Gas Exchange

Small multicellular organisms use diffusion to obtain oxygen. For example, the earthworm uses its moist skin to exchange gases with the outside air. Some aquatic organisms, like fish, pass oxygen-rich water through gills, where it diffuses into blood capillaries. Most land animals use lungs for gas exchange. In all cases, oxygen is absorbed from the environment, and carbon dioxide is removed from the blood. The dissolved gases are transported in the blood.

Gas Exchange in Vertebrates

In humans, air is inhaled through the mouth and nose and passes into the trachea (Figure 5). A flap-like structure in the trachea opens when you breathe, but closes when you swallow food. This prevents food from entering the trachea and lungs. Air travels down the trachea into the lungs. In the lungs, tubes called bronchi branch off into smaller tubes called bronchioles. At the end of the bronchioles are round sacs of alveoli, where gas exchange occurs. The walls of the alveoli are only one cell thick. This allows oxygen to diffuse out of the cells of the alveoli and into the blood cells. The circulatory system transports the oxygen-rich blood cells to the rest of the body. As blood circulates throughout the body, oxygen diffuses out of the blood cells and into the cells of the body.

In the same way, carbon dioxide diffuses out of the body cells and into the blood cells. Blood cells are carried to the alveoli. Carbon dioxide diffuses out of the blood cells and into the alveoli. The carbon dioxide then travels through the bronchioles, bronchi, and trachea. It is removed from the body when you exhale.

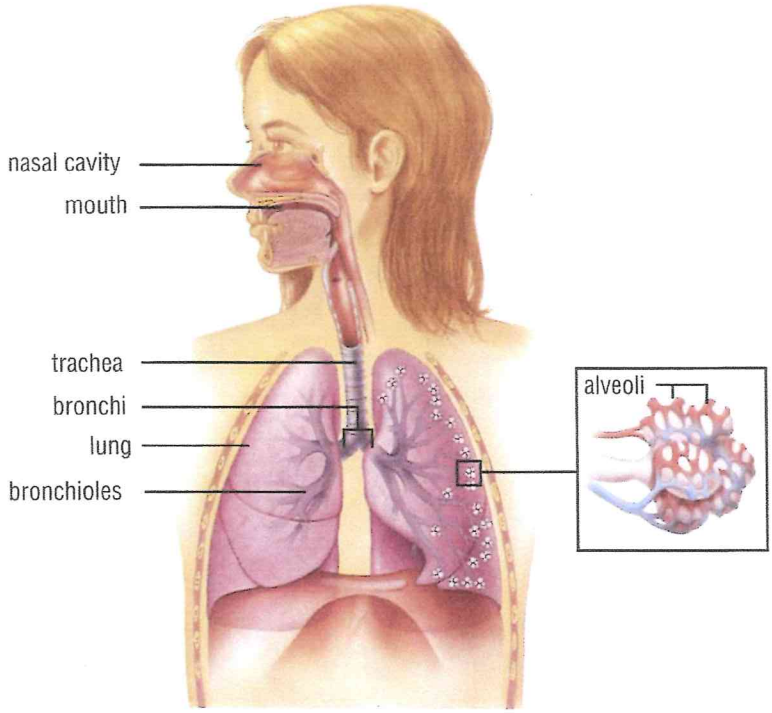


Figure 5 The human respiratory system

Nutrition

Animals are unable to make their own food and must survive either by consuming living things (such as fruits, vegetables, and meat) or by consuming products that come from living things (such as eggs and honey). Food material must be broken down into nutrients that the cells of the body can absorb and use for energy.

Nutrition in Humans

In humans, food is taken into the body and broken down by a digestive system made up of specialized organs and tissues. Food enters the mouth, where it is broken down into smaller pieces by the teeth. Cells in the mouth release chemicals that help with this breakdown. Swallowing moves the food into the esophagus.

Muscle cells lining the walls of the esophagus help push food down into the stomach. Cells in the stomach release chemicals that further break down the food. Stomach muscles contract and relax, moving food into the intestines. In the intestine, the nutrients are absorbed into the blood vessels of the circulatory system and are transported to other parts of the body. Undigested food is passed out of the anus as waste (Figure 2).

The cells of the body use these nutrients for energy and pass wastes into the blood for removal from the body. These wastes pass through the kidneys and are eliminated as urine. Each cell involved in this process has a unique task that is necessary for digestion.

LINKING TO LITERACY

Visualizing

As you read, you can remember and understand informational text by picturing the description or explanation in your mind. With a partner, share and compare your visualizations.

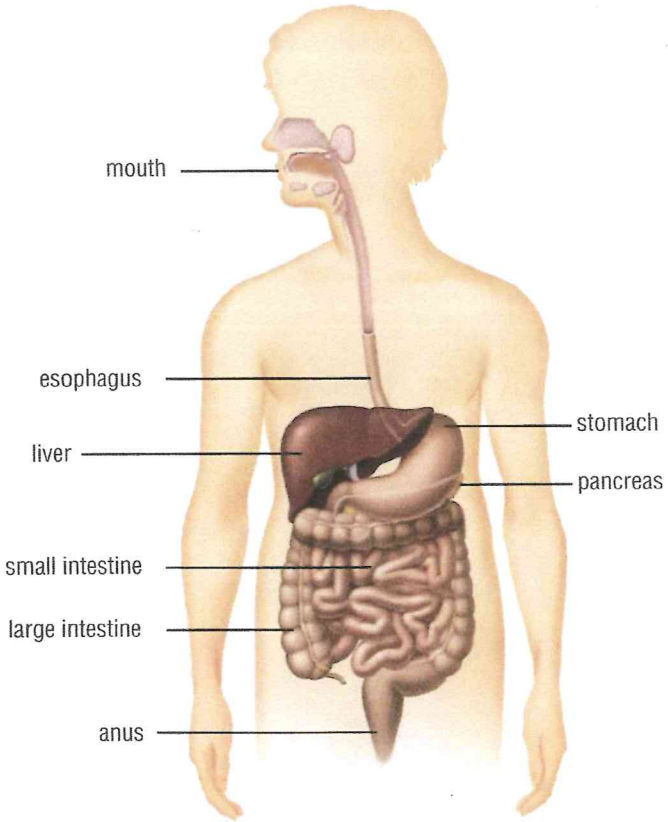


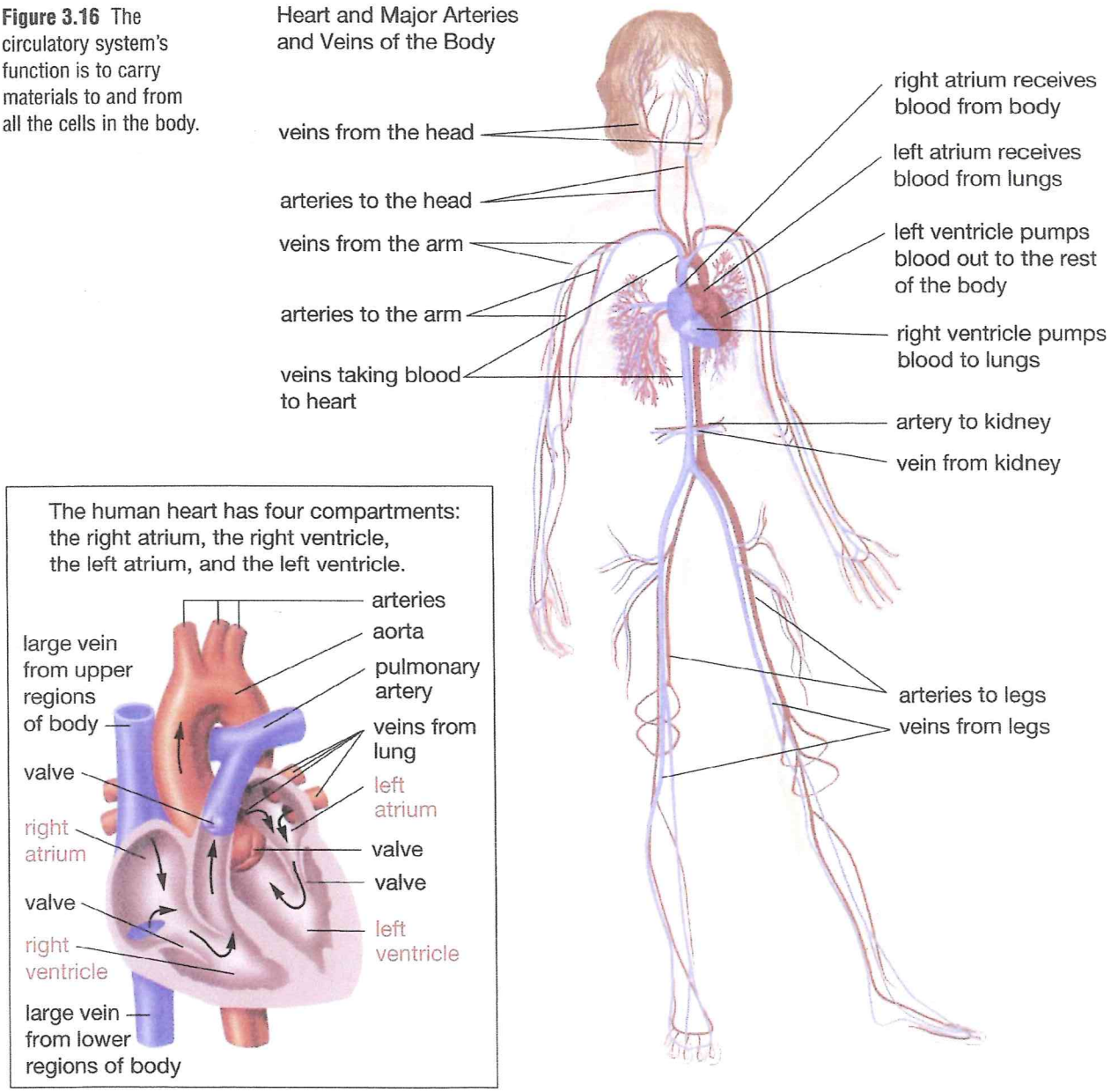
Figure 2 Each part of the human digestive system has a unique task that is needed to complete digestion of food material.

The digestive system puts food into the intestine and the respiratory system puts oxygen into the lungs. How do particles of food and oxygen eventually get from these systems to cells in the toes, the brain, and other parts of the body? A third system transports particles of food and oxygen. The **circulatory system** consists of the heart, blood, and blood vessels (see Figure 3.16). This system circulates blood around the body, delivering food particles, dissolved gases, and other materials to every cell and carrying away cell wastes.

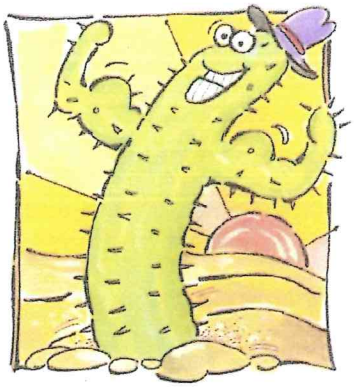
There are about 11 different systems in the human body. Each system has a major function. The systems are co-ordinated into the total living organism, and all the systems depend on one another.

The Circulatory System

Figure 3.16 The circulatory system's function is to carry materials to and from all the cells in the body.



3.2 Organ Systems in Plants



Why don't plants have muscles? The function of muscles is movement. One reason animals need to move is to find food. Plants do not need to move from place to place, however. They obtain their food by photosynthesis, using substances in the air (carbon dioxide) and soil (water). Plants can get these materials while remaining in one place, with their leaves in the air and their roots in the soil.

Because of differences in how plants and animals survive, plants have fewer types of tissues and organ systems than animals have. Movement is not the only difference between plants and animals. Unlike animals, plants do not need sense organs (such as eyes and ears) to locate their food. They do not need a digestive system to break down large pieces of food into small particles for their cells to use. Also, plants do not need a nervous system to send rapid signals throughout the body and to co-ordinate movement.

What do plants need in order to survive, and how do plant structures ensure the plant's survival? Plants have only two main organ systems: a root system below ground and a shoot system (the stems and leaves) above ground, as shown in Figure 3.5. The functions of the root system are to obtain water and minerals from the soil and to anchor the plant in the ground. The function of the shoot system is to make food for the plant. At certain times, flowering plants produce a third system, for reproduction. The main organs of the reproductive system are the flowers.

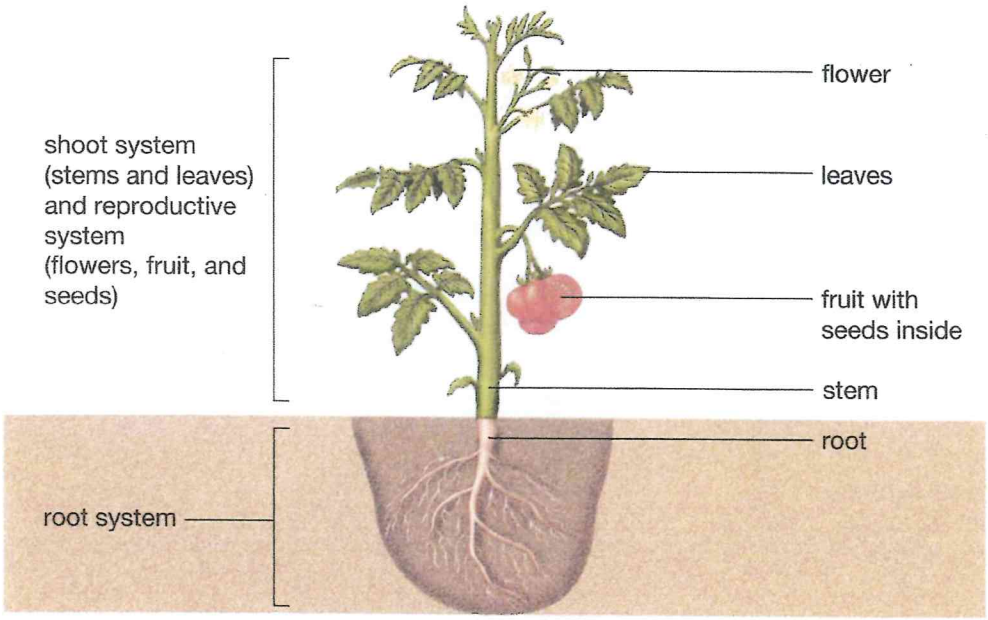


Figure 3.5 Organ systems in a plant

DidYouKnow?

Plants never stop growing in the way that many animals do. Instead, plants continue to add new cells, tissues, and organs at the ends of their shoots and roots. They do this by means of a permanent area of unspecialized cells that can develop into new plant structures and replace any parts that are damaged. Thus, some trees are estimated to be thousands of years old. Some patches of prairie grass are thought to be single individuals that have been growing in one place since the last ice age ended — 10 000 years ago!

Connecting the Systems

At the beginning of this chapter, you were asked how cells in the roots of a tree obtain sugars made in the leaves. Transport of nutrients is the role of a plant's tissues. Inside the plant, two types of tissues, called **vascular tissues**, connect the