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Student Essay on Genetics: a Fight between Technology or Morality........................................1

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Genetic engineering and other related topics are currently under the microscope by many people. These people aren't just scientist; genetic engineering has become a political issue that has surfaced in the media a number of times in the recent past. The purpose of this paper is to educate people about the different aspects of genetic engineering so more people can map out a more educated opinion about this controversial issue. In the pages that follow I will cover: the history of the different types of genetic engineering, to list and explain the procedures involved in genetic engineering, to explain the technology used, to discuss the purpose of genetic engineering, and to present the pros and cons of genetic engineering.

Before we can begin to explain and begin to form an opinion about genetic engineering we must take a look at the history of genetics. I will discuss the history of: Cloning, DNA Fingerprinting, Gene Therapy, Stem-Cell Research, and Transgenic Organisms. Though each of these topics' overall history is minuscule I will try to provide a sufficient overview of what happened and who made it happen.

First, the history of Cloning, like many other topics related to genetics is rather recent. The earliest research with cloning dates back to 1901; in that year Hans Spemann managed to split a two celled newt embryo into two separate larvas. Thought this isn't the cloning we think of it was the beginning of what we now see today. In 1935 German scientist and Noble Laureate in Medicine Hans Spemann theorized that cloning could be accomplished by fusing and embryo with an egg cell, this is also known as the organizer effect.

This theory was put to the test in 1952 when Robert Briggs and T.J. King tried the procedure on a frog. This was an important step because this showed that the first cell divisions that occur after fertilization could be divided to form the whole animal, or totipotent. However, as cell divisions keep on occurring they become more individualistic, and begin to form organs and other vital systems in the body. These first clones were able to form embryos that appeared to be healthy and develop into a copy of the parent cell; despite this, the clones weren't able to make it past the tadpole stage of development. In spite of this, this was considered the first clone. By 1953 Watson and Crick has discovered the double helix pattern of DNA. Though questionable, the first reported cloning occurred in 1963 when a British molecular biologist named John B. Gurdon declared that he had cloned a frog using its' intestinal cells. I was pointed out that the cells in the particular species of frog that he used didn't have much genetic diversity. Also in 1963 the term "clone" was adopted by J.B.S. Haldane. In 1970 Gurdon tried again with his frogs. This time he was able to make a successful transplant and the frogs developed into tadpoles, they died once the tadpoles reached their feeding age. By 1977 German developmental biologist Karl Illmensee, working with Peter Hoppe clamed that they that cloned both fatherless and motherless mice; however, this work was later denounced when Illmensee was suspected of strange lab activity. In 1982 Drs.
James McGrath and Davor Stolter of the Wistar Institute of Anatomy and Biology in Philadelphia after much study and experiment went able to repeat cloning a mouse and concluded that cloning in a mouse was impossible after the embryo has split into two or more cells. Finally, in 1984 Dr. Steen Willadsen made the first verified mammal clone. He used nuclear transfer form sheep embryo cells to create the first cloned lamb. In 1994 Dr. Neal First cloned a calf from cells that had developed into at least 120 cells. By 1997 Dolly the sheep was born. She was the fist mammal to be cloned form a fully developed cell. Dolly was actually born in 1996 but she wasn't revealed until February of the next year. The main scientist behind this break though was Embryologist Ian Wilmut of Scotland. In 1998 researchers in Japan cloned eight cows form the same parent cell; however, only four survived until their first birthday. Also this year the University of Hawaii announced that they cloned fifty mice from the same parent cell along three generations. In addition to these occurrences, the FDA claimed the authority to control human cloning. By 1999 the field had advanced to work on humans. Medical researchers at Kyunghee University Hospital in Seoul managed to clone a human cell form an infertile woman. Nevertheless, pressures of morality proved too great, so they decided to end their experiments before they implanted the cell. Only three years ago in 2000 a cloned female monkey named Rhesus was born. Though various animals have been cloned, this was a big step since monkeys are the closest genetically to humans. Just two years ago in 2001 a biotech company in Worcester, MA cloned a human that grew into six cells. The procedure was stopped because they wanted this technology for stem-cell study and not the cloning of a human. Stunning the world with its news, Clonid a branch of the Raelian sect announced that it has cloned the first human being named Eva. The claims have not yet been backed up with DNA evidence, so the claim is under much speculation. Since then they have claimed to have cloned two more humans.

Throughout the history of cloning there have been many times when false claims have been made, as well as much of the research met with opposition. Fighting for the advancement of cloning has been a long struggle felt by many of its researchers.

Second, is the even smaller history of DNA Fingerprinting. The technique was first developed in England in 1985, DNA testing takes advantage of the fact that, with the exception of identical twins, the genetic material -- DNA -- of each person is unique. Also in 1985 DNA Fingerprinting when to the court room for the first time, unfortunitly it wasn't considered a valid and reliable science at the time. I wasn't until 1988 that proof form a DNA Fingerprinting test was considered valid proof, in that case it sent the defendant to jail. When the National Research Council said in a 1992 study that DNA testing was a reliable method to identify criminal suspects, the technology rapidly entered the mainstream court system. Today, it is hard to pick up a daily paper and not find an article reporting on the use of DNA testing in a civil or criminal court case.

The Future of DNA Fingerprinting seams to be a promising one. Unlike cloning DNA Fingerprinting seams to be more accepted and doesn't step on too many moral toes. This technology has the possibility of putting the guiltier in jail and keeping the innocent out of jail.
Gene Therapy also has a short history, despite this it tells the tale of many beneficial uses of Gene Therapy; however, it also tells the tale of the immoral possibilities of this technology.

History with this technology begins with when W. French Anderson proposed the first gene therapy in 1987, he encountered some criticism. But that experiment was tame compared to what he’s now considering: curing two inherited diseases by directly injecting genetic material into the tissues of a fetus. The first disease is a hemoglobin deficiency that kills the fetus before it is born. The second is ADA deficiency, the “bubble boy” disorder he treated in his 1990 pioneering trial. Anderson believes that fetuses are better candidates than children or adults because fetal cells divide so rapidly they may take up foreign genes faster than other cells in its state of maturity.

Though this technology may currently be used to cure disease it may one day be used to design children, many people seem to have ethical problems with this. Also the reliability of this technology isn’t good enough yet and is considered experimental by the FDA. Most people don’t like the idea of human fetus being experimented on, so because of this Gene Therapy has received much opposition.

Next, stem-cell research has been a hot topic in the news lately. Like all the other topics discussed in this paper, Stem-cell research has a short history just starting in the early 1900s.

By the mid 1800s scientist discovered that cells are the basic unit or building block that makes up all multi-cellular organisms on earth. Nevertheless, it wasn’t until the early 1900s when some European scientist made the conclusion that all blood cells come from one particular cell later named a stem-cell. Even though bone marrow transplants and other forms of transplants move stem cells, it wasn’t until more recently that stem-cells which may be able to regenerate organs were uncovered form a particular source. This occurred for the first time when James Thomson and a team of scientist at the University of Wisconsin isolated and then preceded to grow stem cells that had been extracted form a human embryo. Around the same time researchers at Johns Hopkins University led by John Gearhart accomplished the same feat, but this time instead of using human embryos they used human germ cells. During the years of 1999 though 2000 researches had success with manipulating mouse bone tissue and sticking it in the liver of the mouse. The results were positive and the bone tissue converted into liver tissue. In other words they took stem-cells form mouse bone and placed it into a mouse liver, the bone stem-cells then converted themselves into liver cells. By April 2001, researchers at UCLA and the University of Pittsburgh found stem-cells in fat that had been extracted during a liposuction session. This is good news because instead of using fetal tissue we can use unwanted fat.

As this new technology develops there becomes the amazing possibility for the betterment of the human race. Despite this research must come at a price and some people aren't sure if that's a price worth paying.
Transgenic organisms have one of the longest histories out of all the topics discussed in this paper. Verification of humans attempting to control the "offspring" of plants dates back to the times of the Babylonians. Since then humans have "created" plants and animals to make life undemanding for humans.

The first recorded evidence of humans trying to control the breeding of plants is found somewhere between 4000 B.C. and 2000 B.C. by the Babylonians. They were controlling date palms by only breeding cretin female plants with select male plants. Then in 1322 an Arab chieftain used artificial insemination to create a horse better than the average horse. In 1761 a man named Koelreuter claimed that he had successfully cross bread crops of different species. By 1859 Charles Darwin publishes his theory of evolution by natural selection. This greatly influenced many scientists working on the production of transgenic organisms. Finally, in 1865 the science of genetics officially begins. A monk named Gregor Mendel studied traits that were passed on though pea plants; thus beginning the study of heredity or genetics. From 1870 to 1890 plant breeders crossbred cotton seeds to increase its productivity; also, William James Beal generates the first hybrid corn plant. 1928 was a big year when formulated Bacillus thuringiensis (Bt) is produced to fight corn borers, this became the first genetically altered biopesticide to be used on plants. Also this year a man named Karpechenko successfully crossed cabbage and radishes, this resulted in fertile offspring. To finish of this year a man named Laibach used embryo rescue to acquire hybrids from wide crosses in crop plants Today this is currently known as hybridization. By 1930 with all the different beads of plant coming about the U.S. Congress decided to pass the Plant Patent Act to help protect potentially lucrative breads of plants. 1935 marked the year when hybrid corn was commercially sold to farmers, and by 1945 hybrid corn was used by seventy-eight percent of all the corn grown in the United States. Congress aware of the threat of the depletion of genetic diversity collected and preserved plants used in genetic experiments and alterations in 1946. By 1963 wheat plants developed by Norman Borlaug increased the average yield of wheat by seventy percent. In 1965 Harris and Watkins successfully fuse human and mouse cells together. In 1973 Stanley Cohen and Herbert Boyer figure out the proper techniques to cut and paste DNA by using restriction enzymes; thus, reproducing the new DNA in bacteria. In the case Diamond vs. Chakrabarty the U.S. Supreme Court upheld the right to patent any living organism. By 1982 the first genetically altered plant cell had been had been produced and by 1983 the first genetically altered plant had been grown. In 1889 field testing for cotton that was supposed to repel insects without harming humans was approved. With that advancement in 1889 came corn also repelled insects in 1990. By 1997 the first weed- and insect-resistant biotech crops were commercialized as well as insect-protected cotton. At this time Biotech crops were grown commercially on just about 5 million acres worldwide. In 1998 five Southeast Asian countries form an association to develop disease-resistant papayas. One year after the millennium the Chinese National Hybrid researchers report that they developed a "super rice" that could produce double the yield of normal rice. Also this year a single gene from an Arabidopsis was inserted into tomato plants to create the first crop that is able to grow in salty water and soil. To close out the year researchers grew thale cress that lights up when it is damaged or stressed; this is a step toward developing hardier and stress-resistant crops.
It is evident after looking back on the many different thing that were done and things accomplished through Transgenic research that much can be achieved through this technology.

While the history for the bulk of these topics are relatively new, as you can see, much has been accomplished, even though moral issues stand in the way we managed to make it this far. Hopefully, we can look back on each of these topics histories and make a wise pronouncement now in light of what happened before.

Now this paper will take a close look at what each of these topics are. I will look at the procedures by providing diagrams, and a detailed explanation. I will explain the technology used while the procedures are being executed. Last I will look at the purpose they serve society or what purpose they may serve in the future.

First, we will look at the procedures involved in the complicated process of cloning. Cloning is by definition is the process of making a genetically identical organism through nonsexual means. There are three main types of cloning; these types are plant, animal cloning, and therapeutic cloning.

The Cloning of plants has been around for thousands of years. Without realizing it early civilizations have been taking parts of existing plants and putting them in the ground. If this new part should grow it would be an identical match to the plant that the piece derived form. The most recent procedure for cloning plants is through the cells of a plant's roots. This is commonly known as tissue culture propagation. The basic steps for this procedure are bulleted below.

1. Collect the cells of the specialized root form the chosen plant.
2. Break them down until they are separated root cells.
3. Place the root cells into nutrition enriched soil
4. While these specialized root cells are in this enriched environment they become unspecialized; thus, creating a calluse.
5. On some occasions the calluses will be injected with growth hormones to stimulate the plants maturing rate.
6. These stimulated calluses will then grow into an identical plant to the one the root cells were extracted form, providing that the plant receives proper care.

I have included a diagram to further explain this process.

The second type of cloning is animal cloning. Animal cloning proves to be a more tedious task than it is with plants. Animal cloning is more or less broken down into two groups mammal cloning and non-mammal cloning. Mammal cloning turns out to be a harder task than non-mammals.
The first successful cloning was a frog. John Gurdon, the one who executed the experiment, used a technique called nuclear transfer. The steps involved in this process are listed below.

1. He collected an egg from a random frog.
2. He then used ultraviolet light to destroy the DNA.
3. Next he collected a random skin cell from the frog he wanted to clone.
4. He collected the nucleus out of the skin cell.
5. He put this nucleus into the empty egg.
6. After a while the egg developed into a tadpole.

Even though the cloned frog didn’t develop beyond the tadpole stage it is still considered a clone. This success helped prove that cloning was possible. Here is another diagram showing the basic steps.

The second type of animal cloning is of course mammal cloning. The process of cloning the first sheep was different from the cloning of a frog. The basic steps to cloning a sheep or any mammal are listed below.

1. First an egg is collected from a random sheep.
2. Its’ genetic data is destroyed by ultraviolet light.
3. A cell is extracted from the sheep desired to be cloned.
4. Electricity is used to fuse the cell with the empty egg. Where as in the frog the nucleus from the cell was simply injected into the egg.
5. Once the cell splits as a result from natural reproductive guidelines, they are then placed into the uterus of a sheep.

Though the process may not seem difficult, it took 276 tries to clone and successfully nurture Dolly into a mature sheep. This process is also how human cloning would be accomplished. However, the low success rate has made people shy away from cloning humans. Below is a diagram of this process.

The third type of cloning is therapeutic cloning. Therapeutic cloning is the process by which a person’s DNA is used to grow an embryonic clone. People would clone themselves in order to create an embryo to grow stem-cells for that person incase they contract a disease. The steps for such a process are listed below.

1. DNA is collected form the sick person.
2. The DNA is then inserted into an egg without a nucleus.
3. The egg than divides like any other egg that has been fertilized; thus, forming an embryo.

4. Stem cells are then harvested as they are created.

5. The stem cells are then injected into the unhealthy organ or spot in need of repair.

While on paper cloning may seem to be an easy process it actually is much harder than it sounds. As you may recall it took 276 tries to clone just a sheep. So far the only type of cloning is done through transplanting, or nuclear transfer. We have yet to figure out how to make an artificial growing environment. Until then our non-success rate will most likely stay relatively high.

Next, comes the process of DNA fingerprinting. DNA fingerprinting is accomplished by a test called gel electrophoresis, which measures the length of DNA to determine a match in certain cases. The steps in executing a DNA fingerprinting investigation are below.

1. The DNA is found and extracted form a candidate that may possibly hold DNA samples. (blood, saliva, semen, or hair)

2. If the DNA was found at a crime scene most likely it has been contaminated; thus, meaning that I must be cleaned up. Any foreign material must be cut out.

3. A carefully selected enzyme is chosen to cut the DNA up. This enzyme is chosen on the basis that I will not cut within any of the VNTR (variable number tandem repeats) loci that are under investigation.

4. The DNA strands will now be sorted by length using gel electrophoresis.

5. Since the DNA will disintegrate after about a day you must transfer the data relatively soon after the previous step is done. You will you a nylon membrane; you will lay it on top of the gel so it will soak up into the nylon membrane.

6. You won't be able to see your results on the nylon membrane; so you need to:
   * Make a DNA probe
   * Label the probe using a radioactive Compound
   * Wait a while so the DNA can bind with the probe
   * Use a radioactive tag to figure out where the probe had been attached.

7. Now that the radioactive probe is attached to the target on the nylon membrane you now can take a picture of your results with X-ray film

Here's a complementary diagram depicting the above process.
This is an amazing technology that can help society discern the good from the bad; as time progresses this technique has become more credible in the court room as well as more refined.

There are two different main types of gene therapy that I will explain in this paper. The first type is through virus vectors and the second is chimeraplasty. The processes for these are bulleted below.

There are three types of viruses that can be used in virus vector treatments. Each virus goes through the same basic steps to accomplish its intended goal.

1. The virus is isolated
2. The harmful genes are removed from the virus, thus disarming the virus.
3. Healthy genetic material appropriate for the disease or purpose of therapy is injected into the virus.
4. The new virus is inserted into the necessary place.
5. The virus injects the genetic material into the DNA or the nucleus if your virus is adenoviruses.
6. The healthy genetic material will copy itself and work to repair a damaged organ.

Here is a picture of this general process.

The second type is chimeraplasty. This is a relatively new process that was only discovered in 1999. The basic steps as to how it works are below.

1. A set of complementary base pairs are created. The base pairs will match up apart from at the point of the mutation or disease.
2. It is then inserted and combined with a strand of DNA.
3. The DNA combines properly except in the area of the defect.
4. The DNA polymerase comes along and sees this "mistake" and fixes it.

He's a diagram to explain this process in pictures.

Though gene therapy raises many possibilities for the curing of disease, it will be a few years before this therapy is refined to an efficient method of practice.

Next, the processes used when dealing with stem-cells are extensive and interesting. Typically, the only thing you do with stem-cells is to transplant them into a host body. The basic process is in the following steps.
1. The stem cell is extracted from a number of possible places. There are bone marrow, embryos, and umbilical cords. If the stem cell derives form an embryo it must first be fertilized by sperm.

2. Stem cells are then extracted from the desired source.

3. The stem cells are put into a Petri dish so they can multiply.

4. With some tender loving care the stem cells are injected into the area of defect, and nurtured into the particular tissue it is repairing.

This type of process is still under development and still hasn't been officially been approved by the FDA. Here is a diagram depicting the general process of you were to extract the stem cells from an embryo.

Stem-cell transplants are in reality rather tedious in spite of its easy appearance. As time progresses this technique has been refined and changed to ensure better results from the transplants.

When speaking about transgenic organisms you must break them into two separate groups. These groups are animal transformation and plant transformation. There are different was of accomplishing this in animals and in plants; there are few techniques but they all have the same general process.

The first of the animal methods is microinjection. The processes for executing this type of procedure are listed below.

1. A recently fertilized embryo is removed form the host mother.

2. The desired DNA is injected into the embryo.

3. The altered embryo is then placed into a host mother to finish out the growing process.

Unfortunately, only about one to four percent of these experiments are successful in altering the embryo and resulting in a living organism. Here is a picture of DNA being injected into a one celled embryo.

The process of forming a transgenic organism is less difficult in plants, and the success rate is much higher. There are a number of different techniques being explored by scientist today. I will only talk about a few of these. The first method and the method with the highest success rate, involves the pathogenic bacterium Agrobacterium tumefaciens. The processes are listed below.

1. A desire for an alteration to a select plant is chosen.

2. Other organisms are searched for a gene that would remedy this desire.
3. The pathogenic bacterium, Agrobacterium tumefaciens, is isolated.

4. This bacteria is disarmed from its potentially harmful state.

5. The bacteria's DNA is merged with the desired gene by an enzyme.

6. The bacterium is injected into a young plant cell.

7. The plant is given time to mature, and will hopefully be a properly altered plant.

Perhaps, the latest technique involves the use of gold or tungsten. The general process is bulleted below.

1. A desire for an alteration to a select plant is chosen.

2. Other organisms are searched for a gene that would remedy this desire.

3. The DNA is extracted from the desired organism.

4. The DNA is gently coated over either a gold or tungsten particle.

5. These pieces are shot at the cell with an electrostatic pulse, air pressure, or gunpowder percussion.

6. The DNA is pulled off the gold or tungsten and can now work itself into the plant cell's genome.

Though this method may seem rather haphazard and random it actually has produced some positive results and may be used in the future more often.

As you may have noticed the techniques for performing each of these different procedures can become rather intricate and difficult. However, as time progresses so does research, and the success rate of these methods.

I will now discuss the technology used when performing these different procedures. Without the advancement of technology it would be virtually impossible to accomplish many of these procedures. I will discuss the technology used in cloning, DNA fingerprinting, gene therapy, stem-cell research, and making transgenic organisms.

First, cloning uses, like all the other categories of genetic engineering, similar technology. Here I will be taking a look at what technology is used. The first on the list of technologies is a microscope. Though this may appear simple, cloning would be impossible without it. Microscopes enable the scientist to see what he or she is doing. Second, is precession needles, these help scientist grab a hold of and extract the desired material. Next, Ultraviolet rays can be used to destroy the DNA in an egg so the DNA of the person being cloned can be inserted. Also used is a number of different plant stimulate systems. These include florescent lighting, heating trays, and humidifiers.
The technology used when working with DNA fingerprinting is somewhat different. First and possibly the most important is the technology of gel-electrophoresis. This shorts out the DNA strands by length and is the core process of DNA fingerprinting. Restriction enzymes are used to cut the DNA into proper length before the DNA is placed through gel electrophoresis. Using a combination of a nylon membrane and X-ray film the results of gel electrophoresis are transferred onto a permanent surface.

The varying technologies used when giving someone gene therapy has a few similarities with the other processes discussed. Again like many others, they all demand the use of some type of microscope. Microscopes can be used to isolate a virus or to help insert the proper DNA into the virus or the host body. Also used are tiny needles to help insert these viruses. Ultraviolet light also can be used to destroy and unwanted DNA in the virus. The rest of the technology is left up to nature. Nature injects the DNA from the virus into the DNA of a person in order to change it's proteins.

The technology and equipment used for Stem-cell transplants doesn't vary much form processes like those associated with transgenic organisms. Like many of these processes they all demand a microscope, without a microscope it would be nearly impossible to work with stem cells. Along with microscopes, tiny needles play an important role, they remove and insert stem cells where needed. Often time these cells are grown in a Petri dish during their interim before entering a host body.

The technology used when altering an organism, or making a transgenic organism, resembles many of the other process already discussed. Like every process so far this one requires a microscope of some kind. Microscopes are used to pick enzymes, bacteria, and the correct gene sequence to insert. Small needles are also used to extract and insert small pieces or bacteria into or out of a chosen area. Petri dishes are also used to grow the early stages of the altered organisms. Nature again is used to help us accomplish this goal. A bacterium naturally injects, or infects, the organism that it is placed in, in order to alter the plant.

Many of these technologies used for these different processes are similar; this is because they all are basically under the same main topic, genetic engineering. Even as I am writing this paper these technologies and methods of achieving these different processes are changing. However, I must point out that we are still very dependant on nature to do some of the work. These processes would be near imposable if we couldn't change viruses or bacteria, or even eggs.

Though these processes are somewhat new, they have the promising potential of serving an assorted amount purposes. In the paragraphs to follow I will explain the different purposes for each of these topics.

Cloning serves a number of purposes now and has the potential of serving many more in the future. First, the most common one is cloning animals that posses certain qualities or traits that are deemed "good". For example, if brown haired dogs are a well liked trait, than you might clone a brown dog instead of taking you chances with mating it with another dog and getting something else. In the future cloning may be used to
clone organs for people who need transplants. Cloning can also be used to increase the population of endangered species. In the future we may be able to even replace extinct species like in Jurassic Park. Also in the future we may be able to replace a deceased loved one or a pet that has ceased to live.

DNA fingerprinted pretty much has only a few distinct purposes. First, it can be used to catch criminals who leave evidence at a crime scene; on the contrary it also has lead to the release of prisoners who have been wrongfully jailed. The other purpose is for maturity testing. Typically this is only needed if the woman has been sexually active with more than one male within a short period of time.

Gene therapy for the most part has only one vocation. Gene therapy has been used for medical reasons only. So far it has been used to genetically alter proteins in order to reverse the effects of disease.

Stem cell transplants and other related topics are used a number of different ways. Stem cells can be used to help cure disease; such as Parkinson's disease. In the future they may be used to fix and renew organs.

Transgenic organisms are used in many different ways. First, they can be used to modify crops to produce a bigger yield. They can also be modified to fight off different diseases of their own.

It is quite palpable that genetic engineering can be used to improve human and animal life. These technologies can be used to save lives as well as improve our quality of living, and yes I can also be used in the economic world. So what hold us back? Please read on to find out.

Of course the only part of this easy most people would care to read; the part on the controversy. As you can imagine most people wouldn't have a problem with all of genetic engineering's sub-topics. In the following two paragraphs I will attempt to point out the pro's and con's for genetic engineering without including my own views.

The arguments for genetic engineering are numerous. First, for starters, genetic engineering could benefit mankind if this technology would develop. First, the cloning of people and animals could help in the alteration of that species for the betterment of society. Secondly, genetic engineering could lead to the curing or prevention of a number of diseases, not to mention the possibility of the total destruction of all disease. Another supporting idea, in agriculture cattle or plants could be genetic engineered to produce more food. A way cloning would help is in the field of endangered species, if you could clone these animal they would last longer. Cloning animals that contain organs that could be used in humans is yet another possibility for this technology. Children that die at birth could be cloned and act as a replacement for the dead child, this way the parent would have the same child they would've just a little later.

On the flip side there are also cons to the situation. First, genetic engineering would lead to a decline in genetic diversity. This could later cause inbreeding or a total reliance on genetic engineering in order to continue the human race. Additionally, if we became
to dependant on genetic engineering a disease could easily wipe out the human race. To add to this, the technology hasn't yet reached a point where it has a high success rate, many failed experiments means much loss of potential of life. While cloning is still in its early stages many people have speculated over whether or not clones will experience discrimination, mental trauma, or emotional problems. As well as the possibility of those person's uniqueness robbed from them. To add to these arguments many religious groups have condemned the use of cloning; some of these groups are: the Vatican, the Muslims, the Jews, and the Christian Coalition of America. In additions to this many countries have banned or restricted the research and practice of genetic engineering.

While the controversy continues it is important to keep yourself educated about such topics before you formulate an opinion, most importantly you should look at all angles of the controversy before decide on you stance.

To wrap-up this whole essay, I have come to realize the many different aspects to genetic engineering. I must say I didn't know to much about genetic engineering except for the miniscule amount of information I have already gleaned form my wonderful science teachers. This essay has also helped me form my own opinions on this controversial topic.

Works Cited


Encarta. 2 May 2003 .

