Renal Functions

Guyton 26,27,28

Dr Sitelbanat Awadalla

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**

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, bilrubin**
- **Foreign substances**
  - **drugs, toxins**

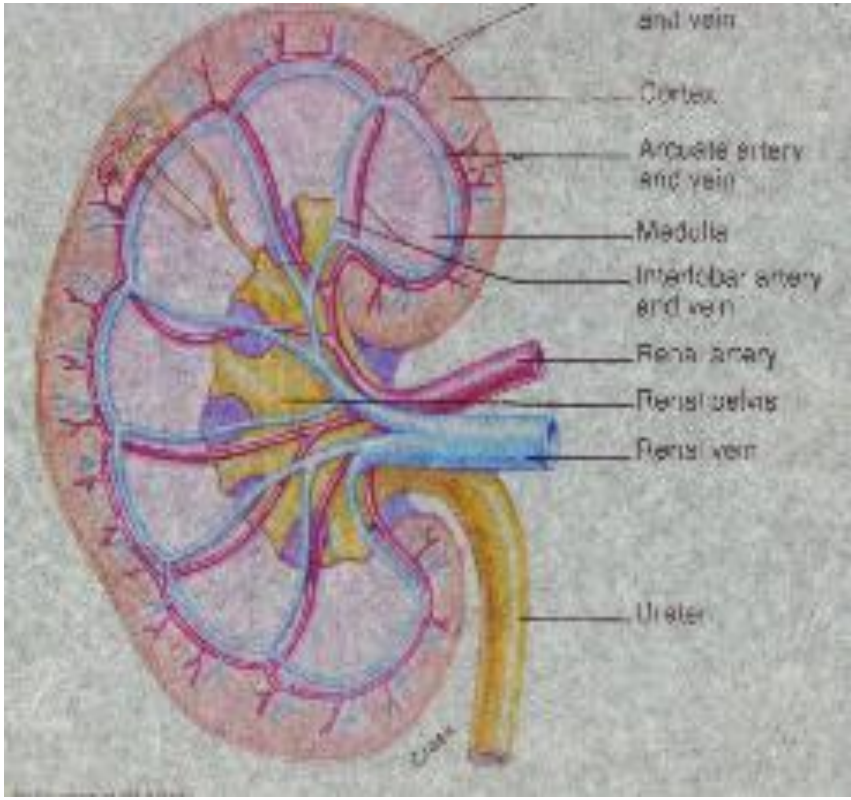
Kidney Functions *Cont*

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 calyxes**
- **Ureter**
- **bladder**

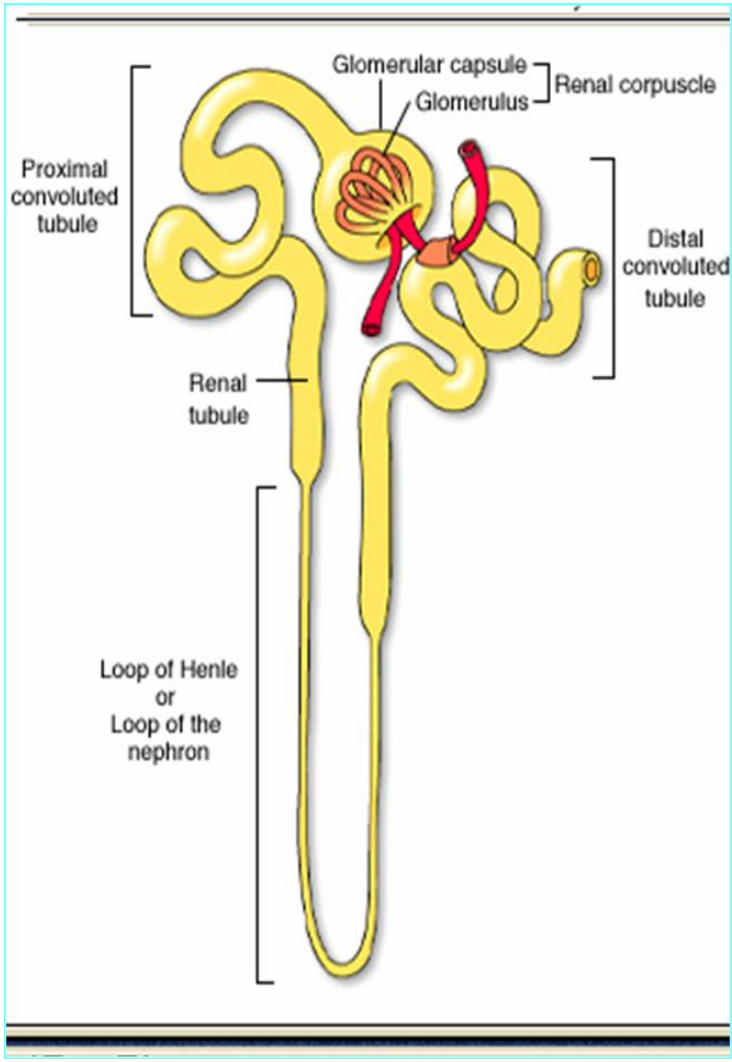


Microscopic structure

- **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**

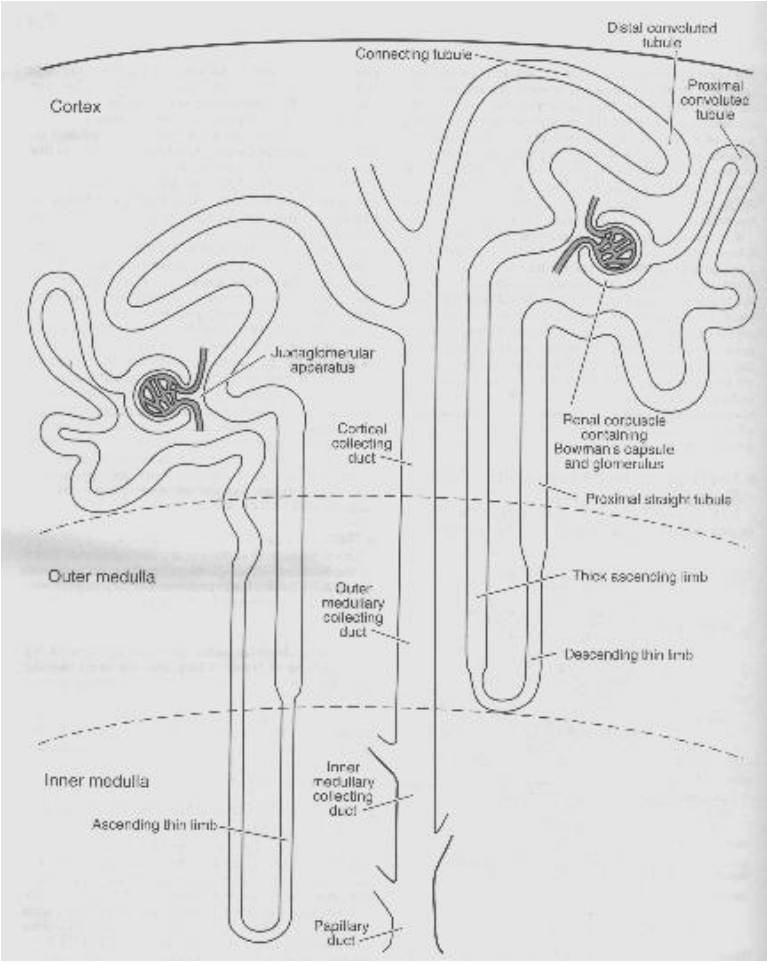
Nephron

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**



Cortical vs juxtamedullary nephron

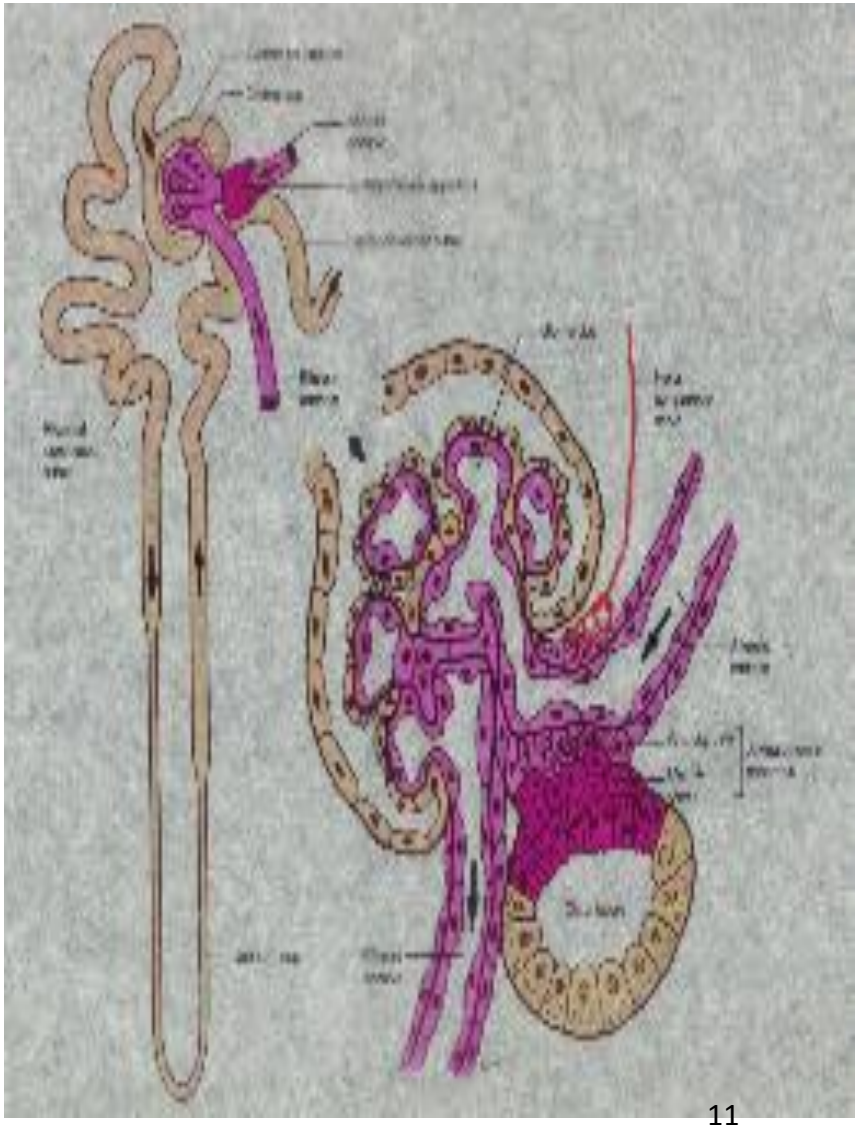
1. Cortical

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

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

Juxtaglomerular appartus

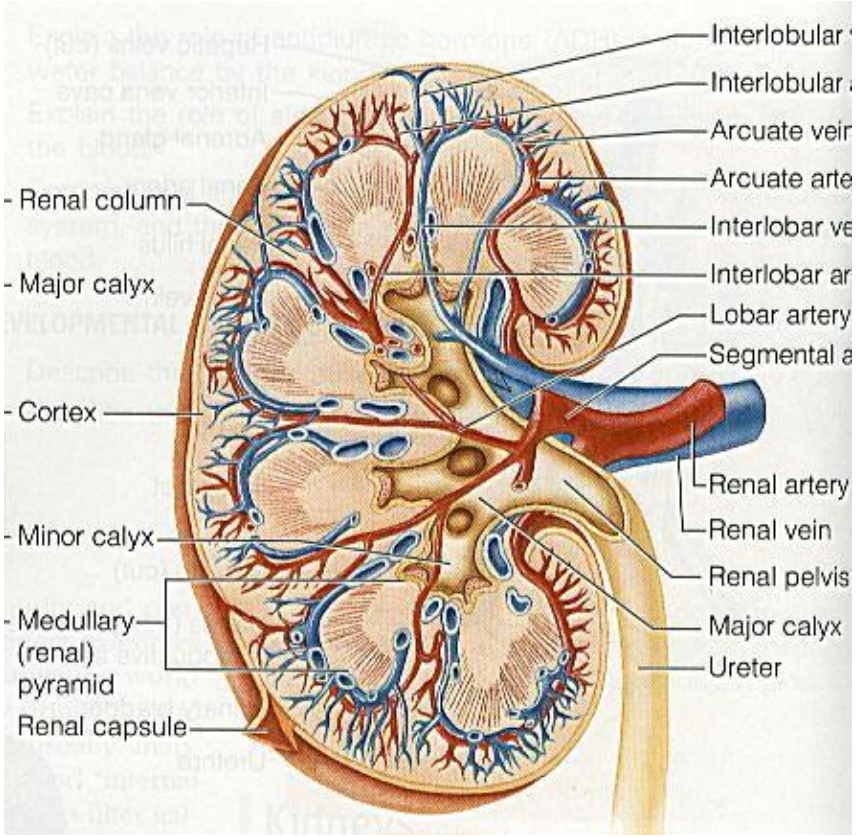
- **Junction between thick limb & afferent of its glomerulus**
- **Tall columnar cells in tubule (macula densa)**
- **Granular cells on afferent (renin)**



Dr Sitelbanat

Renal circulation

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



Renal circulation *cont*

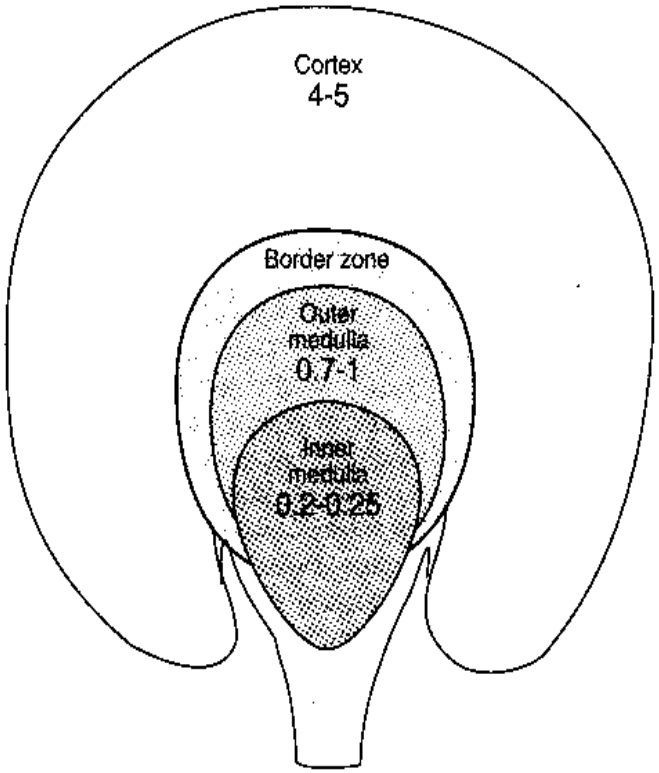
- **RBF=**

  1.2 l/min

(25% of C.O.)

- **Cortical blood flow > Medallary 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**