The Power of Poison

科学素养与读写活动

概述

本活动旨在符合《共同核心州立标准》（CCSS）中的英语语言艺术标准，向学生介绍关于毒药对身体系统的影响的科学知识。学生们将阅读内容丰富的文本，参观《强有力的毒药》展览，并使用他们所学的内容完成一个符合CCSS的写作任务，创作一个包含三种毒药的例子的图解文本，表明哪一种植物或动物使用它们以及它们的效果。

材料

- 教师指导，包括：
  - 事前阅读指导
  - 访问《强有力的毒药》和学生工作表
  - 事后写作任务
- 学生阅读材料：“《强有力的毒药作为药物》”
- 《强有力的毒药》访问学生工作表
- 写作指导
- 教师评分方案

支持多样化学习者：概览

本资源设计旨在结合所有学习者的通用学习设计原则。它以多种方式呈现信息，并允许学生在阅读、讨论、查看和写作科学概念时以他们自己的方式与内容互动。不同的部分（例如，阅读文本或在展览中查找信息）可能会对个别学生构成挑战。然而，本活动旨在提供各种学习机会。我们建议所有学习者参与每项活动，即使挑战性。我们为不同技能水平的学生提供了适应每项活动的方法。

1. 事前访前

此部分活动通过阅读一本非小说性书籍来引导学生学习毒药。阅读将为他们的访问做准备，通过引出话题并为他们的探索定下基调。

学生阅读

学生阅读“《强有力的毒药作为药物》。”引导学生在右面空白处做笔记。例如，他们可以突出关键段落，改述重要信息，或写下他们的问题。

问：

- 毒药在自然界中被找到，并且有什么作用？（答案可能包括：毒药在自然界中被找到并且被植物和动物用作化学防御，通过影响正常身体过程。）
- 毒药如何转化为药物？（答案可能包括：药物和毒药在它们都影响生理过程时是相似的。理解这些毒药对身体系统的影响可以为它们可能有的某些医疗用途提供线索。例如，知道非洲锯鳞毒蛇毒液导致血凝减少，从而导致开发一种用于减少血凝的药物。）

讨论时，提醒学生使用来自文本的证据来解释他们的想法，并提供具体例子。

引导学生创建一个三列图表来比较和对比“毒药”、“毒素”和“毒液”来说明它们之间的关系。他们可以以小组，小群体或全班的形式工作。
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**2. DURING YOUR VISIT**

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

**Museum Visit & Student Worksheet**

Explain to students that they will be focusing on three areas of the exhibition: Chocó Forest, Poison in Myth & Legend, Poison for Good. Students will use worksheets to gather information about three plants or animals that use poison, and create a labelled illustration. Tell students 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 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 Museum.

**Writing Task**

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

Based on the reading, your visit to *The Power of Poison* exhibition, and your discussions, write an essay in which you:

- define “poison”
- name three poisons, indicate what plant or animal uses them and explain their effects

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, the charting exercise, 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 then 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 each of the plants or animals uses their poison and an explanation of the poisons effects.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.
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Student Reading

The Power of Poison as Medicine

The yew tree has a legendary connection to death. Its seeds, leaves, and bark are highly poisonous to humans. In recent decades, however, this long-lived plant genus has earned a different reputation: as a potential preserver of life.

In the 1960s, researchers working for the U.S. National Cancer Institute discovered that the bark of the Pacific yew, contained a toxic ingredient that could be harnessed on a cellular level to inhibit the progress of some cancers. A derived compound produced in the laboratory and available commercially since the late 1990s, has been found to be effective in the treatment of breast, lung, and other cancers, among other medical uses. The drug is a prime example of the use of poisons in the service of medicine, a challenge to the modern view of poison as an instrument of death, whether by accident, suicide, or murder.

Of course, nature’s poisons have been used for medicinal purposes for millennia. Small doses of poisonous plants such as mandrake, henbane, and hemlock numbed the pain of surgery for more than 1,000 years. In William Shakespeare’s time, 400 years ago, poisonous extracts were combined into cough medicine. Well into the 20th century, the element mercury was an ingredient in popular remedies.

But modern scientific techniques have allowed researchers to better understand, and then take advantage of, the underlying mechanisms by which plant toxins and animal venoms attack normal metabolic processes. For example, some neurotoxins block the release of chemical messengers called neurotransmitters; some stop neurotransmitter messages from being received; some send false signals; and still others disrupt nerve cell activity by opening channels in cell walls. If muscles in the heart or lungs fail to get the proper signal to function, the results are fatal. But applying the same effect in nonlethal doses can stem tremors or the registering of pain.

“What is a poison?” asks Mark Siddall, curator in the Division of Invertebrate Zoology who is also curator of the special exhibition The Power of Poison. “It’s a substance that interferes with normal physiological processes, that alters or stops them, or makes things happen. That is essentially what medicines are, too.”

The potential for tapping nature is staggering. By conservative estimates, some 100,000 animals, from lizards and snakes to sea anemones and jellyfish, produce venom, which in turn can contain hundreds of different toxins. So far, only about 10,000 animal toxins have been identified, and 1,000 of these have been studied in depth, with a view to developing drugs.
Two medications that reduce blood clotting, tyrofabin and hirudin, have been derived from animal sources, respectively, the blood-thinning venom of the African saw-scaled viper and a substance secreted by leeches. The diabetes drug Exenatide, which lowers blood sugar and increases the body's production of insulin, is a synthetic version of a component in the saliva of Gila monsters, large venomous lizards found in the southwestern U.S. and northwestern Mexico.

Plants are an even richer mine, with more than 400,000 identified species and many of them toxic to one degree or another. Fixed in place, plants are especially adept at producing chemical defenses against insects, larger plant-eaters, and even other plants – a process that has allowed land plants to flourish for about 450 million years. Caffeine and nicotine are both plant-based products with well-known pleasurable effects on the body until taken in excess, revealing their essentially poisonous nature. But just as with animal toxins and venoms, plant compounds that affect the human body can be employed for medicinal purposes. Salicylic acid, the active ingredient in aspirin, for example, is found in a number of plants, including the willow tree Salix, from which it takes its name.

Researchers are in a race against time as they seek to unlock the potential of poisons. “Habitat loss from overpopulation, climate change and other factors have put more species of plants and animals at risk,” says Siddall. Consider those toxin-rich snakes: by conservative estimates, one in five reptiles is now threatened with extinction, a loss that could radically diminish a promising source for healing.

This reading was adapted from “The Power of Poison as Medicine,” an article in the Fall 2013 issue of Rotunda, the Member magazine of the American Museum of Natural History.
Student Worksheet

Stop 1: Poison in Nature: Chocó Forest
Choose one plant or animal from this section. Sketch it, and label its poison delivery mechanism.

Animal or plant name:  
Name of its poison:  
Describe the poison’s effect: 

Stop 2: Poison in Myth and Legend
Read the Enchanted Book and learn about one of the plants. Sketch it, and label its poison delivery mechanism.

Plant name:  
Name of its poison:  
Describe the poison’s effect: 

Stop 3: Poison for Good
Choose one plant or animal from this section. Sketch it, and label its poison delivery mechanism.

Animal or plant name:  
Name of its poison:  
Describe the poison’s effect: 
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Student Writing Guidelines

Based on the reading, your visit to The Power of Poison exhibition, and your discussions, write an essay in which you:

• define the word “poison”
• name three poisons, indicate what plant or animal uses them and explain their effects

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 poisons and described the plants or animals that use them and their effects.
☐ I included a labeled illustration of each plant or animal, including poison delivery methods.
☐ I only included relevant information about the three poisons, the plants or animals that use them, and their effects.
☐ I used information from “The Power of Poison as Medicine” to explain poisons, the plants or animals that use them, and their effects in detail.
☐ I used information from The Power of Poison exhibition to explain poisons, the plants or animals that use them, and their effects 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.
# Assessment Rubric

<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>
</tr>
</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>
</tr>
<tr>
<td>AMNH Exhibit</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>
</tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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 audience, 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 audience, purpose, and specific requirements of the prompt.</td>
</tr>
<tr>
<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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</tbody>
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AMERICAN MUSEUM OF NATURAL HISTORY