Science Lessons for Grades 9-12

“Taste for Poison”

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Discipline: Biology
Grade: 11 to 12

Standards
National Science Education Standards: Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems. (NSES Content Standard C) Students will evaluate the role of natural selection in the development of the theory of evolution.

Purpose/Goal
At the end of the lesson, students will be able to describe evolutionary pressures, infer potential adaptations to such pressures, understand how heritable variation can be gained or lost in a population, and explain how natural selection drives the evolution of a species.

Context
This lesson was created for the biology unit on evolutionary biology and ecosystems. It can be used to introduce the unit and start discussion on fundamental evolutionary concepts, or as a wrap-up to reinforce material covered in the unit. Students are not expected to have prior exposure to related concepts; an understanding of basic biology fundamentals and vocabulary will be sufficient.

Preparation/Websites
This lesson is written and presented in a problem-based learning (PBL) format, so teachers may need to consider an alternate classroom set up before using the lesson. The lesson materials will be available on the CASES Online website (http://www.cse.emory.edu/cases). Until then, the lesson documents can be requested from the authors.

We recommend that teachers explore the Berkeley “Understanding Evolution” website (http://evolution.berkeley.edu/) before teaching the lesson. The site provides a wide overview of concepts, lists of student misconceptions, teaching tips and potential pitfalls.

Motivation
To stimulate thought about evolution concepts and provide some context/relevance for students, we use analogies that draw on students’ experiences with limited food preferences and exclusive social groups then compare them to variation in populations and the speciation process. When we explore the logic behind their responses, misconceptions will typically come up.

Description
This problem-based learning (PBL) lesson utilizes the graduate fellow’s research on natural selection in fruitfly populations to teach evolution and ecology concepts in high school biology. Students grapple with why certain fruitflies choose to feed and grow on a fruit that kills its relatives. The lesson takes place in two parts. The first part is fairly short and focuses on a research article summary; students will read about how a mutation in smell perception led to changes in food preferences and possibly speciation in Drosophila. This provides students with a real-life example (aided by live specimens) with which to build conceptual foundations. In groups, students identify key facts from the research article and brainstorm relevant questions. Then students research their own questions using provided learning resources. The second part is more extensive and presents students with a fictional situation in which to apply the concepts they learned earlier. They are asked to read through a series of old journal entries describing a habitat and an animal from the early 1900s. Using descriptions from more recent visitors to the area, students are then asked to infer how that species may have changed over time.

Assessment
For the first part, students can be assessed on the kinds of questions they ask about the research article summary and their understanding of the concepts they have researched to answer their questions. For the second part, students are asked to submit a drawing or model of the “current” animal, and a written explanation that includes a definition of natural selection, the evolutionary pressure(s) the creature is facing, and how the creature exemplifies an organism that is successful in the particular habitat with those particular pressures.

Follow-Up Activities
This lesson can be a springboard for more discussions on evolutionary concepts such as predation, conservation, mutation, and trophic interactions.