Lec.6 Food Technology

***Genetically modified foods***

Genetically modified foods (GM foods) also known as genetically engineered foods or bioengineered foods, are foods produced from [organisms](https://en.wikipedia.org/wiki/Organism) that have had changes introduced into their [DNA](https://en.wikipedia.org/wiki/DNA) using the methods of [genetic engineering](https://en.wikipedia.org/wiki/Genetic_engineering) as opposed to traditional [cross breeding](https://en.wikipedia.org/wiki/Cross_breeding) . Genetic engineering techniques allow for the introduction of new traits such as increased resistance to herbicides or improved nutritional content as well as greater control over traits than previous methods such as [selective breeding](https://en.wikipedia.org/wiki/Selective_breeding) and [mutation breeding](https://en.wikipedia.org/wiki/Mutation_breeding).  [Genetically modified crops](https://en.wikipedia.org/wiki/Genetically_modified_crops) have been engineered for resistance to [pathogens](https://en.wikipedia.org/wiki/Pathogens) and [herbicides](https://en.wikipedia.org/wiki/Herbicide) and for better nutrient profiles.

There is a [scientific consensus](https://en.wikipedia.org/wiki/Scientific_consensus) that currently available food derived from GM crops poses no greater risk to human health than conventional food, but that each GM food needs to be tested on a basis before introduction. Nonetheless, members of the public are much less likely than scientists to perceive GM foods as safe. The legal and regulatory status of GM foods varies by country, with some nations restricting them, and others permitting them with widely differing degrees of regulation.

 However, there are [public concerns](https://en.wikipedia.org/wiki/Genetically_modified_food_controversies) related to:

1- Food safety.

2- Regulation.

3- Labeling.

4- Environmental impact.

5- Research methods.

6- The fact that some GM seeds, along with all new plant varieties, are subject to [plant breeders' rights](https://en.wikipedia.org/wiki/Plant_breeders%27_rights) owned by corporations.

According to the [World Health Organization](https://en.wikipedia.org/wiki/World_Health_Organization), "Genetically modified organisms (GMOs) can be defined as organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination. The technology is often called 'gene technology', sometimes also 'recombinant DNA technology' or 'genetic engineering'.

The process of [selective breeding](https://en.wikipedia.org/wiki/Selective_breeding), in which organisms with desired [traits](https://en.wikipedia.org/wiki/Phenotypic_trait) (and thus with the desired [genes](https://en.wikipedia.org/wiki/Genes)) are used to breed the next generation and organisms lacking the trait are not bred, is a precursor to the modern concept of genetic modification.

The first genetically modified plant was produced using an antibiotic-resistant tobacco plant. Genetically modified microbial enzymes were the first application of [genetically modified organisms](https://en.wikipedia.org/wiki/Genetically_modified_organisms) in food production; recombinant [chymosin](https://en.wikipedia.org/wiki/Chymosin) was approved for use ,cheese had typically been made using the enzyme complex [rennet](https://en.wikipedia.org/wiki/Rennet) that had been extracted from cows' stomach lining. Scientists modified [bacteria](https://en.wikipedia.org/wiki/Bacteria) to produce chymosin, which was also able to clot milk, resulting in [cheese curds](https://en.wikipedia.org/wiki/Cheese_curds).

The first genetically modified food approved for release was the [Flavr Savr](https://en.wikipedia.org/wiki/Flavr_Savr%22%20%5Co%20%22Flavr%20Savr) tomato; it was engineered to have a longer shelf life by inserting an [antisense gene](https://en.wikipedia.org/wiki/Sense_%28molecular_biology%29#Antisense_DNA) that delayed ripening.  [*Bacillus thuringiensis*](https://en.wikipedia.org/wiki/Bacillus_thuringiensis) Potato was approved for cultivation, making it the first pesticide producing crop to be approved in the US. *Bacillus thuringiensis*, is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. *Bacillus thuringiensis* crystal protein genes have been transferred into corn, enabling the corn to produce its own pesticides against insects such as the European corn borer.

The first genetically modified animal to be approved for food use was [salmon](https://en.wikipedia.org/wiki/AquAdvantage_salmon) in 2015. The salmon were transformed with a [growth hormone](https://en.wikipedia.org/wiki/Growth_hormone)-regulating gene from a [Pacific Chinook salmon](https://en.wikipedia.org/wiki/Chinook_salmon) and a [promoter](https://en.wikipedia.org/wiki/Promoter_%28genetics%29) from an [ocean pout](https://en.wikipedia.org/wiki/Ocean_pout) enabling it to grow year-round instead of only during spring and summer.

[Rennet](https://en.wikipedia.org/wiki/Rennet) is a mixture of enzymes used to coagulate milk into cheese. Originally it was available only from the fourth stomach of calves, and was scarce and expensive, or was available from microbial sources, Genetic engineering made it possible to extract rennet-producing genes from animal stomachs and insert them into [bacteria](https://en.wikipedia.org/wiki/Bacteria), [fungi](https://en.wikipedia.org/wiki/Fungi) or [yeasts](https://en.wikipedia.org/wiki/Yeasts) to make them produce [chymosin](https://en.wikipedia.org/wiki/Chymosin%22%20%5Co%20%22Chymosin), the key enzyme. The modified microorganism is killed after fermentation. Chymosin is isolated from the fermentation broth, so that the [Fermentation-Produced Chymosin](https://en.wikipedia.org/wiki/Fermentation-produced_chymosin) used by cheese producers has an amino acid sequence that is identical to bovine rennet.

***Advantages and Disadvantages of Genetically Modified Foods***

Advantages of Genetically Modified Foods:

1. Food supplies become predictable.
When crop yields become predictable, then the food supply becomes predictable at the same time.

2. Nutritional content can be improved.
Genetic modifications do more than add pest resistance or weather resistance to GMO crops.

3. Genetically modified foods can have a longer shelf life.
Instead of relying on preservatives to maintain food freshness, genetically modified foods make it possible to extend food life.

4. Receive medical benefits from GMO crops.
Through a process called “pharming,” it is possible to produce certain proteins and vaccines, along with other pharmaceutical goods.

5. It creates foods that are more appealing to eat.
Colors can be improved with genetically modified foods so they become more pleasing to eat; brighter foods are associated with better nutrition and improved flavors.

6. Genetically modified foods are easier to transport.
Because GMO crops have a prolonged shelf life, it is easier to transport them greater distances.

7. Herbicides and pesticides are used less often.
Herbicides and pesticides create certain hazards on croplands that can eventually make the soil unusable.

***Disadvantages of Genetically Modified Foods***:

1. GMO crops may cause antibiotic resistance.
When crops are modified to include antibiotics that kill germs and pests, it reduces the effectiveness of an antibiotic or other medication when it is needed in the traditional sense. Because the foods contain trace amounts of the antibiotic when consumed, any organisms that would be affected by a prescription antibiotic have built an immunity to it, which can cause an illness to be more difficult to cure.

2. Farmers growing genetically modified foods have a greater legal liability, Crops that are genetically modified will create seeds that are genetically modified. Cross-pollination is possible between GMO crops and non-GMO crops as well. Because many of the crops and seeds that produce GMO crops are patented, farmers that aren’t even involved in growing these foods are subjected to a higher level of legal liability.

3. Genes go into different plant species.
Crops share fields with other plants, including weeds; genetic migrations are known to occur. What happens when the genes from an herbicide-resistant crop get into the weeds it is designed to kill? Interactions at the cellular level could create unforeseen complications to future crop growth where even the benefits of genetically modified foods may not outweigh the problems that they cause.

4. Independent research is not allowed.
Because most GMO foods are made from corn, wheat, or soybeans, Over 50% of the seed producers that have created the GMO foods market prohibit any independent research on the final crops as an effort to protect their profits.

5. Some genetically modified foods may present a carcinogen exposure risk.
Crops tolerant to commercial pesticides greatly increased the risk of cancer development in rats.

Where GMO is can be used?

Genetic modifications were first applied to microorganisms, insertion of defined foreign genes into the genome of bacteria, molds, yeast, etc., has resulted in the creation of genetically modified organisms (GMOs), the products of which were useful for humans and found use primarily in industry and pharmacy. Genetic modifications are also the basic research tool in life sciences, where they are applied to study the functions of genes and mechanisms that control their activity, their role in disease processes, etc. However, the use of similar genetic manipulations in plants and animals creates many new problems and unexpected hazards. The strongest doubts are raised by genetic modification of cultivated plants and breeding animals, because:

1. GMOs enter the area of food production.
2. The production is effected in the natural environment.