Genetic Engineering Research

Are there any side effects of genetic engineering that have been discovered so far? What are the advantages and disadvantages of genetic engineering?  
Is it fair to manipulate someone else’s life and body without their consent?

**Research 1**

**Creating Designer Babies**

Genetic testing also harbors the potential for yet another scientific strategy to be applied in the area of [eugenics](http://www.nature.com/scitable/topicpage/Human-Testing-Eugenics-Movement-and-IRB-724), or the social philosophy of promoting the improvement of inherited human traits through intervention. In the past, eugenics was used to justify practices including involuntary sterilization and euthanasia. Today, many people fear that preimplantation genetic diagnosis may be perfected and could technically be applied to select specific non-disease traits (rather than eliminate severe disease, as it is currently used) in implanted embryos, thus amounting to a form of eugenics. In the media, this possibility has been sensationalized and is frequently referred to as creation of so-called "designer babies," an expression that has even been included in the *Oxford English Dictionary*. Although possible, this genetic technology has not yet been implemented; nonetheless, it continues to bring up many heated ethical issues.

Trait selection and enhancement in embryos raises moral issues involving both individuals and society. First, does selecting for particular traits pose health risks that would not have existed otherwise? The safety of the procedures used for preimplantation genetic diagnosis is currently under investigation, and because this is a relatively new form of reproductive technology, there is by nature a lack of long-term data and adequate numbers of research subjects. Still, one safety concern often raised involves the fact that most genes have more than one effect. For example, in the late 1990s, scientists discovered a gene that is linked to memory (Tang *et al.*, 1999). Modifying this gene in mice greatly improved learning and memory, but it also caused increased sensitivity to pain (Wei *et al.*, 2001), which is obviously not a desirable trait. Beyond questions of safety, issues of individual liberties also arise. For instance, should parents be allowed to manipulate the genes of their children to select for certain traits when the children themselves cannot give consent? Suppose a mother and father select an embryo based on its supposed genetic predisposition to musicality, but the child grows up to dislike music. Will this alter the way the child feels about its parents, and vice versa? Finally, in terms of society, it is not feasible for everyone to have access to this type of expensive technology. Thus, perhaps only the most privileged members of society will be able to have "designer children" that possess greater intelligence or physical attractiveness. This may create a genetic aristocracy and lead to new forms of inequality. At present, these questions and conjectures are purely hypothetical, because the technology needed for trait selection is not yet available. In fact, such technology may be impossible, considering that most traits are complex and involve numerous genes. Still, contemplation of these and other issues related to genetic engineering is important should the ability to create genetically enhanced humans ever arise.  
**Source:** <http://www.nature.com/scitable/topicpage/genetic-inequality-human-genetic-engineering-768>  
**Author:** Danielle Simmons, Ph.D. (Write Science Right)   
**Lead Editor:** [Cheryl Scacheri](http://www.nature.com/scitable/topicpage/cheryl-scacheri-lead-editor-30608)  
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**Are there any side effects of genetic engineering that have been discovered so far?  
Research 2**

One of the most controversial of all applications of this technology is in allowing infertile mothers to conceive. This is done by using the eggs from a different mother, leaving the child with the genetic blueprint inherited from three people. This will then be passed on through future generations, leading to untold potential complications. It is still far too early to judge the potential consequences of the use of this type of genetic technology, but if there are any negative side effects they are likely to be far reaching and extremely damaging.

There have been many arguments put forward concerning human genetic engineering, some strongly in favour and some equally strongly against. The potential is there for diseases caused by genetics to be eliminated completely, and this is there area in which fewest dissenting voices will be heard. The use of genetics purely to overcome fertility is far more controversial, especially when you consider the permanent effect that this has on all future generations of that family. There are also many dissenters against the possibility of parents deciding features of their children using an advanced form of this technology, which cannot be used yet but which may be perfectly possible in the future.

If this technology is left unchecked it will definitely have far reaching consequences. There is no doubt that wealthy families would take advantage of such technology to try to give their children every advantage in their future life, and there could be several possible outcomes of this. One would be a rise in productivity and creativity which would penetrate through society, raising the standard of society for everyone and creating more opportunities. It is also possible that poor families who could not afford this technology would be left even further adrift, leading to sharp increases in crime rates, social disorder, and economic chaos.

Even though strong opinions are held on both sides of the argument, the truth is that it is far too early to know for sure exactly what is involved with human genetic engineering. There are some philosophical and moral arguments which will prove exceedingly difficult to resolve one way or another, but there are potential consequences which cannot possibly be known until more research has been carried out. The arguments over this technology are certain to rage for a great many years to come, and it is unlikely there will ever be universal agreement on human genetic engineering.  
**Source:** <http://www.geneticengineeringinhumans.com/>   
**Author:** Unknown  
**Last Editing Date:** 01/05/2014  
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**Research 3**

**And Problems Do Occur**In 1989, the New England Journal of Medicine reported a tragic health crisis caused by a genetically engineered food supplement, tryptophan. Thirty-seven people died from this product, while 1500 others were permanently disabled and 5000 became very ill.

And when Pioneer HyBrid used a brazil nut gene to create a genetically engineered soybean, it caused allergic reactions. Fortunately, this problem was detected before the soybeans went to market, and consumers were not harmed.

Despite these documented incidents and increased warnings from the international scientific community, the FDA continues to claim they find no scientific evidence to support the assertion that bioengineered foods are unsafe. And they continue to maintain their current "honor system" approval process allowing the biotech industry to monitor itself, and release many new genetically engineered products for commercial distribution without thorough pre-market safety testing, advance notice or labels.

How can the FDA justify the release of these products without long-term safety testing or labels? The official government position states that transgenic foods are "substantially equivalent", or essentially the same, as their natural predecessors. Therefore, they don't need to be labeled as different.

But the logic doesn't work. Altering the DNA of an organism changes it on its most fundamental level. No one knows what consequences this kind of manipulation will bring.  
**Source:** <http://istpp.org/genetic_engineering.html>  
**Author:** John Hagelin  
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**Research 4**

**Unknown consequences**Is this a model that society wants to apply to humans, making pinpoint genetic modifications, only to "discard the results when they don't work out?" Krimsky asked during an [Intelligence Squared Debate](http://intelligencesquaredus.org/debates/upcoming-debates/item/798-prohibit-genetically-engineered-babies) held in Manhattan. He added that assuming no mistakes will occur would be sheer hubris.  
He and fellow ban proponent Lord Robert Winston, a professor of science and society and a fertility expert at Imperial College in London, focused on the uncertainty associated with the genetic underpinnings of traits. The two also addressed the consequences of manipulating genes. [[5 Myths About Fertility Treatments](http://www.livescience.com/22662-myths-fertility-treatments-ivf.html)]  
"[Even [for] height](http://www.livescience.com/5552-taller-people-earn-money.html), one of the most heritable traits known, scientists have found at least 50 genes that account for only 2 to 3 percent of the variance in the samples," Krimsky said. "If you want a tall child, marry tall."

**Mother Nature doesn’t care**  
Meanwhile, their opponents, who opposed the ban, talked of empowering parents to give their children a healthy life, even if it meant giving their offspring traits they themselves could not pass down.  
Lee Silver, a professor of molecular biology and public policy at Princeton University, urged the audience members to look at someone sitting next to them.  
"That person and you differ at over 1 million locations in your [DNA [deoxyribonucleic acid]](http://www.livescience.com/25163-dna-directly-photographed-for-first-time.html). Most [of these variations] don't do anything," Silver said. "[But] even if you are a healthy adult, 100 [of these] can cause deadly childhood disease in your children or grandchildren."  
"Mother Nature is a metaphor," he continued. "And it is a bad metaphor, because in reality inheritance is a game of craps … It won't have to be that way in the future."   
His fellow ban opponent, Nita Farahany, a professor of law and of genome sciences and policy at Duke University, attacked the idea that uncertainty should prevent the use of the technology, pointing out that reproduction, completely unaided by technology, involves much uncertainty.  
"We are not going to ban [natural sex](http://www.livescience.com/topics/sex/)," Farahany said.

**Already possible**A significant portion of the debate focused on a particular technology known as [mitochondrial transfer](http://www.livescience.com/24249-gene-therapy-mitochondrial-disease.html). While the majority of DNA resides in a cell's nucleus, a small amount is contained in the cell's energy factories, called mitochondria. This mitochondrial DNA is passed from mother to child. In rare cases, women have mitochondrial defects they can pass down to their children, causing devastating problems or even death.Mitochondrial transfer can replace such defective mitochondrial DNA with that from a donor, allowing affected mothers to avoid passing these defects on to their children, who then carry genetic material from three parents (the father and two mothers, including the donor).Opponents of a ban argued it would prevent women with mitochondrial disorders from having healthy children of their own."I am not here to defend every type of genetic engineering. I don't think we are ready as a society to embrace it all," Farahany said.Rather than an outright ban, she and Silver argued for a middle ground, which would allow for certain procedures once they had been shown to be safe and effective. An emerging scientific consensus says mitochondrial transfer would fit into this category, she said.Winston disagreed.

"We know fiddling with mitochondrial DNA may make a massive difference to what happens to nuclear DNA. … Abnormal children have been born as result of mitochondrial transfer," he said. "I think, in preventing one genetic disease, you are likely to cause another genetic disease." [[The 10 Most Mysterious Diseases](http://www.livescience.com/11333-top-10-mysterious-diseases.html)]  
Society should instead focus on the enormous importance of environmental influences in health, Winston said. "What we should be trying to do, rather than risk making abnormal babies, is to improve the environment so the DNA functions in the best possible ways."  
Neither Farahany nor Silver argued in favor of allowing parents to modify their children to ensure other traits that are less medically necessary, but nevertheless desirable, such as higher intelligence or [blue eyes](http://www.livescience.com/9578-common-ancestor-blue-eyes.html).  
"What I think parents care about most is promoting the health of their children," Silver said.

**Leading to eugenics?**”  
Both sides referred to the specter of [eugenics](http://www.livescience.com/13002-7-absolutely-evil-medical-experiments-tuskegee-syphilis.html), an idea embraced by the Nazis, which holds that selective breeding can be used to improve the human race.  
Winston and Krimsky pointed out that genetically modifying children to choose desirable traits evoked this approach. Meanwhile, Farahany noted that some of the worst abuses of government in recent history involved attempts to control reproduction. How would a ban on the genetic modification of children be enforced, she asked, would all babies be forcibly tested?    
**Source:** <http://www.livescience.com/27206-genetic-engineering-babies-debate.html>  
**Author:** Wynne Parry  
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**What are the advantages and disadvantages of genetic engineering?**

**Research 5**

The process of creating a “designer baby” is often questioned because of it’s shaky moral platform. Though there are certainly some positive things that can be obtained from the use of genetic engineering used on unborn babies, but it is often wondered if parents will have the “right” reasons to genetically modify their baby, or if reasoning will become more superficial. Here are some of the cons associated with the genetic engineering of babies:

* If the process is not done carefully, the embryo could be accidentally terminated.
* Furthermore, the technology used is not 100% safe yet. It is only in the experimental stages at this point.
* Parents may use this technology for superficial purposes; such as purposely seeking out a blonde haired, blue eyed baby for appearance concerns only.
* Could create a gap in society. “Designer” babies would most likely be better looking, smarter, etc. This could create “classes” between designer and non designer babies.
* Because the technology is so new, it is unknown whether genetically modifying the babies will effect the gene pool. This could cause difficulties later on throughout the baby’s family tree.
* A baby cannot consent to having it’s body altered; therefore some do not believe it’s right as parents do not “own” their children.
* Genes often have more than one use. For example, a gene that controls intelligence could also control anger management. You could end up with a genius, but very angry, child.
* Geneticists are not perfect people and cannot 100% properly evaluate every gene. It is more than likely mistakes will be made.
* Individuality will be slighted. Because most people will seek out good-looking, intelligent babies with other optimum characteristics, everyone will be relatively similar.
* The procedure is not cheap, and not everyone would be able to afford it. Could create prejudice between “Designer” and “non designer” children. Could cause the “non-designer” children to miss opportunities because jobs among other things are more likely to take the “optimum” candidate for something.
* The ability to “change” as humans will falter.

Although there are many questions of if genetically modifying babies is ethical and for the moral reason, there are many positives to this type of treatment:

* Installs a better understanding of genetics for genealogists and biologists.
* Increases human life span up to 30 years.
* Prevents genetic diseases such as down syndrome, Alzheimer’s, Huntington’s Disease, Spinal Muscular Atrophy, and many others.
* Reduces risk of inherited medical conditions such as obesity, anemia, diabetes, cancer, and many more.
* Keeps up with modern technologies.
* Enhancement of children.
* Allows parents to give their child a healthy life.
* Genetically engineering babies is an option, not a requirement for all parents. For those that disagree with it, they don’t have to engineer their child.
* Children are already engineered by parents in many ways. Prenatal supplements, education, religion, and morals are all ways parents control their child.
* Taking folate during pregnancy reduces risk of a child developing autism. This is an example of medically altering a child and it is considered ethically acceptable.
* Eliminates mitochondrial disorders.
* Parents set their own limits for genetically engineering their baby.
* A complete ban will increase the demand and send people to unauthorized biologists or overseas to receive the same treatment that the US is capable of.
* Government does not have the right to control means of reproduction.
* Some environmental factors are inevitable so preventative measures should be taken as well.
* Allows prospective parents to give their child genes that they do not carry.
* With all scientific and technological advancements there is ethical disparagement, the ethical view points should not cease the advancement of technology.
* Although not all the kinks in this newly developing technology are fixed, with more clinical trials and experimentation, it has the potential to be a very promising.

**Source:** <http://designerbabiesethics.wordpress.com/2013/04/28/the-cons-of-designer-babies/>  **Author:** Unknown **Last Editing Date:** April 2013 **Date:** 16/05/2014

**Research 6**

**Pros of Genetic Engineering in Humans**There are many potential advantages to being able to alter the cells in our bodies genetically.  
Most people on the planet die of disease or have family members that do. Very few of us will just pop up to bed one night and gently close our eyes for the last time. Our genomes are not as robust as we would like them to be and genetic mutations either directly cause a disease such as Cystic fibrosis, or they contribute to it greatly i.e. Alzheimer's. Or in the case of some conditions such as the heart disease Cardiomyopathy, [genetic mutations](http://www.brighthub.com/science/genetics/articles/39543.aspx) can make our bodies more susceptible to attack from viruses or our own immune system. If the full benefits of gene therapy are ever realised we can replace the dud genes with correctly functioning copies.

**To extend life spans**Having enjoyed life, most of us want to cling on to it for as long as possible. The genetic engineering of humans has the potential to greatly increase our life spans. Some estimates reckon that 100-150 years could be the norm. Of course [gene therapy](http://www.brighthub.com/science/genetics/articles/6123.aspx) for a fatal condition will increase the lifespan of the patient but we're also talking about genetic modifications of healthy people to give them a longer life. Once we fully understand the genetics of ageing it may be possible to slow down or reverse some of the cellular mechanisms that lead to our decline - for example by preventing telomeres at the ends of chromosomes from shortening. Telomere shortening is known to contribute to cell senescence.

**Better pharmaceuticals**The knowledge gained by working out genetic solutions for the above could help with the design of better pharmaceutical products that are able to target specifically genetic mutations in each individual.

Human genetic engineering has the power to shape the future of the human race. This second part of a two-part series focuses on human genetic engineering cons -- the downside to this branch of science.

* slide 1 of 2

### **Risks and Controversy**

### **There's a big question mark over safety** There are risks associated with getting genes into a human body and having them carry out the desired function. Some genes are carried in on viral vectors and these bugs have been altered so as not to infect a patient with a disease. However, a small number of gene therapy trials have resulted in the deaths of some subjects.

Also, we simply do not know long term the potential ramifications of altering genes. For example, if you were to stop telomeres from shortening would this have negative knock-on effects elsewhere in the genome? The human genome and our whole bodies are a maze of complicated biological signals, pathways and interrelationships. A positive change upstream could cause a negative effect downstream.

**Genetic diversity**  
If we were all to undergo genetic modification would this limit our [genetic diversity](http://www.brighthub.com/science/genetics/articles/13897.aspx)? Could there be a danger that our gene pool diminishes and that as a population we become more susceptible to being wiped out by a hitherto unknown disease threat?

**A Slippery Slope? Ethics of Human Genetic Engineering**

To say that genetic engineering has attracted some controversy would be an understatement. There are many cries that scientists are 'playing God' and that it will lead to a two-tier society - the genetically haves and the have-nots. But is this any different to the cries of horror and fears of Frankenstein's monster that greeted Louise Brown, the first child to be born by IVF treatment? There was great uproar in the late 1970's but IVF is now a common, if expensive, fertility treatment. And there aren't any monsters stalking the Earth.

Having said that, genetic engineering does hold the potential that parents could (if the technology worked) assemble their kids genetically, to be smarter, to be more athletic or have a particular hair or [eye colour](http://www.brighthub.com/science/genetics/articles/38797.aspx). Though it's rather fanciful to suggest that intelligence could be improved by the substitution of a gene, it may be found that there are several genes that are more commonly expressed in the genomes of intelligent people than those with more limited intellectual capacity. And parents might want to engineer an embryo to house a greater number of these genes. It is this genetic engineering of humans that so frightens people, that we could somehow design the human race. Though some people point out other potential benefits. What if it turned out that there were sets of genes that were commonly expressed in criminals - could we tackle crime by weeding out those genes?

The technology is nowhere near there yet, but a tiny number of parents undergoing IVF have selected their [embryos to be free from genetic mutations](http://www.brighthub.com/science/genetics/articles/22735.aspx) that have blighted generations of their family. In the UK in January 2009 a mother gave birth to a girl whose embryo had been selected to be free from a genetic form of breast cancer. Some see this as a slippery slope towards a eugenic future, others view it as a valuable use of genetic engineering to prevent disease from striking someone down.

Society will decide how it uses this technology, and it is for governments to weigh up the pros and cons of genetic engineering in humans to see what may be carried out and what should be illegal. They will be prompted by public understanding, desire and concern. It therefore behoves all of us to understand what scientists are trying to accomplish and what they are not trying to do. We must all become better informed, to equip ourselves with more information and to know the difference between science fiction and science fact.  
**Source:** <http://www.brighthub.com/science/genetics/articles/22210.aspx>  **Author:** Paul Arnold **Last Editing Date:** 28/02/2012 **Date:** 16/05/2014

**Research 7**Many human genetic engineering pros and cons are there that have stayed the same since its introduction to humanity. When the humans started harnessing the atomic powers, then just few years later they also start recognizing the [effects of human genetic engineering](http://humangenetic.org/human-genetic-engineering-effects/) on mankind. Many scientists have a belief that gene therapy can be a mainstream for saving lives of many people. A lot of human genetic engineering pros and cons have been involved since the evolution of genetic engineering. Mentioned below are some important advantages or pros of genetic engineering:

* With the help of gene therapy our scientists can easily detect the humans or other resources that have greater chances of getting stuck into hereditary or deadly diseases.
* A lot of diseases are there that have no cure, so the invention of genetic engineering in medical sciences can result as a cure to several deadly diseases. Few infectious or uncured diseases can be treated by the implantation of genes that carry antiviral proteins in code.
* Genetic diversity can be increased to a certain extent with the help of genetic engineering. This will help in producing alleles that varies a lot from each other, and then other species can also be implanted with the crossed over genetic diversity.

Other human genetic engineering pros and cons include the desirable characteristics in different plants and animals at the same time convenient. One can also do the manipulation of genes in trees or big plants. This will enable the trees to absorb increased amount of carbon dioxide, and it will reduce the effects of global warming. However, there is a question from critics that whether man has the right to do such manipulations or alterations in the genes of natural things.  
With human genetic engineering, there is always a chance for altering the wheat plants genetics, which will then enable it to grow insulin. [Human genetic engineering pros and cons](http://humangenetic.org/human-genetic-engineering-pros-and-cons/) have been among the concern of a lot of people involved in genetic engineering. Likewise the pros, certain cons are there of using the genetic engineering. Mentioned below are the cons of human genetic engineering:

* A lot of scientists have a view that the introduction of genes that have been modified genetically can have effects that can never be removed or reversed. Few consequences will always be involved in the use of human genetic engineering.
* Several moral and religious issues will always be there with the use of gene therapy of living beings. Critics have questioned that whether man has the freedom to alter the already available sources of earth.

The evolution of genetic engineering gets the consideration of being the biggest breakthroughs in the history of mankind after the evolution of atomic energy, and few other scientific discoveries. However, human genetic engineering pros and cons together have contributed a lot in creating a controversial image of it among the people.   
**Source:** <http://humangenetic.org/human-genetic-engineering-pros-and-cons/>   
**Author**: Unknown  
**Last Editing Date:** 12/02/2014  
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**Research 8**

Genetic engineering is, at best, a debatable branch of science. For some, it's the wave of the future: a method for perfecting the human genome, discarding flaws from infants before they're even born and ensuring they live longer, healthier lives. For others, it's an abomination: a method of circumventing what nature gave you, and wholly unnatural. Which one is right?

Well, nobody's ever going to agree on that. The debate over the merits of genetic engineering will probably soldier on until there are no more mouths to voice an opinion. Those who are yet undecided on whether genetic engineering in humans is good or not, however, may want to weigh the following pros and cons before coming to a final decision.

**Pros:**  
- As indicated above, genetic engineering is meant to eliminate flaws in humanity's genetic makeup. Consequently, those children that were genetically modified before birth will probably emerge healthier on average than a normal baby. Geneticists will be able to target specific genetic defects and get rid of them before the child ages. Consequently, certain hereditary problems, like baldness, can be weeded out.  
- Along the same lines, genetic engineering can get rid of problems in already living humans by 'activating' certain processes in their cells that were previously absent. For example, gene therapy could be used to trigger the body to create sufficient amounts of insulin in diabetics.  
- Genetic engineering can also be used to move humans above and beyond their normal restraints. Genetically engineered humans can be made tougher, faster, stronger and smarter. This is, in effect, a laboratory-crafted evolution of the species.  
- Genetic engineering can also allow parents to, in essence, custom make their baby. If these parents want a child with green eyes and red hair for example, they can have it done. This can also be used to eliminate superficial traits parents may perceive as flaws, such as overly large or small ears, noses or eyes.  
- Genetic engineering can potentially eliminate the age barrier, and allow humans to live a great deal longer. The lifespan of a body's cells could be lengthened, and regeneration of those cells stretched by several years. It's not likely that genetic engineering can grant any kind of immortality, but the possibilities are fairly broad.

**Cons:**  
- Genetic engineering is currently a moral gray ground, as it delves into tinkering with the natural processes of the body. Is this a science humans should pursue? Presumably, from this standpoint, what nature gave us in the first place should be good enough.  
- Genetic engineering also raises the question of compliance. Genetically altered babies will have no say in what's being done to their bodies before birth, and consequently will have to live with whatever happens as a result of genetic tampering. This is particularly important should the gene therapy somehow go wrong, and the child turn out worse off than if it had been birthed normally.  
- Hinted above, genetic engineering is still a fairly untested science. Much of it is still theoretical, and as with most theories things can go wrong - though in the case of genetic testing, the problems will appear in humans. Such risky science, some argue, shouldn't be touched in the first place.  
- Genetic engineering has the potential to create schisms in society above and beyond politics and wealth. It's likely that only the wealthy will be able to afford gene therapy, at least at first, and the resulting 'improved' humans could be seen as a species above the rest, or perhaps even perceive themselves as such. This could result in some fairly radical class wars, and a great deal of resentment.  
**-** Genetic engineering's ability to expand life has a drawback in that it can cause overpopulation. The Earth is already showing the strains of supporting too many people at once, and preventing natural death can have serious implications for employment, living space, food and energy sources and much more beyond. What's our planet's breaking point where population is involved?

**Source:** <http://www.sciences360.com/index.php/pros-and-cons-of-genetic-engineering-in-humans-6890/>   
**Author:** Matt Bird  
**Last Editing Date:** 13/01/2011  
**Date:** 16/05/2014

**Research 9**

**The Pros of Designer Babies***"Imagine the reaction there would be if organ transplantation were prohibited because it is 'unnatural' -- though that is what some people called for when transplantation was a medical novelty. It is hard to see how the replacement of a defective gene is any less 'natural' than the replacement of a defective organ. Indeed, the major difference is the entirely beneficial one that medical intervention need occur only once around the time of conception, and the benefits would be inherited by the child and its descendants." -- Dr. Roger Gosden*.  
Dr. Roger Gosden is a scientist who is known globally for his work with reproductive biology and medical treatments for infertility. He has published many volumes on the studies of birth defects, the human egg, and fertility preservation. In this quote, he defines the basic reasons for "selecting" a child's genes and characteristics, and the lack of a difference in replacing an organ and replacing a gene. Replacement of a defective gene would be done after the egg has been fertilized in a test tube, instead of being fertilized in the mother's body. This technique is known as IVF, or In Vitro Fertilization, and allows for the sex of the baby to be determined. These children are more commonly referred to as Designer Babies.

**How can IVF be helpful?** Many genetic disorders are caused by mutations in either the X or Y-chromosomes. If a certain genetic disease is only passed down to males in the family, the parents may want to avoid having a male child in order to prevent this disease from continuing in the family.

The benefits of this medical intervention are boundless. It would allow a family to virtually eradicate a genetic disease in only a few generations. Muscular Dystrophy is an excellent example, and a great subject for PGD.. Muscular Dystrophy (MD) is a group of genetic and hereditary (see picture left for gene flow pattern) muscle diseases that weaken the muscles of the body, sometimes very severely. If two parents decide to use either IFV or PGD, doctors can test each of the eggs for the gene for MD. If they find an egg that does not carry the gene, they can implant it and reduce the chances for this disease greatly. This also means less money will be spent in hospitals for medical treatments needed for a sick child in the future.

Designer babies may also be created to help another in need. Parents may have a child suffering from a disease and in need of an organ or blood transplant. Imagine you have a child suffering from Leukemia, a cancer of the blood/bone marrow. He needs a bone marrow donation, or he will die young. You and your husband/wife are not matches for his bone marrow. You are, however, able to have another child. Through designer babies, they could create a perfect match for your child's blood, bone marrow, or other organ.  
  
     A circumstance like this occurred 2002, in the UK. The Hashmi family had a child with a rare blood disorder, and needed a bone marrow transplant desperately. The Hashmis used PGD to screen the mother's embryos in hopes that they would have an egg free from the disorder and who could donate tissue to its sibling. The CORE (Comment On Reproductive Ethics) challenged the decision made by a previous court that the Hashmis could use this treatment. After months of debate over the ethics of the situation, the court determined that the Hashmis could continue treatment because of its important medical value.  
Genetic screening on embryos has potential to wipe out genetic disease by virtually removing the alleles from such disorders. When it is used in correct form, for medical treatment, children born n the future have the potentially to be purely "healthy" and carry no signs of genetic disease. The implications of this are vast are infinite for the human world, and the world of science.

**The Cons of Designer Babies**The future of genetic engineering is full of many possibilities, good things and improvements for our society. Currently, designer baby technology is only used to make sure the parents of a future child will not have a child with an incurable disease. However, it is only a matter of time before a doctor or company will put a price on other aspects of the genome of the baby. The technology can even be dangerous right now as it is to the embryos.

**The embryos** First, the genetic engineering itself may not work correctly. Choosing a certain type of gene, say for hair color, may turn off a different gene, say for aging longer (this would be telomerase, for the curious) (Agar). This type of problem may not manifest itself until the baby is actually born. Furthermore, the parents may not get what they expect. Hypothetically, they might choose a female embryo with fair skin, dark hair, and a minimal chance of disease, and get a healthy daughter who is fair skinned with dark hair who also has a terribly mean personality. Because "personality genes" are difficult to interpret and understand (they may not even exist!), the personalities of designer babies cannot be chosen for. The parents who wanted the fair and brunette daughter may have accidentally passed up a sweet tempered red haired son.

The choosing of embryos brings to the forefront a large moral issue with designer babies. Many embryos are created, and not as many are implanted into the mother. The embryos that do not fit the specifications set by the parents will get thrown away. Had these embryos have been allowed to grow, they could have had long and fulfilled lives, however the ones that are thrown away lose that potential life. Many people, especially those who are pro-life, view this aspect as a huge problem in the creation of designer babies. If many embryos are going to be thrown away, they should not be created.

Even embryos thrown away for medical reasons could still have just as good a life as those selected for without disease. When the genetics of an embryo are analyzed, it must be remembered that the genes for heart disease will not necessarily express themselves; there is only a chance that the expression will happen. Keeping that in mind, an embryo with a 40% chance of heart disease is being denied its life based on a chance.

**Society**When the time comes that a company is willing to put a price on designing aspects of a baby involving appearance, the technology will most likely be very popular. People should be wary of the possible downfalls of overusing this technology, as it could have an extremely detrimental effect on the world’s population.If designer babies were to become commonplace, individuality as we know it would most likely cease to exist. Not everyone would look exactly the same; some parents may want their baby to have brown eyes, as opposed to green. Other parents may want their child to be more tan skinned rather than fair skinned. But as a whole, many people would be pretty, healthy, and intelligent. What parent wouldn't want these basic traits in their child?

A society of pretty, healthy, and intelligent people may sound reasonable and even favorable, until the full social implications are considered. Designing a baby costs money, and will most likely continue to cost lots of money; Genetic engineering for non medical reasons is not necessary for living life and it is doubtful that those who could not afford it would get reimbursed by insurance companies. This cost will mean that not everyone will be able to pay to design their baby, and suddenly people will encounter prejudice, not for their race, but for their inferior genetic makeup. It creates a new class system made up of genetically designed people and naturally made people. The people who were not genetically engineered would experience a loss of opportunity based on a chance that their defective genes will be expressed. In this new society, people with a 50% chance of cancer would get passed over for a job in favor of the person with .01% chance of cancer. That kind of social stratification can be frightening. Even if privacy laws the way they are now stay in place and people’s genetic information is not shared, it could be obvious which children were designed and which were not, creating the same stratification (Agar).

Another potential long term problem of designing babies lies in societies in which one gender or other important characteristic is favored over the other. In countries such as China and India where boys are favored over girls, this technology could be used so that every set of parents that wants a baby boy will get one. However, that is not evolutionarily favorable (Agar). If a generation of only boys were to be made, the human race would die out. That is, nevertheless, difficult to explain to an entire country, where family pride is based on the number of sons one has. The technology would continue to be abused.

Creating a generation of genetically modified humans could mess with evolution in unpredictable ways. The premise of evolution is simply this: as environments change, the individuals in a species best suited to the new environment are selected for. Without diversity in the species, adaptation to the new environment is more difficult without a wide range of individuals to choose from. The evolution of humans has spanned about 2 million years and has resulted in the types of people we see today: people who have imperfections and people who are very different from one another. A large scale of organisms in a particular species is necessary for that species to continue to be competitive with other species and be successful. By creating a generation of genetically similar people, the human species loses its ability to adapt to changing environments (Agar). Furthermore, on moral grounds, whether it is believed that humans evolved or were created by God, it is wrong to try to perfect something that has been perfected over a large span of time or made by God.  
**Source:** <http://designerbabies.weebly.com/cons.html>  **Author:** Mona Ahmad, Harshal Desai, Hannah Morgan, Lara Yoon **Last Editing Date:** Unknown **Date:** 16/05/2014

**Is it fair to manipulate someone else’s life and body without their consent?   
Research 10**

54% Say Yes

46% Say No

* Yes At Least To A Degree If we don't use human genetic engineering then we foresake the opportunity to cure many diseases and end a great deal of human suffering. We can debate about whether using genetic engineering beyond that is appropriate, but it certainly should be used for curing disease. In fact once developed and safely tested no parent should be allowed to refuse such treatment for their child.
* Who are we to decide what's right and wrong? Who are we to play god you ask haven’t we been doing that already. With slavery, deciding who gets what, and what is right for someone without asking their opinion. The common human acts the part of god without realizing it. For example if eating an apple is what got Adam and Eve kicked out of Eden why do we still eat them without fear of retribution. Christians and Jews alike, it is because we have lost our fear in the wrath of god so why start it back up now. Also Stop and think for a minute if you say that if god wanted this to be he would have made us that way in the beginning then stop think about this. If god didn’t want us to have this technology why do we have it. He gave us knowledge for what reason other than to create. And who are you to decide what god wants don’t tell me you got tired of playing god and now want to act the part of the god of god.
* It is ethical. What I don't get is how genetic engineering is unethical. We can argue about how you shouldn't change your child's looks in ways that are disgusting and dumb but that will never change the fact that genetic engineering is an advance in our society for the better so we can either ignore it or harness it and use it to cure disease and stop innocent people from having to experience the suffering of having a lifelong illness.
* Humans will be human If we gain the technology to genetically engineer people, creating "designer babies", yes we can cure disease. But that isn't all. Some argue we would create a master race. But that isn't necessarily true. There will always be people out there who engineer themselves or their young to be different. Spliced cat, dog, horse, make them blue or whatever. They will diversify themselves based on the sheer fact of wanting to be different. That is why we dress differently. The other argument, "let God be God" is childish. "God" is a force, not a being. He is a guide, not a master. He gave us free will, so let us be free. Socio-economic gap? There are two ways to deal with the Socio-economic gap. 1. Don't. 2. Rebel. In the end, there will always be those superior and those inferior, due to a cacophony of reasons. Genetic engineering is not the evil everyone thinks it is. It is merely the vehicle for humans to be evil to each other.
* Yes this idea is good Genetic engineering for humans is good for disorders like Tay-Sachs, Sickle cell, and long QT syndrome because they are deadly. However if the disease is not deadly like down syndrome people should use safer operations. In conclusion genetic modification is good for some cases as long as its worth the risk.

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* You know what's not ethical? Not preventing disease. Genetic engineering is just another form of technology. It's human nature to have some distrust of new and unknown technologies, but we've been all about using new methods since the first time fire was discovered. Genetic engineering is a vast, untapped area of medical research that has the ability to eliminate diseases before they even happen. it's entirely ethical.
* It should be allowed as long as its legal and safe Genetic engineering is a great advancement to human technology and if some parents do not want their child engineered by something or someone it is their decision. Not everybody wants or needs to do this but we could cure major diseases and greatly help us as humans. We could still advance off this thought to, no idea will ever end. I will say I do agree to a few of the cons but the pros outweigh the cons by so much.
* As long as it isn't in prejudice, so eyes, height, skin colour etc... are all left as normal. Well there isn't much need for a supporting argument when there is little to no opposing argument. Since I have to give one though, I would like to say that it can cure disease and if left unhindered in as little as fifty years scientists could have discovered how to make life last forever, you could make farm animals without brains so you can use intensive farming but without being cruel, so we could feed more people. We could decrease the want to have so many children and stop overpopulation, all of life's problems solved if people would just let it happen.
* No, it is not right. It is meddling with something beyond our grasp, we are not meant to play God and try to create life in the way we wish it to be. We are all formed in our mothers womb just as he wants us to be. "Ps 139:13 - For thou hast possessed my reins: thou hast covered me in my mother's womb." "Isaiah 44:24 - Thus saith the LORD, thy redeemer, and he that formed thee from the womb, I am the LORD that maketh all things; that stretcheth forth the heavens alone; that spreadeth abroad the earth by myself."
* The creature improving what the creator has made. The ignorance and arrogance is truly amazing. When will we learn the simple fact that everything man has tried to improve on relating to mother nature and creation has ultimately ended up being a step in the wrong direction? Sometimes irreversible changes we could not have forseen show up decades later. When you put something on this earth that never has and never was intended to be here, you can't possibly see the repercussions it will bring about. There is so much we will never understand about the human body, mind and soul. It is foolish and arrogant to think we can experiment with the human race on this level and say we understand it all. When will we learn? We are not God. If you don't believe in the God who created everything, then most likely you will think man is smart enough and powerful enough to cure any disease, engineer life to last indefinitely, and anything else our heart desires, without any consequences. I'm all for advances in healthcare, but we can't possibly think we can improve on what God created can we? In his ultimate wisdom he created the human race, and the universe. Let's just figure out how to build a car that will last more than 10 years before we start engineering the perfect human race. What do you say?
* It Violates Life When we try to engineer a child, for that is what an embryo is, a child, we change God's plan for the child. If that child was meant to be born with dyslexia, and you take it from them, not only are we taking away something that they will grow through, but we ourselves are playing god. A parent raises a child with unconditional love. If that child is chosen to be a certain sex, hair color, eye color, IQ and all imperfections have been taken out, how can the love of their parents ever be unconditional?
* Immorality of Human Genetic Engineering from High School Perspective As students of a high school summer genetic engineering course, we have decided that human genetic engineering is immoral for the following reasons:

It would eliminate talent; as stated in The Incredibles, “If everyone’s super, then no one will be.” And “Playing God is a dangerous game that inevitably ends with a monster.”- Anonymous

Everyone will be the same, parents will want the “perfect” child, therefore, everyone will have the same talents and advantages, so it will not make a big difference in society.

If a group of people begins to make superior changes in their offspring, the rest of the population will be left with inferior children unless they too join in the practice of designing their baby. Therefore, the company that produces these changes will be in control of the population.

If human genetic engineering were to happen, the various figures of god, which millions of people around the world rely on every day would collapse and becomes us, therefore, reducing faith by having us play the role of a god-like figure.

While creating the “perfect” immune system, only diseases that are already known will be prevented. When a new disease comes along, our immune system will not be comparatively as strong.

We came to the opinion that genetically engineering designer babies is wrong because the social-economic divide would become increasingly more noticeable and potentially more hostile.

Genetically engineering a privileged embryo to be immune to all known diseases would cause the downfall of the pharmaceutics industry, and consequently the deaths of a great number of underprivileged citizens.

* No It leaves people to decide what the "ultimate race" would be like. Genetic engineering doesn't cure diseases as people claim. Genetics in one of the most misunderstood realms of science. (Not that I understand it, but the leading scientist can't come to consensus either.) It is used for growth hormone, insulin production, fertility drugs, and vaccines. Since genetics is so risky and these risks are not fully understood, GE on humans should be restricted to research and experimentation in life or death situations.

* Leave it to God! I believe it is unethical because it goes against the Bible. I believe that only God can truly affect the genetics of a human being and the science doesn't stand a chance. It is morally wrong and takes God out of it. After all we are talking about a human life here. No matter what people say, the cells science messes with are human beings.

* Humans Are Greedy Unless humanity can magically turn 180 degrees and change their historically greedy and gluttonous pattern of behavior, genetic engineering would produce an even larger gap between the rich and genetically superior and the poor and now genetically inferior. If every CEO who genetically engineered their children paid for the procedures to be done on an equal number of children whose parents couldn't afford it, then hell yeah. But we all know that the 1% does next to nothing for the lowly 99%. So no.
* Genetic Divide into two distinct castes In the 21st century, we have seen the vast differences in technological advancements in the developed and developing countries in the world. The poor citizens of developing countries generally have less sophisticated technological gadgets compared to those that are wealthier. If we were to allow genetic engineering, it will certainly create an even larger inequality between the rich and the poor. The affluent ones can simply pay to get muscle enhancements or increase their IQ genetically. However, the poor ones will have to toll and work very hard simply to match up to their rich counterparts. This would certainly create an unbalanced society where the rich will continue to advance and become richer whereas the poor will be left behind in this fast-paced race. Thus, this clear distinction between the two groups: the Genetically Modified and the normal being is known as the Genetic Divide. In such a society, the poor will be extremely disadvantaged and it will be even harder to adopt a meritocratic system. Thus, an equal starting platform will no longer exist. Therefore, genetic engineering should not be pursued as it has the potential to cause an unwanted genetic divide in the society.
* Understand Gods Plan Though there are many naysayers out there God does exist. He has more power and love than we could possibly imagine. He has a divine plan for every person and tragedy happens for a reason, the ripple effect is endless even if we are too stubborn to see. We do not have the right to play God. If diseases happen they happen for a reason and though tragic there is always something good that comes out of it. Plus, messing with genetics and increasing lifespans in an unnatural way only contributes to overpopulation that much more.

**Source:** <http://www.debate.org/opinions/is-human-genetic-engineering-ethical>   
**Author:** Unknown  
**Last Editing Date:** Unknown  
**Date:** 16/05/2014

**Research 11**The relationship between ethics and science has had a long, complicated history.  Although the atrocious Nazi experiments performed in the name of science are 70 years behind us, science continues to cross new boundaries. An advancing science that is currently forcing society to re-evaluate ethical boundaries is genetic engineering.

Genetic engineering (also called genetic modification) is the direct manipulation of an organism’s genome using modern DNA technology. So far, the study and application of genetic engineering has been much slower, more complex, and less effective in humans than in plants and animals. Whereas animal cloning has been somewhat successful since Dolly’s famed birth in 1996 (and more recently the capacity to clone your beloved dog for $100,000), the ability to successfully clone humans has proved difficult scientifically and highly controversial ethically.

Genetically modified plants and animals have led to significant benefits, such as herbicide resistant crops and fast-growing animals.  At the same time, this technology has created major ethical concerns relating to the perceived “unnaturalness” of changing a living organism and a fear that scientists are “playing God” through their alterations of an original being. In humans, researchers have predicted that gene therapy will not only allow us to treat and prevent debilitating diseases (an elusive goal for scientists over the past 20 years), but also enhance or improve normal human traits.

Should we have the right to enhance our muscles, memory and moods through genetic modification? At what point should genetic engineering be forced to draw a line? The answer to this is tricky.

Although still mainly limited to science fiction, genetic enhancement in humans is a controversial issue. The largely publicized topic of “designer babies,” for example, leads to debates over whether it is significantly worse for parents to try and give their children the best opportunities by selecting certain genes using in vitro fertilization (IVF) and pre-implantation diagnosis (PGD), versus hiring sperm and egg donors with coveted genetic traits.  Personally, I find it easier to agree that disease prevention and treatment are beneficial goals of genetic engineering in humans, than for me to accept human enhancement as a morally acceptable goal.

However, we do not yet grasp the full extent of what genetic engineering means for human development. What we deem “acceptable” or “unacceptable” in the world we currently inhabit with our presently available science and technology could easily change as scientific capacity advances. Our notion of what is right or wrong and even our fundamental understanding of what it means to be a “normal” human being have continually changed through scientific progress. Once, the only option for biologically influencing a person’s development was through mate selection. Today, scientific advancements such as prenatal screening technologies, in vitro fertilization, and pharmaceuticals targeting cognitive and emotional functioning allow parents to avoid certain birth defects, select for sex, and improve their child’s cognitive ability and moods.

Instead of drawing an imaginary “do not cross” line or moral boundary for genetic engineering in humans, we should emphasize the need for continuous negotiation with moral notions and beliefs with the purpose of directing and influencing policy as a result of this mutual interaction.  Organizations such as the Stanford [Center for Integration of Research on Genetics and Ethics (CIRGE)](http://cirge.stanford.edu/) are examples of this approach.  CIRGE is one of six interdisciplinary Centers of Excellence in Ethical, Legal and Social Implications (ELSI) Research (CEERs) created by the National Human Genome Research Institute (NHGRI) “to proactively identify and deliberate ethical, legal and social issues in current and emerging genetic research.”

This strategy of anticipatory ethics advocates that “ethics” should accompany and monitor advancing technology rather than simply react to it. Instead of demanding immediate draconian controls, a vigorous concurrent moral debate should occur to provide a framework within which genetic engineering can progress.  Good research-based policy decisions should result from the continuous and simultaneous review of advancements in genetic engineering as studied from an analysis of their ethical and social consequences.  Science should raise ethical issues and ethical issues should influence science, thus creating a healthy tension between genetic engineering research and ethical checks and boundaries, and hopefully avoiding potential harmful consequences of unmonitored science through this balanced approach.

**Source:** <http://www.policymic.com/articles/3971/genetic-engineering-debate-are-there-lines-we-shouldn-t-cross> **Author:** Jessica Erikson **Last Editing Date:** 07/02/2012 **Date:** 16/05/2014