

Levels of Organization

TEKS 10C

Analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.

Vocabulary

tissue

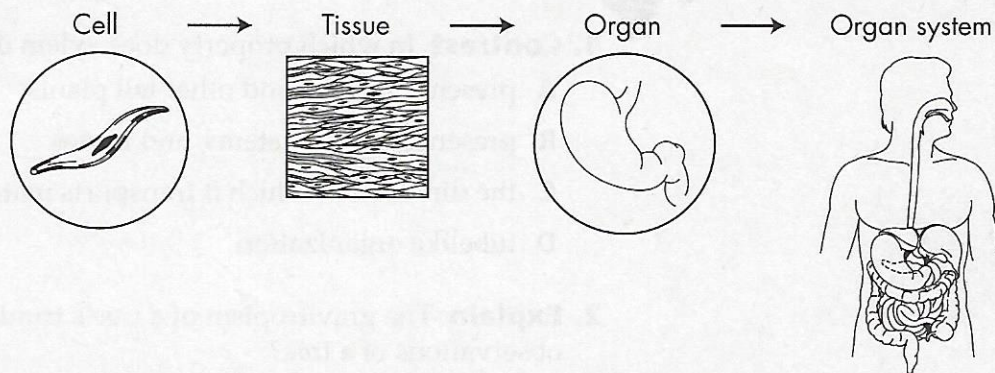
organ

organ system

How are biological systems organized?

Biological systems include systems both outside of and within organisms. An ecosystem, for example, consists of all the living and nonliving things in an area, all of which affect one another. This review, however, examines the organization of systems *within* an organism. Many organisms, including bacteria and most protists, consist of a single cell. But other organisms are multicellular. Some simple multicellular organisms function very efficiently without complex organization. But most large organisms, including all familiar plants and animals, are much more complex. For a complex organism to function efficiently, its cells must be organized into systems that work together to complete essential tasks. You can see the levels of organization that include human stomach muscle cells in **Figure 1**.

Figure 1
Levels of Organization



How do cells compare to tissues?

Cells are often referred to as the “building blocks” of multicellular organisms. Cells with similar structures and functions are organized into **tissues**. For example, reddish, spindle-shaped muscle cells are organized together in muscle tissues. The human body relies on three types of muscle tissue: skeletal muscle tissue for moving bones, smooth muscle tissue for the automatic (involuntary) movements of organs such as the stomach, and cardiac muscle in the heart for pumping blood through the body.

Blood is tissue that consists of cells suspended in a liquid called plasma. Red blood cells carry oxygen, and white blood cells defend the body from invading organisms. Other components allow blood to clot at open wounds, which is important to prevent loss of blood. In addition to blood cells, plasma transports dissolved substances, such as gases and nutrients, throughout the body.

How do tissues compare to organs, and how do organs compare to organ systems?

Organs, which contain different types of tissues, are body parts that have a particular function. Examples of organs in animals include the heart, lungs, brain, skeletal muscles, and bones. In plants, organs include roots, stems, and leaves.

The skin is the largest organ of the human body. The skin is composed of different tissue layers, including epithelial tissues and inner dermal layers. Bones also are made of different types of tissues, including a hard tissue on the outside and a spongy tissue on the inside. Tissues in the center of long bones produce blood cells.

A group of organs that work together to fulfill a function make up an **organ system**. The human body has several organ systems. The heart and blood vessels make up the circulatory system. This system delivers oxygen and nutrients to all body cells, and it removes carbon dioxide and other wastes. The brain, sensory organs, and nerves make up the nervous system. This system senses the environment and internal body conditions, processes the information, and sends messages to control body activities.

In plants, the roots make up an organ system that absorbs water and nutrients from the soil. The leaves make up an organ system that performs photosynthesis. The stems and branches make up an organ system that carries water, nutrients, and food through xylem and phloem and that provides support for leaves and flowers.

Study Tip

In multicellular organisms, all cells need food, oxygen, water, and a process to remove wastes. Cells also need to be controlled or coordinated so they work together efficiently. Organ systems meet all of these needs of cells.

How do the levels of organization relate to one another and to the whole system?

In a multicellular organism, no cell, tissue, or organ can function by itself. Their coordination allows the organism to maintain homeostasis and complete a wide variety of tasks. For example, when you see a dollar on the floor and decide to pick it up, the task requires the nervous, muscular, skeletal, circulatory, and respiratory systems—all acting with one another and at the same time.

Without your conscious knowledge, the systems of your body work together quickly, effectively, and continuously. While you might be focusing your attention on a specific task, such as reading this paragraph, a wide variety of coordinated organ systems are performing tasks such as breathing, circulating blood, cleaning your blood of wastes, and digesting food. Even when you are sleeping, they continue performing these tasks.



- 1. Sequence** Which sequence shows the increasing complexity of levels of organization in multicellular organisms?
 - A cell, organ, tissue, organ system, organism
 - B cell, tissue, organ, organ system, organism
 - C cell, organism, tissue, organ, organ system
 - D organ system, organ, organism, cell, tissue

- 2. Analyze** The femur is a long bone in the upper leg. The femur is classified as an organ because it
 - A functions independently of other organs or organ systems.
 - B is larger than a tissue and smaller than an organ system.
 - C is made of tissues found nowhere else in the body.
 - D is composed of several types of tissues that work together.

- 3. Apply Concepts** Muscle tissue that is involved in movement of the body would most likely be associated with the
 - A digestive system.
 - B circulatory system.
 - C respiratory system.
 - D skeletal system.

- 4. Analyze** Choose a simple activity that you perform every day. Describe the organs and organ systems that are involved in this activity.