Human Genetic Modification

Name

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How far should scientists go to modify humans through genetic engineering?

Somatic genetic modification possesses a vast array of medical benefits. The process involves the manipulation of one’s genome via a process called gene editing. Despite these benefits, various critiques have argued against the application of genome editing in clinical practice. The common opposing arguments that disprove germline genome modification range from infringements of the unborn child's rights, costs, ramifications, the effect on the quality of life, and the preservation of dignity (Van Dijke et al., 2018). However, advancements in research have addressed some of the concerns raised by cliques. Genetic modification has profound advantages that are beneficial to the entirety of the human race.

One major impetus that excites scientists is the possibility of applying genome editing in preventing and treating human disease. Recent advancements in genome editing could potentially address health issues, such as chronic and inherited illnesses. Some conditions occur due to the inheritance of a deleterious variant present in both parents. Novel techniques, such as the Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), could eliminate various illnesses (NIH, n.d.). This aspect could address hemophilia, Tay-Sachs disease, and sickle-cell anemia, among others. According to NASEM (2017), “targeted integration into a safe harbor and in situ correction of mutations are both potentially widely applicable to stem cell-based therapies”. In this regard, the advancements offer a great promise to scientists and patients.

Advances in genome editing have presented gene therapy as a viable alternative treatment method. Gene therapy involves the introduction of external genes into cells to improve a disease condition. According to Naz (2017), “society has started obtaining rewards of genetic engineering in the form of drug therapies” (p. 58). The use of viral vectors is the most efficient gene therapy method. Viral vectors take advantage of the natural abilities of viruses to enter into cells. Physicians use the vectors to introduce functional transgenes and recompense the limited function of a mutant gene i.e. replacement of genes. Additionally, the viral vector can also instruct the original function in the altered cells i.e. addition of genes.

Modern gene targeting techniques supersede traditional gene therapy in terms of efficiency and a more comprehensive array of applications. This notion provides more flexibility in altering the gene sequence within a given cell’s deoxyribonucleic acid (DNA). Further, the precise integration of given gene expressions is advantageous as it is safe and lacks disruptive effects on neighboring genes. This aspect preserves a gene's vigorous expression while reducing potential oncogenesis risks (NASEM, 2017). Furthermore, modern genetic engineering addresses homologous and non-homologous gene repair approaches. This aspect leads to the achievement of cell repair, which could restore tissue functionality and vibrancy.

Several methods have been developed to improve the effectiveness and safety of genome editing. For example, nuclease-based editing methods may eliminate the risk associated with insertional mutagenesis. However, modern practices allow the utilization of late-generation integration which reduces the risk significantly. The method provides scientists with an effective and safer correlation strategy. Therefore, these methods address safety concerns that opponents of gene editing have presented over the years.

Critics of gene editing have often argued that technology will result in injustice and inequality. The main basis for this argument is that technology will be expensive and only accessible to the rich or rich countries. Nonetheless, the democratization of genome editing has led to the development of several nuclease platforms in the past decade. For example, the CRISPR/Cas9, developed from 2012, has resulted in notable optimism among scientists, patient communities, and clinics. CRISPR/Cas9 has med genome editing usable by laboratories around the world. The invention has also promoted awareness of the technique as a viable therapeutic tool. Consequently, technology has also addressed the ethical question surrounding equity and justice, as more health facilities, scientists and patients can access the benefits of genome editing. Also, accessibility lowers the cost of the service.

The application of genetic engineering in sensitive aspects such as modification of preimplantation embryos raises significant concerns that require public and expert deliberation. However, genomic experts see early intervention at the embryo stage as the most effective way of altering genes in individuals. NIH (n.d.) argue that genetic modification at the embryonic stage has a higher chance of achieving preferred functional effects compared to interventions performed after birth. According to Van Dijke et al., (2019), “GGM could pose safety risks for the child and subsequent generations due to off-target and on-target effects” (p. 1787). Regarding the transmission of undesired genes into future generations, proponents contend that future research will be able to address the possibility of this problem.

Not to mention, clinical testing in genome editing is impossible without the approval of relevant bodies such as the Food and Drug Administration. Other bodies such as the NHA and the Institutional review board play a part in reviewing any advancement in medical technology. The bodies provide a platform for scientific and public discussion, ensuring that that all concerns are addressed. Therefore, regulatory bodies can only make approvals when the benefits of an invention outweigh the risks. Clinical data is become increasingly available and can be reviewed within structured frameworks to identify uncertain areas, risk management avenues, and risk management approaches.

On the flip side, the benefits of gene therapies also come with some risks attached to them. The insertion is usually semi-random, hence it may affect the expression and function of genes around the insertion site. Insertion mutagenesis is a big risk but contemporary research has resulted in the reduction of the danger. For higher safety levels in gene therapy, scientists need to develop precise and more flexible genetic modifications e.g. those utilizing gene editing (Van Dijke et al., 2017). Such advancements will also lead to the application of genome therapy in more diseases and conditions. Therefore, the possibilities of a wider application are more apparent than any other time in history. Equally important, the application of genome editing at the embryo stage raises various ethical questions. According to Dow (2018), “we as modern humans now have an enormous responsibility as we enter an age where science can allow us to artificially create beings” (p. 2). Therefore, interfering with the natural development of a human being at the embryonic stage is an infringement to human rights.

In conclusion, scientists are already incorporating genome editing in gene therapy approaches. Recent developments suggest that these applications are likely to increase. Therefore, rather than forcing on the ethical and safety issues that arise from genome editing, it is more rewarding to focus attention on regulations that will ensure the technology is practiced safely and in ways that promote justice and equity. Just like other approaches e.g. biologics, small molecule therapy, and lent viral vectors genome editing is a viable medical alternative. At the end of the day, observers need to evaluate each strategy based on risk, cost, efficacy, and feasibility. The future of genome editing looks bright with innovations such as CRISPR/Cas9 that allow a wider and equitable application of the technology. However, scientists and regulatory bodies must take a cautious approach in allowing a wider application, and make every critical decision based on available data and research.

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