

Who's Afraid of Modern Fertility Treatments?

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Abstract

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My thesis aims to deconstruct several misconceptions about fertility treatments and uses multiple ethical frameworks to prove their ethicality. I use Kantianism, Utilitarianism, and Casuistry to prove that these procedures' are ethical.

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Table of Contents

1. Introduction.....	5
2. IVF and Genetic Testing.....	12
3. Gene-Editing.....	24
4. Human Cloning.....	36
5. Conclusion.....	48
Bibliography.....	53
Biography.....	59

Chapter One: Introduction

If the technology is available and reasonably safe, people should be able to use any and all reproductive treatments in order to have children. I believe that reproductive treatments should not be restricted, except when used for unethical reasons. This thesis is an ethical analysis of modern fertility treatments with mostly positive evaluations.

Background and Current Situation in the United States

About one in five, or roughly 19%, of women in the United States are unable to conceive a baby after trying for 12 months. A couple would be defined as infertile if they were trying to get pregnant for one year if they are under 35 years old, for six months if they are 35 to 40 years old, and for three months if they are 40 years old or older. There are many ways to determine fertility: a fertility specialist could analyze the quantity and quality of a woman's eggs, FSH and thyroid hormone levels, the pH level of a uterus or an oviduct, the ability to release egg and ovulate every month, the anatomy of a woman's uterus and fallopian tubes, and finally, even a man's sperm quality. Having a child the traditional way is with sexual intercourse followed by gestation and includes natural birth and cesarean sections.

The most common reasons why people seek fertility treatments are if they are infertile, as defined above, if they are in a same-sex relationship or alone and want to have a baby, if they are born without a uterus, and finally, if they are diagnosed with cancer and need to preserve their eggs or sperm by freezing them until their chemotherapy treatment is completed. Treatments starting as simple as oral pills that boost ovulation to release more eggs to extracting eggs from the ovaries and fertilizing them in a dish can help solve these issues.¹

From an evolutionary perspective, reproducing and having offspring is the human species' purpose - it is the way we are defined as successful organisms and how we pass down

¹ Valerie, Libby. Personal Interview. 11 September 2022.

our genes. More importantly, if people want to have healthy children and the technology and science is available, they should be able to. This is an important topic to research and understand, as new technologies for genetic testing, in vitro fertilization (IVF), three-parent in vitro fertilization, gene editing, and human cloning are being studied or performed in different labs around the world to help people conceive for countless reasons. There are several misconceptions about and many arguments against all kinds of fertility treatments, even the most common ones such as in vitro fertilization. It is vital for society to understand how these treatments truly work and why they are necessary in many cases in order for these treatments to be supported so they can be performed everywhere and accessible to everyone.

My overall thesis question is as follows: Are fertility treatments and future possible fertility treatments ethical?

Literature Review

I will start my thesis by briefly describing the main fertility treatments accessible today in the United States and their histories. I will then discuss the ethicality of in vitro fertilization and the genetic testing and biopsies that can be paired with this treatment. Next, I will discuss three-parent in vitro fertilization, how it works, and its misconceptions. I will write about treatments that have not yet been performed on humans, but only in the lab and on other animals, including unborn gene editing and cloning. I will be arguing that these two processes can and should be used as fertility treatments, and I will discredit most misinterpretations. Of course, all of these procedures should be and would be monitored to ensure ethical compliance. Finally, I will reiterate the importance of these procedures and how they relate to current events.

There are many different sources of evidence I will examine while writing this thesis. I will be primarily using secondary texts written by other philosophers and scientists who have had the same curiosities and questions as I do. I will categorize these sources based on the topic and whether or not I agree with the arguments made. Additionally, I will write against or for some of these points under the frameworks of the three moral theories. Where appropriate, I will point out logical flaws in some critical arguments levied against the use of some technologies.

After fully understanding the concepts and purposes behind each treatment I discuss, I will make my positions on each area clear using the ethical analysis methodologies stated below. It is important to note that I am operating from a de facto pro choice outlook in this paper.

Methodology

The methodology I will be using while discussing these topics is an ethical analysis, and I will be primarily using Kantianism, utilitarianism, and casuistry to support arguments for and debunk arguments against certain treatments. In terms of Kantianism, the most relevant feature is the categorical imperative. For utilitarianism, it is the greatest happiness principle. Happiness includes health and future opportunities. With casuistry, I will mainly be identifying paradigmatic impermissible cases and permissible cases.

Compiling different ethical frameworks to different philosophical standpoints on fertility treatments constitutes the main work of this thesis. Building on complicated scholarly knowledge, I will be adding a new lens to viewpoints philosophers have already established, applying different philosophical frameworks to them and incorporating my own input. At times, I may even complicate certain arguments.

Kantianism is the philosophy of Immanuel Kant, who believed that rational beings, or humans, have dignity and should be respected. The core idea of this ethical framework is that humans are not just objects and should never be treated as tools in the pursuit of someone else's goals. These rights are thought of as universal, applying to everyone everywhere. Unlike utilitarianism, Kantianism focuses less on consequences. When using Kantianism, I will discuss situations based on this framework's substance, including autonomy, rationality, use or nonuse as means, and universalizability. While using these different ethical analytical methodologies, I will be focussing on the most controversial cases, as most other situations' ethical evaluations will be clear.

Utilitarianism is a framework of morality that promotes actions that cause happiness and oppose actions that cause unhappiness. This ethical theory dictates right from wrong by focusing on the consequences of actions, and it aims to maximize utility, often defined in terms of well-being. Yet, it is important to note that it advocates for equal moral consideration to the happiness of all individuals. When using utilitarianism, I will discuss how fertility treatments in almost all cases benefit the majority and/or increase the overall greatest happiness, but I will be sure to mention any of their relevant negative consequences as well.

Casuistry is a framework that can solve ethical dilemmas by expanding theoretical rules from a specific case and reapplying those rules to a new situation. In other words, it is a case based method of reasoning. When discussing certain situations in terms of casuistry, I will identify paradigms of permissible cases and paradigms of impermissible cases in a process of moral triangulation. For example, in terms of a standard IVF treatment for a couple, we know it is permissible when the parents' intentions are good. Yet, we know IVF is not permissible when

the couple's purpose is to use the child in any way that exploits them, i.e. to work a coal mine or to grow the embryo just to kill them and distribute their organs.

At times, these three theories may clash with one another. Certain issues may be looked at differently depending on the moral theory I use. In each chapter of this thesis, depending on each pro or con argument, a different ethical framework may fit better. Or, it is possible that there are some situations where no framework fits, and in that case, I will discredit specific arguments and misconceptions using science or other information provided by other philosophers. Either way, I believe most anti-fertility arguments can be debunked.

I will now discuss two cases that the reader should keep in mind while reading this thesis: One is ethically permissible - a child is born, they have a problem with their reproductive system, and the parents ensure procedures are performed and treatments are administered to correct it as soon as possible. More specifically, surgical intervention fixes this child's problem. This affects the child's future and affects future generations because they now can reproduce. This case is perfectly ethical and acceptable. Kant would say that this situation is ethical because the parents are not using a child as a means to an end. Utilitarianism would show it is ethical because it increases the happiness of the child and their extended family. The other case is the paradigmatic bad case that is not ethically permissible - cloning is used to create a great battlefield hero, and they are sent into the army. Kant would agree that this case is unethical because this human is used as a means to an end - for battle. Utilitarianism would show that it is unethical as well.

In each chapter of this thesis, these two cases will be brought up. Questions including Is this one case more similar to fixing someone's reproductive system? Or cloning a great battlefield hero to die? will be asked.

I am ready to delve into this topic fully and clearly, hoping to make a difference and encourage others to think about fertility treatments in a new, more conscientious way. I am optimistic that people will be more understanding and accepting of these treatments after reading this thesis, and hopefully they will encourage experimentation to introduce new assistive procedures into fertility specialists' offices around the globe.

Before diving into each treatment, it is important to address the most common argument against all reproductive treatments: using them is “playing God.” Restricting reproductive assisted procedures is more like playing God than not. Not allowing people to pass down their genes is more playing God than helping people have children and using the technologies we have available today. Additionally, everything in healthcare could also be argued to be playing God, like getting a heart transplant, giving birth in a hospital with help, going to see any doctor when you are sick for antibiotics, etc. John Evans does a great job advocating for this point of view in *Playing God? Human Genetic Engineering and the Rationalization of Public Bioethical Debate*.²

² Evans, John H. *Playing God? Human Genetic Engineering and the Rationalization of Public Bioethical Debate*. Chicago, The University of Chicago Press, 2002.

Chapter Two: In Vitro Fertilization (IVF) and Genetic Testing

In this chapter, I will be answering the following questions: What is IVF, and why is it paired with genetic testing? Are they ethical?

IVF and Genetic Testing: A Brief History

In vitro fertilization, or IVF, is the most common type of assisted reproductive treatment due to its high success rate, as around four million children each year are birthed because of this therapy. IVF helps families have children that could not conceive before. Usually, the brain releases a certain amount of FSH every month to release one egg from one of the fallopian tubes. If a woman is infertile, fertility specialists will recommend FSH injections to grow and release more than one egg. Then, the woman is monitored every day until the eggs are big enough for retrieval, and the physician will go into the fallopian tubes and suction out as many eggs as possible. The egg is then fertilized with sperm, either from a donor or the husband, and an embryo is hopefully created and grown until a blastocyst is formed. A blastocyst is a group of cells with identical DNA that is part trophoctoderm, or the part that becomes the placenta, and part inner cell mass, or the part that will be the embryo. If a couple or woman wants to undergo preimplantation genetic testing, or PGT, five to eight trophoctoderm cells are taken from the embryo and sent to a genetic testing company.³ This company will run tests on the cells to see if the embryo is chromosomally normal, and these tests can show the sex of the embryo as well.

Genetic screening is different from genetic testing, as screening refers to a public health program performed on a whole population, such as an ethnic group at high risk for a certain genetic disease. On the other hand, genetic testing refers to a procedure performed on an

³ It is important to note that PGD and PGT are interchangeable terms. PGD stands for Pre-implantation Genetic Diagnosis.

individual because of that individual's risk factors. Many geneticists think this distinction is important because they are for different purposes. Many genetic defects can be detected using an ultrasound, amniocentesis, or chorionic villus sampling, but almost none can be corrected without gene editing. The purpose of testing is usually to prepare the prospective parents for the birth of a child with a genetic disease, specifically when the child is already implanted and growing in the uterus. Sometimes they are used as the basis for selective abortion, and avoiding the birth of a child with a severe genetic disorder is associated with a physician's therapeutic role.

PGD usually works as follows: couples that are at risk for having a child with a genetic disease will use IVF to screen an embryo before the transfer into the woman's uterus. This alleviates the need for later prenatal diagnosis and possible abortion.⁴ Then, a dozen or more eggs are fertilized with sperm, and the embryos are grown to the four or eight-ish cell stage. A few of the embryonic cells are removed to be genetically tested using a technique called polymerase chain reaction. This amplifies a tiny amount of DNA so researchers can detect if there are any genes that are associated with genetic disorders. Only the embryos free of the genetic disorders are eligible for transfer to start pregnancy.

Most clinics in the United States offer PGD, and many clinics use PGD for controversial uses such as sex selections. In fact, 74% of IVF clinics offer PGD, and it occurs in four to six percent of all IVF cycles.⁵ According to the published article "Genetic testing of embryos: practices and perspectives of US in vitro fertilization clinics," 45 percent of all fertility clinics agree with, 43 percent disagree with, and 12 percent are neutral to the statement "there will be restrictions on using PGD for nonmedical genetic traits such as sex."⁶ It was also found that

⁴ President's Council on Bioethics. "Selecting Embryos For Desired Traits." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 473-476.

⁵ Baruch, Susannah, et al. "Genetic testing of embryos: practices and perspectives of US in vitro fertilization clinics." *ELSEVIER*, vol. 89, no. 5, 2008, Accessed 15 September 2022.

⁶ *Ibid.*

most of the clinics and physicians agree that changes in PGD's technology will permit whole genome embryo screening as a routine part of IVF. PGD's use in clinics will only grow in the future.

About 12 percent of American women of reproductive age have trouble getting pregnant, and infertility is often a source of pain and disappointment. IVF, just like all other forms of reproductive technology, is associated with many risks and benefits. But IVF has the power to help families overcome infertility by enabling people to have healthy, biologically related children.

The procedure including PGD and selective transfer using IVF is still new and less than 10,000 children have been born using this process, yet more and more people are using IVF to screen and select embryos free of defects.⁷ PGD has principally been used to screen out embryos with aneuploidy and Mendelian disease, which is a genetic disease caused by a single-gene defect. It is a desirable future intervention because it can avoid implanting an embryo that has a genetic disease. Additionally, current evidence shows that this procedure does not inflict any visible harm on the early embryos or on the child that results.

Criticisms of IVF and Genetic Testing and my Counter-Arguments

I will discuss arguments against IVF and genetic testing, and I will either analyze and object to these arguments using different ethical frameworks, or I will oppose them using scientific facts.

One argument against IVF is that it threatens women's freedom and is oppressive to women.⁸ Sherwin writes that IVF can be used to further exploit women by concentrating power

⁷ Baruch, Susannah, et al. "Genetic testing of embryos: practices and perspectives of US in vitro fertilization clinics." *ELSEVIER*, vol. 89, no. 5, 2008, Accessed 15 September 2022.

⁸ Sherwin, Susan. "Feminist Ethics and In Vitro Fertilization." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill

in the hands of those that are not involved with the raising of the child. Sherwin also states that it reinforces the lack of autonomy which women now experience in our culture even if it seems to be increasing freedom. Her point is that it further deepens the patriarchal notions of a woman's role as a child bearer and reinforces sexist assumptions. I must confess I am baffled by this argument. Many people experiencing IVF genuinely want to have children. Yes, sexist views still exist but endorsing a medical procedure that helps women have children does not emphasize these sexist views. People have the constitutional right to make their own decisions, and because we know that IVF is safe and has been successful millions of times, it is one's right to decide if they want to use it if they are having infertility issues. I believe fertility treatments fall under reproductive and parental rights, which are generally not controversial. Everyone has the freedom to make their own decisions on when to reproduce and how to parent. How would choosing to conceive a baby using reproductive technology diminish a woman's freedom? How would reducing someone's options increase their freedom?

Another argument is one endorsed by Heitman, who states that IVF confuses social meaning and legal definition of parenthood and creates ambiguous defined relationships.⁹ Heitman writes that the relationships between prospective parents, infertility specialists, and the embryos that are created by IVF are highly ambiguous. With this statement I disagree. Getting technical with the social constructs and definitions of parenthood does not make a reproductive treatment unethical. Additionally, parenthood is not about how a child is created, and relationships are formed on trust, not technicalities. Parenthood is what happens when someone's child is born, but it can also happen through adoption or by marrying a partner that has children.

Education, 2021, pp. 426-430.

⁹ Heitman, Elizabeth. "Social and Ethical Aspects of In Vitro Fertilization." *CambridgeCore*, vol. 15, no. 1, 1999, Accessed 20 September 2022.

A parent is someone who brings up and cares for another, an act and attitude of unconditional love.

Another argument against IVF is that it disregards the interests of the children created through these technologies. Some believe that the procreative liberty paradigm is the wrong way to think about ethics of assisted reproduction and state that IVF creates a child in a condition that the child would have been better off never being born.¹⁰ Robertson disagrees with this perspective, as his approach takes into consideration the interests of children born from technology. The choice is either for a child to be birthed with harmful conditions or for the child to not get born at all. It is important to remember that risks are not always avoidable. So, is the child's interests best served by allowing it to be born even if there are risks and/or harmful conditions? Robertson expresses that most people with disabilities find lives worth living, so the answer is usually yes.¹¹

Not surprisingly, many opponents of IVF use the “playing God” argument. As I have stated before, this argument is extremely hypocritical. For example, many cancer patients are infertile due to life saving chemotherapy treatments. With chemo, physicians are restoring these patient's natural function of living. With IVF, physicians are simply restoring these patient’s ability to have a biologically related child. Unfortunately, many people do not see the irony in claiming that the reproductive technology IVF is “playing God,” while chemo is not. To reiterate, any kind of medical intervention could be claimed to be playing God when in reality most simply prevent harm and increase happiness.

¹⁰ “Assisted Reproduction.” *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D. Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 633.

¹¹ Robertson, John. “The Presumptive Primacy of Procreative Liberty.” *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 415-422.

Moving from IVF to PGT, critics argue that if only rich people can afford this procedure, it runs the risk of creating an underclass and poor people that are more at risk of these diseases. This would further exacerbate inequality, which is already a problem.¹² To solve this issue, it would not be necessary to ban the tests but instead subsidize them and make them available to all. One can't address inequality without being a technophobe.

Additionally, many people, specifically Adrienne Asch, argue that pregnancies should not end if a disability is found due to prenatal testing.¹³ Asch states that her focus is on the view of life with disability - many people do not understand what it is like to live with a disability, so why is it their choice to decide if a life with a disability is worth living or not. I understand her point of view here. She is also worried that society will urge prenatal testing on every pregnant woman. Asch states that many should reconsider whether to endorse PGD, especially if public health starts to improve the status of people with disabilities as it has done for other groups, such as the LGBTQ+ community. While I understand this concern, some genetic diseases lead to disabilities that are unbearably painful and lead to a life with little to no happiness. We must think about this question: Is it the parents moral obligation to use genetic testing to avoid the birth of a child with a severe genetic impairment? Humans do have an obligation to prevent harm and sometimes the only way to prevent genetic harm is to prevent the birth. It is a hard decision no doubt, but if a child's life will only be filled with suffering and barely any benefits, is it right to bring them into the world? I say no. According to a Utilitarian, if the detriments outweigh the possible benefits, and the overall greater happiness will decrease, it is problematic to give birth

¹² President's Council on Bioethics. "Selecting Embryos For Desired Traits." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 473-476.

¹³ Asch, Adrienne. "Prenatal Diagnosis and Selective Abortion: A Challenge to Practice and Policy." *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D, Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 609-619.

to a child with a severe genetic disease. On the other hand though, as long as the child can be expected to have a life worth living, procreation is not wrong.¹⁴

Finally, the last argument against genetic testing is that it will diminish diversity. Some believe that the misuse of prenatal testing could lead to children being selected for certain traits and could eventually lead to an homogenous society. There is a worry that once testing becomes automated and cheaper, the use of this approach will lead society towards “better children” with certain traits. I believe this to be untrue. The main use of this reproductive treatment would be for medical reasons, but there is a large concern with the fact that it could be used to only implant embryos with desirable traits. Yet, because most of the desirable human traits are polygenic, the contribution of any single gene identifiable by blastomere testing is unlikely. Finding all of the desired variants in a single embryo is even more unlikely. These facts reduce the relevance of some arguments against PGD.

Arguments for IVF and Genetic Testing

One major argument in favor of IVF is that women and families have the freedom to reproduce or not reproduce, and this right to reproduce includes the right to use reproductive technologies.¹⁵ Women have a right to make a reproductive choice without interference from others. John Robertson supports this view, specifically with “procreative liberty,” which he defines as the freedom to have children or to avoid having them. He writes reproduction always involves genetic recombination and occurs by provision of one’s gametes to a new person. Female reproduction is usually associated with gestation, but IVF allows the genetic and gestational parts of reproduction to be separated. Overall, everyone has a right to make their own

¹⁴ Robertson, John A. “Extending Preimplantation Genetic Diagnosis: Medical and Non-Medical Uses.” *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 467- 473.

¹⁵ Robertson, John. “The Presumptive Primacy of Procreative Liberty.” *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 415-422.

reproductive decisions, whether that means using technology in pursuing these goals or not. Banning or restricting reproductive rights violates the constitutional rights of (infertile) people and takes away one of the most fundamental choices of people's lives. IVF has even been used as part of national policies to increase birth rates.¹⁶ For example, South Korea and Israel are pronatalist countries. This is not necessarily a good thing if it is also paired with a ban on abortions, as it could put women's rights at stake, but it does show that there are many countries that support IVF and trust the research that proves its safety.

I believe the main arguments in favor of genetic testing imply that it should be allowed for medical and nonmedical purposes, including for controversial purposes like selection based on gender. First, in regards to the medical purposes of PGD, the ethics committee of the ASRM, or the American Society for Reproductive Medicine, argues that PGD is ethically justified “when the condition is serious and no safe effective interventions are available.”¹⁷ They also express that as of now, PGD is known as a low risk procedure. Robertson also considers all of the medical uses of PGD, like screening embryos for cancer susceptibility and late onset disorders, to be ethically acceptable.¹⁸ More specifically, using PGD to screen out embryos that carry the p53 mutations would prevent the birth of a child that would live a life filled with the risk of cancer. Using PGD for disorders like Alzheimer's disease could prevent the birth of a person that will experience a progressive neurological disease causing an early death. In my opinion, it is wrong to cause a disabled child to exist instead of a healthy one.¹⁹ I agree with this view, as

¹⁶ Asplund, Kjell. “Use of *in vitro* fertilization—ethical issues.” *NIH*, vol. 125, no. 2, 2019, Accessed 20 September 2022.

¹⁷ Ethics Committee of the American Society for Reproductive Medicine. “Use of preimplantation genetic testing for monogenic defects (PGT-M) for adult-onset conditions: an Ethics Committee opinion.” *Fertility and Sterility*, Elsevier Inc., 2018.

¹⁸ Robertson, John A. “Extending Preimplantation Genetic Diagnosis: Medical and Non-Medical Uses.” *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 467- 473.

¹⁹ McMahan, Jess. “The Morality of Screening for Disability.” *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 494-498.

long as all parties using genetic testing will not use their child as a means to an end. In regards to the nonmedical purposes of genetic testing, if a couple has been struggling with procreation and is using IVF and genetic testing to help them, what is the harm in choosing to implant the boy embryo instead of the girl embryo? Remaining in isolation, no one is harmed.²⁰ The ASRM wrote that when patients undergo PGT for medical reasons, the sex of the embryo could be a secondary finding. These patients have the right to know this information as well as the right to request not to be given this information. They also express that clinics may have policies to not allow sex to influence embryo transfer decisions, and clinics must have nondiscrimination policies in place when the sex is known.²¹

Another important point to note is that IVF could allow women with terminal diseases that have to go through treatments that could damage their eggs to later have their own biologically healthy children.²² For example, the procedure could allow scientists to freeze matured eggs from girls as young as five that are undergoing chemotherapy treatment because they have cancer. Chemotherapy can lead women to be infertile, and IVF gives them an opportunity to have healthy children in the future.

Another Kind of IVF: Three-Parent IVF

Mitochondrial recombination therapy (MRT), also known as three-parent IVF, is an intervention in which the genetic material of three people, the DNA of the father and mother and the mitochondrial DNA of an egg donor, can be used to create a child. The procedure involves transferring the nucleus of an unfertilized egg from a cell with defective mitochondria to a cell

²⁰ It could lead to social problems, but I am talking about one couple making one decision.

²¹ Ethics Committee of the American Society for Reproductive Medicine. "Disclosure of sex when incidentally revealed as part of preimplantation genetic testing (PGT): an Ethics Committee opinion." *Fertility and Sterility*, Elsevier Inc., 2018.

²² *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 400.

with healthy mitochondria and fertilizing the egg using IVF, as mitochondrial DNA is passed down from the maternal line.

Very few studies have been performed to test and experiment with three-parent IVF. My goal is to introduce a new outlook on this treatment. MRT would enable women and families with mitochondrial diseases to have a genetically related child without transmitting the disease to the child. It is important to note that there are very few families with mitochondrial diseases in their genome, but mutations in mitochondrial DNA can cause rare but serious illnesses and defects, including heart failure, dementia, muscular dystrophy, and blindness. The severity and onset of symptoms can vary, but mitochondrial diseases affect tissue with high-energy demands, such as the heart muscle, and brain. Many of these conditions are fatal. There is no way to treat these conditions once acquired, and it is difficult to predict how a child will be affected just from a screening. Women who carry these mutations are more likely to have miscarriages, and if the child is born with a mitochondrial disease they may not survive beyond childhood.²³ About one in 5,000 births and a larger proportion of fetuses that do not make it to birth have a mitochondrial DNA mutation. Therefore, it is more beneficial to undergo the MRT procedure than to have a baby with a disease and/or lose the baby before it is born. A Utilitarian would argue that performing the procedure would lead to the greatest happiness of the most people, assuming that MRT is safe concerning all parties. There is a small but unknowable risk until small clinical trials are allowed to proceed with experimentation. We have accepted this risk before by testing IVF and other reproductive technologies, why not take that risk in this situation?

Three-parent IVF would be extremely beneficial to women and families struggling with mitochondrial diseases in their bloodlines. MRT could save thousands of lives, prevent painful

²³ Rulli, Tina. "What Is the Value of Three-Parent IVF?" *The Hastings Center Report*, U.S. National Library of Medicine, 2016.

suffering, and avoid passing on a genetic defect to future generations. Many of the same arguments that have been raised about IVF have been applied to three-parent IVF, and I have dealt with those above. There are no other significant problems as my arguments have shown.

Applying Ethical Frameworks to Both Kinds of IVF and Genetic Testing

Thinking about the two cases I wrote about in the introduction, we can conclude that IVF and gene testing are more similar to fixing someone's reproductive system, or the ethically permissible case. These procedures are indeed ethical.

In respect to Kantianism, IVF and gene testing are ethical as long as the parents do not have bad intentions. Many would then ask how we discover if parents have the right intentions. I respond with the fact that we do not know if parents have good intentions when they have children the old fashioned way.

According to Utilitarianism, IVF and gene testing would lead to the greatest happiness among all people because they can help an infertile woman create a child biologically related to her and can ensure a baby is not implanted into a uterus that is known to have a painful and unbearable life due to a genetic disease. Remember that in regards to IVF, a low level of risk is acceptable since even normal methods of conception carry small risks of birth defects.

With IVF and PGD, there are concerns, but nothing significantly different than with traditional fertilization and gestation.

Chapter Three: Gene Editing

In this chapter, I will be answering the following questions: What is gene editing and what does it entail? Is it being performed and should it be?

The Definition of Gene Editing and its History

Gene editing is a way to make specific changes to the genome, or the totality of DNA in a cell, of many organisms, including plants, bacteria, and animals. This method can be used to add, eliminate, insert, replace, or change a DNA sequence. Typically, the goal is to improve a crop or farmed animal or correct a genetic disorder. CRISPR-Cas9 is a gene editing technique that is an RNA guided tool consisting of two parts, the clustered regularly interspaced short palindromic repeat part, which is the CRISPR part, and the CRISPR-associated protein 9 part, which is the Cas9 part. It was adopted from a naturally occurring genome editing system that bacteria use to defend their immune system. CRISPR functions as a guide for the Cas proteins to target a certain part of the genome, which are then cut by the Cas proteins. The strands can then be used to modify the nucleotide sequence of DNA and to insert genes or implement changes at that cut site.²⁴

Currently, gene editing is only being performed on human somatic cells, but scientists have created gene-edited pigs, goats, mice, and cattle for numerous reasons. For example, scientists have created cattle that make sperm carrying the genetic material of donor animals. They knocked out a male fertility gene in animal embryos using the gene-editing tool CRISPR-Cas9, which in turn made these animals sterile. The researchers then injected sperm producing cells from another, more desired animal into the sterile animal. This was done so

²⁴ Cavaliere, Giulia. "Genome editing and assisted reproduction: curing embryos, society or prospective parents?" *NIH*, vol. 21, no. 2, 2018. Accessed 5 December 2022.

surrogate males could create offspring carrying the genetic material of more elite animals.²⁵ The goal with genetically enhancing livestock was to improve food production, disease resistance, and meat quality.

Genome editing is of great interest in the prevention and treatment of human diseases. Human genome editing technologies have been utilized on somatic cells, which are non-heritable, and could be on germline cells, which are heritable. Researchers have genome-edited human somatic cells to address HIV and sickle-cell disease, and this gene editing is well established and allowed in some scientifically advanced areas of the globe.²⁶ One new treatment of gene therapy on non-germline cells encompasses transferring a gene into somatic cells that would help reduce symptoms of a child that had spinal muscular atrophy using a virus.²⁷ Society welcomes this kind of gene editing because it is only affecting the individual undergoing treatment, and the studies show that it could possibly act as a cure for the diseases listed above. Yet, it is not accepted everywhere, as many are worried about the ethical permissibility of these therapeutic interventions, as well as their safety.²⁸ Furthermore, heritable human genome editing involves editing of nuclear DNA that will be passed down to future generations. This category of gene editing is under intense debate, as many believe its negative consequences outweigh the possible advantages.²⁹

Why Gene Editing is a Necessary Future Intervention

²⁵ Kelland, Kate. "Scientists create gene-edited animals as 'surrogate sires' to boost food production." Reuters edited by Pravin Char, 2020.

²⁶ It is legal in the UK and many other European countries.

²⁷ Villalpando, Nicole. "New test leads to healthier life for local baby." *Austin-American Statesman*, 2022.

²⁸ World Health Organization. "Human genome editing." 2021. Accessed 5 December 2022.

²⁹ Ibid.

The extreme opinions against heritable genome editing interventions make it very difficult for this therapeutic treatment to be available for reproductive purposes. In fact, because of people's uneasiness about its ethics and safety, germline cell and embryo genome editing is illegal in the United States and many other countries. This is unfortunate because the intervention of modifying the genetic makeup of an embryo created by IVF from couples who have a chance of transmitting such diseases could help avoid the incident of genetic disease in future children.³⁰ If we could exclude particular heritable disorders from a future child that would have been inherited prior to CRISPR, especially if PGD discloses the gene for the disorder during IVF, it would positively affect thousands of families.

Unfortunately, because it is illegal, research on human embryos (like using the unused embryos created from IVF stored in certain fertility clinics) cannot begin. These processes, if regulated correctly, could ensure that future humans that were originally supposed to inherit a lethal genetic disease would live longer and/or without suffering. Therefore, it is important to show its ethicality to possibly have it be put into practice. More research is needed before we can establish whether any of the genome editing techniques would be an effective, safe, and viable approach for reproductive purposes.

Arguments against Gene Editing and my Counter-Arguments

I will discuss arguments against gene editing, and I will either analyze and object to these arguments using different ethical frameworks, or I will oppose them using scientific facts.

Genetic determinism, or the belief that genetic contributions to phenotypes are entirely or much more important than the contributions of the environment, is one common argument used

³⁰ Cavaliere, Giulia. "Genome editing and assisted reproduction: curing embryos, society or prospective parents?" *NIH*, vol. 21, no. 2, 2018. Accessed 5 December 2022.

against gene editing.³¹ People that strongly believe in genetic determinism think that if a genome is edited, even if it is just to ensure someone does not have to live with a lethal disease, it could change much more about a person, like their personality; to them, this is an unacceptable consequence. Yet, this cannot be true. Few genetic modifications, and mostly those performed incorrectly, would change anything meaningful about a person. The differences in DNA between individuals are much smaller than people believe, and this shows that much of what makes you *you* involves environmental factors. Biological traits are the result of genes, chance, and the environment, and all of these elements interact with each other to create even more variability.

In *Biology as Ideology: The Doctrine of DNA*, Lewontin argues this convincingly.³² He provided an example using height that clearly disproves genetic determinism and shows phenotypic traits are not simply due to one's genome: It is a fallacy to believe a certain amount of a trait is determined by genetics, and the rest is due to the environment. If a group of people were fed the same diet and their variability of height was measured, any variability would be due to genetic factors, and none would be from the environment. The heritability under these circumstances would be high. If everyone had been fed a unique diet, the heritability of height would appear low. Furthermore, heritability is not an absolute value but depends on the environment, and it cannot be generalizable. Almost all other biologists also disavow determinism and insist that genes are not exclusively for traits.

Additionally, Dan Brock's writings and research also disprove genetic determinism. In his article "Genetic Engineering," he shows that genetic engineering would not change the fundamental identity of an individual, as children are more influenced by environmental factors

³¹ American Psychological Association. "genetic determinism." *Apa Dictionary of Psychology*. Assessed 5 December 2022.

³² Lewontin, Richard C. *Biology as Ideology: Doctrine of DNA*. Ontario, HarperPerennial, 1991.

and the way they are raised by their parents than by genetic factors.³³ He reiterates that the opponents of genetic engineering view it as changing the identity of a person in a way that a parents' environment doesn't. Parental efforts are not progressing the capacities children already have - the potential is not usually there to begin with. It is developed over time because of environmental factors. Genetic interventions do not make children take on different identities other than who they would have been. Sure, replacing DNA sequences that would have caused Huntington's disease in a person will change what the trajectory of their life would look like, but genes do not constitute anyone's identity. Genetics and environment both interact to create an individual - genetic interventions do not result in a new individual, and environmental interventions do not merely modify the same individual.

Another argument against altering or enhancing human beings is that it threatens human nature, as overtime children would eventually be engineered to be less diverse. Many opponents of gene editing are nervous to change something like the genome because they are worried it tampers with our nature and will make humans 'unnatural' and 'too similar.' Yet, our distinctive nature, which is what really separates us from other animals, is our rationality and the way we make judgments and act based on these judgements. If we make the decision to improve humanity by manipulating certain 'bad' aspects of the genome, we are demonstrating rational judgment, which is what is fundamentally important about our nature. If these changes improve human life and therefore the capacity to make more rational judgments, they are making what is fundamentally human even better.³⁴

³³ Brock, Dan W. "Genetic Engineering." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 493-499.

³⁴ Savulescu, Julian. "Genetic Interventions and the Ethics of Enhancement of Human Beings." *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D, Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 826.

To address the ‘less diverse’ part of the argument, it is implausible to believe that gene editing would lead to children that are less diverse. Scientists and philosophers that are advocating for this intervention are attempting to create children with greater opportunities for fuller lives. Additionally, people value different things. For example, 10% of people choose not to abort a fetus that is known to have Down syndrome. Not everyone will always want their children to attain the same qualities and characteristics. Even with gene editing, the surprise of life will still exist, but with the added perk of the fact that many children will have a better life.³⁵

The third and final controversial argument against gene editing is that its negative effects will significantly hurt the patient and their offspring. In “Germ-Line Gene Therapy,” Palmer and LeRoy write that gene editing should not be performed if the technique has unanticipated negative effects, and these effects would be irreversibly a part of the recipient and their offspring.³⁶ For example, even though this intervention could be used to prevent a genetic disease from progressing in an individual, editing the genome could also cause unforeseen side effects, like an increased rate of mutations. This is a valid concern, but there is no evidence to support this. Furthermore, the objection assumes that a problem could not be corrected or that the mistake may not be known until the recipient has finished developing. Like any other interventions, extensive research must be conducted in order to know if there would or could be unforeseen negative effects.³⁷ If gene-editing research is funded in the future, we could find ways to ensure these problems would not occur. Of course, if gene editing is thoroughly researched and the research shows that it would cause more harm than good, it should be ruled out as a possible future reproductive treatment.

³⁵ Savulescu, Julian. “Genetic Interventions and the Ethics of Enhancement of Human Beings.” *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D. Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 827.

³⁶ Palmer, Julie G. and LeRoy Walters. “Germ-Line Gene Therapy” *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 538-545.

³⁷ The research could be monitored to make sure each experiment was following ethical guidelines.

Arguments for Gene Editing

Some argue that it is a moral obligation to enhance ourselves and future generations in ordinary and molecular ways using gene editing. In “Genetic Interventions and the Ethics of Enhancement of Human Beings,” Savulescu supports this view.³⁸ There are three reasons why we are obligated to at least begin researching gene editing to advance human health. Choosing not to enhance is wrong. If we have the opportunity to make someone’s life better, it would be wrong to withhold that opportunity. Consider these cases: imagine if a set of parents give birth to a baby that has a metabolic condition that will cause serious mental and mobility impairments if given a normal diet. Adding a cheap dietary supplement would effectively erase this problem. But, imagine if they do not provide this treatment, it causes the child to have serious health issues for the rest of their life. Next, imagine parents that birth a child that does not have this genetic disease, but a substandard diet would lead to the same condition. With an average diet, the child has a higher risk of metabolic problems, ranging from diabetes to hypertension to rheumatoid arthritis. If the parents provide the child an excellent diet, the risk of developing these conditions is equal to the general population. Imagine if they did not. Overall, there is one case where the parents can use a high tech supplement and one case where the parents can simply provide an above average diet, but both do not. Both sets of parents in these situations are wrong. Their inactions lead to the same outcome - a child who could have had a healthier life but instead will not. The failure to introduce food that creates better opportunities for a child is unethical. In both situations, the parents have a duty to provide their children with the best future possible.

³⁸ Savulescu, Julian. “Genetic Interventions and the Ethics of Enhancement of Human Beings.” *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D, Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 820-822.

If we substitute the word diet for biological manipulation, it shows that gene editing should not be immediately assumed to be wrong. It is important to enhance our children unless there are extreme circumstances where genetic intervention would worsen a child's life and minimize their opportunities. We should be consistent - if we accept environmental interventions to improve children's health, like diet, why not intervene in their genome to ensure they do not develop a life-threatening disease. I believe that there is no real difference between environmental and biological interventions. For example, in a study of a rat model, stimulating the environment changed the brain structure of the rats in the same way that Prozac³⁹ did. Environmental manipulations can affect biology. Why is it ok for us to implement environmental manipulations that change our biology but not directly manipulate our biology through gene editing? Is there a moral difference? There are risks with every decision we make. There are ways to improve a child's biology using favorable environmental conditions, but direct biological interventions may do the same thing. Therefore, no relevant moral differences exist. Finally, there is no difference between gene editing to prevent a disease and treating a disease, as long as both are thoroughly researched. Some diseases cause pain and stop people from doing activities that make life meaningful. Beneficence⁴⁰ yields a significant reason to enhance people biologically. What truly matters is human well-being, not simply maintaining how well we live now. Our biology affects how well we live. Manipulating biology to increase our opportunities is ethical. If we have an obligation to treat and prevent disease, I believe it is important to manipulate traits to provide the best opportunities and the best life for all.

³⁹ An SSRI medication that can treat depression, OCD, and more.

⁴⁰ The moral obligation to increase the wellbeing of people.

Germ line gene therapy may be the only way to prevent damage to future generations. Palmer and LeRoy emphasize this point⁴¹ - only genetic modifications performed in preimplantation embryos will affect most of the important cell types to prevent irreversible damage to the developing embryo. All of the embryonic cells and the productive cells would be genetically modified. The primary intent of gene therapy is to prevent a genetic disease from developing in an embryo that is indicated by their genome. This kind of intervention may be the only way to hinder genetic diseases from being passed down from one generation to the next because it targets somatic and germline cells.

Finally, there is no real difference between attempting to cure dysfunction and enhancing function. As a society, everyone should try to enhance life and cure disease if the risk is acceptable. In "Is Gene Therapy a Form of Eugenics?," Harris emphasizes this by rejecting the common argument regarding genetic therapy that we have a duty to cure disease, not to enhance a normal healthy life.⁴² If gene therapy can protect life by improving an embryo's certain condition by enhancing its health, there is no *prima facie* reason to not welcome it into medical practice. Imagine a car company building a car, and they had the option to cheaply incorporate safety features that would decrease the likelihood of deadly accidents. Then imagine if they failed to do so - we would hold the company responsible for not adding those features. This can be easily compared to a parent who didn't protect their child from a disease via quarantine or via gene therapy. If gene editing was made legal and researched thoroughly, it could protect human beings from current and future harm from our own genomes.

⁴¹ Palmer, Julie G. and LeRoy Walters. "Germ-Line Gene Therapy" *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 538-545.

⁴² Harris, John. "Is Gene Therapy a Form of Eugenics?" *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 518-523.

Applying Ethical Frameworks to Gene Editing

Let's refer to the two cases discussed in the introduction of this thesis. Remember the ethically permissible case was about a child being born with a problem with their reproductive system, and their parents implemented a surgical intervention to fix it. This affected the child's future and affected future generations because now the child can reproduce offspring. The paradigmatic case that is not ethically permissible consisted of cloning a great battlefield hero to send into the army. Is gene editing more similar to fixing one's reproductive system? Or is cloning a great battlefield hero for the purpose of using them in war?

According to Kantianism, genetic engineering used to produce healthy offspring is not unethical, as it does not use a human as a means to an end. Yes, a prospective parent may want a child in order to make the future parent happy, but this 'end' does not imply the child will be used as a mere means. Furthermore, prospective parents have a right to reproduce. Kant does express that actions that bring happiness may still be wrong, as ends do not justify the means. Yet, the act of removing a piece of DNA and replacing it with another for the sake of health is not wrong. It is an instance of beneficence, an example of a Kantian imperfect duty to others.

According to utilitarianism, editing germline cells to knock out and replace DNA sequences that are associated with genetic diseases would lead to the greatest happiness among all individuals, including individuals in future generations. The goodness of an action or situation is determined by the net happiness achieved. If gene editing results in eliminating a serious genetic disease, it will increase the happiness of the individual, their caretakers, their family, and their offspring by reducing financial and emotional stress.

Therefore, gene editing is more similar to fixing someone's reproductive system, or the ethically permissible case: it is not unethical. Gene editing can and should be used as a

reproductive assistive treatment option. Of course, it would need to be highly regulated, and it should mainly be used as a preventative medical procedure because in these cases the reward outweighs the risks.

Chapter Four: Human Cloning

In this chapter, I will be addressing the following questions: What is human cloning and what would it entail? Is it being performed and should it be? Is it ethical?

The Definition of Human Cloning and its History

Clones have genetically identical nuclear DNA, whether that be individual cells or entire plants, animals, and humans. The process of cloning is the asexual fabrication of a genetically identical thing from an existing one.⁴³ Throughout history, society has used cloning tactics to propagate plant strains for agricultural purposes. Scientists have cloned human and animal cells for different research objectives. Many molecular researchers clone parts of DNA for genetic assembly. Cloning also occurs naturally in the case of identical twins, as these individuals have identical DNA sets. Scientists have also used this process when performing IVF - when the zygote is developed and consists of two to four identical cells, they can isolate them to let the cells grow into different organisms that are genetically identical.⁴⁴

Reproductive cloning, or the construction of a nuclear genetic duplicate of a developed animal or human, has gained a lot of attention in the media. The purpose of reproductive cloning is a live birth of an animal or human. The first successful reproductive cloning of a mammal occurred in 1997, where scientists successfully cloned an adult sheep and birthed a healthy baby sheep named Dolly.⁴⁵ This triggered a worldwide response because people thought if a sheep could be cloned, so could a human. Countries began to ban human cloning with extreme punishments, such as jail time, for even attempting this procedure. Despite the backlash, many other animals have been cloned since Dolly.

⁴³ Vaughn, Lewis. "Cloning." *Bioethics: Principles, Issues, and Cases*, edited by Lewis Vaughn, Oxford University Press, 5th Edition, 2023, pp. 400.

⁴⁴ Ibid.

⁴⁵ Ibid.

How does cloning an animal or human logistically occur? The main method is called somatic cell nucleus transfer (SCNT), where DNA is extracted from an egg cell.⁴⁶ The egg's nucleus is replaced with a donor nucleus of a somatic cell from the individual that is going to be cloned. The reconfigured cell is stimulated with chemicals or electricity to grow and divide into an embryo, and the cloned embryo is transferred into a host uterus to develop. The egg and somatic nucleus can come from the same or different individuals; if they come from different ones, most of the clone's DNA is from the nucleus donor with a small amount from the other individual's mitochondria.

As of now, no human has been successfully cloned, and because of moral reservations and negative portrayal in the media, it is not likely anyone will be cloned for a long time. Policymakers and researchers have valid concerns about the safety and ethics of this kind of procedure. One of the main concerns is that human cloning would lead to lots of birth defects, and if this was the case, it should not be performed. Yet, no research has been performed, so without trial and error, we won't know.

On the other hand, therapeutic cloning is the creation of human embryos using SCNT for purposes besides a live birth like biomedical research or harvesting cells or tissues to be used for medical therapies. For example, therapeutic cloning allows an individual's cells to be used to treat or cure that person's condition without the risk of introducing foreign cells.⁴⁷ There are always some ethical issues with all medical procedures, but the idea has been accepted in some countries with tight government regulation. If therapeutic cloning leads to innovative results, maybe reproductive cloning could be an idea people will begin to consider.

⁴⁶ Vaughn, Lewis. "Cloning." *Bioethics: Principles, Issues, and Cases*, edited by Lewis Vaughn, Oxford University Press, 5th Edition, 2023, pp. 400.

⁴⁷ Kfoury, Charlotte. "Therapeutic Cloning: Promises and Issues." NIH, vol. 10, no. 2, 2007. Accessed 7 February 2023.

Although the concerns of the consequences of reproductive cloning are rational, there are many misconceptions that I believe are blocking further research required to ensure it is safe. For example, when people hear the word “clone,” they immediately think that it is a perfect and identical copy of an individual. That the clone created will look, speak, and act the same way as the original person. This idea is reinforced in literature and movies. In reality, an animal or human clone is not a perfect copy of an individual. It is nothing like a photocopy but instead a living thing that shares a set of genetic instructions with another. Genes do not ‘make’ the person and do not lead to all of a person’s characteristics. We have debunked this view, or genetic determinism, in previous chapters of this thesis. I will similarly address many misconceptions in this chapter.

Why Human Cloning is a Necessary Future Intervention

In this chapter, I will dive into the arguments against and develop arguments for this procedure. I hope to shape new perspectives on the topic and to encourage everyone to open their minds to a possible new medical procedure that, with ethical regulation, could change people’s lives. In some couples, women have no eggs, in others, men have no sperm. These couples may perceive benefits of reproductive cloning. Cloning could also be a viable option for couples who don't want to pass on a genetic disease or health risk to their child that one of the parents has. Overall, reproductive cloning could be used as a fertility treatment for individuals or couples that are not able to reproduce and want children that are genetically similar to them.

Arguments against Human Cloning and my Counter-Arguments

I will discuss arguments against human cloning, and I will either analyze and object to these arguments using different ethical frameworks, or I will oppose them using scientific facts.

The first argument I will discuss against human cloning is the problem of safety and consent. The President's Council on Bioethics discusses that concerns about possible bodily and psychological harms are shared by almost everyone on both sides of the cloning debate; although experiments in other mammals have been successful, there are plenty of potential dangers we do not know about yet.⁴⁸ The Council's primary concern is the risk to the cloned child. Only a small percentage of animal cloning experiments have been successful in leading to a live birth, and some of the born clones have suffered many health complications, including cardiovascular problems and brain defects.⁴⁹ The Council also argues that there are risks to the egg donor and birth mother; for example, risks to a woman's reproductive health caused by hormonal treatments and risks of late term miscarriages of the cloned embryo.

While this argument makes sense, it is important to note that all medical procedures, specifically all live births, come with numerous risks. And while I agree that human cloning should not be normalized if the success rate is low and the chance of defects is high, society will never be able to figure out how to increase its success and decrease its limitations without experimentation on more animals. The most valid part of their argument is that longer term consequences are not known because humans live much longer than other animals. This is a serious risk that should be considered. In regards to the egg donor and birth mother, every birth comes with the risk of miscarriage and death, and plenty of women around the globe have undergone hormonal treatments to increase their chances of an embryo implanting in their uterus.

⁴⁸ The President's Council on Bioethics. "The Case against Cloning-to-Produce-Children." *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D, Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 669.

⁴⁹ The President's Council on Bioethics. "The Case against Cloning-to-Produce-Children." *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D, Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 670.

In regards to the problem of consent, the Council argues that although they know it is impossible to get consent from the clone, especially because it must develop physically and cognitively before it can answer, it should still be required. The Council reasons that attempting to clone a human would expose that cloned person to great harm, and if they are not aware of that beforehand, they should not be created.

This argument is completely useless, as every child that is created in this world has never been asked if it is ok if they are conceived and eventually born. Concerns about consent cannot be applied to the unborn. Babies are conceived all of the time by parents that know they could possibly pass down a serious genetic disease, and some may say it is unethical, but few would say the situation is ethically impermissible. So, why would birthing a child that could potentially have a health risk due to cloning be any different? Of course, we want to limit as many risks as possible, but it is not much different than if two parents that have HIV have a child. Additionally, humans would not be cloned without extensive research.

Another argument against human cloning is that it could violate a right to a unique identity and lessen the worth of people. Dan Brock explains that human cloning could produce psychological distress and harm in the later twin, as the path in life taken by the earlier twin could affect the later twin's individuality. They may feel as though their autonomy and freedom is diminished, and that they may feel pressure to reach the standards of the earlier twin.⁵⁰ While psychological harms from these kinds of feelings are possible, they remain speculative as no human clone exists to date. The President's Council also believes that cloning to produce children could lead to issues of identity. They argue that cloned children may experience concerns about their distinctive identity not only because each will be genetically identical to

⁵⁰ Brock, Dan W. "Cloning Human Beings: An Assessment of The Ethical Issues Pro And Con" *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 460.

another being, but they also may resemble the younger versions of the person who is their “parent” in respect to appearance.⁵¹ The Council does address that one’s genetic makeup does not by itself determine one’s identity, but genetic uniqueness is important in our sense of who one is. They argue that being genetically identical to someone will strain their sense of self, and everything about their predecessor will be compared to them. I disagree with this statement. Additionally, Leon Kass recommends a legal ban on human cloning based on how it creates issues of individuality.⁵² The clone could be worried about their identity because they will have the same genotype and appear similar to another human being, but in a reproductive cloning case, it would be a twin who might be his “father” or “mother.” The cloned individual would be grouped with a genotype that has already lived. Kass argues that this individual would not be a surprise to the world and that everyone would compare their experiences to that of the earlier twin. He even goes on to explain that the clone’s life has a blueprint of a “past life” that will control its entire future.

Despite everything that is said about a clone not having their own identity, most of the concerns are based on false beliefs about genetic influence. The argument regarding the clone not having their own identity because they will always be compared to the earlier twin can be juxtaposed to a family having another child to replace a lost one. Although the child a family has to replace the lost one will not be genetically identical, the family still can compare their old child to the new one, and this action is not banned. Robert Wachbriot expresses that these concerns are not sufficient to sustain a moral objection to cloning unless the parents of every

⁵¹ The President’s Council on Bioethics. “The Case against Cloning-to-Produce-Children.” *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D. Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 676.

⁵² Kass, Leon. “Cloning of Human Beings.” *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 455-458.

clone cannot help but be oppressive.⁵³ The cause would instead be bad parenting and not because they chose to create the child. There are plenty of parents who constrict their children's opportunities for growth and development - of course I condemn this just as much as I would condemn a cloning parent for wrongly treating a cloned child. Additionally, children are at times born with high expectations; the thought that the clone would be overly burdened by the fact that there is someone genetically like them is speculative at best. The Council's argument that genetic uniqueness is important in our sense of who one has no merit. For example, twins, who are also genetically identical, do not determine their identity by the amount of nucleotide differences they have with their sibling. The Council argues that in the twins case is different because they are already free of the burden of measuring up to each other because they begin life together, but this is not always true. Many twins struggle mentally because they constantly compare themselves. In regards to the appearance argument, identical twins that have the same genome do not look 100% the same because of different environmental pressures, neuronal connections, and uterine, nutritional, and chemical levels. Overall, the number of nucleotides differing between individuals does not define who they are. Yes, it does contribute to slight phenotypic differences, but people with the same genome can look and act completely different and have their own identity.⁵⁴ Even if we knew clones had to endure certain difficulties, that is not enough to stop them from being created. Society has never stopped poor families from having children even though it is known they will suffer hardships. No one's life is free of burdens. Only if a clone's life did not have any significant benefits would it make sense to condemn their creation. Finally, understanding that there is an overwhelming scientific consensus that genetic determinism is

⁵³ Wachbroit, Robert. "Genetic Encores: The Ethics of Human Cloning." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 462.

⁵⁴ The President's Council on Bioethics. "The Case against Cloning-to-Produce-Children." *Ethical Issues in Modern Medicine: Contemporary Reading in Bioethics*, edited by Bonnie Steinbock, Alex John London, and John D. Arras, McGraw Hill Companies, 8th Edition, 2013, pp. 677.

false debunks most of the arguments about identity.⁵⁵ Nurture and circumstances in life shape people; genotype is not destiny. One's sense of identity is not dependent on their genetic identity.⁵⁶ For most of human history, there was no knowledge of genomes and DNA, and their identity was perfectly robust.

Finally, an argument that has been made against human cloning is that the clones could be abused and that the process would be used to create a working class or slaves. This situation could occur if the procedure fell into the hands of someone with ill intentions, but most countries already have laws against cloning people. Laws would only be changed if cloning was known to be safe and if there was a procedure developed to ensure it was strictly regulated. More to the point, this argument is inconsistent - the world as we know it already has a persistent underclass, and if people are truly worried about unethically creating a working class, they should instead encourage social mobility and less stratification between classes that already exist. We should deal with the issue by funding education, free college, providing more resources, etc. rather than bashing a procedure that could lead to real benefits.

Another situation to consider is if it is ethical to clone to bring back "a lost loved one." Thomas Murray expresses his disdain of this idea, and he argues that even though he is a grieving parent, he believes cloning will not remove grief from a parents life or bring back their child. I agree with these beliefs, as they are well spoken by Murray, who has experienced a grave loss. Further, Gregory Pence defends having a baby after the loss of a child, but not with the intention of replacing the child for an exact replica.⁵⁷ He expresses that people have children to

⁵⁵ Wachbroit, Robert. "Genetic Encores: The Ethics of Human Cloning." *Medical Ethics*, edited by Jeffory Leon, McGraw-Hill Education, 2021, pp. 462.

⁵⁶ Brock, Dan W. "Cloning Human Beings: An Assessment of The Ethical Issues Pro And Con" *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 459.

⁵⁷ *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 409.

replace their lost ones all the time. A family can have another child after the death of an infant and no one questions it - yet if a family wanted to clone a child to “replace” their lost one, it would be considered wrong when it is really a similar situation. Additionally, if cloning is eventually made safe, there would be tight restrictions put in place just like every other reproductive procedure. This way, it is ensured that the clone is made for the right reasons. It would not be created to duplicate the lost loved one but instead a product of reproductive cloning that would be loved for its own sake. It is important to keep in mind there is no scientific way to relieve the pain of death, and if the family was chasing an illusion to technically bring this person back to life, it would be wrong. As long as the parents or loved ones are not using a cloned child as a means to an end and understand that their cloned loved one will come back as a different person, I believe cloning after a loss could be ethically permissible.

Arguments for Human Cloning:

One of the benefits of human cloning is that it could be used to avoid passing down genetic diseases to children. Dan Brock agrees with this point, and he writes that hereditary risks can be avoided by using sperm or egg donation.⁵⁸ For example, if a couple wishes to have children, but both are carriers of a lethal recessive gene, they can extinguish the risk of conceiving a child that will suffer a short life. Instead, they can opt for cloning to maintain a genetic tie to their child and avoid having a child with non-related DNA.⁵⁹

⁵⁸ Brock, Dan W. “Cloning Human Beings: An Assessment of The Ethical Issues Pro And Con” *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 457.

⁵⁹ Wachbroit, Robert. “Genetic Encores: The Ethics of Human Cloning.” *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 465.

In addition to avoiding the continuation of a genetic disease in a blood line, Wachbriot expresses that cloning is less problematic than other reproductive technologies, like genetic engineering.⁶⁰ Genetic engineering's main goal is to create a child with or without certain traits. While human cloning can achieve some of these goals, such as avoiding a genetic disability, it also provides a couple with a biological child they might not have been able to have. Some people believe cloning is more ethical because acquiring or deleting traits through genetic engineering could cause serious social implications; on the other hand, cloning simply duplicates the genome and does not bring about improvements.

Finally, cloning could be used as an infertility treatment. This would allow women who have no ova or men who have no sperm to produce an offspring that is biologically related to them.⁶¹ Additionally, George Pence expresses the importance of having the freedom to be able to conceive a child.⁶² If a family or person wants a child but is unable to get pregnant, and/or if they have already tried every other reproductive treatment available, they may use cloned DNA of themselves or a healthy relative to have a child. Keep in mind that Pence supports a "go slow" approach with human cloning and favors a ban on all commercial trade in certain human genotypes.

Applying Ethical Frameworks to Human Cloning

Again, let's think back to the two cases we have been referring to. Is human cloning more similar to fixing one's reproductive system? Or is cloning a great battlefield hero for the purpose of using them in war?

⁶⁰ Wachbriot, Robert. "Genetic Encores: The Ethics of Human Cloning." *Medical Ethics*, edited by Jeffery Leon, McGraw-Hill Education, 2021, pp. 463.

⁶¹ Brock, Dan W. "Cloning Human Beings: An Assessment of The Ethical Issues Pro And Con" *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 457.

⁶² Pence, George. *Who's Afraid of Human Cloning?* Lanham, Rowman & Littlefield Publishers, 1998.

According to Kantianism, if human cloning did not use children as a means to an end, it would be acceptable. A Kantian could argue cloning is ethical if the couples who create children do it because they want to respect and love their offspring as persons.⁶³

According to utilitarianism, human cloning is ethical if the benefits of the technology exceed the harms. Most utilitarians would support human cloning if research was done to ensure the risks to children were minimal.

In my view, human cloning is more similar to fixing someone's reproductive system, or the ethically permissible case in casuistry. Since it's permissible, according to Kantianism, Utilitarianism, and case based reasoning, it is not unethical.

In conclusion to this chapter, it is most important to remember that genomes can be replicated, but individuals cannot. Human cloning would not duplicate a personality, and would not produce an exact look alike. Clones would have their own unique identities. It is the nature of a being, not how it is created, that deems its value and determines the respect it deserves. There are serious consequences that could come of this procedure if it was not ethically regulated, but if used with care and good intentions, it could beneficially impact our world by improving the genetic health of the race.

⁶³ *Bioethics: Principles, Issues, and Cases*, edited by Vaughn Lewis, Oxford University Press, 5th Edition, 2023, pp. 404.

Chapter Five: Conclusion

To conclude this thesis, I will be answering this question: Is it morally permissible to employ reproductive technologies, including cloning?

The Utilitarian answer is yes if the benefits of technology outweigh the harm. Most would see a net gain in the use of IVF and other technologies... even cloning if the risks to children and their families were low. These reproductive technologies' real but low risk of birth defects and maternal complications is outweighed by happiness brought to interfile couples. Yet, it may be difficult to use a utilitarian perspective because the money spent on them could possibly yield more happiness if spent on food for the hungry. It is difficult to come to a conclusion because it is hard to weigh which outcome would yield the most happiness.

From a casuistry perspective, in cases where the children will be loved and taken care of and will only have minor diseases/ conditions because of genetics and not the technologies, I believe all the reproductive technologies written about are ethical. More specifically, as I was writing this thesis, a baby named Noah was the first baby in Texas to be identified with spinal muscular atrophy (SMA), a genetic disease caused by a mutation, using newborn screening.⁶⁴ A month after he was born, he underwent gene therapy that prevented him from suffering from the side effects of this disease for the rest of his life. It is important to note that individuals with SMA do not make the survival motor neuron protein, which is necessary for the protection of motor neurons; motor neurons control the body's ability to move muscles.⁶⁵ There are four kinds of SMA, and Noah was an SMA 1 baby, meaning he wouldn't have likely lived beyond 2 years old. Noah looked perfectly healthy, and both of his parents had no idea they were carriers of the genetic mutation. Once diagnosed, they had their options for treatment, and they chose the intravenous gene therapy treatment called Zolgensma that Noah would only need to have once in

⁶⁴ Villalpando, Nicole. "New test leads to healthier life for local baby." *Austin-American Statesman*, 2022.

⁶⁵ Ibid.

his entire life. Zolgesma was approved by the FDA in 2019, and it uses a virus to carry a new copy of the SMN 1 gene, which infects the cells with the new DNA. Because this virus carries the gene therapy, the parents had to wear gloves when changing Noah's diaper. I wrote about this case because it shows how gene therapy, at least in this case, helped cure Noah of a seemingly incurable genetic disease. And without adding this genetic mutation to the newborn screening testing, Noah would not have received this treatment. I also want to note that more therapies for SMA are being developed, and researchers are studying if delivering the gene therapy in a smaller dose directly into the spinal fluid is more effective. The oldest child who has received Zolgensma is now 6 years old and is living a normal life. This case is incredibly heartwarming and special, as it shows that gene editing can and should be used to prevent and/or cure genetic diseases that often shorten people's life spans. I don't see any ethical differences between this treatment and a treatment that could be performed in utero, in vitro, or on gametes. To reiterate, if this procedure was done in vitro, I would not think it would be unethical, and my stance would not change. Because of this gene-editing case and how it saved this child's life, I do not think we should be afraid of this kind of technology.

From a Kantian perspective, it is possible to either oppose or defend technologies. Some could argue that cloning is not ok because they treat children as a means. Yet, this danger still exists with traditional reproduction. But, some also could argue that couples who create children do so precisely because they wish to respect and love their offsprings as persons. It seems likely that children conceived through ART would be cherished at least as much, if not more... It doesn't matter how children are brought into the world but instead how they are treated after they arrive.

More research in the future should be focused on gene editing and human cloning, and discussions, educational outreach efforts, and theses like this one should be encouraged. Some of the biggest arguments against research efforts include safety and consent risks, as attempting these reproductive procedures could lead to unethical experimentation. These unknown risks and safety considerations is what led cloning to be prohibited. Yes, experiments to develop new reproductive technologies are necessary to ensure their safety, but if the experimentation is unethical, it cannot occur. But before we would allow an embryo to develop, testing on other animals would be done to ensure unethical circumstances would not occur. Animals would need to live healthy lives as clones before experimentation on humans, and of course there would have to be minimal side effects. Additionally, unethical circumstances have not stopped scientists in the past from developing and learning about new surgeries. It is also important to keep in mind that people had serious concerns with IVF, but now it is a very popular infertility treatment.

The goal of this thesis was to change perspectives and remove misconceptions about many different fertility treatments, current and future. I hope that I have opened people's eyes to different technological advancements that are available to relieve infertility issues, and I hope much more of society realizes that these future treatment opportunities could help future families grow and possibly help cure infertility. I am also hoping that my research and my work on this thesis will encourage others to look at science and future medical procedures differently. New medical procedures help save lives and/ or make people's lives more bearable. Additionally, it would be incredible if different insurance companies could realize how valuable these fertility treatments are. If they could expand their policies to cover infertility treatments, I know so many more women and families would be able to afford this care.

All in all, the previous procedures talked about in each chapter are ethical and important to understand, as they could relieve women's infertility issues. Remember that it is one's choices, not technology, that brings good or bad things to this world.

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Biography

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