Unit 2 Overview

Lesson	TE pages	ST pages	AM pages	Assessment	Content
Chapter 4: Cells and Classification					
42	91–93	77–79	57		• Unit and chapter opener • Preview the unit and chapter content
43	94–98	80–84			• Characteristics of living things • Microscopes
44	99–100		58		• Using a microscope
45	101–3	85–87	59–62	Quiz 4-A	• Cells, tissues, organs, systems • Animal cells • Plant cells
46–47	104	88		Rubric	**Activity: Cell Model** • Making a 3-D model of a cell
48–49	105	89	63	Rubric	**Exploration: An Organized Cell** • Comparing the function of cell structures to parts of an organization • Writing and presenting a skit
50	106–7	90–91			• Mitosis • Meiosis
51	108	92	64	Rubric	**Activity: Classifying** • Classifying pasta according to chosen criteria
52	109–13	93–97	65		• Classification • Kingdom Eubacteria • Kingdom Archaebacteria • Kingdom Protista • Kingdom Fungi • Kingdom Plantae • Kingdom Animalia
53	114–15	98–99	66–68	Quiz 4-B	• Naming organisms
54	116	100	69–70		**Chapter Review** • Apply knowledge to everyday situations
55	116			Test	**Chapter 4 Test**
Chapter 5: Animal Classification					
56	117	101	71		• Chapter opener • Preview the chapter content
57	118–21	102–5	72		• Invertebrates • Sponges and stinging animals • Mollusks
58	122–23	106–7	73		**Technology: Fiber Optic Sponges** • Identifying ways that a Rossella sponge may improve fiber-optic technology
59	124	108	74	Rubric	**Exploration: Snail Terrarium** • Observing land snails
60	125–27	109–11	72, 75	Quiz 5-A	• Echinoderms • Flatworms • Roundworms • Segmented Worms
61	128–31	112–15	76–78	Quiz 5-B	• Arthropods (crustaceans, arachnids, centipedes, millipedes, insects)
62	132–33	116–17	79–80	Rubric	**Activity: Mealworm Movement** • Observing stages of metamorphosis • Experimenting with mealworms
63	134–37	118–21	81		• Vertebrates • Fish • Amphibians
64	138–41	122–25	82		• Reptiles • Birds
65–66	142–47	126–31	82–84	Quiz 5-C	• Mammal orders • Humans
67	148–49	132–33	85–86	Rubric	**Activity: Blubber Mitts** • Modeling the insulating properties of animal blubber • Experimenting to evaluate the effectiveness of the models
68–69	150–51	134–35	87	Rubric	**Exploration: Animal Robotics** • Researching and designing a robotic animal
70	152	136	88		**Chapter Review** • Apply knowledge to everyday situations
71	152			Test	**Chapter 5 Test**

Lesson	TE pages	ST pages	AM pages	Assessment	Content
Chapter 6: Plant Classification					
72	153	137	89		• Chapter opener • Preview the chapter content
73	154–57	138–41	90–91		• Nonvascular plants (mosses, liverworts) • Seedless vascular plants (horsetails, club mosses, ferns)
74	158–61	142–45	92–93	Quiz 6-A	• Gymnosperms (cycads, ginkgoes, gnetophytes, conifers)
75	162–65	146–49	94	Quiz 6-B	• Angiosperm classifications (annual, biennial, perennial; monocotyledons and dicotyledons)
76	166	150	95–96	Rubric	**Activity: Classification Check** • Making a visual to illustrate classification
77	167	151		Rubric	**Exploration: Plant Products** • Researching and preparing a display about products made from plants
78	168–71	152–55	97–98	Quiz 6-C	• Vascular systems • Stems, roots
79	172–73	156–57	99–100	Rubric	**Activity: How Big is My Tree?** • Measuring a tree and calculating its point value
80	174	158	101–2		**Chapter Review** • Apply knowledge to everyday situations
81	174			Test	**Chapter 6 Test**

Objectives

- Recognize the interrelationship of science concepts in the unit
- Recognize that God supplies the needs of every organism
- Preview the unit and chapter content

Unit Introduction

The purpose of this unit is to show the patterns of classification. The unit is not meant to be an exhaustive exploration of each category. It is an introductory survey of cells and classification, which will be developed further in secondary science classes.

Chapter 4 discusses the basic structures and functions of living things. The chapter also explains how living things are classified scientifically.

Chapter 5 explores how organisms in the kingdom Animalia are classified further according to similar characteristics.

Chapter 6 explains how plants are divided further according to similar characteristics. This chapter also discusses some of the basic structures of plants.

Look through Unit 2. What kinds of topics do you think you will be studying in this unit? Possible answers: cells, classification, animals, plants

Why do you think these chapters are organized into the same unit? Answers will vary. Elicit that God's living creation has patterns that allow the organisms to be classified.

TEACHER HELPS

Weblinks
The BJU Press website offers additional information and links you may find helpful throughout the year.

www.bjupress.com/resources

Unit photos
The photos on Student Text page 77 include a Porcini mushroom, a sand dollar, a maple leaf, a fir branch, and a pine cone.

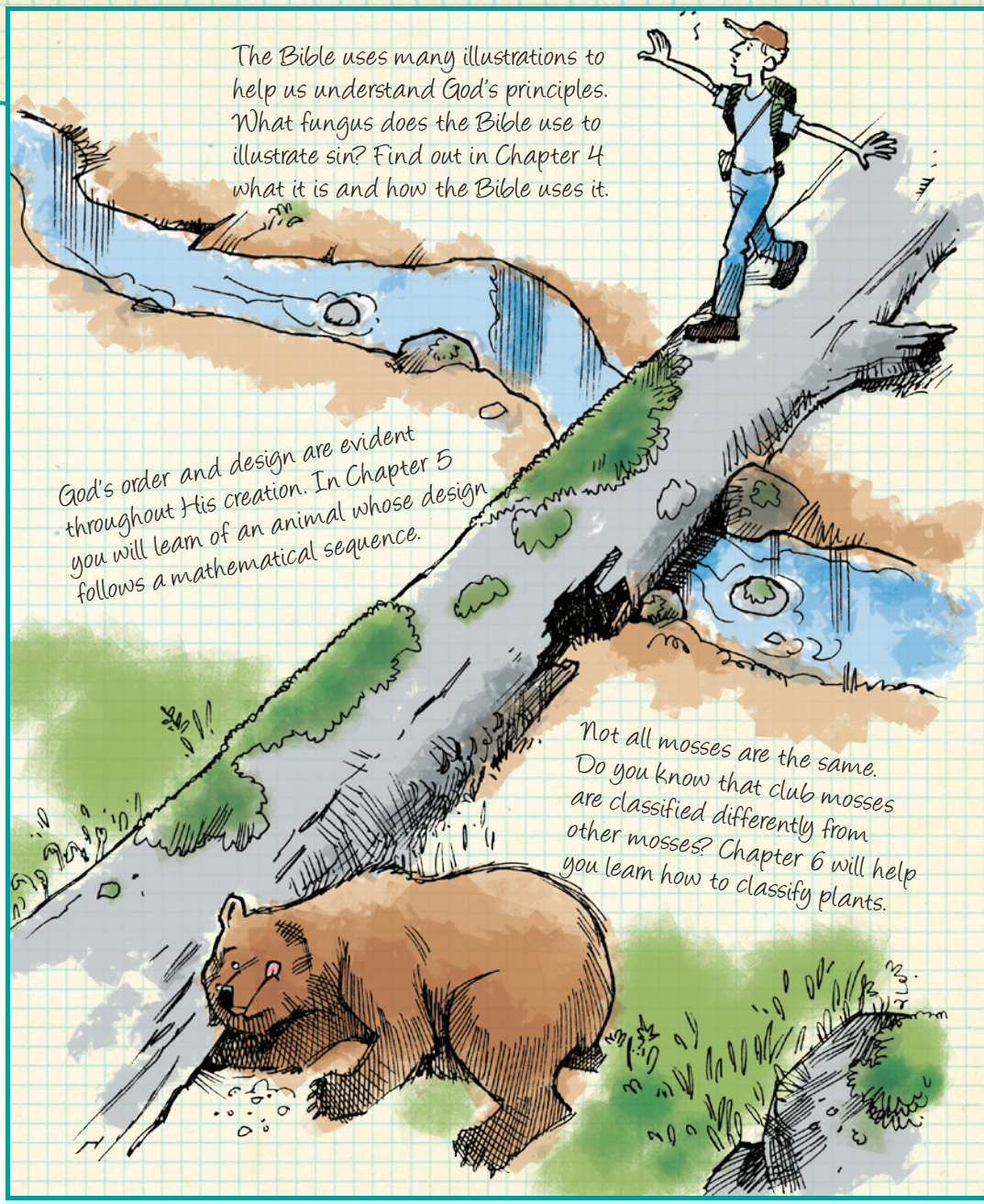
Project Idea

The project idea presented at the beginning of each unit is designed to incorporate elements of each chapter as well as information gathered from other resources. You may choose to use the project as a culminating activity at the end of the unit or as an ongoing activity while the chapters are taught.

Unit 2—A Zoo Habitat

The students design a new zoo exhibit. They choose a habitat and include the plants and animals that will be part of that habitat. They also should include the scientific names for all the plants and animals included in the exhibit.

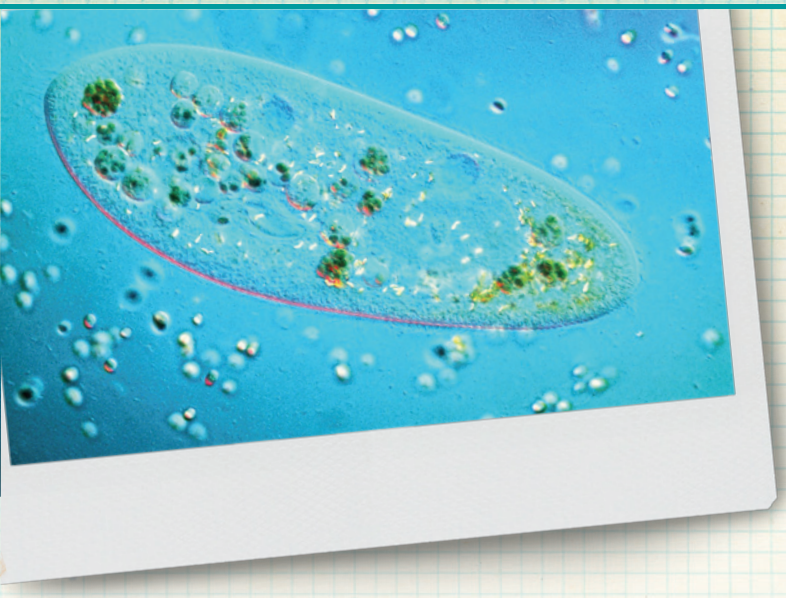
Variation: As a class, design an entire zoo, with each group of students being responsible for a specific habitat.



TEACHER HELPS

Chapter preview
Other preview and prereading activities may include using a K-W-L chart, a probe, or an anticipation guide.

Student Text diagrams
Diagrams from the Student Text are included on the Teacher's Toolkit CD.



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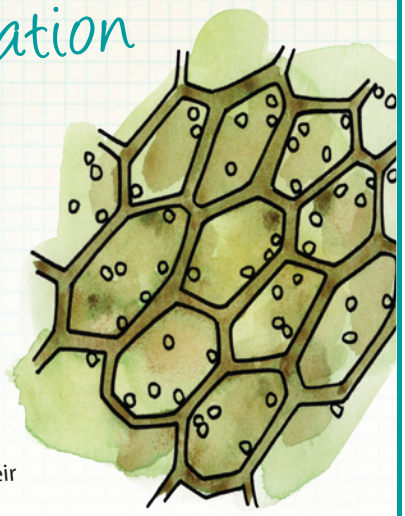
Cells and Classification



Imagine a place where the temperatures are nearly boiling, the environment is poisonous, and the pressure would crush a man. Sound like an alien planet? Actually, these conditions exist in deep-sea hydrothermal vents.

In most places plants produce food using photosynthesis. But the communities at deep-sea vents are very different. Bacteria-like organisms convert chemicals into food using a process called chemosynthesis. Similar to plants, the organisms are the first stage of the hydrothermal vent's food web. Some living things around deep-sea vents consume the bacteria-like organisms. Other living things use the organisms' chemosynthesis ability to produce their own food. Huge tube worms, clams, crabs, shrimp, and some fish can thrive in conditions that were once thought to be deadly. God created all parts of our earth and filled it with living things that can live and function in all kinds of environments.

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Introduction

Some environments seem so harsh, so extreme, or so poisonous that nothing should be able to live there. But God tells us that all of His creation is good. Some organisms were designed by God with characteristics that have adapted to living in places that are inhospitable to most living organisms.

Teach for Understanding

Provide time for the student to complete Looking Ahead, Activity Manual page 57. For part B, encourage the student to think of things he would like to learn about cells and classification. He should write his answers in question form, such as, "How big is a cell?"

Provide the answers for part A and allow the student to check his work. After the chapter is finished, you may choose to have him look back at this page and check his understanding of the items he missed.

As time allows, discuss student questions from part B about cells and classification. You may choose to provide trade books or other resources to help answer questions that are beyond the scope of this chapter.

Allow the student to leaf through the chapter, looking at the headings, pictures, captions, charts, etc., and discuss the things he thinks he will be learning about.

What is the chapter title? Cells and Classification

What is pictured on this page? cells

The photo at the top of the page shows a paramecium, a member of kingdom Protista.

Activity Manual

Preview, page 57

The Looking Ahead page is intended to assess the student's prior knowledge before beginning the chapter.

SCIENCE BACKGROUND

Hydrothermal vents

These vents are much like geysers on the ocean floor. Ocean water that has seeped beneath Earth's crust is heated by magma and hot rocks. This boiling water rises through vents (cracks) in the crust. Because of the tremendous pressures under the ocean, the water (steam) coming from a vent may reach 350°C (660°F). Chimneys of dissolved metals form around the vents. Some of the dissolved metals in the steam look like clouds of black or white smoke spewing from the vents.

Chemosynthesis

In chemosynthesis, organisms produce carbohydrates from water, carbon dioxide, and the oxidation of inorganic chemicals, such as those found near hydrothermal vents.

TECHNOLOGY

Deep-sea exploration

Much of the research of hydrothermal vents is conducted with the use of specially equipped deep submergence vehicles, such as *Alvin*. Deployed from the sixty-man research vessel Atlantis, *Alvin* is a little over 23 feet long and almost 12 feet high. Its three-person crew has access to many tools aboard the submersible, including computers, video recording equipment, sonar, and manipulators, long arms that can reach up to 75 in. and lift up to 250 lb.

Objectives
- Distinguish between living things and nonliving things
- Identify five characteristics of living things
- Identify men associated with the development of the microscope
- Describe the cell theory

Materials
- toy animal or doll

Vocabulary
organism
life span
life cycle
energy
cell
cell theory
microscope

Introduction
Show a toy animal or doll.

Is this object alive?

How do you know this object is not alive?

Record the reasons that the students give.

In this lesson we are going to learn some characteristics that distinguish living things from nonliving things.

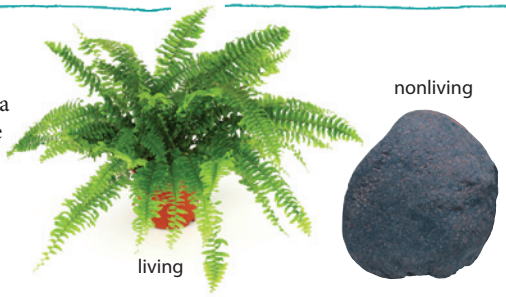
Purpose for reading
What is a life cycle?

What are some examples of a living organism's response to its environment?

What is one characteristic of living things that nonliving things never have?

Which instrument allows men to see cells?

Perhaps you have seen a little girl playing with a doll. She cleans and dresses it, talks to it, and tells it to take a nap. She may even try to feed it. But we all know that the doll is not alive.



Cells and Organisms

An **organism** is a complete living thing. You are an organism. Animals and plants are organisms. Even the mold that grows on old bread is an organism! All organisms have some things in common. These characteristics distinguish living things from nonliving things.

Living Things

Living things grow and develop

Living things are able to grow, maintain, and often repair themselves. Plants grow by using sunlight, water, and nutrients in the soil to make new leaves and stems. People and animals grow by eating food, which is then transformed into energy for growth.

The Bible tells us in Genesis 1 that God created all things perfectly, both living and nonliving. As a result of sin, decay and death entered into the world (1 Cor. 15:21–22). For living things, this process of birth, growth, reproduction, and death is called the **life span**. Some organisms, such as bristlecone pine trees, can live for thousands of years. On the other hand, the mayfly may live for only a few hours as an adult insect. Sometimes we refer to the life span as the **life cycle**. After an organism is born, it grows into an adult and is able to produce offspring. Finally, the organism ages and eventually dies. When an organism dies, it no longer shows the characteristics of life.

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life span

SCIENCE BACKGROUND

Cell theory
The idea that all living organisms are composed of cells is called a theory because even though it is based on many observations, it cannot be proven as absolutely true.

SCIENCE MISCONCEPTIONS

Living or nonliving
For something to be classified as a living organism, it must demonstrate all five characteristics of living things. Nonliving things may demonstrate some of the characteristics, but they are not alive because they do not demonstrate all five characteristics.

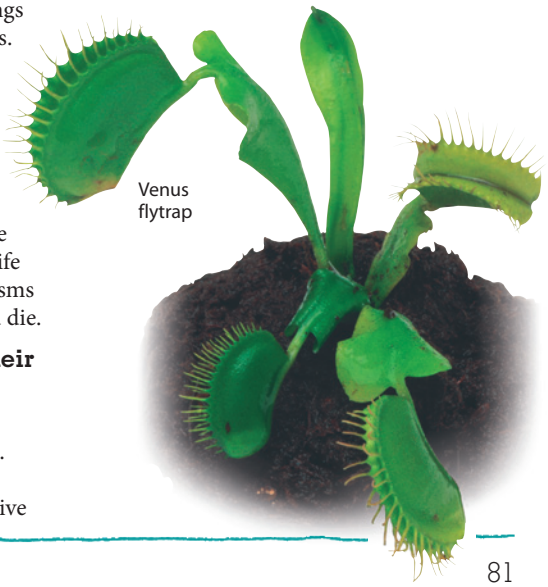
Living things reproduce

One of the most important scientific principles is that life comes only from life. Living things do not simply "appear" out of thin air. They must come from other living things. Since the time of Creation, all living things have come from other living things.

Most new organisms are incredibly small at the start. After an organism grows and matures it will reach a stage where it is able to reproduce itself and form new organisms. We often call organisms that reproduce themselves the *parents*. Reproduction allows the life cycle to begin again as new organisms replace the organisms that age and die.

Living things respond to their environments

When an animal senses that it is in danger, it can readily respond. Sometimes the animal will flee. At other times it will assume a defensive posture and maybe even attack. Living things respond to their environments (surroundings) to protect themselves or to gain an advantage, such as obtaining food. An important part of this response is movement. All living things, including plants, can move. Most plant movement is slow and is not as dramatic as animal movement. However, some plants actually move quite rapidly. A Venus flytrap can close quickly to trap an insect for lunch. Plants also respond by growing toward sources of light and water. Nonliving things do not respond to their surroundings. A piece of paper or a dead animal cannot run away or protect itself from danger.


Venus flytrap

Origin of and remedy for sin God commanded Adam and Eve not to eat of the tree of the knowledge of good and evil. If they ate of that tree, they would "surely die" (Gen. 2:16–17).

When Adam, the father of all people, sinned, he brought sin into the world. The punishment for sin is death. Because Adam sinned, every descendant of Adam is born a sinner and will receive the punishment for sin (Rom. 5:12).

Yet Jesus Christ, the Son of God, obeyed God by dying on the cross. He made it possible for all men to be saved from sin and the punishment for sin (Rom. 5:19; 1 Cor. 15:12). [BAT: 1a Understanding Jesus Christ]

Discussion

What is an organism? a complete living thing

What are five characterisitics of living things? Living things grow and develop, reproduce, respond to their environments, use energy, and are made of cells.

How do plants grow? by using sunlight, water, and nutrients in the soil to make new leaves and stems

How do people and animals grow? by eating food, which is then transformed into energy for growth

Why did decay and death enter the world? because of sin

How do we know that God created the world perfectly? Genesis 1 states that everything was good.

What do we call the process of birth, growth, reproduction, and death? life span

What is another term that means "life span"? life cycle

Where do all living things come from? other living things

Why is it necessary for organisms to reproduce? Eventually all organisms die. Reproduction allows new organisms to replace those that die.

What do we call the organisms that reproduce? parents

How might an animal respond to danger? flee, assume a defensive posture, or attack

Do plants respond to their environments? yes **Give an example to support your answer.** Possible answer: They grow toward sources of light and water.

Most plants respond to their environments slowly. Give an example of a plant that responds quickly. Venus flytrap

Discussion

What is energy? the ability to do work

How does a living thing get its energy? produces it or takes it in as food

How might an organism use energy? Many answers are possible, but students should recognize that everything an organism does requires energy.

When does an organism stop using energy? only when it dies

What happens when living things convert energy from one form to another? some of it becomes unusable

What is an example of energy that is not usable? excess heat that must be released

What is another result of energy changes? waste products

Our cells use oxygen to produce energy. What is produced as a waste product? carbon dioxide

Which characteristic is true only for living things? made of cells

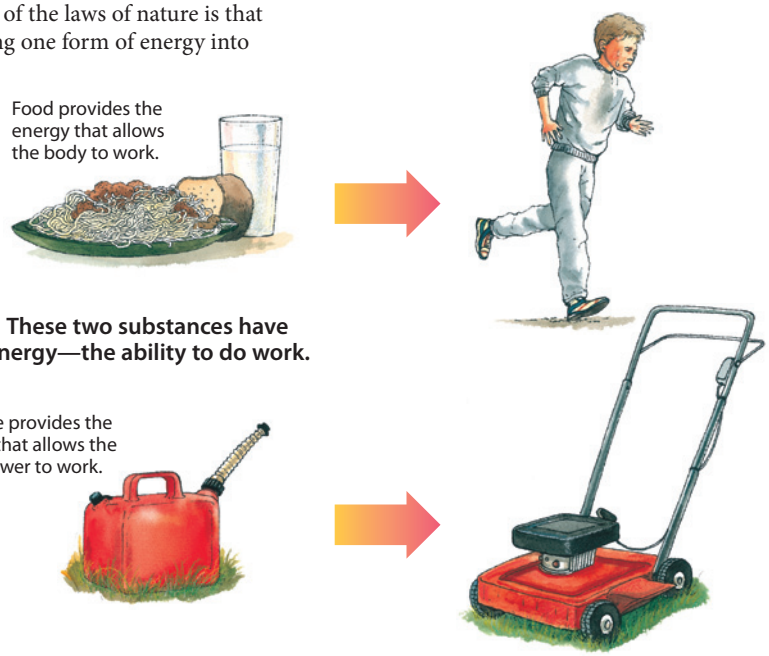
Living things use energy

Have you ever been in a car when it ran out of gas? One minute you are traveling down the freeway, and the next minute you are sitting on the side of the road. In order for a car to move, it needs energy. **Energy** is the ability to do work. The energy a car needs comes in the form of gasoline, but the energy a living thing needs comes from food.

At no point during an organism's life does it stop using energy—even when it is resting. You may not be moving your arms or legs, but your heart is still pumping and your brain is still functioning. Only when an organism dies does it no longer need or use energy.

One of the laws of nature is that changing one form of energy into another is never completely efficient. As living things convert energy from one form to another, some of it becomes unusable. For instance, some of the energy from food might be converted to excess heat, which must be released for the organism to survive.

Waste products are another result of energy changes. A living organism must be able to get rid of the waste it produces. One way you perform this task is by breathing out. As your cells use oxygen to produce energy, they also produce carbon dioxide as a waste product. Your blood carries the carbon dioxide to your lungs, where you get rid of it by breathing out.



These two substances have energy—the ability to do work.

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BIBLE

Spiritually alive

Some characterisitics of living things are also characteristics of people that are spiritually alive in Christ. To be spiritually alive, a person must accept Jesus Christ as his Savior from sin and be born into God's family.

- **Living things grow and develop.** Spiritually alive people grow and develop in Christ (Gal. 5:22–23; 1 Pet. 2:2).
- **Living things reproduce.** Spiritually alive people spread the gospel to others (Prov. 11:30; Matt. 28:19–20). [BAT: 5a Evangelism and missions]
- **Living things respond to their environments.** Spiritually alive people respond to their environments by fleeing temptation and doing what is right (1 Cor. 10:13; James 4:7).
- **Living things use energy.** Spiritually alive people need strength (energy) from the Lord (Phil. 4:13; Ps. 27:1).

Living things are made of cells

We can find nonliving things that exhibit some of the characteristics of living organisms. For example, a mineral crystal may grow in size. Rocks move during an earthquake. And most machines use energy to do work. But none of these are living. Every living thing is a cell or a collection of cells.

In 1665 Robert Hooke, an English scientist, examined a small piece of dried cork with a microscope that he had built. He observed small, empty chambers that he called cells. Scientists soon discovered that what Hooke had actually seen was the cell walls of the dead cork. Living cells are not empty; instead, they are filled with a watery substance containing many different structures. Nevertheless, the name **cell** became the term for describing the smallest unit of a living organism.

However, it was over 250 years later that scientists proposed a theory about the relationship between cells and living organisms. In 1938 two German scientists, Theodor Schwann (SHVAHN) and Matthias Schleiden (SHLY dun), analyzed certain observations they had made while studying plant and animal cells. They found that all the living things they observed were made of cells, but the nonliving things were not made of cells. They also theorized that cells can function as individual living organisms or as the smallest units in a larger organism. Over the years, other scientists have observed these same things and have drawn similar conclusions. With only a few small changes and additions, Schwann's and Schleiden's conclusions form the basis for what we now call the **cell theory**.

Robert Hooke

Robert Hooke (1635–1703) was a man of considerable talent. His ideas and inventions covered a wide range of science topics. Hooke was a firm believer in experimental investigation. As he experimented, he carefully recorded his observations. One of his lasting effects on science was his science picture book, *Micrographia*. The finely detailed drawings in the book demonstrate Hooke's artistic ability and scientific accuracy. Chemist, physicist, naturalist, inventor, architect—Robert Hooke was all of these and more.

cork from *Micrographia*

DIRECT A DEMONSTRATION

Demonstrate the characteristics of living things

Materials: clear container of water, food coloring, balloon, a dead plant or flower, an electric or battery-operated pencil sharpener, a student assistant or pet

Direct the student to determine whether each of the above items is living or nonliving. Set the container of water on an overhead projector or in another easily visible place in the classroom. Drop in a few drops of food coloring. Point out how the colored drops move and spread throughout the water.

Is the food coloring living or nonliving? nonliving **Why?** The coloring moves, but it does not demonstrate other characteristics of living things.

Blow up the balloon. Is it living or nonliving? nonliving **Why?** It grew larger, but it does not demonstrate other characteristics of living things.

Is this plant a living thing? no **Has it ever been a living thing?** yes **How do you know?** When alive, it had all the characteristics of living things.

The pencil sharpener uses energy. Is it living or nonliving? nonliving **What is its source of energy?** Possible answers: a battery, electricity **How do living things get their energy?** from food

Is this student (or pet) a living thing or a nonliving thing? living **How do we know?** He or she has all the characteristics of living things.

Discussion

Who discovered small, empty chambers in a dried piece of cork? Robert Hooke

What did Hooke name these empty chambers? cells

What was Hooke actually looking at? cell walls of dead cork

How are living cells different from dead cells? Living cells are not empty. They are filled with a watery substance containing many different structures.

What is a cell? the smallest unit of a living organism

What two important observations did Theodor Schwann and Matthias Schleiden make? Living things are made of cells, but nonliving things are not made of cells. A cell can function as an individual living organism or as the smallest unit in a larger organism.

Why are these observations important? because they form the basis for the cell theory

Why could Schwann and Schleiden not say that their ideas were absolutely true? Accept reasonable answers, but elicit that they could not test all possible substances, so their ideas might have been disproven by something they had not tested.

Why did their conclusions eventually become accepted as the cell theory? Over the years, other scientists tested substances and gained similar results.

Discuss the Robert Hooke box.

When did Robert Hooke live? 1635–1703

Did Hooke use good scientific practices? Yes; he experimented to prove things and kept careful records.

What is *Micrographia*? a science picture book

Discussion

How do our eyes help us learn about science? They allow us to observe the world around us.

Can we know everything about God's creation, even with instruments such as the microscope? no

Discuss the truth that even with the best scientific tools, man can never see or understand all of God's creation.

What is a microscope? an instrument that uses lenses to magnify objects hundreds or thousands of times

Who is credited with inventing the first microscope? Zacharias Jansen

Why is Anton van Leeuwenhoek also famous for his work with microscopes? He made microscopes that were more powerful than the one that Jansen made. Using the microscope, he noticed tiny creatures swimming in the water and studied them.

How powerful was van Leeuwenhoek's microscope? It could magnify an object to about 300 times its original size.

Before the 1930s, how powerful were most microscopes? They could magnify an object about 2,000 times.

How strong are modern electron microscopes? They can magnify objects 500,000 times or more.

Answers

1. An organism is a complete living thing.
2. Living things grow and develop, reproduce, respond to their environments, use energy, and are made of cells.
3. It is a theory that says living things are made of cells, but nonliving things are not made of cells. Cells can function as individual living organisms or as the smallest units in a larger organism.
4. Zacharias Jansen

Microscopes

Without the microscope, Robert Hooke would not have been able to see the tiny chambers in the cork. Although God made our eyes to be very important tools for observing and learning about creation, our eyes cannot see everything. Some things are too small or too far away for us to see. Since science is based on observation, scientists constantly search for tools that will improve human senses. One of these tools is the microscope. The **microscope** is an instrument that uses lenses to magnify objects hundreds or thousands of times.

Many people credit the Dutch inventor Zacharias Jansen with inventing the first microscope. (He made one in the late 1500s.) However, Anton van Leeuwenhoek (LAY vun HOOK), another Dutch scientist, is also famous for his work with microscopes. He spent many hours grinding and polishing lenses to make more and more powerful microscopes. In the 1660s he used his microscope to study tiny creatures swimming in water. He called the creatures "animalcules."

Leeuwenhoek's most powerful microscope magnified an object to about 300 times its original size. Until the invention of the electron microscope in the 1930s, the most powerful microscope could magnify about 2,000 times. However, modern electron microscopes can magnify 500,000 times or more.

Hooke's microscope

QUICK CHECK

1. What is an organism?
2. What are five characteristics of living things?
3. What is the cell theory?
4. Who is credited with inventing the microscope?

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Zacharias Jansen (Janssen)
His father Hans, a lens maker, probably began making the first compound microscope. This microscope used more than one lens. Zacharias, when he was older, completed his father's work. There is still confusion over whether the father or the son was the inventor. Therefore, many prefer to say that both Hans and Zacharias invented the microscope.

Scientist report
Students can research and prepare a short report about Robert Hooke, Zacharias Jansen (also spelled Janssen), or Anton van Leeuwenhoek.

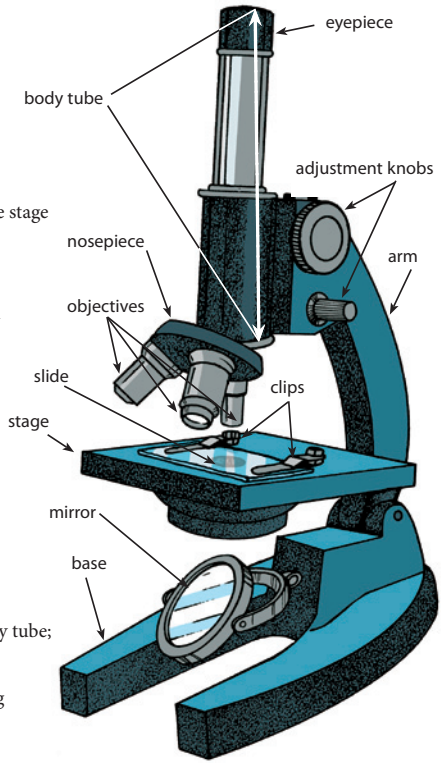
Using a Microscope

Name _____

Cells come in all shapes and sizes. Using a microscope allows us to appreciate the small details and design of God's creation.

Match the microscope parts with their descriptions.

A. adjustment knobs
B. base
C. clips
D. eyepiece
E. mirror
F. nosepiece
G. objectives
H. slide



_____ 1. hold the slide in place on the stage

_____ 2. bottom of the microscope; supports the microscope

_____ 3. turn these to move the body tube up and down to focus the image of the object

_____ 4. reflects light up through the stage

_____ 5. a rotating disc that holds objective lenses of different magnification

_____ 6. a thin, small piece of glass where a sample is placed

_____ 7. located at the top of the body tube; holds magnification lens

_____ 8. extensions under a revolving disc; contain microscope lenses

TEACHER HELPS

Carrying a microscope
The safest way to carry a microscope is to grasp the arm of the microscope with one hand and support the base with the other hand.

LANGUAGE

The word *specimen* comes from the Latin word *specere*, which means "to look at." *Spectacles*, *spy*, and *species* also come from this same Latin word.

MATH

The student may practice calculating the powers of magnification available with the microscope. Direct the student to multiply the power of an objective lens (usually printed on it) and the power of the eyepiece lens (usually 10).

Objectives
- Identify the parts of a microscope
- Explain how to use a microscope

Materials
- magnifying glass
- microscope
- *The Microscope* (IA), for display
- prepared slides

Introduction

Many people wear eyeglasses or contact lenses.

What do we call the part that you look through on a pair of glasses? lenses

Some lenses help a person's vision by magnifying the objects being looked at.

Display the magnifying glass.

Have you ever used a magnifying glass?

A magnifying glass also uses a lens to magnify objects. A microscope is similar to a magnifying glass. A microscope uses several lenses to magnify an object many times.

Teach for Understanding

Discuss the parts of a microscope.

Display *The Microscope*. Identify and discuss the parts of a microscope and how they are used.

Eyepiece—The part of the microscope that you look through. It holds the ocular lens system. Most eyepieces are 10X. This means they magnify the images ten times.

Body tube—The adjustable cylinder that connects the eyepiece and objectives.

Adjustment knobs—Most microscopes have two adjustment knobs located on the arm. These knobs move the eyepiece and the objective lens up and down to bring the image into focus. The larger knob is used to begin bringing the image into focus. The smaller knob is for finely adjusting the focus of the image.

Nosepiece—The rotating disc that holds the objective lenses. It is turned to align an objective lens with the eyepiece.

Arm—The curved part of the microscope that connects the lenses to the base.

Objectives—These lenses are used to magnify the image of the specimen. Many microscopes have more than one objective lens. The objective lenses on many microscopes are 10X, 40X, and 100X powers.

Clips—These hold the slide in place on the stage.

Stage—The place where the specimen (slide) is placed for viewing. The stage has a hole for light to pass through to the specimen.

Light source—The light source focuses light to shine through the hole in the stage. Many microscopes use a small mirror to focus reflected light. Some microscopes use a small electric light bulb to produce the needed light.

Base—The bottom, or foot, of the microscope.

If desired, set up a place for the student to view specimens with a microscope.

Discuss how a microscope works.

The eyepiece and each objective lens may contain two or more lenses each. These lenses work together to focus light and magnify the image of the specimen.

The symbol for magnification power is X. This means the image seen in a 10X lens appears ten times larger than the original specimen.

The light and the magnified image first pass through the objective lens. The magnification power of an objective lens varies for each microscope. Many microscopes include three objective lenses. Often these lenses are 10X, 40X, and 100X.

The light and magnified image then pass through the tube to the eyepiece lenses. Many eyepieces are 10X. This means that the magnified image from the objective lens is magnified again as it passes through the eyepiece.

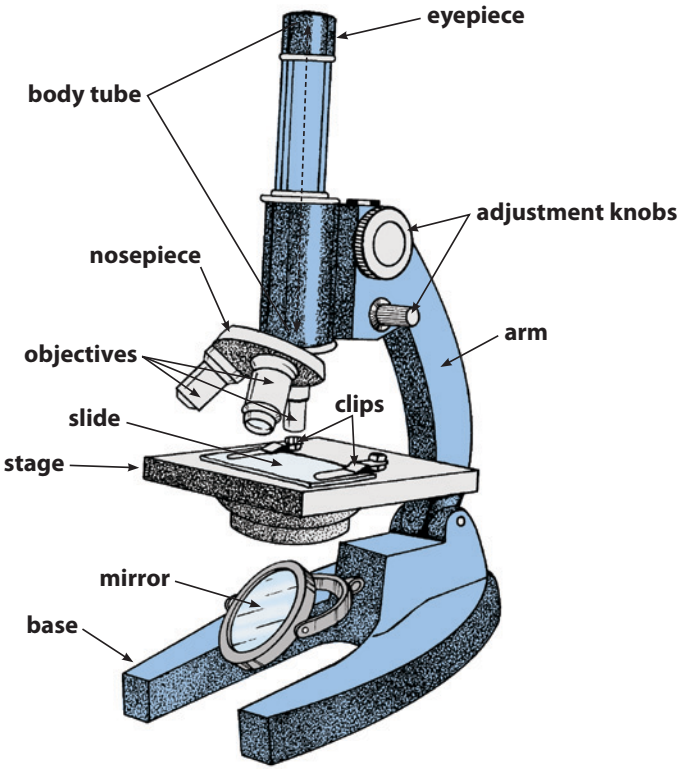
The total magnification of the image is the power of the objective lens multiplied by the power of the eyepiece. For example, an image viewed with a 40X objective lens and a 10X eyepiece will be magnified 400X (40X × 10X = 400X).

Discuss how to use a microscope.

It is important to have clean hands and materials when viewing specimens. The microscope will magnify any lint, fingerprints, or smudges that appear on the slide.

- Turn the nosepiece to the lowest power objective lens.
- Use the adjustment knob to raise the tube so the objective lens is as far from the stage as possible.
- Look through the eyepiece and adjust the light source (mirror) so the light is seen.
- Place a prepared slide under the clips on the stage. Place the slide so the specimen is centered over the hole in the stage.
- Look at the bottom of the objective from the side and carefully lower it until it is just above the cover slip.
- Focus the image by slowly raising the objective by turning the adjustment knob. The slide may also be moved to center the specimen under the objective lens.
- To view the specimen at a stronger power of magnification, turn the nosepiece to one of the other objective lenses and refocus the image using the adjustment knobs.

The Microscope



Science 6
For use with Lesson 44

Activity Manual

Expansion, page 58

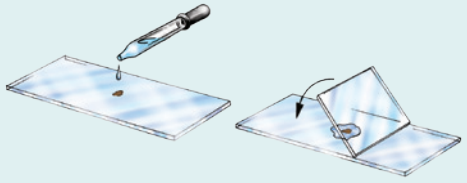
Use this page to reinforce the identification of microscope parts.

DIRECT AN ACTIVITY

Making a slide

Materials: slide, tweezers, specimen, eyedropper, water, cover slip

- Place the slide on a clean surface. Use the tweezers to place the specimen on the center of the slide.
- Place a drop of water on the specimen.
- Hold the cover slip by the edges and gently place one edge next to the specimen. Carefully close the cover slip over the specimen.



Cells

Cells working together

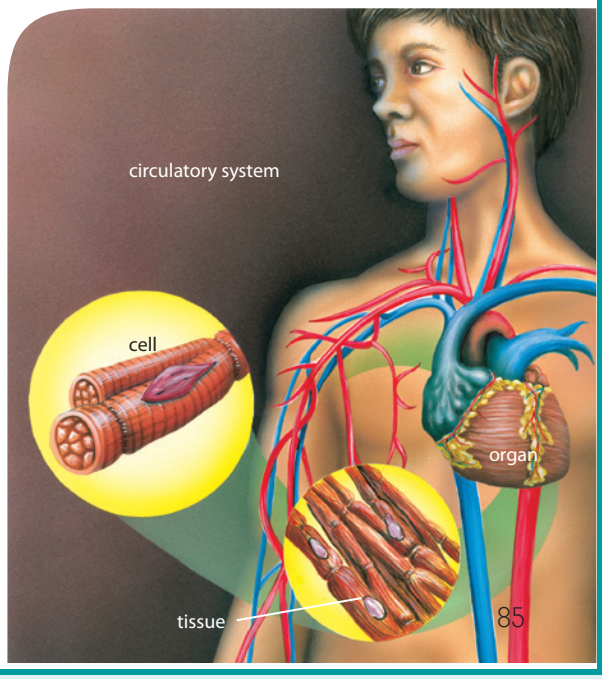
A **cell** is a tiny unit of living material surrounded by a thin membrane. It does nearly all of the things that living organisms do. It grows, reproduces, responds to its environment, uses energy, and produces and gets rid of waste. Eventually it dies.

Many organisms consist of only one cell. They are *unicellular*. The majority of unicellular organisms can be seen only through a microscope. However, most of the living things that we see without a microscope are made of millions and millions of cells. These living things are called *multicellular*. In most multicellular organisms, cells are specialized. We could compare them to a baseball team. Every member of the team must individually be able to catch and throw and run. But some members specialize in pitching or hitting or playing a specific position. The goal is team performance, not individual accomplishment.

You are a multicellular organism. Your body is made of trillions of cells. Each cell in your body is designed to perform a specific function. However, some cells work together to perform a task. A **tissue** is a group of cells working together. If someone speaks of muscle tissue, he is talking about the cells that function together to cause movement. Other organisms also have tissues. For example, phloem is a tissue that allows fluids to move through plants. All of the tissues of an organism must work successfully if the organism is to survive.

Like cells that work together to form tissues, some different kinds of tissues work together to form **organs**. Your heart is an organ. Muscles and nerves are some of the tissues that work together to form the organ that pumps blood throughout your body.

Organs also work together to form **systems**. Without our blood vessels and blood to complete the circulatory system, our heart organs would do us little good. But no matter how different the tasks that systems, organs, and tissues have, they all start with individual cells.



Objectives

- Identify a cell as a living unit
- Discuss the relationship of cells, tissues, organs, and systems
- Identify cell structures
- Compare and contrast plant and animal cells

Vocabulary

cell
tissue
organ
system
cell membrane
cytoplasm
organelle
nucleus
mitochondria
vacuole
cell wall
chloroplast
chlorophyll

Introduction

Discuss how the parts of a car engine differ in appearance and function but work together for the engine to run.

Have you ever looked at the engine of a car?

Do all parts of the engine look the same and have the same job?

Today's lesson discusses cell structure and how cells work together in some organisms.

Teach for Understanding

Purpose for reading

What are specialized cells working together called?

What do plant cells have that animal cells do not have?

Discussion

Discuss the meanings and relationships of cell, tissue, organ, and system.

How are unicellular and multicellular organisms different? Unicellular organisms have only one cell. Multicellular organisms are made of many cells that work together.

What is meant when we say that cells in multicellular organisms are specialized? Each has a specific purpose and task.

Are you a unicellular organism or a multicellular organism? multicellular

What are some tissues in your body? Possible answers: heart tissue, nerve tissue, muscle tissue

Which organ pumps blood throughout your body? heart

What are some other organs found in your body? Possible answers: brain, liver, kidneys

List these terms—cell, organ, system, tissue—in order from smallest to largest. cell, tissue, organ, system

Discussion

Discuss the animal and plant cell diagrams as the parts of cells are discussed.

You may choose for the student to complete Activity Manual pages 59–60 during the discussion. A copy of the diagrams is also available on the Teacher's Toolkit CD.

How is each cell shaped? according to its function

What does the cell membrane provide for the cell? It gives the external boundary for each cell and provides a barrier to keep harmful things out while allowing necessary things into the cell.

What is the jellylike substance inside the cell membrane? cytoplasm

Cytoplasm is mostly which substance? water

What are organelles, and where are they found? Organelles are the structures inside the cytoplasm of the cell that help carry out cell functions.

What is the most recognizable organelle? the nucleus

What important information is found inside the nucleus? the DNA

Why is DNA important to the cell? DNA contains the coded instructions that the cell follows for growth, reproduction, and the building of substances for the organism.

DNA is sometimes found in little bundles throughout the nucleus of a cell. What are these bundles called? chromosomes

Which organelles help to break down food and release energy? mitochondria

What is the name of the organelle that serves as the cell's transportation system? the endoplasmic reticulum

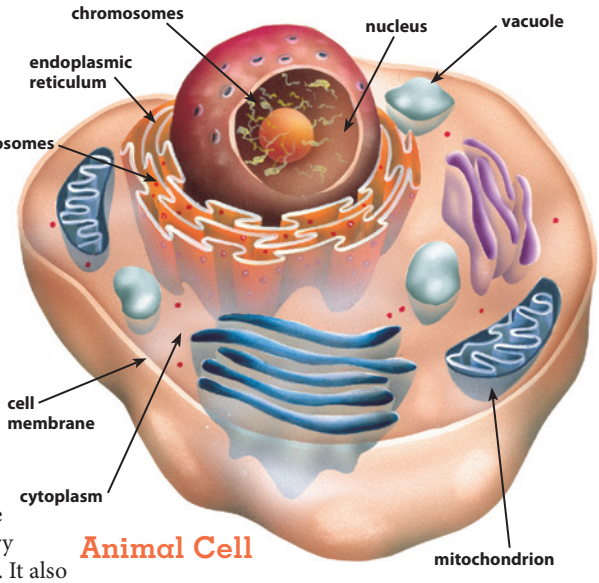
Which organelles are responsible for making proteins for the cell? ribosomes

Cell structures

Cells come in an amazing assortment of sizes and shapes. Some, such as red blood cells, are round and disclike. Muscle and nerve cells, on the other hand, can be long and thin. Cells that provide the outside covering of plants are often flat. Each cell is shaped according to its function.

Although cells are very different, certain structures are common to all of them. A cell membrane surrounds every cell. The **cell membrane** provides the external boundary for the material inside the cell. It also serves as a barrier that keeps out things that do not belong in the cell while allowing necessary things, such as food and oxygen, to enter the cell.

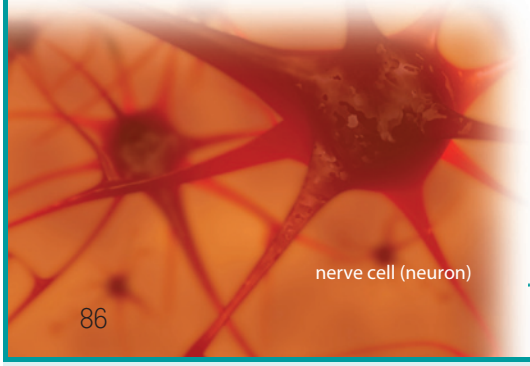
Inside the cell membrane is a jellylike substance called the **cytoplasm** (SITE uh PLAZ um). Cytoplasm is mostly water, but it also contains many other substances, such as proteins and fats, that are essential to the cell.



Animal Cell

Inside the cytoplasm of most cells are many tiny structures called **organelles** (OR guh NELZ), which help carry out the functions of the cell. The most obvious organelle, the **nucleus** (NOO klee us), is a large, ball-shaped structure separated from the rest of the cytoplasm by its own membrane. The nucleus contains DNA, a molecule carrying the coded instructions the cell follows. The DNA may be loose or packed into tight little bundles called *chromosomes*. The cell follows the DNA code as it grows, reproduces, and builds substances for the organism. DNA eventually determines what the organism looks like.

Other organelles also help provide for the needs of the cell. The **mitochondria** (MY tuh KAHN dree uh) are the cell's


nerve cell (neuron)

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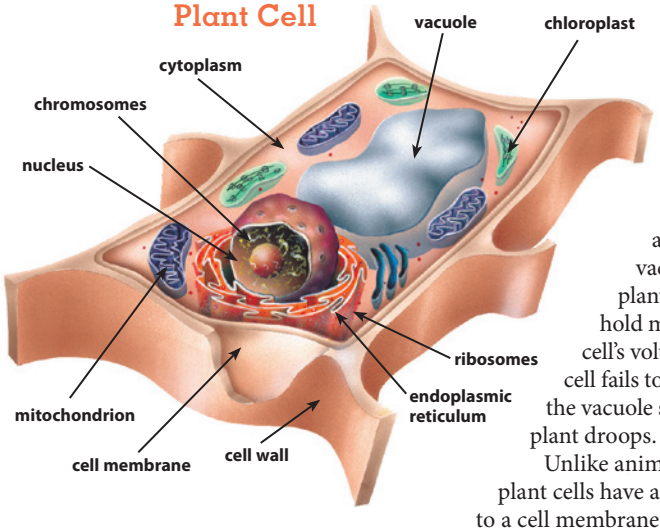
SCIENCE BACKGROUND

Cells, chromosomes, and DNA
Cells have more organelles than just those mentioned in this chapter. Chromosomes and DNA will be discussed again in Chapter 13, *Heredity and Genetics*. DNA is bundled into chromosomes during cell division. At other times, DNA is often floating in the nucleus.

LANGUAGE

Organ and organelle
Organ and *organelle* come from the same Latin word, *organum*, meaning "tool or implement." Organelles function within cells in a similar way as organs function within systems of the body.



engines. They are responsible for breaking down the cell's food and releasing energy. The *endoplasmic reticulum* (EN-duh-PLAZ-mik rih-TIK-yuh-lum), or ER, is the cell's transportation system. It is a system of passageways that allows material to move from one part of the cell to another. Along some of the ER are small organelles called ribosomes. *Ribosomes* (RY buh SOHMZ) are responsible for making the proteins that the cell needs. They do this by reading the code found within the DNA.

Bubble-like organelles in the cytoplasm of plant, animal, and human cells are called **vacuoles** (VAK yoo OHLZ). In animal and human cells vacuoles are usually small and often temporary. They store material until it can be released outside the membrane or used by the cell. Plant cells, however, usually have one central vacuole in addition to other vacuoles. Vacuoles in plant cells sometimes hold more than half of the cell's volume. When a plant cell fails to get enough water, the vacuole shrinks, and the plant droops.

Unlike animal and human cells, plant cells have a cell wall in addition to a cell membrane. The **cell wall** provides support for the plant cell. Along with the vacuoles, the cell wall helps the plant cell stay rigid and firm.

Plant cells also have large structures called **chloroplasts** (KLOR uh PLASTS), which have an abundant amount of a green pigment called **chlorophyll** (KLOR uh FILL). The chlorophyll absorbs energy from sunlight. The chloroplasts store this energy to use later, such as in photosynthesis. Animal cells do not need chloroplasts because they do not use sunlight for energy.

QUICK CHECK

1. What do we call specialized cells that work together?
2. What are the structures that carry out the cell's functions called?
3. Why would a plant cell but not an animal or human cell need chlorophyll?

Discussion

What are the bubble-like organelles called? vacuoles

What is the purpose of vacuoles within a cell? They are storage areas.

How are animal vacuoles different from plant vacuoles? Animal vacuoles are usually small and temporary. Plant cells usually have one central vacuole in addition to other vacuoles.

Which part of the plant cell provides support for the plant? the cell wall

What two things work together to help a plant cell stay rigid and firm? vacuoles and cell walls

What provides support for some animals? Possible answers: bones, skeleton, shell, exoskeleton

What do chloroplasts contain? chlorophyll

Why do plant cells have chloroplasts while animal cells do not? Plants use the chlorophyll in the chloroplasts to make food from sunlight. Animals use other methods of getting food.

Compare the diagrams of the animal cell and the plant cell. Which parts do both types of cells have in common? cell membrane, chromosomes, endoplasmic reticulum, mitochondrion, nucleus, ribosomes, vacuole

Answers

1. tissues
2. organelles
3. Plants manufacture their own food, so they need the chlorophyll to carry out photosynthesis.

Activity Manual

Reinforcement, pages 59–60

Review, pages 61–62

This page reviews Lessons 43 and 45.

Assessment

Quiz 4-A

The quiz may be given any time after completion of this lesson.

Objectives
- Demonstrate knowledge of cell structure
- Construct a 3-D model of a cell
- Prepare a written report

Materials
- picture of an object such as a car and a corresponding 3-D model
- See Student Text page

Vocabulary
cytologist

Introduction

Two lesson days are allotted for this activity. On the first day, introduce the activity, set guidelines and a due date for the cell models to be completed, and begin planning. The second lesson day may occur after the cell models are finished.

Display the picture and the 3-D model.

Which of these best represents what the object really looks like? the model

Why is the model better? Possible answers: You can see all sides. You can see inside for additional details. You can see size relationships better.

Usually a model provides a better representation of a structure.

Teach for Understanding

Purpose for reading
The student should read all the pages before beginning the activity.

Procedure
Explain the guidelines and due dates for the student. Provide time for the student to explain his model and answer questions about it.

Conclusions
Use the questions in the Science Process Skills to discuss communicating.

Assessment

Rubrics
Select the prepared rubric, or design a rubric to include your chosen criteria.

ACTIVITY

Cell Model

Process Skills
- Making a model
- Using a model
- Communicating

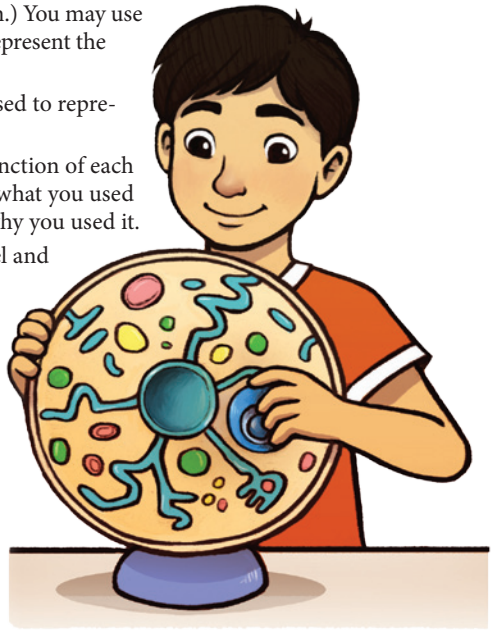
A *cytologist* (sye TOL uh jist) is a scientist who studies cells. A cytologist does most of his work with a microscope. However, seeing only flat pictures or photographs from a microscope makes it difficult to imagine what a cell really looks like. Three-dimensional (3-D) models help people see the parts of cells better.

Purpose
Make a 3-D model of a cell.

Procedure

Materials
You will choose your own materials.

1. Choose to make either a plant cell or an animal cell.
2. Decide on the outward structure of your cell. Remember that animal cells are usually round shaped, while plant cells are usually more square shaped.
3. Design your 3-D model to include all the parts of the cell shown on page 86 or 87 of your student text. (Use the diagram for the type of cell you have chosen.) You may use any materials that you choose to represent the structures in your cell.
4. Prepare a key to show what you used to represent each part of the cell.
5. Prepare a report describing the function of each organelle you placed in your cell, what you used to represent each organelle, and why you used it.
6. Be prepared to explain your model and answer questions.



Follow-up
- Prepare an edible model of a cell.

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TEACHER HELPS

Make an example
You may want to prepare and display an example.

Single student or groups
This activity may be done at home by each student or by science groups in the classroom. If you use groups, you may need to allow a few additional days to complete the activity.

Pictures and models
Possible choices for pictures and models include cars, planes, trains, and 3-D puzzles.

SCIENCE PROCESS SKILLS

Communicating
What would happen if you constructed your model and displayed it with no key? Answers will vary, but elicit that the model would be of limited use because others would not know what the various parts represented.

How does preparing a report make your model more useful to others? Answers will vary, but elicit that others can learn from the report.

How does preparing a report help the preparer? Possible answers: It forces the preparer to have a logical reason for choices. It reinforces the concepts being modeled.

Most scientists' work is largely ignored until the scientists prepare extensive reports on their procedures and findings. This allows other scientists to read and evaluate their work.

An Organized Cell

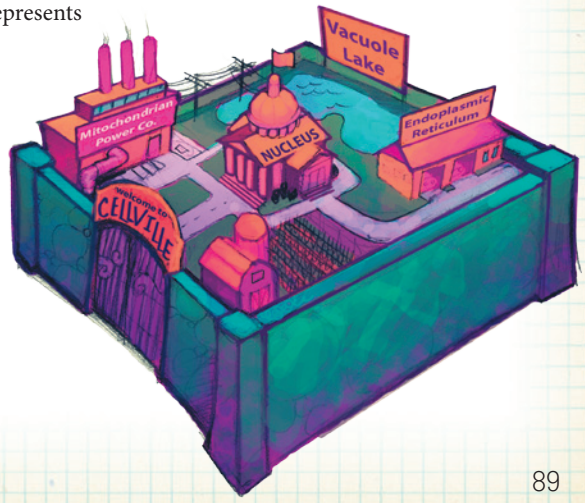
EXPLORATION

Cells are very organized, and each structure in a cell has a specific purpose. You can think of a cell as an organization such as a city. Cities use multiple departments to accomplish tasks. In the same way a mayor's office manages and regulates the city, the chromosomes and DNA molecules of the nucleus regulate the work of the cell. A city also needs departments for transportation, waste management, communication, and various other tasks.

Your task is to prepare a skit comparing a cell and its internal structures to a city, business, country, factory, school, or any other organization that uses multiple departments to function.

What to do

1. Use the planning page in the Activity Manual to decide what organization your cell will be compared to.
2. Decide what part of the organization each part of the cell will represent. Research the parts of the cells as needed to gather information to aid you in your decisions.
3. Prepare a short (five-minute) skit about a day in the organization. Each department (cell structure) should be included in the skit. The skit should demonstrate the jobs of each cell structure.
4. Prepare large name cards listing each cell structure and the department it represents for the organization.
5. Present your skit to an audience.



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TEACHER HELPS

Purpose of exploration
There are no right or wrong answers to this exploration. The purpose is to help students associate the cell's functions with everyday life. Even at a cellular level, God has a very purposeful design.

Grouping
This activity can be done by science groups, or the entire class could work together.

Presenting the skit
The skit could be presented various ways. A group of students may choose to present their skit with puppets or to limit props to signs and/or name cards. Encourage student creativity, but you may need to remind them of due dates and time limitation for the length of their skit.

Objectives

- Correlate the function of cell structure to another organization
- Write and present a skit to compare a cell to an organization

Materials

- paper for name cards

Introduction

Two lesson days are allotted for this exploration. On the first day, introduce the exploration, set guidelines, and allow students to begin planning. Use the second lesson day for the presentation of the skits.

The nucleus of a cell contains the DNA that determines the functions of the other parts of the cell. If we compare a cell to a school, what person would be the nucleus? Possible answers: principal or administrator

What is the function of ribosomes in a cell? They carry out instructions from the DNA and make the proteins that the cell needs.

Which people would be the ribosomes? teachers
Why? They carry out the instructions of the principal or administrator.

Teach for Understanding

Purpose for reading

The student should read all the pages before beginning the exploration.

What to do

Guide the student discussion as needed. Provide resources for student research. You may choose to have the student provide a written copy of his skit.

Activity Manual

Exploration, page 63

Assessment

Rubrics

Select the prepared rubric, or design a rubric to include your chosen criteria.

Objectives
- Describe the process of cell division—both mitosis and meiosis
- Identify when mitosis occurs and when meiosis occurs

Materials
- clay, 2 colors per student

Vocabulary
cell division
mitosis
sexual reproduction
meiosis

Introduction
What are the five characteristics of living things? Living things grow and develop, reproduce, respond to their environments, use energy, and are made of cells.

We have learned about the structure and function of cells. Now we will see some ways that cells and organisms reproduce.

Teach for Understanding
Purpose for reading
How do all cells reproduce?

How many chromosomes are in reproductive cells?

Discussion
How does the body replace dead skin cells? Living cells reproduce through cell division.

What happens first when a cell gets ready to reproduce itself? It duplicates the chromosomes in the nucleus.

What are two types of cell division? mitosis and meiosis

If one cell undergoes mitosis, how many new cells will form? two

Provide clay and direct the student to flatten a circle of it to represent a cell. He should use the second color to represent the four chromosomes pictured in the Mitosis diagram. Guide him in duplicating the chromosomes and modeling the cell division. He should end with two cells that have the same number of chromosomes as the parent cell.

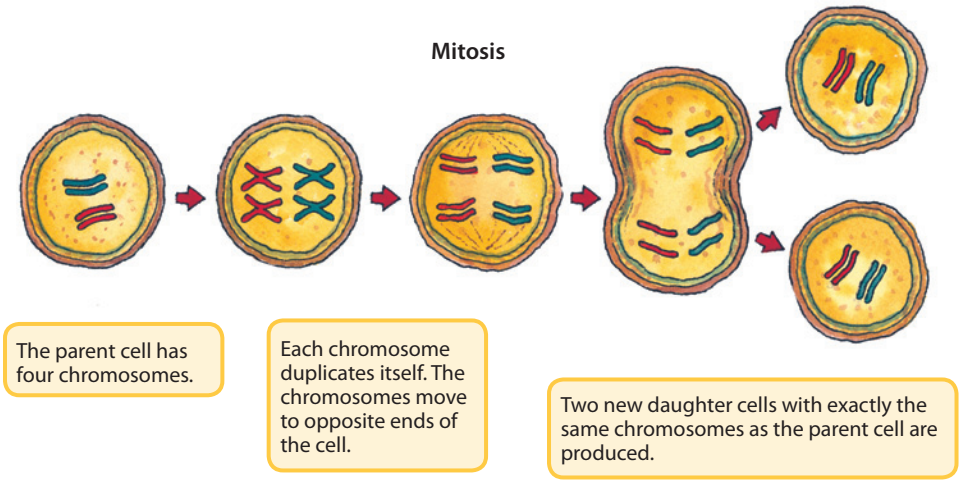
Reproduction of Cells

Single-celled organisms and most cells of multicellular organisms must be able to reproduce in order for the organism to survive. Imagine what would happen if the skin cells in your body were not able to reproduce themselves. As your skin cells died and were washed or rubbed away, there would be no new skin cells to replace them. Before long all of your skin would be gone! God designed cells and organisms to replace themselves through reproduction.

An individual cell reproduces itself by dividing into two cells through a process called **cell division**. The idea that one cell divides into two seems surprisingly simple. But the process is actually very complicated. First each chromosome is copied. Then the process of **mitosis** (my TOH sis) begins. Mitosis is a step-by-step process that ensures that the two new cells will be the same as the original, or parent, cell. As the cell divides, the chromosome pairs separate and move to opposite ends of the cell. Later, new nuclei form, and the cell splits into two new cells containing identical chromosomes.

FANTASTIC FACTS

Did you know that your body replaces the entire outer layer of your skin about once a month? Stomach lining cells last only a few days. Some cells, however, need to last a lifetime. Your heart muscle cells and most of your nerve cells never reproduce. You were born with all the heart and nerve cells you will ever have.



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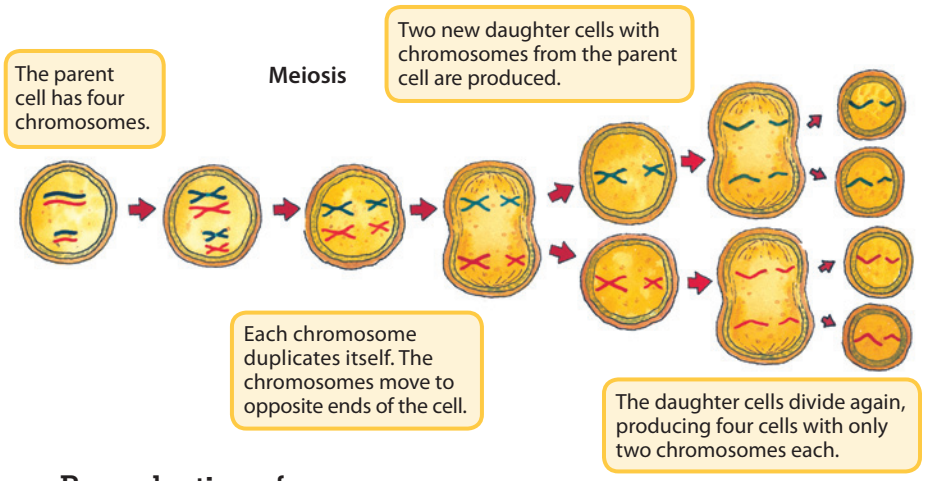
SCIENCE BACKGROUND

Mitosis
The new cells that form during mitosis are genetically identical to the parent cell unless something goes wrong during cell division.

Meiosis
During meiosis, the chromosomes combine differently when the cell divides for the first time. Those chromosomes are not duplicated when the new cells divide for the second time. This leaves each of the four new cells with half of the number of chromosomes that were present in the original cell. Because reproductive cells form in this manner, each new organism is a unique combination of its father and mother.

Other forms of reproduction
Some cells reproduce in other ways. For example, some one-celled organisms divide into two organisms through binary fission. Reproduction is discussed further in Chapter 12, *Plant and Animal Reproduction*.



Reproduction of Multicellular Organisms

Think about the growth of a young puppy. Every day many of the puppy's cells multiply through the cell division process of mitosis. These additional cells cause the puppy's body to grow. Soon she becomes an "adult" dog. Cell division causes one puppy to grow and mature. But how do we get more puppies? More than only a group of new cells is needed to get new puppies.

The process of creating new life using cells from male and female organisms is called **sexual reproduction**. The cells needed for this kind of reproduction are very different from other cells. Each cell contains only half the number of chromosomes as the parent cells. These special reproductive cells form through a process of cell division called **meiosis** (my OH sis).

Instead of simply dividing once as in mitosis, cells that undergo meiosis divide a second time. When they divide the second time, the chromosomes do not duplicate. Each reproductive cell ends up with only half as many chromosomes as the parent cell. Some of these reproductive cells are male and some are female. When a male reproductive cell and a female reproductive cell join, the new cell will again have the proper number of chromosomes. Once a new cell is formed, it continues to grow and multiply through the process of mitosis.

QUICK CHECK

1. What process ensures that two new cells will be the same as the parent cell?
2. Name the process by which special reproductive cells form.

Discussion

What type of cell division forms the reproductive cells needed to make a new life? meiosis

If one cell undergoes meiosis, how many new cells will be produced? four **Why?** Cells that go through meiosis divide twice.

Are these four cells identical to the parent cell? no **Why?** They have only half the number of chromosomes that the parent cell had.

What is the main difference between mitosis and meiosis? In mitosis, chromosomes duplicate once and the cell divides once. In meiosis, chromosomes duplicate once but the cell divides twice.

What would happen with the number of chromosomes in sexual reproduction if the chromosomes duplicated again before the second division? The cell that formed after the union of the male and female cells would have double the number of chromosomes found in either parent.

Provide clay and give the student time to model the process of meiosis. The student should end with four cells that have half the number of chromosomes as the parent cell.

What forms when a male reproductive cell and a female reproductive cell combine? a new cell

How many chromosomes will this new cell have? the same number as the original parent cells

Will the new cell be exactly the same as either parent cell? no **Why?** The new cell is a combination of chromosomes from two different parent cells.

After a new cell is formed, how does that cell grow and multiply? through mitosis

Discuss *Fantastic Facts*.

What are some parts of your body that replace cells frequently? Possible answers: outer layer of skin, stomach lining

Why do you think keeping your heart healthy is important? Possible answer: Special care must be taken not to damage or destroy heart cells, since they are not reproduced.

Answers

1. mitosis
2. meiosis

TEACHER HELPS

Modeling aids learning
Modeling mitosis and meiosis will help some students better comprehend the processes. Clay is suggested since it can easily be pinched and shaped to divide into two cells. The chromosomes can be modeled with a different color of clay or with yarn. Other materials could also be used. You may choose to have a student model each step of the process so that he has several clay shapes that align with each step of the diagrams, or he could use the same clay all the way through, modeling how the process occurs.

Explanations
The explanation of mitosis and meiosis is simplified purposefully. This is an introduction to the processes that will be more thoroughly explained in later grades.

Mitosis
Sixth-grade students should understand that in mitosis, the chromosomes duplicate once and the cell divides once. This process produces two cells genetically identical to the parent cell. Mitosis helps multicellular organisms grow, as old cells are replaced with new cells.

Meiosis
In meiosis, the chromosomes duplicate once and the original cell divides twice. The process of meiosis produces four reproductive cells.

Remembering the difference
To help the student remember the difference, tell him that the *t* in mitosis can remind him that the mitosis cell division ends with only two new cells.

Objectives
- Distinguish groups according to chosen criteria
- Complete a classification chart

Materials
- *Flow Chart* (IA), for display
- See Student Text page

Vocabulary
criteria

Introduction
Systems of classification are all around us. In a library, the books are classified as fiction or nonfiction. Most vehicles can be classified as cars or trucks.

Display the *Flow Chart* and complete it with answers from the following discussion.

Think about how you classify the clothing in your bedroom.

Into which two large groups can you divide all your clothing? clean and dirty

Into which two groups can you divide your clean clothing? folded and hanging

How do you sort your dirty laundry to be washed? light clothes or dark clothes

Add more boxes to the chart as needed. The sections of the chart may not be equal. Additional answers may include the following: Folded clothing is kept *in drawers* or *on shelves.* Hanging clothing *needs ironing* or *does not need ironing.*

Point out the organization of the chart and the way information is added with short answers.

Teach for Understanding
Purpose for reading
What is another name for a standard used to decide how items are classified?

The student should read all the pages before beginning the activity.

Procedure
Discuss the term *criteria.*

Guide the student as he chooses criteria for classifying his pasta. Challenge the student to divide his pasta into many levels.

Use the questions in the Science Process Skills to discuss classifying.

Activity Manual
Activity, page 64

Assessment
Rubrics

Select the prepared rubric, or design a rubric to include your chosen criteria.

ACTIVITY

Classifying

Every day we use systems to classify things. Often charts, graphs, or tables are used to illustrate or show systems of classification. In this activity you will decide the *criteria*, or standards, for classifying types of pasta.

Process Skills
- Observing
- Classifying
- Communicating

Purpose
Develop a classification system.

Procedure
1. List the types of pasta in your Activity Manual.
2. Write *Pasta* in the blue box at the top of the web.
3. Examine and sort your pasta into two groups. You must decide the criteria to use to make your groups. Remember that members of one group should not have the main feature of the other group.
4. Record the two groups in the yellow boxes of the web.
5. Continue dividing each group of pasta into groups according to your chosen criteria. Continue the web using your decisions.

Materials
8 or more varieties of uncooked pasta
Activity Manual

Conclusions
- What other ways might you classify your pasta?
- Compare your chart to the chart of another group. Were the same criteria used?

Follow-up
- Take a poll to find your classmates' favorite types of pasta. Display the results using a graph.

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SCIENCE PROCESS SKILLS

Classifying

What criteria did you choose to begin your classification system?

Does your chart look the same as the chart from another group? Why?

How would your chart be different if your criteria were based on the uses of the pasta in recipes?

What do you think a scientist does if he discovers an organism that fits into more than one category? Elicit that he may consult other scientists, and together they will make the best choice they can.

Sometimes names or the organization of whole categories change because of new organisms.

TEACHER HELPS

Pasta variety

Try to use a wide variety of pasta. Including one or more colored pastas will help the student see that some things do not always fit the specified categories.

Classification

Putting organisms with similar characteristics into groups is called *classification*. Classifying is not an exact science, but grouping and ordering organisms help scientists study the common traits of a group. As God has allowed man to learn more about various organisms, man has changed his ideas about many classifications. When the Swedish scientist Carolus Linnaeus (lih NEE us) originally proposed his method of classification, there were only two broad categories. He called these categories kingdoms—Animalae and Plantae. Currently, most scientists identify six kingdoms.

1. Eubacteria (YOO bak TEER ee uh)
2. Archaebacteria (AR kee bak TEER ee uh)
3. Protista (proh TIST uh)
4. Fungi (FUN jye)
5. Plantae (PLAN tee)
6. Animalia (an uh MAY lee uh)

The Living Kingdoms

Kingdom Eubacteria

The organisms in this kingdom are called **bacteria**. These microscopic organisms are almost everywhere. On your desk right now there are probably several thousand bacterial cells. In fact, bacteria are the smallest living things known to man. Though they are unicellular, bacteria tend to live in groups called **colonies**. Unlike most other organisms, bacteria do not have well-defined nuclei. The DNA usually floats in the cytoplasm. Bacteria also do not have some of the organelles that are part of most cells.

Though you cannot see bacteria, you probably have felt the results of them. Sometimes a colony of bacteria takes up residence in a person's throat or ear. The bacteria irritate the sensitive tissue in the throat and ear and can cause a great deal of pain.

Not all bacteria species are bad. Most are harmless, and some can actually be helpful. Your intestines contain bacteria that help digest your food. Some food items, such as yogurt, contain bacteria that give them a unique taste. Bacteria can grow rapidly as long as they have warmth, water, a food source, and room to grow.

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Activity Manual page
You may want to have the student complete Activity Manual page 65 during the teaching of the lesson. This page is also included as an IA page on the Teacher's Toolkit CD.

Adam's first job
The first job God gave Adam after creating him was to name the animals that God brought to him (Gen. 2:19). This job was important not only because it was first, but also because it required Adam to exercise a gift that the Lord had just given to him—creativity. This was Adam's first responsibility as the person charged with taking care of the garden (Gen. 2:15). While Adam only had to care for the garden, mankind has been charged with the care of all God's creation (Gen. 1:28). One very important way we exercise this responsibility is by defining and classifying life.

Biblical kinds
God commanded all living things to reproduce "after their kind" (Gen. 1:11, 21, 24). You can see the result of God's command by observing the living things around you. Maple trees reproduce maple trees, rosebushes reproduce rosebushes, and mice reproduce mice. These groups of reproducing organisms that God established are called biblical kinds. If two organisms cannot produce offspring (reproduce after their own kind), then creationsists believe they are not in the same biblical kind.

Objectives

- Name the six kingdoms
- Identify characteristics of each kingdom
- Explain how man is similar to and yet different from other living organisms

Vocabulary

bacteria
colony
protozoan
algae
photosynthesis

Introduction

The *Purpose for Reading* section prepares and instructs the student to read all the pages in the lesson. Because the concepts and terms in this lesson may be unfamiliar to most students, the material is divided into one- or two-page sections. Each section begins with *Purpose for Reading*.

If you were trying to classify mammals as sea mammals or land mammals, where would you put a sea lion, since it lives on land but also spends much time in the sea? Answers will vary.

Although classifying is not always easy, scientists have developed a system.

Teach for Understanding

Purpose for reading

How many kingdoms are there?

What size are bacteria?

Discussion

What is classification? putting things with similar characteristics into groups

What name did Linnaeus give to the two broad categories of classification? kingdom

What are the names of the six kingdoms identified today? Eubacteria, Archaebacteria, Protista, Fungi, Plantae, Animalia

Where is bacteria found? almost everywhere

How small are bacteria? microscopic and unicellular

Review the meaning of *unicellular*.

What is unusual about a bacteria cell? Possible answers: A bacteria cell does not have a well-defined nucleus. The DNA floats in the cytoplasm. It does not have some of the organelles that are part of most cells.

What is a group of bacteria called? a colony

Give examples of when bacteria may cause you pain. Possible answers: sore throat, earache

What are some helpful bacteria? Possible answers: bacteria that help digest food, bacteria in yogurt

What is required for bacteria to grow? warmth, water, a food source, and room to grow

Some eubacteria can survive without oxygen.

Purpose for reading

What is the most remarkable feature of Archaebacteria?

What are two major kinds of Protista?

What kind of fungus does a baker use?

Discussion

Why did scientists divide the bacteria-like organisms into two kingdoms? The organisms were so different that each kind needed its own classification.

What are some characteristics of Archaebacteria that are different from those of Eubacteria? Possible answers: Archaebacteria have a unique chromosome structure. They have cell walls that can withstand the extreme environments where they live.

What is another name for a sulphur spring? Possible answer: hot spring

Do you think you would find archaebacteria in mud pots? yes **Why?** Mud pots are hot springs with mud in them.

How are Archaebacteria similar to Eubacteria? Possible answers: They both have no true nucleus and do not have all the organelles that are in most cells.

What are some environments where you might find archaebacteria? Possible answers: sulfur springs, salt lakes

What is meant by "concentrated saline level"? very salty

What other body of water might also have Archaebacteria growing in it? the Great Salt Lake

What kinds of organisms are included in the kingdom Protista? all unicellular organisms that do not fit into any other category

What can we learn about God from studying archaebacteria and their living conditions? Possible answer: God cares for His creation and provides exactly what each organism needs.

What are two groups in the kingdom Protista? protozoans and algae

What does a paramecium use to move around? hairlike structures called cilia

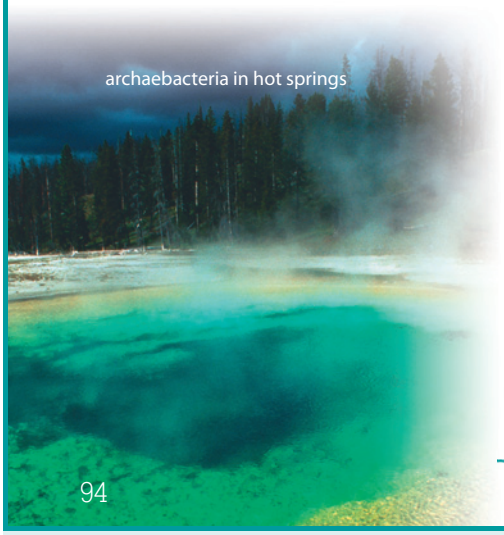
How does an amoeba eat its food? It extends its cell membrane to surround the food and engulfs it.

Kingdom Archaebacteria

Archaebacteria are unicellular organisms similar to "normal" bacteria. In fact, Eubacteria and Archaebacteria used to be classified together. But as scientists have discovered more and more about bacteria, they have concluded that some of these organisms are so distinctive that they need a classification kingdom of their own. Archaebacteria have a unique chromosome structure. They also have cell walls that are specially designed for the extreme environments where they live. Some archaebacteria are able to survive without oxygen.

Many archaebacteria live in conditions that are poisonous to other living things. To most organisms, the hot and acidic sulfur springs near volcanoes are deadly, but scientists have found archaebacteria growing in these springs. Archaebacteria also survive in places such as the Dead Sea, where the concentrated saline levels cause most organisms to die.

Like Eubacteria, Archaebacteria do not have true nuclei. They also may not have some of the organelles that typically make up a cell. However, God has given them a design perfectly suited to the harsh enviroments in which they live.


archaebacteria in hot springs

Kingdom Protista

Kingdom Protista includes all of the unicellular organisms that do not fit into any other category. These organisms have cell membranes and true nuclei. The organisms in this kingdom usually reproduce by cell division.

Two kinds of organisms in this kingdom are protozoans and algae. The **protozoans** (PRO tuh ZOH unz) can move around and often live in water—especially pond water. One common protozoan, the *paramecium* (PEAR uh MEE see um), uses tiny hairlike structures called *cilia* (SIL ee uh) to propel it through the water. *Amoebas* (uh MEE buhz) are very unusual protozoans because they move around by constantly changing their cell shapes. Amoebas eat by extending their cell membranes and surrounding and engulfing food.


paramecium


amoeba


algae

SCIENCE BACKGROUND

Hydrothermal vents
The bacteria-like organisms mentioned in the opening of this chapter are a type of Archaebacteria. Many scientists believe that the Archaebacteria are the main organisms responsible for performing chemosynthesis.

Oxygen
No known organism other than some species found in Archaebacteria and Eubacteria has the ability to live without oxygen.

Mushrooms
Frequently mushrooms grow in a circle called a fairy ring. Once people believed that fairies would hold meetings at these rings. Today scientists know that underground filaments from one mushroom causes the mushroom to create a ring. As this mushroom grows, it sends out filaments. These filaments expand to cover the area of a circle. The boundary of the filaments forms the perimeter of the circle. The original mushroom resides in the center of this circle. From the filaments, other mushrooms grow. Eventually the mushrooms in the center of the circle die out, but the mushrooms on the perimeter continue to live. As they grow, the perimeter expands. Fairy rings usually reach a diameter of about 6 feet. A few have diameters of several hundred feet, although these make distorted circles.

Algae (AL jee) are not as mobile as the protozoans. Algae often grow in colonies that can be seen easily without the aid of a microscope. You have probably seen algae growing in ponds or fish tanks. Like plants, algae have chlorophyll in their cells, so they are able to use sunlight for energy.


mold on cheese

Kingdom Fungi

Much variety exists among members of this kingdom. Some species of fungi are unicellular, and some exist in colonies. Unlike algae, a fungus cannot make its own food. Fungi absorb the food they need from their surroundings.

The most common example of a fungus is the mushroom. A mushroom is a complex fungus that lives off of decaying plant and animal matter. The mold that grows on stale bread is another well-known example of a fungus. Fungus cells are everywhere and can reproduce rapidly in moist, warm conditions.


mushroom colony

You may have seen someone put fungus in homemade bread. Yeast is a special fungus that grows rapidly in bread dough. Living yeast cells produce a gas called carbon dioxide that becomes trapped in the dough. Bread rises when these small pockets of gas expand.

Most fungus species are harmless, but some, such as poisonous mushroom species, are very dangerous. Others, such as the type that causes athlete's foot, can affect humans and cause great discomfort.

SCIENCE & THE BIBLE

Several types of fungi are mentioned in the Bible. The first mention of yeast, or leaven, in the Bible is in Exodus 12:15. During the first Passover feast, God commanded the children of Israel to sacrifice a lamb and eat unleavened bread, or bread without yeast. This bread was similar to the crackers we eat today. The Bible also uses leaven as a picture of sin. In the New Testament, Paul warned the church in Corinth by saying, "Know ye not that a little leaven leaveneth the whole lump?" (1 Cor. 5:6). The believers in that church were tolerating sin among their members. Like yeast that grows and makes bread rise, so a little sin will grow and harm other believers.

DIRECT A DEMONSTRATION

Observe yeast growth

Materials: yeast, sugar, warm water

Stir together 15 mL of yeast and 15 mL of sugar. Add 30 mL of warm water. Stir. Set aside and observe.

What gas causes bubbles to form? carbon dioxide

Discussion

How are algae similar to plants? They contain chlorophyll and are able to use sunlight for energy.

What other organism have we learned also uses sunlight for the process of photosynthesis? phytoplankton

Most phytoplankton are in the kingdom Protista.

Do you think that the term *colony* has the same meaning when describing fungi as it does when describing bacteria? Answers will vary, but elict that in either usage *colony* means a group of organisms living together.

What common fungus might you find in your yard? a mushroom

Why do people who are allergic to mold often have such a difficult time managing their allergy? Answers may vary but should include that fungus cells are everywhere.

What conditions are best for a fungus to reproduce? warm, moist conditions

Why does putting food in a refrigerator slow down the growth of a fungus? A refrigerator is not a warm environment.

Do you think fungus would grow well in a desert? Answers may vary but should include that the dry conditions would discourage growth.

What fungus is used to make bread? yeast

How does yeast cause bread dough to rise? As yeast grows it gives off carbon dioxide, which forms into bubbles when trapped in the dough. The bread rises as the gas bubbles expand.

Give an example of a fungus that causes discomfort to humans. Possible answers: athlete's foot, ringworm

Fungi require certain conditions to grow. What do you think you can do to avoid getting athlete's foot? Possible answer: Keep your feet dry.

Discuss *Science & the Bible*.

What is another name for yeast? leaven

What does leaven often represent in the Bible? sin

Why do you think God commanded the children of Israel to eat unleavened bread at Passover? It showed God's desire for them to live clean, pure lives without sin. [BAT: 4b Purity]

What did Paul mean by "a little leaven leaveneth the whole lump"? Just as a little yeast can cause a whole loaf of bread to rise, a little sin is able to grow and affect others.

Purpose for reading

Why are cell walls important to plants?

How is man different from animals?

Discussion

What important role has God designed for plants? to provide food

What do plants have that helps them make their own food? chloroplasts that contain chlorophyll

What process do plants use to produce food? photosynthesis

What usable source of energy do plants produce through photosynthesis? sugar

How do humans and animals benefit from photosynthesis? When they eat plants, their bodies use the sugar produced by those plants.

In addition to food, what benefit does photosynthesis provide? oxygen

Why is a cell wall more important to plants than it would be to animals? Animals often have skeletons to support their structure. Plants do not, so they need firmer cell boundaries for support.

Which kinds of plants have very thick cell walls? shrubs and trees

Why do these plants need very thick cell walls? Their size puts a lot of pressure on the plant.

What are some types of organs in plants? Possible answers: bark, leaves, roots

Are animals unicellular or multicellular? multicellular

Kingdom Plantae

God has designed organisms in the plant kingdom to provide a crucial need for all living things—food. This group of multicellular organisms has chloroplasts as part of the cell structure. The chlorophyll inside the chloroplasts

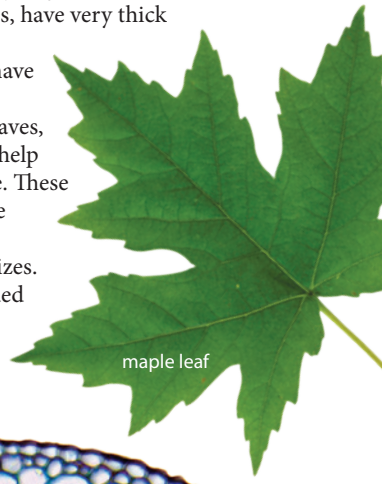
Indian paintbrush

helps a plant make its own food. You may have noticed that most plants require sunlight to stay alive. Plants use a process called **photosynthesis** (FOH toh SIN thuh sis) to convert the energy in sunlight into a usable source of energy, sugar. Animals and humans that eat the plant also use this sugar.

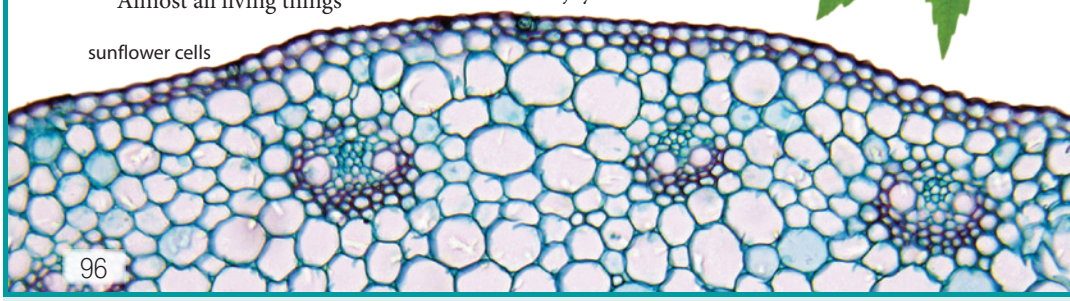
Through photosynthesis plants also release oxygen into the atmosphere. Almost all living things require oxygen to stay alive. Without plants, there would not be enough oxygen for living things to survive on the earth.

In addition to cell membranes, plants have cell walls. This firmer cell boundary is very important to the plant. Some small organisms can survive without much support. Many larger organisms, such as animals, have internal or external skeletons that provide support. However, plants do not have skeletons, and not all plants are small. In fact, some plants are quite large. Therefore, plants need a way to support their structures. Cell walls give the support that plants need. Some plants, especially large plants such as shrubs and trees, have very thick cell walls.

Plants also have various organs, such as bark, leaves, and roots, that help keep them alive. These structures come in a wide range of shapes and sizes. God has provided a variety of plants for our use and enjoyment.



maple leaf



sunflower cells

DIRECT A DEMONSTRATION

Demonstrate the function of cell walls

Materials: large marshmallows, empty toilet tissue tube, ruler, weight (such as a book)

In this demonstration each marshmallow is a cell in the stem of a plant. The weight is the weight of the branches, leaves, and blossoms the stem must hold.

Stack six or seven marshmallows. Measure and record their height. Place the weight on the marshmallows. Measure and record the height of the stack with the weight in place.

Place the same number of different marshmallows in the tissue tube. Measure and record the height of the tube.

Place the weight on the tube. Measure and record the height of the tube with the weight in place.

What effect did the weight have on each stack of marshmallows? The weight squished the first stack but had little or no effect on the stack in the tube.

What does the tissue tube represent? the cell wall

How does the cell wall help the cell? It gives strength and support.

LANGUAGE

Photosynthesis

The word *photosynthesis* comes from the Greek words *photo*, meaning "light" or "radiant energy," and *synthesis*, meaning "to put together."

sickle butterflyfish

Kingdom Animalia

You are probably most familiar with the animal kingdom. All animals are multicellular. Animal cells do not have cell walls, but many animals have skeletal systems to support their tissues and organs.

Unlike plants, animals cannot manufacture their own food. They are dependent on the ability to move to find and gather food for their needs. Their nervous systems help them detect food as well as respond to other conditions in their environment.

The structure, size, and overall characteristics of organisms in the kingdom Animalia vary greatly. Some animals, such as jellyfish and flatworms, have only a few organs and tissues to do small tasks such as eating and removing waste. Other animals, such as mammals, require complex body systems to live.

Border collie

Some people ask the question "Are humans animals?" Physically, human bodies have many traits common to mammals. But man is in a class by himself. God created man in His own image (Gen. 1:27). This is why humans have a sense of right and wrong. This is why humans can have a personal relationship with God. They are not animals. Some scientists believe that man came from animals through the process of evolution. But the Bible tells us that God created animals and humans separately by direct acts. While man may be physically similar to animals, the Bible says that he is God's special creation.

Colorado potato beetle

QUICK CHECK

1. Name the six kingdoms of organisms.
2. Give an example of a fungus that humans use.
3. What process do plants use to make sugar?
4. How is man different from animals?

DIRECT AN ACTIVITY

Classifying plants and animals

Make and display a 3 × 6 grid as shown.

Plantae					
Animalia					

Randomly choose and write a letter at the top of each of the five empty columns.

Give the student one minute to complete the chart with names of plants and animals that start with the corresponding letters. At the end of the time, discuss the accuracy of the answers.

Discussion

Although animals do not have cell walls like plants, many of them have another means of support. What is it? skeletal system

What is another way that animals are different from plants? Animals cannot make their own food.

What can animals do to obtain food? They move to find and gather food.

What helps animals detect food? their nervous systems

What else do their nervous systems help them do? respond to other conditions in their environments

What are some animals that require only a few organs to live? Possible answers: jellyfish, flatworms

How are humans like animals? Many physical traits of humans are common to all mammals.

Even with these common traits, scientists are not certain that man is physically similar to mammals.

How are humans different from animals? Man is created in the image of God. [BAT: 3a Self-concept]

What are two things that humans have because we are created in the image of God? a sense of right and wrong and the possibility of a personal relationship with God

What does the Bible tell us about how God created animals and humans? He created them separately by direct acts.

Answers

1. Eubacteria, Archaebacteria, Protista, Fungi, Plantae, Animalia
2. Possible answers: mushrooms, yeast, mold
3. photosynthesis
4. Man is different from animals because he is created in the image of God. He has a sense of right and wrong and can have a personal relationship with God. God created animals and man separately by direct acts.

Activity Manual

Reinforcement, page 65

Objectives
- Recognize that Carolus Linnaeus was responsible for the method of classification that we use
- List the levels of the classification system from largest to smallest
- Compare the common names and scientific names of organisms
- Write a scientific name properly

Materials
- picture of a mountain lion and/or bison

Vocabulary
kingdom
phylum
class
order
family
genus
species
scientific name

Introduction
Show a picture of a mountain lion or bison.

What do we call this animal? Possible answers: mountain lion, cougar, panther, bison, buffalo

Why is this animal called by different names? Accept reasonable answers.

Do you think this might cause confusion? yes

Scientists also had this problem. Because of the confusion, scientists developed a system to standardize the names of living organisms.

Teach for Understanding
Purpose for reading
Who helped classify the different organisms into groups?

What two levels of classification are part of the scientific name?

Discussion
What difficulties might scientists have if they use common names when identifying organisms? Different scientists may call the same organism by different names.

Name some living things that you know more than one name for. Possible answers: Dianthus plants are sometimes called pinks. Chipmunks may be called ground squirrels.

What scientist proposed a system of classification for plants and animals? Carolus Linnaeus

What are the seven levels of classification of living organisms? kingdom, phylum, class, order, family, genus, species

Discuss *Classification of the African Lion*.

Naming Organisms

Your name is what makes you unique—or so you think. Many people have very common first and last names. If you look for a person's name in a telephone directory or on the Internet, you may find many people with that same name. Sometimes people go by their middle names or make up new first names for themselves. Naming and identifying people can be a very confusing task.

Identifying and naming organisms can be confusing too. Consider the name *spider*. Most of us know what a spider is, but the name is too general. The word *spider* could refer to a tiny, harmless spider or a large, poisonous tarantula. Over the years, people have tried to be more specific as they name organisms, so names such as black widow, roadrunner, and bald eagle have become common names that are widely recognized. But common names still have their problems. Sometimes an organism may have more than one common name, or a common name may apply to more than one organism. Common names are also different in different languages.

Carolus Linnaeus (1707–1778) decided to do something about this confusion. He proposed an ordering system to help classify plants and animals according to common characteristics. Though some of his original system has been changed, his ideas and much of his research are still used today to classify organisms. Currently scientists use seven levels of classification. They have placed every living thing into one of the *kingdoms* discussed earlier. Each kingdom is divided into phyla (FYE luh—singular, *phylum*). Members of each phylum have similar characteristics that set them apart from members of the other phyla. The phyla

Classification of the African Lion

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Carnivora
Family: Felidae
Genus: Panthera
Species: Leo

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SCIENCE BACKGROUND

Linnaen classification
Because Carolus Linnaeus developed the basis of the modern system of classification, the system is called Linnaen classification.

TEACHER HELPS

Memory tip
Allow groups to try to make a sentence using the first letter of each of the seven levels of classification.

Example: **K**ate **p**oured **c**offee **o**n **F**ather's **g**ood **s**uit.

Allow groups to share their ideas. As a class, choose the best sentence and use it repeatedly to reinforce the classification system.

are split into *classes*, and every class is separated into *orders*. Orders are broken down into *families*, families into *genera* (JEN air uh—singular, *genus*), and genera into *species*.

Linnaeus used **scientific names** for each specific type of organism. These names are unique and are not attached to any other organism. We still use many of his ideas for scientific names today.

1. A scientific name is made up of *two names*. The first name is the *genus* name and the second name is the *species* name. For example, the scientific name for dogs is *Canis familiaris*. *Canis* is the genus name and *familiaris* is the species name.
2. The scientific name is in Latin. Linnaeus chose this language because it was widely known. Many common words come from ancient Latin terms. For example, *canis* (as in "canine") is the Latin term for "dog," and *famil* (as in "familiar") is Latin for "friendly."

Canis unfamiliaris

Canis familiaris

Over the years, scientists have established certain rules for writing scientific names. The scientific name must be italicized or underlined, and the genus name always capitalized. Here are some examples of correct and incorrect ways of doing this:

Correct	Incorrect
Canis familiaris	canis familiaris
Canis familiaris	Canis Familiaris

The classification system that Linnaeus invented solved many problems for scientists. Although it is not perfect, this system makes learning about living things much easier.

Looking at the way living things are classified should help us appreciate the orderliness of God's creation. Not only are there many types of living things, but also there are many characteristics that group and set apart those living things. God's design may not always be understandable to man, but we can be assured that He planned and cares for all parts of His creation.

QUICK CHECK

1. List the classification system from the largest group to the smallest.
2. What parts of the classification system make up the scientific name of an organism?

DIRECT AN ACTIVITY

Identify correctly written scientific names

Materials: Prepared cards with the scientific names of common animals written or typed either correctly or incorrectly according to the guidelines on Student Text page 99.

Distribute one card to each student. Each student decides if his card is correct or incorrect. If the card is incorrect, the student must tell how to correct the way the name is written.

SCIENTIST

Linnaeus

Carolus Linnaeus believed that through nature man could learn more about God. His system of classification was a way to demonstrate the orderliness found in God's creation.

In addition to being a botanist, Linnaeus was a physician and a teacher. He arranged for many of his students to travel on expeditions to faraway lands.

Linnaeus constantly reworked and expanded the first edition of his classification of living things, *Systema Natura*, as additional plant and animal specimens were sent to him.

Discussion

When are animals most similar—in the same genus or in the same kingdom? in the same genus

What two parts of the classification system make up the scientific name? genus and species

What language is used to write scientific names? Latin

Why was Latin chosen? Possible answers include that many words have their roots (or beginnings) in Latin, and that Latin was a language that all scientists could use no matter what their native tongues were.

How should a scientific name be written? The genus is first and then the species. All of it is either underlined or italicized. The genus is capitalized.

What does classification show us about God's creation? Possible answer: God's plan for orderliness, variety, and design in His creation

Why do you think Christians should be concerned about names and classifications? Guide the student in concluding that they are important for good stewardship.

Answers

1. kingdom, phylum, class, order, family, genus, species
2. genus and species

Activity Manual

Reinforcement, page 66

Study Guide, pages 67–68

These pages review Lessons 50, 52, and 53.

Assessment

Quiz 4-B

The quiz may be given any time after completion of this lesson.

Objectives
- Recall concepts and terms from Chapter 4
- Apply knowledge to everyday situations

Introduction
Material for the Chapter 4 test will be taken from Student Text page 100 and Activity Manual pages 61–62, 67–70. You may review any or all of the material during the lesson. Questions similar to Solve the Problem or the ones in Thinking It Through, Activity Manual pages 69–70, may appear on the test.

You may choose to review Chapter 4 by playing "Kingdom to Species" or a game from the Game Bank on the Teacher's Toolkit CD.

Diving Deep into Science
Information on this page reflects the concepts the student should know for the test.

Solve the Problem
In order to solve the problem, the student must apply material he has learned. The student should attempt the problem independently. The answer for this Solve the Problem is based on the material on Student Text pages 98–99. Answers will vary and may be discussed.

Activity Manual
Review, pages 69–70

These pages require written responses to application questions.

Lesson 55

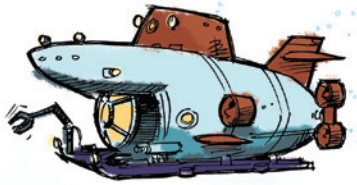
Objective
- Demonstrate knowledge of concepts taught in Chapter 4

Assessment
Tests, Chapter 4

DIVING DEEP INTO SCIENCE

Words to Know
organism
life span
life cycle
energy
cell
cell theory
microscope
cell membrane
cytoplasm
organelles
nucleus
mitochondria
vacuole
cell wall
chloroplast
chlorophyll
cell division
mitosis
meiosis
bacteria
colony
protozoan
algae
photosynthesis

Key Ideas
Characteristics of living things
History and use of microscope
Relationship between cells, tissues, organs, and systems
Structure of animal and plant cells
Comparison of mitosis and meiosis
Characteristics of each of the six kingdoms
Linnaean classification system (largest to smallest)
Scientific names



Solve the Problem
Your cousin in Wyoming keeps writing you about the problems his family is having with ground squirrels in their yard. You write back with suggestions about how you controlled the problem in your yard in North Carolina. Your cousin is not impressed. He says that you do not have "ground squirrels" in North Carolina. What animal do you think each of you is talking about? How could you make sure that you are talking about the same animal?

Answers will vary. Your cousin is probably talking about prairie dogs. You are probably talking about chipmunks. If you each would give the scientific name for the animal, you would be able to determine if the "ground squirrels" are the same animal.

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Review Game
Kingdom to Species

Prepare the classification of several animals, similar to the one on Student Text page 98. List each level of classification on separate sentence strips. Place one animal's classification strips face down. Each time a student answers a review question correctly, he chooses one of the classification strips. Once all of the classification strips for that animal have been chosen, the students who have the strips should arrange their strips in the correct order from kingdom to species.

Read the scientific name (genus and species) aloud. Allow students to guess the common name of the animal. Repeat with other animals as time allows. Students could be divided into teams with points given for correctly organizing the classification strips and identifying the scientific name.