Genetically Modified Organisms and Foods

What We Know

› Genetically modified organisms (GMOs) are plants, animals, or bacteria whose DNA have been modified through genetic engineering. Genetic modified foods are made from genetically modified organisms

• Different terminology may be used, such as genetic engineering, genetic modification, modern biotechnology, gene technology, recombinant DNA technology, or genetically modified foods, depending on the context. However, they all typically are referencing the same process or outcome

• In the interest of precision the United States Food and Drug Administration (FDA) uses the term genetic engineering rather than genetic modification to describe the modification that has resulted through biotechnology. Genetic engineering or modification produces genetically modified organisms

› Genetic modification isolates a specific gene and combines it with another individual plant cell to generate an entirely new plant cell. Selecting one specific desirable gene or attribute allows any undesirable traits to be eliminated. The result is a new plant cell with only the desired traits or attributes

› Genetic modification is done to improve a plant’s flavor, nutrient density, yield, resistance to damage from insects, and protection or immunity from diseases. Genetic modification has been most widely used for insect and herbicide resistance. The use of genes from the bacterium Bacillus thuringiensis (Bt) is an example. The wide-scale use of insecticide spraying is minimized with the use of the Bt gene

• the use of genes from the bacterium A popular method of making plants resistant to insects entails Bacillus thuringiensis (Bt). The wide-scale use of insecticide spraying is minimized with the use of the Bt gene

• Herbicide-tolerant genetically modified plants are resistant to the herbicide glyphosate and tend to produce greater crop yield since weeds are better controlled

• Some believe that genetic modification has the potential to help reduce or eliminate world hunger and starvation. However, others believe that the use of genetically modified crops to improve food supply is not a strategy that is supported by science and that agricultural biodiversity may be a better alternative. Agricultural biodiversity or agrobiodiversity refers to the variety of animals, plants, and micro-organisms used directly or indirectly for food and agriculture, crops, livestock, forestry, and fisheries.

• Proponents of agricultural biodiversity feel that its focus on the biological factors that determine crop yield such as genotype, environment, and management will lead to solutions to world food production needs

› Genetic modification is not new: it has been done for thousands of years in plants and animals in the form of cross-breeding. Cross-breeding, sometimes referred to as cross-hybridization or cross-pollination, entails crossing two different but related plants to create a new one. Genetically modifying foods, a process which takes a single isolated gene and inserts its genetic code into a completely unrelated organism, began to be used in food production in the United States in the 1990s

› Many countries and organizations have reached the conclusion that genetically modified foods are safe to consume. However, there are also individuals and organizations who question the safety and ethical use of GMOs in the food supply and the herbicides used
to treat genetically modified crops.\(^{(2-15)}\) In the United States, the FDA requires that genetically modified foods be subjected to rigorous testing to demonstrate that the food shows no adverse effects on human health.\(^{(1-15)}\) Specifically, in the case of a new GM crop, the crop must be shown to be equivalent to the crop from which it was derived; if a new protein trait has been added to the food, it must be demonstrated that it is neither toxic nor allergic.\(^{(1)}\)

In addition to the FDA, the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA) also have a role in regulating genetically modified organisms.\(^{(2)}\) International foods that contain GMOs are traded and regulated according to the Codex Alimentarius Commission, a joint effort between the Food and Agriculture Organization of the United Nations and the World Health Organization (WHO). The two organizations are responsible for developing the standards and guidelines for international foods.\(^{(14)}\) The United States, the European Union, Canada, and Brazil use guidelines that emanate from the Codex Alimentarius Commission for the regulation of genetically modified foods.\(^{(6)}\)

- Organizations that have concluded that foods derived from GMOs are safe include the European Union, the U.S. FDA, WHO, the American Medical Association, the U.S. National Academy of Sciences, and the Royal Society (the United Kingdom’s national academy of science).\(^{(1)}\) All of these organizations have concluded that eating foods derived from GMOs is no riskier than consuming traditional plant-breeding enhancement.
- Organizations that have cited concerns that GMOs may lead to environmental issues and health challenges for consumers include the Center for Food Safety, the Institute for Responsible Technology, and the Non-GMO Project.\(^{(5)}\)
- Critics of the use of GMO in foods cite concerns about unknown health effects, the potential to incite allergic reactions, nutritional effects of genetically modified organisms, the stability of the genes that have been inserted into new cells to produce new ones, unknown nutritional consequences that may be associated with the genetic modification, and other unintentional consequences to humans or the environment.\(^{(2,7)}\) Critics also cite concerns over the use of the herbicide glyphosate (Roundup\(^{®}\)) since some animal studies and reports from the International Agency for Research on Cancer of the WHO have linked it to cancer.\(^{(6,8,13)}\) However, those opposed to this claim state that subsequent review studies have concluded that glyphosate does not lead to increased cancer risk.\(^{(6,8,13)}\) Proponents of GMOs argue that GMOs are the most regulated and tested of food products.\(^{(1-5)}\)

Over 60 countries require that foods containing GMOs be labeled as such. In 2012 the FDA estimated that GMOs are included in approximately 93% of soybeans and 88% of corn.\(^{(13)}\) Those GMO-containing soybeans and corn are then used in ingredients such as corn starch, corn syrup, corn oil, canola oil, soybean oil, and sugar.\(^{(5)}\) Other foods in the United States that may contain GMOs include tomatoes, potatoes, squash, apples, and papayas.\(^{(7,13)}\) Although the FDA initially did not require U.S. companies to label foods containing GMOs, many companies voluntarily opted to label such foods to meet the requirements of particular states and in order to be transparent with consumers.\(^{(13)}\) Campbell Soup Company, General Mills, Kellogg’s, ConAgra Foods, and Mars, Inc. were some of the first major food companies that opted to include labeling for foods containing GMOs prior to labeling laws going into effect.\(^{(12)}\) A brief timeline of labeling legislation includes:

- In 2012, a bill in California that would have required labeling foods containing GMO ingredients failed to pass.\(^{(15)}\)
- In May 2014 Vermont passed a law, Act 120, which required food to be labeled as produced partially or completely from genetic engineering; however, the law would not go into effect until July 1, 2016.\(^{(12)}\)
- In March 2016 Congress considered Senate Bill 2609 in an effort to establish a national standard for foods containing GMOs, but the bill did not pass.\(^{(12)}\)
- Vermont became the first state to require that foods with GMOs be labeled. Its labeling law went into effect July 1, 2016. Connecticut and Maine also passed GMO labeling laws and such laws are under consideration in other states.
- In July 2016 Congress passed a bill requiring the labeling of GMOs in food. How the requirements of the labeling law will be implemented is yet to be determined.\(^{(11)}\)

There are a wide variety of foods and ingredients that contain GMOs. New crops and foods that contain GMOs, such as drought-resistant crops, fish, and non-food items for pharmaceutical use in vaccinations, continue to be developed by manufacturers.\(^{(15)}\) While GMOs and their food derivatives are generally thought to be safe and there are no illnesses or injuries that have been attributed to GMO-containing foods, each new genetically modified food must be evaluated individually before its safeness can be determined.\(^{(6,7,15)}\)
What We Can Do
› Learn about GMOs and foods so you can accurately assess your patients’ personal characteristics and health education needs; share this information with your colleagues

Related Guidelines
› The Codex Alimentarius Commission (Codex) developed principles for the analysis of human health risk associated with genetically modified foods in 2003.
References


