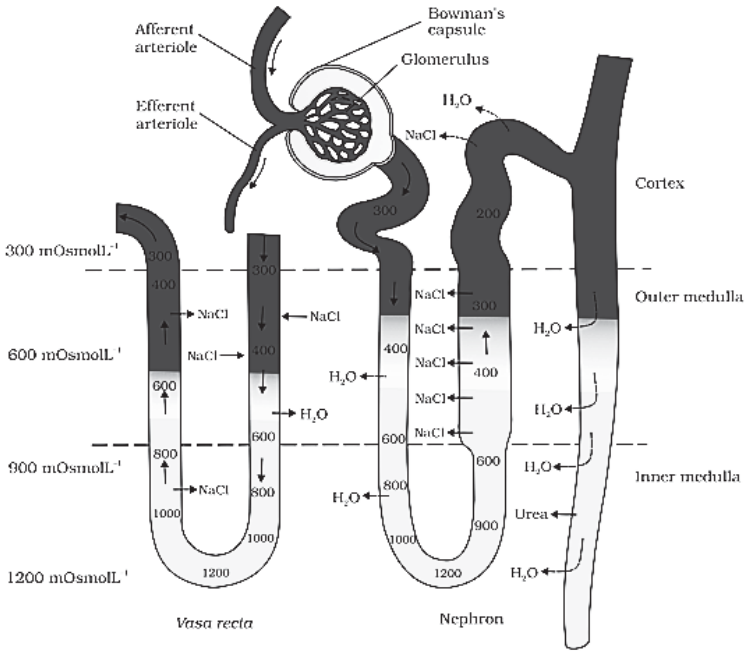
MECHANISM OF CONCENTRATION OF THE FILTRATE

Mammals possess the capability to generate concentrated urine, and the Henle's loop and vasa recta play crucial roles in this physiological process. The flow of filtrate in the two limbs of Henle's loop follows opposite directions, creating a counter-current system. Similarly, the blood flow in the two limbs of vasa recta also exhibits a counter-current pattern. The close proximity between Henle's loop and vasa recta, along with the counter-current arrangement, contributes to the maintenance of an increasing osmolarity towards the inner medullary interstitium. This osmolarity gradient ranges from 300 $mOsmolL^{-1}$ in the cortex to approximately 1200 $mOsmolL^{-1}$ in the inner medulla. The primary contributors to this gradient are NaCl and urea.



Diagrammatic representation of a nephron and vasa recta showing counter current

The counter-current mechanism operates as NaCl is transported by the ascending limb of Henle's loop and exchanged with the descending limb of vasa recta. The ascending portion of vasa recta returns NaCl to the interstitium. Simultaneously, small amounts of urea enter the thin segment of the ascending limb of Henle's loop, transported back to the interstitium by the collecting tubule. This coordinated transport of substances, facilitated by the specialized arrangement of Henle's loop and vasa recta, is known as the counter-current mechanism. The presence of this interstitial gradient facilitates the smooth passage of water from the collecting tubule, ultimately concentrating the filtrate (urine). Remarkably, human kidneys can produce urine nearly four times more concentrated than the initially formed filtrate.