

## Discovering Diversity

By Christine Anne Royce

The overarching question “How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?” is investigated in this month’s column, which explores traits of populations of organisms and how there is both similarity and difference between species. Biological evolution is a complex topic that can be introduced to students by having them examine traits among organisms and identify distinguishing characteristics to explore unity and diversity. Young students use card sets of different animals to make observations, comparing traits and exploring how the diverse organisms can be grouped. As students reach the intermediate grades, they examine the travels and work of Darwin before exploring differences among similar animals to discuss variation and how the variation aids in survival.

### This Month’s Trade Books

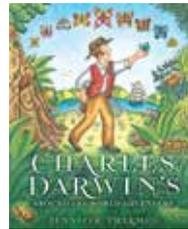


#### Many: The Diversity of Life on Earth

By Nicola Davies  
Illustrated by Emily Sutton  
ISBN: 978-0-7636-9483-8  
Candlewick Press  
40 pages  
Grades K–3

#### SYNOPSIS

Readers are introduced to the idea that the planet is full of many different species ranging from microbes to animals. Beyond describing the diversity that the planet holds, the story also discusses impacts to this diversity from pollution, man’s use of resources, and other factors. Beautiful watercolor illustrations help depict the diversity and how species interact with one another.



#### Charles Darwin’s Around the World Adventure

By Jennifer Thermes  
ISBN: 978-1-4197-2120-5  
Abrams Books for Young Readers  
48 pages  
Grades 2–4

#### Synopsis

This story is a children’s telling of the first voyage that Charles Darwin embarked on in 1831 to look for diversity of animals, evidence of the past, and engage in the pursuit of science. Inclusion of illustrated maps labeling where he went and when, along with different species he found makes the story an appealing biographical and historical account of his life and discoveries.

#### ADDITIONAL TEXTS

Chin, J. 2012. *Island: A story of the Galapagos*. New York: Roaring Brook Press.

Steffoff, R., and C. Darwin. 2018. *On the origin of species: Young readers edition*. New York: Atheneum Books.



## Grades K-2: Considering Animal Characteristics

### PURPOSE

Students will make observations about different animals and classify them into different groups.

### ENGAGE

Begin by having the students brainstorm different kinds of living things found on Earth. Record these answers on the board to help students see the many living things they know about before learning how diverse living things are and how we identify them based on characteristics. Share *Many: The Diversity of Life on Earth* with students and discuss the following points:

- p. 4: If there are more than 600 different kinds of oak trees, what are some of the characteristics that we can use to help tell them apart?
- p. 10: Where are some of the places that living things are found?
- p. 14: What are some of the challenges that scientists have in identifying all of the living things on Earth?
- p. 18: Looking at the pictures on these pages, what are some of the groups that you might be able to organize different animals into?
- p. 22: What are some ways that all living things are connected? How do they help each other survive?
- p. 28: What do we call animals that are no longer alive but lived many years ago?
- p. 30: How do humans impact the different species that live on Earth?

Pose the following questions to students to continue the discussion: “What are ways we can organize animals to create categories? Do you think the type of environment affects the animals that live there?” Allow students to engage in the discussion and provide familiar examples.

### EXPLORE

Provide each group of three students a set of the Diversity Sorting Cards (see NSTA Connection). Ask students to spread the cards on the table and examine each one separately.

## MATERIALS

- *Many: The Diversity of Life on Earth*
- Diversity Sorting Cards (see NSTA Connection)
- Animal Classification Sheet (see NSTA Connection)
- Animal Characteristics Chart (see NSTA Connection)
- Venn Diagram (see NSTA Connection)

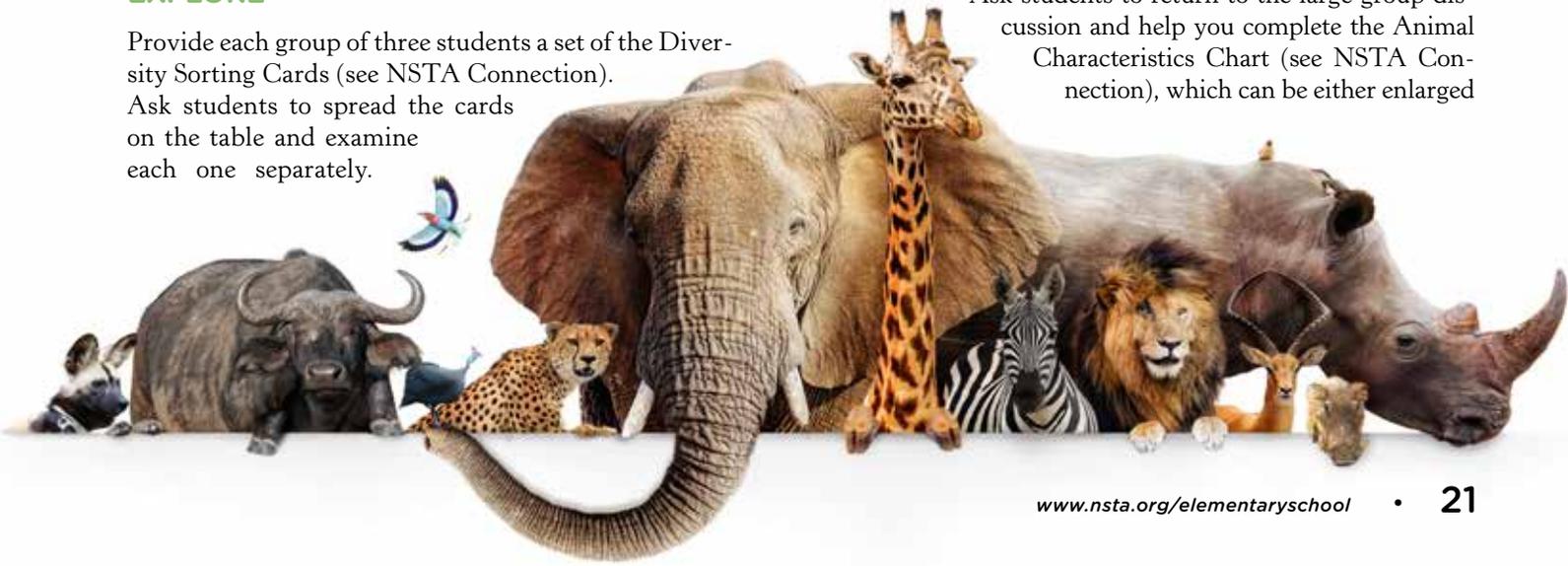
In a discussion with their group members, students consider what type of animal it is and what they know about that particular group of animals, and then predict where the animal might live. Ask students to describe how scientists might classify or group animals and engage students in a discussion about characteristics. After students have had a chance to examine the different animals, ask them to divide the animals into groups based on the following characteristics:

- Animals that live on land and animals that live in the water
- Animals that can fly and those that cannot fly
- Animals with fur or feathers *or* scales or smooth skin

After students have had the chance to practice classifying animals into different groups based on characteristics, introduce the words *mammal*, *reptile*, *insect*, *bird*, *fish*, and *amphibian*. Share a picture of an animal that falls into each group and ask them to describe the characteristics of the animal and record them on their Animal Classification Sheet (see NSTA Connection). Once they have described the characteristics for each group, ask them to find other pictures of animals that match the same characteristics. Have the students sketch the animal on their sheet in the proper category.

### EXPLAIN

Ask students to return to the large group discussion and help you complete the Animal Characteristics Chart (see NSTA Connection), which can be either enlarged



on a poster or projected onto a board. Using the following guiding questions, have students report on their classification activities and record the characteristics that they describe for each group of animals. What characteristics do mammals have? Amphibians? Reptiles? Fish? How are amphibians different from reptiles? How are amphibians and fish similar? What are characteristics of insects? Birds? What characteristics do insects and birds have in common?

**ELABORATE**

Have students select two different animals that are not included in the card sets. The two animals should be from different categories. Ask students to create a Venn Diagram (see NSTA Connection) illustrating the two animals that show characteristics for each and characteristics that overlap for the animals. Using the Venn Diagram, students should be able to report at

least one way that the animals are similar. Use the following example to help students get started: Use pictures of a fish and a frog to share two ways that the animals are alike (e.g., they both live in the water at points in their life).

**EVALUATE**

Students provide their initial understanding of living things by brainstorming different types of living things they are familiar with in the engage part of the lesson. They then consider different characteristics and demonstrate their ability to apply those characteristics by sorting cards into different categories and describing the process that they went through. During the explain part students create an overall list of characteristics that help classify diverse animals. Finally, students are asked to compare and contrast two different animals that fall within two different categories.

**Connecting to the Next Generation Science Standards (NGSS Lead States 2013)**

**K-2: CONSIDERING ANIMAL CHARACTERISTICS**

- The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.
- The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectation listed below.

**Standard**

**2-LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY**

[www.nextgenscience.org/dci-arrangement/2-ls4-biological-evolution-unity-and-diversity](http://www.nextgenscience.org/dci-arrangement/2-ls4-biological-evolution-unity-and-diversity)

**Performance Expectation**

**2-LS4-1.** Make observations of plants and animals to compare the diversity of life in different habitats.

DIMENSIONS	CLASSROOM CONNECTIONS
<b>Science and Engineering Practice</b>	
<b>Planning and Carrying Out Investigations</b>	Students compare and contrast animals in different categories based on their characteristics.
<b>Disciplinary Core Idea</b>	
<b>LS4.D: Biodiversity and Humans</b> There are many different kinds of living things in any area, and they exist in different places on land and in water.	Students develop a listing of characteristics for how they classify animals initially into different groups and then based on the type of animal category.
<b>Crosscutting Concept</b>	
<b>Patterns</b>	Students develop a listing of characteristics that helps classify animals into groups.

## Grades 3–5: Darwin’s Diversity

### PURPOSE

Students will describe variation between similar species and how the variation assists the animals in their survival.

### ENGAGE

Begin by showing the students the inside front cover of the book and share with them the map of the route that Darwin took on his voyage between 1831 and 1835. Ask the students what they think Darwin might have been looking for as he visited different countries and continents. Share with them that Darwin was a scientist who explored the world to learn about animals. Begin to read the book to students and discuss the following points:

- p. 2: What interest did the young Charles Darwin have?
- p. 4: What job did Charles take aboard the HMS *Beagle*? How did the job of naturalist connect to his interest as a child?
- p. 8: What were some of the different animals that Charles saw and wrote about in the rain forest?
- p. 14: What questions did Charles Darwin have as he found the bones of animals that no longer lived on Earth?
- p. 18: What idea did Charles realize about animals and the food they ate?
- p. 24: When Charles climbed the Andes Mountains, what fossilized animal did he find? What conclusion did he come to when he found these fossils?
- p. 30: What type of bird did Charles focus on when he was in the Galapagos Islands? What did he notice about the finches on each different island?

### EXPLORE

Once students have had a chance to listen to how Darwin gathered information about animals during the voyage, explain that they will be examining pictures of different animals to determine differences or variation between the animals. As students observe the different card sets of pictures (see NSTA Connection), ask them to record their observations about the animals on their Discovering Diversity Student Sheet (see NSTA Connection).

*Card Set A – Finches:* Remind students that the type of bird that Darwin observed and took field notes about was the finch, which he found had different adaptations. Ask students to examine the different cards in this set and make observations about finch beaks on their sheet.

*Card Set B – Galapagos Marine Iguanas:* Darwin made notes about iguanas in the Galapagos Islands. Background information on marine iguanas include that they are herbivores and eat mainly seaweed and algae. Larger iguanas may dive

### MATERIALS

- *Charles Darwin’s Around the World Adventure*
- card sets (see NSTA Connection)
- Discovering Diversity Student Sheet (see NSTA Connection)
- Peppered Moth Simulation (see Internet Resources)

to obtain their food as well. Since these animals eat mainly plants that they need to obtain in a marine environment, students should focus on the shape of iguana heads, mouths, and claws as they take notes on their student sheet.

*Card Set C – Kallima Butterflies:* These butterflies were used to help develop the idea of natural selection by a different scientist in the 1800s. One of the adaptations of this particular insect is that the underside of the wings resembles dead dry leaves when the wings are closed. Ask students to consider why this particular adaptation would help the insect survive predators.

### EXPLAIN

Ask students to return to the full class and discuss the following questions related to the topic of adaptations. As students answer the questions, ask them to support their points with the observations and evidence collected as they explore the card sets.

Why do you think you examined different pictures of the same type of animal to determine if there is a difference in how they look?

Considering the pictures of the finches, describe the differences you observed between them. Why do you think that the shape of the beak is important for where the finch lives and what it eats?

In the pictures of the marine iguanas, you were asked to look at claws, mouth shape, and head shape. Why do you think these body parts would be important for helping iguanas dive for and eat seaweed and algae?

Although a different researcher studied the *Kallima* butterflies, the information helped Darwin describe natural selection. Why do you think butterflies that had part of their wings look like dead leaves might live longer than brightly colored butterflies?

After students have had the opportunity to explain their understanding of the different adaptations among the three different animals above, ask the students to explain in their own words how adaptations helped animals survive and natural selection occur.

**ELABORATE**

Ask students to complete the peppered moth simulation (see Internet Resources). Read the story of pollution and the peppered moth with students (the second circle option on the screen) and discuss that they are going to investigate how well a bird might see the two different colored moths from a bird's-eye view. Using a computer or table (Flash must be enabled), ask students to first select the "light forest" and participate in the simulation, which asks them to eat as many moths as possible in a minute time frame. At the end of the minute, students should record their results in the space provided on their sheet using the language shown at the end of the simulation. "Your forest started with 50% light moths and 50% dark moths. Now there are \_\_\_% light moths and \_\_\_% dark moths. Since you could see \_\_\_\_\_ moths easier, you ate

more \_\_\_\_\_ moths than dark moths." Have them repeat the simulation using the "dark forest" and record their results. In the space provided, students complete the statement and use their results as evidence to support their reasoning.

**EVALUATE**

During the explore phase, students can be evaluated on their ability to identify characteristics that are different from each other as they gather information and make observations using the card sorting sets. Their initial understanding is then used in the discussion on adaptations and how adaptations might help in the survival of the animal. Finally, students use evidence from their moth-eating ability in the simulation to support the claim that the moths that have adapted over time and are better camouflaged in their environment have a better chance of survival.

**Connecting to the Next Generation Science Standards (NGSS Lead States 2013)****3-5: DARWIN'S DIVERSITY**

- The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.
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**Standard****3-LS4 BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY**

[www.nextgenscience.org/dci-arrangement/3-ls4-biological-evolution-unity-and-diversity](http://www.nextgenscience.org/dci-arrangement/3-ls4-biological-evolution-unity-and-diversity)

**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.

DIMENSIONS	CLASSROOM CONNECTIONS
<b>Science and Engineering Practice</b>  <b>Constructing Explanations and Designing Solutions</b>	Students use results from the Peppered Moth Simulation to explain how the coloration of the moth in comparison to the environment might aid in survival.
<b>Disciplinary Core Idea</b>  <b>LS4.B: Natural Selection</b> Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	Students observe the differences visible between similar animals in card sets.  Students connect the differences to the ability of the organisms to better survive in its environment.
<b>Crosscutting Concept</b>  <b>Cause and Effect</b>	Students use evidence from the simulation to describe how the coloration of a peppered moth and the background coloration of the environment impacts the survival rate of the moth.

## REFERENCES

National Governors Association Center for Best Practices and Council of Chief State School Officers (NGAC and CCSSO). 2010. *Common Core State Standards*. Washington, DC: NGAC and CCSSO.

NGSS Lead States. 2013. *Next Generation Science*

*Standards: For states, by states*. Washington, DC: National Academies Press.

## INTERNET RESOURCES

Peppered Moth Simulation  
<http://peppermoths.weebly.com/>

### Connecting to the *Common Core State Standards* (NGAC and CCSSO 2010)

This section provides the *Common Core for English Language Arts* standards addressed in this column to allow for cross-curricular planning and integration. The Standards state that students should be able to do the following at grade level.

#### ENGLISH/LANGUAGE ARTS

##### Reading Standards for Informational Text K-5 – Key Ideas and Details

- Grade 1: “Ask and answer questions about key details in a text.”
- Grade 4: “Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.”

##### Writing Standards K-5 – Research to Build and Present Knowledge

- Grade K: “With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.”
- Grade 4: “Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.”

##### Writing Standards K-5 – Text Types and Purposes

- Grade K: “Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.”
- Grade 4: “Write informative/explanatory texts to examine a topic and convey ideas and information clearly.”

##### Speaking and Listening Standards K-5 – Comprehension and Collaboration

- Grade 1: “Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.”

##### Speaking and Listening Standards K-5 – Presentation of Knowledge and Ideas

- Kindergarten: “Add drawings or other visual displays to descriptions as desired to provide additional details.”
- Grade 1: “Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.”
- Grade 3: “Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. “

Vocabulary Acquisition and Use is one of the standards for language. This particular standard is across grade levels: “Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade [appropriate] reading and content.” Furthermore, the *Common Core for ELA* provide a standard related to the Range of Text Types for K-5 where it indicates that students in K-5 should apply the Reading standards to a wide range of texts to include informational science books.

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