

Multicellular Organisms



Figure 1 MacMillan Provincial Park, British Columbia, is home to many giant Douglas firs. Most scientists believe these trees to be up to 800 years old!

Multicellular organisms have more working parts (cells) than unicellular organisms. The Douglas fir tree shown in Figure 1 is one of the largest organisms on Earth. It is 76 metres high and almost 3 metres in diameter! This giant tree is made up of many cells, which form the trunk, branches, leaves, and so on. Multicellular organisms use all of their cells to perform life processes and meet their needs.

Specialization and Differentiation

All multicellular organisms start as a single cell. When the cell divides, the new cells do not move away from each other, but stay close to one another. The number of cells formed determines the size of the organism (Figure 2). As the number of cells increases, each cell becomes better able to perform one particular function within the organism.

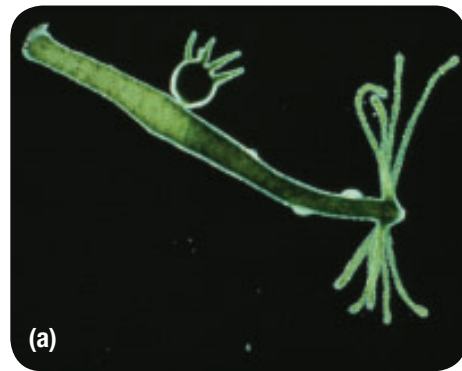


Figure 2 This tiny *Hydra* (a) is made up of several thousand cells, whereas a Canada goose (b) is made up of trillions of cells.

LINKING TO LITERACY

Monitoring Understanding

Effective readers recognize when confusion occurs and use a variety of strategies to regain understanding. As you read, use sticky notes to write predictions, questions, inferences, and connections you may make as you make sense of the text.

Imagine the town or city you live in. People have been trained to do one job well. We take our cars to a mechanic for repairs, but we do not go to that mechanic if we are sick. Another person has the training needed to take care of sick people. By doing one job well, a community is more efficient. Multicellular organisms work in the same way. Instead of every cell trying to do every job, groups of cells are specialized to do one job very well. Multicellular organisms benefit from cell specialization—your heart is very good at pumping blood, but not good at digesting food.

Multicellular organisms may seem simple, but they are very complex systems. The *Hydra* in Figure 2(a) has specialized tentacles that catch food, but it also has different cells to digest that food. The goose in Figure 2(b) has wings for flying and webbed feet for swimming. Different parts are made up of different specialized cells. In complex multicellular organisms, cells are organized into groups that work together to perform specific jobs. When cells work together to perform one specific function, they are generally more efficient than one cell working on its own.

Cell specialization takes place early in the development of a multicellular organism. Each cell undergoes changes and develops characteristics that make it unique from other cells. We call this process **cellular differentiation**. Once a cell has differentiated, it performs a very specific function within the organism. For example, muscle cells are differentiated cells that contract. They are specialized to work with other muscle cells to move certain parts of a body. Other important differentiated cells include epithelial cells, fat cells, and nerve cells (Figure 3).

cellular differentiation: the process by which a cell becomes specialized to perform a specific function

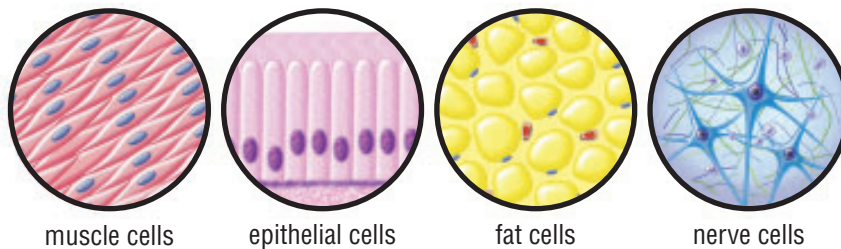


Figure 3 Human cells are differentiated.

Tissues, Organs, and Organ Systems

Within multicellular organisms, differentiated cells are organized according to the function they perform.

Tissues

A group of cells that is similar in shape and function is called a **tissue**. In animals, four basic types of tissue are epithelial tissue, muscle tissue, connective tissue, and nervous tissue. Blood is an example of connective tissue. In humans, epithelial tissue can be found covering the external surfaces of the body, and lining the surfaces of structures such as the mouth, heart, liver, and eyes.

tissue: a group of differentiated cells that work together to perform a specific function

In plants, tissues made from thin-walled plant cells are commonly found in the parts of the plant that carry water and nutrients. Tissues made from thick-walled plant cells are found in the parts of the plant that provide structure.

Organs

Different tissues assemble to form larger structures, such as the skin, stomach, and heart. These structures are called organs. **Organs** are made up of different types of tissue that work together to achieve one or more functions within the organism. Skin, for example, is the largest organ in the human body and is made up of epithelial tissue, connective tissue, nerve tissue, and fat tissue. Skin provides both structural support and a barrier that protects internal structures from the outside environment. Other animal organs include the heart, stomach, brain, lungs, intestines, eyes, and liver. In plants, stems, leaves, flowers, and roots are all organs.

organ: two or more tissues that work together to perform one or more functions

Organ Systems

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

Organs never work alone. Two or more organs working together to perform a related function are known as an **organ system**. In humans, the digestive system is an organ system made up of several organs: the mouth, esophagus, stomach, liver, pancreas, small and large intestines, and anus. Organ systems often overlap and share organs. Both the circulatory system and the respiratory system include the lungs. Organ systems are also interdependent. For example, all organs need contact with the brain to function properly.

Organ systems in animals include the circulatory system, respiratory system, digestive system, musculoskeletal system, and nervous system (Figure 4). Plants have two major organ systems: the root system and the shoot system (Figure 5).

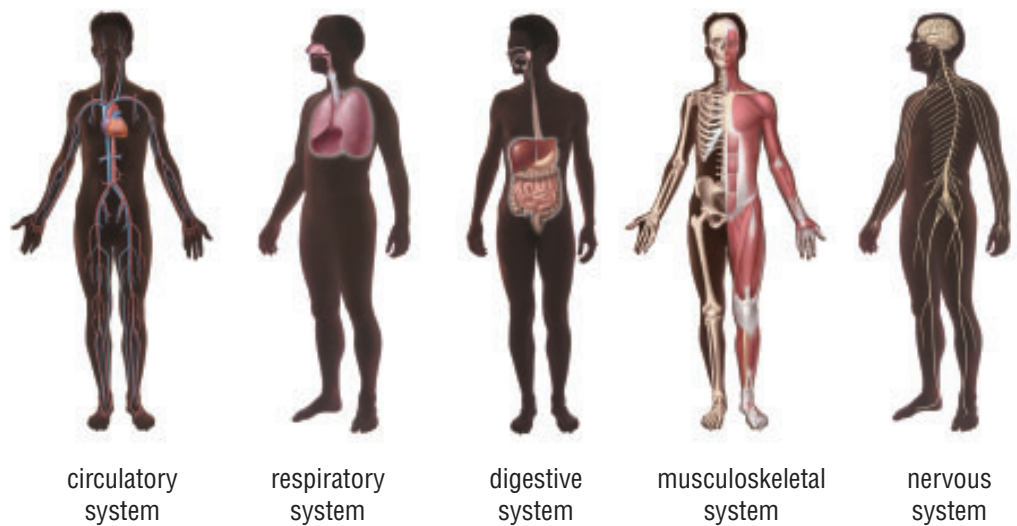


Figure 4 Major animal organ systems

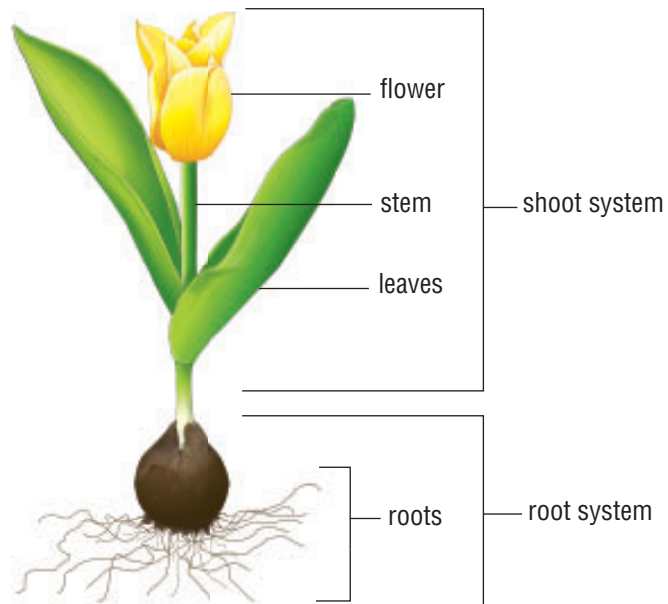


Figure 5 Major plant organ systems

Human Organ Systems

Humans are multicellular organisms made up of several tissues, organs, and organ systems. Human organ systems work together to perform all of the processes necessary for life. Table 1 summarizes the structures and functions of five important human organ systems.

Table 1 Five Organ Systems in the Human Body

	Circulatory system	Respiratory system	Digestive system	Musculoskeletal system	Nervous system
Major function	<ul style="list-style-type: none"> transports nutrients, dissolved gases (oxygen and carbon dioxide), and wastes to and from individual cells in the organism 	<ul style="list-style-type: none"> exchanges oxygen and carbon dioxide between blood and the external environment 	<ul style="list-style-type: none"> breaks food down into small particles, called nutrients, that can be transported by the circulatory system to all cells of the body 	<ul style="list-style-type: none"> provides structural support to the body protects internal structures from the outside environment plays a role in movement and locomotion 	<ul style="list-style-type: none"> responds to changes in the internal and external environment of the body coordinates the function of all other organ systems
Major organs	<ul style="list-style-type: none"> heart blood vessels 	<ul style="list-style-type: none"> lungs windpipe blood vessels 	<ul style="list-style-type: none"> mouth esophagus stomach liver pancreas small and large intestines anus 	<ul style="list-style-type: none"> bones muscles 	<ul style="list-style-type: none"> brain spinal cord sensory organs (eyes, ears, nose, taste buds)
Major tissues	<ul style="list-style-type: none"> epithelial muscle nerve connective 	<ul style="list-style-type: none"> epithelial muscle nerve connective 	<ul style="list-style-type: none"> epithelial muscle nerve connective 	<ul style="list-style-type: none"> epithelial muscle nerve connective 	<ul style="list-style-type: none"> epithelial nerve connective

Unit Task How will you use the information in this section to help you identify multicellular organisms and unicellular organisms when completing the Unit Task?

✓ CHECK YOUR LEARNING

- How did the information in this section add to your understanding of multicellular organisms?
- (a) In your own words, explain “cell differentiation.”
(b) Give three examples of differentiated animal cells.
- In your own words, write a definition for cell, tissue, organ, and organ system. Give an example of each of these in your body.
- (a) Name the five organ systems in your body that you learned about in this section.
(b) What is the major function of each of these systems?
- What four types of tissues are found in most organ systems?
- Provide an example of how organ systems are interdependent.