

# DESTINATION BIOTECH Teacher Notes

Episode 1

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Dr. Clark Wolf



## Topic Overview

Bioethics is the study of the ethical issues arising from advancements in biology and medicine. It critically addresses the moral implications of new discoveries and technologies, such as gene editing, stem cell research, and artificial intelligence in healthcare. Understanding bioethics is crucial in maintaining ethical standards and respecting human dignity amid rapid scientific advancements. It is generally studied and researched through interdisciplinary approaches, combining insights from fields such as law, philosophy, theology, and the social sciences, among others, and seeks to guide the responsible conduct of research and its application in society.

## Conversation Overview

Clark Wolf discusses how his research in bioethics helps us process many of today's most intriguing issues. Conversation topics include gene editing, genetically modified organisms, and sharing and communicating research findings. Dr. Wolf shares a particularly buzz-worthy project about genetically modified mosquitos, too!

## Included NGSS Dimensions

**Science & Engineering Practices:** Engaging in Argument from Evidence

**Disciplinary Core Ideas:** MS-, HS-LS2 (Ecosystems: Interactions, Energy, and Dynamics); MS-, HS-LS3 (Heredity: Inheritance and Variation of Traits)

**Crosscutting Concepts:** Patterns; Systems and System Change

## Useful Terms

**Bioethics:** the study of how biological or medical research and practice interact with what's right and wrong

**Gene-edited/modified organisms (GMOs):** organisms (like food or animals) that have been changed on a genetic level using biotechnology

**Transgenic:** containing foreign genetic material

**CRISPR:** a gene-editing technique that uses enzymes from bacteria

**Naturalize:** when a foreign or exotic species integrates into a new ecosystem

## Ideas & Notes for Classroom Use

### Podcast

- This podcast is approximately 19 minutes long and is available in two versions – video with audio, and audio only. A transcript is also available for download.
- Vocabulary words that may be new to students are highlighted in the video version.
- Best practice may include pausing the podcast for in-the-moment whole-class and small-group discussions

### Activity: Mosquito Dilemma

- Provide students with a copy of the dilemma after watching the podcast and discussing the reflection sheet.
- Students use what they know about genetics and bioethics to decide which position they most closely agree with. They should provide evidence that supports their argument.
- Student products may include written responses, small or large group structured discussions, short videos, or any other format that provides students the opportunity to share their ideas and findings.

### Student Reflection Sheet

- Begin by providing students with the basic information about the podcast
- Ask students to consider the “Before the Podcast” prompts and discuss them before watching or listening to the podcast
- After enjoying the podcast, consider the remaining questions

## Notes from the Expert

Dr. Wolf has provided the following thoughts and talking points related to the development of high-quality arguments and the mosquito research he discussed in the podcast.

### The expert's claim

When discussion is based on reasons and evidence, it is much more productive for all concerned.

### Is introducing genetically modified mosquitos a good idea?

This project's critics and supporters have been a hot topic for discussion among scientists, environmentalists, and ordinary people.



### Evidence to support Position #1

- The targeted mosquito species can spread deadly diseases.
- The introduction of GM mosquitos will reduce the total population of harmful mosquitos.
- The mosquito variety targeted is a non-native invasive species
- The GM mosquito population will die and the altered genes will disappear from the environment over a few mating cycles.
- The mosquito variety targeted will not be driven to extinction.
- Other methods for reducing mosquito populations are more difficult and more expensive.
- Effects on human beings and on the environment will be minimal.

### Evidence to support Position #2

- Might the introduction of these GM mosquitos involve unknown risks to humans and to the environment?
- Has there been enough testing and observation?
- Even though *Aedes aegypti* is non-native, native species are now reliant on them for diet.
- Could these GM mosquitos mutate into new threat?
- The problem is the proliferation of mosquitos, but this proposed solution simply adds more non-native mosquitos to the environment.
- There are other ways to reduce mosquito populations that do not involve creation of a new GM variety.
- Sprays have been ruled safe by government researchers.
- Some GM mosquitos might survive and breed, permanently changing the genetics of the population.
- This solution is both expensive and time consuming!
- There are already other methods for removing mosquitos.

### In the end, is this a good project or a questionable one?

Bioethicists would urge that the conclusion we should come to, after considering all the evidence and the reasons that lie behind people's arguments both pro and con, is the one that is best supported by valid arguments and good reasons.

### Additional links and resources

- Oxitec and Florida Keys Announcement: <https://www.oxitec.com/en/news/florida-keys-mosquito-control-district-and-oxitec-conclude-another-mosquito-season-in-the-florida-keys-plans-for-third-in-2023>
- Smithsonian Magazine: <https://www.smithsonianmag.com/smart-news/first-us-open-air-test-of-genetically-modified-mosquitos-deemed-a-success-180979960/>
- EPA Announcement: <https://www.epa.gov/pesticides/following-review-available-data-and-public-comments-epa-expands-and-extends-testing>

