

*GMOs Are Like a Test: You Think You Know the Answer, But You Really Don't*

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It is all the crazy: GMOs. There are many myths and misconceptions intertwined into the facts of genetically modified organisms. With minimal research, and the concept of genetic modification is still new, it is important to correctly analyze the sources with which your information comes from. Normally, organization-funded websites (.org) sites are always reliable. However, because genetic modification is such a hot topic, those sites tend to only share the facts that will successfully contribute to their organization's cause. Cross referencing is an important part to studying genetic modification sources of information. The ten most common facts and misconceptions about GMOs have been intensively studied and cross referenced for accuracy. These facts and misconceptions range from topics comparing genetic modification to ideas such as selective breeding and factory farming, to the impact that GMOs may have on our environment, children, and generations to come.

One of the biggest interests in genetic modification (GM) is when it originated. Genetic modification is a much more recent development in the science world. It originated in 1973 by a Stanford University Medical Student. The idea behind genetically modifying organisms was to alter the genes of a plant or animal to result in new, desired, or specific traits of that particular plant or animal. In 1975 biologist, lawyers, and doctors collaborated to create safe use guidelines for genetically engineered DNA. The first patent for successful GMOs occurred in 1980. This was settled by a five to four Supreme Court ruling. This genetically modified organism was a bacterium engineered to assist cleaning up oil spills, such as crude oil in the oceans. Approved by the FDA, "Humulin" reached the market in 1982. This was a genetic modification of the E. coli bacteria to produce insulin. However, up until this point there were still no consumable GMOs. It was not until 1994 that the first genetically modified food entered the supermarkets. Approved by the United States FDA, the "Flavr Savr" tomato was genetically modified to ripen slower, which would give it a longer shelf life at grocery stores. By 1999, genetically engineered crops reached over 1 million acres worldwide. Finally, as of 2014, the patent for Monsanto's Roundup Ready line of genetically modified seeds ends. Genetic modification has

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come a long way in the past 40 years, but it still has a long way to go. Compared to other scientific studies, GMOs remain one of the newest and unknown studies the world has.

Genetic modification is new to the world. Often times, it is easiest to understand something by comparing it to something else. Many individuals try to compare genetic engineering to selective breeding because it has been around much longer and studied more intensely. Though selective breeding and genetic modification share an overall similar outcome, the processes of each are much different. Each process is used to control and alter plants and animals to exert a desirable, new or specific trait of that particular organism has to offer. Selective breeding is much less scientific than the complex and specific process of genetically engineering organisms. During the process of selective breeding, an individual nurtures a desired trait(s) through methods such as cross pollination in plants. Selective breeding would also be an example of why many dogs are mixed breeds. Pure-bred dogs are dogs which have been bred with the same type of dog they are. However, when you cross breed two different dogs, you are attempting to get the most desired traits out of each. Genetic modification is exactly how it sounds: the modification of genes in an organism. During this process, an individual would alter the genes, or DNA, of a plant or animal. This takes extensive amounts of detail and precision in order to not contaminate DNA samples. As previously mentioned, genetic engineering is a much more recent discovery and attempt to create similar results to selective breeding.

In today's society, the increase of cancer rates is a concern to the population. One of the biggest concerns about contemporary GMOs is their effects on human health, specifically the cause of cancer. Currently, there is no proof that consuming genetically modified organisms will cause cancer in *humans*. Studies have been performed on rats, in which they developed tumors and other serious health concerns. However, animal testing is never 100 percent accurate, due to the biological differences between animals that are used for animal testing and humans. Due to evolution, animals and humans have developed differently according to molecular biology and genetics results. Both animals and

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humans metabolize substances, like GMOs, differently. Since there has been no research performed on humans to prove that GMOs cause cancer, even if they cause tumors in rats, we have inconclusive data. This means that we are unable to conclude that GMOs have a direct correlation to the increase in cancer rates or that consumption or exposure to GMOs has any correlation to the cause of cancer.

Over the past 40 years, there has been a significant increase in genetically modified crops. Many individuals are beginning to feel as though all crops are genetically modified, and there is no way to avoid them. This is not the case. As of 2007, genetically engineered crops accounted for only nine percent of all grown crops in the world. The four major crops being produce that are genetically modified are soybeans, which account for 51 percent of all GM crops, 31 percent of GM crops are corn, 13 percent are cotton, and 5 percent are GM canola crops. In 2011, there were 29 different participating countries in the growth of genetically modified crops. However, the United States holds the highest rates of genetically modified produce. The United States accounts for half of all GM crops in the world, as of 2007. Though GM crops are still a minority, it was noted in 2011, the 16<sup>th</sup> anniversary of commercialized GM crops, there has been an eight percent increase since 2007 of genetically modified crops. This makes genetically engineered crops the “fastest adopted crop technology in the history of modern agriculture,” according to the International Service for the Acquisition of Agri-Biotech Applications.

Another misconception of genetic modification is the comparison of the production of genetically modified foods to factory farming. Factory farming is mainly animal-based modifications, whereas genetic modifications deal much more with plants. The original goal of factory farming is to inject meet the demands for specific foods that our country requires. This is accomplished through various inhumane means. Due to limited space, animals within factory farms are confined to unreasonably small cages. They are injected with growth hormones to result in unnaturally fast and excessive growth. This will increase their body size beyond an average animal to ultimately produce the

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amount of meat the United States demands. Genetic modification is, again, exactly how it sounds: modifying genes, of mainly plants, to produce a specific outcome. Beyond the fact that factory farming and genetic engineering are trying to accommodate the needs for food we demand, they share no similarities.

The main concern of GMOs surrounds the consumption of food. However, one common misconception of genetically modified organisms is that, though they are mainly found in food, those are not the only products that contain genetically engineered ingredients. The most common foods that contain GMOs are: soy, canola, corn, sugar beets, Hawaiian papaya, alfalfa, zucchini, and yellow squash. However, one of top ten sources of GMOs is cotton, found in clothes, blankets, and even just the cotton ball used to remove make up. Besides cotton, there is also a possibility that several beauty products contain genetically modified ingredients, such as soy.

The most mislead bit of information surrounding genetically modified organisms is that they cause health effects. This misconception is true when discussing animals; however, assuming individuals are concerned about human health due to GMO consumption, this is simply a myth. Though several animal test have been performed that prove various health effects in animals, there is no evidence to prove GMOs cause any morbidity to humans. GMOs have been known to cause infertility in pigs and cows, precancerous tumors in rats, liver and pancreatic issues in mice, changed cell metabolism in rabbits, unexplained testicular cell changes in mice, intestinal damage in mice, and, in some cases, death. There are currently no studies that provide scientific evidence to support health effects in humans due to GMOs. This is currently a hypothesis that is being examined for the future. Animal testing has shown very extreme results that humans have yet to have. However, there is a possibility of a link between the inhalation of GMO pollen and allergies in humans.

For many environmentalists, and even farmers, the environmental factors of GM crops is a great concern. This topic, however, is less black and white. Genetically modified crops produce both positive

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and negative consequences for the surrounding environment. The greatest benefit of GM crops is the great decrease in pesticide and herbicide use because some GM crops were created to produce their own pesticides. Another benefit is herbicide resistant crops have aided in the expansion of no-till crops, which saves over 1 billion tons of soil per year. There are some genetically modified crops that have had no impact on the diversity and population of insects. However, there is evidence that certain GM crops could have made for less diversity and abundance in insect population, mainly found in the Monarch butterfly populations. Unfortunately, one of the major risks of genetically modified crops is the potential to create new "super weeds" that will withstand herbicides and are also protected from insects through plant-producing pesticides, which would make it near impossible to get rid of. This weed could potentially take over crops and cause many more environmental issues than the actual GM crop would have.

If GMOs were to be proven to cause health effects to humans, it is true that children would be most at risk. In general, children are classified as part of the immunocompromised population, meaning that they are more likely to be susceptible to morbidity than others. Children are known to have weaker immune systems because they have been less exposed to potential biological hazards. Due to these notion, the effects of ingestion GMOs is greater for children. Beyond biological standards, children are more exposed and consume higher doses of GMOs than most adults would. GMOs are found in the majority of processed snack foods that children enjoy eating, and parents enjoy giving them. One health concern that could potentially be linked to GMOs is allergies. Children are scientifically more susceptible to allergies in foods. They are also more susceptible to lactose intolerance, or problems with milk. This would be a concern because one of the top genetically modified foods is soy. Infants and small children also rely heavily on converting their food mainly into building organs and tissues, whereas adults store food mainly as fat. This is why it is important for pregnant women to watch what they eat during pregnancy and breast feeding.

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One important point about GMOs is that science has proven animals react much differently to them than humans. This final myth is no different. Currently, there is no proven research that proves any birth defects or abnormalities are linked to GMOs. However, there have been several links to GMOs and birth defects and deformities in animals. One farmer shares a story about his piglets having birth defects due to glyphosate—a herbicide found in GM crops, specifically, Monsanto's Roundup Ready. The birth abnormalities were said to be caused by the mother's consumption of GM feed corn. This is a different story for humans, though. Children, especially unborn children, rely completely on their mother for nutrients. These nutrients are used to build organs and tissues. Many other chemicals and toxins have been known to be passed on from pregnant women to their children during childbearing, though. Since there is already a link among ingested toxins during pregnancy causing birth defects, there is a possibility this myth could eventually become a fact if GMOs are proven to be harmful to humans. Scientific evidence already explains why this would be, making it an easy fix and nothing to truly be concerned about.

In conclusion, GMOs are one of the biggest debates right now. Due to the several misconceptions found in facts of genetically modified crops and foods, it is important to research carefully. With minimal studies currently out, the concept of genetic modification is still new and unknown to everyone. Analyzing the source of your information is important when dealing with controversial topics. Many websites that are funded by organizations are either for or against GMOs and will only share certain bits of information that will successfully contribute to their cause. A simple solution to false information is to cross reference, meaning, check multiple sources for one piece of information to see if multiple sources agree on the same idea. The ten biggest facts and misconceptions of GMOs surround ideas, such as a comparison of GMOs to selective breeding and factory farming, the impact of GMOs on our environment, how many GM crops are actually out there, and what is the impact of genetically modified organisms for us, our children, and generations to come?

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