

Science & Literacy Activity

GRADES 3-5

OVERVIEW

This activity, which is aligned to the Arizona English Language Arts standards and Arizona Science Standards, introduces students to scientific knowledge and language related to how animals use poison to help them survive. Students will read content-rich texts, visit *The Power of Poison* exhibition, and use what they have learned to complete a standards-aligned writing task, creating an illustrated text about how animals use poison to help them survive.

Materials in this packet include:

- Teacher instructions for:
 - Pre-visit student reading
 - Visit to *The Power of Poison* and student worksheet
 - Post-visit writing task
- Text for student reading: "Look but Don't Lick!"
- Student Vocabulary Chart
- Student Worksheet for *The Power of Poison* visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

Arizona English Language

Arts Standards:

3.W.2, 3.W.8, 3.W.10, 4.W.2, 4.W.8, 4.W.9, 4.W.10, 5.W.2, 5.W.8, 5.W.9, 5.W.10, 3.RI.1, 3.RI.2, 3.RI.4, 3.RI.10, 4.RI.1, 4.RI.2, 4.RI.4, 4.RI.10, 5.RI.1, 5.RI.2, 5.RI.4, 5.RI.10

Arizona Science Standards:

3.L1U1.5 Develop and use models to explain that plants and animals (including humans) have internal and external structures that serve various functions that aid in growth, survival, behavior, and reproduction.

3.L1U1.6 Plan and carry out investigations to demonstrate ways plants and animals react to stimuli.

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 represents information in multiple ways and offers multiple ways for your students to engage with content as they read about, discuss, view, and write about scientific concepts. Different parts of the experience (e.g. reading texts, or locating information in the exhibition) may challenge individual students. However, the arc of learning is designed to offer varied opportunities to learn. We suggest that all learners experience each activity, even if challenging. We have provided ways to adapt each step of the activities 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 poisonous frogs found in rain forests of Colombia. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read the article "Look but Don't Lick!" Have them 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. If it is not possible to create color handouts, use a computer projector to display the reading so that students can see the colorful frog photos. You may also have them color their black and white copies to match the actual colors.

Ask:

- What does it mean for an animal to be poisonous? (*A: An animal is poisonous if its body contains a substance that is harmful or fatal to other animals.*)
- How does being poisonous help the frogs in this article survive? (*A: Predators will not eat an animal that is poisonous to them. The frogs signal that they are poisonous by their bright colors, which warn predators not to eat them. The frogs can be active during the day and do not need to hide because they are not in danger of being eaten.*)

Have students complete the Student Vocabulary Chart to define these vocabulary words from the reading and explain how these attributes benefit poison frogs: poisonous, diurnal, aposematic.

They can work in pairs, small groups, or as a class. During discussion, remind students to use evidence from the text to explain their thinking, and to use specific examples.

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.
- For the charting activity, have students locate and circle the key vocabulary words in the text and underline where the word is defined to help them with the definitions.

2. DURING YOUR VISIT

This part of the activity engages students in exploring the exhibition.

Science Center Visit & Student Worksheet

Explain to students that they will be focusing on the Chocó Forest area of the exhibition (see map in the Educator’s guide), and using worksheets to gather all the necessary information about how animals use poison to help them survive. Tell students that back in the classroom they will refer to these notes when completing the writing assignment.

SUPPORTS FOR DIVERSE LEARNERS: Science Center Visit

- Review the Student Worksheet with students, clarifying what information they should collect during the visit.
- Have students explore the exhibition 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 exhibition where answers may be found.

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 Science Center.

Writing Task

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

Based on your reading, your visit to *The Power of Poison* exhibition, and your discussions, write an essay in which you describe how animals use poison to help them survive.

Be sure to:

- define the word “poison”
- include at least three examples of poisonous animals and how they use their poison
- include labeled illustrations of all three poisonous animals

Support your discussion with evidence from the reading and notes from your visit to *The Power of Poison*.

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 Power of Poison*, 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 exhibition, 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 exhibition that helps them understand how poison helps animals survive.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

Student Reading

Look But Don't Lick!

In the 1970s and early 1980s, Museum scientists made a few trips each year to the Colombian rain forest. They were herpetologists, people who study reptiles and amphibians. The scientists were interested in tiny, brightly colored frogs that could be spotted dotting the plants and rocky streams of the jungle.

Although they're beautiful, many of these Central and South American frogs are also very poisonous. The visiting scientists noticed that people who live in the Colombian rain forest – the Emberá – used the poisons that ooze out of the frogs to make their blowgun darts deadly. They rubbed dart tips along the animals' backs to transfer the toxins to their weapons, and hunted for animals using the poisoned darts.

The Emberá used three frog species to poison their darts. One of these species was a bright yellow or sometimes orange frog that the scientists had not seen before. Over several years, they collected hundreds of this new-to-science species. The frogs were about two inches long, larger than any other species of poison frog.

The scientists found that these frogs were also 20 times more toxic than any other kind of frog. Each of them oozed enough poison to kill up to 10 people. The scientists gave this frog species a frightening name: *Phyllobates terribilis*. The common name for the species is less scary: the golden poison frog. It's one of about 180 poison frog species that have been identified so far. New poison frogs are still being discovered today.



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Dendrobates tinctorius
(blue poison frog)

Size: 1 to 1.75 inches

Range and habitat: forests in northern South America

Frog Fact: Some blue poison frog "morphs" combine white, black, yellow-and, of course, brilliant blue.



© AMNH

Phyllobates terribilis
(golden poison frog)

Size: About 2 inches

Range and habitat: tropical rainforests in Colombia

Frog Fact: The most poisonous dendrobatid, golden poison frogs are also excellent "tongue hunters," rarely missing a strike.

Warning Colors

Many small animals in the rainforest are nocturnal, which means active at night. This may help them avoid predators that are active and hunting during the day. But poison frogs are diurnal instead, which means active during the day. You'd think predators like snakes, birds or other hungry animals could easily spot one in the forest where it lives.

As it happens, however, powerful colors and patterns are often used in the natural world to tell hungry predators to stay back. The bright colors advertise that species – from butterflies to berries – are not tasty, and perhaps are even poisonous. Animals with this coloration are called aposematic (Ah-poe-sehm-AH-tick), which is the opposite of camouflage. Because bright colors are a warning, sometimes creatures that are not poisonous at all will have the same bright colors as creatures that are truly toxic. This copycat adaptation may deter would-be hunters.

It has long been thought that the poison frogs' bright colors ward off animals that hope to eat them. In 2007, an experiment in Costa Rica provided evidence to back up that belief. Researchers created 400 life-size clay models of a bright red poison frog species. They also made 400 models of a small, dull-brown frog species. Then the researchers placed the red frog and brown frog models in similar places outdoors. During the study, predators attacked about 100 of the models, but the brown frog models were attacked twice as often as the bright red ones. So brighter coloration in poison frogs does seem to keep some potential predators away.



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Dendrobates auratus (green and black poison frog)

Size: 1 to 2 inches

Range and habitat: rain forests and plantations, Nicaragua to Colombia

Frog Fact: Like most dendrobatids, green and black poison frogs are diurnal and are active all day long.



© AMNH

Dendrobates leucomelas (bumble bee poison frog)

Size: 1 to 1.5 inches

Range and habitat: western Venezuela to Guyana

Frog Fact: Native to dry forests, this species often hides away until the rains come, after which it ventures forth to forage.

Getting the Poison

How do these frogs get their poison? Many poisonous animals create poisons through processes in their own bodies, but these poisonous frogs get the necessary chemicals from their diets.

Recent studies have found that insects like certain mites, ants, beetles, and millipedes in the frogs' diets contain compounds called alkaloids. The frogs are able to concentrate and in some cases modify the alkaloids into poison that oozes out of glands in their skin. The poison comes out of the glands when the frogs are frightened or attacked.

In captivity, poison frogs' natural foods are easily replaced by non-toxic foods. They are fed different types of live fruit flies, crickets and beetles, because the frogs need to see the prey moving in order to catch it. These insects don't contain the alkaloids that are found in the frogs' wild prey, so the frogs can't produce poison.

Passing on Poison

Now we know how these wild adult frogs get their poison. But how do frog tadpoles protect themselves with poison? Taran Grant is a poison frog expert and research associate at the Museum. He says that some tadpoles may get their poisons directly from their parents.

In at least two species of frog, the tadpoles are fed the mother's unfertilized eggs. Since the eggs contain the same poisons found in the skin of the adult frogs, these chemicals eaten by the tadpoles may protect them, until the growing frog is able to produce its own poison.



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Because of their diet, frogs in captivity, like those in the Museum's *The Power of Poison* exhibition, are perfectly harmless.

This article first appeared in the Fall 2013 issue of Rotunda, the member magazine of the American Museum of Natural History.

Student Vocabulary Chart

Instructions: Fill in the blank boxes below to define key vocabulary from the reading and explain how it helps poison frogs survive.

Vocabulary Words	Definition of the vocabulary word	How does this help the frog survive?
Poisonous		
Diurnal		
Aposematic		

Student Vocabulary Chart

ANSWER KEY

Instructions: Fill in the blank boxes below to define key vocabulary from the reading and explain how it helps poison frogs survive.

Vocabulary Words	Definition of the vocabulary word	How does this help the frog survive?
Poisonous	<i>(harmful or fatal to another animal)</i>	<i>(predators avoid poisonous prey)</i>
Diurnal	<i>(active during the day)</i>	<i>(it is easier to find food during the day than at night*)</i>
Aposematic	<i>(brightly colored as a warning that it is poisonous)</i>	<i>(other animals know the frog is poisonous and that they should avoid it)</i>

**Note to teachers: This is not explicitly stated in the text; students may need to brainstorm the advantages with each other and as a class*

Student Worksheet

Instructions: In the Chocó Forest section, find three poisonous animals. Fill in the information for each.

1. Animal name:

How does this animal use poison to survive?

Sketch the animal and label its poisonous parts:

2. Animal name:

How does this animal use poison to survive?

Sketch the animal and label its poisonous parts:

3. Animal name:

How does this animal use poison to survive?

Sketch the animal and label its poisonous parts:

Student Writing Guidelines

Based on your reading, your visit to *The Power of Poison* exhibition, and your discussions, write an essay in which you describe how animals use poison to help them survive.

Be sure to:

- Define the word “poison”
- Include at least three examples of poisonous animals and how they use their poison
- Include labeled illustrations of all three poisonous animals

Support your discussion with evidence from the reading and notes from your visit to *The Power of Poison*.

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

- I introduced the topic of poison.
- I defined “poison.”
- I clearly named three animals and described how they use poison to survive.
- I included labeled illustrations of three poisonous animals.
- All the information I presented is relevant to how animals use poison to help them survive.
- I used information from “Look but Don’t Lick!” to explain how animals use poison to survive.
- I used information from *The Power of Poison* exhibition to explain how animals use poison to survive.
- I included a conclusion at the end.
- I proofread my essay for grammar and spelling errors.

Assessment Rubric

Scoring Elements		1 Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
RESEARCH	Reading	Attempts to include text using examples, quotes, or other references.	Presents some information from reading materials but may lack accuracy or relevance.	Accurately presents information from reading materials relevant to the purpose of the prompt to develop argument or claim.	Accurately and effectively presents important information from reading materials to inform or explain.
	AMNH Exhibit	Attempts to include Museum exhibit content using examples, quotes, or other references.	Presents some information from Museum exhibit but may lack accuracy or relevance.	Accurately presents information from Museum exhibit relevant to the purpose of the prompt to develop argument or claim.	Accurately and effectively presents important information from Museum exhibit to inform or explain.
WRITING	Focus	Attempts to address the prompt, but is off-task.	Addresses the prompt, but focus is uneven.	Addresses the prompt with an adequately detailed response; stays on task.	Addresses key aspects of prompt in a detailed response; stays on task.
	Development	Attempts to inform or explain but lacks details.	Informs or explains by presenting some details.	Informs or explains using appropriate details.	Informs or explains by providing detailed and relevant information.
	Conventions	Lacks cohesion and control of grammar, usage, and mechanics appropriate to grade level	Demonstrates an uneven command of standard English conventions appropriate to grade level.	Demonstrates a command of standard English conventions, with few errors as appropriate to grade level.	Maintains a well-developed command of standard English conventions, with few errors. Response includes language and tone appropriate to the audience, purpose, and specific requirements of the prompt.
SCIENCE	Content Understanding	Content is irrelevant, inappropriate, or inaccurate.	Shows uneven understanding of disciplinary content related to the prompt	Presents generally accurate disciplinary content related to the prompt.	Presents accurate and relevant disciplinary content to enhance understanding of the topic.