

An Overview of Ethical Concerns in Re-Engineering the Human Body**Bilal Shah Syed^{1*}, Mahmud Hussain², Zarinah Jan Binti Yusof Khan³, Inayatullah Shah Sayed⁴**¹Department of Electrical and Computer Engineering, Kulliyah of Engineering, International Islamic University Malaysia, 50728 Kuala Lumpur, Malaysia²Department of Biotechnology Engineering, Kulliyah of Engineering, International Islamic University Malaysia, 50728 Kuala Lumpur, Malaysia³Centre for Languages and Pre-University Academic Development (CELPAD), International Islamic University Malaysia, 50728 Kuala Lumpur, Malaysia⁴Department of Diagnostic Imaging and Radiotherapy, Kulliyah of Allied Health Sciences, International Islamic University Malaysia, Kuantan Campus, 25200 Kuantan, Pahang, Malaysia***Corresponding author**
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Abstract: Today, the tremendous possibilities that arise with scientific advancements in medicine, biotechnology, and affiliated sciences are distinct and clear. And so are the abuses, negative implications, and ethical dilemmas that arise with such revolutionary technology. As a civilized global society, it is our responsibility to ensure that such achievements may not be marred by the negligent actions of a few. The potential of gene modification technology is very exciting indeed, but we need to advance with caution for the sake of the safety of our global community. The aim of this article is to highlight the current practices and experimentations being conducted in the field of genetic engineering, the laws or the lack of laws pertaining to genetic engineering, the ethical concerns that arise from dwelling into such experiments and the Islamic perspective on this issue. It is concluded that the status quo restricts scientists from conducting unauthorised experiments based on a voluntary moratorium. There should be well defined boundaries that do not create unethical issues while at the same time promote research in this field which has the potential to cure diseases and improve the well-being of humankind.

Keywords: Genetic engineering, CRISPR/Cas9, Genome editing, Ethics, Islamic perspective

INTRODUCTION

The desire to change and improve the human body has been in the history of human beings from a long time ago. Not content with the already-perfect body they have been blessed with, humans have long dreamed of making their body stronger, faster, and more immune to diseases and sickness. Since the advancements in science, technology, and medicine, the scientific community has desperately searched for ways to modify the human body, and create parts of it for medical and commercial purposes. The ever-changing environmental issues, along with the spread of incurable disease like cancer and AIDS, have made it evident that in order to survive and thrive in a post-modern society, we as human beings might soon face the conscious choice of deciding on our biological beings and its existence.

A recent meeting at Harvard University School of Medicine in Boston, USA, provides some background into this issue. Scientists, entrepreneurs, and policy leaders were invited to this meeting to draw up an ambitious project to create artificial human genomes. Endy and Zoloth [1] explained that the efforts of the participants of the meeting to create artificial human genomes based on digital data could raise concern among the relevant stakeholders about the impact of such ground-breaking technology.

Initiatives like the one at Harvard School of Medicine have underpinned the peak of our efforts to change, or build up from scratch, the human body and its relevant organs. The meeting at Harvard was the epitome of decades of research into molecular biology, human genetics, and genetic engineering. Today, the science of how human cells work, communicate, and live has been uncovered, and new technologies are emerging which enable scientists to replace, insert, and remove parts of the human genome. The prospect of creating a synthetic human genome has raised concerns in the

scientific community because it could be used to create humans without biological parents. It is therefore not surprising that, along with every other initiative in modifying human bodies, this revolutionary effort has its own ethical concerns.

Keeping in mind both the blessings and the curses these technologies bring forth, there are numerous factors that must be taken into account by the development of respective policies and laws in order to advance the science of re-engineering humans in a way that is responsible, ethical, and beneficiary.

The Blessings and Curses of Gene Modification Technologies

There are both positive and negative impacts of human genome editing. And both kinds of impacts it can have leave a mark on human civilization and its future. Therefore, it is very important to assess and explore both the positive and the negative impact it can have. To understand the context of how these technologies can become a blessing or a curse, some of the mainstream technologies that are being used to edit human genomes need to be explored. The main two technologies that are being used today are genetic engineering and synthetic biology.

Genetic engineering is defined as the modification of a being's genome using specific processes and techniques. The DNA of an organism can be changed using this technology. This technique of editing genes has become a widely used practice in scientific research and industry. According to Nicholl [2], genetic engineering is used in such a scale that "it is now routine practice to isolate a specific DNA fragment from the genome of an organism, determine its base sequence, and assess its function."

Whereas, synthetic biology is a multidisciplinary branch of life sciences which focuses on building genomes from scratch. The subject combines various disciplines from different biological and engineering domains. For example, a description by Vriend [3] presented it as "a new emerging scientific field where ICT, biotechnology and nanotechnology meet and strengthen each other."

Both of these technologies have been crucial to scientific advancements in medicine and life sciences. The applications of these technologies and their impacts are tremendous, leading changes and paradigm shifts from individual to the societal level on how we view ourselves and the world around us.

There are numerous positive impacts that genome editing technologies can have on human life. These technologies are used to create drugs such as insulin, hormones, antibodies, cancer drugs, vaccines, injections etc. This technique is also used to mimic human diseases in animals for studies. For example, genetically modified mice are used as animal models for human disease. It has also been extended to study and model diseases such as obesity, cancer, diabetes, heart diseases, anxiety, aging and Parkinson's disease. New medicine and cures are tested on these models to mimic a human disease. Genome editing is also used for the early detection and treatment of cancer. According to [4], "Biologists at UC San Diego have succeeded in genetically engineering algae to produce a complex and expensive human therapeutic drug used to treat cancer."

However, human genome editing has its curses as well. They have come under the scrutiny of critics in regard to the use of these technologies on several claims, including environmental concerns, ethical concerns, and economic realities. The negative implications of human genome editing often leave consequences that are grave for the individual as well as the society at large. Therefore, identifying them is extremely important in order to ensure safe use of such technology.

Genetic engineering in theory would be able to modify an individual's physical appearance, and even enhance his or her physical and mental capabilities such as memory and intellect. According to multiple researches done in the area of bioethics, the public are ambiguous on the issue of physical and mental enhancements: while some find it an improvement of the human condition, to others it is deeply disturbing and ethically immoral [5-6]. This debate has raised the ethical dilemma of whether individuals should be allowed to enhance themselves or their offspring. On one hand, every child has his or her claim to remain genetically unaltered at birth, whilst still having the right to being born healthy, free of avoidable diseases. This, along with other technologies such as human cloning, can often lead to a treacherous path that may disrupt the socio-economic system of human civilization as well ethnic diversity among people all around the world.

Human genome editing will undoubtedly form the future of human civilization. However, one must keep in mind that along with all the blessings that this technology can bring forth for a brighter tomorrow, the curses must also be considered as capable of destroying that very future.

Laws and Policies Regarding Human Genome Editing

Human genome modification, the engineering of the most basic script of a human, was merely considered science fiction not too long ago. In recent times though, scientist have come a long way in making it a reality. Advancement have been made in this field by adaptation of technique such as CRISPR/Cas9 to edit human genome [7] to the liking of the scientist as pointed out by Cong, *et al.*, [8]. In fact, research in this technique has gone as far as researchers efficiently editing genome in zebrafish, as found by Hwang, *et al.*, [9]. As evident by this research genome editing is a reality now rather than science fiction and it is absolutely possible that the scientific community might attempt at editing the genome of a human embryo. This raises a number of ethical questions which need to be answered at the same pace as the advancements in genome editing are taking place. It is only appropriate that government and international scientific communities should come on a consensus addressing these issues and work out effective policies and laws for responsible use of technologies to edit human genomes.

One should not focus only on the negative aspects of human genome editing as beneficial research is being conducted all over the world. Human genome editing has opened possibilities of curing intractable diseases as sickle cell, leukaemia and disorders passed down from heredity. Such ambitious projects require extensive research and depth of recourses which eventually raise ethical questions. Kang, *et al.*, [10] publicized that they had successfully altered a gene linked to blood disease in human embryos. Even though the embryos used in the experiment were leftovers from fertility clinics which had no chances to be developed in to foetuses. Leading to the development of this report, a leading scientific magazine, Nature, made the remark “That report – world first – fuelled global deliberations over the ethics of modifying embryos and human reproductive cells, and led to calls for a moratorium on even such proof-of-principle research.” With no clear restrictions, it is possible that these proof-of-concepts might eventually lead to experimentation on human embryos which will develop into foetuses [11]. As of now there are no rules and regulations that limit the experimentation on human embryo, the only limitations are the lack of research on healthy embryos, which is only a matter of time. A committee of UNESCO professionals called for a prohibition on “editing” of human DNA to avert unethical modification of heredity traits [12]. Despite the efforts by UNESCO, Chinese researchers were able to conduct research on human embryos recently. It needs to be stressed that the efforts regarding the laws and policies relating to the editing of human genome need to be addressed as soon as possible.

Islamic Perspective on Human Genome Editing

Islam is a comprehensive religion that covers and addresses every issue related a human being. The message by Allah (s.w.t) transcends time and guidelines revealed to his Ummah (Muslim community) are as relevant today as they were during the time of Prophet (P.B.U.H). If there is an ambiguity on any issue, Allah (s.w.t) commanded his followers to *ijtihad* (to reason) and use ones knowledge to address the issue in compliance with the word of Allah (s.w.t). Genetic and human genome editing was obviously not thing in 622A.D but recent generation of Muslims scholars have aptly addressed such issues. In Islamic perspective there is a clearer boundary as to what is ethical and unethical related to human engineering.

Consanguineous marriage, marriage between two people who are closely related, lead to higher number of birth defects, which is widely practiced among Middle Eastern population and South East Asian communities which are predominately Muslim. This is a centuries old tradition which is too radical to stop overnight, thus WHO’s regional office for Eastern Mediterranean in 1994 and 1996 agreed with the local representatives that to tackle this problem of birth defects, genetic engineering can be sought as a viable solution. Practitioners of Islamic jurisprudence have realized the importance of genetic engineering as well as the ethical issue that may arise from this exercise. In the event of The Islamic Jurisprudence Council of Islamic World League in Makkah Al-Mukarama, Muslims collectively discussed the benefits and ethics pertaining to bio-engineering. They concluded on five points as discussed by Al-Aqeel [13]; i) to limit the use of genetic engineering, only allowing it usage for disease prevention, treatment or amelioration; ii) to completely prohibit the usage of genetic engineering for malicious purposes and felonious uses or what is forbidden religiously; iii) to prohibit using genetic engineering or to alter a person’s characteristics such as personality or use it to enhance a being’s genomes artificially; iv) to restrict any form of research on human genes unless it’s absolutely critical and the consequences are known, with the participants’ consent. v) Lastly, to allow genetic engineering in agricultural field. On the pretence that the related parties, such as animals, vegetation or humans do not inflict harm as a result of the experimentations. The guidelines above give a clear stance of Islam on genetic engineering. The Islamic community recognizes the benefits of genetic engineering especially where it can be used to tackle birth defects, use it as pre-marital screenings and in agriculture. At the same place, Islamic community also recognizes the need for having restrictions on such research that may alter humans.

After Satan tempted Adam and Eve to sin by eating from the forbidden tree, he was dismayed that Allah (s.w.t) forgave them and sent them to earth as Allah’s vicegerent. On which he reveals his plot as to how he will lead us astray.

"Verily of Thy servants I shall most certainly take my due share, and shall lead them astray and fill them with vain desires. And I shall command them so that they cut off the ears of cattle (in idolatrous sacrifice), and I shall command them and they will CHANGE ALLAH'S CREATION." (Qur'an 4:119) [14]

CONCLUSION

As a result of the advancement of human civilization, technology has taken the responsibility of catering towards the many needs that arise from the dynamic interactions between individuals, societies, and nations. However, people often forget the key distinctions between what they need and what they want. It is from this constant struggle of the human condition does the abuses and negative implications of technology arise, and the issue of enhancing or modifying the human body is no different in that aspect. The genome editing is a reality and efforts need to be directed toward addressing the ethical issues that will indefinitely arise from the advancement of this field. Currently there are no fixed laws stopping scientist from attempting editing a human genome. Within the scientific community a voluntary moratorium is currently being observed that restricts researchers from making changes to DNA that could be passed down to subsequent generations. This moratorium needs to be a law that will lead to consequences if it is broken by any researcher or group of scientists. The Islamic perspective on genetic engineering also runs parallel with afore mentioned where it differs are at some practices. Islamic scholars have clearly stated what is permissible in Islam and what is not. What it does stress is that this field should not be used unethically and only for the benefit of humankind.

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