Notes

Biology 103, Spring 2007
Dr. Karen Bledsoe
http://www.wou.edu/~bledsoek/

Week 5 **Reading:** Chapter 31, sections 3 and 4

Topic: Urinary system

Main concepts:

- The urinary system helps maintain homeostasis in two ways:
  - Removing nitrogenous wastes and other wastes from the blood stream.
  - Controlling water and salt balance in the body by controlling the amount of water excreted.
- Other systems are involved in removing waste from the body: respiratory system (removes carbon dioxide), digestive system (evacuates solid, undigested material).
- Nitrogenous wastes come from the digestion of proteins: if the amino acids that make up proteins are metabolized for energy, the body removes the amine unit (NH_3), which is converted to urea and carried away in the blood.
- Parts of the urinary system: kidneys, ureters, bladder, urethra.
- Anatomy of the kidney: renal cortex, rental medulla, renal pelvis, nephrons.
- The nephrons are the basic functional unit of the kidney.
  - Glomerulus: filtration of blood plasma into the nephron. This is driven by blood pressure, which is controlled by hormones that cause the dilation or constriction of arteries.
  - Proximal tubule: Reabsorbs water, nutrients, salts.
  - Loop of Henle: Concentrates urine by osmosis. Salts reabsorbed by the proximal tubule surround the loop of Henle, causing water to leave the loop by osmosis.
  - Distal tubule: Active transport is used to move additional waste from the capillaries into the nephron.
- Kidney problems:
  - High blood pressure can damage the kidneys: prolonged exposure to high pressure can cause permanent damage to the glomerulus.
  - If we consume protein in excess of what the body requires, the excess may be metabolized for energy, or the amine groups may be removed from the amino acids and the remaining carbon chain converted into fatty acids and stored as fat. The excess amines must be secreted. This is why people with kidney problems must go on a low protein diet, and diets excessively high in protein can damage the kidneys.

Common misconceptions:

- Common folklore states that sweat glands in the skin get rid of wastes from the body. Sweat, however, is involved in evaporative cooling, not in waste removal. The belief may have come from observations on fever patients. People noticed that when the fever “broke,” the patient sweated. They believed that the patient was sweating out whatever toxic material had caused the fever, when in fact the body was simply cooling itself down because the underlying infection had been conquered by the immune system. Many early treatments consisted of ways of making patients sweat, in the belief that the patient would “sweat out” the fever. Even today, some people believe that sweating or special products will remove “toxins” from the skin, though such claims are usually vague about what those “toxins” are supposed to be.
- Students often learn that “kidneys filter the blood.” Filtration occurs at the glomerulus where the primary filtrate (plasma) moves into the nephron, but osmosis and active transport are used to “clean” the blood of nitrogenous wastes and other waste material, and to recover salts and nutrients.

Reading notes:

- List the functions of the mammalian urinary system.
- Define “urea,” and state why conversion of ammonia to urea is beneficial.
- List the main structures of the urinary system.
- List the parts of the nephron and their functions. Note where filtration, osmosis, and active transport are used to remove wastes and recover water.
- List ways in which the kidney helps maintain homeostasis in the body.
- List ways in which the kidney of the desert-dwelling kangaroo rat helps conserve water.

Useful websites:

- ""Kidney" http://www.kscience.co.uk/animations/kidney.htm is an animated tour through the parts of the kidney. Be sure to use the pull-down menu to see all of the parts.