

# Genetically Modified Organisms and Animal Hormones

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## **I. What I Know**

For my I-search paper, I chose the topic of GMOs and hormones given to animals in the food industry. I learned on a field trip that GMOs, standing for genetically modified organisms, refers to crops that are genetically changed in order to produce certain characteristics in that plant; this can range from making larger fruits and vegetables to making the color of the crop brighter. I also know that many people try to avoid genetically modified crops while shopping because produce that is not modified is better for people to eat. I am also interested in animals that have been given hormones. I learned in my biology class that hormones are naturally produced chemicals made by animals that can change physical characteristics of animals. I also know that chemically produced hormones are given to some animals, especially cows and other animals used for meat, to make them grow faster, grow bigger, produce more milk, and generally make the animals more profitable in a shorter amount of time.

## **II. What I Want To Know**

For this paper, I want to know more about how and why people genetically modify plants and give hormones to animals. I also want to know if any research has been done to study the effects of these modifications on the health of the people eating the plants and animals. I would also like to learn the reasons that make this topic such a heated debate; why are these practices beneficial and why are they detrimental? Also, what effect could genetically modified plants and animals have on the environment? I want to know how the hormones affect the animals and whether or not administering them is humane. I want to know how the hormones given to animals can affect the people who consume them, and if there are any diseases or health risks associated with it. I also want to know why farmers continue to genetically modify their crops and give hormones to their animals when many people choose not to eat food products that have

been modified. I want to learn about both sides of this issue so that I can make an educated decision for myself whether or not I support these practices. To do this, I will read articles, books, watch lectures, and interview a biologist to answer these questions.

### **III. The Search Results**

To learn what I wanted to know about genetically modified organisms and animal hormones, I read articles and watched a TED talk about my topics. My findings suggested that there are many pros and cons for both practices, but since they are usually not labeled it is hard for people to be informed and choose whether or not to eat them. Since no conclusive evidence has been found while studying genetically modified organisms and animal hormones, there should be more research done to determine the safety, environmental impact, and effects on people that these modified foods can have.

Genetically modified organisms have many positive outcomes and advantages over organic crops and animals. In her TED talk, Pamela Ronald presents three scenarios in which GMOs can accomplish what regular crops can't: papayas that are immune to the deadly ringspot virus, implanting of DNA into eggplants to drive out harmful pests, and "golden rice" with beta carotene that prevents children from going blind in third world countries. She continues by saying that all of the largest scientific organizations in the world support the safety and use of genetic engineering in crops and animals, as well as there being no cases of harm to the health of people who eat GMOs so far. Genetically modified organisms may be the answer to saving crops from extinction and helping to prevent malnutrition.

However, there are also many problems that could arise from the continued genetic engineering of our food. One problem is that many people think that genetically engineering crops is allowing farmers to use more herbicide and pesticide on their crops, as demonstrated by

Monsanto, a corporation that engineered their crops to be resistant to their brand of herbicide, Monsanto's Roundup. (Sorenson) One negative outcome that may become more common with the continued development of GMOs is the environmental impact; the herbicides used on resistant GM crops have wiped out a large amount of milkweed, resulting in a 90% drop in the Monarch butterfly population. (Potenza) The increased use of herbicides and pesticides has led to, as the Chipotle restaurant chain calls it, an "escalating arms race with weeds and insects." As corporations develop new chemicals, pests and weeds may evolve to be immune and the vicious cycle of more chemicals and immune targets will continue. (Sorenson) Near the end of her TED talk in support of GMOs, Pamela Ronald went on to say that while GM crops can help improve our lives, if corporations look to profit off their seeds, then the places that need it, especially in developing countries, will not be able to access or use genetic engineering to benefit their communities. Genetically modified organisms may lead to irreversible effects on the environment and be used for profit instead of advancement. Most scientists support them, but only 37% of consumers think they are safe to eat (Potenza); there is not enough conclusive evidence to decide.

There are also many positive advantages that animals with natural and synthetic hormones have over regular animals. A protein given to dairy cows called rBGH, or recombinant bovine growth hormone, increases milk production by 10 to 15%, so not as many dairy cows are needed to fill the demand for milk and dairy products. Also, the steroids given to beef cows make them grow bigger and leaner so fewer cows are needed and there is less waste in the form of fat on the meat we buy. (Laliberte) The levels of hormones administered to animals have been tested and regulated by the Food and Drug Administration to determine safe levels for rBGH and steroids in our food. Also, the level of these natural hormones in untreated animals is

considerably more than any amounts administered by the farmers. (“Steroid Hormone Implants”) The hormones given to beef and dairy cows are effective and declared safe in regulated amounts by the FDA.

However, there are also many problems and variables that cause many consumers to question the safety of eating hormone-treated foods. The hormone rBGH, which is given to dairy cows to produce more milk, may lead to faster development in children, as well as an increase in a protein linked to cancer and udder infections in the dairy cows, which calls for more antibiotics used to fight the infections. Also, the steroids given to beef cows can cause stunted development in children and “reproductive abnormalities.” (Laliberte) The FDA says that the hormones and steroids are safe in regulated amounts, but there is little solid evidence in support of or opposed to animal hormones.

Whether or not they want to, it is hard not to eat genetically modified foods. 94% of soybeans, 93% of corn, and 80% of packaged food altogether is genetically modified, but it is not easy to determine because labeling foods as GM is not mandatory. (Potenza) Based on my research, I support the use of genetically modified organisms out of necessity, but not for profit or convenience. GMOs need to be labeled because if the industry stands by its products, it should “slap ‘proudly GMO’ labels on its products and let the market decide.” (Sorenson) However, I want to see what the future brings in research and the debate over labeling.

Similar to genetically modified organisms, I support administering hormones to animals if it is necessary, but not to make easier profits for corporations. If the hormones allow for fewer cows on farms and more space to graze then it is better than the inhumane alternatives, but farmers should not put personal gain before the just treatment of animals and the health of consumers. However, I will try not to eat as many meat and dairy products with hormones until

more testing is done to determine the safety of these foods. The final part of my research was to interview a biologist to get my final few questions answered.

#### **IV. The Interview**

For the interview portion of my I-Search paper, I emailed Barbara [REDACTED] and Keith [REDACTED], two science teachers at [REDACTED]. Ms. [REDACTED] has a Bachelor of Science degree in Environmental Biology and Forestry and a Masters degree of Science Education in Biology. She is also an Adjunct Professor with SUNY College of Environmental Science and Forestry. Mr. [REDACTED] has a Bachelor of Science degree in Biology and additional studies in Biochemistry. He has taught every level of both biology and chemistry at the high school level. I interviewed them to get the perspective of people who are knowledgeable about science, particularly biology, and would have an educated opinion on my topics. Also, I know that less than half of Americans think GMOs are safe, so I was curious to see whether it was the same or different for men and women with science backgrounds.

First, I asked how plants and animals are genetically engineered. She told me that genetic engineering is essentially implanting DNA from one organism into another to produce a certain trait. It is usually done by attaching the DNA to bacteria because their offspring will be identical to the parent with the desired trait. I asked about practical uses for GMOs and she said that there were many, some of which were long-lasting freshness to decrease food waste, making foods with more nutritional value, and producing leaner meats that are less likely to cause heart disease. However, I asked about harmful effects and she warned that cross-pollination of natural and modified DNA could lead to resistant super weeds and bacteria, lack of biodiversity in ecosystems, and disruption of food webs and resources. Finally, I asked if GMOs are necessary or just convenient and she said that “this is a tough one... While there are many good things I

think there are other ways to accomplish the same things- it might cost more but I feel GMOs are just a convenience.”

Next, I asked Ms. [REDACTED] about animal hormones. I wanted to know the main reasons why farmers give hormones to their animals, and she said it can make housing livestock cheaper and more humane since there are fewer, faster-growing animals. Then, I asked about problems and she said that the hormones have special codes of amino acids that end up in the food we eat and can potentially affect how our body makes proteins. I asked if she supports or opposes the use of GMOs and animal hormones in the food industry and she said that she opposes them because of the limited research and testing so far. Lastly, I asked her if these practices can have any unforeseen effects in the future and she answered, “Absolutely! History is full of ‘good science ideas’ that go horribly wrong. There can be human health impacts as well as ecosystem disruptions that might occur. With no longer term studies (mostly because GMOs haven’t been around long enough to get data) the exact impact is only theory.”

Then, I moved on to my interview with Mr. [REDACTED], asking the same questions to see if his answers differed from Ms. [REDACTED]’s or not. He told me that one method of engineering organisms is to use restriction enzymes, which remove certain sections of DNA, and then insert DNA for the desired trait in the gap. Another method, the CRISPR Cas9 system, essentially engineers organisms so that the desired trait is inserted into all chromosomes and every single one of the offspring will have the trait. He said that some practical uses for GMOs are making crops grow more efficiently, increasing nutrition, curing genetic diseases, and produce drugs and medications. Next, he said that the biggest problem with GMOs is that there is too much we don’t know. He said, “DNA is very complicated, and while we understand much of it, there’s still quite a bit we don’t know... It’s difficult to predict all of the effects of any action, so with

genetic engineering, long-term testing is an important step before any process or GMO goes into widespread use.” I asked if GMOs are necessary or just convenient and he told me that while he doesn’t think they are necessary, there are many situations where they are beneficial and ultimately it is a matter of opinion.

I then asked Mr. [REDACTED] about animal hormones. He said the main reason farmers use these hormones is for efficiency and lowering costs, but the main problem with this practice is altered development of humans, particularly earlier puberty in children (although no consensus has yet been reached). I asked whether or not he supports these practices and he said yes, but with certain caveats; there needs to be testing and peer review to ensure safety, the unpredictable CRISPR Cas9 system should not be used in the wild due to its capability for lethal and unpredictable side effects, and animal hormones are okay so long as they are natural and in regulated amounts. Finally, I asked about possible unforeseen side effects. Mr. [REDACTED] said that changing genetics can affect almost all processes in living organisms, it is hard to “put the toothpaste back into the tube” if a genetically modified organism ends up in the wild, and anyone with malicious intent could potentially produce a devastating bio-weapon. With my interviews concluded, I had gathered all the information I needed on my topics.

## **V. The Search Reflection**

Before I started my research, I thought that genetically modified organisms and animal hormones were all bad and that growing food naturally was completely safe and good. However, the information I found made me think very differently. In many cases, genetic engineering may be the only way to save the foods we love from being wiped out and ensure that what we eat is safe. In fact, without pest-resistant DNA or specially formulated pesticides, many of the foods we eat would be covered with insect wastes or be eaten by insects and other animals.

Furthermore, GMOs are being used in developing countries to fight malnutrition and hunger, a problem that I am very passionate about. Animal hormones, which increase milk and beef production, allow for farmers to have fewer cows that can graze more freely, which is also very important to me. The hormones administered to animals are found naturally in humans so it is safe for us to eat them.

But, there are also many problems with these practices. If corporations try to sell GM seeds instead of freely distributing them, then places in the world with the greatest need will not have the access needed to make a difference in their communities. Also, nature can adapt and over time the amount of harmful herbicides and pesticides will increase; our food will be covered in chemicals. If GM seeds are carried by animals or weather and end up on organic farmland, the modified DNA will blend with the crops and may wipe out the organic food supply. The hormones given to animals can also be harmful in the future. Although not conclusively determined by research, many believe that eating meat or dairy products treated with hormones can cause hormone imbalances in humans that can damage child development and reproductive development. Even though the FDA claims that the levels of hormones used are safe, there has been little federal research or testing that remain constant with the FDA's findings. In my research, I learned many positive and negative aspects of genetically modified organisms and animal hormones.

Overall, my research has made me more conscious of what is in the food I eat. Even though they are widely supported and supposedly safe, I will try to avoid eating GMOs and animal hormones as much as possible because as of now we don't really know if they are safe. This project has inspired me to also research food additives since that goes along with knowing what is in my food. Furthermore, I am in support of making labeling GMOs and animal

hormones mandatory so that people will be able to decide for themselves what is safe and what is not. Researching genetically modified organisms and animal hormones has been an eye-opening experience that has made me think more about what I eat.

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