Ethical Viewpoint Paper

Gene Editing: Boon or Bane

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INTRODUCTION

"China's gene- edited babies may be smarter". Dr. He Jiankui and his team allegedly deleted a gene from a number of human embryos before implanting them in their mother's, a move greeted with horror by the global scientific community [1].
Gene editing is a process by which a segment of DNA is removed, modified or replaced in the genome of a living cell by the means of biotechnology. Gene editing started as the addition of new elements in the genetic material of bacteria in a random nature. The biggest setback of the technology has been its randomness and uncontrollability which could alter or impair the genes within the organism. Although the methods have improved with time and now these are quite targeted to insert the gene at specific sites as well as reduced off-target effects. Through this targeted manipulation, gene editing could be an answer to various genetic diseases. Scientists around the globe have published eight studies, where they edited human embryos for the purpose of studying the intricacies of this technique [2].
However, "With Great Power Comes the Great Responsibility". There is a lot of debate on the right/wrong use of gene editing and concern lies in human germ-line editing [3].

BASIC CONCEPT

The whole idea of gene editing relies on the concept of DNA double-stranded break (DSB) repair mechanics. The DSB can be repaired by two mechanisms:

- Non-homologous end joining (NHEJ) which joins two DNA strands randomly
- Homology-Directed Repair (HDR) which uses the homologous sequence as a template for regeneration of missing DNA segment at a breakpoint.

HDR is more accurate and can be used for gene editing for creating a vector which contains the desired genetic material within a sequence. The crucial step in gene editing is to create a DSB at a specific point within a genome. To create specific DSB specially engineered nucleases are used nowadays. Clustered regularly interspaced short palindromic repeats (CRISPR) are one of these. CRISPR has been proved to the quickest and cheapest method for gene editing [4].

GENE EDITING: BOON

Today we know numerous diseases which are caused by the mutation of a single gene. There are diseases by a mutation in multiple genes also. All these diseases caused us the loss of precious human life. With the help of gene editing, these genes may be repaired or altered and save many lives. Nowadays a lot of research work is going on a number of genetic diseases through gene editing such as β-thalassemia, cystic fibrosis, glycogen storage diseases hemophilia A & B etc. Gene editing can be used to eradicate vector-borne and communicable diseases as well. The genes associated with sterility in A Gambie, a vector of malaria is being modified by researchers through CRISR- CAS9 gene drive [5].
The area of synthetic biology, which aims to engineer cells and organisms to perform certain functions, can use the engineered nucleases to insert or delete elements and create desired systems.

The families, who have a long history of genetic diseases passed from one generation to the next, can be helped through gene editing, to stop the transfer of such genes.
The diseases like obesity, diabetes, mental illness, cancer etc. which are growing rapidly in the world and have some association with genetics can find a solution through gene editing. All these accomplishments and promises in the area of gene editing lead to the concept of 'designer babies' that can be genetically engineered in-vitro for specially selected characteristics ranging from the lowered risk of certain diseases to gender selection, appearance and personality [6].

GENE EDITING: A BANE

The ability of CRISPER-Cas9 to edit genetic cells other than somatic cells can be manipulated to dictate the genetic traits of population and becomes controversial. Although, researches in the area of gene editing seem to be very promising and help to create designer babies, who would be free from all the genetic diseases and have the desired characteristics. It is a very risky procedure as there are always chances of off-target gene targeting that can lead to potentially dangerous consequences at genetic and organism level. With latest advancements, gene editing is getting cheaper day by day which will allow bio-hackers to perform their own experiments and create genetically modified bugs, on the other hand, it is still an expensive technology that can cost in thousands of dollars for fixing a gene mutation. This can also increase economic inequality and will give a class of population an unfair advantage in the economic competition against the other classes [7].

CONCLUSION

Gene editing is a powerful tool for humanity. Many aspects need to be considered and regulated in using this tool. The researchers should just be focused on making engineered nucleases absolutely safe and specific. Gene editing shall be used for fixing serious genetic conditions rather than creating designer babies. Designer babies seem to be an unethical and inhumane idea and should not be pursued further. The National Academies of Sciences, Engineering, and Medicine (NASEM) launched an initiative in December 2015 to facilitate decision making for the responsible use of human gene-editing research. A global consensus should be made on rules and regulations of using gene editing and a global authority should have a stringent oversight on gene editing experiment. If it is used responsibly, gene editing can prove to be a boon to the humankind [8].

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