

Focus

Overview

In this section, students will learn that a cell is the smallest unit of life. In most multicellular organisms, groups of cells form tissues that compose organs. Two or more organs can interact to form an organ system.

Bellringer

Write the following questions on the board for students to answer:

Why can't you use your teeth to breathe? Why can't you use your arm muscles to digest food?

Motivate

Activity

GENERAL

Concept Mapping Organize the class into small groups. Provide each group with pictures of tissues, organs, and organ systems. Have students arrange the pictures into concept maps. Encourage students to notice similarities and differences between organs. For example, the stomach and the heart are very different organs, but both are made of muscle tissue, and both function by holding and moving substances through their cavities. **IS** Intrapersonal/Visual Co-op Learning

READING WARM-UP

Objectives

- ③ List three advantages of being multicellular.
- ③ Describe the four levels of organization in living things.
- ③ Explain the relationship between the structure and function of a part of an organism.

Terms to Learn

tissue	organism
organ	structure
organ system	function

READING STRATEGY

Paired Summarizing Read this section silently. In pairs, take turns summarizing the material. Stop to discuss ideas that seem confusing.

The Organization of Living Things

In some ways, organisms are like machines. Some machines have just one part. But most machines have many parts. Some organisms exist as a single cell. Other organisms have many—even trillions—of cells.

Most cells are smaller than the period that ends this sentence. Yet, every cell in every organism performs all the processes of life. So, are there any advantages to having many cells?

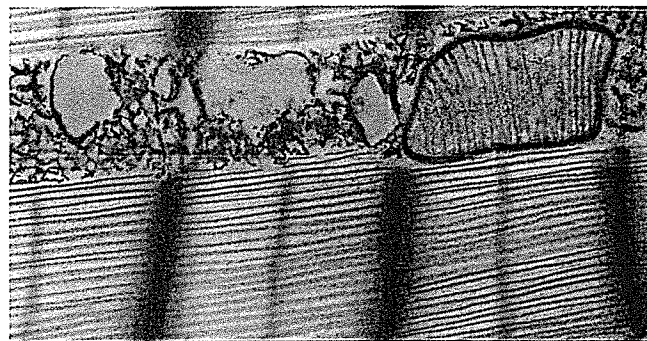
The Benefits of Being Multicellular

You are a *multicellular organism*. This means that you are made of many cells. Multicellular organisms grow by making more small cells, not by making their cells larger. For example, an elephant is bigger than you are, but its cells are about the same size as yours. An elephant just has more cells than you do. Some benefits of being multicellular are the following:

- **Larger Size** Many multicellular organisms are small. But they are usually larger than single-celled organisms. Large organisms are prey for fewer predators. Larger predators can eat a wider variety of prey.
- **Longer Life** The life span of a multicellular organism is not limited to the life span of any single cell.
- **Specialization** Each type of cell has a particular job. Specialization makes the organism more efficient. For example, the cardiac muscle cell in **Figure 1** is a specialized muscle cell. Heart muscle cells contract and make the heart pump blood.

Reading Check List three advantages of being multicellular. (See the Appendix for answers to Reading Checks.)

Figure 1 This photomicrograph shows a small part of one heart muscle cell. The green line surrounds one of many mitochondria, the powerhouses of the cell. The pink areas are muscle filaments.



CHAPTER RESOURCES

Chapter Resource File

- Lesson Plan
- Directed Reading A **BASIC**
- Directed Reading B **SPECIAL NEEDS**

Technology

- Transparencies
 - Bellringer
 - Levels of Organization in the Cardiovascular System

Answer to Reading Check

Sample answer: larger size, longer life, cell specialization

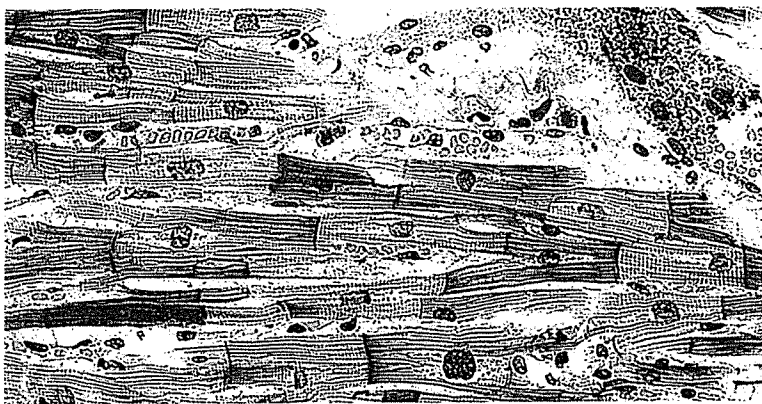


Figure 2 This photomicrograph shows cardiac muscle tissue. Cardiac muscle tissue is made up of many cardiac cells.

ells Working Together

tissue is a group of cells that work together to perform a specific job. The material around and between the cells is also part of the tissue. The cardiac muscle tissue, shown in **Figure 2**, is made of many cardiac muscle cells. Cardiac muscle tissue is just one type of tissue in a heart.

Animals have four basic types of tissues: nerve tissue, muscle tissue, connective tissue, and protective tissue. In contrast, plants have three types of tissues: transport tissue, protective tissue, and ground tissue. Transport tissue moves water and nutrients through a plant. Protective tissue covers the plant and helps the plant retain water and protects the plant against damage. Photosynthesis takes place in ground tissue.

issues Working Together

A structure that is made up of two or more tissues working together to perform a specific function is called an **organ**. For example, your heart is an organ. It is made mostly of cardiac muscle tissue. But your heart also has nerve tissue and tissues that line the blood vessels that all work together to make your heart a powerful pump that it is.

Another organ is your stomach. It also has several kinds of tissue. In the stomach, muscle tissue makes food move in and out through the stomach. Special tissues make chemicals that help digest your food. Connective tissue holds the stomach together, and nervous tissue carries messages back and forth between the stomach and the brain. Other organs include the intestines, brain, and lungs.

Plants also have different kinds of tissues that work together to form organs. A leaf is a plant organ that contains tissue that traps light energy to make food. Other examples of plant organs are stems and roots.

Reading Check What is an organ?

tissue a group of similar cells that perform a common function

organ a collection of tissues that carry out a specialized function of the body

MATH PRACTICE

A Pet Protist

Imagine that you have a tiny box-shaped protist for a pet. To care for your pet protist properly, you have to figure out how much to feed it. The dimensions of your protist are roughly $25\text{ }\mu\text{m} \times 20\text{ }\mu\text{m} \times 2\text{ }\mu\text{m}$. If seven food particles per second can enter through each square micrometer of surface area, how many particles can your protist eat in 1 min?

MISCONCEPTION ALERT

Dead Cells Students may think that hair is alive: advertisements for shampoo create the impression that hair is living tissue. Hair, and fingernails, too, are dead. Hair and fingernails grow out of specialized skin cells. They grow continuously, but both are composed of dead cells and a protein called *keratin*. If hair and fingernails were alive and contained nerve cells, as the deep skin layers do, haircuts and manicures would be quite painful.

Is That a Fact!

In your lifetime, your body will shed about 18 kg (almost 40 lb) of dead skin.

Teach

Discussion

GENERAL

Muscles Ask students to list all of the ways they use their muscles. Responses will probably include walking, riding a bike, swimming, and throwing or kicking a ball. Lead students to understand that muscles are also involved in swallowing food (tongue and esophagus), digestion (stomach and intestines), and blinking eyes (eyelids). Also, help students understand that sometimes muscles act voluntarily (jumping, writing), and sometimes they act involuntarily (heart beating). **LS Auditory/Logical**

Homework

GENERAL



Respiration Variations

Not all living things have the same kinds of tissues and organs. Yet, all must perform similar life processes. Have students do research in order to compare the structures a fish uses to breathe with those that a human uses. Students' reports should also answer the question, What parts of the human and fish respiratory systems are similar? (Even though a fish has gills and a human has lungs, both have cells that exchange and transport oxygen and carbon dioxide.)

LS Logical

Answer to Math Practice

The surface area of the protist is $[(25\text{ }\mu\text{m} \times 20\text{ }\mu\text{m}) + (25\text{ }\mu\text{m} \times 2\text{ }\mu\text{m}) + (20\text{ }\mu\text{m} \times 2\text{ }\mu\text{m})] \times 2 = 1,180\text{ }\mu\text{m}^2$, so it can eat $1,180\text{ }\mu\text{m}^2 \times 7\text{ particles per second} = 8,260\text{ particles of food every second}$, or $60\text{ s/min} \times 8,260\text{ particles/s} = 495,600\text{ particles of food per minute}$.

Answer to Reading Check

An organ is a structure of two or more tissues working together to perform a specific function in the body.

Reteaching BASIC

Levels of Organization Write the following headings on the board:

Cell, Tissue, Organ, Organ system, Organism

Have students write these headings on their paper and list at least two examples under each heading.

English Language Learners
Verbal/Logical

Quiz GENERAL

1. What is the relationship between your digestive system, stomach, and intestines? (The digestive system is an organ system. The stomach and intestines are organs that are parts of the digestive system.)
2. What is the main difference between a unicellular organism and a multicellular organism in the way life processes are carried out? (Sample answer: A unicellular organism must perform all life functions by itself. A multicellular organism may have specialized cells that work together to carry out each function.)

Alternative Assessment GENERAL

Concept Mapping Have students choose an organ system and identify its component organs. Then, have students make a concept map describing the function of the organs and their relationship to one another.

Logical/Visual

organ system a group of organs that work together to perform body functions

organism a living thing; anything that can carry out life processes independently

structure the arrangement of parts in an organism

function the special, normal, or proper activity of an organ or part

Organs Working Together

A group of organs working together to perform a particular function is called an **organ system**. Each organ system has a specific job to do in the body.

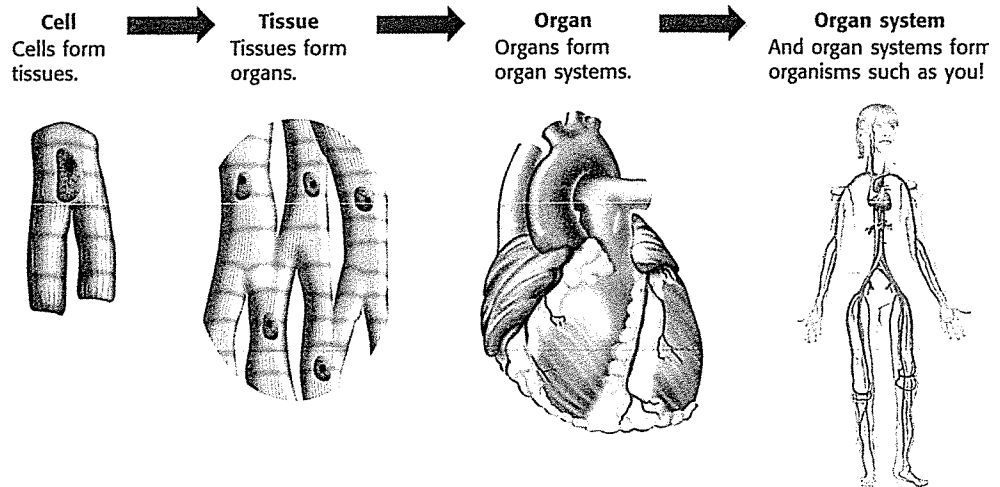
For example, the digestive system is made up of several organs, including the stomach and intestines. The digestive system's job is to break down food into small particles. Other parts of the body then use these small particles as fuel. In turn, the digestive system depends on the respiratory and cardiovascular systems for oxygen. The cardiovascular system, shown in **Figure 3**, includes organs and tissues such as the heart and blood vessels. Plants also have organ systems. They include leaf systems, root systems, and stem systems.

Reading Check List the levels of organization in living things:

Organisms

Anything that can perform life processes by itself is an **organism**. An organism made of a single cell is called a **unicellular organism**. Bacteria, most protists, and some kinds of fungi are unicellular. Although some of these organisms live in colonies, they are still unicellular. They are unicellular organisms living together, and all of the cells in the colony are the same. Each cell must carry out all life processes in order for that cell to survive. In contrast, even the simplest multicellular organism has specialized cells that depend on each other for the organism to survive.

Figure 3 Levels of Organization in the Cardiovascular System



Is That a Fact!

An elephant's trunk is constructed of 135 kg (300 lb) of hair, skin, connective tissue, nerves, and muscles. The muscle tissue is composed of 150,000 tiny subunits of muscle, each of which is coordinated with the others to enable an elephant to greet its friends, breathe, grab, and drink.

Answer to Reading Check

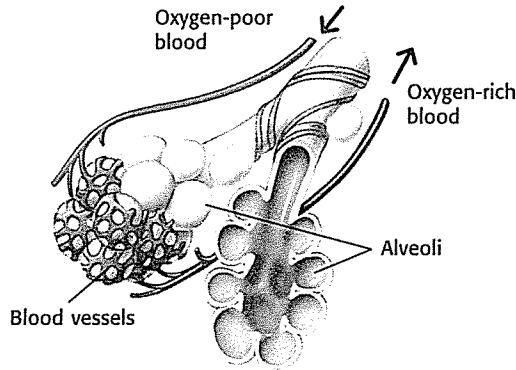
cell, tissue, organ, organ system, organism

Structure and Function

In organisms, structure and function are related. **Structure** is the arrangement of parts in an organism. It includes the shape of a part and the material of which the part is made. **Function** is the job the part does. For example, the structure of the lungs is a large, spongy sac. In the lungs, there are millions of tiny air sacs called *alveoli*. Blood vessels wrap around the alveoli, as shown in **Figure 4**. Oxygen from air in the alveoli enters the blood. Blood then brings oxygen to body tissues. Also, in the alveoli, carbon dioxide leaves the blood and is exhaled.

The structures of alveoli and blood vessels enable them to perform a function. Together, they bring oxygen to the body and get rid of its carbon dioxide.

Figure 4 The Structure and Function of Alveoli



SECTION Review

Summary

- Advantages of being multicellular are larger size, longer life, and cell specialization.
- Four levels of organization are cell, tissue, organ, and organ system.
- A *tissue* is a group of cells working together. An *organ* is two or more tissues working together. An *organ system* is two or more organs working together.
- In organisms, a part's structure and function are related.

Using Key Terms

1. Use each of the following terms in a separate sentence: *tissue*, *organ*, and *function*.

Understanding Key Ideas

2. What are the four levels of organization in living things?
 - a. cell, multicellular, organ, organ system
 - b. single cell, multicellular, tissue, organ
 - c. larger size, longer life, specialized cells, organs
 - d. cell, tissue, organ, organ system

Math Skills

3. One multicellular organism is a cube. Each of its sides is 3 cm long. Each of its cells is 1 cm³. How many cells does it have? If each side doubles in length, how many cells will it then have?

Critical Thinking

4. **Applying Concepts** Explain the relationship between structure and function. Use alveoli as an example. Be sure to include more than one level of organization.
5. **Making Inferences** Why can multicellular organisms be more complex than unicellular organisms? Use the three advantages of being multicellular to help explain your answer.

SCILINKS **NSA**
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For a variety of links related to this chapter, go to www.scilinks.org

Topic: Organization of Life
 SciLinks code: HSM1080

Answers to Section Review

1. Sample answer: The body has several different kinds of tissue. I think that the most important organ in the body is the brain. Sometimes a part of the body with a certain structure performs more than one function.
2. d
3. $3 \text{ cm} \times 3 \text{ cm} \times 3 \text{ cm} = 27 \text{ cm}^3$
 $27 \text{ cm}^3 \div 1 \text{ cm}^3 = 27 \text{ cells}$;
 If each side doubles in length, the organism will have 216 cells ($6 \times 6 \times 6 = 216$).
4. Sample answer: Alveoli are tiny sacs whose function is to contain and exchange gases such as oxygen and carbon dioxide. The structure of alveoli, as tiny sacs surrounded by tiny blood vessels, includes the cells that make up the tissue of the alveoli and the tissue that joins the alveoli to the bronchioles, which are part of the lung. The lungs are made of several kinds of tissue, such as the bronchi, bronchioles, and alveoli.
5. Sample answer: The main reason that multicellular organisms can be more complex than unicellular organisms is that multicellular organisms have cell specialization. Specialization allows some cells to do only digestion while others do respiration or circulation. Therefore, the organism is more efficient. Being multicellular also means that an organism may grow larger than a unicellular organism. Size is an advantage because, in general, the larger the organism is, the fewer predators it faces. Finally, being unicellular means that when your one cell dies, you are dead. In a multicellular organism, the death of one cell does not mean the death of the organism.

Teacher's Note: In fact, only multicellular organisms can have an efficient vascular system, which is the key to efficient delivery of materials to cells and removal of wastes from cells. Most students will probably not know this, but some advanced or interested students may grasp this idea.

ACTIVITY

BASIC

Writing **Explain It to a Friend** A great way to learn something is to teach it to someone else. Have students write a letter to a friend explaining how cells, tissues, organs, and organ systems are related.



Logical/Verbal

CHAPTER RESOURCES

Chapter Resource File

- Section Quiz **GENERAL**
- Section Review **GENERAL**
- Vocabulary and Section Summary **GENERAL**
- Reinforcement Worksheet **BASIC**
- Critical Thinking **ADVANCED**