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### Ethical Debate of Gene Editing on Embryos (Third Place)

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### Ethical Debate of Gene Editing on Embryos

If you were to change what's "wrong" with your child, are you really loving them for who they are? A designer baby is when someone genetically alters the DNA of an embryo in vitro, meaning outside of a human in something like a test tube, to select certain "desirable" traits and remove "undesirable" traits like predisposition for certain diseases (Ly). According to the scholarly journal by Marcus Schultz-Bergin, CRISPR stands for "clustered regularly interspaced short palindromic repeats" and first started to come into the public eye in 2012 (220). Mary Shelley's *Frankenstein* is closely related to this issue of gene editing embryos because in the novel, Dr. Victor Frankenstein uses biotechnology and modern science to use corpses of humans and animals to bring life to a monster. *Frankenstein* has many modern applications related to gene editing because it forces the reader to ask the questions, "What if science goes too far? What happens if we build something we don't understand and can't control? Are there certain roads in science or technology that we just shouldn't go down?" (Haydon). Victor Frankenstein creates life in the novel and tries to make it the "perfect human", but when it ends up being a monster, he runs from it in fear of what he did. When scientists try to create these designer babies, they are essentially doing the same thing as Victor of trying to create a "perfect human". The discussion around genetically engineering embryos is extremely important because until recently, this idea of creating a designer baby was completely far-fetched. This all changed, however, with the developments made with CRISPR and gene editing, and now these designer

babies are actual possible. These designer babies and the prospects of creating them bring up many important ethical questions concerning whether or not using the CRISPR technology to alter human embryo's DNA should be allowed or not (Ly). All of the uncertainty surrounding these designer babies and CRISPR technology has actually led to a partial ban on editing the genes of humans being created in early January 2015, but this is only a temporary ban until scientists can figure out how to go about using the technology (Guttinger 1083). As it is now, the CRISPR and gene editing technology involved with creating designer babies should not be allowed because of all the problems, uncertainty, and ethical questions associated with the use of this technology. There are many reasons that these designer babies are wrong, these reasons include: they are unethical, editing one strand of DNA can lead to problems with other genes or with future generations, and the CRISPR technology used in engineering these embryos is unregulated, flawed, and not safe.

First of all, when scientists edit one strand of DNA, other strands or genes can be altered, and these alterations can carry on and affect future generations. In the scholarly article by Stephan Guttinger, it is stated that the CRISPR technology actually allows modification of almost any type of gene from any organism with relative ease, precision, and speed. (Guttinger 1082). Gene editing with CRISPR technology that is currently being used in the world is called somatic gene therapy which is where researchers modify the DNA of a patient in order to treat diseases caused by mutated genes. This somatic editing of genes only affects the patient's genes because it doesn't involve any sperm or egg genes, so this type of editing has no effect on the DNA of future generations. However, this type of editing is not completely full proof because it can cause mutations with other genes in the patient (Bergman). According to the scholarly article by Christopher Lino, one example of this gene editing type causing other mutations is where

“five children [of the 20 patients suffering from SCID X-1] subsequently developed T-cell leukemia” (Lino 1234). This shows that the gene editing that was trying to correct for X-linked severe combined immunodeficiency (SCID X-1) actually ended up causing some of the patients’ genes to mutate and resulted in the development of a deadly cancer. The other, more dangerous, type of gene editing is called germline editing, and this type can not only cause potentially harmful mutations to occur in the patient’s DNA, but also cause the patient to pass these mutations on to future generations (Baylis 489). Mary Bergman, from Harvard University, talks about germline editing by saying it can be more dangerous because it involves genetically editing embryos, and this can completely change the embryo’s DNA, affecting every cell. While, yes, these gene editing techniques might reduce or prevent the risk of the target disease, they can also create potentially more severe off-target side effects, where the target problem is fixed, but multiple other more severe problems are created. In addition to creating other mutated problem genes, these gene editing techniques can also lead to what is called “mosaicism” which is where only some of the target genes are modified by the gene editing (Bergman). These numerous and potentially harmful results of the different types of genome editing with CRISPR technology show that the editing of genes of human embryos should not be allowed.

Next, this gene editing technology should not be allowed because the CRISPR technology has many flaws including the fact that it isn’t proven to be safe and it was actually banned because of the safety hazards. CRISPR technology is significantly safer to use than older technologies, but there are still so many flaws involved that it can’t be considered completely safe to use on humans yet. Stephan Guttinger makes the argument that the reason CRISPR technology cannot be completely considered safe until the problems involving it are sorted out because, “changing the DNA of an organism can not only have beneficial but also serious

negative effects on the development and/or health of the modified individual” (1078). According to the scholarly article by Kim Baumann, before these gene technologies can be considered safe to use on humans, there must be a lot more research done in order to completely prevent the possibility of mosaicism or mutations of off-target cells (591). In addition to these problems, CRISPR technology is loaded with uncertainties of, “whether scientists can actually achieve the DNA manipulations they want... [and] the question of whether a particular manipulation (even if it happens with 100% precision) has the effect on the target organism that it is supposed to have” (Guttinger 1082-1083) Since these CRISPR methods are not currently considered safe, scientists decided to create a temporary and partial ban on using germline gene editing on human embryos in order to allow for more research and further evaluations to be done on the safety and ethical implications of CRISPR. This ban was created as a result of a conference for researchers where they could discuss the ethical issues that surround CRISPR and decide a course of action in order to use the technology in the safest way possible. The ban is considered temporary because it was put in place in order to allow for “the education of... the wider public about the technology and the discussion of ethical, legal, and social issues it raises” (Guttinger 1084). In addition to the ban on CRISPR technology, the government has also taken other precautionary measures in order to stop the unregulated use of gene editing techniques. One of these measures was taken by Congress and it was that they passed a bill that bans government funding for research on gene editing of human embryos (Witkowsky). All of these examples of ways the government have recognized the dangers involved with the unregulated use of gene editing and the measures taken to prevent this help show why this gene editing should not be allowed to take place with the way it is right now.

The final reason gene editing technology is wrong is because ultimately, it is completely unethical. Using CRISPR technology to remove or alter strand of DNA that cause certain diseases raise many questions: what is considered a disease? where do we draw the line for diseases? who gets to decide where this line should be drawn? Obviously, the genes that cause life-threatening illnesses like heart diseases or cancers are genes that most people think should be targeted with CRISPR technology. However, how would this gene editing technology be applied to things like autism, deafness, or certain mental illnesses like OCD, ADHD, anxiety. These “illnesses” have genetic causes so if gene editing CRISPR technology would be allowed to edit these, people basically saying people with these diseases are undesirable and they need to be “fixed” (Bergman). This also bring up the idea that with diseases like autism spectrum disorder or OCD where there can be cases where it doesn’t affect the person very much or is severe, where do people draw the line at what is considered a “problem” (Witkowsky)? Another issue that shows that gene editing is unethical is that this technology is not widely available for all income levels, so would allowing CRISPR to be used by people create a sort of wedge between the poor and the wealthy. The wealthy would, in theory, be able to freely use this designer baby technology to enhance their children and make them smarter, more attractive, better at athletics, etc, and the poor would be further disadvantaged in areas like school and sports. Finally, the ethical question of whether gene editing should be allowed to be used for cosmetic purposes is a major issue. This idea of cosmetic applications of CRISPR has to do with the topic of eugenics which means, “the attempt to direct human heredity and evolution to ensure procreative advantage to more ‘desirable’ human beings and to discourage or limit reproduction by the less desirables” (Friedman 252). Theodore Friedman then goes on to discuss some of the deemed “undesirable” characteristics of humans including, “genetic traits of poverty, criminality, mental

disorders, laziness and homosexuality” which are not diseases but can be altered with gene editing methods. Designing children to be better at sports, school, or picking their cosmetic features, eye color, skin color, hair color, can be seen as trying to remove characteristics that parents deem to be “undesirable” and gives these children an unfair disadvantage over other children. All of these ethical questions addressed help to show why the implications of CRISPR gene editing technology are unethical.

On the other hand, there are many people who are very excited and hopeful about all the benefits CRISPR technology and designer babies can have on society. First of all, there are many benefits that gene editing technology can have, for example this technology can completely eradicate genes that cause diseases that are extremely deadly for humans, like cancers and heart diseases. Gene editing can also prevent these diseases from appearing in the genes of future generations, effectively getting rid of the disease all together (Cribs 629). However, yes, it might be nice to get rid of major diseases, but this can lead to other issues like editing genes causing other genes to mutate, future generations having new deadly diseases due to these abnormal mutations, overpopulation problems, and it raises ethical questions of where the line for what genes should be gotten rid of is drawn at. CRISPR research can be beneficial, but not as it is now with absolutely no regulations, so there need to be lines drawn that prevent people from messing with what nature creates in order to prevent the consequences. Another reason many people support these designer babies is because some people “argue that parents have a right to prenatal autonomy, which grants them the right to decide the fate of their children” (Ly). In addition, many people argue that parents already have control of how their children turn out; for example, if parents want their children to be smarter, they sign them up for tutors, if they want, they to be stronger they sign them up for sports (Ly). This is not entirely true, however, because a child’s

genetics cannot be changed by going to sports practice, so, yes, the child's environment has something to do with how a child matures, but genetics are innate and you cannot change them. Prenatal autonomy is also not completely accurate because parents shouldn't be able to decide what cosmetic features their children have even though it is their child, this is just unnecessary to put the child through all the gene editing for cosmetic reasons.

In conclusion, there are many important reasons these CRISPR gene editing technologies shouldn't be allowed for use on embryos. The first reason being that an edit on one strand of DNA can cause abnormal mutations that could be more harmful on surrounding genes, and these abnormal mutations can carry on and manifest in future generations. Next, CRISPR and Cas-9 technologies are still in their developing stages, so they have been proven to be extremely flawed and unsafe to use on humans yet. Finally, these technologies should not be allowed for human embryos because of all the ethical questions raised from the implications of using them. These ethical questions include things relating to what should count as a disease and where is the line drawn, eugenics, and cosmetic applications. Designer babies and CRISPR relate to Mary Shelley's novel, *Frankenstein*, because it brings up many ethical questions relating to how Victor created his monster and how we should deal with scientific "monsters", like designer babies, in the world today. *Frankenstein* suggests a solution to this problem of science being allowed to do whatever it wants without regulations, and that solution is that people shouldn't mess with what nature creates. Victor tried to mess with nature by bringing life to the creature, and scientists are messing with nature, today, by trying to edit genes that people are born with. When CRISPR technology eventually blows us in the face of the scientists, they need to learn from Victor's mistakes and own up to their actions and try to fix it instead of running away and ignoring the problem like Victor did. The story of *Frankenstein* can be read in modern times as a

precautionary tale, against gene editing, of what happens when people take science too far and all the terrifying consequences associated with it.

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