



Bring Closure - How do I conclude the lesson?

Review Activity: Headliners

1. Ask students to imagine that they work for a newspaper and that their job is to generate newspaper headlines for each breaking story.
2. Have students identify the two most interesting pieces of information from this lesson.
3. Direct each student to think of a headline for each of the pieces of information they just identified. If time permits, have students write the titles using large print on the back of a piece of scratch paper and hold them up for the class to see.
4. Share a few headlines aloud.
5. Relate the headline concept to possible headlines in the future of GMOs. Make the point that innovative research is happening daily and that advances in technology occur on a regular basis.
6. Thank students for their participation and thoughts.



Assess Learning - How do I assess student learning in the lesson?

Assessment Questions

1. List three existing biotechnology traits that are widely used in agriculture.
2. List five benefits to using biotechnology traits.

Answers

1. Answers will vary. Use the table provided in the lesson plan to check student responses.
2. Answers will vary. Use the table provided in the lesson plan to check student responses.

Lesson 1:

The Benefits of Biotechnology



Lesson Vitals - What must I know to facilitate this lesson?

Objectives

Students will be able to:

- List four trait benefits currently available from plant biotechnology.
- Identify the impacts of plant biotechnology since its inception in 1995.

Lesson Snapshot

Interest Approach: GMOs in the Grocery Store Activity	5 min
Activity: Biotechnology's Impact by the Numbers	15 min
Teacher-Led Discussion: Major Traits	20 min
Review Activity: Headliners	5 min
Total Time:	45 minutes



Materials Used - What do I need to complete this lesson?

- *Activity Sheet 1 - Percentage Signs* (1 set of 10 per class)
- *Activity Sheet 2 - Biotech Impacts Facts* (1 per student)
- *Activity Sheet 3 - Biotech Impacts Answer Flash Cards* (1 set per class)
- *Activity Sheet 4 - Trait Table* (1 per student)
- *Activity Sheet 5 - Trait Information Cards* (1 set per class)
- *Answer Key for Activity Sheet 2 - Biotech Impacts Facts*

Special Notes about Preparing for the Lesson

- Read and review lesson plans and materials.
- Post *Activity Sheet 1 - Percentage Signs* around the room prior to students' arrival.
- Make copies of activity sheets. **IMPORTANT!** Print *Activity Sheet 3 - Biotech Impacts Answer Flash Cards* so that it is double-sided. You'll know it has printed correctly if "Reliably documented human or animal safety issues" matches up (front-to-back) with "0."
- Cut *Activity Sheet 3 - Biotech Impacts Answer Flash Cards* apart.
- Cut *Activity Sheet 5 - Trait Information Cards* apart.



Entry Points - How do I prime my students for learning today?

Interest Approach: GMOs in the Grocery Store Activity

1. Write the following question on the board:
What percentage of food in the average grocery store contains products with Genetically Modified Organisms (GMOs)?
2. Notice the signs around the room.
3. Stand under the sign you believe best answers the question posted.
4. Remove five of the incorrect options and ask students standing under those signs to choose a new number.
5. Repeat step 4, as needed (removing more or fewer options as time allows).
6. End the activity with all students standing under the correct option (72%).
7. Make the point and transition to the core instruction:



Entry Points - (cont'd)

Interest Approach (cont'd)

Who can describe what this means to us in your own words?

Listen for the following: Most of, more than half of, or almost three-quarters of the food available in the grocery store contains GMOs.

Seventy-two is just our first number for the day. If your guessing skills were a little off on this one, you'll have another opportunity in just a moment.

Lesson Objectives Preview

Post the lesson objectives on a writing surface:

- List four trait benefits currently available from plant biotechnology.
- Identify the impacts of plant biotechnology since its inception in 1995.



Core Instruction - How do I facilitate instruction on the core topics?

Activity: Biotechnology's Impact by the Numbers

Activity Directions

Distribute *Activity Sheet 2 - Biotech Impacts Fact Sheet* to students.

Give directions to begin the activity:

1. Take a look at *Activity Sheet 2 - Biotech Impacts Facts*. Notice the column with numbers on the left-hand side.
2. Match each number on the left to the best-fitting statement on the right. When you have a match, write the letter representing the statement in the open box next to the number. (Provide an example, if necessary.)
3. You'll have three minutes to give it your best thought.

Complete Activity

1. Hand out one answer flash card (from *Activity Sheet 3 - Biotech Impacts Answer Flash Cards*) to each student.
2. Have each student share the number on one side of the card and the corresponding statement (biotechnology impact) on the opposite side of the card. (i.e., "1 trillion represents the estimated number of meals consumed as of 2007 containing biotech products," or "1 trillion = G")
3. Ask students to correct their answers on *Activity Sheet 2 - Biotech Impacts Facts* as their peers share.

Debrief Activity

Use the following sample questions to debrief the experience with your students.

- How many items did you have correct? Which items were they?
- Which answers surprised you?
- Which of the items would you like to know more about?

Teacher-Led Discussion: Major Traits

1. Set context for the discussion by sharing that students will have a better understanding of the science behind biotechnology crops by knowing from where the foreign traits come.
2. Sketch the outline of the table shown on the right on the board or overhead. (Students will eventually fill this in.)
3. Hand out *Activity Sheet 4 - Trait Table*. (Students will use this sheet to take notes.)
4. Break students into six groups (one for each plant on the chart). Use 12 groups if it is a large class.
5. Distribute one of the six cards from *Activity Sheet 5 - Trait Information Cards* to each of the groups.

6. Share that groups will have three minutes to read the card aloud within their group and elect a spokesperson to fill in the corresponding row on the table at the front of the room.
7. After students work, review the table at the front of the room to ensure it is complete and accurate. If time permits, allow group representatives to verbally highlight their information for the class. (A completed chart is shown below.)
8. Allow students time to capture notes.
9. Wrap up any discussion.

Plant	Trait	From where did the trait come?	Advantages	Disadvantages
Corn	Bt corn	Bacteria	Eliminates the need for many pesticides that would otherwise have to be sprayed on to protect corn from pests. This is safer for the environment and the farmer. It is also cost-effective. Higher yields	Export limitations Expensive seed Must plant refuge
Soybeans	Low linolenic acid ("Vistive")	Agrobacterium	Produces soybeans with less linolenic acid, which allows processors to make trans fat-free oil (a healthier product).	Export limitations
Potatoes	Cold tolerance gene	Cold water fish	Acts as an antifreeze to keep seedlings from dying due to frost that would normally kill them. Higher yields	Export limitations
Rice	High beta-carotene ("Golden Rice")	Daffodil and soil bacteria	Offers wide availability to suffering nations and could prevent vitamin A deficiencies and blindness in children.	Consumer group concerns over safety
Cotton	Roundup® Ready (also found in soybeans, sugar beets, corn and alfalfa)	Bacteria	Allows for weed control by spraying herbicides over the entire crop without damaging the crop, itself. Saves time and money Higher yields	Export limitations Possible resistance
Tomatoes	High lycopene	Yeast	Redder in color High in antioxidants	Export limitations (The first genetically modified tomatoes contained genes for antibiotic resistance that could be spread to other organisms, but this is no longer the case and is not a problem today.)