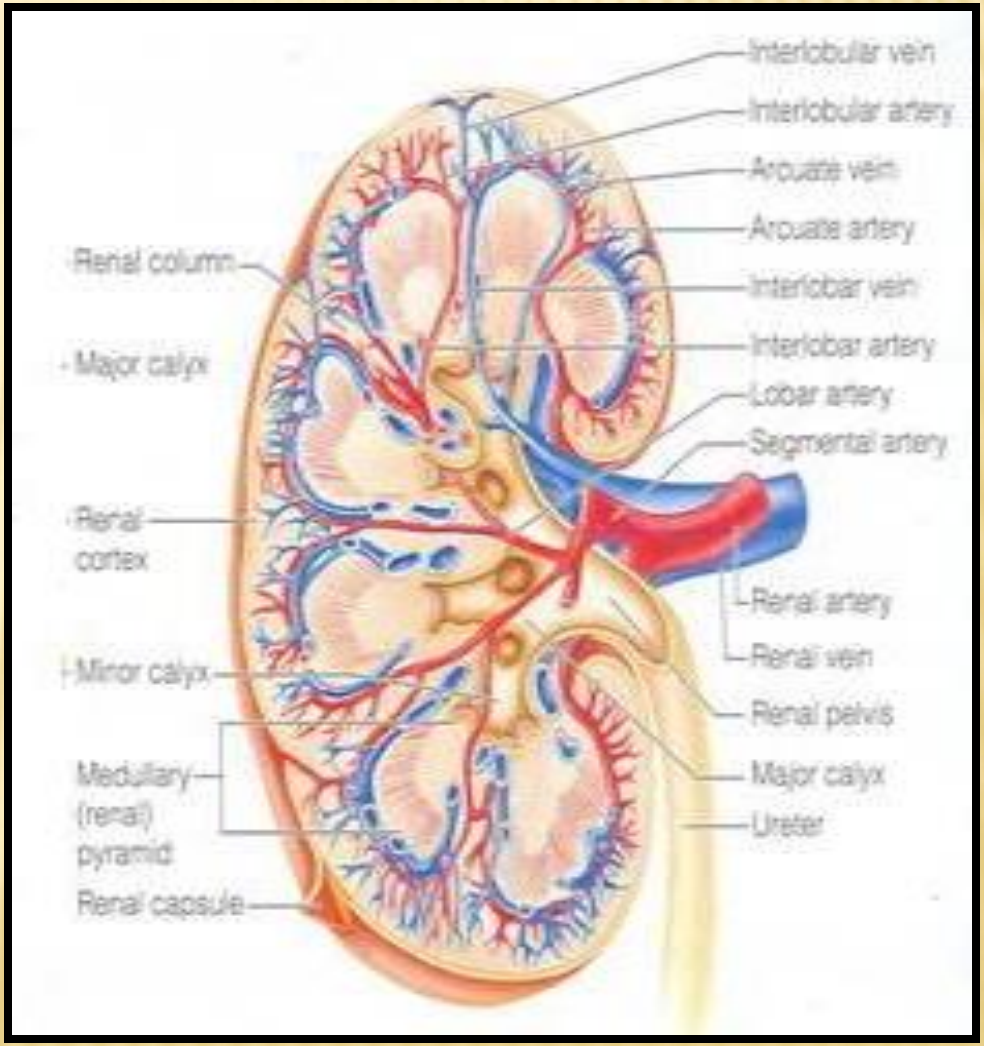
ANATOMY OF KIDNEYS

Dr Jamila EL Medany

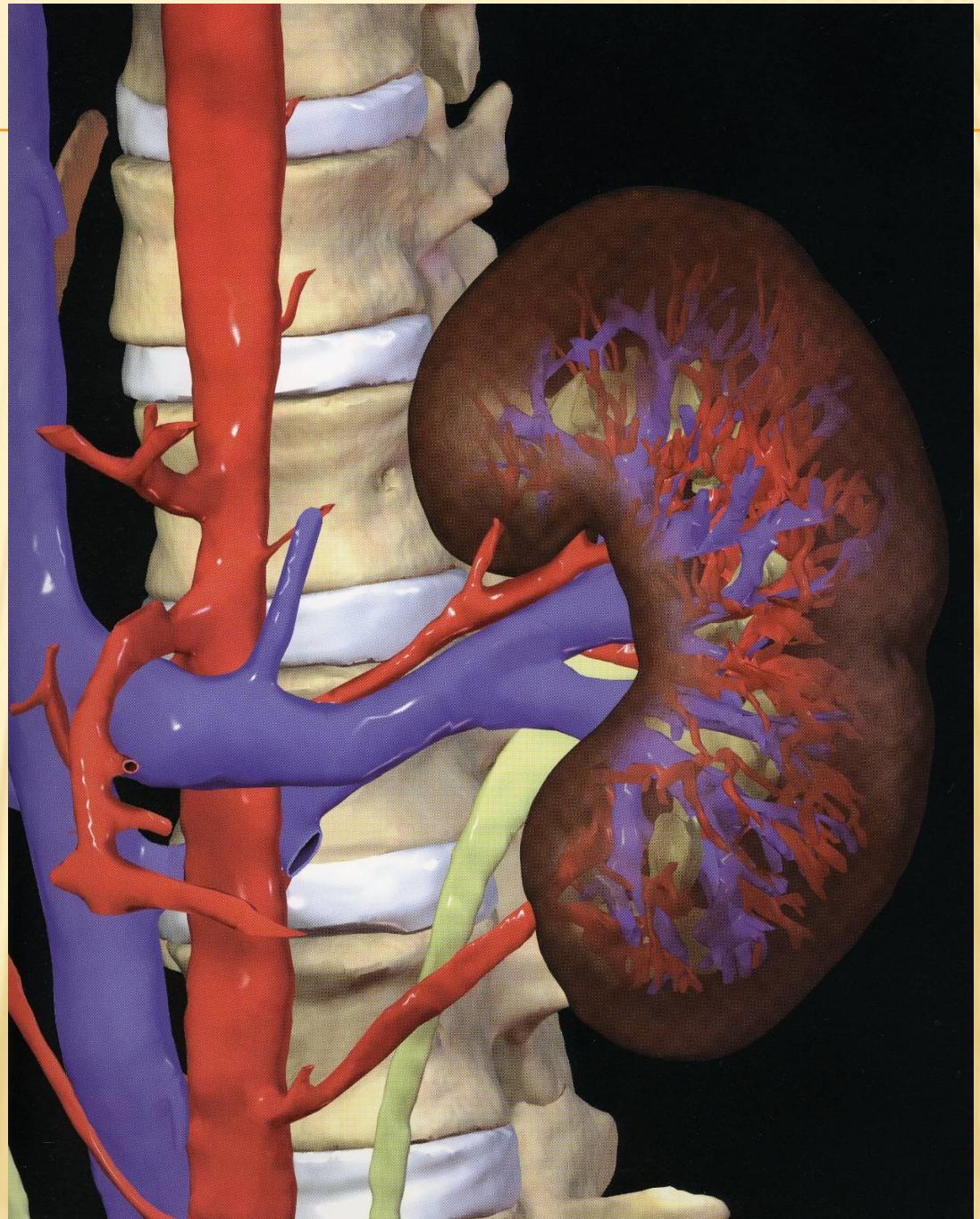
Objectives

- By the end of this course you should be able to discuss :
- COMPONENTS OF THE
- URINARY SYSTEM.
- *KIDNEY:*
- SHAPE & POSITION.
- SURFACE ANATOMY.
- EXTERNAL FEATURES.
- HILUM and its CONTENTS.
- RELATIONS.
- *INTERNAL STRUCTURE.*
- *BLOOD SUPPLY*
- *LYMPH DRAINAGE..*
- *NERVE SUPPLY.*



INTRODUCTION

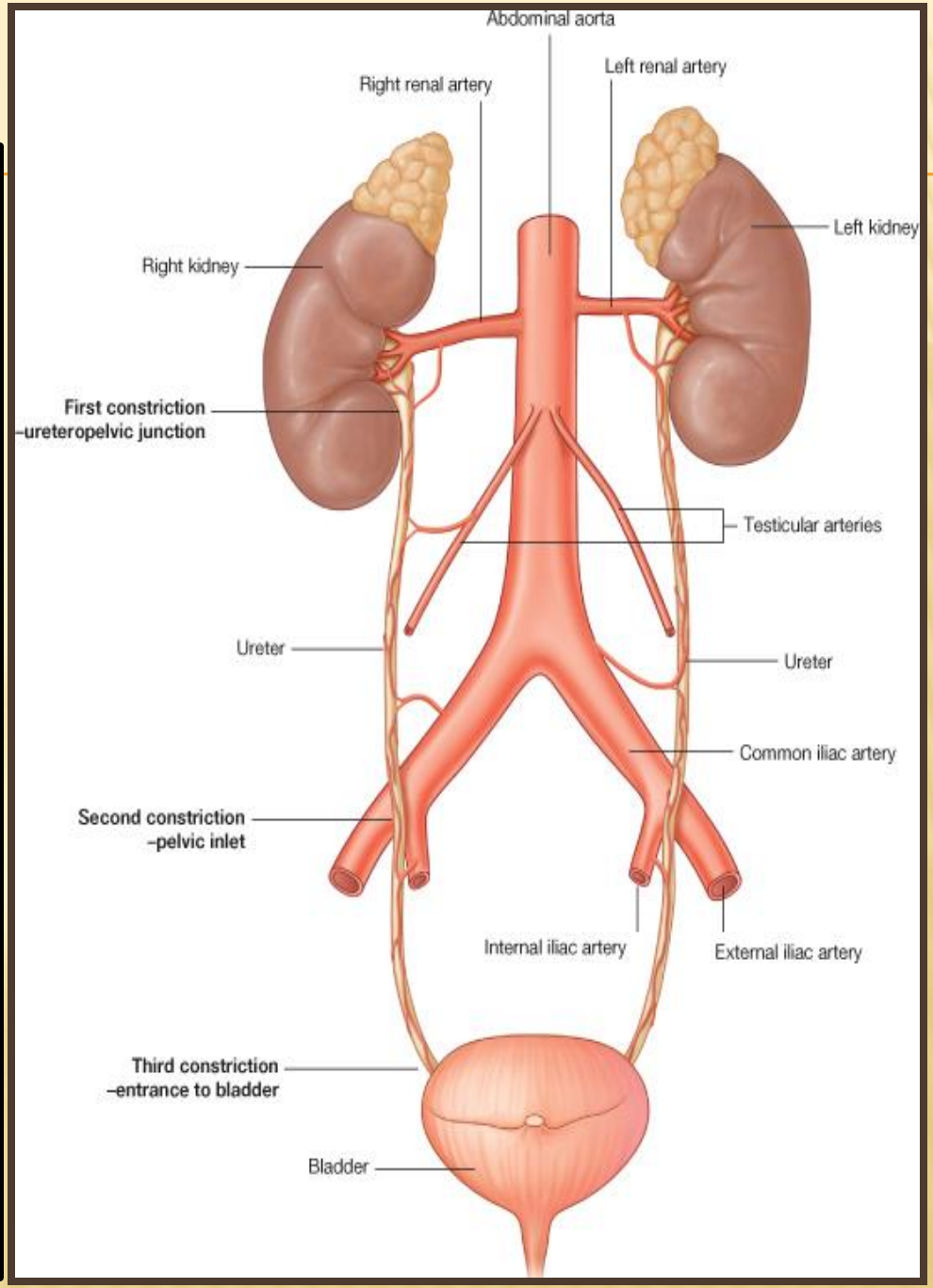
- Every day, each kidney filters liters of fluid from the bloodstream.
- Although the lungs and the skin also play roles in excretion, the kidneys bear the major responsibility for eliminating nitrogenous (nitrogen-containing) wastes, toxins, and drugs from the body.



KIDNEY

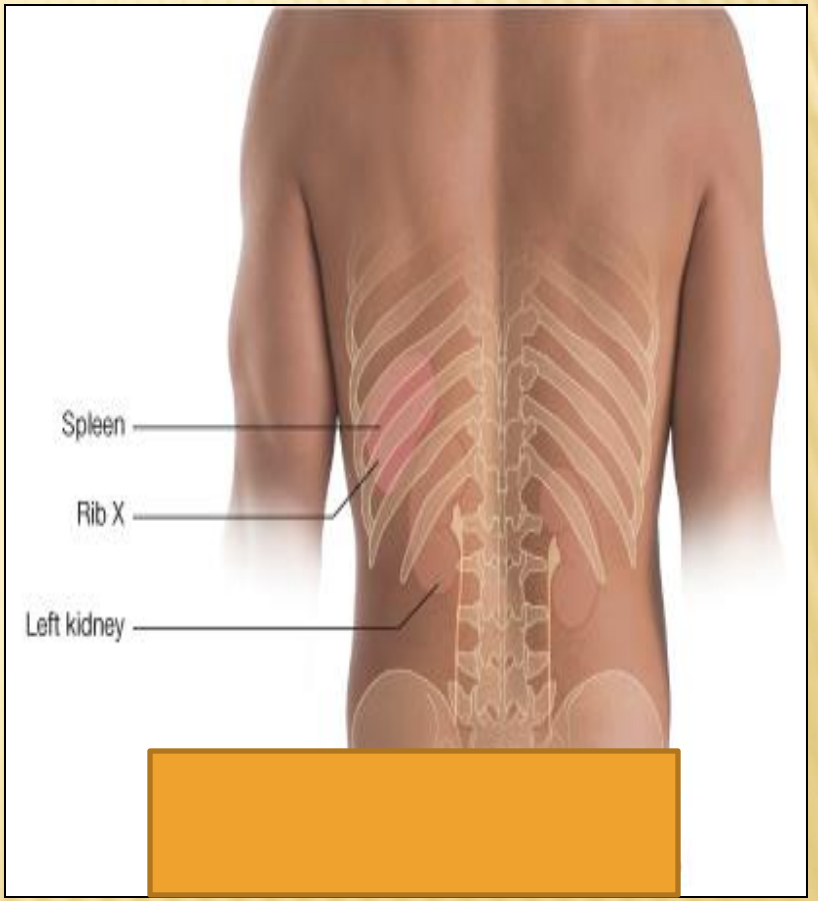
- **Functions:**

1. **Excretes** most of the waste products of metabolism.
2. **Controls** water & electrolyte balance of the body.
3. **Maintain** acid-base balance of the blood.
4. **Erythropoietin** hormone stimulates bone marrow for RBCs formation.
5. **Rennin** enzyme regulates the blood pressure.
6. **Converts** vitamin D to its active form.



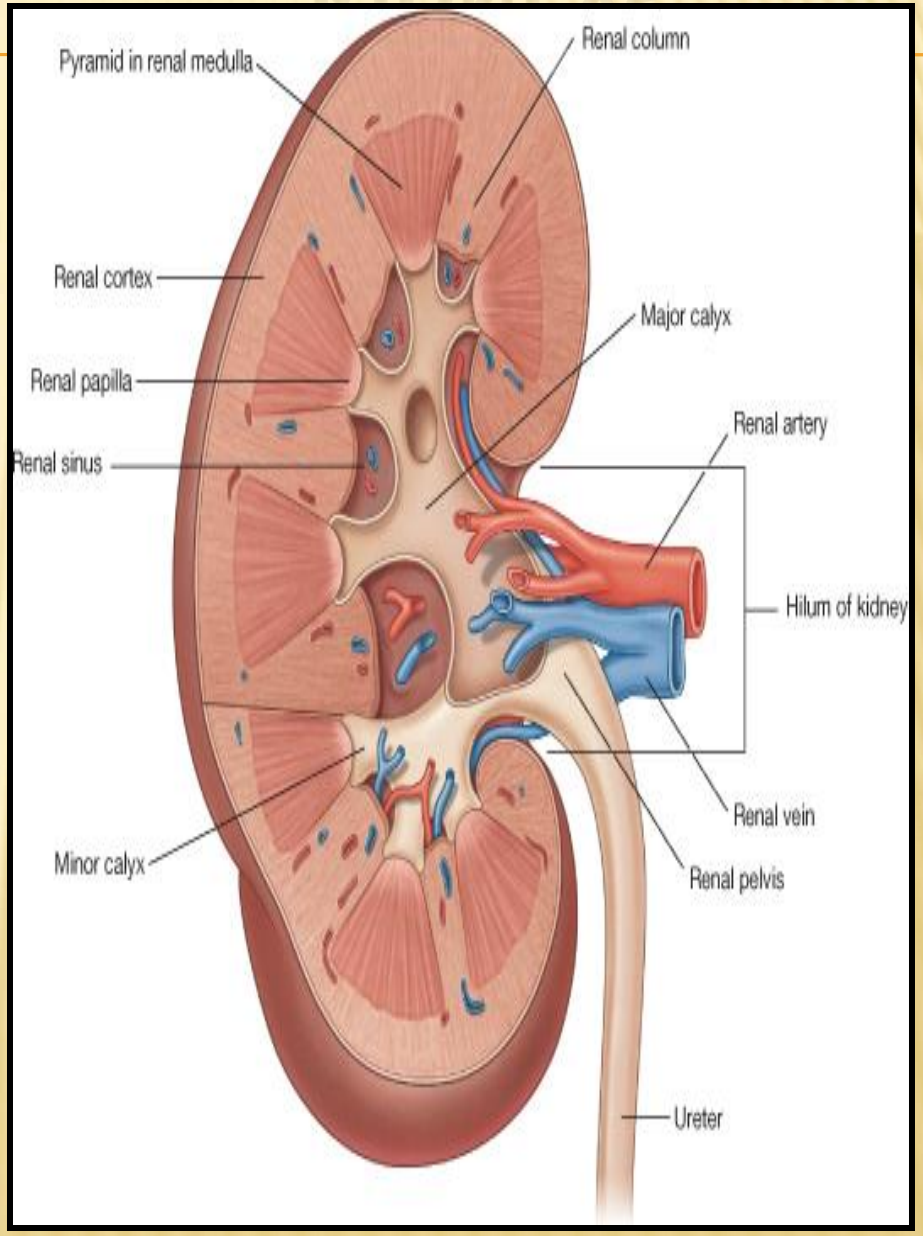
KIDNEY

- Kidneys are reddish brown in color.
- Lie behind the peritoneum on the posterior abdominal wall on either side of the vertebral column.
- They are largely under cover of the costal margin.
- The right kidney lies slightly lower than the left due to the large size of the right lobe of the liver.
- The upper border of the right kidney is at the level of 11^{th} intercostal space.
- **The upper border of the left kidney is at the level of 11^{th} rib**



KIDNEYS

- With contraction of the diaphragm the kidney moves downward as much as 2.5 cm.
- The lateral border is convex, while the medial border is convex at both ends but its middle pat shows a vertical slit called the **hilum.**
- The hilum extends into a large cavity called the **renal sinus.**
- The hilum transmits the renal **vein**, two branches of renal **artery,** ureter, and the third branch of renal **artery** from the front backward **(V.A.U.A.)**



COVERINGS

- 1- **Fibrous capsule:**

  It surrounds the kidney.

- 2- **Perirenal (perinephric) fat :**

  It covers the fibrous capsule

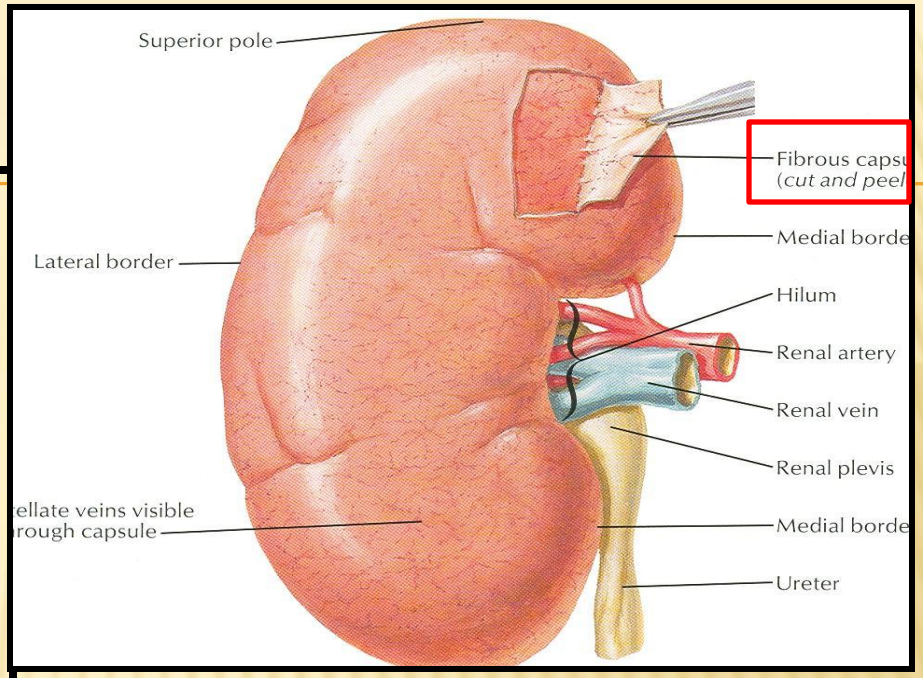
- 3- **Renal fascia:**

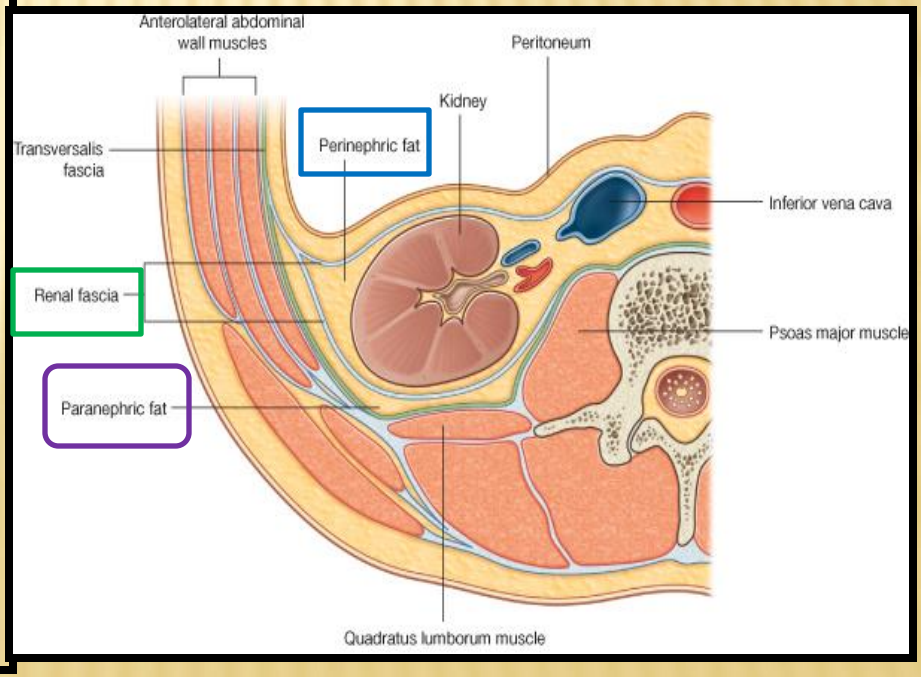
It encloses the kidneys and suprarenal glands.

- 4- **Pararenal (paranephric) fat :**

It lies external to the renal fascia, and forms part of the retroperitoneal fat.

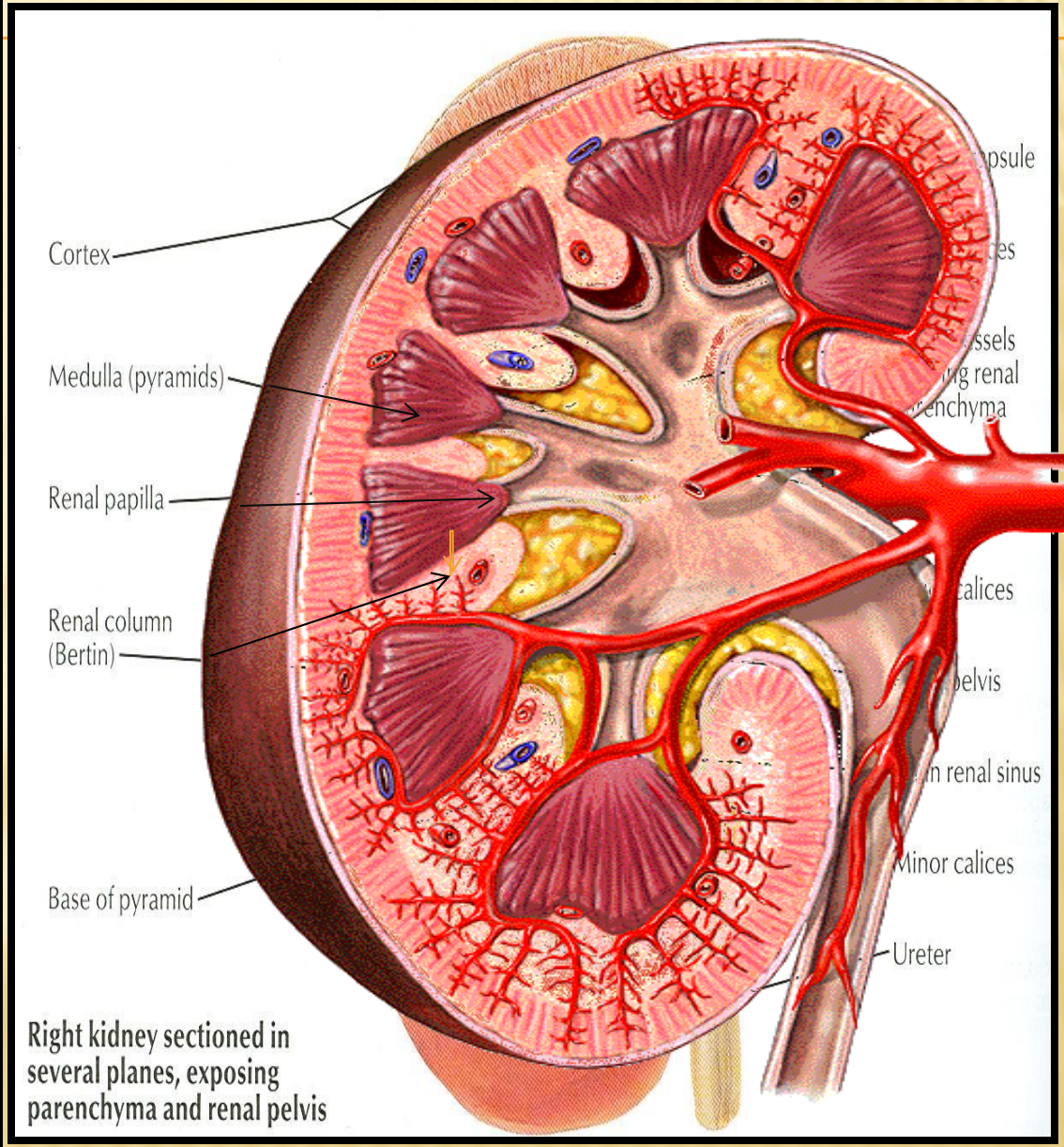
N.B. The last 3 structures support the kidney in position.





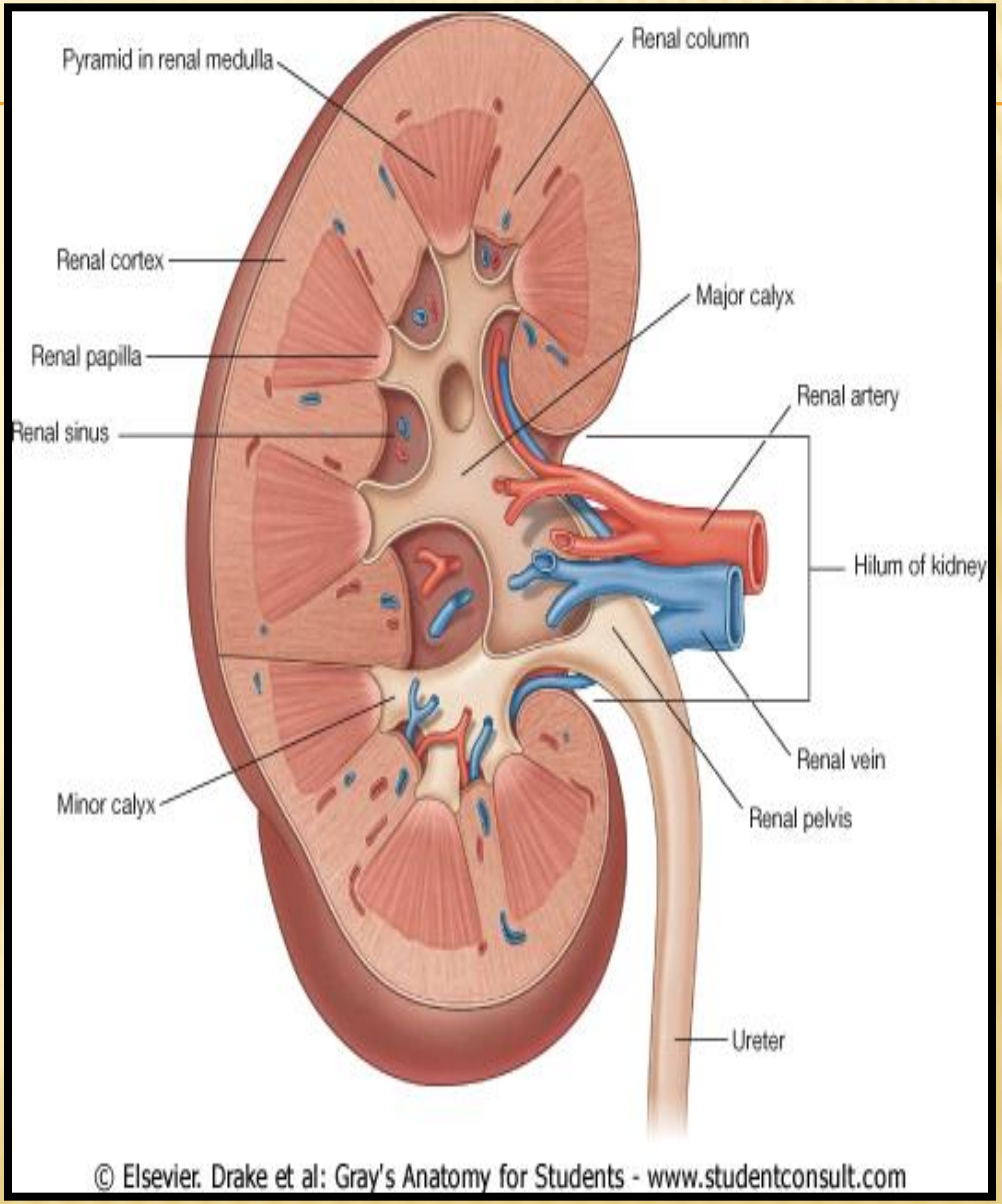
RENAL STRUCTURE

- Each kidney has an outer **cortex** and an inner **medulla.**
- Medulla is composed of about **12 renal pyramids.**
- The base of each pyramid is directed toward the cortex & its apex (the renal papilla) is projecting medially.
- The cortex extends into the medulla between adjacent pyramids as the **renal column.**



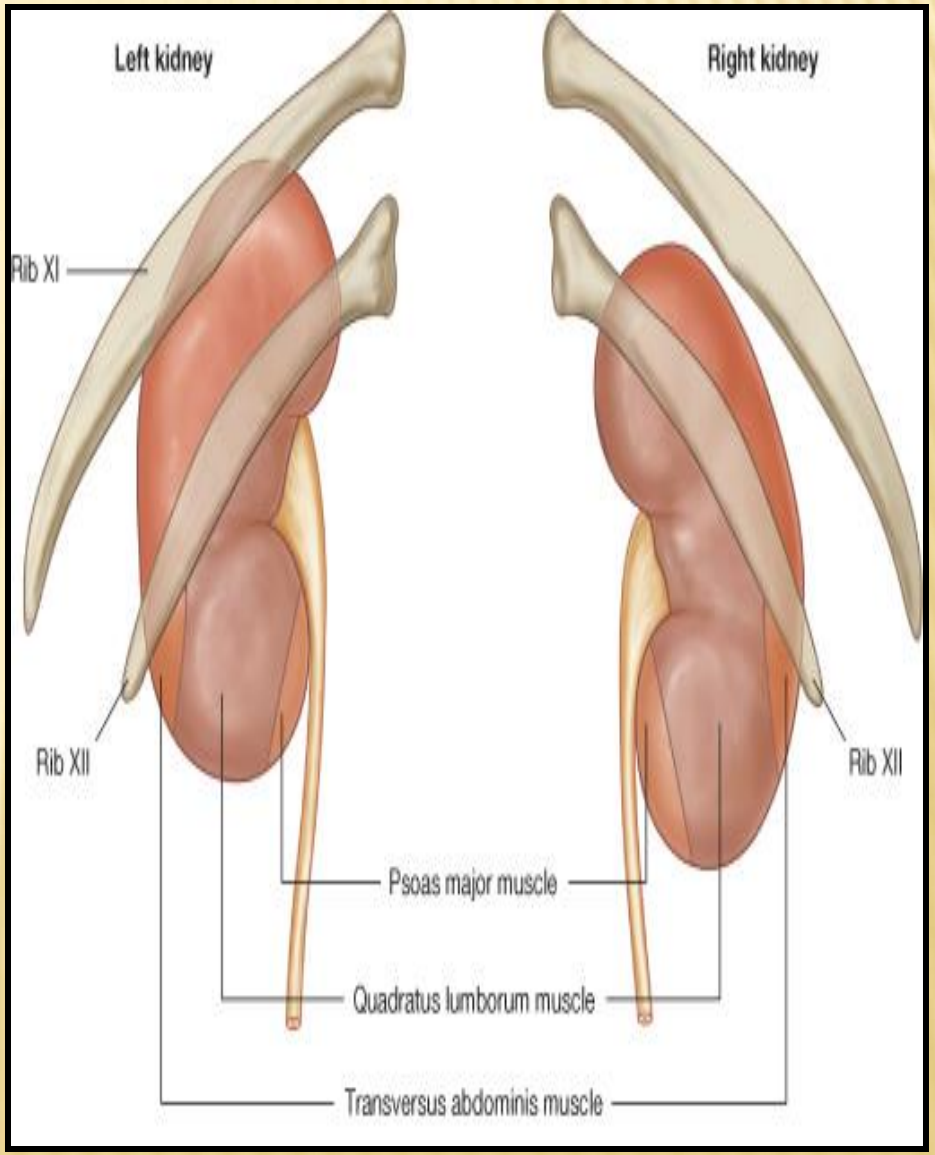
RENAL STRUCTURE

- Extending from the bases of the renal pyramids into the cortex are striations known as **medullary rays**.
- The renal sinus within the hilum, contains the upper expanded end of the ureter, the renal pelvis.
- Renal pelvis divides into two or three **major calyces**, which divides into two or three **minor calyces**.



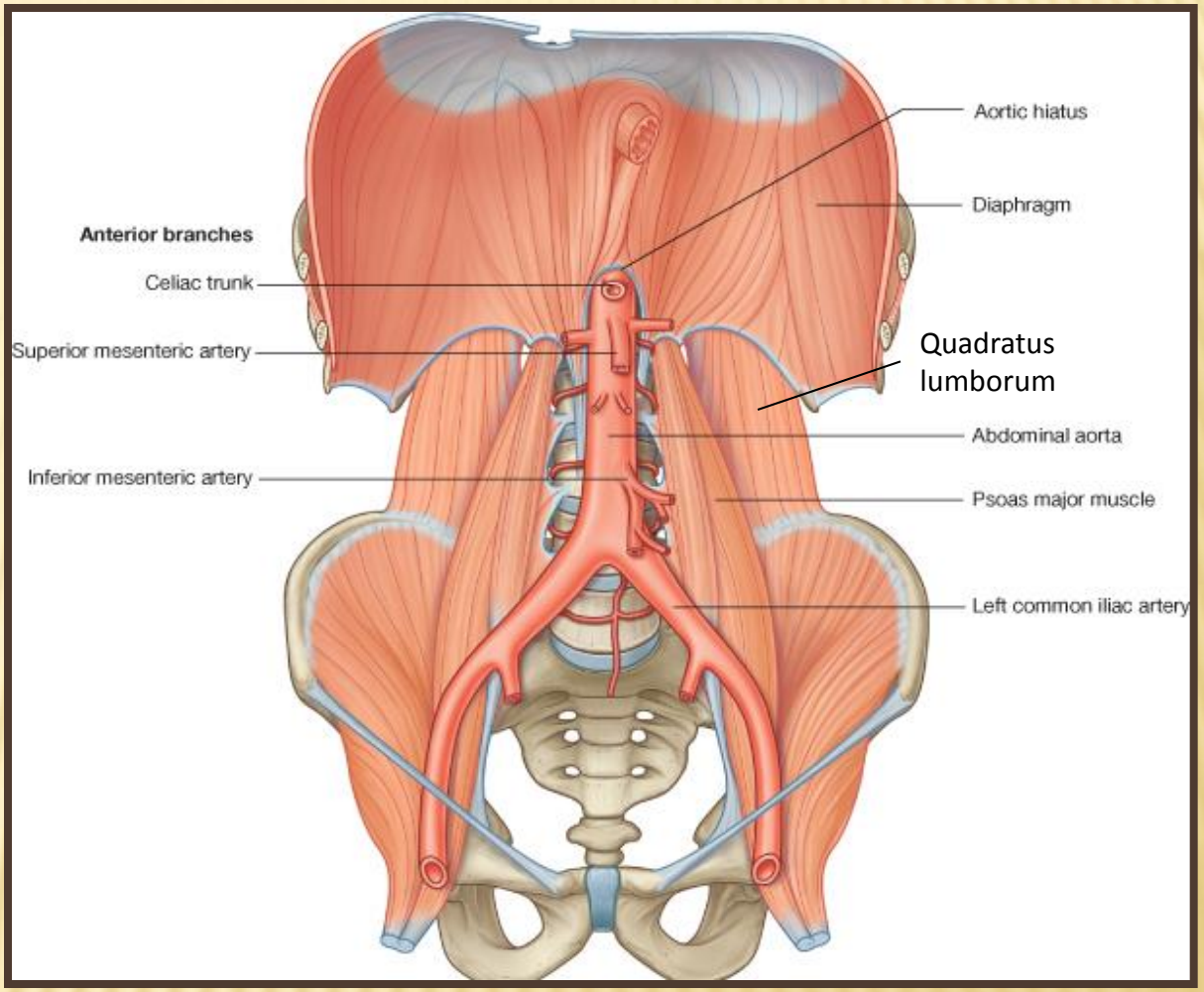
POSTERIOR RELATIONS

- Twelfth rib,
- Costodiaphragmatic pleural recess.
-

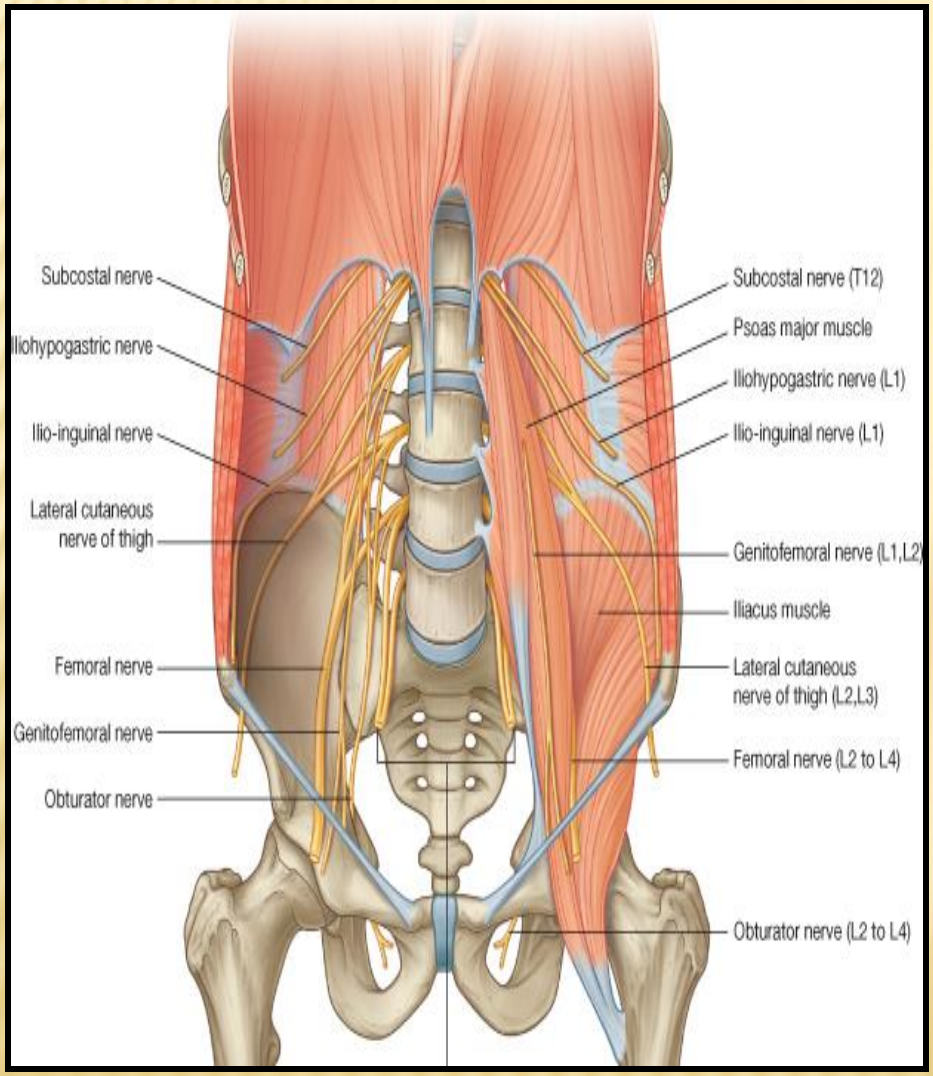


4Muscles:

Diaphragm
Psoas major m.,
Quadratus lamborum m.,
Transversus abdominis m.

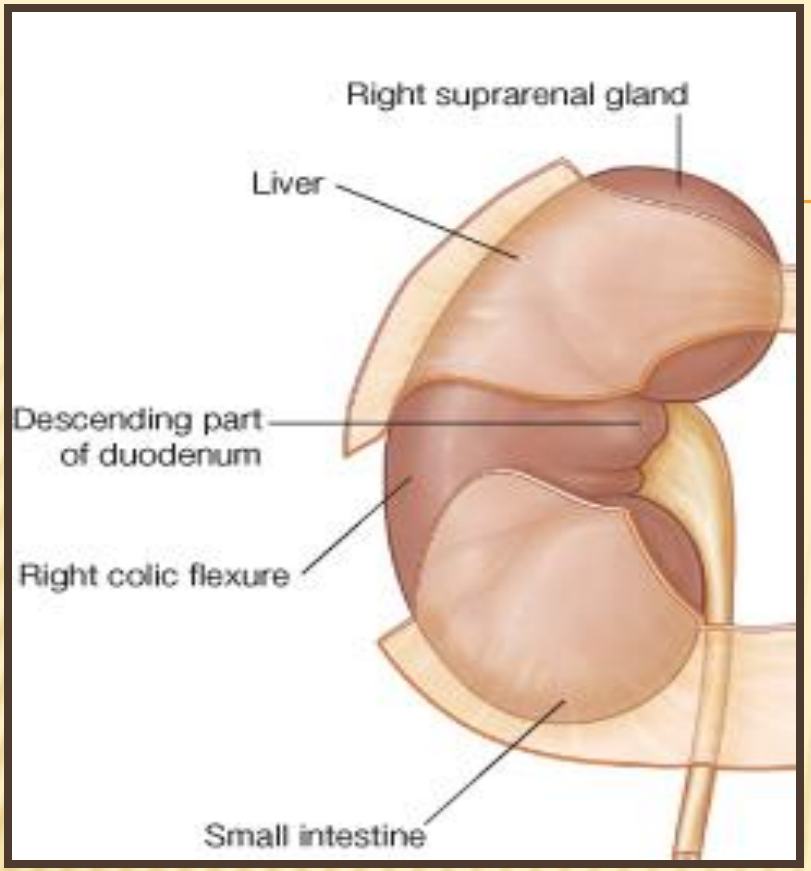


Posterior Relation

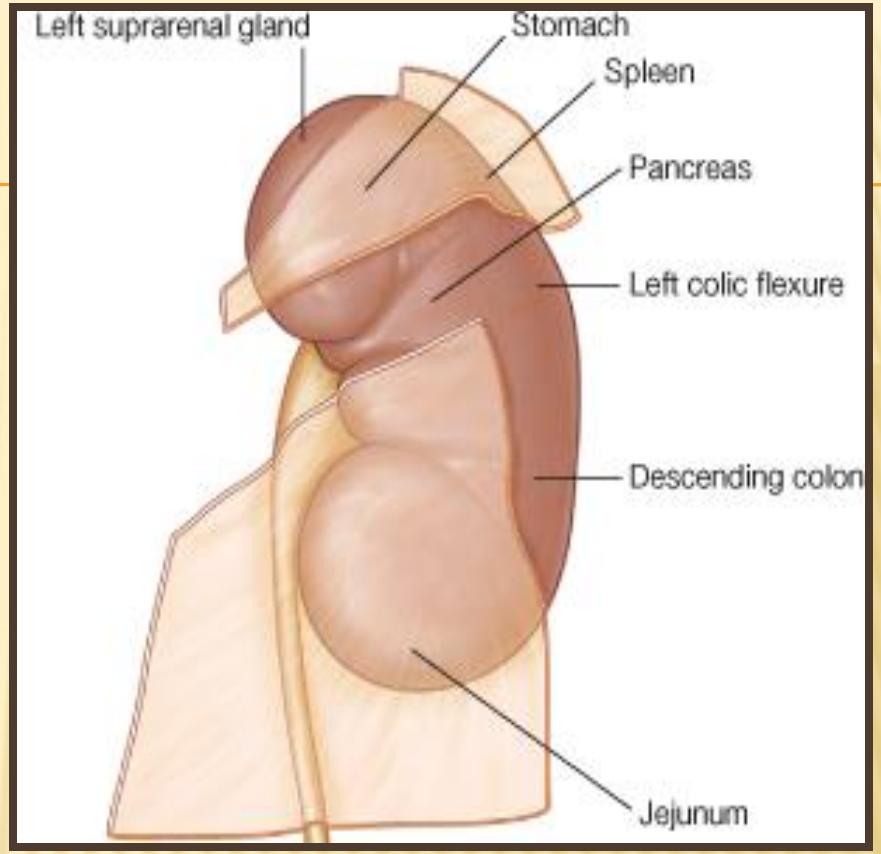


3 Nerves:

Subcostal nerve (T12),
Iliohypogastric (L1) nerve.
Ilioinguinal (L1) nerve



ANTERIOR RELATION

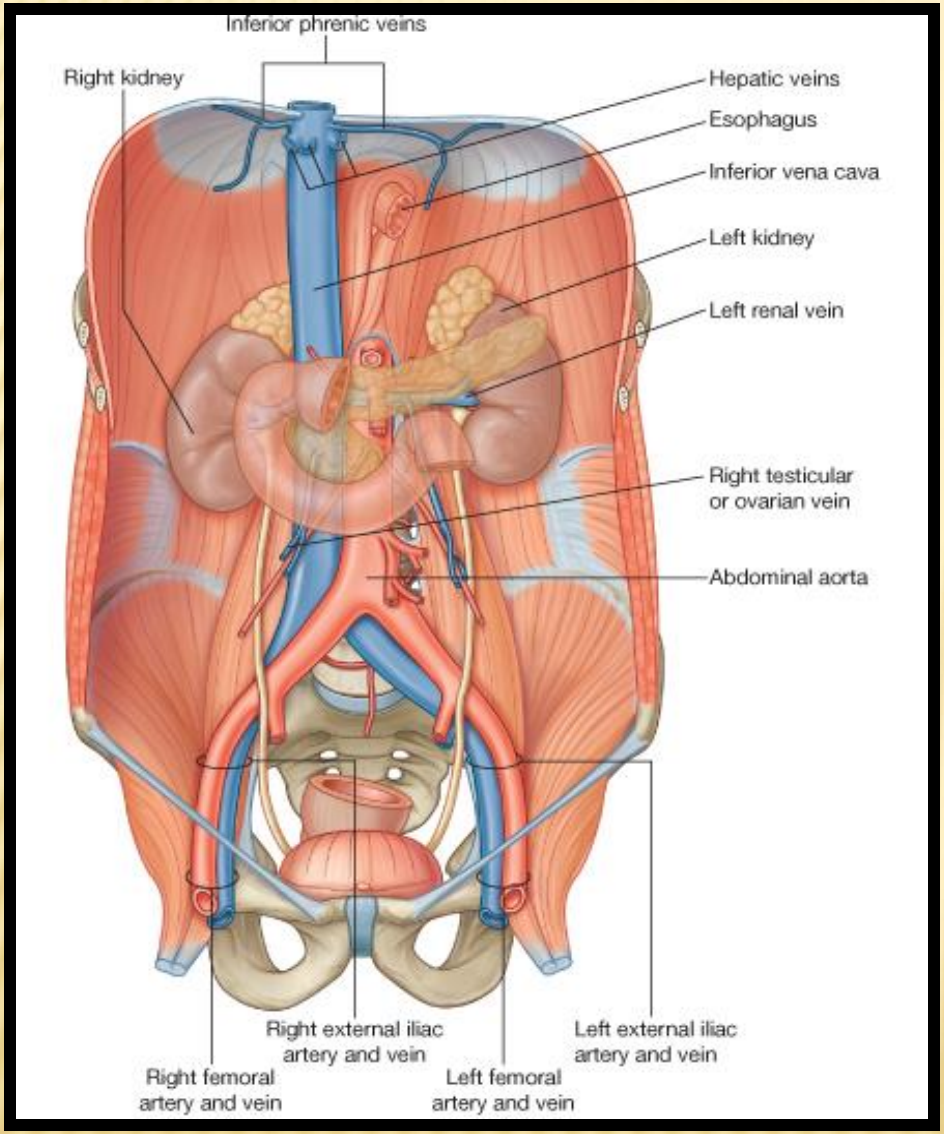


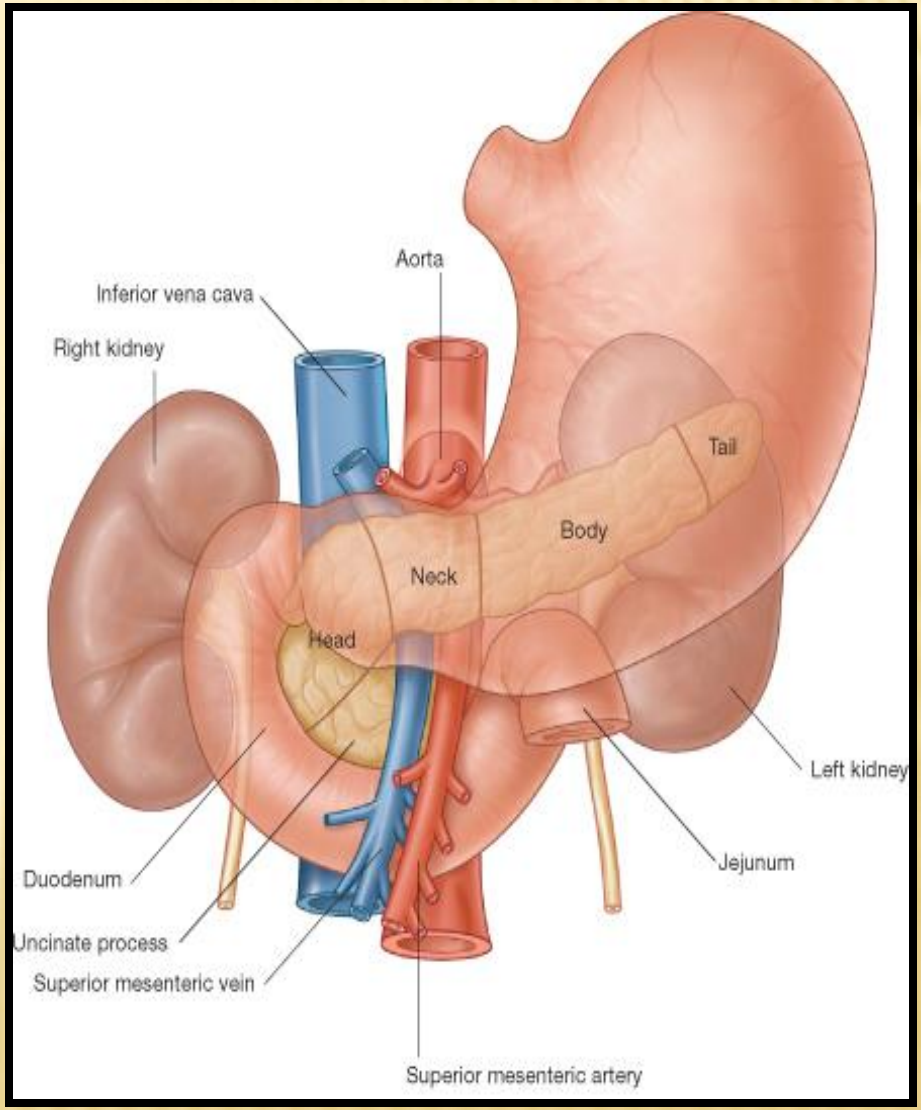
Right Kidney :

- 1- Right suprarenal gland
- 2- Liver,
- 3- Second part of the duodenum
- 4- Right colic flexure
- 5- Coils of small intestine

Left Kidney :

1- Left suprarenal gland,
2- Stomach,
3- Spleen,
4- Pancreas,
5- Left colic flexure,
6- Descending colon
7- Coils **of jejunum**


Inferior phrenic veins
Right kidney
Hepatic veins
Esophagus
Inferior vena cava
Left kidney
Left renal vein
Right testicular or ovarian vein
Abdominal aorta
Right external iliac artery and vein
Left external iliac artery and vein
Right femoral artery and vein
Left femoral artery and vein

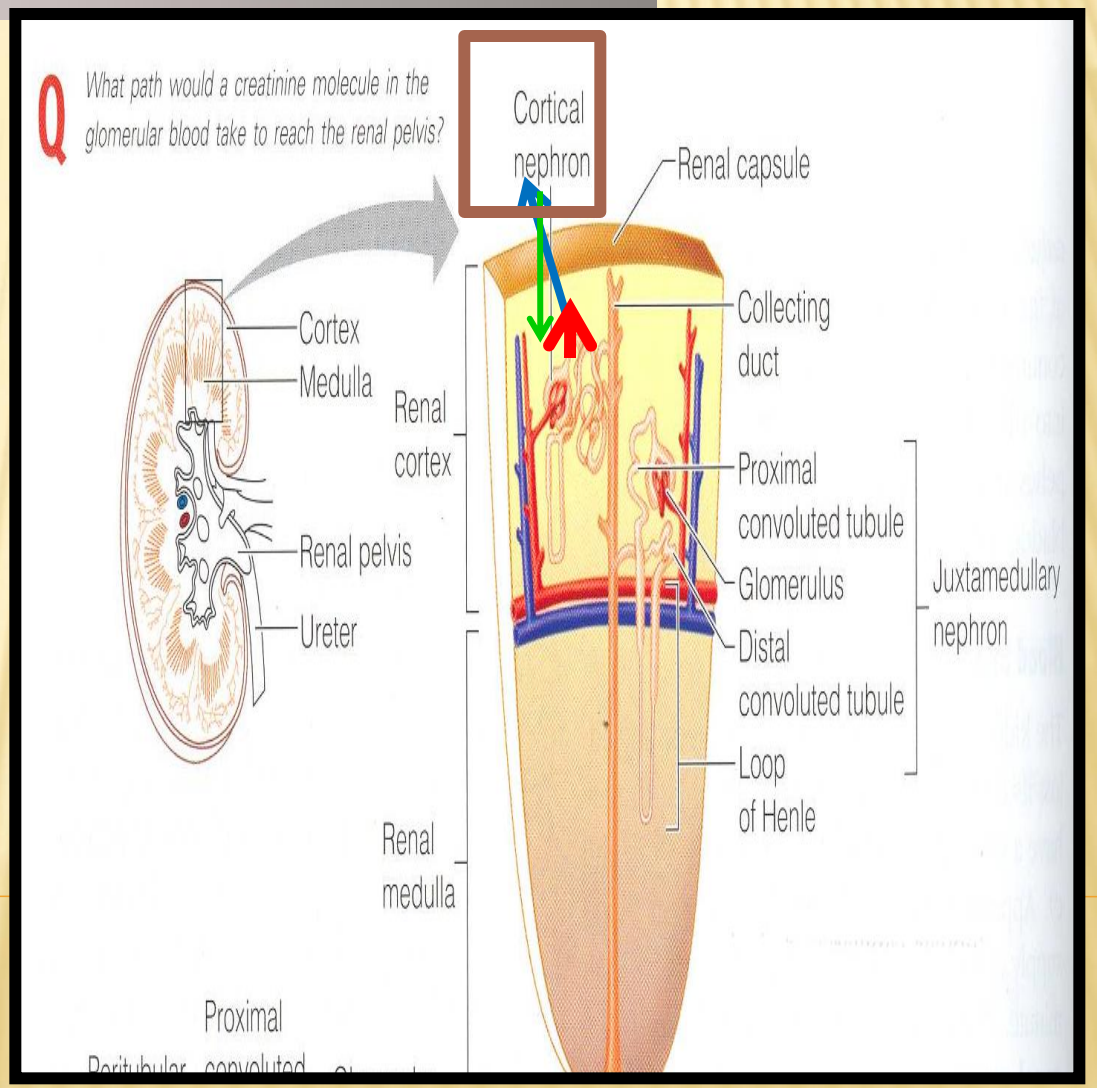

Aorta
Inferior vena cava
Right kidney
Tail
Body
Neck
Head
Left kidney
Jejunum
Duodenum
Uncinate process
Superior mesenteric vein
Superior mesenteric artery

NEPHRON

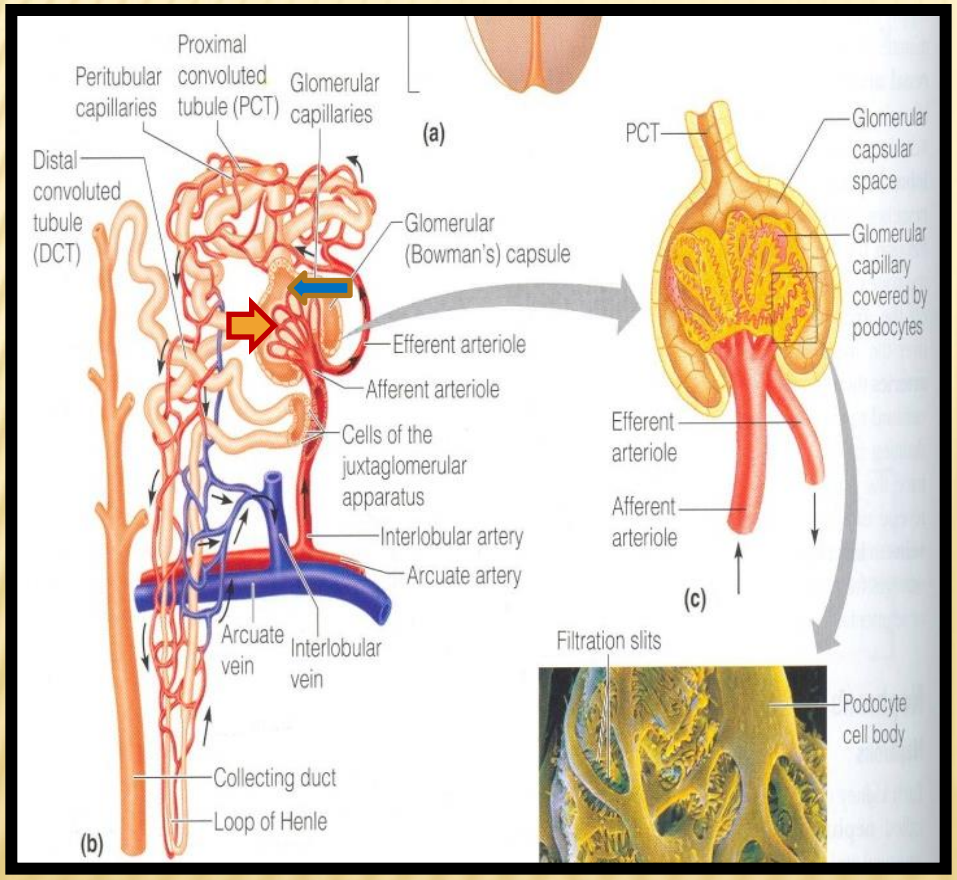
It is the structural and functional unit of the kidney.

There are over one million of nephrons in each kidney.

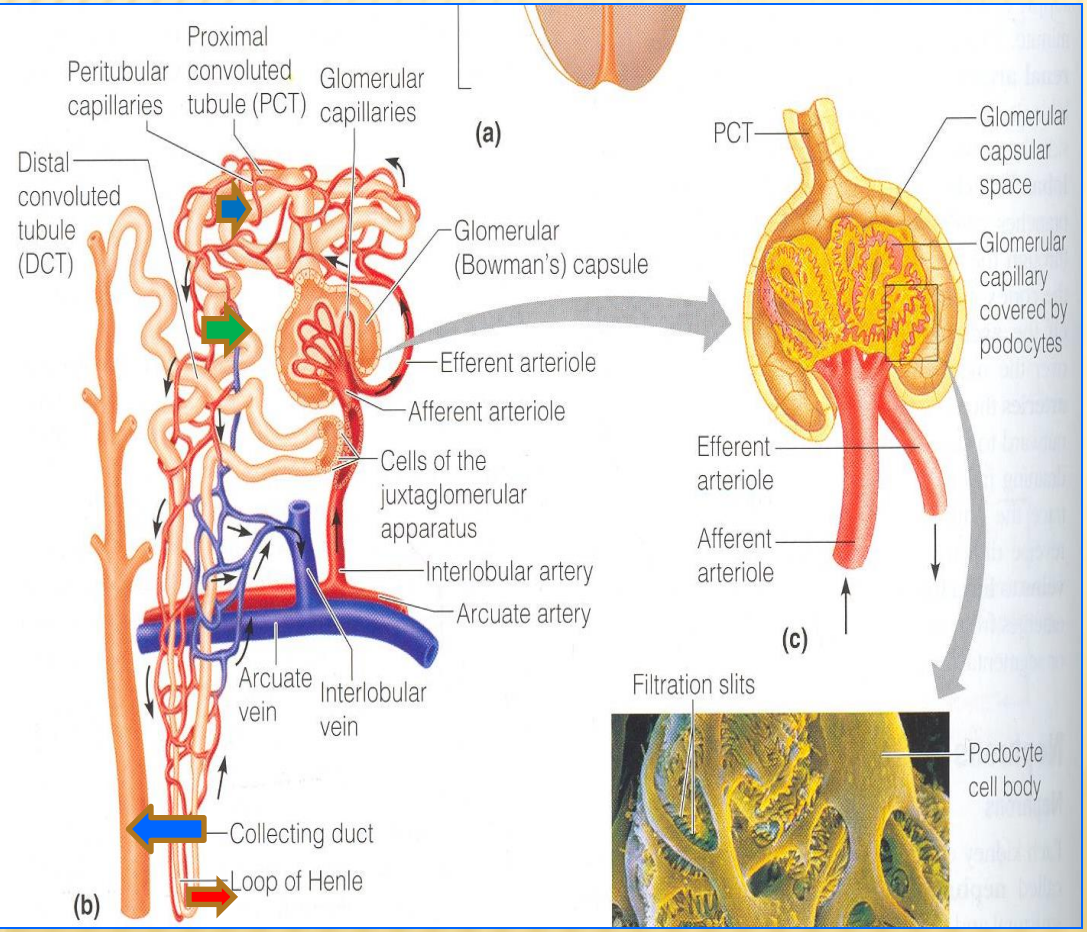
Most nephrons are located within the cortex (cortical nephrons).



COMPONENTS OF NEPHRON



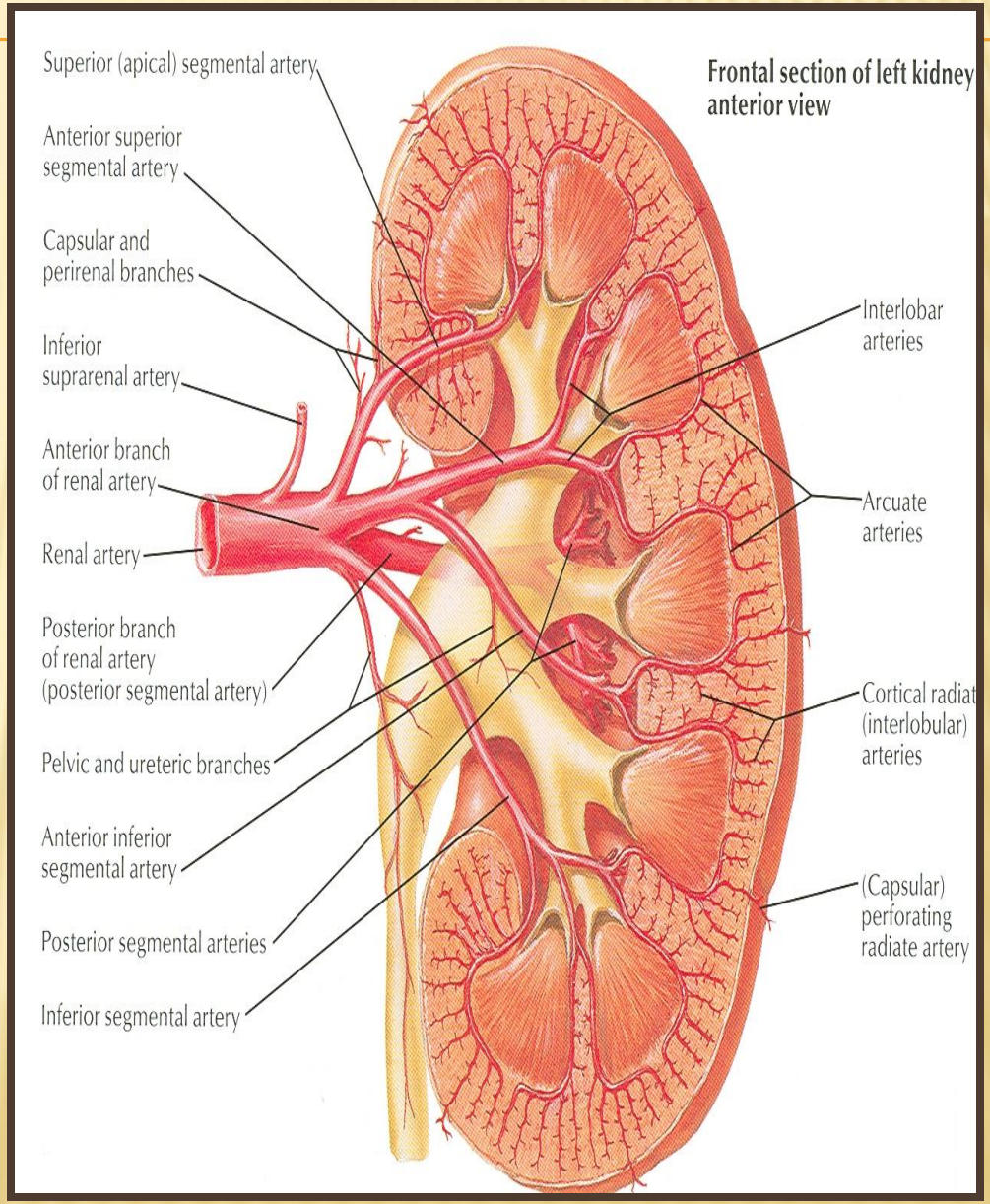
- *(a) Glomerulus :*
- *A Knot of capillaries.*
- *(b) Renal Tubule,*
- *Which is composed of :*
- *1. Glomerular (Bowman's)) Capsule:*
- *The closed end of the tubule.*
- *It is cup shaped and completely surrounding the glomerulus.*



- ***2. Proximal Convoluted Tubule.***
- ***3. Loop of Henle.***
- ***4. Distal Convoluted Tubule.***
- ***Collecting (tubules) Ducts:***
- ***Each of which receives urine from many nephrons, through the medullary pyramids into the calyces and renal pelvis.***

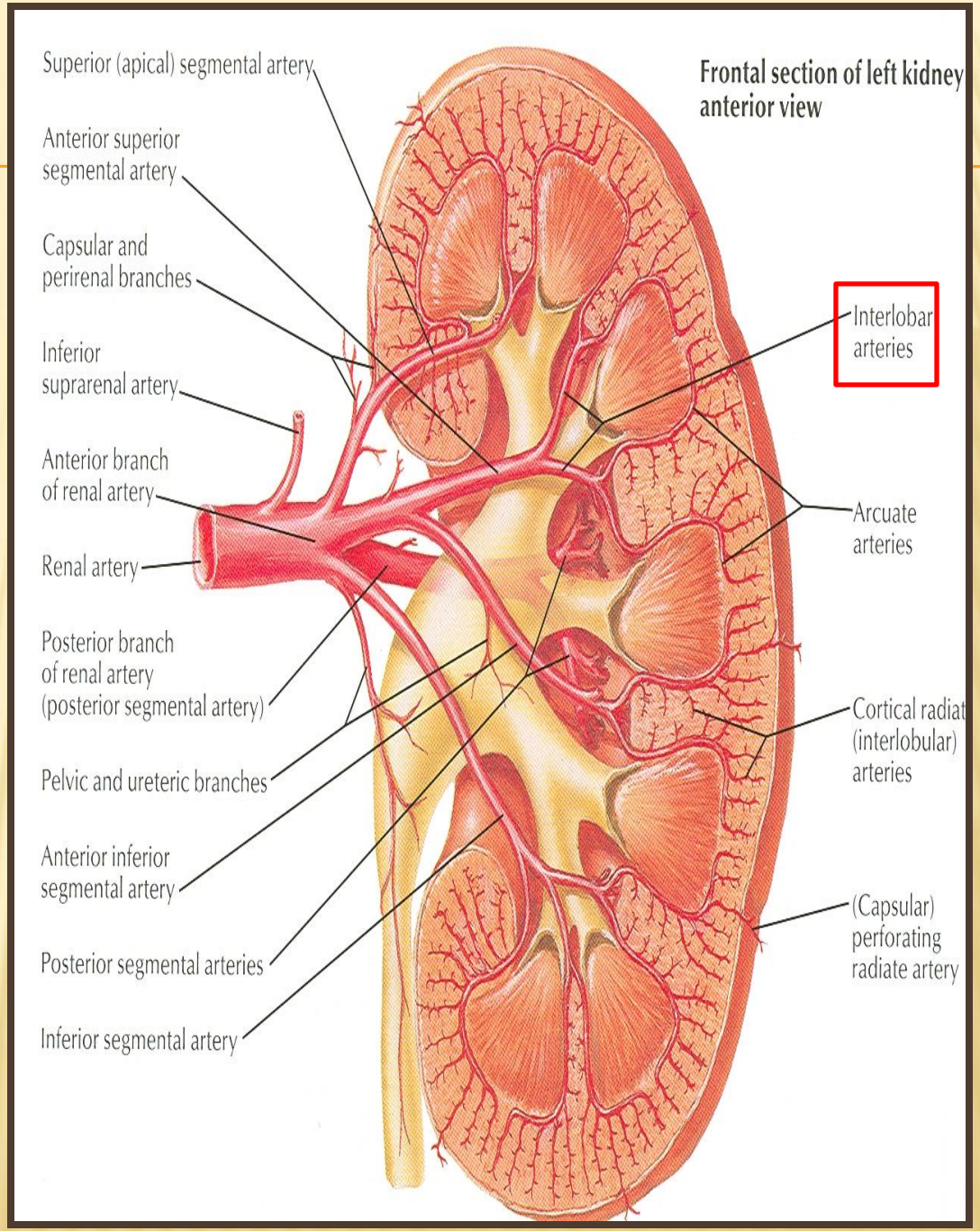
BLOOD SUPPLY

- The renal artery arises from the aorta at the level of the **second** lumbar vertebra.
- Each renal artery divides into ***five*** **segmental** arteries that enter the hilum of the kidney, four in front and one behind the renal pelvis
- They are distributed to different segments of the kidney.
- **Lobar artery** arises from each segmental artery, one for each renal pyramid.

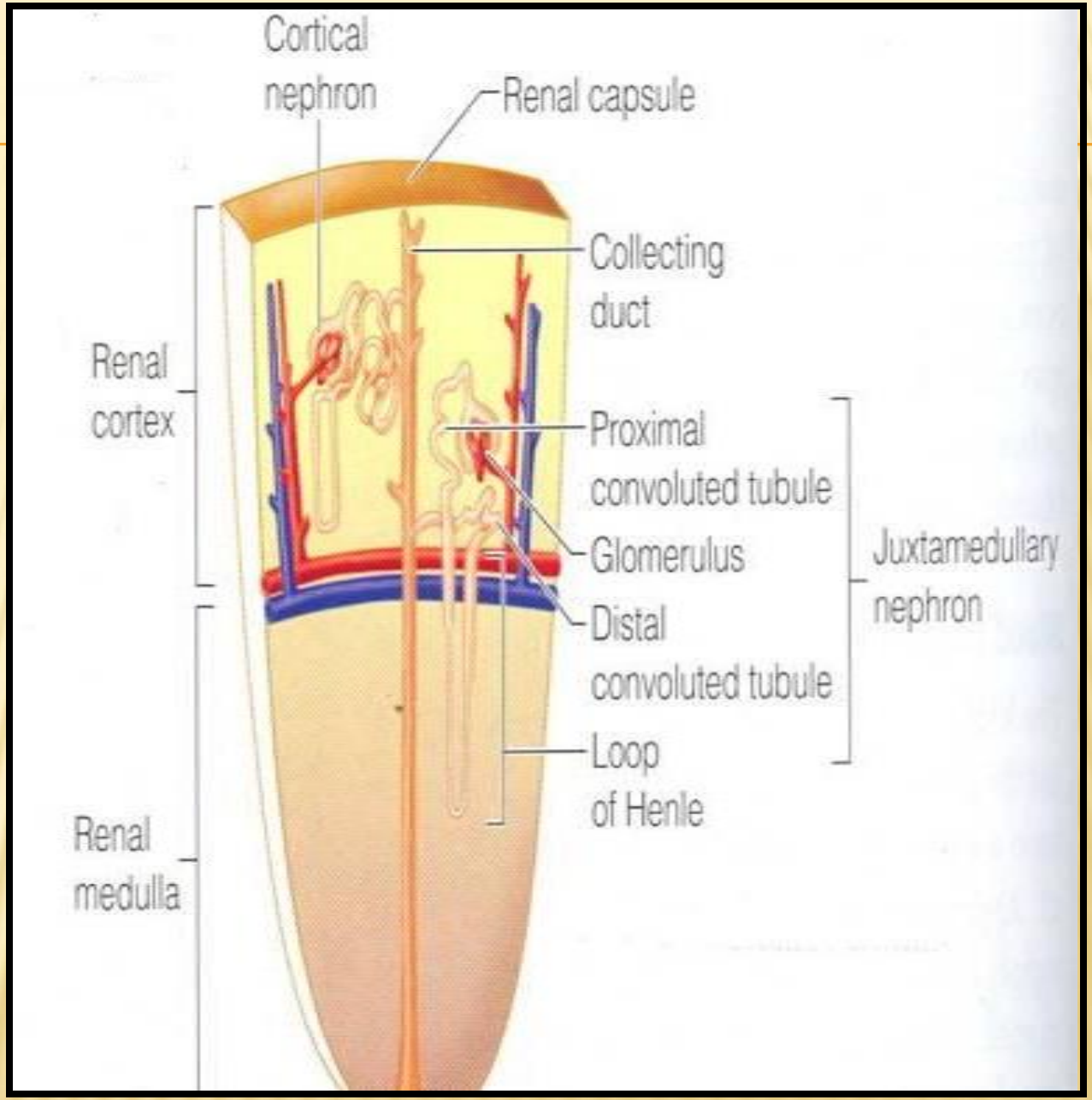


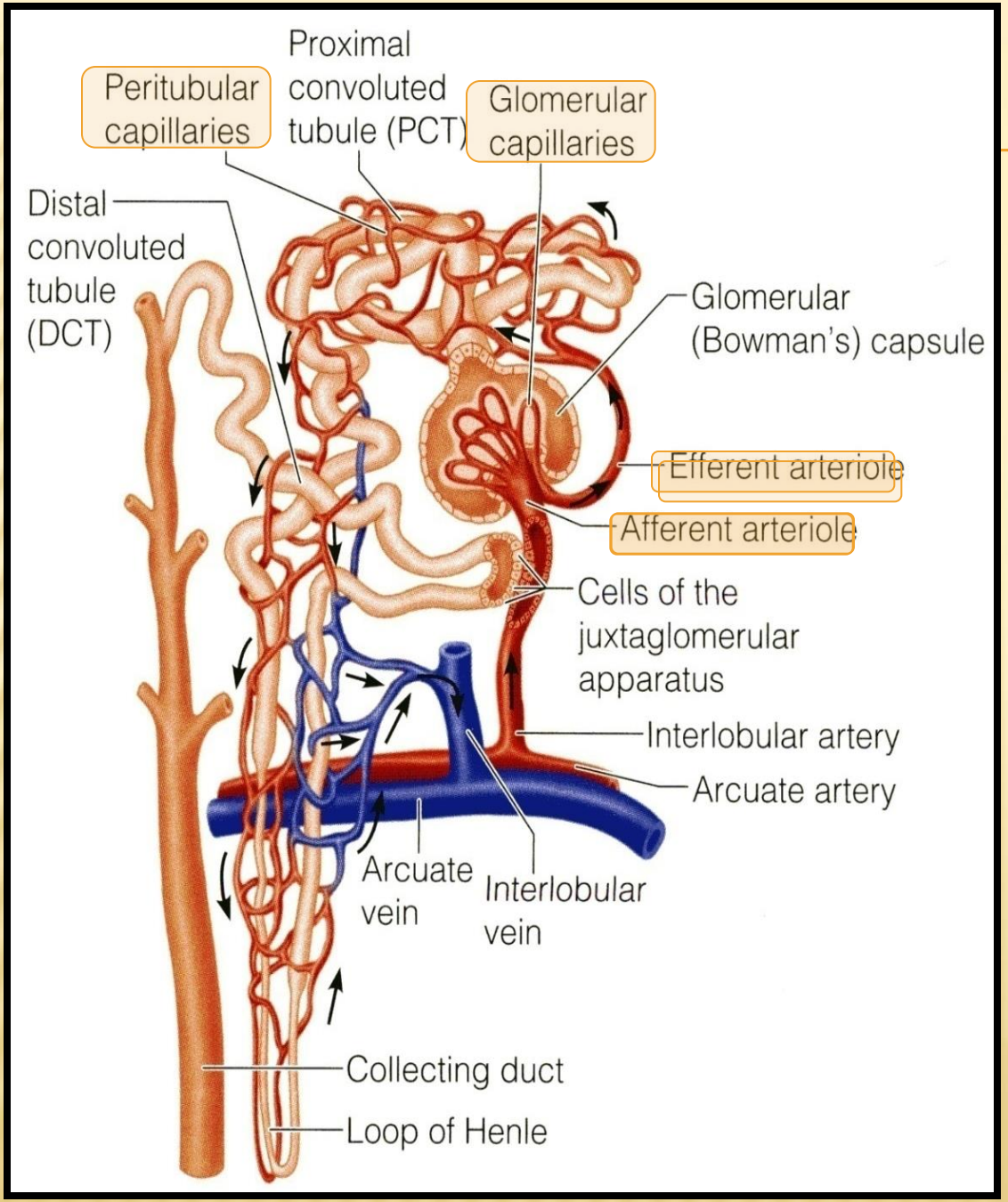
BLOOD SUPPLY

- Each lobar artery gives off 2 or 3 **interlobar arteries.**
- The **interlobar arteries** run toward the cortex on each side of the renal pyramid.
- **Interlobar arteries** give off the **arcuate arteries** at the junction of the cortex and medulla
- The arcuate arteries give off several **interlobular arteries**



- Interlobular artery gives off **afferent glomerular arterioles .**





- Each **nephron** is associated with **two** capillary beds:
  1. **The glomerulus** and
  2. **The peritubular capillary bed.**
- The glomerulus is both fed and drained by **arterioles.**
  - The **afferent arteriole,** which arises from an **interlobular artery**, is the "feeder vessel," and
  - the **efferent arteriole** receives blood that has passed through the glomerulus.

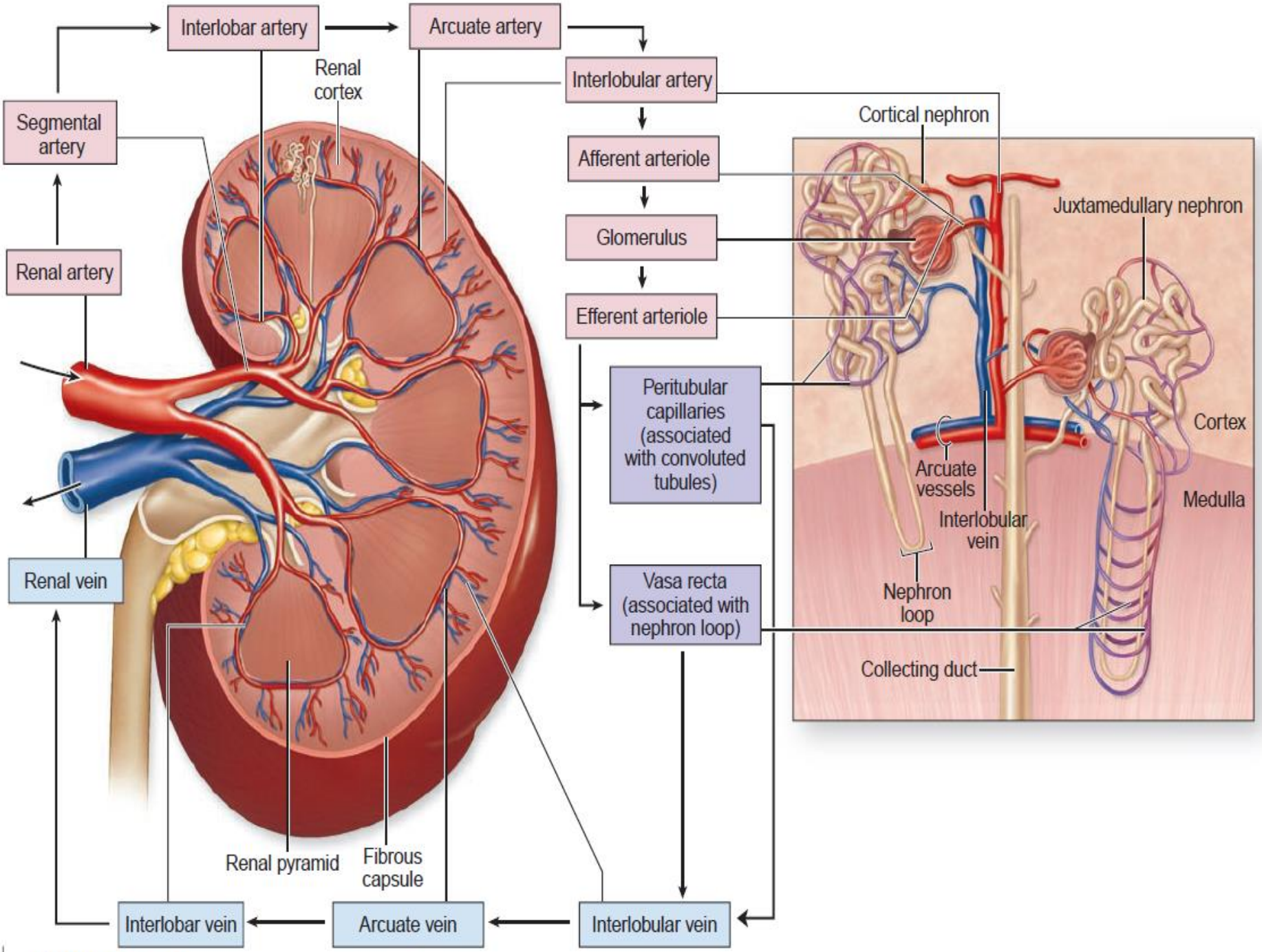
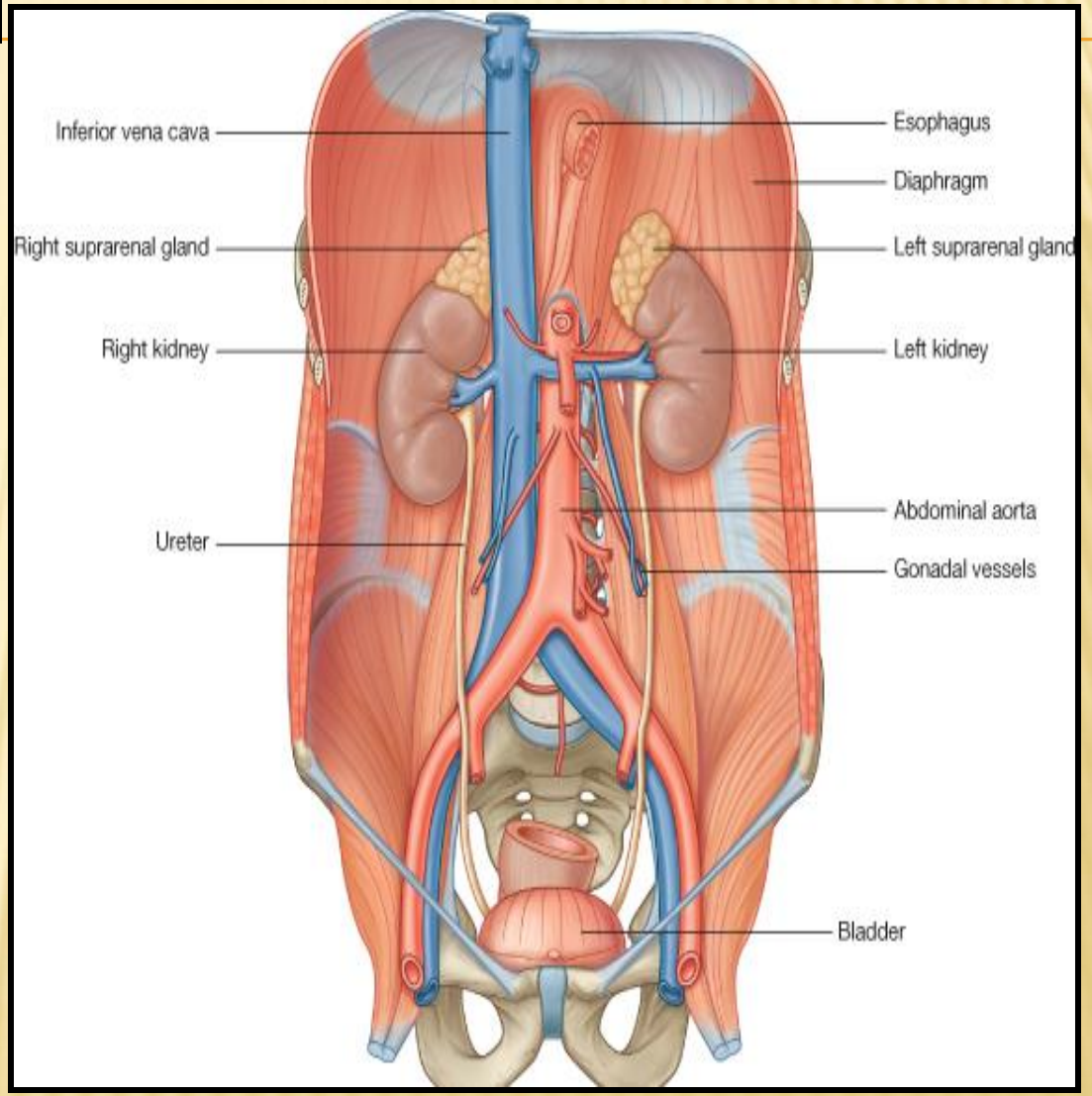

Interlobar artery
Arcuate artery
Renal cortex
Interlobular artery
Segmental artery
Cortical nephron
Afferent arteriole
Juxtamedullary nephron
Glomerulus
Renal artery
Efferent arteriole
Peritubular capillaries (associated with convoluted tubules)
Cortex
Arcuate vessels
Medulla
Interlobular vein
Renal vein
Vasa recta (associated with nephron loop)
Nephron loop
Collecting duct
Renal pyramid
Fibrous capsule
Interlobar vein
Arcuate vein
Interlobular vein

Figure 27.4

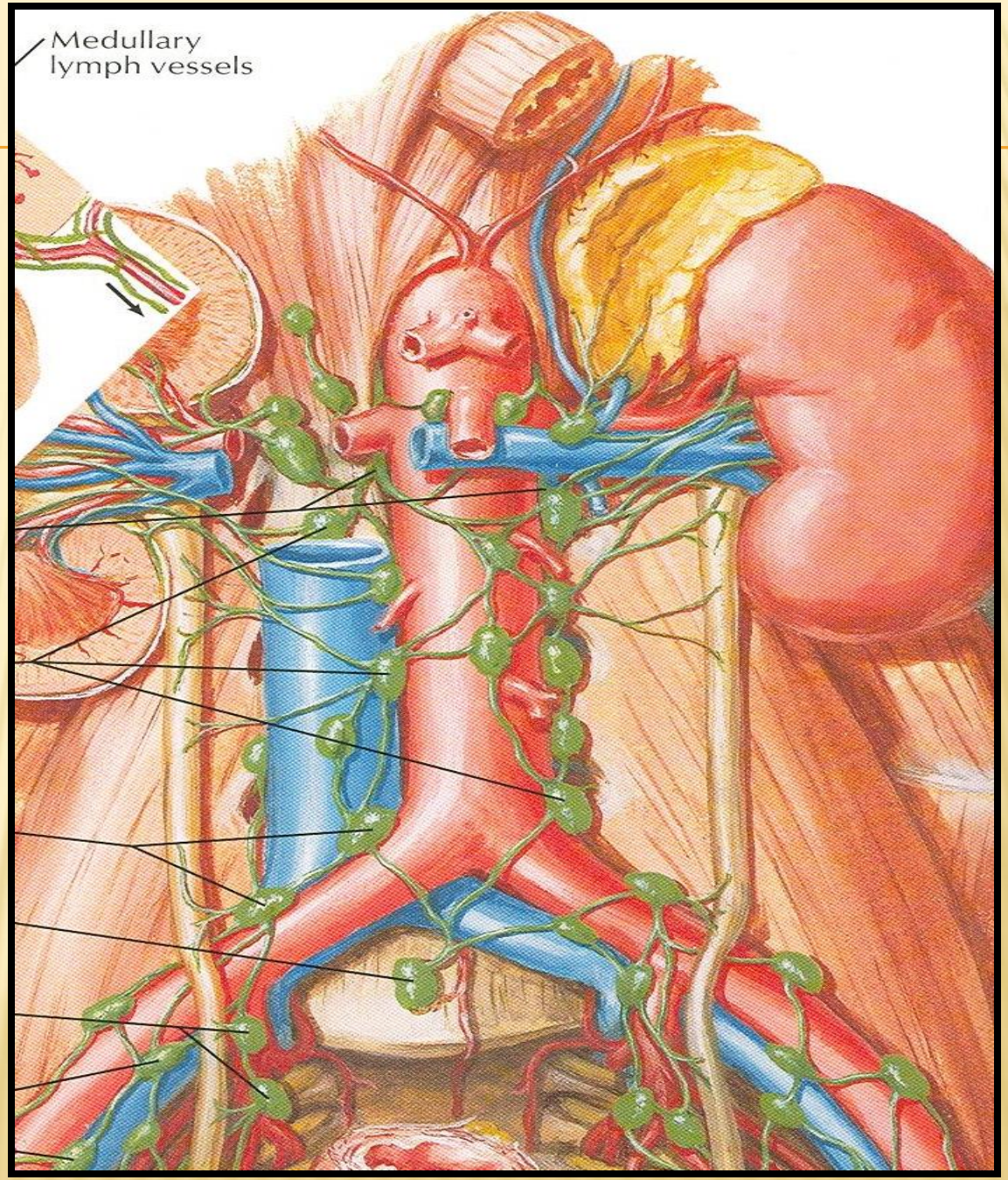
Venous Drainage

- Renal vein emerges from the hilum in front of the renal artery and drains into the IVC.
- The left renal vein is longer than the right renal vein.
- The left renal vein receives the **left gonadal & the left suprarenal veins.**



LYMPH

- **Lymph Drainage:**
- Lateral aortic lymph nodes around the origin of the renal artery.



NERVE SUPPLY

Nerve Supply

- **Renal sympathetic plexus.**
- The afferent fibers that travel through the renal plexus enter the spinal cord in the **10th, 11th, and 12th thoracic nerves.**