

Activity 3.4.1: Hook Up the Plumbing

Introduction

We often take the wonders of water for granted. We drink water to cool off or to rehydrate after exercise, but we rarely think about what this vital resource does inside human systems. In lean adults, water makes up about 60% of body mass. Water is essential for the reactions that take place in the body (think back to the breakdown of food molecules), and water is the major component of the liquid that bathes your cells and tissues. Water helps regulate body temperature, moistens tissues in the eyes, mouth and nose, lubricates joints, dissolves minerals and nutrients to make them accessible to the body, flushes out waste products and helps deliver nutrients and oxygen to cells. Without this vital resource, many systems of the body would shut down.

You drink water and other fluids to fuel your body. The body tries to match the amount of water that leaves the body to the amount that is ingested. Water is lost in urine, sweat, feces, and in evaporation from the lungs. If the amount entering exceeds the amount leaving, the urinary system kicks into gear to try to restore balance.

The urinary system is made of several organs that function together to filter the blood and rid the body of liquid waste called urine. This process helps maintain homeostasis in the body by regulating water and electrolyte concentration and maintaining pH balance of the blood. Your body’s urinary system is designed to help you conserve water, but if no new water is coming in and your body is losing water through sweat, a balance can not be maintained. Without water, blood pressure drops, cells begin to shrivel and overall homeostasis is lost. In this lesson, you will explore the main mechanism your body has to conserve this precious resource. But first, let us look at the major players in this system.

In this activity, you will “hook up the plumbing” and add a urinary system to your Maniken®. You will research the components of the urinary system, work with your partner to design and build the major organs, and begin to think about how these organs work together to conserve water and rid the body of waste products.

Equipment

* Computer with Internet access
* Anatomy in Clay® Maniken®
* Assorted colors of clay
* Wire tool or wooden knife
* Assorted modeling supplies
* Body system graphic organizer handout
* Markers or colored pencils
* Laboratory journal
* Reference textbook (optional)

Procedure

1. With your partner, research the structure and function of organs in the human urinary system. Use the websites and diagrams found below, other reliable Internet sources or reference textbooks to begin your search.
* Human Anatomy Online <http://www.innerbody.com/image/urinov.html>
* Male Urinary System – You Tube video <http://www.youtube.com/watch?v=_kQYCDTi4wI>
1. Design a urinary system on your Maniken®. Think about the organs you will need to create, their placement in the body, the relative size of the organs and their connection to one another.
2. Consider the following “helpful tips” when designing your model system:
* Yellow clay works well for the organs of the system, but you may consider alternate materials for structures such as the kidney.
* The kidney sits in front of the quadratus lumborum muscle, located on the back wall of the abdominal cavity. For now, you may want to place a flap of muscle (terra cotta clay) extending from the bottom of the rib cage to the top of the pelvic bone so you have a place to anchor your kidney. A simple diagram of the muscle is found at Exercise Prescription on the Net – Quadratus Lumborum <http://www.exrx.net/Graphics/QuadratusLumborum.gif>. You may go back and redesign this muscle in later units.
* Bladder size is up to you. How bad does your Maniken® have to “go”? Make sure that the bladder is shaped realistically.
* You can place the bladder on top of the pubic symphysis, the joint at the bottom of the pelvic girdle (where the screw enters your Maniken®); remember, this organ actually sits up a bit higher. Muscle and fat are layered under the bladder for support. You can add a small amount of fat under the bladder to remind yourself of this detail.
* Reference your model’s sex before you build the urethra. The female urethra should not extend very far past the pubic symphysis. Use a little longer piece of spaghetti for the male urethra. The key word is a “little” longer. The male urethra should not extend more than a few millimeters past the pubic symphysis.
* Create a small branch for the artery and vein that service the kidney. Choose appropriate colors of clay for each vessel. You will attach these connectors to major vessels when you build arteries and veins in upcoming lessons.
1. Share your final product with another group. Compare your models and discuss any differences. Remember, the Maniken® urinary systems do not have to look identical, but the anatomy should be accurate.
2. Obtain a human body graphic organizer from your teacher. Label the diagram “Urinary System” and add in the organs you have built on your model. Label each organ and write a simple description of the function of each part.
3. Note that the bladder is made up of a tissue called *transitional epithelium*. Research how the structure of this tissue type is perfect for the function of the bladder. How does cell shape differ when the bladder is full and when the bladder is empty? Describe your findings in your laboratory journal.

Conclusion

1. What are the main functions of the urinary system?
2. Beginning with the kidney, trace the organs through which urine travels.
3. What organs or structures in the body (other than the urinary system) help you maintain a water balance? Explain.
4. How does the urinary system differ in males and females?