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A Critical Analysis of Ethics of Genetic Engineering

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Abstract: Bio scientific technologies have gone to such a level that it is possible to genetically manipulate living organism for the benefit of the society. It is possible to produce transgenic plants, animals, and also use recombinant DNA technology in case of human. But there are certain laws that every individual should follow in the society and the same is applicable in the field of genetic engineering. If on one hand by the use of genetic engineering human are able to change the sequence of gene but at the same time we cannot act against nature or the natural way a living organism comes to the earth. It is obvious that some rules are followed when genetic engineering is applied for manipulating the genes of plants, animals and humans. These are the ethics of genetic engineering which will keep a balance between science and its interventional strategies used in the nature.

I. INTRODUCTION

When a gene of interest is incorporated into the genome of an organisms the gene expresses to produce its traits. The inclusion of the gene changes the whole genetic constitution of the organism which brings phenotypic alteration in the organism. This shows that it can change the characteristics, behaviour or functioning (both internal and external) of the organism. It is against the law to change the genetic make-up of an organism by the application of genetic engineering for our profit. It is strictly8 required to follow certain rules for applying genetic engineering in Human, Animals and Plants. These are known as ethics of Genetic engineering.

A. Ethics of Genetic Engineering in Plants

In case of plants legal issues are not so much and mostly the techniques are applied to improve the productivity, mass production, increase the nutritive values of the fruits of the plants etc which ultimately are economically beneficial for the society. Recombinant DNA technology is now widely used commercially for agricultural advancement and also for the wellbeing of the society. Many researches are going on worldwide in the genetic engineering for improve variety of plants. But before the use of biotechnologically modified crops it is very important to detect if it is having any harmful effects on human being. There are many controversies regarding the genetically modified crops. It is noticed that allergies in children are increasing now a days which are very often linked to genetically modified foods. Science have proven that a genetically modified soybean strain had lower levels of beneficial nutrients that may help protect against heart disease and cancer. The application of Genetic Engineering is for the benefit of human but increase in production of GM crops with low nutritional value are of no use. This is obviously an ethical issue. Genetically modified crops are not happily accepted by farmers

B. Ethics of Genetic Engineering of Animals

Genetic Engineering in animals are done with the same purpose to bring improved character in animals which will be useful for us. The genetic engineering of animals has increased significantly in recent years, and the use of this technology brings with it ethical issues, some of which relate to animal welfare — defined by the World Organisation for Animal Health as “the state of the animal…how an animal is coping with the conditions in which it lives”. There are certain policies formulated by the government for the welfare of the animals and that has to be followed before modification of animals (MacArthur JA et.al 2006) Genetically identical individual or clones are produced by genetic engineering. This is done by taking the cell of an animal and culturing it invitro. This technology could be applied to either extinct or endangered species; for example, there have been plans to clone the extinct thylacine and the woolly mammoth (West C 2006). Genetically modified farm animals are produced with the purpose of getting improved, disease resistant variety. But unnecessary production of clone is definitely an ethical issue as it brings disasters if we try to dictate the natural system in the universe. There are many ethical issues that has to be considered for the welfare of animal and that can arise at all stages in the generation and life span of an individual genetically engineered animal.

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C. *Ethics of Genetic Engineering in Human*

The significant ethical consideration is on genome editing in human. The use of human embryo for research has often created moral and religious objections. There are no rules to give Federal funds for creation and destruction of embryos for research. Editing of gene in human embryos is against ethics and are not funded. The innovations are important but it should not go beyond the ethics that effects human rights and dignity and the consequences in regard to the safety and possible eugenic uses of this technology for human gene editing are to be taken into consideration (Pollack R 2015).) The prevention of congenital genetic defects, such as pre-implantation genetic diagnosis can be done by using safer and ethically acceptable means (Lander ES 2015). Human genome editing can be done for somatic cell or germline cell

D. *Somatic Genome Editing and the Ethical Issues*

Somatic genome editing involves editing of all somatic cell of human except reproductive cell(gametes) and the cells that produce the gametes. The treatment of cancer, infectious diseases, monogenic disorders can be done by somatic gene editing (Brokowski C et.al 2019). Somatic gene editing can also be used in the future for treatment of patients affected by HIV (Huang Z et.al 2017); progressive blindness (Lander ES 2015); haemophilia (George LA et.al 2017); cancer. (Wei C et.al 2018); sickle-cell anaemia (. Wen J et.al 2017); and cystic fibrosis (Schwank G, et.al 2013) among other conditions. The advancement in gene therapy in making genetic changes has been made over the past several decades towards clinical applications of gene therapy to treat disease (Cox et al., 2015; Naldini, 2015). Hundreds of early-stages and a small number of late-stage trials are under way (Mullin, 2016), although only two gene therapies have been approved as of late 2016 (Reeves, 2016).

The unauthorised application of somatic gene therapy is against ethics and it has to be restricted only for treatment of disease as somatic genome editing could be used to revert an underlying genetic mutation to a variant not associated with disease, which would result in a fraction of the targeted cells regaining normal function. This is a major ethical issue which has to be taken into consideration and ethics are required to be followed so that unnecessary somatic genome editing is not practiced in the society

E. *Germline Genome Editing and the Ethical Issues*

There are serious bioethical issues regarding Germline genome editing like the occurrence of undesirable changes in the genome, and the breeding of the human species (eugenics). The genomic editing is of ethical significance as the changes will get transformed into next generation. The side effects in embryos is one of the important bioethical issues as the consequences cannot be predicted before birth (Otieno, 2015; Brokowski, 2018). As only small groups of cell can be controlled so genome editing on embryos becomes unknown and unprevented until birth. In fact, it should be considered that it may take years for many potential problems to emerge (Lanphier et al., 2015; Halpern et al., 2019).

II. CONCLUSIONS

Although the advancement in the field of genetic engineering is bringing new hope in various field but it is very important to follow ethics when such a technology is applied in living organism. Genetic engineering is used to cure many diseases in human and researches are going on in this field which will bring more changes in the future. In case of plants and animals improved variety and quality production is helping the society. But we have to restrict our use and follow ethics so that it will not challenge the normal phenomenon that happens or else it will bring disasters on the earth

REFERENCES

[1] Brokowski C, Adli M. CRISPR ethics: Moral considerations for applications of a powerful tool. Journal of Molecular Biology. 2019;431(1):88-101.
[2] Cox DBT, Platt RJ, Zhang F. Therapeutic genome editing: Prospects and challenges. Nature Medicine. 2015;21(2):121–131.
[3] George LA, Sullivan SK, Giermasz A, Rasko JEJ, Samelson-Jones BJ, Ducore J, et al. Hemophilia B gene therapy with a high-specific-activity factor IX variant. New England Journal of Medicine. 2017;377(23):2215-27.
[4] Huang Z, Tomitaka A, Raymond A, Nair M. Current application of CRISPR/Cas9 gene-editing technique to eradication of HIV/AIDS. Gene Therapy. 2017;24(7):377.
[5] Lander ES. Brave new genome. New Engl J Med. 2015;373(1):5-8.
[6] Lander ES. Brave New Genome. New England Journal of Medicine. 2015;373(1):5-8
[7] MacArthur JA, Potter M, Harding E. The welfare implications of animal breeding and breeding technologies in commercial agriculture. Livestock Sci. 2006; 103:270–281.
[8] Mullin E. MIT Technology Review. Sep 29, 2016. [January 22, 2017]. Despite the hype over gene therapy, few drugs are close to approval. https://www.technologyreview.com/s/602467/despite-the-hype-over-gene-therapy-few-drugs-are-close-to-approval
[9] Naldini L. Gene therapy returns to centre stage. Nature. 2015;526(7573):351–360
[10] Pollack R. Eugenics lurk in the shadow of CRISPR. Science. 2015;348(6237):871-871.

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[11] Schwank G, Koo BK, Sasselli V, Dockers JF, Heo I, Demircan T, et al. Functional repair of CFTR by CRISPR/Cas9 in intestinal stem cell organoids of cystic fibrosis patients. Cell Stem Cell. 2013;13(6):653-8.
[12] West C. Economic and ethics in the genetic engineering of animals. Harvard J Law Technol. 2006; 19:413–442.
[13] Wei C, Wang F, Liu W, Zhao W, Yang Y, Li K, et al. CRISPR/Cas9 targeting of the androgen receptor suppresses the growth of LNCaP human prostate cancer cells. Molecular Medicine Reports.2018;17(2):2901-6
[14] Wen J, Tao W, Hao S, Zu Y. Cellular function reinstitution of offspring red blood cells cloned from the sickle cell disease patient blood post CRISPR genome editing. Journal of Haematology & Oncology.2017;10(1):119.

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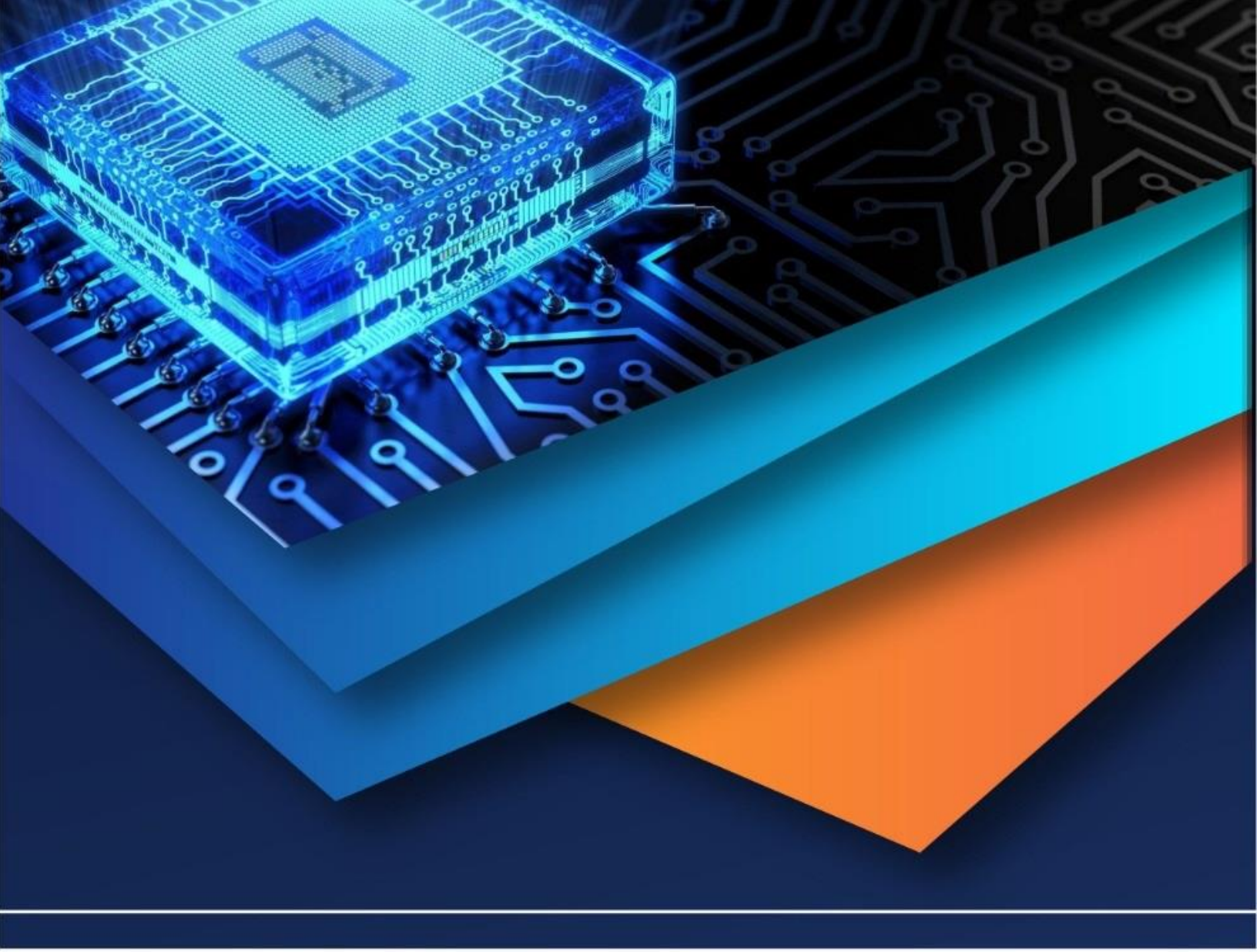

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