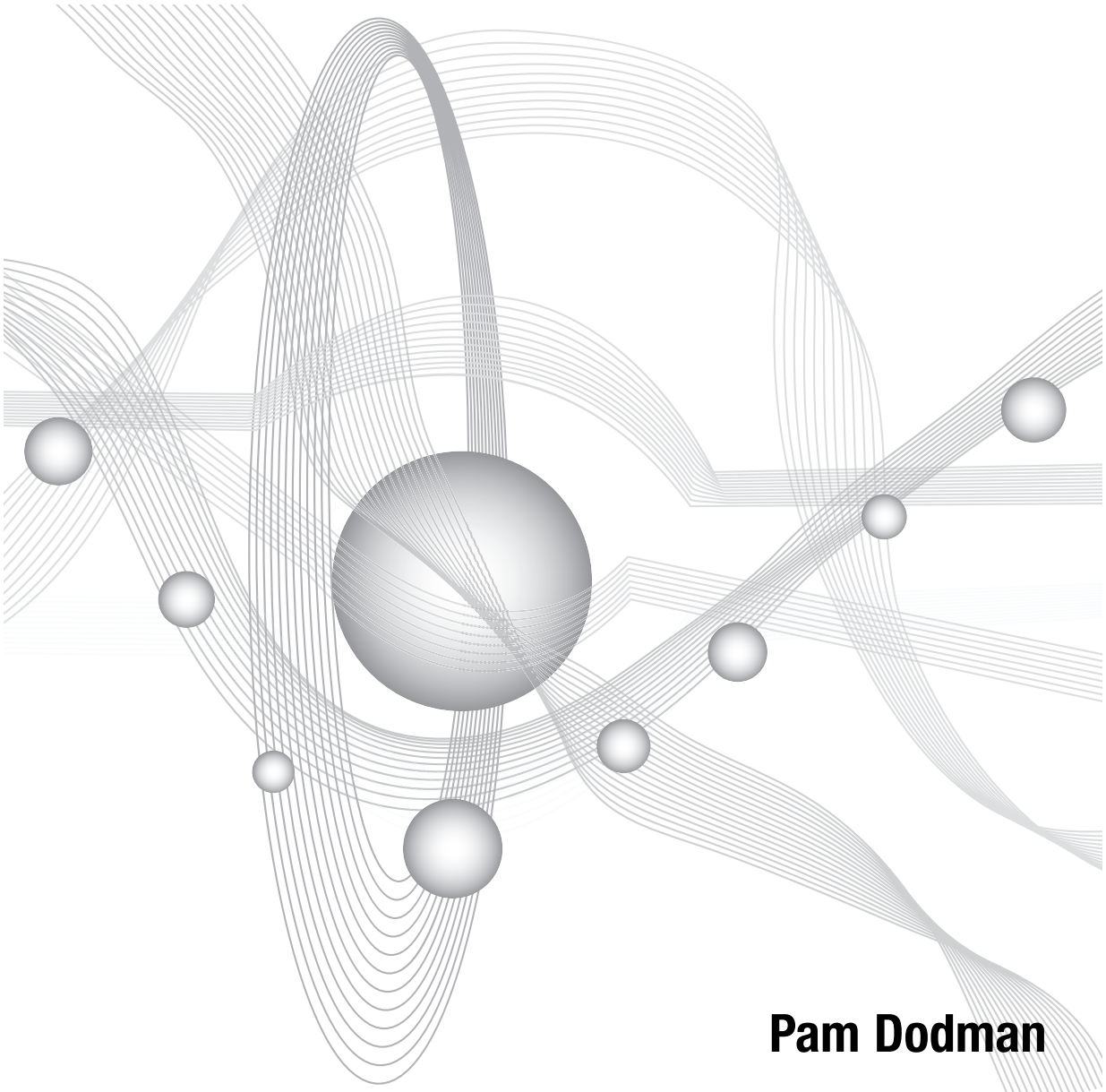
Real-Life Science

BIOLOGY



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WALCH PUBLISHING

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Introduction

The *Real-Life Science* series is designed to engage students with topics of high interest that involve places, phenomena, technology, and concepts that they may encounter in their everyday lives. The topics were chosen by professionals in science education, and the National Science Education Standards were used to develop lessons that addressed a number of content standards. Each book in the series has a correlations chart that shows core standards that are addressed by each lesson, as well as other standards that are addressed, but are not the main focus of the lesson.

Using "real-life" examples is a technique that is well supported by the National Science Teaching Standards as well. The list below includes some of the standards that suggest that quality instruction can and should include material that does more than just require students to memorize and repeat basic facts.

Teaching Standard A

Teachers of science plan an inquiry-based science program for their students.

- Select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students.

Teaching Standard B

Teachers of science guide and facilitate learning.

- Focus and support inquiries while interacting with students.
- Orchestrate discourse among students about scientific ideas.

Teaching Standard E

Teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning.

- Structure and facilitate ongoing formal and informal discussion based on a shared understanding of rules of scientific discourse.
- Model and emphasize the skills, attitudes, and values of scientific inquiry.

Each book in the *Real-Life Science* series features lessons you can use in your classroom today. Use these engaging lessons to help your students explore the intriguing ways that science is at work all around them.

National Science Education Standards Correlations

C = Core standard X = Other or optional skill

Title	Life Science Content Standard C Grades 9–12: The cell	Life Science Content Standard C Grades 9–12: Molecular basis of heredity	Life Science Content Standard C Grades 9–12: Biological evolution	Life Science Content Standard C Grades 9–12: Interdependence of organisms	Life Science Content Standard C Grades 9–12: Matter, energy, and organization in living systems	Life Science Content Standard C Grades 9–12: Behavior of organisms	Science and Technology Content Standard E Grades 9–12: Abilities of technological design	Science in Personal and Social Perspectives Content Standard F Grades 9–12: Personal and community health	Science in Personal and Social Perspectives Content Standard F Grades 9–12: Environmental quality	Science in Personal and Social Perspectives Content Standard F Grades 9–12: Natural and human-induced hazards	Science in Personal and Social Perspectives Content Standard F Grades 9–12: Science and technology in local, national, and global challenges	Physical Sciences Content Standard B Grades 9–12: Motion and forces
1. Do Snakes Really Have Cold Blood?			X		C	X						
2. Why Do Worms Come Out After It Rains?			X			C						
3. Can Fish Drown Even If They Are in Water?			C			X						
4. Why Don't Spiders Stick to Their Own Webs?			X			C						
5. How Do Geckos Walk on Walls and Ceilings Without Falling Off?			X			X						C
6. How Can You Tell the Difference Between a Salamander and a Lizard?			C		X							
7. Why Don't Geese Freeze Their Feet When They Stand on Ice?			X		C	X						
8. Why Do Cats' Pupils Look Like Slits?			C		X	X						
9. What Is the Difference Between Fur and Hair?	X		X		C	X						
10. What Is the Difference Between a Monkey and an Ape?		X	C								X	
11. Are Mushrooms Plants?	X	X	C			X						
12. Since Plants and Trees Cannot Run, How Do They Defend Themselves?			X	X		C						
13. How Does a Venus Flytrap Catch and Eat Flies?			X	X		C						

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14. How Do Seedless Watermelon Reproduce If They Don't Have Seeds?		C	X				X					
15. Why Do Some People Have "Innies" and Others Have "Outies"?			C					X				
16. Why Does Skin Look Wrinkly After a Bath?	C				X	X						
17. What Are Boogers?			X			X		C	X			
18. Why Do We Yawn?				X		C						
19. What Causes an Ice-Cream Headache?					C	X		X		X		
20. Is It Possible to Breathe a Liquid?			X			X	C					
21. Is It Possible to Drink Too Much Water?	X					X		C		X		
22. If We Already Have *E. coli* in Our Bodies, Why Is It Dangerous?	X			X				X		X		
23. Why Is the Bird Flu Dangerous to People?			X			X		X		C	X	
24. Is Global Warming for Real?					X		X	X	C	X	X	
25. What Are Stem Cells?	C						X	X			X	

National Research Council. *National Science Education Standards*. Washington, DC: National Academy Press, 1996.

National Research Council. "National Science Education Standards." http://books.nap.edu/readingroom/books/nses/6e.html#csa912.

1. Do Snakes Really Have Cold Blood?

Topics

thermoregulation, ectotherms, endotherms

Goal

To clarify the difference between ectotherms and endotherms

Context

The term *cold-blooded* has been used to describe a number of animals that do not regulate their temperatures the same way that humans do. It is important for students to understand how these creatures regulate their body temperatures and interact with their environments.

Teaching Notes

After reading the Explanation, discuss and, as necessary, do the following:

- Remind students of the characteristics of ectotherms and endotherms. (Ectotherms regulate their temperature by changing their behavior. Endotherms regulate their themperature through their body processes, or physiology.)
- Clarify for students which animals are ectotherms and which are endotherms. (Fish, amphibians, and reptiles are ectotherms. Birds and mammals are endotherms.)
- Discuss the meanings of the words *ectothermic, endothermic, poikilothermic, homeothermic,* and *thermoregulate.* (Ectothermic describes an animal with cold blood. Endothermic is characterized by or formed with absorption of heat. Poikilothermic describes a cold-blooded organism. Homeothermic means warm-blooded. Thermoregulate means to maintain a specific temperature.)

Extension Activity

Have students research physiological and behavioral ways of thermoregulation. The movie *March of the Penguins* could be used to initiate discussion.

Answer Key

1. cold-blooded
2. variable
3. endotherms
4. thermoregulation
5. mammals
6. poikilothermic
7. cool down
8. warm up

Name _____ Date _____

1. Do Snakes Really Have Cold Blood?

Explanation

While you may have heard of snakes referred to as "cold-blooded" creatures, they do not actually have cold blood. The term *cold-blooded* was used to describe animals such as snakes because it was once thought that they had no control over their body temperature. Snakes are actually *ectotherms*—animals that have variable body temperatures that get heat from outside sources. Animals that maintain constant body temperatures not dependent on the environment are called *endotherms*. (You may have heard these animals referred to as "warm-blooded.")

In fact, all animals are able to control or regulate their body temperatures. The ability to regulate body temperature within certain limits is called *thermoregulation*. Ectotherms regulate their temperature by changing their behavior. Endotherms regulate their temperature through their body processes, or physiology. Of the vertebrates (animals that have backbones), fish, amphibians, and reptiles are ectotherms. Birds and mammals are endotherms. Almost all birds and mammals are also called *homeothermic* because their temperature remains constant. Those animals that have body temperatures that change with the environment are called *poikilothermic*.

Ectotherms use a variety of behaviors in order to cool down. These include getting wet, burrowing underground, finding shade, and exposing more of their body to the air. To warm up, ectotherms lie in the sun, climb to higher ground, and/or reduce the amount of their body exposed to air. Endotherms experience physiological changes such as sweating to cool down and shivering to warm up. When an animal sweats, water evaporates off the skin, taking heat away with it. Shivering creates heat and also helps to prevent further heat loss. Endotherms also use behavioral changes to help regulate their temperature, but the primary control is in their body.

So the next time you go hiking in the woods on a cold day, you probably won't come across a snake on a shady path—but you may see one lying on a rock that is out in the sun.

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assessment page

1. Do Snakes Really Have Cold Blood?

Circle the best choice in parentheses to complete each sentence.

1. The term (*cold-blooded, warm-blooded*) was used to describe animals such as snakes because it was once thought that they had no control over their body temperature.

2. Ectotherms are animals that have (variable, constant) body temperatures that get heat from outside sources.

3. Animals that maintain a constant body temperature that is not dependent on the environment are called (ectotherms, endotherms).

4. The ability to regulate body temperature within certain limits is called (thermostasis, thermoregulation).

5. Almost all birds and (mammals, reptiles) are called homeothermic because their temperature remains constant.

6. Those animals that have a body temperature that changes with the environment are called (poikilothermic, poikilobaric).

7. Ectotherms burrow underground to (warm up, cool down).

8. Endotherms shiver to (cool down, warm up).

11. Are Mushrooms Plants?

Topics

fungi, photosynthesis, cells

Goal

To clarify the differences between a plant and a fungus

Context

Current thinking says that a mushroom has more in common with a human than with an elm tree. The nature of the structures found in a mushroom, as well as the ability of modern scientists to look at the genetic material in a mushroom, are changing the way we think of mushrooms.

Teaching Notes

After reading the Explanation, discuss and, as necessary, do the following:

- Make sure students understand the terms *eukaryote, mycelium, hyphae, decomposer, monophyletic,* and *Basidiomycota.*
- Make sure students are familiar with the six characteristics of fungi and the three parts of a mushroom found above ground.

Extension Activity

Have students perform this mushroom lab following the instructions.

Materials: edible mushrooms, hand lens, scalpel

1. Look at a mushroom and draw it.
2. Carefully cut the mushroom in half from top to bottom.
3. Cut the cap off at the stalk.
4. Pull some of the stem apart, and use a microscope lens to look at the hairlike fibers, *hyphae.*
5. Observe the gills.
6. Place the gills facedown on a clean, white sheet of paper and leave them overnight.
7. Observe the spores that have been left.

Answer Key

1. monophyletic
2. decomposer
3. eukaryote
4. hyphae
5. mycelium
6. Basidiomycota
7. Fungi have cell walls, they are monophyletic, they are eukaryotes, they are decomposers, they absorb food, and they use spores to reproduce.
8. the gill (lamellae), the cap, and the stalk
9. Plants make food, fungi absorb food, and animals ingest food.

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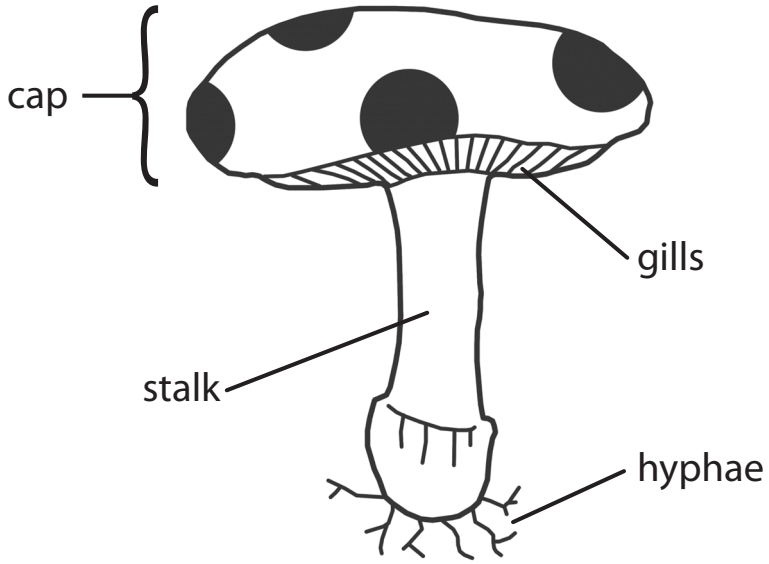
11. Are Mushrooms Plants?

Explanation

Mushrooms may look like plants, but they are not plants. One of the characteristics of plants is that they carry out photosynthesis. Photosynthesis is the process by which plants take carbon dioxide and water and change them to carbohydrates (food) and oxygen with the help of sunlight. Mushrooms cannot do this.

Mushrooms belong to the fungus kingdom. Fungi used to be classified as plants because both fungi and plants have cell walls, and some species in both groups reproduce by spores. These similarities, however, still have differences. Plant cell walls are made of cellulose, while fungi cell walls are made mostly of chitin. The way the spores look and how reproduction takes place is also different. Today, fungi are thought to be more closely related to animals. Both fungi and animals are monophyletic. This means all the species in the group come from a common ancestor. Both fungi and animals are eukaryotes, which means their cells have a nucleus surrounded by a membrane. Like animals, fungi cannot make their food. Animals ingest their food, or take it into the body, and fungi absorb their food. Along with bacteria, fungi are decomposers, meaning they break down dead matter. This releases nutrients back into the soil.

Mushrooms are members of the *Basidiomycota phyla*, better known as club fungi. The club fungus is characterized by having its reproductive structure above ground. This structure has a cap and a stalk. The cap is made of many filaments called *gills*, or *lamellae*, which contain the spores. Most of the mushroom organism lives below ground. The body of the mushroom that is below ground is made of hairlike fibers called *hyphae*. The entire group of hyphae is called the *mycelium*. The next time you eat a mushroom, remember you are eating the reproductive structure of a fungus. Bon appétit!



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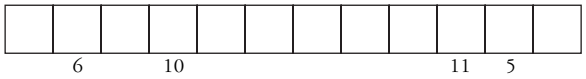
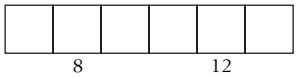
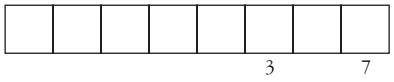
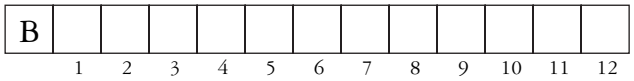
assessment page

11. Are Mushrooms Plants?

Unscramble each of the words below. Then write the letter from each numbered cell in the numbered boxes below. This will reveal another name for club fungi.

		Clues
HCNOOLETMPIY		having a common ancestor
RODMEEPCSO		breaks down dead matter
TEERAUOYK		has cells with a defined nucleus
HAHPEY		hairlike fibers
MYLMEUCI		group of hairlike fibers



Answer the following.

7. What are six characteristics of fungi?

8. Name three parts of the mushroom that are found above ground.

9. Complete the sentence below with the following words: ingest, absorb, make.

   Plants _____ food, fungi _____ food, and animals_____ food.

25. What Are Stem Cells?

Topics

cell development, DNA, stem cells

Goal

To clarify the nature of stem cells, both what they are and how they are used

Context

Debate over the use of stem cells is in the news on a daily basis, both in the United States and abroad. The ethical questions surrounding the collection and use of stem cells make this topic something students should know about.

Teaching Notes

After reading the Explanation, discuss and, as necessary, do the following:

- Help students distinguish between embryonic stem cells and adult stem cells.
- Discuss and identify where embryonic and adult stem cells are found.
- Clarify the definition of *differentiate.*

Extension Activity

Have students find recent stories in the news that pertain to stem-cell use or research. As a class, compile a list of all the ways stem cells are used to treat diseases and a list of restrictions placed on stem-cell research.

Answer Key

1. a
2. c
3. d
4. b
5. Stem cells have the ability to keep dividing without differentiating and can differentiate into any of the body's 220 different types of cells.
6. Adult stem cells repair and/or replace damaged cells.
7. Scientists are interested in using stem cells to replace damaged cells or even grow entire organs.
8. In order to use embryonic stem cells, the embryo must be destroyed. Some people are concerned that scientists could clone embryos only to use them for their cells.

Name _____ Date _____

25. What Are Stem Cells?

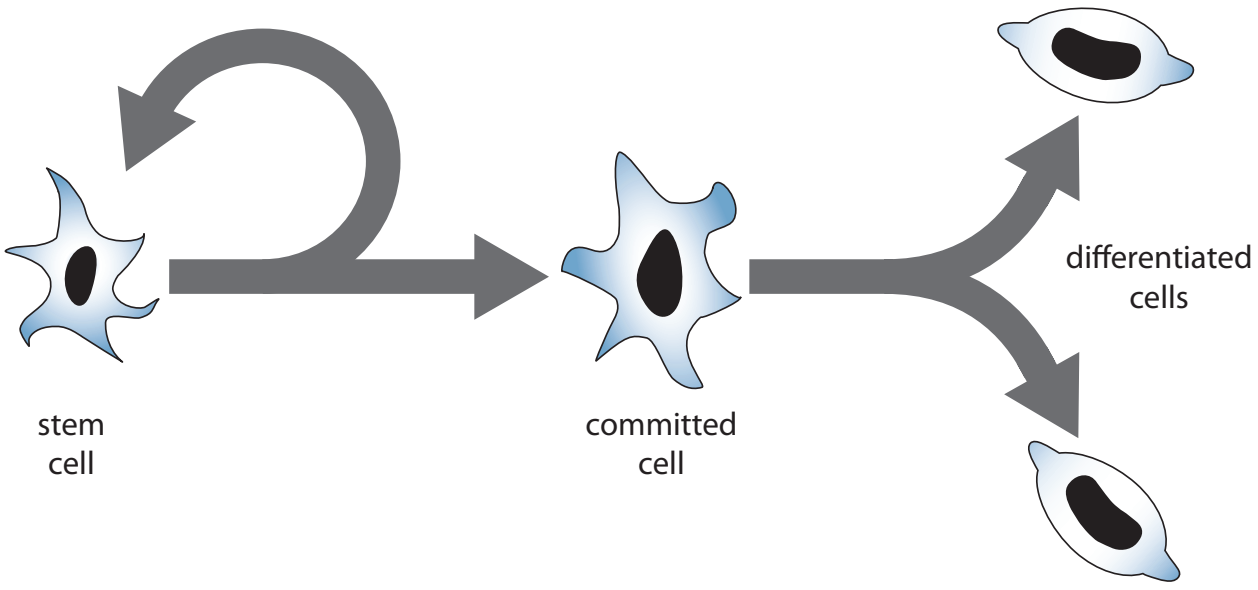
Explanation

You have probably heard stem cells discussed on the news. But what are they, and why are they the subject of such debate? Stem cells are cells that have two important characteristics. They have the ability to keep dividing without differentiating. They also have the ability to differentiate into any of the body's 220 different types of cells.

You probably know that the beginning of a new organism starts when an egg is fertilized by a sperm. Immediately, the fertilized egg splits into two identical cells, which split into four cells, which split again, and so on. Each split produces an identical cell. After about five days, there are about 50 to 150 cells in a ball called a *blastocyst*. The cells inside this ball are the stem cells, called *embryonic stem cells*. These stem cells can differentiate into any type of body cell. The term *differentiate* means to go from unspecialized to specialized.

A second type of stem cell is the adult stem cell. Adult stem cells are undifferentiated cells that are found throughout the body. These cells repair and/or replace damaged cells. Adult stem cells may have limited differentiation abilities.

Researchers are interested in stem cells because of their ability to become any type of body cell. Scientists' goals are to grow stem cells that can be differentiated, and then use them to replace damaged cells or even grow entire organs. Using embryonic stem cells is controversial because in order to use the cells, the embryo has to be destroyed. People have different views about when life begins. Some are concerned that scientists could clone embryos only to use them for their cells. There is no doubt that the debate about stem-cell research will be around for a while.



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25. What Are Stem Cells?

Match the description on the left with the letter of the correct term on the right. Write the letter on the line.

_____ 1. These stem cells are found throughout the body.

_____ 2. This means to go from unspecialized to specialized.

_____ 3. Embryonic stem cells are found here.

_____ 4. These stem cells can differentiate into any of the 220 different types of cells.

a. adult stem cells

b. embryonic stem cells

c. differentiate

d. blastocyst

Answer the following questions.

5. What are the two characteristics of stem cells?

6. What is the role of adult stem cells?

7. How are scientists interested in using stem cells?

8. What are two reasons the use of embryonic stem cells is debated?