COUNTER CURRENT MECHANISM

#Nephron Transport :-

Normal Plasma = 300 mOsm/L

⬇

PCT :- Solute reabsorption same as H_2O reabsorption
∴ Osmolality remains almost same
(ISOSMOLAR = 300 mOsm/L)

⬇

dLOH :- H_2O Reabsorption [to make equilibrium ≅ surrounding interstitium]
(∵ HYPEROSMOLAR = 300/700/1000/1200)

⬇

Thick aLOH :- Solutes Reabsorption (Na^+, K^+, Cl^-, Ca^{++}, Mg^{++}) such that a gradient (-200 mOsm/L) is maintained between osmolality of tubular fluid & medullary interstitium.
(∵ HYPOSMOLAR = upto 100 mOsm/L)

⬇

Early DCT :- Solute Reabsorption

Late DCT & **Cortical collecting duct** :-

In absence of ADH
- NaCl reabsorption
- ↓
- Dilute urine will be formed

In presence of ADH
- H_2O Reabsorption >> Solute reabsorption
- ↓
- Concentrated urine will be formed.

Medullary collecting duct :-
- Urea is reabsorbed
- Very small amount of H_2O is reabsorbed

Urine formed

- Dilute (50 mOsm/L) HYPOSMOLAR
- Concentrated (1200 mOsm/L) HYPEROSMOLAR

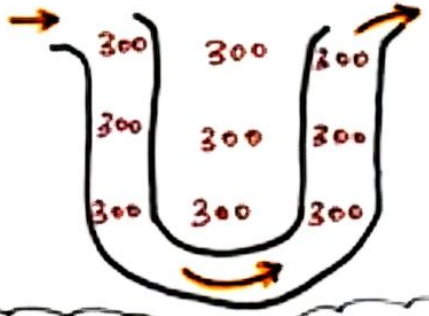
URINE DILUTION & CONCENTRATION

depends on

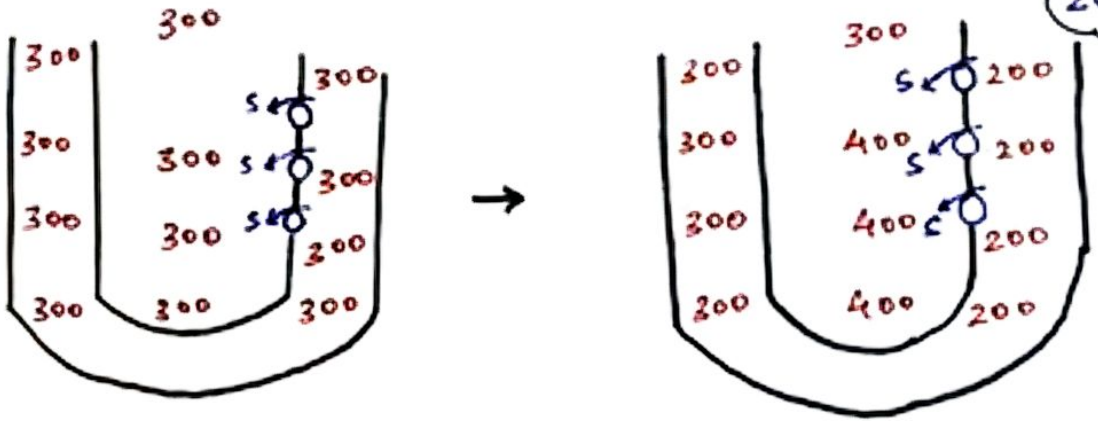
- Hyperosmolar renal medullary interstitium
  (OR)
  Cortico-medullary osmolarity gradient
  - **Produced by :-**
    1. Counter current multiplier [LOH]
    2. Urea recycling in Renal medulla
  - **Maintained by :-**
    (Should not be washed away)
    1. Counter current exchanger [VASA RECTA]
- ADH

① Counter current multiplier system [Produces Hyperosmotic Renal medulla]

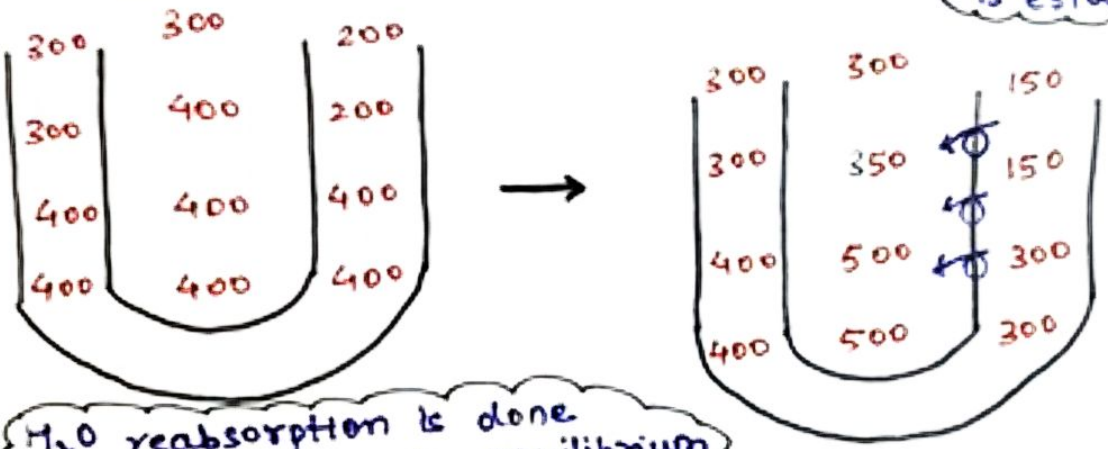
Step 1 :- Assume that nephron has started working for first time.
i.e. LOH is filled by ISOSMOLAR fluid (300 mOsm/L)



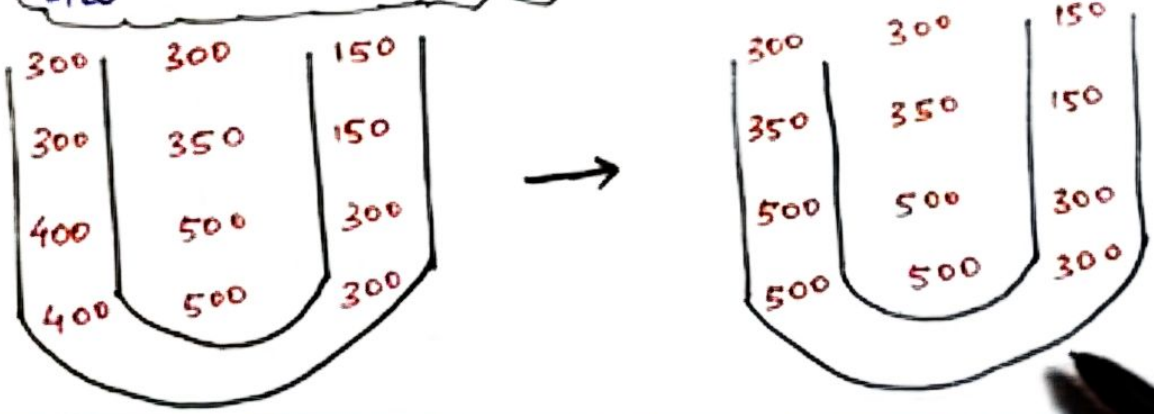
Step 2 :- Active ion pump of aLOH → conc. of solute in tubule ↓ (aLOH), conc. in interstitium ↑ → Gradient b/w tubule & interstitium of 200 mOsm/L



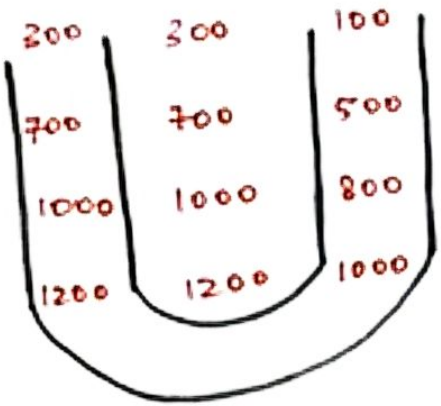
Step 5 :- As gradient b/w aLOH & interstitium is disturbed → Additional ions are pumped into interstitium → Gradient b/w aLOH & interstitium of 200 mOsm/L is established



Step 6 :- H_2O reabsorption is done to maintain osmotic equilibrium b/w dLOH & interstitium



Repeated 4-6 steps



WHAT was being done ?

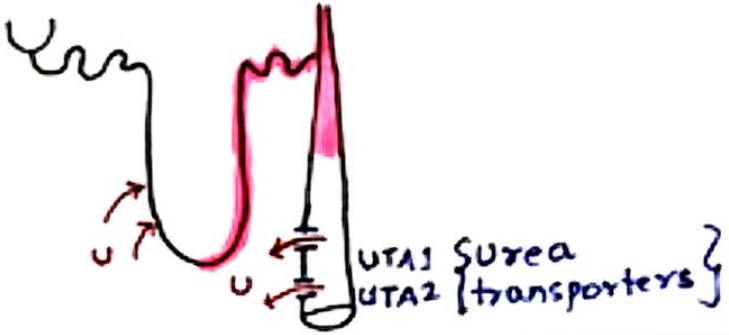
Concentration of solute was being done in dLOH in every step.

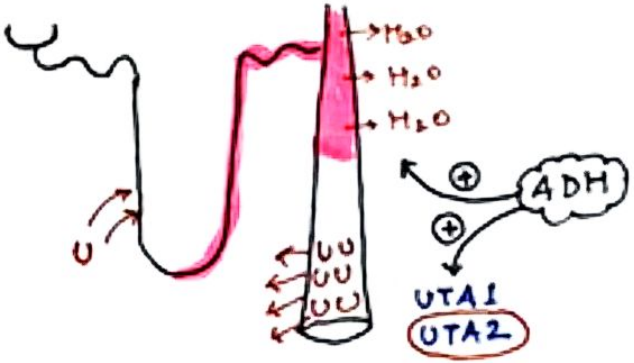
Concentrated solute was poured into interstitium by aLOH in every step

Resulted in corticomedullary osmotic gradient

② Urea Recycling in Renal Medulla

↳ 40-50% Role for Hyperosmolarity of interstitium.





COUNTER CURRENT EXCHANGER :- VASA RECTA

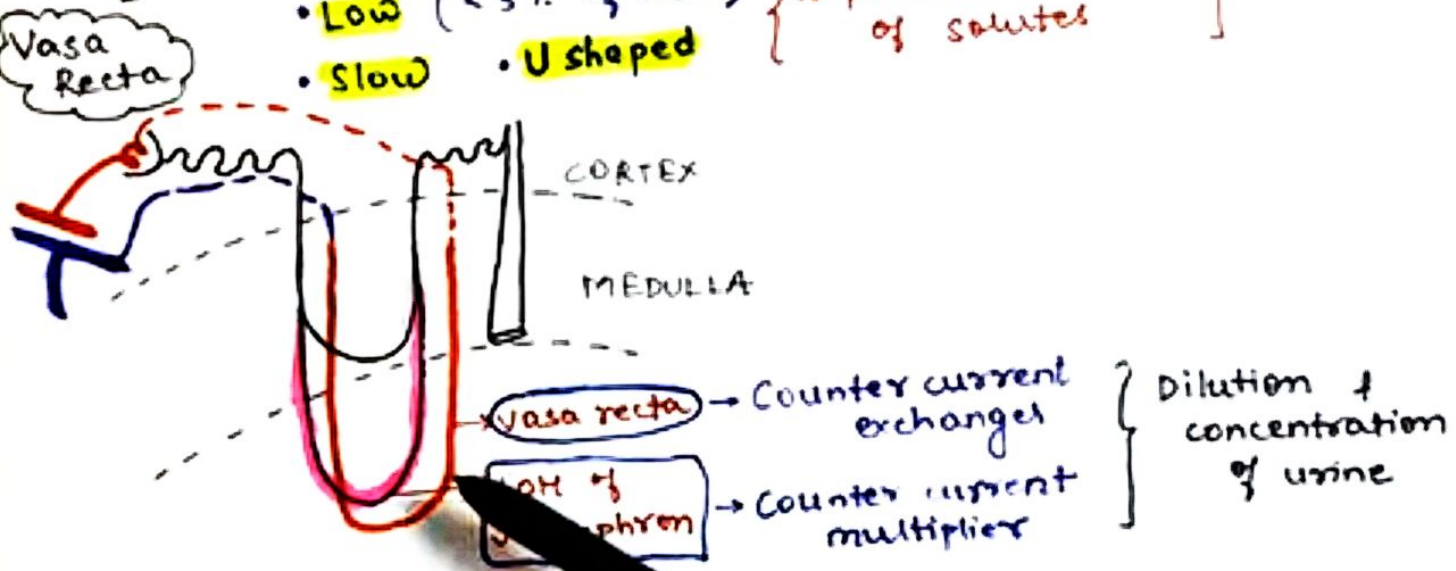
Blood flow to medulla is needed {metabolic needs, O_2, nutrition}

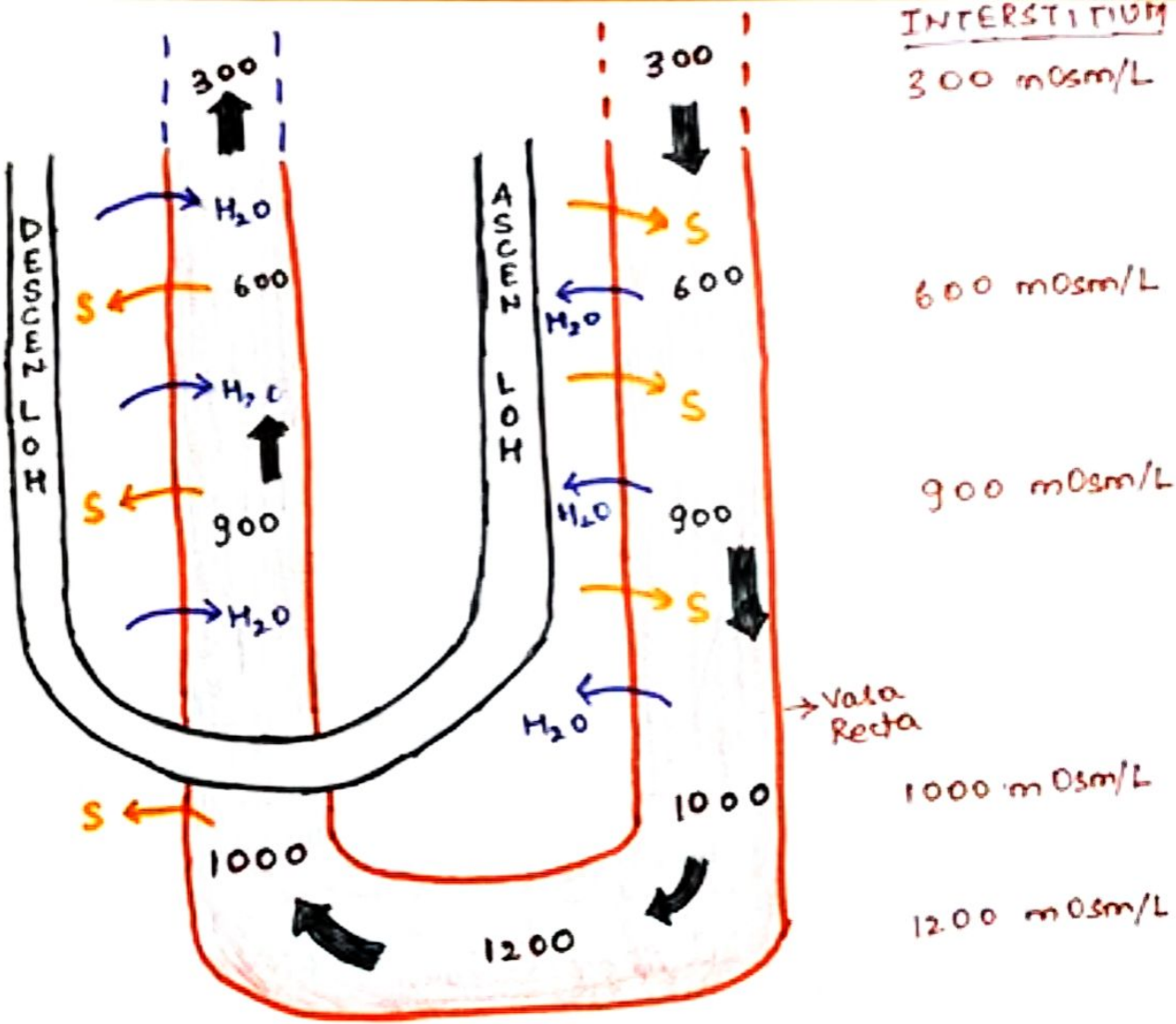
↓

Should be special {otherwise.. solute pumped into renal medulla would dissipiate}

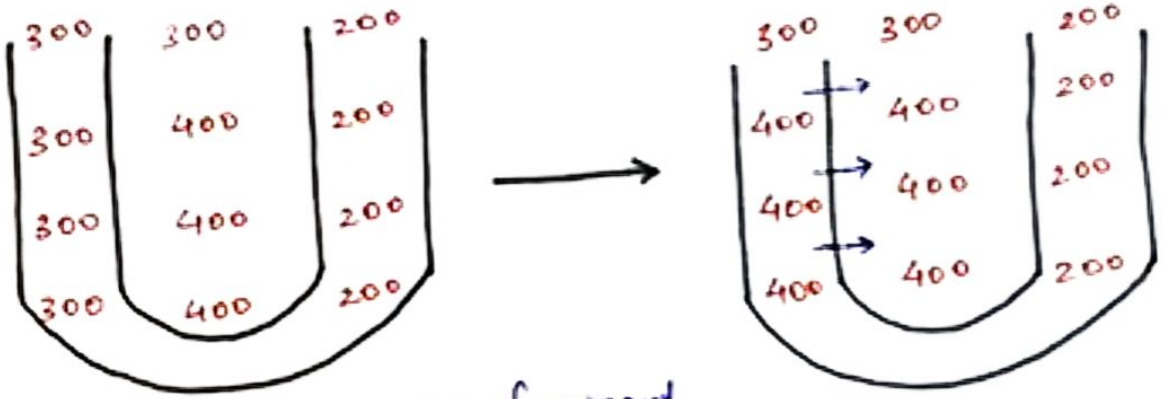
↓

Blood flow is
- Low (< 5% of RBF) {To prevent washout of solutes}
- Slow
- U shaped




INTERSTITIUM
300 mOsm/L
600 mOsm/L
900 mOsm/L
1000 mOsm/L
1200 mOsm/L
300
DESCENDING LOH
ASCENDING LOH
H_2O
S
600
900
1000
1200
Vala Recta

Step 3 :- D/t gradient b/w tubule (dLOH) & interstitium → H_2O reabsorption from dLOH → until osmotic equilibrium b/w dLOH & interstitium is reached



Step 4 :- Fluid column moves forward