Uses and ethics of genetic engineering on humans: a debate on treatment vs enhanc...

Mahatma Gandhi once said, “ It is health that is real wealth and not pieces of gold and silver.” Every day, people all around the world are suffering because they are victims of diseases that have plagued us for far too long. Equipped with the innovations of science and technology, we can now cure the lives of people across the globe using new breakthroughs in biology and genetic engineering. Whether one realizes it or not, genetic engineering has existed in a crude form since the dawn of humans. We select mates that we deem attractive and capable of providing healthy and fit offspring, and we selectively breed plants and animals to increase the yield of certain desired traits. In that sense, genetic engineering has always existed in nature, but now science has allowed us to harness its full potential.

Today, the contemporary definition of genetic engineering describes a much more artificial and laboratory-facilitated process than that of natural selection. In 1973, biochemists Stanley Cohen and Herbert Boyer developed the first technology for DNA recombination using bacteria (Lee 1), which put genetic engineering at the forefront of science and medicine. Recently, the capabilities of genetic engineering have evolved to include human applications, both as a form of treatment and enhancement. Today, people have the option to choose their children’s sex and other physical characteristics, and doctors can utilize genome editing tools to eliminate genetic disorders and diseases before they have any impact on a person’s life. Critics of genetic engineering fear that this technology will be abused as an enhancing agent and take away from the value of human life. Therefore, with the help of adequate dialogue in public forums and proper legislation, genetic engineering should be used only in medicine and not as a way of

enhancing the human race. Applications of genetic engineering in treating HIV/AIDS,

For so many years, we have studied the inheritance of traits and the intricacies of each step involved in that process. In a similar way, discoveries of genetic diseases and disorders have brought about a better understanding of how genetic transmission occurs from one generation to the next—from parents to children. According to geneticists Muntaha et. al, genetic diseases and disorders that afflict humans such as Down's syndrome, cystic fibrosis, Alzheimer's, Huntington's, cardiovascular disease, viral diseases, and cancer can all potentially be cured with the aid of genetic engineering (204). The advent of DNA recombination technology has made gene therapy one of the greatest innovative and effective therapeutic technologies in medicine. By treating these diseases and disorders with genetic engineering therapy, we can improve the lives of all future generations of people across the globe.

For instance, genetic engineering offers the ability to cure humans of one of the most lethal viruses known to humankind—the human immunodeficiency virus (HIV). The traditional treatment for HIV is a lifelong antiviral drug cocktail regimen that must be strictly followed in order to keep the symptoms at bay. Pharmaceutical companies have made great strides in developing different drug treatments to combat the symptoms of the virus, but the disease itself still remains incurable and transmittable.

However, genetic engineering creates the opportunity for developing either a functional cure that will inhibit the virus's reproduction or a sterilizing cure that could possibly completely eliminate it, thus curing the host of the

disease (Wang and Cannon 539). It is to be noted, there have been previous attempts to use genetic engineering on HIV patients by inserting antiviral genetic material directly into infected target cells by using other viruses as vehicles for the genes, but this method lacks documented capability and safety. Nevertheless, with the help of genetic engineering, researchers at the University of Southern California, Los Angeles (UCLA) have found that it is more effective to perform accurate genetic manipulation with only one specific gene site (locus) at a time. Instead of risking the chance of causing collateral harm to nearby healthy cells, doctors can now treat patients one gene at a time. According to Dr. Cathy Wang and Dr. Paula Cannon of UCLA, " The [best] candidate for anti-HIV genome editing is the CCR5 [gene]... disruption of CCR5 to treat HIV has undergone clinical testing and has shown promising safety and potential efficacy" (539). These trials are presenting with promising results that suggest a true cure for HIV is in the near future. There is an enormous amount of potential in pursuing genetic engineering as a treatment and or cure for HIV.

Similarly, genetic engineering can be used to enable our own immune systems to fight back against cancer. Some forms of cancer are largely resistant to conventional therapies such as chemotherapy and radiation, which is a concern for those who are suffering from those forms of the disease. Genetic engineering has reached the point where it can be considered a practical solution to treating these resistant cancers. (Daher and Rezvani 146). These exciting new therapies display a paradigm shift in the treatment of certain cancers and are expected to cause a ripple effect in the field of gene editing.

Moreover, the human body has its own innate immune systems that defend against invading germs. A particular subgroup of the immune system is known as “ natural killer” (NK) cells. As the name suggests, these cells are potent “ killers” of any pathogens or tumor cells that may be present in the body, which has attracted the attention of several researchers who are working in cancer immunotherapy. Recent advances in gene editing technologies have renewed an interest in developing strategies to enhance NK cell activity through genetic engineering. These include approaches to make NK cells stay active longer, home in on tumor sites, have enhanced efficacy against tumors, and be more adept at circumventing the body’s own immunosuppression. Dr. May Daher and Dr. Katayoun Rezvani of the MD Anderson Cancer Center explain that the ideal product for this NK cellular therapy is “ one that is safe, off-the-shelf, universal, and easy to generate in sufficient quantities for clinical use” (150). Over the course of the coming years, more and more breakthrough advancements will be made in the genetic engineering of immune system cells, and with the recent developments in NK cell biology and genetic engineering, it is likely that NK cellular therapy will be integrated into the current arsenal of cancer therapeutics.

Given these applications of genetic engineering, there are still certain ethical and moral dilemmas associated with this technology. The type of genetic engineering that supports my thesis is the type that is only used in the field of medicine, yet there is a growing fear that this technology is going to become a tool that people will use to enhance and modify their offspring for reasons not pertaining to the treatment or prevention of an inherited

disorder, or to aid in facilitating treatment of another condition to make it more responsive to a different treatment. Bioethicist Katarina Lee asserts that genetic engineering as a form of treatment should not be “ controversial” because it is understood to be a way to help sick individuals and prevent further genetic disorders. However, “ genetic engineering as a form of enhancement” raises several ethical questions (1). As human beings, we are continuously enhancing ourselves. People control their diet and exercise to enhance their physical appearance and health. Others may get tattoos or plastic surgery to fulfill individual and societal notions of attractiveness.

It is understood that opponents of genetic engineering fear that people will begin to abuse this technology and use it to effectively design their offspring so that they have a better chance of meeting society’s standards. The most significant concern opposing genetic engineering in humans is the use of abortion. In order to genetically engineer a child, parents must use “ in vitro fertilization” and “ preimplantation genetic diagnosis” (Lee 2). Combined, both of these processes allow prospective parents to decide what traits they want their child to have, as well as screen for and prevent any genetic diseases before impregnating the mother. If parents were given the choice of having a child that is born with Down syndrome or a child that is born healthy, no rational parents would choose their child to be born with a disease. People naturally want their children to be healthy and capable individuals, and society would consider parents negligent if they did not provide their children with the proper medication or nutrition they needed. Abortion becomes an issue when already pregnant parents may realize that

they could potentially engineer a far “ superior” child, and they decide to abort their current pregnancy. Admittedly, this can lead to the promotion of eugenics, which involves artificially controlling the genetic make-up of a population. Some would argue that this violates the fundamental laws of nature, so in order to prevent the advancement of eugenics mentalities, society needs to bridge the gap between public knowledge and the realm of scientific innovation.

Granted, creating an open dialogue between the public and scientists can be difficult, it is not impossible. With regards to genetic engineering, there have been several conferences dating back to the 1970s where scientists have attempted to engage with the public, but what the presenting scientists failed to do was address many of the concerns of the actual public (Hogan 218). Instead, they only debated issues that were already known to the scientific community. This dismissal of the public’s interests is part of the reason why many of the aforementioned ethical and moral issues of genetic engineering exist today. In 2015, the International Summit on Human Gene Editing was held in Washington, D. C., learning from prior conferences, the scientists did a better job of communicating with the public (219). When the scientific community addresses the public’s concerns through legitimate two-way open-dialogue channels, then it becomes possible for the public and researchers to come to a consensus. In order to maintain public interest, any advancements or applications of genetic engineering need to be discussed with the public in regular seminars, conferences, media programs, workshops, and other public platforms (Muntaha 207). Then, regulatory bodies within the government can gather all the information they need from

those meetings to construct legislation regarding genetic engineering and its applications. Perhaps developing international protocols will also prove useful in regulating this technology and minimizing any potential malpractice.

Genetic engineering, being the complex multifaceted topic that it is, tends to draw attention from a variety of different beliefs and theories. There are many hypothetical applications of genetic engineering. Some may save the lives of thousands of people, while others lead to ethical complications. This innovative technology will inevitably lead to the curing of deadly diseases and viruses. Knowing that several thousands of people are suffering in this world from genetic diseases and viruses, and knowing that genetic engineering will provide the tools to help them, society needs to openly welcome genetic engineering on humans. This technology will insure that no one else will ever have to suffer from an inherited disease or devastating virus ever again.

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