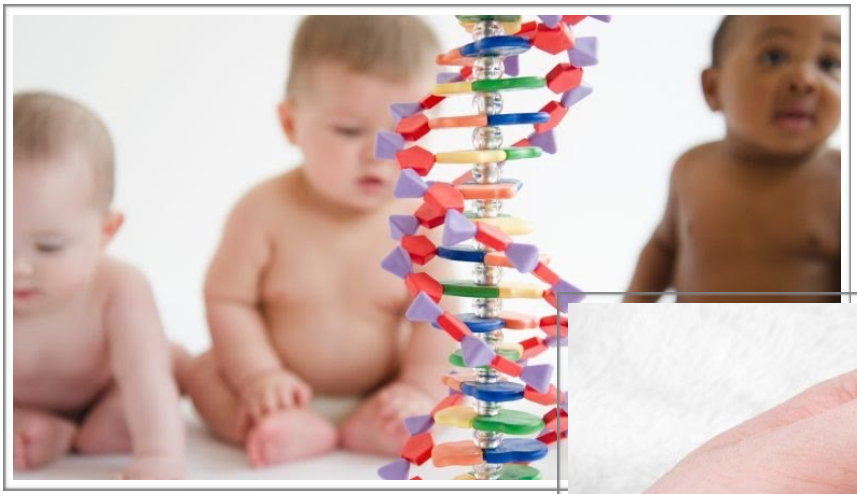
Topic: Gene exchange

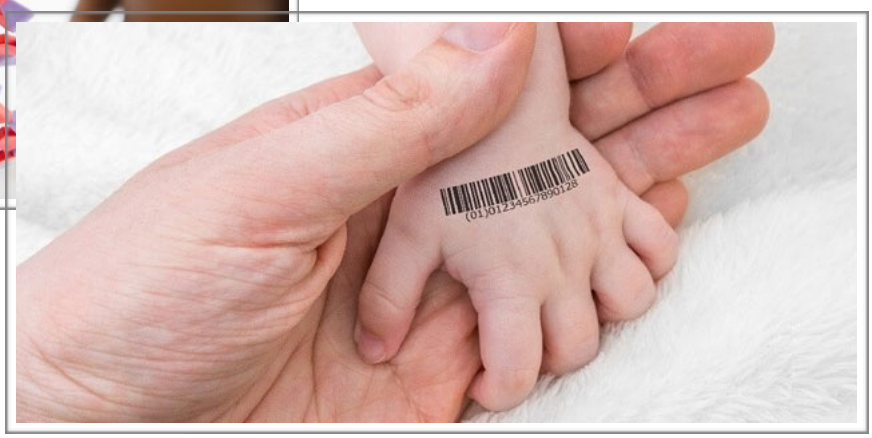
A. Introduction

Genetic technologies —the ability to manipulate and transform the properties of cells, seeds, microbes, insects, plants, animals and even humans—are pushing the frontiers of science and offers us new hope for disease control and cure. This field has come a long way since Gregor Mendel, the father of genetics, first postulated the rule of heredity in the 1850s. Genetic technologies are changing the way we produce food, improving crop yield and preventing catastrophic losses from droughts, floods and pests. They also are offering new solutions for fighting cancer and many hereditary diseases, improving quality of life and life expectancy. In addition, genetic technologies are increasingly used in criminal justice systems to exonerate the innocent and convict the guilty. Such technologies, moreover, have given rise to genetic genealogy, allowing people to find their ethnic roots.

While the upsides of genetic technologies are promising, we also need to consider their downside risks. Access to gene therapies to combat diseases, for example, may be limited to those who can afford them, potentially increasing inequality in health outcomes within and across countries. Genomic research that serves to identify pre-existing conditions can potentially deprive patients from health insurance and medical care. Genetic technologies may exacerbate productivity gaps in agriculture, disadvantaging small farmers, especially in developing countries, who cannot access or afford genetically modified seeds. Moreover, there can be unintended health consequences of genetically modified crop production, including increased risks of contamination and loss of biodiversity.

The downside risks can be even uglier. Genetic modifications can potentially lead to the production of “designer babies” and super-humans and fundamentally alter the human species. Genomic research can be weaponized to target and harm specific population groups. The legal, ethical and moral boundaries of using genetic technologies are increasingly unclear, creating opportunities for their misuse and abuse. Weighing potential benefits against risks thus remains an urgent challenge.





What is gene exchange ?

Gene exchange is changing the DNA of a person.It may be changed by humans and a natural way. In the microbial world, genetic exchange might occur via either an asexual or a sexual process;Meanwhile, in higher plants and animals, it is usually a sexual process yet it may also rarely be the result of a viral infection. Whatever the mechanism of genetic exchange, the final result is an organism-or cell-with an altered genotype. The newly acquired genes could be either useful or detrimental to the organism. Seeing that genetic exchange continues to play a major role in determining how medicine is practiced, it is important to understand how genetic exchange occurs utilizing microbial donors and vectors.

What is genome editing ?

It's a kind of genetic engineering. DNA is inserted, replaced, or removed from a genome which uses artificially engineered nucleases or 'molecular scissors'. The nucleases make specific double-strand breaks at desired places in the genome. The cell's own mechanisms fix the induced break- or breaks- by natural processes.

What is CRISPR ?

CRISPR is a term which is used in microbiology. It stands for Clustered Regularly-Interspaced Short Palindromic Repeats. These are natural segment of the genetic code which are found in prokaryotes- most bacterias have it-

CRISPR has plenty of short repeated sequences. These sequences are part of adaptive immune system for prokaryotes. It let them remember and counter other organisms that prey on them-such as bacteriophages.

They have the potential to modify the genes of almost any organism. They are part of a tool allowing precisely targeted cutting and insertion of genes in genetic modification (GM). Work is under way to find how they can be used to attack virus diseases in humans.

B. Current situation

Advancing human research

Technological breakthroughs are lowering the cost of gene sequencing and editing, but gene therapies are still too expensive for most people. The cost of sequencing genes has declined dramatically—from nearly $9 million in 2007 to just $1,100 per genome in 2017—due to a revolutionary technology called Next Generation Sequencing. This drastic reduction in cost, though still prohibitively expensive for average income-earners in many developing countries, has made sequencing and studying genes feasible for many countries. It has encouraged competition among countries to establish themselves as leaders in genomics, pursuing a range of objectives. While countries are prioritizing genomic research, international cooperation is also playing a critical role. The Human Heredity and Health in Africa (H3Africa) initiative, an example of successful collaboration in genetic research, directs funding from the National Institutes of Health (NIH) and the Wellcome Trust to research sites across Africa that study genomics, environmental determinants of common illnesses, disease susceptibility and drug responses in African populations.

Countries establishing themselves as leaders in genomics: select projects and their objectives

Country	Initiative	Objective
Australia	Australian Genomics Health Futures Mission	Develop national standards and protocols to enhance data gathering and analysis; promote the value of genomics to the broader community; and encourage government partnerships with philanthropists and businesses
China	100,000 Genome Project	Study how Chinese population transform from health to disease, environmental impacts, and the interactions between environmental factors and genes, and its influence on people's health
Estonia	Personalized Medicine Programme	Develop genotypes that will enable personalized reports for use in everyday medical practice through the national e-health portal
France	France Génomique 2025	Integrate genomic medicine into routine patient care and establish a genomic medicine industry to fuel economic growth. By 2020, France aims to have increased its annual sequencing capacity to 235,000 genomes, of which 175,000 are to come from cancer patients, and the remaining 60,000 from rare disease patients
Japan	Initiative on Rare and Undiagnosed Diseases	Develop innovative drug candidates by targeting novel, single pathological mutations, apply new NGS-based genome analyses to cases that remain unsolved, and facilitate international data sharing
Saudi Arabia	Saudi Human Genome Program	Study more than 5,000 inherited diseases using more than 10,000 samples from Saudi patients with inherited diseases that resulted in identi cation of more than 2,000 variants underlying the diseases
Turkey	Turkish Genome Project	Sequence the genomes of 100,000 Turkish nationals and increase that number to 1 million genomes by 2023
United Arab Emirates	United Arab Emirates— Dubai Genomics	Sequence all of its 3 million residents. Dubai Genomics is one of numerous projects within the Dubai Future Foundation's "Dubai 10X Initiative," launched to catapult the UAE 10 years ahead of the rest of the world
United Kingdom	100,000 Genome Project	Incorporate genome sequencing in routine healthcare through the Genomic Medicine Service (GMS). Sequenced 71,095 whole genomes
United States	All of Us Research Program	Glean health and wellness data from 1 million or more Americ

He Jiankui affair

The He Jiankui affair is a scientific and bioethical circumstance which concerns the use of gene-editing technique in human cases following the first use by Chinese scientist He Jiankui, making the first genome-edited babies in 2018. The affair led to legal and ethical controversies with an indictment of He and his two collaborators, Zhang Renli and Qin Jinzhou.

In November 2018, He Jiankui announced that he had edited two human embryos, attempting to disable the gene for CCR5, which codes for a receptor that HIV uses to enter cells. He said that twin girls, Lulu and Nana, had been born a few weeks earlier. He said that the girls still carried functional copies of CCR5 along with disabled CCR5 (mosaicism) and were still vulnerable to HIV. The work was widely condemned as unethical, dangerous, and premature.

In May 2019, lawyers in China reported, in light of the purported creation by Chinese scientist He Jiankui of the first gene-edited humans, the drafting of regulations that anyone manipulating the human genome by gene-editing techniques, like CRISPR, would be held responsible for any related negative consequences. A cautionary perspective on the possible blind spots and risks of CRISPR and related biotechnologies has been recently discussed, focusing on the stochastic nature of cellular control processes.

Gene-edited monkeys

In January 2019, scientists in China reported the creation of five identical cloned gene-edited monkeys,which use the same cloning technique that was used with Zhong Zhong and Hua Hua – the first ever cloned monkeys - and Dolly the sheep, and the same gene-editing Crispr-Cas9 technique allegedly used by He Jiankui in creating the first ever gene-modified human babies Lulu and Nana. The monkey clones were made in order to study several medical diseases.

Duchenne muscular dystrophy (DMD) cure at pigs

Duchenne muscular dystrophy (DMD) is one of the most common and most devastating muscular diseases, greatly reducing patients' quality of life and life expectancy. Now, researchers in Germany have been able to use the CRISPR gene-editing tool to correct the condition in pigs, bringing the treatment ever closer to human trials.

A protein called dystrophin is necessary for muscles to regenerate themselves, but people with DMD have a genetic mutation that removes the gene producing dystrophin. That means that affected children usually begin to show symptoms of muscle weakness by age five, lose the ability to walk by about age 12, and rarely live through their 30s as their heart muscles give out.

Because it's a genetic condition, DMD is a prime target for treatment with the gene-editing tool CRISPR. In experiments in pigs, the researchers on the new study used CRISPR to correct the faulty dystrophin gene. That allowed the pigs to once again produce dystrophin proteins – although they were shorter than usual, they were still stable and functional. That improved the animals' muscle function and life expectancy, and made them less likely to develop an irregular heartbeat.

Genetically modified organism (GMO)

A genetically modified organism (GMO) is any organism whose genetic material has been altered using genetic engineering techniques. A wide variety of organisms have been genetically modified (GM), from animals to plants and microorganisms. Genes have been transferred within the same species, across species (creating transgenic organisms) and even across kingdoms. New genes can be introduced, or endogenous genes can be enhanced, altered or knocked out. Recent advancements using genome editing techniques, notably CRISPR, have made the production of GMO's much simpler.

Many objections have been raised over the development of GMO's, particularly their commercialization. Many of these involve GM crops and whether food produced from them is safe and what impact growing them will have on the environment. Other concerns are the objectivity and rigor of regulatory authorities, contamination of non-genetically modified food, control of the food supply, patenting of life and the use of intellectual property rights. Although there is a scientific consensus that currently available food derived from GM crops poses no greater risk to human health than conventional food, GM food safety is a leading issue with critics. Gene flow, impact on non-target organisms and escape are the major environmental concerns. Countries have adopted

regulatory measures to deal with these concerns. There are differences in the regulation for the release of GMOs between countries, with some of the most marked differences occurring between the US and Europe. Key issues concerning regulators include whether GM food should be labeled and the status of gene edited organisms.

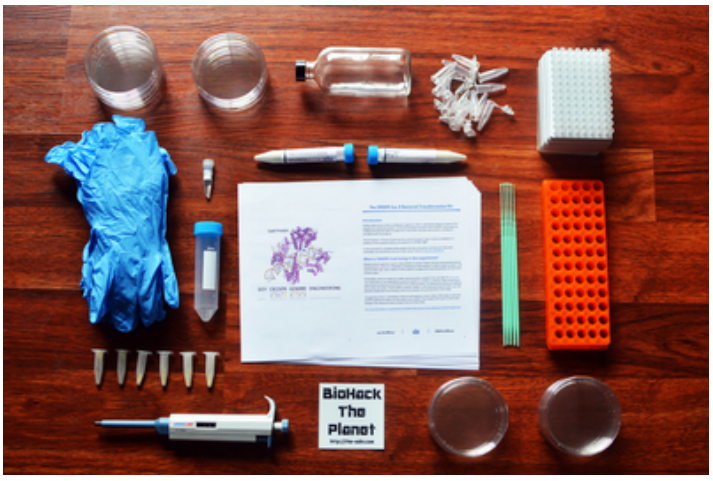
One of the key issues concerning regulators is whether GM products should be labeled. The European Commission says that mandatory labeling and traceability are needed to allow for informed choice, avoid potential false advertising and facilitate the withdrawal of products if adverse effects on health or the environment are discovered. The American Medical Association and the American Association for the Advancement of Science say that absent scientific evidence of harm even voluntary labeling is misleading and will falsely alarm consumers. Labeling of GMO products in the marketplace is required in 64 countries. Labeling can be mandatory up to a threshold GM content level (which varies between countries) or voluntary. In Canada and the US labeling of GM food is voluntary, while in Europe all food (including processed food) or feed which contains greater than 0.9% of approved GMOs must be labelled. In 2014, sales of products that had been labeled as non-GMO grew 30 percent to $1.1 billion.

Online kits

CRISPR has been so common these days that there are CRISPR kits sold online with videos how to use it. This means that everyone could easily work with these kits, which could lead to either good or bad results.

Inside the kits:

- LB Agar
- LB Strep/Kan/Arabinose Agar
- Glass bottle for pouring plates
- Non-pathogenic E. coli bacteria
- Inoculation Loops/Plate Spreader
- 10-100uL variable volume adjustable pipette(1uL increments)
- Box of 96 Pipette Tips
- 14 Petri Plates
- Micro centrifuge tube rack
- Nitrile Gloves
- Micro centrifuge tubes
- 50mL Tube for measuring
- Bacterial transformation buffer 25mM CalCl2, 10% PEG 8000
- LB Media for transformation recovery
- Cas9 plasmid
- gRNA plasmid
- Template DNA



C. Past UN actions

Human genome editing registry

At 6 January 2020 World Health Organization (WHO) published the human genome editing registry. Seeing that everyone who is interested in genome editing could easily have access to it, there was need for a registry. The Committee agreed on a phased approach, with an initial focus on clinical applications and subsequent efforts to incorporate relevant basic research on human embryos and germ line cells. The Committee made a special search filter so they can identify clinical trials using genome editing tools.

D. Conclusions

In this study guide we mentioned, everyone gets easily access to gene-editing kits and the techniques how to use it people do test without anyone knowing about. Like the He Jiankui affair it could be too late to stop someone. But this can go both ways either it could cause to something good or something bad. But what are these good and bad things ?

The good

Genetic technologies are offering new solutions for disease control, prevention and cure. They are now being used to diagnose and treat complex diseases such as heart disease, asthma, diabetes and cancer. Genetic technologies may also soon allow us to eradicate malaria, a major health menace in many developing countries.

The bad

The high price tag of many genetic technologies means that not everyone will benefit. The cost of gene therapies for rare diseases as approved in the United States and Europe can range from $373,000 to $1 million per patient per year. While genomics is shaping the future of medicine, the research is often targeted for certain population groups in mind, especially wealthy people who possess the ability to pay.

In that committee you will discuss on possible solutions for gene exchange like we mentioned that before. We as a united nations social cultural and humanitarian committee have responsibility for solving World issues like that and we will solve it in that committee .

E. Questions a resolution must answer

1. Where is the limit in genome editing ?
2. What are the ethical rules of genome editing ?
3. How can we prevent subterranean study ?
4. Should everyone have access to these method ?

F. Bibliography

https://www.atsu.edu/faculty/chamberlain/Website/Lects/GENEXCH.HTM
https://en.m.wikipedia.org/wiki/CRISPR
https://newatlas.com/medical/crispr-gene-editing-muscular-dystrophy-pigs/
https://www.who.int/news-room/q-a-detail/human-genome-editing-registry
https://en.m.wikipedia.org/wiki/Josef_Mengele#Human_experimentation
https://www.the-odin.com/diy-crispr-kit/
https://sustainabledevelopment.un.org/content/documents/955511_Soltau_CRISPR-Cas9%20_%20gene-editing%20technology%20takes%20off.pdf