

# **SNS COLLEGE OF PHYSIOTHERAPY**

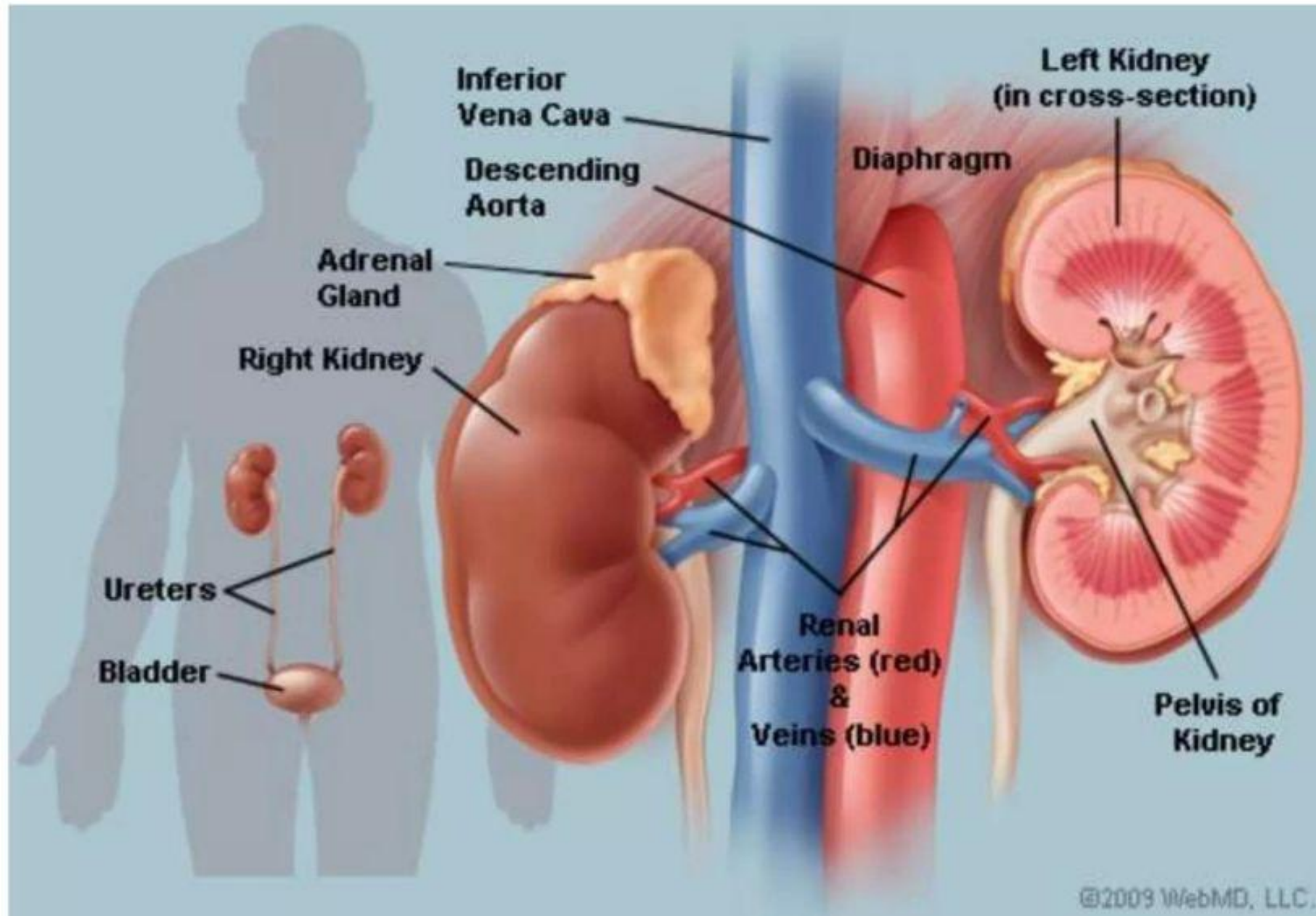
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**COURSE NAME: PHYSIOLOGY AND  
APPLIED PHYSIOLOGY**

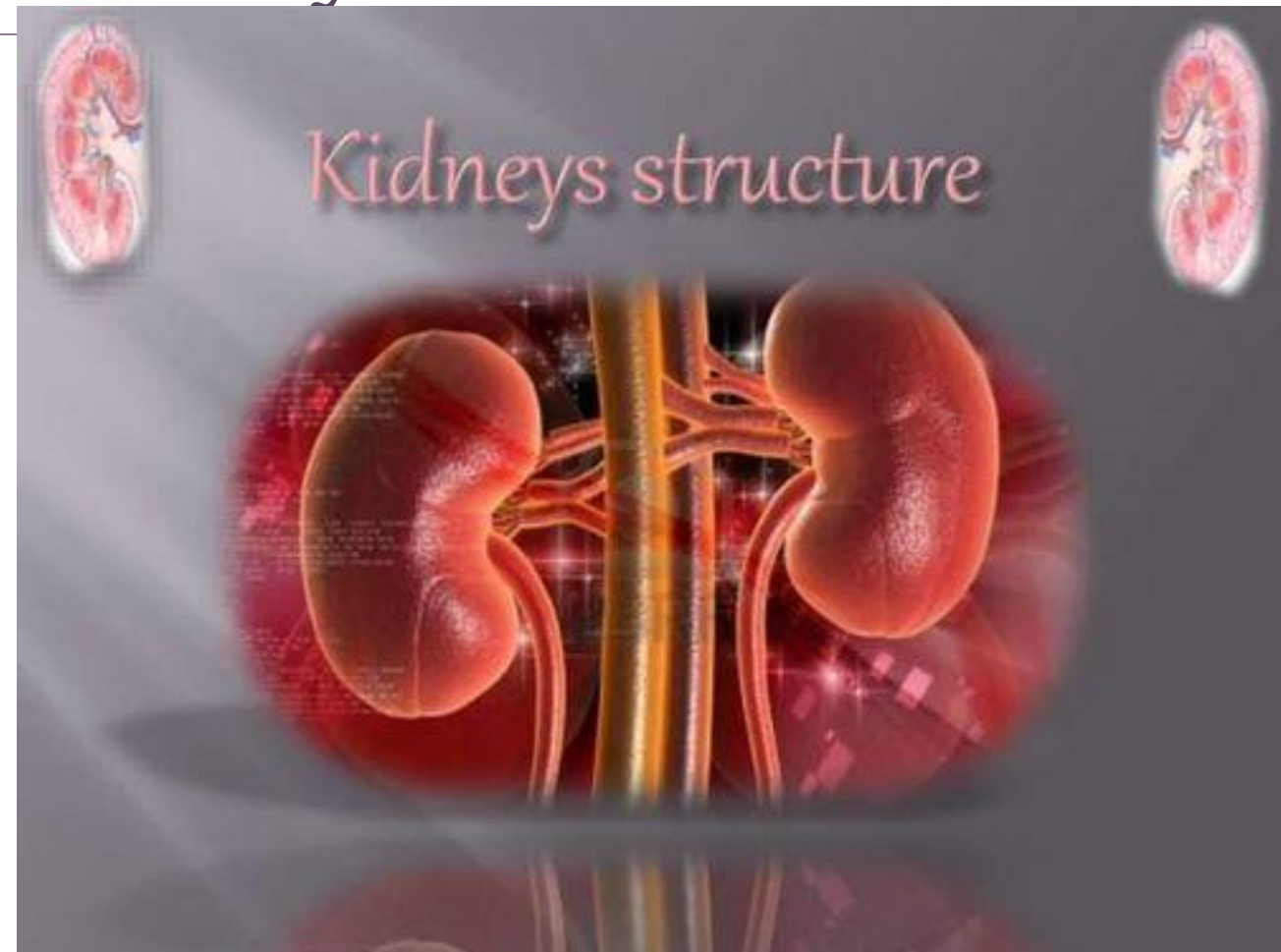
**SUBJECT CODE: 6280**

**TOPIC: EXCRETION**



# Introduction to the Kidneys

- Paired, bean-shaped organs located retroperitoneally in the abdomen.
- Primary functions: Filter blood, remove wastes, regulate fluids/electrolytes, maintain acid-base balance.
- Additional roles: Produce hormones (erythropoietin, renin, calcitriol).
- Each kidney contains ~1 million nephrons (functional units).

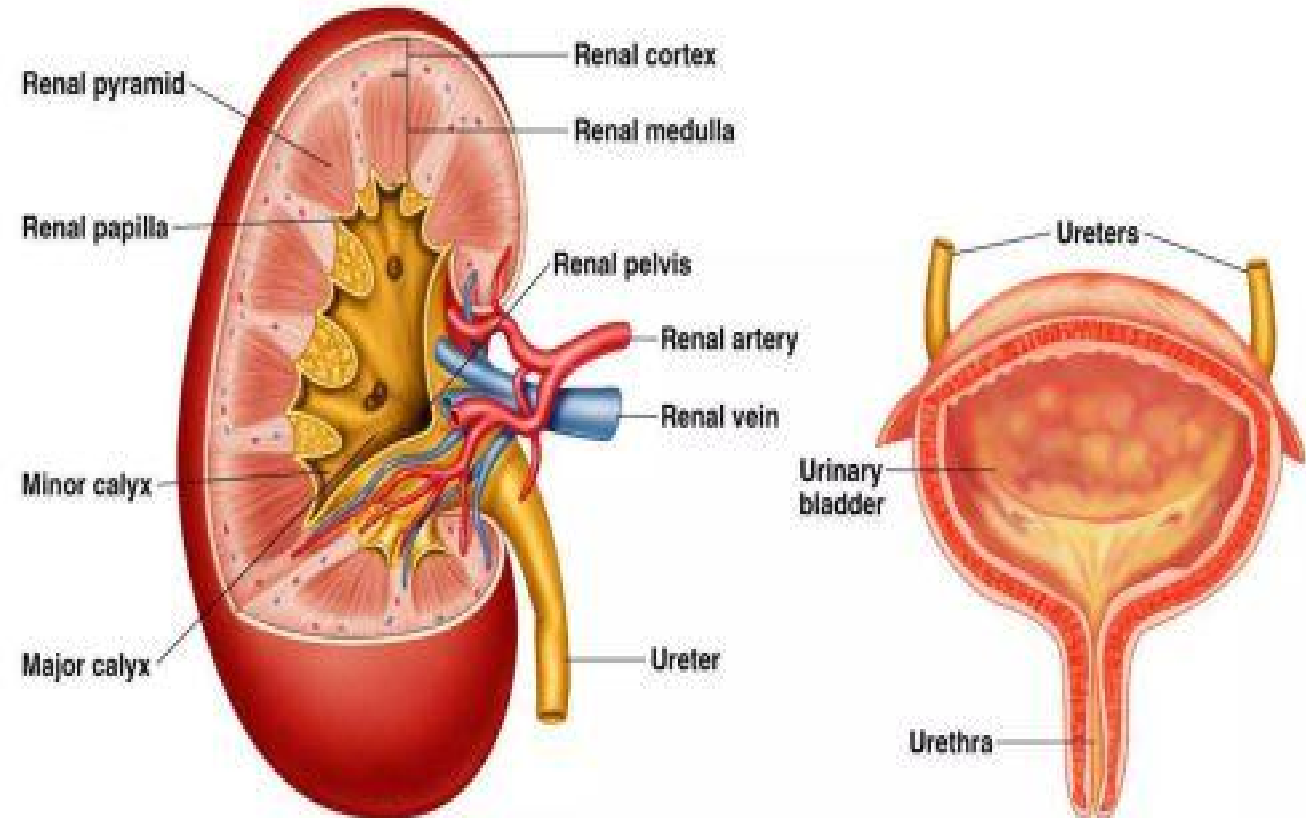


# Gross Anatomy of the Kidney

External: Renal capsule (protective layer), hilum (entry/exit for vessels/ureter).

Internal: Cortex (outer layer), medulla (inner pyramids), renal pelvis (urine collection).

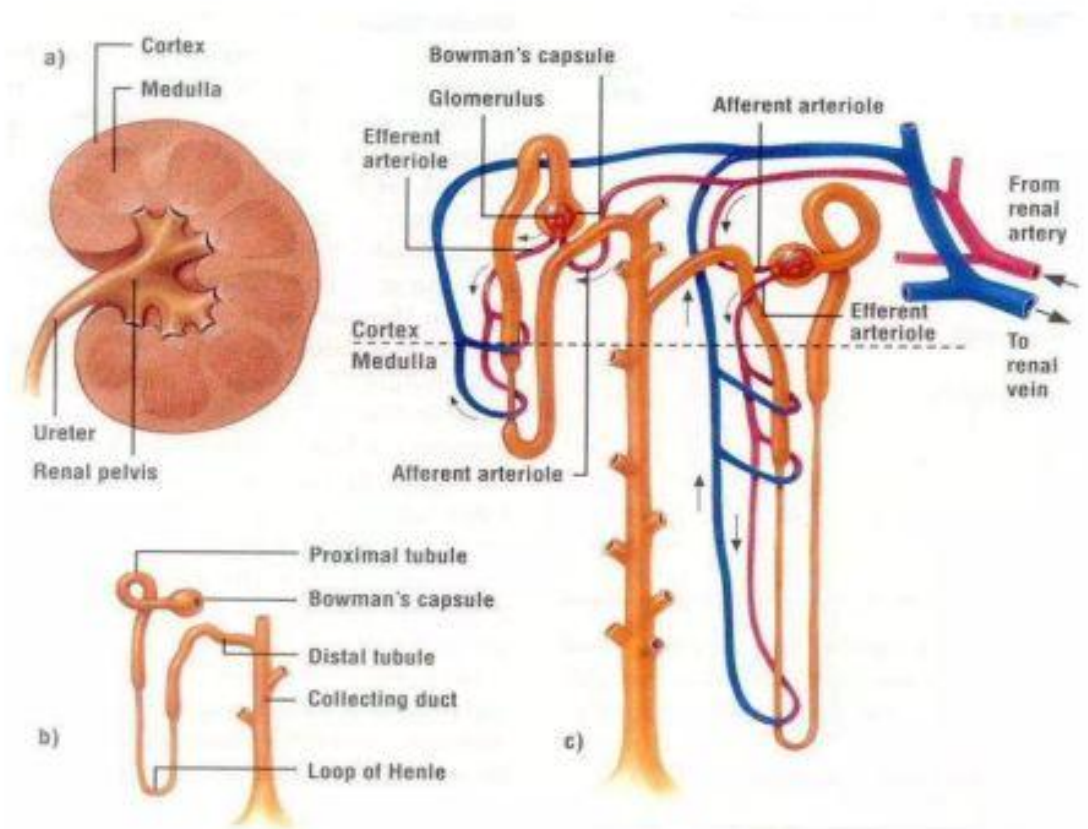
Blood supply: Renal artery → branches → renal vein.



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# The Nephron: Functional Unit

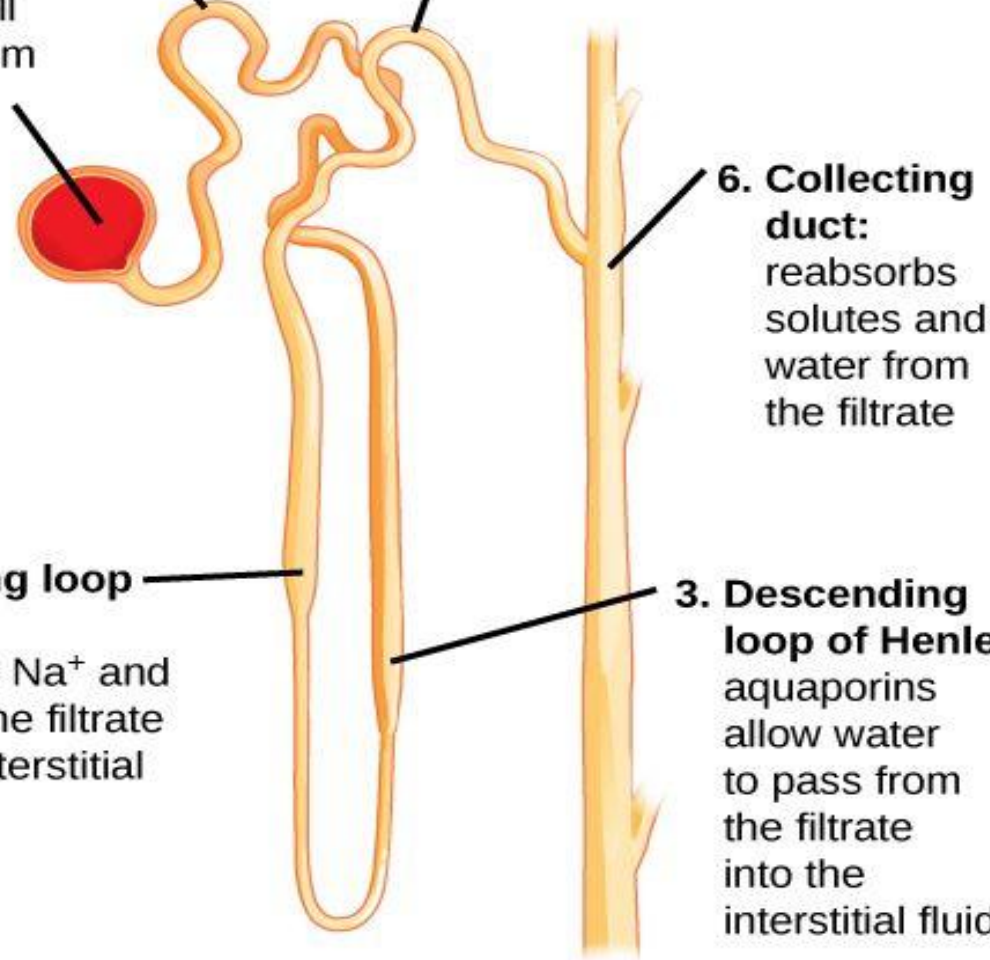
- ~1 million per kidney.
- Types: Cortical (85%) and juxtamedullary (15%, longer loops for concentration).
- Consists of renal corpuscle and renal tubule.
- Responsible for filtration, reabsorption, secretion, and excretion.



**2. Proximal convoluted tubule:**  
reabsorbs ions, water, and nutrients; removes toxins and adjusts filtrate pH

**1. Glomerulus:**  
filters small solutes from the blood

**5. Distal tubule:**  
selectively secretes and absorbs different ions to maintain blood pH and electrolyte balance



**6. Collecting duct:**  
reabsorbs solutes and water from the filtrate

**4. Ascending loop of Henle:**  
reabsorbs  $\text{Na}^+$  and  $\text{Cl}^-$  from the filtrate into the interstitial fluid

**3. Descending loop of Henle:**  
aquaporins allow water to pass from the filtrate into the interstitial fluid

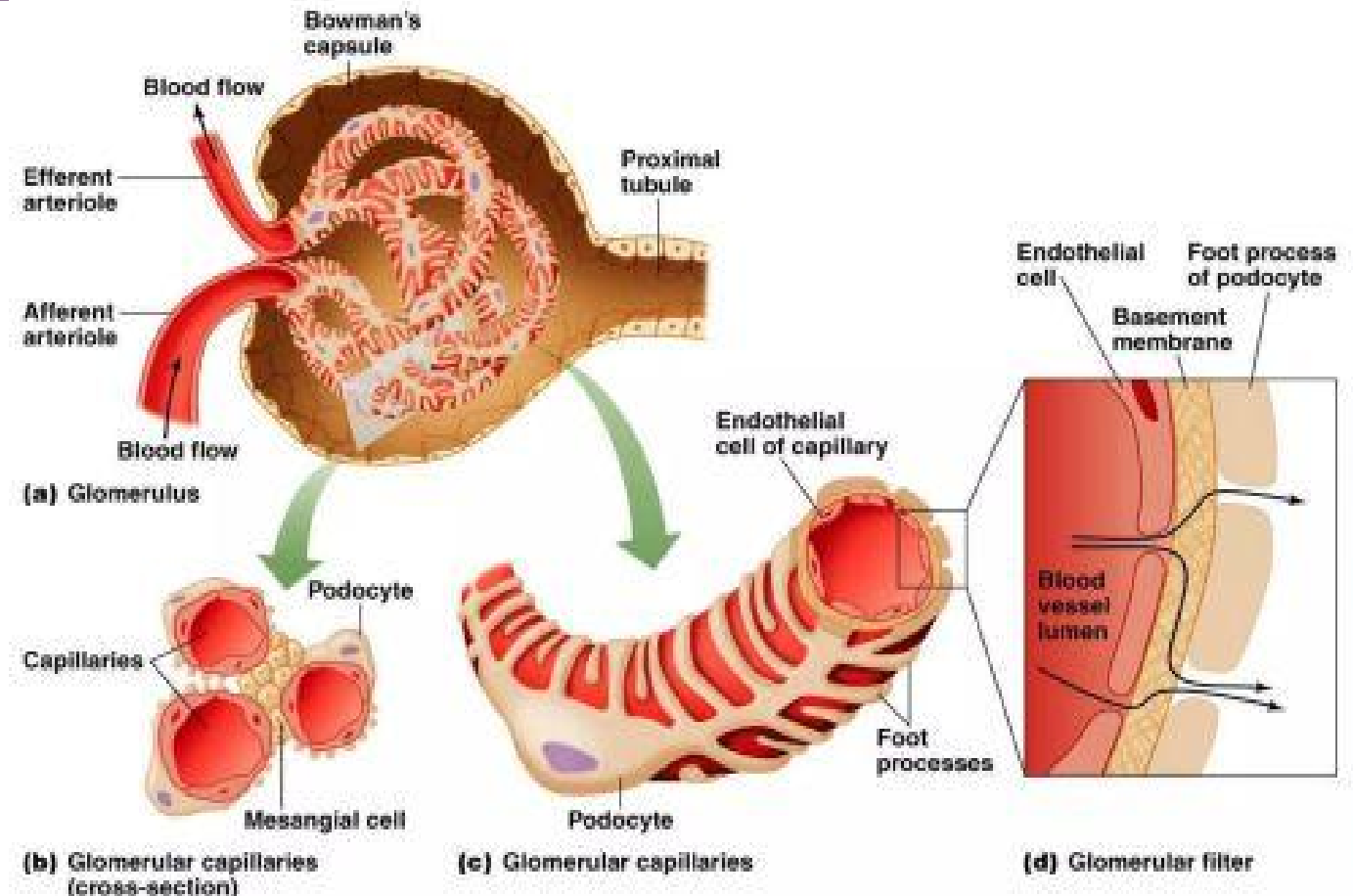
# Structure of the Nephron - Renal Corpuscle

Glomerulus: Cluster of capillaries for filtration.

Bowman's capsule: Surrounds glomerulus, collects filtrate.

Filtration barrier: Endothelium, basement membrane, podocytes.

Afferent/efferent arterioles regulate blood flow.



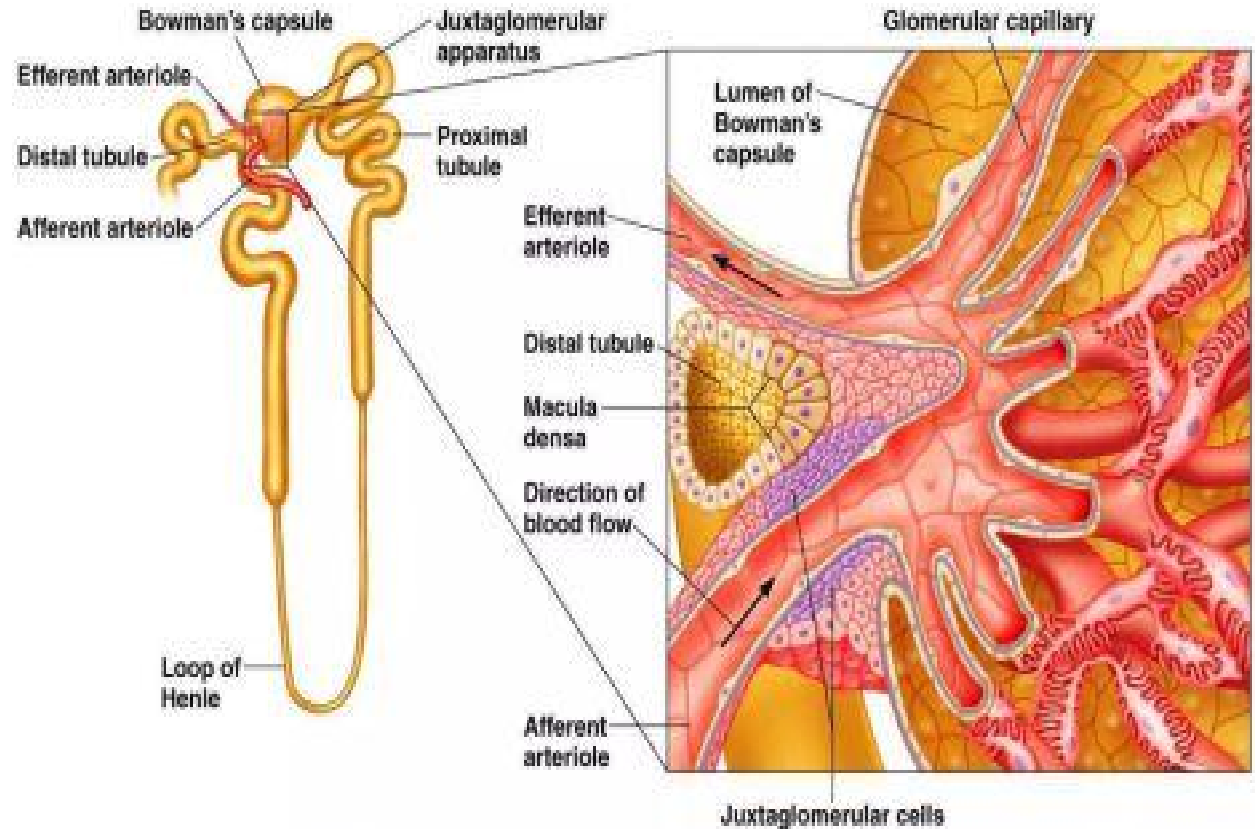
# Structure of the Nephron - Renal Tubule

Proximal convoluted tubule (PCT): In cortex, reabsorption.

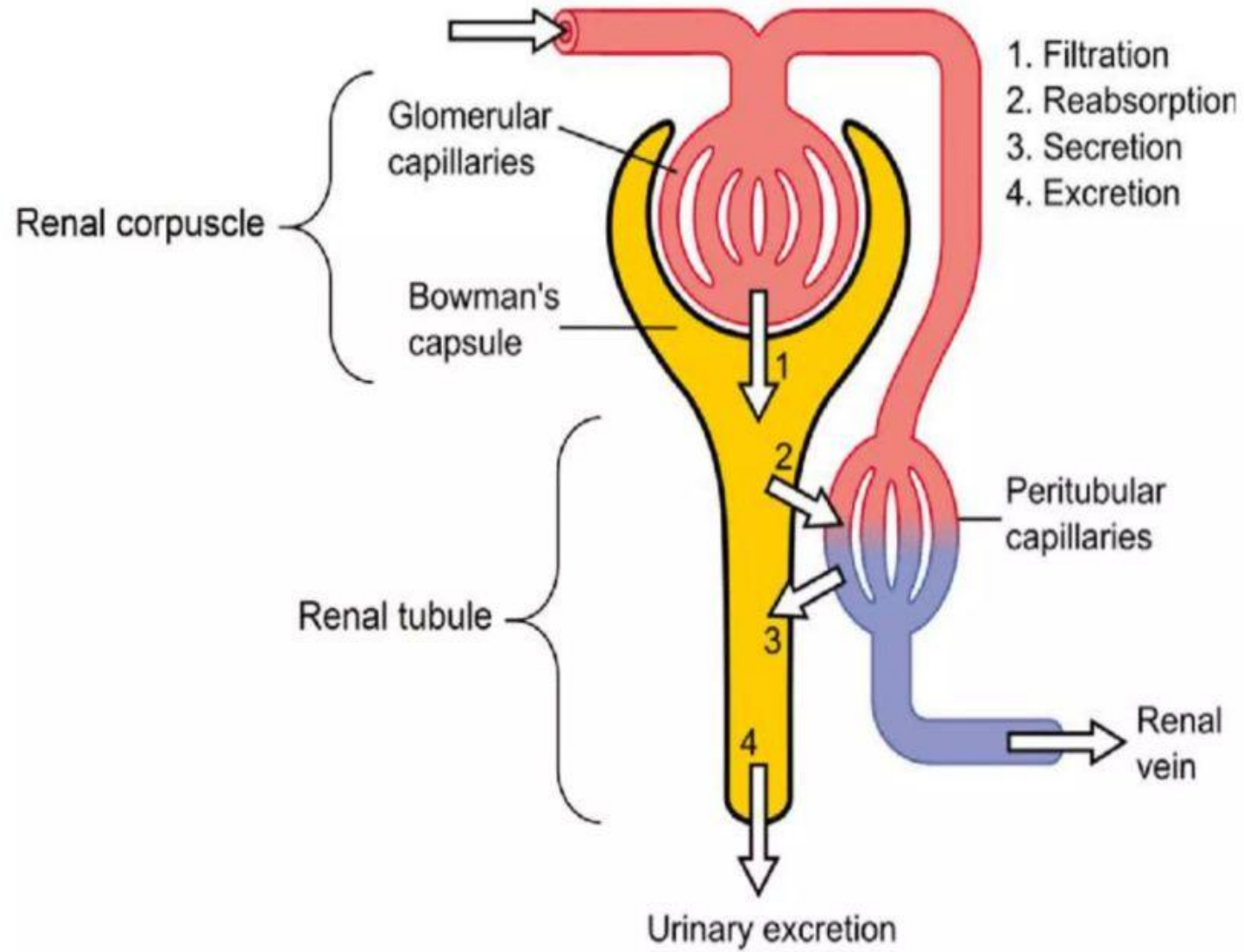
Loop of Henle: Descending (water reabsorption), ascending (salt reabsorption).

Distal convoluted tubule (DCT): Fine-tuning, hormone regulation.

Collecting duct: Final concentration, ADH influence.



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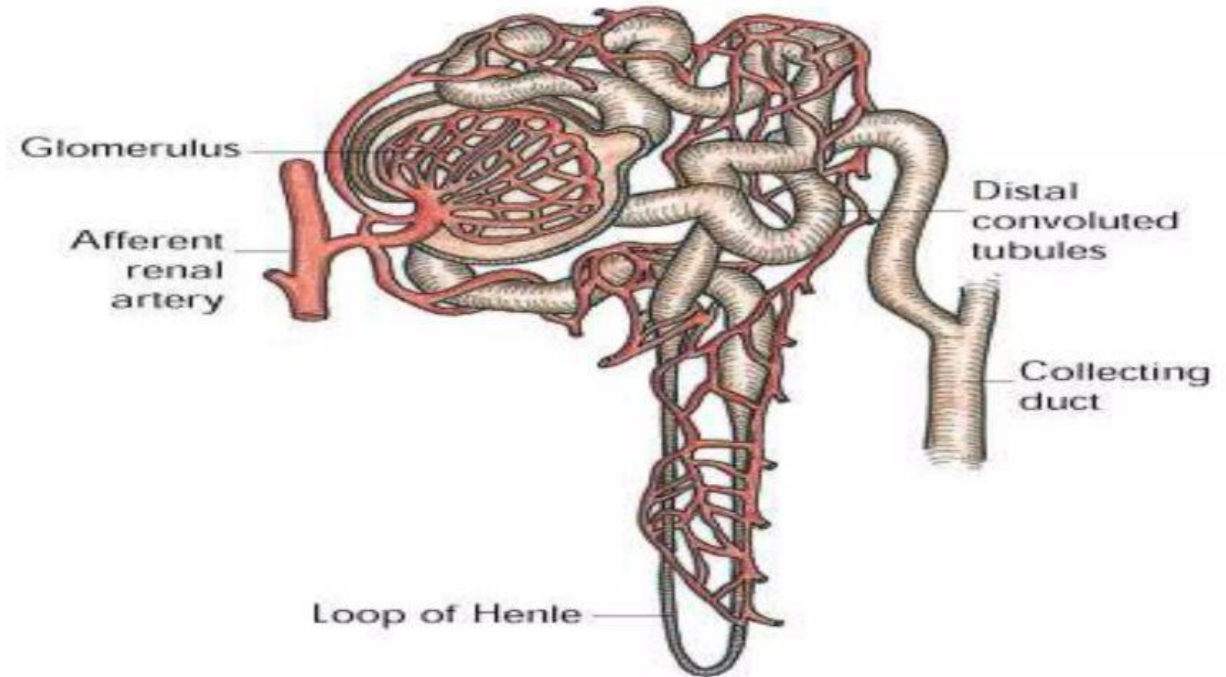


# Urine Formation - Glomerular Filtration

Blood pressure forces fluid through glomerulus into Bowman's capsule.

Filtrate: Water, ions, glucose, wastes (no large proteins/cells).

GFR ~125 mL/min; regulated by juxtaglomerular apparatus.



**Figure 44-2** Renal nephron.

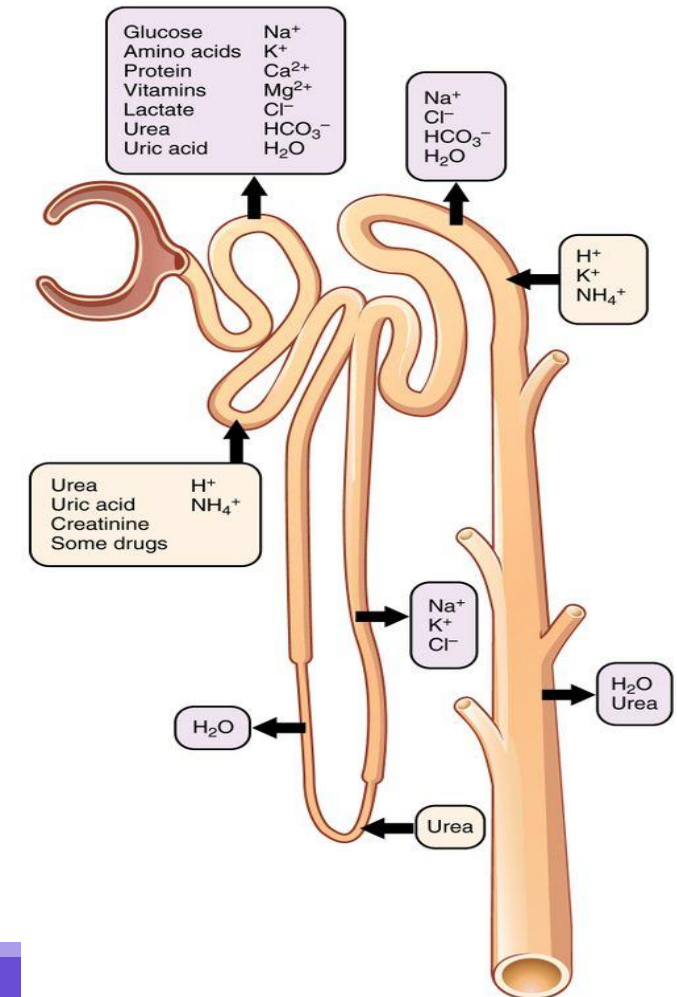
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# Urine Formation - Tubular Reabsorption and Secretion

Reabsorption: ~99% water, glucose, ions reclaimed (PCT: bulk; Loop: concentration gradient; DCT: regulated).

Secretion: Adds wastes (e.g., H<sup>+</sup>, drugs) into tubule.

Countercurrent multiplier in Loop of Henle enables urine concentration.



# Regulation and Other Functions

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Hormones: ADH (water retention), aldosterone (Na<sup>+</sup> reabsorption), renin-angiotensin system (blood pressure).

Maintains homeostasis: Fluid balance, pH, electrolytes.

Other: Hormone production (EPO for RBCs, vitamin D activation).

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Kidneys filter ~180 L blood/day via nephrons.

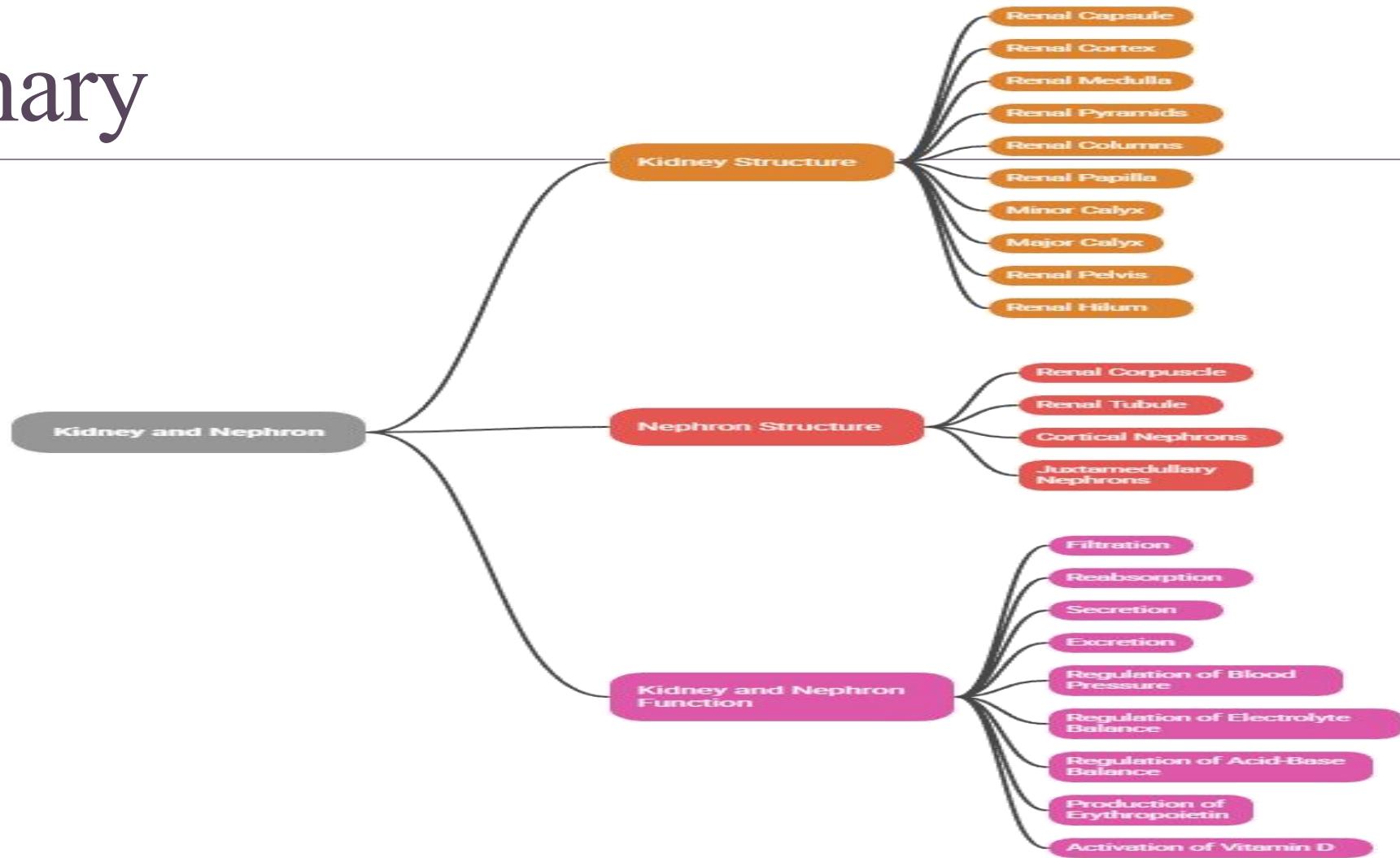
Key processes: Filtration →  
Reabsorption → Secretion →  
Excretion.

Essential for waste removal, balance,  
and health.

Clinical note: Damage leads to CKD,  
affecting millions.

## Kidney and Nephron Structure and Function

# Summary



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# Thank you

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