Should scientists and bioengineers be able to use CRISPR for germline editing?

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Introduction

The advances in genetic engineering and CRISPR-Cas9 technology have resulted in an unprecedented ethical dilemma: humanity has gained the tools required to edit the genomes of unborn children before considering whether they should be employed. Germline editing holds the potential to not only eliminate grave genetic disorders, such as sickle cell anemia or Huntington's disease before a child is born, but also to eventually prevent illnesses (e.g., by increasing resistance to cancer or contagious diseases) (Gyngell 2017).

However, our limited understanding of gene function and interplay poses a risk of unintended complications and threatens the treated child's health and well-being (Frosch 2022). Moreover, germline editing could be misused for objectives akin to eugenics: regulating intelligence, eye color, and other mental or physical attributes (Sufian 2021). Even though germline editing is outlawed in most western countries (Araki and Ishii 2014), the unparalleled abilities it promises cannot be refuted (Gyngell 2017); thus it is necessary to discuss to what extent germ cell editing should play a role in our society.

Course of Action

Currently, germline editing is universally prohibited; however, it is not the only possible course of action for the future. As our experience with genetic engineering advances, we might reach a point where germline editing can offer cures for select illnesses where no other solutions are currently available. While still viewed as ethically undesirable for widespread use, gene editing might be employed as a last resort.

Furthermore, germline editing has the potential to become a standard medical procedure. Susceptibility to genetic disorders could be screened in couples who plan to conceive, and the results could be used as a recommendation for genetic engineering.

Another, although unlikely, possibility is germline editing being fully embraced by society. This would give individuals full power and the ability to decide how to apply germline engineering.

Discussion

Currently, the majority of western nations have either banned or discouraged research on germline editing due to ethical concerns (Araki and Ishii 2014). In December 2015, an international effort led by the UK, USA, and China was launched during the International Summit on Gene Editing with the aim of preventing and prohibiting germline editing. It was also found that highly religious groups are more likely to oppose the idea of germline editing (Funk, Kennedy, and Sciupac 2020). Apart from just being an ethical dilemma, germline editing threatens to exacerbate existing prejudices and wealth-based inequalities (CBS News 2021). Moreover, it can have unforeseen long-term consequences, such as the emergence of novel pathogenic genes and/or the elimination of unknown positive effects of the modified genes (Rubeis and Steger 2018). One of the primary concerns regarding germline editing is its use for eugenics, such as modifications made to optimize appearance and intelligence (World Health Organization 2021).

However, it cannot be ignored that this technology can be employed to treat forms of genetic infertility and prevent grave inherited diseases, which would allow individuals to conceive healthy children (Rubeis and Steger 2018). Since a significant portion of inheritable diseases do not have an approved treatment (Department of Health and Social Care, UK 2021), germline engineering might be the only way to improve quality of life. If germline editing is to be employed only in certain cases, deciding which conditions are 'grave enough' to warrant the risk of complications is key, considering our current limited understanding of gene interplay (Rubeis and Steger 2018).

As the safety and adoption of genetic engineering grow, this technology can be embraced for a broader societal benefit. Germline editing could become a standard medical procedure in treating conventional diseases, such as hypertrophic cardiomyopathy (Ledford 2017). There is even a possibility of eradicating entire genetic diseases from our population in a humane way. Furthermore, one should consider if parents have the right to choose who they want their children to be and how they look, as do individuals really have free will if everything has been predetermined by one's parents. In the case of CRISPR and designer babies, this free will would be intruded upon. The arguments presented demonstrate the difficulty in choosing a prudent course of action from the ones outlined above, which only exemplifies the need for further discussion if we wish to reap the benefits of this technology.

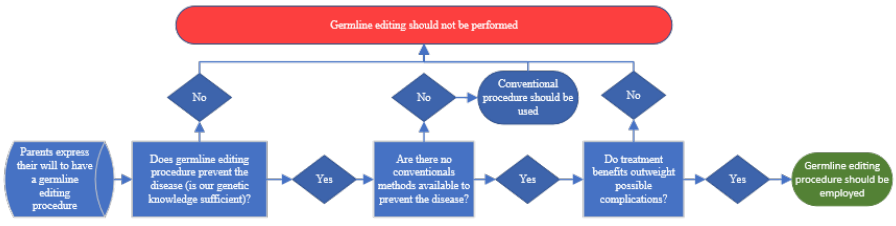

Figure 1: The following represents our decision tree on when germline editing be allowed to prevent grave diseases

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