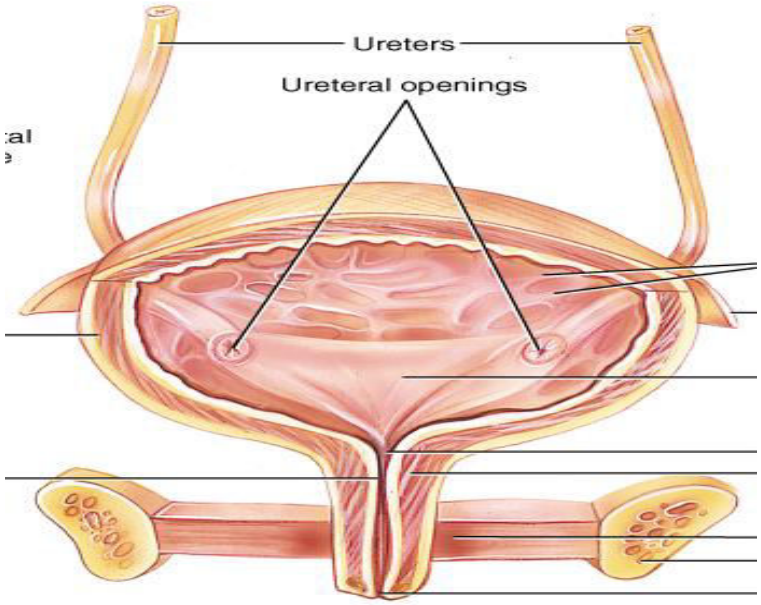
- proximal convoluted tubule
- loop of Henle
- distal convoluted tubule

Collecting ducts and papillary ducts drain urine to the renal pelvis and ureter.

Ureters

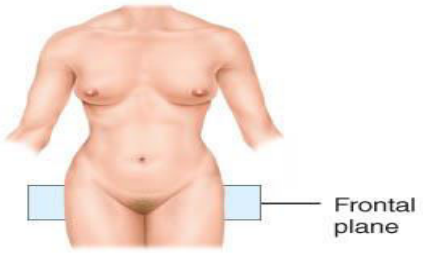
- Each of the two *ureters* connects the renal pelvis of one kidney to the urinary bladder.
- The ureters transport urine from the renal pelvis to the urinary bladder, primarily by peristalsis, but hydrostatic pressure and gravity also contribute.
- The ureters are retroperitoneal.
- 25–30 cm long
- diameter from 1-10 mm
- Extends from renal pelvis to bladder
- Enters posterior wall of bladder

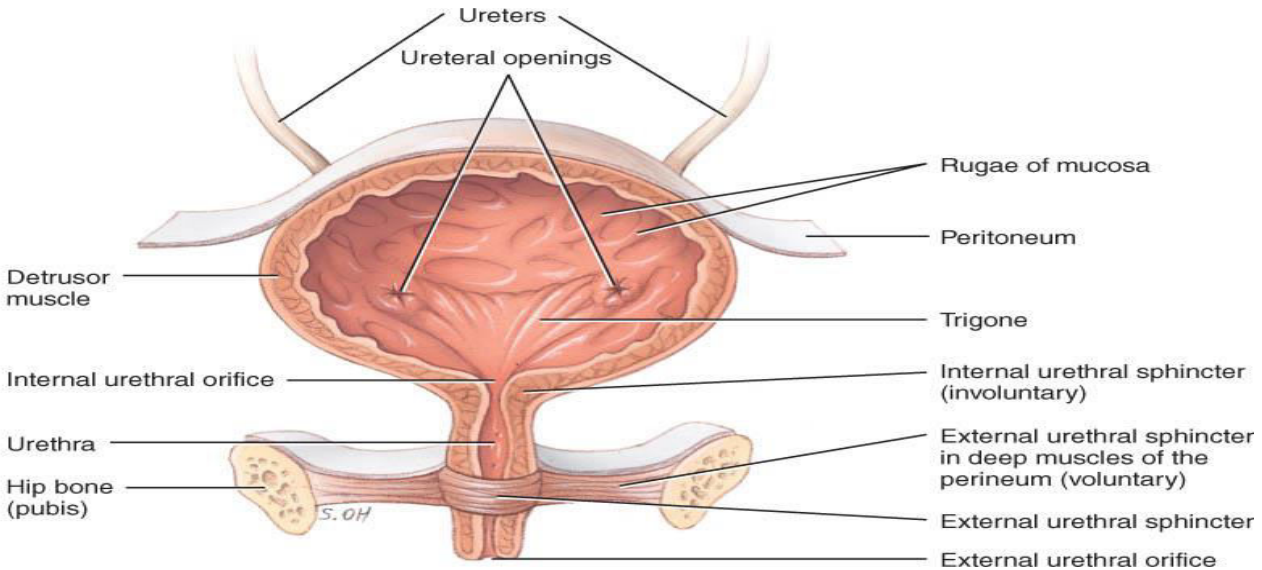




Urinary Bladder

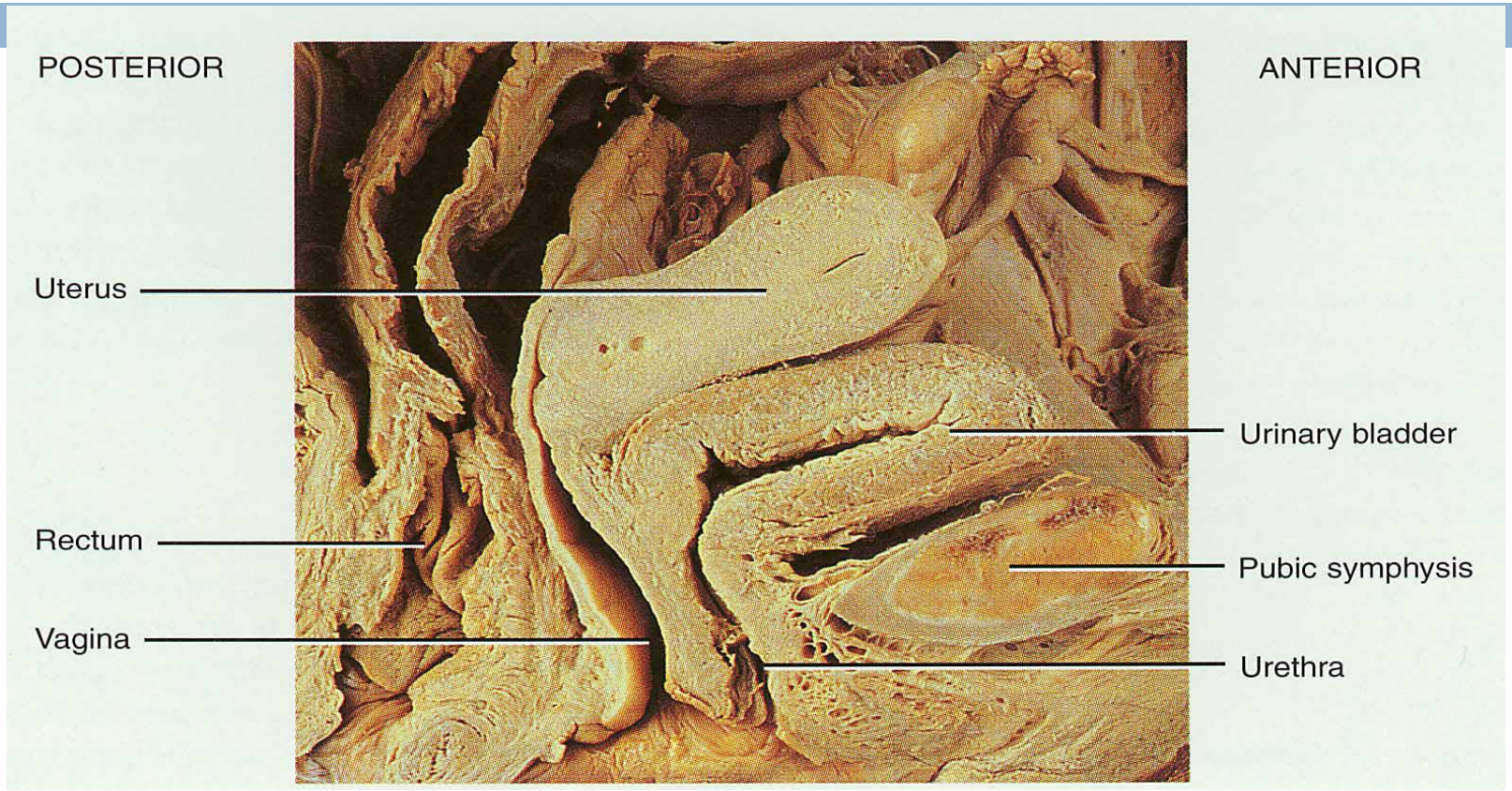
- The *urinary bladder* is a hollow muscular organ situated in the pelvic cavity posterior to the pubic symphysis.
- In the floor of the urinary bladder is a small, smooth triangular area, the *trigone*. The ureters enter the urinary bladder near two posterior points in the triangle; the urethra drains the urinary bladder from the anterior point of the triangle.





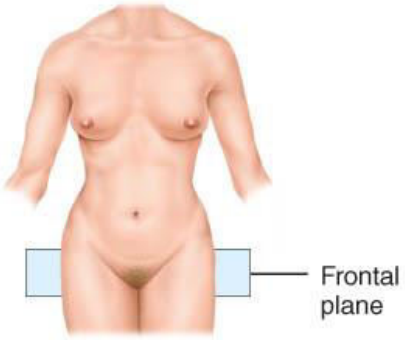
Anterior view of frontal section

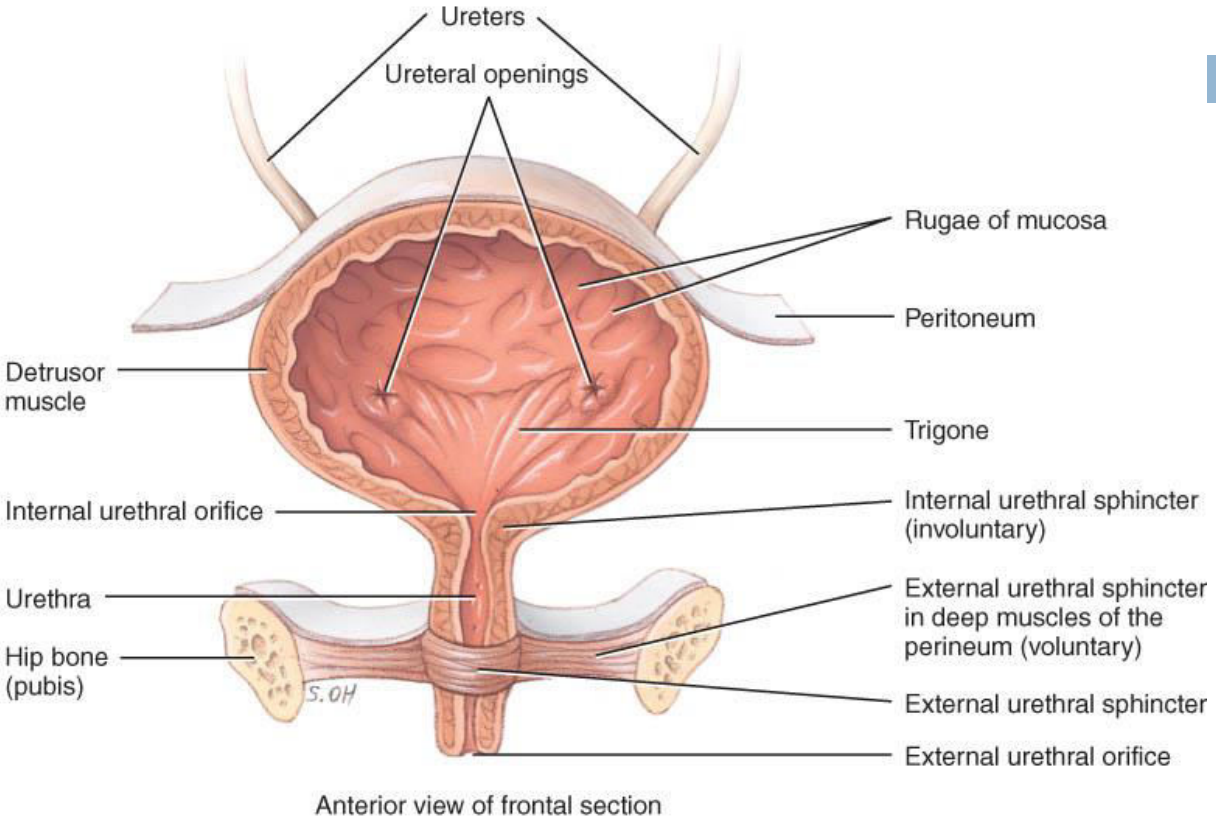
Location of Urinary Bladder



- Posterior to pubic symphysis
- In females is anterior to vagina & inferior to uterus
- In males lies anterior to rectum

Anatomy of Urinary Bladder



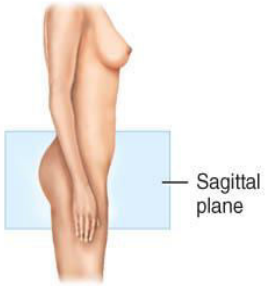


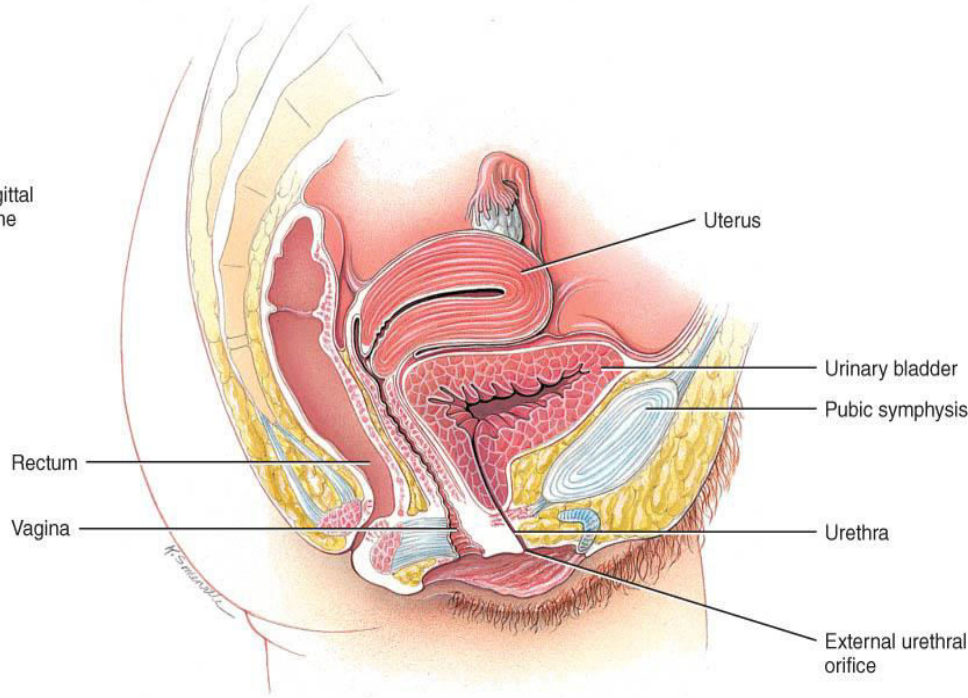
Anterior view of frontal section

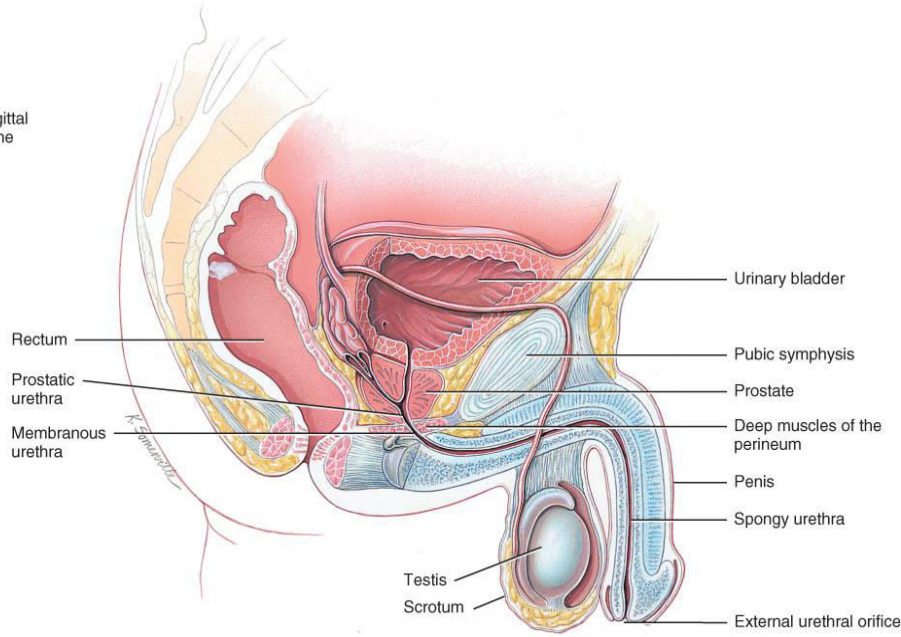
- Hollow, distensible muscular organ with capacity of 700 - 800 mL
- Trigone is smooth flat area bordered by 2 ureteral openings and one urethral opening

Anatomy of the Urethra

- Females
  - length of 4cm., orifice between clitoris & vagina
- Males
  - tube passes through prostate, UG diaphragm & penis about 20cm
  - 3 regions of urethra
    - prostatic urethra, membranous urethra & spongy urethra







(b) Sagittal section