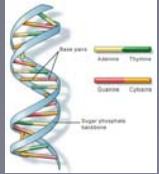




Genetic Engineering



The concept of altering an organism's genes for human benefit dates back over 10,000 years with the beginning of cultivated wheat. Farmers have long crossed plants displaying favorable traits in order to produce an improved hybrid. Today's means of engineering foods include classical breeding, hybridization, molecular breeding, and genetic engineering. Some examples of modern genetic engineering are round-up ready soy bean, Bt corn, Bt cotton, and golden rice. The generation and use of GMOs has many reasons, chief among them are their use in research that addresses fundamental or applied questions in biology or medicine, for the production of pharmaceuticals and industrial enzymes, and for direct, and often controversial, applications aimed at improving human health or agriculture.

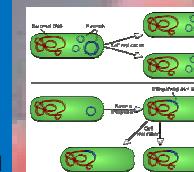
Some of the techniques used to transfer foreign cells into animals and plants include:

- Bacterial vectors
- Biolistics
- Electroporation
- Viral vectors



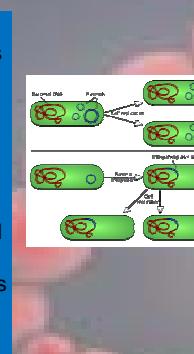
Bacterial vectors

The bacterium *Agrobacterium* can infect plants, which makes it a suitable carrier for delivering DNA. The bacterium is prepared in a special solution to make its cell walls more porous. The selected gene is inserted into a bacterium extra chromosomal DNA molecule (called a plasmid) and dropped into the solution. The solution is heated, which allows the plasmid to enter the bacterium and express the new gene. The genetically altered bacterium (or recombinant) is allowed to recover (is 'rested') and grow and, depending on the plasmid, make extra copies of the new gene. The bacterium is then allowed to infect the target plant so it can deliver the plasmid and the new gene.



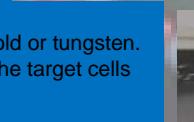
Biolistics

The selected DNA is attached to microscopic particles of gold or tungsten. Like firing a gun, these DNA-laden particles are shot into the target cells using a burst of gas under pressure.



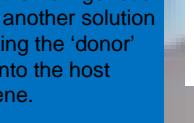
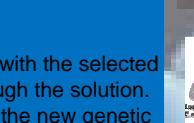
Electroporation

The prepared target cells are immersed in a special solution with the selected DNA. A short but intense electric shock is then passed through the solution. The result is small tears in the cell membranes, which allow the new genetic material access to the nuclei. Then, the cells are placed into another solution and encouraged to repair their breached membranes, locking the 'donor' DNA inside the cell. The selected DNA is incorporated into the host chromosomes to provide the host with a new gene.



Viral vectors

A virus that will invade the target cells but not cause damage or death is chosen. The selected DNA is added to the genetic makeup of the virus, and then the virus is allowed to infect the target. As the virus invades cells and replicates, the selected DNA is added to the target cells.



Products of Genetic Engineering

Crop Production



- Bt corn
- Bt cotton
- Golden Rice
- Roundup Ready Soybean



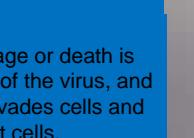
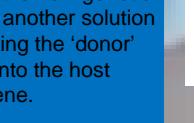
- Vaccinations
- Prescription Drugs



Medical Innovations



Bioremediation



- Oil Eating Bacteria
- Heavy Metal Uptake

