Chapter 11: The Urinary System

Nephrons
Nephrons are the tiny structures in the kidney which filter the blood. There are over one million nephrons in each kidney. Each nephron is comprised of the following structures: 1) a cluster of capillaries called the glomerulus whose function is to filter the blood; 2) an afferent arteriole carries the blood to the glomerulus; 3) an efferent arteriole carries blood away from the glomerulus; 4) surrounding each glomerulus there is a cup-shaped capsule called the Bowman's capsule that collects the liquid waste that is filtered out of the blood; 5) finally there is a renal tubule that carries the waste from the Bowman's capsule to larger tubes called collecting ducts.

Renal Tubule
The function of the renal tubule is to alter the waste, called, the filtrate, by adding or removing molecules, until it eventually becomes urine. Each renal tubule has three main regions: The first region which extends from the Bowman's capsule is called the proximal convoluted tubule or PCT for short. This region connects to the second region, the loop of Henle. The third region of the renal tubule is called the distal convoluted tubule or DCT.

Reabsorption and Secretion
Some of the molecules, such as sugar, which were filtered out of the glomerulus, are needed by the body. Reabsorption is the process whereby molecules are taken out of the filtrate and returned to the blood. Reabsorption takes place in the renal tubule. Secretion is the process whereby more molecules that are not needed by the body, such as uric acid, are taken out of the blood and added to the filtrate. Secretion takes place in the renal tubule.

Maintaining Blood Volume
An important role of the kidneys is maintaining blood volume, the amount of water in the blood. If the blood volume is too low, the kidneys react by secreting renin, a molecule which causes a series of chemical reactions that result in increased blood volume. Also, the afferent arteriole which supplies blood to the kidneys constricts resulting in less water entering the glomerulus and less filtration. Finally the adrenal glands and pituitary gland secrete hormones (aldosterone and ADH) which cause the kidneys to reabsorb more water. Conversely, if blood volume is too high, the afferent arteriole dilates thus allowing more water to enter the glomerulus to be filtered and also the heart secretes a hormone called atrial natriuretic peptide (or ANP) which ultimately causes less water to be absorbed by the kidneys, thus reducing blood volume.