



SCIENCE LITERACY: GMOs in Nature

Instructor Background: Genetically Modified Organisms (GMOs) are a controversial application of biotechnology. Despite the controversy, products of GMOs are prevalent in many everyday products, including foods, medicines, and clothing. So it is important for students to be informed about GMOs and explore their own values and opinions. In this activity students will investigate GMOs using a close-reading process. Through multiple reads of the text, students will define vocabulary, summarize the text, answer analysis questions, and prepare evidence for argumentation. Critics of GMOs argue that they may harm individual health and the environment. The featured article, "[The Nature of Nature](#)" written by Rowan Jakobson for the Grow by Ginko website, uses the American Chestnut tree to provide students with a history of GMOs and evidence for both positive and negative consequences of GMO applications. The goal of this activity is for students to create a well-informed opinion or way to think about GMOs that they can share with others.

Learning Sequence

1. Choose a Section of the Text - Outlined below are 5 sections of the larger article. These sections can be used in any order or in sequence over the course of multiple lessons.
 - Section 1, paragraphs 1-9: A history of the fall of the American Chestnut
 - Section 2, paragraphs 10-17: The anti-GMO movement
 - Section 3, paragraphs 18-33: The science of a GM American Chestnut
 - Section 4, paragraphs 34-42: The presence of GMOs all around us
 - Section 5, paragraphs 43-55: The author's evidence for using GMOs with the American Chestnut
2. Use the text section to complete the Close Reading process outlined below.
 - A. **First Read for Vocabulary** - Students read through the text (independently, with a partner, in small groups, or as a class) and circle the words they do not recognize or understand. Once all students have read the text, model for students how to use context clues and/or available resources to define an unknown word. The definition can be written in the margin or on a separate note sheet. Students will use the modeled process to define their remaining circled words.
 - B. **Second Read for Summary** - Students read through the text (independently, with a partner, in small groups, or as a class) again and after each section of text, they will write a 1 sentence summary with the "gist" of that section. Summaries can be written in the margin or on a separate note sheet. Model the first section for students then they will complete the remaining sections.
 - C. **Third Read for Analysis** - Students read through the text (independently, with a partner, in small groups, or as a class) and use the text to answer text-based analysis questions. Analysis questions for each section of the larger text are outlined below:



1. Section 1 Questions

1. What is the author visiting at the botanical gardens? What is remarkable about the specimen they are visiting?
2. Why is the American Chestnut known as the “cradle to grave” tree?
3. What causes American Chestnut blight?
4. What makes the Darling 4 American Chestnut tree a GMO?
5. Describe the success of the Darling 58 specimen.
6. What tests must the GM American Chestnut “pass” before being allowed in the wild?

2. Section 2 Questions

1. Describe how Roundup Ready Corn and Soy is a GMO.
2. What did people view as possible consequences for the use of the Roundup Ready Corn and Soy crops?
3. How are GM trees different from GM annual crops?
4. What does the author see as the purpose of the GM American Chestnut and how is the purpose different from other GMO examples mentioned?

3. Section 3 Questions

1. Describe or draw the process of the *CRYPHONECTRIA PARASITICA* fungus spreading through the American Chestnut.
2. Why are fewer American Chestnut shoots appearing each year?
3. How does the The American Chestnut Foundation plan to use the Chinese Chestnut to bring the American Chestnut back to the US?
4. Why did William Powell feel it was safe to insert the gene that produces an enzyme that detoxifies oxalic acid in the GM American Chestnut?
5. How is Darling 58 being used to create blight-resistant American Chestnut seedlings?
6. What is the Campaign to Stop GE Trees’ argument against the GM American Chestnut?
7. What tests did the scientists at SUNY perform on the GM American Chestnut and what were the results of those tests?

4. Section 4 Questions

1. What two species does the author use as positive examples for gene transfer?
2. How have mammals’ reproduction been positively impacted by gene transfer?
3. How is Emily Whitehead a success story for gene transfer?



5. Section 5 Questions

1. What is happening to the author's ash tree and how is it similar to the plight of the American Chestnut?
 2. Why does the author compare their property in Vermont to "an unruly botanical garden?"
 3. What role does human behavior play in the decline of trees like ashes, hemlocks, and elms?
3. Argumentation: Do you think using genetic engineering to save the American Chestnut is a good idea? Choose one of the claims below. Add this claim to the organizer below and support your viewpoint with evidence and reasoning from the article and TDQs.
- Claim 1 - Genetic engineering to save the American Chestnut is a good idea.
 - Claim 2 - Genetic engineer to save the American Chestnut is not a good idea.

Claim: <i>Write your chosen claim below.</i>	
Evidence: <i>Below write facts from the text that support your claim.</i>	Reasoning: <i>For each piece of evidence, provide the reason for why the evidence supports your claim.</i>