

March 2010

Dear Educator:

The arrival of spring signals the return of color to many wintry landscapes. This issue of EXTREME EXPLORER celebrates the season by taking readers on three color-filled adventures.

In “Fantastic Frogs,” students come face-to-face with frogs and a dazzling array of colors, patterns, and behaviors. Readers will learn about frogs’ physical characteristics, amazing life cycle, and remarkable survival techniques. They also will learn about a deadly fungus that is wiping out many frog populations and the important role frogs play as sentinel species. The story is an excellent springboard for teaching the interdependence of organisms. Encourage students to complete the Vocabulary Survey on p. T7 to rate their knowledge of key concept vocabulary before and after they read the story. The KWL chart on p. T8 will help them plan and monitor their reading.

“Incredible Iceland” takes students on a journey across Iceland’s ever-changing landscape. They’ll travel from fiery volcanic eruptions to blue lagoons. They’ll trek across rainbow-hued mountains to black sand beaches dotted with striped icebergs. Along the way, readers will learn how moving tectonic plates continue to change Iceland above and below Earth’s surface and how the elements of fire and ice bring both benefits and challenges. You can use the graphic organizer on p. T16 to support students in using the visualize strategy as they read.

Our third adventure takes students into the colorful, microscopic world of bacteria and viruses. In “Disease Detective,” students will work alongside an epidemiologist as he tries to solve a disease outbreak. Readers will learn how food-borne diseases and viruses spread. The story also provides readers with an opportunity to link what they read to current events and their everyday experiences. The T-chart on p. T25 will help students form generalizations about how epidemiologists solve disease mysteries.

We hope this issue inspires readers to look for new and interesting ways to think about and explore the world around them.

Sincerely,



Jacalyn Mahler
Editor in Chief



Fantastic Frogs

Teacher's Guide

March 2010

Curriculum Connections

- Language Arts
- Life Science
- Ecology

Standards Correlations

- Language Arts: Use Strategies to Access Word Meaning
- Life Science: Adaptation; Interdependence of Organisms;
- Ecology: Human Impact on the Environment

Literacy Skills

- Vocabulary: Word-Learning Strategies
- Reading Strategies: Plan and Monitor; Summarize
- Writing: Research Report; Poetry; Persuasive Writing

Activity Masters

Vocabulary Survey, T7

KWL Chart, T8

Comprehension Check, T9

Comprehension Check, Answer Key, T10

Fantastic Frogs

About the Story

When someone says *frog*, what do students think of? Words like *green*, *slimy*, *hopping*, or even *croak* may come to mind. In this story, students will learn that there is much more to frogs than they may think. They will learn about frogs' physical characteristics, amazing life cycle, physical diversity, and remarkable survival techniques. They also will learn about the role frogs play as sentinel species, acting as warning signs of an unhealthy environment.

Fast Facts

- Students and their families can read more about frogs and the threats they face in the April 2009 issue of NATIONAL GEOGRAPHIC.
- Frogs have adapted to many different habitats—from fresh water to deserts. They can be found on all continents except Antarctica.
- Frogs' bulging eyes come in many colors. Their pupils can be horizontal, round, triangular, and even star- or heart-shaped. For an example, see p. 16 of the September 2009 issue of NATIONAL GEOGRAPHIC EXTREME EXPLORER.
- Although frogs swallow their food whole, they have teeth on their upper jaw and the roof of their mouth. The teeth aren't used to chew, but to hold their prey in place before swallowing.
- Toads technically are considered frogs. The distinction is that toads generally have dry, warty skin and short hind legs used for walking instead of jumping. Usually frogs have smooth, moist skin and long, strong hind legs with webbed feet for swimming.

Vocabulary

Access New Words Point out that when students read nonfiction texts, they often come across new words. When they do, they can use different strategies to help them figure out the meanings. As you introduce the strategies, display these steps:

- When you come across a new word, write it down or put a self-stick note next to it.
- Say the word out loud to see if it sounds familiar.
- Look closely at the word to see if it looks like another word you know. Their meanings may be connected in some way.
- Look for familiar word parts such as prefixes or base words.
- Look for clues to the word's meaning in surrounding words and sentences. Think about what meaning would make sense.
- If you are still stuck, look up the new word in a dictionary or glossary, or ask someone.

Model using the first three steps to figure out the meaning of *terribilis* in the introduction on p. 4 of the story. You may want to keep the steps displayed for students to refer to as they read. Next, tell students that in “Fantastic Frogs,” they will come across some words that may be new to them. Examples may include: *froglet*, *dissolve*, *retract*, and *sentinel*. Distribute the vocabulary survey on p. T7. Review the directions, explaining that students will have a chance to rate how well they understand the words before and after reading the story. They can also use the survey to note the strategies they use to figure out new words' meanings.

Fantastic Frogs

(continued)

Preview

Activate Prior Knowledge Remind students that good readers preview nonfiction texts to identify the topic and think about what they already know about that topic. Invite them to begin to preview the story by turning to the opener on pp. 2-3. Call on volunteers to predict what the story will be about, based on the photograph, headline, and deck.

You can use the KWL chart on p. T8 to help students **plan and monitor** their reading. Pair students and have each pair talk for one minute, sharing what they know about frogs. As students brainstorm, have them select five facts to list in the first column. Next, say: *With your partner, preview the rest of the story. Read the headings, photo captions, bold words, and the diagram on p. 9. Then, on your own, decide what you want to learn about frogs from this story. For example, “How do frogs help people?” Write your questions under the W portion of the chart.*

Access Science Content

English Language Learners You may want to pair English language learners with more fluent readers and have them pause at the end of each section to orally sum up the main ideas.

Have all students who are able to do so read the story independently. To further explore the key science concepts, set up four Jigsaw cooperative learning groups. A student from each group goes to a designated area to discuss a set of assigned questions (see below). If necessary, groups can reread the appropriate section of the story. You can adapt this activity for individual students by asking them to focus on one set of questions at a time.

Metamorphosis What stages does a frog go through in its life cycle? What are these changes called? (“Amazing Makeover,” p. 4)

Survival Techniques How do some frog parents help their tadpoles survive? What sign of intelligence do some mother frogs show? (“Piggyback Parents,” p. 5)

Adaptation Where do frogs live? How do their legs and eyes help them survive? (“Got Water” and “Big Peepers,” p. 6)

Traits What are some differences in the size and color of frogs? What are some ways frogs attract mates? (“It’s All About Looks” and “Calling all Frogs,” pp. 6-7)

Ask students to take notes in their discussion groups and report back to their original Jigsaw group on their assigned questions. Then as a whole class, revisit the questions, allowing students to expand their thoughts and ideas. Finally, lead students in discussing these big ideas:

Interdependence of Organisms How do people and frogs depend on each other? What do scientists mean when they say frogs are a **sentinel species**? If necessary, students can reread p. 8 (“Early Warning System” and “Frogs’ Future”) and refer to the cause-and-effect diagram on p. 9 (“A World Without Frogs”). Then work together to develop an expanded cause-and-effect chart. (Sample answer: *Environment gets polluted*→*Frogs get sick, die, or mutate*→*Fewer mosquitoes are eaten*→*Diseases spread*→*More people get sick.*) To extend this idea, ask students how scientists and concerned people might react when frogs in an area get sick. (Sample answer: *Scientists investigate sources of pollution*→*People clean up the environment*→*People and frogs stay healthy.*)

Fantastic Frogs

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Sum Up

After students have finished reading the story, have them go back and complete the appropriate sections of their vocabulary surveys. As they review their surveys, invite students to share the strategies that helped them figure out the meanings of new words. Next, have students complete the *L* portion of their KWL charts by listing new information they learned from the story. Students can reread the facts they listed in the *K* section and check off any fact that was mentioned in the story.

To encourage further investigation, say, *What questions did you have about frogs that the story didn't answer? Turn your paper over and list those questions. Now think about where you might find the answers.* Work with students to brainstorm how they might go about finding the answers to their questions.

English Language Learners Students can summarize the story by completing the following sentence frames orally or in writing: *One important thing I learned about frogs is ___; I didn't know that frogs ___; Frogs help people by ___.*

Assess and Reteach

Materials: Comprehension Check, pp. T9 and T10; “Fantastic Frogs” story

Assign the Comprehension Check for “Fantastic Frogs” on p. T9. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key science concepts. For example, students still may be unclear about the stages in a frog’s **metamorphosis** or why frogs are especially **vulnerable to changes in the environment**.

Ask students to think about four stages in a frog’s life cycle. Then invite a volunteer to read aloud the “Amazing Makeover” section on p. 4. Prompt students to name the four stages and record their responses as a chain of connected events. (Egg→Tadpole→Froglet→Adult Frog) Ask students to give you more details about what occurs during each phase, and record the information. Make sure students understand that during the tadpole stage, frogs have gills that allow them to breathe in water. Then point out that during the huge metamorphosis that takes place over a few weeks, the tadpole changes dramatically: it loses its tail, develops legs, grows new intestines to handle an insect diet, and replaces its gills with lungs that breathe air.

To review frogs’ unique traits, have students skim pp. 5-7 looking for information about frogs’ special body parts and behaviors. Students can jot down key words or phrases or use self-stick notes. Next, work with students to develop a concept web of Frog Traits. Have them share the special traits they read about. Encourage them to elaborate as you add details to the web. (Possible answers: parent frogs carry tadpoles to safe places, some females have great memories, sticky substance keeps tadpoles on parents’ backs, can live everywhere but Antarctica, soak up water through their skin, long legs help them jump, bulging eyes help them see in many directions and swallow, different sizes, different colors, make sounds or dance to attract mates)

Finally, ask students to reflect on why the author might have written the story. Ask: *What did we learn about frogs that can be important to our lives? How can we use this new information?* Lead students to recognize that changes in frogs’ health may be warnings of an unhealthy environment.

Fantastic Frogs

(continued)

Extend the Learning

Review Fact and Opinion Remind students that all authors have a purpose for writing. When good readers read a story, they try to get inside the writer's head by asking: *Did the author write this mainly to give me information, to entertain me, or to persuade me to think a certain way?* Persuasive writers have different ways of expressing their views. One way is their choice of topic and what to include in the story. To understand this concept, ask students to imagine the story without the information about frogs being a sentinel species. Ask them if that changes their impression of the author's point of view, and if so, how.

Other times, writers might include their opinions, or personal beliefs, as well as facts. Invite students to go back into the text of "Fantastic Frogs" and find examples of facts and opinions. Before they begin, you may want to review the difference between a fact and opinion using a few examples. Read aloud the following statements. Have students raise their hands if they think it is a fact. Say: *Frogs are more interesting than snakes.* (Opinion) *Some frogs can jump 20 times the length of their bodies.* (Fact) *Frogs use their eyes to swallow.* (Fact) *Frogs are cute.* (Opinion)

Research Frogs in Your Area Invite students to research the types of frogs that live in your state or region. Using print or online resources, they should find names, descriptions, habitats, predators, and any environmental challenges these particular frogs face. Also encourage students to look for visual aids, such as photographs, diagrams, or even videos. Reports, either written, oral, or multimedia, can be shared with the class.

Poetry Students may enjoy writing a poem about frogs that gives information and entertains the reader. You may want to have each student contribute a line to a single, class poem. Suggest they include details from the story about how frogs look, move, and sound. Students can illustrate their poems when finished and post them on a bulletin board or school website for other classes to enjoy.

PSA or Game Board Tell students there are many plants and animals that are considered sentinel species. Have students research other species that fall into this category. Their research should include important facts about the species including the environmental issues that are adversely affecting the species. When finished researching this topic, challenge students to write a PSA about a specific sentinel species and how changes in the environment are affecting it. As an added challenge, ask students to come up with a plan of action to help protect this species and its habitat. Other students may prefer to make a board game with question and answer cards. Players can leapfrog from the start to end by correctly answering questions about sentinel species.

Fantastic Frogs

Complete this before you read the story. Then complete it again after you read it. Compare your answers.

	Can you say the word?	Rate how well you know the word. 1 = I don't know what it means. 2 = I have an idea what it means. 3 = I know it really well.	What can help you figure out the meaning of the word?
amphibian			
metamorphosis			
froglet			
pest			
sentinel			
mutate			

Fantastic Frogs

Answer the question before you read the story.

Answer the question after you preview the story.

Answer the question after you read the story.



<p style="text-align: center;">K</p> <p style="text-align: center;">What do you know about frogs?</p>	<p style="text-align: center;">W</p> <p style="text-align: center;">What do you want to learn about frogs?</p>	<p style="text-align: center;">L</p> <p style="text-align: center;">What did you learn about frogs?</p>

COMPREHENSION CHECK

Answer these questions about “Fantastic Frogs.” For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

1. Which statement is true for all frogs?
 - (A) They can live both in water and on land.
 - (B) They spend their entire lives in water.
 - (C) They blend into their surroundings.
 - (D) They use their vocal sacs to attract mates.

2. Which is the second stage in a frog’s life cycle?
 - (A) froglet
 - (B) tadpole
 - (C) egg
 - (D) adult

3. What do a frog’s bulging eyes help it to do?
 - (A) find insects
 - (B) swallow food
 - (C) see danger
 - (D) all of the above

4. Why are frogs called a “sentinel species”?
 - (A) They guard Earth’s fragile wetlands.
 - (B) They are the only creature harmed by fungus.
 - (C) They are sensitive to environmental changes.
 - (D) They are found on all continents except Antarctica.

5. Describe the dangers tadpoles face when they are born. Explain how some adult frogs try to help their tadpoles survive.

COMPREHENSION CHECK

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 - They are found on all continents except Antarctica.
- Describe the dangers tadpoles face when they are born. Explain how some adult frogs try to help their tadpoles survive.

Sample top-scoring response: Snakes and other dangerous predators live all around the small
tadpoles. To keep her tadpoles safe, the female strawberry dart frog carries each tadpole up into the
trees and puts it in a pool of water between a plant’s leaves. She lays a special egg in the pool so the
tadpole can eat. To keep his tadpoles safe, the male green poison dart frog lets the tadpoles climb
onto his back. Then he carries them to a safe stream and lets them go.

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Teacher's Guide

March 2010

Curriculum Connections

- Language Arts
- Earth Science
- Geography

Standards Correlations

- Language Arts: Use of Background Knowledge
- Earth Science: Processes that Change Earth and Landforms
- Geography: Physical Processes that Shape the Pattern of Earth's Surface; Interpret Maps

Literacy Skills

- Reading Strategy: Visualize
- Vocabulary: Figurative Language
- Writing: Science Inquiry

Activity Masters

- Access Science Content, T16
- Access Science Content, Answer Key, T17
- Comprehension Check, T18
- Comprehension Check, Answer Key, T19

ICELAND

About the Story

This story takes readers on a journey across Iceland, a country of extremes. Students will explore icy glaciers and sizzling volcanoes, massive icecaps and bubbling geysers. They will learn how moving tectonic plates continue to change Iceland above and below Earth's surface and how the ever-changing elements of fire and ice bring benefits and challenges to residents and visitors alike.

Fast Facts

- Iceland is located in the North Atlantic Ocean between Greenland, Norway, Ireland, and Scotland. Its area is similar to that of Ohio: 40,000 square miles. It slowly grows bigger thanks to continuing volcanic eruptions.
- Iceland's population is just over 300,000 people, about the number of residents in Pittsburgh, Pennsylvania. The main industry is fishing.
- Over 70 percent of Iceland's energy comes from geothermal and hydroelectric sources.

Vocabulary

Synonyms Display these words: *icy*, *frozen*, and *glacial*. Ask volunteers what these words have in common. (They all mean very cold.) Explain that these words are **synonyms**, or words that mean almost the same thing. To confirm this, ask students to look up the words' meanings in a print or online dictionary.

Tell students that “Incredible Iceland” is about a country with unusual geographical features. Some features are very hot; others are very cold. To describe these features, the writer uses many words related to the ideas of hot and cold. Read p. 12 together. As you read, ask students to name words that have something to do with heat. Display these as they are mentioned. (Examples: *bubbling*, *hot*, *steam*, *warm*, *smoke*, *bubble*, *boiling*) Next, ask students to independently reread p. 12 and list all the words that relate to cold. You may want to pair English language learners with more fluent readers for this exercise. (Examples: *snow*, *ice*, *coldest*, *iciest*, *glaciers*, *icebergs*, *ice cube*, *chill*)

Finally, discuss why a writer might want to use synonyms for *hot* like *bubbling* and *boiling* instead of repeating *hot* over and over again. Lead them to understand that using synonyms can make writing more lively. To demonstrate, ask students to substitute the word *hot* in every place in the story where the writer uses a synonym for *hot*. In other cases, a synonym may be more precise. For instance, to describe the water that shoots out of geysers, it is more accurate to say *boiling* water than *hot* water. Encourage students to put a self-stick note next to new words related to hot and cold that they come across when they read the story. They can record these words in their Vocabulary Notebooks with information about the word's precise meaning.

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Preview/Tap Into Prior Knowledge

Often without even being aware of it, students will summon up what they know about a topic when they initially preview a text. Invite students to preview the story by reading the opener on pp. 10-11. Then help them recall what they learned about Earth's layers and tectonic plates from reading "Active Earth" in the January/February issue of NATIONAL GEOGRAPHIC EXTREME EXPLORER. You may want to use the following true/false questions to quickly assess students' recall of the main ideas. Discuss the responses as a group. Encourage students to keep this key information in mind as they read "Incredible Iceland."

1. Earth has two layers: the mantle and crust. (F)
2. Earth's crust is broken into huge pieces called tectonic plates. (T)
3. These plates have stayed in the same place for millions of years. (F)
4. Heat from Earth's core makes rock in the mantle rise up and sink. (T)
5. Moving tectonic plates create earthquakes, mountain ranges, and hot springs. (T)
6. Volcanoes form where two plates move apart and molten rock oozes into the gap. (T)
7. Pangaea is the name of a famous hot spring. (F)

Next, direct students' attention to the photo caption on p. 13. Ask them why they think the author mentions fire and ice. Lead them to understand that both elements played a part in creating Iceland's unusual landscape.

Access Science Content

After students read the story to themselves, work through the story together. Read each page aloud, pausing to discuss the key science concepts, as noted below.

Pages 12-13: Iceland is made up of more than ice. It has volcanoes, hot springs, and geysers. The heat comes from an underwater split in Earth's crust. Iceland sits atop two tectonic plates that are pulling apart very slowly. As the plates move, the land stretches out, covering more area.

Pages 14-15: Some changes to Iceland's landscape happen suddenly. In 1973, a volcano erupted on the small island of Heimaey. Molten rock burned hundreds of buildings; others were buried in ash. The residents stopped the surging lava by spraying cold seawater on it. In just five months, the island grew one-fifth bigger. Other changes happen slowly. Over millions of years, volcanoes and flowing lava have formed such land features as mountains and basalt columns. Icelanders take advantage of the natural heat, using hot water to soak in and to generate electricity.

Pages 16-17: Glaciers cover 11 percent of the country. As the glaciers move toward the sea, they carve valleys deeper. The largest glaciers are called icecaps. Iceland's biggest icecap is larger than all the glaciers in mainland Europe combined. Iceland is one of the few places where active volcanoes lie below icecaps. They can cause destructive floods. The floods carry ash and sand, which form large black plains called sandurs. In some places, the water from melted glaciers fills the exploded tops of volcanoes.

ICELAND

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Sum Up

Distribute the activity master on p. T16. Pairs can work together to complete the graphic organizer. Suggest that they reread the descriptions of the different geological features and use the **visualize** strategy to create a mental picture of each one. Partners then can list each feature in the appropriate column: fire or ice. After students share their responses, read aloud the last sentence of the story on p. 17: *This is Iceland, a land of fire and ice.* Ask students if this is a good ending for the story and invite several to explain why or why not.

Assess and Reteach

Materials: Comprehension Check, pp. T18 and T19; “Iceland” story, “Incredible Iceland” poster in the Teachers’s Edition

Assign the Comprehension Check for “Iceland” on p. T18. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key science concepts. For example, students may be unclear about the **movement of the tectonic plates** and how **volcanic eruptions and glaciers** have shaped and continue to change Iceland’s topography.

Remind students that Earth’s crust is like a jigsaw puzzle, broken into huge plates. Also remind them that these plates move. Explain that the North American plate and the Eurasian plate are slowly pulling apart. Iceland sits on top of an underwater split where these plates are pulling apart. Display the poster and point to the photograph below the headline. Explain that in this location, people can see where the two plates have pulled apart and created a big rift.

Then say: *It may seem unusual for one place to have icecaps and glaciers as well as sizzling volcanoes and steaming hot springs.* Clarify that the combination of Iceland’s geographic location near the Arctic Circle and its underground geology provides the perfect scenario for both icy glaciers and the formation and eruption of fiery volcanoes. You may want to use a globe or world map to show the location of the Arctic Circle to clarify why Iceland has glaciers and icecaps. Next, point to the photograph of the erupting volcano on the poster. Ask students to draw on what they know and describe what lies below Earth’s crust. (Answers may include: mantle and core, hot rocks, molten rock, steam, etc.) Explain that millions of years ago, volcanoes started forming underwater in this area. Ask: *What happens when a volcano erupts and hot lava flows out over an area?* Lead students to understand that the lava kept building up, creating the landmass we know today as Iceland.

Then say: *We also learned in the story that other natural features give Iceland its unique landscape. What are some of those features?* (Answers may include: ice, snow, glaciers, icecap, geysers, hot springs, mud pots, etc.) Continue to help students link what occurs below Iceland with the features that exist on the surface. Ask: *What creates hot springs and geysers? What happens when a volcano erupts beneath a glacier? How do glacial floods change the landscape of Iceland?* Have students scan pp. 15-17 to find the answers. (Sample responses: Heated rocks and hot water below Earth’s surface create hot springs and geysers. A volcanic eruption can melt glacier ice and create a flood. Glacial floods can carry ash and sand, forming plains called sandurs. Glacial water can also form new lakes by flowing into the exploded tops of ancient volcanoes.)

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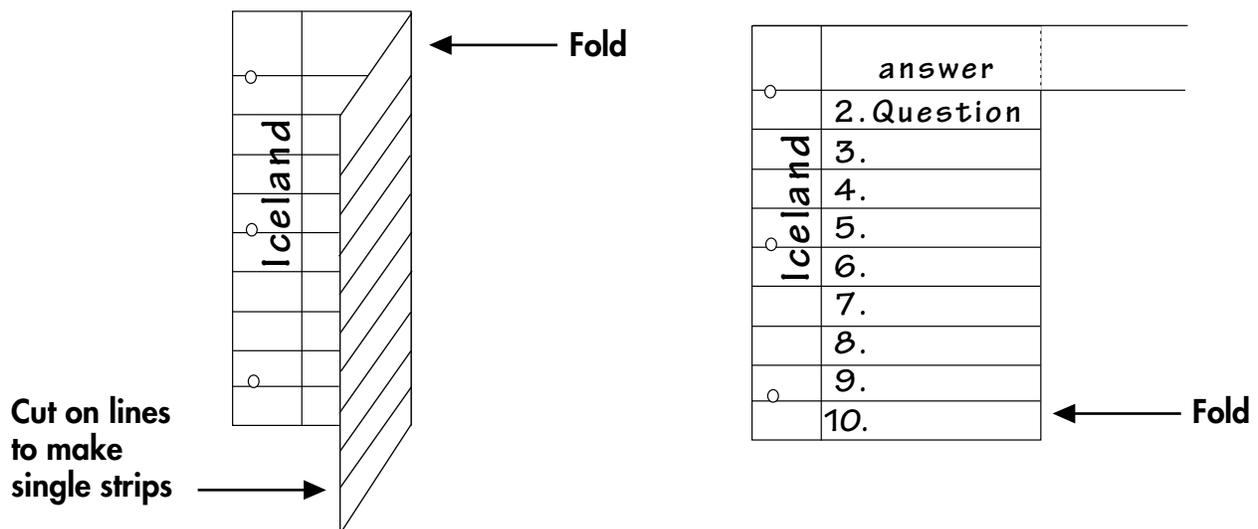
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Extend the Learning

Research Local Topography Students can work in small groups to research the natural features of your town, state, or region. With the class, take a few minutes to brainstorm some of the natural features of your area. Guide students to consider landforms and bodies of water such as mountains, lakes, rivers, canyons, caves, valleys, and sand dunes. Then have small groups select a particular geographical feature and prepare an oral presentation. Encourage them to gather photographs as well as information about how the feature formed and the ways in which it still may be changing. Students also should be prepared to explain how the geographical feature impacts people's lives in terms of both benefits and challenges.

Big Ideas in Nonfiction Point out that when good readers read nonfiction texts, they are able to sift through small details and focus on the author's big ideas. Tell students to skim "Incredible Iceland," placing a self-stick note next to important information. Explain that they should look for big ideas and important facts, not small details. Then have them write a question connected to each idea. Tell them they will be creating a Fact-Check to exchange with other students. To create the Fact-Checks, students should:

- Fold a sheet of notebook paper in half vertically, placing the paper's edge along the left-hand margin line. Crease the fold.
- Along the space under the three holes, horizontally write: Iceland. Next, along the edge facing the title, cut every third line to the fold. This will provide a strip that can be flipped back leaving paper underneath it for the answer to the question.
- Number and write their questions on the top of the cut strip. Then fold it back and write the answer on the paper underneath.



When the Fact-Checks are finished, students can exchange them with a classmate.

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After you read the story, think about the different natural features the author describes. Use the writer's words to make a mental picture. Then decide if each type of feature belongs under the heading "Fire" or "Ice." An example has been done for you.

FIRE

ICE

volcano

Extra credit: Name any natural features that might be caused by both fire and ice.

ICELAND

After you read the story, think about the different natural features the author describes. Use the writer's words to make a mental picture. Then decide if each type of feature belongs under the heading "Fire" or "Ice." An example has been done for you.

<i>FIRE</i>	<i>ICE</i>
volcano	glacier
hot spring	iceberg
geyser	cold seawater
hot, melted rock	icecap
magma	crevasse
lava	ice
hot ash	snow
basalt column	frozen volcanic ash
steam vent	glacial lake
lava field	
bubbling mud pot	
steam	
smoke	

Extra credit: Name any natural features that might be caused by both fire and ice.

sandur, glacial flood

COMPREHENSION CHECK

Answer these questions about "Incredible Iceland." For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

- Which phrase best describes the part of Earth where Iceland is located?
 (A) One large volcano erupts there.
 (B) Two huge tectonic plates split apart there.
 (C) Massive glaciers melt there.
 (D) Hot lava collects there.

- What caused the island of Heimaey to grow in size?
 (A) Heat caused the land to expand.
 (B) Glaciers carved out new valleys.
 (C) Two plates crashed together, forming mountains.
 (D) Streams of lava formed new land.

- What causes the steam in Iceland's steam vents?
 (A) lava from volcanoes
 (B) minerals
 (C) heated rocks and water
 (D) hot springs like Blue Lagoon

- Which event happens first in a glacial flood?
 (A) Water melts and forms a lake.
 (B) A volcano erupts under an icecap.
 (C) Water bursts out of an icecap.
 (D) Melted water runs out of room.

- Explain why the landscape in Iceland is white, black, blue, and yellow. Write one sentence that explains each land color.

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 - Melted water runs out of room.
- Explain why the landscape in Iceland is white, black, blue, and yellow. Write one sentence that explains each land color.

Sample top-scoring response: Much of Iceland is white because of the many glaciers

and icecaps that cover the land. The blue in Iceland's landscape is caused by hot springs

such as the Blue Lagoon and by glacial water flows. The black color is caused by

ash from volcanoes that has settled on the ground. Minerals in the rock cause yellow

streaks in the mountains.

Disease Detective

Teacher's Guide

March 2010

Curriculum Connections

- Language Arts
- Biology
- Health

Standards Correlations

- Language Arts: Form Generalizations
- Biology: Cell Science; DNA
- Health: Effect of Infectious Agents on the Human Body; Healthy Behaviors

Literacy Skills

- Vocabulary: Relate Words; Develop Academic Vocabulary
- Reading Strategies: Form Generalizations; Steps in a Procedure
- Writing: How-To Texts

Activity Masters

Synthesize, T25

Synthesize, Answer Key, T26

Comprehension Check, T27

Comprehension Check, Answer Key, T28

Disease Detective

About the Story

When many people get sick with the same symptoms, could a microscopic bacteria or virus be to blame? In this story, students will follow epidemiologist Dr. Richard Besser as he solves the mystery of a disease outbreak. Readers learn how diseases, including food-borne illnesses and swine flu, spread, and the steps they can take to stay healthy.

Fast Facts

- Dr. Richard Besser was head of the Centers for Disease Control and Prevention during the initial swine flu outbreak in 2009.
- To predict and help people prepare for worst-case scenarios for the 2009-2010 swine flu pandemic, epidemiologists studied past flu outbreaks—such as the Spanish flu in 1918 that caused 50 million deaths worldwide.
- Each bacterium contains all the genetic information needed to make copies of itself. Some can multiply fast: It can take only three hours for one bacterium to become 500!
- It takes less than ten *E. coli* bacteria to make a person sick.
- While some strains of *E. coli* can make people very sick, other strains are actually good for us. In fact, we have as many as 400 different kinds of helpful bacteria in our intestines. Many help us digest our food.

Vocabulary

Relate Words/Academic Vocabulary Display the word *doctor*. Ask students what it means and what other words they might expect to find in a story about a doctor. Then explain that one way to learn new words and gain a deeper understanding of their meanings is to explore how the words relate to each other. Students can use word maps to explore these connections.

To demonstrate, circle the word *doctor*. Then draw five spokes pointing away from the circle. Draw circles at the end of the spokes. Fill in the circles with the following words: *sick, disease, symptoms, flu, patient*. Ask students how each word is connected to the word *doctor*. If they are unfamiliar with a word, encourage them to use a dictionary to look up its meaning.

Tell students that one way to remember a new word, and make connections with familiar words, is to do a “Two in One.” Ask students to write a sentence using the word *doctor* and at least one of the other words in a single sentence. For example, A **doctor** takes care of **sick** people.

Explain that when they read “Disease Detective,” they will come across other words they can connect to the words in the displayed Word Map. (Examples: *hospitalized, epidemiologist, virus, epidemic, pandemic, vaccine*) Encourage students to record these words in their Vocabulary Notebooks and to write a “Two in One” for each new word.

Disease Detective

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Activate Prior Knowledge

Continue to tap into students' prior knowledge. Ask them to share what they know about the work of different types of doctors. Explain that they may know doctors who provide ongoing care to the same group of patients. Then explain that in "Disease Detective," they are going to meet a doctor who specializes in widespread epidemics, or outbreaks of diseases that affect many people at the same time, often from the same source. This type of doctor is called an epidemiologist. Ask students to share what they know about cases in which a lot of people have gotten sick from the same virus or bacteria.

Next, invite students to preview the story, focusing on the subheads and photographs. Ask them why they think some photos are shown as puzzle pieces and why the subheads include words like *case* and *fingerprints*. Lead them to understand that an epidemiologist is like a detective who searches for clues and pieces them together to solve a disease mystery. Based on this, work with students to develop a list of possible "job requirements" for someone whose job is to figure out what makes people sick. First, they may want to brainstorm ideas with a partner before sharing their ideas. Sample answers:

- A medical degree and experience diagnosing illnesses
- Good powers of observation
- Good at asking questions and interviewing people
- Able to interpret results of lab tests
- Persistence and patience

Tell them they will have a chance to revise and add to the list after they read the story.

Access Science Content

Read the story with students, pausing at the end of each page to discuss the key concepts. You may want to use the following prompts to guide discussion.

Pages 18-19: *How are epidemiologists like police on a crime case?* (They look for clues to what causes disease.) *What had made the children in Massachusetts sick?* (*E. coli* bacteria) *Why was this an important clue for Dr. Besser?* (It can live in food and liquids.) *Are food-borne illnesses serious?* (They can be. Every year about 5,000 people in the U.S. die from eating or drinking contaminated food.)

Page 20: *What are two clues that epidemiologists use?* (patients' symptoms and lab tests) *How can DNA tests be useful to disease detectives?* (It can identify the specific strain of bacteria. If everyone who is sick has the same dangerous strain, that bacteria might be the cause of the epidemic.)

Before moving on, you may want to reinforce the key concepts of **food-borne illness** and **contagion**. Explain that some types of bacteria such as *E. coli* live inside different animals, including deer and cows. The animals themselves don't get sick, but the disease spreads when people come in contact with the animals' waste products or when they eat food contaminated with the bacteria. People also can spread *E. coli* to other people if they don't wash their hands after using the bathroom or before preparing food.

Disease Detective

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Access Science Content,

Invite students to read p. 21, including the sidebar “A New Flu.” Then ask, *Think about the way that E. coli can be spread. Based on what you learned, what questions do you think Dr. Besser will ask the sick patients?* (Students should say that he will question patients about the foods they’ve eaten and if they’ve been near any animals.)

Next, ask students: *How does a virus make people sick?* (It invades people’s cells and makes lots of copies of itself.) *How do cold viruses spread from people to people?* (When a person sneezes or coughs, bits of the virus fly through the air. When another person inhales the virus, it invades that person’s cells.) *How did doctors try to fight H1N1, or swine flu?* (They gave people vaccines so their bodies could create and store antibodies to fight off infection.)

As you read p. 22 with students, work together to list the questions that guided Dr. Besser’s investigations and the answers he found. After you read the second paragraph in the section “Cider Clues,” pause and help students recall the three strong clues that he discovered at the cider mill: He saw deer droppings at the orchard. He found out the apples weren’t washed before they were crushed to make cider. Also, the cider wasn’t pasteurized.

Sum Up

Have students read p. 23 to themselves. Ask them to use their own words to summarize the tips in the sidebar “Be a Disease Fighter!” Then distribute the activity master on p. T25. Explain that the statements in the first column are general statements about the way that epidemiologists approach solving disease mysteries. Ask students to complete the second column of the chart by connecting each statement to specific steps Besser took to solve the *E. coli*-cider case.

After you review the steps Besser took, remind students that figuring out the cause of the epidemic is just one part of his job. Have students answer the question at the bottom of the activity master. If they have difficulty answering the question, refer them to the section “Mystery Solved” on p. 23. Students’ responses should indicate that once epidemiologists identify the cause of an epidemic, then they try to prevent future outbreaks. Finally, encourage students to revisit the list of job requirements they came up with before they read the story. Discuss what they would like to add or change based on what they learned about disease detectives.

Disease Detective

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Assess and Reteach

Materials: Comprehension Check, pp. T27 and T28; “Disease Detective” story, “Getting a Jump on Germs” poster

Assign the Comprehension Check for “Disease Detective” on p. T27. Use the Answer Key to score the assessment. Based on the results, you may want to reteach key science concepts. For example, students may still be unclear about **how food- and air-borne diseases spread** or about **the steps an epidemiologist takes** to identify the cause of an epidemic.

Reread the section “Identifying the Source” on p. 21 with students. Point out that the results of lab tests told Besser that a bad strain of *E. coli* was making the children sick. The next mystery to solve was where the bacteria came from. Ask students where *E. coli* typically live and explain how infected animals can pass the bacteria on to people. Then ask how people can spread the bacteria even when they themselves don’t get sick. You may want to capture student responses in a graphic flow chart. You can use the poster to reteach how air-borne diseases spread. To reinforce the main ideas, have students read aloud the speech balloons in the comic strip. Then ask them what steps they can take to prevent spreading and catching air-borne illnesses like colds.

To retrace the steps Besser took to solve the disease mystery, reread p. 22 with students. As you work through the story, develop a numbered list of steps that Besser followed. Lead them to understand the process of elimination that he used to focus his investigation on apple cider. Although there was no more fresh cider for Besser to test, he put together important clues to reach his conclusion. List each clue and connect them with a plus sign (+). Ask students, *What did all these clues add up to?* Complete the equation by writing an equals sign (=) and the sentence *Fresh apple cider was the source of the epidemic.*

Extend the Learning

PSA Ask students to create a poster or 30-second video with tips on how to stay healthy and not spread germs. Students can use the story, poster, and independent research to come up with tips.

Careers While Dr. Besser is a medical doctor (he is a pediatrician, or doctor who treats children), other epidemiologists have different professional backgrounds. Epidemiologists also can be veterinarians, nurses, statisticians, biologists, or demographers. Ask students to pick one of these careers and learn more about it, including what kind of education you need for that job, what kind of things you might do in that job, etc. Encourage them to think of adults they know who might hold one of these jobs and interview them. Ask volunteers to share what they find with the rest of the class.

Write a How-To Ask students to think about the things they do to stay healthy. Ask them to pick one activity, such as eating nutritious meals or playing a sport. Then tell them to imagine describing this to someone who has no clue about it. Have them write a step-by-step list that explains, in order, how to do the healthy activity. Volunteers can share their lists with the rest of the class.

Disease Detective

Read the general steps an epidemiologist takes to solve a disease mystery. Then reread "Disease Detective" in *EXTREME EXPLORER* to find and list the steps Dr. Richard Besser took in the *E. coli*-cider case.

General	Specific
1. List patients' symptoms	1.
2. Determine cause	2.
3. Determine possible sources	3.
4. Find source	4.
5. Prove source	5.
6. Prevent future disease outbreaks	6.

Sum Up: What are the two most important jobs of an epidemiologist during a disease outbreak?

7. _____

8. _____

Disease Detective

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General	Specific
1. List patients' symptoms	1. Patients had kidney failure.
2. Determine cause	2. Lab tests showed <i>E. coli</i> infection.
3. Determine possible sources	3. Besser knew <i>E. coli</i> is food-borne and can be spread through animal droppings.
4. Find source	4. He compared lists of food eaten by healthy and sick people.
5. Prove source	5. He went to a cider mill; saw apples and deer droppings on the ground; noticed cider wasn't pasteurized; tested cider and droppings for <i>E. coli</i> .
6. Prevent future disease outbreaks	6. He came up with safer ways to make apple cider.

Sum Up: What are the two most important jobs of an epidemiologist during a disease outbreak?

7. Find out what is making people sick

8. Find out ways to prevent future disease outbreaks

COMPREHENSION CHECK

Answer these questions about "Disease Detective." For items 1–4, fill in the circle by the correct answer. Write your answer to item 5.

1. How are epidemiologists like police detectives?

- (A) They ask people a lot of questions.
- (B) They use DNA tests.
- (C) They put clues together to solve a mystery.
- (D) all of the above

2. Which of these did Dr. Besser do first?

- (A) He examined the patients' kidneys.
- (B) He gave the sick children vaccines.
- (C) He visited the apple cider mill.
- (D) He made a list of what the sick children ate.

3. What is one way *E. coli* bacteria spread?

- (A) People sneeze or cough.
- (B) People make antibodies.
- (C) People eat undercooked food.
- (D) People wash their hands with soap.

4. Which of these is true of a virus?

- (A) It can live on its own.
- (B) It is larger than bacteria.
- (C) It invades the cells of people.
- (D) It cannot reproduce.

5. Explain why it was important for Dr. Besser to solve the *E. coli*-cider mystery.

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- Explain why it was important for Dr. Besser to solve the *E. coli*-cider mystery.

Sample top-scoring response: Children were in the hospital. Their kidneys were failing.

They could die. If Dr. Besser figured out what made them sick, he could find ways to make sure

that other people did not get sick, too. He could warn people, and he could find ways to make

food safer.