Investigate

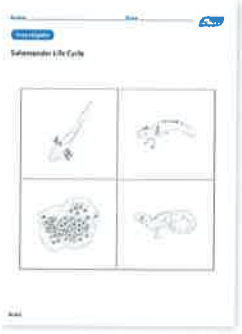
Life Cycles

How can you show the sequence of stages in the life cycle of a spotted salamander?

Spotted salamanders are close relatives of frogs. Like frogs, spotted salamanders live in two different habitats during their life cycles. Adult salamanders live on land, but young salamanders live in water. In this exercise, you will sequence the stages of the life cycle of a spotted salamander.

Materials

- Stages in the Life Cycle of a Salamander Chart



- scissors

- marker

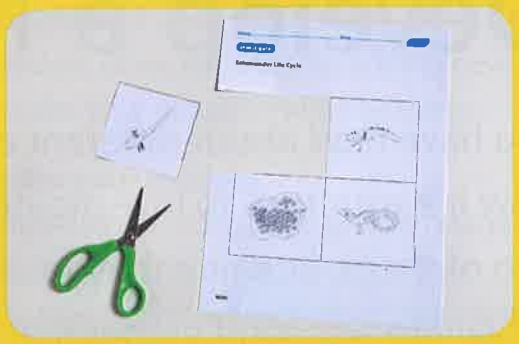
- glue stick

- construction paper

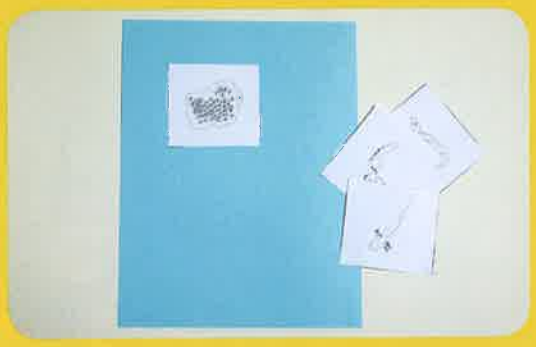
NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS
LS1.B: Growth and Development of Organisms
Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

1 Look at the chart of the stages in the life cycle of a salamander. Use the Internet or other resources to find out about when each life stage begins and how long it lasts. Record the information in your science notebook.

2 Cut out the different stages of the salamander life cycle.



3 Place the steps on the construction paper in order. Check to be sure they are in the correct position. Then glue the steps to the construction paper.



4 Use the marker to draw arrows between the steps. Add a title to the life cycle diagram.

Wrap It Up!

1. **Describe** Where does the larva of a spotted salamander live?
2. **Compare** How are the life stages of the spotted salamander similar to the life stages of a frog?
3. **Contrast** How are the life stages of a spotted salamander different from those of a frog?

Develop a Model

You have read about different examples of life cycles. Now it's your turn to investigate, describe, and contrast two of them. Imagine that you have been asked to explain to a second grader that different living things can have very different life cycles. You choose two from the following examples:

- a gray whale
- a toad
- a monarch butterfly
- a tomato
- a dandelion

To help you explain the life cycles, you decide to develop models of them.

1. **Research the models.** My Science Notebook
   Choose two of the plants or animals listed above. Use library books or the Internet to find out about the life cycles of the organisms you have chosen. Write down what you learn.

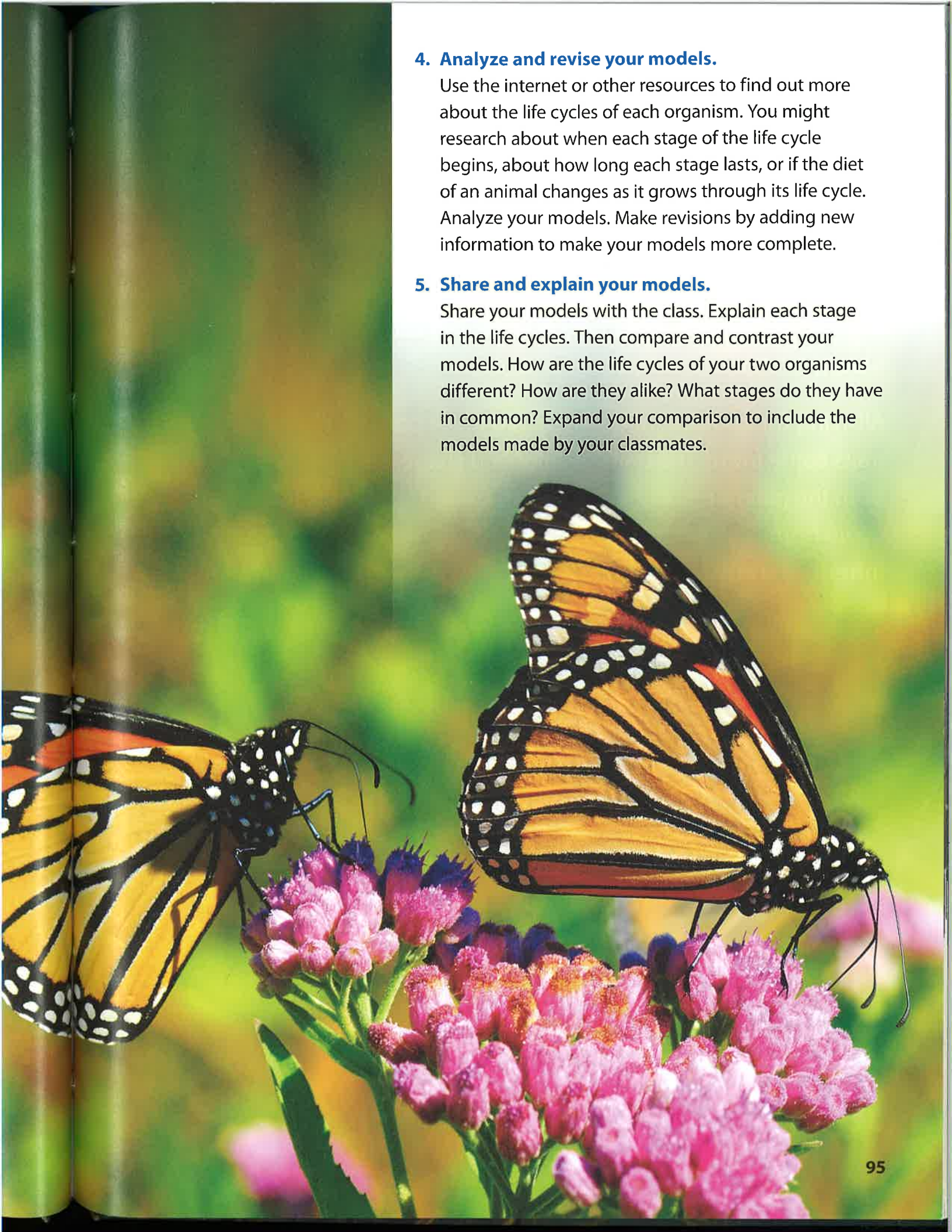
2. **Construct explanatory models.**
   Design models that use your research. Draw or describe your models. Explain all the life cycle stages you are going to include for both organisms.

3. **Construct your models.**
   Make your models. You may make more detailed drawings, or make physical models out of clay or other materials that show each life cycle stage.

NEXT GENERATION SCIENCE STANDARDS | PERFORMANCE EXPECTATION
3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

4. **Analyze and revise your models.**
Use the internet or other resources to find out more about the life cycles of each organism. You might research about when each stage of the life cycle begins, about how long each stage lasts, or if the diet of an animal changes as it grows through its life cycle. Analyze your models. Make revisions by adding new information to make your models more complete.

5. **Share and explain your models.**
Share your models with the class. Explain each stage in the life cycles. Then compare and contrast your models. How are the life cycles of your two organisms different? How are they alike? What stages do they have in common? Expand your comparison to include the models made by your classmates.



Inherited Traits: Looks

Did you know that not all potatoes are brown? There are potatoes of many different colors. Look at the large photograph. These potatoes have red, orange, white, yellow, and purple skins! The color is a **trait,** or characteristic, of the potatoes.

All living things have traits. Where did these potato traits come from? The traits of color and shape came from the parent plants. Traits that are passed down from parents to offspring are called **inherited traits.**

Corn can grow in many different colors on the same cob.

Tomatoes grow in many varieties, too. Most of their looks are inherited traits.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)

NEXT GENERATION SCIENCE STANDARDS | PERFORMANCE EXPECTATION

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

Analyze and Interpret Data

When you squeeze a snapdragon flower from the sides, it looks like a dragon that opens and closes its mouth. Snapdragons can vary in other traits, such as color. Observe the characteristics of the parent snapdragons and their offspring below.

1. What evidence can you provide to show that the offspring have inherited traits from their parents?
2. What evidence can you provide to show that the offspring have traits that vary from each other?

A potato's inherited traits include its size, shape, and color. The color can vary on the inside as well as the outside.

Wrap It Up!

My science notebook

1. **Define** What is an inherited trait?
2. **List** List some inherited traits of potatoes.
3. **Generalize** List two other traits of tomatoes and corn besides color.

Inherited Traits: Functions

Color in potatoes is an inherited trait that mainly affects how the potatoes look. But traits can also serve functions. For example, the shape of a bird's beak is an inherited trait. The size and shape of a bird's beak help the bird catch and eat its food.

The birds shown on these pages eat different types of food. They need different types of beaks. Catching a fish in a marsh, like whooping cranes do, requires a long beak that can poke into shallow water. Eating meat and cracking seeds require different kinds of beaks.

The bald eagle inherits a hooked beak that helps the bird tear meat from its prey.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)

NEXT GENERATION SCIENCE STANDARDS | PERFORMANCE EXPECTATION

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

The tan whooping crane is a young bird. It has the same inherited beak shape as the white adult whooping cranes.

Analyze and Interpret Data

Parakeets have a variety of traits such as feather colors and markings. Their strong, curved beaks help them crack husks off of seeds. Observe the characteristics of the parent parakeets and their offspring in the photos below.

1. What evidence can you provide to show that the offspring have inherited traits from their parents?
2. What evidence can you provide to show that the offspring have traits that vary from each other?

Wrap It Up!

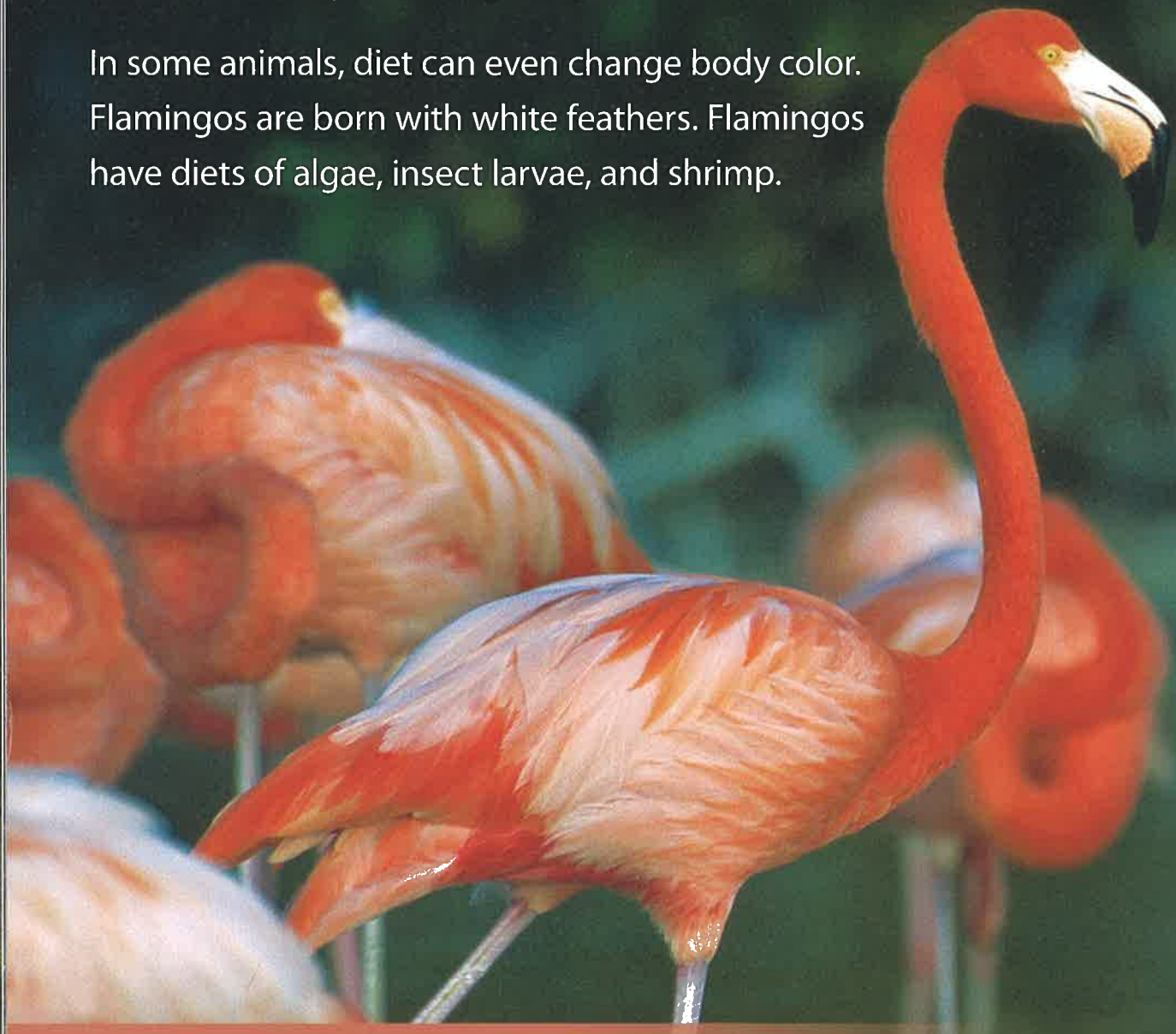
My science notebook

1. **Recall** What makes beak shape an example of an inherited trait?
2. **Explain** How does the shape of the whooping crane's beak affect the way the beak functions?

Acquired Traits

Not all traits are inherited. Some traits are acquired. **Acquired traits** are gained from the environment. For example, animals can acquire traits from their diet. A diet is all the foods an animal eats. Diet affects an animal's body size, weight, and health.

In some animals, diet can even change body color. Flamingos are born with white feathers. Flamingos have diets of algae, insect larvae, and shrimp.



NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

Some foods in their diet cause flamingos' feathers to turn pink. The more of these foods the birds eat, the pinker they get. Their color is an acquired trait.

These whiter flamingos have eaten less of the diet that causes the birds to change color.

These pinker flamingos have eaten more of the diet that causes the color change.

Wrap It Up!

My science notebook

1. **Contrast** What is the difference between an inherited trait and an acquired trait?
2. **Identify** What is the evidence that pinkness in flamingos is an acquired trait?
3. **Explain** How might diet affect an animal's body weight?

More Acquired Traits

Traits can be acquired from other factors in the environment besides food. For example, weather can affect a plant's traits. A sunflower that gets a lot of sunlight will grow taller than a sunflower that only gets a little sunlight.

Some traits are inherited *and* affected by the environment. The general shape of a tree and its limbs are inherited traits. But a tree's branches can be bent and shaped by strong winds.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS

LS3.A: Inheritance of Traits

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

Strong winds blowing from one direction over time gave this tree its shape.

Wrap It Up!

My science notebook

1. **Analyze** Which part of the shape of the tree shown on this page is inherited? Which part is acquired?
2. **Identify** What factor in the environment affects this tree's shape?
3. **Infer** Describe how you think this tree might look if it were growing in a place with little wind.

Learning

Many traits are physical characteristics, but other traits are actions or behaviors. Animals act to get food and meet their other needs. They interact with their environments. From those experiences, animals may change the way they behave. They can learn to behave differently.

Chimpanzees are skilled learners in the animal world. They not only learn how to find food, but they can learn how to use tools to do so! The ability to use a tool is not a skill a chimpanzee is born with. It is a behavior the chimpanzee acquires through learning. Animals can acquire many learned behaviors.

This chimpanzee uses a twig to collect termites from inside a termite mound.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS

LS3.A: Inheritance of Traits

- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. (3-LS3-2)

LS3.B: Variation of Traits

- The environment also affects the traits that an organism develops. (3-LS3-2)

This chimpanzee eats termites off of a twig that it used as a tool to collect them.

Wrap It Up!

My science notebook

1. **Recall** What is behavior?
2. **Explain** What is something a chimpanzee can learn?
3. **Summarize** How can the environment affect the way an animal behaves?

Investigate

Environment and Traits

How does the amount of water a plant receives affect its growth?

You have read that traits can be inherited, acquired, or both. Now it is your turn to test this idea. How much water a plant receives is a factor in the environment. In this investigation, you'll observe the effect of various amounts of water on plant growth.

Materials

wheatgrass seedlings	spray bottle with water	ruler	masking tape
			

NEXT GENERATION SCIENCE STANDARDS | PERFORMANCE EXPECTATION
3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

My science notebook

1 Use masking tape to label one cup **water** and one cup **no water.** Observe the seedlings. Predict what will happen if one cup of seedlings gets watered and the other does not. Record your predictions.

2 Place your seedlings in a sunny spot. Measure and record the height of each seedling.

3 Spray the soil in the cup labeled **water** until the soil is slightly moist. Record the number of sprays you used.

4 Repeat step 3 every day for one week. Measure the height of the seedlings in both cups each day. Record your observations.

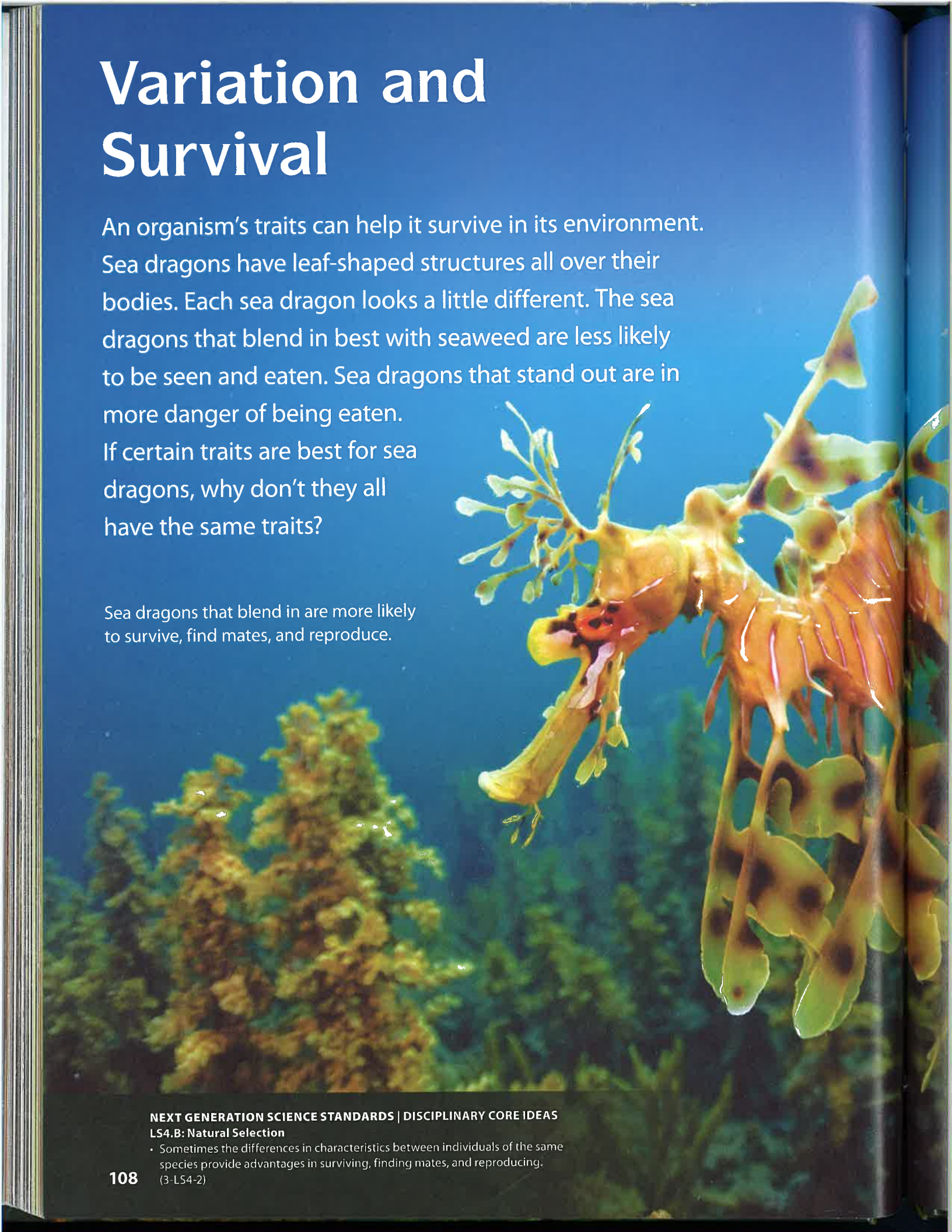
Wrap It Up!

My science notebook

1. **Predict** Did your results support your predictions? Explain.
2. **Interpret** Explain whether your results provide evidence that traits can be affected by the environment.
3. **Conclude** Is seedling height an inherited trait, an acquired trait, or both? Explain.

Variation and Survival

An organism's traits can help it survive in its environment. Sea dragons have leaf-shaped structures all over their bodies. Each sea dragon looks a little different. The sea dragons that blend in best with seaweed are less likely to be seen and eaten. Sea dragons that stand out are in more danger of being eaten. If certain traits are best for sea dragons, why don't they all have the same traits?



Sea dragons that blend in are more likely to survive, find mates, and reproduce.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS
LS4.B: Natural Selection
- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

The answer is that environments change. The best traits in one place and time may not be best in another place and time. Variations help some of a type of living thing survive over time as things change. **Variations** are differences between individuals of the same type of organism.

These thorn bugs all look very similar. The more each bug looks like a thorn, the less likely it is to get eaten by a bird.

Wrap It Up!

My science notebook

1. **Explain** Describe how traits of the sea dragon shown here help it survive.

2. **Infer** Suppose a few of the thorn bugs in the photo above were orange. What could you infer about the variation in thorn bug color?

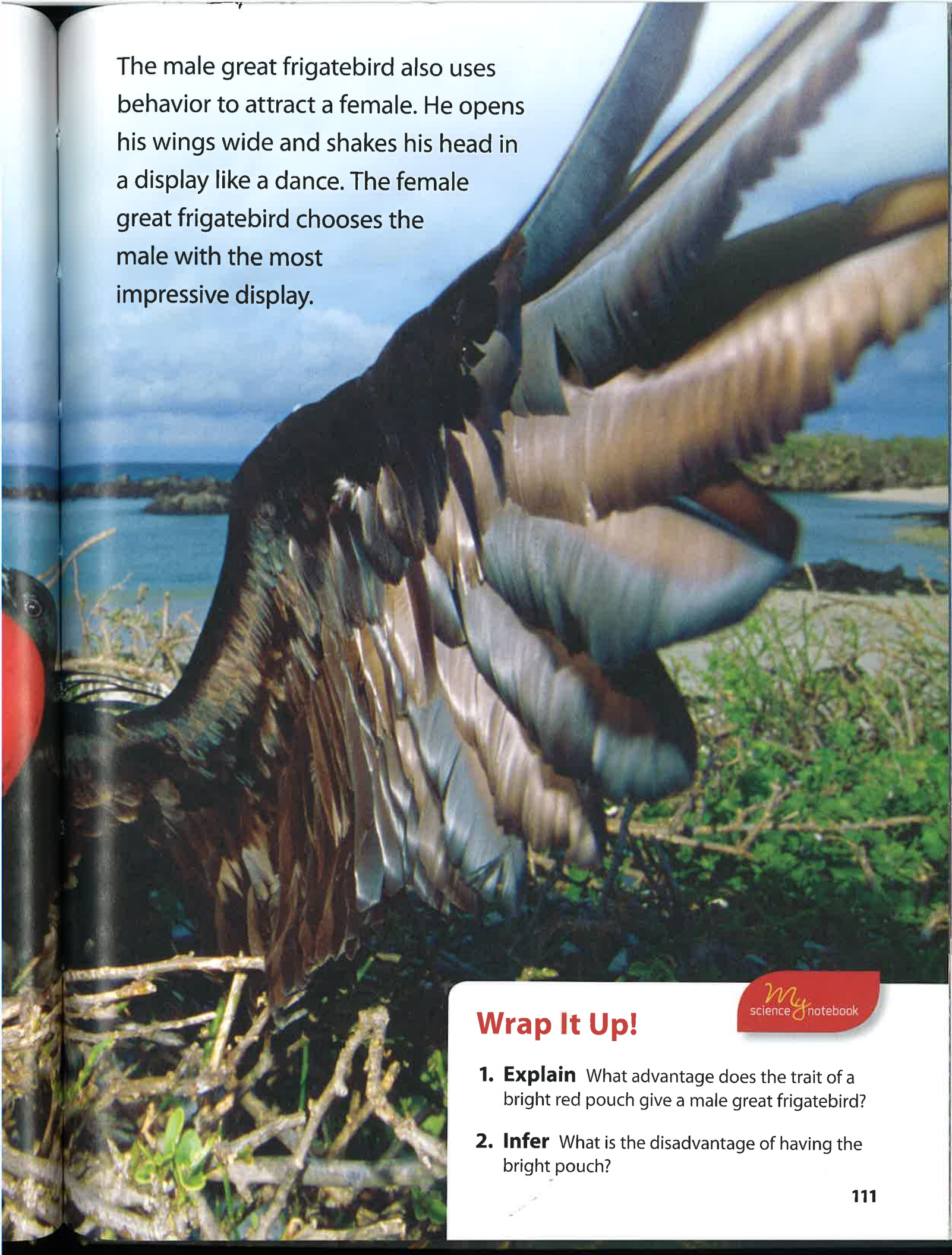
Variation and Mates

Some traits help an organism find a mate. A male great frigatebird has a bright red pouch on his throat. He can fill the pouch with air so it swells up like a red balloon! This bright display gets the attention of females.

Female great frigatebirds do not have the showy patch of red. That helps the female and her young stay hidden from predators.

NEXT GENERATION SCIENCE STANDARDS | DISCIPLINARY CORE IDEAS
LS4.B: Natural Selection
- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

The male great frigatebird also uses behavior to attract a female. He opens his wings wide and shakes his head in a display like a dance. The female great frigatebird chooses the male with the most impressive display.



Wrap It Up!

My science notebook

1. **Explain** What advantage does the trait of a bright red pouch give a male great frigatebird?

2. **Infer** What is the disadvantage of having the bright pouch?

Construct an Explanation

Katydids are related to grasshoppers and crickets. They live on shrubs and trees and feed on green leaves. In katydids, color is an inherited trait. The photographs on this page show actual colors of katydids. When katydids hatch from eggs they can be green, yellow, orange, or even pink! However, in adult katydids, the green form is far more common than other forms, such as pink. Think of what you've learned about how variation can provide advantages in surviving, finding mates, and reproducing. Study the photos, then answer the questions.

Yellow adults were green as hatchlings.

Pink hatchlings remain pink in adulthood.

NEXT GENERATION SCIENCE STANDARDS | PERFORMANCE EXPECTATION
3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

Wings of all colors of katydids have a veined pattern that resembles plant leaves.

Wrap It Up!

My science notebook

1. **Construct an Explanation** Why might the pink form of katydid be less common in adults than in hatchlings?

2. **Cause and Effect** How does the trait of color help katydids survive?

Marine Ecologist

Enric Sala grew up on the coast of Spain. He loved the sea. But he also saw how people were hurting the sea. They were polluting the water. They were taking too many fish. That made Enric want to spend his life working to save the health of the ocean.

Today Enric is a marine ecologist. He studies marine ecosystems—the communities of living things in the ocean. Enric leads scientific explorations to some of the most unspoiled parts of the ocean. He and his team have discovered crystal clear water, a coral reef growing deeper in the ocean than any other, new kinds of fish, and an amazing number of sharks!

Enric shares what he discovers in National Geographic publications and television programs. He says, "I want to show the world what the ocean was like hundreds of years ago and why we have to preserve it."

His work has inspired the leaders of some countries to set aside marine protected areas. He hopes that his work will help save some of the last untouched marine ecosystems on Earth.

Enric takes photos of organisms in the ocean ecosystems he studies.

NEXT GENERATION SCIENCE STANDARDS | CONNECTIONS TO NATURE OF SCIENCE
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Science assumes consistent patterns in natural systems.

NATIONAL GEOGRAPHIC | Explorer

Enric Sala is a marine ecologist and National Geographic Explorer-in-Residence. He works with organizations and governments to protect ocean ecosystems.

The endangered dusky grouper is one of the animals that Enric 's work might help to save.