



McKeesport Area School District
Flexible Instruction Days – High School Lesson Plan

SUBJECT: Biology			LESSON TITLE: Natural Selection	
<input type="checkbox"/> LESSON 1: 1 st or 2 nd 9-Weeks	<input type="checkbox"/> LESSON 2: 2 nd or 3 rd 9-Weeks	<input type="checkbox"/> LESSON 3: 2 nd or 3 rd 9-Weeks	<input type="checkbox"/> LESSON 4: 2 nd or 3 rd 9-Weeks	<input checked="" type="checkbox"/> LESSON 5: 3 rd or 4 th 9-Weeks
STANDARD(S): BIO.B.3.1.1 Explain how natural selection can impact allele frequencies of a population.				
BIO.B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population.				
INSTRUCTIONAL OUTCOMES: Students will: <ul style="list-style-type: none">• Understand how the environment affect a population of organisms.• Be able to predict what may occur if the environment changes				
STUDENT PARTICIPATION (<i>Lesson steps</i>): Students will: <ol style="list-style-type: none">1. Read excerpts from a few different sources about how rodent populations changed due to the introduction of poison				
ACCOMMODATIONS: For struggling learners: <ul style="list-style-type: none">• Do not need to include explanations• Do not need to complete the “Prediction” section• Can work with a teacher upon return to school For advanced learners: <ul style="list-style-type: none">• Must provide 2-3 full sentence explanations• Must complete the “Prediction Section”				
HANDOUTS (<i>exact names of ALL accompanying handouts</i>) & RESOURCES (<i>materials, websites, books, etc.</i>) <ul style="list-style-type: none">• Natural Selection				
EVIDENCE OF LEARNING Students will demonstrate their: <ul style="list-style-type: none">• Understanding of natural selection by answering questions about population changes in rodents.• By being able to make predictions about what would happen if the environment changes.				

Directions: Read through the modified article and answer questions below.

How Mice Have Developed a Resistance to Warfarin Based Poison

October 6, 2016 by [Bill Dowd](https://www.skedaddlewildlife.com/blog/how-mice-have-developed-resistance/) <https://www.skedaddlewildlife.com/blog/how-mice-have-developed-resistance/>

You're using different rodent poisons, but noticing it's doing nothing to reduce mouse activity inside your home. Well mice are advanced creatures adapting to different and new environments. They've become used to coexisting with people and the dangers that can bring. Mice can easily become immune to the poison you're using.

1. What do scientists call the process of an organism becoming better adapted to its environment?
 - a. Mitosis
 - b. Natural Selection
 - c. Genetics
 - d. Hereditary Adaption

What is warfarin?

Warfarin is an anticoagulant used by many Ottawa area pest control companies and sold in hardware stores to kill mice. It prevents the formation of blood clots in blood vessels and results in internal bleeding. It is the most widely used oral anticoagulant drug in North America. It was introduced as pest control in 1948.

2. Based on the paragraph above- what would happen to a rat that eats poison containing warfarin?

3. PREDICT: What may happen to a cat that eats a rat that has eaten poison containing warfarin?

Warfarin as a form of pest control.

Since its discovery warfarin has been heavily used around the world to control mice and rat populations. A reliance on warfarin to kill rodents has resulted in the development of warfarin-resistant species of mice and rats. The first detection of rodent resistance occurred in rats in Scotland in 1958.

4. What does the term "resistance" mean?

Basically mice have a genetic mutation to be immune to warfarin. The mutation to *vkorc1*, a gene found in all mammals that manages vitamin K, makes mice resistant to the anticoagulant. Warfarin works to reduce vitamin K creating blood clots. So, the production of more vitamin K is the obvious way to overcome poisoning. Rodents adapt through spontaneous mutations during DNA replication. These mutations can result in beneficial, harmful or neutral changes in proteins. For example, the mutation that makes the mice resistant to the warfarin, also make them have to eat 20x the amount of vitamin K to survive.

5. What is a genetic mutation?
 - a. A change in the DNA that can cause a change in a protein.
 - b. A change in the RNA that can cause a change in the DNA

c. A change in the protein that can cause a change in the DNA

6. How does warfarin prevent blood clots?

7. How could what has occurred that allows some rodents to not be affected by this poison?

Extension:

Part 1: Answer the question as true or false. Provide a short explanation of your answer.

8. True or false: The genetic variation that allows rats to be resistant to warfarin must be present in the population before they are exposed (eat) the warfarin.

9. True or false: If rats that have the warfarin resistant mutation require 20x more vitamin K in their diets they will be at a disadvantage when there is no warfarin.

Part 2: Prediction- Write your thought in response to the following prompt. Use evidence from the article as support. Prompt: When warfarin is present, the percentage of the population that has the *vkorc1* gene mutation increases. If warfarin is removed from the environment, do you think the percentage of mutants would go up or down? Provide evidence to support your answer.