

# Renal Functions

**Guyton 26,27,28**

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# Objectives

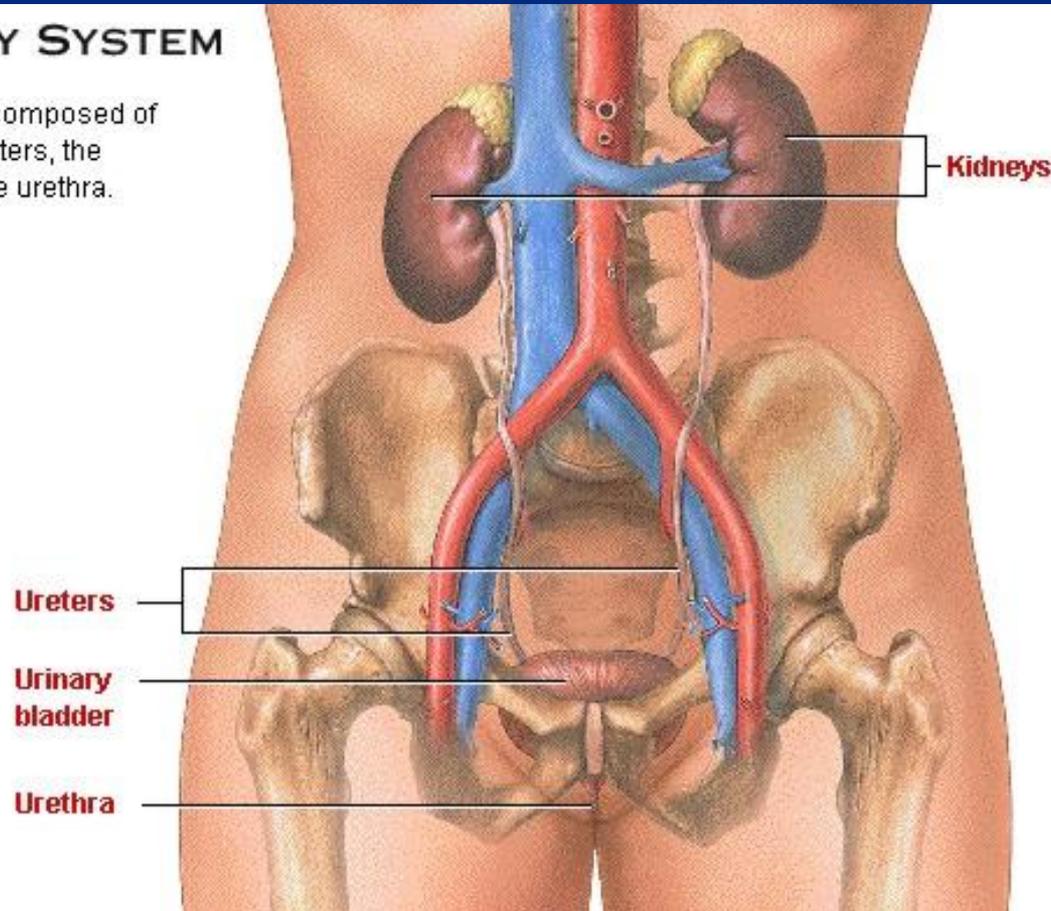
**At the end of this lecture student should be able to describe:**

- **Physiologic anatomy of Urinary system**
- **Functions of the kidney**
- **Structure, Parts and Types of Nephrons**
- **Juxtaglomerular Apparatus**
- **Blood Supply and innervation**

# Renal System

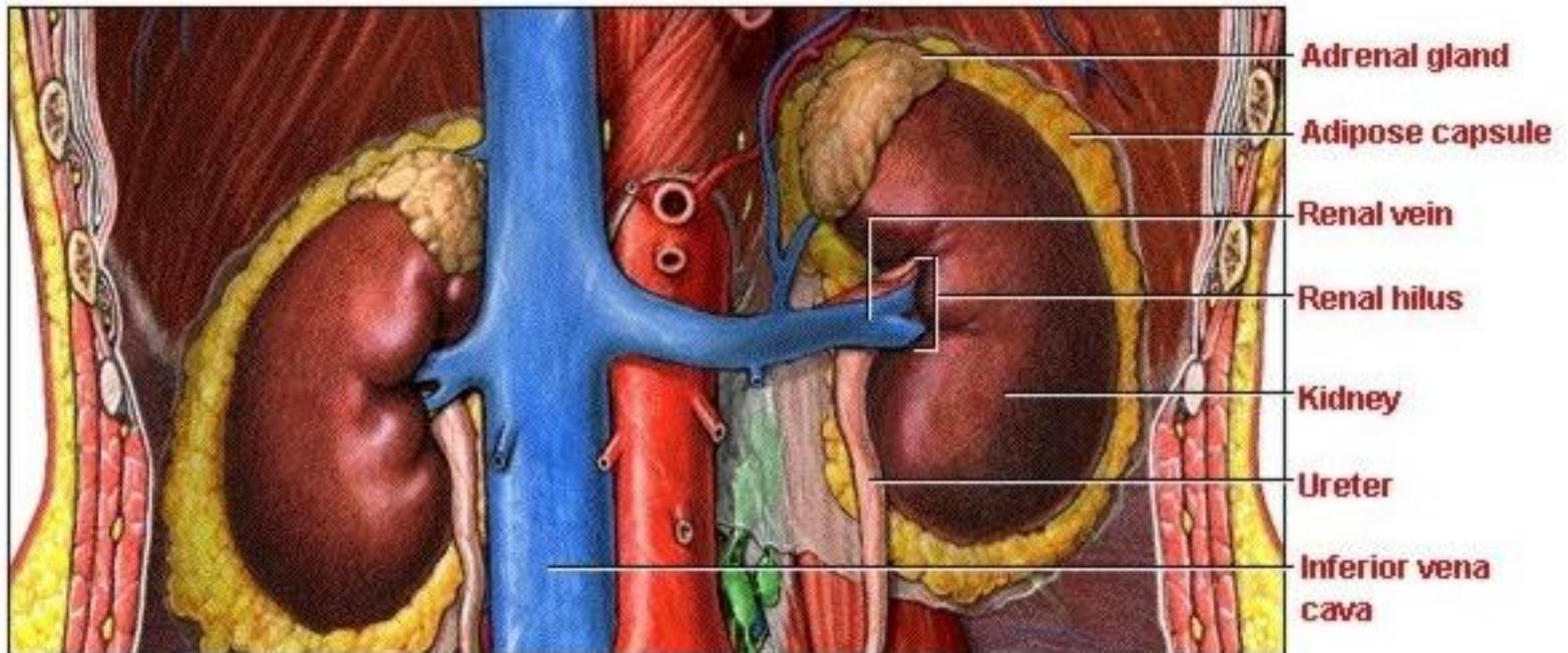
## THE URINARY SYSTEM

The urinary system is composed of paired kidneys and ureters, the urinary bladder, and the urethra.



## EXTERNAL STRUCTURE OF THE KIDNEYS

The bean-shaped kidneys are **retroperitoneal**, lying against the dorsal body wall in the upper abdomen.



To learn more about the kidney's blood supply, click the left renal vein to remove it.

# Kidney functions

## 1. Homeostatic function

### ■ Regulates:

- Osmolality of ECF
- Plasma ions concentration
- ECF volume
- Arterial blood pressure
- Acid-base balance

# Kidney Functions *Cont*

## 2.Excretion

- **Metabolic end products**
  - Urea, creatinine, uric acid, bilirubin
- **Foreign substances**
  - drugs, toxins

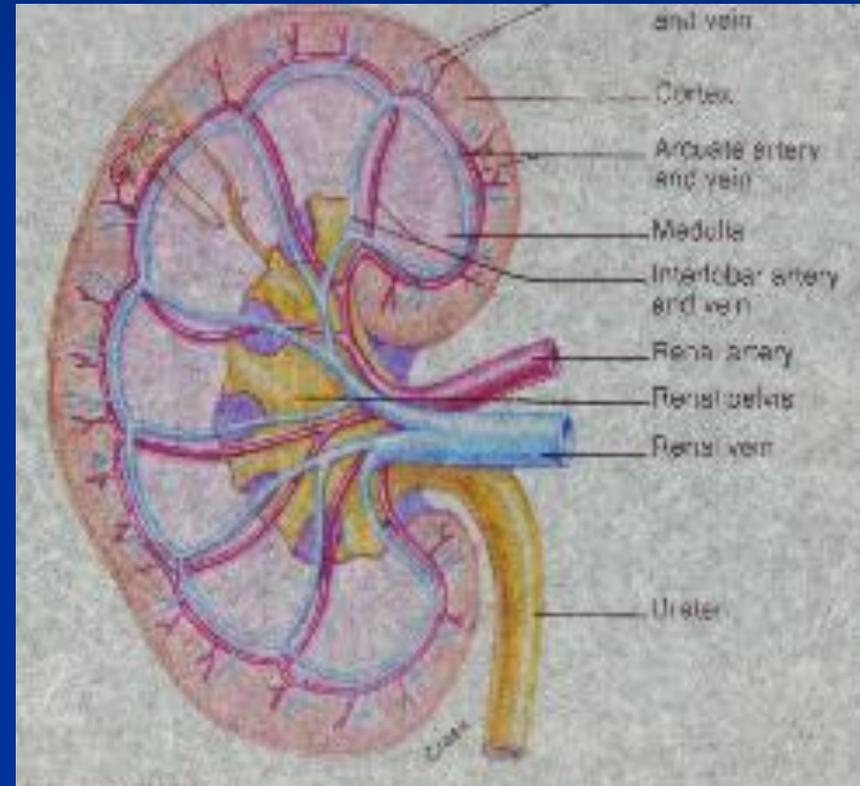
# Kidney Functions *Cont*

## 3. Biosynthesis

- **Renin**
- **Erythropoietin**
- **Calciferol (1,25 dihydroxy Vit. D)**
- **Glucose (gluconeogenesis)**  
angiotensinogen, ammonia
- **Prostaglandins, adenosine, endothelin, nitric oxide, bradykinin**

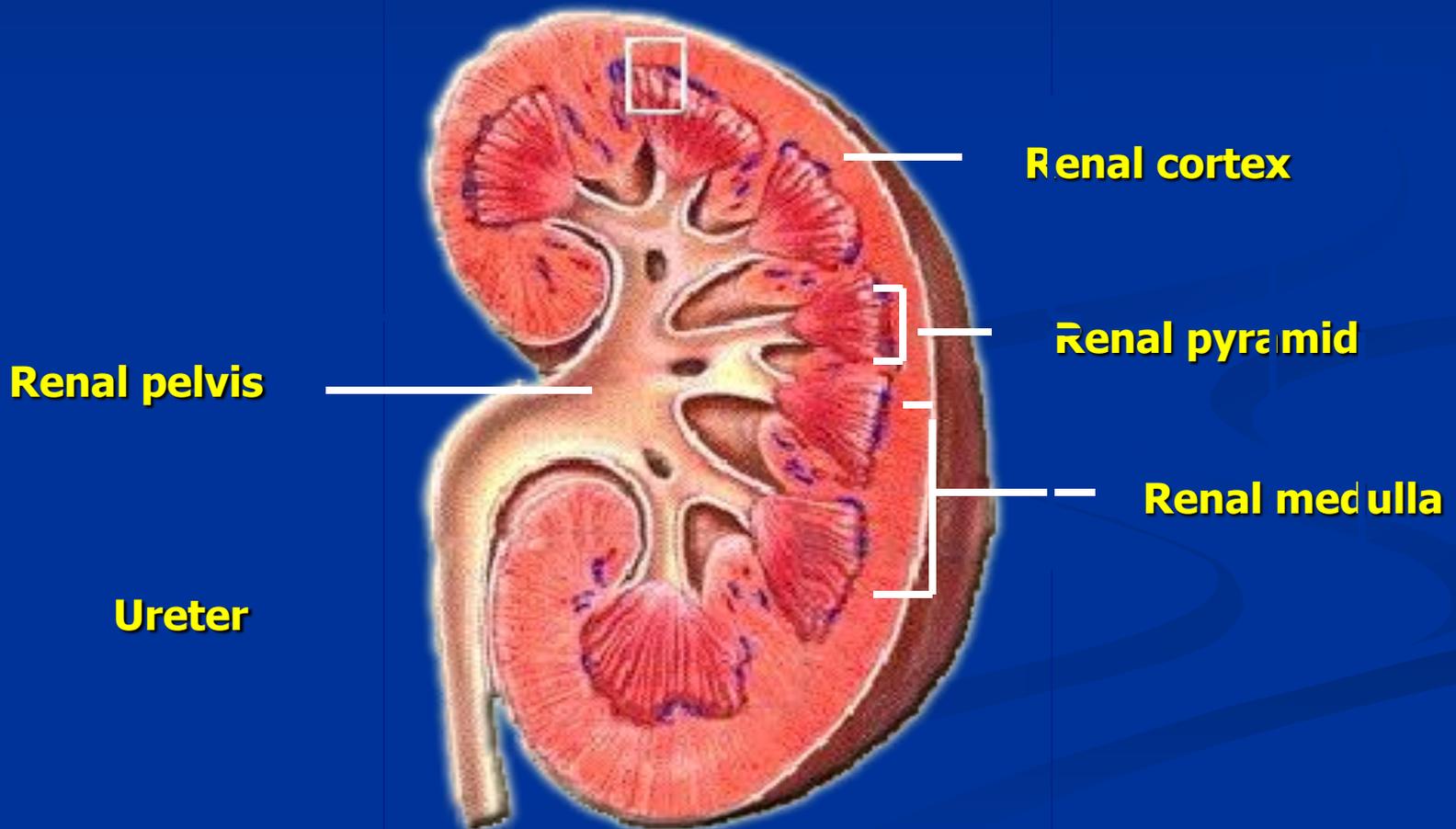
# Macroscopic structure of the kidney

- Renal capsule
- Cortex
- Medulla – pyramid – papilla
- Pelvis – major & minor calyces
- Ureter
- bladder



# Macroscopic Structure of the Kidney

human kidney is composed of three regions: the renal cortex, medulla, and pelvis.

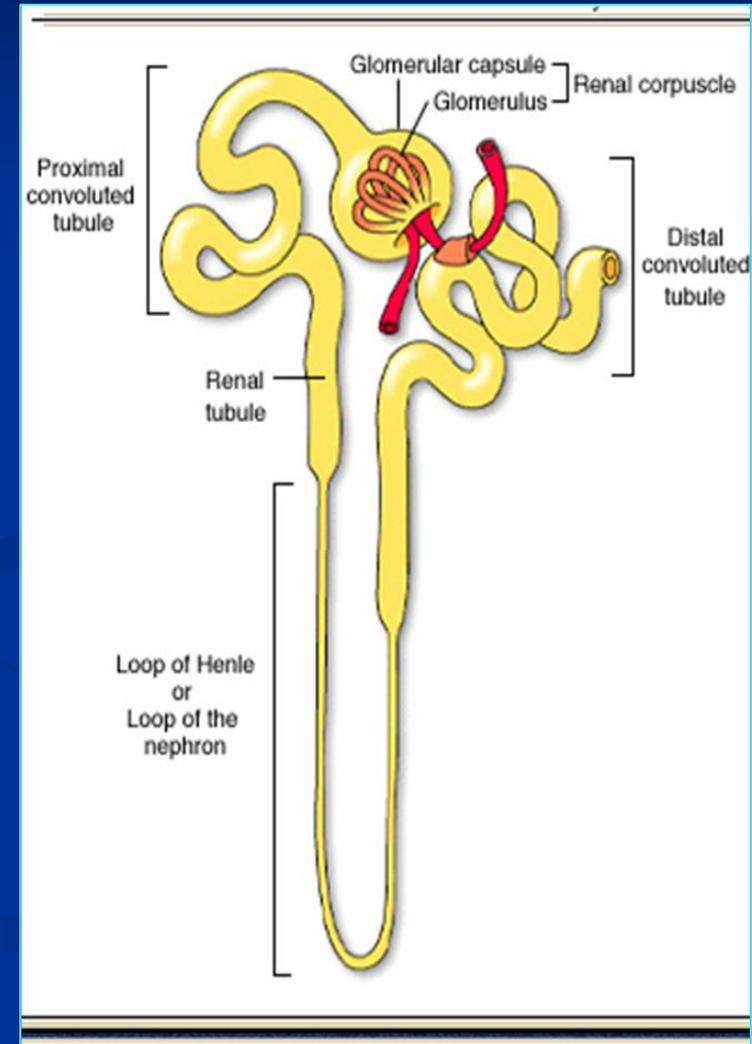


# Microscopic structure

- Nephron is the basic unit of the kidney
- Each kidney consist of  $10^6$  nephrons
- All kidney functions are performed by nephron
- Nephron is a blind tube consist of 5 different regions

# Nephron

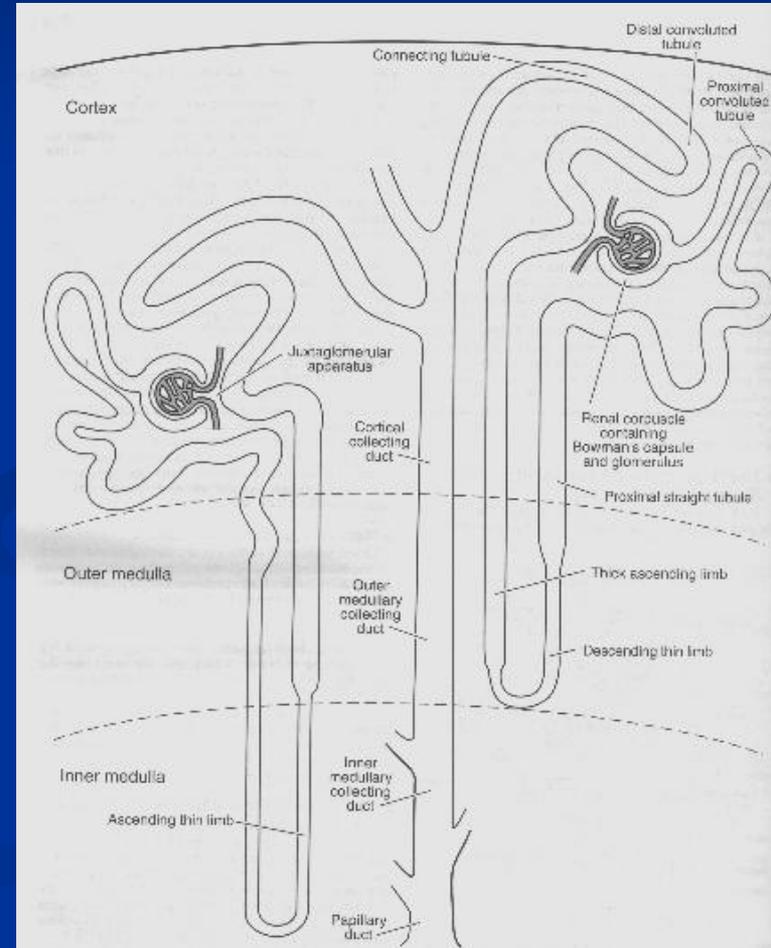
- 1. Glomerulus**
  - Bowman capsule
  - Tuft of capillary
- 2. Proximal convoluted tube (PCT)**
- 3. Loop of Henle**
  - Descending – thin
  - Ascending
    - 1/3 thin
    - 2/3 thick
- 4. Distal convoluted tubule (DCT)**
- 5. Collecting duct**



# Types of nephron

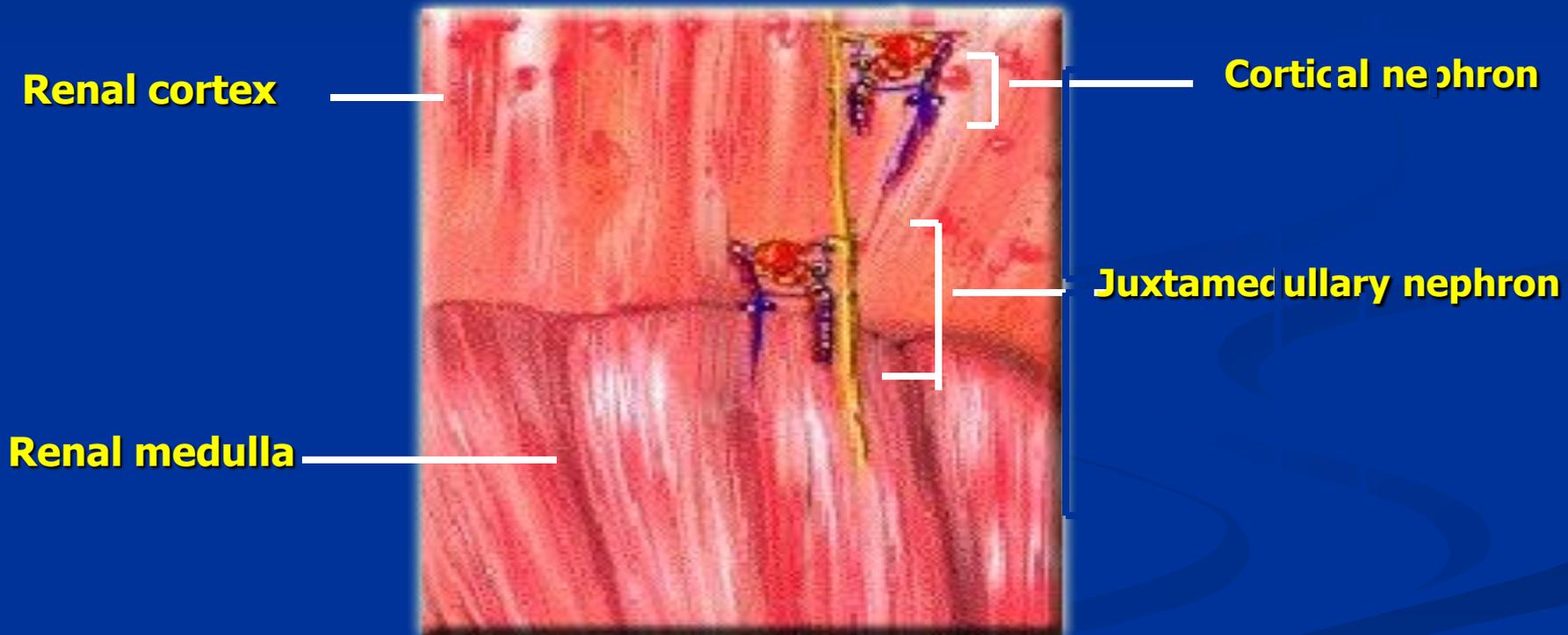
- Cortical nephrons

- Juxtamedullary nephrons



# Types of Nephron

1. cortical nephrons in the cortex
2. juxtamedullary nephrons in both the cortex and the medulla



# Cortical vs juxtamedullary nephron

## 1. Cortical

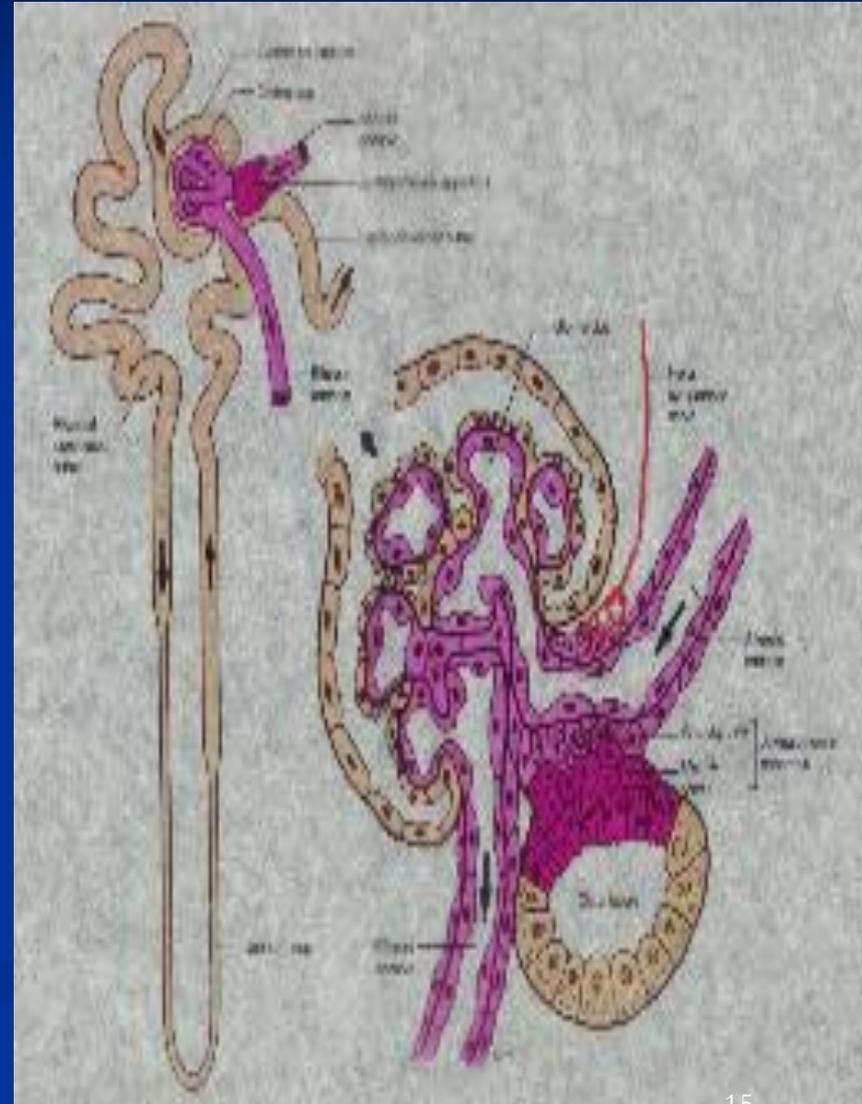
- 85%
- Outer cortex
- Larger glomerulus
- Short loop
- Peritubular capillary blood supply

## ■ Juxtamedullary

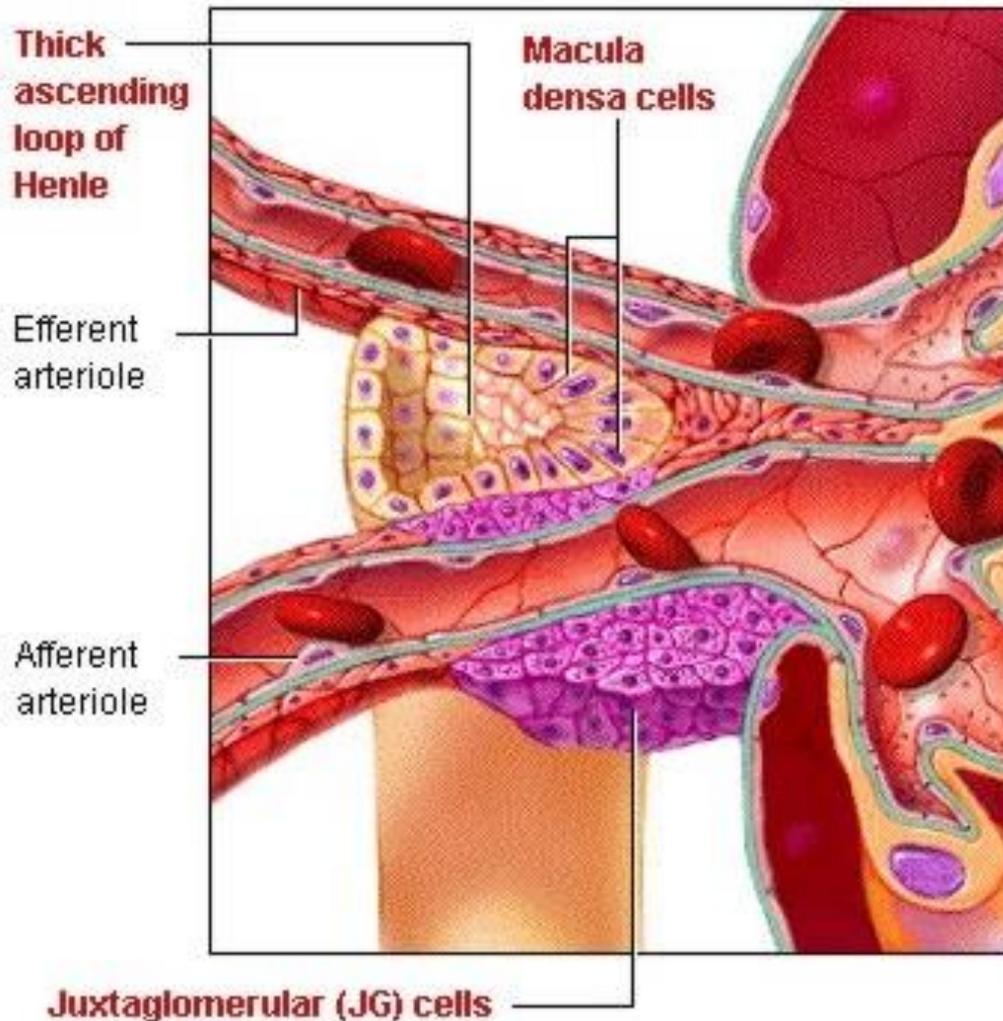
- 15%
- Deep in the cortex
- Small glomerulus
- Long loop
- Vasa recta

# Juxtaglomerular apparatus

- Junction between thick limb & afferent of its glomerulus
- Tall columnar cells in tubule (macula densa)
- Granular cells on afferent (renin)

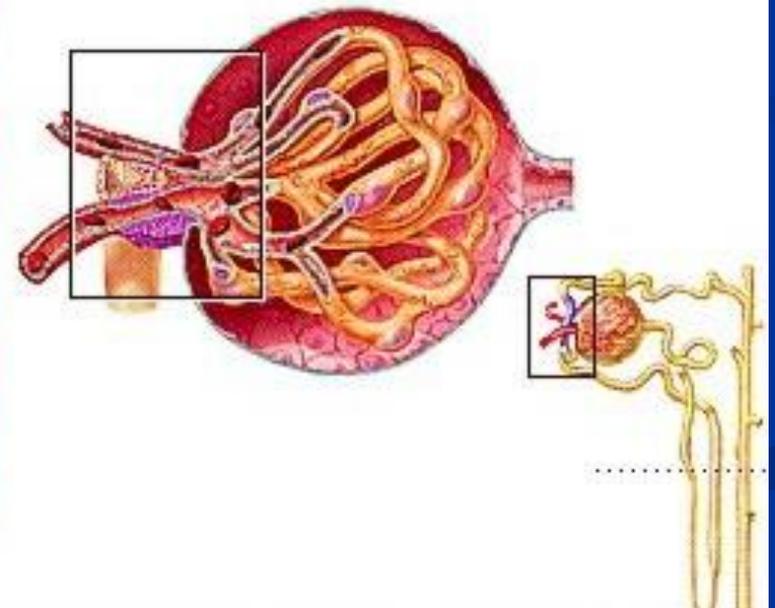


# THE JUXTAGLOMERULAR APPARATUS



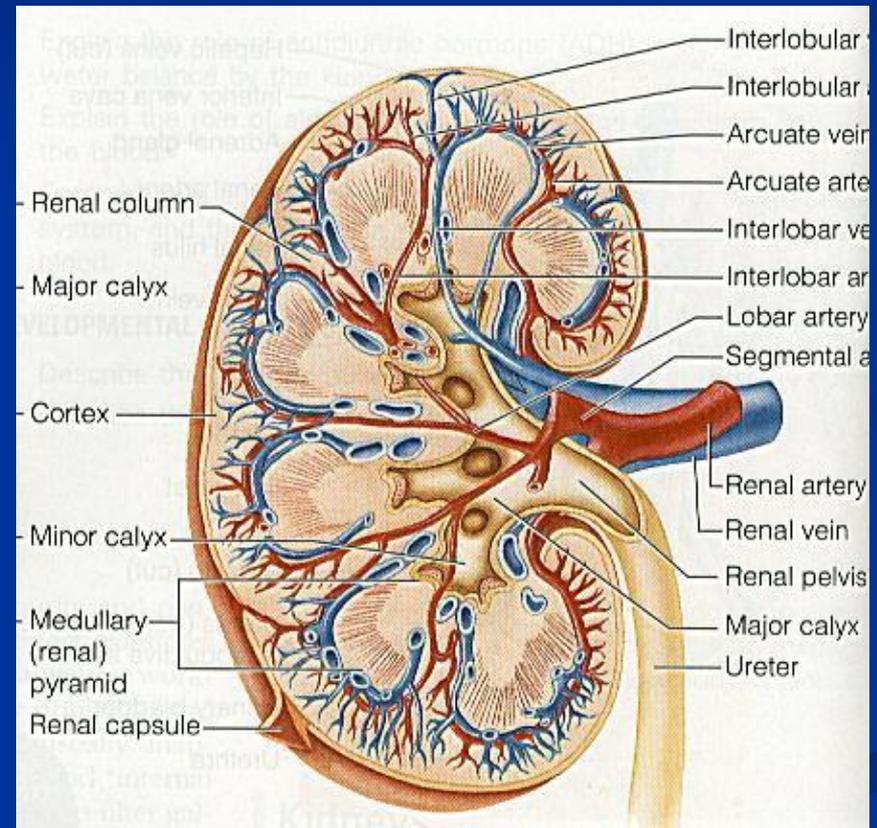
As the thick ascending loop of Henle transitions into the early DCT, the tubule runs adjacent to the afferent and efferent arterioles.

Where these structures are in contact they form the monitoring structure called the **juxtaglomerular apparatus (JGA)**, which is composed of macula densa and JG cells.

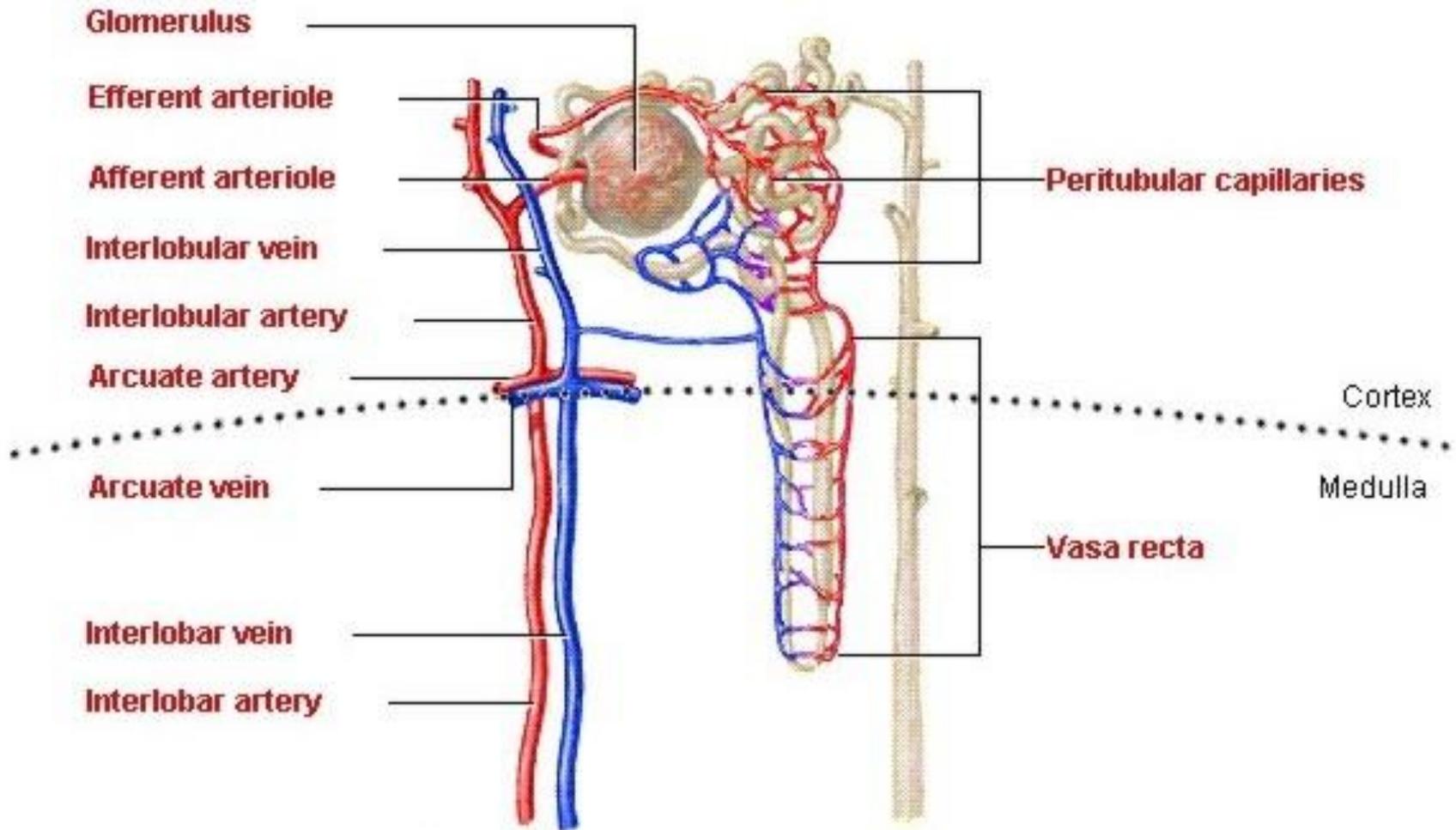


# Renal circulation

- Renal artery
- Segmental branch
- Interlobar
- Arcuate
- Interlobular
- Afferent arteriole
- Glomerular capillary
- Efferent arteriole
- Peritubular capillary



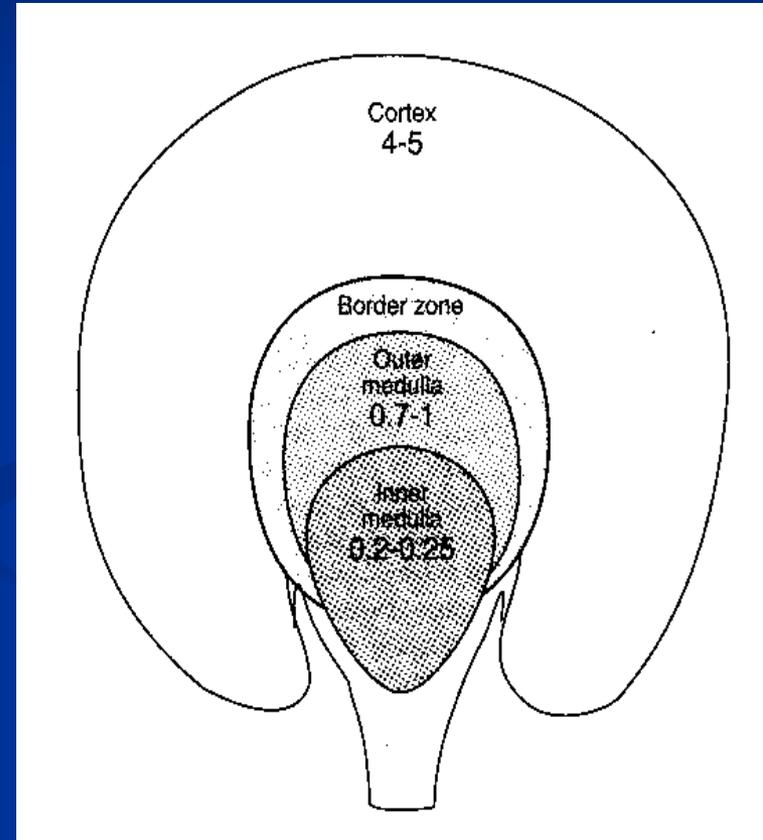
# NEPHRON STRUCTURE: ASSOCIATED BLOOD VESSELS



Click the nephron to see its tubular structure.

# Renal circulation *cont*

- RBF=  
1.2 l/min  
(25% of C.O.)
- Cortical blood flow >  
Medullary flow
- Cortical blood flow  
meant for filtraion



# Renal innervation

- Renal plexus sympathetic
  - Vasomotor regulate renal blood flow
- Parasympathetic

# Summary

1. **Function**
2. **Component of Renal System**
3. **Macroscopic Structure of kidney**
4. **Nephron; structure, types**
5. **Blood supply & Innervation**
6. **Juxta-glomerular apparatus**

