Research report IMZMUN 2021

IMZ | MODEL UNITED NATIONS

At the crossroads: technological advancement

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GMO

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Selection of key terms

- **Asilomar Conference:** An international conference in 1975, resulting in recommendations for matching the kinds of containment necessary for different types of experiments relating to GMO research.

- **Bacillus thuringiensis (Bt):** a bacteria which for decades has been used as an insecticide.

- **Cartagena Protocol:** an international agreement on biosafety, seeking to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.

- **Clones:** The creation of an exact copy of an organism. Hence, cloning and GMO should not be mixed up.

- **DNA:** the molecule that contains the genetic code of organisms. It is the DNA which is being manipulated when genetically engineering organisms.

- **FAO:** The Food and Agriculture Organization of the United Nations that has been involved with informing about GMO.

- **FDA:** The U.S. Food and Drug Administration, in the US responsible for approving GMO produce.

- **GMO:** Genetically modified (GM) organisms, including **genetically engineered (GE)** plants and animals.

- **Precautionary principle applied to GMO:** proofs needed that GMO are harmless.

- **Proactionary principle applied to GMO:** proofs needed that GMO are harmful and else should be developed.

- **WHO:** The World Health Organization of the United Nations is responsible for international public health.

- **WTO:** The World Trade Organisation, dealing with the regulation of trade between countries and hence has been involved when trading countries have different opinions regarding GMO.

Introduction[1]

Although many associate genetic engineering (GE) with new technologies and futuristic societies, it has existed since the beginning of time. By practicing the process of "selective breeding" or "artificial selection", definitions coined by Darwin, humans, or rather, all lifeforms have been directly manipulating the DNA without even being consciously aware that they have been doing so. When Darwin started testing his theories on DNA and traits, he purposefully mated organisms with the intention of passing on their traits to their offspring. This was the predecessor of modern genetic modification.

The first lifeform that our predecessors artificially selected was none other than man's best friend: the dog. Dating back to over 32'000 years ago, our hunter forefathers would domesticate and mate certain wolves in order to improve their traits as scavengers. Over many years, the genetic codes of these animals would change according to which traits were desired from humans. This practice is still continued today, where certain breeds such as Chihuahuas don't resemble wolves at all! Of course, artificial selection has passed on to other species helping us optimize any animal based on our needs or desires. It is said that, due to our optimization, cows have become so domesticized that they wouldn't be able to survive in the wild with the genetic traits that they now have!

The optimization of plants also took place thousands of years ago. Today, artificial selection with plants is used for a variety of reasons ranging from capitalism to allergies or even consumers comfort (for example removing seeds from a fruit).

Nowadays, genetically modified organism (GMO) technology exists everywhere. It has found its way into more than just agriculture and livestock. We have now returned to modifying bacteria and other organisms to help break down crude oil, improve insulin, enhance aesthetic aspects of lifeforms and even used to produce vaccines!

Leading up to the modern definition of GMO technology, Boyer and Cohen (1973) created the first genetically engineered organism. By successfully transferring a specific gene from one organism to another, they managed to pass on the antibiotic resistance to the recipient organism. In 1974, Jaenisch and Mintz managed to use the same procedure in animals.

Although these successful experiments could lead the way to new and exciting advancements, scientist, governments and the media immediately started questioning the effects of this technology on human health as well as the world's environment and ecosystem.

In 1974, all genetical engineering projects all over the world were put on hold for scientist to have the possibility to reflect on and consider possible outcomes. This led to the Asilomar Conference in 1975. Lasting three days, this conference concluded that genetical engineering would be permitted to continue under certain restrictions. The conference enforced

[1] Adapted from http://sitn.hms.harvard.edu/flash/2015/from-corgis-to-corn-a-brief-look-at-the-long-history-of-gmo-technology/ & https://www.greenamerica.org/blog/gmo-timeline-history-genetically-modified-foods (accessed 05/05/20)

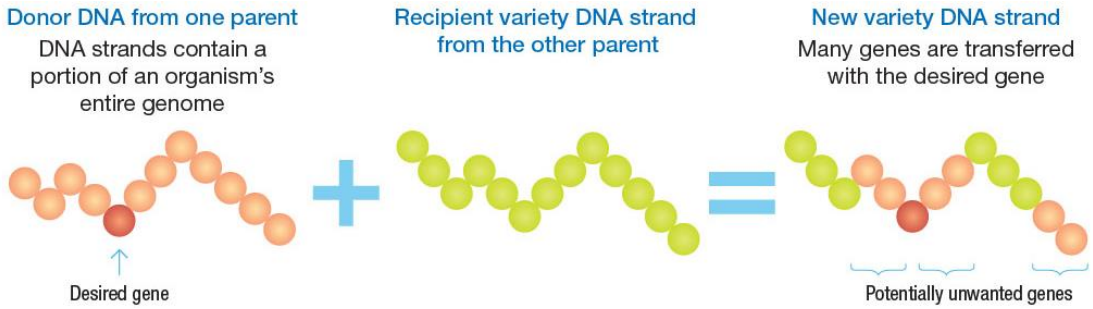
regulations and emphasized the essentialness of sharing important developments in this field.

While GM crops in many places by now are common, most GM animals are limited to research purposes.

The process of generic engineering[2]

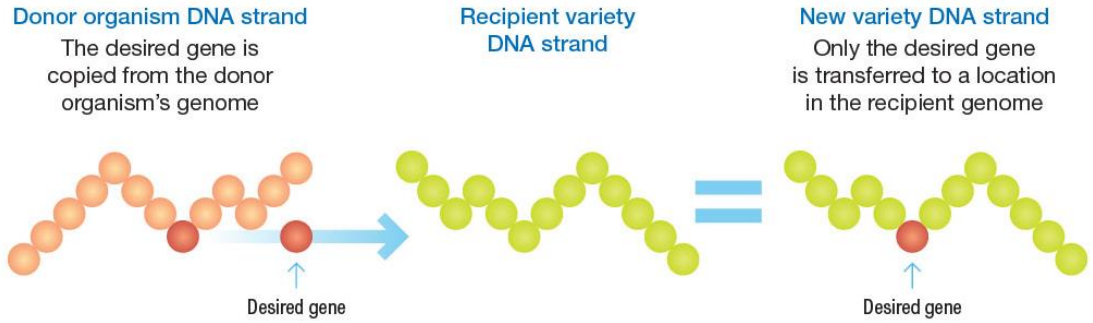
Traditional breeding

The traditional breeding process introduces several genes into the organism. These genes may include the gene responsible for the desired characteristic, as well as genes responsible for unwanted characteristics.



Genetic engineering (GE)

Genetic engineering enables the introduction into the organism of the specific gene or genes responsible for the characteristic(s) of interest. By narrowing the introduction to one or a few identified genes, scientists can introduce the desired characteristic without also introducing genes responsible for unwanted characteristics.



[2] Adapted from: https://www.science.org.au/curious/policy-essays/what-genetic-modification (accessed 05/05/20)

Timeline[3]

1935 – the Russian scientist Andrei Nikolaevitch Belozersky isolates pure DNA

1940 – Plant breeders use radiation or chemicals to change an organism's DNA at random

1953 – Watson and Crick identified a double helix in the structure of DNA based on research and discoveries by Franklin

1973-74 – Boyer and Cohen develop genetic engineering, transferring DNA from one bacterium to another. A year later Jaenisch and Mintz successfully use the same procedure in animals.

1974 – Genetical engineering projects all over the world were put on hold in order for scientist to have the possibility to reflect on and consider possible outcomes.

1975 – The Asilomar Conference was held to create guidelines for the safe use of genetically engineered DNA, deciding that genetical engineering would be permitted to continue under certain restrictions.

1982 – The US Food and Drug Administration approves Humulin, insulin produced by genetically engineered E. coli bacteria.

1985 – The bacteria Bacillus thuringiensis (Bt), which for decades have been used in pesticide sprays, was inserted to tobacco plant making them resistant to insect plagues.

1994 – First GMO produce, a GMO tomato, created through genetic engineering. Studies by federal agencies prove it is as safe as traditionally bred tomatoes.

1998 – The EU restricts trade with GM crops until 2004.

1999 – The scientific journal *Nature* published a paper on potential toxic effects of Bt maize on butterflies. Later research to a large extent dismissed the danger of Bt.

2002 – The GM food aid crisis in southern Africa: Swaziland and Lesotho accepted US GM maize, while Mozambique, Malawi and Zimbabwe insisted it is milled into flour, so that farmers cannot plant the seed. Zambia rejected it in any form.

2003 – World Health Organization and Food Agriculture Organization of the UN develop international guidelines and standards determining the safety of GMO foods.

2003 – The GM glow fish pet (GloFish™) is introduced for sales.

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[3] Adapted from: https://www.fda.gov/media/135276/download & https://www.theguardian.com/science/2002/oct/17/gm.famine1 (accessed 05/05/20)

2005 – Swiss voters votes for five-year ban of GMO, which in 2010 was extended by the parliament.

2018 – A Chinese scientist claims he had edited human embryos to make them resistant against HIV.

Concerns relating to GMO[4]

- The ethics of gene manipulation of humans.
- The ethics of gene manipulation of animals for medical and commercial (e.g. make them less sensitive to diseases or the commercially sold glow-in-the-dark fish for aquariums) purposes.
- Mixing genes from different species that have never shared genes in the past makes GMO unique. It is impossible to create such organisms through traditional crossbreeding methods. Because of this uniqueness, there are many unknowns about GMO.
- Outcrossing: the migration of genes from GMO into natural species, as well as the mixing of crops derived from conventional seeds with GM crops. Several countries have adopted strategies to reduce mixing, including a clear separation of GMO and conventional organisms.
- Generally, consumers consider that conventional foods with an established record of safe consumption over history as safe.
- Depending on the region of the world, people often have different attitudes to food. In addition to nutritional value, food often has societal, historical or religious meanings.
- Where medicines are concerned, many consumers more readily accept biotechnology as beneficial for their health In the case of the first GM foods introduced onto the European market, the products were of no apparent direct benefit to consumers (not significantly cheaper, no increased shelf-life, no better taste). The potential for GM, resulting in bigger yields per cultivated area should lead to lower prices. However, public attention has focused on the risk side of the risk-benefit considerations.
- Data shows that Bt maize and cotton significantly reduced the use of insecticide but significantly increased the use of herbicides.
- There are concerns about the risk of an undesirable level of control of seed (and potentially animals) markets by a few chemical companies and countries, reducing the range of varieties used by farmers to mainly GMO. The exclusive use of herbicide-tolerant GM crops would make the farmer dependent on these chemicals and also lead to a reduction in the spectrum of other plants (loss of biodiversity).
- The risk related to allergies by transferring genes from commonly allergenic organisms to non-allergic organisms.

[4] Adapted from https://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/ & http://www.organicitsworthit.org/learn/concerns-about-gmos (accessed 05/05/20)

- Gene transfer from GM foods to cells is concerning if the transferred genetic material adversely affects human health. This is particularly relevant if antibiotic resistance genes are transferred. Although the probability of transfer is low, the use of gene transfer technology that does not involve antibiotic resistance genes is encouraged.

- Concerns regarding the impact on non-target organisms e.g. offsprings or insects which are not pests.

Opinions of different Member States[5]

The genetically modifies animals are being researched in many countries, but are often held back by laws set up to address ethical concerns. The legal boundaries can differ heavily between different countries.

The genetically modifies crops are grown in several nations around the world, while several other countries ban farmers from planting GMO crops. Countries that ban GMO received considerable attention in 2015, when most European Union nations decided to block the cultivation of new GMO crops within their borders, and Russia issued a ban on both cultivation and imports. Yet, most the nations that prohibit GMO cultivation still allow GMO products – particularly animal feed – to be imported. European countries, for example, import 30 million tons of GMO grain annually. Many other nations – China, Japan and Canada for example – restrict GMO products, but only until they pass regulatory standards.

Countries growing GMO crops are: Brazil, United States, Canada, South Africa,Bolivia, Philippines, Spain, Vietnam, Bangladesh, Colombia, Honduras, Chile, Sudan, Slovakia, Costa Rica, China, India, Argentina, Paraguay, Uruguay, Mexico, Portugal, Czech Republic, Pakistan and Myanmar.

To the countries that have total or partial bans on GMO counts Australia, Austria, China, India, France, Germany, Hungary, Luxembourg, Greece, Bulgaria, Poland, Italy, Mexico, Russia and Switzerland. Restrictions regarding GMO exist in several other countries.

[5] Adapted from https://www.biotecnika.org/2019/12/most-accepted-gmos-till-date-voice-of-biotecnika/ & https://gmo.geneticliteracyproject.org/FAQ/where-are-gmos-grown-and-banned/ (accessed 05/05/20)

Selection of previous attempts to address the question of GMO[6]

- The Asilomar Conference (1975) gave recommendations for matching the types of containment necessary for different types of experiments relating to GMO research. These levels were categorised as minimal, low, moderate and high risk.

- The Convention on Biological Diversity (1993) is a multilateral treaty with three main goals: the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity.

- United Nations Statement Regarding the use of GM Foods as Food Aid in Southern Africa (2002) suggested to establish a long-term policy for food aid involving GM foods or foods derived from biotechnology.

- The Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2003) is an international agreement on biosafety as a supplement to the Convention on Biological Diversity. It seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.

- World Trade Organisation dispute between the US and the EU (2006) settled against the precautionary principle approach of the EU.

- The Millenium Development Goals (2010) Goal 1: To eradicate extreme poverty and hunger and the Sustainable Development Goals (2015) 1: No Poverty, 2: Zero Hunger and 3: Good Health and Well-being can be related to the development and use of GMO.

- Nagoya Protocol on Access and Benefit Sharing (2013) is another supplementary agreement to the 1993 Convention on Biological Diversity. Its aim is the implementation of fair and equitable sharing of benefits arising out of the utilization of genetic resources, thereby contributing to the conservation and sustainable use of biodiversity.

- The Food and Agriculture Organization (FAO) of the United Nations GM Food platform for simple, neutral, easy-to-access information on food safety assessment of GM plants.

[6] Adapted from http://www.fao.org/, https://www.cbd.int/ & https://www.theguardian.com/science/2006/feb/08/gm.wto (accessed 05/05/20)

Selection of approaches to address the question of GMO

- A general prohibition of the use of GMO
- A general acceptance of the use of GMO
- Not allowing GM of animals, but only of plants
- Not allowing GM of mammals
- Not allowing GM of humans
- Application of the precautionary principle: proofs needed that GMO are harmless
- Application of the proactionary principle: proofs needed that GMO are harmful
- Free trade of GMO crops but limitation of its cultivation
- Acceptance of import bans of GMO produce
- Case-by-case decisions based on the principals of the Asilomar Conference
- Case-by-case decisions based on the principal of cost-benefit analyses
- Improve the access to unbiased information regarding GMO
- Addressing the intellectual property issues (patents) issues related to GMO
- Addressing the diverging attitude of developed and developing countries
- Addressing the diverging attitude countries of similar development
- Comparing the natural and human selection of the past with GMO today
- Discussing the risk of natural uncontrolled spread of GMO
- Increased responsibility of the FAO and/or other UN agencies
- Comparing the technological development regarding GMO with the technological development in other areas
- Short term vs. long term impacts of GMO
- Considering the impact on different stakeholder groups
- Develop existing protocols and conventions
- Make existing protocols and conventions internationally legally binding
- Mandatory labelling of GMO
- The conflict between the UN Millenium Development Goals (MDG) and GMO development, as GMO may not take local needs and traditional knowledge and practices in to consideration.
- Etc.

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