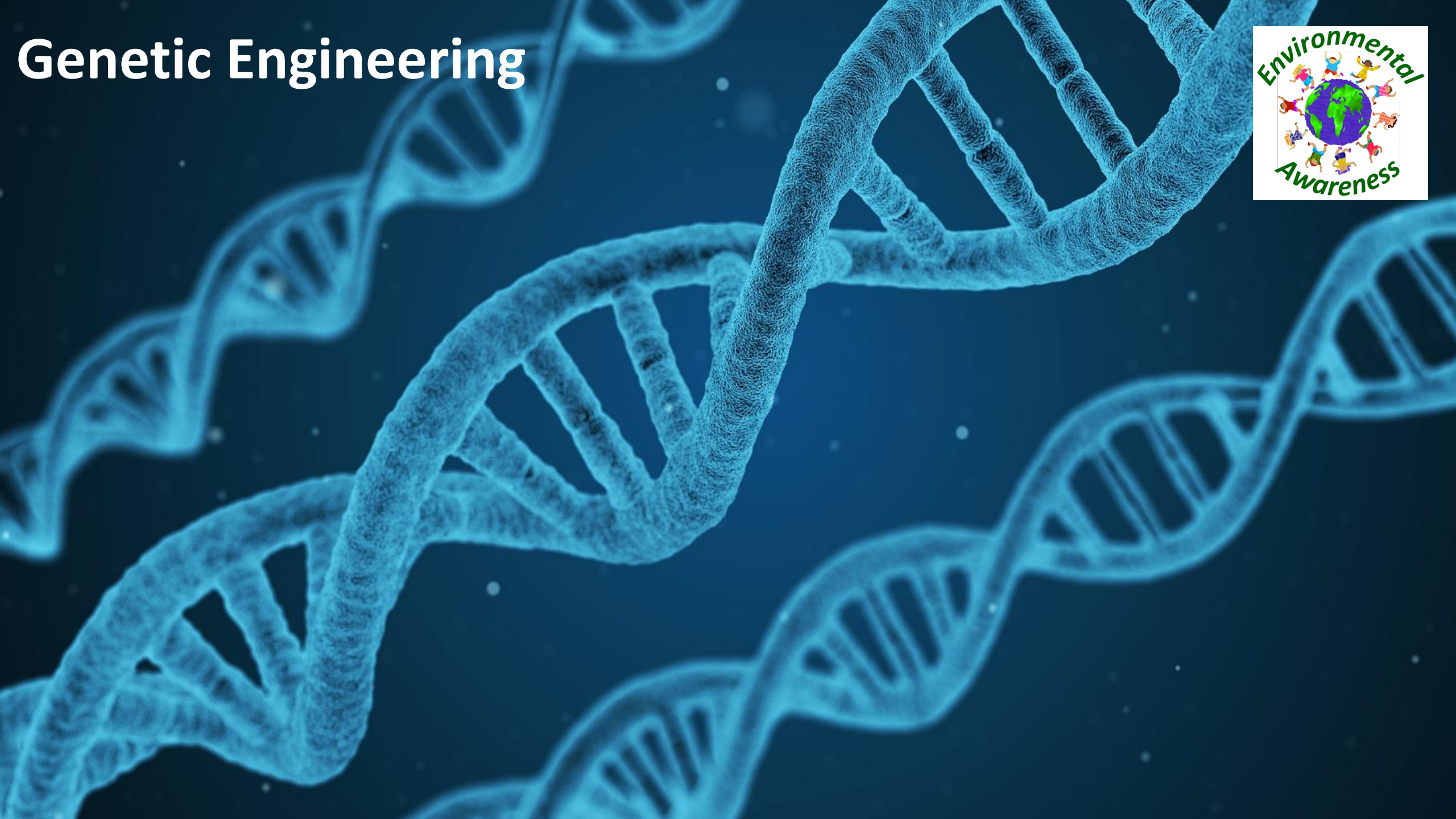
Genetic Engineering



What is genetic engineering?

- Genetic engineering can be defined as manipulation of an organism's genes with the help of biotechnology.
- The first official genetic manipulation happened in 1972 by Paul Berg when he combined the DNA from a monkey virus with the lambda virus.
- Genetic engineering is a very controversial topic in our society.
- There are many pros and cons regarding this topic.
- In the following, the advantages as wells as the downsides of genetic manipulation are examined.

Fields of application

- Research
- Medicine
- Agriculture
- Industry
- Regulation

Benefits from genetic engineering

- Fighting diseases
- Increase in life expectancy
- Increased variety of foods and drinks
- Nutritious food
- Decrease in the use of pesticides
- Medical foods
- Decrease in the use of resources
- Increase in growth rates of animals and plants
- Development of specific characteristics

Fighting diseases

- There are some severe diseases which we will likely never be able to fight if we do not use genetic engineering.
- From only small manipulations of genes, it is expected that we can fight a significant number of deadly diseases.
- Moreover, even for unborn babies, there could be genetic diseases detected.
- The most prominent example for this kind of genetic disease is the Down syndrome.
- If our scientists get quite advanced, it is likely that we would be able to cure all genetic diseases, even that of unborn children.
- Abortions because of the diagnosis of genetic diseases would no longer be necessary since we could ensure the babies health through genetic manipulation.

Increase in life expectancy

- Since we can fight many diseases with genetic engineering, the overall life expectancy of people is likely to increase since the dangers of death due to these diseases decreases.
- Moreover, if we are able to further improve our knowledge regarding genetic modification, diseases could be treated more effectively.
- Especially in poor countries where some diseases can cause the death of many people, also the development of genetically modified plants for medical use could be a great measure in order to mitigate the issue.
- We could also fight diseases which usually cause death for old people and thus prolong their lifes.
- Moreover, we can increase their life quality since old people do not have to suffer from these diseases anymore.
- Thus, genetic engineering may lead to an increase in average life expectancy.

Increased variety of foods and drinks

- With the help of genetic manipulation, we could increase the variety of foods and drinks for our daily consumption.
- Moreover, we could further improve the crop yields since we could create sorts of plants that are resistant to all kinds of pests.
- Thus, we could supply enough food to all people worldwide and fight famine in an effective way.

Nutritious food

- Additionally, with the help of genetic engineering, it may be possible to create more nutritious food.
- This would be especially beneficial in countries where people suffer from vitamin deficiencies.
- If we are able to increase the level of these vitamins in crops or other foods, we could help people to overcome their vitamin deficiency.

Decrease in the use of pesticides

- If we are able to modify the genetics in a way that they naturally become resistant against pests, we will no longer have to use harmful chemical pesticides.

- Thus, genetic engineering may also lead to a reduction in the use of pesticides.

Medical foods

- With the help of genetic engineering, we may also be able to create certain medical foods which may also replace some of the common injections.
- Medical foods may also help to prevent certain diseases.
- Therefore, genetic engineering could also lead to an improvement of medical standards.

Decrease in the use of resources

- Through genetic engineering, it would be possible to create plant species which need less water than the plant species currently used in agriculture.
- By replacing the natural species with genetically modified ones, farmers could save plenty of water.
- This would be especially useful in regions where water shortage is a serious problem.
- Water shortage will be a quite big issue in the future due to global warming.
- If the average temperature increases, water scarcity is likely to also increase.
- Thus, with the help of genetic modification, water can be saved and the problem of water shortages may be mitigated to a certain extent.

Increase in growth rates of animals and plants

- We may also be able to increase the speed of growth of plants and animals.
- By doing so, we could produce more food in a given period of time.
- This may quite important since our world population is growing and therefore the demand for food is increasing.

Development of specific characteristics

- Through genetic modification, we may also be able to strengthen specific characteristics of plants.

- This may include that plants are better able to adapt to the global warming problem or that they may become more resistant to changes in their natural conditions.

Problems with genetic engineering

- Religious and ethic concerns
- Genetic issues
- Health issues
- Allergies
- Resistant insects and pests
- Antibiotic resistance
- Reduction in genetic variety
- Effects on wildlife
- Soil pollution
- Displacement of natural species
- Influence of certain industries and interest groups

Religious and ethic concerns

- Many followers of religions are strictly against genetic engineering since they think „playing god“ should not be a task performed by humans.
- There are also ethic concerns if genetic manipulation should become a valid instrument for changing the course of our lifes.
- There is also the argument that diseases are a natural phenomenon and that they have a role in nature since they persisted over a quite long time horizon of evolution.
- Moreover, there are many scientist who believe that the creation of „designer babies“ could not be in the interest of humanity.
- If perfected, parents could choose the eye color, hair color or even the sex of the baby.
- This could lead to an optimization contest in our society which could also have vast negative effects if pushed too far.

Genetic issues

- Genetic manipulation can also cause genetic problems if we do not handle it in a proper way.
- Since science is still on an early stage on the understanding of genetics, manipulations of genes may even do more harm than good at our current state of genetic understanding.
- Errors could even lead to the development of new diseases or to miscarriages.

Health issues

- Genetic engineering also poses a risk to human health.
- For example, genetically modified food may lead to long-term health issues.
- There is just not enough reliable data yet on how harmful genetic engineering really is in the long term.
- Thus, it may pose serious health effects, some of them currently even unknown by scientists.

Allergies

- Genetic engineering may also lead to the development of allergies against certain food items.
- Since the DNA-structure is altered in the genetic modification process, food that has former been uncritical for people could now cause allergic reactions.

Resistant insects and pests

- Genetic engineering is also used to modify plants.
- Specifically, some plant species have been developed which include their own pesticide which can protect them from animals and insects.
- In this way, scientists hope to be able to increase crop yields.
- However, this altering of genetic code in plants can lead to a resistance of certain insects to the pesticide.
- This may pose big problems to the agricultural system since if insects or other pests become resistant against toxins, they are harder to fight.
- Thus, in the short run, altering genetic material in plants may have its advantages.
- However, in the long run, there may be severe issues when it comes to resistance of pest strains.

Antibiotic resistance

- Some researchers are afraid that genetic engineering may also lead to a resistance against antibiotics for humans.

- This may lead to serious problems since the treatment of diseases with antibiotics will not be effective anymore.

Reduction in genetic variety

- Genetic engineering would also lead to a reduction in genetic diversity.
- Since the process of gene manipulation would be quite expensive, only rich people would be able to afford it.
- Thus, this would likely lead to human behavior which favors being rich over all other things in order to be able to afford genetic manipulation.
- As a consequences, the variety of human behavior would be reduced.

Effects on wildlife

- Since genetically modified plants often contain own pesticides, they can be quite harmful to animals which are consuming these kinds of plants.
- Animals can suffer severe diseases from these pesticides and even die.
- This problem is especially severe for butterflies and other insects which usually rely on certain plants in their near surroundings.
- If the natural versions of plants are replaced by genetically modified plants containing pesticides, these insects are likely to suffer from severe health conditions.

Soil pollution

- Researchers found that residues of genetically modified plants persist on the soil of fields for many month.
- Thus, the activity of microbes is adversely affected which can lead to a loss in fertility of the soil.

Displacement of natural species

- If genetically modified plants are more resistant against pests, chances are that they will displace local natural plant species in the long run.

- This also contributes to a reduction in genetic variety and can cause the issues related to this phenomenon.

Influence of certain industries and interest groups

- Genetic engineering is an area which can be quite profitable for some firms.
- However, it is also quite expensive field of study.
- There are some big companies which have huge control over the seed market and thus also have a big influence on political decisions regarding the admission of genetically engineered plants for agricultural purposes.
- Thus, even if there may be dangers from these admissions, companies may still get permission to sell the genetically modified seeds since they may have high influence on political decision makers.

Conclusion

- Gene engineering is a quite controversial topic in our society.
- It has many advantages and fields of application, but can also have detrimental effects on humans as well as on the whole ecological system.
- There are also many religious and ethic concerns against the use of gene manipulation.
- Thus, as humans, we have to make difficult decisions in the future on whether we want to „play god“ in order to be able to fight deadly diseases or if we do not want to take the risk.

Sources

- http://www.fao.org/3/Y5160E/y5160e10.htm#P3_1651The
- http://www.fao.org/3/y4955e/y4955e06.htm
- https://en.wikipedia.org/wiki/Genetic_engineering