9-28-2020

# Human Genetic Enhancement: Is it Cheating?

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A Senior Honors Thesis

Submitted in Partial Fulfillment of the Requirements
for Graduation in the Honors College

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May 15, 2020

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**Abstract**

Genetically modifying organisms has been a very useful technology in the development of ways that we can solve many agricultural problems. This technology, which has been around since the 1990s, is starting to be used on humans in an effort to combat many genetic diseases. But does human genetic enhancement (HGE) cross a moral line? Many consider HGE to be a form of cheating since people who have been enhanced would have many advantages over those who have not been enhanced. To address this issue, I first distinguish between modifications and enhancements. Then, in light of Ken Kirkwood's analysis of cheating, I describe four ways in which someone can be said to cheat. I conclude that, whatever other moral lines HGE might cross, HGE is not a form of cheating.

## Table of Contents

**Acknowledgements**

I would like to thank Dr. Joseph Long for his knowledge in philosophy, his support, and his time in helping me develop and present this topic.

I would also like to thank Andrea Vella, Dr. Pam Beach, and Dr. Austin Busch for providing assistance to the Honors College students.

I appreciate Dr. Rongkun Shen's suggestions that he made to my presentation which gave me some ideas to incorporate into my argument.

Finally, I would like to thank everyone that made it possible for the students of Brockport to continue their education during these tough times.

## Introduction

Genetic enhancement technology has been used on other organisms, such as plants and insects, for agricultural purposes. Many researchers are interested in looking at the potential of using this technology in humans. However, a lot of experts and organizations continue to push back on using this technology on humans, especially embryonic subjects. I do want to preface that while the interest in this technology is growing and it has been used on humans in select cases, HGE is not at a stage where it can be properly and regularly applied to human subjects. For this reason, it is important that we explore now the morality of using this technology to modify humans in order to determine if continuing to develop HGE will be in our best interest.

To discuss my argument about HGE, as it relates to cheating, I begin by providing the present moral arguments surrounding HGE. Cheating is not the only concern having to do with the morality of HGE, so I quickly point to other viewpoints from which HGE is discussed. After I talk about the moral arguments involved in HGE, I describe the science of HGE. There are multiple ways that this technology can be applied, and I go over many of these methods. I also examine previous uses of enhancing technology as well as the pitfalls that have led to this research being slowed down. I finally, in this section, try to define the differences between modifications and enhancements and why this is relevant to the overall argument. Following this biological section, I enter the realm of defining cheating. Here I provide Kirkwood's requirements for cheating and, ultimately, the definition of cheating based on these requirements. I show how this definition can relate to four possible different forms of cheating. Following this section, I relate all of these ideas back to HGE. I explain how each form of cheating relates, or does not relate, to HGE. Finally, I conclude my paper by summarizing my argument and providing my view of HGE as it relates to the immorality of cheating.

## Moral Background

Human genetic enhancement is a relatively new area that started to be realized in the late 1990s to the early 2000s. This, however, has been a very good amount of time for many who want to discuss the morality of human genetic enhancement. During this time, people have discussed different ways that someone can approach the morality of human genetic enhancement. In this section, I will discuss a few of these ideas and present the idea that I will be pursuing in the rest of my paper.

Not only are there many intricacies to the discussions surrounding this topic, but there are many angles that one can observe it from. One idea is that if we continue down the road to start genetically enhancing human beings, then we may begin to compromise authenticity. Rather than working to obtain authentic achievements, we will settle for easy victories through genetic enhancement. In this view, we would lose the opportunity to build character in favor of an easier life. Another issue with genetically enhancing humans that has been proposed is the idea that genetic enhancements are dehumanizing. Some believe that through continued use of genetic enhancements in humans, the idea of what really makes us humans will be lost. A third idea that has been put forward involves the belief that genetic human enhancement could be cheating. While this could easily be applied to sports, especially with the term “gene doping”, there could be a social context attached to this whereby genetic human enhancement creates an unfair social landscape in human society (Stanford Encyclopedia).

When people are asked about why HGE might be morally forbidden, I think the idea that would come to mind most frequently is that it would be unfair. I am not sure that most people would think about dehumanization or compromising authenticity as reasons to not pursue this technology. While these may be concepts that they could comment on, I think most people

would identify with the opinion that the social playing field would be shifted in an unfair way if we continued with human genetic enhancement. Because of this, I thought that tackling the idea of human genetic enhancement, which we will refer to as HGE, as cheating to be the best route to take in this paper. I think it would be valuable to first better understand how this technology was developed and how it is currently used.

## The Biology of Enhancements

In this section, I discuss the biological technologies associated with HGE. This includes the different ways that researchers intervene in the genome of an organism and the methods by which they can change the genome. I also present the ways in which these methods have been used on human subjects, as well as how they have failed. Finally, in this section I differentiate between modification, enhancement, and therapy in terms of HE and other interventions. The writings of Walter Glannon and David Resnik were instrumental in providing criteria by which I develop these definitions.

'CRISPR' stands for clustered regularly interspaced short palindromic repeats. They are repeating segments of genetic code, the genetic code being RNA. This genetic code is made up of RNA and it forms a complex with a Cas, CRISPR associated, protein. CRISPR was first discovered as a defense system that bacteria used to fight viral infections. When a virus would insert its DNA into the bacterium, the CRISPR would connect to the viral DNA, using a matching guide RNA sequence in the CRISPR, and the Cas protein would cut the viral DNA. Now, the use in animal gene editing is the same in that if there is a segment of DNA that you want to replace then you use the CRISPR-Cas system to cut the DNA. You would then introduce the desired DNA segment into the cell where it will link with the split ends of the cut segment

and become part of the organism's genome ("What is CRISPR?", 2020). But how has this manifested in studies with animal subjects?

In the beginning, biologists and other researchers enhanced insects. Often, these researchers modified fruit flies to see if they would express different traits. Most students, especially those in high school, have seen in science textbooks from the early 2000s many images of these flies with differing wing structures, eye colors, and even limbs that were not in the correct places, such as a leg on the head where the antennas should be. For example, scientists would modify homeobox (HOX) genes, developmental genes in animals that determine the segmentation of the body in the embryo, in fruit flies so that they have legs where their antennas should be. Many times, these experiments were performed to show that it is possible to modify organisms in this way.

While we have modified organisms that are much more complex than insects, we continue to modify insects to solve many of our problems in different areas. In my introduction, I discussed that scientists are working to combat vector-borne illnesses by modifying the insect vectors. Luke Alphey, Ph.D., is a scientist who participates in these types of studies (Wise et.al. 2011). By engineering mosquitoes so that males are infertile, either through not being able to reproduce or producing offspring that are not viable, he is working to stop illnesses spread by mosquitoes such as Malaria. But we have continued using this technology far past insects and towards much more complex animals.

We have used the same technology, CRISPR, to enhance animals such as mammals and fish. In many cases, these modifications are being done to further understand how the current system can work better. In other cases, these modifications are done for some sort of commercial gain. For example, Elsa Wenzel discusses the use of CRISPR to create designer pets (Wenzel,

2007). According to Wenzel, South Korean scientists were able to create cats that would glow under UV light using fluorescence protein genes. Wenzel also discusses a company where one could pay to clone their cats, you could bank their genes in a cryogenic chamber, or even pay money to get hypoallergenic kittens.

To determine how close we are to this point in human genetic enhancement, let us first look at where we are with actually enhancing humans. According to an article titled "Genetic Modification of Preimplantation Embryos: Toward Adequate Human Research Policies" there are many issues that are surrounding the ability of us to successfully enhance humans. Two methods that are important to understand are somatic cell gene transfer and germ line genetic intervention. Somatic cell gene transfer, called 'SCGT' hereafter, involves incorporating the desired gene into the somatic cells of a child or adult. The somatic cells are all the cells of the body except for the germ cells, spermatozoa and ovum. This is commonly done by modifying viruses after which they will introduce the virus into the system and the virus will "infect" the human host with the desired genes. The gene will then be incorporated into the person's genome. An aspect of SCGT is that whatever gene is changed will not pass on to the offspring. The germ cells contain the DNA that are passed onto the offspring and therefore if the good genes are not in the germ cells, the children will not get the benefit of the enhancement. The desired "correct" gene being incorporated into the patient's genome occurs during a successful SCGT, and while numerous studies have been conducted since 1990, no instances of SCGT have proven to be reliable in terms of safety and efficacy to move forward with clinical testing (Dresser 2004).

One case in which SCGT was used proved that this method could, in fact, be very dangerous (Rinde 2019). In September of 1999, 18-year-old Jesse Gelsinger died when he was being treated using SCGT. In 1981, Jesse Gelsinger was born, but he had a deadly disease.

Gelsinger was diagnosed at two years old with ornithine transcarbamylase deficiency syndrome, or OTCD, which is a disease that is linked to the X chromosome. People with this disease cannot properly metabolize ammonia, allowing it to build up to toxic levels in the blood. This is a large problem since ammonia is a by-product of protein digestion. The seriousness of this disease is exemplified in the fact that many babies with OTCD fall into comas, suffer brain damage, and die within months of being born. Luckily, Gelsinger had a milder version of this disease and was therefore able to be put on a restrictive diet and given medication to regulate ammonia levels. When Gelsinger was 17, scientists from the University of Pennsylvania were working on a means to fix the *OTC* gene. This treatment would use the virus method in which the researchers would use a cold virus, that was made harmless, to insert a new *OTC* gene into the target liver cells. This *OTC* gene would produce an enzyme that would allow for the regulation of ammonia in the blood. There were multiple patients before Gelsinger who had experienced mild symptoms, but he was excited to help and allow researchers to solve problems for future babies born with OTCD. However, after being injected, Gelsinger suffered major issues as his body suffered severe immune responses. This led Gelsinger to experience multiple organ failures which cause him to become brain dead. Within days of being injected with such a promising treatment, Gelsinger was taken off life support and died. This case not only caused much surprise in the scientific community, but also caused the research into this technology to come to a halt (Rinde 2019). Now that we know the shortcomings of SCGT, maybe we can explore some other form of genetic enhancement.

Germ line genetic intervention, or GLGI, is the other form of genetic enhancement. As you may be able to tell from SCGT, GLGI would proceed by enhancing the germ cells of the parents. This approach has a different result from SCGT in that any changes will pass on to the

subject's children and they will stay as the person develops and reproduces (Dresser 2004). The other variance from SCGT is the fact that the whole organism will be affected by the changes to the genome. In SCGT, researchers are normally targeting one type of somatic cell in the body, depending on the organ affected by the "undesired" gene. Likewise, the changes in the genome using SCGT only pass on to cells that originate from the cells that were affected by the gene transfer. With GLGI, you are modifying the genome of an embryo which will be the origin of all the cells in the organism. Therefore, the change in the genome will permeate into all the target and non-target cells. But the greatest differences about this method is also what can be its greatest detriment as any desired changes will affect future generations, so do undesired changes. So, if a gene fails to produce the desired effect or even produces an unwanted effect, now there are further problems that the descendants of the subject may have to face in the future.

Another biological limitation plaguing HGE is the fact that many genes are 'interrelated'. What I mean by this, is that many genes do not operate alone. Some genes operate with other genes that may be near each other or located in totally different places in the genome (Shen, April 2020). The National Institute of Health, NIH, recognizes these as gene groups. While some gene groups may share similar genetic code, "In other cases, dissimilar genes are grouped together because proteins produced from these genes work together as a unit or participate in the same process" (NIH 2020). This issue can lead to the development of polygenic disorders. These are disorders that are caused by the malfunction of more than one gene (Shiel Jr. 2018). Variation can even be seen in single-gene disorders. Single-gene disorders can be caused by different mutations within the same gene, or even the same mutation with varying degrees in phenotypes (Alliance 2010). The biological limitation that is highlighted in these issues is that of targeting. It is difficult enough to figure out one target gene to change in an attempt to correct a

mutation without having to think about the cascading effect of other separate, but related genes. More testing would be required to determine what other effects would result from changes in the single genes. So, what is limiting this further research?

In the same article that discusses SCGT and GLGI, Dresser states many different reasons for why HGE is not improving. The United States, in particular, has regulations, agencies, and advocate groups that are working against using embryos to further studies in HGE. Dresser, for example, states that, "At this point, only one federal law explicitly addresses experimental interventions on embryos expected to become children. This is the provision that prohibits the NIH from funding research that involves the destruction of human embryos (U.S. Congress 1996)." According to the provision, human embryos cannot be created for the purpose of research that would lead to their destruction. The only circumstance that embryos can be used in this way is if it would lead to biomedical knowledge that could be obtained by no other means. Dresser also goes into a discussion about the common rule of human research.

The Common Rule of the U.S. Department of Health and Human Services, UDHHS, involves three requirements that must be met for research to continue. The first requirement is that, "...the risk of subjects must be minimized" (Dresser 2004). Researchers must work to understand the risks involved in certain treatments and use that understanding to make sure that participants suffer as little as possible from these risks. The second requirement involves researchers, "...helping... participants or their representatives make informed and voluntary decisions…" (Dresser 2004) relating to them joining and remaining in research groups. Just as researchers need to understand the risks of treatments, so do participants in research. They should be able to give informed consent on how they proceed with treatments. The third, and final requirement, "...mandates equitable subject selection" (Dresser 2004). Subjects should be

chosen in a way the harms and benefits are distributed fairly between participants. Dresser further argues that it is difficult to determine if research on human embryos follow or go against the requirements of the Common Rule. At the very least, we can acknowledge that it can be argued that research done to human embryos do not follow these requirements. In research using human embryos, risk to embryos may not be able to be minimized as many embryos would be destroyed in the process of the research. Embryos themselves cannot give any sort of consent and the lack of knowledge on the risks of this research may make it difficult for their representatives to be properly informed. Finally, we cannot ensure subjects will be given fair distributions of harms and benefits because some embryos will receive much more harm than other embryos, especially embryo destruction in early stages of the research.

The combined lack of following the UDHHS Common Rule of human research and the regulations set by the NIH result in the ultimate lack of funding in further HGE research. This lack of funding is one of the reasons that research on this subject has not grown as much as it possibly could. But the United States is not alone in its stance of not allowing for HGE in embryos as there are many other nations that have banned this type of testing. Despite these efforts to outlaw this type of testing there is one scientist who successfully modified a human embryo.

In 2018, He Jiankui, a Chinese biophysics researcher, had announced that the first genome-edited babies had been created who were made to be resistant to HIV ("He Jiankui" 2020). He had done this by enhancing the gene, using the CRISPR system, that produced the cell receptor protein CCR5. This receptor is one that the HIV binds to when infecting the cell. By enhancing the *CCR5* gene in the embryos, He made the embryos resistant to HIV because the virus could no longer, in most cases of HIV infection, bind to the target cells properly and infect

them. However, they are not immune to the virus as it may mutate to use a different method to bind to the target cell membrane. This just means that it is harder for them to contract HIV than it is for others with the normal *CCR5* gene (Shen 2020). While He did receive some support, he also received a lot of criticism from biologists, bioethicists, and even the Chinese Academy of Science. Many condemned his research as being reckless and irresponsible and in 2019 he was fired from the Southern University of Science and Technology as well as sentenced to three years in prison and a fine equivalent to $430,000. This situation answers questions such as "What have we done with HGE," "What would happen if someone were to enhance human embryos," and "How do many leaders in the research community feel about enhancing embryos?" But it also brings up more issues involving how we should categorize HGE.

There are possibly many people who are thinking to themselves, "Don't we enhance our cells and genes as we develop anyways?" For example, by getting vaccines as we grow up, the weakened pathogens cause our white blood cells to enhance the proteins they produce in order to fight the pathogen. This is causing a change in the expression of our genome at the very least. Other drugs cause changes in our gene expression as well, such as antidepressants. "Different classes of antidepressant drugs have also been found to induce epigenetic changes in both animal brain cells and in clinical studies" (Antidepressants 2015). Epigenetic changes refer to changes in phenotypic expression that do not result from changes in the actual genes. So why should we allow vaccines and other drugs to be used if we do not allow embryos to be enhanced? This question may be answered using definitions on modification and enhancement.

Walter Glannon tried to present an idea forward, in his essay "Genetic Enhancement", about how we should distinguish between therapy and enhancement (Glannon 2020). Glannon argued that these should be determined by a baseline in terms of health. If intervention were used

to restore this baseline, then that intervention would be therapeutic. However, if the intervention were used to augment an otherwise normal function, then this would be enhancement. An example that Glannon uses is between an athlete with slightly lower levels of hemoglobin, thalassemia, and a child suffering from severe thalassemia. The athlete has slight thalassemia and desires to raise his hemoglobin levels to be more competitive. If the thalassemia does not interfere with his normal functionality, then getting treatment would be an example of enhancement. The girl, on the other hand, cannot function normally with her extreme thalassemia, so receiving treatment would be therapy. This form of distinguishing between therapy and enhancement has one large problem, and that is the distinction is too vague. The reason it is too vague is that the idea of a baseline with human physiology is, in a sense, an almost impossible notion. Humans as a population are extremely diverse and I do not think that there is a truly adequate way to determine what a true baseline should be. Are we judging based overall, because various regions around the world will have very different baselines for physical functioning, likely using different metrics as well? Are we judging based on race, because that may bring us to some completely different ethical issues? This all might seem like I am being too harsh, but I think that we must be precise in order to eliminate as much gray area as possible. For this reason, I do not think that we should completely accept the distinction given by Glannon.

Let me attempt to describe how Glannon is being too vague in a more precise way. While Glannon's example of the athlete and the girl seems obvious, I will use three examples that require us to be more specific than an overall baseline. My first example involves testosterone in patients. Say someone is born with low levels of testosterone and they want to provide them with treatment that will bring them back up to around the normal level of testosterone. The fact that we do not know the sex of this person means that we cannot properly assess how to treat them.

Both women and men have testosterone but the levels between them differ. While these differences may seem small, they result in large differences between the two sexes. If we follow the idea of Glannon, we could make an overall baseline that their testosterone levels should lie within. However, this baseline as an overall average would mean that males will have too little testosterone and females would have too much testosterone. Let us now look at someone who has a problem with their bone production. They are not able to produce as many osteoblasts, bone building, as they should. However, without knowing the age of the person we cannot determine how to modify their production of osteoblasts, even with an overall baseline. If we were to create a general baseline, then we would be giving some patients a production of osteoblasts that is too high and some that is too low based on age. A third example is dealing with a patient whose skin does not contain enough melanin and are therefore at risk of serious injuries from exposure to the sun. But race would be very important in determining how we should regulate this person's melanin levels. Creating an overall baseline would be neglecting the person the ability to receive the correct treatment as levels of melanin in different people vary greatly.

I am not trying to insinuate that Glannon does not think that baselines can be made relative to factors such as sex, race, and age. The issue that I have with his idea is that he attempts to draw a distinction between enhancement and therapy without providing a more precise method to determine physiological baselines. Even his example has some flaws involving this issue. He tries to compare an athlete to a person who is not an athlete. However, trained athletes can have what is called "sports anemia" which results in them having lower concentrations of red blood cells and hemoglobin in their blood. This occurs because the athlete has increased levels of plasma in their system (2017). Glannon says the athlete has slightly lower

levels of hemoglobin, but is he comparing the athlete to non-athletes or to other athletes? The answer to this question may be insignificant in his case, because the athlete is being enhanced if he gets treatment either way, but if we try to apply this to other situations then we may run into problems. Let us frame this same problem with a different example. There is a person who has been training for a couple of years and wants to be given legal medication that could help improve his muscle growth. This person is well below the average muscle content for someone who has been lifting as long as he has. However, he is well above the average muscle content of the average citizen in his country. As an athlete, receiving the medication would be therapeutic but as an average citizen, receiving the medication would be an enhancement.

The reason that the lack of preciseness is important is because Glannon attempts to make a moral argument about therapy versus enhancement. But, as I have shown, cases can easily fall into a gray area which would bring us back to square one. I think it is very difficult to make a moral argument without having the precise guidelines in place. So, it is not that I think Glannon does not believe that we can make more precise baselines that I am arguing. The problem is that by not providing a somewhat precise baseline, Glannon makes it harder to differentiate between enhancement and therapy which makes it harder to approach the moral issues involved.

One may argue that we can easily solve these issues by providing baselines based on the physiological issue being presented. However, many physiological functions are affected by many different factors at once and therefore a broad baseline would be too vague. An example of this could be obesity. While obesity is mainly affected by a discrepancy in calories being burned against calories being eaten, there are a lot of other factors involved. Obesity may be affected by psychological issues leading to food addiction. It may be affected by hormone levels in a person that differ greatly from the average. Genetic diseases may make some people more prone to

being obese. Even peoples' body frames can affect their weight in a way that they cannot properly operate under a certain weight that would technically classify them as obese. Obesity is only one condition of many that may have similar effects on where someone lies within a baseline. So how do we combat this issue?

David B. Resnik is another philosopher who tries to crack the code of distinguishing between therapy and enhancement in his paper "The Moral Significance of the Therapy–Enhancement Distinction in Human Genetics" (Resnik 2000). To do this, he presents many arguments that have been made on the subject. The first concept is that of health and disease which he further splits into value-neutral and value-laden approaches. In the value-neutral approach, we are trying to find statistical norms in the function of organisms. For example, statistical averages based on factors such as age and sex. In the value-laden approach, we are viewing the social, moral, and cultural norms. What is unhealthy in one society may be seen as beyond healthy in another. In the Western world, schizophrenia is seen as an illness whereas some 'primitive' tribes would see someone with schizophrenia as having some sort of gift. While I like these distinctions better than Glannons, I think they still run into the issue of being somewhat vague. Even statistical realities change over time in and between populations, such as body weight averages. The second concept from Resnik is the idea of the goals of medicine. Resnik brings up many good points as to why this would fall apart that I tend to agree with. For one, it seems that it would not be possible to unanimously create the goals of medicine. This would be because people have different ideals and goals that they think are going to be important. Even if we could agree on the goals of medicine, why should we not partake in procedures that do not fit this goal? Many people would say that plastic surgery does not fit the goal of medicine, yet we do not try to stop that practice. Again, we tend to create more questions

than answers as we create an ambiguous situation. The last two concepts that Resnik provides us are our humanness and the rights of the unborn. I do not really want to touch these aspects too much for two reasons. One, these concepts are easily understood but extremely difficult to determine what they are and how they apply. Two, they cause us to drift into the argument of abortion which may clear up some questions, but I think strays too far from my goal in this paper. Resnik concludes the distinction between therapy and enhancement may not matter as enhancements may be justified based on its safety, efficacy, and its benefits to the patients. But this does not help me in trying to determine what should be considered enhancement. So how can I go about this?

I first start by describing the difference between genetic modifiers and genetic non-modifiers. On the one hand, a genetic non-modifier is an intervention that does not change the genome of the organism even if it causes a change in the expression of that genome. This, I believe, tends to occur most frequently with modern medicine. This is what happens when you take many different drugs. For example, when you receive a vaccine, the weakened or dead version of the pathogen causes you cells to express different proteins. These proteins are the antibodies that are used to fight the disease. This vaccine, though, does not cause any actual changes in your genome. In fact, the effects and side effects of most drugs are the result of a change in the genome expression due to the makeup of the medicine. On the other hand, a genetic modifier is an intervention that changes the genome of the organism. I derived these definitions from a couple of ideas. One, modifications do not necessarily mean something is being enhanced in reference to genes. As we have talked about earlier, we have modified mosquitoes to be infertile to control the spread of diseases. I would say that this type of modification is not enhancing in any way to the organism. Second, we have described situations

in which the expression of genes can be modified through different treatments without ever changing the actual genome. I then determined how we should differentiate between enhancing and therapeutic modifiers and non-modifiers. Modifications are therapeutic if it brings the patient back to a statistical baseline for given population factors. Modifications are enhancing if it brings the patient above a statistical baseline for given population factors. I attempted to combine both Glannon's and Resnik's views in these definitions. I think that these are vague as well but for a different reason. I am not experienced enough to create statistical baselines for every physiological aspect of humans. But I do provide greater specificity in the sense that these baselines will be created through different population factors that experts will determine are the most relevant.

Based on these definitions, when discussing HGE we could be referring to therapeutic genetic modifiers, TGMs, and enhancing genetic modifiers, EGMs. While one may argue that HGE should only refer to EGMs, I would argue that we are still enhancing an individual's genes through TGMs. Remember that the patient in this case would be operating below the population baseline. Therefore, we are still enhancing, as in bettering, this person's genes to meet the population baseline. However, when discussing the aspect of cheating, we will focus on EGMs.

This is differentiation, I think, is where we start to see the issues. Earlier we discussed how this enhancing technology was being used on animals and designer pets. Many would say that it is fair to test these systems with animals for the overall goal of being able to use this technology successfully on humans. This way we can learn how to better utilize the technology to possibly rid ourselves of many different diseases. But here we have animals that were being engineered with the goal of creating a profit. While I do not believe that people will want their children to glow, it would not be out of the question to think that they may want a certain hair

color, or a certain ability to grow muscle, or the ability to have better higher brain functions. I also would not think it would be too far to think that they may be willing to pay a price for these modifications. The connection to cheating, in this case, would be that some may be given better chances in life through the use of HGE. So, before we claim that this is the case, We should try to understand what cheating is and how it may apply to HGE.

## Discussing Cheating

Cheating is an important topic within the philosophy of sport, and there are many proposed analyses of the concept of cheating. In this section, I will first present a definition of 'cheating' proposed by Ken Kirkwood; second I will discuss some flaws with Kirkwood's definition; and, finally, propose a definition that avoids the flaws in Kirkwood's definition.

According to my analysis of Kirkwood's paper, An actor 's' cheats if, and only if, s intentionally breaks the rules of a rule-governed, co-operative, and fair activity in order to alter the competitive balance in s's favor through gaining either a primary or a secondary advantage. Kirkwood begins his analysis by discussing a situation with an athlete that he names Dave. Dave attempted to use performance-enhancing drugs (PEDs) in order to gain a competitive edge. When tested, however, Dave's results came back negative, and it was determined that Dave was likely given counterfeit PEDs. Although Dave intended to gain an illicit advantage by using PEDs, the fact that Dave took only counterfeit PEDs arguably makes it the case that Dave did not cheat after all. Here, Kirkwood begins to formulate his analysis of cheating.

Kirkwood lays out three different requirements that he considers when forming his definition of cheating. I will discuss each. The first requirement is, "... Breaking Rules in Co-Operative Rule-governed Activities that are Fair." The setting for this requirement involves at

least two participants involved in activities that are mutually beneficial as well as cooperative. Now, according to Kirkwood, a rule is fair if, and only if, "... the collective activity [to which the rule applies] involves reciprocity; agents surrender some of their liberties and agree to participate by agreed-upon rules as a logical necessity of participation."(Kirkwood 2014). In other words, rules are fair when all members involved agree to follow them. Paradigmatic cases come especially from sports, where there are many rules that one must follow just to play a game. For example, in Rugby you are not allowed to pass the ball forwards. You can only pass the ball backwards and laterally. If you are caught passing the ball even slightly forward, a penalty for knock on is called and the other team decides how they would like to gain advantage with the ball. Another example would be in Football where you are not allowed to false start. A false start differs whether you are on the offensive or defensive side of the ball. If you are on offense, you are guilty of a false start if you jump forward before your center snaps the ball to the quarterback. If you are on defense, a false start occurs when you jump forward before the offensive center snaps the ball. In both cases, whoever committed the foul loses yardage on the play. Now, if participants in these sports do not agree on the rules, the participants can change the rules in order to maintain reciprocity between teams, players, coaches, managers, etc. For example, George Mikan was a player in the NBA who caused changes in the rules because of his height. Mikan stood at seven feet tall and was so tall that if he were to get the ball close to the net, most opponents would not be able to stop him. Officials thought this gave him an unfair advantage, so they widened the free throw lane, to give other players a chance, and he also played a part in the changing of goaltending rules in the NBA (These 2019). Another example would be Coach Roger Neilson who played a part in changing many rules in the NHL. In hockey, some penalties result in a penalty shot which is when a player has the opportunity to

score by facing the goalie alone. Back when Coach Neilson was around there was no rule that the shooter had to face a goalie, so he would place a defenseman in net. This defenseman would charge the player taking the penalty shot making it virtually impossible for the player to score. This led the NHL to change the rules insisting that a goalie must tend the net during a penalty shot (These 2019). It is worth noting that something similar can occur in social settings in which there are rules that everyone agrees to follow, and if members do not follow these rules, then they can be removed from the co-operative social activity. For example, could be participants in the stock market. This is not strictly social but could be considered socioeconomic. When trading in the stock market, there are many rules that are put in place to protect people. Times at which the stocks close and open allow the greatest opportunity for all people to have a chance to trade fairly. One of the rules in trading stocks is that people shall not be given information directly from companies that gives them special information involving how stocks will fluctuate, this is insider trading. This decreases the fairness as not everyone is privy to receiving this special information. If someone is caught participating in insider trading, they can be arrested and removed from trading in the stock market.

Kirkwood's next requirement has to do with intent. According to Kirkwood, an action is a case of cheating only if it "involves intent" (Kirkwood 2014). As an added specification, the action must work to gain an advantage over other members of the activity. For example, we can go back to the idea of the false start in the NFL. The offensive center may intentionally pretend to snap the ball by moving just slight enough to not be noticed. In doing so, he could cause a defensive player to jump forward, thereby drawing a false start call. This would in turn give the offense an advantage over the defense in terms of gained yardage. Another example could be made through the passing in Rugby. A player with the ball could intentionally try and pass it

forward slightly enough to not be caught. This would give the players with the ball an advantage over the other team as it is easier to pass a ball forward than it is backwards or laterally. Kirkwood rejects the concept of unintentional cheating on the grounds that, if we were to accept it, it would be difficult, "... to distinguish between cheating and behavior which is simply careless or negligent." (Kirkwood 2014). So, Kirkwood concludes, cheating must be intentional.

Kirkwood's final requirement involves the commonly drawn distinction between primary and secondary advantages. Primary advantages, according to Kirkwood, are advantages that the actor is focused on achieving. For example, when you start going to the gym to work out and become healthier. Your main advantage that you are trying to achieve is a healthier life so that is the primary advantage of going to the gym. By contrast, secondary advantages are those that are unintentional or not the primary focus of the actor. For example, the placebo effect can provide one with a secondary advantage. The placebo effect occurs when, "... people experience a benefit after the administration of an inactive substance or sham treatment" (Cherry 2020). An example of the placebo effect comes from Kirkwood's account of Dave who seemed to experience athletic gains from counterfeit PEDs. The PEDs were fake, however, Dave believes that since he thought he was taking legitimate PEDs he gained more muscle and did better in his sport than if he thought that he was not taking PEDs. Dave experienced a benefit after the administration of counterfeit PEDs, a perfect example of the placebo effect. While some believe that only gaining primary advantages counts as cheating, Kirkwood insists that "... an actor who seeks to intentionally and unfairly alter the competitive balance in his or her favor but only succeeds in gaining a secondary advantage is still a cheat who gains from the proceeds of his self-regarding deceit." So, Kirkwood believes that if you gain either primary or secondary advantages then you are cheating.

In what follows, I will evaluate Kirkwood's proposed definition of 'cheating' in light of four kinds of ostensible cheating, which we can label as follows: Cheating Proper, Strategic Intentional Fouls, Unintentional Cheating, and Cheating by Enabling. Let us begin with the form of Cheating Proper.

Cheating Proper occurs when a person intentionally breaks the rules of a game and gains an advantage by hiding the fact that they broke the rules. So, a person 'P' commits Cheating Proper in a situation 'S' if, and only if, P intentionally breaks the rules of S, intends to hide that they broke the rules, and gains an advantage from breaking the rules. This tends to be the most common, or at least most well-known, form of cheating. Examples of this include when a hockey player trips another hockey player. Tripping occurs when a player uses the blade of their stick to intentionally trip another player. In most cases the player tries to act like they did not trip the player, satisfying the intention to hide the breaking of the rule. In tripping the player, and hiding that they committed this action, the player gains an advantage by giving themselves a better position to get possession of the puck. Another example of this form of cheating would be if an athlete of any sport dives to draw a penalty on the opposing team. Diving, in sports involving some level of contact, is when a player intentionally falls or acts like they are hurt in a way that makes it look like an opposing player committed some foul. Diving is against the rules in sports and when a player dives, they try to make it look like they really got hurt. In diving and successfully drawing the penalty, that team of the player that is diving gains an advantage through either sending the opposing play off the field, or gaining possession of the sports projectile (ball, puck, etc.). Both situations involved people breaking a rule to gain an advantage, and they hide the fact that they broke the rules. These examples follow the requirements of

Kirkwood's view of cheating. A rule is being broken in a rule-governed co-operative activity, there was intention involved, and the actors breaking the rules gained primary advantages.

Strategic Intentional Fouls (SIFs) are described by José Luis Pérez Triviño, "... as rule violations committed in order to be detected and accept the corresponding sanction. However, there is an additional goal of obtaining an advantage or subsequent benefit in the competition" (Triviño 2012). Some examples of this form of cheating could be icing in hockey. When a team has the puck in their own zone and they send the puck past the goal line of the opposing team's zone before they skate across center ice, that is icing. If a team ices the puck, play is stopped, and the puck is dropped in the zone of the team that committed the icing. This may be disadvantageous, however if you have been held up in your zone for a while without changing players then purposefully icing the puck will provide an opportunity to put new players on the ice. Another example of this, this one provided by Triviño, would be in soccer if a player tips the ball. Tipping the ball occurs when a player kicks the ball at a player on the opposing team and the ball tips off the opposing player and then goes out of bounds. When the ball goes off a player and out of bounds in soccer, the other team gets possession of the ball. So purposefully having it hit an opposing player and go out of bounds will give the ball back to the player who kicked it and may put that player in a better position. This better position may be obtained from a stoppage in play allowing your team to rest a bit or it may allow you to utilize a strategy from a throw-in. I think this also follows Kirkwood's requirements as well. In both situations, actors are intentionally breaking rules of a rule-governed co-operative activity and they are both gaining primary advantages through better positioning.

Unintentional Cheating occurs when a person unintentionally breaks the rules and gains an advantage. A person 'P' commits Unintentional Cheating in a situation 'S' if, and only if, P

unintentionally breaks the rules of S and gains an advantage from breaking the rules. But how can someone unintentionally break the rules? There are two ways that this can occur. One way is, you may be participating in an activity and only have some knowledge of the rules. You may, in this case, break many rules that you do not know about. The second case could be that you know the rules, but you do something in the moment that you do not realize breaks the rule. We could go back to the example of passing in Rugby. Previously we have discussed passing the ball forward on purpose but trying to hide it. Now take away the intention of the act. You are trying to pass it laterally, but it ends up that the pass moves slightly forward. The ref does not catch it and you do not know that you in fact passed it forward. You broke the rule by passing the ball forward, though unintentionally, and gained an advantage since it is easier to pass forward than backwards and laterally. Another example, again in Rugby, is tackling. When tackling in Rugby, you are supposed to hit the mid-section of a player so that both you and the other player are safe. A safe tackle includes anything ranging from the chest to the hips. If you hit too high, then you risk injuring the other player by giving them a concussion. If you tackle too low, then you can injure someone by damaging important joints. Sometimes when you are tackling, however, in certain circumstances you cannot get low enough. This could result in you injuring your opponent. You do not mean to tackle high and you most likely do not know that you did tackle him high. But by not being called on the infraction, you gain an advantage that comes from possibly hurting a good player on the opposing. The key factor with either way of Unintentional Cheating, either lack of knowledge or inability discern if you broke the rule, is that an advantage is still gained. This may occur because the referee did not notice the rule being broken and therefore did not make the call. But how does this form of cheating fit in with Kirkwood's definition of cheating?

Unintentional Cheating contains two requirements that were laid out by Kirkwood. Unintentional Cheating results from a breaking of the rules and an advantage is being gained from the rules being broken in the scenario. However, we run into some issues with Kirkwood's requirements. One of Kirkwood's pillars in his argument is intentionality, and while he believes that a person is still morally responsible when breaking rules unintentionally, without intentionality it is not cheating. Kirkwood believes that unintentional cheating would fall into the category of, "... behavior which is simply careless or negligent." This is where I believe that Kirkwood's definition begins to fall short. I think there are two aspects of Kirkwood's criteria that I do not think are necessary for cheating. The first aspect of that is intentionality. By entering the rule-governed co-operative activity you are agreeing to not participate in a way that is careless or negligent, as Kirkwood would describe Unintentional Cheating. Being careless and negligent, you are not partaking in the reciprocity, especially if the competitor is being careful to follow the rules, that is expected in a rule-governed co-operative activity. So, while you are not purposefully breaking the rules, you are still gaining an advantage through not respecting the terms of the activity. I would also like to argue against Kirkwood's intentionality requirement by bringing up the idea of strict liability. According to strict liability, in a rule-governed co-operative activity, you are held just as responsible for breaking the rules whether or not you purposefully or unknowingly broke them. If members of one of these activities is held strictly liable in a case of rule-breaking, then why should it not be considered cheating if you unknowingly break a rule and gain an advantage? Another problem I have with intentionality as a necessary condition to cheat is the implications it makes for those who do intentionally break rules. According to this necessary condition, someone can always feign ignorance when they are caught breaking a rule by people who are claiming that they are cheating. This way it could be

possible that no one ever cheats because they will always claim that they do not know the rules. The idea that it is possible for no person to cheat because they claim to not know the rules seems ridiculous, at least to me. For these reasons, I believe Kirkwood's definition falls short and intentionality is not a necessary condition for cheating.

My final form of cheating is Cheating by Enabling which occurs when a person intentionally or unintentionally breaks the rules so that another person can gain an advantage. A person 'P' commits Cheating by Enabling in a situation 'S' if, and only if, P intentionally or unintentionally breaks the rules of S and gives another person 'A' an advantage. Examples of this form of cheating would be a little less well-known. One example could be a coach who gives his athletes protein shakes that contain PEDs, without them knowing, so that they gain an advantage at their competitions. In this case, the Coach is intentionally cheating because he knows that giving his athletes PEDs is against the rules. He is enabling his athletes by conferring an advantage onto them through their unknown use of PEDs. An example of unintentional Cheating by Enabling could be if a doctor performed a new type of surgery that would extend a patient's life. This surgery is an illegal surgery as it is very risky and has had no success in clinical trials. However, the doctor does not know that the surgery has not been approved by the necessary agencies yet and is therefore illegal. In this case the doctor is unintentionally cheating because he lacks the proper knowledge of the legality of the surgery. The doctor is enabling the patient by giving them an advantage over similar patients who will not get the surgery because their doctors will not perform the surgery. This example could serve as a direct comparison to the use of embryos for HGE such as could be the case with Jiankui He. But how does this fit within Kirkwood's idea of what cheating is?

Does this count as cheating given Kirkwood's definition of the term? I would say that this answer is yes and no. It does fit Kirkwood's criteria if the rule breaking is intentional, such as the case involving the coach secretly giving his players PEDs. This would mean that the Cheating by Enabling involves a rule-governed co-operative activity, intentional rule breaking, and a gained advantage. However, if the Cheating by Enabling is unintentional, as in the case of the doctor, then we would be lacking intentionality and it would not fit in Kirkwood's model.

I can use these examples to again argue against intentionality as a necessary condition to cheat. Another way to look at the argument against intentionality as a necessary condition for cheating is digging deeper into the case of the coach secretly giving his athletes PEDs. We already know that the coach is intentionally breaking the rules, but the athletes have no idea that they are taking PEDs. The athletes are still committing an infraction in the rules that is punishable. In fact, once it is found that they test positive for the substances, they will likely be kicked out and restricted from any further events. Along with this, I would not identify the actions of the athletes as careless and negligent. In fact, wouldn't it be expected that they trust their coach to train them properly and follow the rules? To them, they were trying to avoid negligence and were trying to be careful. So even if you can't identify with my objection that by entering the cooperative activity you agree not to act careless and negligent, then surely you can agree that there is no proper way to determine if someone is acting careless or negligent. Even if you try to be safe and follow the rules, you could still end up breaking them. I think, given this reality, it is only proper to assume that when a rule is being broken the person has the intention to not act negligent and careless. Therefore, unintentional cheating should still be considered as being an aspect of cheating.

The second condition that I do not like about Kirkwood's definition of cheating is the involvement of secondary advantages. I do not think that secondary advantages are a sufficient condition for cheating. Let us take Kirkwood's example of Dave for this. Kirkwood believes that Dave cheated because, even though Dave did not take PEDs, he thought he was using PEDs which drove him to obtain training gains at a greater rate than if he did not think he was taking PEDs. The problem that I see with this argument is that there are many other factors that could have possibly caused this difference in training gains. Even if he did not think that he was taking PEDs, he might have gained motivation from his trainers and teammates to push himself harder. He may have improved his diet allowing for better muscle growth. He could have found a way to get better rest to increase recovery. Even if we take the examples from Cheating by Enabling, both the coach and doctor are gaining primary advantages. The coach is leading his team to win, which is what he wants, and the doctor is saving his patient's life, which is what he wants to accomplish. It is not the secondary advantages that make these forms of cheating but the primary advantages. Therefore, I do not think that intentionality and secondary advantages are necessary or sufficient conditions for cheating.

I do like other parts of Kirkwood's criteria and I think I can make an even better definition by combining aspects of both Kirkwood's views and my views. An actor 'A' cheats in a situation 'S' if, and only if, A intentionally breaks the rules of S, given S is a rule-governed, co-operative, and fair activity, in order to alter the competitive balance of S in their favor. This includes the more precise aspects of Kirkwood's definition while also including all four types of cheating that I have presented. My new definition still requires that the rules of a rule-governed co-operative activity must be broken. This follows the forms of Cheating Proper and SIFs, but it also includes Unintentional Cheating and Cheating by Enabling because it does not require that

the rules have to be broken intentionally in order to count as cheating. My definition also still results in an advantage gained by the cheating individual in all forms of cheating.

In conclusion, I believe that, though I disagree with some aspects, Kirkwood's amended idea of cheating does bring us further clarity in the discussion of cheating. I think, though, as more counterexamples are suggested, the definition will further change to include more scenarios. For this reason, the conversation about cheating will continue to change its definition.

## Is Human Genetic Enhancement Cheating?

The question before us, now, is whether human genetic modification is a form of cheating. In what follows, I will argue that, whatever the moral status of human genetic modification is, human genetic modification is at least not a form of cheating. To make my case, I will focus specifically on HGE. For, while TGM is a form of HGE, since one is enhancing genes that are operating below par, it should not be considered connected to cheating because an advantage would not be achieved through TGM.

In any case, a disadvantage is being corrected making it harder to associate TGM with cheating. So, this allows us to focus on EGM and its connections to cheating. In the case of EGM, you are correcting a gene in a way that brings its function above the average functioning within the population. Therefore, an advantage is being obtained through EGM. But, is there a rule-based cooperative activity and are there rules being broken? It seems that there is no objective moral rule against EGM or even HGE as a whole. We allow people to have cosmetic enhancements and do not consider it to be cheating. It is obvious that these aesthetic enhancements provide an advantage in social settings, but no obvious rules are broken. It seems to be generally accepted to use therapeutic genetic non-modifiers, TGNM, in the form of

vaccines and therapeutic drugs. These could be argued to be advantageous, especially when being compared to countries that do not have these therapeutic methods available. When considering all these aspects of modifiers and non-modifiers it does not seem that there is no obvious objective moral rule. If there is no obvious objective moral rule, then a rule-based cooperative activity does not exist, and rules cannot be broken. Even if there is an advantage gained, we are missing two of three of Kirkwood's requirements for cheating. Therefore, I do not think that HGE can be considered cheating. We can explain this ore by discussing each type of cheating and how it relates to HGE.

With Cheating Proper, we are looking at a situation where and advantage is gained from breaking a rule intentionally and trying to act as if you did not break the rule. As we discussed, an advantage is clearly gained when someone is genetically enhanced in some way. However, even if there is an objective moral rule against receiving genetic enhancements, it has not yet been shown what that rule is, and it is not obvious how to demonstrate what that rule is. What is more, it does not seem that a person who has gotten a genetic enhancement would try to hide the fact that they have receive these enhancements, unless this rule has been demonstrated. Like other enhancements that are more aesthetic, such as breast enhancements or nose jobs, some people who receive genetic enhancements may even be looking forward to showing off the enhancement that they received. For these reasons, HGE is not obviously a case of Cheating Proper, and it is not obvious how one can establish that HGE is a case of Cheating Proper without first establishing which moral rule that HGE violates—and which is not obvious how to establish which rule that would be. So, it is doubtful that one can establish that HGE is a form of Cheating Proper.

When trying to apply SIFs to HGE I think we run into even more problems. With SIFs, again, an advantage is gained from a person breaking the rule in a rule-governed co-operative activity. Again, like with Cheating Proper, even if there is an objective moral rule against using genetic enhancements, it has not yet been shown what that rule is, and it is not obvious how to establish what that rule is. The added aspect of SIFs from Cheating Proper involves that one breaks the rules in a way that causes the punishment to lead themselves to gain the advantage. With HGE, let's assume there was some objective moral rule against using genetic enhancements, for a SIF to have been committed someone would have had to force another person to be genetically enhanced. In turn, the person who received the enhancement would get in trouble and the person forcing them to get the enhancement would gain an advantage. Otherwise, the first person may have tricked the other into receiving the enhancement and the person receiving the enhancement still gets punished leaving the first person to gain an advantage. In either of these situations, it would seem very strange that someone would gain an advantage through HGE by having someone else receive the enhancement. Because of these examples, it is unlikely that HGE would be a form of a SIF.

Let us then explore the possibility of HGE being Unintentional Cheating. The advantage, like Cheating Proper and unlike SIFs, would be gained by the person receiving the genetic enhancement. But, what about a rule being broken? Well Unintentional Cheating involves a rule being broken, but in this case the person breaking the rule does not know that they broke a rule. I think this could be applied to HGE. To be sure, if an objective moral rule against HGE were discovered, then anyone who has gotten a genetic enhancement would be unknowingly breaking the rule. But, again, it is not clear how one could establish what this rule is. So, it is not clear how one could establish that HGE is a form of Unintentional Cheating.

Finally, we can take a look at Cheating by Enabling. With Cheating by Enabling, we are looking at someone who is breaking the rules to confer an advantage on another person. In HGE this would be if a doctor were to break the rules to genetically enhance a patient. This may be the most analogous form of cheating to HGE. This is actually related to the situation of Jiankui He as he genetically enhanced embryos, giving the embryos an advantage. However, like the other forms of cheating, there seems to be no obvious objective moral rule that doctors are breaking when genetically enhancing their patients. If we were to find this objective moral rule, I would think it may be related to the oaths that doctors take in relation to the medical field. If it is found that there is a rule pertaining to the goals of medicine that shows HGE is immoral, then doctors who genetically enhance patients would be breaking this rule to give their patients an advantage. This would therefore be Cheating by Enabling. But, once again, it is not clear how one could establish what this moral rule is.

In short, in order establish that HGE is a form of cheating, one must first establish that HGE violates some moral rule, which requires establishing what that moral rule is. But as I have pointed out, it is not clear what that moral rule is or how one would establish what that rule is. So, I conclude that in whatever ways HGE might be immoral, it is not yet clear how to establish that HGE is a form of cheating; and whether one can establish which, if any, moral rule HGE that violates is a question for further research in ethics more broadly.

## Conclusion

In conclusion, genetic modification technology has been applied successfully in agricultural settings as a form of pest management. However, the application of this technology in humans, though, has run into scientific and moral walls as people question the methods used

and the morality of these procedures. After looking at Kirkwood's analysis of cheating and differentiating between modifications and enhancements, I believe that I have shown that HGE is not cheating. However, there may be other moral lines that are crossed through the use of HGE which provide other future avenues of research.

One possible avenue of future research is to explore the other arguments that I mentioned earlier in this paper. We could look at how HGE could compromise authenticity, leading us to cherish shallow victories over authentic accomplishments and character building. We could also discuss how HGE may lead us to lose what it means to be human beings. These are very interesting topics of discussion but for the discussion of cheating there are other aspects that we should be pursuing. First, and foremost, we should look to discover if an objective moral rule exists that says it is wrong to participate in HGE. This moral rule can relate to some moral interactions such as social or economic hierarchies. Social hierarchies could be like those found in *GATTACA* in which we would start identifying HGE as a way to say enhanced individuals are better than non-enhanced individuals. Economic hierarchies could manifest in a way where rich people use their money to receive enhancements to gain an advantage that allows them to gain more money. This would ultimately allow a large growth in wealth gaps in varying countries. Both results open doors to many moral issues that have been discussed in different fields. We could also see if there are other forms of cheating that have been developed which do not involve one to break rules. If we can define this form of cheating, then we may be able to expose HGE as cheating, even if it does not break some objective moral rule. Finally, we can develop accurate statistical baselines within populations. I think that this is important even if we do not believe that HGE is cheating. Determining these baselines is important for defining the difference

between enhancement and therapy. I think that all these ideas will be expanded as we develop our understanding of HGE and its ultimate impact on our society.

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