Collecting Duct

The collecting duct system is a set of tubules and ducts that lead from the nephron to the ureter for urine excretion. One function of the collecting ducts is the absorption of sodium using active transport, specifically sodium-potassium ATPase pumps. At the expense of ATP, sodium is pumped back in the principal cells of the collecting duct and potassium is pumped out. This process is regulated by aldosterone, which stimulates the synthesis of more pumps.Vasopressin also acts on these cells, increasing the water reabsorption by upregulating aquaporin channels, allowing osmosis to occur coupled with sodium reabsorption. Finally, the collecting duct concentrates urine by reabsorbing necessary salts and water, reducing the volume, and increasing the concentration of urine output.

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Characteristics

Na+ Reabsorption

Aldo-stereo throwing out Salt-shaker

Aldosterone, a mineralocorticoid secreted by the adrenal cortex (zona glomerulosa), acts on principal cells in the collecting duct. It increases the expression of:
Na?/K? ATPase pumps on the basolateral membrane (pumping Na? into the blood and K? into the cell)
Epithelial sodium channels (ENaC) on the luminal membrane allow Na? reabsorption from the tubular lumen.
This active sodium reabsorption is coupled with potassium secretion into the lumen.
Aldosterone release is stimulated by angiotensin II, hyperkalemia, and ACTH (to a minor degree).

Vasopressin Causes Water reabsorption

Vase-presents pressing Water onto Sponge

Vasopressin (antidiuretic hormone, ADH), released from the posterior pituitary, acts on V? receptors in the collecting duct. Activation of these receptors increases aquaporin-2 (AQP2) channel insertion on the apical membrane of principal cells.
This allows water reabsorption from the tubular lumen into the hyperosmolar medullary interstitium, concentrating the urine.
The osmotic gradient that drives this process is generated by the loop of Henle and maintained by urea recycling in the inner medullary collecting duct.

Concentrates Filtrate

Concentrated-drop dripping into Filter-jar

The collecting duct is responsible for the final concentration of urine. As the tubular fluid descends through the medulla, the high osmotic gradient created by NaCl and urea allows water reabsorption (under ADH influence), reducing urine volume and increasing solute concentration.
