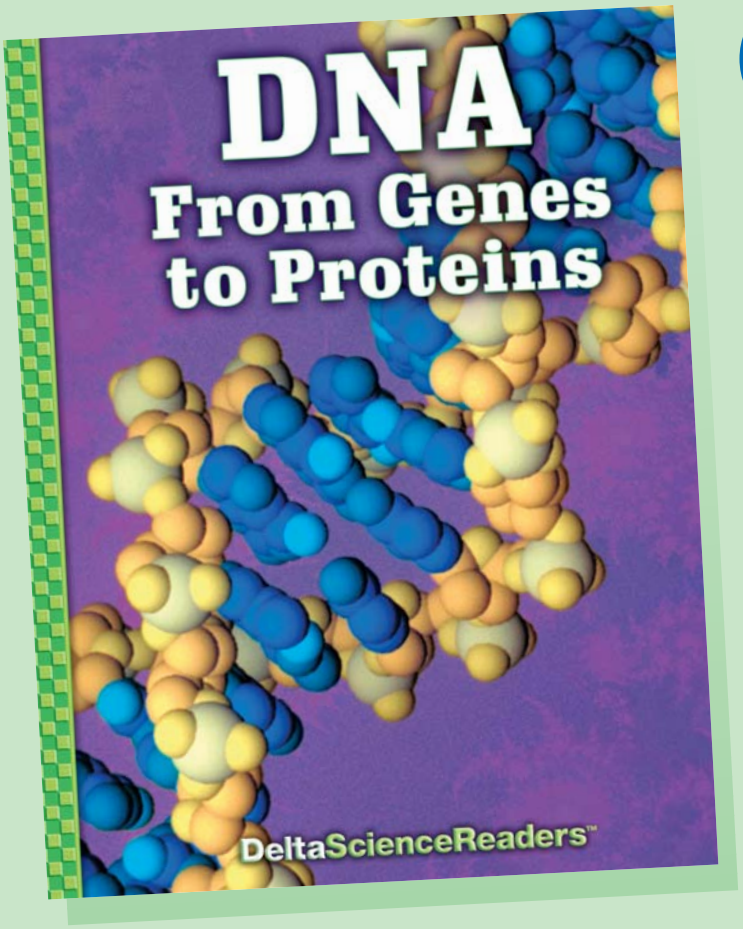
Delta Science Reader
DNA: From Genes to Proteins
Teacher's Guide



In the Delta Science Reader ***DNA: From Genes to Proteins,*** students find out about cell theory and the role of cells as the building blocks of life in all organisms. They read about the compounds that make up cells and how specialized cells differ in structure and function. Next, students discover how cells work to gather, release, store, and use energy to carry out life processes. Students learn about a key life process, growth, as they explore the cell cycle. They find out about genes, chromosomes, and DNA. They learn how traits are passed on through heredity and how natural selection operates. Finally, students are introduced to the researchers who constructed the double-helix model of the DNA molecule and to the Human Genome Project.

DELTA SCIENCE READERS for grades 6–8 are content-rich, 24-page informational texts that present key science concepts and vocabulary. They cover important science topics in an accessible, engaging format.

TEACHER'S GUIDES for Delta Science Readers for grades 6–8 contain general background information for linking science and literacy, assessment, and including all learners, as well as a comprehensive teaching plan. The teaching plan features three-step lessons and spotlight panels on science, literacy, and meeting individual needs.

Contents

INTRODUCTION

Delta Science Readers for grades 6–8 are content-rich, 24-page informational texts. Based on key science standards for the topic, they are used in conjunction with hands-on kits or as stand-alone texts.

As students reach middle school, their reading abilities and knowledge of literacy skills and strategies greatly affect their success in understanding informational text. Middle school readers often need guidance in reading for information, especially as the content load of the text increases and becomes more complex. This guide provides the middle school teacher with both science and literacy support to help students learn.

Science and Literacy

Delta Science Readers are outstanding resources for building both science knowledge and literacy skills and strategies. Students interacting with informational text are exploring language fully, exercising all four aspects of literacy: reading, writing, speaking, and listening.

Reading Informational Text

Reading to gain information is markedly different from reading for literary experience or to perform a task. Informational text is often read nonlinearly, or selectively. From section to section, the difficulty level, concentration of new vocabulary, structural pattern, and unfamiliarity of content may vary. Use the following guidelines to help your students get the most out of reading nonfiction text.

Prereading. Help students anticipate content and predict learning outcomes before they begin to read. Always preview informational text with students so that they can develop a focused purpose for reading and be able to answer the question, "Why am I reading this?"

Reading Strategically. A number of reading strategies support the comprehension of science text, in part because of the strong relationship between science and reading comprehension skills. The following comprehension skills are common to both reading and science:

- Identify main ideas and supporting details
- Compare and contrast
- Relate cause and effect
- Trace a sequence of events
- Draw conclusions based on evidence
- Demonstrate critical thinking
- Generate questions
- Summarize information
- Interpret graphics
- Recognize patterns and relationships
- Make predictions

Some of these skills are applied in the process of extracting and processing information. Others are applied in more demanding ways as students evaluate, analyze, interpret, and synthesize ideas.

Monitoring Comprehension. Help students read actively. Active readers think about the organization and presentation of information and monitor their own comprehension. Provide these tips: reread difficult passages; vary the pace of reading; stop and think about a passage; ask questions; think aloud while reading; take notes; make a prediction about what will come next; or paraphrase what has been read. Also, some students can process and share information better when paired with a reading partner.

Using Graphic Organizers. Graphic organizers are diagrams that show the relationships among ideas. Unlike traditional outlines, graphic organizers are visual representations. They show, rather than tell about, associations among important facts and supporting details. Encourage students to create their own graphic organizers. The most effective ones are those generated by students themselves as they interact with information. Useful formats include the KWL chart (see p. T1), concept web, T-chart, Venn diagram, flowchart, and cycle chart.

Keeping Science Notebooks. Responding to informational text in writing promotes higher levels of understanding. Students should use their notebooks for all writing related to the topic. This can include graphic organizers, vocabulary lists, predictions, questions, observations, labeled illustrations and diagrams, personal discoveries, activity sheets, and note taking.

Building Science Vocabulary

Studying science involves learning specialized vocabulary terms. It may also mean relearning familiar words that have different meanings in science. Help students acquire new science vocabulary through multiple activities. Examples include analyzing word parts, understanding word origins, identifying word families, crafting definitions in their own words, role-playing or illustrating definitions, connecting new words to known words, using context clues, and using science language as they write and talk about science topics.

Previewing Vocabulary. When previewing the boxed vocabulary words for each section, you may wish to focus on the terms most critical to your curriculum needs. You may also wish to have students work in pairs or in small groups to share their ideas about words and meanings.

It is important for students to keep written records of their growing science language in their science notebooks. You may begin this record during the vocabulary preview, using any of the following ideas or your own method:

- Have students sort the vocabulary words into lists of terms they know and don't know. As they read and learn, the "Know" list should grow and the "Don't Know" list should shrink.
- Ask a volunteer to read the words out loud so students can hear correct pronunciations.
- Group related words together in a chart.
- Identify words that have familiar roots, prefixes, or suffixes.
- Note familiar words that have a special or different meaning in science.
- Let students select one vocabulary word they know and illustrate it or use it in an original sentence.

Reading and Vocabulary Growth. Support the natural link between science and literacy by making your science classroom a library as well as a laboratory. Make available other kinds of reading material about the topic in addition to the Delta Science Readers. Examples include nonfiction trade books, newspaper and journal articles, computer printouts from validated and reliable sources, textbooks, reference books such as almanacs and encyclopedias, posters, CD-ROMs, and so on. Seeing science concepts and vocabulary used in other contexts reinforces understanding.

*See the **Glossary** pages, T23–T24, for many additional suggestions on building vocabulary.*

Assessment Features

Students' knowledge and skills should be assessed in as many modalities as they are taught so that all students can show what they know. This Delta Science Reader teacher's guide offers a variety of tools and strategies for measuring student achievement throughout the learning process.

Preassessment Preassessments take place prior to learning and provide information on students' awareness and experience regarding the topics.

- **Access Prior Knowledge**—informal assessments of students' entry-level understanding.

Ongoing Assessment Ongoing, formative assessments are integrated into the daily teaching and learning process. They not only measure ongoing student progress but also provide insights for reshaping and improving instruction.

- **Read to Understand Questions**—self-assessments or more formal evaluations of student mastery of key concepts. Suggested answers are provided.
- **Alternative Assessments**—additional choices, usually nonverbal, that provide other ways for students to demonstrate competencies.
- **Meeting Individual Needs**—teaching ideas that serve as assessments for students who have difficulty communicating fluently.
- **Answers to Caption Questions**—self-assessments related to student interpretation of graphic elements.
- **Notebooks**—student responses to science text and experiences that reveal growth in level of understanding and ability to organize ideas.

Postassessment Postassessments, or summative assessments, are opportunities for students to demonstrate what they have gained as a result of the learning experience.

- **Review and Reflect**—summative assessments that show the degree to which students can recognize patterns and understand relationships in the overall subject matter.
- **Writing Links**—writing assignments that require students to apply and communicate knowledge.
- **Cover to Cover**—opportunity for students to synthesize learning by comparing and contrasting front and back cover photographs.
- **Unit Test**—selected-response and short-answer questions (with answer key), provided with this teacher's guide, that measure comprehension of key science vocabulary and concepts.

Including All Learners

All students can be active participants in the scientific process and can become scientifically literate citizens. Further, all teachers can successfully guide students to learn and enjoy science. Making science content universally accessible may require implementing different instructional strategies and accommodating multiple intelligences. The guidelines listed below will help you meet the challenges of your diverse classroom.

Hands-on Science

The science classroom is an ideal environment for diverse learners because of its reliance on hands-on exploration of the world. Research has shown that all students are highly motivated to learn science when actively engaged in hands-on activities. Hands-on investigations are therefore an essential component of science education. Hands-on, inquiry-based science helps extend the reach of instruction to all students while enhancing and reinforcing student learning.

English Language Learners

When reading informational science text, English Language Learners (ELLs) are confronted with the challenge of learning content while becoming proficient in English. They may have the cognitive ability to perform in class and understand scientific meanings, but they may be unable to communicate, by reading, writing, speaking, or even listening, with proficiency and confidence. Using effective strategies, teachers can make content more accessible while language learners improve their English.

- Reinforce reader content with hands-on activities.
- Simplify vocabulary, not content.
- Allow multiple opportunities to practice new vocabulary.
- Present information orally and visually.
- Allow ELLs to demonstrate science learning nonverbally.
- Assess science comprehension, not English fluency.
- Promote a classroom environment in which students are comfortable sharing ideas and taking risks.

Learners with Special Needs

Individual student needs, abilities, and disabilities vary widely, and the accommodations appropriate for each classroom will be unique. Begin with a student's individual educational plan (IEP). Tailor the presentation, classroom setup, teaching strategy, and materials to ensure student safety and to enable each student to participate as fully as possible.

- Present instruction in the context of real-world situations.
- Pair students who have difficulty reading with friends who read fluently.
- Allow extra time for completing activities.
- Assign one task at a time and give instructions in different ways.
- Introduce new vocabulary in different, meaningful ways.
- Review material more often.
- Repeat other students' comments and questions for everyone to hear clearly.

Advanced Learners

Advanced learners benefit from meaningful assignments that extend and enrich their knowledge of science. Encourage students who readily grasp the basics of science concepts and processes to deepen their explorations. Students performing above grade level can cultivate high levels of science thinking through further research, investigation, or other guided or independent projects.

- Provide enrichment opportunities for students who can and wish to work on independent projects.
- Ask questions that encourage creative or imaginative answers.
- Model thinking that leads to problem solving, synthesizing, analyzing, and decision making.
- Make available more sophisticated resources for exploring the topic.
- Invite students to present their research to the class in a format of their choosing.

*See the **Meeting Individual Needs** spotlight panels throughout this guide for specific suggestions for including English Language Learners, learners with special needs, and advanced learners.*

About the Teaching Plan

The format and content of the three-step lesson plans and spotlight panels for each ***Think About . . .*** section in the student book are described below. Use the suggestions and strategies as appropriate for your teaching style and the needs of your students.

Three-step Lesson Plan

The lesson plan for each section begins with a list of **learning objectives.** The final objective in each list highlights one reading skill that promotes science comprehension.

1 Before Reading Before-reading strategies set the stage for reading each section. Prereading efforts are particularly important with informational text because the reader will encounter new and complex ideas, different text forms and structures, and unfamiliar vocabulary. Make the process less daunting by accessing prior knowledge and previewing the section.

Access Prior Knowledge. These discussion prompts help you engage and motivate students by linking the main ideas students will read about to their existing knowledge and experiences. In some cases, it may be appropriate to identify and address common misconceptions about the topic at this point.

Preview the Section. This is a "walk-through" of the section content and vocabulary. Point out or discuss the boxed Read to Understand questions and vocabulary words. These indicate the main topics and key terms covered in the section. Also, look together at the section title and subheads. Based on the preview, students can generate questions, make predictions, and set a purpose for reading this section.

2 Guide the Learning Help students interact with the text, monitor comprehension, and integrate new ideas with existing knowledge as they read. A variety of grouping strategies is suggested so that students may benefit from collaborative learning.

Discuss and Explore. These questions elicit student responses that demonstrate comprehension of facts and concepts. The science and literacy skills developed during reading include

- relate cause and effect
- identify the main idea and supporting details
- trace a sequence of events
- compare and contrast
- describe
- predict

Critical Thinking. These questions challenge students to dig deeper and exercise higher-order thinking skills, such as

- infer
- draw conclusions
- interpret
- summarize
- generate questions

3 Assess After-reading assessments for each *Think About . . .* section include

Read to Understand Answers. Sample answers to the Read to Understand questions are provided. The questions can function either as informal self-assessments for students or as part of an ongoing written or oral assessment of student progress.

Alternative Assessment. These assessment opportunities, such as hands-on demonstrations or visual presentations, accommodate multiple learning and communication modes.

This teacher's guide offers opportunities for multiple measures of student progress. See ***Assessment Features,*** *p. Tiii, for additional tools.*

Spotlight Panels

Special feature boxes appear on each page to provide additional support.

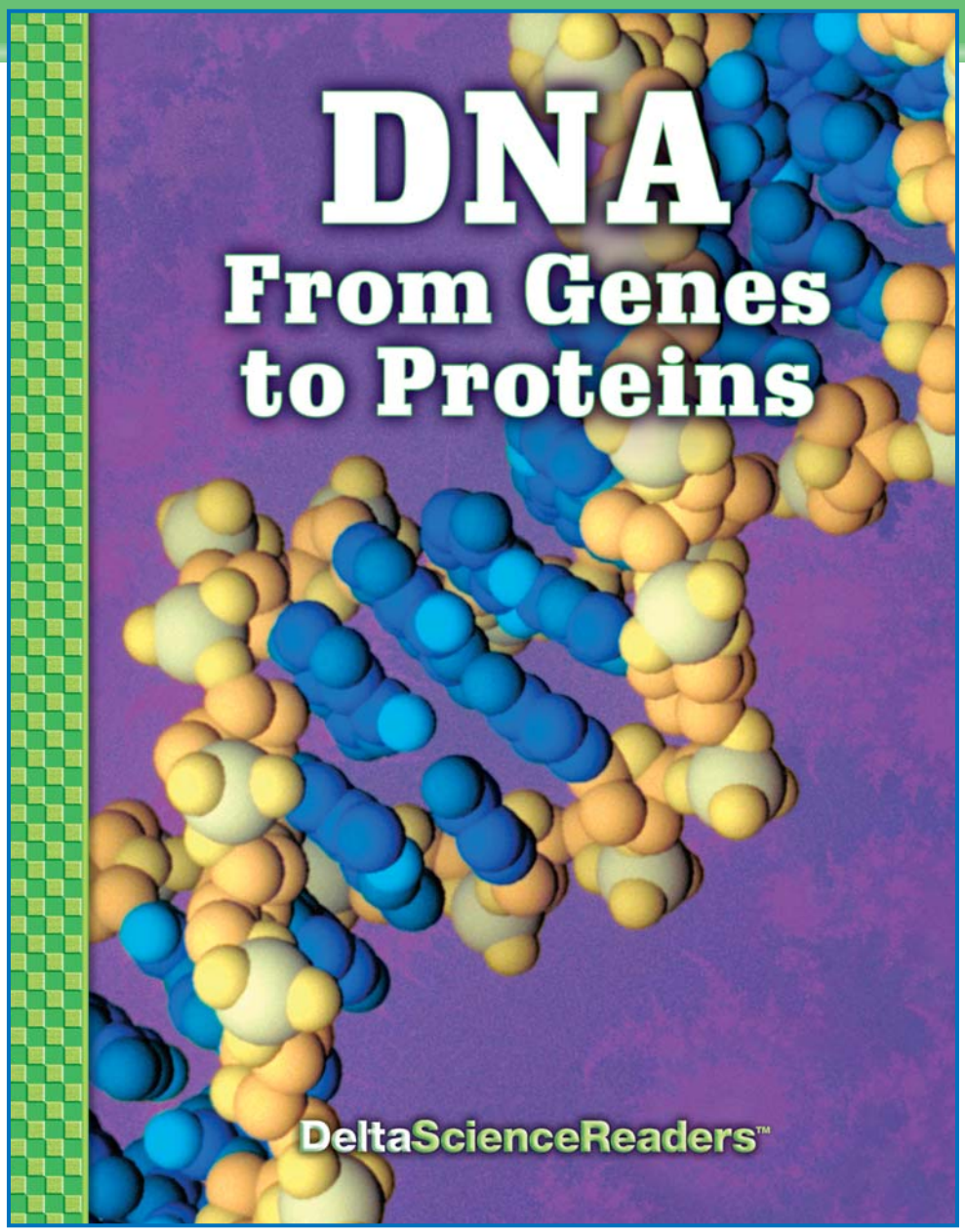
Science. Additional science background information, historical perspectives, and facts and figures of interest that support science instruction and can be shared with students as appropriate.

Literacy. Ideas for strengthening literacy skills in the areas of reading comprehension, vocabulary, notebooking, organizing ideas, and using the visuals.

Meeting Individual Needs. Suggestions for making science content and vocabulary accessible to English Language Learners and students with special needs and for including and challenging advanced learners.

Teaching pages for ***People in Science*** *and* ***Did You Know?*** *also offer suggestions for activating prior knowledge and building comprehension and include science spotlight panels. The Glossary pages provide many helpful vocabulary-building strategies.*

TEACHING *DNA: From Genes to Proteins*



The Delta Science Reader ***DNA: From Genes to Proteins*** presents the key science concepts related to cells, life processes, and heredity and genetics. The book provides opportunities for students to engage in science inquiry by applying literacy skills and strategies to nonfiction text. Students explore science as they develop informational literacy.

Build Background

Front Cover. Access students' prior knowledge of DNA by displaying the front cover and discussing the title. *What do you observe in this picture?* (Student ideas may range from a collection of colored balls or dots to a spiral staircase.) Explain that the picture shows a model of a molecule with a special shape called a double helix. *What kind of molecule might this represent?* (Accept all ideas.) *What do you know about the three terms in the title: DNA, genes, and proteins?* (Accept all ideas. Genes, which are specific segments of DNA, contain instructions for making proteins, which cells need to grow. Genes control inherited traits, which are our characteristics and features.)

Encourage students to share what they know about how cells carry out life processes from their personal experiences and from previous hands-on explorations in science. Stimulate discussion with questions such as *What are cells? Why are they important? Where do cells come from? What are some of the kinds of cells that make up our bodies?*

Such discussions help students make connections between what they already know and new information that will be presented in the book. Based on the title and cover, have students predict what they might learn about in this book.

Preview the Book

In a preview, students scan the book quickly to see the structure and to find the main topics and most important text features. Have students preview *DNA: From Genes to Proteins* before reading.

Roadmap for Reading. Tell students that previewing is like looking at a map before taking a trip. It helps us know where we are going! Using a preview to anticipate content increases student interest in the material to be studied. For that reason, a preview is a vital part of reading for information, or nonfiction reading. Use the preview to activate prior knowledge, make predictions about what the text will present, and set a purpose for reading.

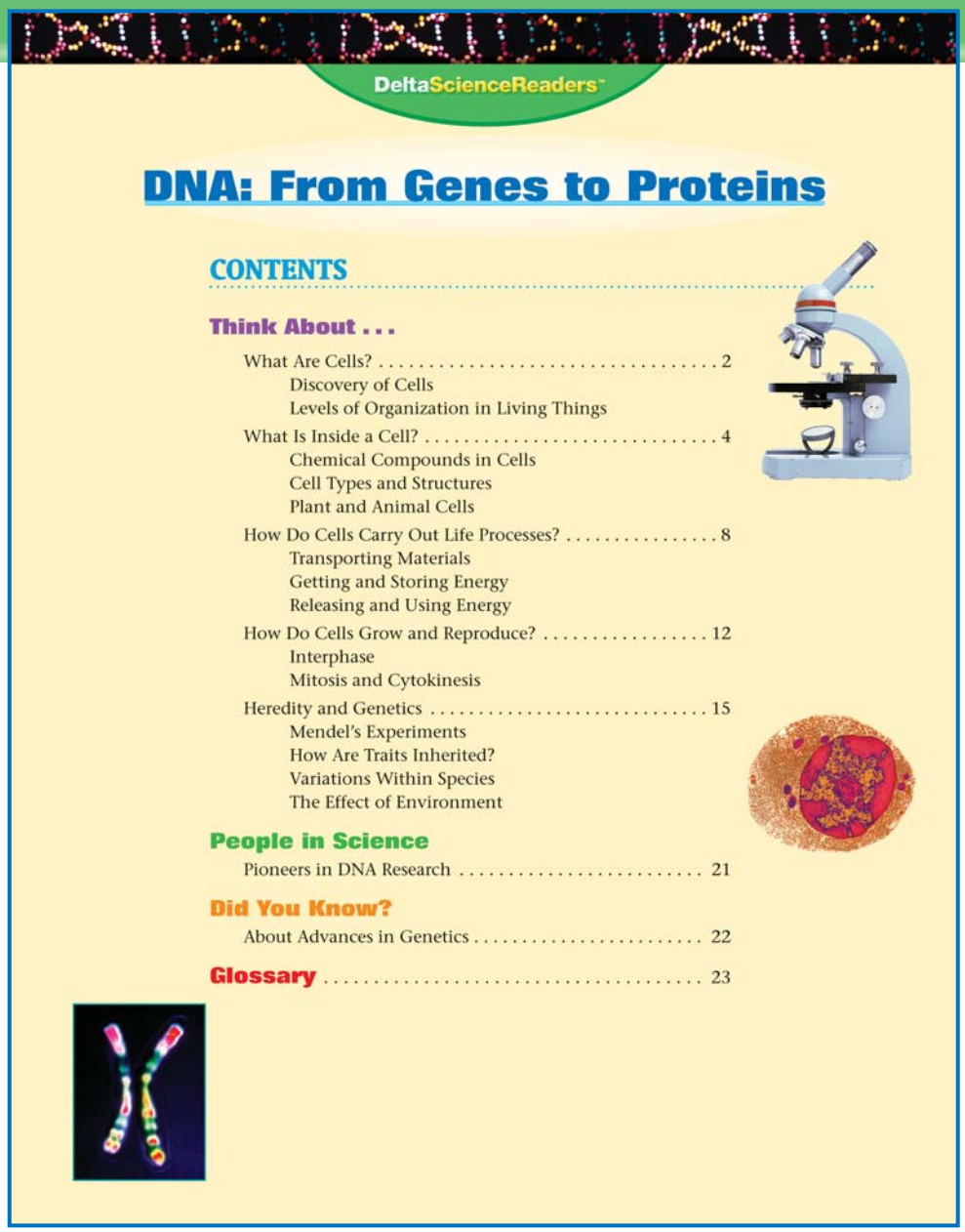


Table of Contents. Begin the preview with the table of contents. Think of the table of contents as an outline of the book. It lists the different parts of the book and the topics covered in each part. Page numbers are given for the main section headings. After students have skimmed the table of contents, ask if they have ever studied any of these topics before. Look at the photographs on the contents page. Can students guess where in the book they might find out about the objects pictured?

Text Features. Next, have students "walk through" the book. Ask them to look at the headings, subheadings, and graphics (photographs, diagrams, captions, illustrations, labels, graphs, and tables) and tell why they are helpful. Focus their attention on organizational features such as the boxed Read to Understand questions, boxed Vocabulary lists, boldfaced words, and Glossary.

For each new text feature students identify, have them ask questions: Why are these [*boxes*] here? What is the purpose of [*captions*]? How do these [*boldfaced words*] help us understand the topic? What if the book did not have [*labels*]?

Start a KWL Chart

Have students make a four-column KWL chart in their science notebooks. Based on the book's title and their preview, have them fill in the first two columns—What I Know (K) and What I Want to Know (W). Have students fill in the third column, What I Learned (L), as they work through the book. After students have finished reading about each topic, they can fill in the last column with questions they still have about the topic.

Conceptual Framework

Help students make meaning of the content covered in *DNA: From Genes to Proteins* by building a conceptual framework—a theme around which they can organize ideas and information. For this topic, such a framework might be **Cells are the building blocks of life.** Though cells are microscopically small, their structure and makeup are very complex. And all life processes, including the passing of traits from generation to generation, depend on the healthy functioning of cells and the cell cycle.

Begin by discussing students' common experiences of the diversity of life and the needs of living things. For example, what plants and animals did they observe at home or on their way to school today? How do they account for the many differences they observe? What do these organisms need to survive and grow? How do they get and use what they need? Help students understand that all the life processes, structures, features, and activities originate at the cellular level. As students read, they can relate their learning about growth and development, life processes, and heredity and genetics to this framework.

OBJECTIVES
(pages 2–3)

- Relate the invention of the microscope to the discovery of cells.
- Summarize the cell theory.
- Explain how living things are organized.
- Use reading skills such as paraphrasing to achieve science comprehension.

1 Before Reading

Access Prior Knowledge

Ask students questions to elicit their ideas about cells. *What is a cell? What do cells do? How many cells do you think make up your body? How many kinds of cells are there?* (Accept all ideas.) Invite students to describe any observations of cells they may have seen in photographs or under microscopes.

Preview the Section

Use the Read to Understand questions to set a purpose for reading (answers on p. T3). Preview the Vocabulary words using one of the methods described on p. Tiii. Remind students that these important words appear in boldfaced type in the text and are defined in the Glossary. (See pp. T23–24 for vocabulary-building ideas.)

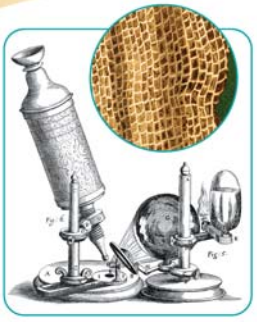
2 Guide the Learning

Discuss and Explore

Paraphrase Ask students to paraphrase, or describe using their own words, the cell theory. (Possible answer: Cells are found in all living things. Nonliving things do not have cells. Cells make up every part of living things, give them shape and form, and make them function. Cells cannot form by themselves but have to be made by other cells.)

Think About . . .

What Are Cells?



▲ **Figure 1** This image shows a drawing of Robert Hooke's microscope and his 1665 sketch of cork cells.

READ TO UNDERSTAND

- How did the discovery of cells depend upon technology?
- What is the smallest unit that makes up all living things?
- What are the levels of organization within multicellular organisms?

VOCABULARY

convex lens
magnification
microscope
cell
compound microscope
cell theory
tissue
organ
organ system

Discovery of Cells

People, animals, and plants are living organisms. All living things take in and use energy, grow and develop, reproduce, and respond to their surroundings. But what is unique about the structure of a living thing that makes it alive?

Scientists struggled to answer this question for thousands of years. The ancient Greek philosopher Aristotle (384–322 B.C.E.) made many observations of living things. But he did not have the right tools to learn what made living things different from nonliving things. For almost two thousand years after Aristotle's time, scientists could not answer the question.

In the early 1600s, glassmakers invented a tool that led to the answer. Glassmakers learned how to grind glass into a curved shape that was thick in the middle and thin at the edges, forming a **convex lens.** When objects are viewed through a convex lens, they appear larger. This is known as **magnification.** Convex lenses were used to build a magnifying tool called the **microscope.** The microscope made tiny objects visible to the human eye.

In 1665 an English scientist named Robert Hooke (1635–1703) made an interesting discovery. While using a microscope to observe thin slices of cork from a woody plant, Hooke saw what looked like "tiny rooms," or **cells** (Figure 1). When he looked at other plants, he saw that they had cells, too. But nonliving things did not have cells.

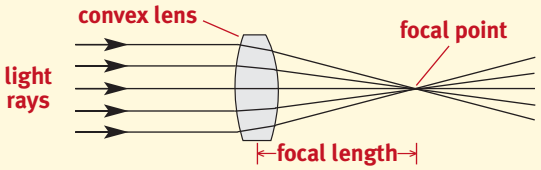
Advances in microscope technology soon allowed scientists to see much more detail in cells. **Compound microscopes** use two or more lenses. The first lens magnifies an object and creates an upside-down and backwards image. The second lens magnifies that image even more. A compound microscope can magnify an object about 1,500 times its actual size. This and later inventions changed the way scientists viewed the living world (Figure 2).

Today, Robert Hooke is known as the father of modern biology. However, it took scientists many years to understand fully what Hooke had discovered. Over time, biologists have developed the three parts of the **cell theory.** This theory first states that all living things are composed of one or more cells. Second, cells are the basic unit of structure and function in living things. Third, all cells come from other cells.

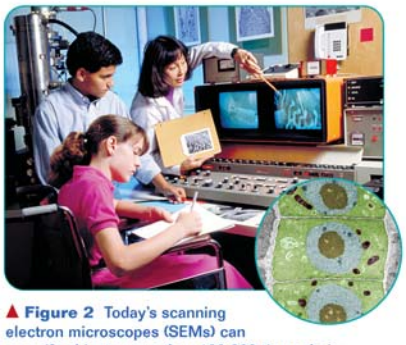
2

SCIENCE

Background Convex lenses magnify objects because they refract, or bend, rays of light. A smooth convex lens will bend the rays into a focal point, as shown below.



The rays of light that hit the top and bottom edges of the lens are bent the most, while the rays of light that travel through the center of the lens are not bent at all. This property allows objects that are placed between the lens and the focal point (that is, inside the focal length) to appear larger. The magnifying power of a lens, such as 10×, refers to the number of times the diameter of an object is magnified—in this example, ten times.



▲ **Figure 2** Today's scanning electron microscopes (SEMs) can magnify objects more than 100,000 times their actual size. An SEM image of onion cells is shown.

Levels of Organization in Living Things

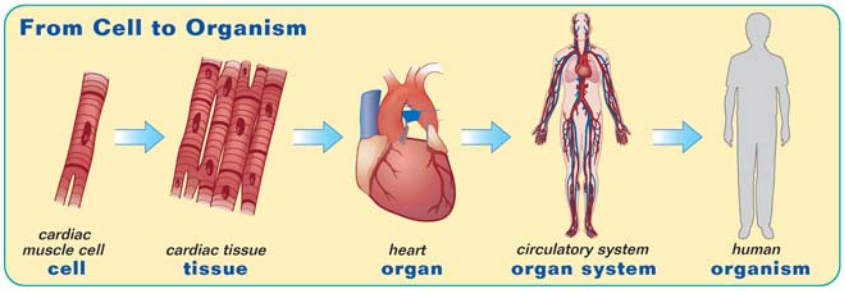
Some organisms are made up of just one cell. These single-celled, or unicellular, organisms include bacteria, some algae, protozoa, and certain fungi. Inside the single cell, all functions needed for life take place. These functions include taking in oxygen and nutrients, getting rid of wastes, and reproducing.

Other living things are made up of more than one cell. In these multicellular organisms, each cell still carries out its own life functions. But cells also work together to keep the whole organism functioning. That is why cells are known as the building blocks of life. They are the first level of organization in living things (Figure 3).

A group of one type of cells that works together to carry out a job for an organism is called a **tissue.** For example, the muscle cells that make up muscle tissue work together to produce movement. Nerve tissue carries electrical signals throughout the body, to and from the brain and spinal cord. Epithelial tissue protects and lines most of the body's organs.

Groups of tissues working together form **organs.** Organs are structures that do a specific job for the organism. Each organ is made up of more than one kind of tissue. The heart, for example, is an organ that pumps blood throughout the body. The heart contains muscle tissue, nerve tissue, and epithelial tissue.

Groups of organs form **organ systems.** The organs in an organ system work together to do a highly complex job for the organism. The heart and blood vessels, for example, are organs that make up the circulatory system. This system delivers blood, carrying oxygen and nutrients, to all cells of the body. To do this job, the circulatory system works with other organ systems. It gets oxygen from the lungs, which are part of the respiratory system. The nutrients come from the digestive system. All of the organ systems working together make up a whole organism.



▲ **Figure 3** Cells make up tissues, which make up organs, which make up organ systems, which make up an organism as a whole.

MEETING INDIVIDUAL NEEDS

English Language Learners Help students acquire science vocabulary by pointing out words from this section that have different meanings in everyday use: *cells, tissue,* and *organs.* Have students create a chart with the column headings "Word," "Everyday Meaning," and "Scientific Meaning." They can use the Glossary and a dictionary to fill in the columns for each word and then work together to make up and write sentences for each definition. More words can be added to the chart while reading the book.

Learners with Special Needs Copy Fig. 3 without the labels for students. Provide them with a word bank consisting of *organ system, cell, organism, organ,* and *tissue* and have them fill in the levels of organization. Or, cut apart the illustrations and labels and have students put them in order, from simple to complex. Ordering the interacting parts from cell to organism reinforces understanding of nested systems.

Critical Thinking

Interpret Have students work with sets of interlocking blocks to construct complex structures with several levels of organization. Begin by having each student use three to five basic units (cells) of one color to create a small structure (tissue). Then have small groups of students connect their smaller structures into a larger one of the same color (organ). Continue the process with larger groups and assorted colors (organ system). Finally the entire class can assemble all of the structures into one "organism." Invite students to explain how each of the levels of organization in their block structure relates to the levels of organization shown in Fig. 3. Discuss other things that have different levels of organization, such as sports leagues, schools, corporations, governments, or the universe.

3 Assess

Read to Understand Answers

How did the discovery of cells depend upon technology? Cells are too tiny to see without a microscope.

What is the smallest unit that makes up all living things? cells

What are the levels of organization within multicellular organisms? cells → tissue → organ → organ system → organism

Alternative Assessment

Ask students to develop their own analogies for the levels of organization in multicellular organisms. Students may use one of the ideas discussed above or think of their own. Have students draw a diagram or create a model and explain their "levels of organization" analogy. (Sample: individual → family → neighborhood → city → state → country → world)