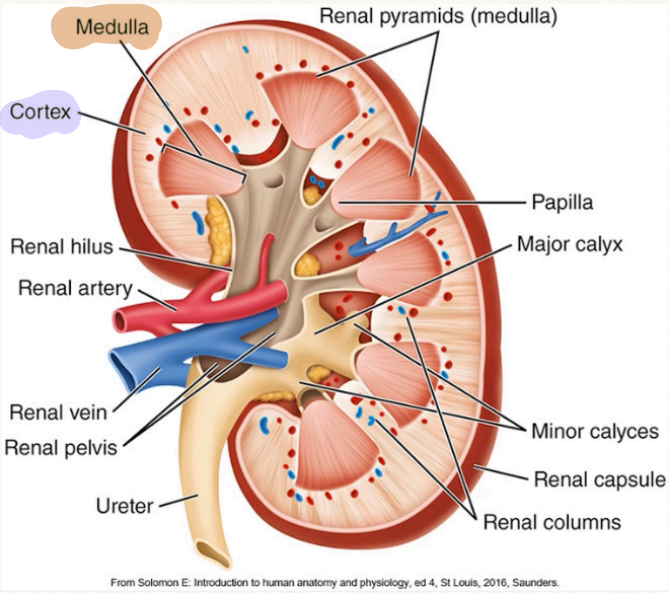
Kidneys

: Maintains a stable internal environment for optimal cell & tissue metabolism

- Balancing water & solute transport
- Excreting metabolic waste products
- Conserving nutrients
- Regulating acids-bases
- Secretes renin
- Erythropoietin Production
- Vitamin D3
- Urine formation



Nephron: functional unit of kidney

Renal Corpuscle

Glomerulus: Group of capillaries in renal cortex that loop into bowman's capsule. Filters blood plasma

Bowman (glomerular) capsule: surrounds glomerulus and empties filtrate into proximal tubule

Renal tubule: reabsorb & secrete

Proximal tubule: reabsorbs water, glucose, Na, K, Ca, Cl, HCO3

-Will return back in to circulation

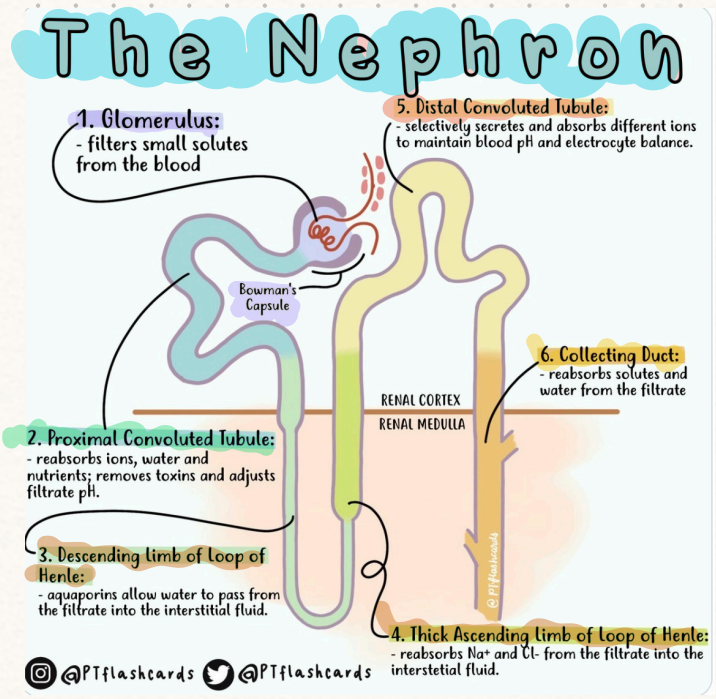
Loop of Henle: entirely in medulla

-Concentration of urine through reabsorption

-Only water can flow out

Distal tubule: Filtrate enters collecting tubules

Collecting duct: releases urine into ureters



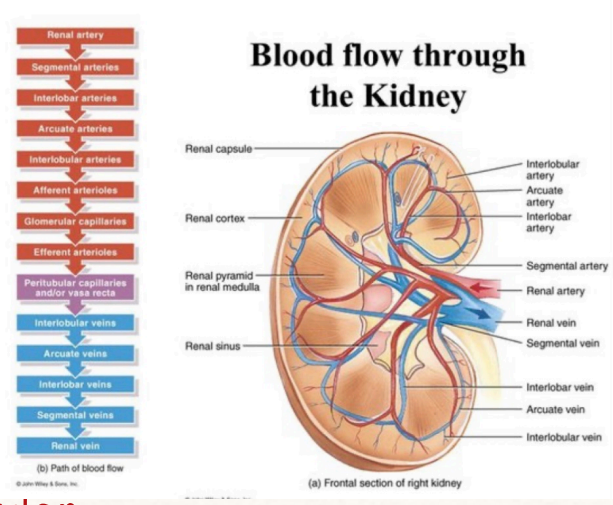
Renal artery: supplies blood to kidney

Afferent: blood arrives into glomerulus

Efferent: blood exits glomerulus

-Turns into peritubular capillaries

Glomerular capillaries: blood to peritubular



Renal vein: 99% of filtered blood is reabsorbed & circulated through vein, back to circulation

GFR: Filtration of plasma per unit of time

- Directly related to renal blood flow

Blood pressure

-Autoreg of intrarenal blood flow

-BP↑=afferent arteriole contracts

-BP↓=afferent arterioles dilate

Kidneys are innervated by sympathetic nerve fibers

Decreased systemic BP - release catecholamines

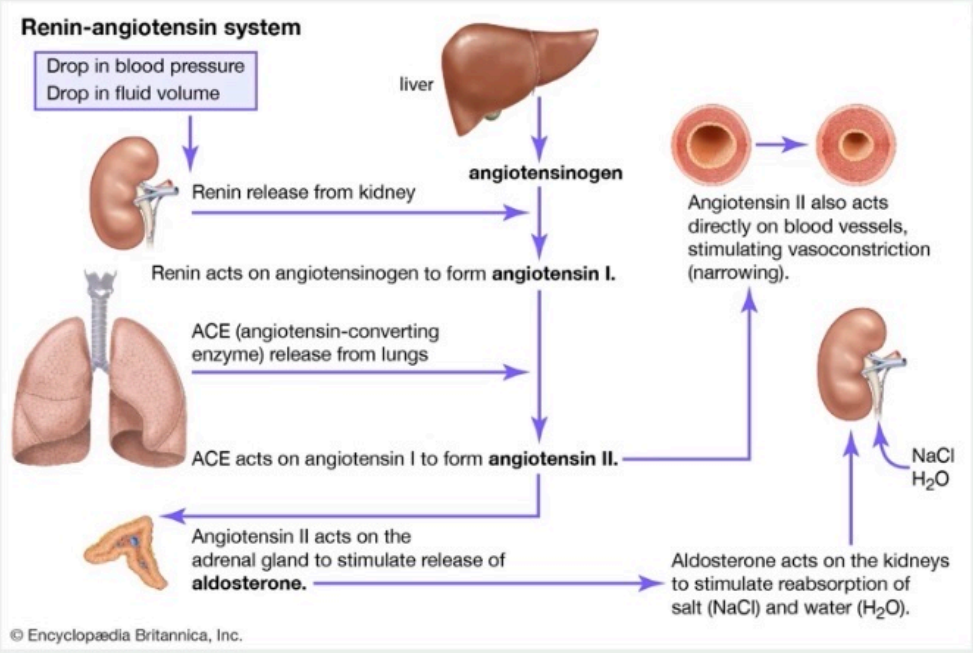
- Vasoconstriction - reduces RBF and GFR
- Increases renal tubular sodium and water reabsorption
- Increases systemic BP

Increased systemic BP - opposite effect

- Renalase is released that promotes metabolism of catecholamines to reduce BP

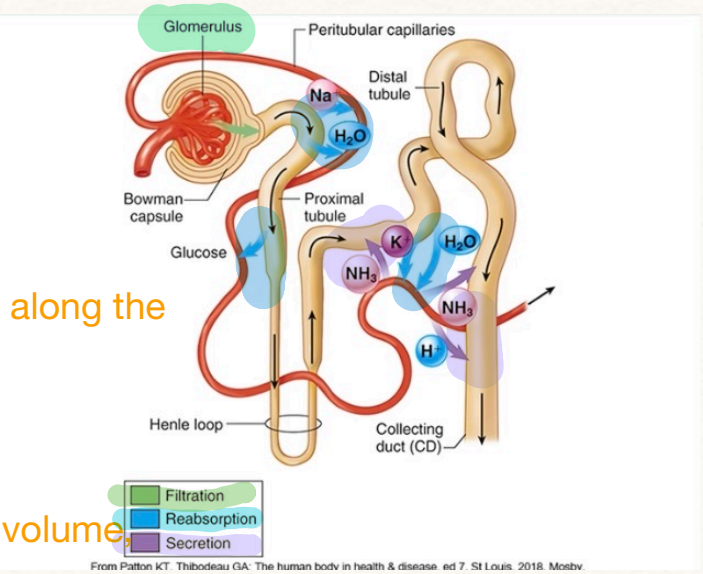
Major hormone regulator is renin-angiotensin-aldosterone system (RAAS)

- Renin releases is triggered by a decrease in blood pressure to afferent arterioles
- Renin helps to convert angiotensinogen to form angiotensin I.
- Angiotensin-converting enzyme (ACE) is released from the lungs.
- ACE acts on angiotensin I to form angiotensin
- Angiotensin I stimulates release of aldosterone and vasoconstriction of blood vessels.
- Reabsorption of water and sodium.

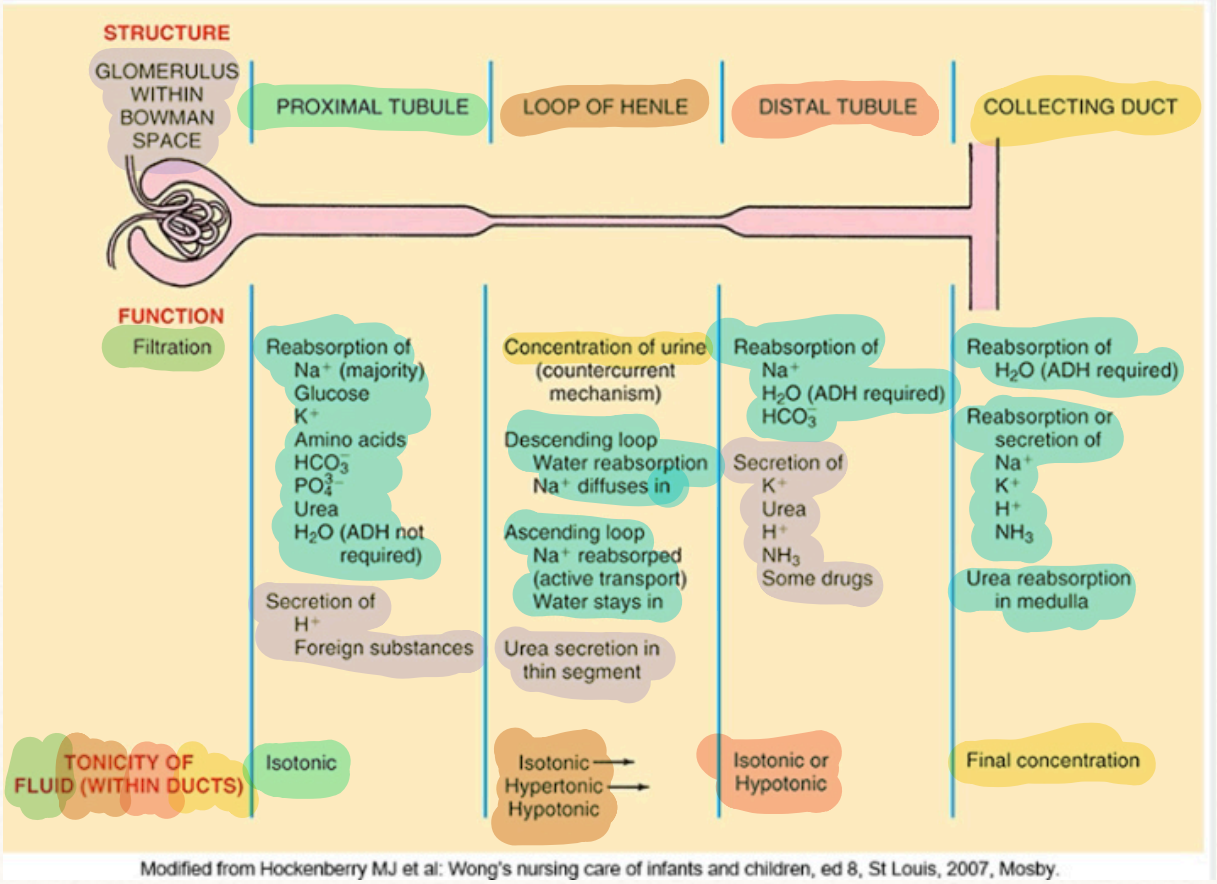


Urine formation

- Major function of nephron is urine formation.
- 1. Filtering plasma at the glomerulus
- Glomerular filtration
- 2. Reabsorbing and secreting different substances along the tubular structures.
- Proximal (convoluted) tubule
- Loop of Henle and distal tubule
- 3. Forming a filtrate of protein-free fluid
- 4. Regulating the filtrate to maintain the body fluid volume, electrolyte composition, and pH with narrow limits



From Patton KT, Thibodeau GA: The human body in health & disease, ed 7, St Louis, 2018, Mosby.



Modified from Hockenberry MJ et al: Wong's nursing care of infants and children, ed 8, St Louis, 2007, Mosby.

Hormones activated or synthesized by kidney

Vitamin D - necessary for absorption of calcium and phosphate by small intestine
• Vitamin D from sun and food are inactive and require two hydroxylations to become active (One from liver and second from kidney)
• Renal hydroxylation is stimulated by secretion of parathyroid hormone
•**Erythropoietin** - stimulates bone marrow to produce BC in response to hypoxia

BUN, Creatinine, GFR

Creatinine - freely filtered at the glomerulus
• Normal is 0.7 - 1.2 mg/dL
• Serum creatinine increases as GFR decreases

Blood urea nitrogen (BUN) - urea is filtered at the glomerulus
• Normal is 10 to 20 mg/dL
• BUN increases as GFR decreases
• Rise in states of dehydration and in renal failure

Glomerular filtration rate (GFR)
• Normal is > 60 ml/min
• Best indicator of renal function
• Damage to glomerular membrane or loss of nephrons leads to decrease in GFR