

Biotechnology: Designer Genes for Familiar Foods - Teacher Guide

Lesson Objectives:

- Become aware of foods that are produced using biotechnology
- Be able to identify pros and cons of food biotechnology
- Become aware of agencies that safeguard foods produced using this technology
- Become informed about biotechnology legislation in Oregon

Materials for Teachers:

- Biotechnology: Designer Genes for Familiar Foods” videotape (12 minutes)

Materials for Participants:

- HE 3-908 Participant Handout
- HE 3-909 Evaluation

Before the Lesson:

- Arrange a meeting site with a videocassette player and TV monitor.
- Determine whether you’ll be able to include all parts of the lesson in the time available for the lesson. The following time frame is suggested:

5 to10 minutes	Introduction and taking the quiz
12 minutes	Videotape
10 to 15 minutes	Quiz answers
20 to 30 minutes	Biotechnology hearing
5 minutes	Biotechnology and public policy
5 minutes	Evaluation

You’ll need to include all parts of the lesson to achieve all of its objectives. About 1½ hours would be needed. If less time is available, consider one of these options:

- a) Skip the videotape. (However, it includes the only explanation of how biotechnology is done.)
- b) Skip the hearing if there isn’t adequate time to both hear the testimonies and to discuss them. Instead read the list of pros and cons. (The hearing is a great chance to hear differing points of view, however.)

- Prepare the hearing activity by cutting testimonies into strips for volunteers to read.

After the Lesson:

Ask participants to complete the lesson evaluation. Collect and return these to the county Extension office.

Introduction

Biotechnology is the use of living organisms to make or modify products such as foods. This is often done by changing the genes. Genes make up the blueprint that determines the traits of a plant or animal.

Genes have been modified in foods for more than a century. This conventional cross-breeding has given us broccoflower (offspring of broccoli and cauliflower), the plumcot (a cross between a plum and an apricot), and the tangelo (a cross of a tangerine and grapefruit). There are many other examples of modifications made through traditional methods. For example, tomatoes have been improved over the years by cross-breeding.

Conventional crossbreeding results in the random combinations of thousands of genes from each parent. Through genetic engineering, it's now possible to modify individual genes or to transfer genes from one type of organism to another. This is faster as well as more precise and more reliable than classical techniques. The product that results sometimes is called genetically modified or genetically modified organisms (GMO). They are also called genetically engineered.

Genetic engineering (GE) is said to have had the most rapid acceptance of any agricultural technology since the tractor. Genetically engineered foods did not appear in markets until the mid-1990s. Now, they're commonplace.

Teaching instructions are italicized.

Bold type gives key points to share with participants.

Read the introduction aloud.

Biotechnology is the modification of genes that determine the traits of a plant or animal.

Conventional cross-breeding has given us plants with new traits.

Genetic engineering makes it possible to modify individual genes. This creates genetically modified organisms.

Genetically engineered crops have been widely adopted.

Activity: Ask participants to take the biotechnology quiz in the hand out.

Show the "Designer Genes" videotape (12 minutes)

Quiz Answers:

1. True. Over 70 percent of U.S. soybeans and over 30 percent of corn are genetically modified. These foods are included in many processed products. Few genetically engineered fresh foods are currently available in stores. For example, sweet corn is not, but some papayas are.

2 True. Genetically engineered crops are regulated at every stage of development from research planning through field testing, food and environmental safety evaluations, and international marketing. The **U.S. Food and Drug Administration** (FDA) is responsible for safety and labeling of all foods including plants produced by biotechnology. The **U.S. Environmental Protection Agency** (EPA) regulates genetically engineered crops that produce pesticides. The **U.S. Department of Agriculture** (USDA) oversees agricultural safety of planting and field testing genetically engineered plants

3. True. However, if a bioengineered food is significantly different from its conventional counterpart, FDA requires labeling that indicates that difference. For example, if the nutritional value changes or if food allergies are caused, labeling would be required. Otherwise labeling is voluntary.

4. True. Starlink corn had not yet been approved for human consumption. It was inadvertently mixed with corn intended for animal consumption. Tortilla products were recalled from the market because of a concern about potential allergic reactions from the untested corn. Tests completed since then have demonstrated that Starlink corn does not cause allergic reactions.

5. False. A 1999 lab experiment suggested that a heavy dose of pollen from **Bt** corn (which contains an insecticidal protein from the *Bacillus thuringiensis* bacteria) could kill caterpillars that develop into Monarch butterflies. Since then field studies have shown that the effect of the pollen from commercial hybrids is negligible because toxicity and exposure of caterpillars is low. (Note: Conventional insecticides would kill all kinds of insects.)

6. True. New National Organic Program regulations prohibit use of genetically modified products in foods certified as “organic.” After October 2002, products can be labeled “organic” only if they comply with the new standards.

7. Fish is the only food item listed that isn’t a potential source of genetically modified components at this time.

*Read answers to the quiz.
Refer participants to their
handout.*

*Refer to “Food Products
Likely to Contain Ingredients
from GE Plants” and the first
three questions on pages 2 and
3 of the participant
handout.*

*Refer to 5th question on
participant handout “How are
genetically modified foods
regulated?”*

*Refer to 6th question on
participant handout “Why
aren’t genetically engineered
foods labeled?”*

*Refer to 4th question on
participant handout “Are
genetically modified foods safe
to eat?”*

*Refer to 2nd question on
participant handout “Why are
we using biotechnology in our
food supply?”*

*Refer to 7th question in
participant handout “What if I
don’t want to eat GE foods?”*

*Refer to table in participant
handout “Food Products
Likely to Contain Ingredients
from GE Plants.”*

Congressional Hearing

Hearings are an opportunity for legislators to learn a variety of viewpoints. They then use this information to take legislative action.

In this scenario, participants (legislators) are considering whether to require labeling on genetically modified processed food that is distributed nationwide. They will need to decide whether there is justification to single out foods with GMO components by labeling.

The six testimonies offer differing perceptions about the pros and cons of foods produced using biotechnology.

Group Discussion

•What are some of the pros identified in the testimonies? What are some of the cons?

Some potential pros:

- Crops can be made herbicide tolerant or virus resistant. That can reduce the use of pesticides which can help to protect the environment.
- Crop yields can be increased, providing more food for the world.
- The nutritional value of crops can be enhanced.

Some potential cons:

- Some people might have allergic reactions.
- There might be environmental impacts. So-called “super weeds” resistant to herbicides might be created. There might be harm to insects or birds.
- There might be a decrease in biodiversity if wild species are lost through inter-breeding.
- A few large corporations might control genetic diversity.

•Were they skeptical about any of the opinions offered?

Not everyone’s opinions are based on facts supported by research. It’s important to be aware of research findings as they evolve. For example, further research refuted the initial concern about potential impact of GMO corn pollen on Monarch butterflies.

Hearings are an opportunity for legislators to learn a variety of viewpoints before taking legislative action.

Activity: Conduct a hearing about labeling of genetically modified foods.

Explain the scenario.

Ask for volunteers to read each of the testimonies.

Ask listeners to list pros and cons that they hear on the chart in their hand out.

Lead discussion about what the “legislators” have heard.

Set the stage for open-minded debate. Advise participants that everyone has a right to his or her own viewpoints. Set ground rules before you begin: one person talks at a time; everyone listens to other. there are no judgmental comments.

Many pros and cons have been identified. We all make our own judgments about use of biotechnology based on our personal interpretations.

•*Where would you go for further information?*

Web sites of reputable organizations (such as universities) are a good resource. OSU's Program for the Analysis of Biotechnology Issues is a good starting point:
<<http://oregonstate.edu/extension/pabi/>>

•*How would you vote?*

If participants were voting legislators, would they support or reject labeling of genetically modified food? Take a hand count – or a written ballot.

What are some pro-labeling arguments?

- People with allergies would be forewarned.
- People with health, religious or moral concerns about GMO foods could make informed food choices.

What are some anti-labeling arguments?

- Labeling may imply that non-labeled foods are inferior even though they're "substantially equivalent" to their non-GMO counterparts.
- Labeling might increase the cost of food.
- Labeling might be a trade barrier if other countries have different standards.
- State-by-state labeling regulations might impede inter-state commerce.

Many consumers express uncertainty about using biotechnology. For example, 36 percent of Washington state consumers surveyed in 2000 didn't know whether they supported or opposed the use of biotechnology in agriculture and food production. Sixty percent didn't know if any foods produced through biotechnology were in the grocery store currently. So, many consumers are learning about this new technology.

Certain Web sites are a good source of information.

There are arguments both in favor of and against labeling GMO foods.

Many consumers express uncertainty about use of biotechnology in agriculture and food production.

Biotechnology and Public Policy

Biotechnology has become a public policy issue. Many states had legislative activity related to agricultural biotechnology in 2001. In Oregon, the State Legislature defeated a bill urging Congress to require labeling of genetically modified foods and a bill prohibiting release of genetically modified plants into unconfined areas. The Governor signed three bills that make it a crime to destroy crops produced with agricultural biotechnology.

An Oregon ballot measure (Initiative 23) requiring labeling of GM foods has been circulating. If enough signatures are obtained, it will be on the November 2002 ballot. The label requirements would extend to GM foods that pass through the Port of Portland headed for non-Oregon destinations. The majority of foods at the supermarket would require labeling under this initiative. Critics have charged that it's not realistic to require national companies to prepare GM label for just one state. (In fact, some companies might withdraw their products from the Oregon market rather than go to this expense.) Federal legislation is perhaps the best approach for labeling regulation.

Review public policy related to biotechnology in Oregon. (Refer participants to their hand out.)

Biotechnology is a public policy issue in Oregon. The legislature considered biotechnology bills in 2001.

An Oregon initiative requiring labeling of GM foods might be on the November 2002 ballot if enough signatures are obtained.

Developed by Carolyn Raab, Extension foods and nutrition specialist; Patty Case, Extension Family and Community Development educator, Klamath County; Iva Jane Will, Family and Community Education volunteer, Klamath County.

Reviewed by Terri Lomax, Ph.D., O.S.U. Program for the Analysis of Biotechnology Issues



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Testimonies for the Biotechnology Hearing

Consumer

I'm the mother of two young children. I don't want to risk my family's safety on a technology that doesn't benefit me. This stuff can get into our food supply without our even knowing it. I panicked when I heard about the taco shells being recalled. Tests showed that they were made with corn that wasn't approved for humans to eat. You could have an allergic reaction. There's no way to tell which foods are genetically engineered and which aren't. Since organic foods don't use genetic engineering, that may be my only option but I know that will cost a lot more. I don't support having more genetically engineered foods until they're labeled as such. I have a right to information on the products that I buy for my family.

Environmental Activist

As an environmental activist, I'm concerned about the impact of genetically engineered crops on the delicate balance of nature. The gene flow from the pollen of these crops could "pollute" wild plants. In addition, genes that make crops resistant to herbicides might pass into weedy relatives growing nearby and create so-called "super weeds" that we can't get rid of. The pollen from these crops also has the potential to harm wildlife. For example, maize pollen was originally thought to be toxic to Monarch butterfly larvae. What happens when we create tomatoes with a gene from a fish? I don't support the expansion of GE foods. There won't be a way to undo the damage or recall new organisms that have been unleashed.

Organic Farmer

It's been said that the only way to feed our growing population is through genetic engineering. We hear claims that organic farming isn't a viable option at this time. Yet, we already grow enough food to feed everyone; the excess simply isn't distributed where it's needed. Industrial agriculture is actually undermining the resource base—healthy soil, clean water, and diversity of plants and animals. We must live in harmony with our resources. I don't support genetic engineering; it's all about profits for a few agri-chemical conglomerates. If GE continues to expand, a few large companies will own all the seed and others will be fully dependent on them

Social Activist

As a social activist, I worry about the 800 million undernourished people in the world. The New Yorker magazine reported that up to 40 percent of vegetable crops in Asia and Africa either rot in the fields or are lost to pests. If genetically altered crops are grown, there could be less pest damage in areas with famine. That means greater yields and more food for those who need it most. Biotechnology could also give a special nutritional bonus in rice-eating countries. One-third of the world's population relies on rice, but it's a poor source of vitamins. "Golden" rice fortified with carotene could help to prevent vitamin A deficiency which weakens thousands of children worldwide and causes many cases of blindness. I think that we need to explore the potential of biotechnology for feeding the world.

Physician

I was a physician delegate at the December 2000 meeting of the American Medical Association. We adopted a favorable position concerning crops and food produced using biotechnology. This action followed an AMA Council of Scientific Affairs review of numerous reports and journal articles relating to agricultural and food biotechnology. The review found that foods produced through biotechnology are "substantially equivalent to their conventional counterparts" and therefore there is no scientific justification for special labeling. We issued a list of recommendations which include having science-based federal regulation of agricultural biotechnology, continuing research on environmental impacts, and assessing safety of these foods. We also recommend ongoing research and development by government, industry, scientific, and medical communities to increase consumer education and access to unbiased information on agricultural biotechnology.

Scientist

As a scientist, I see a division between what the public is concerned about and what scientists are concerned about. The public, in general, is most concerned about potential food safety issues. The scientific and medical communities, on the other hand, agree that genetic engineering doesn't pose a threat to human health or to the safety of food or feed. I believe that we need to examine each new biotech crop for potential environmental impacts. It's possible that introducing some genes to certain crops may have unintended consequences in specific locations, such as gene flow to wild species. For example, gene flow from GE corn pollen in Mexico could make wild ancestors of corn herbicide resistant to herbicides. This isn't a concern in the U.S. where there aren't any wild ancestors of corn. An interesting aspect of this problem is that herbicide-resistant crops have also been developed through "conventional" plant breeding techniques. While the GMO versions are extensively tested and regulated, the conventional versions aren't regulated currently and can be released into the environment without any testing at all.
