FREQUENTLY ASKED QUESTIONS ABOUT GENETIC ENGINEERING

THE CAMPAIGN FOR HEALTHIER EATING IN AMERICA
No Genetically Modified Organisms

Q. What IS genetic engineering or genetic modification?

A. Genetic Engineering (GE) or Genetic Modification (GM) is the laboratory process of taking genes from one species and inserting them into another in an attempt to obtain a desired trait or characteristic. The resulting organism is called a genetically modified organism or GMO. It is now possible for plants to be engineered with genes taken from bacteria, viruses, insects, animals or even humans.

Q. How is Genetic Engineering done?

A. Because living organisms have natural barriers to protect themselves against the introduction of DNA from a different species, genetic engineers have to find ways to force the DNA from one organism into another. These methods include:

- Using viruses or bacteria to "infect" animal or plant cells with the new DNA.
- Coating DNA onto tiny metal pellets, and firing it with a special gene gun.
- Using electric shocks to create holes in the membrane covering sperm, and then forcing the new DNA into the sperm through these holes.
- Injecting the new DNA into fertilized eggs with a very fine needle.

The first two methods are those primarily used for creating GM plants.

Q. What is the difference between genetic engineering and genetic modification?

A. For most people, the terms Genetic Engineering (GE) and Genetic Modification (GM) mean the same thing. Some individuals and organizations define genetic modification is any method that changes the genome, including selective breeding. We believe that this alternate and broader definition is being promoted by pro-biotech organizations who wish to give the false impression that Genetic Engineering is the same as traditional plant breeding. GM is a brand new technology that creates new organisms never before in existence.

Q. Is genetic engineering precise?

A. The technology of genetic engineering is currently very crude. It is not possible to insert a new gene with any accuracy, and the transfer of new genes can disrupt the finely controlled network of DNA in an organism.

Current understanding of the way in which DNA works is extremely limited, and any change to the DNA of an organism at any point can have side effects that are impossible to predict or control. The new gene could, for example, alter chemical reactions within the cell or disturb cell functions. This could lead to instability, the creation of new toxins or allergens, and changes in nutritional value.

Q. Why do genetically engineered foods have antibiotic resistant genes in them?

A. The techniques used to transfer genes have a very low success rate, so the genetic engineers attach "marker genes" that are resistant to antibiotics to help them to find out which cells have taken up the new DNA. That way scientist can then douse the experimental GMO in antibiotics and if it lives, they have successful altered the genes. The marker genes are resistant to antibiotics that are used in

human and veterinary medicine. Some scientists believe that eating GM food containing these marker genes could encourage gut bacteria to develop antibiotic resistance.

Q. What are the potential dangers of eating GM foods?

A. There are a number of dangers that broadly fall into the categories of potential toxins, allergens, carcinogens, new diseases, antibiotic resistant diseases, and nutritional problems. The book Genetic Roulette identifies 65 health risks of GMOs. Lab animal studies have identified damage or unexplained changes in virtually every organ and system evaluated. Medical and first hand reports also link GMOs to toxic and allergic reactions in humans and thousands of sick, sterile and dead livestock. See www.ResponsibleTechnology.org for more information.

Q. What foods are GM?

A. Currently commercialized GM crops in the US include soy (91%), cotton (87%), canola (80%), corn (73%), Hawaiian papaya (more than 50%), zucchini and yellow squash (small amount), and tobacco (Quest® brand). Other sources of GMOs include: dairy products from cows injected with rBGH; food additives, enzymes, flavorings, and processing agents, including the sweetener aspartame (NutraSweet®) and rennet used to make hard cheeses; meat, eggs, and dairy products from animals that have eaten GM feed; and honey and bee pollen that may have GM sources of pollen. GM sugar beets were planted in 2008. Unless action is taken to prevent its use, the sugar supply in the US will also be genetically engineered by the end of the year.

Q. Hasn't the Food and Drug Administration (FDA) proved that GM foods are safe?

A. Many consumers in the US mistakenly believe that the FDA approves GM foods through rigorous, in-depth, long-term studies. In reality, the agency has absolutely no safety testing requirements. Questionable research from companies like Monsanto who voluntarily perform tests on their own crops, have been meticulously designed to avoid finding problems (see *Genetic Roulette*). FDA policy claimed that the agency was not aware of any information showing that GM crops were different "in any meaningful or uniform way," and therefore didn't need testing. **But 44,000 FDA internal documents made public from a lawsuit show that this statement was false.** The overwhelming consensus among the FDA's own scientists was that GM foods were quite different and could lead to unpredictable and hard-to-detect allergens, toxins, new diseases and nutritional problems. They had urged superiors to require long-term studies, but were ignored.

A recent poll showed that Americans are completely in the dark: Only about 1 in 4 know that they have ever eaten a GM food in their lives (even though the vast majority of processed foods contain derivatives from the four major GM crops: soy, corn, cotton-seed and canola). Ironically, the same companies that carefully avoid GM ingredients for concerned Europeans are happy to sell GMOs to unknowing consumers in the US.

Q. Has any independent research shown GM foods to be safe?

A. No. While only a pitifully small number of animal feeding safety studies have been conducted, several showed evidence of problems. Rats fed an experimental GM potato developed potentially pre-cancerous cell growth, damaged immune systems, smaller brains, livers, and testicles, and partial atrophy of the liver. Rats fed GM soy showed odd shaped cell nuclei in their livers. Rats fed GM canola had livers that were heavier, and rats fed GM corn had several unexplained anomalies.

Pigs fed GM corn on several farms in the Midwest developed false pregnancies. Twelve cows fed GM corn mysteriously died in Germany. And eyewitness reports from all over North American describe how several types of animals including cows, pigs, geese, elk, deer, squirrels, and rats, when given a choice, avoid eating GM foods.

Since no one is monitoring the human health impacts of GM foods, it might take years to discover most reactions. One epidemic, however, was rare, serious, and fast acting, and therefore more easily discovered. Called EMS, it wastraced to a GM brand of the food supplement L-tryptophan. In the 1980's, the contaminated brand killed about 100 Americans and caused sickness or disability in about 5,000 to 10,000 others.

Q. How dangerous, or potentially dangerous, are GM foods relative to other food dangers, e.g., pesticides, irradiation, additives, preservatives?

A. Since so little research has been done on the safety of GM food, it is not possible to rank its risks. Unlike the others, GM crops not only persist but multiply in the environment, and may continue to pose risks to health for centuries. In addition, transfer of GM genes from the GM food we eat into the bacteria inside our intestines may present long-term chronic exposure, since the foreign protein may continue to be produced inside of us even after we no longer consume GM food. (The only human feeding study ever conducted confirmed that GM soy genes do transfer into human gut bacteria, and continue to function.)

Q. Haven't people been eating GM foods without any ill effect?

A. The biotech industry says that millions have been eating GM foods without ill effect. This is misleading. No one monitors human health impacts of GM foods. If the foods were creating health problems in the US population, it might take years or decades before we identified the cause.

Again, the L-tryptophan epidemic described above was one example of traceable sickness and death that was likely caused by the genetic engineering process used to create that food supplement.

Soon after GM soy was introduced to the UK, soy allergies skyrocketed by 50 percent. Without follow-up tests, we can't be sure if genetic engineering was the cause, but there are plenty of ways in which genetic manipulation can boost allergies. Similarly, according to a March 2001 report, the Center for Disease Control says that food is responsible for twice the number of illnesses in the US compared to estimates just seven years earlier. This increase roughly corresponds to the period when Americans started eating GM food. But we cannot determine the cause without tests.

Milk from rbGH-treated cows contains an increased amount of the hormone IGF-1 which is one of the highest risk factors associated with breast and prostate cancer. If cancer rates were increasing as a result, we would not necessarily be able track this as a cause due to a lack of labeling, testing and regulation.

Q. Why are children particularly susceptible to the effects of GM foods?

A. Children face the greatest risk from the potential dangers of GM foods for several reasons:

- Young, smaller, fast-developing bodies are most susceptible to toxins i.e. lead
- Children are more susceptible to allergies.
- Children are more susceptible to problems with milk.
- Children are more susceptible to nutritional problems.
- Many children rely on antibiotics and may be more impacted by antibiotic resistant diseases.

Q. Have any GM foods been banned or labeled anywhere in the world?

A. All over the world countries and towns have banned or not approved GM crops. In the European Union most major food companies refuse to use GM ingredients in their brands, and many refuse the use of GM feed to animals used for their milk, meat and eggs. Japan has largely rejected GMOs, and

Canada has refused US grown GM papayas and wheat. States in Australia, regions in New Zealand and Brazil, the countries of Venezuela, Zambia, Sudan, Angola, and others all have very active movements GM-free movements. Thus, world markets are shrinking.

This industry-wide rejection of GMOs can be achieved by a "tipping point," in which a sufficient number of shoppers avoiding GM ingredients force the major food companies to stop using them. Europe reached the tipping point in April 1999 and within a single week, virtually all major manufacturers publicly committed to stop using GM ingredients in their European brands. The tipping point was reached quickly thanks to the buying power of consumers that convinced manufacturers to keep GMOs out of the EU, in spite of official approvals by the pro-GM European Commission.

Q. Why is there an effort to create GM-free agricultural zones?

A. Farmers, such as those growing organic crops, strive to keep crop varieties separate from others to meet purity requirements of their buyers. Unwanted varieties may cross-pollinate or get mixed up in the seed, harvest equipment, or during storage and transport. Some farm regions create entire zones that exclude unwanted varieties, where all the farms and collection and distribution points only handle approved non-GM crops. In the US, voters in Mendocino and Marin Counties in California passed ballot initiatives to ban GM crops. Officials in California's Trinity and Santa Cruz Counties have passed ordinances banning the outdoor cultivation of GM crops, as have towns in Maine and California.

Q. Does biotechnology offer benefits?

A. Biotechnology refers to a much wider field than just genetically modified crops and animals. Unraveling the secrets of DNA may benefit many areas including medicine. People have different opinions on the ethics of biotechnology. Regardless of ethical issues, we know that the current technology of GM foods is based on obsolete information and theory, and is prone to dangerous side-effects.

Q. What is wrong with genetic engineering of food – haven't growers been grafting trees, breeding animals, and hybridizing seeds for years?

A. Genetic engineering is completely different from traditional breeding and carries unique risks.

- In traditional breeding it is possible to mate a pig with another pig to get a new variety, but is not possible to mate a pig with a potato or a mouse. Even when species that may seem to be closely related do succeed in breeding, the offspring are usually infertile—a horse, for example, can mate with a donkey, but the offspring (a mule) is sterile.
- With genetic engineering, scientists can breach species barriers set up by nature and transfer genes between kingdoms. For example, they have spliced fish genes into tomatoes. Other examples of genetic engineering experiments that have already been done include:
- Spider/Goat – inserting a gene from a spider into goats, in the hope that the goats can then be milked for the spider web protein in order to make bullet proof vests.
- Fish/Strawberries – taking a gene from an Arctic flounder and putting it into a strawberry to try to make it frost-resistant.
- zCorn/Human – taking a human gene and putting it into corn so that the corn contains human antibodies that attack sperm. The idea is to develop the corn as a plant-gel contraceptive that kills sperm on contact.

Q. What are the problems created through genetic engineering of food and crops?

A. Genetic engineers continually encounter unintended side effects – plants create toxins, react to weather differently, contain too much or too little nutrients, become diseased or malfunction and die.

Q. How have money and politics worked against the public in the area of GM foods?

A. Industry manipulation and political collusion and not sound science allowed dangerous GM foods into our diet. Industry research was rigged; data was omitted or distorted. In the case of genetically modified bovine growth hormone, for example, an FDA scientist who expressed concern and was slowing up the approval process by demanding more tests was fired. The remaining whistleblowers had to write an anonymous letter to Congress complaining of fraud and conflict of interest at the agency. In Canada, government scientists also complained that they were being pressured to approve the GM hormone, which is injected into cows to increase milk supply. They were concerned about human health impacts. They testified that the drugs maker, Monsanto, offered them a bribe of $1-2 million to approve it. They also reported that documents were stolen from a locked file cabinet in a government office. Other stories of pressure, bribes, and threatened whistleblowers are reported through the history of GM foods and their approval, research, and promotion.

Q. Is it possible that organically grown corn and soybeans can be infected by GM genes?

A. Yes. Organic standards do not allow the use of GM seeds and therefore steps are taken to try to prevent contamination. Tests are not currently required, although some vigilant organic companies require them.

Corn cross-pollinates, while soy generally does not. Canola and cotton also cross-pollinate. In Canada, cross-pollination has made it impossible for organic farmers to grow organic, non-GM canola.

Q. What can we do to help end the genetic engineering of the food supply?

A. Refer to the Campaign for Healthier Eating for several effective ways, which are designed to create the tipping point of consumer resistance to GMOs, sufficient to force them off the market.