ALAYEN IRAQI
UNIVERSITY
AUIQ

COLLAGE OF DENTISTRY

الفرع العلمي: العلوم الاساسية

المادة: General Physiology

المحاضرة: Renal physiology or Urinary system

رقم المحاضرة: 12

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The major function of the urinary system is to help maintain homeostasis by controlling the composition ,volume and pressure of blood within normal limits.

Body fluids:

The intracellular component of the body water accounts for about 40% of body weight.

The extracellular component for about 20% BW.

Body fluids :

- Intracellular fluid 40% of BW.
- Extracellular fluid 20% of BW
- Interstitial fluid 15% of BW.
- Plasma 5% of BW.

The exchange between plasma and interstitial fluid is influenced by the changes in

*hydrostatic pressure(HP)

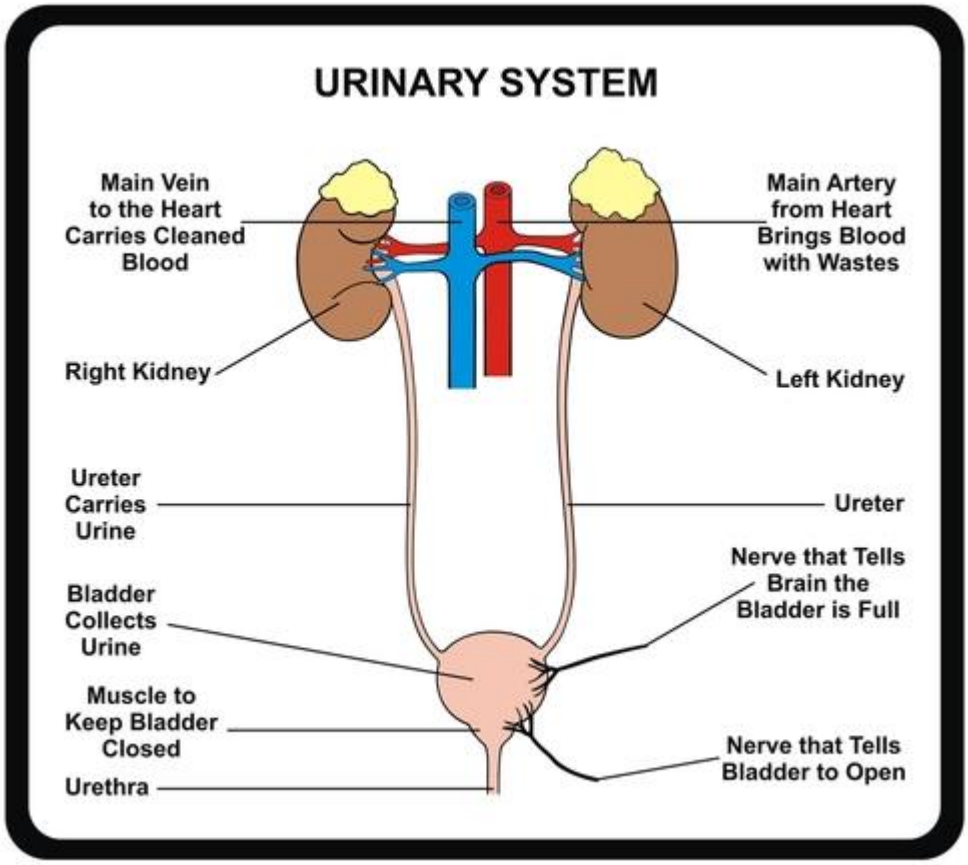
*colloidal osmotic pressure(COP).

• HP: is the pressure of heart action on blood which push the water and salts outside the blood vessels (capillaries).

• COP: is resulting from the colloid particles specially protein found in plasma, its essential in maintaining blood volume and counteracting the HP exerted by the heart.

Composition of urinary system:

1-kidneys 2-ureters 3-urinary bladder 4-urethra



Kidneys:

Kidneys are paired, reddish, bean shaped, retroperitoneal organs in the abdominal cavity located between the last thoracic and third lumber vertebra on either side of the vertebral column.

Functions of kidneys:

1- Excretory function: formation and excretion of urine.
2- Acid-base balance: control of blood pH by various buffer system. Acids like H_2so_4 and H_3po_4 which are products of protein metabolism can be removed from the body only the kidneys.

3- Regulation of blood volume and composition of body fluids (blood and interstitial fluid).

4- Regulation of blood pressure by secreting renin.

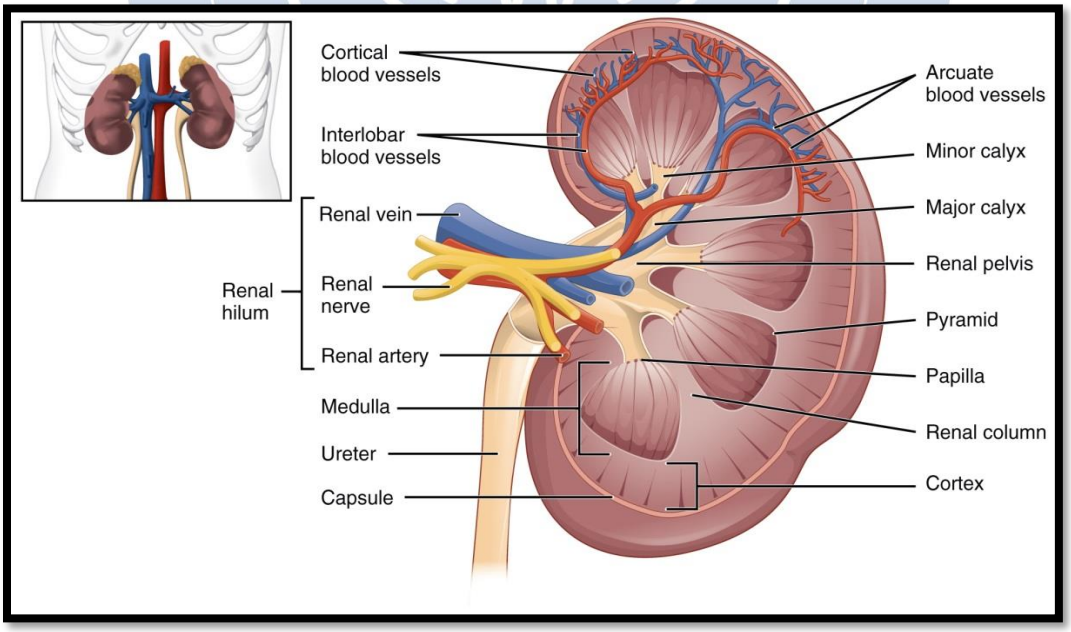
5- Metabolism function: kidney performs gluconeogenesis, i .e, synthesis of glucose from amino, lactic acid, glycerol during performance of fasting.

6- Endocrine function: secrete erythropoietin, renin, prostaglandins.

Physiologic anatomy of the kidney:-

• **Medulla**:- this tissue appears as pyramids their apex are towards the renal pelvis it appears striated because the collecting ducts and loops of Henle.

• **Cortex**:- this tissue appears granulated because of the large number of glomeruli, the cortex is surrounded by a connective tissue called Renal Capsule.



The kidney is a complex structure consisting of more than one million, structural and functional unites called Nephrons, separated by connective tissue(interstitial tissue).

Nephron: nephron is the structural and functional unit of the kidney each kidney has approximately 1.3 million nephrons.

Function of nephron:

1- Glomerular filtration
2- Tubular reabsorption
3- Tubular secretion

Parts of nephron

Each nephron consists of two portions:

1-A renal corpuscle where plasma is filtered

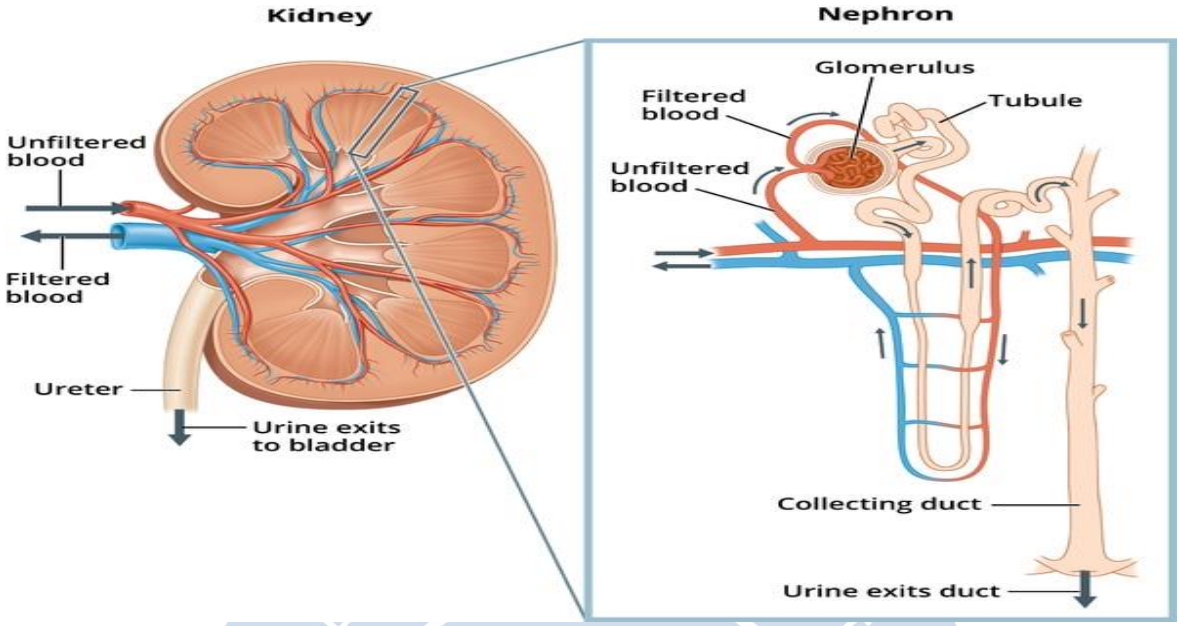
2-A renal tubule through which the filtered fluid passes.

Renal corpuscle or Malpighian corpuscle

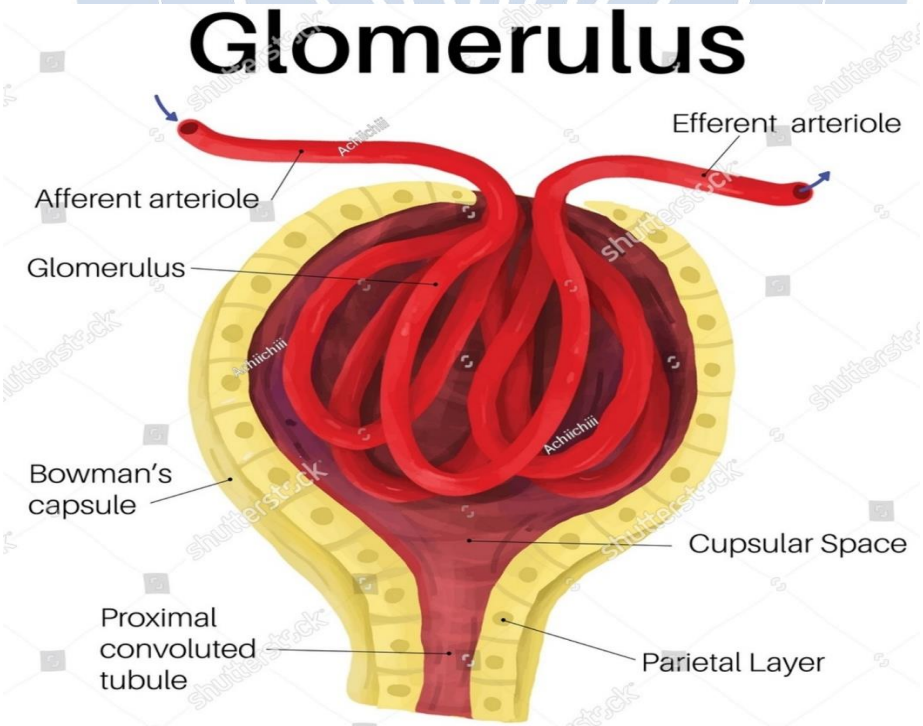
Renal corpuscle lie in the renal cortex. Each corpuscle has two components:

a-Glomerulus which is a capillary network.

b-Bowman's capsule or glomerular capsule which is a double-walled epithelial cup which surrounds the glomerulus.



Glomerulus: formed by the invagination of a tuft of capillaries into the dilated blind end of the nephron (Bowman's Capsule).” The capillaries are supplied by an afferent arteriole and drained by an efferent arteriole.

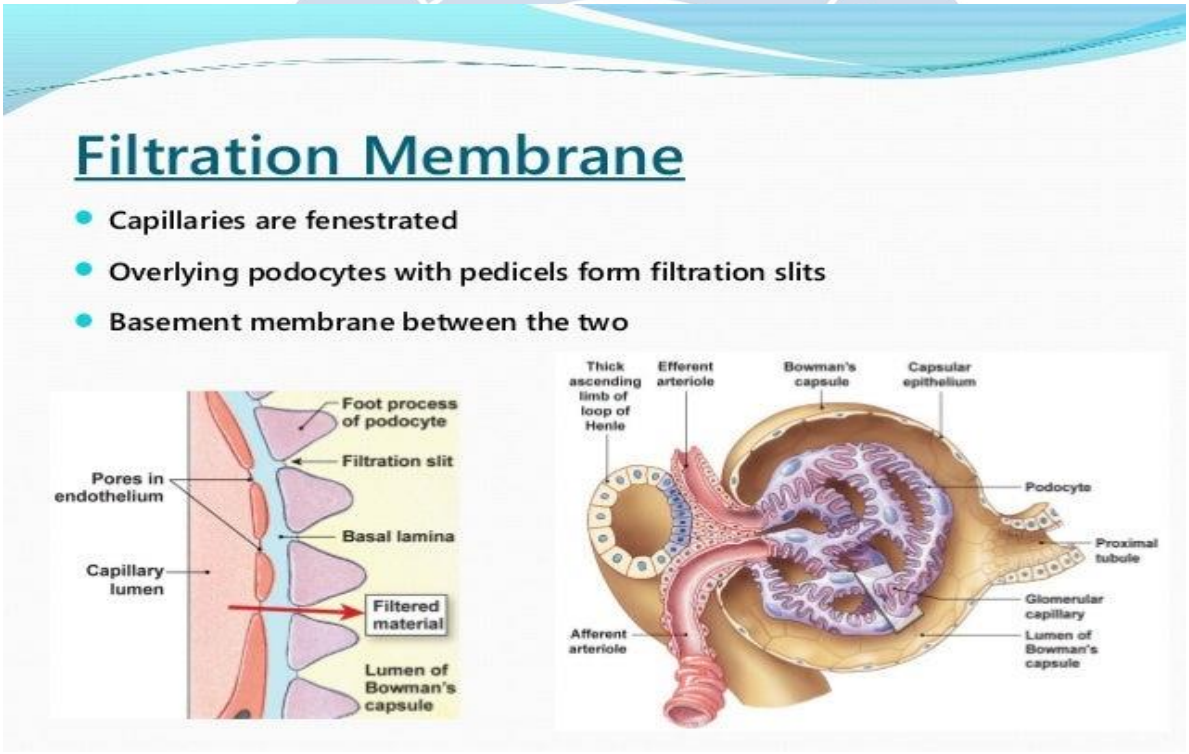


Renal tubules:

a. Bowman's capsule:the invaginated end of the tubule surrounding the glomerular tuft. Two cellular layers separate the blood from the glomerular filtrate in Bowman's capsule, the capillary endothelium and specialized epithelium of the capsule made up of podocytes

• the endothelium of glomerular capillaries is fenestrated with pores that are 50-100 nm in diameter.

• the epithelium(podocytes) form filtration slits approximately 5 nm in diameter.



b- Proximal Convoluted Tubule: (PCT) it contains cuboidal cells that are linked tightly at the apex but contain large lateral intracellular space. Its rich with mitochondria & the surface is covered with micro-villi. Around 65% of filtrated fluid is reabsorbed in the PCT.

c- Loops of Henle: thin descending loop with high permeability to water & thick ascending loop which is impermeable to water but permit Cl⁻ active reabsorption followed by Na movement.

d- Distal Convoluted Tubule: (DCT) the first part(diluting segment) continues from the ascending thick loop, then the distal segment which are both under the effect of Aldosterone for Na+-K+ exchange reabsorption.

e. Collecting Duct: cortical and medullary parts, both under effect of Anti Diuretic Hormone ADH. Contain Principle cells(P-cells) for active Na+ reabsorption and Intercalated cells(I-cells) for H+ secretion.