2.1 Body Systems

A system is made of parts that work together as a whole. In the human body, many different systems work independently, but are also connected to each other. Each organ system consists of organs that are made from various types of tissue. Tissue refers to a group of similar cells working together to carry out a specific function.

Key Terms

organ
organ system
tissue

Have you ever walked into a bicycle repair shop like the one in Figure 2.1 and noticed all the bike parts, such as wheels, chains, cables, and brake pads? To understand what these parts do, it is helpful to think of the systems that make up a bicycle, such as the gear system and the brake system. It is the parts of these systems working together that make the bicycle an efficient machine.

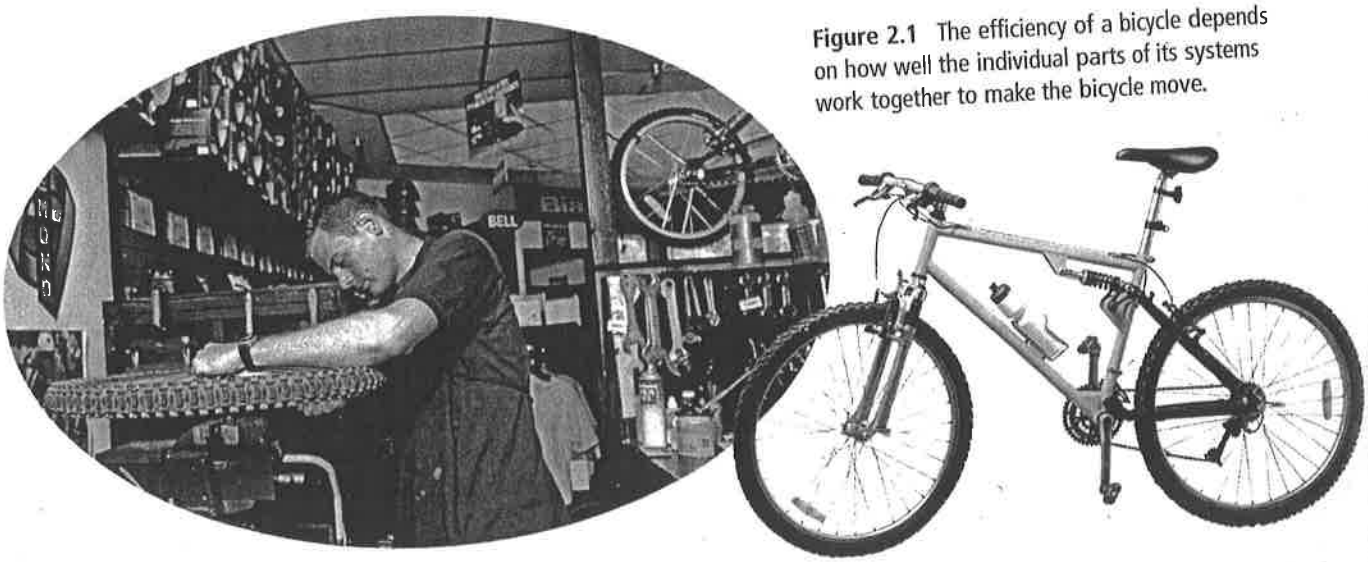


Figure 2.1 The efficiency of a bicycle depends on how well the individual parts of its systems work together to make the bicycle move.

The Characteristics of Systems

All **systems** have the following characteristics:

1. A system is made of individual parts that work together as a whole.
2. A system is usually connected to one or more systems.
3. If one part of a system is missing or damaged, the system will not function well or may not function at all.

The idea of a system is probably not new to you. Think of the human-made computer system you use and the electrical system that powers it. Scientists use the system idea to study natural systems, too, such the solar system or an ecosystem. For example, scientists study the interaction of living things and non-living things within ecosystems (see Figure 2.2 on the next page).

Your body has a variety of systems that work together to maintain your health. For example, your digestive system converts the food you eat into energy that is used when you carry out your daily activities, and your excretory system removes the waste from that process.

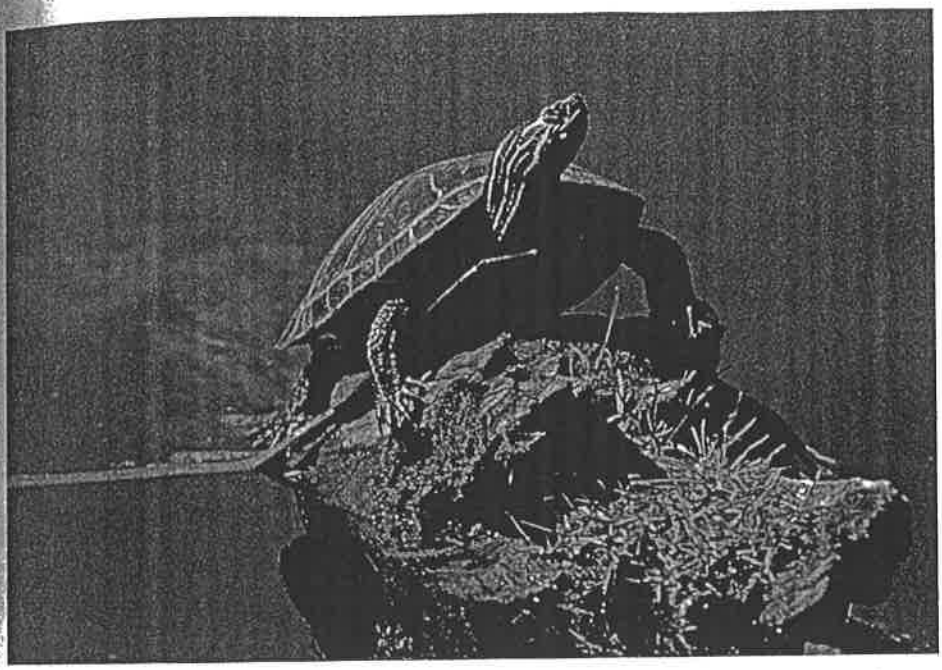


Figure 2.2 Living things (such as turtles) interact with non-living components (such as water and rocks) in this pond.

Connection

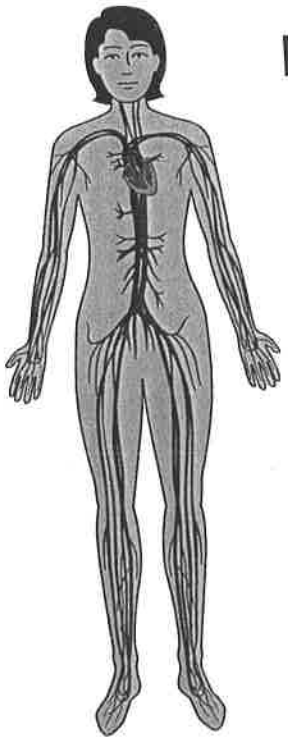
Section 12.1 has more information about pond ecosystems.

Did You Know?

Aristotle, who lived from 384 to 322 B.C.E., was a great philosopher. He also closely observed natural objects and events. He dissected animals to compare their body systems, a form of scientific inquiry that became known as comparative anatomy. Historians believe he made such studies to develop hypotheses about how human body systems might work.

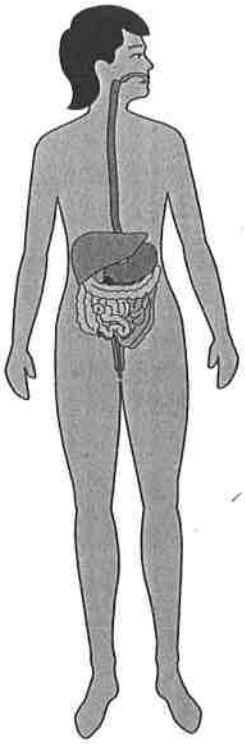
Introducing the Systems of the Human Body

Figure 2.3 Eleven systems of the human body



Circulatory System

Transports blood, nutrients (chemicals needed for survival), gases, and wastes.

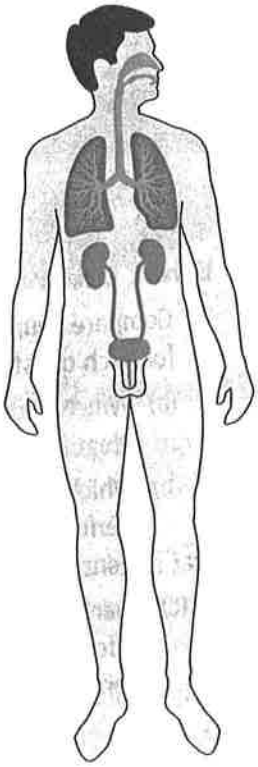


Digestive System

Takes in food.
Breaks down food.
Absorbs nutrients.
Eliminates solid waste.

internet connect

To see an interactive, three-dimensional body, go to **www.bcscience8.ca.**

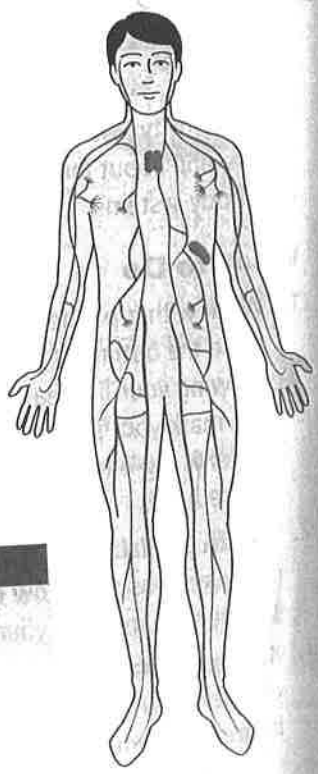


Respiratory System

Controls breathing.
Exchanges gases in lungs and tissues.

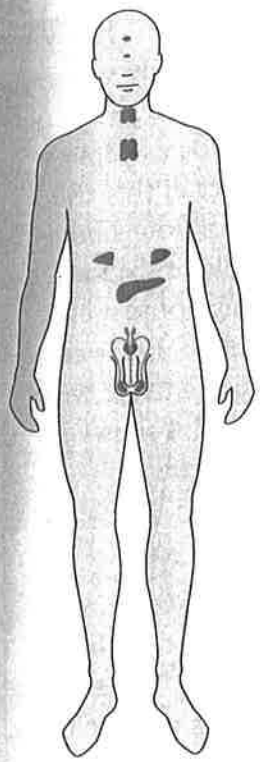
Excretory System

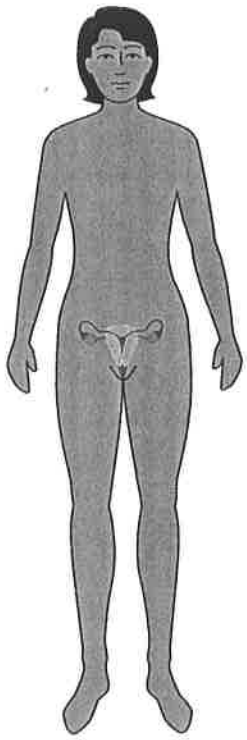
Removes liquid and gas wastes from the body.



Immune System

Defends the body against infections.





Endocrine System

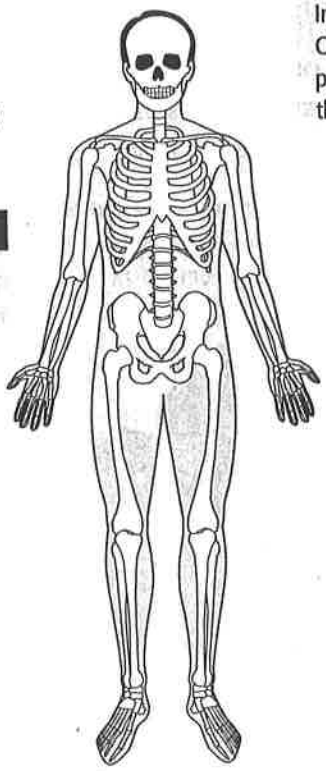
LEFT: Manufactures and releases hormones.

Reproductive System

RIGHT: Includes reproductive organs for producing offspring.

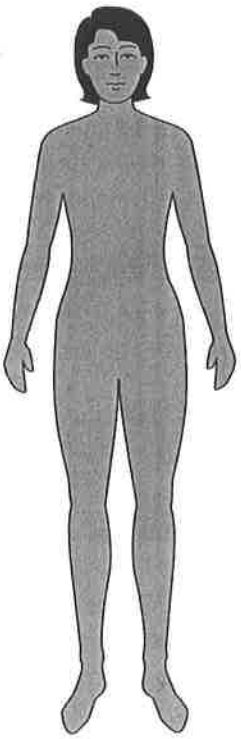
Integumentary System

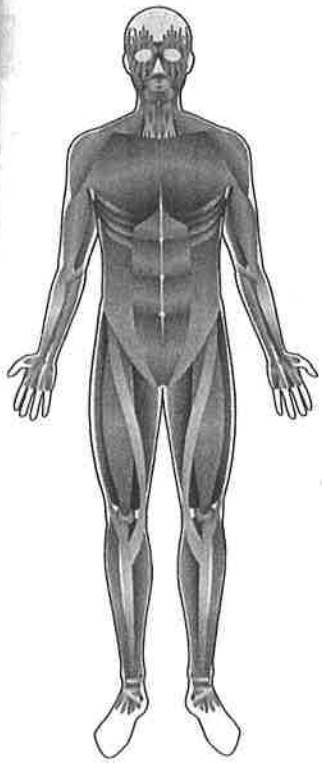
Includes skin, hair, and nails. Creates a waterproof protective barrier around the body.



Skeletal System

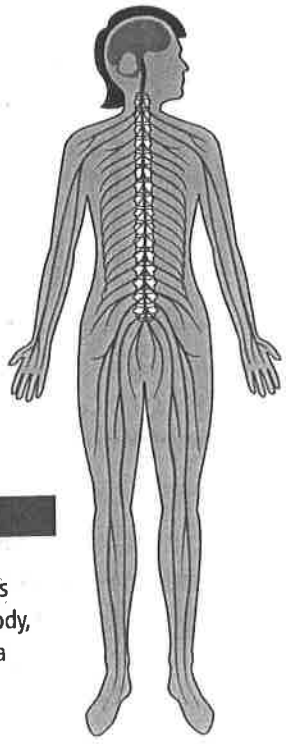
Supports, protects, and works with muscles to move parts of the body.





Muscular System

Has muscles that work with the bones to move parts of the body.



Nervous System

Detects changes in the environment and signals these changes to the body, which then carries out a response.

Organ Systems: Putting It All Together

In Figure 2.3 on pages 56–57, you can see 11 different body systems. Each body system is called an **organ system**. An organ system has one or more organs that perform specific body functions. For example, your heart is part of the circulatory system. You may recall that the heart pumps blood to the lungs and out into the rest of your body.

Within each organ system are tissues and cells. Cells of the same structure and function are grouped into **tissues**. Groups of tissues form **organs**, such as the lungs or the heart. For example, heart cells work together to form heart tissue. Several types of heart tissue work together to form the organ you call your heart. Figure 2.4 shows the relationship between cells, tissues, organs, and organ systems.

Did You Know?

There are different types of cells in your heart. One unique type of cell is called a myocyte. (In Greek, *myo* means muscle, and *cyte* means cell.) This cell can do something no other cell can do. It can beat on its own just like a tiny heart. When a group of myocytes are close together, they send chemical signals back and forth, which cause them to beat together at the same time.

Tissues: The Foundation of Body Systems

The word "tissue" comes from a Latin word meaning to weave. The cells that make up tissues are often "woven," or held together by fibres or sticky materials that form between tissue cells. Table 2.1 on the next page describes how each type of tissue works in your body. These four types of tissue form the basis for all organs in your body.

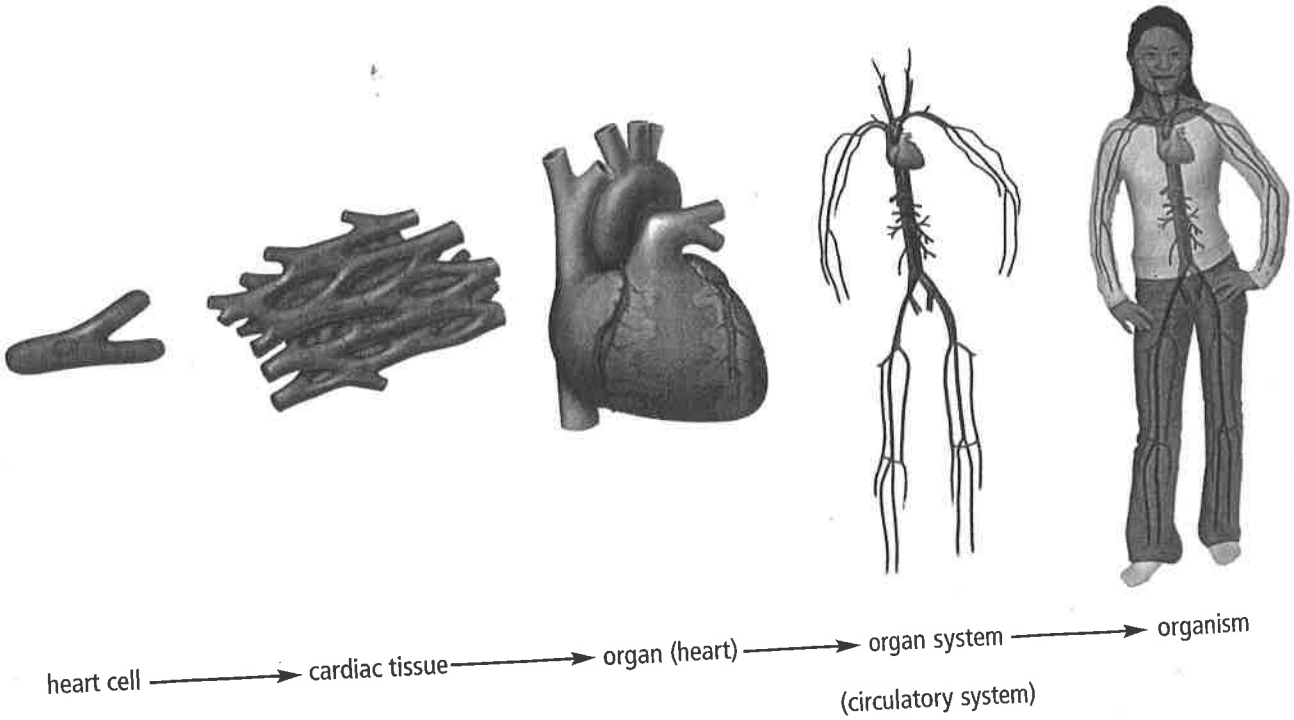
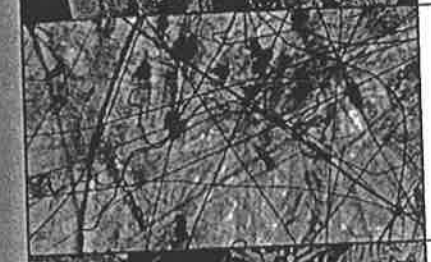


Figure 2.4 The cell is the basic unit of life. Cells working together make up tissue. An organ consists of several types of tissues working together to perform a task, such as the pumping of blood by your heart. Organs working together make up an organ system.

Table 2.1 How Tissues Function in the Human Body

	**Muscle tissue**, such as skeletal muscle tissue, assists in body movement. It also helps some organs carry out specific functions, such as the heart pumping blood.
	**Nerve tissue** transfers signals in the body and its organs to tell the body how to respond to changes in its internal and external environments.
	**Connective tissue** holds together and supports other tissues, such as skeletal connective tissue. Connective tissue connects, protects, and insulates organs.
	Epithelial tissue covers the surface of organs and the body. It also lines the inside of body parts, such as the mouth, esophagus (shown here), and the stomach.

Explore More

Select one of the systems from Figure 2.3 on pages 56–57. Research and describe the characteristics of the main structures and their functions. Explain how this system interacts with at least one other system. Begin your research at **www.bcscience8.ca.**

Wild, Weird, Wonderful

WWW Science

Building Bones in Space

Have you ever dreamed of being an astronaut and rocketing to Mars? Within your lifetime, astronauts may travel to distant planets or live in space for years at a time. But first, scientists have to solve some tricky problems. One of the trickiest is how to keep the crew from wasting away.

Being in space is something like lying in bed for a long time. Without the normal pull of gravity, muscles become flabby and shrink rapidly. More seriously, the weight-bearing bones of the lower body lose minerals at an average rate of about 2 percent each month. And the longer the time spent in space, the worse the problem gets. Back on Earth, problems continue as astronauts readjust to gravity. Crew members who spent four months on the Russian space station Mir took up to three years to regain their pre-flight strength. Sometimes, bones never fully recover.

Working on Earth and in space, scientists are tackling the problem from several angles. One is in-flight exercise. Astronauts typically work out for two hours a day using treadmills, harnesses, and other contraptions that try to mimic the force of gravity on bones and muscles. But these devices have not stopped bone loss.

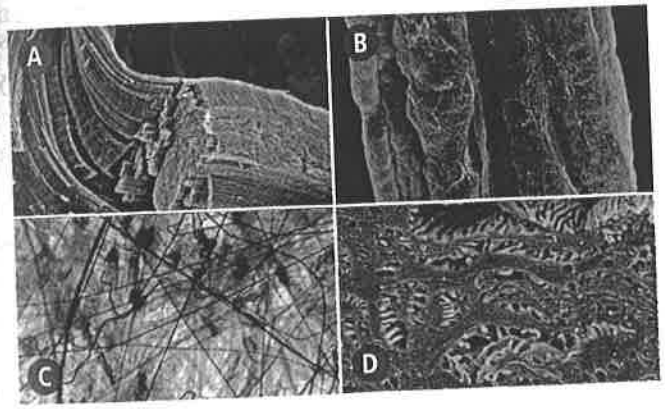
Another idea is creating artificial gravity inside the spacecraft by spinning the ship. But a spinning ship would not produce enough gravity to prevent bone loss. More promising, perhaps, is a vibrating plate that astronauts would stand on for a few minutes a day. The theory here is that new bone cells form mainly as a result of thousands of tiny muscle pulls that occur in daily activity. Vibrating devices would cause these small contractions and have worked well in animal experiments. Other research focusses on hormone, nutrition, and drug therapies.

The solution to bone and muscle loss may turn out to be a combination of approaches. In any case, research that helps astronauts get to Mars will benefit people on Earth, too. Bone thinning in space, after all, is a speeded-up form of osteoporosis, a disease that affects many people as they age. Any treatment that saves bones could also help people with spinal cord injuries or other conditions that keep them immobile for long periods.

Check Your Understanding

Checking Concepts

1. What are the three characteristics of a system?
2. How is a bicycle an example of a human-made system?
3. Which body system removes liquid and gas wastes from the body?
4. Which system does the heart belong to?
5. Which system controls breathing?
6. Which system defends the body against infection?
7. Match the following four images of tissue to the correct function.



(a) holds together and supports other tissues
(b) transfers signals in the body
(c) covers the surface of the body
(d) assists in body movement

8. If you were given a copper wire from an extension cord and asked which type of tissue this cord best modelled, what would be your answer? Explain.
9. What is the difference between an organ and a tissue?
10. Explain the four levels of organization within the human body.

Understanding Key Ideas

11. Think of a human-made system not discussed in this textbook or class. Describe this system and explain how the three characteristics of a system are represented in your example.
12. Give an example of how two body systems interconnect or rely on each other to function.
13. Multiple sclerosis (MS) is a disease that causes the breakdown of tissue in the central nervous system. Which types of tissue are affected by MS?
14. Select one graphic organizer described in Science Skill 10 and use this organizer to explain the bolded terms in this section.

Pause and Reflect

Figure 2.3 on pages 56–57 shows 11 different body systems. If one of these systems no longer functioned, what would be the impact on the rest of the body? Explain your answer in a paragraph.