



Franken Foods? – Genetically Modified Crops

Middle School Food and Agricultural Literacy Curriculum

Precepts

- N. Decision Making
- N3. Make ethical decisions

National Standards

- PS.03.01.05.c. Evaluate the performance of genetically modified crops.
- BS.01.01.02.a. Investigate current applications of biotechnology in agriculture.
- CS.03.02.01.c. Make decisions for a given situation by applying the decision-making process.
- NL-ENG.K-12.12 – Applying Language Skills
- NS.5-8.3 – Life Science
- NS.5-8.5 – Science and Technology

Student Learning Objectives

- As a result of this **unit** the students will...
- Discuss technologies and methods related to plant production.
- As a result of this **lesson** the students will ...
- Explain major concepts behind Genetically Modified Organisms (GMO's)

Content Outline

Objective 1. Explain major concepts behind Genetically Modified Organisms (GMO's)

- A. What are **GMO's**
 - 1. **Genetically Modified Organisms**
 - 2. A **genetically modified organism (GMO)** or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques.
- B. How do you genetically modify an organism?
 - 1. Find a **trait** in an organism you want.
 - 2. Remove a piece of **DNA** that causes that **trait**.
 - 3. Put the **DNA** into a **bacterium**.

Time

Instruction time for this lesson: 45 minutes.

Resources

Krock, L. (2001). Guess What's Coming To Dinner? Retrieved September 27, 2009. From PBS Online. http://www.pbs.org/wgbh/harvest/coming/coming_lo.html — National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 9, 2009, from — <http://agedlearning.org>

Tools, Equipment, and Supplies

Overhead projector/transparencies
Writing Surface
Molding clay (four different colors for each group – four students per group)
MS.PS.5.2.TM.A – one per teacher
MS.PS.5.2.TM.B – one per teacher
MS.PS.5.2.ASSESS.A – one per student

Key Terms

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

Genetically Modified Organism (GMO)

Gene

Trait

DNA

Bacterium

- 4. Let the **bacteria** inject the **trait** (piece of **DNA**) into the organism you're modifying.
- 5. Grow the new organism.
- 6. Select the organisms that have the **trait** you were trying to add.

Interest Approach

Welcome back to class!

Today we are going to talk about a really cool subject that is also somewhat controversial. I have a few questions for you.

Do you think it is possible to create a fish that can glow when the lights are off?

Elicit responses from students.

You can have a picture of an actual GloFish if you would like to make the point. They can be found on the Internet through a simple image search.



Actually there is a fish called a GloFish that glows when under different colors of light. How do you think a fish like that could have been created?

Elicit Responses.

Those are interesting thoughts! So how did they do it? A scientist found some coral at the bottom of the ocean that glows in the dark. They were able to take some of the **DNA** from that coral and put it into the fish's **DNA**. As the fish developed, the **DNA** from the coral caused the fish to glow. This process is called genetic engineering and the fish is called a **Genetically Modified Organism or GMO**. Basically scientists can take any **trait** from one organism and put it into another organism.

Making fish glow is cool, but what if we could do things to help people across the globe with this technology? Right now, many organisms have been genetically engineered to help people. For example: There are bananas that provide valuable medicines to people who need them. Farmers grow corn that tastes bad to bugs so they don't destroy their crops. In other countries, they are growing rice that has important nutrients to help people live, and just for fun, they have also created cats that can glow.

GMO's are changing how we produce food. Many people think it is a great way to help people around the world and better our food supply. Others are worried that we don't know what kind of effect it will have on the environment in the long run. It is important for you to understand how this process works so you can make an informed decision.

Turn to your neighbor and give them the best "I'm a really smart scientist" look, because we're headed for some high-tech science talk.

By the end of today, you will know what a **GMO** is and how you transfer **DNA** from one organism to another.

Lesson Number: MS.PS.5.2

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Summary of Content and Teaching Strategies

Objective 1. Explain major concepts behind **Genetically Modified Organisms (GMO's)**

What exactly is a **Genetically Modified Organism** or **GMO**?

Utilize **MS.PS.5.2.TM.A** as an overview of content.

Chances are you have heard about **GMO's** before. What exactly are they? The formal definition is: A **genetically modified organism (GMO)** or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques.

So basically anything that has had its genetics changed through genetic engineering is a **GMO**.

Is this the first time we have ever tried to work with genetics to make things better?

Elicit responses. You may push students toward the selection of desirable traits in plants and animals.

We've worked to improve animals and plants for a very long time using a process called selective breeding. Selective breeding involves choosing animals or plants that we like and breeding them to produce more organisms like the ones we like. So how is this different from creating **GMO's**? Who has an idea?

Elicit Responses.

The difference is that selective breeding happens naturally and Genetic Modification happens in a lab and involves the sharing of **DNA** that would not occur naturally. An example is the **DNA** of ocean coral being placed into the **DNA** of a fish.

Now that we know what a **GMO** is, let's look at how a scientist does this in a lab. Prepare yourself – it is pretty cool.

Utilize **MS.PS.5.2.TM.B** as an overview of content.



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In order to fully understand this **DNA** magic trick, we're going to break into groups and go through each step. When I say **GMO**, you will pull your desks together and gather near four of your classmates that are closest to you. Send the shortest member of your group to get your set of three Molding clay jars. Don't open them yet. Once you have those, wait for further instructions. **GMO!**

Help students break into groups. Make sure students remember to not open their jars yet. Ensure each group gets three jars of different-colored Molding clay.

Great! Now we're ready to do some genetic modification! We are going to use the example of corn that bugs don't like. This corn is called Bt Corn. Bt stands for *Bacillus thuringiensis*, which is a small **bacterium** that lives in the soil and produces the taste bugs don't like. By inserting the **DNA** of this **bacterium** into the **DNA** of corn, you can create corn that bugs don't like to eat. How in the world do they do this?

DNA is a really amazing part of any living thing. It is a double helix that looks like this.

Show an example of a double helix you have created with your own molding clay.

DNA is what holds the blueprint or code for any organism. It's what makes your hair brown, a fish glow, or corn taste bad to bugs. In order to modify our corn, we need **DNA** from the corn and **DNA** from the **bacterium**. Create two **DNA** strands out of different colored molding clay and wait for further instructions.

Monitor students' work and make sure they are on track. As you go through this activity, create your own example that students can follow.

Great! Now you have Corn **DNA** and **Bacterium DNA**. This is where it gets fun. The first thing that happens is scientists take a small piece of the **bacterium DNA** from the **DNA** strand. At your table, take a small piece of the **bacterium DNA**.

Check that students follow the process.

Now you have the **gene** that you need, but how does it get into the corn's **DNA**? Well, we need **bacteria** to help us with that.

Take the third color of molding clay and make a large circle. That circle is living **bacteria**, which is really good at getting into the corn's **DNA** and changing it. Place the piece of **DNA** into the **bacteria**.

Demonstrate.

Next we let the **bacteria** grow and then place it with the corn. Move the **bacteria** with the **DNA** piece to the corn **DNA**. The **bacteria** makes its way into the cells of the corn, takes out a piece of corn **DNA** and replaces it with the **bacterium DNA** that bugs don't like. Take a piece of the corn **DNA** out and replace it with the **bacteria DNA**. You have **genetically modified** the corn!

The final step is to grow that corn. Bugs will still eat some of the new plants but not the ones that got the new **DNA** from the **bacterium**. The scientist can take those plants and use them to produce a crop that bugs won't destroy.

As any great scientist does, put all your supplies back into their color containers, and put your tables back as they were before. When you are finished, look at me so I know we're ready to finish up.

Review/Summary

GMO's have the potential to really help our country and our entire world. However, we also have to be careful not to do damage to our ecosystems that can't be reversed. It is important to know that **GMO's** are what it takes to genetically modify a plant or animal.

Utilize the Picasso e-Moment®.

Now that we have studied **GMO's**, each of us has an idea of what that means. For the next five minutes, create a drawing that represents what **GMO's** are to you. Include as much detail as you can and be prepared to share your picture with your peers. Begin!

Check students' pictures and provide feedback as they draw.

Who will share first?

Allow as many students to share as time allows.



After today, when you hear about **GMO's** in the news or see a **GMO** free label in the store, you will know exactly what that means.

Application

Extended classroom activity:

To extend this lesson, you could have students visit <http://www.pbs.org/now/classroom/geneteachers.pdf> and discuss the pros and cons of genetic engineering. Students could then develop personal statements in regards to **GMO's**. You could also purchase the PBS video "Harvest of Fear" and utilize the accompanying website to expand students' study of the topic. (<http://www.pbs.org/wgbh/harvest/>) There is also a great interactive simulation of the **GMO** process at: <http://www.pbs.org/wgbh/harvest/engineer/>

FFA activity:

GMO's are a highly debated agricultural issue, which would be an excellent platform to develop an agricultural issue team presentation around the **GMO** issue.

SAE activity:

Students who work with various genetically engineered crops could bring in samples for the class to see. Students also could find some type of **genetically modified organism** that relates to their SAE. Finally, each student could create a potential **GMO** that would be of benefit to his or her specific SAE.

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Evaluation

MS.PS.5.2.ASSESS.A

Answers to Evaluation

1. C
2. D
3. Find a trait in an organism you want.
Remove a piece of DNA that causes that trait.
Put the DNA into a bacterium.
Let the bacteria inject the trait (piece of DNA) into the organism you're modifying.
Grow the new organism.
Select the organisms that have the trait you were trying to add.
4. Answers will vary. Look for specific examples from the lesson as evidence of their answer.



What are GMO's?

- **Genetically Modified Organisms**
- **A genetically modified organism (GMO) or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques.**



How do you genetically modify an organism?

1. Find a trait in an organism you want.
2. Remove a piece of DNA that causes that trait.
3. Put the DNA into a bacterium.
4. Let the bacteria inject the trait (piece of DNA) into the organism you're modifying.
5. Grow the new organism.
6. Select the organisms that have the trait you were trying to add.



Name: _____

Multiple choice

1. What does GMO stand for?
 - a. Genetically Made Organism
 - b. Genes Moved Over
 - c. Genetically Modified Organisms
 - d. Genetic Manipulation Organization
2. What is the different between genetic modification and selective breeding?
 - a. Genetic Modification is only in animals.
 - b. Selective Breeding is only in animals.
 - c. Selective Breeding happens in a lab and not in nature.
 - d. Genetic Modification happens in a lab and not in nature.

Short Answer

3. List the 6 steps of creating a GMO

4. Would you eat food that had been genetically modified? Explain why or why not.
