Genetically modified food

Biotechnology is providing us with a wide range of options for how we can use agricultural and commercial forestry lands. Genetically Modified Organisms (GMOs) are being made by inserting a gene from an external source such as viruses, bacteria, animals or plants into usually unrelated species. Biotechnology has granted us the ability to overcome insurmountable physiological barriers and to exchange genetic materials among all living organisms.

The use of recombinant DNA technology has the potential to allow the creation of an organism which is desired and designed by human. Genetically Modified Food (GMF) means any food containing or derived from a genetically engineered organism

Agrobacterium has been used as an intermediate organism for transferring a desirable gene into plant . This has been a successful method for modification of trees and cereal crops. Biolistic transformation is a physical method by which the genes of interest are bombarded into the plant cells and DNA-coated beads are usually used as carriers

Another technique which facilitates the in-corporation of genes into the host genome is called Electroporation. This is a suitable method for plant tissues without cell walls. DNA enters the plant cells through minute pores which are temporarily caused by electric pulses. These holes can be also created by microscopic crystals. Another recent method consists of Microinjection which is direct introduction of DNA into genome . Antisense technology is also a useful method for deactivation of specific genes such as those responsible for softening of fruits and fighting against plant viral infections

With currently available techniques the favorite DNA are inserted to only a few numbers of the treated cells. Therefore, in order to detect whether the incorporation of the gene to the cell has taken place, the desired DNA are generally attached to marker gene before their transfer. These marker genes allow researchers to verify whether transfer of the desired DNA has properly occurred. However, after the successful gene transfer, important factors that have triggered debates over the safety of GM crops are the genotypic and phenotypic stability and permanence inheritance

The majority of the Biotech-crops available on the global market have been genetically manipulated to express one of these basic traits:

1. resistance to insects or viruses,
2. tolerance to certain herbicides and
3. nutritionally enhanced quality.

To make a GM crop, the gene of interest is inserted into the crop's genome using a vector. This vector might contain several other elements, including viral promoters, transcription terminators, antibiotic resistance and marker genes. The genes incorporated into a genome, could reside anywhere, cause mutation in the host genome, and move or rear-range after insertion or in the next generations. Transgenic DNA might break up and reintegrate into the genome again (recombination) leading to chromosomal rearrangement in successive generations and could potentially change the transgenic crops in a way to produce proteins that are allergic or cause other health problems

As DNA does not always fully defragment in the digestive system, human gut microflora and pathogens can take up GM materials including antibiotic resistance genes. This may cause the reduction of the effectiveness of antibiotics and therefore increasing the risk of antibiotic-resistant diseases. Some scientific advices have proposed that such markers should be replaced by non-antibiotic marker system in GMF production. In this regard, the Food Safety Unit of WHO has been assessing the safety of antibiotic resistance marker genes . However, the proponent of commercial production of GMF believe that DNA are abundant in all the foods we eat, but there has not been any evidence of the gene transfer from the food source to gut bacteria.

In the future, genetic modification could be aimed at altering the nutrient content of food, reducing its allergenic potential or improving the efficiency of food production systems. All GM foods should be assessed before being allowed on the market. FAO/WHO [Codex](http://www.fao.org/fao-who-codexalimentarius/en/) guidelines exist for risk analysis of GM food.

Papaya has been developed by genetic engineering which is ring spot virus resistant and thus enhancing the productivity. This was very much in need as in the early 1990s the Hawaii’s papaya industry was facing disaster because of the deadly papaya ring spot virus. Its single-handed savior was a breed engineered to be resistant to the virus. Without it, the state’s papaya industry would have collapsed. Today 80 % of Hawaiian papaya is genetically engineered, and till now no conventional or organic method is available to control ring spot virus.

Canola oil is the third most widely consumed vegetable oil in the world. The genetic modifications are made for providing resistance to herbicides viz. glyphosate or glufosinate and also for improving the oil composition.

Maize, also called corn in the USA and cornmeal, which is ground and dried maize constitute a staple food in many regions of the world. Grown since 1997 in the USA and Canada, 86 % of the USA maize crop was genetically modified in 2010 (Hamer and Scuse [2010](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791249/#CR24)) and 32 % of the worldwide maize crop was GM in 2011 (Clive [2011](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791249/#CR14)). A good amount of the total maize harvested go for livestock feed including the distillers grains. The remaining has been used for ethanol and high fructose corn syrup production, export, and also used for other sweeteners, cornstarch, alcohol, human food or drink.

Corn oil is sold directly as cooking oil and to make shortening and margarine, in addition to make vitamin carriers, as a source of lecithin, as an ingredient in prepared foods like mayonnaise, sauces and soups, and also to fry potato chips and French fries. Cottonseed oil is used as a salad and cooking oil, both domestically and industrially. Nearly 93 % of the cotton crop in USA is GM.

To make soybeans herbicide resistant, the gene of 5-enolpyruvylshikimate-3-phosphate synthase from Agrobacterium was used.