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Genetic Engineering and its Application to Christianity

A Thesis Submitted

To the Teacher and Students of Advanced Apologetics

By

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Introduction

Within the world of today, particularly within the society of the United States, Christians are frequently faced with not just theological questions, but also the application of this theology to complex ethical questions. This is largely a result of developing sciences and technologies, as many of these questions relate to bioethics; assisted suicide and euthanasia, for example, present difficult questions that are not blatantly answered in the Bible. Genetic engineering, for instance, is a steadily progressing science that is likely to be fully realized in the relative future as the study of human DNA and its various impacts on individuals continues to yield new discoveries. Because such a science is undoubtedly only to continue to develop, Christians have a responsibility to address its implications and determine how it applies to their lives, if it does so at all. The topic raises questions that revolve around sin's effects on the world as well as humankind's purpose and the value of an individual within that world.

This thesis aims to address these questions from a Christian standpoint in relation to the science of genetic engineering. In order to understand the implications of genetic engineering, one must first possess a basic understanding of DNA and its functions within an organism; this thesis begins by providing this foundation, as well as discussing current technologies and their most controversial ethical issues. Because these ethical issues have a tendency to cloud the usefulness of a fully-developed, safe form of genetic engineering, this thesis will seek to provide answers to the aforementioned questions from a futuristic standpoint in which a full understanding of genetic engineering has been reached, allowing for its safe practice within the DNA of humans, unborn and born alike.

Following this information, a basic theological breakdown of humankind as God's earthly ambassadors tasked with maintaining the order of his creation will be explained and

supported using biblical text. Throughout the remainder of this thesis, this theology will be applied to three main types of genetic engineering: genetic engineering in life-threatening situations, genetic engineering in non-life-threatening medical situations, and genetic engineering for the purpose of aesthetics, complete with hypothetical examples. Because the manipulation human DNA is obviously not a topic discussed in the Bible, this thesis will seek to produce a set of criteria applicable to these hypothetical examples and any future situations that may arise.

Research Note

Because the majority of authors that address this topic condemn genetic engineering for its ethically questionable research, few sources provide relevant information that can be cited within this thesis; however, these sources did aid in the development of the criteria produced as a result of this thesis. For this reason, the bibliography found at the end of this thesis contains both a *Works Cited* and a *Works Consulted* section in an effort to distinguished texts quoted within this thesis and text used to further background research.

Textual Note

All verses used within this thesis are found in the English Standard Version (ESV) of the Bible.

Genetic Science

The Beginnings of Genetic Studies

In order to assume the mastery of genetic engineering for the purpose of this argument, one must first have a basic understanding of where the science of genetic engineering originated and how the human genome works. Long before genetic engineering was even a thought in the minds of scientists, Gregor Mendel conducted an experiment that provided the foundation for all genetic science. Until Mendel, the commonly held belief was simply that the traits of parents blended to create the traits of the child, a hypothesis known as the "blended" hypothesis.[1] The concept essentially equated genetics to the mixing of paint; if blue and red are mixed, the resulting color will be purple. This hypothesis, however, is easily disproven. If a dark-haired couple has a child, that resulting child will not necessarily have a mixture of the two dark shades; the child could be blonde. There must therefore be other factors in the inheritance of traits, and Mendel, an Augustinian monk, set out to find evidence to support this "particulate" hypothesis, conducting his famous pea plant experiment. By controlling the breeding of two pea plants with different characteristics, Mendel was able to discover two of the most basic laws of genetics: the law of segregation and the law of independent assortment.[2]

Mendel's experiment isolated certain characteristics of pea plants and used offspring of these plants to determine where those characteristics originated; in selecting these characteristics, he chose only those with two distinct variations. For example, Mendel used pea plants with both purple and white flowers but took special care not to include any plants with a third flower variety.[3] He also took special care to use only lines of plants that were "true-breeding," meaning

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[1] Reece, Jane B., Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, and Robert B. Jackson. Campbell Biology. Ninth ed. San Francisco, California: Pearson Benjamin Cummings, 2011. 262.

[2] Ibid., 263.

[3] Ibid.

the plant he used was the descendant of plants that, for several generations, possessed one of the two distinct options for the characteristic he was observing. This guaranteed an experiment in which Mendel could accurately assume the nature of the plants' alleles. He controlled the breeding of the plants by removing the stamens, or pollen-producing organs, from one plant and transferring pollen from a separate plant onto the altered plant's carpel, or egg-bearing organ, causing the usually self-fertilizing pea plants to exchange DNA in a manner that allowed Mendel to be certain of the origin of that DNA.[4] The first generation of pea plants that followed yielded an interesting assortment (or lack thereof) of flowers; they were all purple. This had to mean, Mendel concluded, that whatever was causing the flowers to be purple was dominant over whatever had caused one of the parent flowers to be white,[5] a conclusion that found further support in the next generation of flowers, as about 75% were purple and 25% were white.[6] Once again, the number of purple flowers was much higher than that of white flowers, but the production of white flowers led Mendel to conclude that though the cause of the purple flowers was dominant, it did not eradicate the cause of the white flowers; the two had to coexist alongside each other.

Mendel repeated this breeding experiment several times, focusing on different characteristics in each instance, but no matter whether he was breeding plants with long stems against those with short stems or plants with green pods against those with yellow ones, he encountered this same 3:1 ratio in the second generation of offspring.[7] Mendel's conclusions can

[4] Ibid.
[5] Ibid., 264.
[6] Ibid.
[7] Ibid.

be summarized in four concepts, the fourth of which is the law of segregation. The concepts are as follows:

1. "Alternative versions of genes account for variations in inherited characters."[8]
2. "For each character, an organism inherits two copies of a gene, one from each parent."[9]
3. "If the two alleles at a locus differ, then one, the dominant allele, determines the organism's appearance; the other, the recessive allele, has no noticeable effect on the organism's appearance."[10]
4. "The two alleles for a heritable character segregate (separate from each other) during gamete formation and end up in different gametes."[11]

The first of these characteristics establishes the difference between dominant and recessive alleles. The former, if possessed by an organism, is the trait expressed by the gene; the latter is the allele that will remain dormant unless both inherited alleles are recessive. In terms of the color analogy, if blue is the dominant allele and red the recessive, the resulting color would not be purple, but an expressed blue with a "hidden" red, a finding that directly disproves the "blending" hypothesis. The second characteristic simply states that an organism will obtain two genes for each characteristic, one from each parent; the third follows with the conclusion that the organism expresses only one of these two genes. Lastly, the law of segregation provides support for the second characteristic by stating that during reproduction, the two alleles split, causing the resulting gamete to contain only half of the parent's DNA.

[8] Ibid., 265.
[9] Ibid.
[10] Ibid.
[11] Ibid.

Mendel's other major conclusion, known as the law of independent assortment, states that "each pair of alleles segregates independently of each other pair of alleles during gamete formation."[12] This conclusion simply explains that individual traits have no bearing on other individual traits when the alleles separate into gametes.[13]

Autosomal Recessive vs. Autosomal Dominant Conditions

One of the main modern applications of Mendel's research in today's medical world is the study of autosomal recessive and autosomal dominant conditions. The former are conditions characterized by the presence of a certain recessive allele; Cystic fibrosis (CF), for example, is an autosomal recessive disorder. In order to be a carrier, an individual must have either one or two of the recessive alleles that cause CF. If only one is present, then that individual will be a "healthy carrier," meaning that while they have the ability to pass on the disease to their children, it does not affect them in any way, but if an individual has two recessive alleles, that person will be an "affected carrier."[14] Affected carriers are guaranteed to pass the disorder onto to their children, making them either a healthy carrier or an affected one, and the individual themselves will be affected by that disorder. If an individual has two dominant alleles, meaning they lack the recessive allele responsible for carrying cystic fibrosis, they will possess no trace of the disorder at all and therefore can neither pass it on nor be affected. Take, for instance, a couple comprised of a non-carrier father (AA) and an affected carrier mother (aa).

[12] Ibid., 267.
[13] While this holds true for alleles located on separate chromosomes, modern science has proven that alleles located near each other on the same chromosome will have an effect on others.
[14] Ibid.

		Affected Partner	
		a	a
Non-carrier Partner	A	Aa	Aa
	A	Aa	Aa

When these allele combinations are cross, the resulting combination of alleles will yield four possible results, but in this case, each result is identical—Aa-- because the father only possesses non-carrier DNA, and this must be imparted onto each possible offspring. Because CF is an autosomal recessive condition, the couple has a 0% chance of having an affected child; however, because the mother is an affected carrier, they have a 100% chance of having a healthy carrier child. Now consider a couple comprised of two healthy carriers (Aa).

		Healthy Carrier	
		A	a
Healthy Carrier	A	AA	Aa
	a	Aa	aa

This combination of the DNA of these individuals yields three possible results: a healthy non-carrier child (AA), a healthy carrier child (Aa), and an affected child (aa). Because it requires both alleles to be recessive to have an affected child, there is only a 25% chance, but this couple has a 50% chance of having a healthy carrier child and a 25% chance of having a non-carrier child.

Above, it is mentioned that autosomal recessive conditions require two recessive alleles in order for an individual to be affected; autosomal dominant conditions are the exact opposite, and the presence of any dominant allele responsible for a disorder will cause its presence in the resulting child. Where there are healthy carriers for autosomal recessive conditions, there are none for autosomal dominant conditions. Take, for example, Huntington's disease in an instance where an unaffected mother-- who *must* be aa-- has a child with an affected father, meaning the father *must* be either AA or Aa in order to be an affected carrier. For this example, he will be AA.

		Non-carrier Partner	
		a	a
Affected	A	Aa	Aa
Carrier	A	Aa	Aa

This couple has a 100% chance of having an affected child because each resulting combination is Aa, meaning there is no combination possible in which the child does not possess the dominant

allele responsible for Huntington's disease. Consider the same example of an unaffected (aa) mother and an affected father, who this time is not AA but Aa instead.

		Non-carrier Partner	
		a	a
Affected Partner	A	Aa	Aa
	a	aa	aa

Where before each of the four resulting allele combinations were Aa, this combination of parent DNA yields two different possible combinations-- Aa and aa-- meaning that this couple has a 50% chance of having an affected child (Aa) and a 50% chance of having an entirely healthy child (aa).

While these Punnett squares are helpful in predicting the likelihood of a child to have a disorder, numerous factors come into play, as these disorders are not, like the traits Mendel studied, independent characteristics. Several factors contribute to the expression of a disorder, so a more thorough genetic study is required to determine whether a disorder is truly present, and while there are different forms of genetic testing in existence today, such as prenatal testing, they are not anywhere close to 100% accurate. They are, however, useful in determining certain factors that are not otherwise discernble to the naked eye. For example, these prenatal tests can detect the presence of disorders not obviously inherited from the parents; recessive conditions, as

demonstrated above, can occur in a child whose parents are both healthy carriers. These parents will show no sign of carrying the condition, making genetic screening the only way to determine (before birth) whether their child will carry the condition in question. These genetic tests, even when accurate, still only provide the knowledge of a condition's presence, not a cure for the condition itself, and that is only if the test is actually accurate. While today's genetic screening helpful in certain circumstances, it cannot accurately test for all disorders or defects possibly found in a child; because so many disorders exist, many do not have tests designed to detect their presence.

Genetic Engineering and its Assumed Mastery

Today's genetic engineering, like genetic testing, is not close to perfect either; while the concept has been around for decades, the science has yet to catch up to the thought process. Technology is just now developing to allow for the successful alteration of an organism's genome, such as CRISPR (clustered regularly interspaced short palindromic repeats), a technique that effectively allows scientists to edit a genome in a matter of hours as opposed to a matter of days, was developed in 2013 and has been proven to work.[15] Since CRISPR's development, further studies have been conducted in an effort to test the viability of genome modification on the human species specifically. However, these experiments raise a major ethical issue as they were conducted on fertilized human embryos, but the non-viable embryos were, for lack of a better word, tossed out. This process occurs even outside of research today during IVF (in vitro fertilization), an incredibly expensive process used in cases of infertility that involves the removal of several eggs from the ovary of a woman and the combination of these eggs with

[15] Ibid.

sperm outside of her body, producing a successfully fertilized embryo before implanting that embryo back into the woman. While the actual process of IVF does not appear to most individuals to be unethical, the fertilized embryos undergo pre-implantation screening, otherwise known as pre-implantation genetic diagnosis, that allows doctors to implant only those embryos that are healthy and likely to result in a healthy baby. However, the embryos that fail to pass this pre-implantation genetic diagnosis are discarded, as they are diagnosed with some form of genetic disorder or may even cause complications during pregnancy that could be harmful to the mother. In addition to testing for the purpose of diagnosing genetic disorders, this preimplantation genetic diagnosis can also determine the sex of the embryo, creating the possibility for parents to have a choice as to what gender they choose to implant and what gender they choose to discard. While this method seems more humane than terminating a pregnancy after prenatal testing has yielded undesirable test results, it still prompts numerous ethical issues. This same process of fertilizing eggs outside of a woman's body produces the fertilized embryos also used in stem cell research; as with IVF, fertilized embryos used in genetic engineering are destroyed if they prove to be useless to researchers or if an experiment fails, raising many issues with this science that is currently employed in the study of genetic engineering. In both the cases of IVF and stem cell research, whatever embryos deemed unsuitable or unusable are discarded, raising numerous ethical questions that would require an entire separate thesis-- or several-- to address in their entirety.

It presents issues centered around the value of human life and when life begins, which are such major issues that massive numbers of individuals discount the usefulness of the medical benefits and scientific discoveries that occur through these methods, leading to the quick condemnation of genetic engineering. Because the focus of this thesis is the application of

genetic engineering to Christian life, not the Christian view of these controversial procedures, for the remainder of this thesis, the mastery of genetic engineering is to be assumed. This, of course, does not discount the techniques used to achieve such a mastery of the science, but because this thesis is operating from a futuristic standpoint, there is nothing that can be done about the steps taken to reach that level of expertise. The past cannot be altered, so Christians have a responsibility of deciding whether the resulting science is applicable to their lives in such a way that still reflects their faith. Because of this, the resulting argument presented in this thesis will address genetic science in cases which present no threat to the child in question or to fertilized human embryos, as well as in cases where the genetic screening and subsequent alterations have an almost negligible margin for error. This will allow for the ethics of genetic engineering to be discussed without considering the ethics of today's experiments conducted in order to master genetic engineering.

Humans as God's Ambassadors on Earth

The Dominion of Humankind

There exists a universal question that, according to the majority of the earth's population, has no clear answer: *Why were humans created*? This particular question, however, does not address an equally important question to which an answer can be easily found but is often overlooked: *What were humans created to do?* Regardless of why humans were created as a part of this world, every single one has a common purpose to fulfill that is obvious within the text of the Bible, especially Genesis, to act as God's earthly ambassadors and maintain the order of his kingdom here on earth. Genesis 1:26, according to the ESV, reads, "Then God said, "Let us make man in our image, after our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and over every creeping thing that creeps on the earth." The phrase "after our likeness" originates from a Hebrew word (כִּדְמוּתֵֽנוּ) that literally translates to "similitude," indicating that humankind must be similar to God in some way.[16] The following phrase "let them have dominion," directly translated from the Hebrew (וְיִרְדּוּ), is a verb that reads as "reign."[17] Humans are designed to reign over God's creation on earth, answering to God as their authority; this makes humankind God's ambassadors on earth. The similarity of God and humankind can be derived from this verb; in the same way that God rules over humanity, so will humanity rule over God's creation. The same verb (וְיִרְדּוּ) used in the previous verse is also used in Genesis 1:28: "Be fruitful and multiply and fill the earth and subdue it, and have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth." Once again,

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[16] Strong's Exhaustive Concordance: New American Standard Bible. Updated ed. La Habra: Lockman Foundation, 1995. Accessed March 22, 2011. http://www.biblestudytools.com/concordances/strongs-exhaustive-concordance/.

[17] Ibid.

dominion-- also defined as "control"-- is given to humankind over the rest of creation, establishing humanity's designated power and reign over God's creation.[18] In addition, the Hebrew word (וְכִבְשֻׁהָ) used here for the verb "subdue" means to *forcefully* subdue something and bring it into bondage; this implies that humankind has direct control over creation, and those created creatures *must* fall under humankind's authority.[19] Genesis 2:15 demonstrates how humanity is to use this dominion, as "The Lord God took the man and put him in the garden of Eden to work it and keep it." The Hebrew verb (וּלְשָׁמְרָהּ׃) used for the phrase "and to keep it" has a literal meaning of "to keep, watch, preserve," meaning humankind has the responsibility of preserving, or maintaining, God's creation.[20] Because this creation was initially without sin, this responsibility consisted solely of maintaining the preexisting order of that creation, as no restoration was necessary to achieve such order.

An example of the fulfillment of this duty can be found in Adam's task of naming every living creature found in the garden of Eden. Adam did not create these creatures, and therefore had no authority with which to name them until that power was given to him by whoever did create them: God. Genesis 2:19 states, "Now out of the ground the Lord God had formed every beast of the field and every bird of the heavens and brought them to the man to see what he would call them. And whatever the man called every living creature, that was its name." Here, the verb "call" must be examined in order to further understand the authority that has been given to humankind; the original Hebrew word (יִקְרָא־) used directly translates to not only "to call," but also to "to proclaim."[21] This verb "to proclaim" illustrates humankind's authority, as a proclamation is an official declaration, which is something that cannot be given or issued without

[18] Ibid.
[19] Ibid.
[20] Ibid.
[21] Ibid.

a certain level of authority. In the case of Adam naming the creatures of God's creation, this authority has to have come from God, as nobody other than the creator of those creatures can delegate authority relating to those creatures. In the same way, Adam has no claim to dominion over the living creatures of the world until God bestows that dominion upon humankind in Genesis 1:26 as a part of his earthly purpose. In God's delegation of that power to Adam, humankind is distinguished as an ambassador to God whose purpose is to maintain the order of his creation.

Humankind and the Fall

When the fall of humanity occurred, humans failed in their duty as God's earthly ambassadors, as they disrupted the order of creation as it was found in the garden of Eden, but their intended purpose did not change; they still had the responsibility of maintaining the order of God's creation. In directly disobeying God's command not to eat from the tree, humanity neglected its position as God's subordinates and was consequently punished through its removal from the garden of Eden. Genesis 3:23 says, "therefore the Lord God sent him out from the garden of Eden to work the ground from which he was taken." The phrase "to work," or in some versions of the text, "to cultivate," comes from a Hebrew verb (לַעֲבֹד) that literally means "to serve," and in other verses in the Bible, the same word is translated into English to mean "to labor."[22] Though the English phrase "to work" is used in both Genesis 2:15 and Genesis 3:23, the original Hebrew text carries drastically different implications: humankind no longer possessed the duty of preserving the land; because of their sin, they now had to serve the land in a brutal, laborious way. Because of the Fall, humankind must physically maintain the creation

[22] Ibid.

they were placed over; humanity had to adapt their methods of carrying out their duty as God's earthly ambassadors. Now, the order of the garden of Eden is gone, and there is no way to maintain the order of the sworld if that world is in chaos, as humankind cannot maintain something that is not present. Before Christians can *maintain* the order of God's creation, they must first work to *restore* that creation to what it once was as the world progresses. Because humans are a species prone to failure through sin, this is a task they cannot fulfill on their own; the ultimate restoration was given through Christ's death and resurrection. While the action itself was instantaneous on this earth, all of its effects were not immediately visible, as the world is still trapped in a cycle of sin. Consider man's battle with sin comparable to a war that humanity was unquestionably losing. Christ's intervention acted as a sudden victory in a final battle, effectively ending the war, but not erasing the carnage and pain of the war's aftermath. Humans are the ones responsible for repairing the damage and restoring the world to the order it once knew before this war even began through whatever means present. This restoration can only be achieved through the intentional removal not of sin, as this has already been accomplished by Christ, but the intentional removal of the *effects* of sin.

The Progression of Humankind

This idea of removing the effects of sin coincides with the commands given to Christians by Christ in the New Testament, as these commands are direct instructions to avoid sinful attitudes and actions, such as lust, oaths, retaliation, etc. The Sermon on the Mount for example, found in Matthew 5-7, contains numerous examples of Christ's instructions against these effects of a sinful nature; in obeying these commands and striving to remove sin from one's individual life, Christians are working to remove the results of sin from the world as a whole. Before

modern science began to develop, this removal of sin's effects could only be accomplished through intentional self-betterment and partially-effective medicine, but major illnesses lacked safe, effective cures. As time progresses, more of these necessary cures continue to develop, opening the door for larger, more prominent effects of sin to be removed through medicinal practices that are continually emerging. In today's world, Christians are even able to battle such effects of sin's worldly invasion, such as sickness, before they ever occur through the use of vaccines. This modern medicine provides an avenue for Christians to fulfill their purpose of maintaining order through safe, reliable treatment, such as (for the sake of this thesis) a perfected form of genetic engineering. While the ultimate victory against the disease of sin has been won, these symptoms of sin's presence on earth are still evident and must be gradually overcome to aid in the restoration of humanity. Because of this, assuming the mastery of genetic engineering is realized, the act is justified in life-threatening situations and non-life-threatening situations that require medical attention to reach proper human function and entirely unjustified for aesthetic purposes.

Genetic Engineering in Life-Threatening Situations

A Christian couple walks into an OB-GYN's office in the hopes of learning more about the child they are soon to be having. The results of a DNA scan show that their unborn baby is affected by achondroplasia, an autosomal dominant disorder that is a leading cause of dwarfism and is known for its high mortality rate. Accompanying this horrific news, however, is the possibility of a not only a complete cure-- guaranteed to be of no harm to the child-- but the complete erasure of the disorder from the child's genetics, prohibiting its repetition in all future offspring of that child. As Christians, is the couple permitted to follow through with such a cure? Think, first, of the child's safety and remember that the assumption of the mastery of genetic engineering for this situation, given the procedure's nearly negligible margin for error. It can, of course, be argued that a *nearly* negligible margin for error is, nevertheless, a margin for error and could cause extreme detriment to the unborn child if a mistake is made. Consider, then, the couple's two options: allow the child to be born with achondroplasia (a nearly 100% chance of early death), or remove the achondroplasia altogether (a nearly 100% chance of survival). It is absurd to sentence a child to death because the most effective cure has a barely-there possibility of negative results. Therefore, if the safety of the cure is not the issue, is it the ethics of the cure? Does something about manipulating human DNA to benefit certain individuals unsettle countless others?

Perhaps the negative attitude toward the manipulation of human DNA stems from the negative connotations surrounding such a word as "manipulation." After all, manipulation typically describes the skillful crafting of something *in a way that lacks morality,* as it is done to benefit oneself; however, this ignores the alternate definition of the word that simply means the skillful crafting of something. Here, there is no morality directly connected to the manipulation

itself and leaves the decision of how this manipulation is used to those involved in a particular situation. The choice then falls into the hands of that Christian couple who has just been shocked with the news of their child's likely death if they do not act and their child's survival if they opt for a cure via genetic engineering. If their aim is to save the life of an innocent child, how then can such a decision lack morality or possess their benefit as a primary goal? Logically, it cannot.

Since this cure lacks any major risk and is executed with the correct intentions in mind, consider it then from a specifically Christian perspective. As explained above, Christians have a job on earth to serve as God's ambassadors in restoring and maintaining the order of the world. While God has already defeated sin and death, it is the responsibility of Christians to serve him by removing the effects of sin and death still present in the world through whatever methods presented, such as medicine. If medicine can rid the world of some of the death present, Christians have a moral and ethical obligation to utilize it-- as long as it is safe-- in their own lives, meaning that if the ability to eradicate a life-threatening disorder exists and has little to no risk associated with it, Christians have a responsibility to act upon it. Death is undoubtedly a result of the Fall and sin's subsequent invasion of the world, as demonstrated through Romans 5:12: "Therefore, just as sin came into the world through one man, and death through sin, and so death spread to all men because all sinned." As stated in this verse, death is a direct result of sin; the Hebrew word (Διὰ) translated into the word "through" literally means "because of" or "on account of;" death therefore must fall under the category of chaos and disorder, both of which oppose humankind's task of restoring the order of God's creation.[23] Consequently, Christians have a direct responsibility to rid God's earthly kingdom of as much death as possible, and the

[23] Ibid.

use of genetic engineering to save lives most certainly provides a permanent method of saving a life.

Think once again of the Christian couple at the OBGYN; their child has been diagnosed with achondroplasia, an autosomal dominant disorder, sentencing the unborn baby to a nearly certain death. Even if the child lives long enough to marry and have children of their own, those children have a 50% chance of being affected by the disorder as well, assuming this person reproduces with a completely healthy non-carrier. If the affected dominant allele is safely removed before the couple's baby is ever born, not only is that baby almost guaranteed a chance at life, but the removal of that allele from their DNA would prevent them from passing it on to their potential offspring. This same cure could be instituted in the case of autosomal recessive disorders, as well; if couples take the precautionary measure of having their child genetically tested at some point during pregnancy, it could be determined whether their child will be a healthy carrier of an autosomal recessive disorder, not just affected by one. Through genetic engineering, this autosomal recessive condition could be removed, thus removing the possibility of its presence in future generations. While the recessive disorder would not directly threaten the life of the individual carrying it, it could potentially threaten the life of that individual's descendants, so removing it from their DNA could save countless lives in the time that follows. If genetic engineering were to be utilized in situations such as these, thousands of potential descendants could be safely cured from numerous disorders with just one actual genetic surgery. Through each cure utilized in these life-threatening situations, God's creation is progressively restored to its intended order.

Genetic Engineering in Non-Life-Threatening Medical Situations

There are, no doubt, medical circumstances that exist that could be resolved with the employment of genetic engineering that are not nearly as extreme as life-threatening disorders. As Christians, should these more minor issues be treated with such a controversial procedure? Consider once again the task of humankind to order and thus restore God's creation; if detriments to the human body occurred as a result of sin-- not individual sin, but the presence of sin in the world-- do they not fall under the category of necessary "repairs?" Say, for instance, that a child is going to be born with nearsightedness, a variety of poor vision that allows an individual to see clearly for a short distance but prohibits them from seeing well past that point, and the condition tends to worsen with time. If such a thing can be corrected using genetic engineering so that that child will never need glasses, is that not considered to be an act of restoration?

In order for this to be a restorative action, it must first be established that a condition such as nearsightedness is a physical defect and therefore a direct result of the presence of sin in the world. Though such minor physical detriments are not specifically discussed in the Bible, the overall physical condition and its continual destruction due to sin are discussed by Paul in Romans 8:20-23. Paul writes,

> "For the creation was subjected to futility, not willingly, but because of him who subjected it, in hope that the creation itself will be set free from its bondage to corruption and obtain the freedom of the glory of the children of God. For we know that the whole creation has been groaning together in the pains of childbirth until now. And not only the creation, but we ourselves, who have the firstfruits of the Spirit, groan inwardly as we wait eagerly for adoption as sons, the redemption of our bodies."

As Paul states, humanity is now subjected to the "bondage of corruption" as a direct result of sin's effect on humankind, causing humankind to experience a "futility," or uselessness. It is this

use of the word "corruption" that allows for the classification of physical defects as a result of sin; in the original Greek text, the word used (ματαιότητι) literally translates to "destruction" as well as "decay."[24] Because the word used in the Greek text for "bodies" translates directly to mean "body," it is clear that this decay is a physical decay and destruction of the flesh.[25] This means, without a doubt, that any physical ailment that requires a medical correction of any sort in order to achieve full function must fall under the category of disorder that Christians have a calling to overcome. Nearsightedness, as previously mentioned, is a prime example of such a minor ailment; an individual afflicted with such a detriment must either utilize corrective lenses or undergo corrective surgery in order for their eyesight to be restored to its full function. Therefore, this restoration would be considered a restoration of order.

[24] Ibid.
[25] Ibid.

Genetic Engineering in Aesthetics

Problems of Enhancement

Each time genetic engineering is mentioned, there is one massive, unavoidable hurdle that must somehow be cleared: how far can it go? Some believe genetic engineering should be avoided altogether, but for those who disagree, they must either justify the use of genetic engineering in any and all situations, or they must draw a solid line as to what is too much. As Christians, this line must be drawn in a way that is in accordance with biblical principles, such as humankind's aforementioned role as those who maintain the order of God's creation. If maintaining order adheres to the principle of restoration and not enhancement, then genetic engineering with aesthetic motivations cannot be in line with Christians' job of maintaining God's kingdom here on earth.

In addition, genetic engineering for aesthetic purposes creates numerous problems and countless questions that have no answers except to draw a line of no genetic engineering if it involves aesthetic motivations. For example, what if a couple wishes to change the color of their unborn baby's eyes from brown to blue? If this is done simply out of their own personal preference for blue eyes, there is one main objection that arises: the parents are acting on behalf of the child in a way that, while it does not harm the child, it does not have a guaranteed benefit for them, either. But what if it did? What if blue-eyed individuals were proven to be more successful in life, more well-liked, and more attractive? Would those parents not then be acting in the best interest of their child by trying to improve their life in a way that will not cause them any harm whatsoever? While this appears to be a solid argument, there is one main objection that invalidates it; the criteria for attractiveness are subjective and therefore constantly shifting, so while blue eyes may be a praised feature when this child is born, they may be as common as brown eyes by the time they have reached adulthood. In attempting to guarantee their child's

success, these parents may have unknowingly changed their child's life in a negative way because there is no possible way to guarantee that an aesthetic change will benefit anything other than parental preferences due to fluctuations within society and overall preferences. There is a guaranteed positive outcome for an individual that would corrective lenses or surgery of some kind in order to see clearly to have their vision restored, but aesthetic changes lack certain outcomes, and unnecessarily altering an unborn baby's DNA is not a procedure that should be left to chance.

Another major objection to aesthetic-based genetic engineering is that in order to justify even one instance, one must justify all instances because whatever principle is applied to justify the practice, there cannot be such a principle that exists that justifies only the instances individuals deem to be appropriate for their benefit. If an individual can claim a comparatively minor adjustment is acceptable just because it benefits themselves or their child in a certain way, another individual must then be able to claim that a more extreme version of the same adjustment is also acceptable. If it is acceptable to raise the height a child is projected to reach by just a few inches, should it not then be acceptable to raise their height by an entire foot so that they excel at basketball? A parent could argue that raising the height of the first child would benefit them later in life by preventing teasing or making them more attractive, a fact that in the present day may possibly hold true, that second parent could argue that raising the height of their own child by a foot or more would practically guarantee their success at basketball, therefore making them even more popular throughout life and creating an easy pathway to a level of success that would practically guarantee wealth. If the moderate-- albeit unnecessary-- use of genetic engineering is deemed to be acceptable in any situation, then the extreme use of genetic engineering must also be justified in that situation.

Physical Enhancement

In addition to these two common objections, there is no biblical evidence or support that justify the alteration of an individual's DNA if not for a restorative purpose; this includes both physical traits and character traits of an individual. In fact, such a focus on the former directly contradicts statements found in the Bible, such as in Romans 8:6 where Paul says, "For to set the mind on the flesh is death, but to set the mind on the Spirit is life and peace." Here, the Greek word used for "flesh" literally translates to not only "flesh," but "body" as well and includes "materiality" in its definition.[26] Paul quite literally states that to focus on one's physical body or material possessions will result in a negative consequence, and this concept is reiterated in Galatians 5:16-21:

> "But I say, walk by the Spirit, and you will not gratify the desires of the flesh. For the desires of the flesh are against the Spirit, and the desires of the Spirit are against the flesh, for these are opposed to each other, to keep you from doing the things you want to do. But if you are led by the Spirit, you are not under the law. Now the works of the flesh are evident: sexual immorality, impurity, sensuality, idolatry, sorcery, enmity, strife, jealousy, fits of anger, rivalries, dissensions, divisions, envy, drunkenness, orgies, and things like these. I warn you, as I warned you before, that those who do such things will not inherit the kingdom of God."

In this passage, the same Greek word is used for "flesh" as in Romans 8:6, and idolatry is classified as a sinful desire of this flesh.[27] Because "idolatry" here is translated from a Greek word that literally means "image worship," an individual's love for their own self qualifies as idolatry and therefore a sinful thing.[28] In the instance of genetic engineering, for one to value their own self-image or the physical image of their child so highly as to genetically alter aspects of it in a way that yields no corrective restoration most certainly qualifies as idolatry.

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[26] Ibid.
[27] Ibid.
[28] Ibid.

Intelligence Enhancement

In addition to the question of physical enhancements, there also arises a question regarding mental/emotional enhancements. For example, is it acceptable to alter an individual's IQ in an attempt to make them more intelligent and quite possible more successful, and is it justifiable to alter a person's personality in a way that could possibly better society? The former, intelligence, must without a doubt be addressed, as a frequent argument in favor of its enhancement poses the question of success: if a child is smarter, will they not be more successful in life? Firstly, one must address the effects of intelligence in an individual's life; when the brain function of a person is altered, their entire personality is altered as a result. Say, for instance, a couple has their unborn child scanned so as to test their intelligence level and discover that it is far lower than they had anticipated and hoped. Because of this, they choose to alter their child's DNA in such as way that increases that one specific factor, causing their child to be exponentially more successful in subjects involving science and mathematics. However, boosting this area of their child's brain has caused logical reasoning and mathematics to overpower the portion of the brain that had previously tested incredibly high for artistic talent. whereas this individual had the potential to become a talented actress such as Meryl Streep or a gifted musician whose compositions would be remembered alongside Mozart's and Beethoven's, this individual must now focus on a mathematic career, as its requirements will ultimately compute within their brain much more easily. This, of course, is a hypothetical extreme that is unlikely ever to occur at such a drastic level, but it serves to demonstrate both the uncertainty of a benefit of intelligence alteration and the necessity of individuals with varying strengths within the world. This is supported in the functional differences between men and women, which science has proven to exist in a variety of ways; if individuals possessed every trait possible,

each person would be genetically identical, . These differences must exist in order to create a functional society in which all jobs in existence have individuals suited to perform them; if every single person on earth had identical high levels of intelligence in mathematics, the quality of art and its quantity in the world would drastically decrease. In the same way, if parents chose to value artistic intelligence over mathematical reasoning, and the world was populated with individuals of matching levels of artistic intellect, there would be no one left to develop city infrastructure, create new technology, discover new cures for diseases, etc. Society's success hinges upon the unique talents and varying inclinations of its individuals.

Personality Enhancement

In addition to the alteration of the brain for intelligence purposes, aesthetic genetic engineering for the purpose of personality trait alterations also constitutes a significant topic of discussion. Alterations for the purpose of suiting parental preferences would certainly fall under the category of enhancement as described previously in this section, as acting on a child's behalf for a parent's own personal desires cannot be considered an act of orderly restoration. However, there is still an argument that is frequently made that disregards parental preference and focuses solely on the well-being of the child and those around them. If an individual is prone to anger because of their personality, can that personality be altered in order to reduce that anger? In order to address this question completely, a distinction must be made between anger and its effects; while anger itself is not a sin, as it is an uncontrollable emotional response to environmental stimuli, any violent actions-- physical or verbal-- committed as a result of such anger are most definitely sinful actions. Removing an individual's genetic inclination toward anger will not prevent them from taking such actions, either, as removing anger will not impart

self-control upon that individual. Therefore, altering an individual's personality to make them "less angry" does not seem to fit the criteria previously set forth for restoration.

However, there are certain instances in which the alteration of an individual's personality would constitute as acts of restoration and should be promoted as such. For example, just as some individuals have tendencies toward anger that they cannot prevent, other individuals have tendencies toward violence, even when anger is not the cause for their actions, though these tendencies are most commonly attributed to various mental disorders. Psychotic disorders, to name just one type of many, cause an affected individual to lose touch with reality and act in a violent manner without provocation do to unpreventable hallucinations and delusions. It is hard to argue that a disorder that causes an individual to act in such an uncontrollable way and commit sinful actions as a result of their genetic state is anything other than a chaotic effect of sin's presence in the world. Because of this, healing such a disorder through a genetic alteration does not qualify as an enhancement; this individual's mental state must be corrected in order for that individual's brain to reach a fully-functioning capacity.

Enhancement vs. Restoration

Genetic enhancement, as the name suggests, involves elevating a feature above its intended state in order to "improve" an individual; because it involves producing an unnatural level of some quality, that quality must be chosen by certain individuals, not by nature. For instance, one does not choose to be nearsighted, but it is an individual's choice and responsibility if they decide to elevate their eyesight unnecessarily past the well-functioning level they were born with. In such a case of correcting nearsightedness, an individual is simply restoring a deficient quality-- one that is not deficient of their own selection, but of their DNA-- to a level

that allows them to function without the medical assistance of glasses, contacts, or corrective surgery. If an individual chooses to genetically engineer their child for the purpose of altering their physical appearance, they are choosing to enhance that child without restoring them in any way; that parent is simply acting upon the idolatry mentioned previously, acting in a way that creates disorder rather than restoring order.

Christian Arguments against Genetic Engineering

While the above portion of this thesis addresses arguments made against specific types of genetic engineering, it fails to address arguments made against the overall practice of genetic engineering; the assumption of the science's future safe practice eliminates arguments against its secular ethics, but it does not eliminate arguments made specifically by Christians. While there are certainly numerous verses that those against genetic engineering could employ in some argument or another against the science, there are three main verses that continue to resurface: Genesis 1:26, Psalm 139:13, and Jeremiah 1:5.

Genesis 1:26

In the previous section entitled *Humans as God's Ambassadors on Earth,* Genesis 1:26 is used in support of humankind's God-given dominion and authority, and the idea of humanity's similarity to God in this way. The verse itself in the ESV reads, "Then God said, 'Let us make man in our image, after our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and over every creeping thing that creeps on the earth..'" This previous section addresses the use of the phrase "after our likeness" and its literal translation in terms of the "similitude" of God and man, but it fails to address the issue raised from that very same phrase: if humanity is created in God's image, altering that image genetically would therefore be altering God's intentional creation. This argument, however, fails to take into account that God's creation has already been altered through sin; when humankind disobeyed God and the Fall occurred, sin gained a foothold in God's creation and proceeded to twist it away from its original state. In altering individuals

genetically in such a way that would remove the effects of this invasion from God's creation, humanity would be restoring God's intentional creation, not perverting it further.

Psalm 139:13

Another frequent objection that arises to genetic engineering is founded upon the verse Psalm 139:13, which says, "For you formed my inward parts; you knitted me together in my mother's womb." This verse, part of a Psalm of praise directed at God's knowledge, indicates that God intentionally designed each and every part of the author within his mother's womb, which is a concept that aligns with the concept of God as an active God, not a deistic one. This once again raises the argument of whether humankind has the authority to alter an intentional creation of God and if doing so is perverting his intentionally designed creation. However, as previously mentioned, this argument fails to account for the perversion that sin has already caused within God's creation; God did not create humankind with the effects of sin because such a creation would not be in his likeness. This idea is further supported through verses such as Deuteronomy 32:4, which says, "The Rock, his work is perfect, for all his ways are justice. A God of faithfulness and without iniquity, just and upright is he." It is made incredibly clear here, as well as throughout the Bible, that God's works, such as his creations, are perfect; God created humankind as it was intended to be, but sin corrupted humankind, and the effects of this sin will continue to corrupt humanity until it has been fully restored through Christ.

Jeremiah 1:5

In addition to the two previous verses, Jeremiah 1:5 is a common verse used to disapprove of the use of genetic engineering by Christians; the verse itself reads, "'Before I

formed you in the womb I knew you, and before you were born I consecrated you; I appointed you a prophet to the nations.'" This verse is part of a larger dialogue in which Jeremiah describes what the Lord said to him, which is where the main issue of this verse's use against genetic engineering occurs. Those who use it in their argument claim it shows that God formed all individuals in the womb, but regardless of whether or not this statement is true, it cannot apply in an overall situation because the statement is directed solely at Jeremiah in regard to what God called him to do and not to readers as a whole.

The Necessity of Prayer

Apart from direct biblical quotations used to oppose genetic engineering, there is one common argument that arises amongst Christians when the topic of genetic engineering enters into discussion: what about prayer? Many would argue that taking matters into one's own hands to cure disease by manipulating DNA eradicates the possibility of a miracle provided as an answer to prayers made on behalf of an ailing individual. This argument, however, assumes that those who would opt for a genetic engineering procedure would completely neglect the necessity of prayer in a life-threatening situation, which is entirely false. Just because a trustworthy and majorly successful cure is a viable option in this situation does not mean the necessity of prayer has in any way been diminished. Christians do still have a calling to gather and pray in all instances, especially in distress, such as that caused by receiving the news that one's unborn baby is affected by a fatal disorder. Think back to that Christian couple who is informed of their baby's genetic disorder while at an appointment at the OB-GYN, and consider a prayer that such a couple might lift up: "God, if it is your will, heal my child from this illness." Does God only heal by direct intervention? How is the provision of a nearly guaranteed cure not an answer to a

prayer for healing? Acting upon this provided cure would not only save the child, but would also aid in the fulfillment of humankind's purpose on this earth.

This argument also falls short in other medical situations that are already present in today's world. Most Christians, if a loved one is diagnosed with cancer, would not encourage that individual to refrain from undergoing chemotherapy because doing so would rob God of the chance to cure them through a miraculous work. On the contrary, the majority of Christians would pray for that individual as they walked through the process of chemotherapy, praying that the cure would be effective so that the affected individual would be healed. The effectiveness of such cures as chemotherapy or genetic engineering are miraculous acts in and of themselves; they should not be refrained from in order to test exactly how miraculous God truly is.

Conclusion

While this thesis has presented several arguments for and against certain types of genetic engineering, it cannot cover every single situation in which genetic engineering may be presented as an option. Because of this, a set of applicable criteria must be determined in order to make these arguments practical for future use. These criteria are as follows:

1. Will genetic engineering save the life of the individual in question? If yes, then it is acceptable in all situations.
2. Will genetic engineering restore proper function to the individual in question in some way? If yes, then it is acceptable in all situations.
3. Will genetic engineering alter the appearance/intelligence/personality of the individual in question in some way that does not fall under the second criterion? If yes, then it is not acceptable in any situation.

These criteria aim to provide answers to any questions relevant to the use of genetic engineering in the life of a certain individual, based particularly on the role of Christians as God's ambassadors on earth. If the case made previously in this thesis for this duty of Christians has not been convincing enough for Christians, these criteria may still prove useful, though the massive, overarching question of the use of genetic engineering will not-- and cannot-- be answered.

Works Cited

Reece, Jane B., Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, and Robert B. Jackson. Campbell Biology. Ninth ed. San Francisco, California: Pearson Benjamin Cummings, 2011.

Strong's Exhaustive Concordance: New American Standard Bible. Updated ed. La Habra: Lockman Foundation, 1995. Accessed March 22, 2011. http://www.biblestudytools.com/concordances/strongs-exhaustive-concordance/.

Works Consulted

Blumberg, Roger B. "Mendel's Paper in English." MendelWeb. Accessed October 11, 2017. http://www.mendelweb.org/Mendel.html.

Flaman, Paul. Genetic Engineering, Christian Values and Catholic Teaching. Mahwah, New Jersey. Paulist Press, 2002.

Jersild, Paul. The Nature of our Humanity: Ethical Issues in Genetics and Biotechnology. Minneapolis, Minnesota: Fortress Press, 2009.

McClean, Phillip. "Mendel's First Law of Genetics (Law of Segregation)." Mendelian Genetics. Accessed October 11, 2017. https://www.ndsu.edu/pubweb/~mcclean/plsc431/mendel/mendel1.htm.

Nelsen, Eleanor, and Tim De Chant. "Genetically Engineering Almost Anything." NOVA Next. July 17, 2014. Accessed October 11, 2017. http://www.pbs.org/wgbh/nova/next/evolution/crispr-gene-drives/.

Sandel, Michael J. The Case Against Perfection. Cambridge, Massachusetts: Harvard University Press, 2007.

Thistlethwaite, Susan Brooks. Adam, Eve, and the Genome: the Human Genome Project and Theology. Minneapolis, Minnesota: Fortress Press, 2003.

Venema, Dennis. "ENCODE and "Junk DNA," Part 1: All Good Concepts are Fuzzy." BioLogos. September 24, 2012. Accessed October 11, 2017. http://biologos.org/blogs/dennis-venema-letters-to-the-duchess/encode-and-junk-dna-part-1-all-good-concepts-are-fuzzy.

"What are the types of genetic tests? Genetics Home Reference." U.S. National Library of Medicine. October 10, 2017. Accessed October 11, 2017. https://ghr.nlm.nih.gov/primer/testing/uses.