Body Organization and Homeostasis

The bell rings—lunchtime! You hurry down the noisy halls to the cafeteria. The unmistakable aroma of hot pizza makes your mouth water. At last, you balance your tray of pizza and salad while you pay the cashier. You look around the cafeteria for your friends. Then, you walk to the table, sit down, and begin to eat.

Think about how many parts of your body were involved in the simple act of getting and eating your lunch. Every minute of the day, whether you are eating, studying, walking, or even sleeping, your body is busily at work. Each part of the body has a specific job to do. And all the different parts of your body usually work together so smoothly that you don't even notice them.

This smooth functioning is due partly to the way in which the body is organized. The levels of organization in the human body consist of cells, tissues, organs, and organ systems. The smallest unit of organization is the cell. The next largest unit is tissue; then, organs. Finally, the organ system is the largest unit of organization.

Cells

A cell is the basic unit of structure and function in a living thing. Complex organisms are composed of many cells in the same way a brick building is composed of many bricks. The human body contains about 100 trillion cells. Cells are quite tiny, and most cannot be seen without a microscope.

Try This Activity

How Is a Book Organized?

In this activity, you will analyze the levels of organization in a book.

1. Examine this textbook to see how it is subdivided—into chapters, sections, and so on.
2. Make a concept map that shows this pattern of organization. Place the largest subdivision at the top of the map and the smallest at the bottom.
3. Compare the levels of organization in this textbook to those in the human body.

Making Models Which level of organization in the textbook represents cells? Which represents tissues? Organs? Organ systems?

Structures of Cells

Most animal cells, including those in the human body, have a structure similar to the cell in Figure 1. The cell membrane forms the outside boundary of the cell. Inside the cell membrane is a large structure called the nucleus. The nucleus is the control center that directs the cell's

activities and contains the information that determines the cell's form and function. When the cell divides, or reproduces, this information is passed along to the newly formed cells. The material within a cell apart from the nucleus is called the cytoplasm (syt uh plaz um). The cytoplasm is made of a clear, jellylike substance containing many cell structures called organelles.

Functions of Cells

Cells carry on the processes that keep organisms alive. Inside cells, for example, molecules from digested food undergo chemical reactions that release energy for the body's activities. Cells also grow and reproduce. And they get rid of waste products that result from these activities.

Tissues

The next largest unit of organization in your body is a tissue. A tissue is a group of similar cells that perform the same function. The human body contains four basic types of tissue: muscle tissue, nervous tissue, connective tissue, and epithelial tissue. To see examples of each of these tissues, look at Figure 2.

Figure 2 Types of Tissues Your body contains four kinds of tissues: muscle, nervous, connective, and epithelial. Comparing And Contrasting How is the function of nervous tissue different from that of epithelial tissue?

Like the muscle cells that form it, muscle tissue can contract, or shorten. By doing this, muscle tissue makes parts of your body move. While muscle tissue carries out movement, nervous tissue directs and controls the process. Nervous tissue carries electrical messages back and forth between the brain and other parts of the body. Another type of tissue, connective tissue, provides support for your body and connects all its parts. Bone tissue and fat are connective tissues.

The surfaces of your body, inside and out, are covered by epithelial tissue (ep uh thee lee ul). Some epithelial tissue, such as your skin, protects the delicate structures that lie beneath it. The lining of your digestive system consists of epithelial tissue that allows you to digest and absorb the nutrients in your food.

Organs and Organ Systems

Your stomach, heart, brain, and lungs are all organs. An organ is a structure that is composed of different kinds of tissue. Like a tissue, an organ performs a specific job. The job of an organ, however, is generally more complex than that of a tissue. The heart, for example, pumps blood throughout your body, over and over again. The heart contains all four kinds of tissue—muscle, nervous, connective, and epithelial. Each type of tissue contributes to the organ's overall job of pumping blood.

Each organ in your body is part of an organ system which is a group of organs that work together to perform a major function. Your heart is part of your circulatory system, which carries oxygen and other materials throughout the body. Besides the heart, blood vessels are major structures in the circulatory system. Figure 3 shows some of the major organ systems in the human body.

Figure 3 Organ Systems The human body is made up of eleven organ systems. Eight of the systems are shown here. Interpreting Diagrams Which two systems work together to get oxygen to your cells?

Homeostasis

For: Links on body systems
Visit: www.SciLinks.org
Web Code: scn-0411

The different organ systems work together and depend on one another. When you ride a bike, you use your muscular and skeletal systems to steer and push the pedals. But you also need your nervous system to direct your arms and legs to move. Your respiratory, digestive, and circulatory systems work together to fuel your muscles with the energy they need. And your excretory system removes the wastes produced while your muscles are hard at work.

All the systems of the body work together to maintain homeostasis (hoh mee oh stay sis), the body's tendency to keep an internal balance. Homeostasis is the process by which an organism's internal environment is kept stable in spite of changes in the external environment.

Homeostasis in Action

To see homeostasis in action, all you have to do is take your temperature when the air is cold. Then, take it again in an overheated room. No matter what the temperature of the air around you, your internal body temperature will be close to 37°C. Of course, if you become sick, your body temperature may rise. But when you are well again, it returns to 37°C.

Maintaining Homeostasis

Your body has various ways of maintaining homeostasis. For example, when you are too warm, you sweat. Sweating helps to cool your body. On the other hand, when you are cold, you shiver. Shivering occurs when your muscles rapidly contract and relax. This action produces heat that helps keep you warm. Both of these processes help your body maintain homeostasis by regulating your temperature.

Figure 4 Maintaining Homeostasis Regardless of the surrounding temperature, your body temperature remains fairly constant at about 37°C. Sweating and shivering help regulate your body temperature. Applying Concepts What is the term for the body's tendency to maintain a stable internal environment?

Stress and Homeostasis

Sometimes, things can happen to disrupt homeostasis. As a result, your heart may beat more rapidly or your breathing may increase. These reactions of your circulatory and respiratory systems are signs of stress. Stress is the reaction of your body to potentially threatening, challenging, or disturbing events.

Figure 5 Stress Your body reacts to stress, such as the start of a bike race, by releasing adrenaline and carrying more oxygen to body cells.

Think about what happens when you leave the starting line in a bike race. As you pedal, your heart beats faster and your breathing increases. What is happening in your body? First, your endocrine system releases a chemical called adrenaline into your bloodstream. Adrenaline gives you a burst of energy and prepares your body to take action. As you pedal, your muscles work harder and require more oxygen. Oxygen is carried by the circulatory system, so your heart beats even faster to move more blood to your muscles. Your breath comes faster and faster, too, so that more oxygen can get into your body. Your body is experiencing stress.

If stress is over quickly, your body soon returns to its normal state. Think about the bike race again. After you cross the finish line, you continue to breathe hard for the next few minutes. Soon, however, your breathing and heart rate return to normal. The level of adrenaline in your blood returns to normal. Thus, homeostasis is restored after just a few minutes of rest.