An Uneven Sense of Touch

Unlike other senses such as vision, hearing, smell, and taste, the sense of touch is not found in one specific place. The sense of touch is found in all areas of your skin, making it the largest sense organ.

When blind people read, they pass their fingertips over tiny bumps that form the braille letters. There is a reason they use their fingertips: they are loaded with touch receptors. But not all parts of the body have the same amount of touch receptors. Think of your body surface. Which areas are the most sensitive?

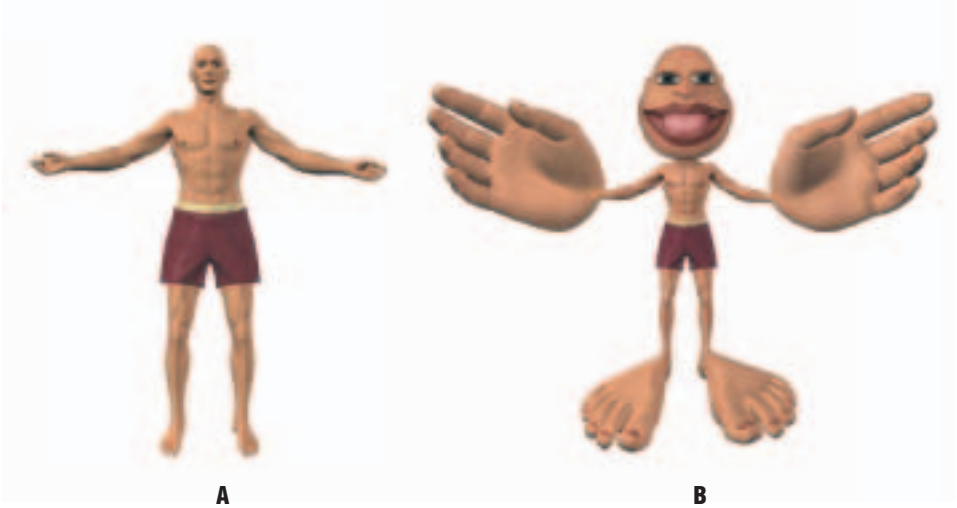

Figure 3.36 Drawing A represents the human body drawn to normal proportions. Drawing B represents the body when each area of the skin is drawn in proportion to its sensitivity to touch.

Check and Reflect

1. Add the nervous system to the systems concept map you started previously.
2. List at least six stimuli you have experienced so far today and which sense was responsible for experiencing each of them.
3. What is the role of the nervous system?
4. Describe the similarities and differences between the central and peripheral nervous systems.
5. Current brain research suggests that the more a particular set of neurons is used in the brain, the more automatic the response becomes. Use this information to explain why practising is so important in learning to play a musical instrument or in playing a sport.
6. How does the structure of a neuron help it to carry out its function?

TRY This at Home

ACTIVITY

CELLS IN 3-D!

Actual cells look much more exciting than the two-dimensional representations you see in photos or through a microscope. Using your current understanding of cell structures, design a three-dimensional model of a cell that is made from common household items.

Make a chart or mind map listing all the household items that you would use to make your cell model. Which cell structures did you include? Why did you choose the item to represent each structure?

Careers and Profiles

MEDICAL LAB TECHNOLOGIST

How would you like a job that saves people's lives? A job that helps people get better from sickness? Most people think only doctors and nurses have jobs like this, but there's another important life-saving job—that of a lab technologist.

Figure 3.37 Technologist testing a blood sample

When doctors see a sick patient, they sometimes have an idea of what the problem is from the symptoms, but they are not totally sure. To find out exactly what's wrong, the doctor sends the patient's specimen (such as a blood or urine sample) to a medical laboratory. At the medical laboratory, a lab technologist takes the specimen and tests it. Infections, such as strep throat, and many serious diseases are often hard to identify without a lab technologist's help.

1. How does a medical lab technologist contribute to human well-being?
2. Does being a lab technologist seem like an interesting career? Why or why not?

Assess Your Learning

1. Imagine you have just eaten a meal containing the sugar, glucose. Using a concept map or flowchart, plot the path and roles for glucose in the body. You should be able to include almost all of the body systems you have studied in your flowchart.
2. a) Which two body systems work together during the process of gas exchange?
   b) Describe how they work together in this process.
   c) Is this an example of interaction? Why or why not?
3. What is the difference between an artery and a vein?
4. Draw and label the parts of the heart.
5. If you were lost in the desert and you hadn't had any water for a day, how would your body respond?
6. What is the role of skin in your excretory system?
7. What is the difference between the somatic nervous system and the autonomic nervous system?
8. Are there any body systems that a person could live without? Give reasons to explain your answer.

The Nature of Science

Scientific ideas help organize, interpret, and explain findings. Review the information you have learned in this section.

1. Models are often used in interpreting and explaining observations. What models have you been introduced to that help explain how parts of the body work?
2. Scientific language is precise and uses specific terms. What are some new terms you have encountered in this section?
3. Why do you think these terms are necessary?

4.0

Scientific investigation leads to new knowledge about body systems and new medical applications.

Key Concepts

In this section, you will learn about the following key concepts:

- health and environmental factors

Learning Outcomes

When you have completed this section, you will be able to:

- describe examples of research into how the body does or doesn't work
- understand how research has led to improvements in health and nutrition
- describe factors that affect different body systems

Surgeons rely on scientific knowledge about body systems.

Scientific research and modern medicine have improved many aspects of our lives. Humans are now living longer and leading healthier lives than ever before. Even those people who, against the advice of their doctors, continue self-destructive activities—such as smoking cigarettes—can do so knowing what the health effects of this decision may be. Others, who decide to live healthier lifestyles, have the benefit of sound advice on how to maintain good health through proper diet, exercise, and lifestyle choices.

4.1 Developing a Theory for Disease

Have you ever fallen off a bike and received a wound that needed attention in the hospital? Have you ever cut yourself with a knife so that you needed stitches? Have you or has anyone you know ever seriously broken a bone?

If you answer "yes" to any of these questions, consider yourself lucky. Why? Because you're alive. If you had lived before the mid-1800s, you would probably have died from your injury. In those days, 50% of people who had some kind of punctured wound and went to the hospital died of infection. That means that if you and your friend lived before that time, and you both cut yourselves and went to the hospital for treatment, the chances were that *one of you would be dead within a week!*

The First Vaccine

That's quite a startling fact. Doctors long ago were really quite helpless when it came to treating their patients for some illnesses and injuries.

During the 1600s and 1700s, people in Europe and the rest of the world suffered and died from a disease called **smallpox**. Victims broke out in a rash filled with pus (called pox). They developed chills, high fever, nausea, and muscle aches. Up to 40% of those infected died and many of the survivors were left blind.

Then in the late 1700s, Edward Jenner, an English country doctor, noticed an interesting coincidence. Milkmaids who had had cowpox, a mild and related form of smallpox, rarely got smallpox. He concluded that contracting the milder cowpox made them immune to the more serious smallpox. Jenner began infecting people with cowpox on purpose. These people became immune to smallpox. Jenner had created the world's first **vaccine**.

Figure 4.1 Edward Jenner (1749–1823) discovered how to prevent smallpox. He called his procedure *vaccination*, from the Latin word *vacca*, which means "cow." Here he is pictured vaccinating a small boy.

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The End of Smallpox

The last recorded case of smallpox occurred in Merca, Somalia, in 1977. The World Health Organization has considered the disease eradicated from the planet since 1979.

Watch Out for Germs!

But what caused disease and infection? That's what doctors and scientists couldn't figure out. Jenner and others tried for nearly 90 years to come up with at least one other vaccine that would prevent disease. They failed, because they just didn't understand what they were dealing with.

The French chemist, Louis Pasteur, did. He was the first person to identify living micro-organisms (organisms too small to be seen with the naked eye) as "germs." He suggested and later proved that germs were the cause of most infectious diseases. Using his knowledge, he found a way to prevent and cure many common but deadly diseases.

Louis Pasteur and the Beginning of Modern Medicine

Figure 4.2 Louis Pasteur (1822–1895) was originally a chemist. His first "great" discovery was finding out why wine and beer spoiled. He proved that yeast was actually a micro-organism and not a chemical, which is what people had thought. More importantly, he showed that it was a micro-organism floating in the air that made the wine and beer go bad.

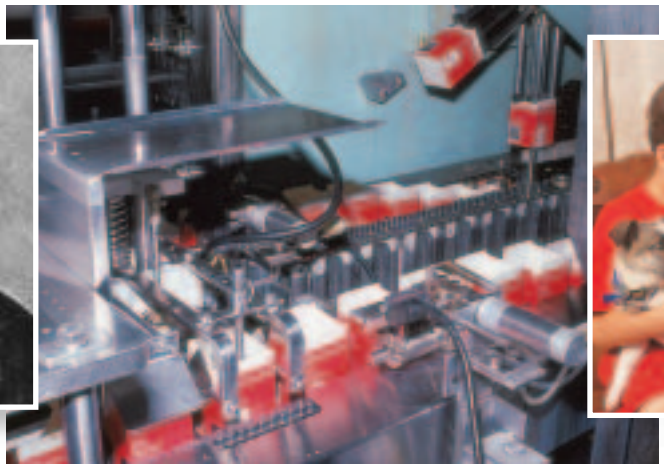

Figure 4.3 Pasteur realized he needed to kill the harmful micro-organisms in wine and beer to keep them from spoiling. His solution was simple but effective. He heated the wine and beer to 60°C, which killed the micro-organisms but didn't change the taste. This process of heating food became known as **pasteurization**. It is still used today for fruit juices, milk, wine, and beer.

Figure 4.4 Pasteur worked tirelessly to produce vaccines and cures for cholera, anthrax, swine erysipelas, and rabies. Now each year, pet owners take their dogs and cats to veterinarians for annual rabies vaccination shots.

Cleaning Up the Germs

Pasteur's discovery of germs led to other discoveries in medicine. For example, Joseph Lister (1827–1912) was an English surgeon. Many of his patients died of infection even though their operations were successful. He thought that these infections were caused by Pasteur's "germs" entering the surgical wounds. So he introduced the practice of cleanliness and sterilization to medical procedures. Before Lister, doctors and nurses never thought about keeping themselves or their patients' wounds and incisions clean.

Inquiry Activity

Tracking Down Disease

Before You Start ...

Long before modern medicine, people realized that certain diseases were spread from person to person. It was important then to find the source and isolate the person or persons until the disease had run its course.

This simulation models how an infectious disease might spread in a group. Your job is to find out which of your classmates is the source of the disease.

Materials & Equipment

- clean test tubes
- labels for test tubes
- eyedroppers
- protective gloves
- standard solution
- phenol red solution

The Question

How difficult is it to find the source of a disease?

The Hypothesis

Form a hypothesis based on the question.

Procedure

1. Write your name on a label to place on your test tube.
2. Don't allow the solutions to touch your skin. Remember, you are simulating an infectious disease!
3. Obtain from your teacher 5 mL of a standard solution in a test tube.
4. Label your test tube.
5. Choose a partner. Put one drop of your solution into your partner's test tube. Have your partner add a drop of solution to your test tube. Gently shake the test tube to mix the solution.

Figure 4.5 Step 5

Figure 4.6

- If your test tube turned red, you are disease-free!
- If your test tube turned yellow, you are infected!

Collecting Data

6. Record the name of your partner in your notebook.
7. Repeat steps 5 and 6 with two other partners.
8. Add 1 drop of phenol red solution to your test tube. Record the colour of your solution.

Analyzing and Interpreting

9. What colour was your test tube? Were you infected or are you disease-free?
10. If you were infected, from whom did you get the disease? How many in the class became infected?
11. As a class, try to track the transmission of the disease. Who was its source?

Forming Conclusions

12. What inferences can you make about the way diseases are spread?

Figure 4.7 Early expeditions to find the Northwest Passage took months and sometimes even years.

Nutritional Research

When early sailors went on voyages of discovery to find the Northwest Passage, the only foods they could take with them were those that would not spoil on the long journey: salt beef, hard bread, dried peas, and cheese. After months at sea, many sailors developed scurvy. They had sores that would not heal, bleeding gums, loose teeth, and an unsteady gait. But in 1747, a British naval surgeon called James Lind successfully treated sailors by feeding them oranges and lemons. It wasn't until very much later that the cause of scurvy was discovered: a lack of vitamin C in the diet.

By studying various diseases such as heart and liver disease, researchers have determined that diet affects the human body. Too much of some foods and too little of others can interfere with the proper functioning of all the body systems. Canada's Food Guide has been developed to show you how much of certain foods you should eat on a regular basis.

Figure 4.8 Canada's Food Guide

Check and Reflect

1. In your opinion, how important is scientific research in solving problems of human health? Give reasons to justify your answer.
2. How does the smallpox vaccine work?
3. Describe how Joseph Lister contributed to human health.
4. Give an example of how nutritional research on cells, organs, or body systems has brought improvement to human health.

4.2 Factors That Affect the Healthy Function of Body Systems

Figure 4.9 Asthma can be managed with medication.

You are outside skating on a frozen pond when all of a sudden your friend stops. He is doubled over and is having trouble breathing. You skate over and ask him what's wrong, but he is having trouble getting enough air to tell you. What do you do?

Luckily, you know your friend has asthma. You notice that he has dropped his inhaler. You pick up the device and give it to him immediately. After taking the medication, your friend feels weak and tired, but he's all right.

Asthma is a condition where the airways become narrowed temporarily. About half a million Canadian children under the age of 19 have asthma. An asthma attack can be triggered by a variety of environmental factors including colds, allergies, dust, cold air, pets, and pollution.

Give it a **TRY** ACTIVITY

IMITATING ASTHMA

You've just read about the effects of asthma. Now you will have a chance to know what having asthma feels like. Breathe normally, first through your nose, then through your mouth. Observe what it feels like. Then, put one end of a drinking straw into your mouth and pinch your nose so that you cannot breathe through it. Now try inhaling air through the straw for 10 s.

- How did your breathing pattern change when you breathed through the straw? Did you feel short of breath?

Caution!
Do not perform this activity if you have any medical condition that could be worsened by temporary shortness of breath.

FACTORS THAT AFFECT HUMAN HEALTH

Scientific research has shown that many factors affect the health of your cells and, therefore, your body systems. These factors include:

- diseases or conditions that you have inherited from your family
- sensitivity to environmental conditions, such as smog, or specific substances such as pollen, dust, or dairy products
- how you respond to physical, emotional, and psychological stresses
- how you treat your body in general (for example, the choices you make about diet, exercise, sleep, and whether or not to smoke)

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How Old Are You?
Smokers are more likely to show signs of aging prematurely and get deeper wrinkles than non-smokers.

Decision Making Activity

The Science of Health

The Issue

What is the best way to maintain the health of our body systems?

Figure 4.10 Maintaining a healthy body

Background Information

1. To make your recommendations, you need more information. Working in groups of three, have each group member choose one of the following body systems to investigate further:
   a) circulatory system
   b) digestive system
   c) respiratory system
2. Use the guidelines below to focus your investigation. Record the process and results of your research with notes, diagrams, flowcharts, tables, and graphs. (Some of these may not apply in all cases. Use your judgment to choose the best methods for recording your data and information.)
   a) List the system's main organs, tissues, and cells. Give examples of key features or specializations of the cells that contribute to the healthy functioning of the system.
   b) List other body systems that support this system. Briefly describe how they support it.
   c) List at least three examples of scientific developments that have improved our understanding of this system and its cells. Briefly describe each example.
   d) Describe at least three ways that we have used our new understanding to improve or safeguard human health.
   e) Identify at least two helpful and two harmful substances that alter the way the cells of this system function. Describe the impact of these changes on its tissues and organs. Include possible effects on other body systems and on the body as a whole.
3. Share your discoveries with other members of your group. Consult with other groups as well. You may have gathered information that they can benefit from, and they may have done the same for you.

Support Your Opinion

4. What do you think is the best way to maintain your body's health? Develop a plan and outline your recommendations. For example:
   - Describe the kind of exercise you would like to maintain for your body and body systems.
   - Write up a balanced diet plan that provides you with the nutrition you need.
   - List the things you can do to reduce stress and enjoy each day.
5. Think back to when you worked in your group. What did you do well as a group? What would you improve upon next time?

Factors Affecting the Respiratory System

You have already read that asthma is a disease that affects the proper functioning of the respiratory system. The decision to smoke is an example of a behaviour that can influence how your respiratory system functions.

The Contents of Cigarettes

Because cigarettes have such huge effects on the respiratory system, it's worth taking a closer look at them. There are over 4000 different chemicals in a cigarette. Tar, carbon monoxide, and nicotine are the most destructive. **Tar** is a dark, sticky substance that forms as a cigarette burns. When a smoker inhales, the tar in the smoke settles on the surface of all the organs of the respiratory system. There are small hair-like projections called cilia on the lining of the respiratory tract. Their function is to move mucus from the lungs and nasal passages to the throat. Research has shown that tar makes the cilia clump together and prevents the movement of mucus.

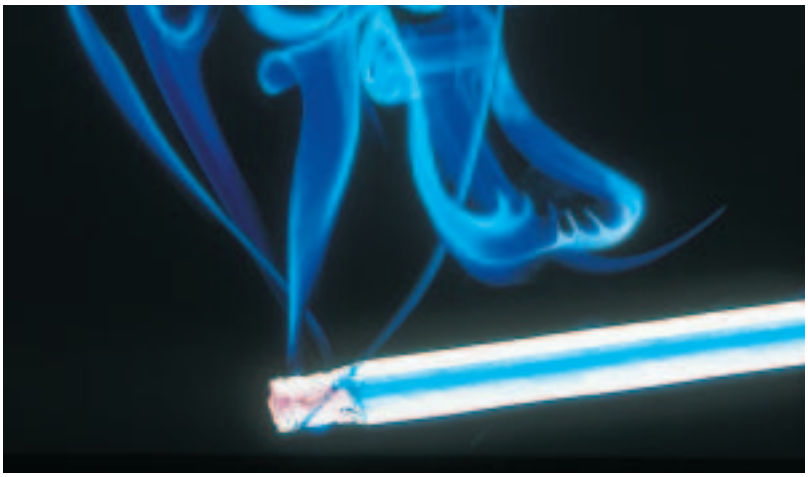


Figure 4.11 Smoke from a cigarette contains over 4000 chemicals.

Carbon monoxide is a colourless, odourless gas that is released when a cigarette burns. In the gas exchange process, carbon monoxide gets absorbed by red blood cells instead of oxygen, so smokers then get less oxygen into their bodies. This causes their hearts to beat faster.

Another chemical found in cigarettes is **nicotine**. Nicotine is a drug that speeds up the heart, and raises the blood pressure. Nicotine is also addictive. Even though tar is more damaging to the body, it's nicotine that keeps smokers smoking.

Smoking-Related Diseases

Smoking can cause a number of serious respiratory diseases including **bronchitis**, **emphysema**, and **lung cancer**. Bronchitis occurs when mucus builds up in the bronchi and causes them to become narrower. People with bronchitis have a hard time breathing. Infections and permanent damage to the lungs can occur if left untreated. Smokers are five to ten times more likely than non-smokers to develop bronchitis.

Figure 4.12 A healthy lung and a damaged lung caused by smoking

Emphysema occurs when the smoke from a cigarette damages lung tissue. The damaged tissue is unable to function properly and breathing becomes difficult. People with emphysema have trouble breathing and are always short of breath. The damage is permanent.

Of the 4000 chemicals in a cigarette, 40 are known to cause cancer. When people develop lung cancer, a tumour or cancerous growth starts to form in the lungs. As the tumour grows, it takes up space in the lungs and makes it harder for the person to breathe. Unfortunately, these tumours are very difficult to locate early on. As the cancer spreads, it becomes much harder to treat. In 1999, 17 400 Canadians died of lung cancer.

Factors Affecting the Circulatory System

Diet can affect the healthy functioning of the circulatory system. One reason why French fries and chocolate taste so good is that they contain lots of fats. (Recall that oils and fats together are called lipids.) When you eat these fatty foods, these fats are turned into cholesterol, a lipid that is found in the blood. The more fat you eat, the more cholesterol enters the bloodstream. Over time, it builds up on the walls of arteries. Look at Figure 4.13. Notice how much narrower the diameter of the artery on the left is.

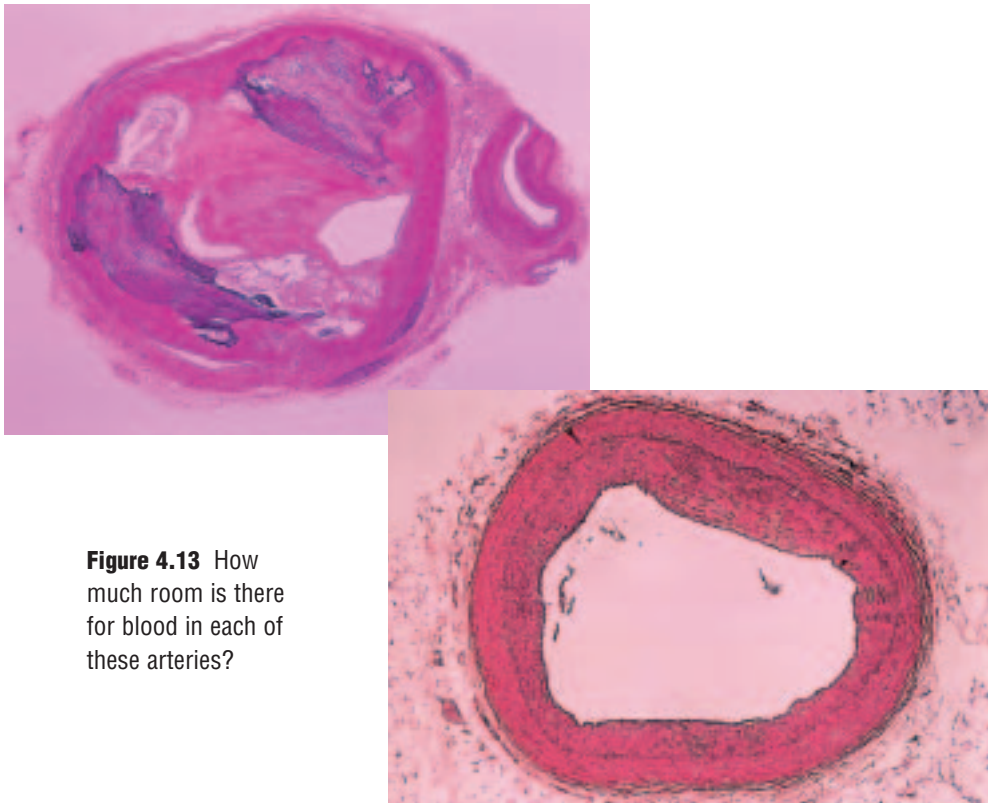


Figure 4.13 How much room is there for blood in each of these arteries?

reSEARCH

Hypertension and Strokes

High blood pressure, or hypertension, is often called "the silent killer." Find out more about hypertension and why it can be so dangerous.

Another factor that can affect the circulatory system is having a stroke. Find out what strokes are and how they can be prevented.

This build-up of cholesterol in the arteries is called **atherosclerosis**. As the arteries become narrower, the heart has to pump harder to move blood through them. If the arteries that feed the heart become blocked, the heart muscle can't get enough oxygen to do its work. This can lead to a heart attack. During a heart attack, heart cells begin to die through lack of oxygen. If people with heart attacks aren't treated immediately, they can die. Sometimes hearts that have been damaged by heart attacks or other diseases can be replaced with heart transplants.

Factors Affecting the Digestive System

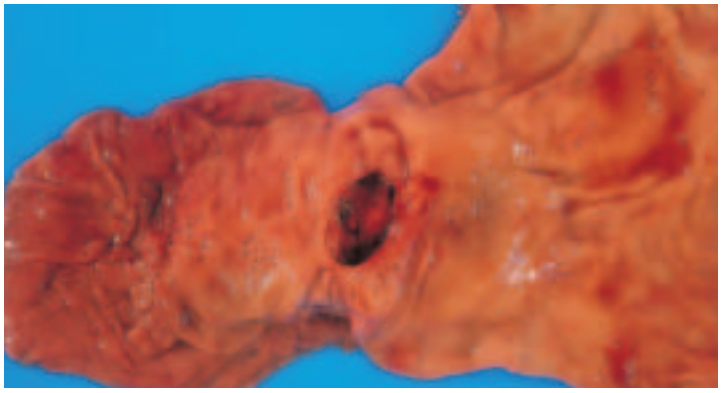


Figure 4.14
Stomach ulcers can be very painful.

There are a variety of factors that can affect the healthy function of the digestive system. A common problem of this system is **ulcers**. They are painful sores of the stomach lining. For a very long time, it was believed stomach ulcers were caused by stress. When a person was under stress, the stomach wouldn't produce enough mucus to protect the lining of the stomach. The gastric juice would then attack the stomach lining causing a painful sore. Now researchers have found that stomach ulcers are caused by a bacteria called *Helicobacter pylori* (or *H. pylori*). Unlike other bacteria you swallow with your food, *H. pylori* is not killed by the strong acidic digestive juices. When this bacteria is present in the stomach, it can break down the mucus layer in the stomach wall. For some reason not yet understood by researchers, not everyone who is infected with *H. pylori* gets a stomach ulcer. Because the cause has been found, the treatment is quite straightforward: taking antibiotics to kill the bacteria.

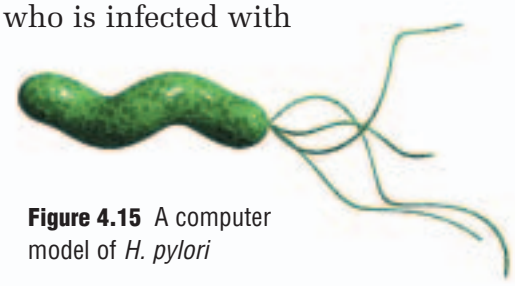


Figure 4.15 A computer model of *H. pylori*

Check and Reflect

1. Give an example of research involving the study of functional or dysfunctional body systems.
2. What are three diseases caused by smoking?
3. What is atherosclerosis?
4. What is a stomach ulcer and what causes it?
5. What is one thing you learned in this subsection you didn't know before?

Assess Your Learning

1. Identify and describe two environmental factors that can affect the health of your cells, organs, or body systems.
2. Name three people whose research led to our early understanding of diseases and how they can be prevented. What did each of those individuals discover?
3. What is pasteurization? Describe a food that has to be pasteurized.
4. Why is it important to know how nutrition affects human health?
5. Describe three chemicals found in cigarettes and explain their effect on the human body.

Focus On THE NATURE OF SCIENCE

Scientific knowledge results from the shared work of many people over time. Scientific knowledge also changes as new evidence is gathered.

1. What scientific knowledge did Jenner discover, and what evidence did he interpret?
2. How did Pasteur's work build on Jenner's discoveries?
3. Why did Lister need to know about Pasteur's work in order for him to make his discoveries?

SCIENCE WORLD

Case Study

Do Energy Bars Boost Performance?

The Issue

Out training for that next track-and-field or triathlon event? Do you wish there were a way you could boost your performance to give you that edge over the competition? Why not reach for the latest in athletic food supplements, an energy bar! You've seen the ads. They claim these bars give you a superhuman burst of energy, allowing you to run faster, jump higher, and throw farther. As a result, athletes are gobbling up energy bars at an unprecedented rate. But are the claims true? Can you believe everything you read? Do energy bars really work?

Should you eat energy bars to boost your athletic performance?

Yes, you should.	No, you shouldn't.
Energy bars are loaded with carbohydrates. Your body uses carbohydrates as fuel to do strenuous activities, like running a marathon. If you run out of carbs during an athletic event, your performance drops. Eating more carbs boosts your performance.	**Other foods like rice, pasta, and bread contain carbohydrates.** Recent scientific studies have shown that a bowl of oatmeal provides the same amount of carbohydrate energy as a typical energy bar.
Energy bars have been endorsed by famous athletes. If famous athletes are endorsing these bars, they must boost your performance.	**Energy bars are expensive.** A bowl of oatmeal costs a lot less than an energy bar.
Energy bars are convenient. An energy bar fits neatly into your pocket so that you can take it with you and eat it on the go. You could not do this with a bowl of oatmeal.	**There is no need for energy bars if you exercise for only a short time.** The body can store enough fuel from carbohydrates to give you about two hours of non-stop, strenuous activity.

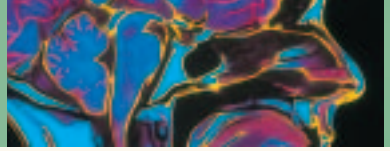
Go Further

Now it's your turn. Look into the following resources to help you form your opinion.

- Look on the Web: Check out energy bars and nutrition on the Internet.
- Ask the Experts: Try to find an expert such as a nutritionist or exercise physiologist. Experts can be found in all sorts of places: your community's health department, universities, hospitals, and government agencies.
- Look It Up in Newspapers and Magazines: Look for articles about energy bars or nutrition.
- Check Out Scientific Studies: Look for scientific studies about exercise and sports nutrition.

In Your Opinion

Write a memo to your coach or local athletic association stating your point of view, and don't forget to support your opinion with facts.



Unit Summary: Cells and Systems

Key Concepts	Section Summaries
1.0 • organisms • cells • organs • structure and function • systems • response to stimuli	**1.0 Living things share certain characteristics and have structures to perform functions.** • All living things share certain characteristics. They are made of cells, require energy, grow and develop, respond to their environment, reproduce, and have adaptations for their environment. • Organisms have structures that allow them to do functions needed to keep them alive. These structures can be very different in different plants and animals. The structures can be slightly different in closely related plants and animals. • Most animals have organs. Different organs that work together to perform a common function are organized into organ systems.
2.0 • cells • tissues • organs • structure and function	**2.0 Cells play a vital role in living things.** • The microscope is an important scientific tool. It allows scientists to see extremely small structures, such as cells. • The cell is the basic unit of life, and all organisms have at least one cell. Cells have structures in them called organelles, which carry out specific functions. The cells of plants and animals are similar, but plant cells have some organelles that animal cells don't have. • Organisms can be made of a single cell or many cells. Multicelled organisms have specialized cells. • Substances move in and out of cells by diffusion and osmosis. Diffusion is the movement of particles from areas of high concentration to areas of low concentration. All cells have a selectively permeable membrane. Diffusion of water through this membrane is called osmosis. • In multicelled organisms, cells combine to form four tissue types in animals and three tissue types in plants. These tissues combine to form organs.
3.0 • cells • organs • tissues • structure and function • response to stimuli • systems	**3.0 Healthy human function depends on a variety of interacting and reacting systems.** • Organs in organ systems all interact to perform certain functions, such as digestion, circulation of the blood, breathing, getting rid of wastes, and responding to stimuli. • All these organ systems interact to keep the body functioning normally. All the systems react to internal stimuli in the body. The nervous system monitors external and internal stimuli and responds to them.
4.0 • health and environmental factors	**4.0 Scientific investigation leads to new knowledge about body systems and new medical applications.** • Research into diseases such as smallpox has led to an understanding about what causes diseases. These discoveries have led to improvements in health and nutrition. • Human health is affected by a variety of factors. Any of these factors can lead to the poor health of cells, organs, or organ systems.

PROJECT

Getting Started

Experiments offer many opportunities for making new discoveries for yourself. In this activity, you will plan and carry out an experiment based on your own "what if" questions. Using a unicellular organism, you will try to determine what its basic needs for survival are. You may wish to refer to Toolbox 2 for further information on planning an experiment.

Your Goal

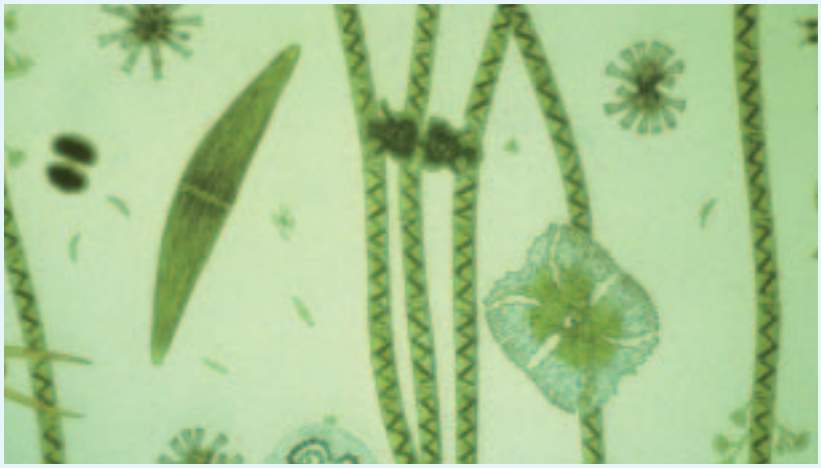
To determine what ways unicellular organisms meet their basic needs.

What You Need to Know

This activity involves asking your own questions about unicellular organisms, planning your own experiments to investigate one of these questions, and drawing your own conclusions from them.

Use the question, "In what ways do unicellular organisms meet their basic needs?" to help you brainstorm all the questions you have about the lives and behaviours of unicellular organisms. Then, review your questions to see which one intrigues you enough to investigate further. Do you see opportunities for experiment that could help you answer your questions?

What Is Needed?



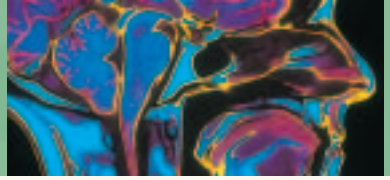
Steps to Success

1. Select a question and write a hypothesis to answer it. Then, plan an experiment to test your hypothesis.
2. Make sure your experiment is a fair test of your hypothesis. How will you know?
3. Decide what equipment and materials you will need. Ask your teacher what live unicellular organisms are available.
4. Write up the procedure you'll follow to perform your experiment. Obtain your teacher's approval, and carry it out.
5. Decide how you will record your results in a clear, meaningful manner. Examples include diagrams, data tables, graphs, and flowcharts. The method or methods you use will depend on the kind of experiment you design.
6. Explain how you decided on the experiment you planned. Which variable did you consider changing? Did you have a control?
7. What do the data you collect mean? Are there other ways to interpret them?

Caution!
Be careful when handling microscopic organisms. Wash your hands thoroughly when you've finished this activity.

How Did It Go?

Based on the experiment you planned and carried out, write a summary statement that answers a question that you have asked. Remember to use your data and observations to support your answer.



Unit Review: Cells and Systems

Unit Vocabulary

1. Create a mind map that illustrates your understanding of the following terms.

cell
diffusion
organ
multicellular
organelle
osmosis
tissue
selectively permeable
system
unicellular

2. Explain the following terms: enzyme, peristalsis, arteries, atrium, capillaries, digestion, nervous system

Check Your Knowledge

1.0

3. What is an organism?

4. Are your fingernails a living thing? Why or why not?

5. Name three different structures animals use for the same function.

6. What is an organ? Name six different organs.

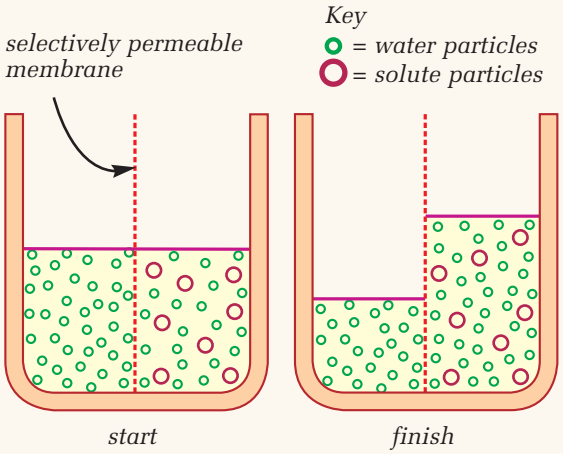
2.0

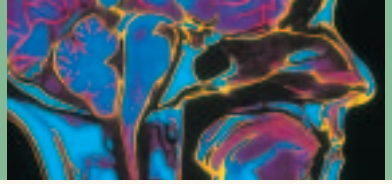
7. a) Which of these terms do scientists use to describe the most basic unit of all living things: *tissues*, *organs*, *cells*, *body systems*?
b) Explain how the other three terms are related to the one you chose in a).

8. a) Draw a labelled diagram comparing a typical plant cell and a typical animal cell.
b) Explain any differences between the cells you drew.

9. Different kinds of specialized cells have different shapes. They often have different organelles, or different numbers of them. For example, the cells that make up muscles have many mitochondria, while the cells that make up skin have very few. Infer a reason why.

10. a) In the illustration below, which particles can move through the selectively permeable membrane? Explain why.
b) Is this an example of diffusion or osmosis? How do you know?
c) Look closely at this illustration. What do you notice? Why do you think this happened?





3.0

11. a) What do these terms have in common, and how are they different: *artery*, *capillary*, *vein*?

b) The layer of muscle tissue that surrounds your arteries is much thicker than the layer that surrounds your veins. How does this difference in structure suit the function of arteries and veins?

12. Agree or disagree with this statement, and give two examples to support your decision: *The organs of humans interact.*

13. Infer from the following information which person could have emphysema.

a) Marta is breathing (inhaling and exhaling) 12 times a minute. She is filling her air sacs with 4200 mL of oxygen-rich air each minute.

b) Douglas is breathing 20 times a minute. He is filling his air sacs with 3000 mL of oxygen-rich air each minute.

c) Cathy is breathing 30 times a minute. She is filling her air sacs with 1500 mL of oxygen-rich air each minute.

14. How does the structure of a villus help the small intestine absorb nutrients?

15. You are playing soccer and you are running to kick the ball. What parts of the brain are active, and what are they doing?

4.0

16. What was Pasteur's contribution to our understanding of disease?

17. What is scurvy?

18. List some of the factors that can affect your health.

19. What is tar, and how does it affect the health of your cells?

Connect Your Understanding

20. Explain how the four sections that you have explored are related to one another. Your explanation can be in the form of a mind map, an illustration, or a written summary.

21. When scientists think about the possibility of life on another planet, they want to know if that planet has water. In fact, scientists find it hard to imagine life without water. Why might that be?

22. Explain the similarities and differences between a cell organelle and an organ system.

23. Meat and fish are sometimes preserved from spoiling by salting them or by placing them in a salty solution. What effect do you think the salt has on these foods?

24. Choose three types of cells in your body. For each, describe how it contributes to your health.

25. Your friend has a bad cold, and has been coughing and sneezing around you. Several days later, you develop a cold. Explain how this could have happened.

26. Identify at least two things that you can do to improve your health. Describe the impact and effect of each of your choices.

27. Based on what you have learned, give two examples of ways that research has improved human health.

28. Give two examples of substances that change the way cells function. Describe their effect, and the consequences of their effect.

Practise Your Skills

29. Your classmate is viewing a specimen using high power and is about to refocus using the coarse adjustment knob. What would you recommend your classmate do and why?

30. A neighbour has brought in a water sample from a nearby pond. He would like you to check the sample for any microscopic organisms. Describe how you would prepare the sample.

Self Assessment

31. Describe one idea that you learned in this unit you would like to explore further.

32. When you did activities in groups, what did your group do well? What did your group need to improve?

33. During this unit, what did you learn about the role, contributions, and limits of science and technology?

34. Do you think that the choices you make about your lifestyle affect the environment?

Focus On The Nature of Science

In this unit, you have investigated the nature of science in relation to cells and systems. Consider the following questions.

35. Turn back to the Focus on the Nature of Science on page 83 of this unit. Use a creative way to demonstrate your understanding of one of the questions.

36. Describe the process of doing a scientific investigation. What are the steps involved?

37. Do you think we know everything there is to know about cells and organ systems? Explain your answer.