

# ANATOMY OF KIDNEYS

BY  
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B

Dilated calyces

Obstructed ureter

Left kidney emptied



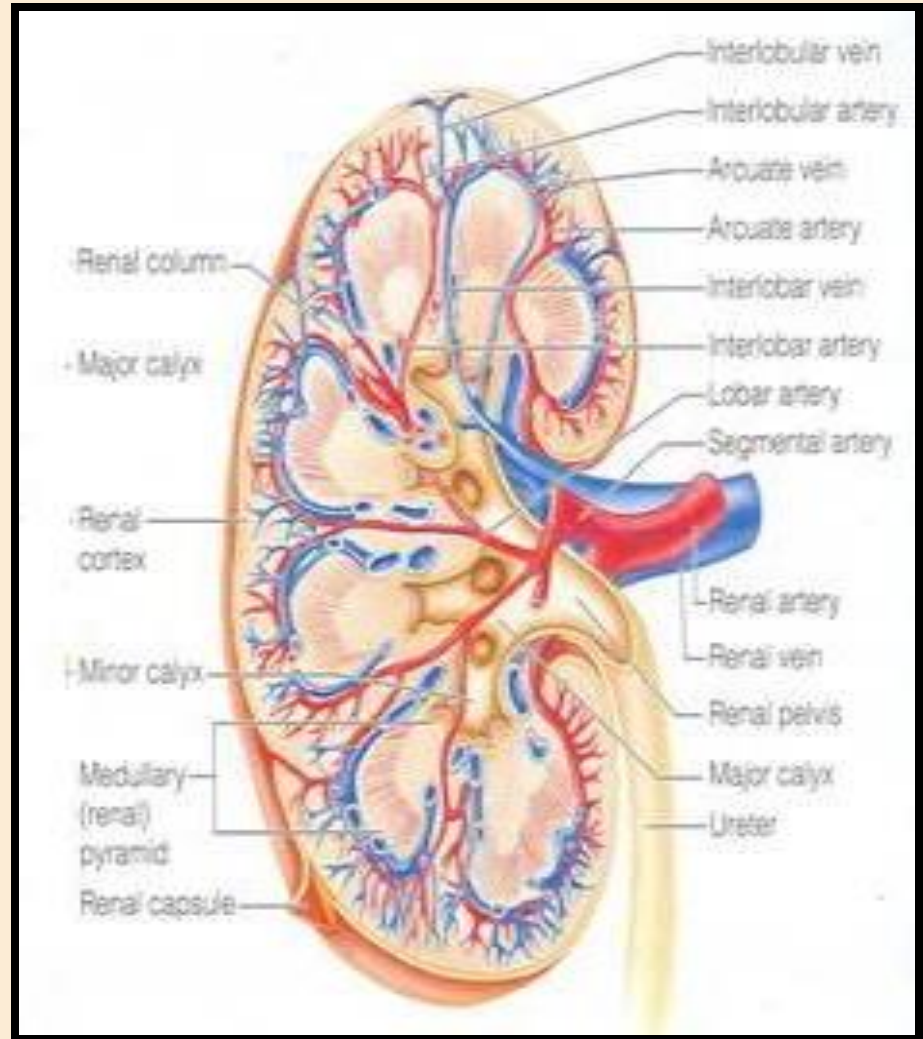
# Objectives

- ✘ **By the end of this course you should be able to discuss:** COMPONENTS OF THE URINARY SYSTEM (kidney, ureter, urinary bladder, urethra)

By the end of this lecture you should be able to discuss the

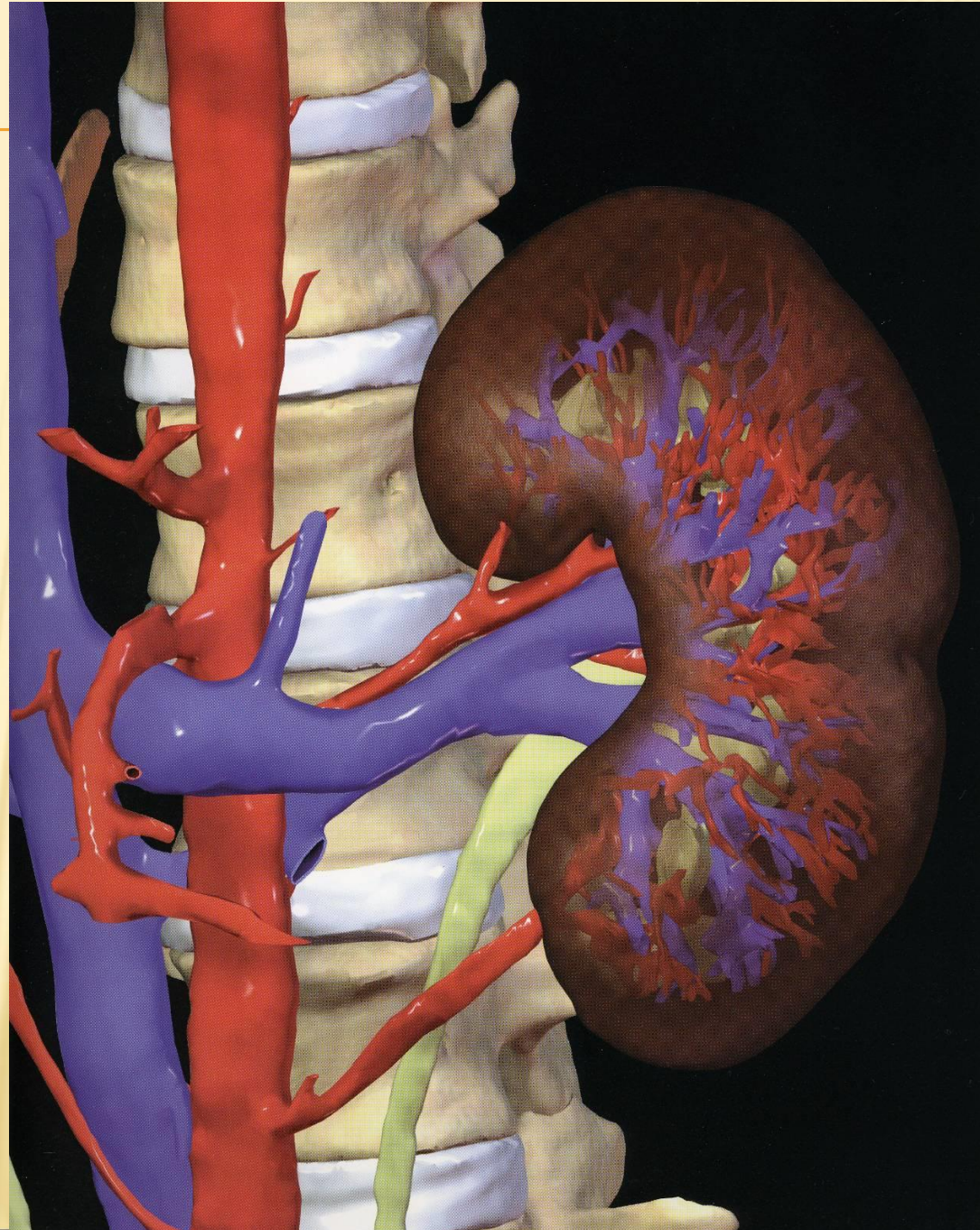
## KIDNEY

- ✘ SHAPE & POSITION.
- ✘ SURFACE ANATOMY.
- ✘ EXTERNAL FEATURES.
- ✘ HILUM and its CONTENTS.
- ✘ RELATIONS.
- ✘ **INTERNAL STRUCTURE.**
- ✘ **BLOOD SUPPLY**
- ✘ **LYMPH DRAINAGE..**
- ✘ **NERVE SUPPLY.**



# INTRODUCTION

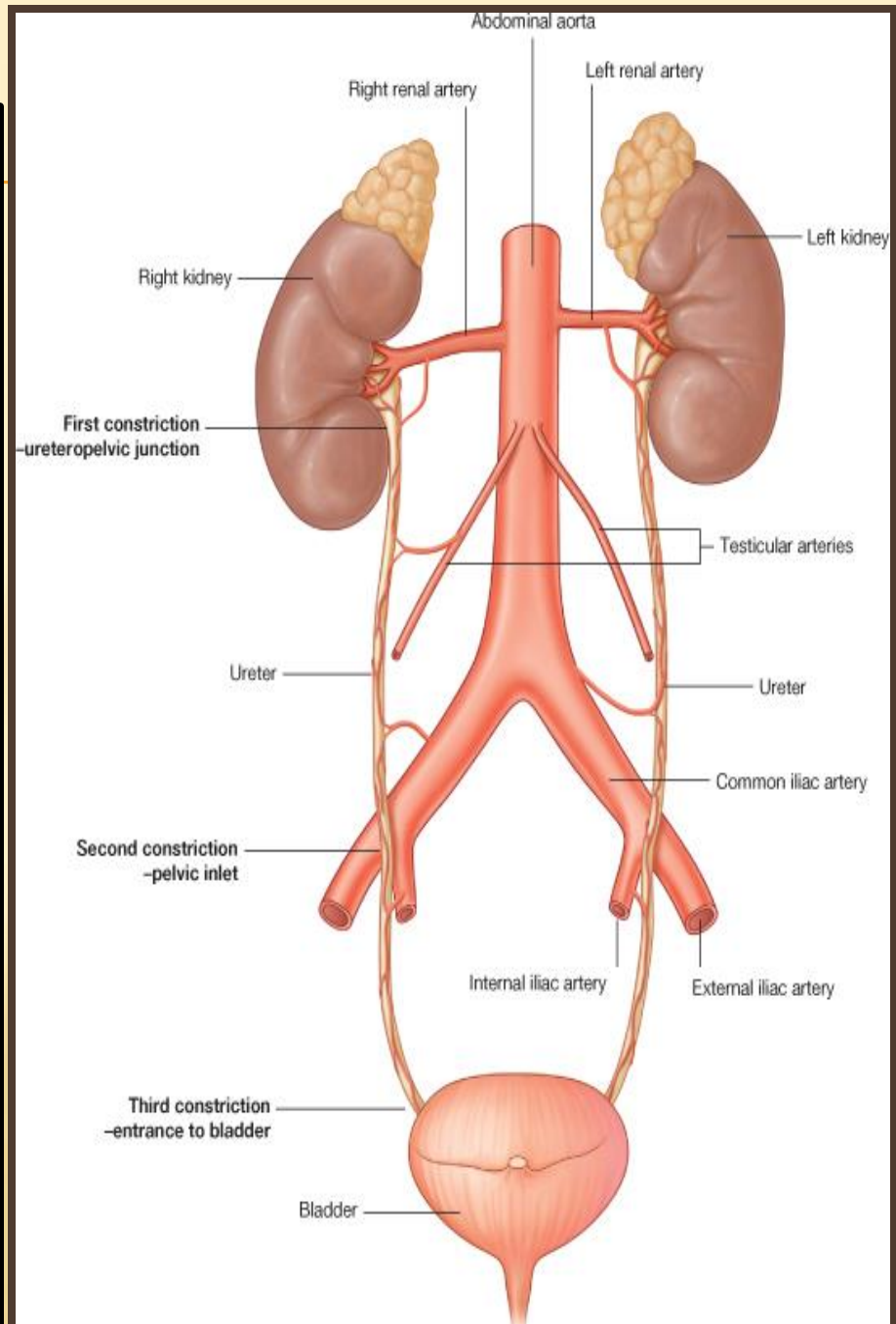
- ✘ Every day, each kidney filters liters of fluid from the **bloodstream**.
- ✘ Although the **lungs** and the **skin** also play roles in excretion, the kidneys bear the major responsibility for eliminating nitrogenous (nitrogen-containing) wastes, toxins, and drugs from the body.



# KIDNEY

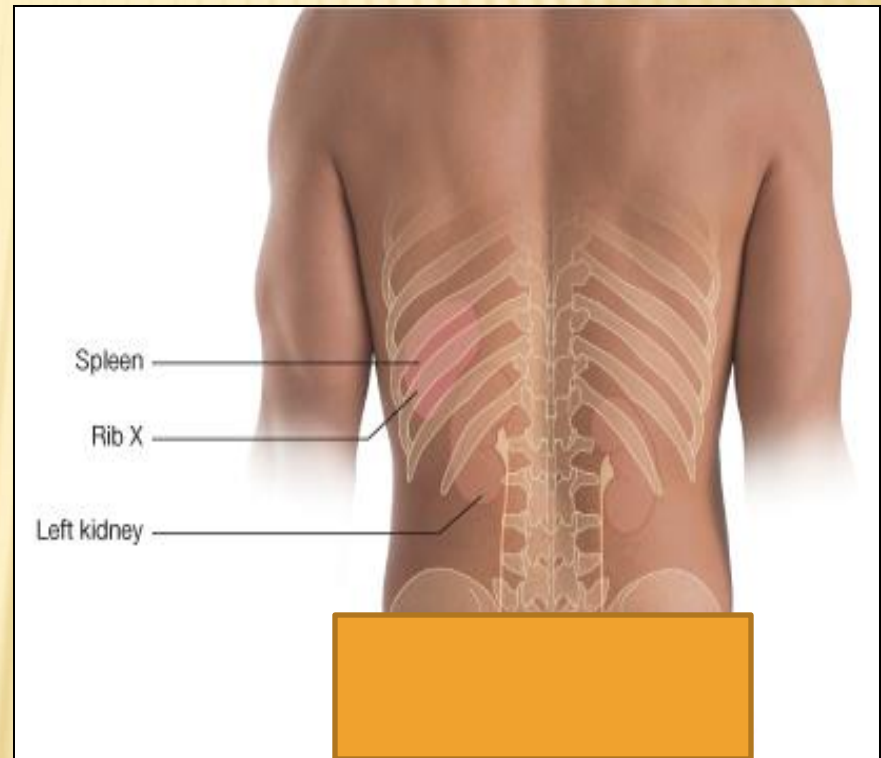
## × Functions:

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. **Stimulate** bone marrow for RBCs formation by **Erythropoietin hormone**.
5. **Regulates** blood pressure by **Rennin enzyme**.
6. **Converts** vitamin D to its active form.



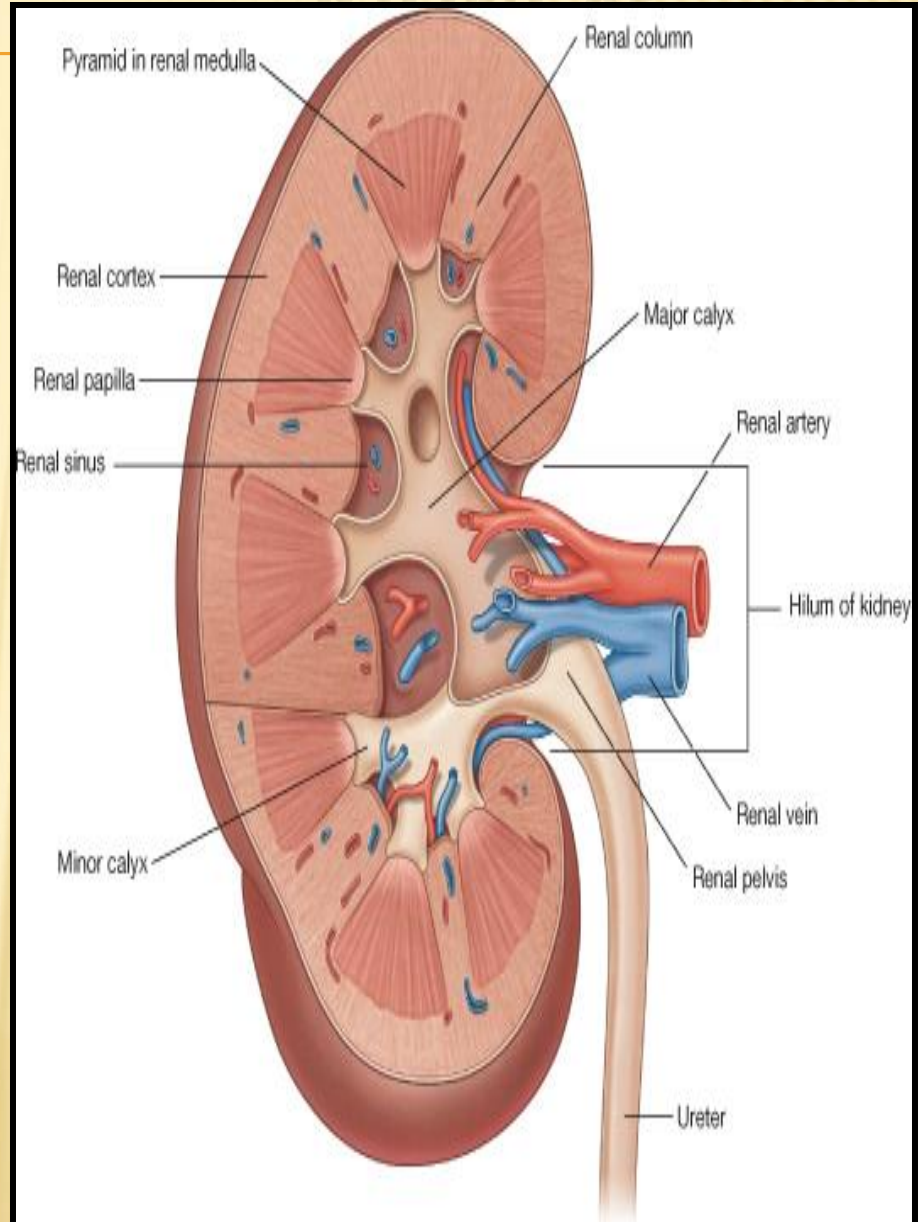
# KIDNEY

- ✘ Kidneys are **reddish brown** in color.
- ✘ Lie **behind** the peritoneum (retroperitoneal), on either side of the **vertebral column** on the posterior abdominal wall.
- ✘ 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.



# 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 part 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

## From inward to outward

### 1- Fibrous capsule:

It is adherent to the kidney.

### 2- Perirenal fat :

It covers the fibrous capsule

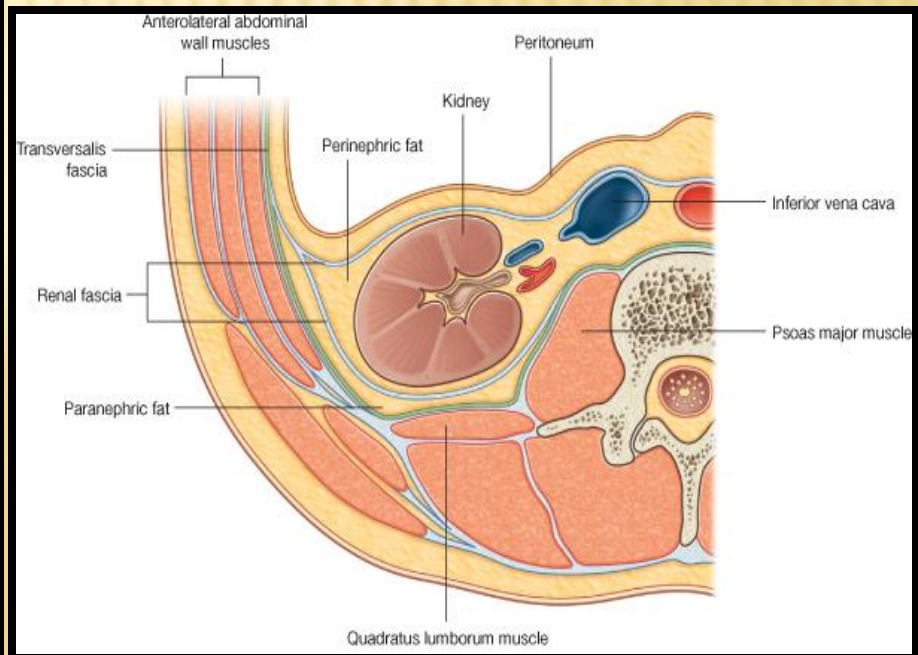
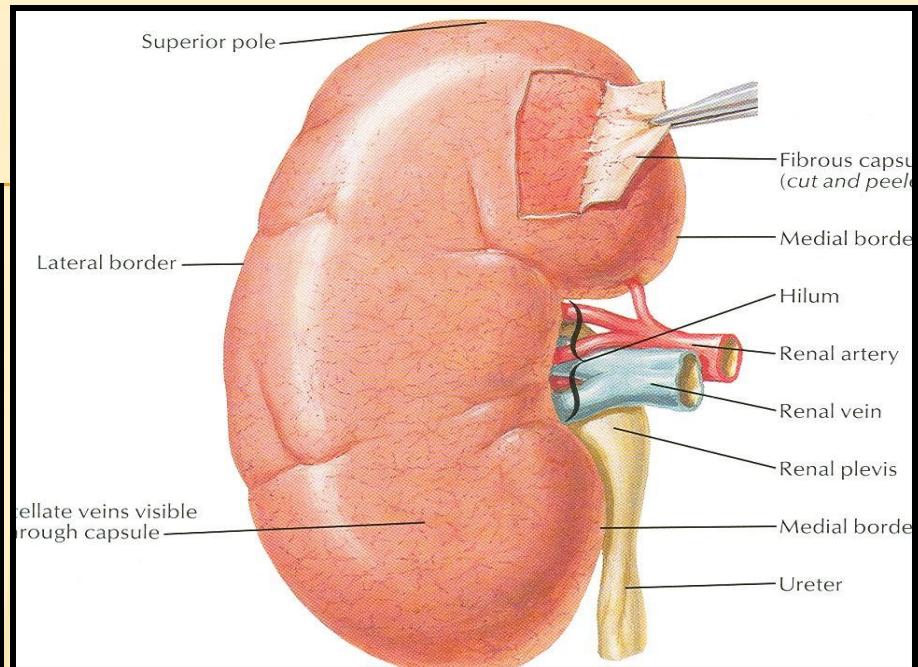
### 3- Renal fascia:

it encloses the kidneys and suprarenal glands.

### 4- Pararenal fat :

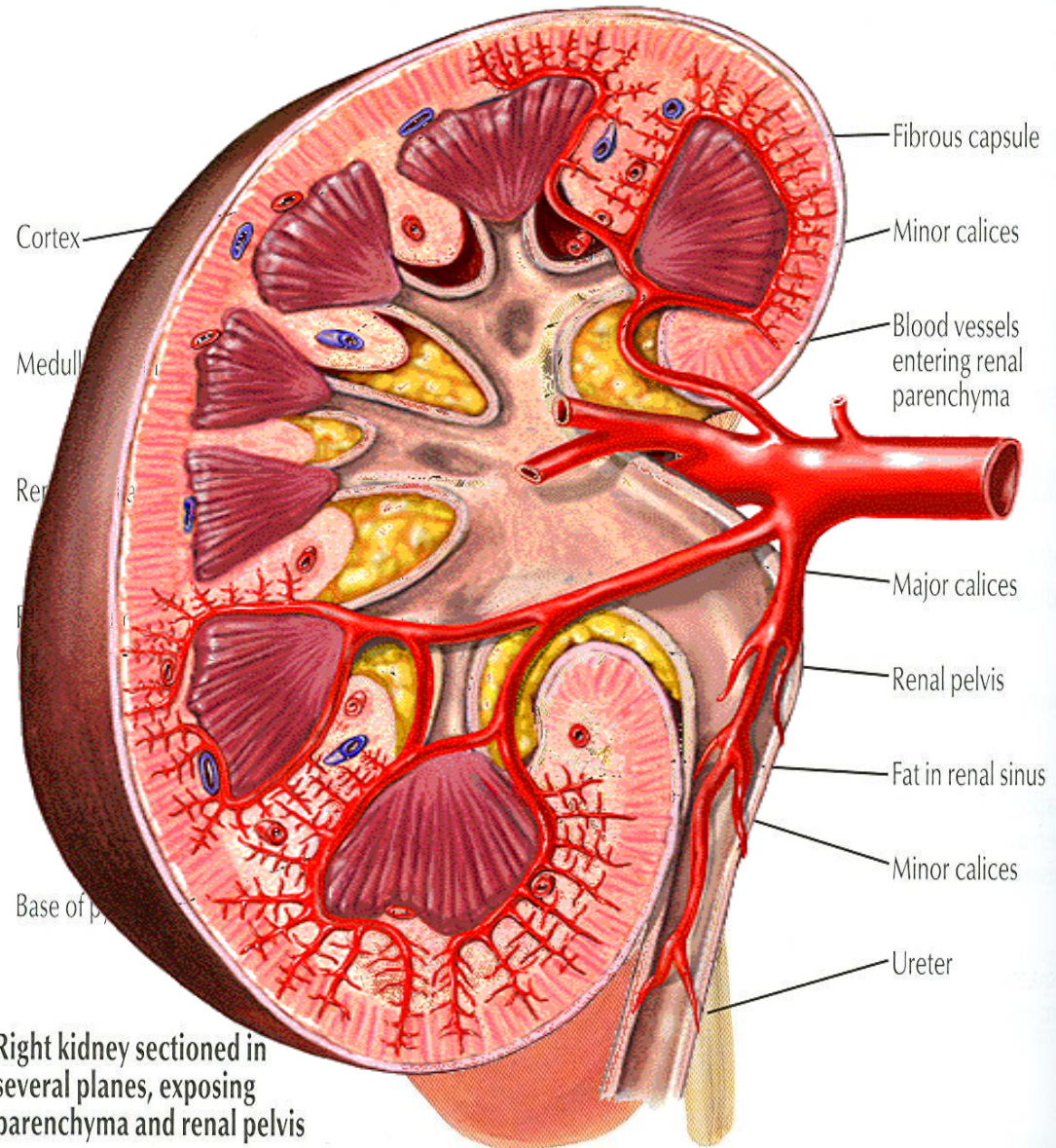
it lies external to the renal fascia, and forms part of the retroperitoneal fat.

**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 laterally toward the cortex & its apex (the renal papilla) is projecting medially.
- ✘ The cortex extends into the medulla between adjacent pyramids as the renal column.

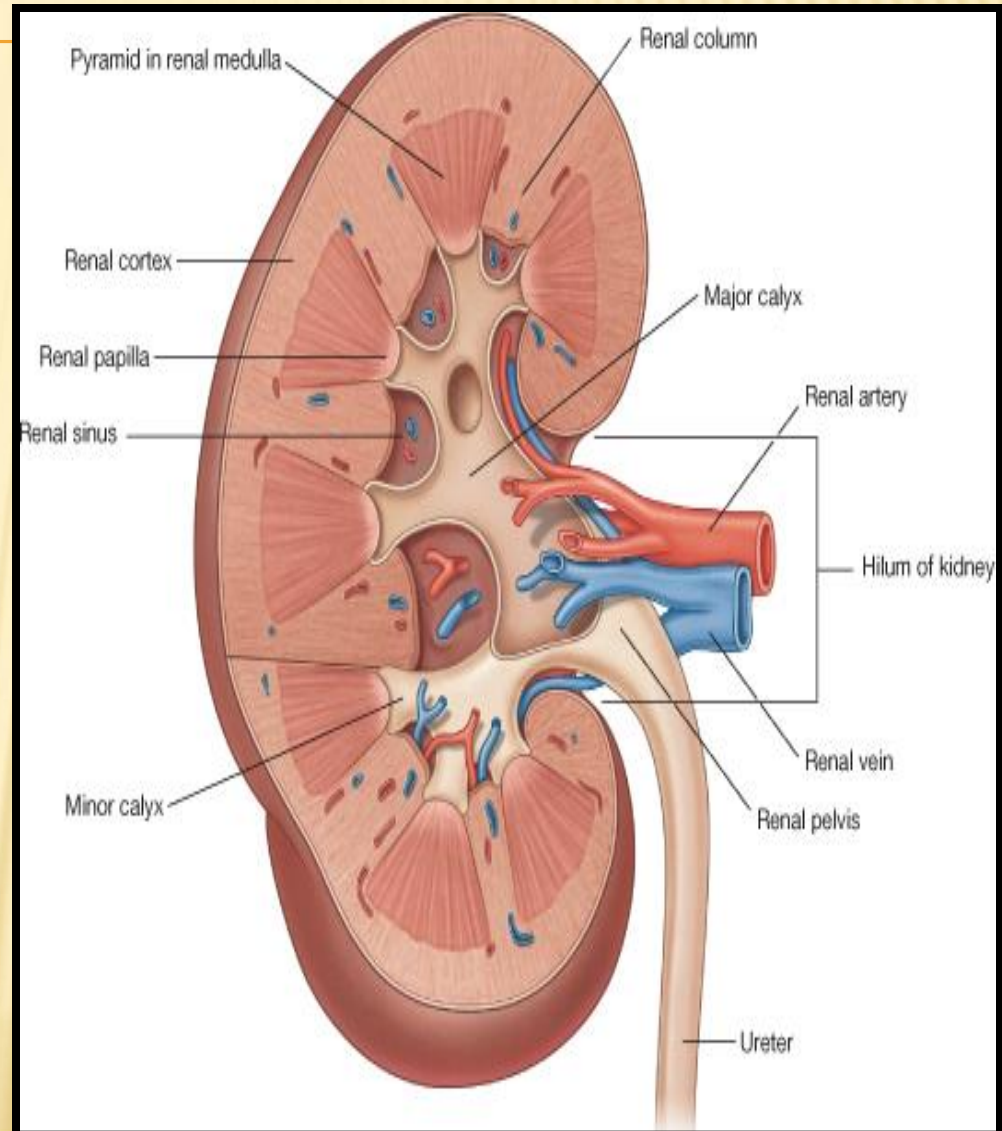


Right kidney sectioned in several planes, exposing parenchyma and renal pelvis



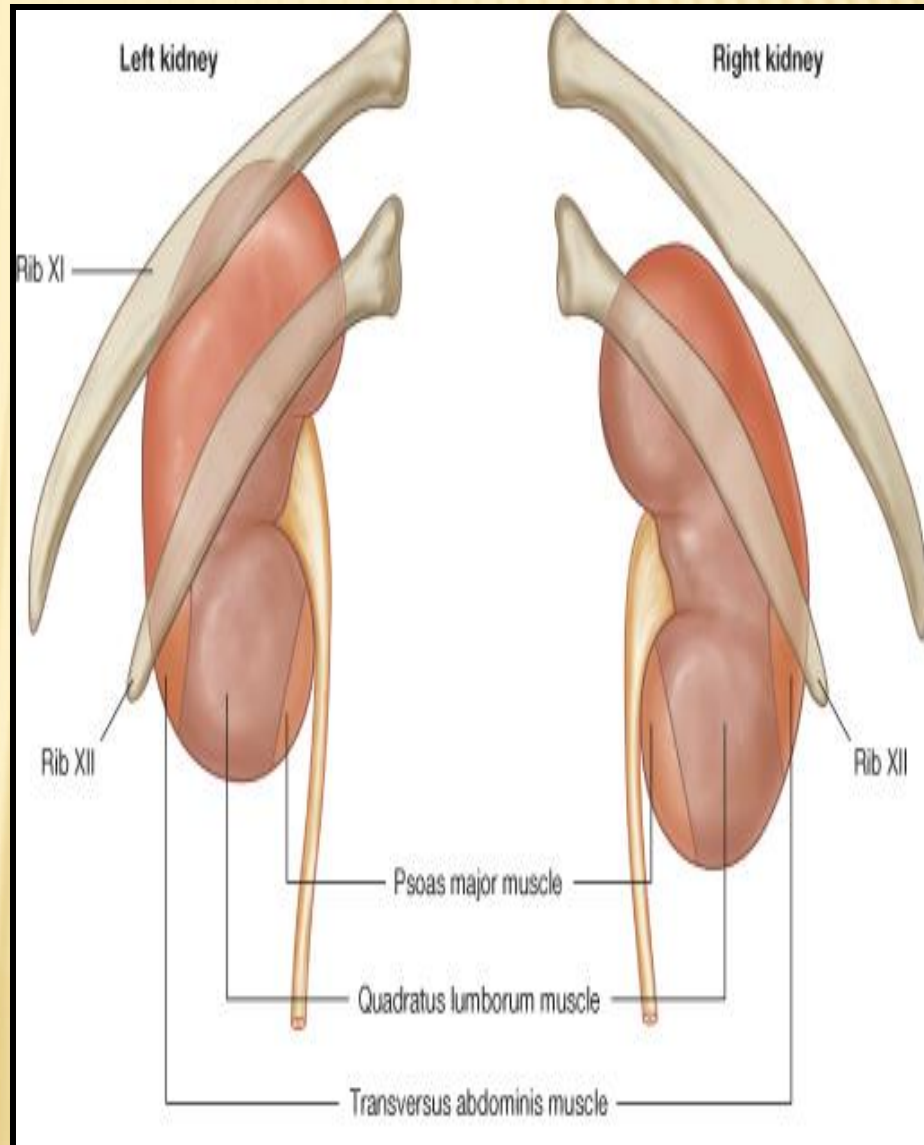
# RENAL STRUCTURE

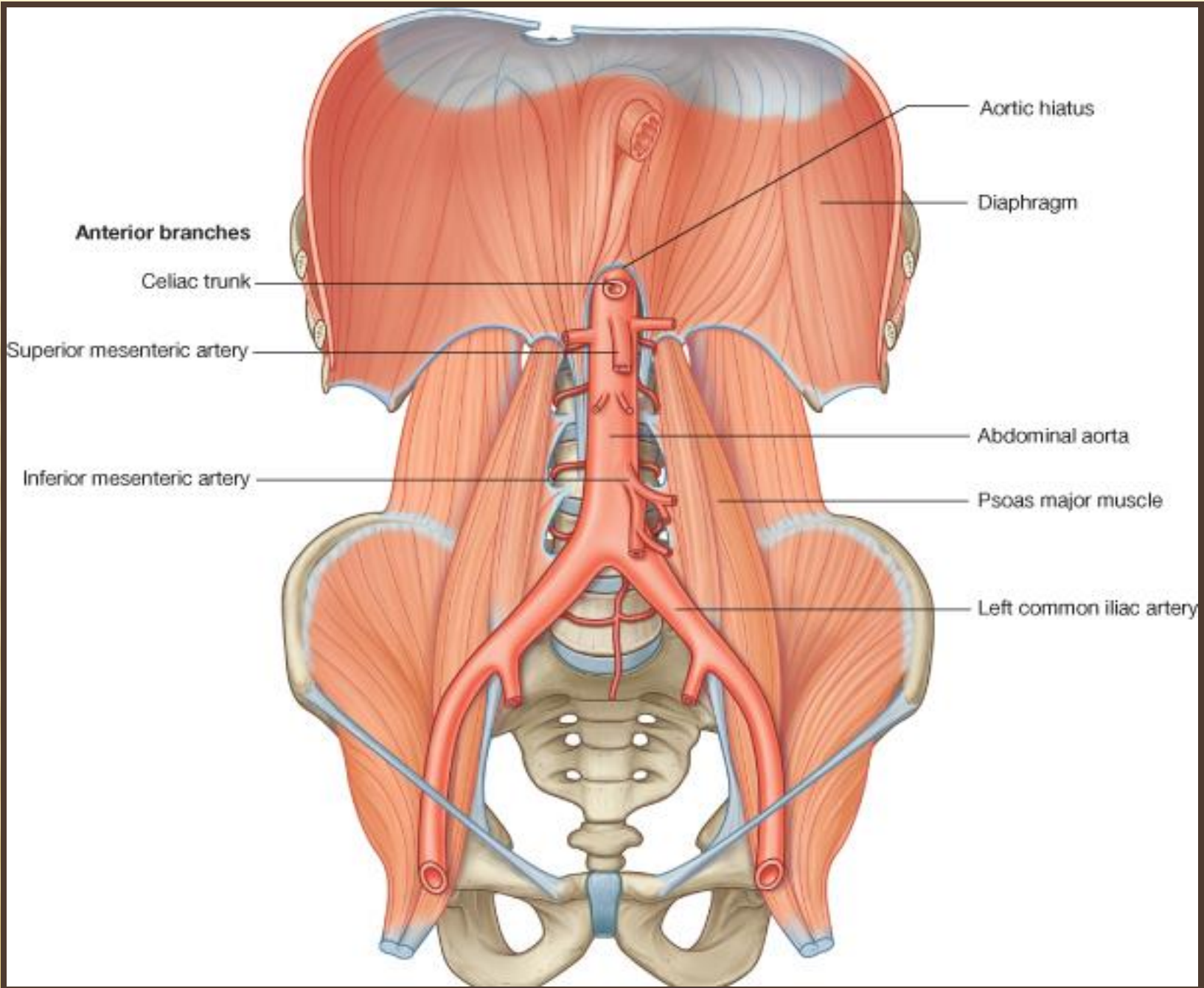
- ✘ Extending from the bases of the renal pyramids into the cortex are striations known as medullary rays.
- ✘ The renal sinus within the hilum, contains the upper expanded end of the ureter, the renal pelvis.
- ✘ Renal pelvis divides into two or three major calyces, which divides into two or three minor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



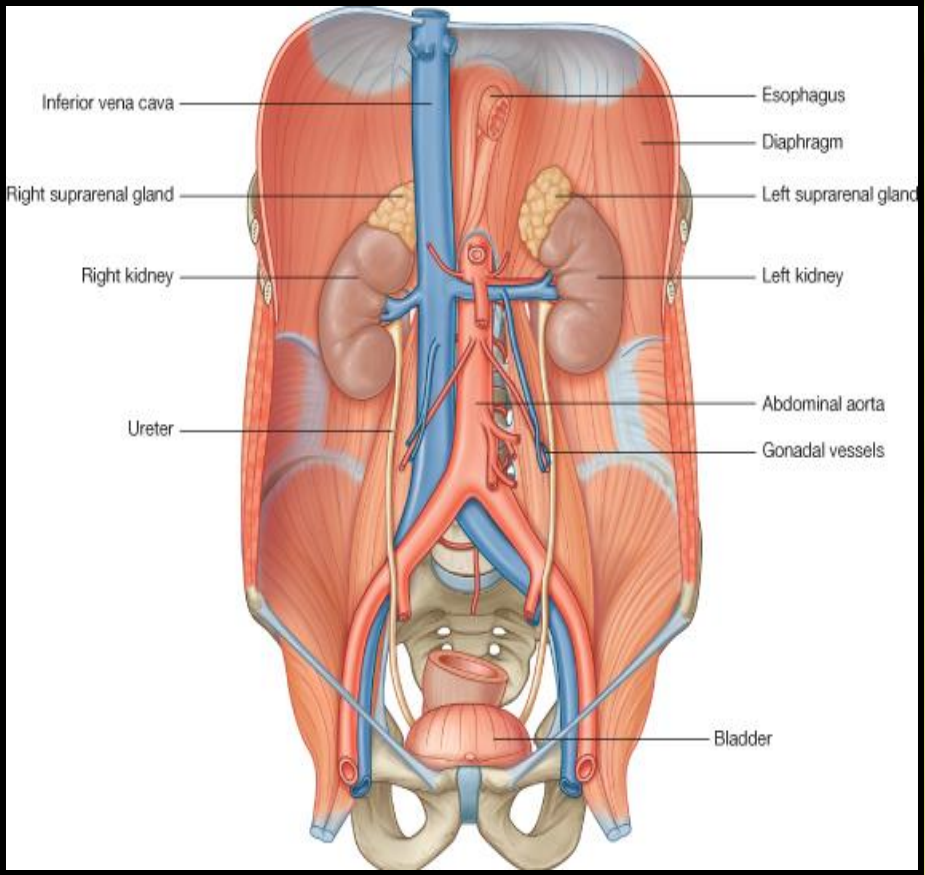
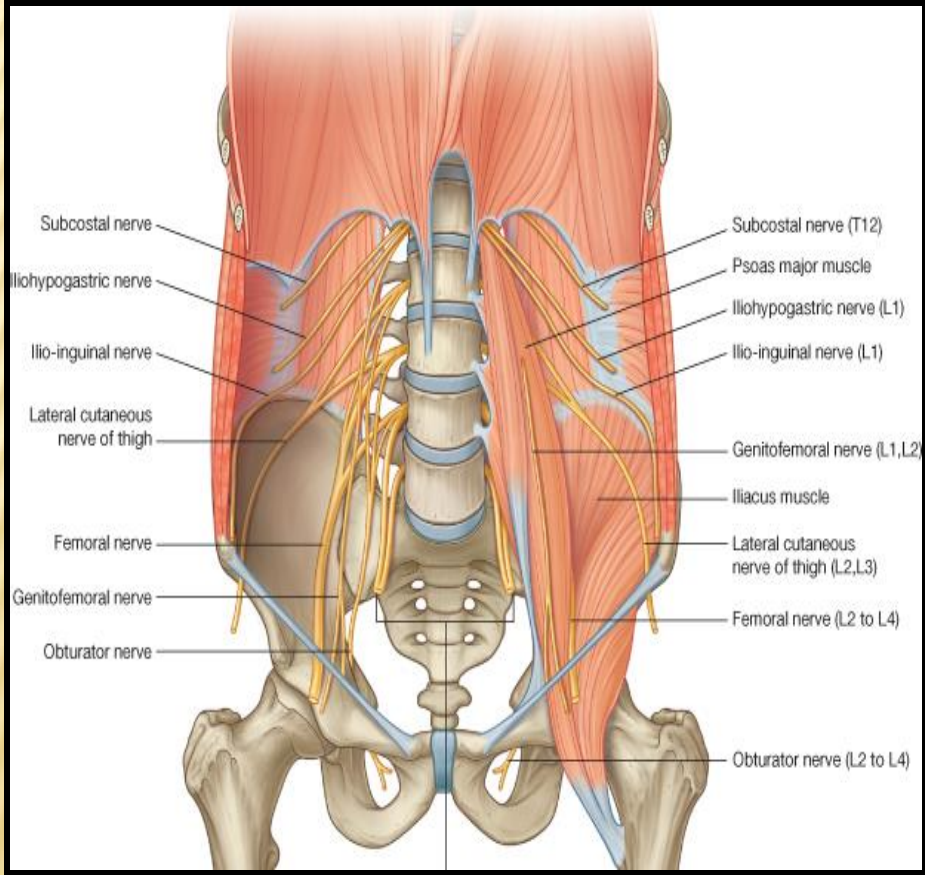
- ✘ ( Last rib + 4muscles + 3 nerves)
- ✘ Diaphragm, (last intercostal space)
- ✘ Costodiaphragmatic pleural recess.
- ✘ Twelfth rib,
- ✘ Psoas major muscle,
- ✘ Quadratus lamborum m.,
- ✘ Transversus abdominis m.,
- 1. **Subcostal nerve (T12),**
- 2. **Ilioypogastric (L1) nerve.**
- 3. **Ilioinguinal (L1) nerve**
- ✘ NB. The left kidney reaches up to the 11<sup>th</sup> rib.

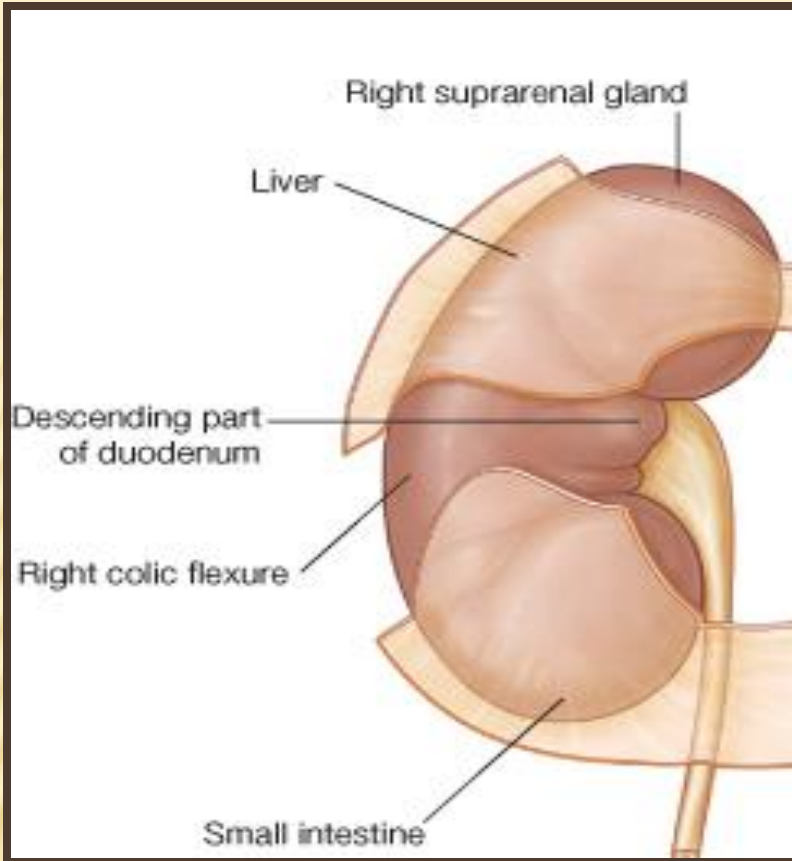
## POSTERIOR RELATIONS



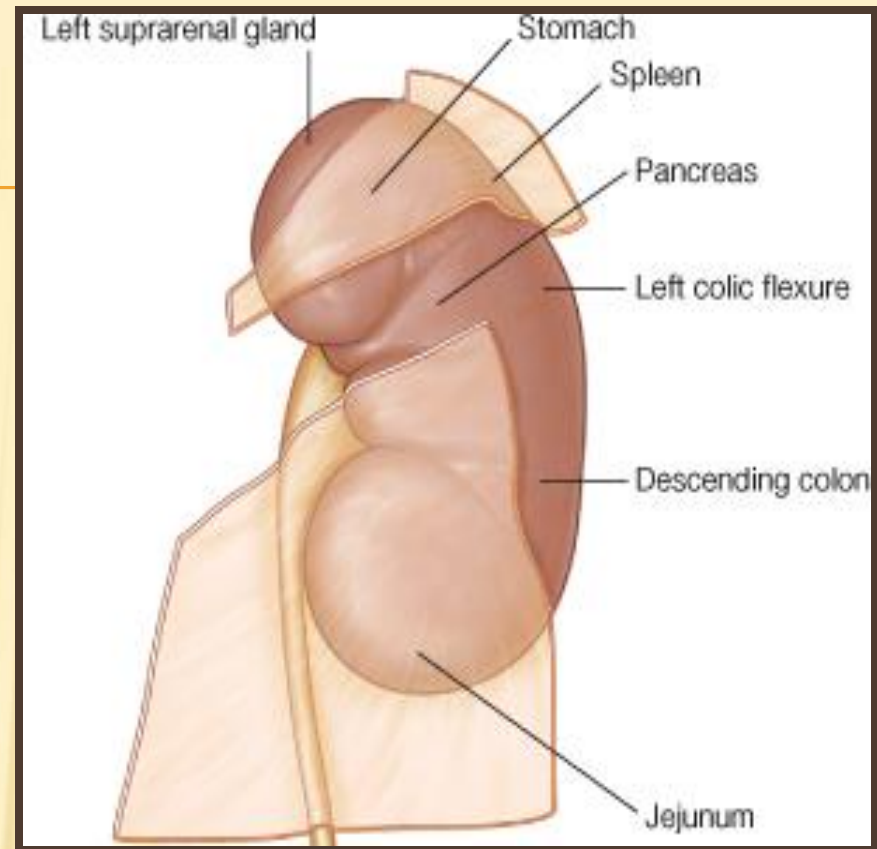


# Posterior Relation





# A N T E R I O R R E L A T I O N

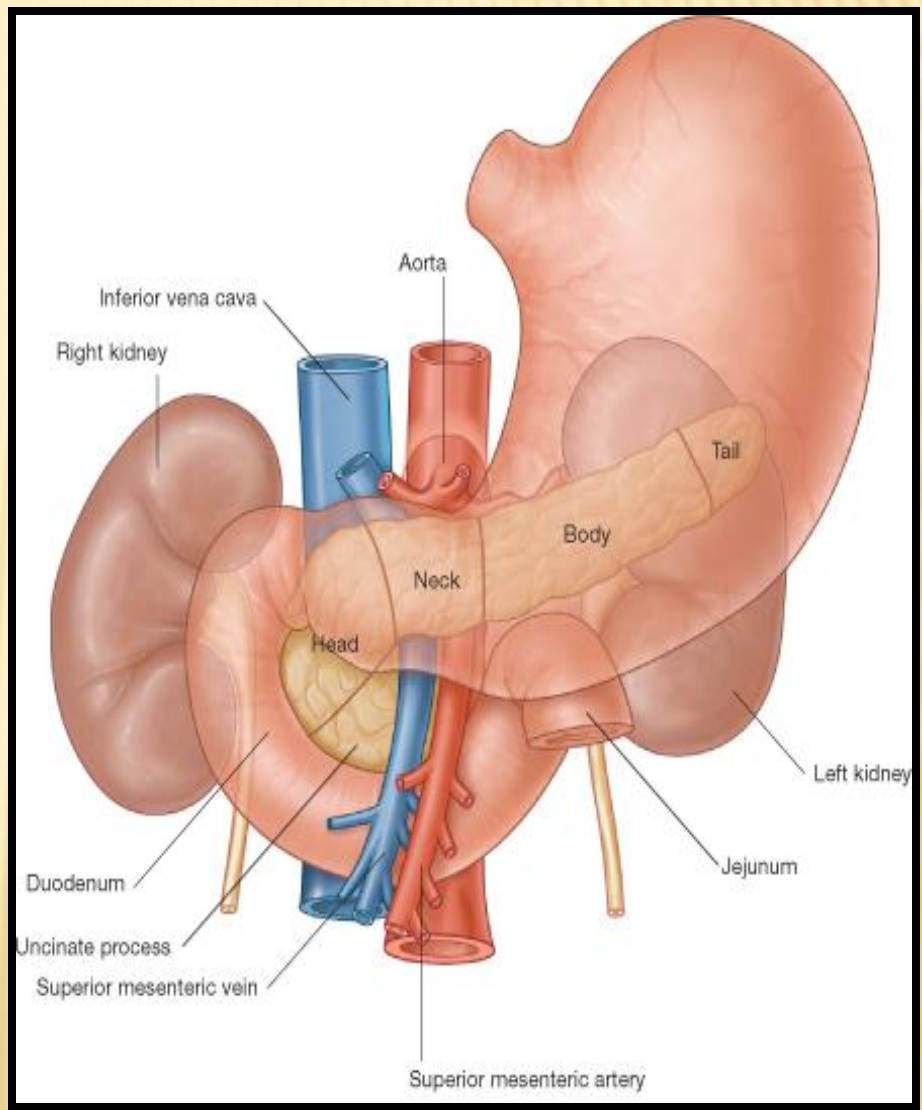
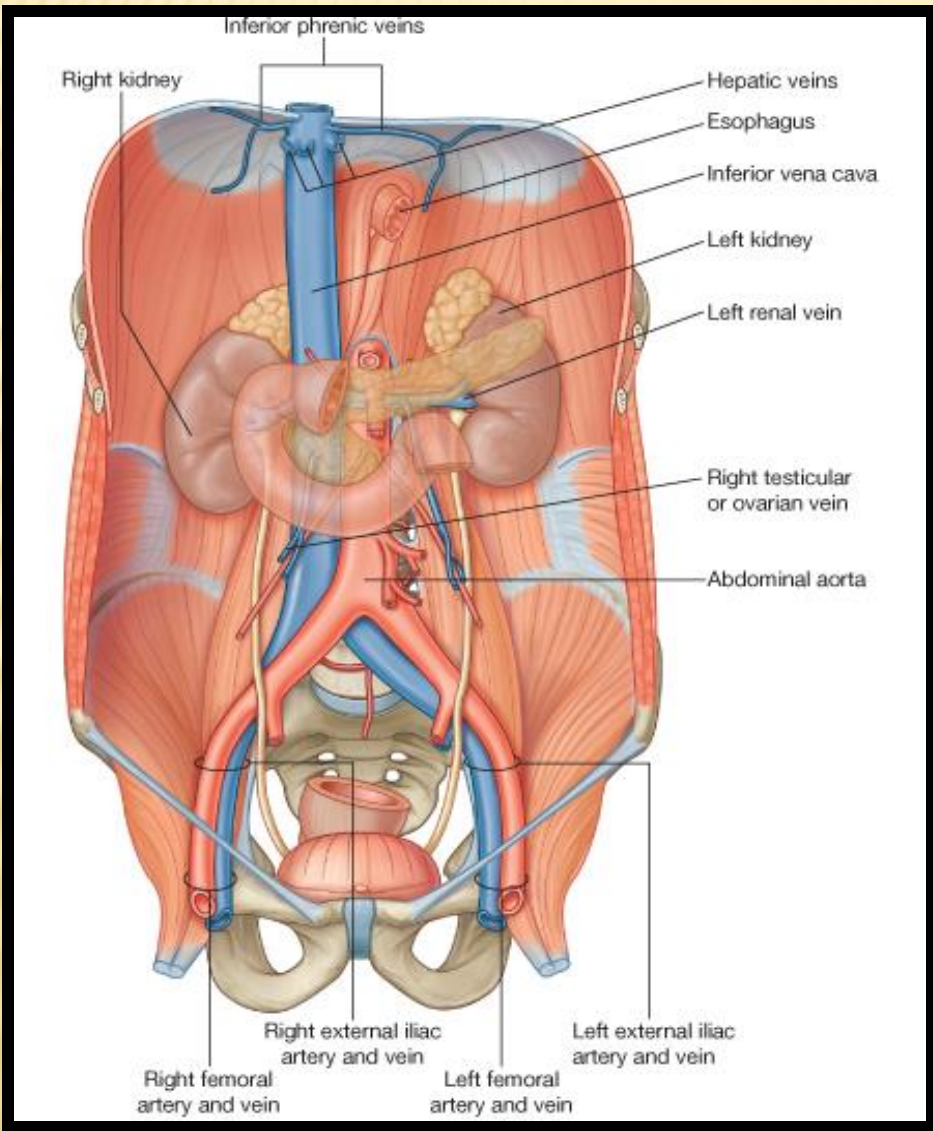


## Right Kidney :

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

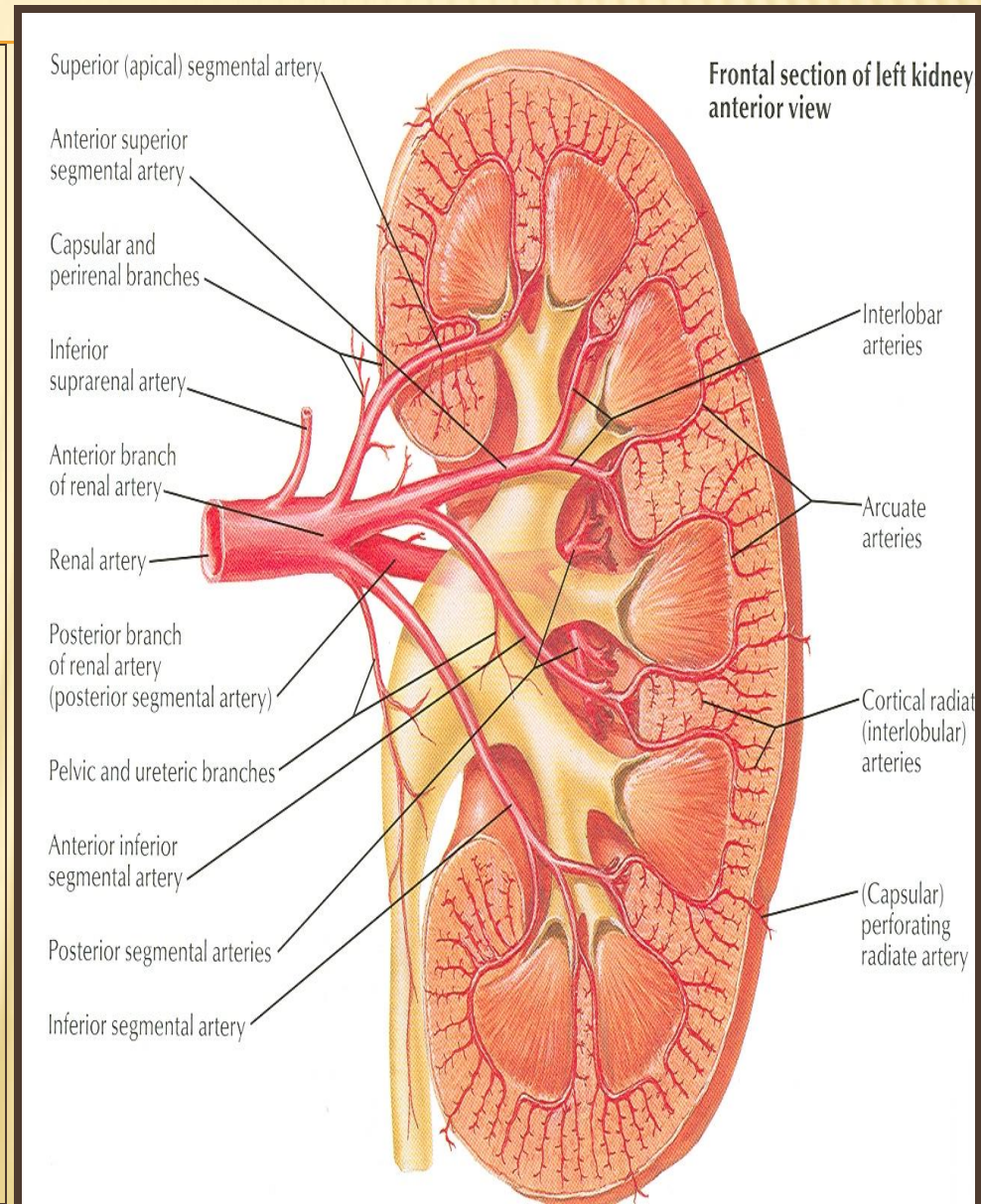
## Left Kidney :

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



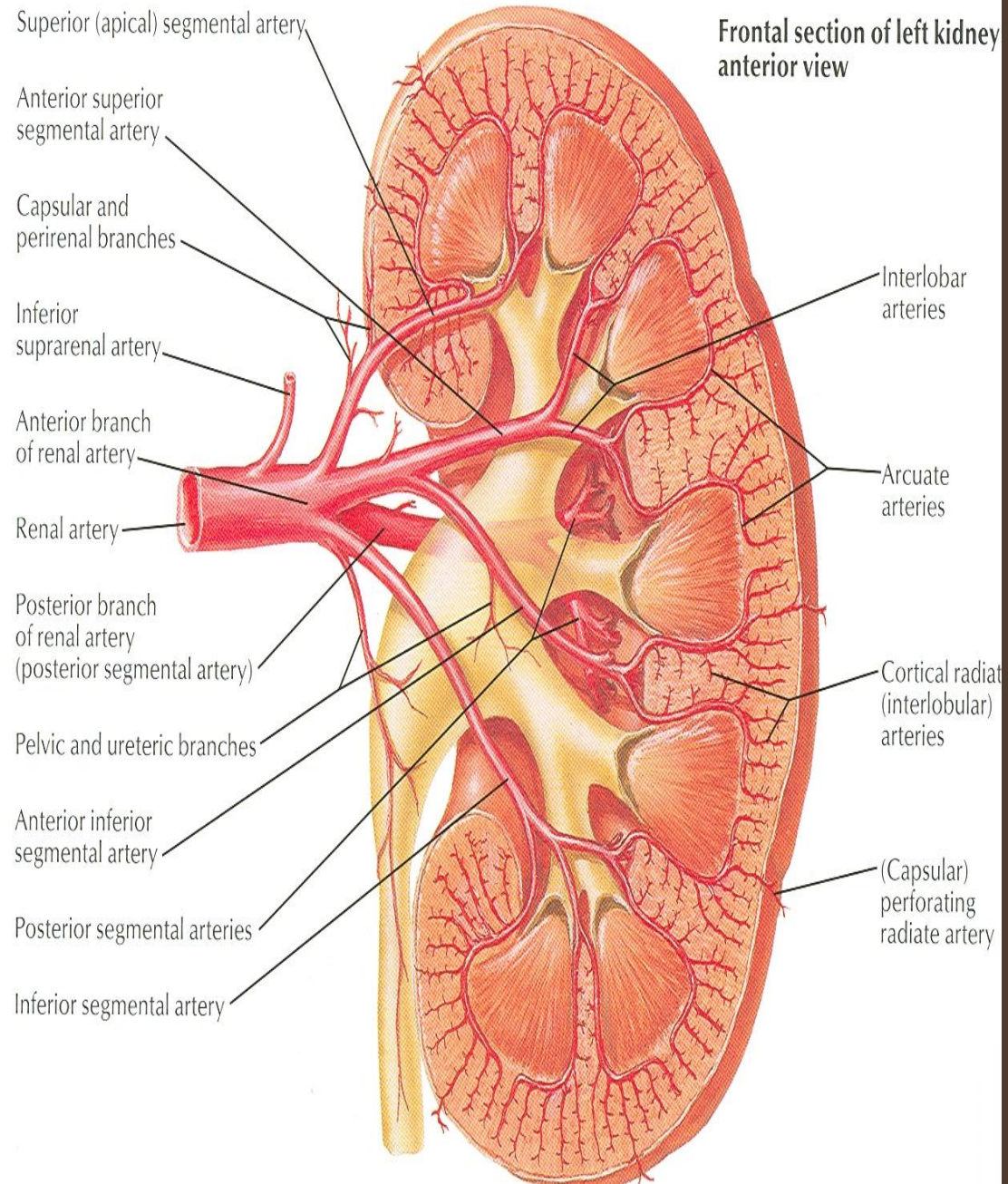
# BLOOD SUPPLY

- ✗ 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 arteries arise 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 arteries give afferent glomerular arterioles**.





The renal artery divides into 5 segmental branches

Apical segmental artery

The renal artery

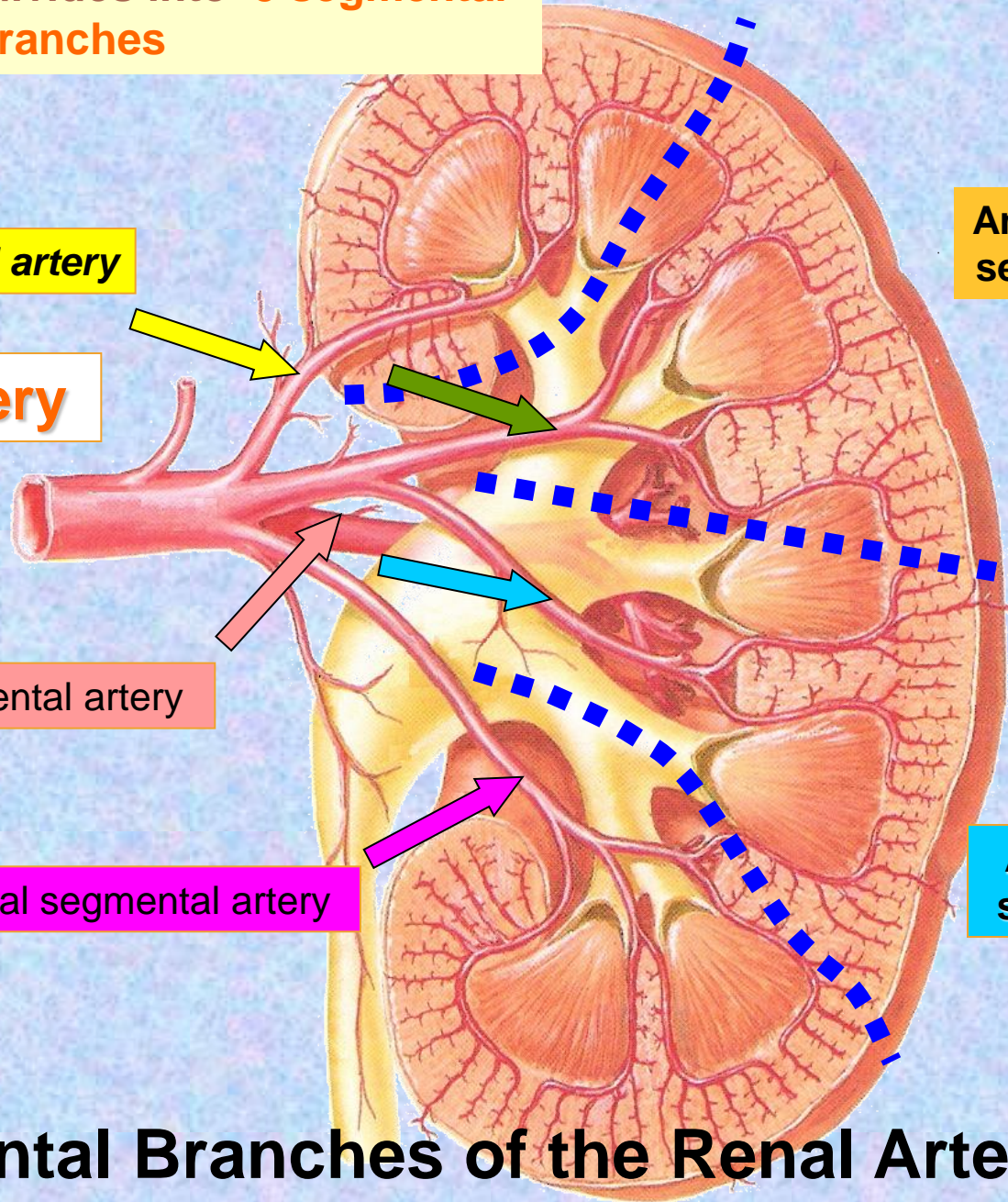
Anterior superior segmental artery

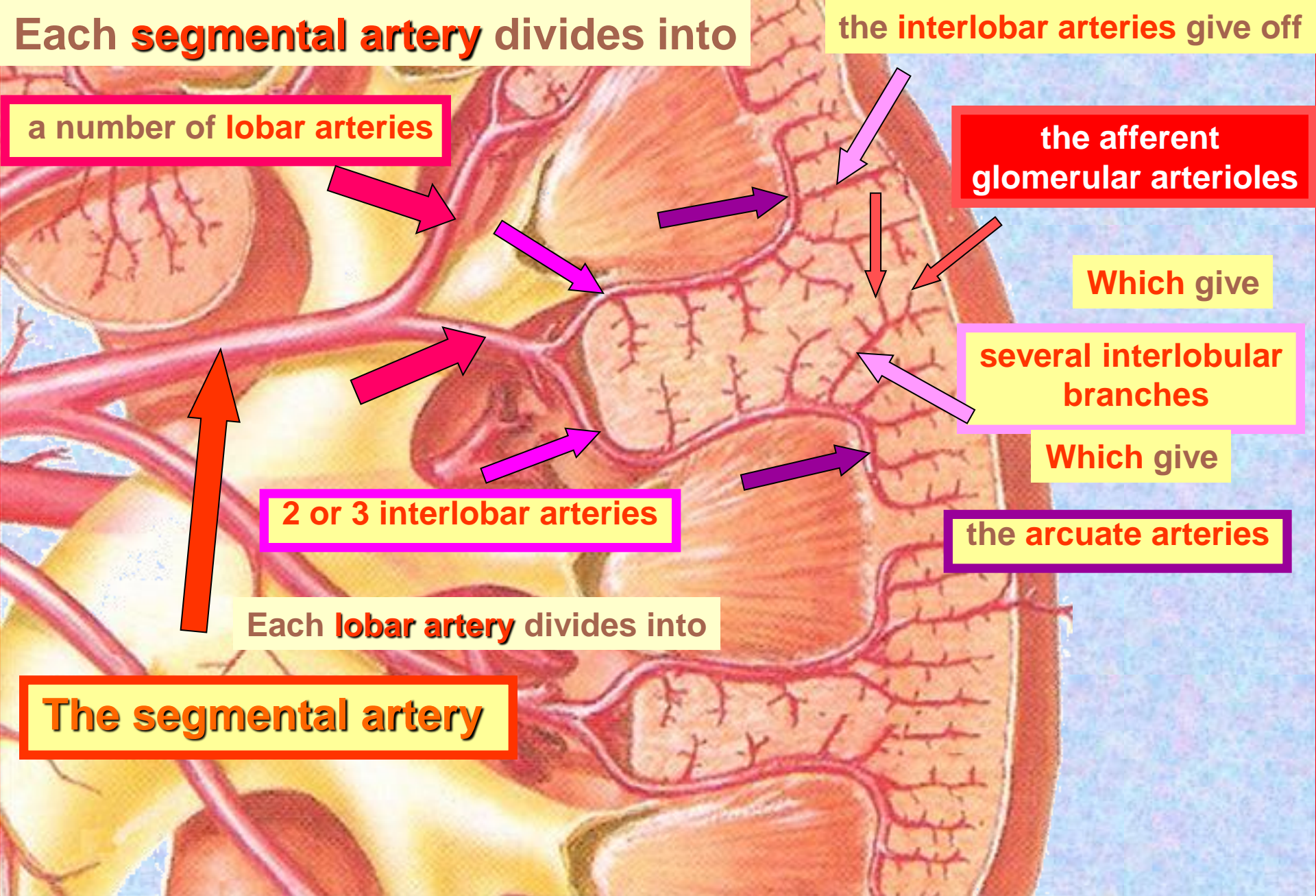
Posterior segmental artery

Caudal segmental artery

Anterior inferior segmental artery

# Segmental Branches of the Renal Artery





Each **segmental artery** divides into

the **interlobar arteries** give off

a number of **lobar arteries**

the **afferent glomerular arterioles**

Which give

**several interlobular branches**

Which give

**the arcuate arteries**

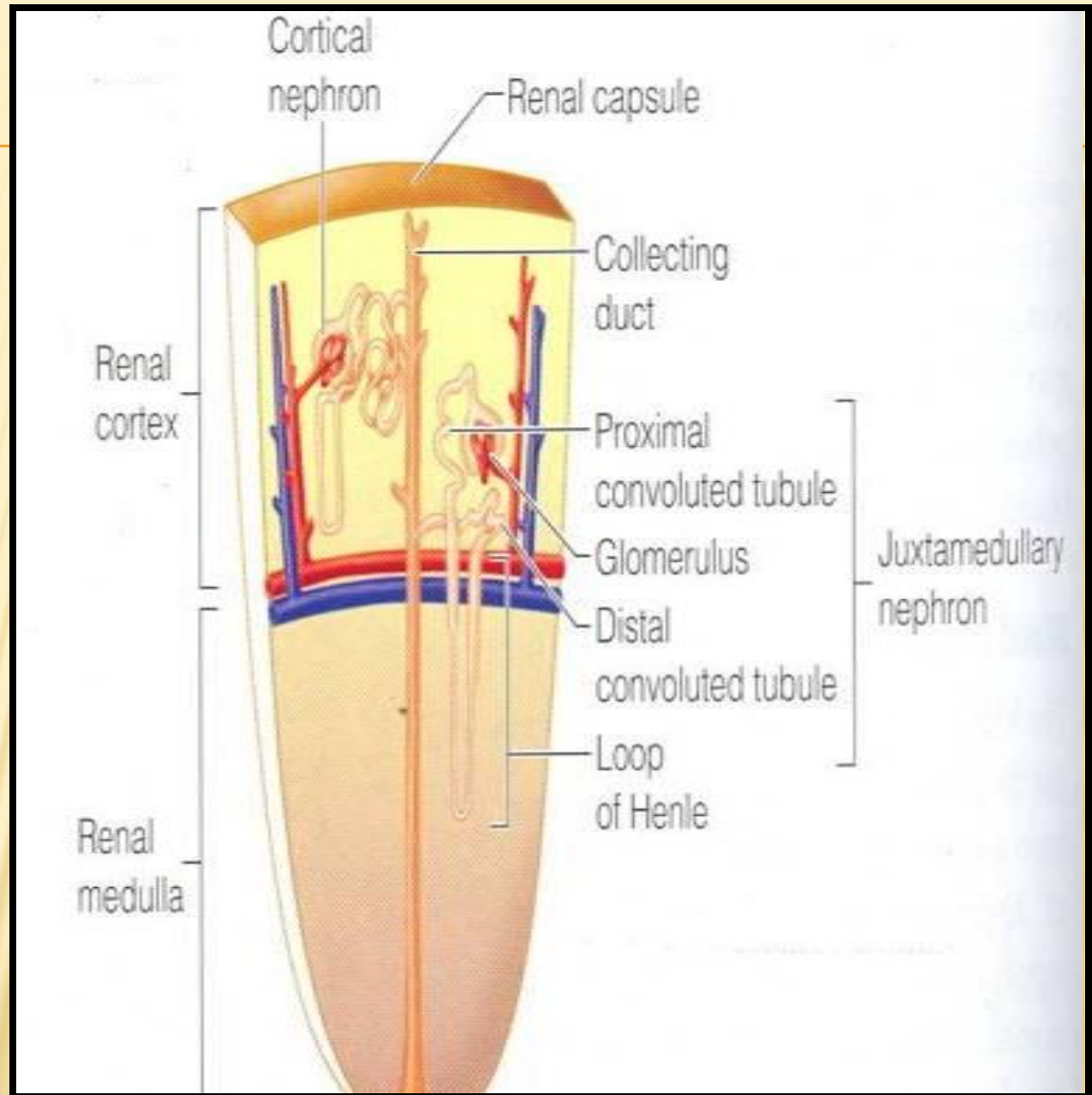
**2 or 3 interlobar arteries**

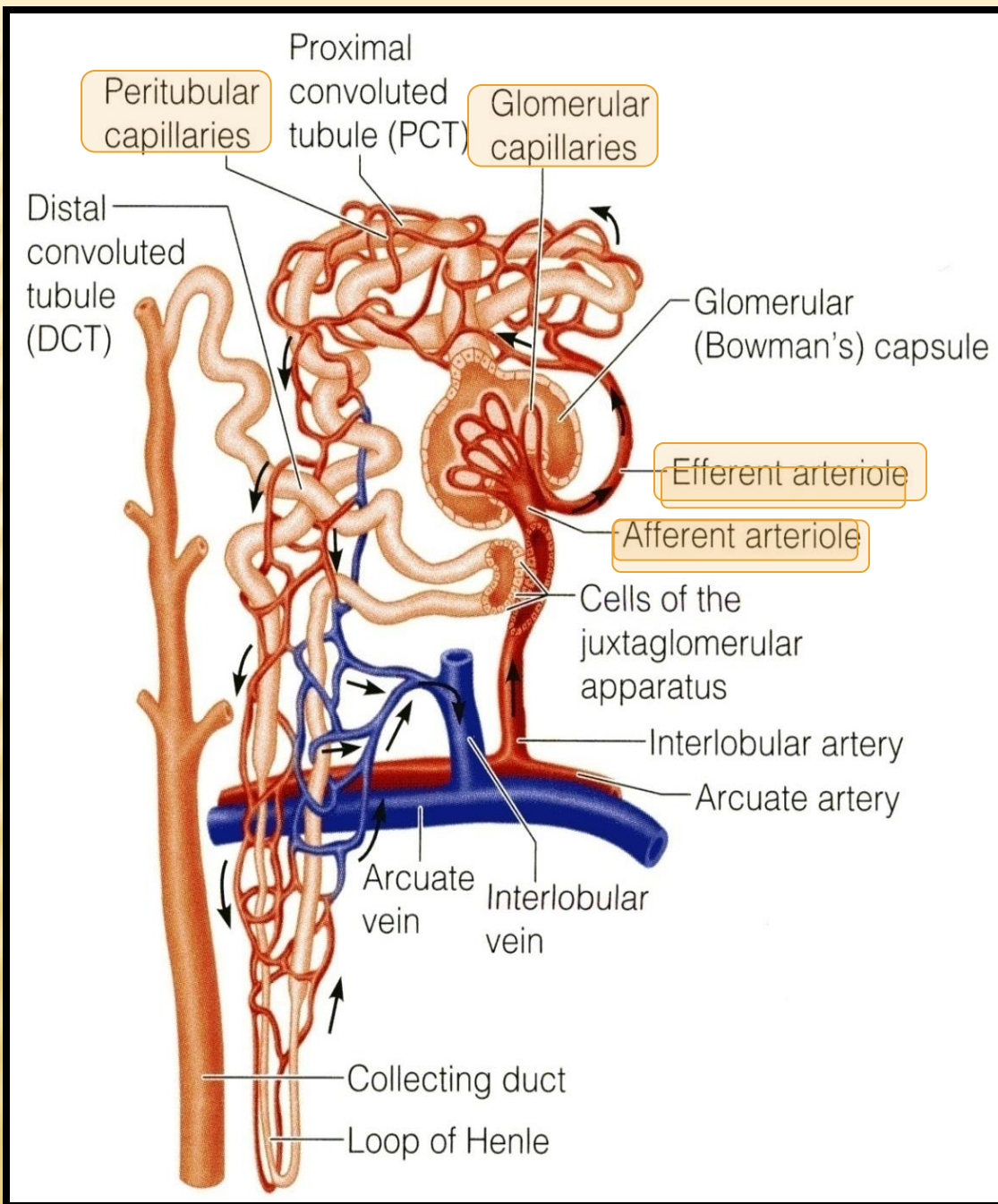
Each **lobar artery** divides into

**The segmental artery**

# Branches of the Segmental artery

✘ 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.

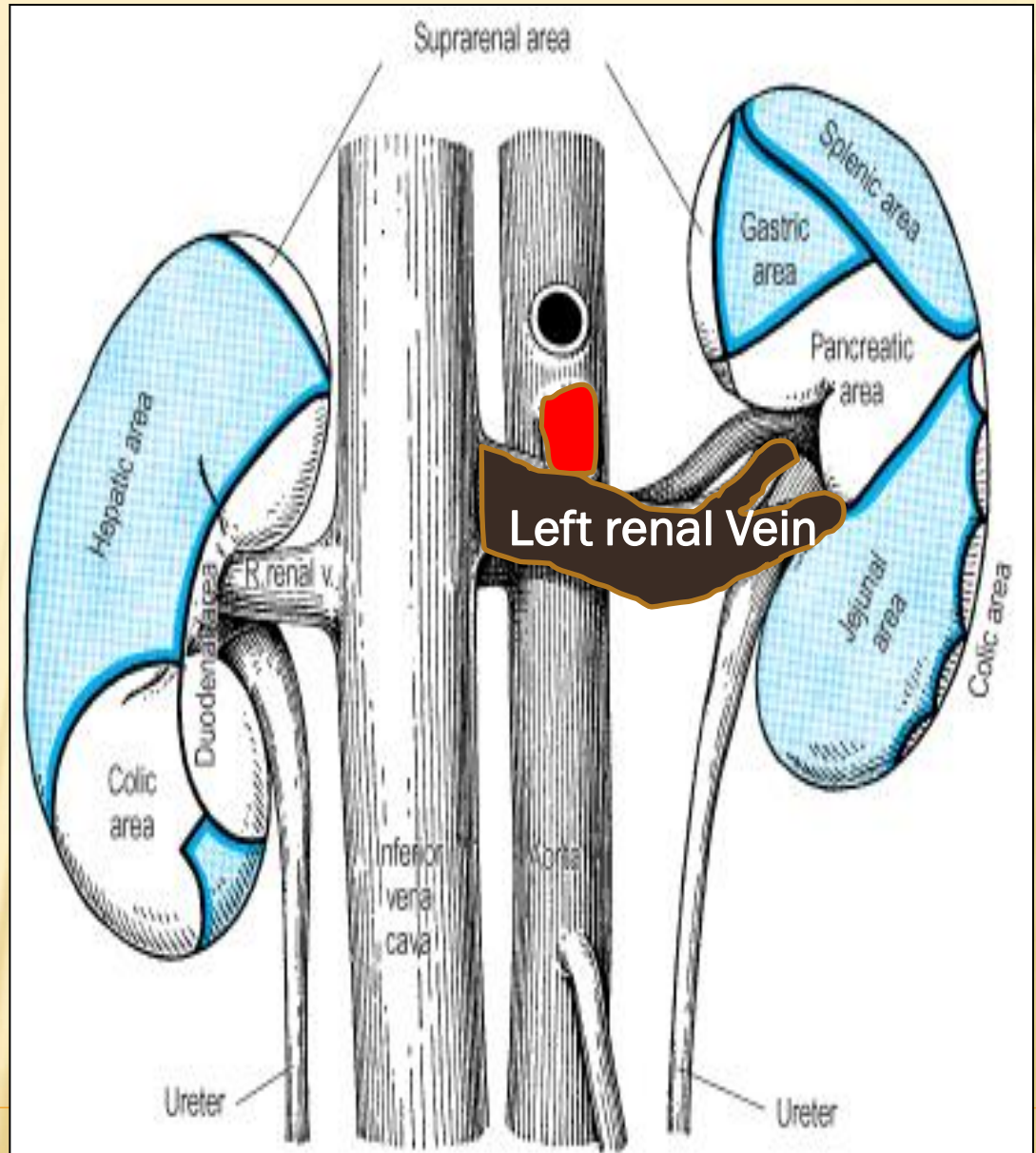
# VENOUS DRAINAGE

Both renal veins drain to the inferior vena cava.

The **left** is three times longer than the right (7.5 cm and 2.5 cm).

So, for this reason the left kidney is the preferred side for live donor **nephrectomy**.

It runs from its origin in the renal hilum, posterior to the **splenic vein** and the body of pancreas, and then across the anterior aspect of the **aorta**, just below the origin of the **superior mesenteric artery**.

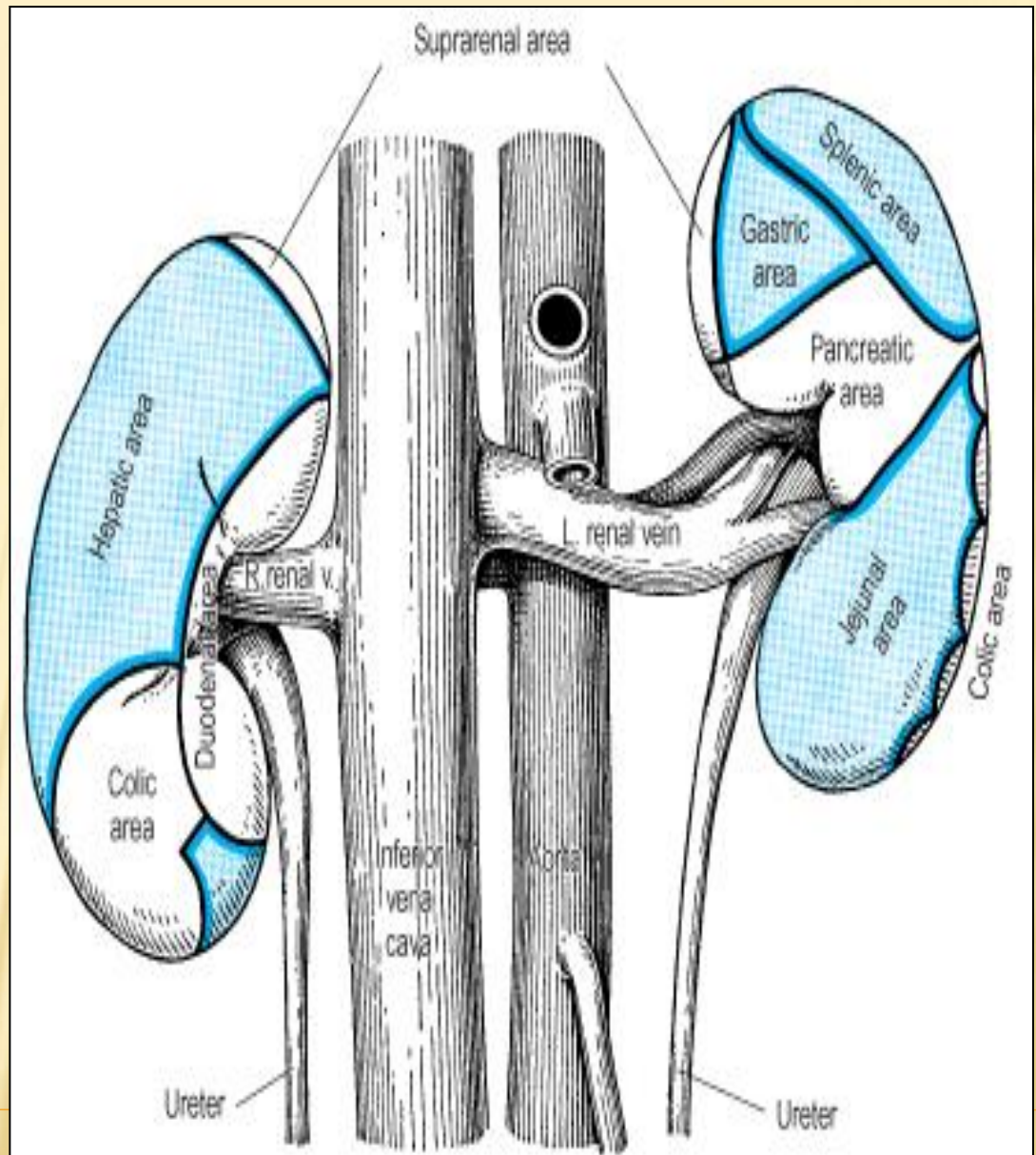


# VENOUS DRAINAGE

The left gonadal vein enters the left renal vein from below while the left suprarenal vein, enters it from above but nearer to the midline.

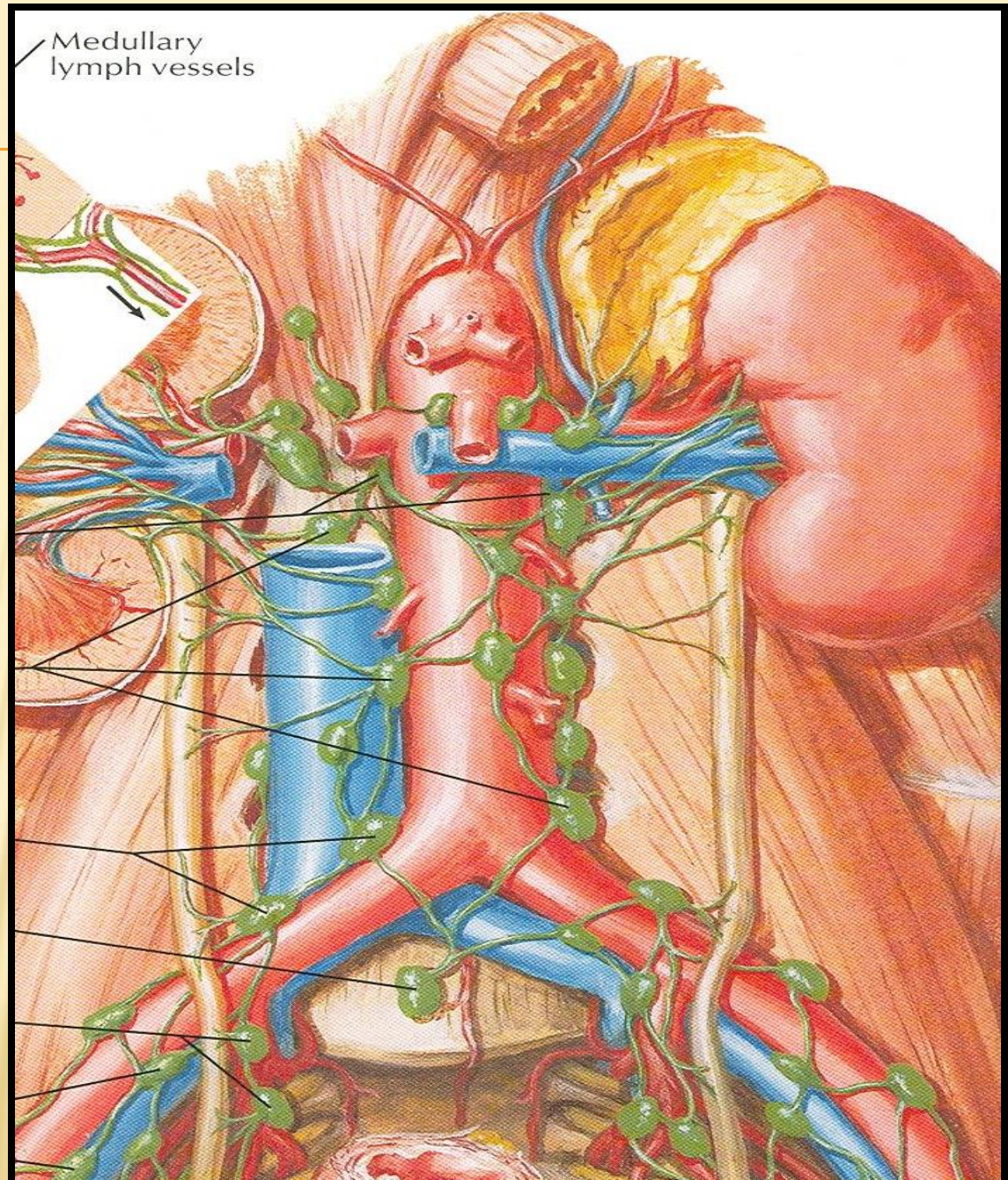
The left renal vein enters the inferior vena cava a little above the right vein.

The right renal vein is behind the 2<sup>nd</sup> part of the duodenum and sometimes the lateral part of the head of the pancreas



# LYMPH

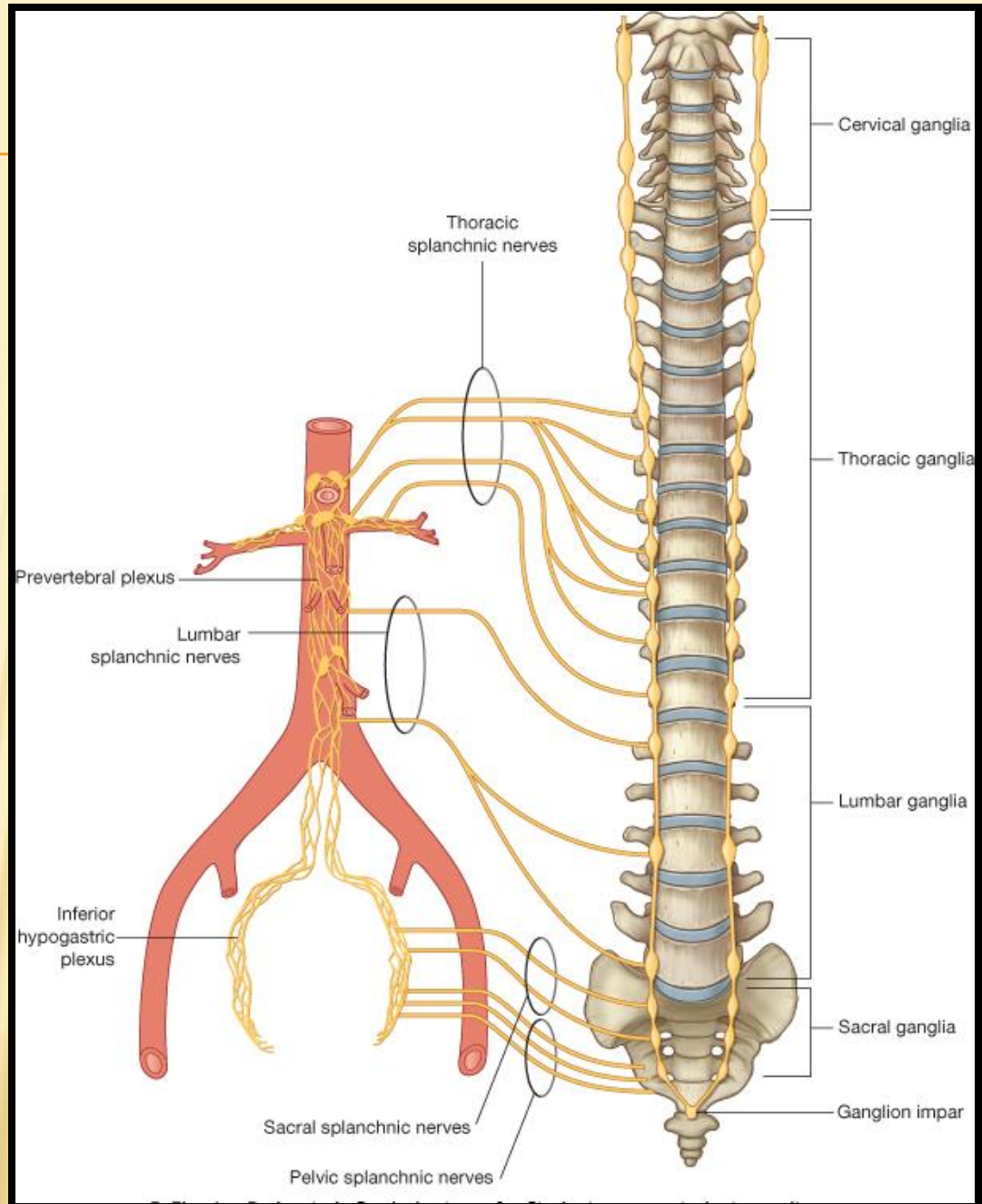
- ✘ **Lymph Drainage:**
- ✘ Lateral aortic lymph nodes around the origin of the renal artery.



# NERVE SUPPLY

## Nerve Supply

- ✘ Renal sympathetic plexus.
- ✘ The afferent fibers that travel through the renal plexus enter the spinal cord in the:
  - ✘ **10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup> Thoracic nerves.**





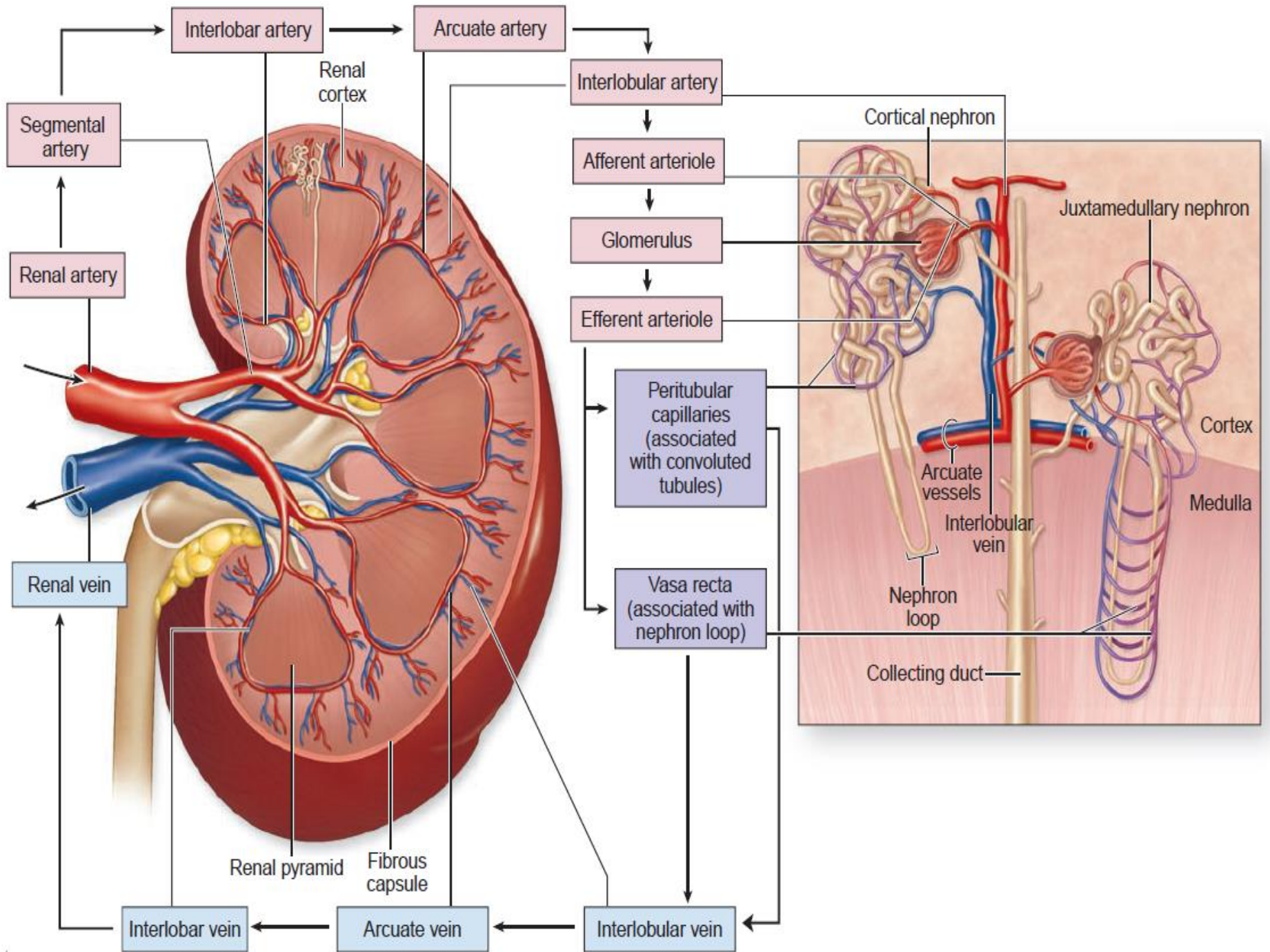
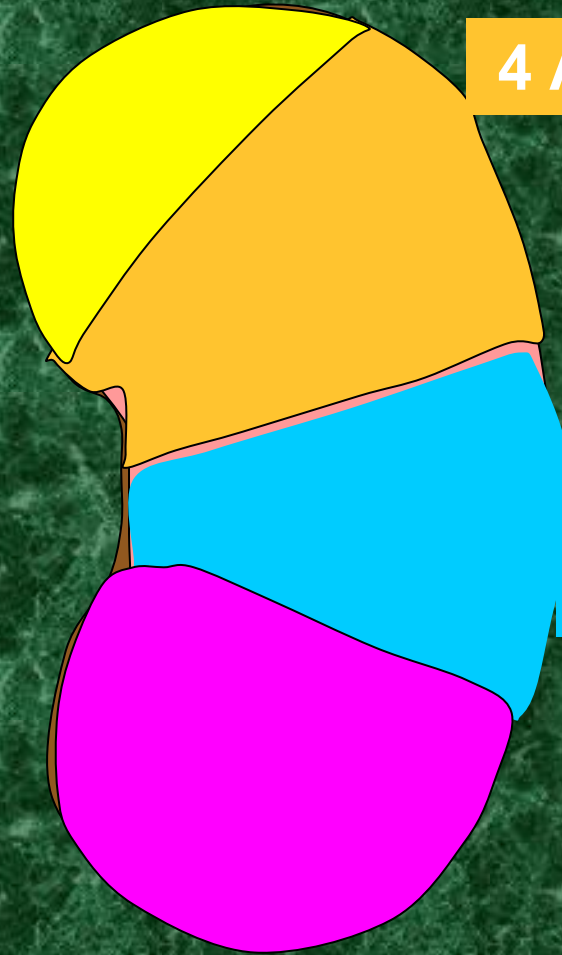


Figure 27.4

# Each kidney consists of 5 segments

**1- Apical segment**



**4 Anterior superior segment**

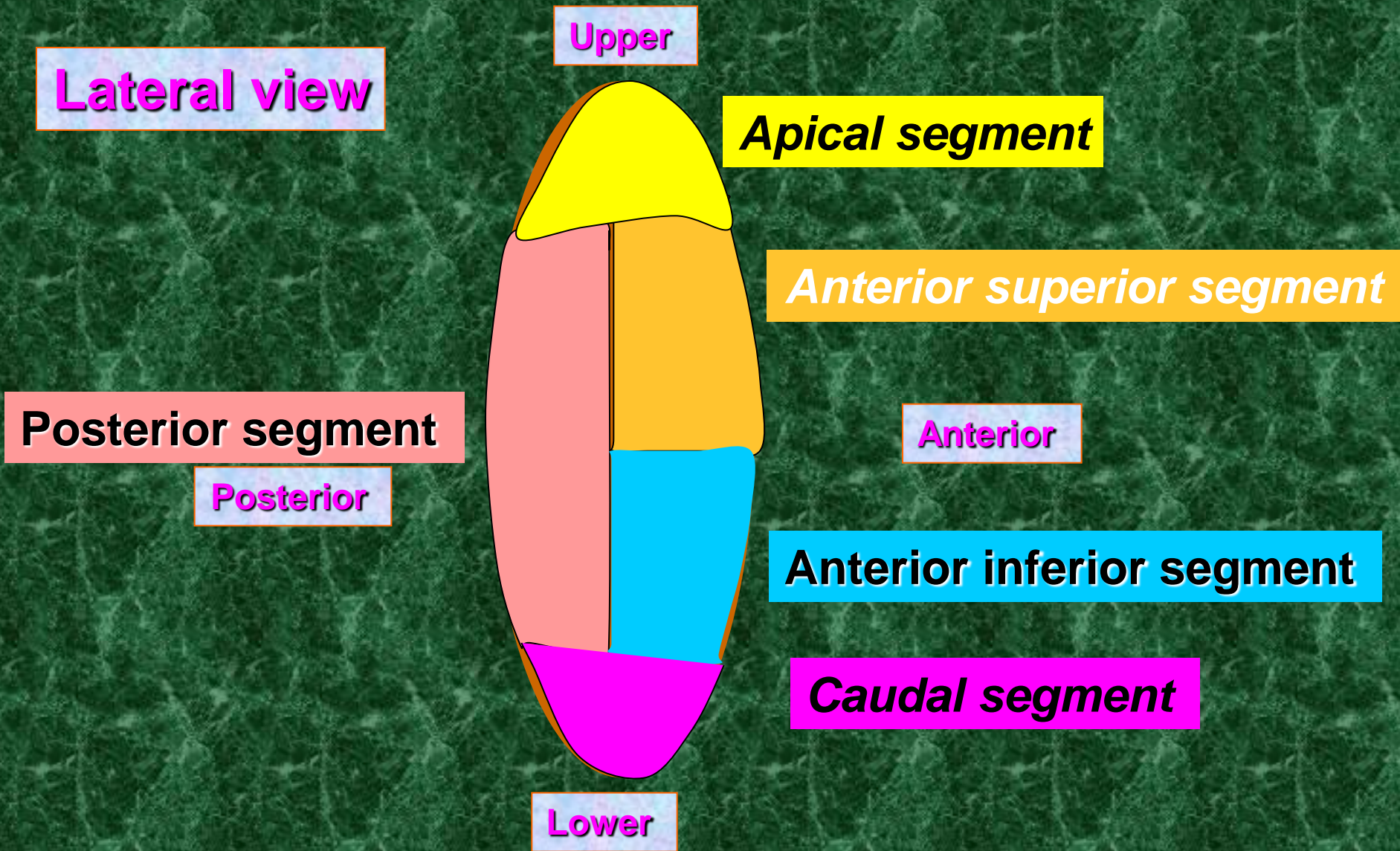
**3-Posterior segment**

**5- Anterior inferior segment**

**2- Caudal segment**

## Segments of the kidneys

**Each kidney consists of 5 segments each has its own blood supply**



**Segments of the kidneys (Rt.)**