**- Biotechnology in our life -**

# POSTER PROJEKTJAHR 2017/2018

**des von der Europäischen Union unterstützen internationalen Projektes**

**RED BIOTECHNOLOGY**

Personalised Medicine

Antibiotics

Prenatal Diagnostics

**GREEN BIOTECHNOLOGY**

Golden Rice

Bt-Corn – general information

Bt-Corn – controversity

**WHITE BIOTECHNOLOGY**

Enzymes in the Food Processing Industry

Biotechnology on Amino Acids

Company Profile - Janssen

**GREY BIOTECHNOLOGY**

Microbial Soil Remediation

Biological Pest Control

Oil Biodegradation and Bioremediation

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# Bt-Corn

*Juan and Ruth*

## What is Bt-Corn?

https://www.thealternativedaily.com/gmo-corn-found-in-humans-creates-a-living-pesticide-factory/

Bt-Corn is corn (or maize) that has been genetically modified. **Genetically modified organisms** (GMOs) are organisms that have had their genes changed through the addition of genetic material from other organisms

The Bt-Corn was genetically modified to control the Lepidoptera larvae which damage or kill the corn plant.

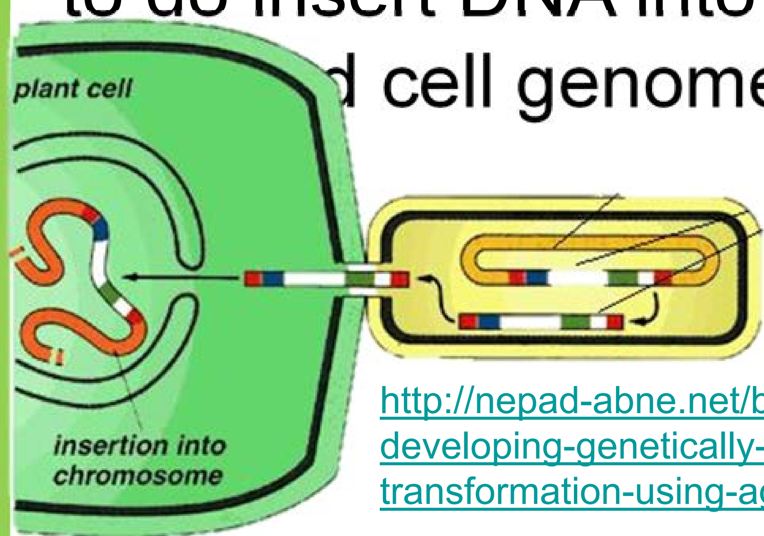
https://en.wikipedia.org/wiki/Caterpillar

## How does it work?

The corn was injected with the Bt Delta Endotoxin. Bt Delta Endotoxin was selected because it is very successful and controlling the Lepidoptera larvae. The Bt Delta Endotoxin is harmless to humans, other mammals, fish and birds therefore is considered safe to introduce into the corn plant.

The process used to insert the DNA of the Bt Delta Endotoxin was by using a soil bacterium called Agrobacterium tumefaciens.

This bacterium is used because it has a natural ability to do insert DNA into plant ... cell genomes




http://nepad-abne.net/biotechnology/process-of-developing-genetically-modified-gm-crops/plant-transformation-using-agrobacterium-tumefaciens/

## Uses and Benefits of Bt-Corn

The farming of corn is greatly affected by these larvae which prevent a large amount of corn from being able to be sold. This results in: farmers earning little profit; land and energy being wasted; and food shortages. To overcome this problem, the larvae must be controlled.


http://isaaablog.blogspot.nl/2013/06/bt-toxin-story-of-pen-and-its-cap.html

It is recorded that, on average, farmers who adopt GM crops make 68% more profit than those who do not. This impacts the farmers' lives positively as they have more money to afford their needs and luxuries.

## Disadvantages of Bt-Corn

People are often skeptical about GM crops due to recent introduction of it resulting in long term effects being unable to be tested thoroughly. Also the modified genes can be transmitted to nearby crops through pollination and seeds. This contaminates other crops and, especially if the contaminated crops are labelled as organic, this can cause problems.

Bt-Corn has been shown to damage the monarch butterfly species. The pollen from the Bt-Corn can spread onto the monarch butterfly larvae's main food source of milkweed and causes death or poor growth of the larvae.


https://nl.pinterest.com/pin/495325658996210784/

## Conclusion

Bt-Corn is a great success and very beneficial for farmers in controlling the pests that reduce their crop yield and therefore profit. However, the future of Bt-Corn and other GM crops should involve further research into reducing the impact on other species as well as humans.

Also the public should become more educated on GM crops to avoid skeptism and avoidance.

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# The controversy behind GM-corn

*Ani and Arlet*

## What is GM-corn?

GM-corn is a type of corn that has been genetically altered to give different properties. To achieve that, a gene must be inserted in to the corn. GM-corn increases production com- pared to natural corn. GM-corn is being looked in to due to the growing population of the world. Most of the population is concentrated in poorer regions that are less friendly for farming. GM-corn can help solve that problem by making the plant accustomed to harsher climates. GM-corn innate ability to resist natural predators has made them evolve to resist these new preventative methods and in the future it might make it impossible to take care of pests.

Source: https://pixabay.com/en/corn-corn-on-the-cob-piston-young-1605664/

An example of GM-corn is Bt-corn. Bt-corn has been given the Bt-delta endotoxin that helps the corn fight against corn borers, a pest that is really hard to fight against with traditional methods. With Bt-corn fewer insecticides are used. Many insecticides linger on in the crop so using it less makes it healthier for the consumer.

## Current use of GM-corn

The U.S.A. has adapted GM-products in to their diets. US farmers grow corn on around 80 million acres annually. Around 80% of that corn is GM-corn

## GM-corn producing regions

Gm-corn is mainly grown in South and North America: Uruguay, Brazil, Paraguay, Colombia, Chile, Argentina, Honduras, U.S.A, Canada. Also in the

Most countries in the EU have banned the use of GM products. The only notable exception is Spain, where Bt-corn is still in use.

## Opposition of GM-corn

The largest producer of GM-plant seeds is Monsanto Monsantos' claims do not reflect what other studies have found. Some stuides have found that the Bt-delta endotoxin is in fact harmful to humans as opposed to Monsantos' claim, that it only targets pests. Other studies have also found that GM-corn has higher concentrations of harmful substances, such as chloride, formaldehyde, glyphosate. The food of the future has many negative side-effects that can harm the health of humans long-term.

One danger of using GM-corn is that it kills biodiversity. The fewer types of crop are planted, the more harmful effects it has on humanity if a disease for example wipes out that specific plant.

GMOs have given rise to super weeds that have become resistant herbicides and are extremely difficult to control.

Source: https://pixabay.com/en/riot-violence-anarchy-revolution-41342/

The **European Commission** has laid out a legal framework to ensure that modern biotechnology, and more specifically modern GMOs, takes place in safe conditions. The legal framework aims to protect human and animal health and the environment, put in procedures for risk assessment and authorisation of GMOs that are efficient, time-limited and transparent, ensure that all GMOs are labelled as such in order for consumers to make an informed choice and ensure the traceability of GMOs placed on the market (European commission).

Most GMOs have not been able to pass their standards and have been denied and some more acceptable GMOs have been on hold for over 10 years waiting for the approval of the EU. It has made GMOs next to non-existent in Europe. Only the Bt-corn has been able to pass their regulations and it has seen some use in Spain, but not much elsewhere and is only used as animal feed. The spanish farmers saw significant reductions in toxic mycotoxin levels when compared to traditional corn.

Source: https://commons.wikimedia.org/wiki/File:Flag_of_Europe.svg

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# Golden rice

*Leonardo and Rijk*

https://en.wikipedia.org/wiki/Golden_rice

## What is Golden Rice?

Golden rice was developed to solve a big problem mostly in Asia or other places where there is a shortage of vitamin A. It is a type of rice that is genetically engineered. The difference between the white rice and the golden rice is the amount of vitamin A that is produced by the addition of three beta-carotene biosynthesis genes. There is also golden Rice 2 that is still in development now. This new type of golden rice produce 23 times more beta-carotene than the original golden rice did.

## How is the rice modified:

To produce and store beta-carotene the rice is genetically engineered with 3 genes. This three genes will produce the vitamin A. This genes, along with promoters, are inserted into plasmids, small pieces of DNA. They add the agrobacteria into a petri dish which contains rice embryos. When agrobacteria infect the embryos they also transfer the genes that encode the instruction for making beta-carotene.

## Why is golden rice so important ?

The development of the Golden rice is to decrease the deficiency of Vitamin A. This vitamin is very important for children. When you don´t have enough Vitamin A in your younger years you could be diagnosed with blindness, Xerophthalmia (your eyes can't produces tears that can lead to blindness) and even to death.

https://www.flickr.com/photos/communityeyehealth/5636914713

## The upsides and the downsides:

**Two German economists have quantified:**

- The price of the opposition, in human health. Their study estimates that the delayed application of Golden Rice in India alone has cost 1,424,000 life years since 2002. Not only death is quantified but blindness as well.

https://www.flickr.com/photos/65421715@N02/6150594251


**Greenpeace says:**

- That Non-GMO organic, traditional and conventional plants would be at a high risk of contamination by the Golden rice, if this GMO rice were released into the environment. Because this GMO will damage the fields.

- The production and use of golden rice citing this GMO will encourage the development of more GMOs in the future.

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# Biotechnological Aspects of Biological Pest Control

*Paul, Jonathan und Sofie*

## *Biotechnology as pest control*

As a form of pest control, biotech can be used on crops so that they need fewer applications of pesticides. With this kind of pest control crops get genetically modified so they are toxic to certain insects. An organism is genetically modified when the DNA has been altered by the insertion, deletion or a mutation of a gene.

When genetic modification is used as pest control, we often insert a different gene from another organism. Most of the time the aim is to insert a new trait into the crop. This way the plant will create a resistance to pests, diseases, environmental conditions or chemical treatments. This will give the crop an advantage.

## *Chemical pest control*

There are a lot of chemicals being used to prevent the crops from getting ruined. These chemicals are used as toxicants, sterilants, growth regulators and semiochemicals.

Toxicants are supposed to kill pest that come in contact with the chemical, sterilants eliminate the reproductive potential of pests, growth regulators disrupt their development potential and semiochemicals influence their behaviour. Even though chemical pestcontrol is bad for your health and for the environment because they also kill useful insects there are some benefits to using chemicals.

| | *Biotechnolgy* | *Chemicals* |
|---|---|---|
| *Advantage* | efficient | cheap |
| | good for environment | readily available |
| *Disadvantage* | expensive | poisonous |
| | time consuming | resistance |
| | scepticism | |

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# Oil biodegradation and bioremediation

*Mariasole and Júlia*

## *Bioremediation*

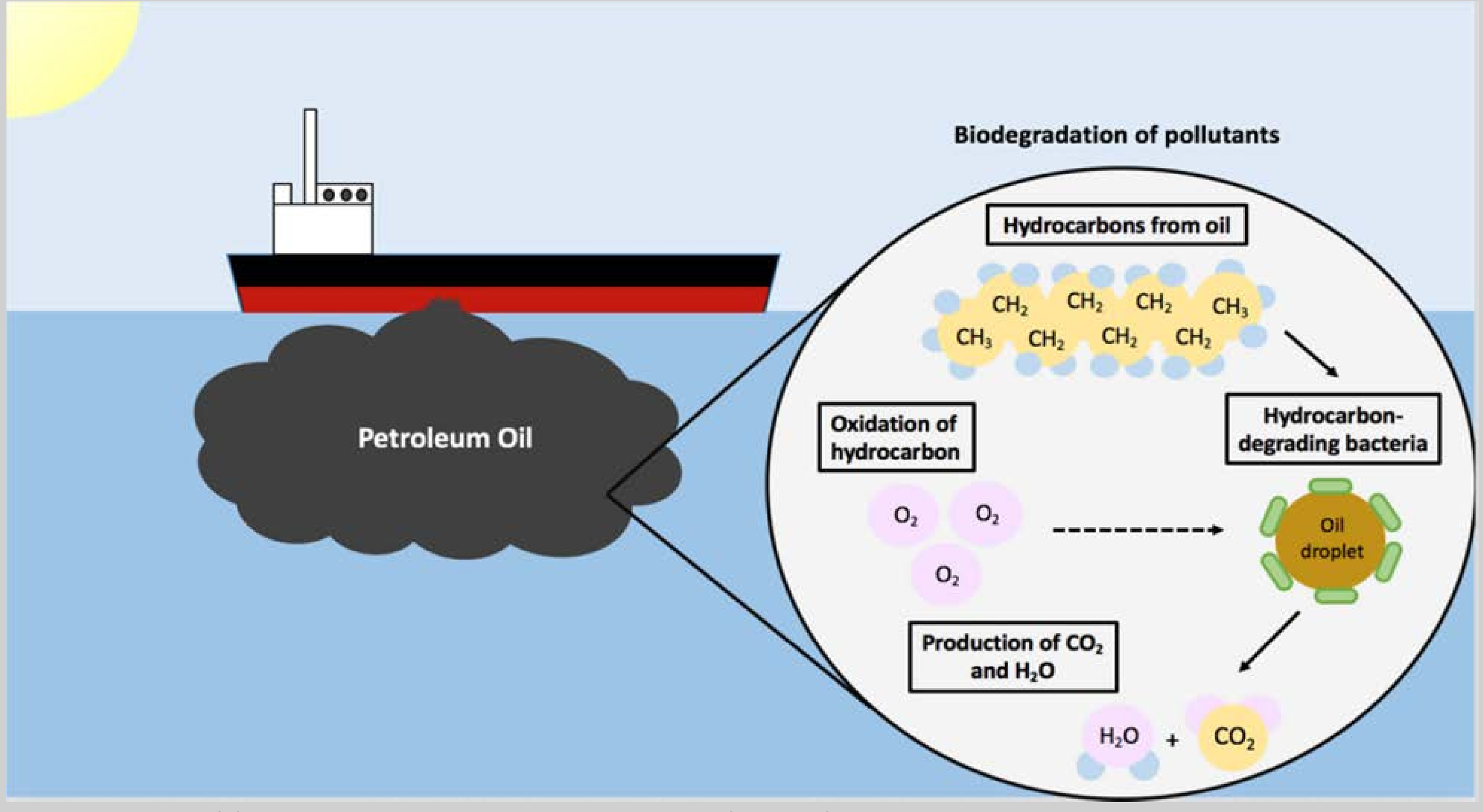
Algae laid down 100-200 million years ago constantly input small amounts of hydrocarbons as waste products: crude oils are natural part of marine environment. Because of this, a huge number of aquatic microorganisms have evolved the capability of turning hydrocarbons into carbon dioxide and energy; in other words they are able to use what we commonly call "pollutant compounds'' as source for their growth.

The use of microorganisms in order to degrade contaminants, such as oil, is called ''bioremediation''.

## *Who?*

*Alkanivorax Borkumensis* is a marine bacterium which naturally propagates in seawater containing crude oil. Its genome encodes for many efficient oil-degrading enzymes. It flourishes only near the surface of water.

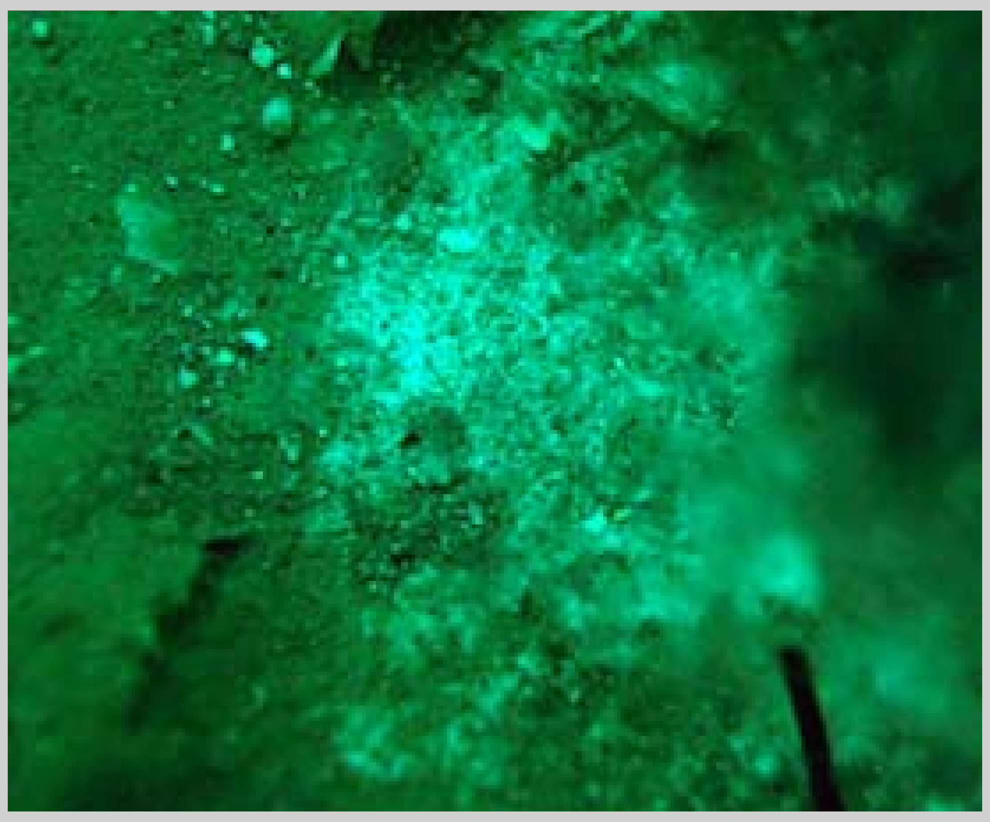
*Oleispira Antarctica* is a cold marine bacterium, which means that it is able to perform remediation of oil even in cold and deep water, where *Alkanivorax* can't live.




https://commons.wikimedia.org/wiki/File:Biodegradation_of_Pollutants.png

## *How?*

- Oil leakage = increase of bacteria's nutrient = increase of population.
- Use of emulsifiers to break up oil into droplets.
- Creation of a biofilm around the droplets.
- Enzymes (Alk1 and Alk2) are used to oxidize alkanes and obtain carbon dioxide and water.
- Bacteria use $CO_2$ as source for their growth.

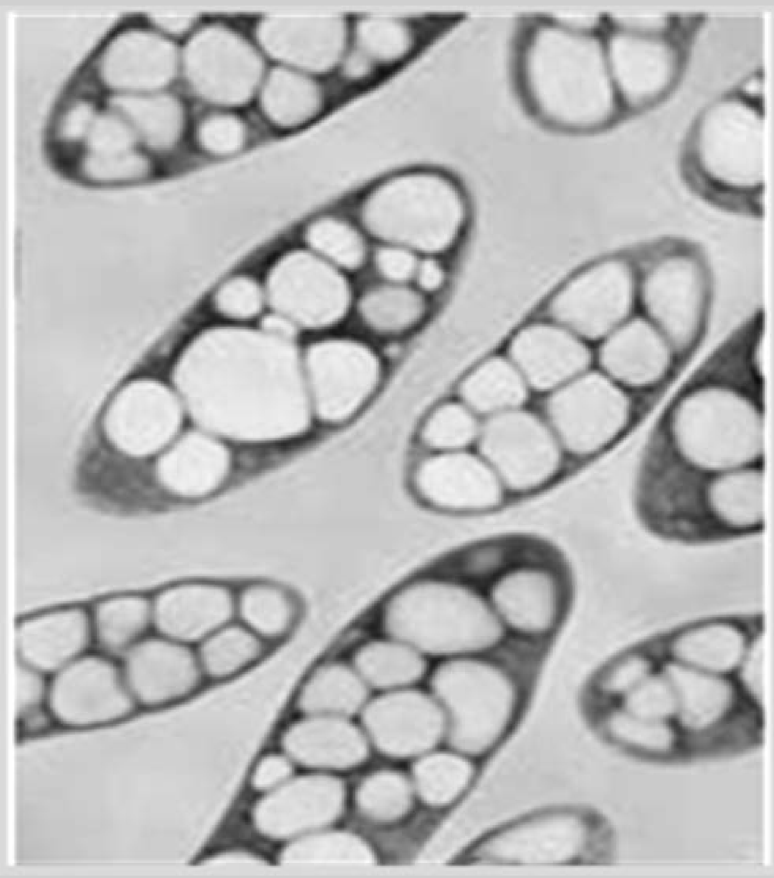


https://en.wikipedia.org/wiki/Biofilm#/media/File:Screen_Shot_2017-12-13_at_1.40.19_PM.png

https://www.worldwildlife.org/stories/five-years-after-deepwater-horizon-spill

## *Minerv Biorecovery*

It's a new project based on the use of bioplastic powders suitable to host bacteria. It offers a home to microorganisms, makes them grow and strengthen them to attack the oil. This bioplastic is obtained from renewable plants sources.



https://commons.wikimedia.org/wiki/File:PHAs.png

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# Microbial soil remediation

*Annabel and Michael*

## Global waste issue

As a direct result of human waste, soils have become contaminated with a number of polutents which have left the soil toxic and baron. The problems that are caused to our health and environment by waste disposal are timely issues.

Waste production has grown dramatically over just a few decades and is set to triple by 2100, decreasing the amount of land available and increasing disposal costs which were already as much as $205 billion in 2010, with costs showing no sign of slowing down.

http://www.af.mil/News/Article-Display/Article/110516/jb-elmendorf-richardson-turns-landfill-gas-into-energy/

## Issues

Some examples of wastes are food materials, kitchen and other natural wastes. Microorganisms and other abiotic factors together break these kind of complex substances into simpler organic matters which eventually suspend and fade into soil. The whole process is natural which can be rapid or slow. Therefore the environmental issues and risks caused by biodegradable wastes are low. Bigger problems are related to non-biodegradable wastes.

https://commons.wikimedia.org/wiki/File:Rot_strawberry.jpg

Unlike biodegradable wastes, they cannot be easily disposed of. Non-biodegradable wastes are those what cannot be decomposed or dissolved by natural agents. They remain on earth for thousands of years without any degradation. Hence the threat caused by them is also more critical. A notable example is plastic which is a commonly used material in almost every field, globally produced at a rate of about 300 million tons each year. Only about 10 percent of that is recycled.

## Issues

The wastes in landfills and oceans are huge problems nowadays. The toxic wastes contaminate the soil and water that eventually make it to our food and drinking water. Plastic containers in oceans and estuaries can harm fish, seabirds and other marine life. Plastic wrappers in all shapes and forms injure, trap or suffocate marine animals. Microplastics, tiny bits of polypropylene or polyethylene, hide beneath the water and pose a risk as well.

https://www.flickr.com/photos/tedxgp2/5143679378

https://www.flickr.com/photos/noaamarinedebris/7656597150

## Promising solution

Nature does have mechanisms for dealing with the problems of non degradable substances through the adaptation of microbes by natural selection which eventully produce enzymes to solve the issue. The production development of new plastics however has dramatically outstretched nature's capacity to deal with the solution, with plastics only being discovered in 1839 and mass produced around the 1950s. Some microorganisms have already developed enzymes that can degrade certain types of polymers but they have a low efficiency. Problem with plastic is that there is a huge amount of different types of polymers which all need a different type of enzyme to break them down. In nature it would take thousands of years to degrade them all. We need a quicker solution. One promising solution for that problem would be bioengineering. It's based on altering the genes of microorganisms so we could have specific proteins we need. There are new techniques, like CRISPR- Cas technique, that make gene insertion much quicker. Using this method, we could produce microbes that degrade various plastic polymers. They can then be added into landfill or contaminated soil (this has to be under ideal conditions; moist, 30 degrees, oxygenated and supplied with nutrients) where the plastics will then slowly be turned to soil/sludge. It's however not without issues. If a bacteria that degraded PET got released outside of the soil and entered a city it would wreak havoc and degrade the plastics in buildings, cars and bikes within a matter of decades (or at least damage it beyond repair). Smaller problems include; the amount of $CO_2$ given off by the decomposition and plastics which contain chemicals like chlorine (PVC) which can damage the environment. So it's needed to develope microbes who wouldn't do that. In conclusion bioengineering is a promising field in soil remediation but like with all new techniques, you have to be careful otherwise it could make the situation much worse.

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# Antibiotics

*Irene and Larissa*

## WHAT ARE ANTIBIOTICS?

https://upload.wikimedia.org/wikipedia/commons/1/1a/A_course_of_green_cefalexin_pills.jpg

Antibiotics also called antibacterials, are a type of antimicrobial drug used in the treatment and prevention of bacterial infections. Antibiotics are not effective against viruses. They are usually considered safe and well tolerated. However, some antibiotics have been associated with a wide extent of adverse side effects.

## PAST

Paul Ehrlich was the man who created the first modern antibiotic. He discovered an antibiotic that was the first effective medicinal treatment for syphilis. By accident Alexander Fleming discovered the antibiotic Penicillin, that were among one of the first medications to be effective against many bacterial infections. In 1940 antibiotic was first used by Selman Waksman, who discovered over 20 antibiotics.

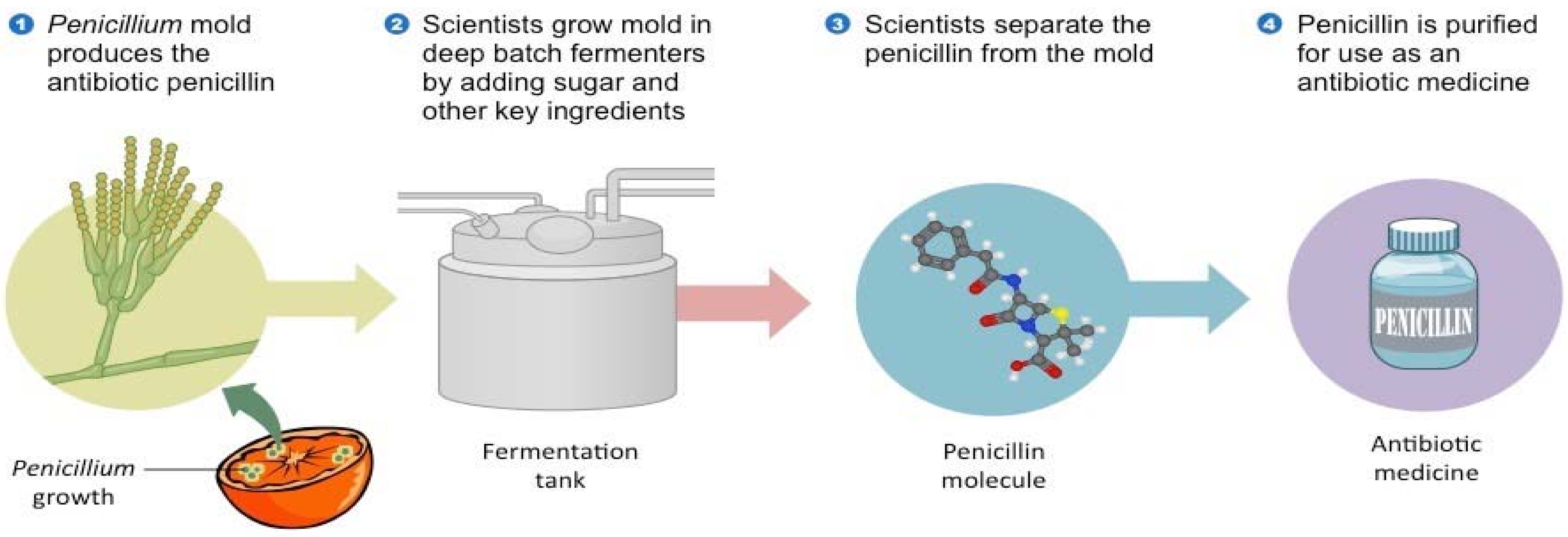
https://commons.wikimedia.org/wiki/File:Selman_Waksman_NYWTS.jpg

## FUTURE

At present, most bacterial infections can still be treated with available antibiotics used alone or in combination, but increasing numbers of clinical failures with the current armamentarium can be expected. The future could look dim, as there are relatively few new agents on the horizon. Surely our scientific abilities are up to this challenge. New approaches to antimicrobial chemotherapy are needed if we are to survive the increasing rates of antibiotic resistance predicted for the future.

## HOW ARE ANTIBIOTICS PRODUCED?

Antibiotic production can be grouped into three methods: natural fermentation, semi-synthetic, and synthetic. The process of fermentation, the source microorganism is grown in large containers containing a liquid growth medium. Semi-synthetic production of antibiotics is a combination of natural fermentation and laboratory work to maximize the antibiotic. Synthetic antibiotics are totally made in the lab, without needing any bacteria.




http://ib.bioninja.com.au/options/untitled/b1-microbiology-organisms/batch-versus-continuous.html

(fermentation process)

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# Personalised medicine

*Karin and Laura*

## What is personalised medicine?

Personalised medicine is a way of treatment and care of patients, that tries to find each patient their own individual cure plan.

http://images.all-free-download.com/images/graphicthumb/pills_312257.jpg, (modified by Laura Marie Klatt)

The approach relies on information that has been found from human genome. A big role is also played by the surrounding environment and the person's lifestyle. Together these aspects give information that can help to find out some risks of developing diseases and discover illnesses earlier. It also provides a precise diagnosis, and determines the best way to help improve our health. Things like medicines, lifestyle changes and simple variations in diet can do that. There is hope that acknowledging people about their personal risk will help them feel more empowered to change their lifestyle.

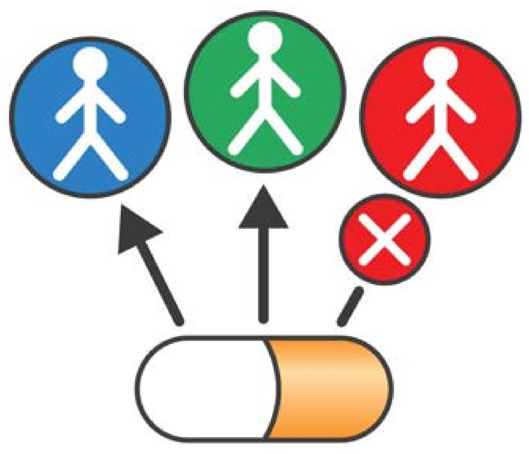
## How personalised medicine works in comparison to one-size-fits-all?

Unlike the one-size-fits-all medicine the personalised medicine tries to give the right medicine to the right patient. It maximizes the benefits of medical treatments while reducing side effects and costs. As well as it can save important time and a lot of effort.
With the help of a biomarker diagnostic medical decisions like the diagnosis, treatment or no treatment and the dose can be detected, to find the right therapy more quickly. Biomarkers are characteristics, that may be used to see how well the body responds to a treatment and can be detected for example out of blood draw, biopsy, gene sequencing, microscopic analysis or protein analysis.
Without personal medicine only some patients benefit from the one-size-fits-all medicine , some patients do not benefit and some maybe get adverse effects.

https://upload.wikimedia.org/wikipedia/commons/e/ee/Vacutainer_blood_bottles.jpg

## Estonian Genome Center

Estonian Genome Center's main priorities are to improve population's health and introduce personalised medicine in Estonia. There are nearly 52,000 gene donors, who closely reflects the age, sex and geographical distribution of the Estonian population. This number makes about 5% of adults in Estonia. Collected data allows to do scientific researches, which help to understand, how genetic information and its mutations can affect individuals.This valuable information can be used in personalised medicine.



https://www.flickr.com/photos/fdaphotos/14792960374

Autumn 2017 all of the 52,000 gene donors started to get their personal gene cards.

This year, 2018 Estonian Genome Center's mission is to collect 100,000 new gene donor's blood tests. This can dramatically change our current medical system.

## Advantages

People's average age is constantly growing. However, healthily lived years do not really rise. This means less workers and more people in need of medical care. A solution to it can be personalised medicine. Personalised medicine gives us a chance to increase the opportunity to prevent diseases. When a somebody has a predisposition to have for example diabetes, then he can focus on preventing it by changing his diet and doing more sport. Preventing diseases mean reduced healthcare costs and more healthy people, who are able to work and who have a better life quality.
If a person has a disease, then personalised medicine allows more quickly target right treatment for the patient, which raises probability of improved health outcomes. It is extremely essential if a patient has cancer and needs a very quick and precise treatment. Better-targeted cure also helps to avoid adverse drug reactions. What actually shows that one medicine does not fit for everyone. So we should look at personalised medicine as an investment rather than an additional expense.

## Disadvantages

We can see that personalised medicine has many advantages but it has also some disadvantages and ethic problems. When participants donate their blood samples to biobanks, they also have to share a lot of personal information, like details about their lifestyle, medical and family history. All this information is anonymized by using numbers and codes instead of names. But it may not guarantee complete privacy, information can get into third person's hand.
When biobanks do research to genes, they can uncover a person's genetic future – like having a great risk of developing Alzheimer's disease, which the patient maybe did not want to know. Personalised medicine is still quite expensive. Because it is very costly to screen patients and to produce medicines for individuals or groups. Fortunately the cost has dropped dramatically so far and will probably keep falling.

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# PRENATAL DIAGNOSIS: ARRAY CGH

*Angela and Elisa*

## Prenatal diagnosis

Worldwide, millions of individuals are affected by dominant or recessive genetic mutations. In order to avoid the transmission of severe pathogenic genetic variants and to enable early detection of genetic disorders, prenatal testing is offered.

There are two types of prenatal diagnosis techniques: Non-invasive and Invasive ones.

**Non-invasive techniques**

Non-invasive procedures are used to detect general disease or deformations and they don't have particular risk of abortions.

Rh safe and Prenatal safe are two of them.

**Invasive techniques**

These techniques have 1% risk of abortion because they take the cells from the amniotic fluid (Amniocentesis) from the uterus or from the chorionic villus (Chorionic villus sampling).

## HOW CAN SCIENTISTS ANALYSIS THE FETAL DNA?

Several technologies have been invented in order to examine the fetus DNA.

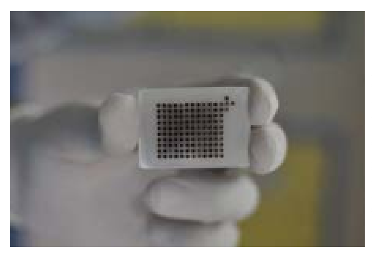
There are general or specific analysis that can use fast methods, so the result would be ready sooner, or slower methods which are very precise so also microdeletions and micro mutations can be detected.

The traditional way to analyse the fetus DNA is the karyotype but more specific techniques are being developed.

One of them is the microarray CGH, now we want to examine what they are and how do they work.

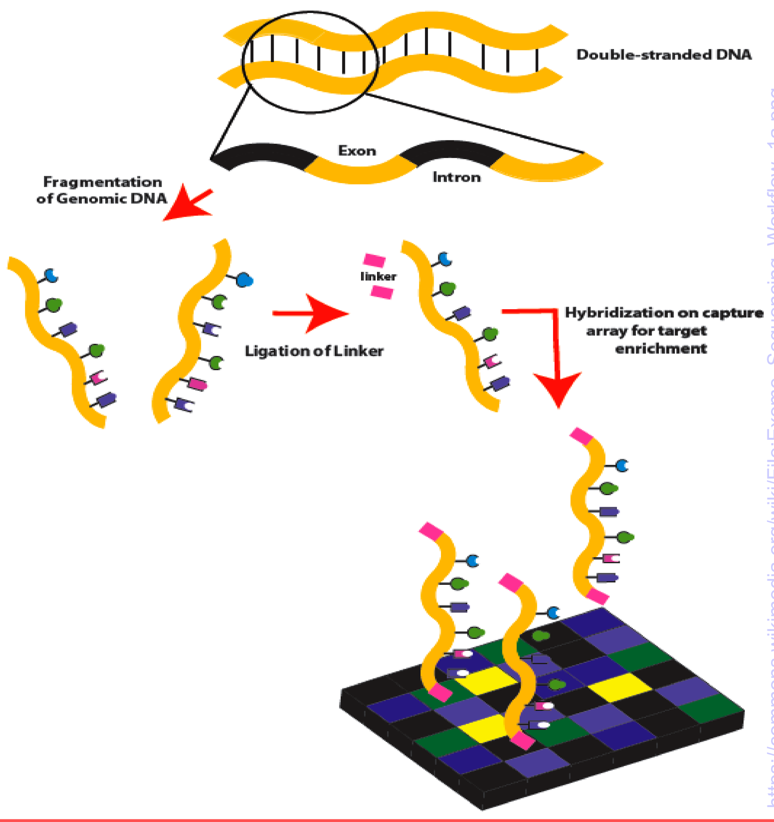
https://pixabay.com/it/dita-mani-bambini-bambino-infante-109158/

## ARRAY CGH



**What is it?**

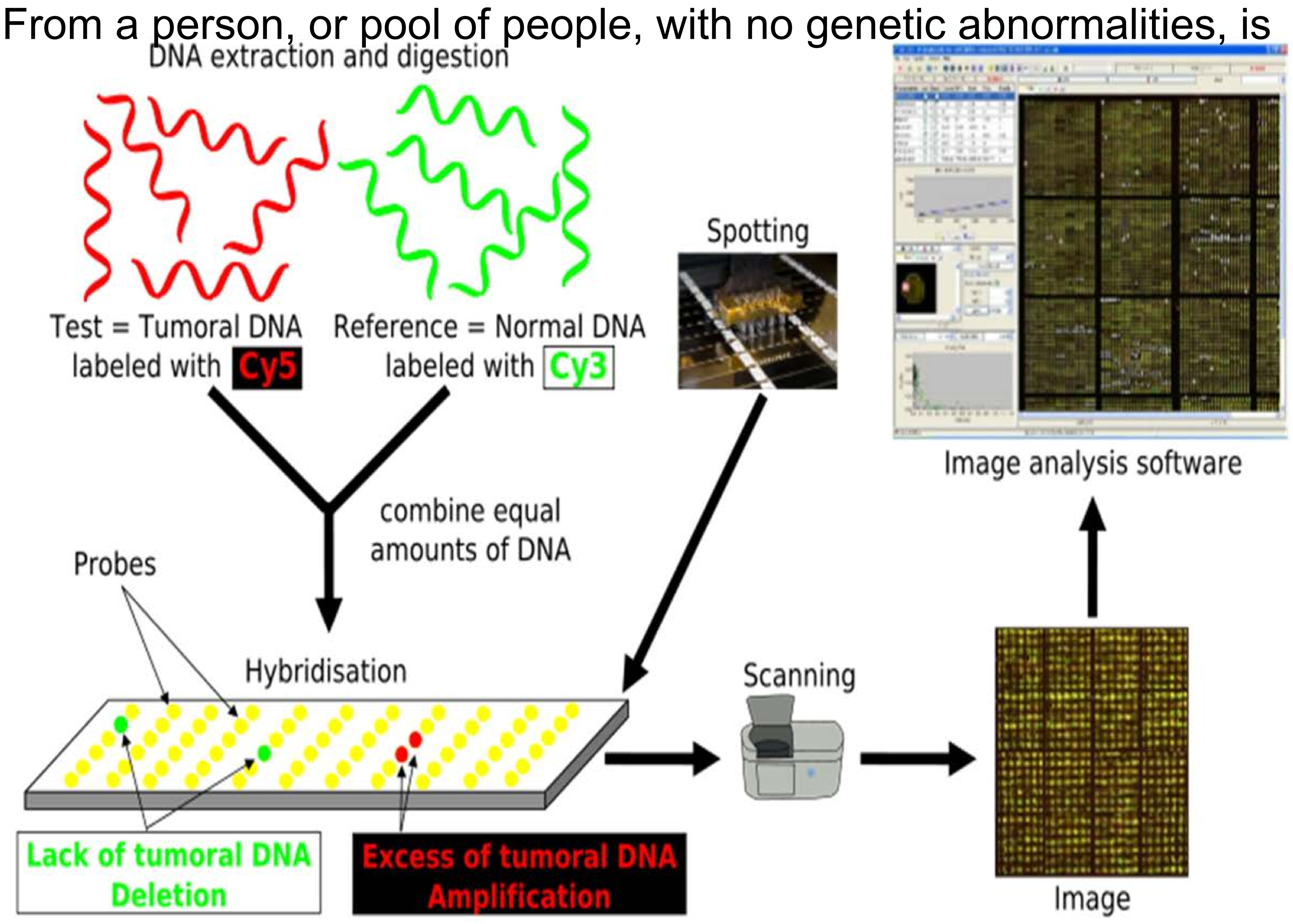
Array CGH is a significant advance in technology that allows detection of chromosomes imbalances that are too small to be detected by looking down the microscope. Karyotyping is only as good as the resolution of a microscope and is not able to detect subtle chromosomes changes. These smaller alternations, often called submicroscopic alterations because they cannot be seen down the microscope, can still disrupt growth and development. These very small changes are often called microdeletions and micro-duplications. It compares the fetus DNA with a control DNA sample and identifies differences between the two sets of DNA. In this way deletions and duplications can be identified.




## How does array CGH work?

A microarray works by exploiting the ability of a DNA molecule or strand to bind specifically to or hybridize to, another DNA molecule. The microarray compromises tens of thousands of short sequences of DNA arranged in a precise grind on a glass slide called a chip. DNA from the patient is "digested" (chopped up into short lengths or fragments ), then these fragments are labeled with a colored fluorescent dye. Reference DNA, From a person, or pool of people, with no genetic abnormalities, is labeled with a different colored fluorescent dye.

The fluorescent dyes commonly used are red and green. Reference and patient samples are mixed together and applied to the chip and hybridization takes place- the fragments of DNA hybridize with their matching probes on the array. The chip is then scanned in a machine called a microarray scanner which measures the amount of red and green fluorescence on each probe. The microarray scanner together with computer analytical software calculates the ratio of the red to green fluorescent dyes to determine whether, for the piece of DNA represented by each probe. The patient sample has the correct amount of DNA (shown as yellow), too much DNA (a duplication) which would be shown by too much red, or too little DNA (a deletion) shown by too much green.




https://upload.wikimedia.org/wikipedia/commons/d/d2/Array-CGH_protocol.svg

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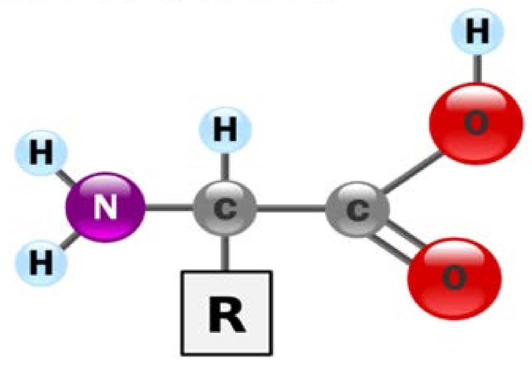
# BIOTECHNOLOGY ON AMINO-ACIDS

*Luca and Tom-Lukas*

## What are amino-acids?

First of all, amino-acids are organic compounds containing both an amino group (NH2) and a carboxyl group (COOH) connected by a CH group with a specific R compound connected to the carbon in the middle. The generic formula for an amino-acid is H2N-CH-R-COOH.



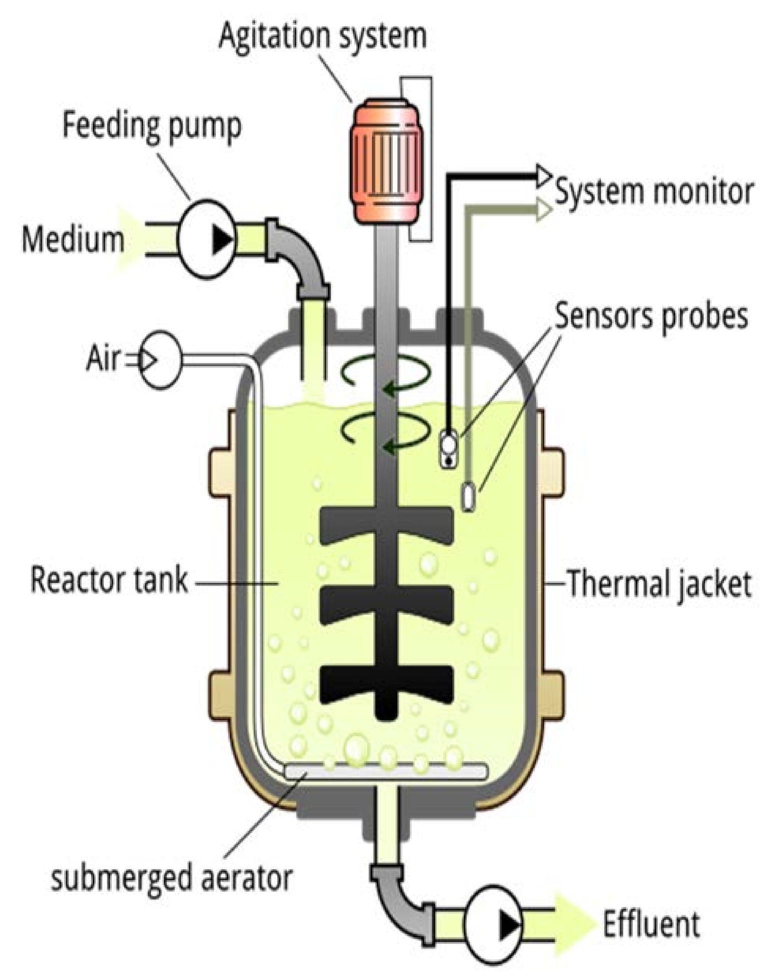

https://commons.wikimedia.org/wiki/File:AminoAcidball.svg

The amino-acids differ from each other in the R group, which can be organic compounds alone or after a polymer chain. Based on the number of carbons in this chain, they are divided in classes using Greek alphabet letters.
As part of proteins, which make up cells and our whole body, the amino-acids are the most important basic components in our body and they are responsible for our metabolism in muscles, organs and the cells themselves. But they also have other functions: they are optimal for transportation or storage of nutrients, like water or fats, they can be oxidized to produce energy, or they can be used to synthesize other molecules used in our body, like neurotransmitters.

## Production

The chemical production usually uses the Strecker-amino-acid-synthesis, also known as Strecker synthesis, where aldehydes (RCHO), ammonia (NH3) and hydrogen cyanide (HCN) react to form an α-amino-nitrile, which is subsequently hydrolysed to give the desired amino-acid.

Biotechnological production of amino-acids consists in a synthesis process that goes through bacteria cultures and fermentation. The first bacteria used for the culture were E. Coli but then C. Glutamicum was discovered for the production of glutamic acid and it replaced. Coli in all the other fields of amino acid production.




https://commons.wikimedia.org/wiki/File:Bioreactor_principle.svg

## Usage

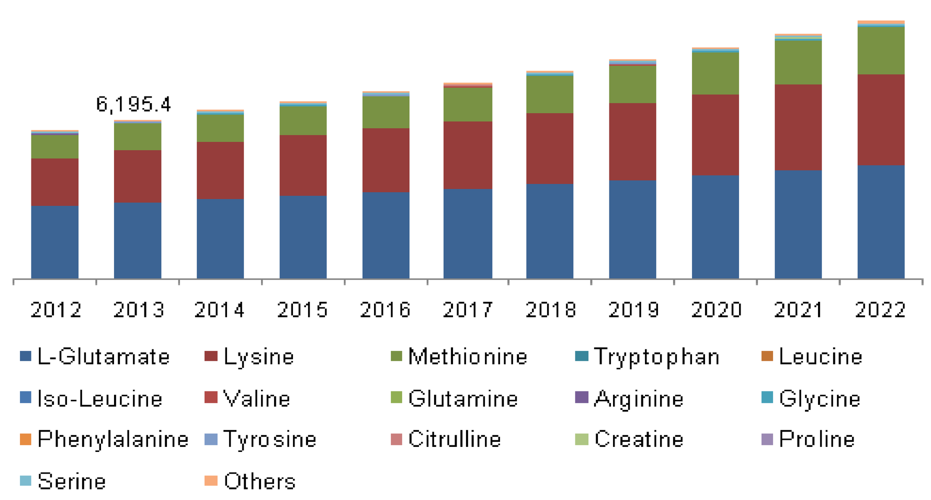
In first place, for the animals, essential amino-acids are used to feed them to increase the profit. In common animal food you have deficiency of some amino-acids, like Lysine, so by feeding them with these types of amino-acids you can control their health and meanwhile also increase the production with less food.

They are also used to treat nutrient deficiency or increase energy in the human patients. Some non-proteic amino-acids are instead produced and used in the pharmaceutical industry because they can be converted to neurotransmitters, like tryptophan.


http://www.nutrientsreview.com/wp-content/uploads/2014/10/Limiting-Amino-Acid.jpg

## Industry

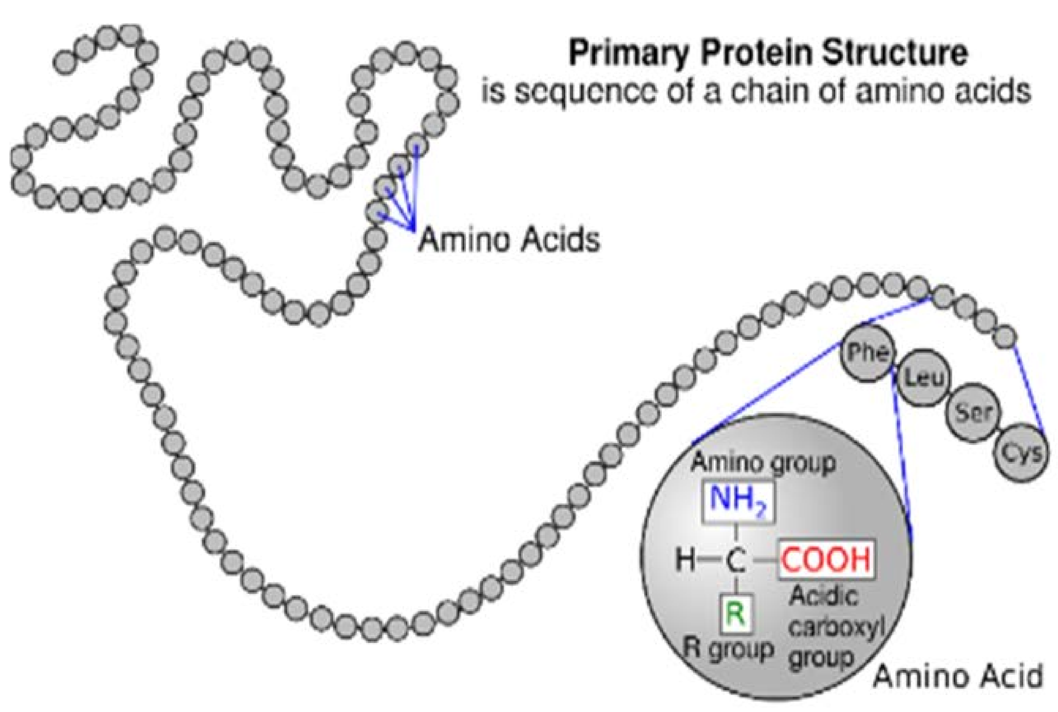
The amino-acids industry is a field in development: in 2013 there were 6.19 million tons produced worldwide. The production is expected to grow continuously in the next years, especially for L-Glutamate, Lysine and also Methionine. There are various industries that are specialized in the amino-acids production: for instance Evonik Industries is a worldwide famous German company that uses biotechnological techniques to produce amino-acids for the animal food industry.




https://www.grandviewresearch.com/industry-analysis/amino-acids-market

## Conclusion

In conclusion, amino-acids are one of the most important factors for life and we are not able to produce all of them by ourselves, so it is fundamental to have renewable and effective ways to produce them. The biotechnological way is by far the best method that can be utilized, because it uses natural instruments and it is quite self-sustainable. Manufactory is already using this method in the most part and research is also considered really important to further develop it in the best way possible. Biotechnology is already a big sector and it will grow faster than any other, as technology did in the past 20 years.




https://upload.wikimedia.org/wikipedia/commons/thumb/3/38/Protein_primary_structure.svg/2000px-Protein_primary_structure.svg.png

Erasmus+
This project has been funded with support from the European Commission.

- white biotechnology -

# Company Profile - Janssen

*Theodor Paal Põlluste, Lynn Jakobs*

## Facts about Janssen


Photo by: Lynn Jakobs

- Janssen is a worldwide group of pharmaceutical companies
- Janssen is part of the Johnson & Johnson Family of Companies, the USA based Healthcare Corporation
- 40.000 employees working around the world
- Around $4.5 billion investments in research and development annually
- At top 10 company in the global pharmaceutical sales


https://de.wikipedia.org/wiki/Janssen-Cilag#/media/File:Unternehmenssitz_Janssen-Cilag.jpg

## History

Janssen was founded in 1953 by Dr. Paul Janssen in Belgium. He was a young doctor who wanted to save lives by developing better cure for diseases. Under the supervision of Dr. Paul Janssen they developed medication in different treatment areas.

Janssen joined the Johnson & Johnson-group in 1961. In 2011 all the pharmaceutical activities of Johnson & Johnson started to go by the name Janssen Pharmaceutical Companies. Joining Johnson & Johnson gave the opportunity to exchange knowledge and ideas with scientists around the world.

## Johnson & Johnson

Johnson & Johnson is an American Multinational founded in 1886. The company is active in the pharmaceutical industry and medical and consumer products. The Johnson & Johnson-group consists of 265 companies in 60 countries and has about 128.000 employees worldwide.

Johnson & Johnson

https://upload.wikimedia.org/wikipedia/commons/e/e9/Johnson%26Johnson_Logo.svg

## Products

Janssen has a wide variety of products in different therapeutic areas. They currently have 45 different medical products for cardiovascular & metabolism diseases. Janssen wants to eliminate the cardiovascular diseases and diabetes. Janssen wants to cure all the immune-meditated diseases around the world. Right now they have 16 products on the market to treat the diseases. They have 94 vaccines for infectious illnesses. Janssen wants to reduce the misery caused by neuropsychiatric diseases and pain conditions by providing 122 products against it. Janssen also provides 28 products to prolong and improve cancer patients' lives.

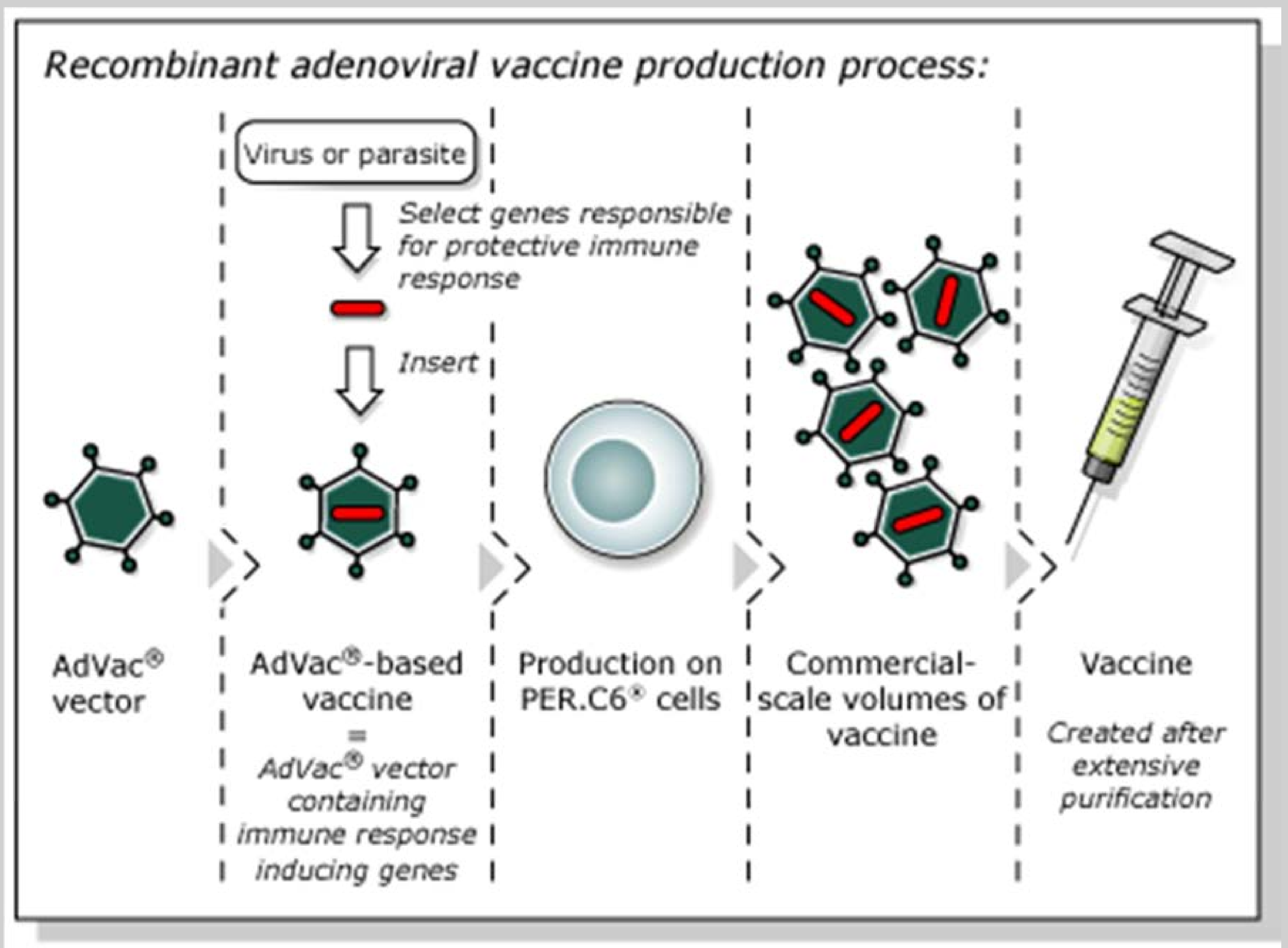

https://upload.wikimedia.org/wikipedia/commons/2/22/Risperdal_tablets.jpg

## Technologies

Janssen has 12 research and development centres and 9 manufacturing sites in Europe, Africa and the Middle East.

Janssen has a broad development pipeline, with several Janssen products based on its unique PER.C6® production technology. The Company licenses this and other technologies to the biopharmaceutical industry. PER.C6® is a human cell line technology, it is good for manufacturing vaccines and monoclonal antibodies on a large-scale. It is especially good for manufacturing hard-to-grow viruses and by doing so it lowers the cost of the development of vaccines.

Janssen also uses its AdVac® production technology based on the development and production of gene carriers. It can be used together with PER.C6® technology to develop recombinant vaccines against life-threatening infectious diseases.

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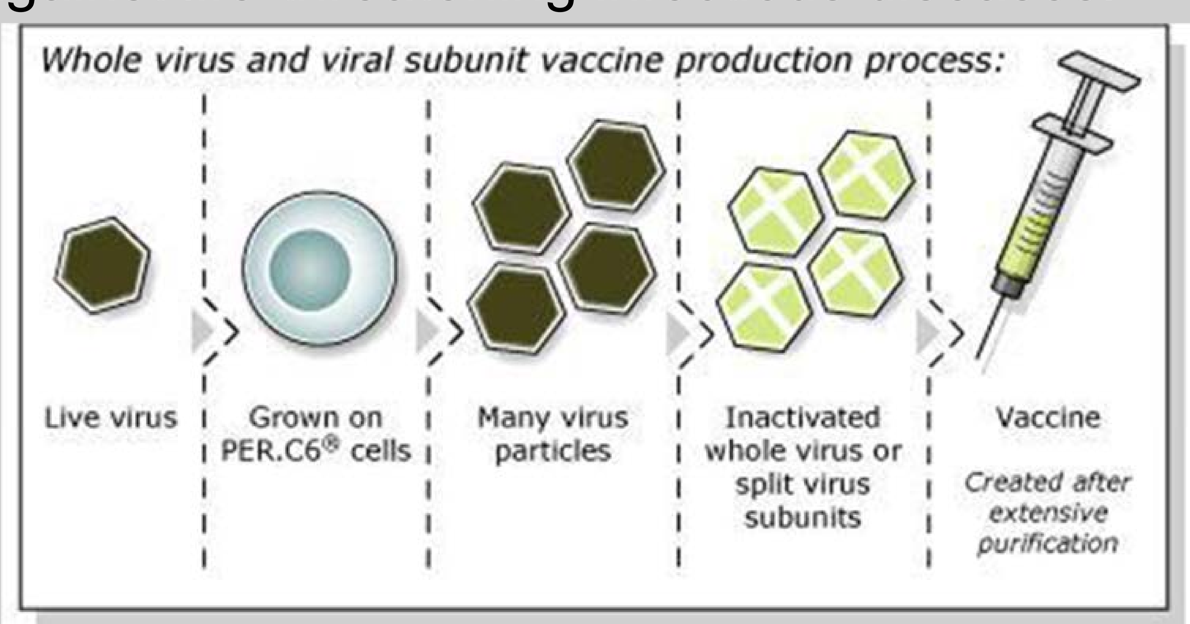


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