

Gentic engineering essay



**ASSIGN
BUSTER**

The world has seen many changes and advances over the last century, but possibly none that hold as many possibilities as genetic engineering. Genetic engineering is turning up in more and more places, and it is almost certainly here to stay. Just as computers and plastics changed most aspects of living since they were invented, biological engineering has the potential to do the same in the future. This new technology has a wide range of possible benefits, from helping farmers, to improving foods, to helping the environment, to helping sick people. Genetic engineering may even one day be used to help solve world hunger. However, it also has its dangers and risks, which need to be considered along with its benefits. The fact that not everything is known about genetic engineering, and that large corporations use it to make a profit, is scary to many people. The recent technology of genetically engineering crops, plants, and animals, which involves modifying their genetic structure, has lead to benefits for farmers and everyday people; however, there are also numerous concerns due to the fact that the long term results are unknown, the possibility of dangerous accidents, and the danger of increased chemical usage.

In the past decade, the world has seen genetic engineering become more and more common, and it is affecting many aspects of life. It has found applications in fields such as pharmaceuticals, farming, and research, to name a few. But many people still don't understand what it means for something to be "genetically altered." To understand this technology, it is necessary to explain a few basic principles.

Every living organism in the world is made up of cells that contain deoxyribonucleic acid (DNA). As many people learned from watching Steven

Spielberg's Jurassic Park, DNA is the "blueprint of life." The online article "What is Genetic Engineering?" explains how DNA and genes work in an organism. DNA contains information that the body needs for functions such as cell reproduction (growth) and biochemical processes. All species have a unique DNA code, and every feature of an organism depends on this code to function normally. Genes are special segments of DNA, which control certain functions, characteristics, and features of an organism (such as eye color, metabolism, size, etc.). Molecular biologists have recently learned how to manipulate genes to a certain extent. They have discovered enzymes that allow them to cut and splice specific genes and build customized DNA codes. Also discovered were vectors, which are DNA codes that can insert themselves into other separate codes. A virus is an example of a vector. Scientists learned how to build and use special vectors to insert genes of their choice into an organism's DNA code ("What is Genetic Engineering?"). Numerous techniques (such as selective breeding) have been used for years to change gene codes, but through genetic engineering, scientists can move genes much easier than before and with greater precision ("What are the Dangers?"). Scientists believe that by using these techniques, they will be able to improve the quality and characteristics of food that people eat.

Genetically modified food ("GM food") is food with ingredients that have been genetically altered for traits such as larger size, pest resistance in the field, and faster growth. For example, scientists have used this technology to improve a tomato's ability to resist freezing. To achieve this, a gene from a flounder was added to the tomato's DNA code, which enable the plant to resist frosts and extends its growing season ("What is Genetic

Engineering?”). Another gene was found that could help wheat grow in fields that normally would not support it. Cows with altered DNA can even produce milk that contains chemicals such as human insulin, which diabetics need to survive (“ Frequently Asked Questions”). These are all examples of how scientists can use gene-splicing technology to alter a plant or animal’s characteristics.

The numerous potential benefits of this recent technology are very intriguing. Proponents of this technology claim that biotech crops could, or do, reduce pesticide usage, increase yields per acre, raise the nutritional value of food, and require less water to grow. In a recent speech, the US Secretary of Agriculture, Dan Glickman, spoke of how the field of medicine is being transformed by biotech. Human insulin, cancer medications, antibiotics, and vaccines are all products of genetic engineering. A new genetically engineered (GE) drug has the potential to save hemophiliacs from bleeding to death. Scientists are also researching GE bananas that could one day be used to give vaccines to children in third-world countries (Glickman).

Proponents of genetic engineering also believe that this technology will help the environment. In the article “ Monsanto: Playing God,” by Kirkpatrick Sale, some of these benefits are discussed. Monsanto, one of the largest corporations involved in genetic engineering and research, has developed crops that can be sprayed with the powerful herbicide Roundup (also manufactured by Monsanto) without being affected by it. This means that a farmer can spray a field of crops with a chemical that is lethal to virtually all weeds and plants and, as a result, not have to worry about cultivating or

plowing. This is beneficial since plowing fields causes much loss of topsoil through wind and water erosion (25 billion tons of topsoil are lost each year). Monsanto claims that by using its “ Roundup Ready” seed, the need to plow the ground before planting is greatly reduced, since weeds can be sprayed after the crops are planted. They also assert that using “ Roundup Ready” crops and Roundup in combination increases crop yields by five percent, which also benefits the farmer through increased profits (Sale 17).

A reduction in the need for pesticides is another benefit of genetic engineering that is often cited. Robert Shapiro, the CEO of Monsanto, explains this theory in the magazine article “ How Genetic Engineering Will Save Our Planet.” Ninety percent of the costly chemicals sprayed on crops are wasted, which is not good for the environment, or for the farmer who is paying for them. But by using biotech, plants can be genetically coded to resist or kill insects and pests by themselves, without using chemical pesticides. The genetic technology is also more efficient than chemicals, which take a large amount of raw materials and energy to produce and apply (Shapiro 29). Bt, a pesticide that naturally occurs in the environment, has also been incorporated in genetically modified (GM) crops. Crops such as corn and soybeans have been engineered to produce the Bt substance by themselves, using a gene from the Bt gene code. This allows the plant to defend itself from pests by manufacturing its own natural pesticide. One statistic shows that Arizona farmers who use Bt corn have reduced their usage of chemical insecticides by 75 percent (Nash 46). GM crop advocates cite these types of statistics as proof that genetic engineering in agriculture will benefit the environment.

Probably the most-used argument for genetically engineered food is that it will help solve world hunger. In “ How Genetic Engineering Will Save Our Planet,” Shapiro states that 800 million people in the world are so malnourished that they can’t even work or live normal lives. As the population continues to grow by the billions, the demand for food will, too. By some estimates, the world will need two to three times as much food to feed its people than it requires now. For this reason, food production will need to greatly increase to meet these needs, and Shapiro believes that biotech is a large part of the answer (Shapiro 28-29).

In the article “ Grains of Hope” by J. Madeleine Nash, the argument of world hunger and GM foods are discussed in great detail. Over one million children die each year from vitamin A deficiency, and 350, 000 go blind from it. Many poor people in developing countries eat only a few bowls of rice a day, which obviously does not supply all their nutritional requirements. Seeing this, two scientists, Ingo Potrykus and Peter Beyer developed a GM rice seed with genes that enable the plant to produce beta-carotene-enriched rice. Beta-carotene, which is a nutrient found in such foods as carrots, would supply vitamin A and also benefit the immune system. A deal was struck with a British biotech corporation to give Asian farmers the GM rice seed for free, but the efforts to distribute the seed have been protested by anti-GM food activists. They claim that it would make third-world countries even more dependent on the United States and other successful countries.

Nash goes on to describe other ways that genetic engineering can help third-world countries. In Africa, sweet potato fields produce yields which are less than half of the rest of the world. The potatoes are affected by a disease

called “ feathery mottle virus,” which is very hard to control- the plants can’t be bred for resistance, and the disease cannot be controlled in the field. However, scientists are currently developing GE potatoes that are genetically coded to resist the virus (Nash 46). In another example from “ Grains of Hope,” half of African produce is lost because it rots on the way to market. If transgenic produce could be developed that ripened slower, there would be a much greater amount of available fruits and vegetables to Africans. In the same article, Florence Wambugu, a Kenyan plant scientist, is quoted as saying, “ Weeding enslaves Africans; it keeps children from school.” She believes that herbicide-resistant crops would allow Asian farmers to use pesticides on their crops, which would free people from constantly weeding the fields (Nash 46).

Genetic technology has also helped papaya farmers in Hawaii. In 1994, a ringspot virus had infected half of the papaya fields and forced many farmers out of business. The virus was very hard to control and almost got out of hand. Genetic scientists worked to develop two transgenic papaya strains which were able to resist the virus, and had good results in the test fields. In 1998, most papaya growers switched to the transgenic virus-resistant lines, which grew healthy, and have had excellent luck since then (Nash 46).

However, even with all of these benefits and potential solutions that genetic engineering offers, there has still been a tremendous amount of public outcry and protest. In a recent speech, US Secretary of Agriculture, Dan Glickman, shared an experience he had had with the protests: “ When I chaired the US delegation to the World Food Conference in Rome in 1998, I got pelted with genetically modified soybeans by naked protesters”

(Glickman). Protesters have a number of concerns with genetic engineering and what it may cause.

One foremost concern in the debate is whether or not GM crops will actually reduce chemical usage, as the manufacturing corporations claim they will. The online article “ What’s Wrong with Genetic Engineering?” cites the fear that with the increased use of pesticides such as Roundup and Bt, pests will evolve that can resist the chemicals being used against them. This would, in turn, cause the need for even stronger and more dangerous chemicals. In fact, researchers at Michigan State University found that plants engineered to resist certain viruses may cause the virus to mutate into a stronger form capable of attacking other types of plants. Another concern is that the pesticide-resistance genes could spread to the same weeds that the pesticide is meant to kill- and “ superweeds” would be created that could not be killed by herbicides. However, ecologist C. Neal Stewart, Jr., tracked the spread of spliced genes in offspring from herbicide-resistant plants, and found that while the offspring does contain the resistance genes, it is highly unlikely that they would make a bad weed worse. It is also possible to place spliced genes into “ safe” zones in a plant’s genetic code where the gene is much less likely to be transferred to a weed (Barrett 74).

Protesters also question the motives of the biotech corporations. The biotech companies claim that genetically engineered crops will lower the (over)usage of dangerous chemicals; this is one of their main selling points. However, the same leading companies that sell these biotech crops are also the manufacturers of the chemicals that they will reduce the usage of. Why

would they want to lose profit on their chemical sales? In a quote from “Whats Wrong with Genetic Engineering?”,

These companies are genetically engineering plants to be resistant to herbicides that they manufacture so they can sell more herbicides to farmers, who, in turn, can apply more poisonous herbicides to crops to kill weeds. In fact, crops genetically engineered to be herbicide-tolerant account for nearly half of the applications for field testing submitted to the USDA since 1988.” (“ What’s Wrong with Genetic Engineering?”)

The chemical issue obviously has two sides to it; there are those who claim genetic engineering will reduce pesticide usage, and those who believe that it is just a tactic to sell more Roundup-type products. It does make sense that corporations would want to sell more chemicals rather than less. Some scientists even believe that herbicide-resistant crops will greatly increase herbicide usage. They fear that if farmers know their crops can tolerate it, they will apply a far greater amount of pesticides (“ What are the Dangers?”)

Another issue that frightens a great number of people is the fact that there are no long-term tests of this technology. Andrew Kimbrell, the executive director of the International Center for Technology Assessment, has voiced concerns over biotech.

The FDA has placed the interest of a handful of biotechnology companies ahead of their responsibility to protect public health. By failing to require testing and

labeling of GE foods, the agency has made consumers unknowing guinea pigs for

potentially harmful unregulated food substances. (“ Quotes from Scientists”)

The main point of this issue is that genetic engineering uses genes from organisms that have never been in the human food supply before, to alter the characteristics of food that people eat (“ What are the Dangers?”). It is hard to predict the effect of these things that have never been eaten before on the human immune system. Scientists can borrow proteins that have never been in the food chain and use them in food; for example, they could borrow a protein from soil, a bacteria, an algae, or any other living thing. The safety of these proteins for human consumption is unknown, since there has been no long-term testing. Along the same lines, using out-sourced proteins could lead to allergic reactions in some people. For instance, a GM banana could incorporate a protein from a fish. A person allergic to this fish protein would have no way of knowing this, and die as a result from eating the banana. This same issue could be used with vegetarians or people on religious diets, who could be unknowingly eating meat proteins in their fruits and vegetables (“ Whats Wrong with Genetic Engineering?”. Without requiring labeling on foods that have been genetically engineered, it would be impossible to trace the proteins to their source.

There are two sides to this issue, though. Monsanto claims to have done 1, 800 tests on its modified soybeans, comparing substances such as fatty acids, proteins, and hundreds of other materials. The results showed no difference from regular soybean plants. Monsanto also fed rats high doses of

the enzyme from their GM soybeans, and fed the soybeans to chickens, rats, and fish with no negative effects. Monsanto claims that even most “natural” foods wouldn’t pass FDA testing for the allergens their GM crops are tested for (Barret 72).

Possibly, the most common fear of this technology is the belief that genetic engineering is an imprecise technology that is bound to cause a disaster, and that once a disaster happens, it won’t be able to be contained. It is true that genetic engineering is imprecise and not fully understood. As Philip James, the Director of the Rowett Research Institute said, “The perception that everything is totally straightforward and safe is utterly naive. I don’t think we fully understand the dimensions of what we’re getting into.” Since genetic engineers move genes between organisms, that means that a gene can be exactly cut from a DNA code. But inserting it into the “target” organism is basically a hit-and-miss process, which means there is a risk that the inserted gene could disrupt the functioning of the genes of the organism it was inserted into (“What are the Dangers?”). GE organisms are also unpredictable- they have the potential to mutate, migrate, reproduce, etc. It is said that genetic pollutants are more dangerous than chemical pollutants, since once a GE organism escapes a lab, it is virtually impossible to recall, and the effects on the environment would be irreversible (unlike a chemical or nuclear accident). People also fear that GE organisms will run amok in the wild and damage the eco-system. They believe that through their “superior” genes, some genetically altered plants could out-compete their natural relatives, and overpower wild species in the same way that exotic diseases

such as Dutch Elm Disease have caused change in the ecosystem (“What’s Wrong with Genetic Engineering?”).

One other concern with genetic engineering is the fact that it will reduce genetic diversity on the planet. People who object to GE fear that scientists will use only the “perfect” types of each species, and species with less desirable traits will be left behind, while the “perfect” types are cloned in large numbers, reducing genetic diversity (“Whats Wrong with Genetic Engineering?”). Another danger of losing genetic diversity is that it could cause crop failure. If seed companies hope to profit from their GM seed, they must patent its genetic structure. This means that all seeds and plants would have the same genetic makeup, and if a virus or fungus could attack one plant, it could attack all others that had the same genes- causing widespread crop failure (“What are the Dangers?”).

As anyone can see, there is a great deal of debate about genetic engineering, and there are many valid points of view on the subject. This recent technology is becoming more and more commonly used in many aspects of life, and it offers benefits in everything from the environment, to medicine, to helping third-world countries feed their people. But there is a great amount of opposition to the use of genetic engineering in foods that will be eaten by humans, and many believe there has not been enough long-term testing on the effects of GE food on people (“Whats Wrong with Genetic Engineering?”). Finally, it is true that not everything is known about genetics yet, and a genetic accident could wreck the environment and cause irreversible damage (“What are the Dangers?”). It will probably take years before this technology is completely accepted by society. But for now,

people will probably be fine if they use some caution and common sense when dealing with GE foods, and try to understand the different viewpoints in the debate. Above all, it is scientists' responsibility to make sure that this new and powerful technology is used responsibly and to the benefit of more than just a few large corporations. It definitely has the potential.

Works Cited

" Agricultural Biotechnology- Frequently Asked Questions". USDA. 15 Nov. 2000 .

Barret, Amy, John Carey, and Ellen Licking. " Are Bio-Foods Safe?" Business Week 20 Dec. 1999: 70-76.

" Dangers of Genetic Engineering in Agriculture". 19 Nov. 2000 .

" Genetically Engineered Food- Is GE Food Safe?". 15 Nov. 2000 .

Glickman, Dan. " New Crops, New Century, New Challenges." Washington D. C. 13 July 1999.

Nash, Madeleine J. " Grains of Hope." Time 31 July 2000: 38-46.

" Quotes from Scientists and on the Dangers of GE Food". Purefood. 15 Nov. 2000 .

Sale, Kirkpatrick. " Monsanto: Playing God." The Nation 8 Mar. 1999: 14-18.

Shapiro, Robert B. " How Genetic Engineering Will Save Our Planet." The Futurist Apr. 1999: 28-29.

" What is Genetic Engineering?". Safe-Food. 19 Nov. 2000 .

<https://assignbuster.com/gentic-engineering-essay/>

“ What is Genetically Modified Food?”. 19 Nov. 2000 .

“ What’s Wrong with Genetic Engineering?”. Purefood. 15 Nov. 2000