

Handling/Transport of different solutes in Loop of Henle and Distal S

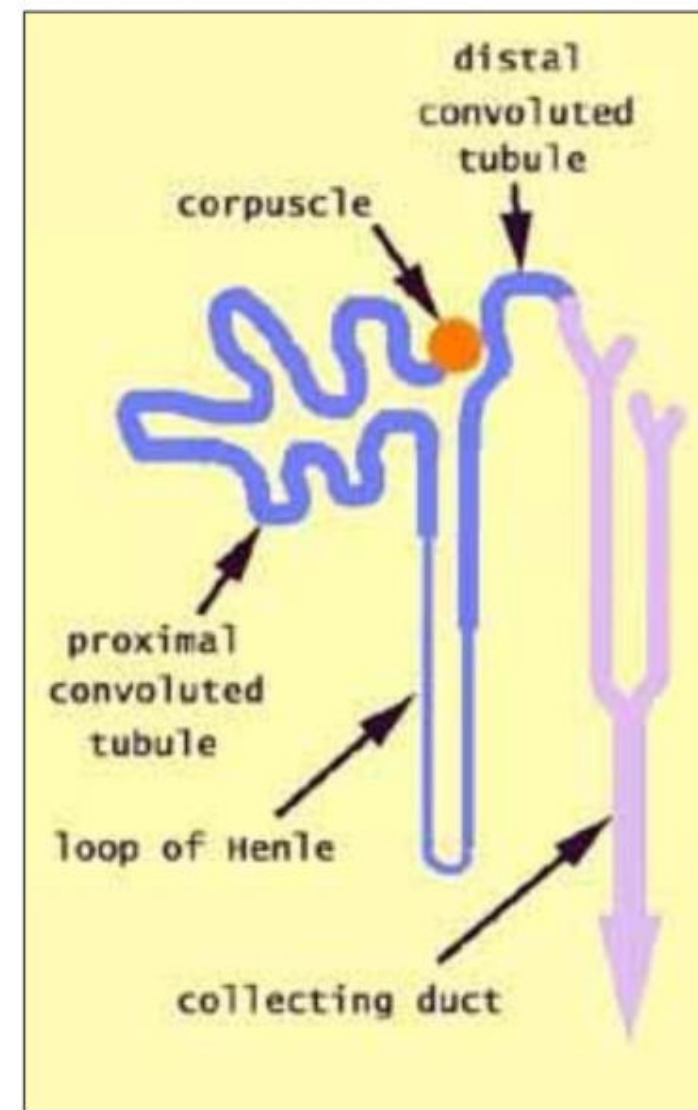
Learning Objectives

To understand

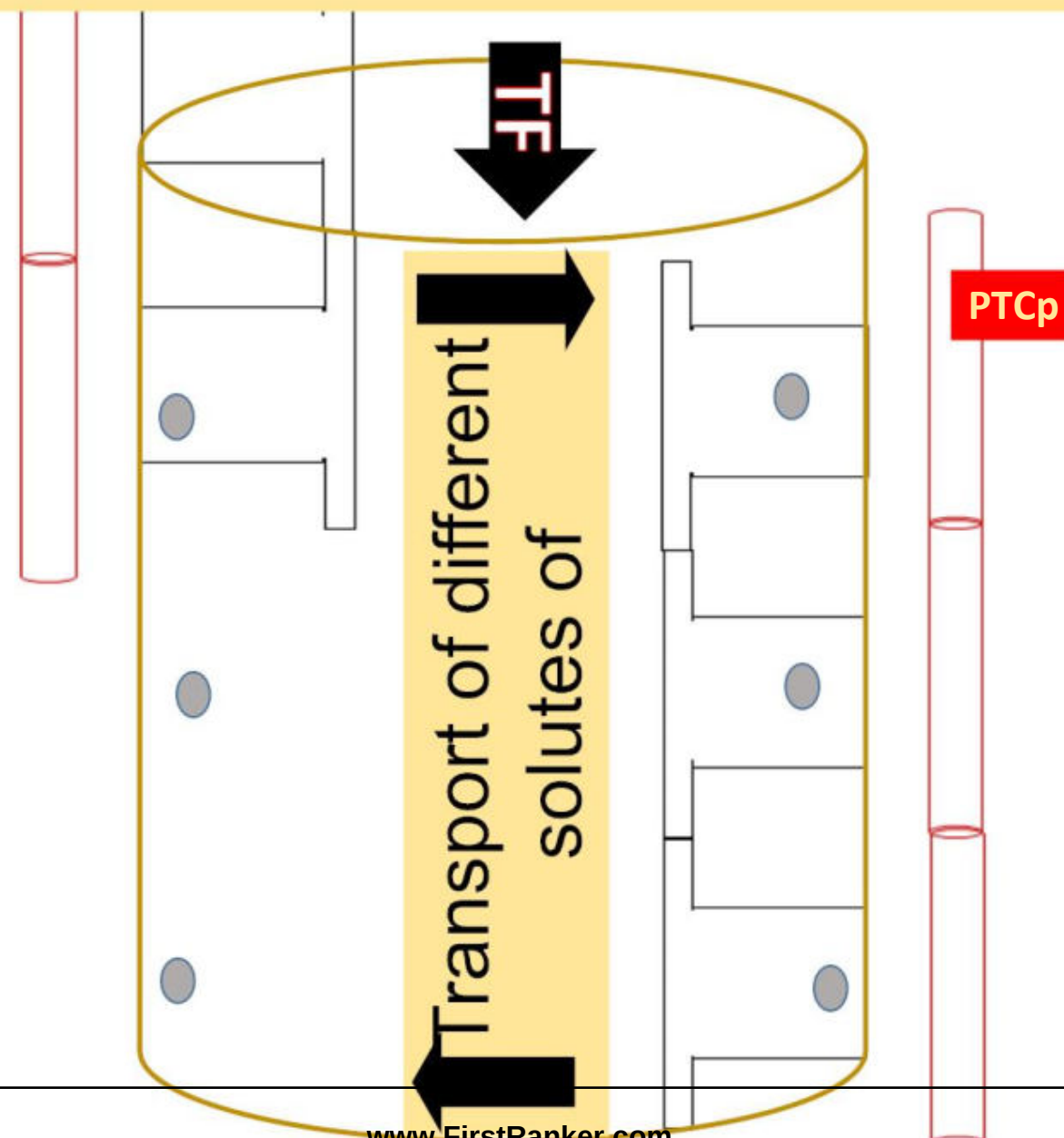
- **Handling of water, organic compounds, and ions in LOH and Distal segment.**
- **Different membrane proteins and osmolality of these segments.**

Nephron : Tubular Segments

Three major segments:

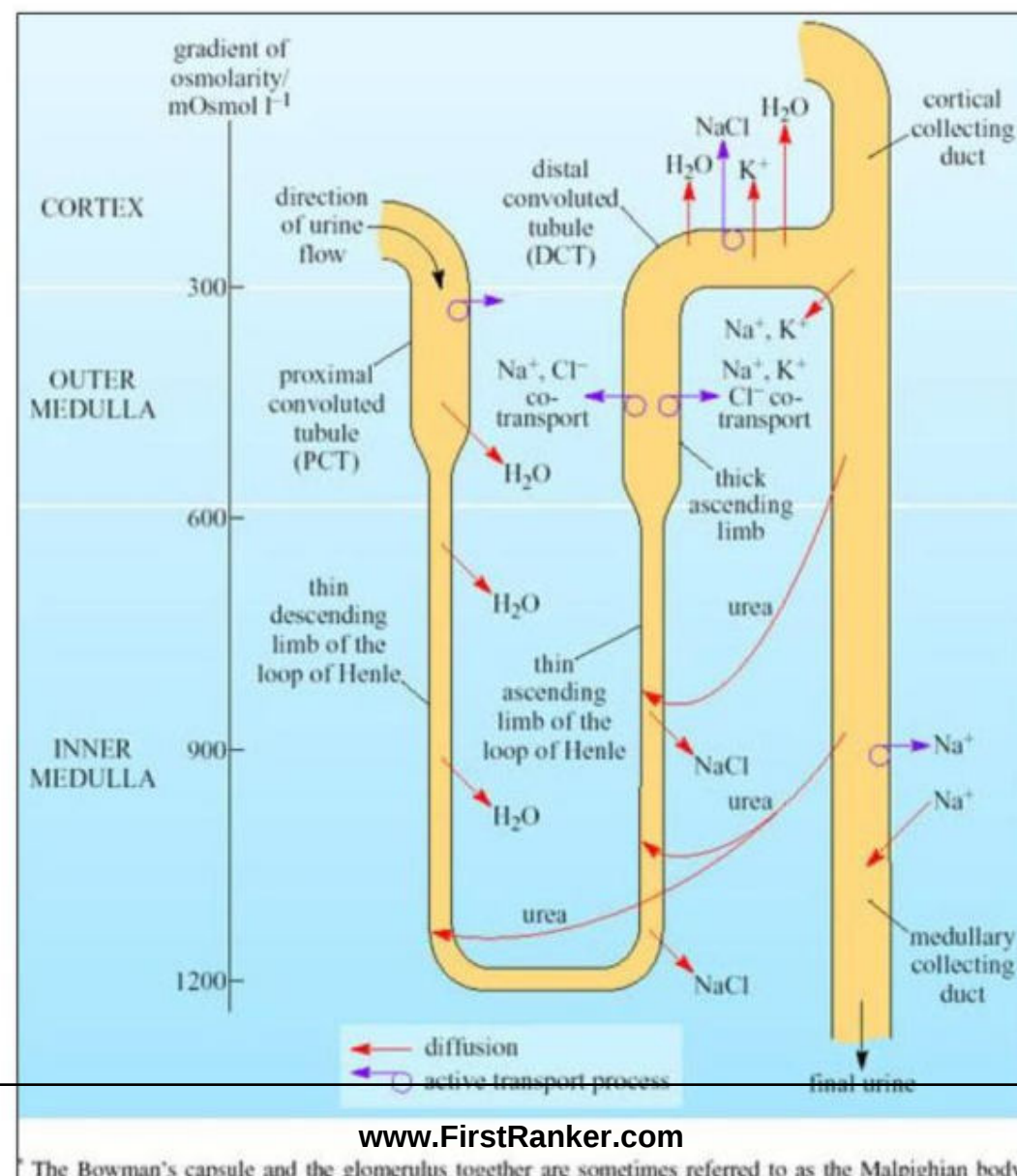


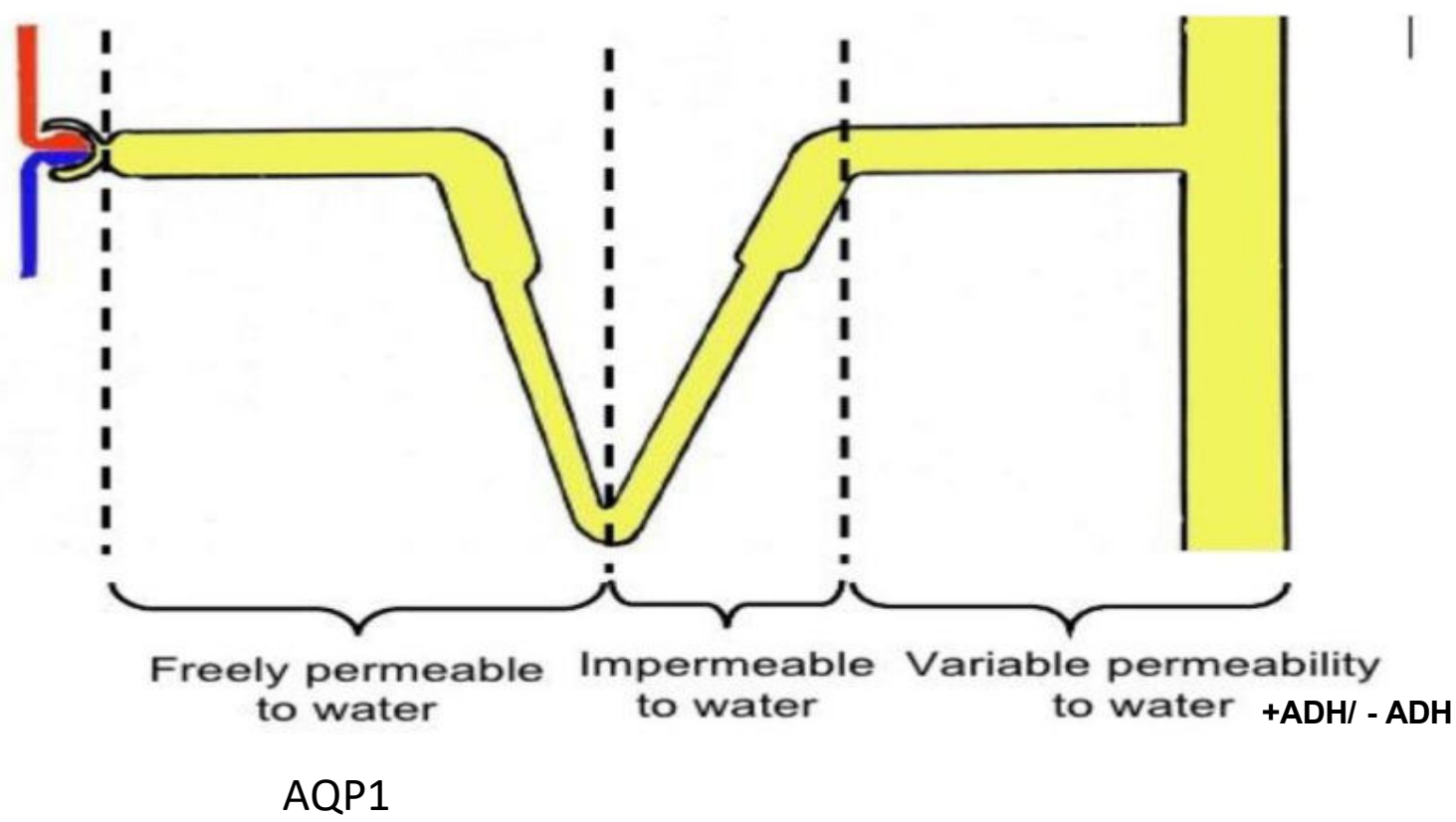
Handling/Transport of different solutes in Loop of Henle



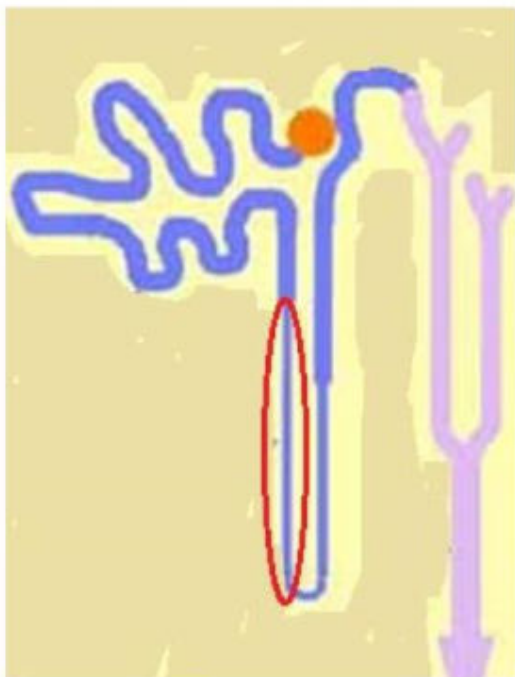
Segment – Loop of Henle

Loop of Henle



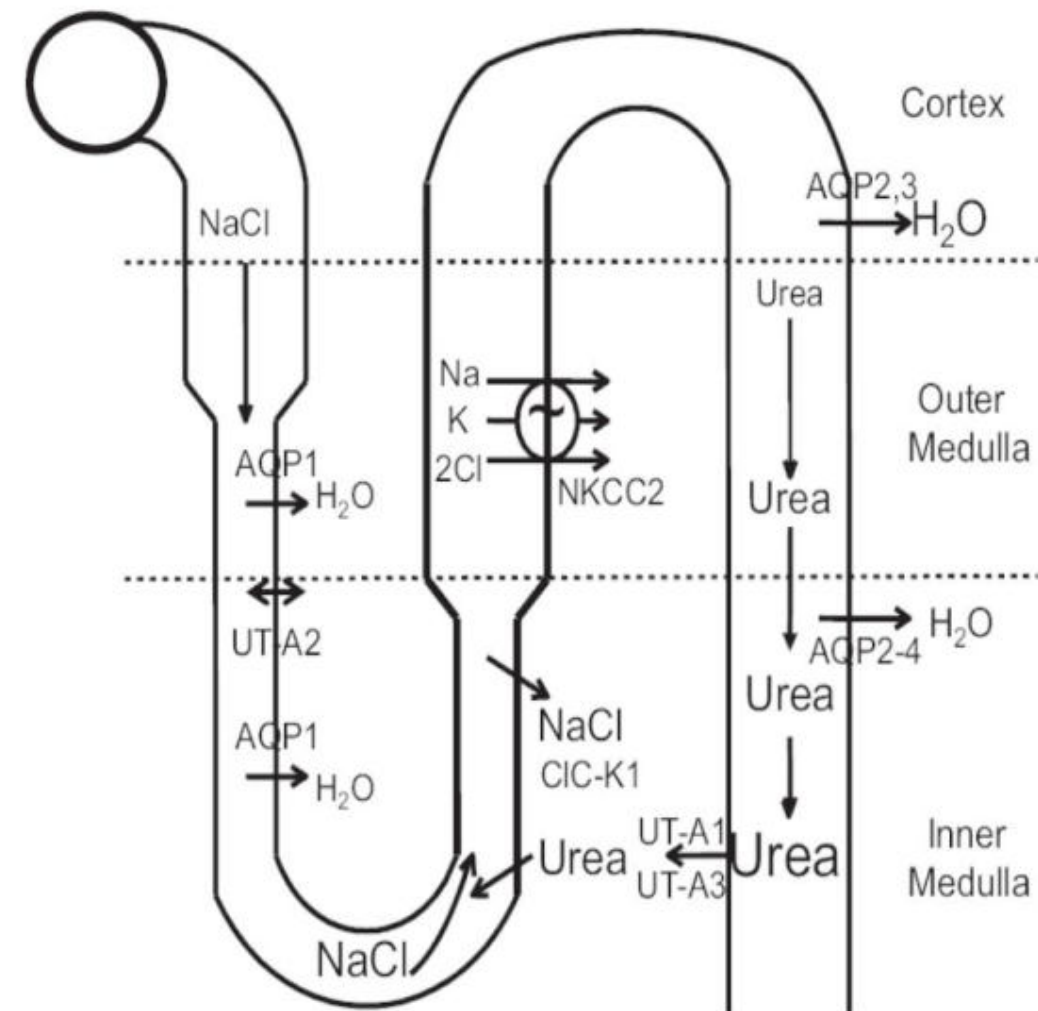


Segment-Thin Descending Limb of LOH



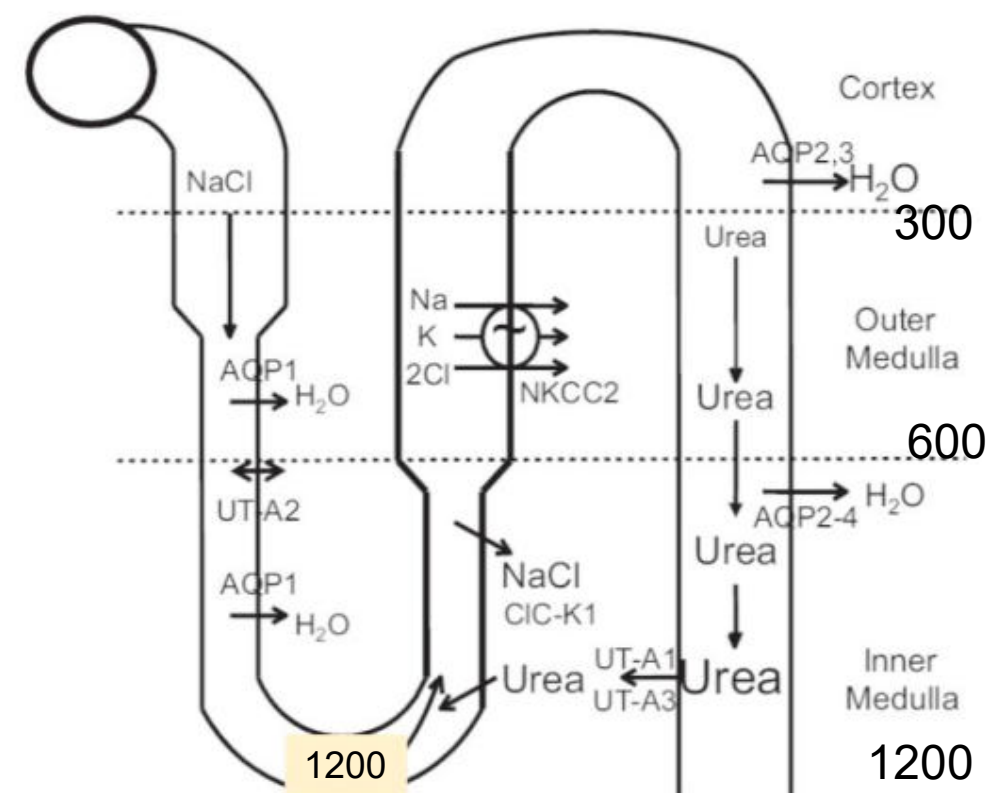
Thin descending limb of Loop of Henle

Since water and solutes are reabsorbed (65-67%) in PxCT – it receives: 1/3rd of the original volume and isosmotic to surrounding fluid (400 mosm/kg)



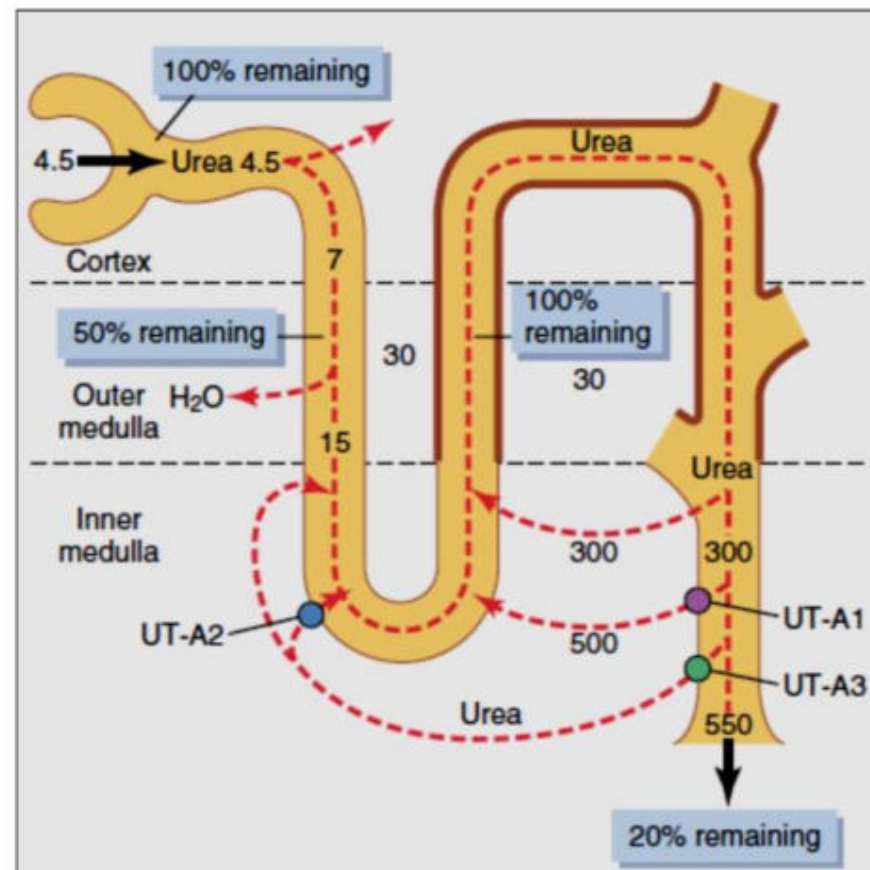
Segment – Thin descending limb of Loop of Henle

- **Water reabsorption**
- **Na⁺ - also reabsorbed.**

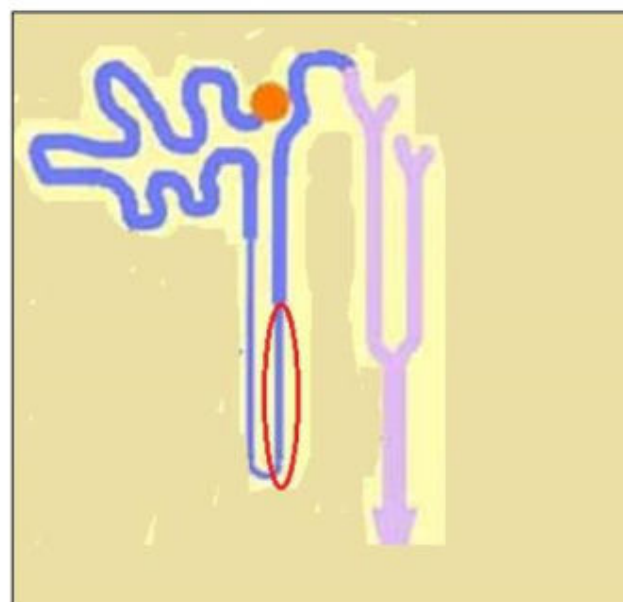


Segment – Thin descending limb of Loop of Henle

Secretion of urea →



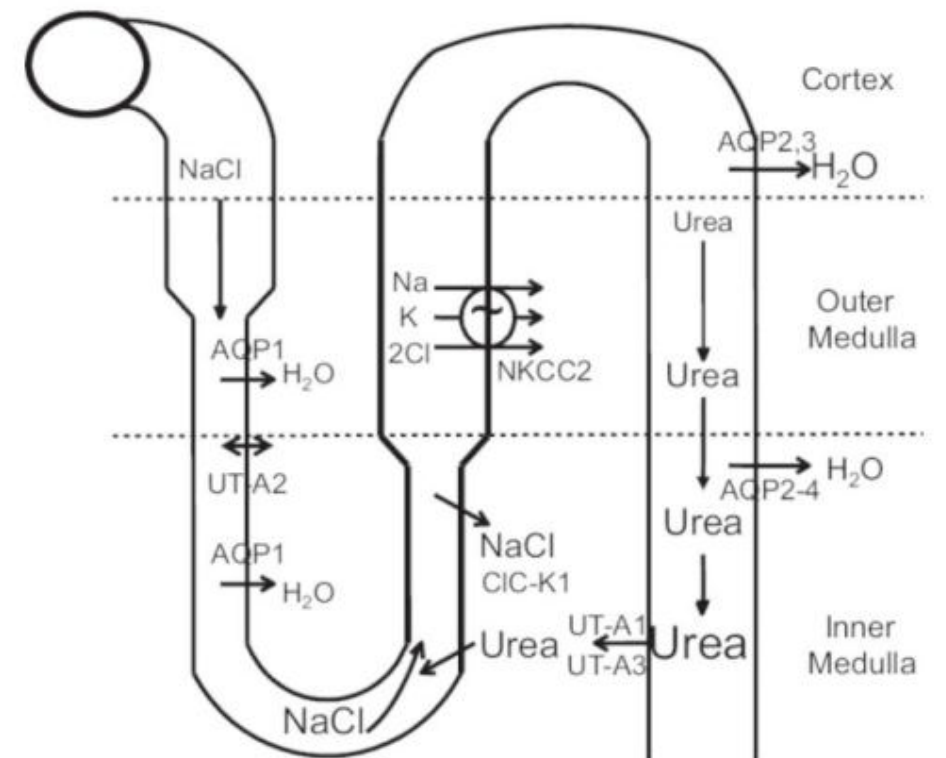
Segment Thin Ascending Limb of LOH



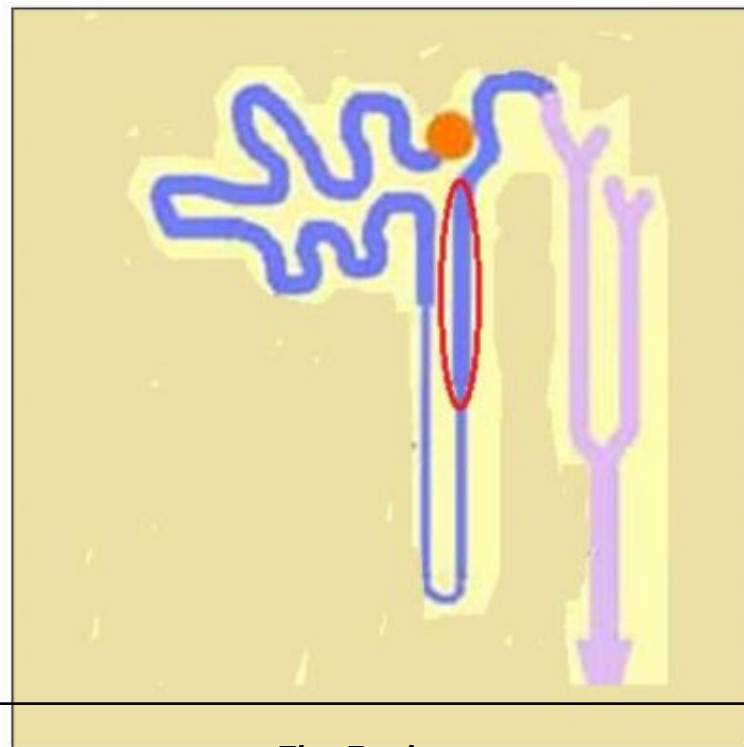
Thin Ascending Limb of LOH

•This segment is impermeable to water – ‘NO’ H₂O reabsorption here.

- Reabsorption of NaCl
- Small amount of Ca⁺⁺ & HCO₃⁻ - reabsorbed
- Secretion of urea →

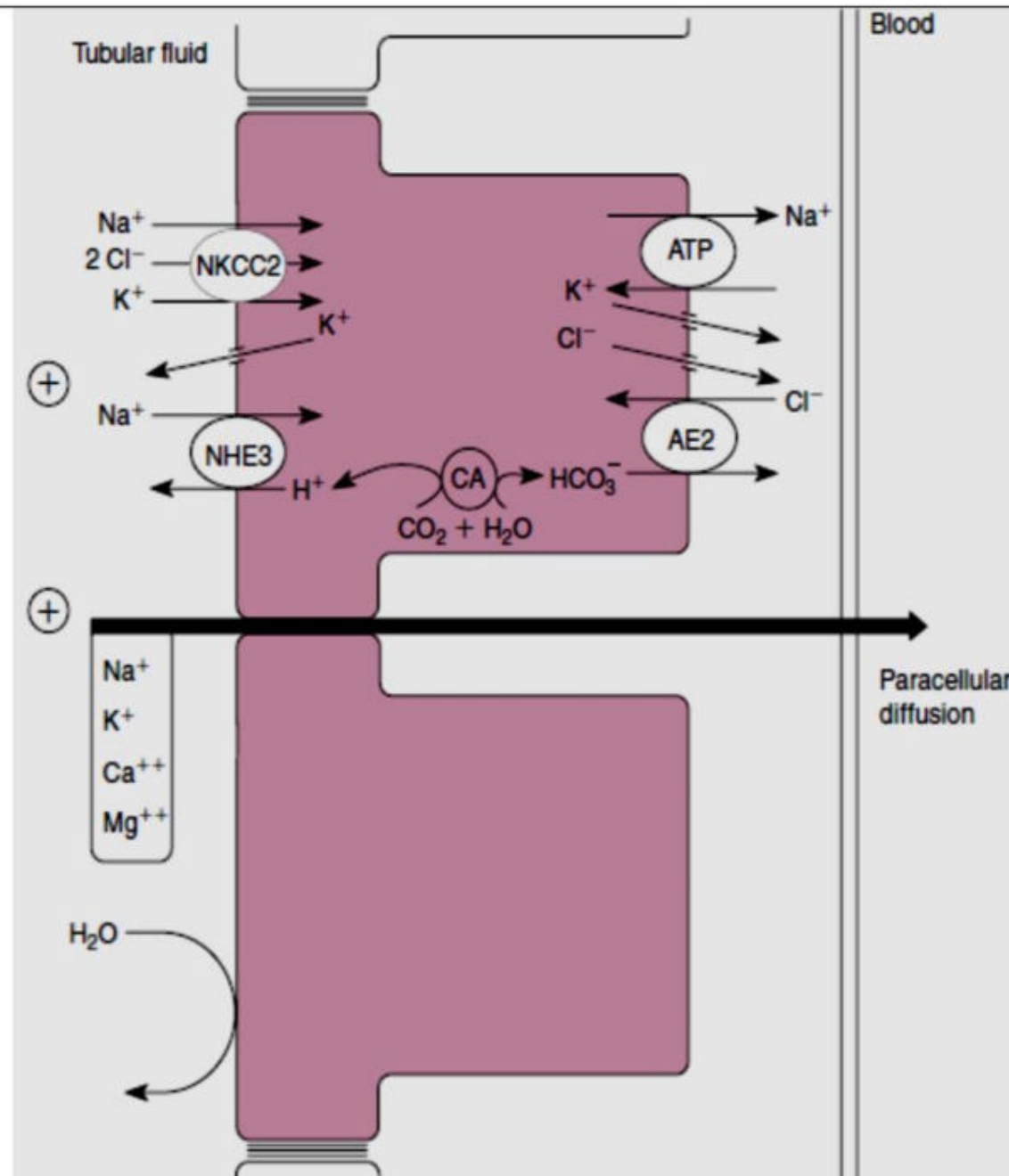


Thick Ascending Limb of LOH



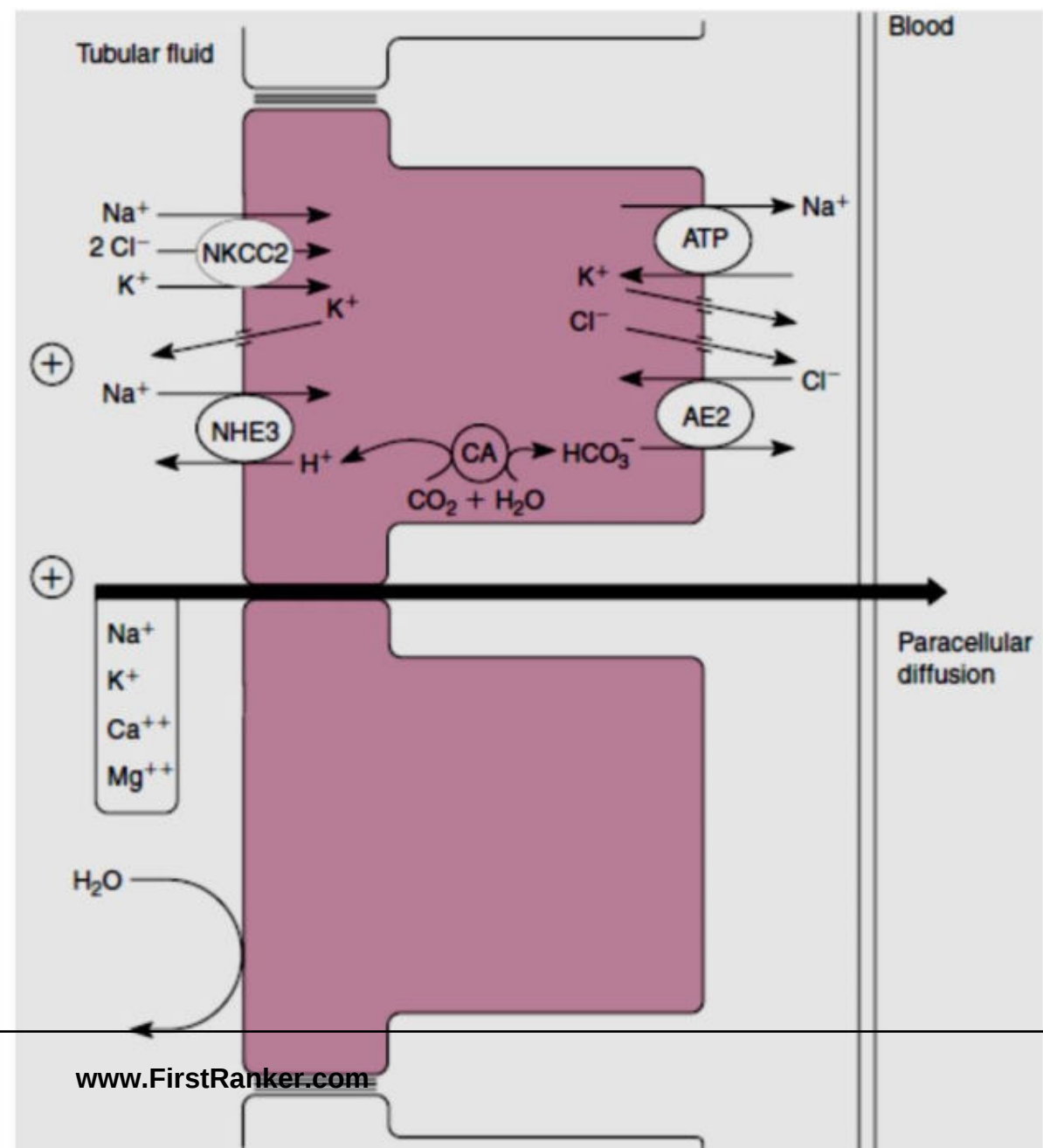
Thick ascending limb of LOH

NaCl reabsorption –



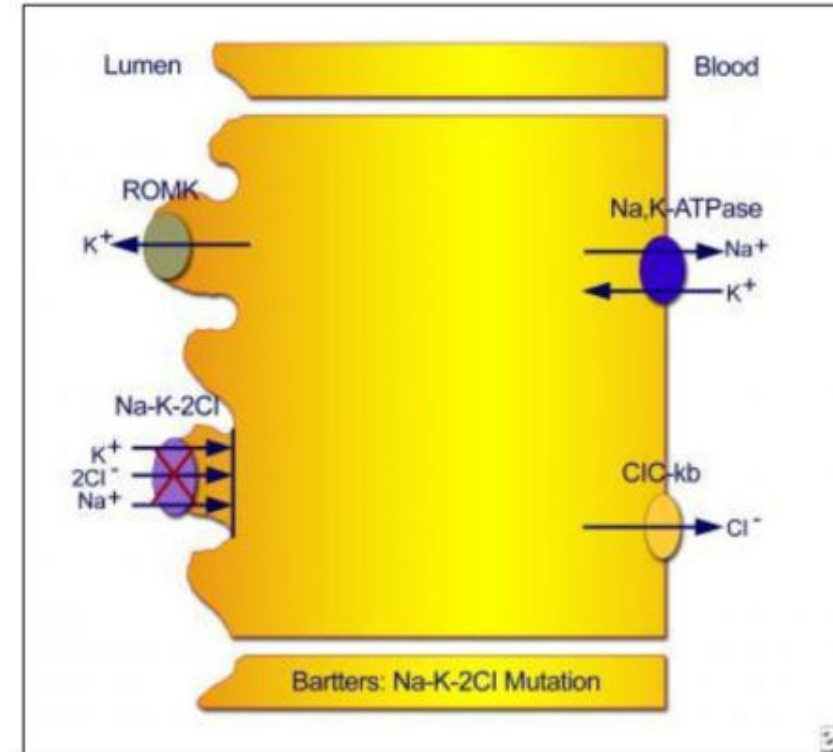
Thick ascending limb of LOH

paracellular reabsorption of

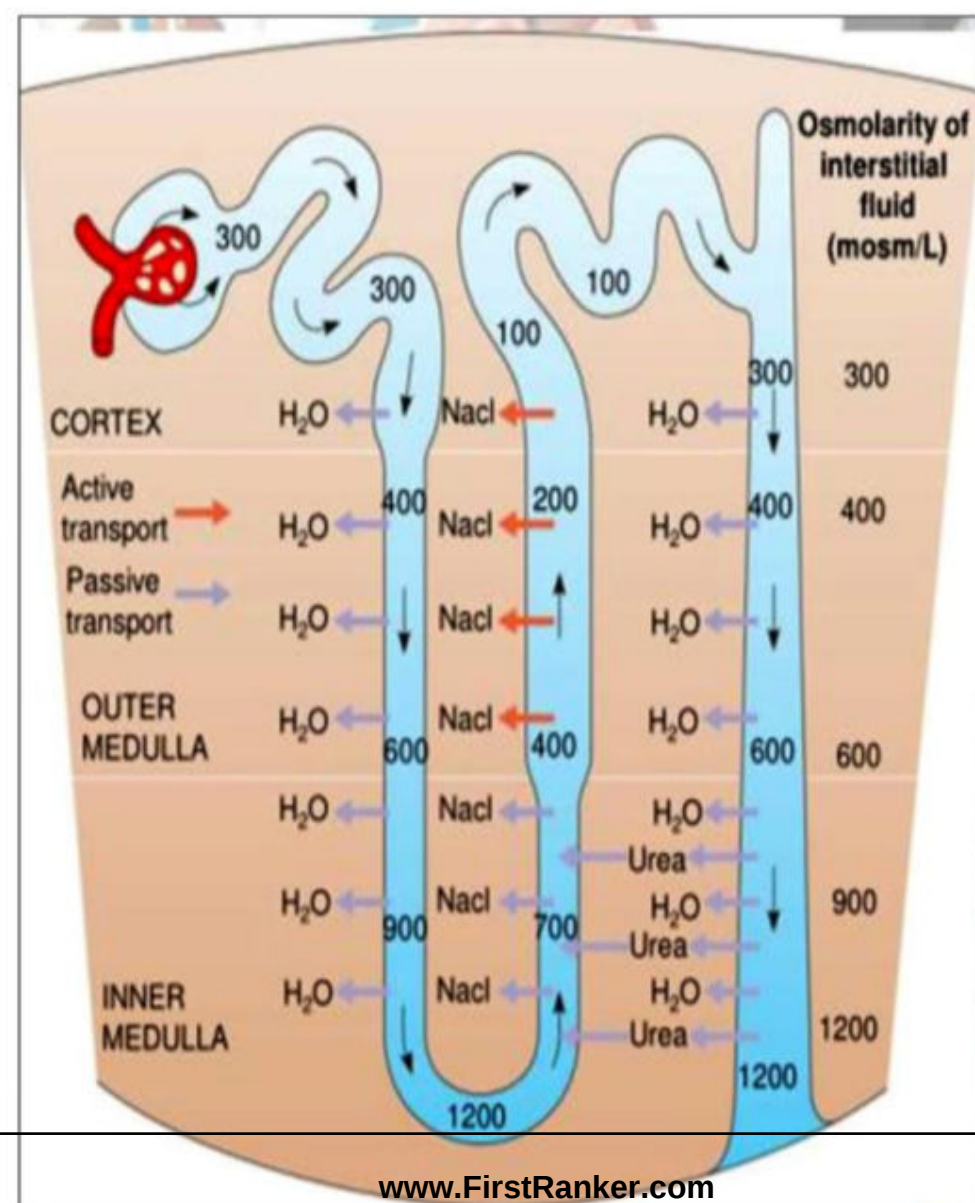


Applied - Bartter Syndrome

Mutations in the gene coding for the **$\text{Na}^+\text{-K}^+\text{-2Cl}^-$ symporter (NKCC)** →

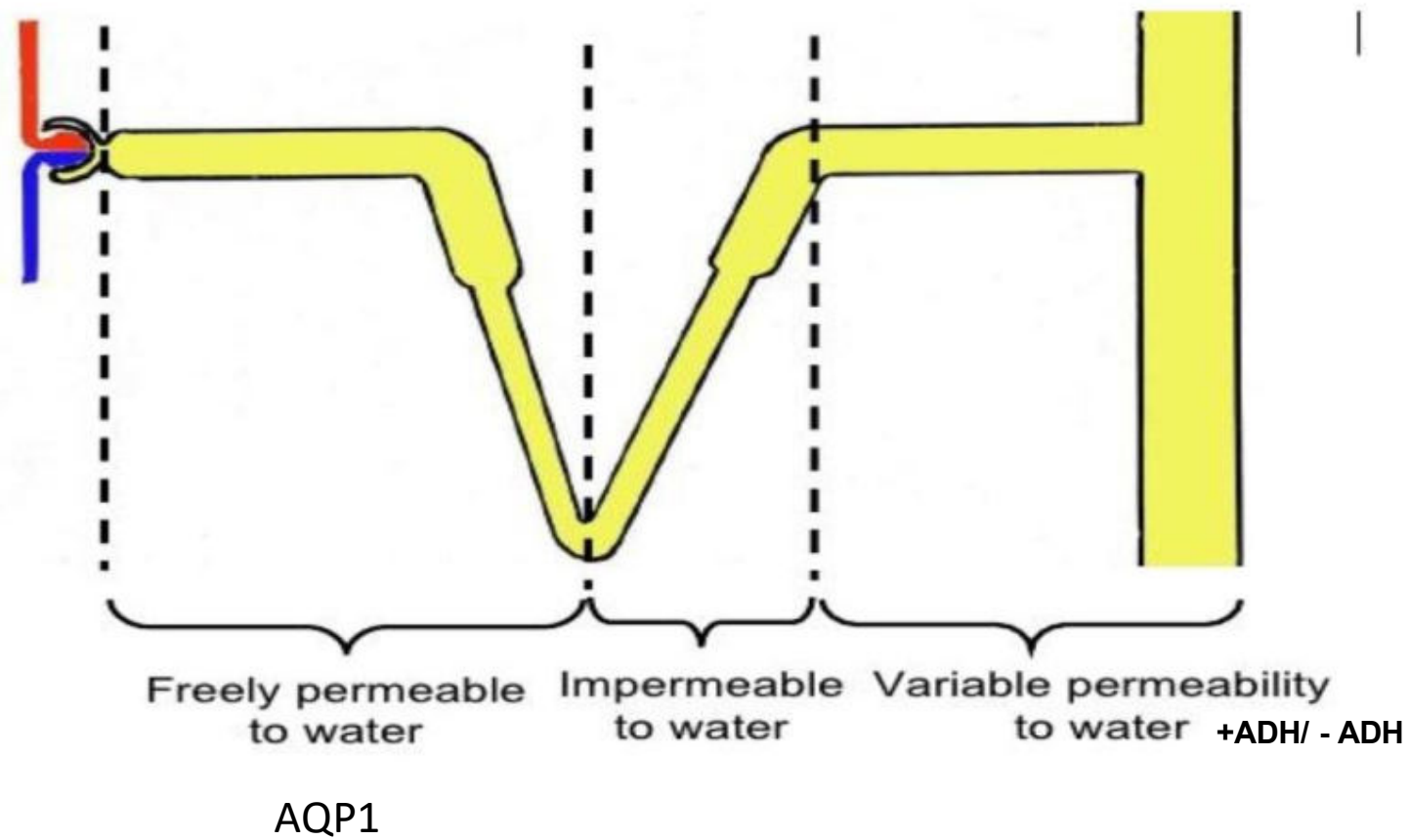


OSMOLALITY of TF leaving LOH-Diluting Segments



Summary of Events- Handling of TF in LOH

Distal Segment

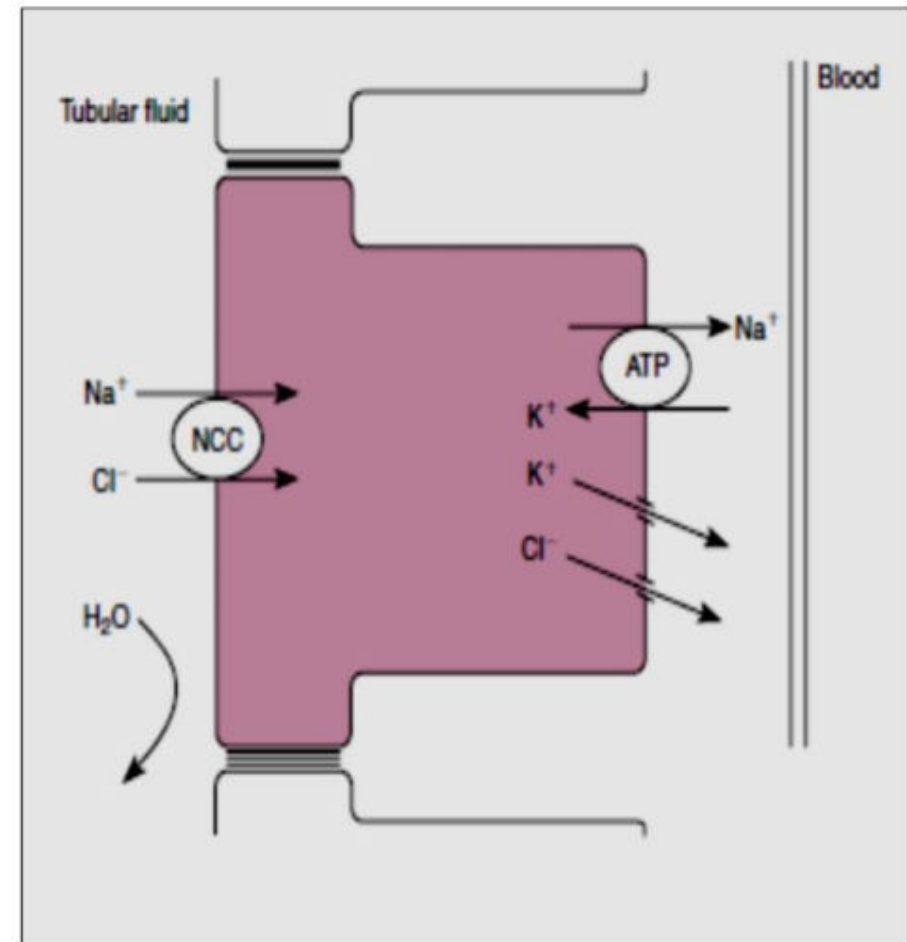


Distal Segment

DxT (Early and Late) and Collecting Tubule (C_LT)

Early segment of the distal tubule (DxT)

Functionally, similar to thick ALOLOH, This segment is also impermeable to water.



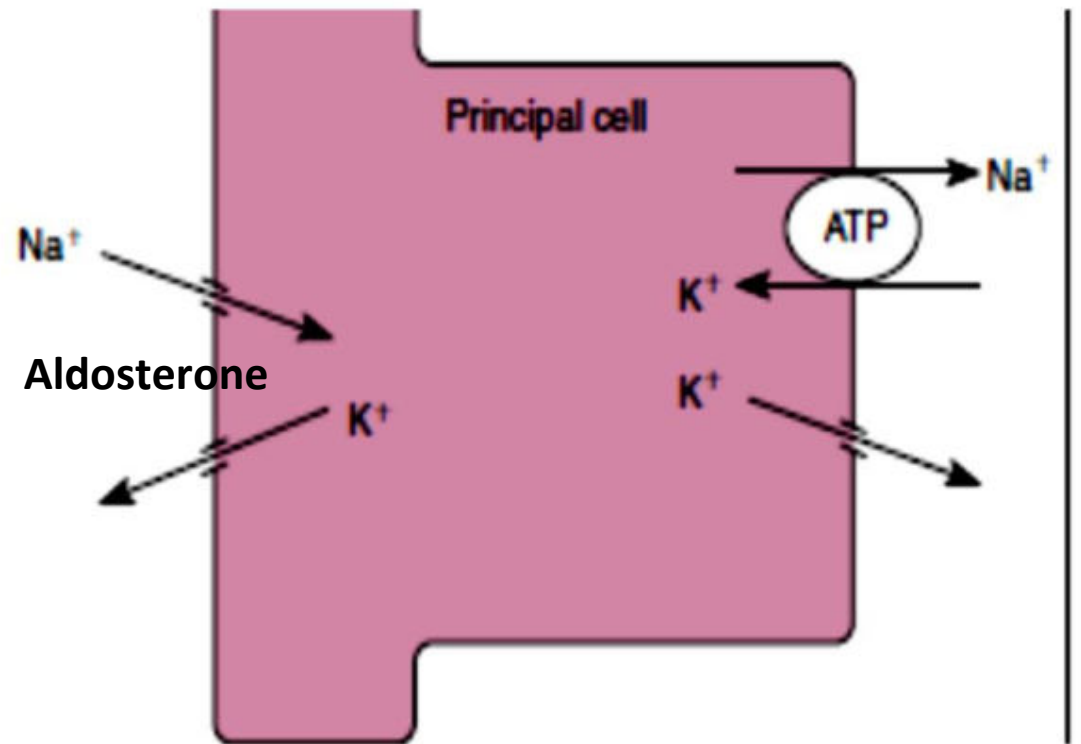
Late segment of the distal tubule and collecting tubule

Late segment of the distal tubule and collecting tubule

1. **Principal cells reabsorb Na^+ and water and secrete K^+ .**
2. **Intercalated cells – Imp for acid base balance and K^+ balance.**

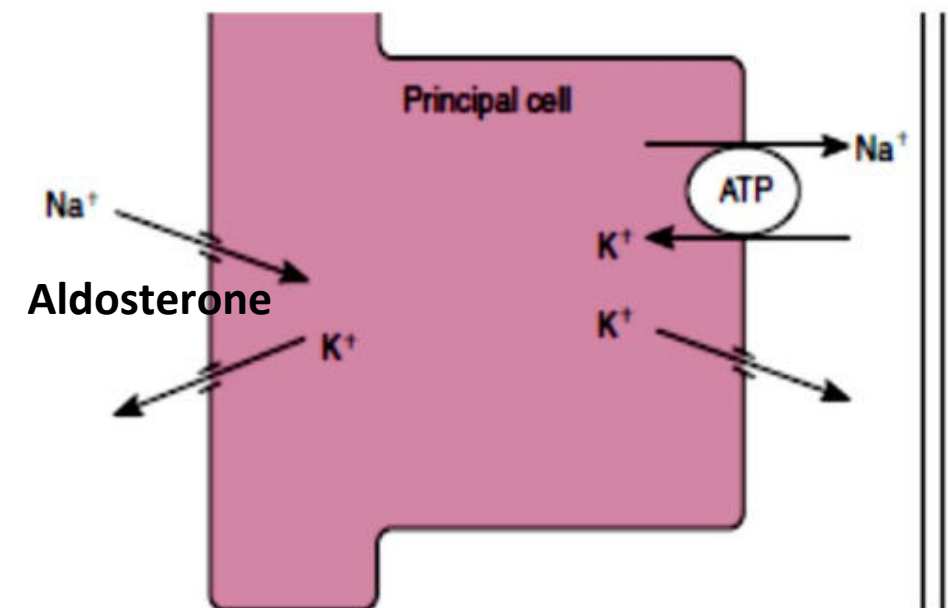
Principal cells –

Principal cells

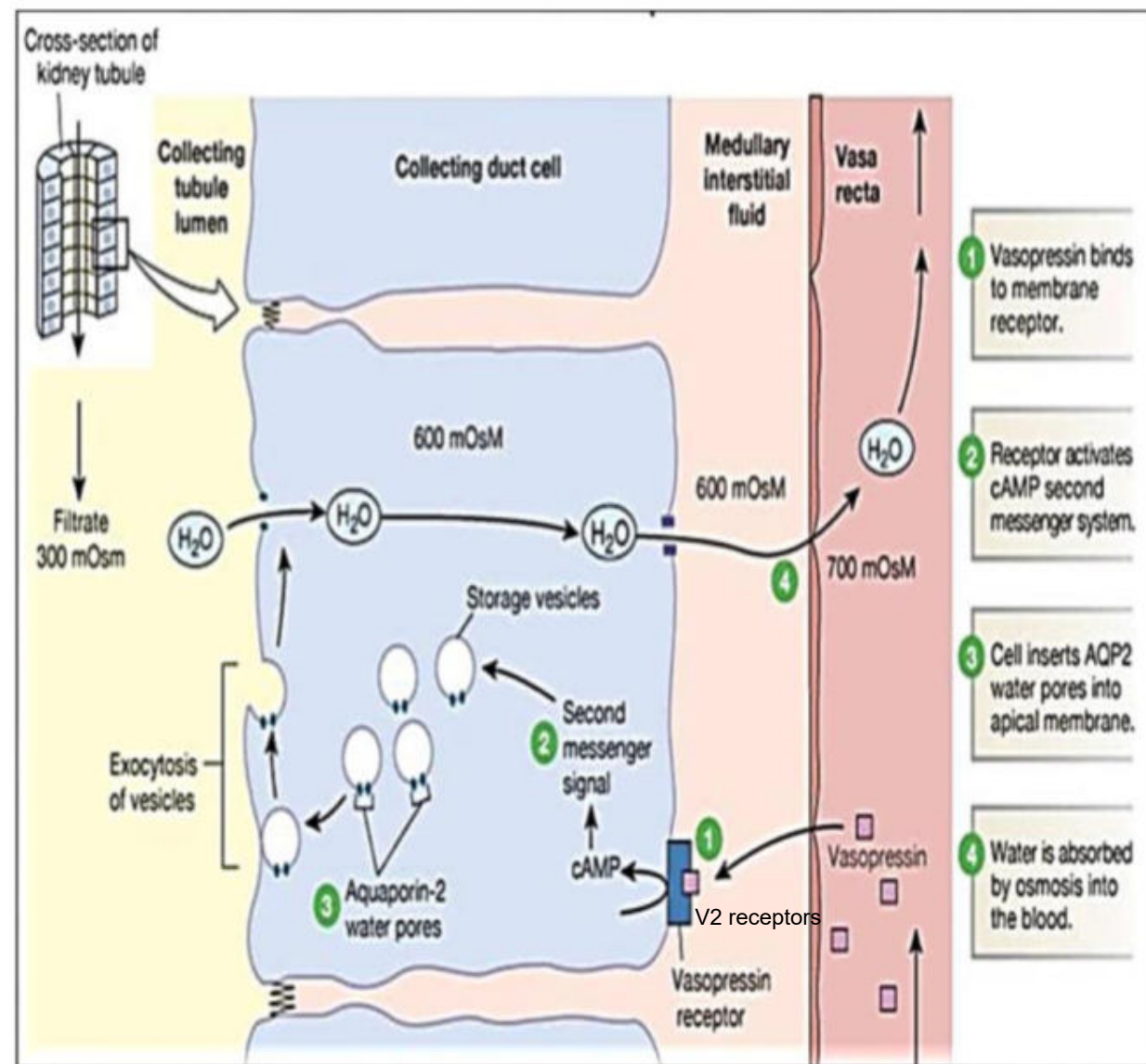


Principal Cells-Mechanism of action of Aldosterone

- $\uparrow$ Na^+ - K^+ ATPase pump on
- $\uparrow$ Na^+ reabsorption and
- $\uparrow$ K^+ secretion

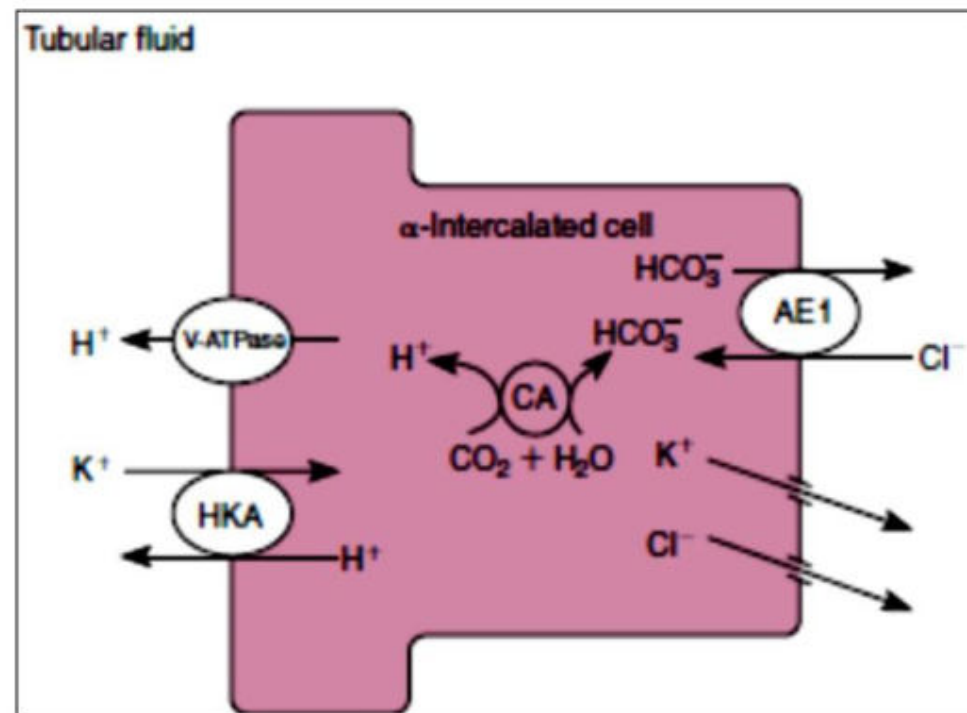


Principal Cells-Mechanism of action of Arginine Vasopressin (AVP) /ADH



Intercalated cells (IC Cells) –

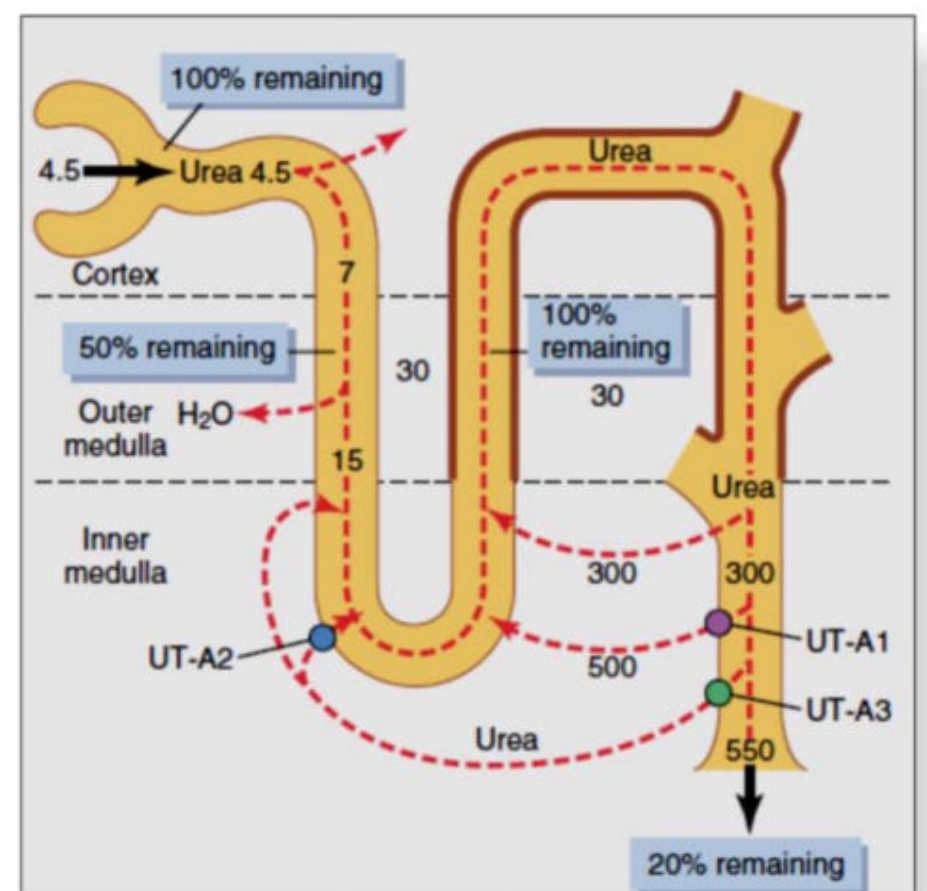
IC Cells – Late segment of the DxT & C_LT (Cortical & Medullary C_LT)



Secretion of K⁺ and H⁺ based on body pH

Medullary Collecting Tubule

There are special **urea transporters (UT A1 and UT A3)** that facilitate urea diffusion across the luminal and B_L memb.



Regulatory Control of Intercalated cells

Aldosterone and systemic acidosis -

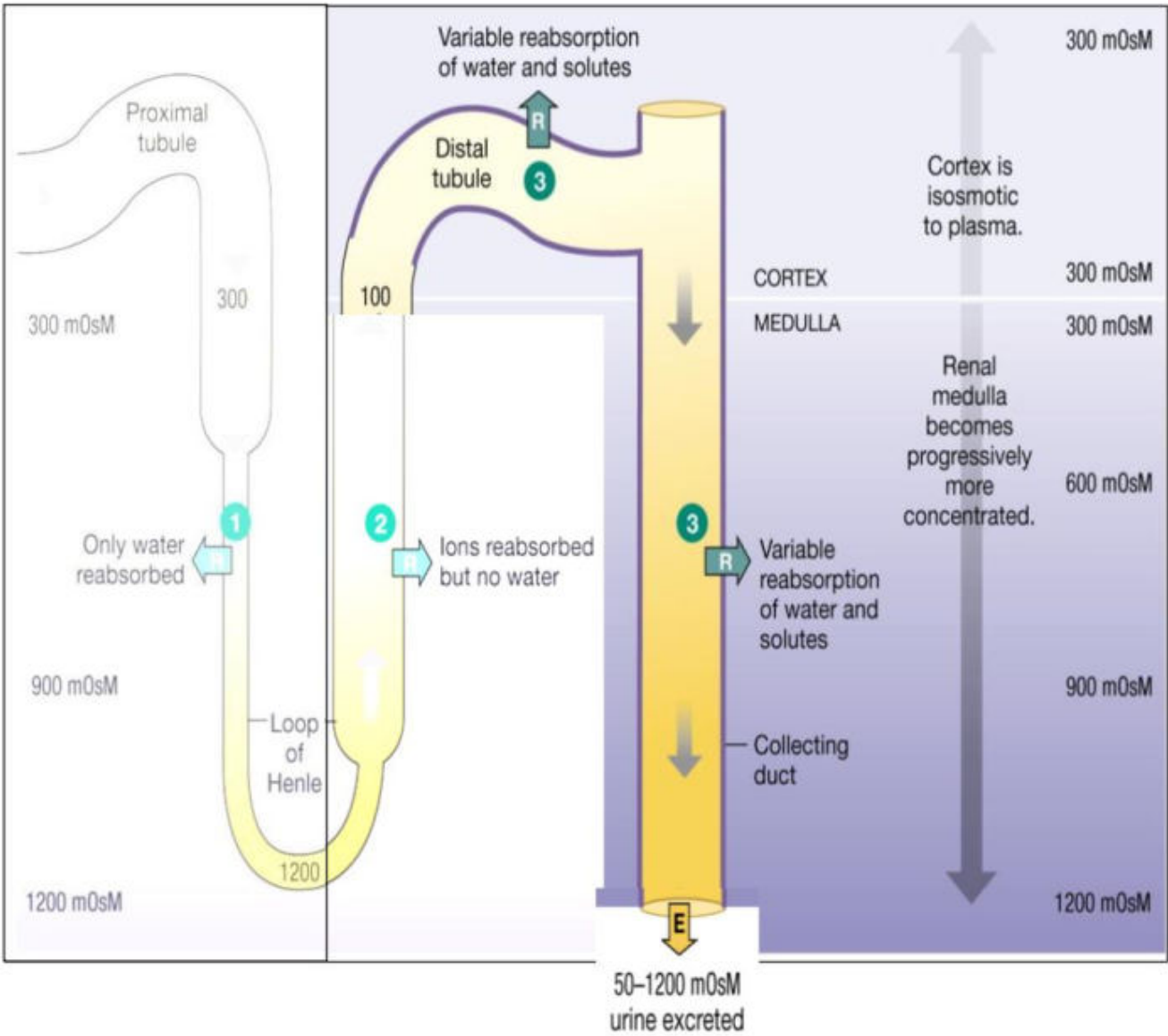
Aldosterone and alkalosis -

Summary of Events- Handling of TF in DxT

OSMOLALITY of TF leaving Dx Segment

Hyposmotic fluid to ISF (100 mosm/kg H₂O) enters the DxT
↓
Undergoes water reabs and solutes reabs under the regulatory control of hormones →

normally final fluid osmolality ranges from **50-1200 mosm/kg H₂O** (isosmotic fluid to ISF) when permeable to water (**+ADH**).



Hormones that regulate tubular reabsorption

	Site of action	Effects
Aldosterone	D _x CT, Collecting tubule	↑NaCl, H ₂ O reabs, ↑K ⁺ & H ⁺ secretion
Angiotensin II	PxT, Thick ALOLOH , DxT and CT	↑ NaCl, H ₂ O reabs, ↑H ⁺ secretion
Antidiuretic Hormone	D _x CT, Collecting tubule	↑ H ₂ O reabs
Atrial natriuretic peptide	D _x CT, Collecting tubule	↓ NaCl reabs
Para thyroid hormone	PxT, Thick ALOLOH , DxT	↑ Ca ⁺⁺ reabs, ↓PO ₄ ⁻⁻⁻ reabs

Self Assessment

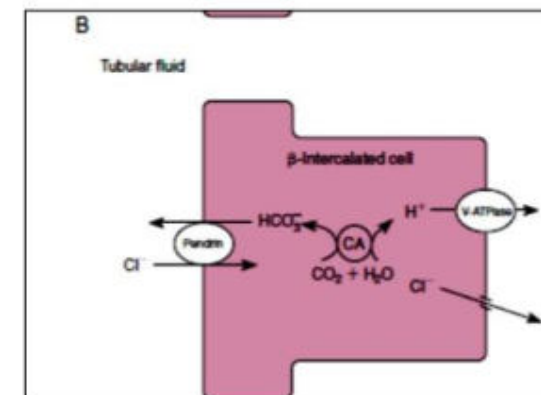
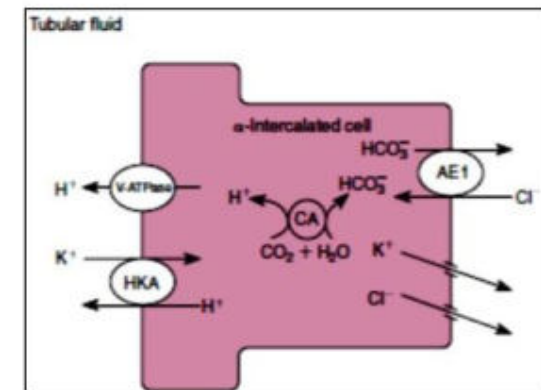


About urea , all are true except :

- a) concentration rises in tubular fluid as the glomerular filtrate passes down the nephron.
- b) is actively secreted by the renal tubular cells
- c) concentration in the blood rises slightly after a high protein diet
- d) causes osmotic diuresis when its blood concentration is increased .

Aldosterone and systemic acidosis –

- ↓ proton pump in apical memb
- ↑ proton pump in B_L memb
- ↑ expression of **AE1** in B_L memb
- ↓ expression of **AE1** in B_L memb



Thank you