DRIVING QUESTION: HOW IS BIOTECHNOLOGY USED?

LENGTH: 1 hour

OBJECTIVES: Students will be able to:

- identify specific ways biotechnology can improve food nutrition, safety and quality
- identify specific ways biotechnology supports social, economic and environmental sustainability
- identify specific ways biotechnology helps to meet the increasing needs of the world's growing population

Standards:

Next Generation Science Standards Addressed

Disciplinary Core Ideas

LS3.A Inheritance of Traits

Practices

Engaging in an Argument From Evidence

Cross-Cutting Concepts

Cause and Effect: Cause and effect relationships may be used to predict phenomena in natural systems.

National Standards for Art Education Addressed

NA-VA.9-12.1 Understanding and Applying Media, Techniques and Processes

Materials:

- TV monitor or projector/screen and speakers
- Internet connection with YouTube access
- Copies of "Food Biotechnology: A Communicator's Guide to Improve Understanding" (pages 6–11) available at www.foodinsight.org/biotech (1 per group of 2–3 students)
- Blank sheet of paper (1 per group of 2–3 students)
- Coloring utensils (1 set per group of 2–3 students)
- Sample infographic images. Great examples can be found by simply searching Google images for "infographics."

Suggested Video:

"What are the Benefits of Food Biotechnology" by FoodInsightTV

http://www.foodinsight.org/media/food-biotechnology-videos (2:33)

Lesson Context

This section provides guidance for teachers for how lessons build on each other.

Now that the students have defined plant biotechnology during Lesson 4, it is time to identify specific ways biotechnology can improve food nutrition, help the environment and meet the needs of the world's growing population. During Lesson 5, student teams become chief communicators as they prepare an infographic to convey an assigned key message about biotechnology. They will use pages 6–11 of "Food Biotechnology: A Communicator's Guide to Improve Understanding" as a key resource. This will need to be downloaded from www.foodinsight.org/foodbioguide.aspx and a copy provided to each student group.

KEY CONCEPTS: Biotechnology is being used to improve nutrition and enhance food safety and quality. Biotechnology supports the social, economic and environmental sustainability of agriculture. Biotechnology has a role to play in ensuring that safe and abundant food can be produced on existing farmland to meet the increasing needs of the world's growing population. In addition to food applications, biotechnology is used in other areas such as pharmaceuticals and environmental protection, such as the use of bacteria to clean up oil spills (bioremediation).

SETUP: Preview video and find examples of infographics. Set up coloring utensils and supplies. Prepare copies of handouts.

Outline:

1. Challenge students to recall five things they have learned in their exploration of biotechnology thus far. When they have five, they are to turn to a partner, share and give a high five.
2. Play the video "What Are the Benefits of Food Biotechnology" (2:33) by FoodInsightTV at http://www.foodinsight.org/media/food-biotechnology-videos.
3. Introduce the concept of infographics. Ask students if they are familiar with the term "infographic." Have them speculate what it might mean. (Listen for: An infographic is an image that conveys information using graphics. They are commonly seen in social media, magazines, commercials, etc.)
4. Share sample infographics found online. Ask students to generate a class checklist for qualities that make a great infographic. (Listen for observations such as purposeful graphics, minimal text and large numbers.)
5. Introduce infographic design project: In collaborative working groups, students will create an infographic using evidence to create an argument communicating the three key benefits of biotechnology. Break students into groups of two to three. Give each group a copy of "Food Biotechnology: A Communicator's Guide to Improve Understanding" pages 6–11.

- Assign each group one of the three selected key messages:
  - (Message One) Plant biotechnology is being used to improve nutrition, enhance food safety and quality.
  - (Message Two) Biotechnology supports the social, economic and environmental sustainability of agriculture.
  - (Message Three) Biotechnology has a role to play in ensuring that safe and abundant food can be produced on existing farmland to meet the increasing needs of the world's growing population.

6. Instruct students to review the content provided for their section. Challenge student groups to highlight the three to five most interesting facts they discovered. In making their selection, prompt students to identify the need and summarize what research says about the need. Inform students that they will be asked to present their infographic.
7. Guide students as they work together to create an infographic communicating this information.
8. Have students present their infographics to the class.
9. Collect infographics and post them in a common area.
10. Remind students that fear of change is often driven by a lack of understanding. Effective communication of research-based information is crucial in the process of developing new strategies for solving problems.

Additional Content Support

Pre/Post Assessment

This section provides a suggested assessment tool that may be used before and after a lesson to assess student readiness. See the Pre/Post Assessment file for a ready-to-distribute file for your students.

1. What is plant biotechnology? The USDA's National Institute of Food and Agriculture defines plant biotechnology as "a set of techniques used to adapt plants for specific needs or opportunities."
2. What are some specific ways biotechnology can improve food nutrition, food safety and food quality? See pages 6–7 of "Food Biotechnology: A Communicator's Guide to Improve Understanding."
3. What are some specific ways biotechnology can support social, economic and environmental sustainability? See pages 8–10 of "Food Biotechnology: A Communicator's Guide to Improve Understanding."
4. What are some specific ways biotechnology helps to meet the increasing needs of the world's growing population? See pages 10–11 of "Food Biotechnology: A Communicator's Guide to Improve Understanding."

Suggested Accommodations

This section provides optional tools to enrich learning and meet students where they are.

1. For students struggling to meet performance expectations:
   a. Students may have seen an infographic before on social media and not known what it is called. This could be an opportunity for them to create an infographic of something they know well to share details about it. Before the infographic design challenge, but after sharing infographic examples, have the students research something they enjoy and create an infographic to hang around the classroom.
2. For students who have already met performance expectations and have high interest:
   a. Using the resource "Food Biotechnology: A Communicator's Guide to Improving Understanding," have students research the answers to these tough questions.
      - Is there danger in genetically altering foods? What does research say?
      - Should GMO foods be labeled? What would be the effect of doing this?
      - What is the role of GM crops in alleviating world hunger?
      - What is the environmental impact of biotechnology?
      - Will biotech crops compromise seed integrity?
      - Are there any long-term studies on the health effects of genetically modified foods?
3. For students who are English Language Learners, have special needs or are reading below grade level:
   a. As the teacher chooses example infographics, selection should include easy-to-interpret images and numbers to provide access to the ELL students and their understanding of the assignment.
4. For engaging ways to connect learning to students' home and community:
   a. Have students explore "U.S. School Lunch Nutrition Facts & Calories," (http://nutritiondata.self.com/facts/recipe/1163312/2) where near the bottom of the page there is a sample school lunch of a hotdog with ketchup and mustard, with sides of French fries and raw broccoli and cauliflower and ranch dressing. Included is the nutrition label for this school lunch and infographics that graphically represent various aspects of the lunch such as a "fullness factor" or "nutrient balance" with a completeness score. Have the students pick an infographic and click on the link "How to interpret this" at the top of the page to assist with the nutritional information explanation. Have students report on their chosen information about the school lunch and what the graphic means.

Rubrics

We have created two optional tools for evaluating learning at the end of each lesson.

- **LESSON RUBRIC:** This can be provided to students and used by the teacher for evaluation.
- **STUDENT REFLECTION:** This can be provided to students to empower them to self-assess learning before turning in the rubric and completed work. The general Student Reflection sheet can be found at the end of this educator guide.

NAME: _____ **DATE:** _____ **CLASS PERIOD:** _____

INFOGRAPHIC DESIGN

Your Task: Create an infographic communicating one of the three key benefits of biotechnology.

Our key message is:

_____ Biotechnology is being used to improve nutrition, enhance food safety and quality.

_____ Biotechnology supports the social, economic and environmental sustainability of agriculture.

_____ Biotechnology has a role to play in ensuring that safe and abundant food can be produced on existing farmland to meet the increasing needs of the world's growing population.

What makes a great infographic? Create a checklist below based on the ideas your class discusses.

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

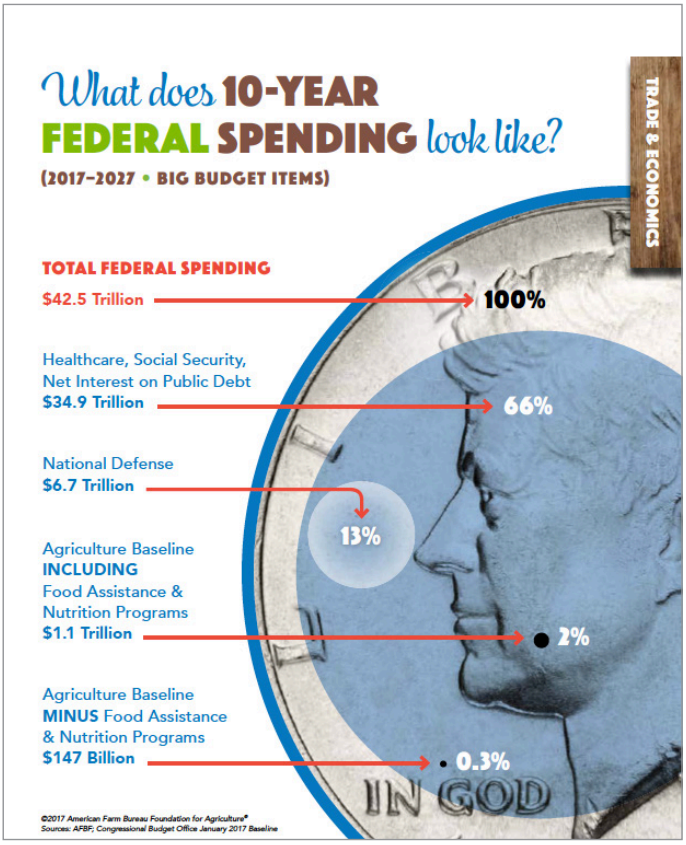
What is the need (assumption) behind your key message?

What does research say about your key message?

GRADING RUBRIC – FOR TEACHER		
Factual information is presented in the infographic. Score _____/_____	The infographic focuses on the selected key message. Score _____/_____	The infographic follows the student-driven checklist "What makes a great infographic?" established by the class. Score _____/_____

NAME: _____ DATE: _____ CLASS PERIOD: _____

INFOGRAPHIC SAMPLES



This sample infographic from Food and Farm Facts, by the American Farm Bureau, shows a single image with supporting text to convey a message.

This sample infographic from Food and Farm Facts, by the American Farm Bureau, shows multiple images with supporting text to convey a message.

NAME: _____ **DATE:** _____ **CLASS PERIOD:** _____

Pre/Post Learning Assessment

1. What is plant biotechnology?

2. What are some specific ways biotechnology can improve food nutrition, food safety and food quality?

3. What are some specific ways biotechnology can support social, economic and environmental sustainability?

4. What are some specific ways biotechnology helps to meet the increasing needs of the world's growing population?

5 LESSON HANDOUT
Bringing Biotechnology to Life · Educator's Guide

NAME: _____ DATE: _____ CLASS PERIOD: _____

Pre/Post Learning Assessment

1. What is plant biotechnology?

2. What are some specific ways biotechnology can improve food nutrition, food safety and food quality?

3. What are some specific ways biotechnology can support social, economic and environmental sustainability?

4. What are some specific ways biotechnology helps to meet the increasing needs of the world's growing population?

NAME: _____ **DATE:** _____ **CLASS PERIOD:** _____

RUBRIC

		ADVANCED	PROFICIENT	NOVICE
DISCIPLINARY CORE IDEAS	Inheritance of Traits	The student can explain the key issues that were focused on during the infographic design challenge and identify specific inherited traits of an organism that will assist with the key issues.	The student can explain the key issue that was focused on during the infographic design challenge and identify specific inherited traits of an organism that will assist with the key issue.	The student can identify specific inherited traits of an organism that connects to data on the infographic but does not explain how it will assist with the key issue.
PRACTICES	Engaging in an Argument From Evidence	The student can use information from the infographic design challenge to effectively convey the benefits of the use of biotechnology in ALL of the key areas: in food nutrition, safety and quality; how it supports social, economic and environmental sustainability; how it meets the needs of world's growing population.	The student can use information from the infographic design challenge to effectively convey the benefits of the use of biotechnology in one of the key areas: in food nutrition, safety and quality; how it supports social, economic and environmental sustainability; how it meets the needs of world's growing population.	The student uses information from the infographic design challenge to convey benefits of the use of biotechnology without identifying specific key areas that were assigned.
CROSS-CUTTING CONCEPTS	Cause and Effect	Student can explain specific ways biotechnology is utilized to benefit food nutrition, safety and quality. Also, how it supports social, economic and environmental sustainability to meet the needs of world's growing population. The student can also answer tough questions about the use of GMOs.	Student can explain specific ways biotechnology is utilized to benefit food nutrition, safety and quality. Also, how it supports social, economic and environmental sustainability to meet the needs of world's growing population.	Student can explain specific ways biotechnology is utilized to benefit food.