

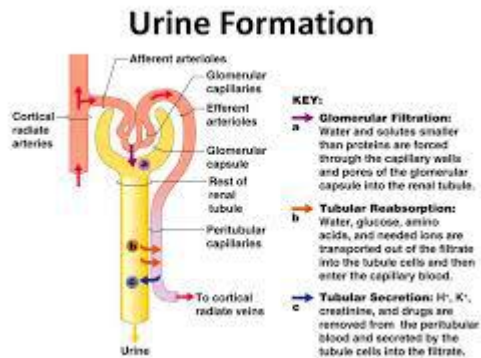
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Assignment

URINE FORMATION

Urine is formed in the kidneys through the filtration of blood. Urine formation occurs in three stages:

1. Glomerular filtration
2. Tubular reabsorption
3. Secretion



- **Glomerular filtration:** Here, water and solutes are forced through the capillary walls of the glomerulus into the Bowman's capsule. Blood is filtered as it passes the glomerular capillaries by filtration membrane. When blood passes through glomerular capillaries, the plasma is filtered into the Bowman's capsule. All the substances are filtered except plasma proteins. The filtered fluid is called glomerular filtrate.

Glomerular filtration rate which is used to estimate the amount of blood passing through the glomeruli per minute is about 180 liters each day and 125ml/min and is regulated by mechanisms AUTOREGULATION and SYMPATHETIC CONTROL.

- **Tubular reabsorption:** Water and other substances are transported from renal tubules back to the blood.

This process occurs both passively & actively; glucose, amino acids and other ions (Na, K, Cl, Ca, HCO₃) are transported out of the filtrate into the peritubular capillaries (they are reabsorbed back into the blood).

Reabsorption of substances from tubular lumen into peritubular capillary occurs by two routes which are transcellular and paracellular routes. Reabsorption occurs in the proximal convoluted tubule, loop of Henle and distal convoluted tubule.

- **Secretion:** Here waste products are moved out of the peritubular capillaries into the filtrate this removes unwanted wastes and help regulate pH.

URINE CONCENTRATION

The loop of Henle is critical to the ability of the kidney to concentrate urine. The high concentration of salt in the medullary fluid is believed to be achieved in the loop by a process known as countercurrent exchange multiplication. Maximum concentration takes place at the bottom of the loop. The ascending limb of the nephron loop is impermeable to water, but Na⁺ and Cl⁻ are pumped out into the surrounding fluids by active transport. As fluid travels up the ascending limb, it becomes less and less concentrated because Na⁺ and Cl⁻ are pumped out.

As filtrate passes through the nephron, its osmolarity (ion concentration) changes as ions and water are reabsorbed. Glomerular filtrate is same as that of plasma. The filtrate entering the proximal convoluted tubule is 300 mOsm/L. If urine is concentrated its osmolarity is four times more than that of plasma (1200 mOsm/L).

Osmolarity depends on 2 factors

1. Water content in the body
2. The anti diuretic hormone (ADH)

FORMATION OF DILUTE URINE

Formation of dilute urine depends on the decreased secretion of ADH. The kidneys continue to absorb more solute and not absorb water. In the absence of ADH, the collecting ducts are impermeable to solute

and water, and, thus, the fluid in the lumen, from which some solute has been removed, remains less concentrated than plasma; i.e., the urine is dilute.

FORMATION OF CONCENTRATED URINE

In the presence of ADH, the medullary collecting ducts become freely permeable to solute and water. As a consequence, the fluid entering the ducts (en route to the renal pelvis and subsequent elimination) acquires the concentration of the interstitial fluid of the medulla; i.e., the urine becomes concentrated.

Diluted vs. Concentrated Urine

