
# Committee Guide Social, Cultural and Humanitarian Committee

## ETHICS OF HUMAN GENETIC ENGINEERING

MIKA JELKO NIEDERHEIDE; ARMAN KAMAR

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# 1. Personal Introduction

## 1.1 Mika Jelko Niederheide

Esteemed delegates of the General Assembly's Third Committee,

my name is Mika (Jelko) Niederheide. I am honored to welcome you to the OLMUN 2022 in my hometown. I am very much looking forward to meeting you and to chair SOCHUM with Arman. I am 18 years old and currently in 12th grade in school. My main classes include mathematics, physical education (including theory - meaning analyzing movements and speaking about the biological aspects of physical training) and biology. I love to do sports of all kinds and I am currently playing soccer in a club as well as going to the gym. The rest of my free time I like to spend with friends (e.g. BBQ by the lake). See you soon :D

## 1.2 Arman Kamar

I am Arman Kamar and I would like to start by welcoming all of you to this annual OLMUN session. I am an 11th grade student currently 17. I enjoy writing, a lot. It might be my favorite activity. I also love listening to music and would advise all to check out Mt.Joy. I live and study in Turkey and am looking forward to exploring Oldenburg. During this conference, I will be chairing your committee. I am grateful for the opportunity to work with you guys as well as my awesome co-chair Mika. I hope that the conference will be an occasion you yearn to attend again. I know that there will be both well-experienced delegates and first timers in this committee, which is something that should not be worried about. Even the experienced delegates had to start their MUN journey one way or another so I encourage you to have fun and improve yourself as MUN'ers. Remember that MUN is also a place for socializing and making friends. That being said, as your friendly chairboard we do expect you to participate in the debate to the best of your abilities and adhere to the rules of conduct. I am confident that we will come up with great products. If you have any further questions please feel free to contact me at arman.kamar@olmun.org Hope to see you soon :)

# 2. Introduction

## 2.1 How to Use this Guide

This guide is meant as an introduction to the topic. It provides some information about the topic to get you started but you will have to research a lot on your own as well. This guide does not provide information about specific states. Therefore, you will need to do research on your states position and laws or reports regarding the topic as well as former resolutions. In addition, think about or look for possible measures your state could take. You will have to write a **policy statement** and a **draft resolution** in preparation for the conference.[1] The better your research is the better your policy statement and your draft resolution will be as well as the easier it becomes for you to speak during the conference. Please read the **Handbook 2022** and the **Rules of Procedure 2022**. If you have any further question do not hesitate to contact us under sochum@olmun.org. Also, there is nothing as asking too much so please reach out to us of anything is unclear.

## 2.2 Broad Overview

Genetic engineering has definitely been a crucial part of recent history and the ethical concerns related to it are just as important. Human genetic cloning and engineering are now possible thanks to advances in science and technology. These biological technologies are polarizing in today's society. Many political, scientific, and religious organizations are strongly opposed to genetic engineering based on concerns about safety and moral consequences. Nonetheless, backers and advocates claim that these technologies are vital to giving treatments through regenerative medicine using genetically identical human cells, organs, or tissues. Other methods of medicine, such as cosmetic and reconstructive surgery, infertility, burn treatments, heart disease, cancer, and diabetes, can benefit from the new gene therapy technology. Genetic modifications have the potential to treat millions of people who are afflicted with diseases and disorders. This study guide on the “Ethics of Human Genetic Engineering” will specifically be focusing on what the issue is, how it prospered and the problems that come along.

[1] You will find information on how to write both in the Handbook 2022.

## 2.3 SOCHUM

The Social, Humanitarian, and Cultural Committee (SOCHUM) was founded in 1945 and is classified as the Third General Assembly committee. It came to be as a reaction to the Universal Declaration of Human Rights (UDHR). Ever since its establishment the values it upholds and the goals it seeks have remained the same. Those being the protection and promotion of fundamental human rights on an international level. SOCHUM is designated to enforce basic freedoms which should be accessible to everyone.[2] Mainly, the right to life, the expression of cultures, the freedom of political participation, the protection of children's rights, and the promotion of social development.

## 2.4 Genome Editing

Genome editing, commonly referred to as gene editing is the accumulation of technologies which allow one to alter the genetic material of living organisms. They create the opportunity to remove, add or adjust segments of the DNA. There are a large variety of techniques, which will be addressed in further points, but one of the most crucial ones is the CRISPR-Cas9 technique. CRISPR-Cas9 was adapted from a naturally occurring genome editing system that bacteria use as an immune defense. When infected with viruses, bacteria capture small pieces of the viruses' DNA and insert them into their own DNA in a particular pattern to create segments known as CRISPR arrays. The CRISPR arrays allow the bacteria to "remember" the viruses (or closely related ones). If the viruses attack again, the bacteria produce RNA segments from the CRISPR arrays that recognize and attach to specific regions of the viruses' DNA. The bacteria then use Cas9 or a similar enzyme to cut the DNA apart, which disables the virus.[3,4]

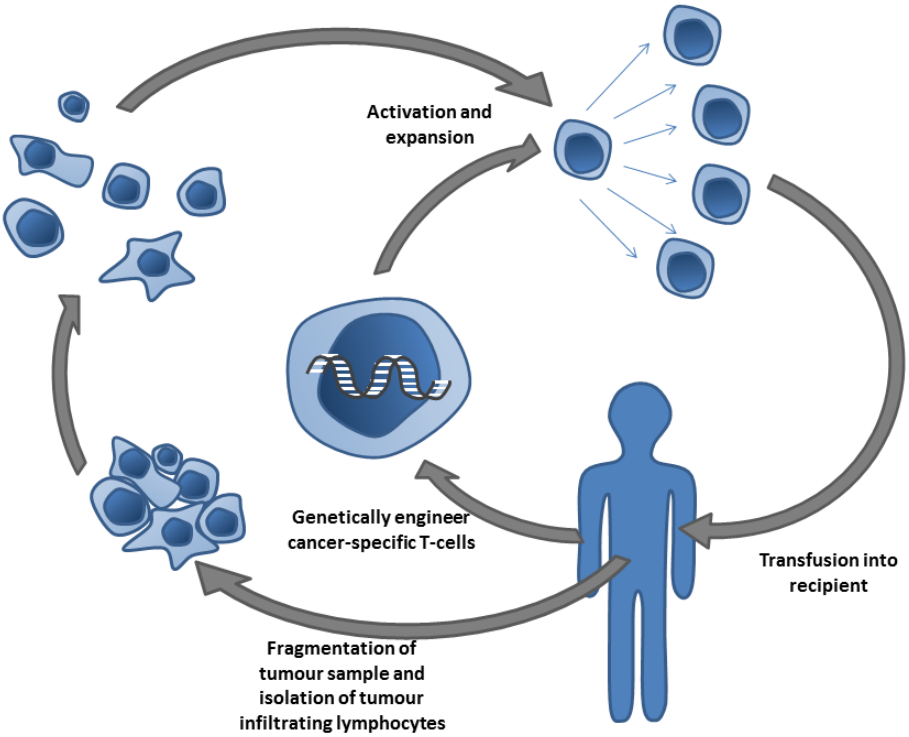
## 2.5 Genetic Diagnosis

There is a genetic component to diseases. However, the amount to which genes have a role in disease varies, and there is still much to discover. The development of early diagnostic tests, novel therapies, or actions to prevent illness onset or limit disease

[2] SOCHUM: Social, Humanitarian & Cultural Committee, NHSMUN https://imuna.org/nhsmun/nyc/committees/sochum-social-humanitarian-cultural-committee/
[3] What are genome editing and CRISPR-Cas9? | MedlinePlus
[4] In depth explanation video for those who are interested: CRISPR-Cas9 Genome Editing Technology | Professor Dave Explains

severity is enabled by advances in understanding the genetic pathways underlying these diseases. This chapter discusses the significance of clinical symptoms such as family history that may indicate a genetic condition, as well as the many uses of genetic testing and the various types of genetic disorders. There is a genetic component to all disorders. Environmental stressors such as viruses or poisons can cause mutations, which can be inherited or produced. The ultimate objective is to use this knowledge to treat, cure, or prevent illness from developing.

## 2.6 Cell Therapy




Cell therapy is a commonly used method to repair and/or adjust damaged tissue. It works by transplanting (modified) human cells into the injured cells. Many different types of cells may be employed as part of a therapy or treatment for a number of diseases and disorders thanks to new technology, inventive products, and imagination. For example, it is possible to cure some kinds of cancer using cell therapy.

## 2.7 Treaties and Laws

While there are no international treaties of general application directly regarding genetic engineering, there are a few legal frameworks which can be applied to genetic engineering. In addition, many organizations, including ones of the UN, have published statements regarding genetic engineering, its regulations and its issues. Furthermore,

many states and state unions have their own laws on the regulation of genetic engineering.

International legal framework which can be applied to genetic engineering are the **Convention on Biological Diversity (CBD)**[5] and the **Universal Declaration of Human Rights (UDHR)**[6]. Moreover, there is the **Oviedo Convention** which includes 29 ratifications from states from the Council of Europe.[7] The Oviedo Convention is not signed by many technologically advanced member states like Germany, the UK, Italy or Russia. Another suitable international law is the **EU Charter of Fundamental Rights**[8] which does not address genetic engineering directly as well. You will find two documents in the resources which discuss in detail which international laws exist and to which extent they can be applied.[9,10] Supplementary you will find three documents about the regulation of genetic engineering published by the WHO in July 2021.[11] These include ideas for a framework of governance. To support your opinion, you should also pay attention to statements of scientific groups and other organizations.

[5] Convention on Biological Diversity
[6] Universal Declaration of Human Rights | United Nations
[7] Oviedo Convention and its Protocols
[8] EU Charter of Fundamental Rights | European Commission
[9] REPORT ON REGULATION The Regulation of Genome Editing and Human Reproduction Under International Law, EU Law and Comparative Law | Dr. Rumiana Yotova, University of Cambridge on behalf of Nuffield Council on Bioethics
[10] REGULATING GENOME EDITING UNDER INTERNATIONAL HUMAN RIGHTS LAW A. Scientific Background and Recent Developments In November 2018 | British Institute Of International & Comparative Law
[11] Human Genome Editing | WHO

# 3. History and Background Information

## 3.1 History

Until today, scientists have designed microbes that manufacture pharmaceutical-grade medicines, crops with built-in insecticides, and glow-in-the-dark beagles. While these are all modern developments in scientific technology, humans have been modifying species' genomes for over 30,000 years. How did the initial approach of selective breeding evolve into the modern idea of genetically modified organisms? Innovators, spurred by some of the world's most pressing issues, paved the route for GMOs – a path that leads to an inconceivable array of advantages while also raising serious concerns.[12]

The term genetic engineering first came into place for approaches used to modify or manipulate organisms through the processes of heredity and reproduction. As such, the phrase encompassed both artificial selection and all biomedical treatments, including artificial insemination, in vitro fertilization, cloning, and gene modification. However, by the late twentieth century, the term had come to refer more specifically to methods of recombinant DNA technology (or gene cloning), in which DNA molecules from two or more sources are combined either within cells or in vitro and then inserted into host organisms in which they can propagate.

The discovery of restriction enzymes by Swiss scientist Werner Arber in 1968 paved the way for recombinant DNA technology. The next year, Hamilton O. Smith, an American microbiologist, isolated type II restriction enzymes, which were shown to be important to genetic engineering due to their capacity to cleave a specific location within the DNA (as opposed to type I restriction enzymes, which cleave DNA at random sites). In 1970–71, American molecular scientist Daniel Nathans helped enhance the process of DNA recombination by drawing on Smith's work and demonstrating that type II enzymes may be beneficial in genetic investigations.[13] American biochemists Stanley N. Cohen and Herbert W. Boyer were among the first to break DNA into pieces,

[12] From Corgis to Corn: A Brief Look at the Long History of GMO Technology | Harvard University
[13] Britannica, The Editors of Encyclopaedia. "genetic engineering". Encyclopedia Britannica, 20 Dec. 2021, https://www.britannica.com/science/genetic-engineering. Accessed 6 April 2022.

reconnect various segments, and introduce new genes into E. coli bacterium, which then proliferated.

In 1974, a moratorium on genetic engineering projects had indeed been uniformly observed, providing time for experts to gather and discuss the next steps during the Asilomar Conference of 1975.[14] For three days, scientists, attorneys, and government officials argued the safety of genetic engineering research during the meeting. The delegates finally agreed that the genetic engineering initiatives should be permitted to proceed under specific conditions. For example, the conference established safety and containment requirements to reduce the hazards associated with each experiment. They also assigned the chief investigator of each lab with ensuring proper safety for their researchers and informing the scientific community about significant discoveries.[15]

## 3.2 Process

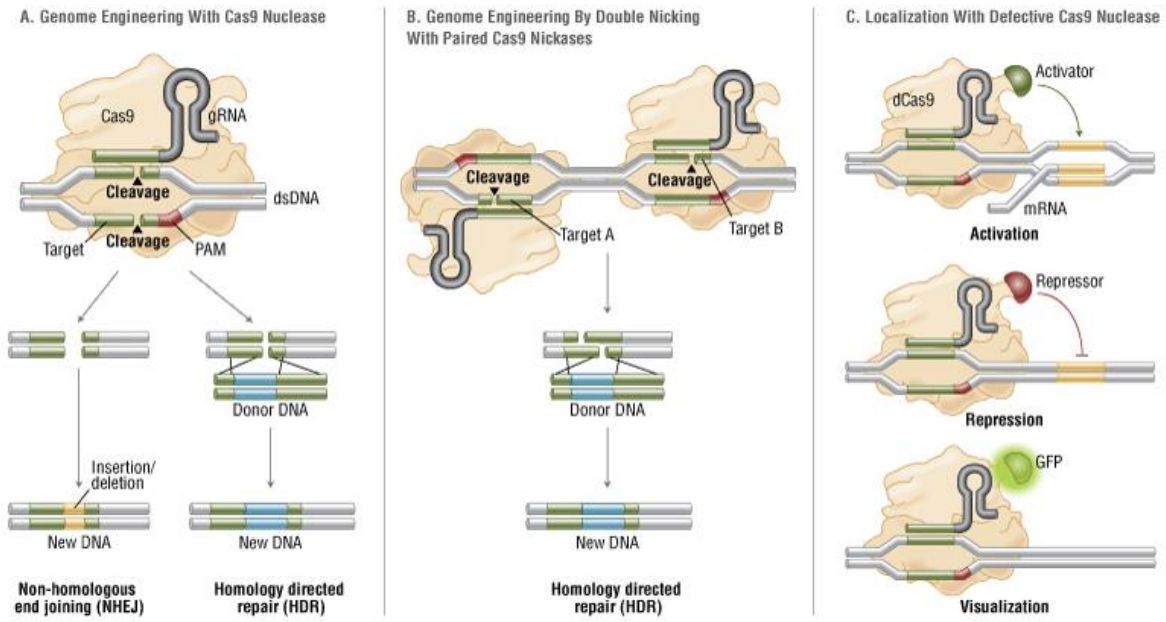
A major part of DNA technology involves inserting foreign genes into the plasmids of typical laboratory bacterial strains. Plasmids are tiny DNA rings that are not part of the bacterium's chromosome (where most of the genetic information is stored). Nonetheless, they can guide protein synthesis and, like chromosomal DNA, are replicated and passed on to the bacterium's offspring. Thus, by inserting foreign DNA into a bacterium, researchers may generate an essentially infinite number of copies of the inserted gene. Furthermore, if the inserted gene is functional (if it does protein synthesis), the transformed bacteria will generate the protein encoded by the foreign DNA.[16] This system is most frequently used with CRISPR-Cas9 as it is the easiest and safest way to alter DNA.

[14] Berg, P et al. “Summary statement of the Asilomar conference on recombinant DNA molecules.” *Proceedings of the National Academy of Sciences of the United States of America* vol. 72,6 (1975): 1981-4. doi:10.1073/pnas.72.6.1981

[15] From Corgis to Corn: A Brief Look at the Long History of GMO Technology | Harvard University
[16] genetic engineering | The Editors of Encyclopaedia Britannica

CRISPR-Cas9 was developed from a naturally existing genome editing mechanism used by bacteria as an immunological response. When bacteria become infected with viruses, they grab little fragments of the viruses' DNA and insert them into their own DNA in a specific pattern to form CRISPR arrays. CRISPR arrays enable bacteria to "remember" viruses (or closely related ones). If the viruses strike again, the bacteria generate RNA segments from CRISPR arrays that detect and bind to particular sections of the viruses' DNA. The bacteria then employ Cas9 or a similar enzyme to tear the DNA apart, rendering the virus ineffective.[17]

This immune defense mechanism was tweaked by researchers to modify DNA. They generate a small fragment of RNA with a short "guide" sequence that binds to a specific target sequence in a cell's DNA, similar to how bacteria manufacture RNA segments from the CRISPR array. This guide RNA connects to the Cas9 enzyme as well. When the guide RNA is inserted into cells, it detects the intended DNA sequence, and the Cas9 enzyme breaks the DNA at the desired position, mimicking the process in bacteria. After cutting the DNA, researchers employ the cell's own DNA repair mechanism to add or remove fragments of genetic information, or to transform the DNA by replacing an existing segment with a personalized DNA sequence.[18]




[17] What are genome editing and CRISPR-Cas9? | MedlinePlus
[18] What are genome editing and CRISPR-Cas9? | MedlinePlus

# 4. Questions to Be Addressed

In this section of the committee guide we will be presenting some of the significant questions that should be thought upon and included in your resolution. These questions are especially important for you as it gives you a chance to reflect on the issue rather than just gather the information. We firmly believe these will be a helping hand in your research and solution process, that's why we advise you to give your utmost attention while reviewing this section. Also, we would like to remind you to focus on your delegations point of view and to keep out your personal opinion as good as possible.

## 4.1 Would it Be Ethically Correct to Use "Genetic Engineering" to Battle Diseases if Safety is Attained?

Genetic engineering is currently still under development and cannot be used safely for human beings in most areas. Nevertheless, there were some experiments with human embryos by Dr He Jiankui[19] but they were heavily criticized and, in most states, considered illegal. In addition, there where experiments using cell therapy which successfully cured cancer.[20] Other scientists experiment on using cell therapy to cure other diseases as well. The results are promising.

Even though genetic engineering is already used in some experimental studies today, it is important to discuss whether or not we want to use these new treatments. Assuming the technology is safe:

Would it be ethically correct to use genetic engineering to battle diseases in adults? By consent: Would it be ethically correct to use genetic engineering on embryos to battle diseases as well? It is possible to analyze the genetic code of embryos using pre-implantation genetic diagnosis (PGD or PIDG).[21] Using the genetic code, scientists are able to predict which diseases/disabilities the unborn child might have. Genetic engineering could be used to "correct trouble causing genes" e.g. to prevent hereditary diseases.

[19] E.g.: Scientist in China defends human embryo gene editing The Guardian, November 2018
[20] First patients of pioneering CAR T-cell therapy 'cured of cancer' The Guardian, 2022
[21] Additional information: Preimplantation Genetic Diagnosis (PGD) | Genetics & IVF Institute

## 4.2 How Could Diversity Be Retained if Gene Editing is Put into Use?

Almost every state (excluding the United States of America and the Holy Sea) has ratified the **Convention on Biological Diversity (CBD)**.[22] The three main goals of the CBD are:

1. The conservation of biological diversity
2. The sustainable use of its components
3. The fair and equitable sharing of benefits arising from genetic resources

With these signatures the importance of biological diversity has been reassured, and humanity has once again set their intentions on protecting their values of keeping biodiversity alive, this including divergence in humans.

If it becomes easy to change one's genome, as our goals aspire, there could either be an increase or a decrease in genetic diversity. There is concern that the power of being able to use genome editing could "encourage an increasingly inflexible and uniform idea of how human bodies should be".[23] This could include aspects of the physical appearances (e. g. green eyes and black hair) as well as other characteristics (e.g. sporty and intelligent). If the pinnacle for humans is attempted to reach this will undoubtedly cause a decrease in our genetic assortment.

To retain the diversity of human genetics it is important to regulate the use of genetic engineering. How could diversity be retained without violating the **right for self-determination**?

## 4.3 How Could the Next Generation's Right of Choice Be Satisfied?

There are a lot of different ways of genetic engineering. Genome editing is generally divided into two sections: Firstly, somatic genome editing and secondly germline editing. The difference is basically that somatic genome editing is limited to the body cells of the treated individuals whereas germline genome editing influences oocytes,

[22] CBD - List of Parties
[23] Gene editing: a chance to think about diversity | Impact Ethics

embryos or sperm cells as well and therefore changes made can be passed on to future generations.[24]

The GA3rd focuses, among others, on the **right to self-determination**. This right could be violated by two things.

Firstly, if a person decides to germline edit his/her genome and afterwards is getting a child the child could be affected by the changes implemented by his/her parents. Do the rights of an unborn child count more than the ones of their parents?

Secondly, if it is possible to decide about the genetic make-up of your children, this could easily be misused. For example, if some parents come up with some "crazy" idea which ends with the child being bullied or excluded in his life. How can it be prevented that the ability of parents to decide about the genetic code of their children is not bad for the children? Are so-called "Designer Babies" ethically acceptable?

## 4.4 How Could This Affect Religions and Their Methods?

Many religions have some kind of codex regarding the use of medicine or the intervention in the human body, some more strict than others. Although most accept approved technology, some see the human body and/or the diseases a person has to face as a creation of god which we aren't allowed to change (using technology or medicine because every person has to beat their own obstacles). You will find the view of a Buddhist,[25] the view of the Seventh-day Adventist Church (a Christian church),[26] Muslim arguments for and against genetic engineering (summarized by the BBC),[27] a discussion on the Jewish view by Dr. Fred Rosner[28] and Hindu arguments for and against genetic engineering (summarized by the BBC)[29] in the footnotes. These viewpoints do not represent every follower of the religions and are meant as examples. In addition, these are not statements by the leaders of the religions.

How could the different views of the religions be respected?

[24] Further information: Somatic vs. Germline Genome editing - Graphic | The Harvard Gazette (from Harvard researchers share views on future, ethics of gene editing | The Harvard Gazette )
[25] Genetic Engineering: A Buddhist Assessment | Tricycle
[26] Adventist Guidelines on Genetic Engineering | Center for Christian Bioethics | Loma Linda University)
[27] Muslim arguments for and against gene therapy and genetic engineering | BBC
[28] Gene Therapy and Genetic Engineering in Judaism | My Jewish Learning
[29] What does Hinduism say about gene therapy and genetic engineering? 1 | BBC
What does Hinduism say about gene therapy and genetic engineering? 2 | BBC

## 4.5 How Could Crime Prevention Be Dealt With?

Wherever a problem crime is destined to blossom. That being said, it is no surprise that this is also the case with genetic engineering. Some of the key issues are related to cybercrime, which evolved with the introduction of the internet; biocrime which may have a big influence on society, but it may also have an impact on people's health. The extent of devastation inflicted by the SARS-CoV-2 epidemic, for example, demonstrates the potential effect of future biocrime and emphasizes the need for preventative methods. To date, there has been very little systematic research estimating the criminal prospects provided by synthetic biology. Another major issue is the privacy of clients. On the one hand, falling genome sequencing prices have paved the door for improved preventative and tailored therapy. On the other hand, genetic data poses severe privacy concerns because it is the ultimate identifier of an individual and contains private data (e.g., disease predispositions, ancestry information). As a result, it is critical to identify strategies to use genetic data without invading people' genomic privacy. These are all reasons as to why efforts should be made to stop crime. One possible helping factor could be the “United Nations Office of Drugs and Crime (UNODC)” which is tasked with *Countering terrorism, tackling corruption, strengthening crime prevention, addressing the world drug problem and strengthening member states to fight transnational organized crime.* This committee could be a viable option to opt out crime in further instances. Nonetheless, this question should definitely be thought upon.

## 4.6 How Could We Ensure That Everyone Will Be Able to Use These Techniques Unrelated to Their Social Status?

If perfected genetic engineering will surely cause some controversy. Like many high-end tech, it will not be cheap which may raise an even bigger ethical concern. The top 20% economically owns more than 90% of the world market which only leaves 10% to the remaining 80%.[30]

Due to this remarkable difference, it is difficult to overcome the economic challenges and ensure that everyone will have the ability to equally make use of these processes. The solution to this problem is mind boggling as it is not solely dependent on this topic.

[30] Wealth, Income, and Power by G. William Domhoff

One possible way is to regulate the use of these techniques either by the private sector or by government control. Whether this should be the case or how much it should be is a separate question in itself (which will be addressed).
Whatever is decided to be done equality should always be a significant worry, and should be a goal on the way for a viable resolution.

## 4.7 How Ethical Is It to Test on Living Organisms and Humans?

Ever since humans started to experiment on living organisms there has been critic about it. Such called research organisms reach from a single cell to more complex organisms like mice or even human. Research organisms have played an important role in scientific research because they help scientists to understand biological processes not only of the "test object" but through them of the human bodies as well.[31] There is much controversy about whether or not animals should be used for scientific research.[32] You can find a lot of resources about this online. How correct is the use of animals and cells like bacteria for scientific experiments in the field of genetic engineering? By consent: Is it ethically acceptable to test on volunteer humans as well? What happens if an experiment fails and the "test object" represent a danger for other persons? Is it ethically justifiable to experiment with human embryos?

## 4.8 How Much Should the Government Control and How Much Should Be Given to the Private Sector?

The development of new products including manufacturing processes and medical treatments has always been guided by companies. Especially when it comes to the medical sector many ask the question of how much power pharmaceutical companies should have?
When the Coronavirus crisis and its vaccines were new there was a big discussion on nationalizing the patents of the "big pharma" to improve the general welfare of the world's population. The companies were reproached, to exploit the bad situation of humanity.[33]

[31] Research Organisms | National Institute of General Medical Sciences
[32] Example: Should animals be used in research? | YourGenome
[33] The Covid vaccine will benefit humanity – we should all own the patent The Guardian, November 2020

It is not only possible that some pharmaceutical companies earn their money by exploiting the unpleasant situation of diseased people but some treatments may only be accessible for some persons. Should companies be allowed to patent superior genetic code or similar techniques and medicine so that it is only accessible to some people? How do we assure that patented genetic code will not be used to the bad of people with needs? Should the governments take more control in research so that the general welfare will profit and not just “the rich”?

## 4.9 Possible Solutions

Your task as a delegate of the GAs Third Committee is to discuss and find viable solutions to the problems mentioned. In the following you will find some incentives and examples. Please come up with your own ideas.

Two of the most obvious solutions would be to either forbid or allow genetic engineering completely. It is, however, unlikely that these two solutions will find many sympathizers. More likely there will be a balancing between allowing medical treatment and prohibiting unwanted changes to the human genome especially when it comes to germline genetic engineering. To specify which change to the human genome should be allowed or not allowed one could set up an international committee of experts. To regulate changes made to the human genome one could set up a database in which all changes, therapies or research experiments must be entered. You will find these and other solution ideas in more detail in a document published by the Harvard Model Congress from Boston 2022.[34]

[34] Human genome Editing by Serena Fernandopulle | Harvard Model Congress from Boston 2022

# 5. Further Readings & Sources

The following documents are long. We do not expect you to read them completely nor all of them. We would like to remind you that these are only supplementary resources and shouldn't be restrictive. Please do your research on your own terms. We are aware that it may seem hard for new delegates since it is frustrating to not know where to start. We hope you will slowly get used to this sort of work ethic and see how the process can be more fun than the product itself. Always bear in mind that we are not here to intimidate you but here to help you. Almost all of the following links were mentioned in the footnotes already.

## 5.1 Genetic Engineering - About the Techniques

- Ethics of Genome Editing and Basic Information | UNESCO - YouTube Playlist
- Redman, Melody et al. "What is CRISPR/Cas9." *Archives of disease in childhood. Education and practice edition* vol. 101,4 (2016): 213-5. doi:10.113
- What are genome editing and CRISPR-Cas9? | MedlinePlus
- In depth explanation video for those who are interested: CRISPR-Cas9 Genome Editing Technology | Professor Dave Explains
- genetic engineering | The Editors of Encyclopaedia Britannica
- Preimplantation Genetic Diagnosis (PGD) | Genetics & IVF Institute
- First patients of pioneering CAR T-cell therapy 'cured of cancer' The Guardian, 2022
- Harvard researchers share views on future, ethics of gene editing | The Harvard Gazette (Somatic vs. Germline editing)
- Human genome Editing by Serena Fernandopulle | Harvard Model Congress from Boston 2022

## 5.2 History

- From Corgis to Corn: A Brief Look at the Long History of GMO Technology | Harvard University
- genetic engineering | The Editors of Encyclopaedia Britannica

## 5.3 Laws and Treaties

- Convention on Biological Diversity
- Universal Declaration of Human Rights | United Nations
- Oviedo Convention and its Protocols

- EU Charter of Fundamental Rights | European Commission
- Universal Declaration on the Human Genome and Human Rights | UNESCO
- Playing with genes: The good, the bad and the ugly | UN Frontier Technology Quarterly
- REGULATING GENOME EDITING UNDER INTERNATIONAL HUMAN RIGHTS LAW A. Scientific Background and Recent Developments In November 2018 | British Institute of International and Comparative Law
- REPORT ON REGULATION The Regulation of Genome Editing and Human Reproduction Under International Law, EU Law and Comparative Law | Dr. Rumiana Yotova, University of Cambridge on behalf of Nuffield Council on Bioethics
- Human Genome Editing | WHO
  - Human genome editing: recommendations | WHO
  - Human genome editing: a framework for governance | WHO
  - Human genome editing: position paper | WHO
- Gene-Editing: Interpretation of Current Law and Legal Policy | Na-Kyoung Kim, College of Law, Sungshin University, Seoul about BioAct of South Korea
- Oversight of Human Genome Editing and Overarching Principles for Governance
- Ethics of Genome Editing | European Commission

## 5.4 Ethical Concerns

- Scientist in China defends human embryo gene editing The Guardian, November 2018
- Gene editing: a chance to think about diversity | Impact Ethics
- Religions
  - Genetic Engineering: A Buddhist Assessment | Tricycle
  - Adventist Guidelines on Genetic Engineering | Center for Christian Bioethics | Loma Linda University)
  - Muslim arguments for and against gene therapy and genetic engineering | BBC
  - Gene Therapy and Genetic Engineering in Judaism | My Jewish Learning
  - What does Hinduism say about gene therapy and genetic engineering? 1 | BBC
    What does Hinduism say about gene therapy and genetic engineering? 2 | BBC

- Should animals be used in research? | YourGenome
- Wealth, Income, and Power by G. William Domhoff