Forum: World Health Organisation (WHO)

Topic: Discussing ethical considerations, safety standards, and international guidelines for the responsible use of gene editing technologies

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PERSONAL INTRODUCTION

Delegates,

Hi! My name is Maritella Petsa and I am a Grade 11 student in Athens College. I am beyond grateful and excited to welcome you to the third SCMUN conference as one of the two deputy presidents of WHO! First of all, allow me to wish you all an amazing and fruitful experience!

Having conducted quite a few study guides, it is vital that the following is a not only correct and helpful, but an also inclusive and creative study guide. So, feel free to navigate through this guide so as to acquire any information you may possibly need prior to conducting your research and writing your resolutions!

Personally, this will be my 11th overall conference but my 4th time chairing and thus I am really excited to be part of this conference and to be able to collaborate with every and each one of you.

The only thing I would like for you to remember is to always be yourselves and never be afraid to speak up. We would love to hear your voice! For anything you might need you can contact me at this email address: maritella.petsa9@icloud.com.

Best wishes,

Maritella Petsa

TOPIC INTRODUCTION

We live in a world of rapid changes. Changes in political regimes, economic changes but most of all we live in an era of rapid technological advancements. The issue of gene editing technologies has become a current global issue up for debate in a variety of agendas but mostly that of the World Health Organization (WHO). Gene editing technologies trouble a number of scientists on many levels such as the ethical matter of such processes, health and safety standards being met as well as, the necessary

guidelines for their responsible use.

To a great extent, genome editing technologies have laid the foundations for the advancement of genetic science. Such technological advancements carry several advantages and disadvantages in the genetic scientific field. For instance, the discovery of CRISPR-Cas9 technology in the process of germline genome editing (genetic modification of human germline cells and embryos) is currently a great concern to scientists in the field for several reasons. Although it stands out for its efficiency, accuracy and cost it has been questioned about its application and bioethical reasons it touches upon. These concerns not only link to effects on humans (e.g.: undesirable changes of the genome) but also, environmental issues that link to agriculture.

It is of utmost importance when discussing such topics to take into close consideration the process, application and outcome linked to the use of genome editing technologies. The main fields that the current topic is related to are humans, animals, agriculture and by all means medicine. Therefore, when it comes to ethical considerations of this topic, one needs to consider the possible stakeholders such as individuals/organisms affected by the modification. Such breakthroughs come with their own set of risks and more often than not there is confusion as to whom and who informed consent is obtained and whether the breeding of the human species is ethical or not. Of course, various ethical uncertainties such as the role of embryos in research, possible harms of gene editing (off-target effects and mosaicism), and justice and equity should be researched and discussed.

Additionally, safety standards of their application need to be considered as in all areas, worldwide legislation needs to be prepared to take into account the possible risks of their misuse. For this reason, existing regulatory frameworks need to be revised including the opinions not only of doctors and bioscientists but also, one of life and social scientists and of policymakers who own expertise in this sector. One possible question to consider in your research can be: How to govern the use of these technologies through the implementation of restrictive frameworks enforced by governmental bodies and organisations.

Finally, when discussing genome editing technologies, we should also focus on the responsible use of the material produced and how this is linked to biological research in medicine. The main use of genetically modified material is linked to the treatment and prevention of disease and disability. By and large, its use ranges from processes linked to restoring function in diseased organs to preventing entire classes of genetic diseases from emerging into the future human genome (future generations). However, research in the past has indicated that more than 40 countries in the world have discouraged or even banned genome editing technologies mainly because of the safety and ethical concerns around the topic. Hence, is gene therapy a safe and effective method to be used or should further research be conducted to land a holistic approach to the issue?

DEFINITION OF KEY TERMS

DNA: Deoxyribonucleic acid (DNA) carries genetic information/ material inside human body cells which gives people different characteristics such as hair colour, eye colours etc.

Genome Editing: modification of the genetic material of a living being by embeddings, supplanting, or erasing a DNA arrangement, ordinarily with the point of moving forward a few characteristics of an edited or cultivated creature or rectifying a hereditary clutter.

Genetic Engineering: the purposeful alteration of the characteristics of an organism by controlling its genes and genetic material.

Genetic Selection: the method by which certain characteristics become more predominant in a species than other characteristics

Genetically Modified Organism (GMO): organism whos genetic material has been altered through gene editing methods and technologies

BACKGROUND INFORMATION

Gene Editing Technologies

Scientists can alter DNA through genome editing technology, which can alter physical characteristics like eye colour and disease risk. Scientists accomplish this through a variety of technologies. These technologies operate at a specific location in the DNA, cutting it like scissors. Then, where the DNA was sliced, scientists could add, subtract, or replace it.

In the late 1900s, the first genome editing techniques were created. Today, we possess three potent families of nucleases that may be manipulated to produce double-strand breaks (DSBs; DNA is double-stranded) at any desired location: The 2009 discovery of CRISPR, a novel genome editing tool, along with zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs) have made DNA editing simpler than before.

One use of genome editing by scientists is the study of various human disorders. Animals share many genes with humans, therefore they modify the genomes of animals like mice and zebrafish. Scientists can study the effects of modifying one or more genes on the health of mice, and then extrapolate these observations to human

health by modifying equivalent genes in human genomes. Exactly this is being done by researchers at the National Human Genome Research Institute (NHGRI). Zebrafish genomes, for instance, are being studied in the Burgess lab. Researchers in this lab use CRISPR to remove individual genes from zebrafish one at a time, observing the effects on the fish.

Zinc Finger Protein

The cleavage domain of the restriction enzyme FokI is linked to a specially engineered zinc finger protein (ZFP) to create a ZFN, an artificial endonuclease. By creating ZFPs with different sequence specificities, a ZFN can be modified to cleave new targets. Zinc-finger nucleases (ZFN) were first used by researchers in the 1990s to decrease off-target edits and increase genome editing specificity. The naturally occurring proteins found in eukaryotic species are the source of the structures of ZFNs. Scientists design these proteins to bind to particular DNA sequences in the genome and cut DNA.

Transcription Activator-Like Effector Nucleases

A novel class of proteins known as Transcription Activator-Like Effector Nucleases (TALENs) entered the field of genome editing in 2009. ZFNs and TALENs can both modify the genome with similar efficiency, although TALENs are simpler to use. The engineering of TALENs is far simpler than the synthesis of ZFNs. The genome editing revolution was started by TALEN, the first readily used genome editing technique.

Meganucleases and zinc finger nucleases (ZFNs) were the key players in the creation of the field of genome editing back in the 1990s, laying the foundation for the idea. The world's first genome-edited organism was created in 2002, marking the pinnacle of this development. Biotech businesses with the necessary expertise use ZFN and meganucleases despite their greater difficulty. The restriction endonuclease FokI's catalytic domain and a transcription activator-like effector (TALE) were fused to create TALEN in 2010. Because they were so much simpler to use than their predecessors, genome editing became accessible to a wider audience in science.

Ethical Considerations

Apart from the potential health and safety hazards, there are numerous ethical concerns in terms of Genome editing, including the issue of informed consent and equity amongst others.

Considering that the majority of gene editing technologies are to be implemented on embryos, it is utopic to expect their consent. Parents are asked to make many decisions about their children and Genome editing would be a surplus. The long-term results nevertheless will affect the embryo and the future generations who will not be capable nor able to partake in any decision-making concerning their genetical information. This allows room for concern regarding bodily rights.

Moreover, there are concerns about justice and equity. The price of genome editing is high and thus there is a great possibility that gene editing technologies will not be accessible to the general public but will rather become a luxury only available for the wealthy. Subsequently, genome technologies could increase the already existing inequalities in the medical/ healthcare sector.

In general, there is the question of whether it is ethical to modify a genetical sequence and intervene in biological mechanisms. Genome technologies could offer solutions or resistance and immunity to certain illnesses increasing the vulnerability of a particular organism to other factors and illnesses. There have been Ethical Principles, developed by the World Medical Association, but the issue at hand is very complicated.

It is necessary for anyone undertaking the aforementioned processes to be fully informed about both the risks and the benefits. Nevertheless, depending on the experiment or trial this has not always been the case. Apart from the embryos involved, subjects to such experiments have in the past been unaware of the potential susceptibility to other infections. A great example is the clinical trial conducted by Jiankui He.

Numerous "mistakes" or simple omissions lead to participants ignoring the hazards of said processes, embryos undertaking dangerous procedures, information not being registered before the experiments and other "accidents".

Thus, the use of genome technologies could be deemed irresponsible until the appropriate safety, efficacy and ethical guidelines are developed. The criteria mentioned above, have not yet been met.

International Guidelines

The ethical, legal and safety aspects in the use of gene editing has driven the creation of worldwide guidelines for its application.

The ubiquitous Declaration on the Human Genome and Human Rights, which was adopted by UNESCO in 1997, is a foundational text that has shaped the international gene editing guidelines, where this declaration focuses mainly on the need of protection of human dignity and fundamental human rights in the context of biological and medical developments, such as genetic editing..

In addition, the Convention on Human Rights and Biomedicine, which is also known as the Oviedo Convention, has provided a legal structure in order to address ethical and legal issues in biomedicine, as well as genetic engineering. Adopted by the Council of Europe in 1997, this convention puts emphasis on the same values as the Declaration

on the Human Genome and Human Rights and also calls for measures which protect individuals from the misuse of genetic information and will ensure the equitable distribution of benefits that may arise from genetic research.

In more detail, the Nagoya Protocol, which is a supplementary agreement to the Convention on Biological Diversity (CBD) which was endorsed in 2010, addresses the fair and equal sharing of benefits arising from the utilisation of genetic resources which allows this protocol to be relevant to gene editing technology as it governs access to genetic resources and the sharing of benefits derived from their use.

Similarly to the international agreements and treaties mentioned before, multiple countries have created their own regulations for gene editing technology and its implications, often involving multiple governmental agencies, and addressing many aspects, including biosafety, environmental impact , and ethical considerations. These regulatory bodies may include health ministries, food and drug administrations (FDA), agricultural departments, and environmental protection agencies.

Additionally, ethical guidelines which have been set by international scientific organisations and bioethics committees provide scientists with guidance on the responsible use of gene editing technology. The principles and ideas of transparency, informed consent, equity of access, and the consideration of potential societal effects are prominently mentioned.

Scientific research communities also have a detrimental role in the establishment of the ethical and safety standards in the use of gene editing. These standards may be systematized in professional codes of conduct, research protocols, and institutional review processes. International collaborations among researchers and institutions facilitate the exchange of best practices and in order to develop common standards for gene editing and research.

To conclude, international guidelines on the use of gene editing technology consist of a range of ethical, safety, and legal considerations. These guidelines are informed by international treaties and agreements, national regulations, ethical principles, and scientific community standards. By following these guidelines, researchers are ensuring that gene editing technology is utilized responsibly.

TIMELINE OF EVENTS

Date of the Event	Event
1997	Universal Declaration on the Human Genome and Human Rights: Adopted by UNESCO, this declaration emphasizes the importance of ethical considerations in genetic research and medicine.
1997	Convention on Human Rights and Biomedicine (Oviedo Convention): Adopted by the Council of Europe, this treaty addresses ethical and legal issues in biomedicine, including genetic engineering.
2010	Nagoya Protocol: An international agreement supplementary to the Convention on Biological Diversity, aimed at fair and equitable sharing of benefits arising from the utilization of genetic resources.
2015	CRISPR-Cas9 Breakthrough: Scientists demonstrate the potential of CRISPR-Cas9 gene editing technology for precise and efficient modifications to the genetic code.
2015	International Summit on Human Gene Editing: Organized by the U.S. National Academy of Sciences, the U.S. National Academy of Medicine, the Chinese Academy of Sciences, and the Royal Society of London, this summit brings together scientists, ethicists, and policymakers to discuss the ethical and regulatory implications of human gene editing.
2016	National Academies of Sciences, Engineering, and Medicine Report: The report provides guidelines and recommendations for the responsible use of gene editing technologies in human embryos.
2017	World Health Organization (WHO) Expert Advisory Committee on

	Developing Global Standards for Governance and Oversight of Human Genome Editing: Established to provide guidance on ethical and regulatory frameworks for human genome editing research.
2018	European Court of Justice Ruling: The ECJ classifies gene-edited organisms as genetically modified organisms (GMOs) under European Union law, subjecting them to strict regulations.
2018	FDA Modernization of Regulatory Framework: The U.S. FDA announces a modernization of its regulatory framework for biotechnology products, including gene-edited products, to streamline the regulatory process.
2019	International Commission on the Clinical Use of Human Germline Genome Editing: Convened by the U.S. National Academy of Medicine, the U.S. National Academy of Sciences, and the Royal Society, the commission develops a framework for the clinical use of human germline genome editing, emphasizing safety, efficacy, and ethical considerations.
2020	World Health Organization (WHO) Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing (continued): The committee releases a preliminary report outlining principles and criteria for governance and oversight of human genome editing.
2021	International Summit on Human Gene Editing (Second Summit): Held virtually, this summit revisits the ethical and regulatory considerations surrounding human gene editing in light of technological advancements and societal developments.

MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

The International Centre for Genetic Engineering and Biotechnology

An intergovernmental organization with labs located in Italy, India and South Africa; working with 70 Member states. This organization plays a primary role in biotechnology and promoting research excellence whilst also providing a scientific environment for advanced research and the development of biotechnological products for over 60 Member States.

Precision BioSciences, Inc.

A publicly traded American gene editing company, located in North Carolina. The company is in the clinical states and uses ARCUS genome editing technology to develop medications that are designed to combat (and potentially cure) conditions, that were once deemed hard to treat.

Inari Agriculture, Inc

This company uses breeding technology to design seeds targeted at creating a more sustainable global food system. SEEDesign technology addresses the biological complexity of plants, using artificial intelligence and multiplex gene editing.

Italy

Italian Members of Parliament have expressed their support for the use of genetic modification techniques to be used in creating more resistant crops given the current agricultural situations (i.e. the droughts and heat waves) which affect Italy.

United Kingdom

The Human Fertilisation and Embryology Authority issues specific licences for creating human embryonic stem cells. These licenses ensure that human embryos are used for therapeutic and research purposes only and that there is no misuse. Further, these licences require that the embryo is destroyed by or on the 14th day of development due to them beginning to develop the primitive streak (which is the first indicator of a nervous system)

United States of America

The Joined together States government government has not passed any laws concerning human cloning due to differences inside the authoritative department approximately whether to boycott all cloning or boycott as it were regenerative cloning. The Dickey-Wicker correction, connected to U.S. assignments bills since 1995, has avoided the utilisation of government dollars to finance the hurt or devastation of human embryos for inquiry. It is assumed that atomic exchange and any other shape of cloning are subject

to this confinement. Although the U.S. has no through-and-through boycott on altering the qualities of human embryos, a prohibitive administrative scene and a need for government bolster have forced noteworthy confinements on analysts. Moreover, Congress has prohibited NIH from subsidizing inquiries about including live human embryos, driving analysts to either forsake these ventures completely or look for private financing with fewer restrictions. Additionally, an interwoven of worldwide controls assists obstruct endeavours at making a comprehensive system for controlling CRISPR and other quality-altering innovations.

Russia

The use and circulation of GMOs have been regulated by Federal Law, since 5 June 1996. Further, the use of GMOs for specific uses, such as food is regulated by national normative documents and recent acts of the Customs Union.

China

They actively supported the formulation of an international convention against the reproductive cloning of human beings, as it is seen as a threat to the dignity of mankind and gives rise to ethical, moral and religious problems. Thus, they are opposed to cloning humans and will not permit any such experimentation.

POSSIBLE SOLUTIONS

Development of appropriate guidelines

In times of development, and medical and technological evolution, Genome Editing could be considered an imperative part of future research and application of said technological advances. Thus, all participants or guardians in the case of embryos must be fully aware of both the advantages and the potential risks of such processes. It is of major importance that all participants of experiments of the type mentioned above are informed about all types of data processing and the goal of the editing of their genetic material.

Utilising Genome Editing technologies responsibly

Following both ethical and safety considerations in terms of Genome editing technologies usage, it is of major significance that no genetical material is been edited nor experimented upon unless deemed mandatory. Any research taking place shall be scrutinised and approved by a potential body or a nation, before taking place to ensure the amelioration of the outcome. The appropriate type of Genome Editing should be chosen based on criteria concerning the safety, well-being and rights of the subjects of research and not in correlation with personal or national interests and benefits.

The creation of a new body/ The investment of member states in time and research

It could be proven greatly beneficial if certain individuals or organisations, in close collaboration, can further research and experiment in terms of Genome Editing without using biological materials. Today's knowledge of gene editing technologies is insufficient for it to be widely reinforced despite its potential life-changing advantages in terms of providing treatment for certain illnesses and diseases. Thus, acquiring more information before proceeding with any other type of measure could finally allow for a more responsible utilisation of such technologies.

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