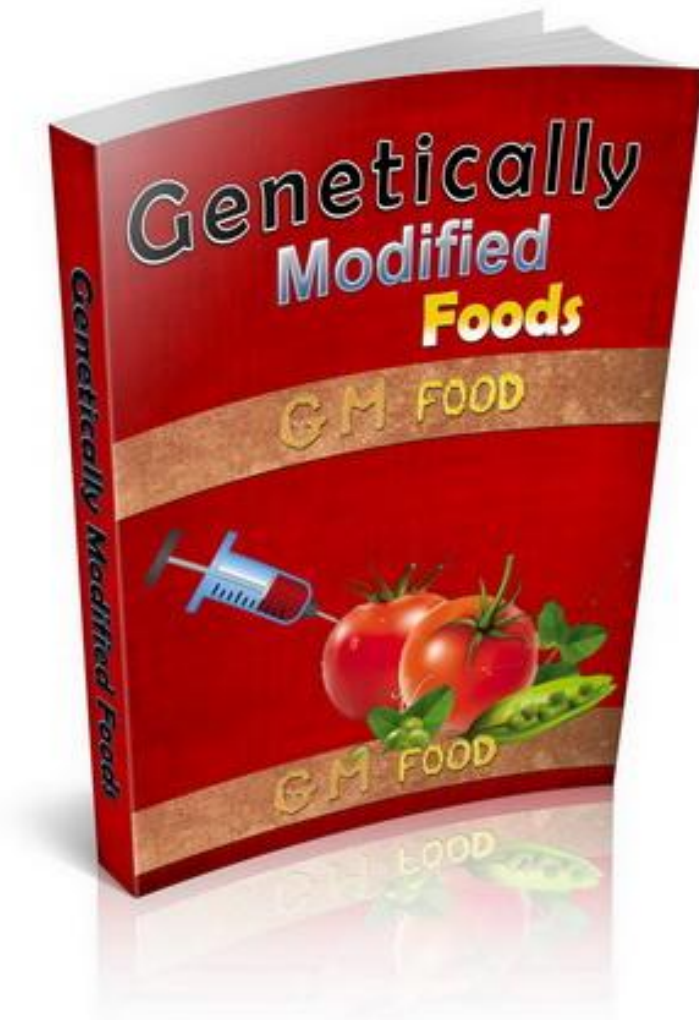


# Introduction to Genetically Modified Foods



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# **Introduction to Genetically Modified Foods**

## **Introduction**

Around the country, and even the world, an increasing number of people are becoming concerned about the use of genetically modified foods. Also known as genetically engineered foods, these crops are certainly nothing new, but they are becoming increasingly common. The increasing use of these crops and foods, combined with increased research, has led many consumers to question the safety of genetically engineered foods and also to wonder how they may avoid them.

In many parts of the world, Europe included, genetically engineered foods have now been banned. That is not the case in North America, where genetically engineered foods remain widely available. As we will discuss in this guide, the matter of avoiding such foods and the risks they may pose might be easier with the existence of labeling requirements; however, there are currently no laws which would require foods containing genetically modified organisms to be labeled as such.

Therefore, it is the responsibility of the consumer who wishes to avoid GMO foods to educate themselves and the best ways to avoid these foods.

In this guide we will discuss what comprises GMOs, how to spot GMO foods and the best way to avoid these foods. We will also discuss the various possible health risks and concerns that are linked to foods that contain genetically modified organisms.

Let's get started!

## Chapter 1

### What is Genetically Modified Food?

Genetically modified food, also sometimes known as genetically engineered food, is created taking specific genes from types of organisms such as viruses, bacteria or animals and then combining them with other species. In some instances, the species may be unrelated. Through genetic engineering it is possible to create entirely new organisms that could not be created in nature.

The term genetically engineered or modified food refers to any type of product that either contains or is derived from genetically modified organisms. Some of the most common genetically engineered ingredients come from crops such as soy, corn, canola and cotton. Many companies today now genetically engineer their crops in order to produce a pesticide or in some instances to withstand herbicidal application.

Genetically engineered and modified foods have become so common today that thousands of different products can now be found on supermarket shelves that are made with genetically modified or engineered crops. This has led to much controversy in the United States because genetically modified foods are not labeled in the U.S. Many consumers today have concerns about the possible health risks of such foods and are thus concerned about the lack of mandatory labeling, which makes it difficult to ascertain which products may be produced with genetically modified ingredients.

Genetic engineering can involve animals, plants and micro-organisms. Traditionally, farmers bred animals and plants to produce desired traits. Over time, selective breeding has produced a wide number of different types

of variations. Genetic engineering is often used today to make it possible to speed up the growth process of crops. This is accomplished by moving certain genes from one plant into another plant or from one animal to another animal. Genetically engineered or modified foods are also sometimes known as bioengineered foods.

### **Potential Benefits of Genetically Modified Foods**

Along with speeding up the growth process, scientists have pointed out that some of the potential benefits of genetically modified foods may include:

- Tastier food
- More nutritious food
- Plants that are drought and disease resistant
- Foods that require less environmental resources, such as fertilizer, water, etc.
- Decreased use of pesticides
- Faster growing animals and plants
- Increased supply of food
- Reduced cost of food
- Longer shelf life for food
- Foods that have more desirable traits
- Medicinal foods

### **Risks of Genetically Modified Foods**

While there may be potential benefits associated with genetically modified foods, there is also some concern that there may be serious risks associated with genetically modified foods. These risks include:

- Potential harmful or unexpected genetic changes in foods
- Possible unpredictable environmental effects
- Plants may become less resistant to pests
- Possible health risks

### **Possible Health Risks**

There are numerous possible health risks associated with genetically modified foods.

#### ***Cancer***

A Greek study published in 2009 found that genetically modified foods may share specific toxic effects on the pancreas, liver, reproductive system and kidneys which can cause cancer. Recombinant growth hormone is a genetically modified substance which has come to be widely used today in the agricultural industry. It has been linked with increases in IGF-1, which is a growth hormone that can lead to cancer in excess quantities.

#### ***Allergies***

In some cases there may be allergic reactions to genetically modified foods as a result of the presence of proteins that are produced from the animals or plants that may be used for modifying the food. This is according to a study



published in the United States in 2009. To combat this problem, there are now safety standards which involve evaluating the foreign proteins for their allergenic potential. In addition, a database of known allergenic proteins has been developed as well as a computer program for the purpose of assessing the potential allergic reaction of proteins.

### ***Intestinal Immunity***

An Italian study published in 2008 in the Journal of Agricultural and Food Chemistry found that genetically modified corn resulted in an immune reaction in mice. According to the study, mice that were fed genetically modified corn for a period of thirty days demonstrated altered levels of white blood cells that are responsible for regulating immune function.

### ***Endometriosis***

The increasing rate of endometriosis is believed to coincide with increasing consumption of foods that have been genetically modified over the past few years. This is according to a Canadian study that was published in Gynecology, Obstetrics and Fertility in 2010. The presence of residue from pesticides as well as foreign proteins in genetically modified foods could be the cause of increasing levels of endometriosis, according to the report.

### **Genetically Engineered Foods and Organic Foods**

Organic food standards prohibit the use of genetically engineered organisms. Organic foods must be grown without the use of any synthetic chemicals. In addition, organic foods must be grown without any irradiation.

### **History of Genetically Modified Foods**

When genes from different organisms are combined, the process is also known as recombinant DNA technology. The final result is known as

genetically modified, transgenic, genetically engineered. Genetically modified products may include feeds, food ingredients, foods, vaccines, medicines and fibers.

The basic theory behind genetically modified foods is that the process makes it possible for genetic material to be transferred between organisms. It is even possible for genes to be transferred between animals and plants and vice versa.

Genetic engineering has actually been practiced as a part of selective breeding for quite some time in agricultural history. It was in 1953 that the structure of DNA was discovered. This discovery provided scientists with the ability to actually insert genes from one life form into another life form. This eventually led to modern genetic engineering.

The most commonly genetically modified organisms are crop plants. This type of technology has also been applied in many other areas as well. Genetically modified foods began to appear in the United States in large numbers between 1997 and 1999. During this time, approximately 2/3 of all processed foods in the United States were produced with gene-modified ingredients.

This alteration was in large part due to a ruling of the Supreme Court which allowed the patenting of life forms for commercial purposes for the first time. Since that time, there have been thousands of applications submitted for experimental genetically modified organisms with the US Patent Office.

The tomato was the first whole food crop to be commercially grown and genetically modified. This food was produced to be more resistant to rotting.

The tomato, known as the Flavr Savr, was first released onto the market in 1994. No special labeling was provided.

Two years later, the first genetically modified food product was released in Europe. It was a variation of the Flavr Savr tomato, a tomato paste. Following this release, there were subsequent genetically modified food crops produced, including soybeans that were made to be herbicide tolerant and cotton that was insect resistant.

In the beginning, the motivation behind genetically modified foods was to produce food in a more adequate manner for feeding large populations of people in poor countries. The goal was to produce modified crops that were capable of producing higher yields. As a result, it was also hoped that there would be a reduced need for additional herbicides and pesticides.

In addition, genetically modified foods were meant to be better able to withstand the extremes and fluctuations in weather in many parts of the world. Over time, as more has been discovered regarding the effects of genetically modified plants on people as well as animals and the environment, there have been serious concerns regarding the benefits and the potential risks of these foods.

### **The Debate about Genetically Modified Foods**

When compared side by side, genetically modified foods can appear the same as non-genetically modified foods. The DNA of genetically modified foods is actually different from that of non-GM foods. The news is frequently filled with reports regarding genetically modified foods. Environmental organizations and public interest groups in Europe have begun to actively protest the use of genetically modified foods practically from the beginning.

There have recently been several controversial studies regarding the effects of genetically engineered corn pollen on the monarch butterfly caterpillar population. These studies have brought the concerns related to genetically modified foods to the forefront of public attention.

Some scientists are often quick to point out the numerous benefits of genetically modified food crops, which can include the ability to create crops that are disease resistant as well as strains that are herbicide tolerant. In addition, it is possible to produce genetically modified crops that have vitamins that might otherwise be lacking.

Due to the perceived risks of genetically modified foods, opponents have countered that there is ample enough food in the world without the use of genetically modified foods and that famines are actually the result of politics and food distribution rather than production. Many activists are opposed to genetic engineering due to the fact that based on current technology there is no secure method for ensuring that genetically modified foods are controlled. They further believe that the risks to ecosystems and humans are simply too great and unacceptable.

### **Genetically Modified Foods and Labeling**

In the United States, there is often a concern regarding the labeling of foods and the fact that it can be difficult to determine whether foods you consume have been genetically modified. In other parts of the world, labeling is frequently demanded so that consumers can choose between organic foods, conventional foods and foods that have been genetically modified.

For instance, in Australia and New Zealand, all foods that are genetically modified are required to undergo a safety evaluation from the Food

Standards Australia New Zealand or FSANZ, which is an independent government agency. Genetically modified foods will not be approved by this agency unless they are safe to eat. Foods that are genetically modified must be identified on labels in both New Zealand and Australia. This has been law in New Zealand and Australia since 2001.

## **Chapter 2**

### **Recognizing Genetically Modified Foods**

It can be practically impossible to obtain a comprehensive list of genetically modified foods in the United States. This is because there are now laws relating to genetically modified crops.

According to some estimates, there could be as many as 30,000 different products currently on supermarket shelves that have been modified. This is primarily due to the fact that many of the processed foods sold in supermarkets today contain soy. Approximately half of the soy crop in North America is genetically modified.

Below is a list of foods that are known to have been genetically engineered.

#### **Genetically Engineered Foods List**

##### **Rapeseed**

This food has been modified for resistance to certain pesticides.

##### **Honey**

Honey may be produced from genetically modified crops. In Canada, exports of Canadian honey have been prohibited from going to Europe due to the fact that bees may collect nectar from genetically modified plants.

##### **Cotton**

Cotton has been genetically engineered to be resistant to certain types of pesticides. Cotton is considered to be a food due to the fact that the oil can be consumed.

##### **Rice**

This crop has been genetically modified to contain high amounts of Vitamin A.

### Soybean

This crop has been genetically modified in order to be resistant to herbicides.

Soy food products can include:

- Soy beverages
- Soy oil
- Tofu
- Lecithin
- Soy flour
- Snack foods
- Pastries
- Breads
- Baked products
- Fried products

### Sugar Cane

This crop has been modified to be resistant to certain types of pesticides. Many of the sweeteners that are used in processed foods are actually derived from corn rather than beets or sugar cane.

### Tomatoes

Tomatoes have been genetically modified in order to have a longer shelf life and also to prevent a certain substances that results in the degradation and rotting of tomatoes.

### Corn

This crop has been modified to be resistant to certain types of pesticides.

Products can include:

- Fried foods
- Baked goods
- Snack foods
- Edible oil products
- Soft drinks
- Confectionary products
- Special purpose foods

Sweet Corn

This crop has been genetically modified in order to produce its own insecticide.

Canola

Also known as canola oil, this crop produces such products as fried foods, edible oil products, snack foods and baked products.

Potatoes

Crops such as Russett, Atlantic and others may produce such products as snack foods, processed potato products and other processed foods that contain potatoes.

Flax

An increasing number of food products today now contain flax oil and flax seed due to the nutritional properties associated with flax. At the current time there are no genetically modified flax grown. A genetically modified flax that was herbicide resistant was introduced in 2001, but it was quickly



removed from the market because importers in Europe refused to purchase it.

## Papaya

The first papayas that were virus resistant were grown commercially in 1999 in Hawaii. Transgenic papayas now total approximately 75% of the total papaya crop grown in Hawaii.

## Squash

Currently some types of squash are genetically modified, but they have not yet become popular with many farmers.

## Radicchio

Also known as red-hearted chicory, this food product is popular in many areas as a green used in salads; particularly in Belgium and France. A modified version of this food was developed but currently there are no genetically modified radicchios available on the market.

## Cotton Seed Oil

Food products that contain this crop may include:

- Baked foods
- Fried foods
- Blended vegetable oils
- Snack foods
- Edible oil products
- Small goods casings

## Tobacco

At the current time there is a brand of cigarettes sold in the United States, Quest®, which contains genetically modified tobacco. The tobacco is modified to produce little to no nicotine.

## Meat

Some meat and dairy products come from animals that have been fed genetically modified feed.

## Peas

Genetically engineered peas have been known to create immune responses in mice. This research suggests they may also produce allergic responses in humans. Genetically modified peas have been inserted with a gene taken from kidney beans, creating a protein that acts as a pesticide.

## Vegetable Oil

Many of the generic vegetable oils as well as margarines that are used in restaurants as well as processed foods in North America are now made from soy, cottonseed, canola or corn. Unless these oils have a label that specifically states they are non-GMO or organic, they are likely genetically modified.

## Dairy Products

Approximately 22% of the cows in the United States are injected with genetically modified bovine growth hormone, also known as rbGH.

## Vitamins

Vitamin C or ascorbic acid is frequently produced from corn while Vitamin E is often made from soy. Vitamins A, B3, B6 and B12 often are derived from genetically modified organisms. In addition, it is believed that Vitamin D and Vitamin K may also have carriers that have been derived from genetically modified sources such as glucose, starch and maltodextrin.

### **The Lack of Information about Genetically Modified Foods**

There are now more than 40 plant varieties that have gone through the federal requirements for commercialization, according to the United States Department of Agriculture and the FDA. There are also future planned applications of genetically modified organisms that are quite diverse and could potentially include drugs within foods. Examples might include fruit that contain vaccines for fighting infectious diseases, fish that have been metabolically engineered to mature more rapidly and fruits and nuts that are engineered to produce earlier than is traditionally expected.

## Chapter 3

### Techniques used for Genetically Modifying Foods

Genetically modified foods are produced through the use of biotechnology in order to change the basic genetic material. Many different techniques are used for this purpose. Often, the technique involves introducing desired genes or inactivating undesired genes. Such techniques can include:

- Benign bacterial or viral infection (bacterial carriers)
- Gene splicing
- Gene silencing
- Biolistics
- Calcium phosphate precipitation
- Electroporation
- Lipofection (or liposome transfection)
- Microinjection
- Viral carriers.

Each of these techniques can be used in order to increase the shelf life of food, make crops more resistant to insecticides and pesticides or improve the nutritional yield of the crop.

### How Genetic Engineering Works

In every living organism, genes act as blueprints that control a variety of different factors, including growth and development. In practically every cell within the body genes have a beaded structure along strands of DNA that are tightly bundled together. They are known as chromosomes. The chromosomes are then encased with a membrane known as the nuclear membrane for the purpose of producing the nucleus.

Chemical messages are used by genes for providing instructions to cells to perform functions such as making enzymes or proteins. When a foreign gene is introduced, scientists are able to prompt the changed cell to create new enzymes or proteins. Essentially, the cell is then able to perform a new function. Such genes can be taken from a plant, animal or micro-organism. When genes are inserted into another species, the resulting product or organism is known as transgenic.

### *Bacterial Carriers*

A bacterium known as *Agrobacterium* can be used for infecting plants for the purposes of delivering DNA. The bacterium may be prepared with the use of a special solution in order to make the cell walls more porous. The desired gene is then inserted into the bacterium with an additional chromosomal DNA molecule that is known as a plasmid. It is then dropped into the solution. Once the solution is heated, the plasmid is then able to enter the bacterium and a new gene is expressed.

The recombinant or genetically altered bacterium undergoes a recovery period and then grows in order to produce additional copies of the new gene. At that point the bacterium can be used to infect the targeted plant cells in order to deliver the plasmid and the new gene into the cells so they can be transformed.

### *Biolistics*

In this method, the desired DNA is attached to extremely small particles of either gold or tungsten. They particles are then shot into target cells through the use of gas that has been pressurized.

### *Calcium Phosphate Precipitation*

In this method, the desired DNA is exposed to calcium phosphate. The resulting mixture then produces small granules. Targeted cells can then be exposed to the granules, making it possible for the granules to release the DNA and thus deliver it to the hosted nuclei and chromosomes.

### *Electroporation*

In this method, prepared target cells are immersed in a specific solution that contains the desired DNA. An intense electric shock passes through the solution. As a result, there are small tears within the cells walls. This allows the newly produced genetic material to gain access to the nuclei. The cells will then be placed in a different solution in order for the breached walls to be repaired. This effectively locks the donor DNA inside the cell.

### *Gene Silencing*

In this method, it is necessary to identify the gene that is responsible for the undesired trait in the organism. It is then possible to silence that gene by attaching an additional copy of the gene backwards. This method can be used for preventing plants such as wheat or peanuts from producing allergens.

### *Gene Splicing*

Bacteria contain restriction enzymes and form a portion of the bacterium's immune system to protect it against invasion by any other organism. Such restriction enzymes are used for attacking foreign DNA. This is done by cutting it into very precise portions and then preventing it from being inserted into the chromosome of the bacterium.

### ***Lipofection***

Small bubble type structures of fat that are known as liposomes are used as carriers for chosen DNA. Targeted cells and liposomes can then be placed in a special solution, allowing the liposomes to combine with phospholipids within the cell membrane. This makes it possible for the DNA to enter the cells and be included in the chromosome.

### ***Microinjection***

Chosen DNA is injected within a female egg cell through a slender device that is known as a glass capillary tube. The egg that has been genetically modified can then be transplanted into a uterus of a receptive female that has already been prepared. It is allowed to grow to term. This technique guarantees that practically every cell within the body of the developing organism will contain the new DNA.

### ***Viral Carriers***

In this technique, a virus is used for invading the target cells without causing damage or death. The chosen DNA is added to the virus' genetic makeup. The virus is then allowed to actually infect the target. The chosen DNA can be added to the target cells as the virus invades the cells.

### ***Examples of Genetically Engineered Foods***

As a result of the above techniques, foods can be genetically modified for many different purposes. As previously mentioned, some crops have been genetically modified in order to be resistant to certain insect pests. For instance, toxin genes from a bacterium that is found in soil might be inserted into the DNA of a plant crop in order for the plants to produce toxins that will be deadly to the larvae of specific pest insects. As a result, the crop is said to be insect resistant or IR.

Another common example of genetically modified crops include soybeans that have been genetically modified in order to make them more tolerant to high levels of herbicides that kill weeds. Ordinarily, these herbicides would kill the soybeans. The resulting plant is said to be herbicide tolerant or HT.

Other common examples include:

- Plants that have been genetically modified to provide them with a longer shelf life
- Plants that have been genetically modified to make them more resistant to frost
- Farm animals, including cows, pigs and chickens, that have been genetically engineered to produce faster growth rates, improved resistance to disease, leaner muscle to fat ratios or the ability to produce increased levels of Omega-3s within their meats
- Plant crops that have been modified to produce higher nutrient levels or protein levels
- Plant crops that have been engineered to produce healthier oils which contain components such as Omega-3 fatty acids
- Genetically engineered cows that produce milk containing increased levels of human blood clotting components



## **Chapter 4**

### **Identifying and Avoiding Genetically Modified Foods**

Due to the potential health risks associated with genetically modified foods, many consumers would like to be able to identify them so they can avoid them. Due to a lack of consistent labeling this can be quite difficult in North America. There are some techniques you can use to identify and then avoid foods that have been genetically modified.

Admittedly, if you live in North America, it can be difficult to avoid buying products that do not contain genetically modified food, at least to some degree. The good news is that is you how the proper way to identify food that has been genetically modified you have a better chance of keeping your consumption of such foods to a minimum.

#### **Research**

One of the simplest ways to avoid foods that have been genetically modified is to educate yourself about some of the most common culprits. Take the time to research the Food and Drug Administration website. Here, you will be able to locate some of the more commonly genetically engineered foods. In addition, you will also be able to obtain the latest FDA information on the use of those foods as well as rules regarding what may be genetically engineered, possible benefits and the results of FDA research.

#### **Avoiding Some Foods Completely**

Many consumers have opted to avoid certain foods, such as soy and corn, altogether rather than attempting to identify foods that have been genetically modified. Corn and corn products are often some of the most common culprits. In fact, corn is the single largest genetically modified vegetable on the market today.

Some of the foods that may contain genetically modified ingredients include:

- Infant formula
- Salad dressing
- Bread
- Cereal
- Hamburgers
- Hotdogs
- Margarine
- Mayonnaise
- Cereals
- Crackers
- Cookies
- Chocolate
- Candy
- Fried food
- Chips
- Veggie burgers
- Meat substitutes
- Ice cream
- Frozen yogurt
- Tofu
- Tamari
- Soy sauce
- Soy cheese
- Tomato sauce
- Protein powder
- Baking powder
- Alcohol
- Vanilla

- Powdered sugar
- Peanut butter
- Enriched flour and pasta

Keep in mind that chocolate uses soy lecithin and breads use soy flour. Shakes are made using soy protein concentrate and baby formulas are made using soy milk. You can find high fructose corn syrup in such foods as cereals, sodas, cookies, salad dressings, candy, spaghetti sauces and more than one thousand other products.

Avoiding the sweetener aspartame is important as it can be found in more than 6,000 different products, including gum, soft drinks, desserts, candy, yogurt, mixes, tabletop sweeteners and even some pharmaceuticals such as sugar-free cough drops and vitamins.

You might also consider choosing corn that is locally grown. Be sure to check with the farmer to find out whether their seed stock is free from genetically modified organisms to be certain.

### **Contact the Manufacturer**

Another method is to contact the manufacturer of foods that you may be concerned about. You can typically find the phone number for manufacturers directly on the back of the food label. Be sure to ask whether there are any genetically modified foods within the product when you call the manufacturer.

It is also a good idea to ask whether the manufacturer uses any type of radiation for destroying contaminants within the product. You might also consider shopping at a market where you know there is a selection of products that are genetically modified free. Be sure to ask the produce

manager which vegetable may be genetically modified so you can avoid them.

While there may not be any labeling requirements regarding genetically modified foods throughout most of North America, you can still check labels. When you choose foods that are organic, you can be certain it is already non-GMO. In addition, you might also see the product labeled as All Natural, as this can be a good indication of foods that are non-genetically modified.

### **Know the Most Likely Culprits**

It is also important to make sure you know which foods are more likely to contain genetically modified food products, such as:

- Soy
- Canola
- Corn
- Cotton
- Hawaiian papaya
- Sugar beets
- Alfalfa
- Zucchini
- Yellow squash

Furthermore, dairy products that come from cows that have been injected with rbGH, enzymes, additives, the artificial sweetener aspartame and flavorings may also contain GMOs. Also, any food that contains the above ingredients or foods that may be derived from these foods should typically be avoided.

You might be surprised to learn that a large percentage of foods do contain ingredients that are derived from these foods, particularly corn. These foods include:

- Ascorbic acid or Vitamin C
- Aspartame
- Caramel color
- Cellulose and methylcellulose
- Citric acid
- Corn meal
- Corn oil
- Corn starch
- Dextrin or maltodextrin
- Dextrose
- Fructose
- Glucose
- Dyes
- High-fructose corn syrup
- Monoglycerides and diglycerides
- Monosodium glutamate (MSG)
- Sorbitol
- Vanilla extract
- Xanthan gum

Avoiding foods that contain corn can be difficult because so many food products contain high fructose corn syrup. It is used in a large percentage of baked foods as well as processed foods and sodas. Any food label that contains anything related to corn should be avoided unless the label says it is 100% organic. The only exception to this rule is popcorn. At the current time, there is no popcorn on the market that has been genetically modified.

You should avoid the type of popcorn with artificial butter flavor as the flavoring does probably contain genetically modified food.

In addition, you should attempt to avoid soy products as many are derived from soybean crops that have been genetically modified. This includes:

- Soy flour
- Lecithin
- Soy protein
- Soy isolate
- Isoflavone

Be sure that any soy based products you purchase, such as endamame, soy milk or tofu, carry a label stating that product is organic and does not include any GM foods.

Be aware that canola oil, which is made from the rapeseed plant, typically comes from crops that have been genetically engineered. This oil is extensively used in margarine and cooking oil.

Cottonseed oil is often used in vegetable oil, margarine and shortening. It is also commonly used in processed foods such as fried snack foods and potato chips.

In order to boost the production of milk, some farmers have chosen to inject their cows with the genetically engineered hormone rBST or rBGH. In addition, the cows may also be fed hay or feed that has been genetically modified. Look for dairy products with labels that state they are RBST or rBGH free.

It can be virtually impossible to know whether a product that is labeled as containing sugar is derived from sugar can or if it contains sugar that comes

from beets. This is because there are no labeling requirements. In order to avoid beet sugar, make a point to look for products with labels that state the product comes from evaporated cane sugar, organic sugar or 100% cane sugar.

It is also important to avoid sweeteners that are made with aspartame. This is because aspartame comes from GMOs. This sweetener is used in such products as Equal® and NutraSweet®.

You should also try to buy fruit juices that contain only 100% juice. Most fruit juices, with the exception of papaya, are not produced from genetically modified foods; however, the sweetener that is often used in many fruit juices is high fructose corn syrup, which is genetically modified.

You should also check the stickers on produce as this can tell you how the produce was grown. For instance:

- A 4-digit number will indicate the food was grown conventionally.
- A 5-digit number that starts with an 8 indicates the food is genetically modified. Keep in mind that not all genetically modified foods can be identified due to the fact that such labeling is only optional.
- A 5-digit number that starts with a 9 indicates the food is organic.

It is also important to look for meat that is 100% grass fed. In the United States, most cattle are grass-fed and will spend three to four months in feedlots where they may be provided with grain or corn products that are genetically modified. The purpose of this is to increase the amount of marbling in the meat. Meat that comes from feedlot animals may also contain higher levels of saturated fats than animals that are 100% grass fed.

In order to avoid meat that contains genetically modified organisms, be sure the animal was 100% grass fed or pasture fed. You should also look for fish that was wild caught rather than farm raised as farm raised fish are typically fed a fish meal that contains genetically modified grains. Also, eggs should be labeled as 100% organic. Keep in mind that eggs that are labeled as free-range, cage-free or natural may not necessarily be free of genetically modified organisms.

You should also make a point to buy as much of your food as possible at local farmers' markets. Most genetically modified food actually comes from large industrial farms. When you shop at a farmer's market, you gain the ability to speak directly with the farmer that grew the food so you can determine the way in which the food was grown. You will also usually find a wide selection of products, including organic meat, baked goods, grains, etc.

In addition, be sure to buy whole, fresh foods instead of processed foods. Foods that you cook and prepare yourself are typically going to be much healthier than any foods you can buy that are ready-made.

### **Buying GMO Free Foods**

There are, generally speaking, some foods that you can be relatively certain are free from GMOs.

### ***USDA Certified Organic Foods***

The National Organic Program, part of the United States Department of Agriculture, requires all USDA certified organic products as well as ingredients to be produced without the use of biotechnology methods. Any food product that has a label that says 100% organic or USDA Certified Organic must, by law, be free of genetically modified organisms. It should be noted that prepared food products that have labels indicating they are



produced from organic produce or that contain organic ingredients are not required to be free from GMOs. As a result, some of their non-organic elements may contain plant material that has been bioengineered. In fact, if food is only labeled as organic rather than 100% organic, it may still contain as much as 30% genetically modified foods.

### *Foods Imported from Ireland*

In 2009, the government of the Republic of Ireland declared the country to be a GMO free zone. As a result, the cultivation of all genetically modified plants was prohibited. Since then, the Irish government has offered food producers the option of being able to voluntarily label their products as being GMO free.

Even so, you can be relatively certain that all food that is raised and produced in Ireland is free from genetically modified organisms. There are many foods that originate in Ireland and are now available in the United States, including cheese, butter, beer and baked goods. There are also many other countries, including Germany, where restrictions have been passed regarding labeling requirements on foods that contain GMOs.

### *Brands that are GMO Free*

There are some brands that are known to be free of GMOs. These brands are not typically common, but your support of manufacturers that produce foods that are free from genetically modified foods will help to encourage other manufacturers to follow.

These brands include:

- Bob's Red Mill
- Cascadian Farms
- Arrowhead Mills

- Eden Foods
- Spectrum Oils
- Barbara's Bakery

You will also find a more extensive list of GMO free brands in the appendix at the end of this guide.

Keep in mind that the list of brands that are free from GMO can be subject to change, so it is important to always check each brand or the product's website or label before you make a purchase to be absolutely certain that product or brand is actually GMO free.

## Chapter 5

### How to Avoid Genetically Modified Foods when Dining Out

If you like to dine out or if you must eat frequently at restaurants because of business travel, it is important to know how to avoid genetically modified foods in restaurants. It can be beneficial to have a chef or server who is knowledgeable about what is contained in the menu assist you in avoiding genetically modified foods. It doesn't have to be as difficult as you might imagine to identify options on the menu that are not genetically modified.

One of the most important questions to ask of any restaurant where you dine is what type of oil they cook with. If the response is cottonseed, corn, canola or soy oil, there is a good chance they are genetically modified, if they are not organic. You should also find out whether anything they serve is cooked without oil or if olive oil or some other type of oil can be used.

If the response is that the food is cooked using vegetable oil or margarine, you can usually be certain the oil is soy, canola, cottonseed, corn or canola oils. If they do use olive oil, make sure it is not a blend. Many restaurants actually do use a blend of olive and canola oils.

As many processed foods do contain genetically modified derivatives, such as soy and corn, be sure to ask which foods are prepared that are fresh so you can order those items. You should also check to find out whether packaged sauces are used in that restaurant.

Try to avoid ordering processed foods that contain the oils that are mentioned above or with corn and soy derivatives, such as:

- Soy flour
- Soy protein
- Soy lecithin

- Textured vegetable protein
- Corn meal
- Corn syrup
- Dextrose
- Maltodextrin
- Fructose
- Citric acid
- Lactic acid

Other possible sources of genetically modified foods at restaurants can also include bread, salad dressings, mayo and sugar from genetically modified sugar beets.

In order to avoid dairy products from cows that have been treated with genetically modified rbGH in restaurants in the United States, keep in mind that you will probably need to avoid items on the menu that contain dairy, unless the restaurant specifically used organic products.

You should also avoid tabletop sweeteners with aspartame, such as Equal® or NutraSweet®.

While this may seem like a time consuming process, using this process will allow you to choose from healthy options when you are dining out. It will also notify the restaurant you desire healthier non-GMO options.

## Chapter 6

### How to Avoid Invisible Genetically Modified Ingredients

Processed foods frequently contain hidden sources of genetically modified foods, unless they are organic or they have been declared as being non-GMO.

Below is a list of ingredients that may be made from the top GMO culprits, canola, cotton, corn or soy.

- Aspartame
- Baking powder
- Bee pollen
- Caramel color
- Cellulose
- Citric acid
- Cobalamin (Vitamin B12)
- Corn gluten
- Corn masa
- Corn oil
- Corn syrup
- Cornmeal invert sugar (colorose or inversol)
- Cornstarch
- Cyclodextrin
- Cystein
- Dextrin
- Dextrose
- Diacetyl
- Diglyceride
- Fructose
- Fructose (crystalline)

- Glucose
- Glutamate
- Glutamic acid
- Gluten
- Glycerides
- Glycerin
- Glycerol
- Glycerol Monooleate
- Glycine
- Hemicellulose
- High fructose corn syrup (HFCS)
- Hydrogenated starch hydrolates
- Hydrolyzed vegetable protein
- Inositol
- Inverse syrup
- Isoflavones
- Lactic acid
- Lecithin
- Leucine
- Lysine
- Malitol
- Maltodextrin
- Maltose
- Mannitol
- Methylcellulose
- Milo starch
- Modified starch
- Monosodium glutamate
- Oleic acid

- Phenylalanine
- Phytic acid
- Sorbitol
- Soy flour
- Soy isolates
- Soy lecithin
- Soy protein
- Starch
- Stearic acid
- Tamari
- Tempeh
- Threonine
- Tocopherols (Vitamin E)
- Tofu
- Trehalose
- Triglyceride
- Vegetable fat
- Vegetable oil
- Vitamin B12
- Vitamin E
- Xanthan gum

## Appendix

### List of Non-GMO Food Brands

#### Eggs and Dairy

- Egg Innovations Organic
- Eggland's Best Organic
- Land O'Lakes Organic
- Nest Fresh Organic
- Organic Valley
- Pete and Jerry's Organic Eggs
- Wilcox Farms Organic

#### Dairy

- Alta Dena Organics
- Butterworks Farm
- Harmony Hills Dairy
- Horizon Organic
- Kirkland Organic
- Lactaid Organic (Organic only)
- Morningland Dairy
- Nancy's Organic Dairy
- Natural by Nature
- Noris Organic
- Oregon Ice Cream Company
- (Alden's, Julie's)
- Organic Valley Dairy
- Pacific Village



- Radiance Dairy
- Rogue Creamery
- Safeway Organic Brand
- Seven Stars Farm
- Straus Family Creamery
- Stremick's Heritage organic
- Stonyfield Farm
- Trader Joe's (organic line)
- Wallaby
- Whole Foods organic line
- Wisconsin Organics
- Woodstock Farms

#### **Alternative Meat Products**

- 365 Brand (Whole Foods)
- Amy's
- Bountiful Bean
- Small Planet Tofu
- Sunshine Burger
- The Simple Soyman
- Vitasoy
- Wildwood
- White Wave
- Woodstock Farms
- Berkeley Farms
- Bravo Farms cheese
- Clover Stornetta Farms
- Cowgirl creamery
- Eberhard

- Fred Meyer /Mountain Dairy
- Joseph Farms Cheese
- Mallories
- Market of Choice
- Oregon Gourmet cheese
- Rogue Creamery
- Rose Valley butter
- Sunshine Dairy Foods
- Tillamook Cheese
- Trader Joe's store brand
- Umpqua
- Western Family
- Wilcox Family Farms
- Willamette Valley cheese
- Yami
- Chippewa Valley Cheese
- Erivan Dairy Yogurt
- Promised Land Dairy
- Westby Cooperative Creamery
- Blythedale Farm Cheese
- Crescent Creamery
- Derle Farms
- Erivan Dairy Yogurt
- Farmland Dairies
- Oakhurst Dairy
- Trader Joe's store brand
- Wilcox Dairy

### **Alternative Dairy Products**

- Belsoy
- EdenSoy
- Imagine Foods/Soy Dream
- Nancy's Cultured Soy
- Organic Valley Soy
- Pacific Soy
- Silk
- Soy Delicious
- Sun Soy
- Stonyfield Farm O'Soy
- Tofutti
- Trader Joe's brand
- VitaSoy/Nasoya
- WestSoy
- WholeSoy
- Yves The Good Slice
- Zen Don

### **Baby Food and Infant Formula**

- Baby's Only
- Earth's Best
- Gerber products
- HAPPYBABY
- Mom Made Meals
- Organic Baby
- Plum Organics
- Tastybaby
- Baked Goods
- Alvarado Street Bakery

- Arrowhead Mills
- Bakery on Main
- Berlin Natural Bakery
- Bob's Red Mill
- Dr. McDougall's Right Foods
- Dr Oetker Organics
- Eden
- French Meadow
- Natural Ovens Bakery
- Nature's Path
- Rudi's Organic Bakery
- Rumford Baking Powder
- Safeway O brand
- Trader Joe's brand

### Cereals

- Ambrosial Granola
- Barbara's
- Cascadian Farms
- Eden
- EnviroKidz
- Golden Temple
- Grandy Oats
- Health Valley
- Lundberg® Purely Organic
- Rice Cereal
- Nature's Path
- Nonuttin'
- Omega Smart Bars

- Peace Cereal Organic
- Ruth's
- Safeway O brand
- Simple Sweets
- Sunridge Farms
- Trader Joe's brand
- Whole Foods 365

### **Pasta and Grains**

- Amy's
- Annie's
- Bob's Red Mill
- Casbah (Hain-Celestial)
- Dr. McDougall's Right Foods
- Eden certified organic grains
- Fantastic Foods
- Field Day
- Ian's Natural Foods
- Kamut
- Lotus Foods
- Lundberg Family Farms
- Organic Planet
- Rising Moon
- Seeds of Change
- Sensations
- Sunridge Farms
- Trader Joe's store brand
- Vita-Spelt pasta
- Whole Foods 365

### **Canned Foods**

- Amy's
- Annie's
- Eden
- ShariAnn's certified organic beans
- Trader Joe's store brands
- Westbrae certified organic beans
- Whole Foods 365

### **Soups and Sauces**

- Amy's
- Annie's
- Eden
- Emerald Valley Kitchen
- Fantastic Foods
- Field Day
- Green Mountain Gringo
- Hain
- Health Valley/Westbrae
- Imagine Natural
- Muir Glen Organic
- Rising Moon
- ShariAnn's Organics
- Seeds of Change
- Trader Joe's store brands
- Walnut Acres
- Whole Foods 365

### **Frozen Foods**

- A.C. LaRocco
- Amy's Kitchen
- Cascadian Farms Organic frozen meals and vegetables
- Cedarlane
- Helen's Kitchen
- Ian's Natural Foods
- Linda McCartney frozen meals
- Mom Made Meals
- Morningstar Farms
- Rising Moon
- The Simple Soyman
- Trader Joe's store brands
- Woodstock Farms

### **Condiments and Spreads**

- Annie's
- Bountiful Bean
- Bragg's liquid amino
- Carrington Farms Flax Seed
- Crofter's Organic
- Drew's salad dressing
- Eden
- Emerald Cove
- Emperor's Kitchen
- Emerald Valley Kitchen
- Field Day
- Follow Your Heart
- Harvest Moon Mushrooms

- I.M. Health SoyNut Butters
- Ian's Natural Foods
- Krazy Ketchup
- Maranatha Nut Butters
- Miso Master
- Muir Glen organic tomato ketchup
- Nasoya
- Newmans Own Organic
- Ruth's
- The Simple Soyman

#### **Snack Foods**

- Barbara's
- Bearitos/Little Bear Organics
- Earthly Treats
- Eco-Planet
- Eden
- Field Day
- FritoLay Lay's Naturals potato chips
- Garden of Eatin'
- Grandy Oats
- Hain Pure Snax/Hain Pure Foods
- Health Valley
- Ian's Natural Foods
- Kettle Foods
- Kopali Organics
- Late July Organic Snacks
- Mary's Gone Crackers
- Namaste Foods



- Nature's Path Organic
- Newman's Own Organics & Newman's Own
- Peeled Snacks
- Plum Organics Tots
- Revolution Foods
- Tasty Brand
- Ruth's
- Simple Sweets
- Sunridge Farms
- Safeway O organic brand
- Trader Joe's store brand
- Woodstock Farms

#### **Sodas and Beverages**

- After the Fall organic juices
- Big Island Organics
- Blue Sky
- Cascadian Farm
- Crofters Organic
- Eden
- Odwalla
- Quinoa Gold
- R.W. Knudsen organic juices and spritzers
- Santa Cruz Organic
- Sea20 Organic Energy Drink
- Teeccino Herbal Caffe
- Walnut Acres Organic Juices

## **Conclusion**

As you can see, it can sometimes be difficult to avoid genetically modified foods, especially when so many foods on the market today contain foods derived from crops that have been genetically engineered. The issue becomes even more problematic when you take into consideration the fact that there are virtually no labeling requirements that would make it easier for you to determine which foods have been genetically engineered and which foods have not been genetically modified.

Understanding which foods are most prone to contain genetically modified organisms and developing an understanding behind the techniques behind genetic modification can help you to learn how to avoid GMO foods.