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URINE FORMATION

The basic functional unit for the urine formation is **nephron:** it begins with renal corpuscle that consists of a glomerular, which is supplied by afferent glomerular arteriole and drained by the efferent glomerular arteriole, and Bowman's capsule.

The kidneys filter unwanted substances form the blood and produce urine to excrete them. There are three main steps of urine formation. There are

1. Glomerular filtration
2. Reabsorption
3. Secretion

These processes ensure that only wastes and excess water are removed from the body.

1. The glomerulus filters water and other substances from the blood stream:

Glomerulus filter occurs in the glomerulus where blood is filtered. This process occurs across the three layers- epithelium of Bowman's capsule, endothelium of glomerular blood vessels, and a membrane between these layers.

The first step in making urine is to separate the liquid part of your blood (plasma), which contains all the dissolved solutes, from your blood cells. Each nephron in your kidneys has a microscopic filter, called a glomerulus that is constantly filtering your blood.

Blood that is about to be filtered enters a glomerulus, which is a

tuft of blood capillaries (the smallest of blood vessels). The glomerulus is nestled inside a cup-like sac located at the end of each nephron, called a glomerular capsule. Glomerular capillaries have small pores in their walls, just like a very fine mesh sieve. Most capillary beds are sandwiched between arterioles and venules (the small vessels delivering blood to and collecting blood from capillary beds), and the hydrostatic pressure drops as blood travels through the capillary bed into the venules and veins.The glomerulus, on the other hand, is sandwiched between two arterioles - afferent arterioles deliver blood to the glomerulus, while efferent arterioles carry it away. Constriction of efferent arterioles as blood exits the glomerulus provides resistance to blood flow, preventing a pressure drop, which could not be achieved if blood were to flow into venules, which do not really constrict. The two arterioles change in size to increase or decrease blood pressure in the glomerulus. In addition, efferent arterioles are smaller in diameter than afferent arterioles. As a result, pressurized blood enters the glomerulus through a relatively wide tube, but is forced to exit through a narrower tube. Together, these unique features plus the fact that your heart is supplying your kidneys with over a liter of blood per minute (around 20% of its output) maintain a high glomerular capillary pressure and the filtration function of the kidney, regardless of fluctuations in blood flow. For example, the sympathetic nervous system can stimulate the efferent arteriole to constrict during exercise when blood flow to the kidney is reduced.

2. Reabsorption

Reabsorption is the process by which the nephron removes water and solutes from the tubular fluid (pre-urine) and returns them to

the circulating blood. It is called reabsorption (and not absorption) both because these substances have already been absorbed once (particularly in the intestines) and because the body is reclaiming them from a post glomerular fluid stream that is well on its way to becoming urine (that is, they will soon be lost to the urine unless they are reclaimed). Substances are reabsorbed from the tubule into the peritubular capillaries. This happens as a result of sodium transport from the lumen into the blood by the Na+/K+ATPase in the basolateral membrane of the epithelial cells. Thus, the glomerular filtrate becomes more concentrated, which is one of the steps in forming urine. Reabsorption allows many useful solutes (primarily glucose and amino acids), salts and water that have passed through Bowman's capsule, to return to the circulation. These solutes are reabsorbed isotonically, in that the osmotic potential of the fluid leaving the proximal convoluted tubule is the same as that of the initial glomerular filtrate. However, glucose, amino acids, inorganic phosphate, and some other solutes are reabsorbed via secondary active transport through cotransport channels driven by the sodium gradient.

3. Secretion

The filtrate absorbed in the glomerulus flows through the renal tubule, where nutrients and water are reabsorbed into capillaries. At the same time, waste ions and hydrogen ions pass from the capillaries into the renal tubule. This process is called secretion. The secreted ions combine with the remaining filtrate and become urine. The urine flows out of the nephron tubule into a collecting duct. It passes out of the kidney through the renal pelvis, into the ureter, and down to the bladder.