

Poison, and who gets away with it

Grades 6 to 8, ages 11 to 14. Two 50-minute sessions.

Milkweed makes a heart poison. Monarchs eat it, store it and advertise it. Viceroy's copy the advertisement. Students work through the whole arms race and meet mimicry as a testable idea rather than a fact to memorize.



Captain-tucker. CC BY-SA 3.0. Wikimedia Commons.

What students will be able to do

- Explain what cardenolides do to an animal that eats them.
- Describe sequestration: eating a poison and keeping it.
- Distinguish Batesian from Müllerian mimicry and say what evidence would separate them.

Materials

- Images of monarch, viceroy and queen butterflies
- The species pages for common and whorled milkweed
- Whiteboard

How it runs

1. Start with the plant's problem: it cannot run, and everything wants to eat it. List the defenses students can think of, then add the two milkweed uses: sticky latex and cardiac glycosides.
2. Explain the sodium-potassium pump simply, as the machine that keeps a cell's electrical balance. Cardenolides jam it. In a heart, that is very bad.
3. Pose the puzzle: monarchs eat this and are fine. Ask how that could be possible. Take every suggestion before revealing the answer, which is a mutation in the pump itself.
4. Then the twist: the monarch does not just tolerate the poison, it stores it and becomes poisonous. Ask what a poisonous animal should look like, and why bright orange is a sensible choice.
5. Introduce the viceroy, which looks like a monarch. Present two competing explanations: it is harmless and cheating, or it is also distasteful and they are reinforcing each other.
6. Ask groups to design an experiment that would distinguish the two. Then tell them the current evidence points to the second, and that the textbook answer changed.

Discussion questions

- Newly hatched caterpillars cut a circle in the leaf before eating inside it. What are they doing, and to which defense?
- Narrow-leaved milkweeds are more toxic by weight than broad-leaved ones. What might that cost them?
- If mimicry works because predators learn, what happens to the system when the model becomes rare?

Taking it further

Compare with the milkweed bug, tussock moth and milkweed beetle, all orange and black on the same plant. That is a lot of independent arrivals at the same answer.

Safety

Discussion-based. If handling plants, gloves, and nothing near eyes.

NGSS alignment

Code	Performance expectation
MS-LS1-4	Use argument based on empirical evidence to support an explanation for how specialized plant structures and characteristic animal behaviors affect the probability of successful reproduction.
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing.

<https://milkweedusa.com/learn/poison-and-the-free-rider/>