When Agents Strike

Trace how harmful agents can shift inherited traits in a population.

BIO.4.7 "Enrichment: Construct explanations for how various disease agents (bacteria, viruses, chemicals) can influence natural selection."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle each harmful agent and underline the inherited difference it acts on. In each paragraph, number the sentences that show how survival and offspring change the population.

Three Challenges, Three Populations

1. At a fish hatchery, a harmful bacterium spreads through a tank of young trout. It enters damaged skin and causes sores that make feeding and swimming difficult. Before the outbreak, the trout already differed in inherited immune traits. Some could stop the infection faster than others. In this imagined case, infected trout that recover are more likely to reach breeding age and produce young. If their young inherit the protective traits, those traits can become more common over generations. The bacterium does not give trout a useful trait because they need one. It creates a challenge that favors existing variation.

2. On an island, a virus infects wild rabbits and causes severe illness. It can enter a rabbit's cells only after attaching to a matching surface protein. In this imagined population, some rabbits inherit a version of that protein that makes attachment less likely. During an outbreak, those rabbits tend to survive and reproduce more often than rabbits with the other version. Their young may inherit the protective version, so its frequency can rise across generations. The virus might also evolve, but that is a separate selection process in the virus population. A single rabbit does not evolve during its illness.

3. Near a mine, dissolved arsenic can enter a stream and damage fish organs. Arsenic is a harmful chemical, not a living pathogen. Suppose fish in this stream already vary in an inherited ability to remove arsenic from their bodies. Fish that remove it more effectively may stay healthier and leave more offspring when the water is contaminated. Their offspring may inherit this ability, making it more common over many generations. If the stream becomes clean, that advantage may shrink or disappear. Whether the agent is a bacterium, a virus, or a chemical, selection requires inherited differences that affect survival and reproduction.

2 ANSWER WITH EVIDENCE

Use the passage

1. Explain how the bacterial outbreak could make a protective immune trait more common in the trout population.

2. How could the virus change the frequency of the rabbits' surface-protein versions over generations?

3. Explain why the fish trait favored by arsenic-contaminated water might lose its advantage if the stream becomes clean.

4. What must be true about a population for any of these three harmful agents to cause natural selection? Explain why exposure alone is not enough.

3 YOUR TURN

Your own words

Create a new, plausible case involving a bacterium, virus, or harmful chemical not named in the passage. In 3 to 4 sentences, explain an inherited difference, how exposure affects survival and reproduction, and how the population changes over generations.

When Agents Strike

PART 1 · READ AND MARK

Circle each harmful agent and underline the inherited difference it acts on. In each paragraph, number the sentences that show how survival and offspring change the population. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Explain how the bacterial outbreak could make a protective immune trait more common in the trout population.	**Trout with an inherited trait that helps them stop the infection are more likely to survive, breed, and pass that trait to young. Over generations, the trait can become more common.**
2	How could the virus change the frequency of the rabbits' surface-protein versions over generations?	**Rabbits with the inherited version that makes viral attachment less likely tend to survive and reproduce more. Their young may inherit that version, increasing its frequency.**
3	Explain why the fish trait favored by arsenic-contaminated water might lose its advantage if the stream becomes clean.	**The ability to remove arsenic helps fish stay healthy and reproduce when arsenic is present. Without arsenic, that ability may no longer improve survival or reproduction.**
4	What must be true about a population for any of these three harmful agents to cause natural selection? Explain why exposure alone is not enough.	**Individuals must differ in inherited traits that affect survival and reproduction during exposure. Exposure alone cannot make a trait more common unless it changes which inherited traits are passed to offspring.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In a wetland, lead from old paint enters the water and harms snails. Suppose some snails inherit a trait that reduces lead uptake, while others absorb more. Snails that absorb less lead are more likely to survive and produce young that inherit the trait. Over many generations, the trait that limits lead uptake becomes more common in the snail population.

Accept plausible cases that link an inherited difference to unequal survival and reproduction, then to a change in trait frequency across generations. Do not accept claims that exposure creates a needed trait in an individual.