CRISPR: The Next Big Step?

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Audience Analysis: The target audience of this paper is educated adults with an interest in biology, medicine, and current affairs. The material in the paper is slightly niche, and thus, the audience is slightly narrowed down to those adults who have a particular interest in the advances of biology and biotechnology. It could potentially be further narrowed to readers residing in more developed countries which have access to this kind of technology and research facilities or who could be affected by these advances. The audience also likely applies to those who are in the upper and middle classes, as they are more likely to have access to the paper and the sources that would publish it.

Throughout mankind's existence, our goal has been to understand and take control of the world around us. We have progressed beyond simply understanding the world around us to actually changing and altering our environment and even ourselves. There have been huge leaps in the field of biotechnology, with each new development showing more promise than the previous one. The latest and possibly the most promising advance is the development of CRISPR Cas9 gene editing. CRISPR or Clustered Regularly Interspaced Short Palindromic Repeats is a series of DNA sequences found in the genome of prokaryotic organisms like bacteria, and Cas9 refers to the CRISPR associated protein 9. Here, the CRISPR acts as a marker to indicate where the editing is to take place on the DNA and the Cas9 enzyme makes a cut at the indicated position. More simply, CRISPR gene editing is a method by which the genome of a living organism, that is, all the genetic material present in the cell, can be altered. To alter the genome would be to alter the DNA of the organism, basically giving control over every characteristic of the body, both observable and not. Naturally, this much control over the human body raises multiple ethical dilemmas, such as how much this technology should be used, to what extent we

should be allowed to modify ourselves, and which authority should oversee regulating the prevalence and use of this technology. The best way to do this would be by establishing regulations to be implemented by individual countries governing when CRISPR technology should be utilized, preferably exclusively for therapeutic purposes.

The biggest fear when it comes to the utilization of a technique that makes it incredibly easy to alter gene sequences is the abuse of the power that comes with the almost total control we would have over our DNA. This fear is not a recent one and often brings up reminders of eugenics, particularly the experiments carried out by the Nazi party during World War 2. Eugenics is defined as the set of beliefs and practices that aim to better the genetic quality of the human population. This definition sounds quite harmless. However, eugenics can also be defined as the practice of improving the human race by selectively mating those with desirable characteristics and traits. This has far more dangerous and racist implications. Adolf Hitler popularized eugenics during the Second World War, in his attempt to create a superior Aryan race. He did this by massacring or confining to concentration camps those who did not fit his Aryan ideals and encouraging the union of many couples with Aryan features. Modern day genetic engineering has brought back this fear of eugenics, as it enables the so-called desirable traits to be far more easily produced.

However, much of this fear is groundless. The ability to create a genetically superior race is not fully possible with the technology at our disposal due to the incredible variation of our genes. The variation is caused by ‘crossing over’ during the formation of the gametes that later make up the zygote. Crossing over can be defined as the mutual exchange of genetic information between two chromatids of homologous chromosomes during meiosis or the creation of sex cells (gametes). This phenomenon results in new allelic variations and combinations in the daughter

cells. In other words, the genetic information between two chromatids is exchanged to bring about more variations in the new cell created. This process is the reason there is so much genetic variation in the human population, and why we tend to look so different from our parents. Due to this, even if a few genes were to be altered in an individual, it would not have a lasting impact as the genetic combination would be far too scrambled in the offspring (Kozubek, 2017). Any further individuals produced from the same line would simply show more and more deviation from the expected result. Thus, a race with desired traits could be created, but would not last even a few generations.

Another danger is the potential militarization of this technology. As it enables precise editing of the genes, the CRISPR gene editing technique creates the possibility of creating super-soldiers. The CRISPR technology could be used to shorten the recovery period of the body, increase strength, provide immunity to bioweapons, and provide enhanced vision. It is also possible that PTSD could be caused by a gene, thus making it possible for the CRISPR Cas9 technology to alter it, possibly leading to the elimination of the trauma that soldiers endure after wartime. All of these are extremely beneficial at the surface level but come with moral implications of their own. Creating a human that is superior both physically and mentally is more dangerous than an extremely powerful weapon as these individuals have minds of their own, making them difficult to control. Moreover, the use of such soldiers comes with many ethical issues. A paper published in *Bioethical Inquiry* discusses the primary ways in which this is particularly harmful. The primary concern is the risk that comes along with any research experiment. Though the CRISPR Cas9 technique is effective and quite precise, there is much we do not know about our DNA. The risks would be difficult to assess and could very easily lead to mutations resulting in possibly fatal illnesses. Another factor to consider is the consent of the

soldier. It is undoubtedly wrong to perform experiments on those who do not give consent yet obtaining consent from military personnel is surprisingly difficult. The very structure of the military revolves around the obedience of superiors. The Uniform Code of Military Justice states that it is a crime to disobey an order from a superior commissioned officer. It would be difficult for a soldier who is accustomed to this structure to disagree with what is being told to them (Greene &Master, 2018). They must also fully understand what the procedure is before giving consent, which would be difficult, as many have been deprived of higher learning and might not completely comprehend the risks of such experiments. Therefore, while the CRISPR technology creates the possibility of overcoming major, age-old issues, it also raises some major concerns.

These concerns are extremely valid and cannot be overlooked. In the light of the potential for abuse of this technology, it is important to define where the technology should be used. As in most bioethical debates, what should distinguish when the CRISPR technology is used is a necessity. According to Greene and Master (2018), "The distinction is meant to draw a line between practices that are considered morally permissible (gene editing for therapeutic purposes) versus those that are prohibitory (gene editing for enhancement)." It should only be used in cases of therapy or for medical purposes and not used for enhancement. If there is a genetic defect or an issue with the DNA, it would be permissible to research and use the CRISPR Cas9 technique to fix it. The technology should not be used to enhance or beautify any of the existing normal features. Currently there is no legislation restricting the research of this technology by the Department of Defense, though laws should be implemented completely banning the research and use of CRISPR gene editing techniques in relation to non-therapeutic procedures. To differentiate between what can be classified as therapy and what as enhancement, it is important to only fix something that deviates from the healthy gene sequence. If there is a genetic

abnormality, the use of the technology would have no ethical repercussions and would only do good. However, even this solution comes with potential issues. Some believe that it would create a greater inequality for disabled people as their disability could come to be viewed more as a disease (Greene & Master, 2018). It could also widen the gap between those who can afford gene therapy and those who cannot. Though there is no ideal solution, stricter regulations on its usage would eliminate many of the ethical dilemmas that this extremely powerful technology comes with.

Regulations may be created, but to be effective, must be enforced as well. An article published in the *Georgetown Journal of International Affairs* believes that it would be best to let each individual nation decide how to regulate the use of the gene editing technique within its own borders. This paper suggests that any international ban or restriction would eventually be broken as much of the technology is already easily available. It also points out that any international bans would be symbolic at best as most countries already control the drugs and licenses, meaning that international organizations would have no real control over them. Additionally, any international restrictions or bans would favor richer, more powerful countries, while leaving poorer nations voiceless (Kozubek, 2017). A simple solution is to introduce international guidelines as suggestions for each country, leaving the actual implementation of these guidelines to individual countries.

The use of this technology has far reaching applications, particularly in the medical field and holds far too much promise to be ignored. CRISPR gene editing technology has already been applied to the research of cancer cells and has shown extremely promising results. It also has the potential ability to treat immunodeficiency diseases like AIDS, influenza, malaria, and various heart diseases (McCarthy, 2020). The possible application of this technology goes beyond

superficial alterations to potentially curing diseases that have plagued the human race since the beginning of time. However, currently, this incredible leap in science is being used in laboratories to alter plant and animal cells for various other projects when it could be saving lives. Meanwhile, to not research and further investigate the scope of the CRISPR gene editing technology would be to purposely further much human suffering and pain, simply due to a few ethical qualms that can be easily dealt with. In time, these ethical issues can be addressed and overcome. The fact that the use and development of this technology is in jeopardy is a universal issue that needs to be addressed immediately.

No technology is inherently harmful or immoral; it is the abuse of it which makes it so. The CRISPR Cas9 gene editing technique is no different. It has immense, far-reaching applications in the medical field, and is quite possibly one of the greatest leaps in the domain of biotechnology of the century. However, much of its potential remains undiscovered, as research on this technique has become such a controversial topic. Implementing the right regulations and restrictions could lead to a phenomenal revolution of the way we treat many diseases as well as create possible ways of treating diseases and disorders that have previously had no cure. The way this technology develops will set a precedent for many other forms of bioengineering that have been overlooked due to similar ethical qualms. Thus, with the right initiative, the CRISPR Cas9 gene editing technology could quite possibly be the start of the biggest revolution in the medical field of the 21st century.

Works Cited

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