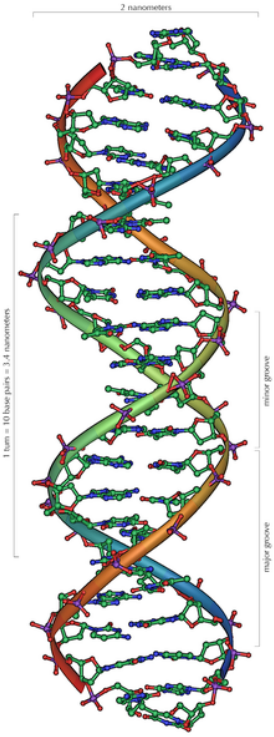
Genetic Engineering

1. Genetic Engineering



Genetic engineering is a laboratory technique used by scientists to manipulate genes of living organisms, usually outside the organism's natural reproduction process. It involves the isolation, manipulation and reintroduction of DNA into cells or model organisms. The aim is to introduce new characteristics, such as making a crop resistant to an herbicide. DNA (deoxyribonucleic acid) is the blueprint for individuality of an organism. The life, growth and unique features of an organism depend on its DNA. The segments of DNA which have been associated with specific features or functions of an organism are called genes.

The molecular biologists Daniel Nathans and Hamilton Smith received 1978 the Nobel Prize in physiology or medicine for their isolation of enzymes which are able to cut DNA at specific sites. Together with other enzymes which are able to join fragments of DNA together, scientists are able to build customized DNA sequences. They also learned about vectors, strands of DNA such as viruses, which can infect a cell and insert themselves into its DNA. Formerly this knowledge makes modern genetic engineering possible.

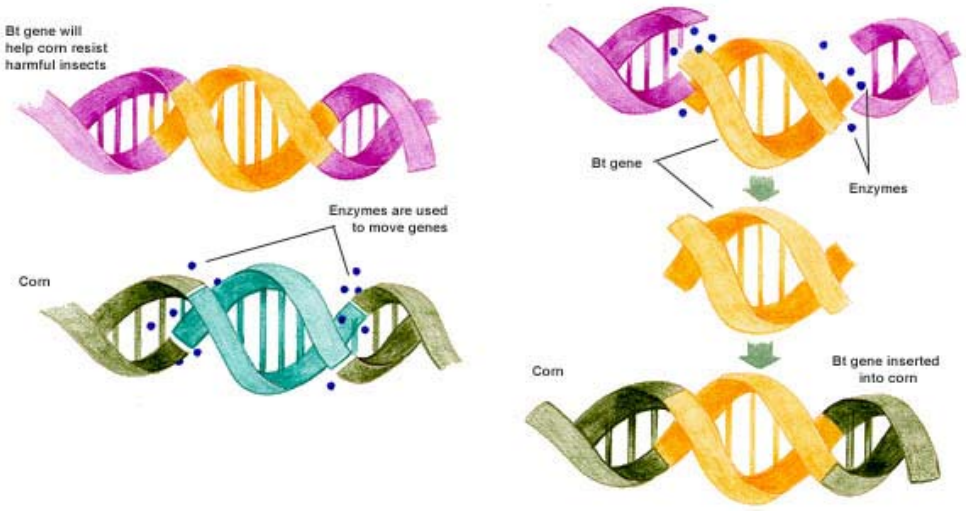
The first genetically engineered food products were tomatoes, which went on the market in 1994. These tomatoes were genetically improved to be resistant against frost and made it possible to extend the growing season.

The first genetically engineered drug was human insulin in 1982. Another early application was to create human growth hormone as replacement for a drug that was previously extracted from human cadavers.

2. Methods

The scientists know 3 main methods for genetic engineering.

- **Knockout experiment**
  Knockout experiments are performed if an organism should loose functions. The organism is engineered to lack the activity of one ore more genes. This allows analysing the defects caused by this mutation and can be useful in discovering the function of a gene.
- **Gain of function experiment**
  The gain of function experiment is the logical counterpart of the knockout experiment. The new construct is designed to increase the functions of the gene.
- **Tracking experiment**
  Tracking experiments are used to gain information about the localization and interaction of a gene.



3. Genetic Engineering and Foods

Genetically engineered foods are produced from crops whose genetic structure has been altered through processes called recombinant DNA, to give the plant a new trait. Scientists and farmers have been genetically modifying plants for hundred of year. Hybrid corn for example is the result of genetic modification through traditional methods of plant breeding. Through traditional genetic modification methods, such as cross-fertilization, farmers mixed up thousand of genes from several plants to weed out the unwanted traits. An estimate says that about 70-75% of the grocery available in US grocery stores today may contain ingredients from genetically engineered plants. Bioengineered foods do not pose any risks for consumers and strong regulations make sure that there are no hazards, such as unexpected allergen or poisonous substances in the food, or that the food is not changed in some way that would affect its nutritional value.

The first generation of genetically engineered crops was developed primarily to benefit the growers. Plants were created to resist diseases and to tolerate herbicides. The next generation of genetically engineered products benefits the consumers directly. Scientist are adding nutrient to food, try to reduce allergens and toxins, and making food tastier. For example Soya crops have been modified over year so that nowadays the allergic reactions from infants, occurring through eating products out of original Soya, could be nearly wiped out.

4. Genetic Engineering and Humans

Inheritable characteristics are passed from one generation of humans to the next one through DNA. Nowadays it is even possible to perform modifications of the DNA of living beings like mice and other mammals to change the characteristic and behaviour of these creatures. The technology exists to build humans like a “construction set” and ideals and fantasies of scientists. But there are some ethical questions and concerns about it. Do we really want an exact copy of our self? How far is it allowed to modify an embryo and predict how the behaviours and the look like of the new baby should be? These are principal questions and are often discussed. But as I mentioned before the techniques exists. Nowadays there exist three different approaches.

- **Cloning**

Cloning uses the DNA of an existing individual to create a new individual. The best-known example is Dolly, a sheep that was cloned using DNA from a sheep that had been dead for six years. A human has not yet been cloned.

- **Somatic cell manipulation**
  Somatic cells are cells of the body that do no pass DNA on to the next generation. This method is better known as “Gene therapy”. Genes are introduced into the blood cells or into the cells of the immune system. The idea is to correct genetic components of the disease instead of treating the disease with drugs. Hundred of trials have been carried out, but in most cases the patients have not been cured.
- **Germ line manipulation**
  Germ cells (sperm and eggs) do pass DNA from one generation to the next. Through germ line manipulation it is possible to design the future generation of the human beings, but this is still in the realm of science fiction.

5. References

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