

Should Genetically Modified Foods be Produced and Consumed?

Genetically Modified Foods: The Facts and Debates

By Ryan Charkow, [CBC News](#) Mar 8, 2011

Genetically modified organisms (GMOs) have been the source of much debate regarding their necessity and safety for many years. These organisms, for better or worse, now have a firm place in our food chain, finding their way into upwards of 30,000 different food products.

The first genetically modified food item, a tomato, appeared in the United States in 1994 and in Britain in 1996.

Following subsequent controversy in 1999 surrounding a study indicating genetically modified potatoes could be toxic to rats, many environmental groups began calling for the elimination of all genetically altered foods from store shelves.



A handout photo shows fluorescent green pigs in a Taipei lab in Jan. 2006. ((Reuters/STR New))

What are genetically modified foods?

For thousands of years, farmers have used selective breeding to yield plant crops with particular genetic traits. The process can combine genes of similar plants in order to create a more-sustainable crop.

Animals can also be bred selectively, within the same species, as is most commonly done with dogs, cats and horses.

Selective breeding, however, can be a time consuming process and the potential combinations are limited.

Genetic modification is a quicker means to a similar end but is seemingly limitless. With this process, scientists can combine genetic traits from entirely different plant and animal species, essentially 'cutting' a trait from one organism and 'pasting' it into another.

What are the benefits of genetic modification?

The majority of genetic modification is done on basic commodity crops like soybeans, corn, rice and wheat, which is the reason so many different food products now contain GMOs.

Herbicide-resistant crops are by far the most widely grown genetically modified plant, accounting for more than 70 per cent of worldwide GMOs. These crops allow farmers to use the more effective non-specific herbicides without fear of killing their valuable plants.

Plants can also be modified to be insect resistant (removing the need for polluting insecticides), and disease resistant.

Some plants have been engineered to thrive under stressful conditions, such as in dry or salty soil. In 2001, for example, a strain of tomato was engineered to remove salt from the ground and distribute it into its leaves, leaving the tomato tasting normal. These modifications allow crops to grow in areas usually unfriendly to sustainable growth, such as drought-prone regions.

What are the concerns?

The biggest threat when it comes to GMOs involves the possibility of cross-pollination in the wild, leading to genetic pollution.

The risk is especially great when crops meant for human consumption are grown near crops altered and grown



A Sept. 2000 picture shows boxes of Taco Bell taco shells recalled after it was found they contained StarLink corn, genetically modified corn unfit for human consumption. (Toby Talbot/Associated Press)

for specialized pharmaceutical needs. This process, known as biopharming, can isolate traits in certain plants that can be useful for things such as vaccine production. Biopharming has also been used to engineer plants used in producing biodegradable plastic and improved animal feed.

Cross-pollination also puts wild plants at risk. If genetically modified plants passed on traits to wild relatives, the resulting wild plants would play a different role in their respective ecosystems and potentially out-compete other species for resources such as light or water, depending on the traits inherited.

Certain strains of corn modified to be herbicide and insect resistant are not fit for human consumption. Bt corn, a strain engineered to contain the *Bacillus thuringiensis* (Bt) toxin, is meant to combat the European corn borer, a common pest. In Canada, farmers growing Bt

corn are required to adhere to a resistance management plan, usually consisting of a non-Bt "refuge" corn crop planted nearby, so that pests do not become immune to the Bt toxin. The refuge crop allows pests to thrive without affecting the cash crop.

Another concern exists surrounding the potential mixing up of certain GMOs unfit for human consumption with safe ones. As many side effects of some GMOs are unknown, the risk can be substantial. In 2000, StarLink corn, a Bt strain developed by Aventis Crop Sciences and approved for use in animal feed, somehow found its way into some food products, including Taco Bell taco shells. The consumer and regulatory backlash put increased scrutiny on genetically modified foods in the U.S. and even caused some developing countries to turn away food aid fearing StarLink contamination.

Do foods with GMOs need to be labeled?

In Canada, the Canadian Food Inspection Agency, in association with Health Canada, is responsible for ensuring food products are properly labeled according to certain regulations. According to their website, manufacturers can indicate the presence of genetically engineered ingredients as they see fit and on a strictly voluntary basis, as manufacturers might indicate their food is trans fat free or has less sodium. The CFIA can, however, require a manufacturer to indicate the presence of GMOs if they pose a potential risk to consumers or alter the composition of the product.

In Europe, regulations surrounding GMOs are far more stringent simply because a lack of farming space could put more crops at risk of cross-pollination. Many Europeans are strongly against GMOs and the majority of bioengineering studies are conducted there. France, Germany, Austria, Hungary, Greece, and Luxembourg have all banned GMOs on some level from being cultivated and strict labeling practices are adhered to across the EU. Canadian manufacturers looking to export food with genetically engineered ingredients to Europe must label them accordingly.

Can animals be genetically modified?

The majority of genetic modification has been restricted to the plants and crops, as many environmental groups have expressed extreme ethical concern with the modification of animal species.

The first genetically modified animal, Herman the bull, was developed in a Dutch lab in the early 1990s.

In 1999, scientists at the University of Guelph developed Enviropig, a line of Yorkshire pigs genetically modified to produce phytase in their salivary glands. The phytase acts as an agent to reduce the presence of phosphorus in the pigs' manure by 30 to 70 per cent (phosphorus is harmful to the environment). Approved in 2010, Enviropig will not only cut harmful phosphorus, but also save money for farmers who would otherwise add phytase to their pig feed or engage in expensive techniques for removing phosphorus from their pigs' manure.

Japanese scientists, in 2002, successfully implanted genetic material from a spinach plant into a pig embryo. The resulting pig had meat lower in saturated fat.

In 2006, scientists in Taiwan developed fluorescent pigs that exert a green glow in the dark. The glowing pigs could help with stem cell research, the idea being that cells from the pigs will be easily traceable in organisms where they are transplanted. Other fluorescent creatures have included a puppy, fish and a monkey.

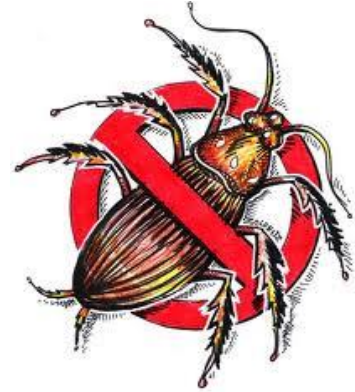


Seen in the light, the fluorescent pigs show a tinge of green pigment in this Sept. 2006 photo. (Simon Lin/Associated Press)

What are the benefits of Genetic Modification (GM)

List adapted from: <http://www.csa.com/discoveryguides/gmfood/overview.php/>

- Pest resistance- Farmers can lose many crops from insects and pest. Many people do not want to eat crops that have been treated with pesticides because of health risks. Pesticides also pollute water supplies. Creating GM crops can eliminate the need for chemical pesticides and reduce the cost of producing crops.
- Herbicide Tolerance- Many farmers spray their crops with herbicides to kill weeds. This takes a lot of time and money to make sure that the herbicides do not harm the crops being grown. GM crops can be designed to be resistant to one powerful herbicide so that farmers can spray their crops once so that they can kill weeds without worrying about harming the crop they are trying to grow.



- Cold Tolerance- Some crops have been modified to withstand cold temperatures that would normally kill them. For example, an antifreeze gene from fish has been introduced in some plants like tobacco and potatoes so that they can survive colder temperatures.
- Drought and Salinity Tolerance- With an increasing population, more areas are needed to grow crops. Plants have been created that can survive in areas that were once thought to be inhospitable places for plants to grow. Some GM crops can now live through long periods of droughts and in places where there is high salt content in the soil and groundwater.
- Nutrition- Malnutrition is a common problem in third world countries where impoverished peoples rely on a single crop, like rice, for the main staple of their diet. However, rice does not have enough of all the necessary nutrients to prevent malnutrition. For example, vitamin A deficiency can cause blindness and is a common problem in third world countries. Scientists were able to create a strain of "golden rice," which has unusually high amounts of vitamin A in it. The Rockefeller Foundation hopes to offer golden rice seeds to any third world country that requests it.
- Pharmaceuticals- Third world countries are not always able to afford to produce or provide the special storage conditions required to store medicines and vaccines. Researchers are working to make edible vaccines in tomatoes and potatoes that will be easier to ship, store, and give to people than traditional vaccines that you inject with a shot.



What are the risks of Genetic Modification (GM)

List adapted from: <http://www.csa.com/discoveryguides/gmfood/overview.php/>

- Unintended Harm to Other Organisms- It is possible that GM crops can cause harm unintentionally to other organisms. An example of this would be B.t. corn, which is corn that has been modified to include a pesticide. Pollen from this corn has been shown to cause high mortality rates in monarch butterfly caterpillars. The pollen from B.t. corn can be blown by the wind to plants in neighboring fields. It's not possible to design a B.t. toxin that would only kill pest that damage crops, but is harmless to all other insects.
- Reduce Effectiveness of Pesticides- Many people are fearful that insects will become resistant to B.t. or other crops that have been GM to make their own pesticides.
- Gene Transfer to Non-Target Species- Crops that have been genetically-modified could cross-breed with non-modified crops that are close by. This cross-breeding will give the modified traits to the new crops. For example, plants that have been modified to be made herbicide tolerant could cross-breed with weeds. This would cause the weeds to become "superweeds" that would not be able to be killed with herbicides.



"THEY COST MORE BECAUSE THEY MAY DO THINGS TO YOUR GENES THAT NOBODY KNOWS ABOUT."

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- Allergies- Many people have food allergies (e.g., peanuts). It is possible that introducing a gene into a plant may create a new allergen or cause an allergic reaction in susceptible individuals.

Unknown Effects on Human Health- While scientists believe that besides allergies, GM foods do not present a risk to human health, there is still growing concern that placing foreign genes into food plants could have unexpected and negative effects on human health.

- Ethics- Humans are genetically altering nature (in a new way) for their own convenience and profit.

- Economic Concerns- Many genetic engineering technologies and GM plants have been patented. Many believe that patenting these products will raise the cost of seeds so much that small farmers and third world countries will not be able to afford the seeds for GM crops. This will widen the gap between the wealthy and poor even more.
- Food Labels- In the United States, it is not required to label a food as Genetically Modified, so you may not know if you are consuming a product that has been genetically modified.



Name: _____

Genetically Modified Foods Debate

NC Essential Standard L.2.1/ Common Core: W1, R1, R10,

Summarize aspects of biotechnology including: specific genetic information available, careers, economic benefits to North Carolina, ethical issues, implications for agriculture

Introduction: For many years, there has been debate about the use of Genetically Modified (GM) foods. Some believe that these foods are a necessity and benefit the human population. Others believe that they pose health and safety risks to humans and other organisms. GM foods are not going away anytime soon; they are currently in more than 30,000 different food products! In this activity you will read and analyze information about both sides of the GM food debate before finally taking a stance on if Genetically Modified Foods should be produced and consumed.

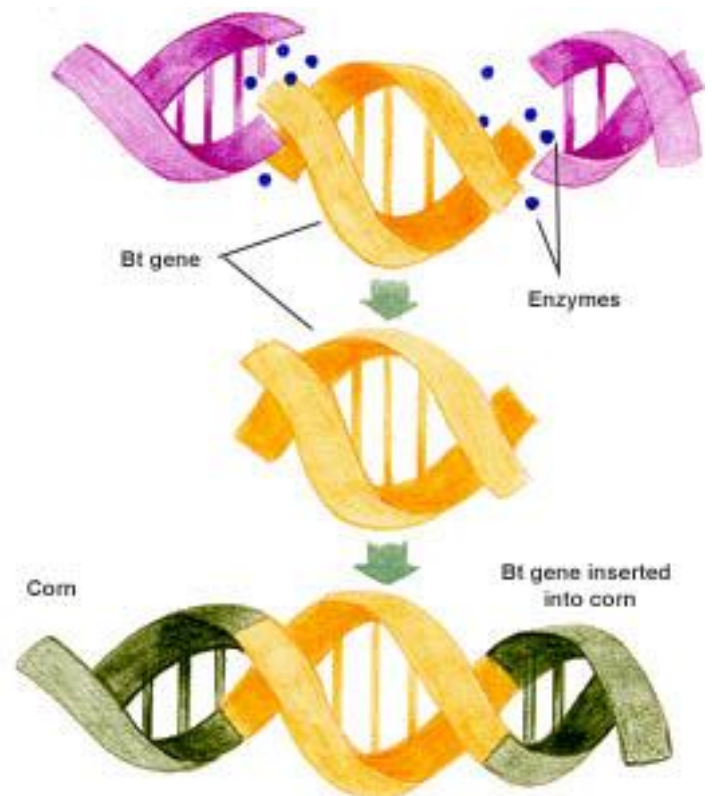
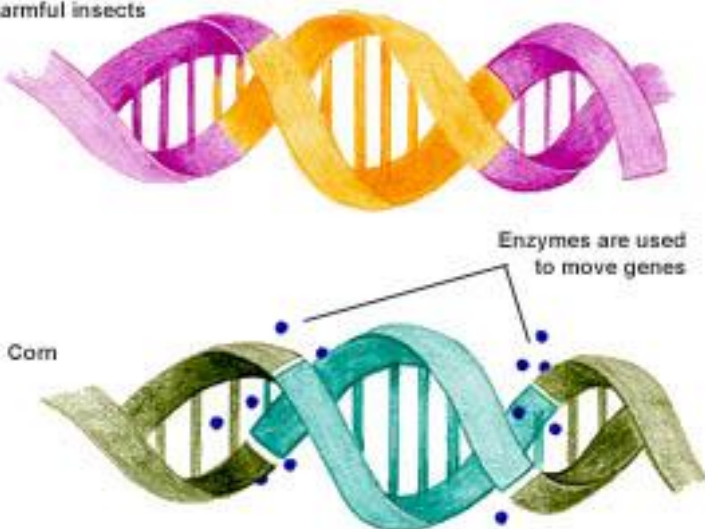


Objective: Analyze the benefits and risks of Genetically Modified foods and choose and defend a position for or against the use of GM foods.

Background Information:

Genetically modified foods contain an ingredient whose genetic material (DNA) has been altered in a way that does not occur naturally. To alter DNA, scientists select individual genes from one organism and transfer them into another organism, even between non-related species! This is done so that genes that do something useful in one organism can be transferred to another species so that it can now also have the desired trait.

Bt gene will help corn resist harmful insects



Procedures:

1. Read the article "Genetically Modified Foods: The Facts and Debates" from CBC news. Answer the discussion questions that follow.
2. Read the information sheets "What are the Benefits of Genetic Modification" and "What are the Risks of Genetic Modification." Choose what you think are the greatest benefits and risks of genetic modification and record your responses.
3. Complete any additional research that you find necessary to make an informed decision about whether or not GM Foods should be produced and consumed. Here are some suggestions:

Additional Resources:

- <http://www.pbs.org/wgbh/harvest/viewpoints/>
- <http://www.csa.com/discoveryguides/gmfood/overview.php/>
- Search "Genetically Modified Food: A Growing Debate" and go to the cbc.ca website to view video clips on the topic
- <http://www.agbioworld.org/biotech-info/topics/dev-world/academies.html>
- Research the 'Golden Rice' debate
- Search www.youtube.com for informational videos about GM Foods (be care to make sure they are published by reputable sources!)

4. Complete the graphic organizer to sort out your thoughts before writing your final paper.
5. Write a paper that includes your answer to the question: Should genetically modified foods be produced and consumed? You must fall on one side of debate (i.e., you cannot say both yes and no). Your paper must have an introduction, at least 3 reasons why you choose your answer and explanations for your reasons using your research, and a conclusion.

What do you already know about Genetically Modified Foods? Do you think you have ever eaten a product that has been genetically modified? Would you want to?

Discussion Questions:

1. How many different food products contain genetically modified organisms (GMOs)? Why do so many different food products now contain GMOs?

2. What benefit does making crops herbicide- and insecticide- resistant have for farmers?

3. What is another benefit of GMOs for farming?

4. A risk of GMOs is that crops grown for food will cross-pollinate with crops grown for medicine or crops that are unsafe for humans to eat. What is one example of an instance when crops that were grown for animals were mixed with a crop grown for humans?

5. Can animals be genetically modified? Name at least one example of a genetically modified animal and why it was modified.

6. What do you think are the **3 greatest benefits** to producing GM foods? Why did you choose these three?

7. What do you think are the **3 greatest risks** to producing GM foods? Why did you choose these three?

THESIS STATEMENT (answer to question + 3 reasons why)

REASON 1

MORE INFORMATION

REASON 2

MORE INFORMATION

REASON 3

MORE INFORMATION