
بسم الله الرحمن الرحيم


رب اشرح لي صدري ويسر لي أمري

EXCRETORY SYSTEM

أ.د/ عمرو شلبي

Egestion - Food waste is the expulsion of non-digestible and within the large intestine. There was no such waste at any one time with in the cells of the body

Excretion -Is to get rid of excess materials or harmful in the cells of the body as a result of various metabolic processes, and not a waste if food is digested.

What is it?

The excretory system is the body system that separates and gives off the waste from the body, usually as urine or sweat.

Ammonia Excretion

Ammonia

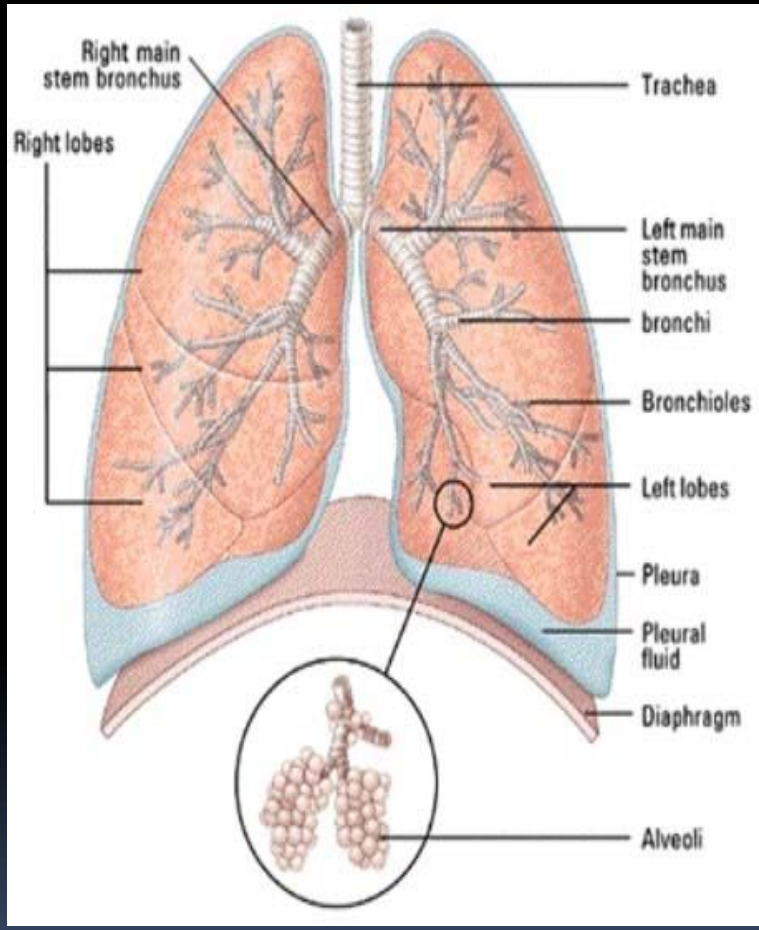
Uric acid

Urea

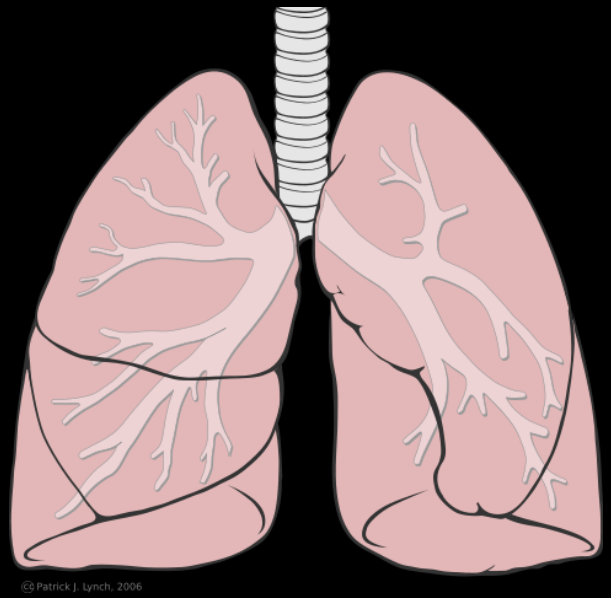
Skin and Lungs

- The skin excretes extra salts, water, and heat
- Usually as sweat
- The lungs excrete the carbon dioxide from the body

- We may not be aware of it, but our lungs also undergo excretion.
- When our cells convert oxygen into energy, they return carbon dioxide.
- This carbon dioxide has to be removed if not we might die. Thus, our lungs play an important role of removing carbon dioxide from our body.



The Lungs



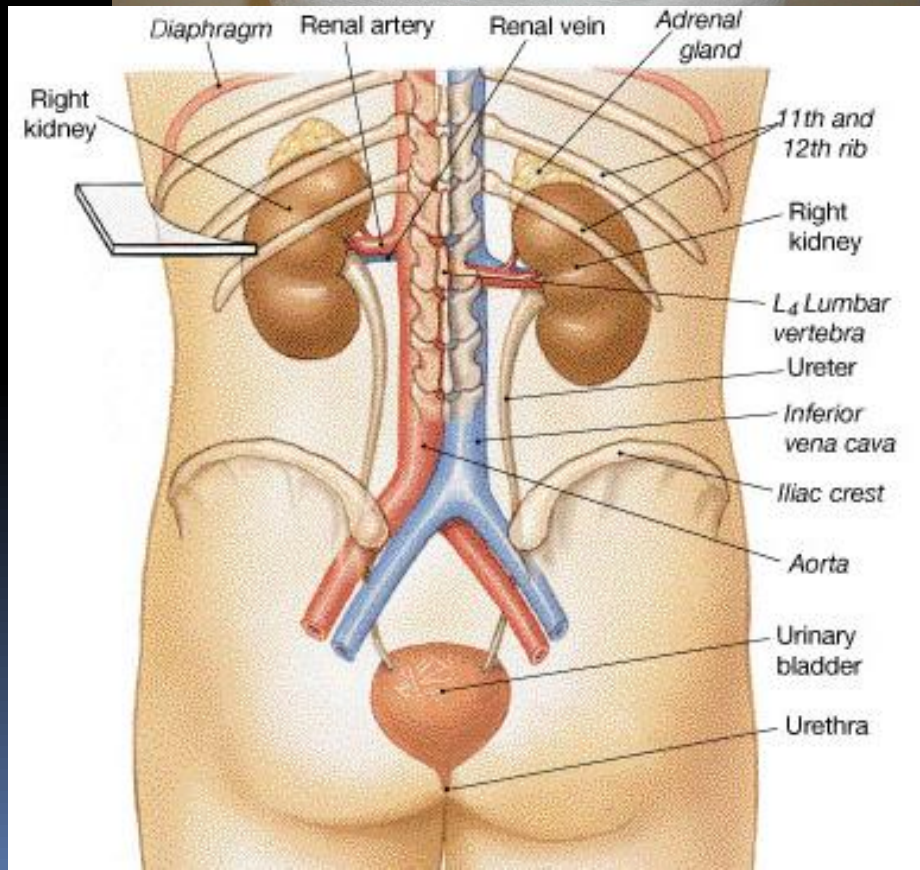
Remove CO_2 and H_20 in the form of water vapor

The Skin

Removes Heat, Urea, Salts in the form of sweat

Kidney Location

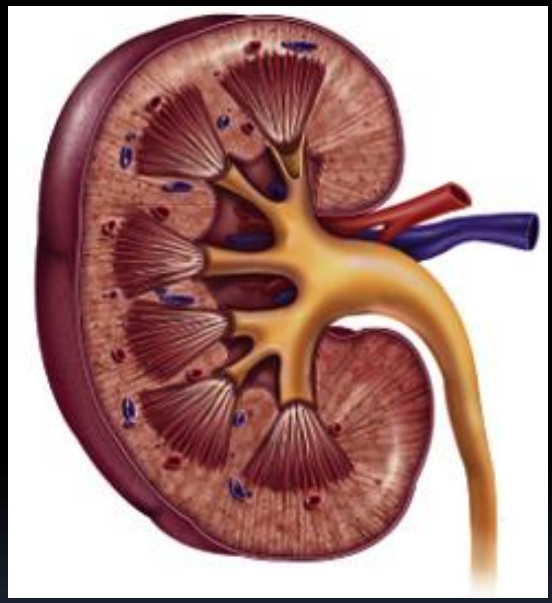
Lateral to vertebral column high on body wall, under floating ribs
in **retro-peritoneal** position



Functions of the urinary system

Anatomy of the kidney

- Urine formation
  - glomerular filtration
  - tubular reabsorption
  - water conservation
- Urine and renal function tests
- Urine storage and elimination

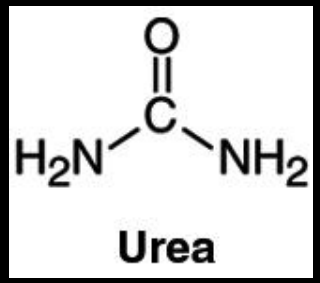


Kidney Functions

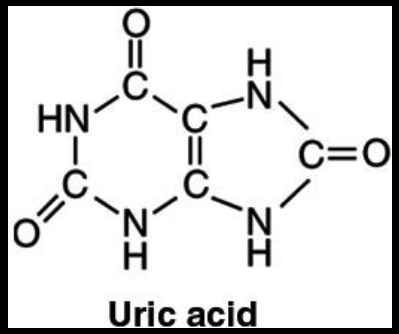
- Filters blood plasma, eliminates waste, returns useful chemicals to blood
- Regulates blood volume and pressure
- Regulates osmolarity of body fluids
- Secretes renin, activates angiotensin, aldosterone
  - controls BP, electrolyte balance
- Secretes erythropoietin, controls RBC count
- Regulates P_{CO_2} and acid base balance
- Gluconeogenesis

Nitrogenous Wastes

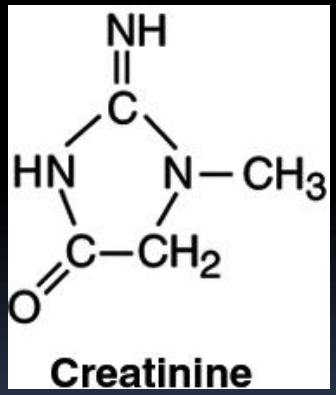
- Urea
  - proteins→amino acids →NH_2 removed →forms ammonia, liver converts to urea
- Uric acid
  - nucleic acid catabolism
- Creatinine
  - creatinine phosphate catabolism
- Renal failure
  - azotemia: nitrogenous wastes in blood
  - uremia: toxic effects as wastes accumulate



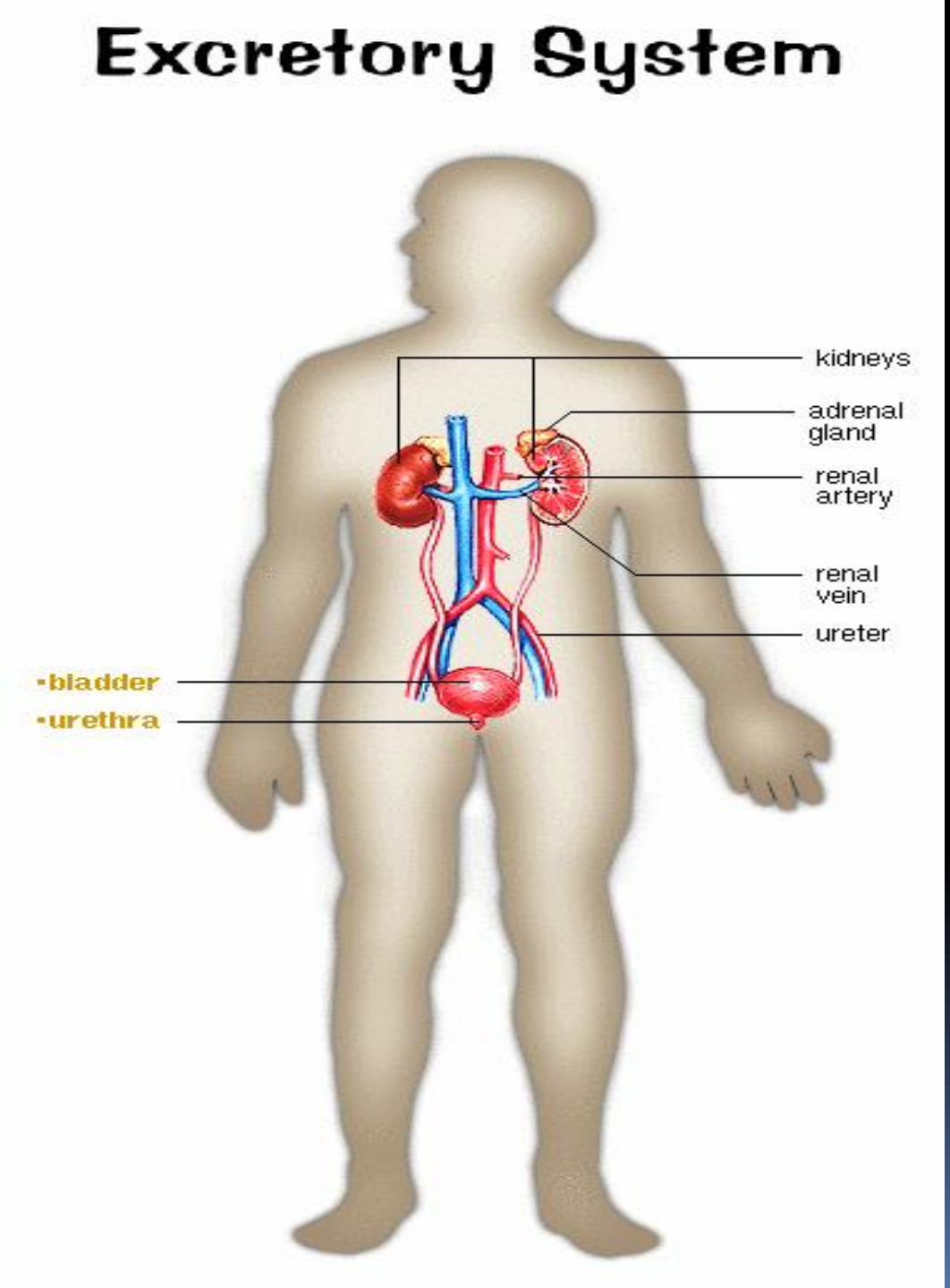
Urea



Uric acid



Creatinine

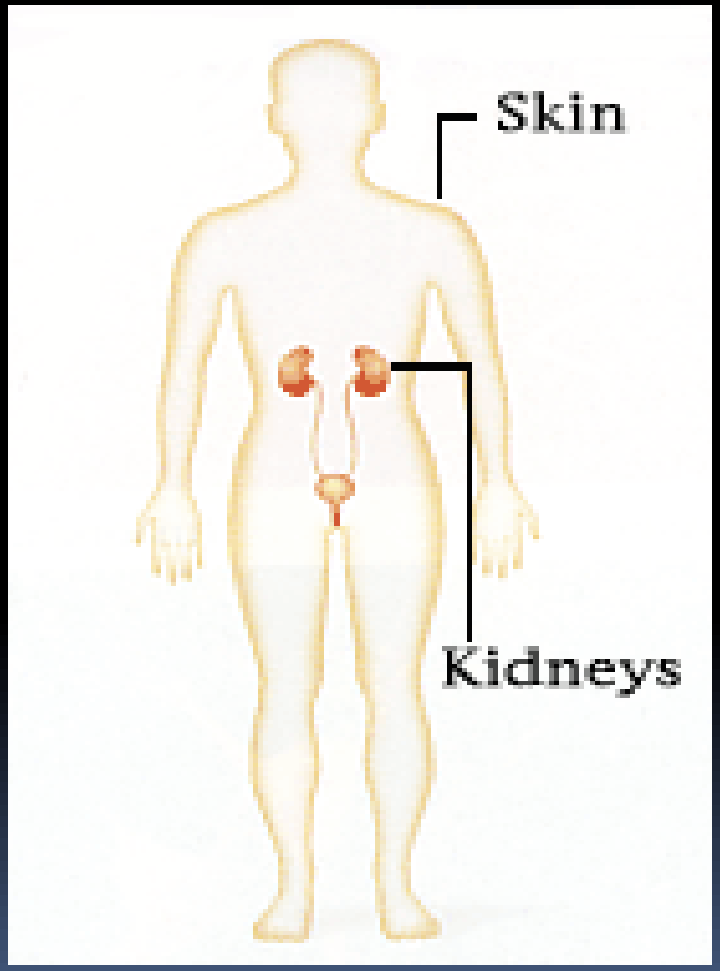


Excretory System

The function of the Excretory System is ridding the body of waste.

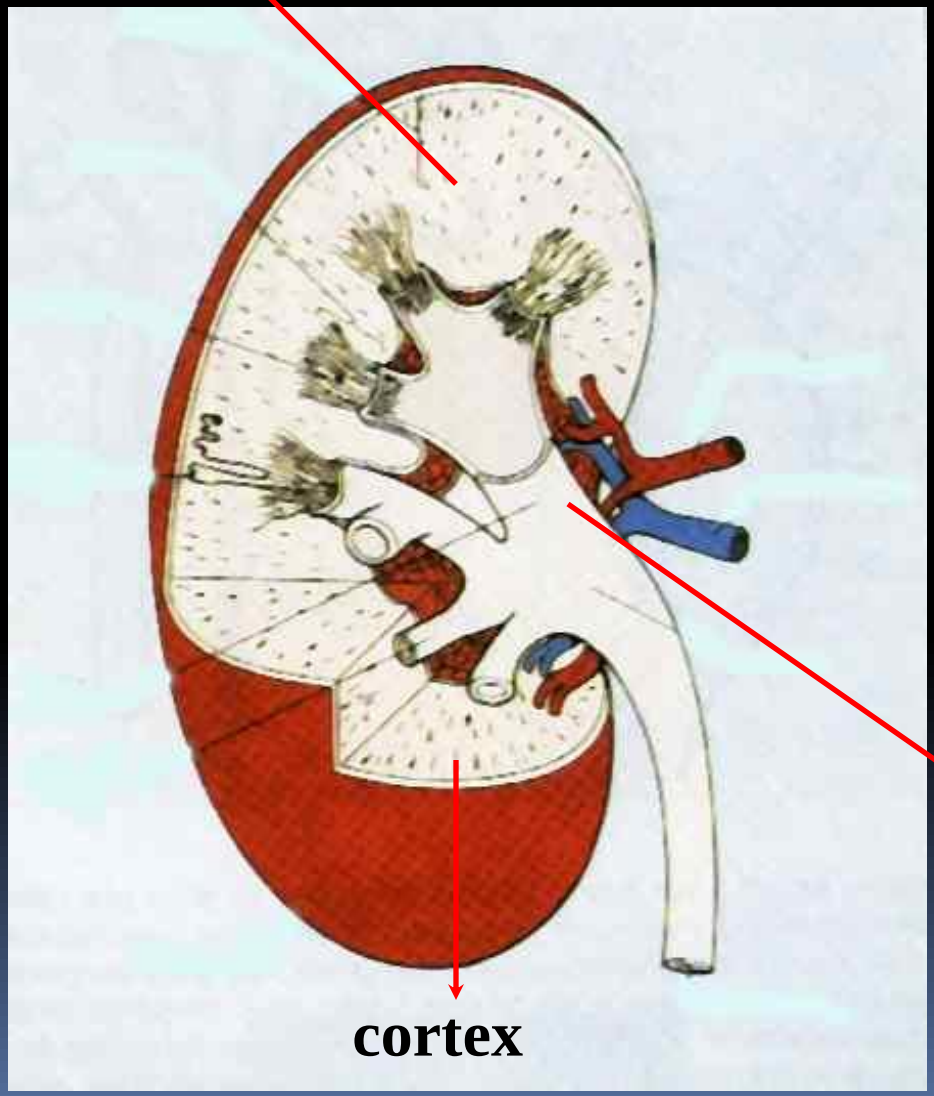
Life Science

Excretory System



- The main organs of the excretory system are the bladder, kidneys, lungs, liver and skin.
- The excretory system is like the sewage system because the excretory system gets rid of waste that the body does not need.

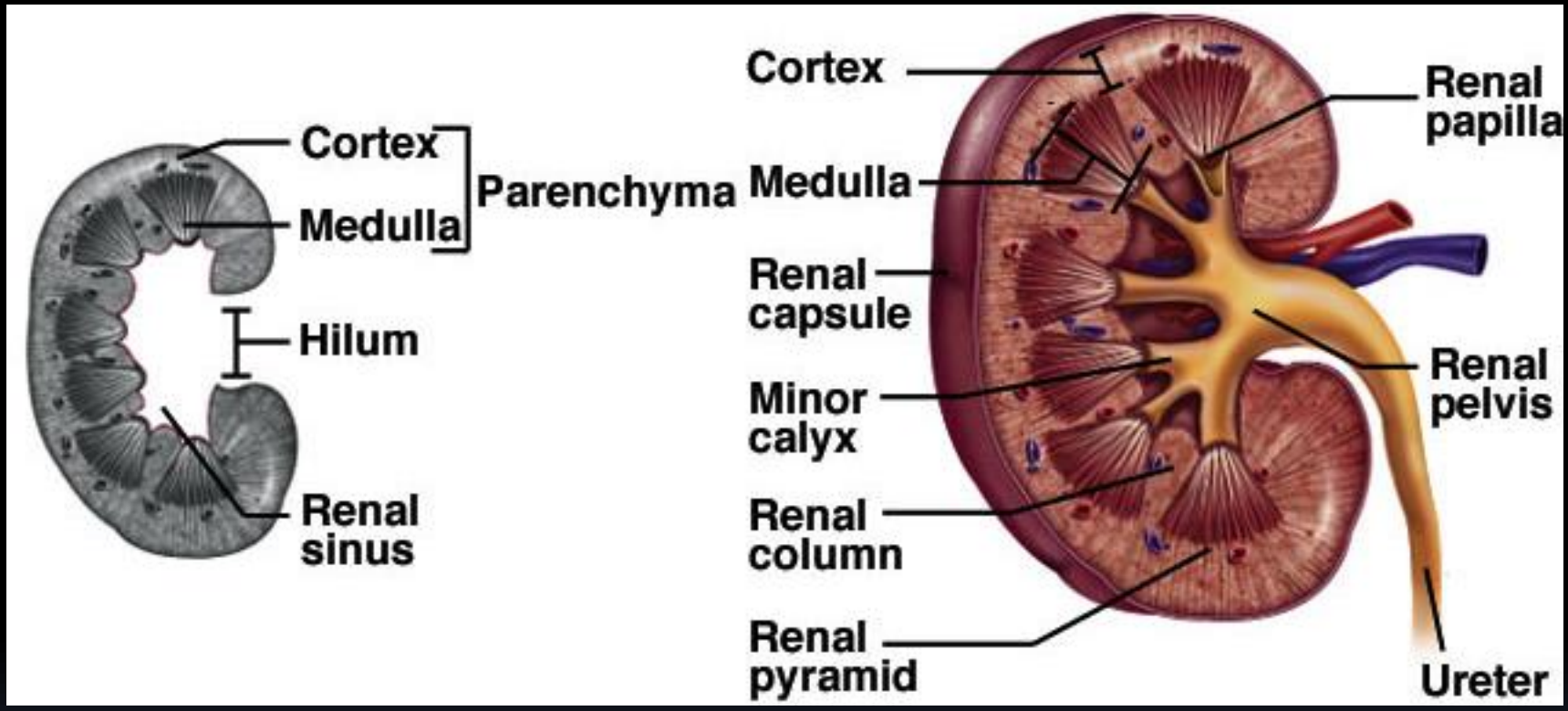
KIDNEY



.1 cortex.:

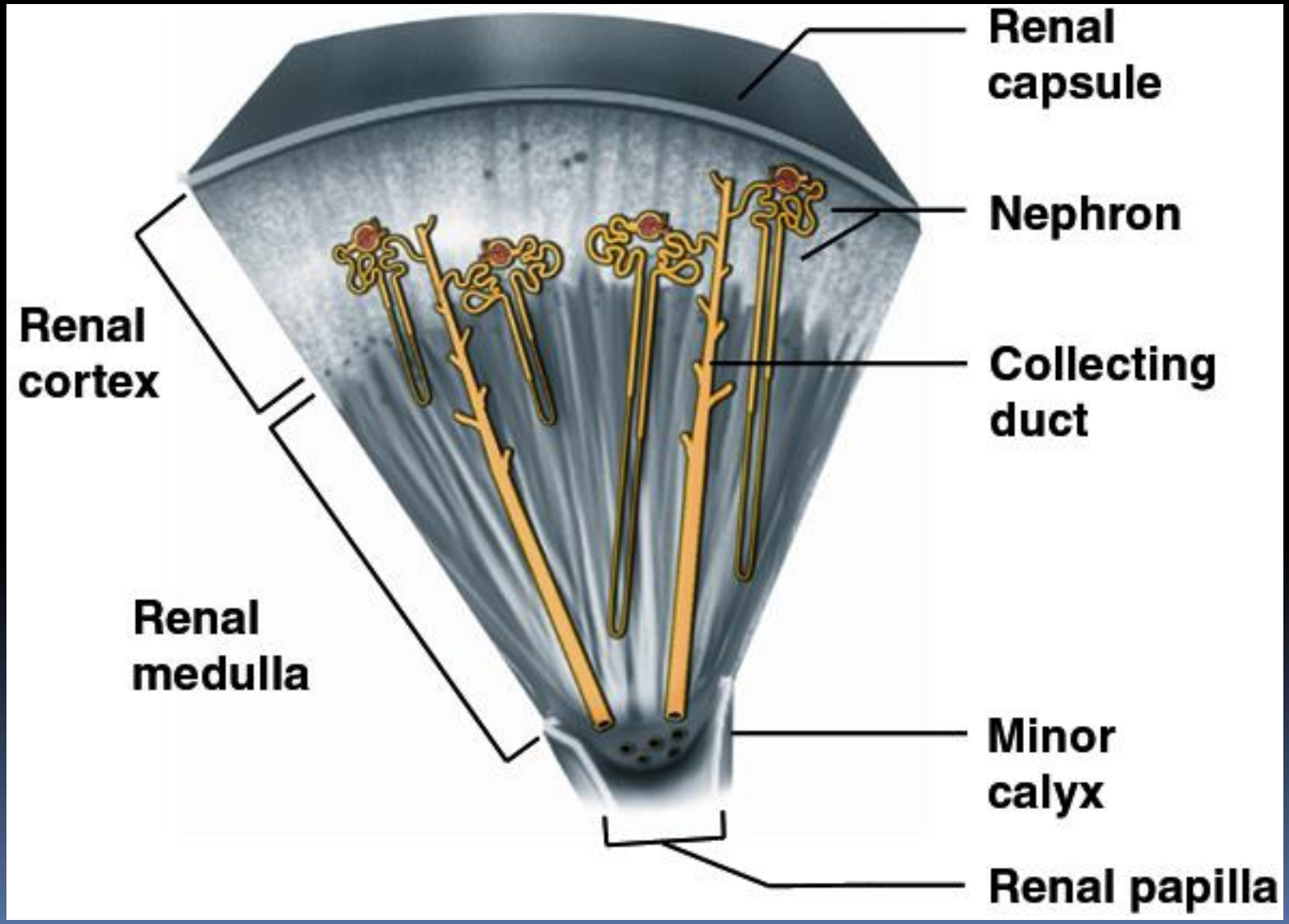
.2 medulla

.3 pelvis



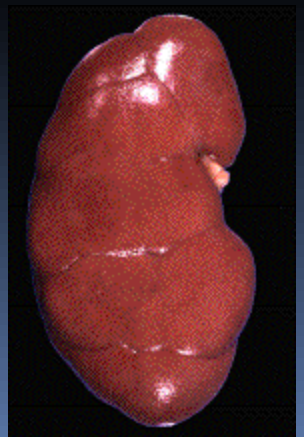
- Renal cortex:
- Renal medulla: renal columns, pyramids - papilla
- Lobe of kidney: pyramid and it's overlying cortex

Lobe of Kidney



Kidneys

- One of the main jobs of the kidneys is to filter the waste out of the blood.
- The kidneys filter that blood as many as 400 times a day! More than 1 million tiny filters inside the kidneys (nephrons) remove the waste.



Waste

- The **waste** that is collected combines with water (which is also filtered out of the kidneys) to make **urine**. Each day, your kidneys produce about 1.5 liters of urine.
- As each kidney makes urine, the urine slides down a long tube called the **ureter** and collects in the **bladder**, a storage sac that holds the urine.
- When the bladder is about halfway full, your body tells you to go to the bathroom. When you pee, the urine goes from the bladder down another tube called the **urethra** and out of your body.

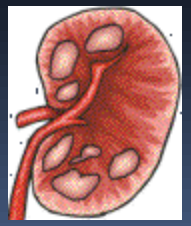
The kidneys

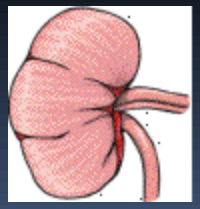
- The kidneys
- These are the main organs in the the system

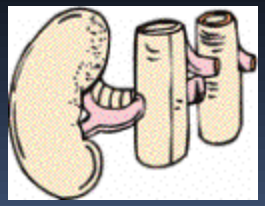
- It keeps the saltwater balanced in the body
- Is about 10 centimeters long

- Is actually a mass of tiny tubes

- Each tube is a knot of capillar



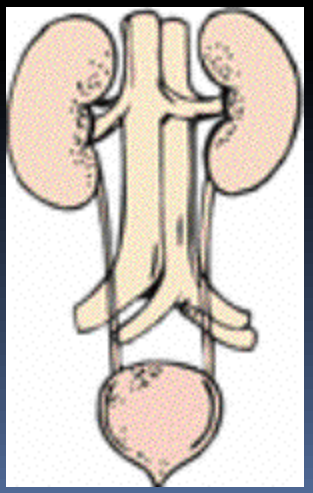




Ureter, Urethra, and Urinary Bladder

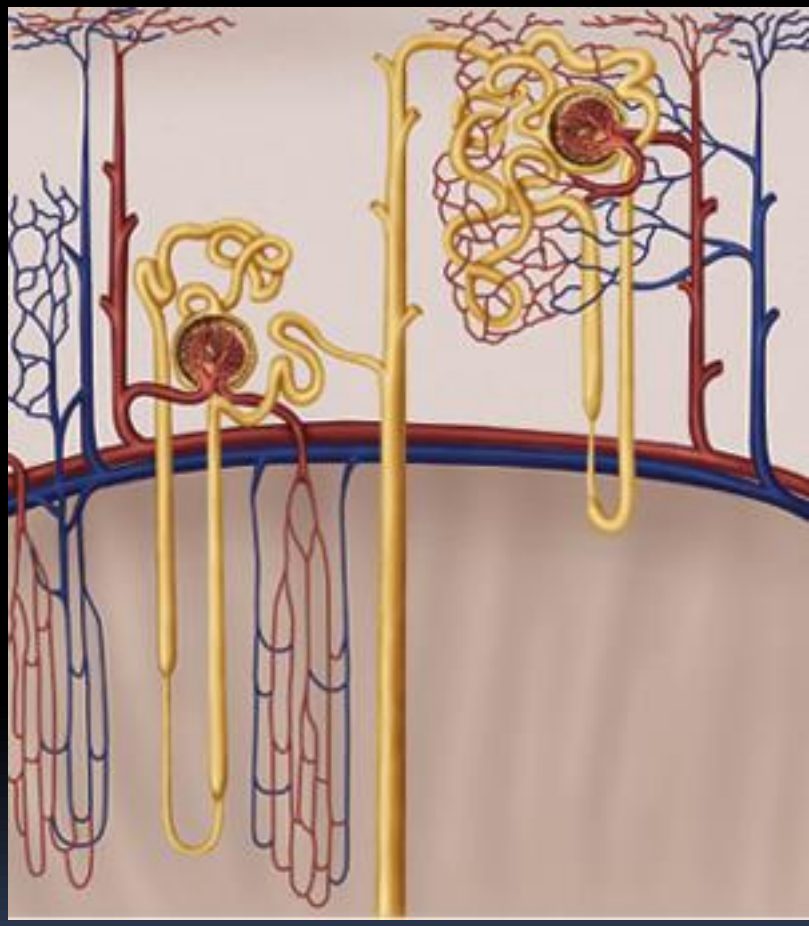
- Ureter carries the urine away from the kidneys to the urinary bladder

- The urethra is the tube that carries the urine from the bladder to outside the body

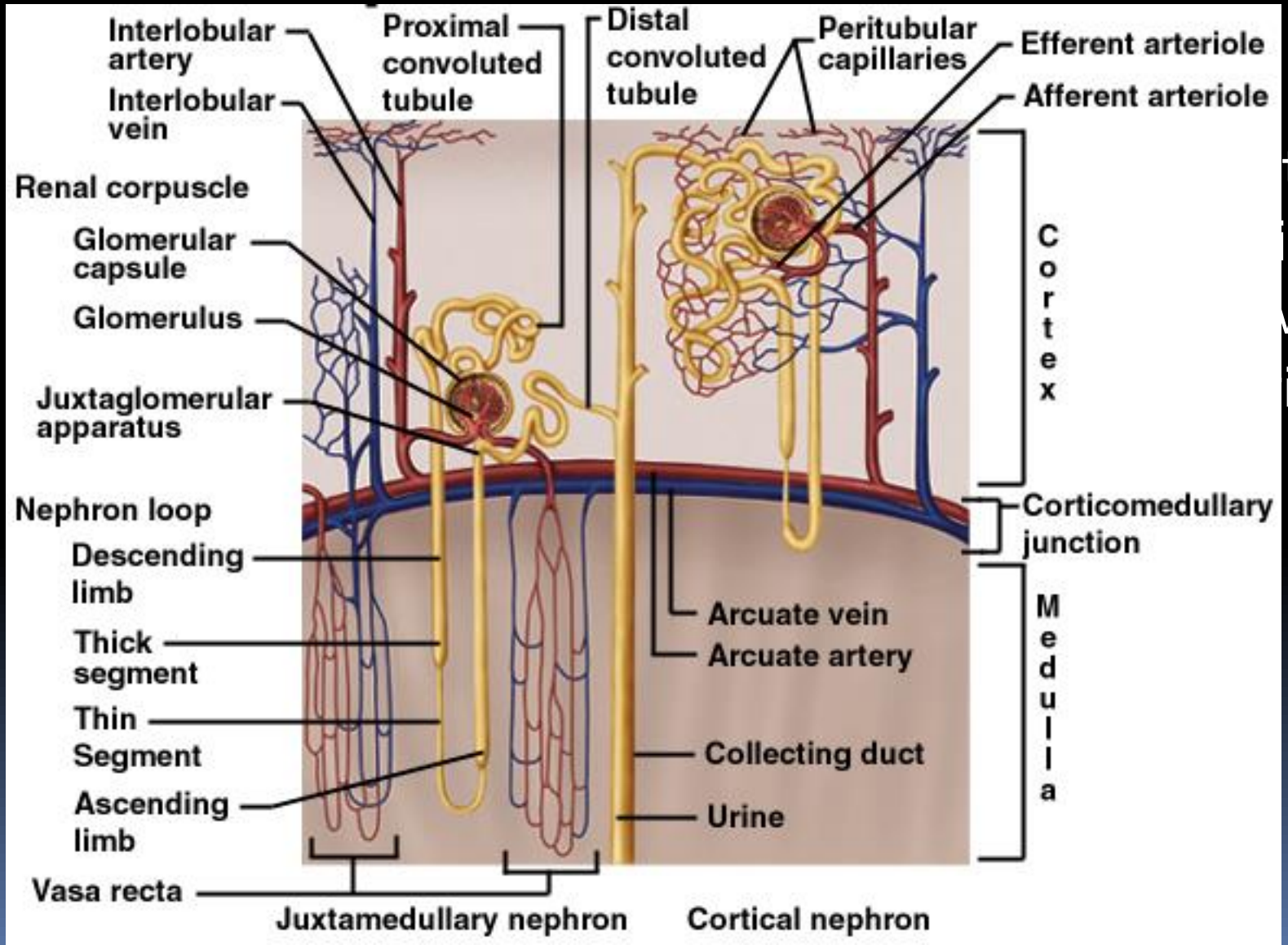


Renal (Uriniferous) Tubule

- Proximal convoluted tubule (PCT)
  - longest, most coiled, simple cuboidal with brush border
- Nephron loop - U shaped; descending + ascending limbs
- Distal convoluted tubule (DCT)
  - cuboidal, minimal microvilli



Nephron Diagram



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URINE FORMATION

- Urine Formation
- Filtrate in the Bowman's capsule contains
- water, wastes, and essential nutrients
- As filtrate flows through the nephron
- tubule, urine is formed by 3 processes
- filtration
- Tubular reabsorption
- Tubular secretion

- As filtrate travels through the ascending limb of the loop of Henle
  - Salt diffuses out of the permeable tubule into the interstitial fluid
- The distal tubule
  - Plays a key role in regulating the K^+ and NaCl concentration of body fluids
- The collecting duct
  - Carries the filtrate through the medulla to the renal pelvis and reabsorbs NaCl

TUBULAR REABSORPTION

- Occurs primarily in the proximal tubule,
- although water and other nutrients are
- also reabsorbed in other tubule areas
- Tubule cells actively transport many
- nutrients
- – Examples: salts, amino acids, glucose
- • Water follows nutrients by osmosis
- – 99% of water reabsorbed from filtrate

CONTROL OF WATER LOSS

- Producing hypotonic urine
  - NaCl reabsorbed by cortical CD
  - water remains in urine
- Producing hypertonic urine
  - GFR drops
  - tubular reabsorption ↑
  - less NaCl remains in CD
  - ADH ↑ CD's water permeability
  - more water is reabsorbed
  - urine is more concentrated

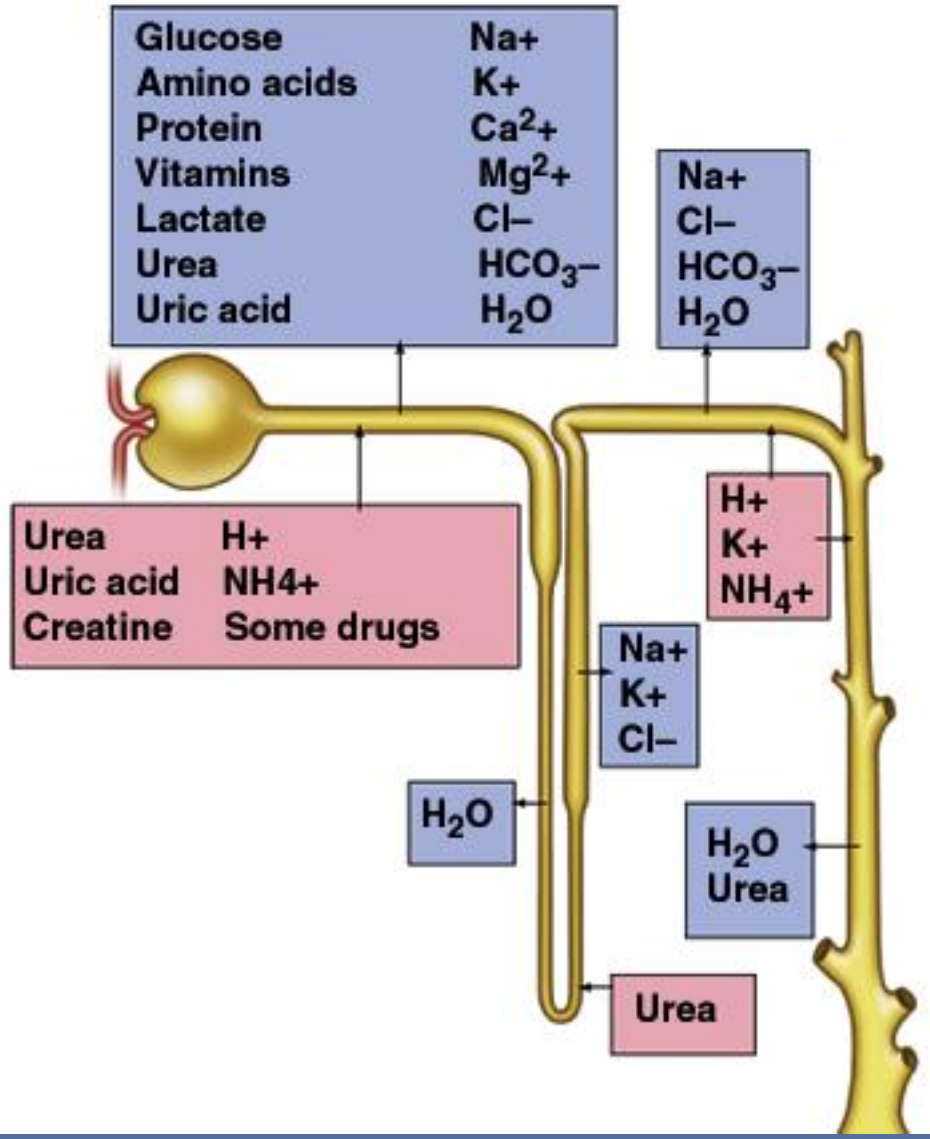
Filtration & reabsorption

- Secretion and reabsorption in the proximal tubule
  - Substantially alter the volume and composition of filtrate
- Reabsorption of water continues
  - As the filtrate moves into the descending limb of the loop of Henle

TUBULAR SECRETION

- • Occurs primarily in the distal tubule
- • Tubule cells actively transport wastes and
- excess substances from blood into filtrate
- – Examples: hydrogen and potassium ions,
- ammonia, and many drugs

Summary of Tubular Reabsorption and Secretion



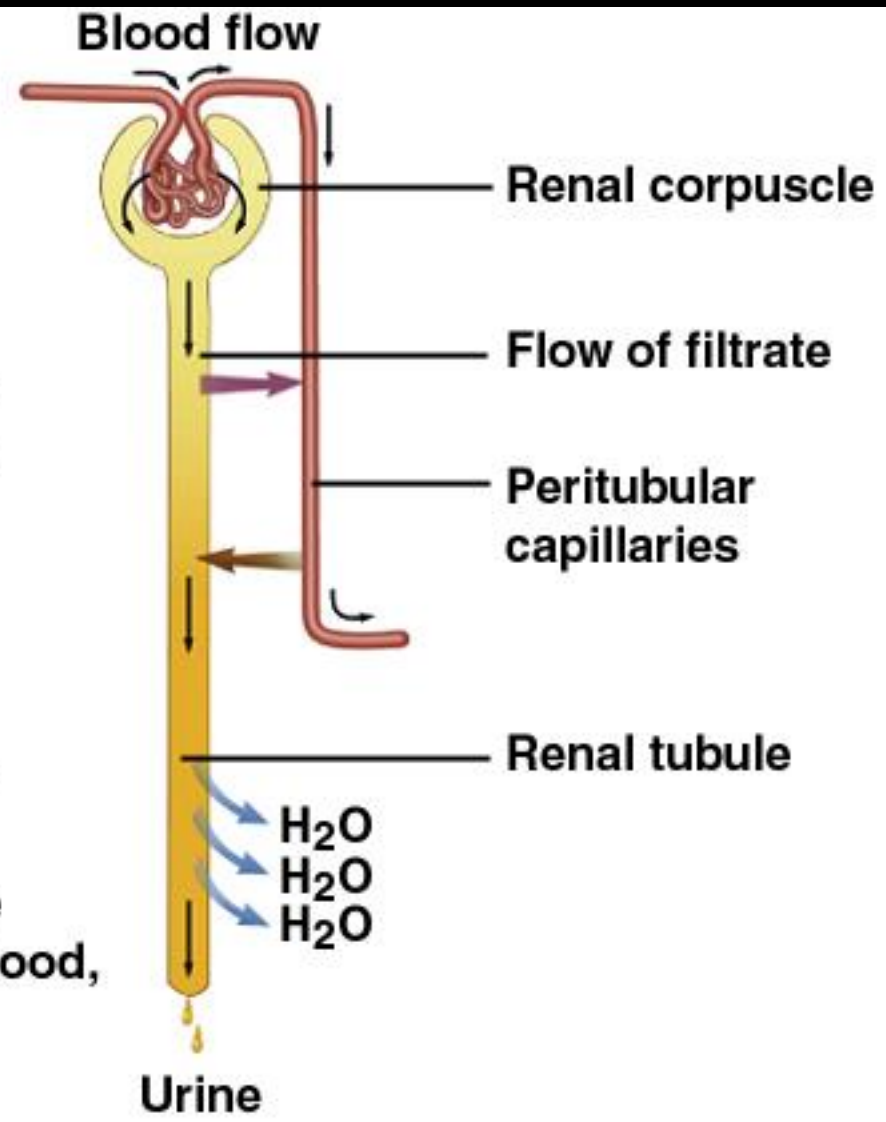
Urine Formation Preview

① **Glomerular filtration**
Creates a plasmalike filtrate of the blood

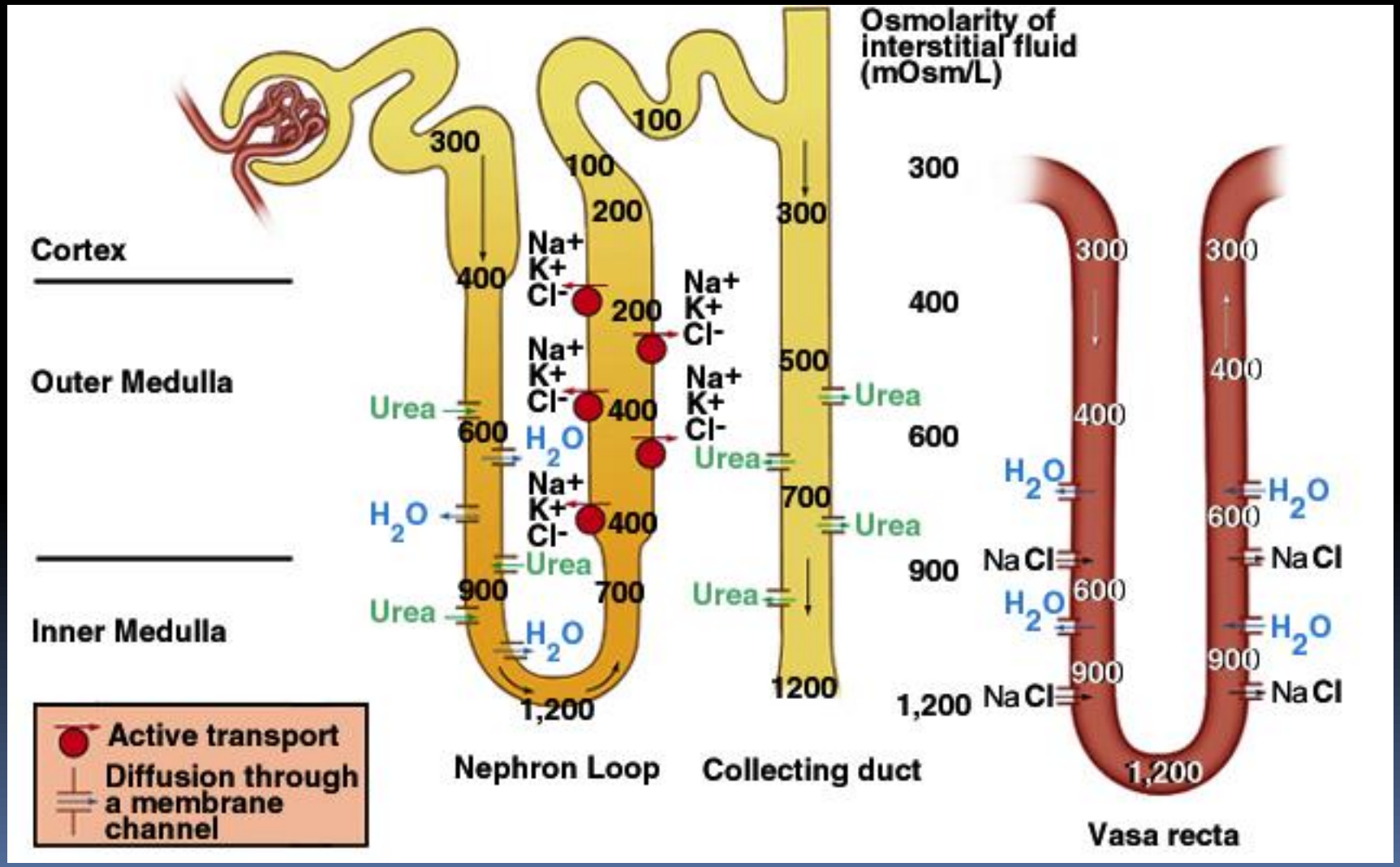
② **Tubular reabsorption**
Removes useful solutes from the filtrate, returns them to the blood

③ **Tubular secretion**
Removes additional wastes from the blood, adds them to the filtrate

④ **Water conservation**
Removes water from the urine and returns it to blood, concentrates wastes



MAINTENANCE OF OSMOLARITY IN RENAL MEDULLA



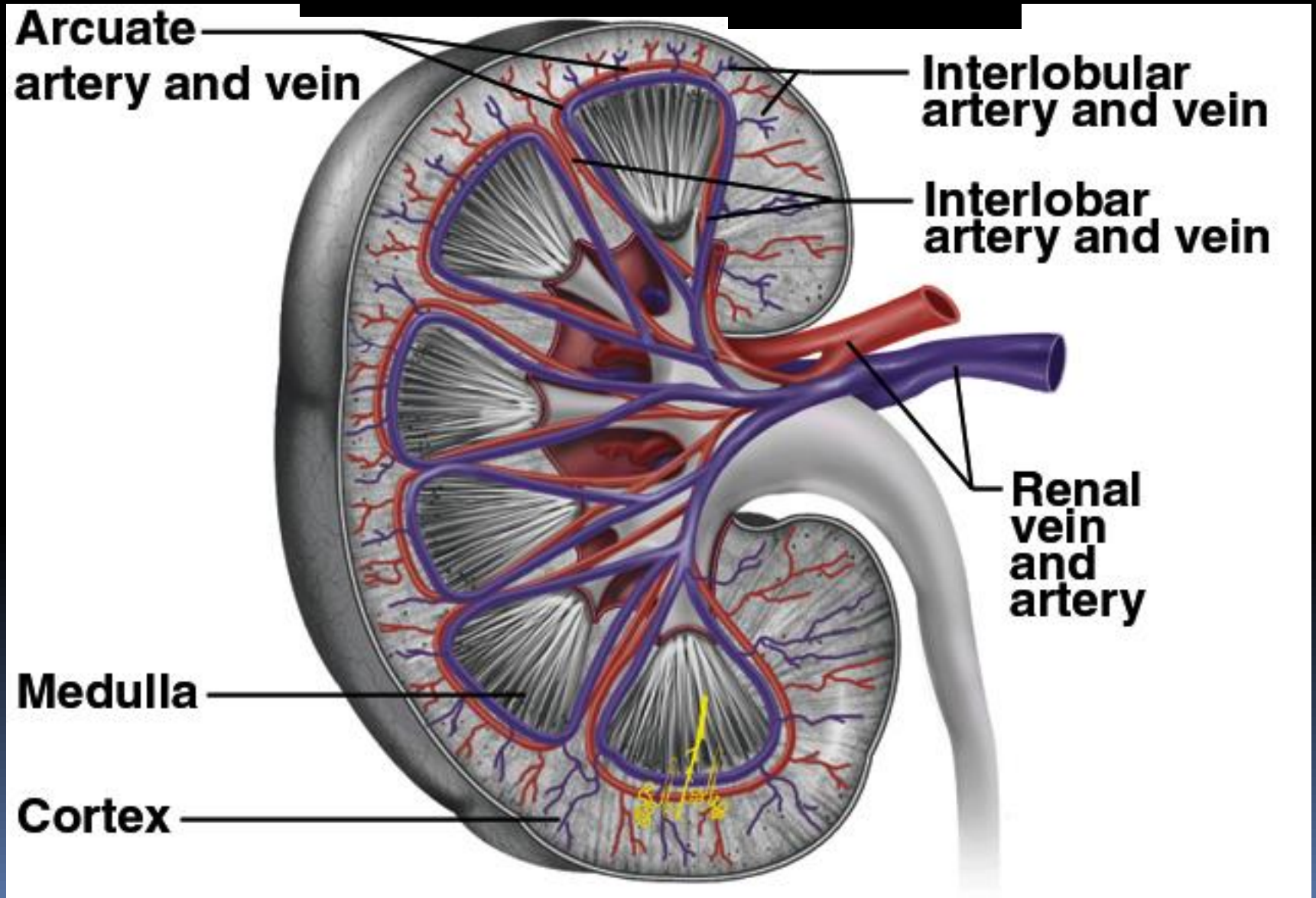
Excretion

- Separation of wastes from body fluids and eliminating them
  - **respiratory** system: CO_2
  - **integumentary** system: water, salts, lactic acid, urea
  - **digestive** system: water, salts, CO_2, lipids, bile pigments, cholesterol
  - **urinary** system: many metabolic wastes, toxins, drugs, hormones, salts, H^+ and water

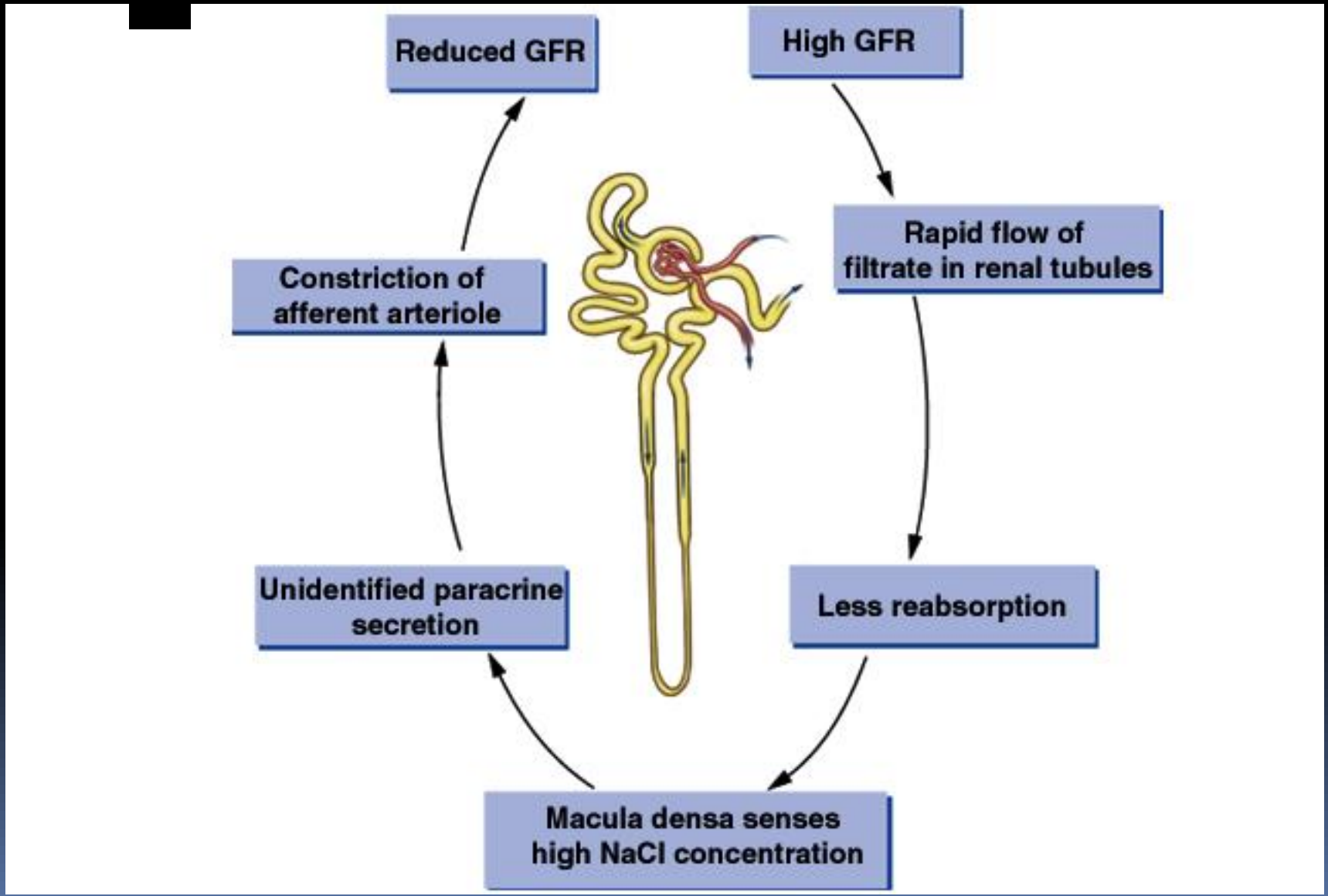
Path of Blood Through Kidney

- Renal artery
  → interlobar arteries **(up renal columns, between lobes)**
  → arcuate arteries (over pyramids)
  → interlobular arteries (up into cortex)
  → afferent arterioles
  → glomerulus (cluster of capillaries)
  → efferent arterioles (near medulla → vasa recta)
  → peritubular capillaries
  → interlobular veins → arcuate veins → interlobar veins
- Renal vein

Blood Supply Diagram



Negative Feedback Control of



Sympathetic Control of GFR

- Strenuous exercise or acute conditions (circulatory shock) stimulate afferent arterioles to constrict
- ↓ GFR and urine production, redirecting blood flow to heart, brain and skeletal muscles

أي أسئلة متعلقة بالدرس؟

جزآكم الله خيرا

د / عمرو شلبي

بالتوفيق أن شاء الله