Science & Literacy Activity

OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to social interactions and group behavior in mammals. Students will read content-rich texts, visit the Bernard Family Hall of North American Mammals, and use what they have learned to complete a CCSS-aligned writing task, creating a text about social interactions and group behavior in mammals.

Materials in this activity include:

- Teacher instructions for:
  - Pre-visit student reading
  - Visit to the Bernard Family Hall of North American Mammals and Student Worksheet
  - Post-visit writing task
- Text for student reading: “Warm Welcome”
- Student Worksheet for the Bernard Family Hall of North American Mammals visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

SUPPORTS FOR DIVERSE LEARNERS: An Overview

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It presents multiple ways for your students to engage with scientific concepts through reading, observing, discussing, and writing. While certain tasks may challenge individual students, we suggest that all learners participate in each part of the experience. In the paragraphs labeled “Supports for Diverse Learners” that supplement this activity, we have provided suggestions for how to adapt each section for students with different skill-levels. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

1. BEFORE YOUR VISIT

This part of the activity engages students in reading a non-fiction text about social interactions and group behavior in mammals. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read “Warm Welcome.” Ask them to write notes in the large right-hand margin. For example, they could underline key passages, paraphrase important information, or write down questions that they have.

Working in pairs, small groups, or as a class, have students discuss the following questions about the reading. During discussion, remind them to use evidence from the text to explain their thinking, and to support their answers with specific examples. Have students take notes on the discussion to refer to later when writing their culminating essays.

- What two possibly contradictory facts does the author use to set up the story? How can they be reconciled by studying beaver lodges?
  (Beavers remain under the ice in their lodges all winter, unable to break through the ice. However, their survival rate is very high. The author thinks that their lodge is the key to their success.)

- What do the author and his students find when they enter the beaver lodge?
  (They find a space that is very clean and well kept, with a temperature that is warmer than the air outside.)
• The following passage appears on page 5: “The compression of their fur in the water and the resultant displacement of air from the otherwise superbly insulated pelt, coupled with water’s high capacity to conduct heat, greatly accelerate heat loss from the beaver’s body and can render the animal hypothermic within about thirty minutes.” What does this sentence mean, and why is it important to this article? (When beavers enter cold water, their fur loses some of its ability to keep them warm, and it is dangerous for them to stay in the water for too long. This is important because the article is about the temperature of the lodge and why it is important to beavers’ winter survival.)

• How does the author think that the group behavior he describes benefits the individual beavers? (By staggering their feeding times during the winter, the non-hunting beavers can stay in the lodge and keep it warm do that the beaver coming in from the water can warm up quickly after feeding.) What evidence does he use to support his idea? (He points to the fact that beavers’ activity patterns don’t match the day-night cycles during the winter, suggesting that there are other factors driving their feeding patterns.)

SUPPORTS FOR DIVERSE LEARNERS: Student Reading
• “Chunking” the reading can help keep them from becoming overwhelmed by the length of the text. Present them with only a few sentences or a single paragraph to read and discuss before moving on to the next “chunk.”
• Provide “wait-time” for students after you ask a question. This will allow time for students to search for textual evidence or to more clearly formulate their thinking before they speak.
• “Warm Welcome” originally appeared in Natural History magazine, and may contain vocabulary and sentence structures that are challenging for some students. If this is the case, have students identify which words or sentences are giving them trouble, and read closely within the text for clues to meaning, looking up words if necessary.
• Group notes on the discussion questions may be created on chart paper or on the board instead of individual student notes.

2. DURING YOUR VISIT
This part of the activity engages students in exploring the Bernard Family Hall of North American Mammals.

Museum Visit & Student Worksheet
Explain to students that they will be using worksheets to gather all the necessary information about social interactions and group behavior in mammals. Have them explore all the dioramas, and then pick two that demonstrate group behavior to focus on to complete their worksheets. Tell them that back in the classroom they will refer to these notes when completing the writing assignment.

SUPPORTS FOR DIVERSE LEARNERS: Museum Visit
• Review the Student Worksheet with students, clarifying what information they should collect during the visit.
• Have students explore the hall in pairs, with each student completing their own Student Worksheet.
• Encourage student pairs to ask you or their peers for help locating sources of information. Tell students they may not share answers with other pairs, but they may point each other to places in the hall where answers may be found.
• In addition to sketching, students may be allowed to take photos of the dioramas they are focusing on.
3. BACK IN THE CLASSROOM

This part of the activity engages students in an informational writing task that draws on the pre-visit reading and on observations made at the Museum.

Writing Task
Distribute the Student Writing Guidelines handout, which includes the following prompt for the writing task:

Based on the article “Warm Welcome,” your visit to the Bernard Family Hall of North American Mammals, and your discussions, write an essay in which you describe specific group behaviors and social interactions in at least two mammal species and how they increase the chances for the survival of individual within the group, and/or the group as a whole. Be sure to include a definition of group behavior, and to support your discussion with evidence from the reading and your Museum visit.

Go over the handout with students. Tell them that they will use it while writing, and afterwards, to evaluate and revise their essays.

Before they begin to write, have students use the prompt and guidelines to frame a discussion around the information that they gathered in the Bernard Family Hall of North American Mammals, and compare their findings. They can work in pairs, small groups, or as a class. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading, and their notes from the hall, that can be used in their response to the prompt. Instruct each student to take notes on useful information that their peers gathered as they compare findings. Students should write their essays individually.

SUPPORTS FOR DIVERSE LEARNERS: Writing Task
• Re-read the “Before Your Visit” assignment with students. Ask what they saw in the Bernard Family Hall of North American Mammals that helps them understand social interactions and group behavior in mammals.
• Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.
Student Reading

Warm Welcome

By Peter J. Marchand


Northern winters can be long for a beaver—longer than for most nonhibernating mammals. Though equipped to gnaw through the hardest wood, beavers show little inclination to chisel through ice and thus are seldom seen from the time their ponds freeze over until spring melt, often long after snow has left the land. Yet beavers rarely die during the winter from cold stress or a shortage of food. The key to their success in the North seems to lie, in large measure, with their lodge—the most massive communal nest constructed by any animal.

Not until I actually crawled inside a lodge did I understand the full implications of this structure for a beaver’s life under ice. My opportunity came early one winter in northern Vermont as a result of an unusual circumstance. Just before freeze-up, a local highway maintenance crew had rifted a colony’s dam to prevent the flooding of a road. When the pond’s water level dropped below the entrances to their lodge, the beavers, rather than attempting to repair the dam, vacated the premises. A month later, my students and I ventured onto the frozen pond to investigate the lodge and found the exposed entrances. We couldn’t resist the temptation. Shedding some of our bulky clothing, two of us wiggled and squirmed (with an occasional push from behind by others) into opposite tunnels until we met in the middle.
That firsthand inspection gave me an insight into the winter lives of beavers that none of my previous studies had ever provided. Outwardly, a beaver lodge appears to be nothing more than a mud-plastered pile of woody debris – an unkempt heap of odd-sized sticks that occasionally reaches twenty feet in diameter and rises four or more feet out of the water. In this case, the interior turned out to be a marvel of neatness and cleanliness. The earthen floor of the lodge was worn smooth by the countless comings and goings of wet feet on silky clay. The walls and ceilings were trimmed evenly; not a single nub protruded to discomfort a huddling animal (which explained why the beavers in lodges I’d previously attempted to study had been so quick to chew off the ends of some temperature probes I’d inserted). A small chamber branched to the side of one entrance tunnel, apparently having served as a feeding platform just above the water level. It held a single scrap of food: a frozen aquatic quillwort, still whole and green. The main nest chamber, roomy enough to permit us to raise our heads and pass a camera back and forth between opposite tunnels, was devoid of any detritus – not a trace of food, fecal material, or odor.

The lodge had been empty for some time, but my initial sensation upon entering it was one of subtle warmth. Heat, conducted upward from the unfrozen water beneath the floor, maintained the temperature near the freezing point – considerably warmer than the snowy world outside. It was easy to imagine the relative comfort of an occupied chamber. A family of beavers crowded into a small space, huddling and grooming, can generate significant heat (it is not unusual for a pair of adults and two litters of kits to winter together). On a zero-degree day, I once recorded a lodge temperature of 60°F, well within a beaver’s thermoneutral zone (the temperature range within which an animal can remain comfortable without raising its metabolic rate) and warm enough to melt a hole in the snow at the top of the lodge.

But there’s another, colder side to this picture. Beavers face an energy dilemma every time they slip into the icy water for an excursion to their food cache. (In the fall, beavers stockpile tree branches underwater.) The compression of their fur in the water and the resultant displacement of air from the otherwise superbly insulated pelt, coupled with water’s high capacity to conduct heat, greatly accelerate heat loss from the beaver’s body and can render the animal hypothermic within about thirty minutes. The need to procure food can become a repeated trauma for the kits, which may enter the water daily in feeding forays lasting from less than five minutes to more than forty. (Adults may make fewer trips, subsidizing their energy needs with fat stores in the tail.) A foraging beaver benefits by being able to return to a warm lodge, where its body temperature can be quickly restored to the requisite 98°F.
But herein lies a potential problem. Four hundred cubic feet of earthen lodge, if allowed to cool, can quickly turn into a massive heat sink instead of a life-saving refuge. One way to prevent this might be for family members to stagger their foraging trips, ensuring that the lodge is occupied at all times – and this is where an unusual aspect of beaver behavior comes into play.

To maximize effectiveness in functions such as feeding and mating, virtually all animals maintain biological rhythms that are precisely cued to day length and seasonal cycles. Scientists aren’t sure why or how, but beavers’ biological clocks (and thus their activity patterns) drift out of phase with the day/night cycle in winter. Although long isolation in the lodge without external light cues would promote such drift (and I can attest to the darkness of a lodge interior), even infrequent excursions underwater should recalibrate internal clocks, since light easily penetrates ice and snow cover on a pond. Yet all across southern Canada and the northern United States, beavers display winter activity patterns based on a twenty-six- to twenty-nine-hour cycle, resulting in a considerable shift, over time, in their daily schedules. Having a free-running internal clock probably carries little risk under the ice, where predators are not a threat, but what is the advantage? One possibility is that in winter, staggered foraging times may maintain an equable indoor temperature, guaranteeing a warm welcome whenever a beaver returns to its lodge.
Student Worksheet

Find two dioramas that show group behavior in mammals, and complete the following information.

**Name of Diorama:**

What animals does this diorama show?

Describe the group behavior they are shown engaging in.

How does this behavior benefit the entire group?

How does this behavior benefit the individuals in the group?

Does this behavior increase the chances of survival of the individuals in the group? Why or why not?

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Describe the group behavior they are shown engaging in.

How does this behavior benefit the entire group?

How does this behavior benefit the individuals in the group?

Does this behavior increase the chances of survival of the individuals in the group? Why or why not?
Student Writing Guidelines

Based on the article “Warm Welcome,” your visit to the Bernard Family Hall of North American Mammals, and your discussions, write an essay in which you describe specific group behaviors and social interactions in at least two mammal species and how they increase the chances for the survival of individual within the group, and/or the group as a whole. Be sure to include a definition of group behavior, and to support your discussion with evidence from the reading and your museum visit.

Use this checklist to ensure that you have included all of the required elements in your essay.

☐ I introduced and defined group behavior in mammals.

☐ I described group behavior in at least two mammal species.

☐ I explained how the group behavior in those mammal species increases the chances for survival of individuals in the group and/or the group as a whole.

☐ I only included relevant information about group behavior in mammals.

☐ I used information from “Warm Welcome” to explain social interactions and group behavior in mammals in detail.

☐ I used information from the Bernard Family Hall of North American Mammals to explain group behavior in mammals in detail.

☐ I used academic, non-conversational tone and language.

☐ I included a conclusion at the end.

☐ I proofread my essay for grammar and spelling errors.
<table>
<thead>
<tr>
<th>Scoring Elements</th>
<th>1 Below Expectations</th>
<th>2 Approaches Expectations</th>
<th>3 Meets Expectations</th>
<th>4 Exceeds Expectations</th>
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</thead>
<tbody>
<tr>
<td><strong>Reading</strong></td>
<td>Attempts to present information in response to the prompt, but lacks connections to the texts or relevance to the purpose of the prompt.</td>
<td>Presents information from the text relevant to the purpose of the prompt with minor lapses in accuracy or completeness.</td>
<td>Presents information from the text relevant to the prompt with accuracy and sufficient detail.</td>
<td>Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the text.</td>
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<tr>
<td><strong>AMNH Exhibit</strong></td>
<td>Attempts to present information in response to the prompt, but lacks connections to the Museum exhibit content or relevance to the purpose of the prompt.</td>
<td>Presents information from the Museum exhibit relevant to the purpose of the prompt with minor lapses in accuracy or completeness.</td>
<td>Presents information from the Museum exhibit relevant to the prompt with accuracy and sufficient detail.</td>
<td>Accurately presents information relevant to all parts of the prompt with effective paraphrased details from the Museum exhibit.</td>
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<tr>
<td><strong>Focus</strong></td>
<td>Attempts to address the prompt, but lacks focus or is off-task.</td>
<td>Addresses the prompt appropriately, but with a weak or uneven focus.</td>
<td>Addresses the prompt appropriately and maintains a clear, steady focus.</td>
<td>Addresses all aspects of the prompt appropriately and maintains a strongly developed focus.</td>
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<td><strong>Development</strong></td>
<td>Attempts to provide details in response to the prompt, including retelling, but lacks sufficient development or relevancy.</td>
<td>Presents appropriate details to support the focus and controlling idea.</td>
<td>Presents appropriate and sufficient details to support the focus and controlling idea.</td>
<td>Presents thorough and detailed information to strongly support the focus and controlling idea.</td>
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<td><strong>Conventions</strong></td>
<td>Attempts to demonstrate standard English conventions, but lacks cohesion and control of grammar, usage, and mechanics.</td>
<td>Demonstrates an uneven command of standard English conventions and cohesion. Uses language and tone with some inaccurate, inappropriate, or uneven features.</td>
<td>Demonstrates a command of standard English conventions and cohesion, with few errors. Response includes language and tone appropriate to the purpose and specific requirements of the prompt.</td>
<td>Demonstrates and maintains a well-developed command of standard English conventions and cohesion, with few errors. Response includes language and tone consistently appropriate to the purpose and specific requirements of the prompt.</td>
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<td><strong>Content</strong></td>
<td>Attempts to include science content in explanations, but understanding of the topic is weak; content is irrelevant, inappropriate, or inaccurate.</td>
<td>Briefly notes science content relevant to the prompt; shows basic or uneven understanding of the topic; minor errors in explanation.</td>
<td>Accurately presents science content relevant to the prompt with sufficient explanations that demonstrate understanding of the topic.</td>
<td>Integrates relevant and accurate science content with thorough explanations that demonstrate in-depth understanding of the topic.</td>
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<td><strong>Understanding</strong></td>
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