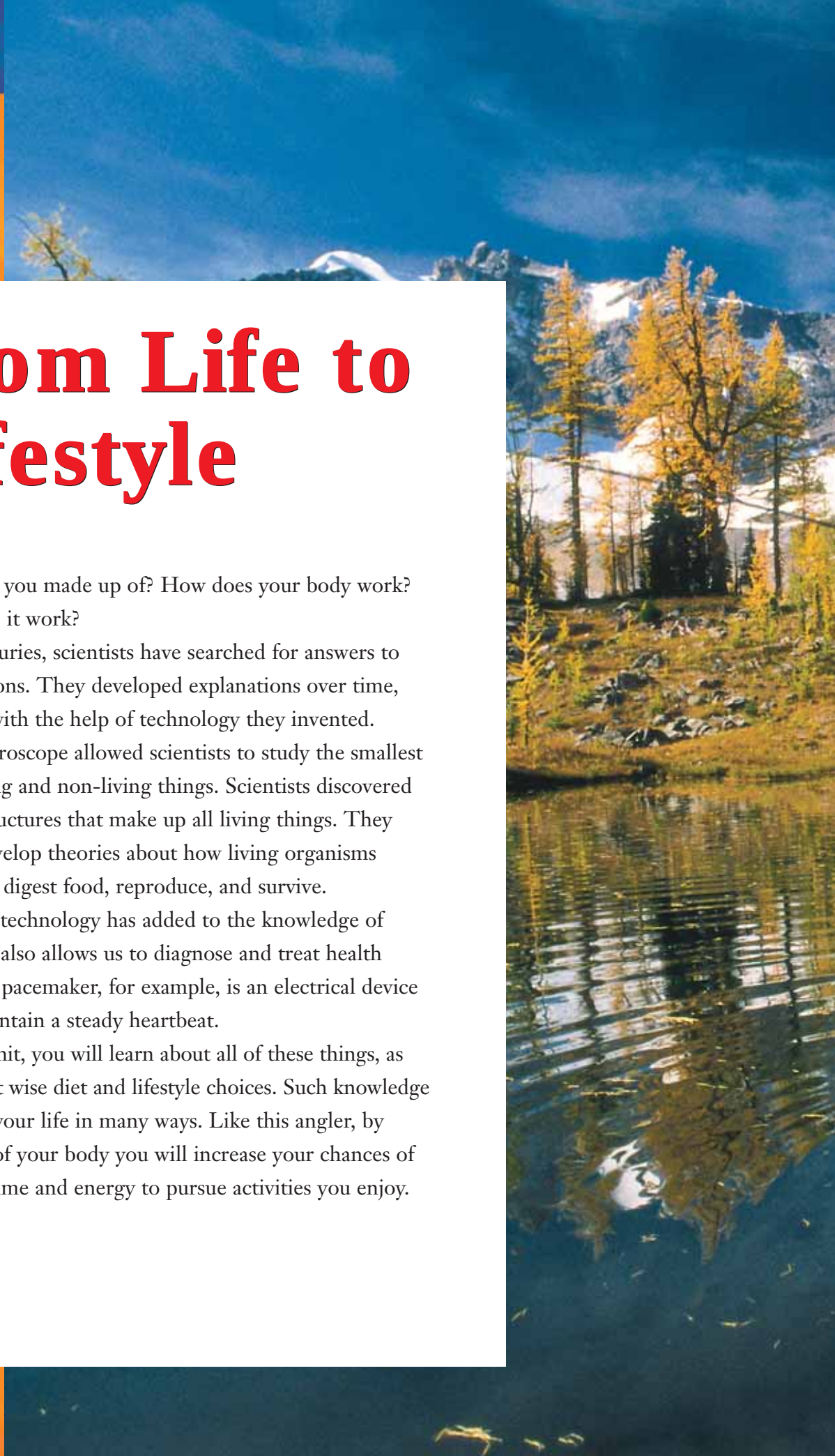
UNIT C

From Life to Lifestyle



What are you made up of? How does your body work? What makes it work?

For centuries, scientists have searched for answers to these questions. They developed explanations over time, sometimes with the help of technology they invented.

The microscope allowed scientists to study the smallest units of living and non-living things. Scientists discovered the basic structures that make up all living things. They began to develop theories about how living organisms move, grow, digest food, reproduce, and survive.

Modern technology has added to the knowledge of scientists. It also allows us to diagnose and treat health disorders. A pacemaker, for example, is an electrical device that can maintain a steady heartbeat.

In this unit, you will learn about all of these things, as well as about wise diet and lifestyle choices. Such knowledge can benefit your life in many ways. Like this angler, by taking care of your body you will increase your chances of having the time and energy to pursue activities you enjoy.

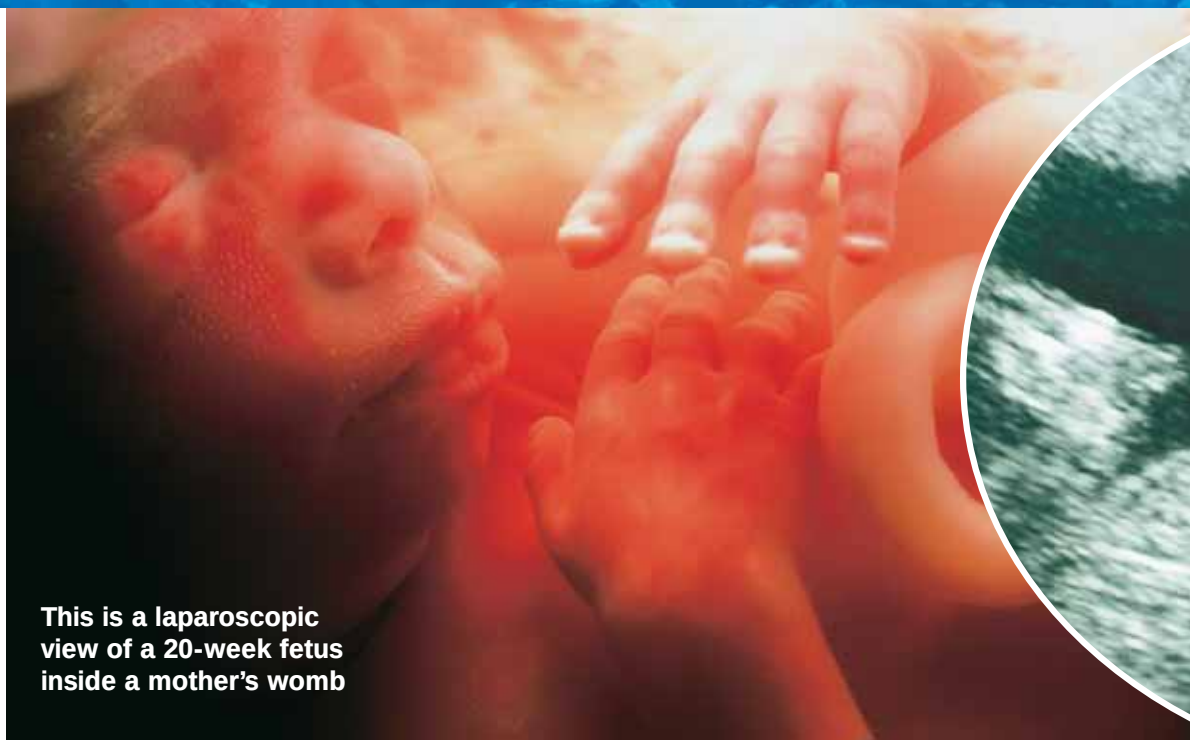
Unit Contents

CHAPTER 8

Structure and Function

Getting Ready...

- What are cells?
- Are cells living or non-living?
- What makes a plant cell different from an animal cell?



This is a laparoscopic view of a 20-week fetus inside a mother's womb

Science Log

Sketch a diagram of a cell. Label all the parts you know. Is your cell a plant cell or an animal cell?

Technology has greatly changed the way we look at the world today. The photographs shown here show an unborn fetus. Today, medical professionals are able to use images such as these to learn many things about a baby long before he or she is born.

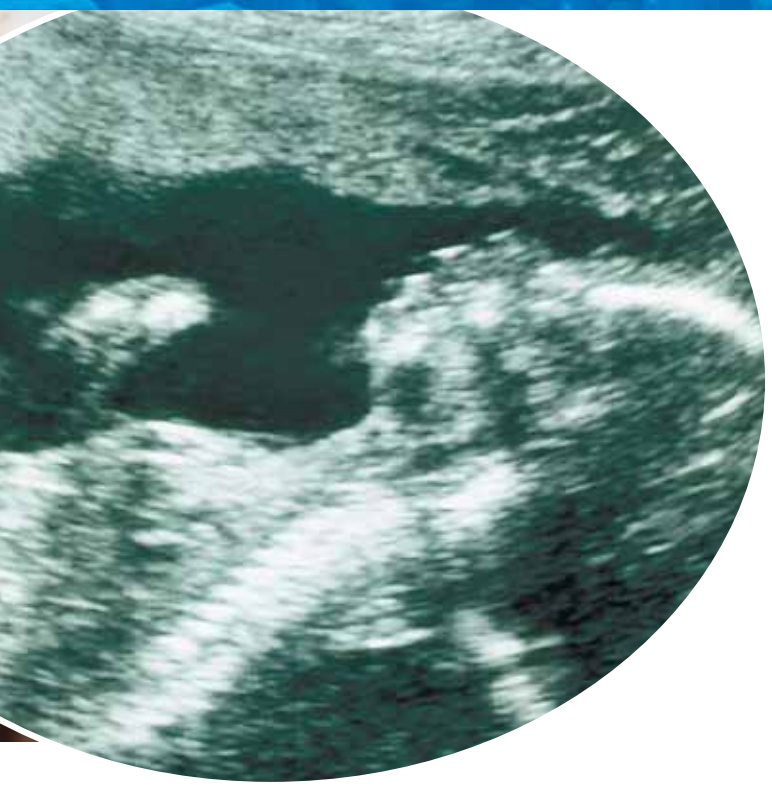
Each baby begins as a single cell. It was not until the **microscope** was invented that scientists discovered that all living organisms are made up of cells.

Prior to using microscopes, scientists could observe objects and organisms only with the naked eye. They developed explanations for what they saw based on assumptions. Because they could not see the basic components of life, they made guesses about these components.

Today's technology allows scientists and students to observe cell structure, cell reproduction and growth, and the basic life processes of an organism.

In this chapter, you will learn how scientists first developed a microscope. You will learn how to use a compound microscope, and then you will use it to discover various structures and functions of plant and animal cells.

# of Plant and Animal Cells



This is a view of another 20-week fetus through ultrasound.

What You Will Learn

In this chapter you will learn:

- how the microscope developed and its history
- what the differences are between plant cells and animal cells
- about various cell structures and their functions
- how the cell theory developed and its components

Why It Is Important

- Each cell has the potential to become a complete organism. Have you heard of cloning? Scientists are using this and other techniques to learn more about cells. What they are learning today may help grow a new limb for you in the future — or prolong your life.

Skills You Will Use

In this chapter you will:

- review how to use a microscope
- prepare wet and dry mounts
- identify and sketch cell structures
- calculate the magnification of specimens under a microscope

Starting Point ACTIVITY

Is It Living or Non-living?

Your team of scientists has landed on Mars and is observing the new environment. One of your team members turns over a rock and finds an interesting object that you have never seen before.

What to Do

1. Discuss the following questions with your team.
2. Summarize your answers on chart paper.
3. Share your information with the class.

What Do You Think?

1. How could you and your team determine if this object is living or non-living?
2. Assume that it is a living thing. How might you determine if it is like a plant or an animal?

8.1 A Closer Look

Figure 8.1 The Janssens' microscope magnified specimens up to 30x. This is a spider face.

Since the beginning of time, people's curiosity about the world around them has generated much discovery and debate. In ancient times, people used simple lenses or glass spheres to examine things. As early as 1590, two scientists named Janssen began to magnify objects up to 30 times their actual size using a microscope they developed (see Figure 8.1).

In the 1600s, a Dutch merchant named Anton van Leeuwenhoek (LAY wen hook) experimented with grinding lenses from high quality glass and even diamonds to make microscopes. Leeuwenhoek was able to magnify his "beasties" (later identified as bacteria) 200 times. His contribution to the development of the microscope allowed people to observe objects invisible to the naked eye.

Today's **compound microscopes** have a much stronger magnification than those early ones. These modern microscopes use light to illuminate the object being viewed. A light microscope will magnify an object 400 to 1000 times its normal size. Figures 8.5 and 8.6 show compound microscopes.

Scientists in Germany invented the first **electron microscope** in 1932. Canadians refined it. In 1938, at the University of Toronto, Albert Prebus of Edmonton and James Hillier of Brampton made it possible to view objects in the smallest details by magnifying them more than 600 000 times. The electron microscope relies on a beam of electrons rather than light.

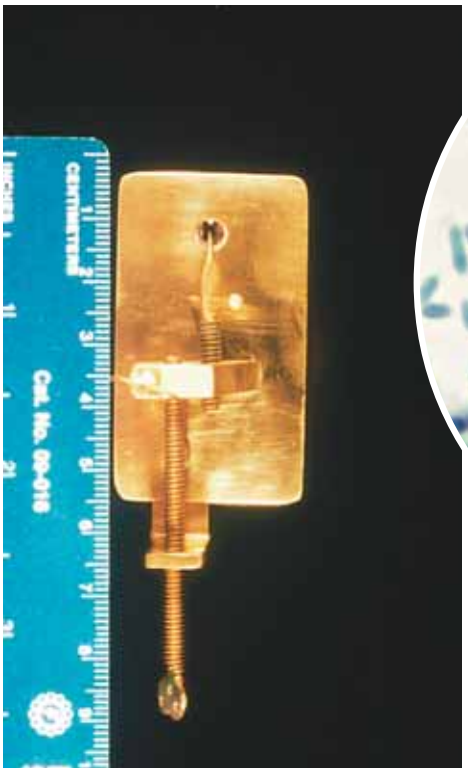


Figure 8.2 Anton van Leeuwenhoek made a single-lens microscope. He held it in his hand and looked through the small lens at an object.

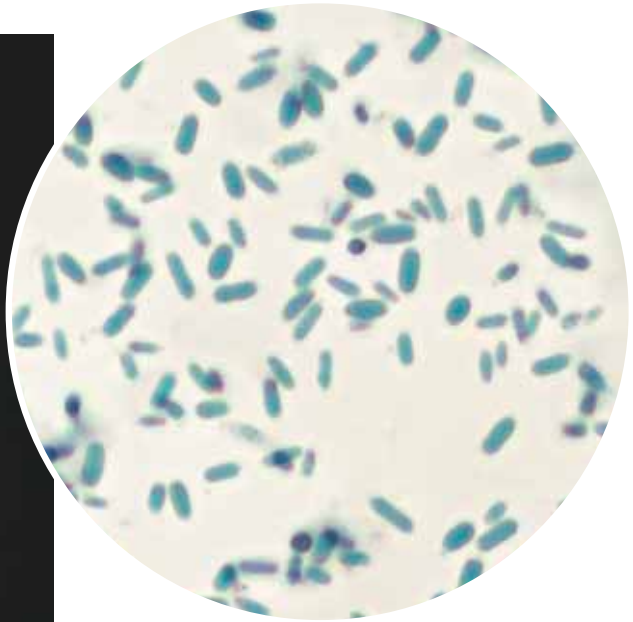


Figure 8.3 The "beasties" that Leeuwenhoek saw are similar to these bacteria that are magnified 200x.

There are two types of electron microscopes: the transmission electron microscope (TEM) and the scanning electron microscope (SEM). The TEM focusses a beam of electrons at a very thin slice of the object under study. The object or specimen is covered in chemicals and is inserted into a vacuum-sealed part of the microscope. Scientists can make detailed observations using the TEM, but the specimen must be dead to be observed.

In the SEM, a beam of electrons is passed over the specimen being observed. This produces a 3-D image of a specimen on a computer screen. Scientists can use the SEM to examine living organisms.

Scientific investigations using the microscope teach us about the living things around us. Scientists and students use many different types and styles of compound microscopes. The two most common styles used in schools today are shown in Figures 8.5 and 8.6. The model on page 160 uses an attached lamp, or condenser, for a light source. The model on page 161 uses a mirror attached at the base to reflect light into the opening in the stage.

READING Check

Describe how the electron microscope differs from the compound microscope.

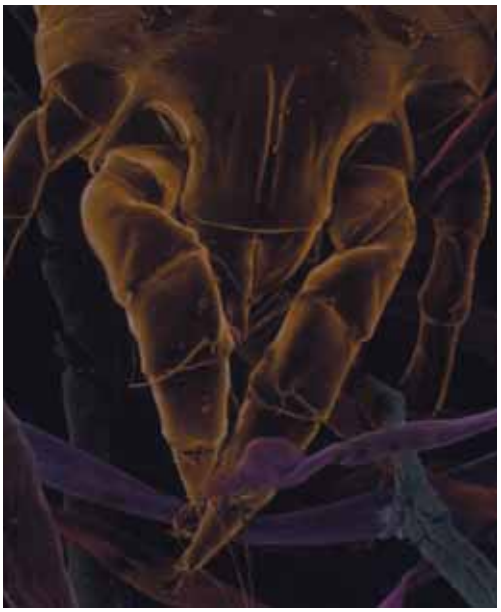
Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

The Scanning Electron Microscope (SEM) is an important tool in medicine and industry. Learn how an SEM works and view images captured by this technology. Go to the above web site, then to Internet Connects, Unit C, Chapter 8, and then to Scanning Electron Microscope.

Figure 8.4 How do these two images of dust mites compare?

A This image of a dust mite is magnified 90x using a compound microscope.



B This dust mite is magnified 400x using a scanning electron microscope (SEM)

Study the parts and functions of a compound microscope. You will discover the basics of how a compound microscope works.

A. LIGHT SOURCE: a bulb or reflection from a mirror sends light up through the object being viewed

B. DIAPHRAGM: controls the amount of light reaching the object

C. STAGE: supports the microscope slide

D. STAGE CLIPS: hold the slide in place

E. OBJECTIVE LENS: magnifies the image

F. TUBE: holds the eyepiece and the objective lens at the correct working distance from each other

G. EYEPIECE: has a lens that enlarges the image from the objective lens

H. COARSE-ADJUSTMENT KNOB: brings the image into focus; used only with the low-power objective lens

I. FINE-ADJUSTMENT KNOB: brings the image into clearer focus; used with the medium-power and high-power objective lenses

J. ARM AND BASE: supports the microscope

Figure 8.5 Microscope with a condenser

Disc CONNECT

The light microscope is an optical instrument. It is used to greatly increase our powers of observation by magnifying objects that are too small to be seen by the unaided eye. What are the parts of the microscope? What is the function of each part? How do you focus the microscope? To answer these and other questions, load the student CD-ROM onto your computer. Launch the **Microscope** applet and follow the instructions.

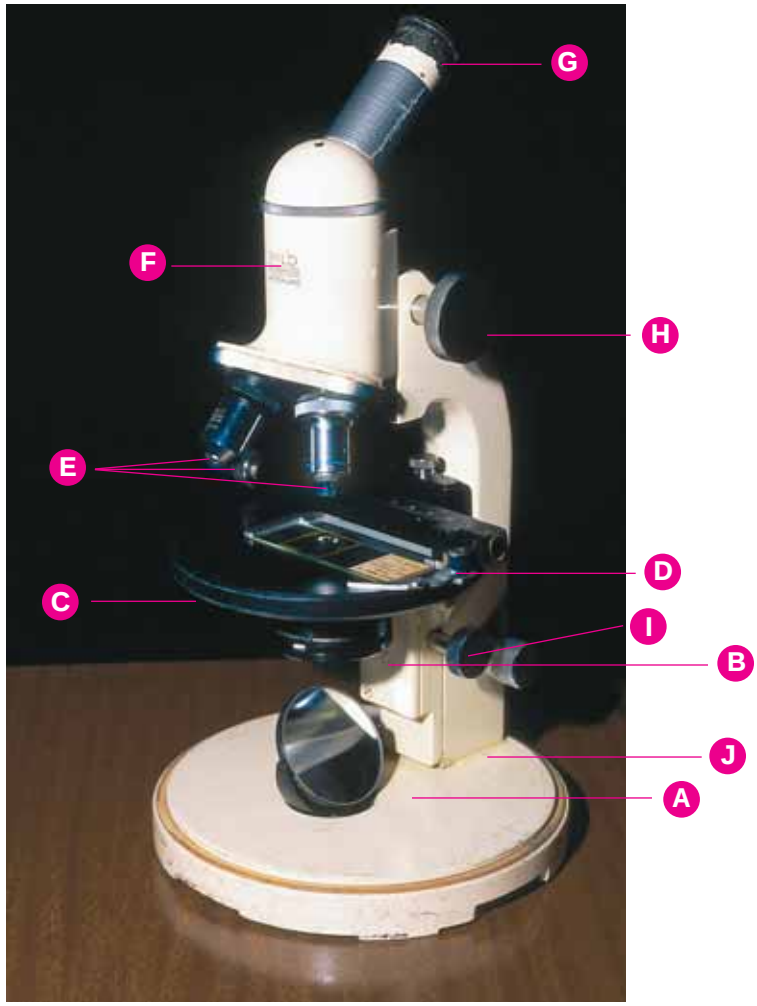


Figure 8.6 Microscope with a mirror

Find Out ACTIVITY

Eye Power

If you wear prescription glasses, find out whether you have to wear them while using a microscope.

Safety Precaution

- If you do not wear glasses or if you are trying this activity with someone else's eyeglasses, do not look through the lenses with the glasses close to your eyes.

What You Need

pair of prescription glasses

What to Do

1. Place this page of the text open in front of you.
2. Hold the glasses at arm's length in front of you. Looking through the lenses, rotate the glasses while looking at the black square.
3. Try this using eyeglasses with different prescriptions.
4. Share what you see with a partner.

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

What Did You See?

1. The square did *not* change shape — If these are your glasses, you can use the microscope without wearing them.
2. The square turned into a rectangle — If these are your glasses, you need to wear your glasses for microscope work!

CONDUCT AN

INVESTIGATION 8–A

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Big, Bigger, Biggest!

The very first microscopes were pieces of curved glass much like the **hand lenses** or magnifying glasses that we use today. Later, people began to vary the curve of the lenses and put them together to make microscopes. **Dissecting scopes** consist of two eyepieces, a low-power lens, and a medium-power lens. In this investigation, you will use these pieces of equipment to observe differences in magnification.

Problem

When is it best to use each of these pieces of magnifying equipment — hand lens, microscope, dissecting scope?

Prediction

Predict when it would be better to use each of the following: a hand lens, dissecting scope, and microscope.

Safety Precautions

- Be sure to carry the microscope properly.
- Never use the Sun as a source of direct light.

Apparatus

compound microscope
dissecting scope
hand lens
pencil

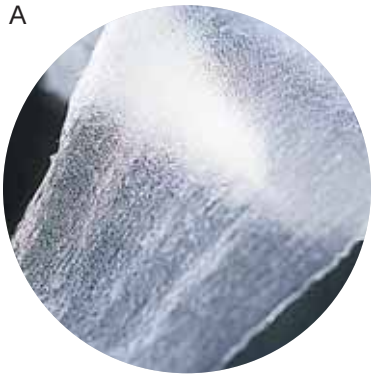
Materials

prepared samples/slides of a bee wing
prepared samples/slides of garlic skin
worksheet

Procedure

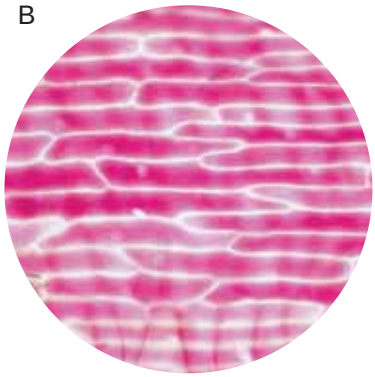
1. Use the hand lens to view the prepared samples of the bee wing and the garlic skin.
2. On your worksheet, sketch what you see. Use Photograph A to guide your observations.
3. Calculate the magnification of your samples.
4. Use the dissecting scope to view the prepared samples.
5. Sketch your observations on your worksheet. Use Photograph B as a guide.
6. Calculate the magnification of your samples.
7. Use the compound microscope to view the prepared samples. Carefully change to higher magnification.
8. Sketch your observations. Use Photograph C as a guide.
9. Calculate the highest magnification you used when observing your samples.
10. Wash your hands when you have finished.

A



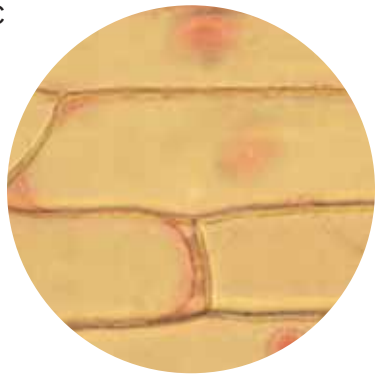
Onion skin magnified 5x using a hand lens

B



Onion skin magnified 20x using a dissecting scope

C



Onion skin magnified 400x using a compound microscope

Analyze

1. Which piece of equipment was the easiest to use? Why?
2. Which piece of equipment showed the most detail?

Conclude and Apply

3. Identify a situation where you would use each piece of magnifying equipment to the best advantage.
4. Make a list of at least three things that were discovered because the microscope was invented.

Try This!

Place a piece of plastic wrap over some text on a piece of paper. Use a medicine dropper to put a drop of water on the plastic. What happens to the text?

How to Calculate the Magnification of Samples

To calculate the magnification of samples, multiply the magnification of the eyepiece by the magnification of the objective lens.

Example

magnification of eyepiece 10x
magnification of objective lens 4x
Total magnification = $10 \times 4 = 40$

Use the same method to find the magnification of these samples:

1. magnification of eyepiece 10x
   magnification of objective lens 10x
2. magnification of eyepiece 10x
   magnification of objective lens 40x

Key Terms

microscope
compound microscope
electron microscope
hand lens
dissecting scope

Check Your Understanding

1. Which instrument would scientists use to magnify small objects up to 10X? 20x? 1000x? thousands of times?
2. Why is it better to view a specimen under the low-power objective lens before going to the high-power objective lens?
3. Why should you not use the coarse-adjustment knob with the medium-power and high-power objective lenses?
4. With a partner, discuss how the following people helped to develop the microscope:
   – the Janssens
   – van Leeuwenhoek
   – Prebus and Hillier

8.2 Cell Theory

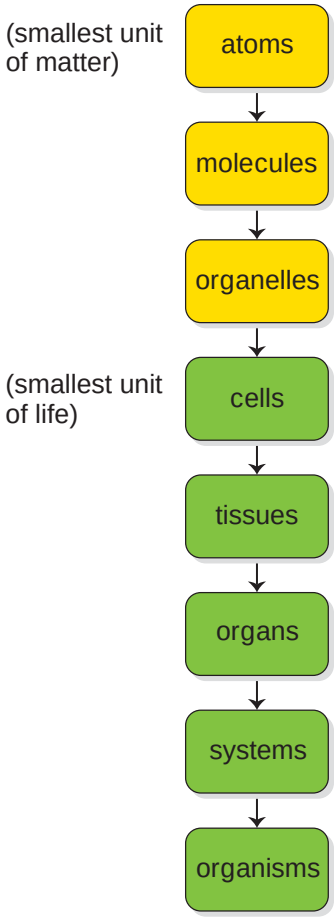


Figure 8.7

One of life's most unique and fascinating characteristics is how it is organized. At the centre of the flowchart shown here, you see the **cell**. The cell is the smallest unit of life and is therefore the building block of all living organisms. Cells, however, must come from somewhere. What makes up a cell?

There are three levels of organization below the cell. The cell is made up of smaller units called **organelles**. Organelles are parts of a cell that carry out a particular function or role. In turn, organelles are made up of molecules, and molecules are composed of atoms.

Atoms are the smallest unit of matter, both **living** and **non-living**.

When cells combine and work together to carry out a specific task or function, they are called **tissues**. For example, the muscles you use to move your eyes to read this page are tissues.

As two or more tissues combine and work together to perform a specialized role, they are called **organs**. Your stomach is made up of many different tissues and is a major organ in your body.

In complex organisms such as humans, organs also work together in **systems**. Your digestive system is a complex set of organs including the stomach, the liver, the gall bladder, and the pancreas.

The first person to see individual cells and give them that name was Robert Hooke. Hooke was an English scientist during the 1600s who used an early compound microscope. While looking at samples of cork, he wrote in his journal that he could see individual pockets that looked like little rooms. He called them "cells" from the Latin word *cella*, meaning a small room. Today, we know that what Hooke actually observed were the cell walls of dead cork cells.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

What are the two main types of cells? What organelles are found in cells? What is the function of each cell organelle? To answer these and other questions, go to the above web site, then to Internet Connects, Unit C, Chapter 8, and then to Plant and Animal Cells.

From their investigations of cells, scientists have formed theories or beliefs about cells. A **theory** is an explanation of something that has been supported by repeated experimental results. The majority of scientists have accepted the cell theory that follows:

1. All living organisms are made up of cells.
2. Cells are responsible for function and structure in all living organisms.
3. All cells are reproduced from other living cells.

Bacteria and amoebas are examples of **organisms** made up of only one cell. You are likely more familiar with organisms made up of more than one cell.

READING Check

Cells are the building blocks of life. What are the building blocks of the cell?

Just like every living organism, individual cells carry out all the activities necessary in order to survive. These necessary activities or **life processes** include reproduction, growth, and transportation. You will learn more about these activities — and other life processes — in chapter 9.

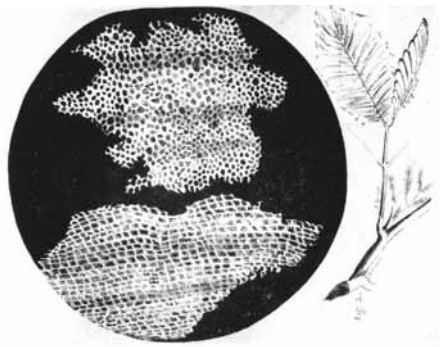


Figure 8.8 Hooke noticed a regular pattern of box-like squares in cork cells.

Check Your Understanding

1. Do scientists today believe in the cell theory? Explain why or why not.
2. Use a chart to compare living and non-living cells.
3. Develop a short oral explanation of the cell theory.
4. Make a table with two columns.
   - In the first column, list the levels of organization in living organisms. Begin with cells.
   - In the second column, give an example of each level.

Key Terms

cell
organelle
living
non-living
tissue
organ
system
theory
organism
life processes

8.3 Plant and Animal Cell Structures

DidYouKnow?

The crunch that celery makes when you eat it comes from the cell walls breaking.

Cells are able to carry out life processes because of their organelles. Organelles are structures or forms within a cell that carry out a specific function.

Some organelles are common to both plant and animal cells — for instance, the cell **nucleus**. The nucleus is the cell's "brain" or control centre. It controls the manufacture of materials within the cell. It also directs the overall functioning of the cell.

Other organelles are specific to either a plant or an animal cell. Conduct an Investigation–8B will help you identify the structure of many organelles within a plant cell.

Parts of the Cell

Be aware that drawings can be misleading because they show cells as two-dimensional (2-D) when they are really three-dimensional (3-D). Drawings may show only one mitochondrion. There could be hundreds!

A. NUCLEUS: controls all of the activities in the cell. The nucleus is the "brain" of the cell. It contains the DNA, which holds hereditary instructions for things like height and eye or hair colour.

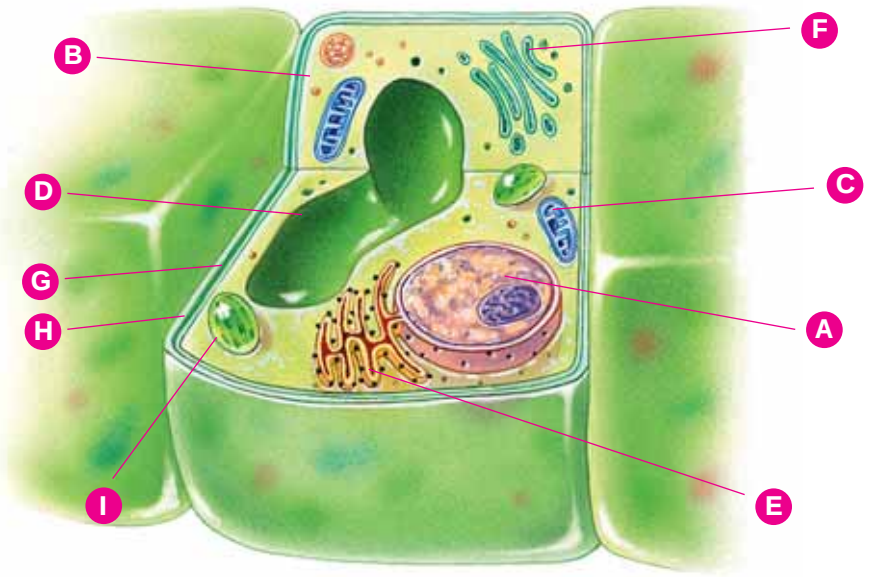


Figure 8.9 Plant cell

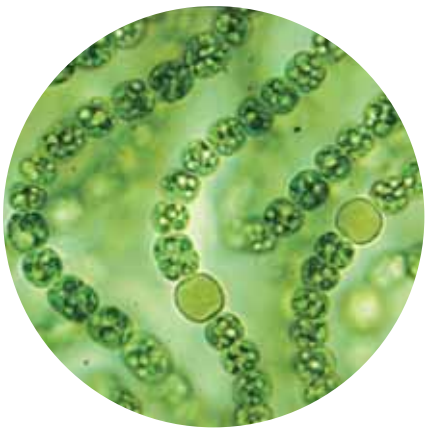


Figure 8.10 Pond scum magnified 1000x

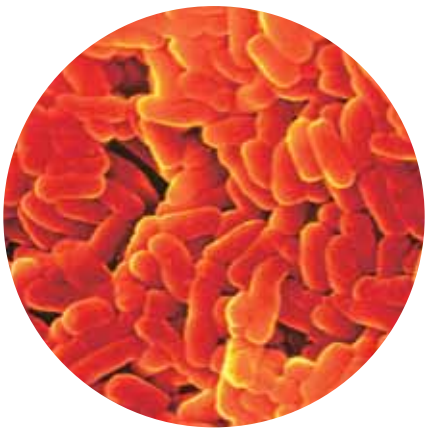


Figure 8.11 Bacterial cells magnified 11 408x

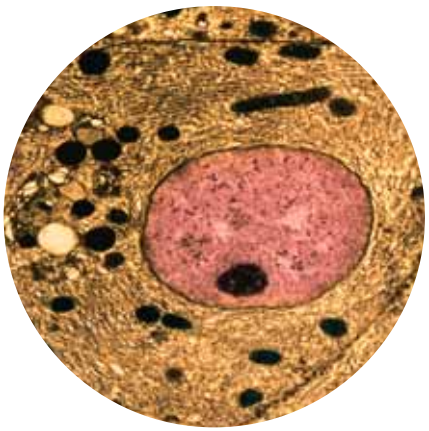


Figure 8.12 Animal cell magnified 1875x

B. CYTOPLASM: holds all the other organelles in place. This jelly-like substance surrounds the nucleus.

C. MITOCHONDRION: releases energy in the cell. This is the "powerhouse" of the cell. It uses oxygen and releases energy from digested food.

D. VACUOLE: stores water, food, and waste that the cell cannot use right away. This looks like an empty sac.

E. ENDOPLASMIC RETICULUM (ER): transports materials. Food, water, and waste move around and out of the cell through the ER.

F. GOLGI BODY: packages and transports proteins, and holds waste products until the cell is ready to get rid of them. This is a specialized part of the ER.

G. CELL MEMBRANE: separates the inner parts of the cell from the surrounding environment. This is semi-permeable — it allows some things, such as water and food molecules, through to the inside of the cell, but keeps things out that may be harmful or unnecessary.

H. CELL WALL: provides protection and strength for the cell. This is a non-living part and is found only in plant cells.

I. CHLOROPLAST: contains pigment called chlorophyll, which gives colour to plants. This also provides a large surface area to collect sunlight for photosynthesis. Chloroplasts are found only in plant cells.

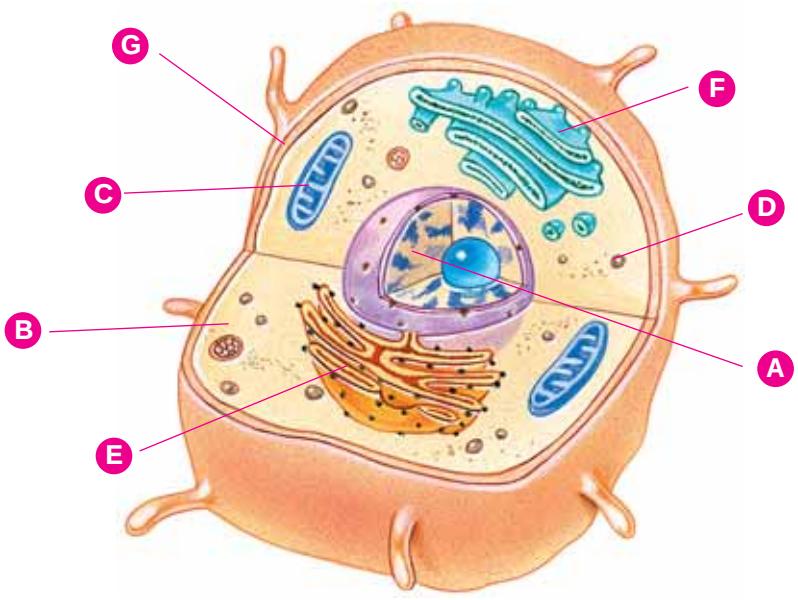


Figure 8.13 Animal cell

READING Check

How can you distinguish between a plant cell and an animal cell?

Figure 8.14 Plant cell magnified

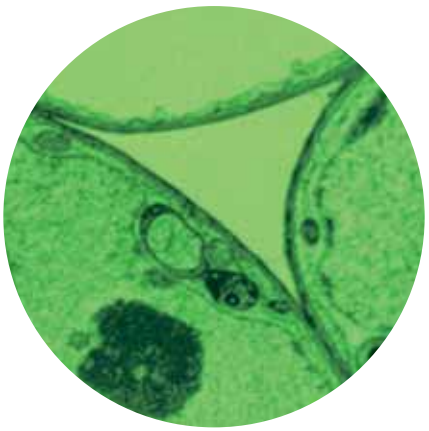


Figure 8.15 Plant cell magnified

Figure 8.16 Animal cell magnified

CONDUCT AN

INVESTIGATION 8–B

SKILL CHECK

Initiating and Planning

Performing and Recording

Analyzing and Interpreting

Communication and Teamwork

Plant Cell Organelles

Plant and animal cells have many features that are the same and some that are very different. In this lab, you will prepare and observe various plant cells under a microscope. You will add a stain to make the cell parts more visible. At the end of the lab, you will be able to identify many plant cell organelles.

Problem

How many plant cell organelles can you identify using a microscope?

Prediction

What organelles do you expect to see under the microscope?

Safety Precautions

- Do not use the Sun as a direct source of light.
- Use caution when handling iodine solution. It can cause skin irritations and stain your skin and clothing. The vapours can be toxic if inhaled in large amounts. Iodine can ruin equipment, so clean up any spills immediately.
- Be careful to cut away from yourself when slicing sections of cork.

Apparatus

compound microscope
medicine dropper
razor blade or sharp knife
5 slides and 5 cover slips
tweezers

Materials

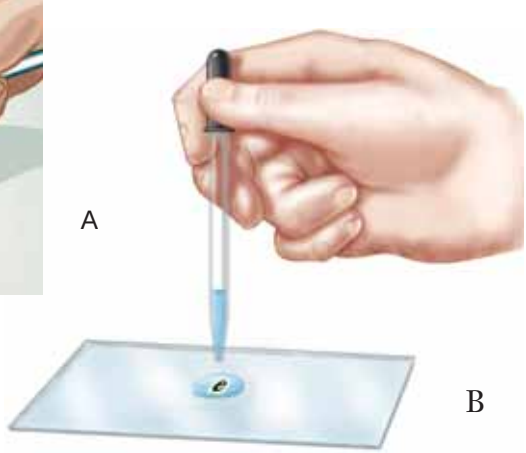
cork
iodine solution
leaf from a small-leafed water plant such as Hornwort or Cabomba
tissue paper
tomato skin
tap water

Note: This lab has three parts. Each part will require some different materials and some different procedures. Be sure to read instructions carefully.

Procedure

Part 1: Cork Cells

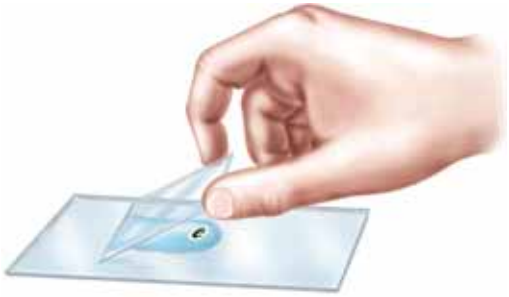
1. Cut a thin slice of cork.
2. Use tweezers to place the slice of cork in the centre of a slide.
3. Use the medicine dropper to place a drop of water on the cork.



A

B

4. Pick up a cover slip by its edges. Place the cover slip, in an upright position, on the slide near the drop of water.
5. Gently lower the cover slip over the cork sample.
6. Use the tissue to blot up excess water.
7. Place the slide on the microscope stage. View the cork under each power setting, starting with the lowest one.
8. Sketch your observations. Use your textbook to help you label the parts of the plant cell you can identify.



Part 2: Tomato Skin

1. Peel off a piece of tomato skin about the size of your smallest fingernail.
2. Use tweezers to place the skin on the slide — the outside of the skin should face up.
3. Prepare a wet mount of tomato skin. Follow steps 3–6 of Part 1.
4. Place your slide under the microscope and view it at each power setting, starting with the lowest one.
5. Sketch what you see. Use your textbook to help you label the parts you can identify.
6. Lift the cover slip and add a drop of iodine solution to make a stained wet mount of the tomato skin.

7. Place your slide under the microscope and again view it at each power setting, starting with the lowest.
8. Sketch your observations. Label any cell parts you can see.

Part 3: Leaf

1. Prepare a wet mount of a leaf.
2. Observe your leaf under each power setting, starting with the lowest.
3. Sketch your observations. Use your textbook to help you label the cell parts you can see.
4. Stain your wet mount with iodine solution.
5. Place your slide under the microscope and view it at each power setting, starting with the lowest.
6. Sketch what you see. Label the cell parts you can identify.
7. Wash your hands thoroughly after completing the investigation.

Analyze

Part 1

1. Are these cork cells alive or dead? Explain why you think so.
2. What is inside the cell walls?
3. Why do corks float?

Part 2

4. What is the difference between a cell wall and a cell membrane?

Part 3

5. What colour are chloroplasts?
6. What is the name of the pigment found inside the chloroplasts?
7. What is the purpose of the pigment?
8. In what part of a plant (that is, root, stem, leaf, flower) do you usually find chloroplasts?

Conclude and Apply

9. Compare the shape of the plant cells you observed with the plant cell in your text on page 166.
10. List the plant organelles you were able to identify from your specimens.
11. List the organelles you were not able to identify from your specimens.
12. Suggest why you could identify some, but not all, organelles.
13. Did staining the tomato skin and the plant leaf help you identify any additional organelles? If so, list the additional organelles you saw.
14. Would staining the cork cells have helped you to identify other organelles? Explain.

Extend Your Knowledge

15. Your teacher will provide you with some slides of various animal cells.
    - View them to identify parts of an animal cell.
    - Choose one slide and sketch what you see. Use your textbook to help you label the cell parts you can identify.
    - Explain how your observations of animal cells differ from your observations of plant cells.

DESIGN & DO

INVESTIGATION 8–C

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Edible Cells

Making an edible cell will help you remember the parts of a cell and their functions. Besides, it's fun!

Challenge

Design and build edible plant and animal cells that contain all the necessary parts.

Safety Precautions

- Wash hands and work area thoroughly before and after handling food.
- Never eat or drink anything in the science lab.

Materials

icing

2 large flat cookies (such as oatmeal or shortbread)

Popsicle™ stick

various colours and shapes of candy and licorice

Design Criteria

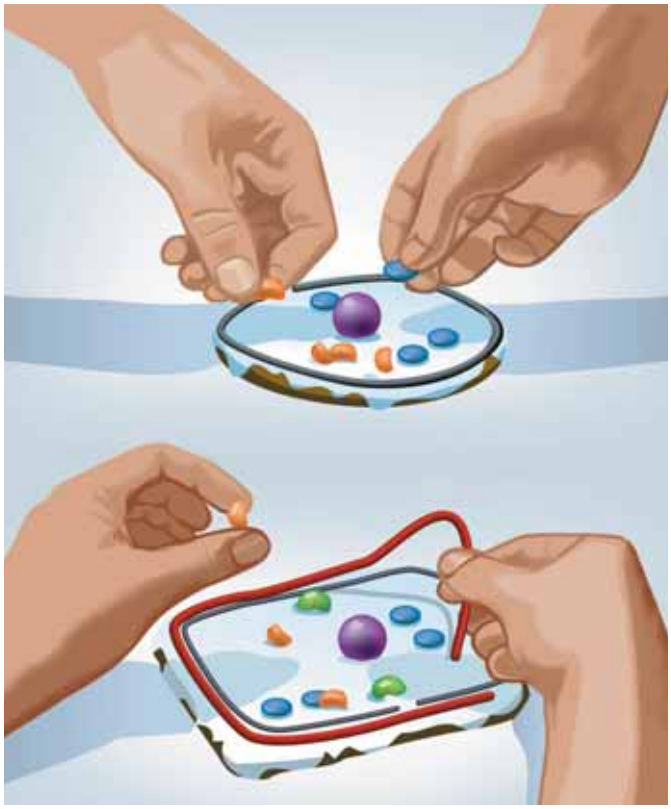
A. You need to make both a plant cell and an animal cell.

B. You need to represent all of the organelles mentioned in this chapter.

C. The organelles should look similar to those found in an actual cell.

Plan and Construct

1. In your small group, make a list of the organelles you need to represent. Brainstorm ideas about what kind of candy best represents the shape of each organelle.
2. On your own, beside each organelle on your list, record its function and the kind of candy you will use to represent it.
3. Sketch and label your edible cell in your notebook.



4. Build your cell. Use the Popsicle™ stick and the icing to glue your cell parts onto your cell. Have fun and be creative! **Do not** sample the candies or icing while working on the activity.
5. Wash your hands, the work area, and all equipment.

Evaluate

1. Be prepared to show your teacher your edible cells when you have finished them.
2. Choose a partner. Take turns identifying and explaining the function of each cell part. Also explain your choices of particular types of candy to represent each part.
3. How was it helpful to work as a group? How could you improve your group work?

INVESTIGATION 8–D

SKILL CHECK
- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Who Did It?

Think About It

Forensic experts use tools such as microscopes to solve crimes. Sometimes, materials collected at a crime scene are used as evidence. Careful examination of such materials can help forensic experts solve crimes.

Take a look at the various pieces of hair in the photos here. Hair from each species is unique. Examining the hair found on crime suspects can therefore help to determine whether or not the suspects might have been near the scene of a crime.

To see how this works, examine the police records in the notebook below and the various hair samples collected from the two crime suspects. Which of the two suspects has been hunting rabbits out of season?

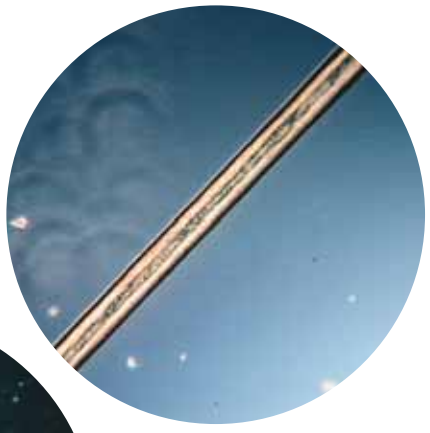
Suspect 1: female
brown hair
65 kg 175 cm
1993 blue truck
DOB: November 18, 1982
shell casings in truck box
snare wire in glove box
Suspect 2: male
blond hair
100kg 190 cm
DOB: March 2, 1982
searchlight in possession
used snare wire in right jacket pocket
pocket knife with snare wire

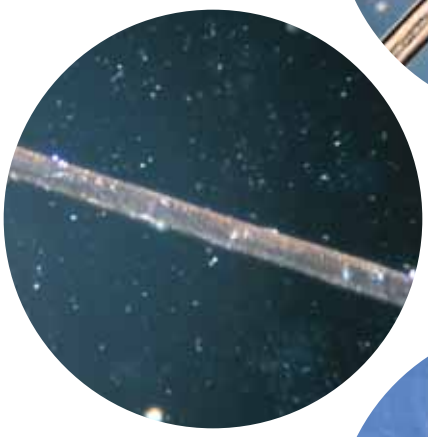
Discovery Evidence:
1. Found a variety of hair samples on each suspect's clothing:
suspect 1 – three samples
suspect 2 – four samples
2. Each suspect submitted a specimen of head hair.
3. Suspect 1 owns a dog.
4. Suspect 2 owns a cat.
5. Type of hair– rabbit hair in truck?

Crime Lab Report

The evidence collected confirmed five different hair samples.

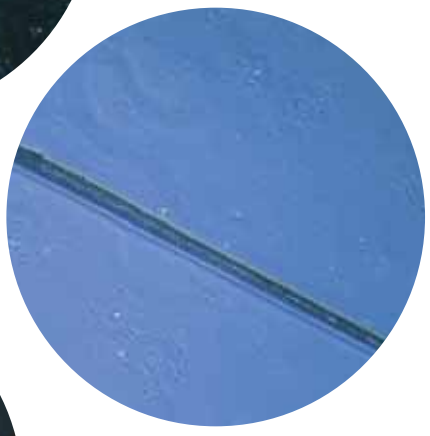
Brown hair sample

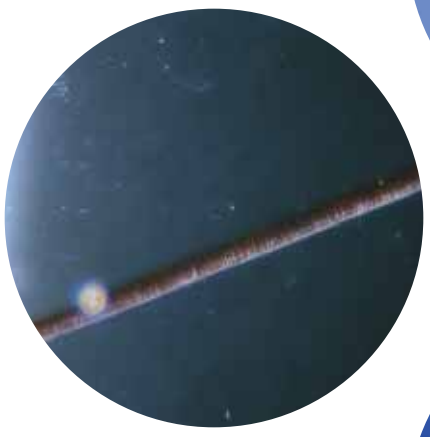




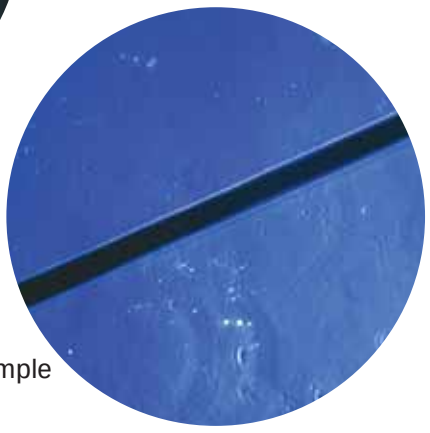
Blond hair sample

Rabbit hair sample





Cat hair sample



Dog hair sample

Safety Precautions

Apparatus

microscope
slides
cover slips
tweezers

Materials

hair samples (brown human hair, blond human hair, rabbit hair, dog hair, cat hair)

What to Do

1. Obtain one of each of the hair samples collected at the crime scene from your teacher.
2. Prepare a slide of each sample. You will get better results if you prepare slides from the root area.
   - View each sample under the microscope, starting with the lowest power.
   - In your notebook, draw a sketch of each sample.
3. Identify each of your samples. What is the source of the hair?
4. Wash your hands thoroughly and clean up the work area.

Analyze

1. List the hair samples found on Suspect 1.
2. List the hair samples found on Suspect 2.
3. Based on the evidence, which suspect do you think committed the crime?
4. Do you think this method is foolproof? Explain your answer.

Extend Your Skills

5. What other technologies could experts use to analyze this evidence?
6. Find out what other evidence investigators usually collect at crime scenes.

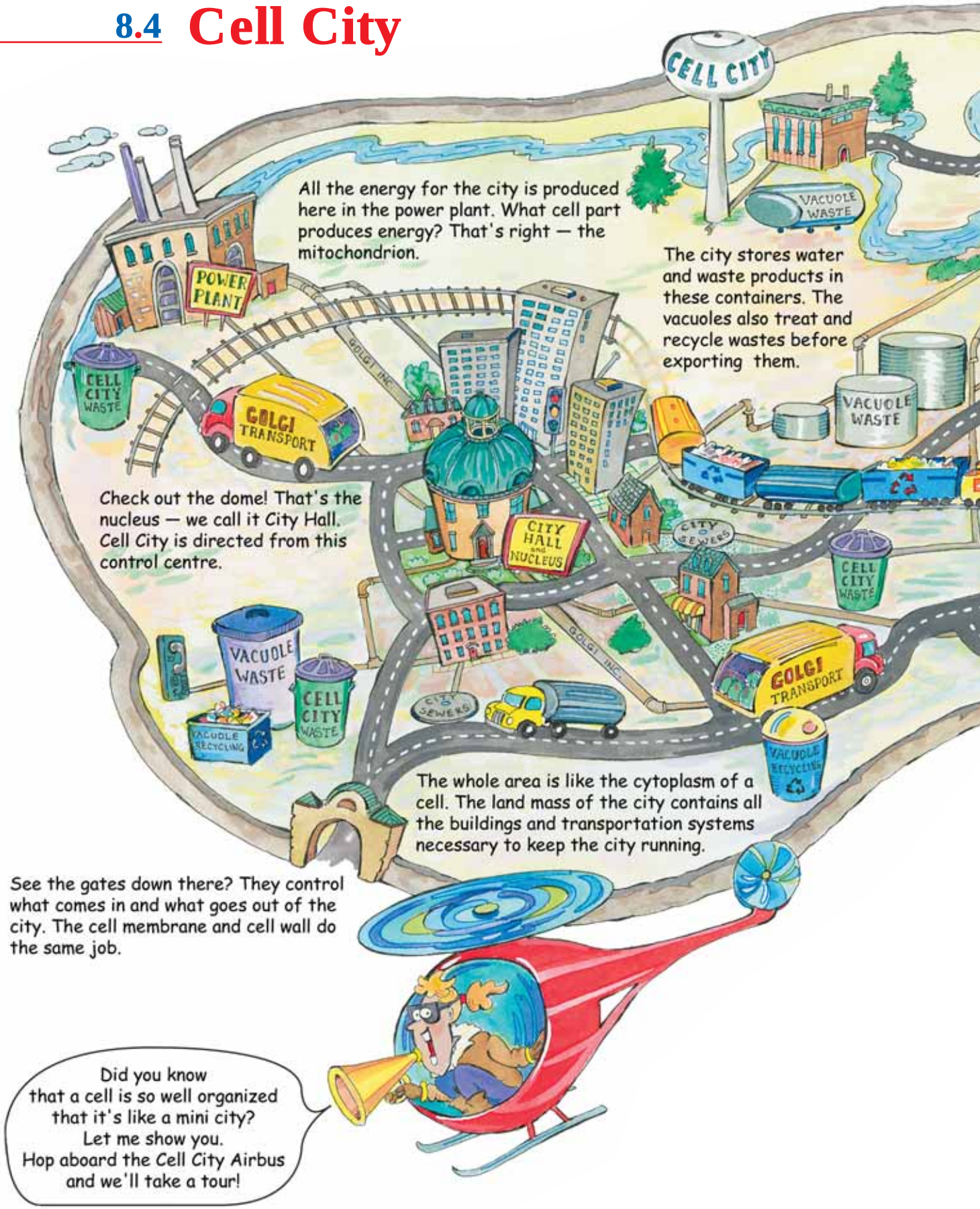
Check Your Understanding

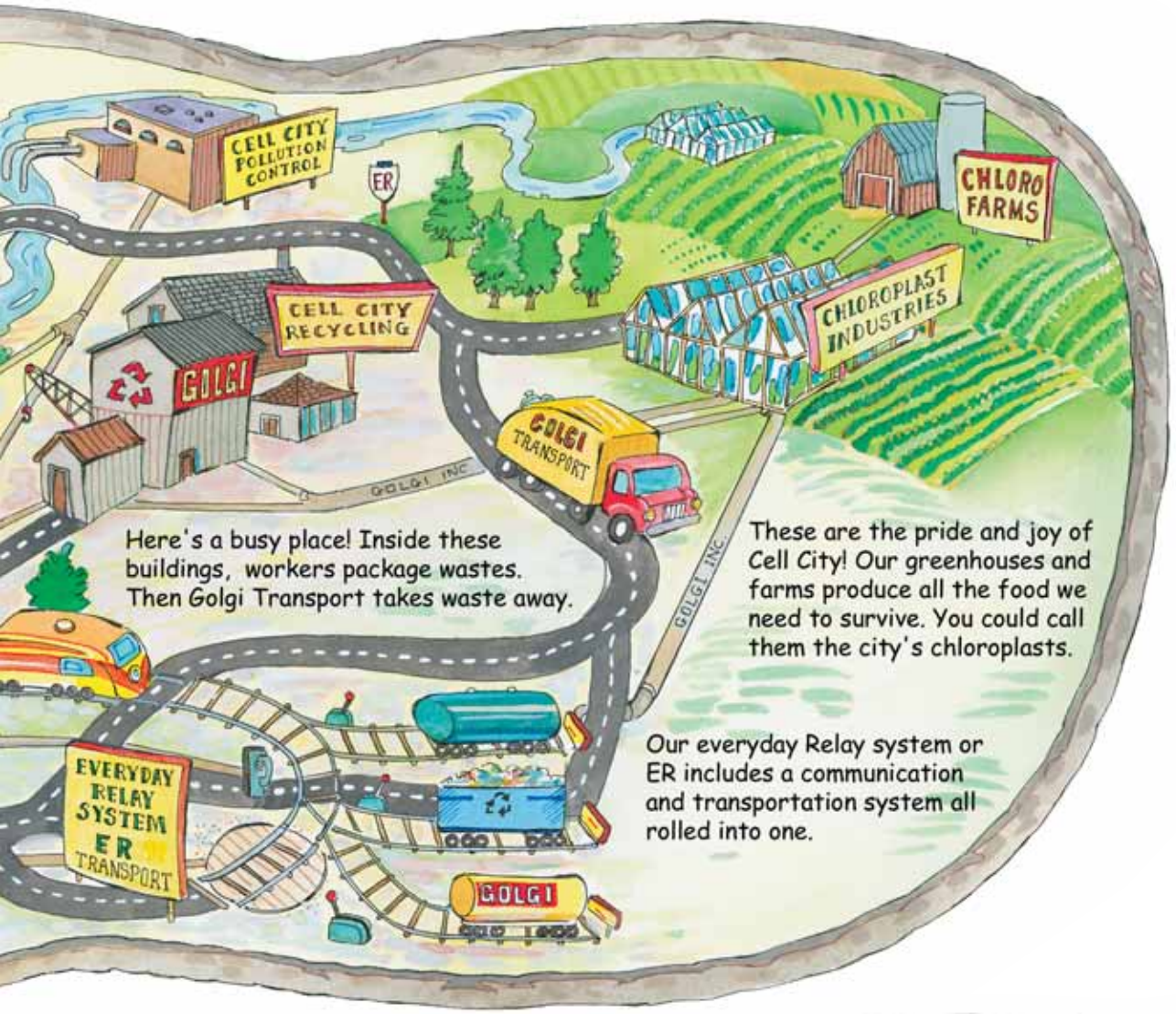
1. What is an organelle?
2. What is the purpose of adding a stain to a wet mount?
3. Why do you need to make a wet mount of a live sample right after you get it?
4. What structure of the cell stains the darkest?

Key Terms

nucleus
cytoplasm
mitochondrion
vacuole
ER
cell membrane
cell wall
chloroplast

8.4 Cell City


CELL CITY
VACUOLE WASTE
All the energy for the city is produced here in the power plant. What cell part produces energy? That's right — the mitochondrion.
POWER PLANT
The city stores water and waste products in these containers. The vacuoles also treat and recycle wastes before exporting them.
CELL CITY WASTE
GOLGI TRANSPORT
GOLGI INC.
VACUOLE WASTE
Check out the dome! That's the nucleus — we call it City Hall. Cell City is directed from this control centre.
CITY HALL and NUCLEUS
CITY SEWERS
CELL CITY WASTE
VACUOLE WASTE
VACUOLE RECYCLING
CELL CITY WASTE
GOLGI TRANSPORT
CITY SEWERS
VACUOLE RECYCLING
The whole area is like the cytoplasm of a cell. The land mass of the city contains all the buildings and transportation systems necessary to keep the city running.
See the gates down there? They control what comes in and what goes out of the city. The cell membrane and cell wall do the same job.
Did you know that a cell is so well organized that it's like a mini city? Let me show you. Hop aboard the Cell City Airbus and we'll take a tour!



Check Your Understanding

1. How do raw materials come into the city? into the cell?

2. Use a chart such as the one below to compare the tasks performed in a cell to those done in Cell City.

Cell Part	Task(s) Performed	Cell City Part	Task(s) Performed

3. Use diagrams to help you compare the recycling process in Cell City with recycling in a cell.

4. Predict what would happen.
   (a) A breakdown occurs in the transportation system of Cell City.
   (b) It happens in a cell.

CHAPTER

8 Review

Key Terms

microscope
compound microscope
electron microscope
hand lens
dissecting scope
cell
organelle
living
non-living
tissue
organ
system
theory
organism
life processes
nucleus
cytoplasm
mitochondrion
vacuole
ER
cell membrane
cell wall
chloroplast

Reviewing Key Terms

If you need to review, the section numbers show you where these terms were introduced.

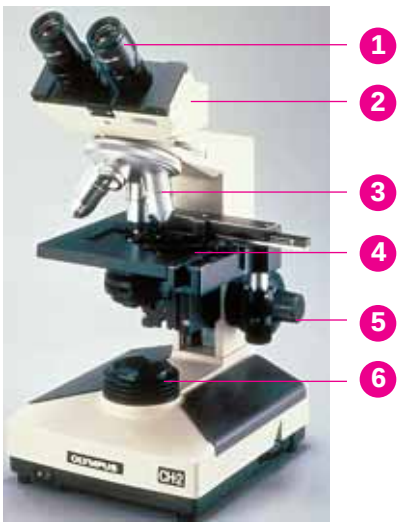
1. In your notebook, write the key term that corresponds to each of the following clues.
- **(a)** semi-permeable layer (8.3)
- **(b)** performs a function in a cell (8.2)
- **(c)** control centre (8.3)
- **(d)** *cannot* breathe or reproduce (8.2)
- **(e)** instrument that magnifies up to 15x (8.1)
- **(f)** transportation system (8.3)
- **(g)** building blocks of life (8.2)
- **(h)** contains chlorophyll (8.3)
- **(i)** storage container for food, water, and waste (8.3)
- **(j)** substance that holds all the organelles in place (8.3)
- **(k)** necessary activities for all living things (8.2)
- **(l)** system of lenses used to view an object (8.1)
- **(m)** used to magnify objects up to 600 000x (8.1)
- **(n)** "powerhouse" of the cell (8.3)
- **(o)** similar to a hand lens (8.1)
- **(p)** cells combine to carry out a task (8.2)
- **(q)** tissues combine to perform a role (8.2)
- **(r)** organs work together (8.2)

Understanding Key Ideas

Section numbers are provided if you need to review.

2. List four ways to keep a microscope in good working condition. (8.1)

3. **(a)** Name the microscope shown here. (8.1)
(b) In your notebook, write the name of the part that corresponds to each number on the diagram. (8.1)
(c) Explain the function of each of these parts. (8.1)



4. What happens to an image when you move a slide from left to right on the microscope stage? (8.1)

5. Explain how you should bring a specimen into focus. (8.1)

6. Which one of these photographs of a grasshopper's mouth is viewed under the highest magnification? (8.1)

7. Identify the main contribution these individuals made to the study of cells.
(a) Robert Hooke
(b) Anton van Leeuwenhoek (8.1)

8. Compare the outer boundaries of an animal cell and a plant cell. (8.3)

Developing Skills

9. Involve your group to create a human cell. (8.3)
(a) Make a list of all the organelles. Decide who will play each role.
(b) After you have arranged all the cell parts, try practising some cell activities. Use sounds and movements to give life to your cell.
(c) Share your performance with the class. Give feedback to each other.

10. Draw a diagram of an animal cell. (8.3)
(a) Label the parts.
(b) Explain the function of each part.

Problem Solving/Applying

11. Why is it necessary to have a membrane around the cytoplasm? (8.3)

12. Hosni's teacher gives him a variety of prepared slides made from living and non-living material. He is supposed to identify each slide as coming from either living or non-living material. Make a list of what he should look for to help him make the classification. (8.2, 8.3)

Critical Thinking

13. Sometimes when you look at freshly-made slides of plant cells, you can see green parts moving in the cell. (8.3)
(a) Suggest a reason why these parts might be moving.
(b) Name the moving part.

14. Sara was viewing a cell under low power. When she switched to high power, the object disappeared despite her attempts to refocus the slide. Why do you think the cell disappeared from view? (8.1)

15. Red cabbage is a plant. Why is it not green? (8.2, 8.3)

Pause & Reflect

1. Go back to the beginning of this chapter on page 156 and check your original answers to the Getting Ready questions. How has your thinking changed? How would you answer these questions now that you have investigated the topics in this chapter?
2. Cells need food, water, and oxygen. They need to get rid of wastes, and they need to live in a healthy environment. Imagine you are a plant or an animal cell. Write a description of all the action that is taking place inside your walls.