GMO Science – Understanding How GMOs Are Created, and What Prominent Scientists Are Saying

According to the World Health Organization, GMOs are "Organisms in which the genetic material has been altered in a way that does not occur naturally."

Genetically modified organisms are organisms built with genes from more than one species. The process involves laboratories and scientists followed by regulators, lawyers and lobbyists. There is nothing natural about it. So when biotech argues that the techniques for creating GMO crops are just like traditional crop breeding techniques, those statements are blatantly false.

The First Frankenfoods

One of the first GMO crops to be put on the market was Bt-corn. Bt-corn was made a few decades ago by combining the genes of a bacterium, Bacillus thuringiensis, with the DNA of corn. This genetic modification was engineered to create corn that produces pesticide. Every cell now produces a new protein never before seen in corn, the Bt endotoxin or Bt protein. The toxin is produced in sufficient quantities to kill insects.

The Bt protein or Bt endotoxin must be ingested in order for it to kill. After ingestion, the Bt protein binds to the insect's digestive tract. It can no longer feed, and in a matter of hours its gut breaks down, and bacteria from its digestive tract flood the insect's body. It dies of septicemia, eaten from within.

The Bt toxin has been found in human blood and in pregnant women and their fetuses. This means that these toxins are not only making their way into our bodies, our bodies are not fully eliminating them.

Other examples of GMOs include adding a gene from a fish into tomatoes and strawberries to protect them from freezing. Goats have been injected with spider genes in order to produce milk that contains proteins more durable than Kevlar. Also rice has been injected with human genes to manufacture pharmaceuticals.

Methods to Create GMOs

Genetically modifying plants and animals are typically created using one of three methods: the gene gun, the plasmid method, and the vector method.

Gene Gun

The gene gun literally shoots genetic material into the targeted cells. Genetic modification using the gene gun begins with either a young plant, or with cells grown in a culture. The gene gun, using specially prepared bullets, bombards the cultured cells or the young plant. The bullets are coated with microscopic gold or tungsten particles that contain segments of DNA. Once the microscopic particles are inside the nucleus of cells, the DNA can merge into the genes of the young plant or the genes of the cells in a tissue culture.

It is interesting to note that the young plant (now called a chimera) will retain most of its physical characteristics, but the plant grown from a cell culture may grow to look very different from the original plant.

The Plasmid Method

The plasmid method, the most common method, uses bacteria to modify an organism. Plasmids are a type of DNA found in

bacteria. The process involves bathing the plasmids in enzymes, encoding the bacteria for antibiotic resistance, and then fusing the plasmids into target bacteria. The culture is then treated with antibiotics that kill all of the unmodified bacteria.

The Vector Method

The vector method uses a modified virus to alter the genes of the target cells. The genes to be modified or removed are isolated. The virus is altered to be less destructive and to carry the genetic payload. The virus then infects the target cells with altered genes. The infection modifies the cells' genetic structure. As the cells multiply, all copies of the cells will express the modified genes.

Artificial Selection Vs. GMOs

Biotech argues that genetically modifying food is no different than artificial selection. Irrefutably, both processes change the genes of plants and animals.

But artificial selection and natural selection carry genes within populations that are constrained by species. Genetically modified foods have no such constraints. Genes from different species are put together to make new organisms. Let's take a closer look at artificial selection.

What is Artificial Selection

Artificial selection is a process by which natural evolutionary processes are altered by human intervention. Current estimates place the beginning of life at 3 ½ to 4 billion years ago. This long time span is what accounts for the rich diversity of life on Earth. More than 99.9% of all species that have existed on this planet are now extinct. Of those that remain, the plants and animals most useful to us have been domesticated. Instead of survival of the fittest,

think survival of the friendliest and survival of the most nutritious and delicious. With our help, the evolution of these plants and animals was put on fast forward.

Through artificial selection (also called artificial breeding) we have bred plants and animals that are in almost all cases so different from their wild counterparts as to be unrecognizable.

Wild carrots, and wild lettuce are, by today's standards, inedible. Wild carrots produce natural pesticides, which are good for carrots and bad for us, so we bred that trait out of carrots. Wild carrots also provide fewer calories, and less nutrition than their domesticated counterparts. Wild lettuce contains latex. As you might have guessed, latex tastes horrible, and it irritates our digestive tract.

The main limitation of selective breeding is that the organisms to be bred must be closely related, usually of the same species. If not of the same species, they must be very closely related and share a recent common ancestor, such as dogs and wolves, or wild boars and pigs. Attempts to breed more distant relations such as horses and donkeys or lions and tigers usually produce sterile offspring, or no offspring at all. (A mule is bred from a male donkey and a female horse. A hinny is bred from a female donkey and a male horse. Less commonly known, a liger is an animal bred from a male lion and a female tiger. The progeny of a female lion and a male tiger is called a tigon.)

This radical alteration of plants and animals has been going on for a long time. Selective breeding has a proven track record. It isn't perfect, and agronomists still have a lot to learn to learn in order to improve upon it, but we have been doing it for thousands of years. Without the domestication of plants and animals we could not support our population, not nationally and definitely not globally.

The changes made to domesticated plants and animals over time do alter genes. Desired traits are selected and undesirable traits are selected against. To say this modifies genes is semantically correct, but so does natural selection, but it is not the same thing as genetic modification.

Despite this limitation, it is incredible what can be achieved via artificial selection. We can produce purple potatoes, black tomatoes, yellow watermelon, over 300 breeds of dogs, and more than 800 breeds of cows. Heirloom fruits and vegetables, commercial cultivars, and hybrids have all been realized through artificial selection.

The GMO Debate and Prominent Scientists

Neil Degrasse Tyson argues that all foods are genetically modified, and that people have an irrational fear of these new foods. Bill Nye echoes the same sentiments. Both have begun publicly supporting GMOs. Neither individuals are experts on genetics, nutrition, health, or biology. Dr. Tyson is an accomplished astrophysicist. Bill Nye earned a bachelor's degree in mechanical engineering. Both individuals studied under Carl Sagan, and the late Carl Sagan had something very different to say about genetic engineering.

> *"Fortunately, we do not know, or at least do not yet know…how to assemble alternative sequences of nucleotides…to make alternative kinds of human beings. In the future, we might well be able to put nucleotides together…in any desired sequence…to produce human characteristics we think desirable. A disquieting and awesome prospect." – Carl Sagan*

> *"Biology is more like history than it is like physics. You have to know the past to understand the present. There is no predictive theory of biology just as there is no predictive theory of history. The reason is the same both subjects are*

still too complicated for us." – Carl Sagan

A Geneticist Weighs In – David Suzuki

David Suzuki agrees that biology and genetics (a subfield of biology), are unpredictable. He doesn't think that GMOs have been adequately tested, and he says that biotech has put us all in great experiment by prematurely introducing GMOs to the food supply.

> *"The problem is this: geneticists follow the inheritance of genes in what we call a vertical fashion. You breed a male and a female. You follow their offspring. You breed them. You follow it on down, within a species. What biotechnology allows us to do is to take genes from this organism and move it, what we call horizontally, into a totally unrelated species. …What biotechnology allows us to do is to switch genes from one to the other without the biological constraints." -David Suzuki*

> *"The problem is this you see, it's very, very bad science. We assume that the principles governing the inheritance of genes vertically applies when you move genes laterally or horizontally. There is absolutely no reason to make that conclusion. We have to do more experimentation." – David Suzuki*

Biotech claims that they are thousands of studies proving the safety of GMOs. Many short-term studies, up to 90 days, do show their products are safe. Many long-term studies, show a very different outcome.

Dr. Goodall's Informed Opinion

Before Jane Goodall's work our definition of mankind was "man the toolmaker." Dr. Goodall has made many important scientific discoveries. She proved that chimpanzees use tools, that they

eat meat, and that they have a complex social system. She is a highly respected scientist.

She is well informed on GMOs, so her opinion of them is not borne of ignorance. Dr. Goodall has publically accused GMO supporters of fraud, and says that they are the ones who are "anti science". She has warned Britain and Europe not to lower GM safeguards, and she has condemned politicians for endorsing "Frankenstein food."

"I pursued nature to her hiding-places. Who shall conceive the horrors of my secret toil, as I dabbled among the unhallowed damps of the grave, *or tortured the living animal to animate the lifeless clay?"* Mary Shelley's Frankenstein

When the GMO Studies Are Not Funded By Industry…

A two-year study in France has shown that rats didn't get cancer in the first 90 days of being fed GMO corn, they began to get cancer after four months. The journal, which published the study, retracted it.

The scientists stand by their results, and they believe that the editorial appointment of Richard Goodman, a former Monsanto employee, is the reason behind the retraction. The study has been criticized for what kind of rats was used, but these are the same kind of rats used in many Monsanto studies.

There have also been long-term studies that show disruption of reproduction due to GMOs with low fertility and high infant death rates in rats and mice.

And while articles will state that there is no evidence, even anecdotal evidence of disease or problems due to GMO livestock feed, this is another lie. Farmers have complained about their animals' poor health and sterility due to GMO feed.

GMO Contamination

Biotech said they could contain GMOs, but this was another lie. GMOs contaminate other varieties by cross-pollination. This contamination typically comes from natural sources. Birds, insects, wind, and weather can carry pollen or seeds from GMO crops many miles to other farmer's fields. When this happens, if the farmer isn't growing the same GMO crop, he isn't considered the victim, he is often sued for patent violation. The usual procedure is a settlement agreement that forces the farmer into silence.

GMO wheat was not approved by the FDA, but a field of GMO wheat was found in Montana, well after the GMO crop was ordered to be destroyed.

The South Korean government bans the cultivation of GMO crops, but GMOs have been found growing in their country; especially along shipping routes. South Korea imports animal feed, and they import GMO crops, but they do prohibit growing GMOs. Now they have no choice; GMOs are growing themselves.

Many countries have banned the cultivation of GMOs, and most countries require GMOs to be clearly labeled. Canada and the U.S. do not currently require GMO labeling, except in a few states. There is currently a bill called the Safe and Accurate Food Labeling Act, which would eliminate state's rights to label GMOs.

The Labeling Double-Standard

Biotech has opposed GMO labeling for consumers, but they are certainly pro-labeling when it comes to their seeds. When farmers buy their seed, they extensively label it, and they explain the many restrictions placed on their seeds. One of the restrictions is that farmers are prohibited from growing non-GMO crops alongside GMO crops, making it impossible to

compare yields. Biotech claims GMOs increase yield, but this is another lie as proven by crop yields across the world.

One of the more common genetic modifications renders a plant immune to Round Up. This allows the farmer to spray Round Up in large amounts all over his or her field to kill weeds. Unfortunately, this process has resulted in Round Up resistant weeds, and it increases herbicide residues in the crops. Recently, the World Health Organization said the widespread use of Round Up is a main cause of the rising cancer rates worldwide.

How To Avoid GMOs

Avoiding GMOs won't be easy for most people who eat prepackaged, processed foods. The NON-GMO project verified label is helpful. It means the ingredients are 99% GMO free. Organic also means 99% GMO free. More than 80% of processed foods contain GMO ingredients. If you buy processed foods, buy organic.

Trader Joe's sells GMO foods, though their name brand items do not contain them.

Whole Foods talks a good game, but so far they have done nothing except provide some organic options. Exclusively organic restaurants are few and far between, and unfortunately, almost any other restaurant will be serving GMO food. The most common GMOs are canola oil, soy (including milk and oil), corn (including high fructose corn syrup), cottonseed oil, zucchini, yellow squash, papaya, aspartame (which is produced from genetically modified bacteria) and sugar (from sugar beets).

Conclusion

Despite what biotech would have you believe, it is not

unscientific to reject GMOs. The rest of the world is not too keen on genetically modified foods, and the scientific community is divided on the issue. The majority of scientists appear to support GMO technology, but there is a lot of money involved in supporting it and nothing but hardship for those who dare oppose it. Many scientists are harshly criticized, censored, and have their funding disappear if they are critical of biotechnology.

Censorship has no place in science, and in order for science to thrive, scientific inquiry must be given free reign. If allowed, science is ultimately self-correcting, but not when scientists are coerced into supporting commercial interests before science. This is exactly what is happening.

The belief that GMOs are harmful to human health certainly has scientific validity. Despite what biotech companies would have us believe, we evolved to eat food, not chemicals. We evolved to eat organisms that came from the earth, not organisms that came from a laboratory.

What We Can Do About It

In a free society, it should be easier to opt out of this GMO experiment. We should have the right to choose what we put into our bodies and not have it chosen for us.

We can vote with our dollars, but not when we are kept in the dark.

Please contact your representative and senators (also check out How To Contact Congress) now and let them know you want to see all GMO foods labeled. Ask them to vote against the Food Safety and Labeling Act, which would deny states the right to require GMO labeling.

Further Reading:

- *Understanding and Detoxifying Genetically Modified Foods*
- *GMO Science*
- *How to Avoid GMOs*
- *The Difference Between Heirlooms, Hybrids, and GMOs*
- *How To Detoxify and Heal From Vaccinations – For Adults and Children*

Sources:

- *Bt Corn: What It Is and How It Works* – University of Kentucky
- *Seeds of Death* – You Tube
- *Transformation 2 – Transformation Methods – Plant and Soil Sciences eLibrary*
- *Genetic Engineering and Its Methods* – Biotech Articles.com
- *Professor David Suzuki speaks out against GMO's* – You Tube
- *A Comparison of the Effects of Three GM Corn Varieties on Mammalian Health* – International Journal of Biological Sciences
- *Study linking GM maize to rat tumours is retracted* – Nature
- *Failure to Yield – Union of Concerned Scientists*
- *Research indicates That GMO Could Be a Cause of Infertility – National Fertility Info*
- *GMO Defined – GMO Awareness*
- *Jane Goodall Biography* – Biography.com
- *Senior academic condemns 'deluded' supporters of GM food as being 'anti-science' and ignoring evidence of dangers* – Daily Mail