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Unnecessary Use of CRISPR in Medical Situations: Effects on Ethics, the Future, and the Environment

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AUTHOR BIO

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ABSTRACT

Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) has recently been used in situations that are considered unnecessary or not immediately life-threatening. An example of this situation are CRISPR babies, which have caused a great deal of discussion and uncertainty around this technology. This development puts the public at risk of data and statistics that have not been fully developed or researched despite many experts' urgency on making such technology widespread. This phenomenon may also bring the possibility of overpopulation as a result of a great increase in the quality of life.

Keywords: Cellular and Molecular Biology, Genetics, Genetics and Molecular Biology of Disease, CRISPR, CRISPR babies, Evolution, Gene Editing, Quality of Life.

INTRODUCTION

Evolution is an essential part of human and animal species as a means to survive and prosper. Humans, however, have grown to evolve much faster with the use of tools such as "clustered regularly interspaced short palindromic repeats", more commonly known as CRISPR. CRISPR is a tool in genetic engineering that allows researchers and doctors to edit the genes of humans as well as animals and plants. This technology essentially copies pieces of RNA into a protein called CAS9 that cuts up the viral DNA of a bacteria's immune system (*CRISPR and the Future of Human Evolution*, 2017). Such revolutionary technology allows for the possibility of cutting out diseases like HIV and cancer cells, however using this on not immediately life-threatening diseases seems unnecessarily risky as they have other effective treatments. With the large unknowns of the side effects on health and the world, CRISPR's use in medical situations that do not find it immediately necessary should not currently become widespread.

Ethical Considerations

With the rise in gene-editing, such things as CRISPR babies have come to light. These children are called this because researchers have begun "changing the DNA of embryos before a baby is born in order to greatly reduce the baby's risk of developing serious diseases or health conditions over their lifetime." (Marx, 2021) Though these diseases often have other treatable options later in life, many parents have begun opting into changing it down to the DNA as this also limits the hereditary disease from being passed down through generations. In a peer reviewed journal published by Nature Publishing Group in 2021, this use of CRISPR is stated as first beginning in a lab at Southern University in Shenzhen, China where He Jiankui conducted an experiment on two babies who were born with genomes that were edited using CRISPR (Marx, 2021). This caused an uproar of conversations around the ethical implications of the experiments as there was little supervision of the experiment leading to his eventual arrest for 'illegal medical practice'.

However, there were other possible drawbacks that will only be possibly seen as these babies grow up. Such drawbacks scientists have predicted are the possibility of these changes causing off-target edits in an intergenic region of chromosome 1 that has already begun in one girl's genome (Marx, 2021). The impact on real children with such new and largely unknown technology – namely CRISPR – when there is current treatment with more known data, brings to question the ethics of its potential drawbacks as well as changing a course of life for a family's generations through gene-editing. However, the current outdated scheme for biotechnology and regulations makes it difficult for scientists to undertake experiments to learn more about CRISPR babies. In *The Meditations of the Emperor Marcus Aurelius Antoninus, Book IV*, one of the rules to follow was "34. Willingly resign yourself to Clotho, permitting her to spin thread of what yarn she may" (Chrystal, 1902). This refers to Clotho who was a mythological figure that spun the thread of life that essentially controlled people's lives from when their "thread" was drawn and to when it was cut. Marcus Aurelius, a roman emperor who wrote a series of writings to himself and ideas on Stoic philosophy called *Meditations*, encourages people to go with life as destined without interference because fate should determine the end result. Particularly, regarding the consent of the life with which a baby would not be able to give. In a survey provided by the Pew Research Center, they found that those with high religious commitment most likely have concern about the "potential widespread use of gene editing to reduce a baby's health risk" likely because of the commonly held belief that the fate given to them

should be held and followed closely. In the same article, they found that 48-53% of U.S. adults would find CRISPR more acceptable if done only to adults who could give consent, since they could choose which diseases and conditions are affected, and if the effects were not passed on to later generations. Genetics finding the latter to address a major concern about these changes being hereditary and affecting the societal and ethical implications of using gene editing on babies (Rainie et. al., 2022). These many concerns about the widespread or small-scale use of gene editing on babies show the unpreparedness of society and the science community for such a large step in evolution.

Environmental Consequences

The possibility of such technology becoming widespread would also have a large effect on how the environment changes and the evolution of humans and animals. Because CRISPR would largely eliminate the possibility of hereditary diseases, the population would grow as people begin to live longer and with a better quality of life as well. In an article written by *Knowable Magazine's* E. Bender, animal evolution is described as having been heavily influenced by the growth of urban environments that caused urban animals to adapt. Such as "that urban Daphnia have significantly higher concentrations than rural water fleas of total body fat, proteins and sugars, trait changes that are associated with handling stresses such as heat as well as with faster life cycles." (Bender, 2022). This discovery shows how cities have become hotspots for evolution. As such environments have become fast-growing, they contain more than half of the world's people. With this increase, "'A city changes an environment dramatically. It creates a completely novel ecosystem,' says Marc Johnson, an evolutionary ecologist at the University of Toronto Mississauga." (Bender, 2022). These changes to the planet have been a result of increasing populations across the world as in many places life expectancy and quality of life increase from their innovations in technology like the innovations in CRISPR that would have the same effect. Such significant factors affecting the environment have caused "things like higher temperatures, pollution and habitats fragmented by buildings and roads." (Bender, 2022). This difference is easily seen when looking at the two sides of evolution: "On one side, most of nature with natural selection and random mutation, holding a whole planet worth of diverse spaces. On the other side is us, a single species with tools that could match or maybe exceed, the speed and power of evolution as we know it." (*CRISPR and the Future of Human Evolution,* 2017). With such speed of evolution, the world would expect CRISPR to cause overpopulation with plants and animals simply attempting to catch up without the same tools' humans have.

As species are currently attempting to adapt to our evolving population, CRISPR's widespread use would significantly speed up this process, likely leading any other species in the dust and the world struggling to maintain. With the philosophy that "this Universe as one living being, with one material substance and one spirit.... how all things are concurrent causes of all others; and how all things are connected and intertwined." (Chrystal, 1902), Aurelius notes that the universe and Earth is one whole that feels the effects and causes of all things connected and intertwined. This means the actions and innovations of people are one that directly affects how the Earth reacts and the many species caught and intertwined with the human structures and destruction that comes with its growth.

Future Quality of Life

With this said, CRISPR would improve overall quality of life especially through this

breakthrough in health. In 2021, a new revolution in gene-editing that made room for revolutions in hereditary gene-editing occurred that for the first-time doctors had directly injected CRISPR to patients that had diseases or disorders that heavily impeded on their day-to-day life and overall span of life. Patrick Doherty was one of those patients who first experienced this life changing technology that rid his body of bad protein that had given him a disorder called amyloidosis. This disorder had previously caused his body to get shortened breath and would eventually die from it like his father and two others he knew. In a broadcast, Doherty even described how much his life had improved from the previous shortened breath to being able to climb stairs without the typical loss of breath he was used to. Though the long-term effects are still being studied in patients like Doherty this could provide the opportunity to change lives across the world (*He Inherited A Devastating Disease. A CRISPR Gene-Editing Breakthrough Stopped It*., 2021). However, if the use of CRISPR becomes widespread to the public it would likely become exclusive to those who can afford it for instances that are not immediately necessary. This would further the disparity across economic classes as the wealthy would live longer and with a better quality of life, benefiting the most from CRISPR, as opposed to lower classed individuals.

Other uses of CRISPR have been beneficial for detecting diseases prevalent in remote parts of Africa that previously could only be detected in inefficient and costly ways. They began "developing methods to detect and contain the spread of infectious diseases that spread to humans from animals. Many of the existing ways to do so are costly and inaccurate. … [so, researchers] used CRISPR-Cas13a technology (a close relative of CRISPR-Cas9) to detect diseases." (Whang, 2022). This test was able to detect the SARS- CoV-2 virus within weeks of the pandemic showing how this technology could be essential in "pandemic preparedness" and eventually lead to better quality of life though such test that are not immediately necessary as there are other means to test for viruses. Being able to detect highly contagious viruses early would make it quicker for governments to contain the virus and therefore improve the health of their citizens. This, however, comes with a cost. Increasing health will lead to more people but not more land and not more economic benefit as jobs that rely on caring for those ill will be less often needed and necessary despite needing more jobs for that growing population.

CRISPR Discourse

Discussions over the use of CRISPR has the overall public starkly divided between whether they would choose to have gene editing done on their own children with 49% stating they would not and 48% would, but other surveys from the past have found large differences in these views depending on how the genetic modification is used. Though it was also found that if such use was widespread, many, 73%, would feel pressured to get this on their own children emphasizing the dangers of this unnecessary use on the beliefs of individuals (Rainie et. al., 2022). When these discussions were brought to the Expert Panel on Bioethics of the Council for Science, Technology, and Innovation in Japan, they concluded that "clinical usage of gene editing techniques on human embryos that would lead to heritable genetic changes in future generations should not be allowed at this time, owing to safety concerns, as well as other ethical, social, and philosophical issues." (Kato et. al., 2016). Academic Societies in both America and Japan have created a joint statement that proposed to prohibit clinical application of germline editing and urged the government to establish appropriate national guidelines for basic research (Kato et. al., 2016). Therefore, CRISPR

should be used sparingly until more data is found and shown to the public so they can make their own educated decision for their family and self. However, finding this data to make conclusions from becomes difficult with America's current regulations around such research that now seems outdated to the new revolutions of CRISPR for the medical use of humans. Such regulations must be updated and improved to regulate this technology more effectively, through a focus, "on the processes used to create products using CRISPR, rather than the products themselves, with a focus on enabling ethical research using human embryos to maximize the potential benefits of CRISPR." as to give Americans an educated choice about a potentially heavily significant impact on their own or their family's health. Until then, however, this technology should only be provided to the public in situations that find it necessary and/or immediately needed for diseases too severe or untreatable.

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