Unit 3 Life Science: Part II

Chapter 10 The Human Body
Chapter 11 Energy for Life
Chapter 12 Staying Healthy
Chapter 13 Depending on Each Other

Humans have complex body systems and large brains. These help them to survive in many different environments, even underwater.

Use the chart below to answer the questions.

1. Which body system allows the diver to breathe in oxygen from the air tank?
2. Which body system helps the diver move through the water?
3. A wetsuit protects the diver from the environment. What organ is like the wetsuit?

Some Human Body Systems

System	Main Function	Organ in the System
Immune	Protects from the environment	Skin
Muscular	Allows movement	Biceps (arm)
Nervous	Receives and sends messages	Brain
Respiratory	Takes in oxygen from air	Lungs

Chapter 10 The Human Body

Humans have thumbs to grasp things and large brains to figure things out. This man is repairing a communications tower. What special human abilities is he using?

Learning Objectives

- Define body tissue and organ.
- Compare two body systems.
- Identify the control center of the human body.
- Name the five sense organs.
- Compare the uses of bones and muscles.
- Describe the reproductive system and puberty.
- LAB ACTIVITY: Explore how taste and smell work together.
- ON-THE-JOB SCIENCE: Relate checking heart rates to fitness instruction.

Words to Know

tissue	a group of similar cells that work together to do a job
organ	a body part made up of one or more kinds of tissue
system	a group of organs working together to do a job
hormone	a substance made by organs called glands
skeleton	the bones that support, allow movement, and protect the organs of an animal with a backbone
calcium	a mineral found in teeth and bone
joint	a place where two bones meet
tendon	a tough band of tissue that attaches muscle to bone
puberty	the time in life when the reproductive organs develop
testes	the male organs where sperm cells are made
ovaries	the female organs where egg cells are stored
uterus	the female organ in which a fetus develops
fetus	an unborn baby that develops in a woman's uterus
menstruation	the monthly flow of blood from the uterus of a woman who is not having a baby

10-1 From Cells to Systems

Words to Know

tissue	a group of similar cells that work together to do a job
organ	a body part made up of one or more kinds of tissue
system	a group of organs working together to do a job
hormone	a substance made by organs called glands

The Basic Plan

Remember
Cells are the smallest units of living matter. All animals have specialized cells that do different jobs.

The human body is made up of many kinds of **tissue.** A tissue is a group of similar cells that work together to do a job. Blood tissue is made up of blood cells.

An **organ** is a body part made up of one or more kinds of tissue. The heart is an example of an organ. It is a pump made mostly of muscle tissue. A **system** is a group of organs working together to do a job. The heart is part of the circulatory system. The circulatory system sends blood around the body.

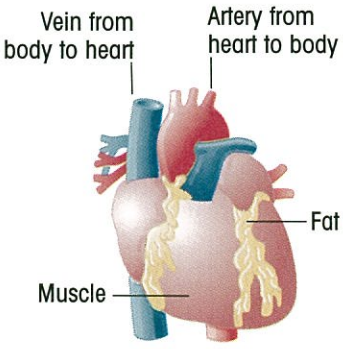


Figure 10-1
The human heart

Human Body Systems

System	Main Function	Organ in the System
Circulatory	Sends blood around the body	Heart
Digestive	Breaks down food into usable parts	Stomach
Immune	Protects from the environment	Skin
Muscular	Allows movement	Biceps (arm)
Nervous	Receives and sends messages	Brain
Reproductive	Makes offspring	Ovaries/Testes
Respiratory	Takes in oxygen from air	Lungs
Skeletal	Supports body and protects organs	Backbone

✓ **How are tissues, organs, and systems related?**

The Body's Control Center

The brain is the control center of the human body. It is made up of billions of nerve cells, or *neurons*. The brain sends messages around the body. It also receives messages. The brain controls many of the body's functions. It also stores information.

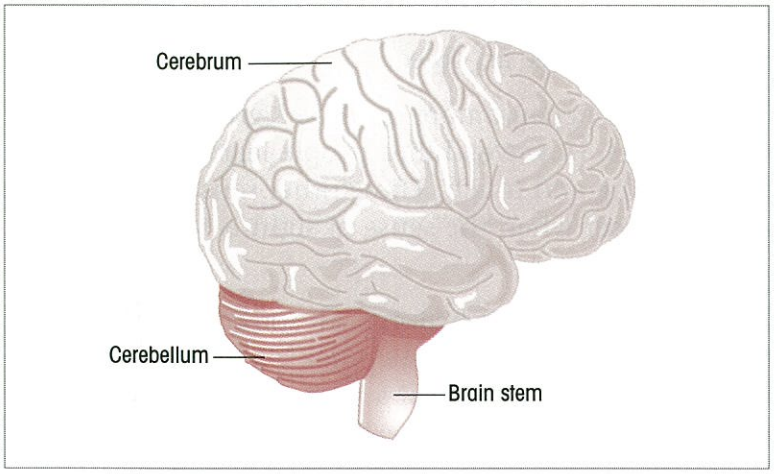


Figure 10-2 *The human brain*

Messages go from your brain down to your *spinal cord*. The spinal cord is like a big rope of neurons. It runs along the inside of your backbone.

The spinal cord connects to neurons all over your body. Messages travel from one neuron to the next until they reach their destinations. The brain, spinal cord, sense organs, and neurons are all parts of the nervous system.

Another way body functions are controlled is by hormones. A **hormone** is a substance made by organs called *glands*. Some glands make hormones that circulate in the blood and cause changes in the body.

Why is the brain said to be the control center of the human body?

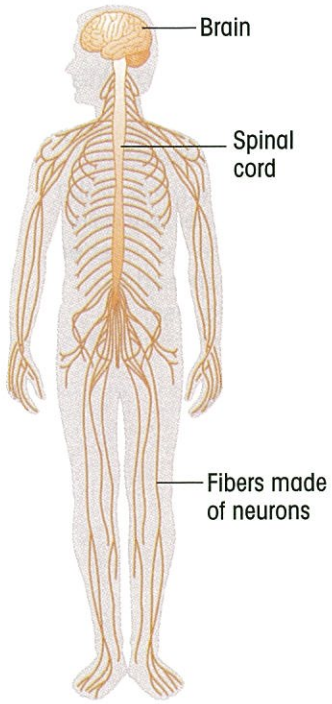


Figure 10-3
The nervous system

The Five Senses

Humans have five senses: sight, hearing, taste, smell, and touch. Each of these senses has an organ. These sense organs are also part of the nervous system.

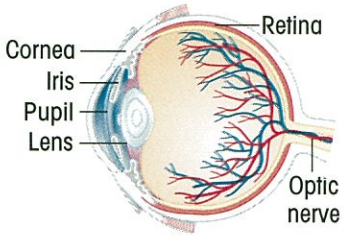


Figure 10-4
The human eye

Sight

Eyes are the organs of sight. Light bounces off objects and enters your eyes. This light triggers nerves in the back of the eyes. These nerves send messages to your brain, and you see an object.

Most people depend more on their sight than on their other senses. However, blind people learn to depend on their hearing and touch. These other senses become much sharper when the sense of sight is taken away.

Hearing

Ears are the organs of hearing. All sounds are made by vibrations. Vibrations are quick back and forth movements of air. Think of a violin. When you pluck a string, you make it vibrate. The vibrations travel long distances in waves. The sound waves enter the ears. Tiny bones inside the ears are moved by the vibrations. Nerves pick up the movement and send a signal to the brain. You hear this as sound. People sometimes cup their hands behind their ears to hear better. This directs the sound to the inner ear.

Safety Alert

Listening to very loud noises can damage parts of the ear, especially cells that line the inner ear. This can lead to hearing loss.

Taste

The tongue is the organ of taste. People can taste only four types of flavors: sour, sweet, salty, and bitter. Different areas of the tongue taste different flavors. The tip tastes sweet and salty things. The sides taste sour things. The back tastes bitter things. Not all animals have the same sense of taste. Cats do not taste sweet things.

Smell

The nose is the organ of smell. Think of smelling an onion. Tiny molecules from the onion drift up to your nose. There, the molecules from the onion trigger nerve cells that send a message to your brain.

Touch

Skin is the organ of touch. Some areas of skin, such as the fingertips, are very sensitive to heat, cold, touch, and pain. These areas have more nerve cells than other areas. The sense of touch protects the body from harm. It works like an alarm system. If something sharp or hot touches your body, you know to move away.

Skin is the human body's largest organ. It serves many functions besides passing sensory messages to the brain. For example, it keeps the body from drying out. As part of the immune system, it also keeps out some harmful bacteria.

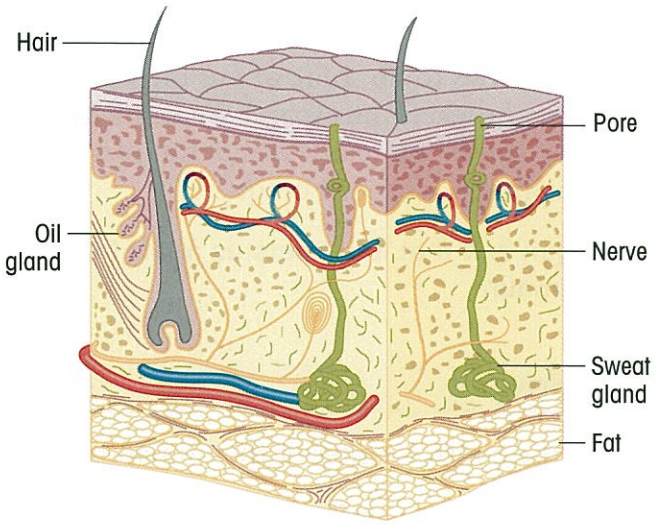


Figure 10-5 *Cross section of human skin*

Skin has sweat glands in it. Sweat glands make sweat. Sweat is made mostly of water and salt. The water in sweat cools the body when a person gets overheated. So skin also helps the human body stay at the right temperature.

✓ What are the five sense organs and what do they do?

How Are Humans Unique?

Science Fact

Having large brains gets humans in trouble sometimes. For example, we cut down trees and build huge cities. However, more cities lead to more pollution and less land for wildlife.

The human body is a lot like the bodies of other animals. The human brain, though, is larger and more complex. This is what makes humans special, or unique. Scientists say the human brain may be one of the most complex things in the universe.

Humans cannot run as fast as cheetahs. We cannot smell as well as dogs. We cannot fly like birds. Many animals have more muscle power than we do.

However, we make up for much of this with our large brains. We use our brains to design cars and airplanes that move fast. We make telescopes and microscopes to see things that other animals cannot see.

We build machines to do some of our muscle work for us. We send rockets into space. We can write stories and beautiful music and paint wonderful pictures. The human animal is indeed unique.

✓ **What organ is it that most sets us apart from other animals?**

Lesson Review

1. What is the control center of the human body?
2. Name the four types of flavors humans can taste.
3. What is the most important difference between humans and other animals?
4. **CRITICAL THINKING** Nails cover the skin on the ends of fingers and toes. What do you think the nails are for?

10-2 Your Body at Work

Words to Know

skeleton	the bones that support, allow movement, and protect the organs of an animal with a backbone
calcium	a mineral found in teeth and bone
joint	a place where two bones meet
tendon	a tough band of tissue that attaches muscle to bone

Getting Some Support

The human body has 206 bones in it. These bones all connect together. They are called your **skeleton.** The skeleton gives your body support and allows you to move. You would not be able to sit, walk, or stand without a skeleton.

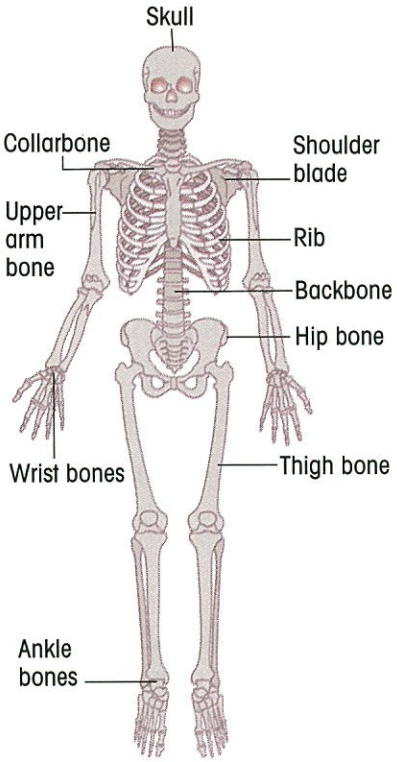


Figure 10-6
The human skeleton

The skeleton also protects many of your most important organs. The narrow bones, called *ribs*, form a cage around your heart and lungs. Another part of your skeleton forms a hard shell, called a *skull*, that protects your brain.

Bones are made of living cells and also the mineral called **calcium.** Calcium is found in teeth, too. You get calcium from the foods you eat. Foods rich in calcium are milk, yogurt, and cheese.

The place where two bones meet is called a **joint.** You have joints at the wrists, the knees, and on your fingers. The elbows, hips, and shoulders also contain joints.

The largest bone in the human body is the thigh bone. The smallest, called the *stirrup*, is in the ear. A child has more bones than an adult. As the child grows, some of the bones join together.

✓ **What are bones are used for?**

Muscles on the Move

You can tighten, or flex, many of your muscles. Try flexing your arm muscle. The arm muscle is attached to your arm bone by tendons. A **tendon** is a tough band of tissue that attaches muscle to bone. Muscles that help you move parts of your skeleton are called *voluntary muscles*.

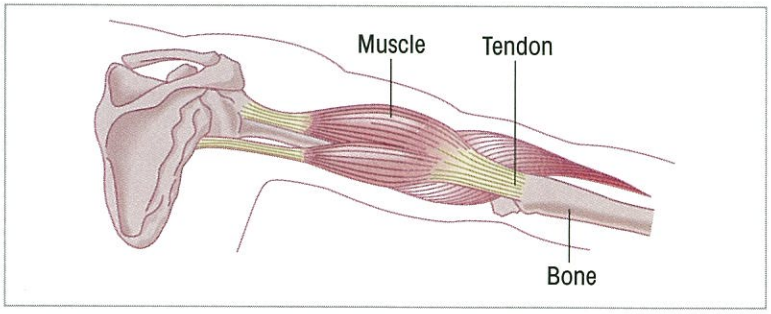


Figure 10-7 *Arm muscles are attached to bones by tendons. As the muscle tightens, the tendon pulls the bone into a new position.*

Some muscles work without bones. When you swallow food, certain muscles push the food down into your stomach. Other muscles cause blood to move throughout your body. These muscles are not attached to bones. They are called *involuntary muscles*.

✓ **What do tendons do?**

Lesson Review

1. How many bones are in the human body? What two purposes do they serve?
2. What are the two kinds of muscles?
3. **CRITICAL THINKING** The heart automatically pumps blood around the body. Other involuntary muscles control the blinking of your eyes, breathing, and the digesting of food. Why do you think involuntary muscles control those actions?

10-3 Reproduction

Words to Know

puberty	the time in life when the reproductive organs develop
testes	the male organs where sperm cells are made
ovaries	the female organs where egg cells are stored
uterus	the female organ in which a fetus develops
fetus	an unborn baby that develops in a woman's uterus
menstruation	the monthly flow of blood from the uterus of a woman who is not having a baby

Puberty

The human reproductive system does not fully develop until **puberty.** Puberty is the time in life when the male and female reproductive organs develop. During puberty, certain glands begin producing hormones. These chemicals cause physical changes in the body.

For instance, during puberty girls develop breasts and broader hips. Boys develop broader shoulders and more muscles. Both boys and girls grow hair under their arms and around their reproductive organs. Boys' voices get lower. Puberty for girls usually begins between the ages of 10 and 13. It usually begins for boys between the ages of 13 and 16.

During the time of puberty, males begin producing the sex cells known as sperm cells. The male organs that make sperm cells are called the **testes.** An adult male makes millions of sperm cells a day. Certain hormones that affect sexual development are also produced in the testes.

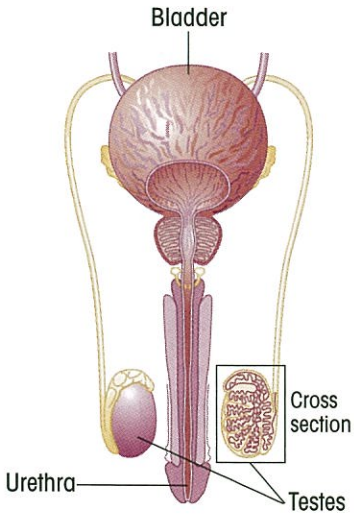


Figure 10-8
The male reproductive system

✓ **What happens at puberty?**

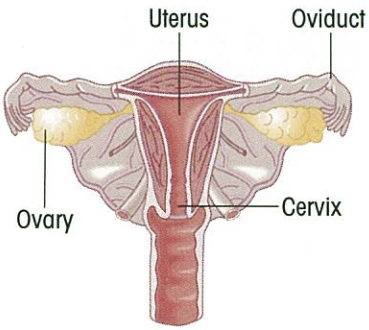


Figure 10-9
The female reproductive system

The Female Cycle

Females are born with all the egg cells they will ever have. The egg cells along with certain hormones are stored in the female organs called the **ovaries.** Each month, starting at puberty, an egg cell is released from one of the ovaries. When this happens, the walls of the **uterus** become thick with blood. The uterus is the organ in which a **fetus** develops. A fetus is an unborn baby.

If no baby is created, the extra blood that lines the uterus leaves the body. This monthly flow is called **menstruation.** When a woman grows older, menstruation stops. This usually happens around the age of 50.

✓ **What are the female reproductive organs?**

The Developing Baby

Remember
Fertilization occurs when sperm cell and egg cell unite. All humans begin as one cell. This divides into two, four, and so on. A newborn baby is made of trillions of cells.

If the egg cell is fertilized by the sperm cell, a fetus will begin to grow in the uterus. The extra blood will not be lost. It will remain to feed the fetus. Because the uterus is made of mostly muscle tissue, it can stretch. This gives room for the developing baby.

Figure 10-10 *Most fetuses develop in the uterus for nine months before emerging as babies.*

For the first two months, the fetus, called an *embryo*, does not look human. By four months, the fetus has developed many human features. By seven months, most of its organs are developed and working.

✓ **What happens when an egg cell is fertilized?**

Lesson Review

1. What is puberty? When does it usually happen?
2. What happens during menstruation?
3. **CRITICAL THINKING** Look carefully at the pictures of the fetus on page 148. Describe the changes you see taking place from week to week.

A Closer Look

PREMATURE BABIES

Babies born before about nine months in the mother's uterus are called premature babies. Babies born between the eighth and ninth month are usually developed enough to survive. They do well if they get proper care. Babies born before this are at great risk. Many die. Those that survive often have lifelong health problems. They can have brain damage. They may have trouble breathing, walking, or talking.

A premature baby must often live in a germ-free, warm environment.

About 250,000 premature babies are born each year in the United States. Nearly 75,000 of these are born in the seventh month or earlier. Premature births cost families and society millions of dollars each year.

CRITICAL THINKING How could seeing a doctor help a woman who is expecting a baby?

LAB ACTIVITY
Tasting What You Smell

BACKGROUND
The tongue is the organ for taste. But your tongue can only sense four basic flavors: sweet, salty, sour, and bitter. Your sense of smell is much stronger than your sense of taste. Often, when you think you are tasting something, you are really smelling it.

Safety Alert

If you are allergic to these foods, do not taste them.

PURPOSE
You will see how taste and smell work together to help you recognize and enjoy foods.

MATERIALS
blindfold, onion, potato, apple, mint leaf, paper plates, plastic spoons, paper towels, water, plastic cups

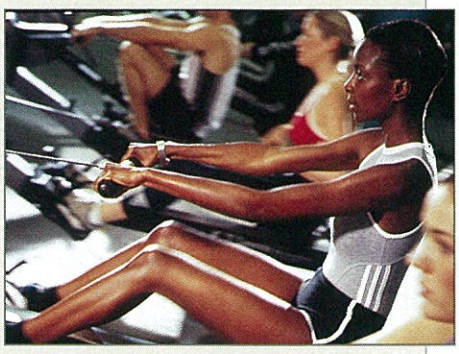
WHAT TO DO
1. Copy the chart to the right.
2. Work with a blindfolded partner. Put a tiny piece of each food on the plate. Have your partner hold his or her nose closed. Using the spoon, give your partner the food to taste but not swallow.
3. Ask your partner to describe the taste and name the food. Write this down in the chart. Have your partner remove the food, put it into the paper towel, and rinse his or her mouth with water. Repeat Steps 2 and 3 with each food sample.
4. Now have your partner leave his or her nose open. Repeat the activity. Again, write down the guesses.
5. Now you be the taster. Repeat Steps 1 to 4.

Food	Nose Closed	Nose Open
Onion		
Potato		
Apple		
Leaf		

DRAW CONCLUSIONS
- Which foods did you recognize with your nose closed?
- Which foods did you recognize with your nose open?
- What can you say about how taste and smell work together?

ON-THE-JOB SCIENCE
Fitness Instructor

Jennifer is a fitness instructor. She knows that heart rate is one measure of how healthy people are. Regular exercise strengthens the heart. A stronger heart pumps more blood throughout the body with each beat. This lets the heart beat more slowly, or less often.



Regular exercise strengthens the heart.

Jennifer's students check their heart rate three times during a workout. They check it when they are "warming up," or slowly building up their pace. They check it when they are working hard, or going at a strong, steady pace. They check it a third time when they slow down their pace. During this cooldown, the heart rate slowly returns to normal.

Some fitness machines exercise both your arms and legs at once. Here is one exercise plan you might use in a gym that has those machines.

Time (in minutes)	Activity	Heart Rate (beats per minute)
5	Warm-up	125
15	Steady pace	145
5	Cooldown	125

An exercise bicycle must be ridden longer because you are not using your arms.

Create a good exercise plan for a bicycle. Write the time and heart rate for each activity.

1. Warm-up
2. Steady pace
3. Cooldown

Critical Thinking

What body systems do you think are most affected by exercise? How are they helped by doing the exercise?

Chapter

10 Review

Summary

The human body has complex body systems and a large brain. These systems control all the body's activities.

Lesson 10.1

Cells form tissues and organs. Organs form into complex systems. The nervous system's main organ is the brain, which receives and sends messages. Hormones also control some body functions and growth. The sense organs are the eyes, ears, nose, tongue, and skin.

Lesson 10.2

Bones give the body support. Muscles allow movement.

Lesson 10.3

At puberty boys and girls develop sexually. This means they can reproduce, using the organs of the reproductive system.

Vocabulary Review

tissue
hormone
system
fetus
organ
skeleton
joint
puberty

Complete each sentence with a term from the list.

1. The heart is an example of an _____ in the body.
2. A _____ is a group of cells that all do the same job.
3. Organs working together form a body _____.
4. Another name for an unborn baby is _____.
5. After a _____ is produced by a gland in the body, it may be circulated in the blood.
6. The time of life that boys and girls develop sexually is called _____.
7. There are 206 bones in the _____ of an adult.
8. A _____ is where two bones meet.

Chapter Quiz

Write your answers on a separate sheet of paper.

1. What are two kinds of body tissues?
2. What are two organs? What do they do?
3. What are two body systems? What do they do?
4. What are the five senses and the organs that go with each sense?
5. Which body organ helps keep you at a steady temperature? How does it do this?
6. Where are billions of your nerve cells found?
7. What are important uses of your bones?
8. What is one kind of voluntary muscle? What is one kind of involuntary muscle?
9. What chemicals cause changes in the body at puberty?
10. What are male and female sex cells called? Where are they made?

Test Tip

Always reread the questions and your answers at the end of a test if you finish early. Many times you know the right answer, but rushing may cause you to make a mistake.

Research Project

Bones continue to grow throughout the teens. To keep them strong and healthy, you need to take in enough calcium in the food you eat. Research how much calcium is needed by an adult man, a 13-year-old boy or girl, and a woman over 50. Write up a daily menu for each person that includes food containing enough calcium.

Chapter 11 Getting Energy Into and Around the Body

Everything you do during the day requires energy. The more active you are, the more energy your body needs. Which people in the picture are using the most energy? Which are using the least energy?

Learning Objectives

- Describe the digestive system and what it does.
- Describe the respiratory system and what it does.
- Describe the circulatory system and what it does.
- Explain how blood pressure and heart disease are linked.
- LAB ACTIVITY: Measure the air in your lungs.
- SCIENCE IN YOUR LIFE: Show how different forms of physical activity affect the health of the heart and other muscles.