



The Pros and Cons of Biotechnology

Middle School Food and Agricultural Literacy Curriculum

Precepts

- G. Physical Growth
 - G1. Practice healthy eating habits
 - G3. Participate in a fitness program
 - G4. Set goals for long-term health

National Standards

- BS.01.01.02.a. Investigate current applications of biotechnology in agriculture.
- NL-ENG.K-12.12 – Applying Language Skills
- NS.5-8.3 – Life Science
- NS.5-8.5 – Science and Technology
- NS.5-8.6 – Science in Personal and Social Perspectives
- NT.K-12.2 – Social, Ethical, and Human Issues

Student Learning Objectives

- As a result of this **unit** the students will...
- Discuss concepts and issues related to biotechnology
- As a result of this **lesson** students will...
- Discuss the influence of biotechnology on agriculture.

Content Outline

- I. **Discuss the influence of biotechnology on agriculture.**
 - A. Advantages:
 - 1. Reduces the use of pesticides on our crops.
 - 2. Crops that are able to grow in salty soils or in drought conditions.
 - 3. Using gene therapy we can treat and cure genetic diseases that were once thought to be incurable.
 - 4. Farmers are able to make more money because crops are higher quality and in some cases, their crops are increasing in yield.
 - 5. Increases the shelf-life of our food.

Time

Instruction time for this lesson: 45 minutes.

Resources

Frequently Asked Questions about Biotechnology. (2008). Retrieved August, 09, 2009, from United State Department of Agriculture: Official Web site: <http://www.usda.gov/wps/portal?navid=BIOTECH> — Herren, Ray. (2005). Introduction to agriculture: an agriculture revolution. Clifton Park, New York: Delmar Learning. — National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 9, 2009, from <http://agedlearning.org> — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success.

Tools, Equipment, and Supplies

Writing Surface
Large Sheets of Paper – one per group of 3-4
Markers
Scissors – one per every 2-3 students
Glue sticks or tape – one per every 2-3 students
Note card – one per student
MS.AST.3.2.AS.A– one teacher copy, cut apart
MS.AST.3.2.AS.B – one per student
MS.AST.3.2.AS.C – one per student
MS.AST.3.2.ASSESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in **bold italics**:

Biotechnology

- B. Disadvantages:
 - 1. Concerns over transgenic organisms that may insert a plant gene into an animal gene or vice versa.
 - 2. Could cause allergic reactions with people who suffer from some type of food allergy.
 - 3. Long-term effects of some biotech products are not yet known.
 - 4. A decrease in biodiversity, or number and variety of organisms.
 - 5. A crop that is herbicide resistant may transfer some of its traits to a weed. Then this superweed could not be killed by herbicides.



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Interest Approach

Assign students to groups of three to four. Give each group a large piece of paper and instruct the students to draw everything that makes their life good. If they have difficulties thinking of things, give them some suggestions such as fast food, grocery stores, automobiles, Internet, phones, etc.

You know what I just realized today? Life is good! There are so many things that make our lives fantastic. Really, just think about it for a second. We get to take hot showers in the morning; we don't have to go out and kill a chicken to eat it. Instead we can just go to KFC and order a whole bucket of it. Shoot, we even have cell phones and iPods that can connect us to the Internet anywhere we go. Life is good! Let's find out what exactly makes your lives good.

When you hear the phrase, LIFE IS GOOD, we will do two things. How many? Two! Number one: send one person from your table group to the front to gather a big poster paper and markers. Two: as a group, create a poster that represents all things that make your life great by drawing pictures of these things on your poster. Questions? LIFE IS GOOD!

Allow students approximately five minutes to create their poster. Give them time checkpoints to keep them on task. At the end of five minutes allow them to share their posters with the class.

Another reason life is good is because we have some amazing poster-makers in this room! Let's take a look at some of the posters we made. Who will give us a quick 30-second run-down of their group's poster?

After groups have finished sharing, lead them in a short discussion on why these things make our lives good. Then further students' thinking by asking if these things also have a negative effect on their lives.

Why do these things make our life good?

Anticipated responses: the convenience, makes things easy, keep us healthy, don't have to worry about killing our food to get a meal, etc.

While we are on the topic of what makes life good, let's talk about some things that we can do right now that will help make sure our bodies are around for a long time to enjoy these things.

Think to yourself, what are some things that you currently do to help your body stay healthy? Go ahead and share that thought with a partner at your table. What were some things that you heard?

Allow students to share responses. Answers will vary: Eat vegetables and fruit, stay away from drugs and alcohol, playing sports, exercising, etc.

Next, think of one thing you could do this week to help make your body healthy. Write this goal on a piece of paper.

So what I'm hearing is that these things make life easier and more enjoyable for us. What about the other side of things? How can the very things that make our life good also have drawbacks?

Listen for: these things could make us lazy, we might not spend as much family time because we are always doing something with technology, we could eat unhealthy, etc. There is no right or wrong answer, just so they understand there is a pro and con to everything.

I wonder if we can apply this same concept to **biotechnology**. **Biotechnology** certainly has some great benefits to all of us. Just like how all those things that make our lives good have benefits. Today, we will not only take a look at how **biotechnology** influences agriculture positively but also how it could influence agriculture negatively.

Summary of Content and Teaching Strategies

Objective 1. Identify the influence of biotechnology on agriculture.

Before doing this activity have items from **MS.AST.3.2.AS.A** cut out and taped on the board at the front of the room. This will serve as a great modeling strategy to help demonstrate to your students what to do. Pass out **MS.AST.3.2.AS.A** to each student. Instruct them to cut out each square and sort them into two categories.

Hold up the paper you just received! On this paper there are many advantages and disadvantages to **biotechnology**. When you hear **DIVIDE**, take three minutes to cut out all of these squares and sort them into two categories.



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The first category is advantages and the second category is disadvantages. What do we do first? Second? DIVIDE!

Give the students reminders to make sure they are staying on task. Help anyone who may need it. At the end of three minutes, ask for volunteers to help sort out the teacher set of squares at the front of the room. This provides students the opportunity to correct any they may have wrong. This is another opportunity to elaborate on the statements made on the paper to make sure students understand what they mean.

Excellent! Looks like everyone has succeeded in organizing their boxes into two categories of either advantages or disadvantages of **biotechnology**. Let's see how we did. Who will volunteer to come to the front to organize this list?

Here are the correct answers to the biotechnology sort:
Advantages:

- Reduces the use of pesticides on our crops
- Crops that are able to grow in salty soils or in drought conditions
- Using gene therapy we can treat and cure genetic diseases that were once thought to be incurable.
- Farmers are able to make more money because crops are higher quality and in some cases, their crops are increasing in yield.
- Increases the shelf-life of our food

Disadvantages:

- Concerns over transgenic organisms that may insert a plant gene into an animal gene or vice versa.
- Could cause allergic reactions with people who suffer from some type of food allergy.
- Long-term effects of some biotech products are not yet known.
- A decrease in biodiversity, or number and variety of organisms.
- A crop that is herbicide resistant may transfer some of its traits to a weed. Then this superweed could not be killed by herbicides.

Next students will be pasting their squares to **MS.AST.3.2.AS.B** and **MS.AST.3.2.AS.C**. They will paste or tape their advantages and disadvantages in the first column on either sheet. Then students will be using the *Hieroglyphic e-Moment®* to draw a picture or icon that will help them remember that sentence.

Now that we have our list sorted, we are going to take our five advantages and our five disadvantages and paste them to these papers. Take a look at the top of your sheet to make sure to paste the advantages to the sheet that says advantages of **biotechnology** and the disadvantages to the sheet that says disadvantages of **biotechnology**.

Give students about five to seven minutes to get everything glued or taped to their two worksheets. Begin instructions for the next part when most students are finished. It is also suggested to have an example of an icon that you created at the front of the room.

Let's take a time-out from gluing! Put down those glue sticks and tune in for an update. As soon as we finish gluing, we have a new task. In the second column in your worksheet we will be creating an icon that helps us remember that advantage or disadvantage. When we are finished we will each have five icons on each page. Take a look at this icon that I created.

To help move students along that struggle with drawing, have volunteers draw their icon on the board as the class works.

Review/Summary

Have students complete a ticket-out-the-door activity. On a note card have them state whether or not they are for or against biotechnology. Have them write out three responses explaining their position.

Let's review where we have been today! We started out talking about all the things that make life great. Then we took a look at **biotechnology** and its pros and cons. After looking at the pros and cons let's see what we all think. On this note card we will write four things. How many? Four – right. The first thing is whether or not you think we should use **biotechnology**. Write that now.

Next, write out three reasons to support your answer. If you need to use your worksheets that we completed in class today that is completely okay. This will be our ticket-out-the-door for today.

If time allows you could ask for a few students to share what they wrote on their note cards.



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Application

Extended classroom activity:

Students could create Wanted posters to hang on the wall. They could center them on a certain part of biotechnology, such as plants, animals, environment, or medicine. Allow them to research on the Internet advantages and disadvantages of each area and then transfer that information to a Wanted poster. Use key Wanted poster phrases such as: last seen, wanted for, likely hangouts, nicknames, etc.

FFA activity:

Visit a business in your area that conducts research in the areas of plant or animal biotechnology.

SAE activity:

Have a student or group of students start a cheese-making business as their SAE.

Evaluation

MS.AST.3.2.ASSESS.A

Answers to Evaluation

1. B
2. A
3. A
4. B
5. A
6. B



Reduces the use of pesticides on our crops	Farmers are able to make more money because crops are higher quality and in some cases, their crops are increasing in yield.
Crops that are able to grow in salty soils or in drought conditions	Using gene therapy we can treat and cure genetic diseases that were once thought to be incurable.
Increases the shelf-life of our food	Concerns over transgenic organisms that may insert a plant gene into an animal gene or vice versa.
Could cause allergic reactions with people who suffer from some type of food allergy.	Long-term effects of some biotech products are not yet known.
A decrease in biodiversity, or number and variety of organisms.	A crop that is herbicide resistant may transfer some of its traits to a weed. Then this superweed could not be killed by herbicides.



Advantages of Biotechnology

Glue/Tape sentences here.

Draw an icon here.



Disadvantages of Biotechnology

Glue/Tape sentences here.

Draw an icon here.



Name _____

Directions: Mark each statement as either an advantages or a disadvantage of biotechnology.

A. Advantage	B. Disadvantage
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- _____ 1. Could cause allergic reactions with people who suffer from some type of food allergy?
- _____ 2. Reduces the use of pesticides on our crops.
- _____ 3. Using gene therapy we can treat and cure genetic diseases that were once thought to be incurable.
- _____ 4. Long-term effects of some biotech products are not yet known.
- _____ 5. Increases the shelf-life of our food.
- _____ 6. A decrease in biodiversity, or number and variety of organisms.