The Purpose of Individual Parts and Processes

By Christine Anne Royce

Understanding that different organisms have different structures that help them survive and a life cycle that is similar to—but different from—other organisms are two separate but related concepts that help students understand life science structures and processes. This month's activities have students examine the purposes of different plant or animal parts and then adapt these to solve a human problem. Students also consider how plant and animal life cycles are similar and different.

This Month's Trade Books

Feathers: Not Just for Flying
By Melissa Stewart
Illustrated by Sarah S. Brannen
ISBN: 978-1-58089-430-2
Charlesbridge
32 pages
Grades K–4

Synopsis

This book introduces readers to different birds and the ways birds use their feathers, from building to camouflage to protection. Information about each bird is provided, including a narrative description about the type of feather each bird has and how that helps birds perform certain tasks.

Handle With Care: An Unusual Butterfly Journey
By Loree Griffin Burns
Photographs by Ellen Harasimowicz
ISBN: 978-0-7613-9342-9
Millbrook Press
32 pages
Grades 1–5

Synopsis

Through photos and text, this book details the process of raising the Blue Morpho Butterfly at the El Bosque Nuevo Butterfly Farm in Costa Rica. The life cycle of the butterfly is explained in vivid detail, giving the reader a clear understanding of how these beautiful creatures go from egg to adult.

Curricular Connections

To master the concept of structures and processes, students must understand how all parts of an organism work together to keep it alive and allow it to be able to reproduce. In the first activity, students consider how external parts of one organism can be mimicked or adapted to help solve a human problem. By doing so, students think about what that particular external structure does for the organism and how its design could help in a different situation, encouraging engineering applications. *Feathers: Not Just for Flying* demonstrates that external structures that seem to serve only one purpose can actually be used for a variety of different things.

The second activity asks students to think about how organisms' structures affect their life cycles. By conducting research on various organisms, students compare and contrast the life cycles of plants and animals, as well as different types of plants and animals. ■

Christine Anne Royce* (caroyce@aol.com) *is a professor at Shippensburg University in Shippensburg, Pennsylvania.

NSTA Connection

For student data sheets, a list of alternate books, and accompanying pictures, visit *www.nsta.org/SC1607*.

Grades K–2: The Purpose of Parts

Purpose

Students consider how a human problem can be solved by mimicking a structure from the animal world that has a similar purpose. Students then describe how they would adapt the animal part to solve the human problem.

Materials

- *Feathers: Not Just for Flying*
- student data sheet (see NSTA Connection)
- actual bird's feather (purchased from a craft store)
- pictures of feathers
- access to the internet and other media sources
- pictures of animals
- craft materials for constructing models

Engage

Bring in a bird's feather or pictures of a bird's feather and ask students to describe its purpose: "What are feathers used for?" It is best to use real feathers purchased from a craft store, as these have already been sanitized. Most students will say that feathers help birds fly; this is true, but it is not the only purpose of a feather. Show students the front of the book *Feathers: Not Just for Flying* and ask them to make observations about the different feathers on the cover of the book and to brainstorm possible other uses of feathers.

CAUTION

Read *Feathers: Not Just For Flying* to the class. Before reading an entire page, stop at each of the following pages and only read the large-print information at the top, and then ask the appropriate question:

- On the page with the blue jay: How can feathers help keep a bird warm, similar to a blanket?
- On the page with the wood duck: Why would some feathers help cushion like a pillow?
- On the page with the bird in the tree: How do some feathers help hide a bird and camouflage them?
- On the page with the peacock: Why do some feathers attract other birds?

After reading the entire story, have students record on their student data sheet other possible uses for feathers that are mentioned in the book. Their answers might include warmth, cushioning, shade or protection from the Sun, a sponge or cleaning agent, camouflage, a way to attract mates, or tools for digging or building. After students have listened to the story, engage them in a discussion about how a single body part—in this case, feathers—can help to solve a problem birds have. Ask them if there are other animals that use a part of their body to resolve a problem. Possible animals might include lizards with scales, turtles with hard shells, elephants with trunks, and geckos with sticky toes for climbing.

Explore

Ask students to consider an animal that uses a body part to help them in some way. Giving them pictures of different animals might be helpful to encourage student thinking. Then ask students to consider how any single part of that animal could be mimicked or adapted to help solve a human problem. Examples from the *Next Generation Science Standards* include "protect[ing] bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animals tails and roots on plants; keeping out intruders by mimicking thorns on branches and animals quills; and detecting intruders by mimicking eyes and ears" (NGSS Lead States 2013, p. 12). Have students either find a picture of the animal structure on the internet and print it out, or draw it in detail and describe what the structure does for the animal, using their student data sheet. Then have students either locate an image on the internet or once again draw a way in which humans have adapted or mimicked a similar structure to solve a problem. Have students identify what problem is solved and why this particular structure helps solve that particular problem (CC ELA: Writing Standards Research to Build and Present Knowledge). For example, students might find a picture of a turtle with a shell that protects the turtle from injury and a bicycle helmet that protects a rider's head (see NSTA Connection). Both structures are shaped in a similar way, are hard, and can withstand some force.

Explain

Once students have had a chance to explore different animals and have selected a particular structure to focus on, ask them to explain their selection to the class. Then group students by like purposes; for example any students who selected an animal with a structure used for protection should be grouped together. Ask students to then compare how each animal uses its own structure to accomplish a similar purpose. Potential purposes include camouflage, tools, protection, and attraction. Have students consider the following questions:

- How are the structures similar? How are they different?
- Why would the structures need to be similar? Why

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

1-LS1 From Molecules to Organisms: Structures and Processes

www.nextgenscience.org/dci-arrangement/1-ls1-molecules-organisms-structures-and-processes

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 expectations listed below.

Performance Expectation	**Connections to Classroom Activity** *Students:*
1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	• identify a human problem that can be resolved using a structure similar to an animal structure or part. For example, to protect a bicycle rider, a helmet is worn that is similar in shape and design to a turtle's shell.
Science and Engineering Practices	
Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information	• use the internet or other media sources to find images of animal adaptations. • identify and describe how a solution to a human problem is similar to and different from an animal adaptation. • compare similar structures on different animals that are designed to do the same thing (i.e., protection) and evaluate the pros and cons of each design. • discuss different adaptations in the human world that are similar to a structure in the animal world that serves a particular purpose.
Disciplinary Core Idea	
LS1.A: Structure and Function • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.	• consider how different feathers on birds are used for different purposes, after listening to the story. • locate pictures of different animals using the internet and other media sources to identify a particular structure that an animal has for a particular reason.
Crosscutting Concept	
Structure and Function	• consider the purpose of different parts of different animals and what each part does. • identify a human problem that can be resolved using a similar structure to an animal structure or part. For example, to protect a bicycle rider, a helmet is worn that is similar in shape and design to a turtle's shell.

would they be different?
- How could the characteristics from each of these structures be helpful in solving "my" human problem? (This question asks students to bring together several ideas and adapt them to form a better idea.)

Elaborate

Present a challenge to students that asks them to consider the following task:

- Take any human problem that can be solved by studying animals. Each group of students can select one particular human problem from all of the ones they discussed. Using the last question posed in the Explain phase, ask them to design their new idea using parts from each of the individual ideas. They should then explain why they selected the different components or individual aspects for the overall design (CC ELA: Writing Standards K–5 - Text Types and Purposes).
- Using available craft materials, have students create a full-size or miniature prototype to represent their solution to the human problem.
- Ask them to illustrate their final design on the back of their student data sheet and label the different parts with statements that explain the purpose of the part and how it is similar to a specific animal structure. An example description might read, "The hard top helps if someone falls and hits their head and is like a turtle's shell because…" (CC ELA: Speaking and Listening Standards K–5— Presentation of Knowledge and Ideas).

Evaluate

Initial evaluation can be conducted through student conversation related to their prior knowledge and, later, knowledge gained from the book and answering questions. Application of the understanding that different structures can help serve different purposes happens as students select an animal and connect a particular structure to solving a similar human problem.

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

This section provides the *Common Core for English Language Arts and/or Mathematics* 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

Writing Standards Research to Build and Present Knowledge

- Grade 2 standards ask students to "participate in research and writing projects."
- Grade 4 standards ask students to "conduct short research projects that build knowledge through investigation of different aspects of a topic."

Writing Standards K–5 – Text Types and Purposes

- Grade K students will "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 2 students will "write informative/ explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.
- Grade 4 students will "write informative/ explanatory texts to examine a topic and convey ideas and information clearly."

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."

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

- Kindergarten students should "add drawings or other visual displays to descriptions as desired to provide additional details."
- Grade 1 students will "add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings."

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

Grades 3–5: Commonalities in Life Cycles

Purpose

Students learn that flowering plants and animals all have birth, growth, reproduction, and death in common within their life cycles, even though their individual life cycles may have unique characteristics.

Materials

- *Handle With Care: An Unusual Butterfly Journey*
- pictures of a corn plant, pumpkin, frog, butterfly, kitten, and bird (see NSTA Connection)
- student data sheet (see NSTA Connection)
- craft materials for creation of models
- access to reference materials and internet

Engage

Show students pictures of a corn plant, pumpkin, frog, butterfly, kitten, and bird. Starting with the plant pictures, ask students to explain how each of the plants are "born," "grow," "reproduce," and "die" (CC ELA: Vocabulary Acquisition and Use). Repeat with the animals. (Note: Only ask students about the kitten if you think they are mature enough.) The fact that there are distinct differences between these stages in plants and in animals may cause some debate among students. It may help to start a chart showing the different organisms on the left side and the different stages in the life cycle across the top, allowing information to be filled in as it is discussed. Introduce the terms *birth*, *growth*, *reproduction*, *death* and *life cycle* to students using these different organisms and discuss what is meant by each, based on student examples.

Explore

Tell students that they are going to explore one organism's life cycle through listening to a story. Read to students *Handle With Care: An Unusual Butterfly Journey*, which describes a farm in Costa Rica that raises blue morpho butterflies. Explain to students that while these butterflies are raised to be shipped to other people, the life cycle the insects go through will be the same. While reading the story, stop and focus on the following parts of the life cycle:

- Birth: A butterfly isn't born a butterfly—it is actually born a *larva*, or caterpillar, after hatching from an egg (p. 5).
- Growth: A caterpillar grows, and eventually will turn into a pupa, which is part of the butterfly's growth process (pp. 16–22).

- Reproduction: Adult blue morpho butterflies mate and lay eggs, which eventually become the next generation of caterpillars (p. 23).
- Death: The book (and most books about animals) does not show the final stage of the life cycle. However you can discuss with students what happens when an animal can no longer sustain itself. Depending on the age of the children, the teacher, after careful consideration, might also want to include a conversation about the causes of death for different organisms.

After students have listened to the story, ask them to illustrate the life cycle of the blue morpho butterfly in one of the life stage boxes on the student data sheet.

Explain

Ask pairs of students to select a plant and an animal. Recommendations include:

- Plants: corn, pumpkin, squash, bean, sunflower
- Animals: butterfly, frog, dragonfly, bird, turtle

Once students have selected their choices, ask them to research and create a visual representation of the life cycle of each organism, making sure to include the stages of birth, growth, reproduction, and death in the model. Reproduction for plants can be illustrated through the reproductive parts of flowers or pollen being transferred from the anther of a plant to the stigma of a plant. For the animals, reproduction can be represented by the animal laying eggs. Discuss with students the need for fertilization of the eggs, as well as the fact that different animals fertilize eggs in different ways. Again, based on the age of the children, the level of discussion that happens will need to be considered by the teacher (CC ELA: Writing Standards Research to Build and Present Knowledge). Students' representation can take the form of either a 2-D or 3-D model using available craft materials. In addition to the model, students diagram their life cycles on their student data sheet and should label their diagrams with important information related to the approximate time it takes for their organism to move

through each stage of the life cycle (CC ELA: Writing Standards K–5 - Text Types and Purposes).

Elaborate

After creating a visual representation of their chosen organism's life cycle, ask students to explain how each of their organisms is similar to and different from the blue morpho butterfly. This can be done using a graphic organizer found on the back of the student data sheet.

Evaluate

Students should be able to demonstrate their understanding of key terminology used in the process of life cycles and then apply that terminology to different types of organisms, both plant and animal. Students should also be able to use research materials to determine the actual stages in the life cycles of different organisms, including the stages' time frames. Finally, students should be able to differentiate between the similarities and differences of three different organisms.

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. *www.nextgenscience.org/next-generation-science-standards*.

Resource

Royce, C.A. 2012. Teaching Through Trade Books: Looking at life cycles. *Science and Children* 50 (1): 16–21.

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

3-LS1 From Molecules to Organisms: Structures and Processes

www.nextgenscience.org/dci-arrangement/3-ls1-molecules-organisms-structures-and-processes

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Performance Expectation	**Connections to Classroom Activity** *Students:*
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.	• research a plant and animal life cycle and create a model that contains the stages of birth, growth, reproduction, and death. • describe the similarities and differences between their selected organism's life cycle and that of the blue morpho butterfly.
Science and Engineering Practice	
Developing and Using Models	• research a plant and animal life cycle and create a model that contains the stages of birth, growth, reproduction, and death.
Disciplinary Core Idea	
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.	• identify the life cycles of a selected plant and selected animal. • compare the life cycles of their selected organisms to that of the blue morpho butterfly.
Crosscutting Concept	
Patterns	• identify that each life cycle discussed has a similar pattern that contains at least birth, growth, reproduction, and death as part of the life cycle.

The main purposes of conducting a job analysis process is to use this particular information to create a right fit between job and employee, to assess the performance of an employee, to determine the worth of a particular task and to analyze training and development needs of an employee delivering that specific job. Letâ€™s understand the concept with the help of an example. If the job of an executive sales manager is to be analyzed, the first and foremost thing would be to determine the worth of this job. The next step is to analyze whether the person is able to deliver what is expected of him....Â of an individual. Purpose of Job Analysis. Production Part Approval Process(PPAP) is used in the automotive supply chain for establishing confidence in suppliers and their production processes. Actual measurements are taken from the parts produced and are used to complete the various test sheets of PPAP. "All customer engineering design record and specification requirements are properly understood by the supplier and that the process has the potential to produce product consistently meeting these requirements during an actual production run at Ensuring that the procedure or process follows the details noted in the individual SOP and to detail in writing when the SOP or a component of that SOP has not been followed. Staff and the QAM. Ensuring that all routine operations and activities in their area are documented by SOPs.Â The purpose of SOP is to assign the procedures for the preparation, approval, distribution, amendment and storage of Standard Operating Procedures (Cardiff University, 2009). The purpose or objective of the procedure should express and expand well written title (Jain SK., 2008). SOPs serve as frame for organizational action â€“ support direction and structure. They tell what, how, when, why, and who.