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Designer Babies: Choosing Our Children's Genes

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Abstract

In this paper, I examine the concept of designer babies and argue for their potential benefits. Designer babies are babies conceived through in vitro fertilization (IVF) and selected based on specific genes or created through genetic manipulation of pre-implantation embryos to influence desired traits. I support my position with the following three arguments. First, designer babies have the potential to prevent genetic diseases. Second, designer babies have the ability to enhance the immune system. Third, designer babies provide the opportunity to enhance inherited traits. I also consider alternative arguments. The arguments include ethical concerns, the impact on the human gene pool, and limitations on freedom of choice. While these positions have merit, I show that designer babies will adhere to ethical acceptability in research, will enhance the gene pool, and will preserve individuals' freedom of choice. I conclude my paper by recommending the promotion of scientific research in genetic engineering.

Keywords: Designer babies, in vitro fertilization, human genome editing, CRISPR, Cas9

Designer Babies: Choosing Our Children's Genes

In this paper, I argue that designer babies would be beneficial to society. The term *designer babies* refer to babies who are either conceived through in vitro fertilization (IVF) and selected based on the presence or absence of specific genes or created by genetic manipulation of pre-implantation embryos with the aim of influencing the characteristics of resulting children (Pang & Ho, 2016). More specifically, the term "designer" implies the deliberate selection or alteration of genetic traits, often to improve desired traits and suppress unwanted ones. The concept of genetically modified embryos, designer babies, was introduced in 1978 when the first IVF took place (Wang & Sauer, 2006). The new technology has brought a variety of options for parents to determine what features they want in their newborns. However, many questions arise regarding the issue of designer babies. Therefore, I address the concerns of using genetic engineering in the creation of designer babies by providing evidence that shows the advantages far outweigh the concerns.

I support my position with the following three arguments. First, I argue that promoting designer babies will help in the reduction of genetic diseases and disorders. For instance, gene editing technologies such as germline gene therapy (GGT) offer a promising approach to correcting monogenic disorders caused by mutations in a single gene (Wolf et al., 2019). Second, the promotion of designer babies will allow the ability to fine-tune the immune system of embryos. This approach could offer potential advantages such as reducing the costs and logistical challenges associated with vaccine development, production, and distribution (Glover, 2008). Finally, designer babies will provide a chance for individuals to enhance inherited traits. In a study by Bouchard and McGue (2002), researchers estimated that genetics could influence cognitive abilities and intelligence by between 30% and 80%. Thus, modifying genes associated with cognitive abilities through gene editing technologies could potentially have an impact on enhancing inherent traits related to intelligence.

I also consider three alternative views to my position. First, many argue that genetically editing embryos is considered unethical (Sandel, 2005). Second, others claim that genetic modification of embryos can alert the variation of the gene pool (Newson & Wrigley, 2016). Third, opponents posit that it limits humans' freedom of choice (Ranisch, 2017). I show that the above claims have merit, but that they may not be considering the full picture. For instance, research aimed at advancing scientific knowledge and developing better genetic engineering techniques involves the use of non-viable IVF embryos that were deemed unsuitable for infertility treatment as they had no chance of resulting in a live birth. (Munsie & Gyngell, 2018). As such, the research on designer babies does not interfere with ethical and moral beliefs.

This paper is important because it addresses an array of issues that may facilitate our understanding of designer babies. These questions include "Will genetic engineering permanently change our society", recommendations such as "Promoting research into genetic engineering", and solutions such as "Making genetic engineering for therapeutic purposes available through insurance." Through addressing these issues, providing recommendations, and offering solutions, the goal of this paper is to help clarify misconceptions that critics have placed upon designer babies. Dispelling these believes is important to ensure that the public has accurate information about genetic engineering and can make informed decisions about advanced genetic technologies.

The Benefits of Designer Babies

While the concept of designer babies may be controversial, it offers a range of potential benefits that cannot be disregarded, despite certain limitations. One significant benefit of designer babies is the ability to prevent genetic diseases and disorders through gene editing technologies. By modifying specific genes associated with disorders and inherited diseases, the risk of inheriting such diseases can be significantly reduced. Additionally, designer babies provide an opportunity to modify human immune systems, potentially leading to advantages such as enhanced disease resistance and reduced dependency on traditional vaccination methods. Designer babies also have the ability to enhance inherited traits, particularly cognitive abilities, which hold the promise of advancing intelligence and unlocking human potential.

Prevention of Genetic Disorders

Designer babies made through germline gene editing (GGT) have the potential to prevent genetic diseases and disorders. This solution is possible by altering the genetic makeup of an individual before birth. More specifically, GGT involves altering the DNA of reproductive cells, such as sperm and eggs, or early-stage embryos with the aim of correcting the abnormal gene responsible for causing a certain disease (Gonçalves & Paiva, 2017). For example, Ma et al. (2017) conducted a study where they used genome editing technology to correct a genetic defect in viable human embryos that have been fertilized with sperm cells from a carrier of the MYBPC3 mutation. This mutation is associated with hypertrophic cardiomyopathy, which is a heritable heart condition. The study resulted in the majority of the embryos being mutation-free, demonstrating the feasibility of correcting gene mutations in viable human embryos using genome editing methods.

An alternative technology that allows the selection of embryos free from genetic mutation is the preimplantation genetic diagnosis (PGD). Wolf et al. (2019) discuss that PGD involves the screening of embryos before implantation, which can identify those with pathogenic genetic mutations. This screening can provide parents with the option to select only healthy embryos for implantation and reduce the likelihood of having to face the difficult decision of terminating a pregnancy or giving birth to an affected child. More specifically, PGD is particularly important in regions with high rates of consanguinity, such as Arab countries where rates range from 25-60% (Al-Ghazali et. all, 2006). This percentage further highlights the urgent need for gene-editing technologies like PGD to prevent genetic disorders and reduce infant mortality and morbidity.

Child's Immunity

Genetic Engineering has the ability to fine-tune the immune system of embryos. This enhancement can open possibilities for improving human health and disease resistance from an early developmental stage. A well-understood and developed gene-editing tool called CRISPR (clustered regularly interspaced short palindromic repeats)/Cas9(CRISPR-associated protein 9) shows exceptional capabilities in genome editing through the use of guided enzymes to cut and alert DNA strands to create the desired gene (Bak et al., 2018).

An example of successful a trial of genome editing is the development of HIV-resistant twins in China. Alonso and Savulescu (2021) conducted a review of the study by Jiankui, a Chinese biophysics researcher, who performed a clinical trial with consent from the parents in 2018 in which he was able to successfully help in the birthing of twin girls with immunity to HIV using CRISPR/Cas9. The study discusses how Jiankui managed to create genetically modified genes that are involved in HIV infections to create HIV-resistant babies. This ability to create an immunity trait against an infectious pathogen creates prospects that could combat and completely get rid of the dilemma surrounding vaccination and could quickly eliminate the need for vaccination procedures in children at least. The potential for gene-editing technologies could have significant long-term benefits, including reducing yearly costs and expenses of developing vaccines and decreasing the burden of distribution to the public on an extensive worldwide scale, especially in developing and third-world countries.

Although the use of gene editing is still under research and cannot yet be implemented on humans, it has shown great results on animals. However, gene editing has been used to develop disease-resistant animals that could lead to disease-resistant livestock populations. For example, Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) is a viral disease that caused significant economic losses in the swine industry worldwide (Whitworth & Prather, 2017). Navarro-Serna et al. (2020) explain that PRRSV results in a financial loss for producers in Europe and North America, losses are estimated to be up to 6,000,000$ per day as the virus is still able to elude the vaccine. To address this issue, a study by Burkard et al. (2017) was conducted in which genome editing using the CRISPR/Cas9 tool was used to specifically delete the segment of the gene that was responsible for a specific domain to which the PRRSV virus would bind and affect the swine livestock. The study demonstrated successful deletion of the targeted segment of the gene without compromising the normal biological functions of pigs. The results and positive outcomes of the genetic engineering of embryos justify the need for further development and research in more feasible and effective techniques.

Physical and Cognitive Traits

Genetic engineering provides a chance for individuals to enhance their inherited traits. More specifically, Genetic engineering has the potential to overcome the inherent limitations of individuals' genetic makeup, allowing them to access their full capabilities. These benefits could include enhancing physical and cognitive traits such as strength, endurance, general physique, flexibility, memory, problem-solving as well as the ability to comprehend complex ideas along. While experience and deliberate training can improve physical and cognitive traits to some extent, there are limits determined by the genetic makeup of the individual. Some individuals may reach this limit before others and not be able to maximize and benefit from their potential fully. Therefore, variations in intelligence and cognitive abilities between individuals are highly influenced by genetics. Bouchard & McGue (2002) argues that it is estimated that genetics influence 30% to 80% of cognitive abilities and intelligence, with the remaining percentage being based on environmental factors and experiences.

Two genes associated with intellectual ability and cognition are the COMT and CHRM2 genes. According to Dickinson and Elvevåg (2009), the COMT gene is associated with dopamine regulation in the prefrontal cortex, which is responsible for controlling working memory, attention, and decision-making in the brain. The study has shown a specific variation (Val158Met) that has been associated with improvement in these cognitive functions. Similarly, Gosso et al. (2007) discussed specific variations (rs2061174 and rs324650) of the CHRM2 gene that were strongly associated with enhanced cognitive and intellectual abilities. Therefore, with the use of gene editing tools such as CRISPR/Cas9 to increase the expression of specific variants of genes, the prospect for generations with higher average IQ and decreased risk of mental and cognitive-related disorders becomes feasible and achievable.

Regarding physical abilities, the MSTN gene encodes the protein that inhibits muscle growth. Ginevičienė et al. (2021) illustrate how variants of the MSTN, which is also known as Hercules's gene, showed increased skeletal muscle mass and low body fat percentages that have been reported in a canoe rowing athlete in the study. Improved skeletal muscle mass would marginally improve physical capabilities such as strength and endurance, promoting better overall health and quality of life. Moreover, lower body fat percentages could reduce the risk of heart-related diseases and Type 2 diabetes, leading to better mental health. These benefits can be achieved via gene editing tools on embryos, improving the human race and allowing future generations to prosper and live healthier lives mentally and physically.

Arguments Against Designer Babies

Some critics hold the perspective that designer babies are damaging. For example, some argue that genetic engineering research can be unethical. Additionally, many argue that the accessibility to designer babies may worsen existing socioeconomic inequalities. Some also argue that the use of designer genetic engineering could have negative effects on the human gene pool. Although these concerns have some validity, I show that these concerns are based on unfounded assumptions.

Designer Babies are Unethical

Some people may argue that research on human embryos is considered unethical. For instance, critics may argue the practice of destructive embryonic experimentation in order to advance scientific knowledge regarding designer babies should be prohibited. This argument is formed on the basis that viable embryos have the same moral status as humans, as embryo structures have the potential to develop into a human fetus and mature human being. However, Douglas and Savulescu (2009) explain it is morally acceptable to create embryos explicitly for research purposes as long as the consent of the parents is taken. The authors also posit that embryo research has the potential to help in the development of life-saving therapies, reducing suffering and pain, and allowing parents to achieve their reproduction goals. In addition, according to a review by Munsie and Gyngell (2018), all research on germline modification has been limited to the early stages of embryo development. The review further highlights the concern by discussing studies on GGE that use non-viable IVF embryos that were deemed unsuitable for infertility treatment as they had no chance of resulting in a live birth. For example, triploid embryos, which are embryos that have an extra set of chromosomes, were used by researchers to correct common β-thalassemia mutation (Munsie & Gyngell, 2018). Although the study identified a high rate of off-target mutation, these experiments did not possess any morally significant harm.

Other critics may argue that if designer babies become widely accessible, it could create a socio-economic division between the wealthy and the poor. The average delivery cost of a healthy IVF-PGD baby is around $57,000 (Tur-Kaspa et. al, 2010). The high cost makes it inaccessible for many, further widening the gap since poor people already face other social disadvantages. Critics believe that wealthy people may have children with desirable traits such as creativity and physical excellence, making genetic enhancement only available to a certain class of people. This issue makes those who cannot have access to technology are more prone to diseases. However, Gyngell et. all (2016) argues that many medical technologies such as plastic surgeries can be used for both therapeutic and enhancement purposes, and regulatory tools can be applied to limit the enhancement uses. The author shows that laws can be used to limit enhancements to an extent where the benefits of therapeutic applications outweigh the moral costs of enhancing uses.

Affecting the Gene Pool

Another common argument is that designer babies could be responsible for damaging the human gene pool. Critics claim that designer babies would reduce the variation of genes in the pool, thus negatively affecting the human population by making humans more prone to diseases. Furthermore, critics speculated that natural selection is akin to a master engineer that creates an optimal match between organisms and their environment. That is, the traits in the current gene pool are optimal, and therefore it cannot be improved by intentional genetic modification, and also indicates that any intervention in the genetic makeup of humans by various genetic technologies would only result in worsening the gene pool. Powell and Buchanan (2011) explain that intentional genetic engineering is more reliable, versatile, and efficient than natural selection. The authors show that intentional genetic modification (IGM) has the potential to overcome many of these natural obscures. The author discussed that the human population had to sustain enormous death from smallpox to achieve resistance to it, showing that beneficial mutations could take a long period to develop without human intervention.

Other critics argue that the advancement of genetic engineering could lead to a new form of eugenics. Eugenics is a set of beliefs and practices revolving around the concept of selecting desirable hereditary in order to improve future generations (Wilson, 2023). These practices lead to undesirable genetic traits in the gene pool being eradicated. However, the concept of eugenics has been condemned because of its association with the racial policies of the Nazis in the 1930s. Kevles (1999) discusses how the Nazi regime’s implementation of eugenics policies, such as forced sterilization, euthanasia programs, and genocide of millions of people, were used against marginalized groups such as the Jews during the Holocaust. Furthermore, the author highlights the Nazi policy of identifying German citizens, who deemed physically or mentally unfit that often were systematically killed. As a result, eugenics lost much of its credibility as a scientific movement.

As such, the unethical practices associated with classic eugenics, many critics argue that designer babies would lead to the past eugenics practices. That is, critics claim that designer babies align with the deeming of undesirable traits that would lead to discrimination and marginalization of certain societal groups. Nevertheless, Suter (2007) contends that the concept of designer babies is not parallel with eugenics and equating them to each other is a misconception. According to the author, eugenic efforts in the past were marked by coercion, such as compulsory sterilization that was practiced in the United States and Germany. By contrast, genetic technologies are not forced by the state; instead, the choice is solely individual. In addition, the author also argues that eugenics has been associated with racist discriminatory practices, including racial and biased views about certain ethnic or racial groups based on flawed ideas about genetic traits. The author further highlights that today's practice of genetic engineering of humans is not based on racial or discriminatory grounds. As such, the author shows that humans share approximately 99.9% of their genetic makeup, regardless of ethnic or racial background. Therefore, the practice of genetic engineering should be distinguished from the historical association of eugenics with racist and coercive practices.

Human Freedom

Many critics argue that genetic modification interferes with the modified person's free choices. Parents will be able to control their children's future as a result of controlling their genes. However, the assertion claimed is not supported by scientific evidence, since it neglects the environmental and developmental factors. Resnik and Vorharus (2006) discuss the claim that genes strongly determine the development of a particular trait as a false assumption of psychological determinism. The study shows that even if an individual has been genetically modified to possess a specific trait, such as musical ability, the individual still has the freedom to choose whether to pursue it fully or not. Therefore, genetic makeup is only one factor along with many others in determining the behavior and life choices of an individual.

In addition to the argument of free choice, critics claim that parental choices made before birth violate the child's right to an open future. According to critics, genetic modification narrows the paths available to a modified individual. However, Resnik and Vorharus (2006) argue that "in the absence of a strong causal link between genotype and phenotype, genetic modification might not close off any options for the child" (p.6). Authors also discuss that modified genes determinative for a specific trait may not always be expressed, given the trait's complexity.

Conclusion

There is a plethora of conflicting opinions when it comes to the ethical implications and societal impact of designer babies. Some people advocate for the potential benefits in eradicating genetic diseases, while others express concerns about playing with nature and creating a divide between genetically enhanced individuals and the rest of society. In this paper, I argued that designer babies made through genetic editing technologies would be beneficial to society. For instance, I argued that designer babies have the potential to eliminate genetic diseases and disorders by selectively modifying genes associated with these conditions. Another way in which designer babies are beneficial is by offering the opportunity to enhance the individual's immune system. In addition, I argued that designer babies offer the potential to enhance inherited traits, particularly cognitive abilities that could lead to advancements in intelligence.

Despite the many hopes placed on genetic engineering, it still faces several challenges from critics and misinformed members of the public. One such challenge is that critics express concerns about the ethical implications of manipulating the genetic makeup of humans. However, non-viable embryos, which are not destined for implantation, are the primary source of genetic experimentation and research. Some also argue that genetic modification of embryos could affect the natural variation of the gene pool. Although this claim emphasizes the natural diversity that has evolved over the years, research shows that intentional genetic engineering has the potential to overcome many of the limitations of natural selection. Meanwhile, others raise concerns about the limitation of human freedom of choice. Again however, research showed that genetic modification does not determine an individual's life choices since genes do not act in isolation in determining various aspects of an individual's phenotype.

Although the implementation of genetic engineering in humans will no doubt continue to face challenges, we should acknowledge the potential benefits that the technology can provide. Scientific progress and research can address many of the challenges that are faced by designer babies. For example, continued research can help in overcoming technical limitations, enhance safety, and enhance the efficiency of genetic engineering techniques. Critics have concerns about the regulation of genetic engineering since the technology can be easily misused by various parties. Thus, in order to benefit human beings and future generations, efforts from governments alongside scientists and bioethicists are necessary to shape the current frameworks and regulatory laws to normalize the concept of designer babies.

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