Before the Release

Weigh scientific evidence in a biotechnology decision

GEN.3.4 "Enrichment: Develop logical arguments based on scientific evidence for and against ethical concerns regarding biotechnology/bioengineering."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two pieces of evidence that support the proposed gene drive, circle two uncertainties or risks, and number each piece you mark. Use your marks to compare the arguments for and against an outdoor release.

Should Gene-Drive Mosquitoes Be Released?

1. In a town where malaria is common, residents hear a proposal to release gene-drive mosquitoes. Malaria is caused by parasites passed to people through the bites of infected mosquitoes. Scientists can edit a gene in a mosquito and link it to a gene drive, which makes the edit more likely to be inherited than an ordinary gene. One proposed edit would reduce the number of female mosquitoes able to reproduce. Because female mosquitoes bite and can transmit malaria, fewer of them might mean fewer infections. The proposal raises an ethical question: should people alter a wild species to protect human health?

2. Supporters point to experiments in enclosed cages. In some studies, gene drives that disrupted female fertility caused populations of malaria-carrying mosquitoes to collapse in cages. This result supports the claim that a drive could reduce disease transmission, but no cage can reproduce every feature of a wetland or village. Supporters argue that preventing serious illness could justify carefully controlled research before any outdoor release. They also note that malaria control tools, such as bed nets, do not stop every infection. Their argument depends on two links: the drive must spread as intended, and a drop in mosquitoes must lead to fewer infections.

3. Critics focus on what cage results cannot settle. Mosquitoes interact with other animals, and researchers cannot yet predict every ecological effect of sharply reducing one species outdoors. A drive could also cross political borders as mosquitoes move, affecting communities that did not agree to a release. Critics argue that consent and environmental monitoring matter because a spreading edit may be difficult to recall. Mutations can also make some mosquitoes resistant to a drive, weakening its effect. This uncertainty does not prove that release would cause harm. It does support a different decision: continue contained tests and seek public input before considering an outdoor release.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the cage studies support an argument for continuing gene-drive research? Explain the possible benefit and a limit of the evidence.

2. A supporter claims that fewer mosquitoes will mean fewer malaria infections. What two things must happen for that claim to hold, according to the passage?

3. Why is consent from communities beyond the release site an ethical concern? Connect your reasoning to how a gene drive could spread.

4. How does possible resistance weaken the case for release without proving that release would cause harm?

3 YOUR TURN

Your own words

Write one paragraph of five to six sentences advising a health board whether to allow an outdoor release now. Use a cage-study result and an uncertainty from the passage, then set one measurable evidence requirement and one public-consent step before any future release.

Before the Release

PART 1 · READ AND MARK

Underline two pieces of evidence that support the proposed gene drive, circle two uncertainties or risks, and number each piece you mark. Use your marks to compare the arguments for and against an outdoor release. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the cage studies support an argument for continuing gene-drive research? Explain the possible benefit and a limit of the evidence.	**The drives caused mosquito populations to collapse in some cages, suggesting they might help reduce malaria transmission. Cages do not show whether the same result would occur outdoors or reduce human infections.**
2	A supporter claims that fewer mosquitoes will mean fewer malaria infections. What two things must happen for that claim to hold, according to the passage?	**The drive must spread as intended, and the resulting drop in mosquitoes must lead to fewer infections.**
3	Why is consent from communities beyond the release site an ethical concern? Connect your reasoning to how a gene drive could spread.	**Mosquitoes carrying the drive could move across political borders, affecting communities that did not agree to the release.**
4	How does possible resistance weaken the case for release without proving that release would cause harm?	**Mutations could make some mosquitoes resistant, so the drive might not reduce their numbers as intended. That possibility questions its expected benefit but does not show that it would cause harm.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I advise the health board not to allow an outdoor release yet. Gene drives have caused mosquito populations to collapse in some cage studies, which suggests a possible way to reduce malaria. However, cages cannot show every ecological effect of reducing mosquitoes outdoors. Before considering release, the board should require two independent contained studies that track mosquito numbers and resistance over several generations. It should also hold public meetings with residents at the proposed site and in neighboring communities, then seek their agreement before making a decision.

Accept other defensible decisions in Part 3 if students connect a cage result and a passage-based uncertainty to their recommendation. The evidence requirement must be measurable, and the consent step must identify who should be consulted.