



Red Edition
Grade 3–4
reading level

Purple Edition
Grade 4–5
reading level

Objectives

- Explain why offspring look like their parents in order to understand the connection between traits and heredity.
- Understand instincts.
- Explain how the environment affects the traits of living things, including learned behaviors.
- Describe cells, chromosomes, and genes.
- Compare two ways that living things reproduce.
- Understand how and why cells divide.
- Discuss differences among individuals and how they occur.
- Interpret Mendel's experiments with pea plants in order to understand dominant and recessive traits.
- Explore how adaptations help a species to survive in its environment, and describe how species change over time.

Reading Comprehension Skills

Preview the Book ♦ Sequence

How to Read Diagrams ♦ Main Idea and Details

Skillbuilders are available for this title.

Supporting English Learners

Develop Vocabulary Create meaningful opportunities for English Learners to use new vocabulary in speaking, reading, and writing. Provide multiple exposures to science vocabulary such as *trait* and *adaptation*. Also emphasize the use of context clues and dictionaries.

Summary

The Delta Science Content Reader *Heredity* introduces students to physical and behavioral traits and their relationship to heredity and the environment. The book explores the role of genes in the inheritance of traits and describes how genes are passed on through reproduction. Students learn about variations within species and factors that affect the expression of parents' traits in their offspring. The book concludes by explaining how species change over time through the inheritance of helpful traits.

Science Background

Heredity is the process by which parents pass traits to their offspring. Traits passed on in this manner are called inherited traits. Offspring inherit both physical traits and behavioral traits, or instincts. Certain traits, however, are not inherited but are caused or influenced by an organism's environment. For example, an oak tree has the inherited trait of great height. But if the tree grows in an environment with limited resources, it will not reach the full height that its heredity allows.

Hereditary information is coded in genes, which make up the chromosomes of an organism's cells. Each gene carries a single unit of information that may determine or influence one or many traits. When an organism reproduces, it passes on its genes to its offspring. In organisms that reproduce asexually, all the genes come from a single parent. In organisms that reproduce sexually, generally half of the genes come from each parent. Thus sexual reproduction results in greater genetic variation.

Environmental pressures can cause certain traits to become more beneficial. Individuals with helpful traits, or adaptations, are more likely to survive and pass on these traits to their offspring. Over time, the entire population will inherit these adaptations. This is the mechanism by which species change.



What Is Heredity?

(pages 2–5)

Before Reading

Discuss the Cover

Cover Image Discuss the photograph on the cover of *Heredity*. Use the information on the inside front cover to support the discussion.

Science Statement Discuss the science statement. Ask: *What kinds of traits do you think a zebra inherits from its parents?* (Possible answers: black and white stripes, pointy ears)

Build Reading Skills (page 2)

Preview the Book Use Build Reading Skills on page 2 to review how to preview the book. Discuss the steps. Then model previewing the words in bold type.

Think Aloud *Why are some words set in bold type? I know that important vocabulary sometimes is set in bold type. Maybe that's what's happening here. Let me check. When I read the Vocabulary box on page 3, I see the words trait and heredity are both listed. Do these words appear in bold type later in the book? Yes, I see them on page 4. I was right: the words in bold type are Vocabulary words.*

Guide students as they finish previewing *Heredity*. Focus on nonfiction text features.

- Prompt them to look at the headings, photographs, captions, and diagrams. Ask questions such as *Why do you think that feature is there? How will it help you understand what you read?*
- Prompt them to look at other bold Vocabulary words. Guide the class in looking up a Vocabulary word in the Glossary.

Students can apply the skill in the Reflect on Reading activity on page 5.

K-W-L Chart Have students begin a K-W-L chart. They should add to it after each section.

What I K now	What I W ant to Learn	What I L earned
People in a family often look alike.	How does this happen?	

Make a Connection (page 3)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about heredity. (Possible answer: Most birds build nests, so I think it must be something they do not have to learn.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *traits* in the center. Have students add information to the web as they read.

During Reading

Heredity and Traits (page 4)

- Discuss the photographs of ears on page 4. Ask: *What is different about these ears?* (One has an attached lobe, and the other hangs free.) *What is this an example of?* (inherited trait)
 - You may wish to have students compare their earlobe shapes or other features to further explore human traits.
- ✓ **Checkpoint** (page 4) (a trait that parents pass to their offspring; Possible answers: zebra's striped coat, birds' ability to build nests)

The Environment and Traits (page 5)

- Emphasize that a living thing's environment is all the physical things and conditions that surround and affect it, including other living things, such as plants and animals, and nonliving things, such as, water, air, soil, sunlight, and weather.
 - Ask: *If you teach a dog to fetch, can it pass that behavior on to its offspring? Explain.* (No, because that is a learned behavior, and learned behaviors are not inherited.)
- ✓ **Checkpoint** (page 5) (It is a learned behavior. People are not born knowing how to do it.)

After Reading

Reflect on Reading (page 5) Encourage partners to use their own words to define the bold words they choose. Have them provide examples for each bold word, either from the book or their own experiences.

Apply Science Concepts (page 5) This activity applies concepts from Find Out About on page 3. Remind students that their lists should include only inherited traits, not acquired traits or learned behaviors.

How Are Traits Inherited? (pages 6–13)

Before Reading

Build Reading Skills (page 6)

Sequence Use Build Reading Skills on page 6 to review sequence. Discuss the tips. Then model how to identify the cell division sequence on page 13.

Think Aloud *What happens first in cell division? I see the word first on page 13. It says that first, the cell makes a copy of each chromosome. What happens next? I will keep looking for other clue words to help me follow the order of steps.*

Guide students to identify other sequence signal words on page 13. Students can apply the skill in the Reflect on Reading activity on page 13.

Make a Connection (page 7)

Make a Connection Discuss the Make a Connection questions. Use this discussion to build background and activate prior knowledge about how traits are inherited. (Possible answer: Something in the parents gets passed on to the children.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *cell* in the center. Have students suggest other Vocabulary words and information to add to the web as they read.

During Reading

Genes (page 8)

- Discuss the picture of a plant cell on page 8. Ask: *Look at this plant cell. Where in the cell are the plant's genes?* (in chromosomes in the nucleus of the cell)

- Emphasize that because each cell in an organism contains the same genes, each cell carries all the instructions needed for that organism to live and grow.

✓ **Checkpoint** (page 9) (A gene is the basic unit of heredity. It carries instructions for traits.)

Passing On Genes by Reproducing (page 10)

- Discuss the photograph of the hydra on page 10. Ask: *Look at the bud on this hydra. Will the new hydra have the same genes as its parent or different genes?* (same)

- Emphasize the relationship between genes and chromosomes. Genes are sections of chromosomes. In sexual reproduction, an offspring receives two full sets of genes and therefore two full sets of chromosomes.

✓ **Checkpoint** (page 11) (Asexual reproduction: offspring gets all genes from one parent; Sexual reproduction: offspring gets genes from two parents)

Cell Division (page 12)

- Ask: *Why do you think cell division has to happen in a special order, or sequence?* (Possible answer: to make sure the two new cells are exact copies)

✓ **Checkpoint** (page 13) (so many-celled living things can grow, develop, and repair themselves; so one-celled living things can reproduce)

After Reading

Reflect on Reading (page 13) Have groups use the cell division diagram on pages 12–13 to help them make their cards as detailed as possible. Remind them to omit the step numbers, but encourage them to include labels and captions to make each step clear.

Apply Science Concepts (page 13) This activity applies a concept from Find Out About on page 7. Before students begin their lists, review that only inherited traits are controlled by genes. (Possible answers: tell body what color and texture hair to grow, what eye color to have, whether or not to have freckles)

What Are Variations?

(pages 14–19)

Before Reading

Build Reading Skills (page 14)

How to Read Diagrams Use Build Reading Skills on page 14 to review how to read diagrams. Discuss the tips. Discuss with students that arrows, numbers, keys, legends, symbols, and color coding can be important features of diagrams. Then model reading the diagram on page 18.

Think Aloud *What does this diagram show? First, I read the title and look at the pictures. The title tells me the diagram is about crossing, or breeding, pea plants. I see two bigger flowers—one purple and one white—and four smaller flowers that are all purple. The smaller purple flowers are labeled “offspring.” These must be the offspring from crossing the two bigger flowers.*

Guide students as they continue reading the diagram. Students can apply the skill in the Reflect on Reading activity on page 19.

Make a Connection (page 15)

Make a Connection Discuss the Make a Connection questions. Use this discussion to build background and activate prior knowledge about variations. (Possible answers: Animals or people with the same parents usually don’t look exactly the same. Maybe this means different offspring get different genes from their parents. These kittens have fur that is different in color and length.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *variations* in the center. Have students add information to the web as they read. (Possible answers: different fur lengths, different flower colors)

Variations (page 16)

- Ask: *What causes variations in offspring from sexual reproduction?* (Each offspring gets its own combination of genes from the two parents.)

✓ **Checkpoint** (page 16) (Possible answers: different color patterns, different size ears and tails)

Dominant and Recessive Traits

(page 17)

- Share with students some additional dominant and recessive human traits: Dominant—curly hair, free earlobes, can roll tongue; Recessive—straight hair, attached earlobes, cannot roll tongue.
- Ask: *If you have one gene for blue eyes and one gene for brown eyes, which trait will you probably have? Explain.* (brown eyes, because blue eyes is a recessive trait)

✓ **Checkpoint** (page 18) (He saw that different pea plants had different traits. He wondered how these traits passed from parent plants to their offspring.)

Crossbreeding and Hybrids (page 19)

- Discuss the photographs of the donkey, horse, and mule. Ask: *What features did the mule inherit from each parent?* (Possible answers: Donkey: long ears, black nose with white band, short legs and neck; Horse: brown coat, long tail, flat belly)

✓ **Checkpoint** (page 19) (the offspring of a cross of two different species)

After Reading

Reflect on Reading (page 19) (Possible answer: The diagram shows that when Mendel crossed a purple pea plant with a white pea plant, all the offspring were purple. This is because purple flowers are dominant in pea plants.)

Apply Science Concepts (page 19) This activity applies a concept from Find Out About on page 15. Before writing, have students brainstorm plants they are familiar with and list what traits they like about each one.

How Do Traits Help Organisms Survive?

(pages 20–23)

Before Reading

Build Reading Skills (page 20)

Main Idea and Details Use Build Reading Skills on page 20 to review identifying main idea and details. Discuss the tips. Then model identifying the main idea about how species change on page 23.

Think Aloud *Sometimes, an entire page or section has one main idea. I know from the heading that this page is about how species change. To find the main idea, I ask, What is this page mostly about? I read that individuals with helpful traits are more likely to survive and pass on genes for helpful traits. The book says that this is how species change over time. I think this must be the main idea.*

Guide students to identify details that support this main idea. Students can apply the skill in the Reflect on Reading activity on page 23.

Make a Connection (page 21)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about how traits help organisms survive. (Possible answer: Camels must have traits that help them live there. Maybe one of these traits is that they do not need as much water as other animals.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a T-chart on the board for examples of *adaptations*. Label one side of the chart *physical adaptations* and the other *instincts*. Have student suggest examples of each as they read. (Possible answers: Physical adaptations: beaks, claws, feathers, wings, elephant trunks, plant thorns; Instincts: migration, spiders' web spinning, nest building)

Adaptations (page 22)

- Ask: *Pelicans are birds that dive down to catch fish from the water. A pelican has a long beak with a stretchy pouch underneath. How might this adaptation help it?* (Possible answer: It might help it catch and hold the fish.)

- ✓ **Checkpoint** (page 22) (an inherited trait that helps a living thing survive in its environment; bird's beak helps bird get and eat foods in its environment, some birds migrate to area where they can more easily find food in winter)

How Species Change (page 23)

- Emphasize the benefits of diversity to the survival of a species. If the environment changes, diversity makes it more likely that some individuals will have traits that are helpful in the changed environment.
- ✓ **Checkpoint** (page 23) (Individuals with helpful traits are more likely to survive. When they reproduce, they pass on genes for the helpful trait to their offspring. As a result, all the individuals in the species eventually inherit the helpful trait.)

After Reading

Reflect on Reading (page 23) (Possible answer: Main idea: Adaptations are inherited traits that help a living thing survive in its environment. Details: can be physical parts, such as beaks, claws, feathers, wings, trunks, thorns; can be instincts, such as migration)

Apply Science Concepts (page 23) This activity applies a concept from Find Out About on page 21. Encourage students to choose an animal they have some prior knowledge of so that they may better infer how one of its adaptations helps it. To help students think of what they know about the animal, ask questions such as *What does it eat? What physical parts does it have?*

 **Continued on last page**

Name: _____

Date: _____

Test: Heredity

Part A: Vocabulary

adaptations	gene	heredity	inherited traits
instinct	learned behavior	reproduce	variations

Choose the correct vocabulary word for each sentence. Write the word on the line.

1. The passing of traits from parents to offspring is called _____.
2. Features that pass from parents to offspring are called _____.
3. A spider knows by _____ how to build a web.
4. Sitting on command is one _____ a dog might have.
5. One _____ might control whether a person has dimples.
6. Every kind of living thing can _____, or make more of its own kind.
7. Differences in eye color are an example of _____ among individuals.
8. Traits called _____ help a living thing survive in its environment.

Part B: Science Concepts

Mark the best answer to each question.

9. What causes traits that are not inherited?

<input type="radio"/> (A) the environment	<input type="radio"/> (C) dominant genes
<input type="radio"/> (B) sexual reproduction	<input type="radio"/> (D) recessive genes
10. One reason cells divide is so a living thing can _____.

<input type="radio"/> (A) learn behaviors	<input type="radio"/> (C) change its genes
<input type="radio"/> (B) grow and develop	<input type="radio"/> (D) find food

Test: Heredity (continued)

11. The scientist Gregor Mendel studied pea plants to learn how _____.

- (A) pea plants' adaptations help them survive
- (B) cell division in pea plants happens
- (C) to breed pea plants with purple flowers
- (D) traits pass from parent pea plants to their offspring

12. A father and mother both have brown hair, but their daughter has blond hair. What is blond hair an example of?

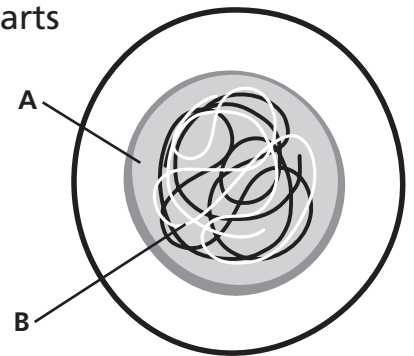
- (A) inherited behavior
- (B) dominant trait
- (C) recessive trait
- (D) learned behavior

Write the answer.

13. Look at this diagram. What does it show? Label the parts marked A and B.

A _____

B _____



14. Strawberry plants can grow from seeds formed from two parents. They can also grow from special stems called runners formed from one parent. Which way would cause more variations? Explain.

15. Describe how species can change over time. Use the word *diversity*.

Let's Review

(inside back cover)

Have students complete their K-W-L charts before answering these questions. Possible answers are shown.

- Cover Connection** (Traits are features of a living thing. The passing of traits from parents to offspring is called heredity. Traits passed this way are called inherited traits. Inherited traits are controlled by genes. Genes are passed from parent to offspring during reproduction.)
- (Living things can inherit traits from their parents, such as height, or acquire traits from the environment, such as a scar.)
- (Cells hold a set of instructions for traits, called genes. Genes are carried in the chromosomes in the nucleus of each cell.)
- (Dominant traits are strong, and recessive traits are weak. An organism needs only one dominant gene for a trait for the dominant trait to show. It needs two recessive genes for a trait for the recessive trait to show.)
- (An eagle's sharp, curved beak is an adaptation. The beak helps the bird catch, hold, and eat its food.)
- Main Idea and Details** (Main idea: A gene is the basic unit of heredity. Details: Genes are sections of DNA. DNA is the material chromosomes are made of. Chromosomes are cell parts in the nucleus of a cell. All inherited traits are controlled by genes. A trait can be controlled by more than one gene. One gene can control more than one trait.)
- Write** (Students' paragraphs should explain how

they learned to do something, such as playing a sport or a musical instrument. Their paragraphs should make clear that the activity is a learned behavior and should also tell about any inherited traits that may help with this behavior, such as long legs for a playing a sport.)

Try It! Guide students to list only inherited traits of offspring of the same parents. Possible traits include eye color, size, hair or fur color and texture, and shape of body parts such as head and ears.

Science at Home Have students do this activity at home with a family member. Encourage them to list as many inherited traits of the plant as possible. When students discuss their lists with their families, have them explain the difference between inherited traits and traits caused by the environment.

Answers to Test

(Teacher's Guide pages 6–7)

1. heredity 2. inherited traits 3. instinct 4. learned behavior 5. gene 6. reproduce 7. variations 8. adaptations 9. A 10. B 11. D 12. C 13. a cell; A: nucleus; B: chromosomes 14. Growing strawberry plants from seeds would cause more variations, because in sexual reproduction each offspring gets its own combination of genes from the two parents. Runners are a form of asexual reproduction, so the offspring and parents would have exactly the same genes. 15. Individuals in a species have a diversity of traits. Individuals with helpful traits are more likely to survive. When they reproduce, they pass on genes for the helpful traits to their offspring. As a result, all the individuals in a species eventually inherit the helpful trait.

ADDITIONAL ASSESSMENT OPPORTUNITIES Use the Checkpoints, Reflect on Reading, and Apply Science Concepts features and Let's Review questions as additional assessment opportunities.

Delta Science Content Readers are 24-page nonfiction student books with informative, engaging text and full-color photos and illustrations. The readers present key science content and vocabulary found on state tests, present key reading skills and strategies useful for reading informational text, support and extend the experiences and content of hands-on activities, promote scientific inquiry, and serve as a home-school link. They are available in two editions: Red Edition for Grades 3–4 and Purple Edition for Grades 4–5.

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Heredity
Teacher's Guide
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