

● counter current mechanism in kidney:

• What is counter current mechanism:

✓ counter current mechanism is the mechanism through which kidney concentrates the urine.

✓ we the terrestrial animals need to conserve water and to conserve the water we need to urinate the urine which is very concentrated.

✓ In normal condition when we are well hydrated then there is no need of this mechanism but when we are not very hydrated we are feeling dehydrated at this time kidney makes a concentrated urine.

• Meaning of counter current is →

counter means → opposite  
current means → flow.

✓ Here in the kidney, nephron have loop of henle which have one descending limb and one ascending limb and that flows filtrate downward and upward respectively.

✓ Similarly in vasa recta, there is also one descending limb and one ascending limb that flows blood downward and upward respectively.

✓ In these both sides the blood and filtrate flows in opposite direction and that is why it is called counter current.

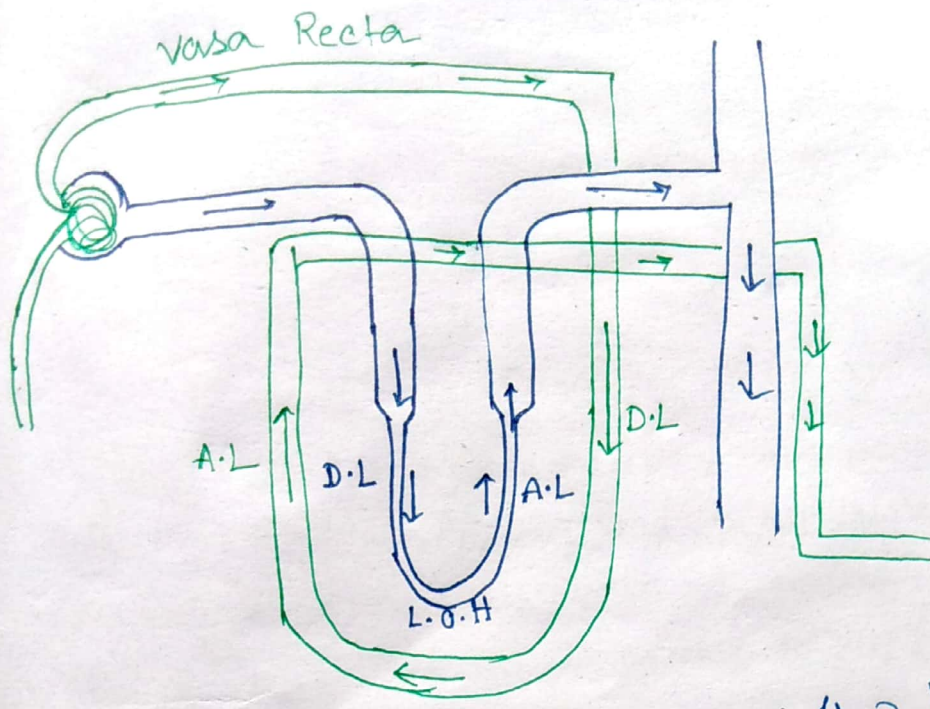
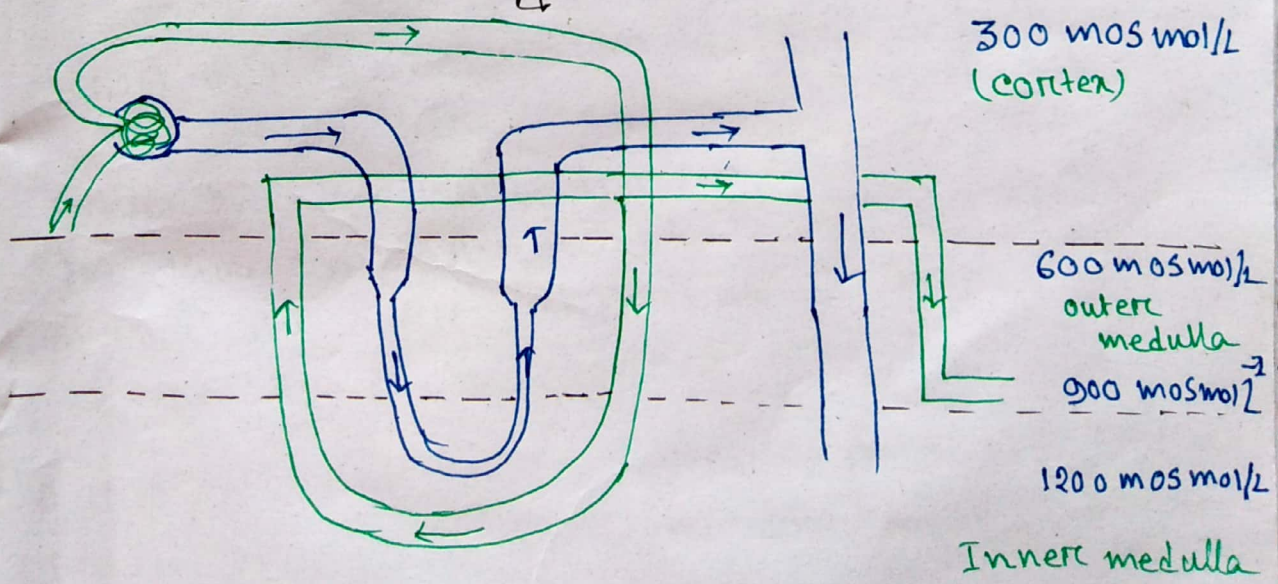


Fig → counter current flow in loop of Henly and in vasa recta.

D.L → Descending limb, A.L → Ascending limb

Why this counter current mechanism:

The osmolarity of cortex interstitium is 300 mosmol/L and in medullary interstitium is 1200 mosmol/L. The osmolarity continuously increased. And this specific osmolarity is maintained by counter current mechanism.



## ① Mechanism :⇒

The osmolarity from cortex to medulla is maintained by NaCl and urea.

↓  
As the filtrate passing through the ascending limb of loop of Henle (LOH), this ascending limb is impermeable to water but permeable to ions. Therefore with the help of energy in the form of ATP NaCl is transported to out <sup>of this tubule</sup> into the interstitium (space bwn two limbs). So NaCl is into the interstitium.

↓  
Now as the filtrate pass through distal convoluted tubule to collecting duct, some of urea are absorbed back into the interstitium.

↓  
As this ions and solutes are coming into the interstitium, this makes this interstitium towards medulla more concentrated. So conc. increases towards the medulla.

↓  
Now this concentration is helpful to the absorption of H<sub>2</sub>O here. Because as the filtrate passes through descending limb of L.O.H, it get conc. As this limb permeable to H<sub>2</sub>O but not ions. And as the outer interstitium is more conc. so the H<sub>2</sub>O is reabsorbed from D.L of L.O.H

↓  
A that is why the <sup>so</sup> filtrate passes through descending limb is more concentrated from cortex to medullary

so the medullary interstitium gradient is <sup>④</sup> maintained by NaCl and urea and also help in absorption of H<sub>2</sub>O as it pass through D.L of L.O.H.

↓  
Now the NaCl that release from A.L of L.O.H to interstitium is now entire into the descending limb of vasa recta.

↓  
This NaCl is again back into the interstitium through the ascending limb of vasa recta

↓  
The H<sub>2</sub>O that release from descending limb of L.O.H is now entire to the ascending limb of vasa recta. This increases the medullary concentration

↓  
This is <sup>that</sup> thus the countercurrent mechanism, main tain the specific osmolarity from cortex to medulla.

↓  
And thus the flow of Renal tubule and vasa recta helps in producing the medullary interstitium is so much concentrated.

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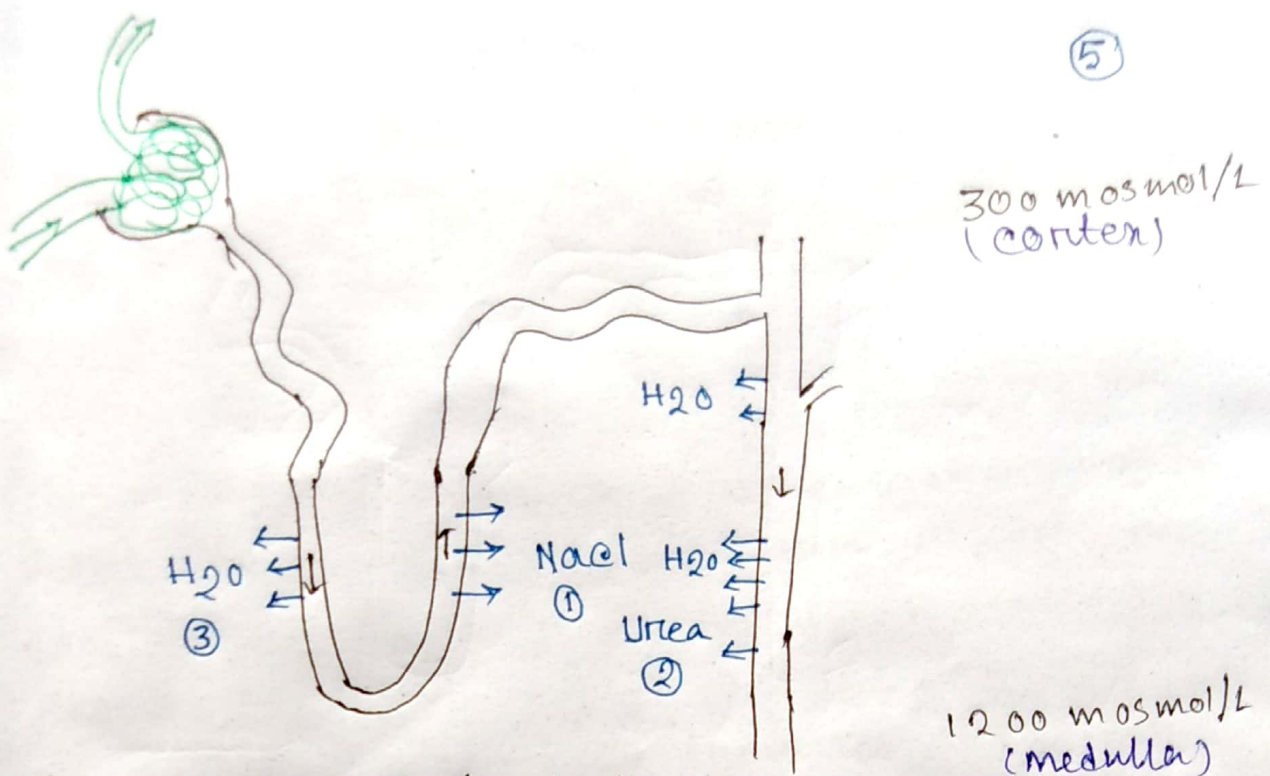


Fig-1 (only in a renal tubule).

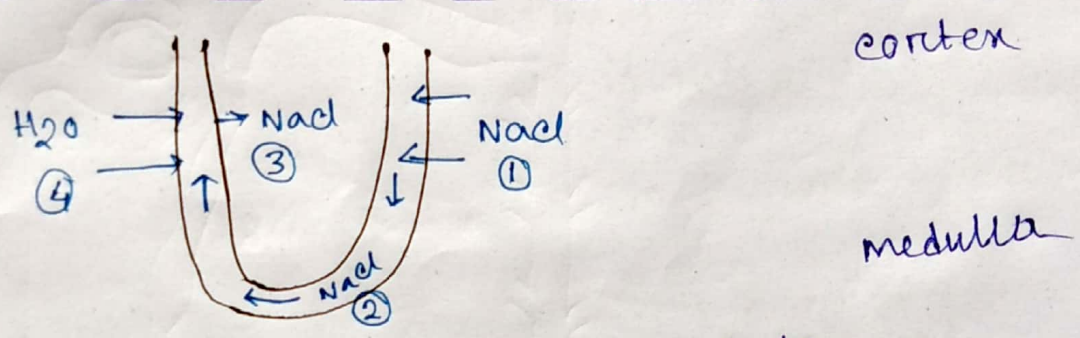


Fig-2 (only in case of vasa recta)

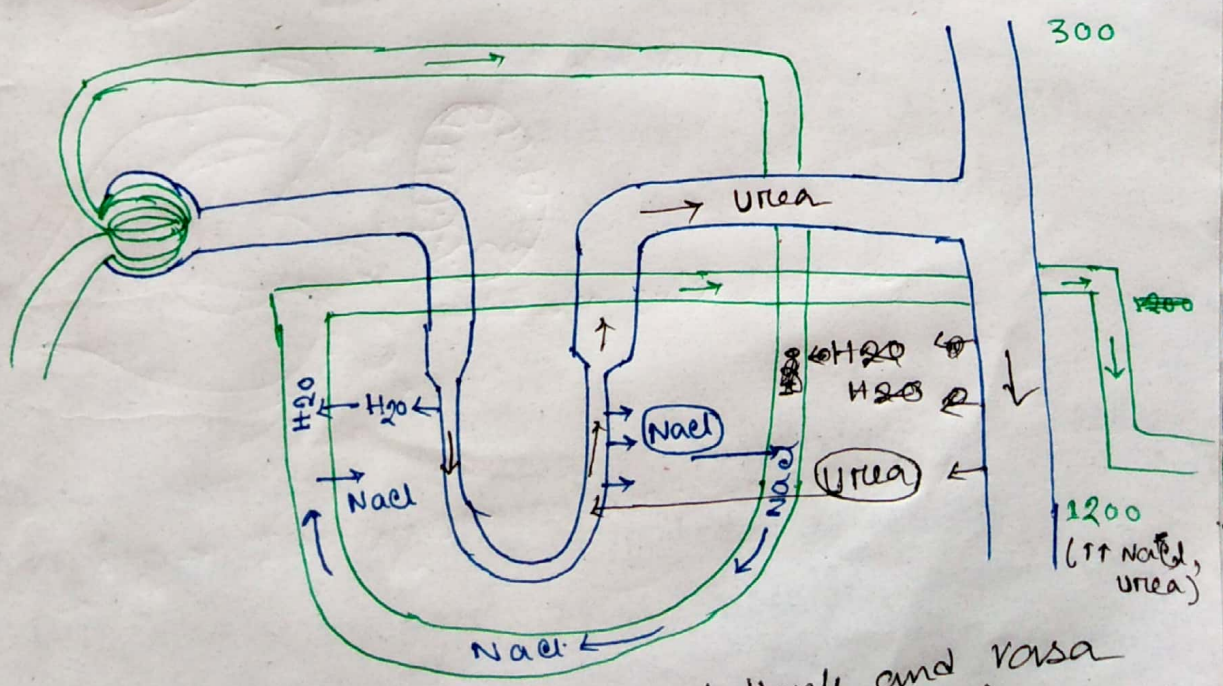


Fig-3 (both in a Loop of Henle and vasa Recta)

⑥ Why it is important to maintain highly concentrated interstitium of medulla?

Human can pass concentrated urine as up to 1200 mosmol/L also it can pass some dilute urine as 100 mosmol/L.

↓  
When a human ~~can~~ body have not enough water inside the body then they require to conserve water. Then the hypothalamus secrete ADH that act on DCT and CD and causes absorption of H<sub>2</sub>O from the above part.

↓  
For this ADH to act, the medullary gradient must be present because if this gradient is not occur then if the ADH also secreted, the body ~~doe~~ does not able to absorb water.

↓  
Now when some one ~~does not pres have~~ is drinking enough water and the body not need to conserve water and body need to pass the water outside in the form of urine.

↓  
Then ADH not secreted and not absorb water from DCT and CD. And the urine may be diluted.

↓  
Thus depending on water condition your body may secrete <sup>both</sup> concentrated or dilute urine where this specific osmolarity in medulla helping ADH to secrete concentrated urine.