Debate Brief February 17, 2017

Dr.Ray
BIOL 4301

Genetic modification of humans should not be banned in the United States. Genetic modification of humans can have positive effects on the population through discoveries in Medicine, specifically human Gene therapy, future reproductive advances, increasing age mortality, and improvement to pharmaceuticals.

Genetic engineering is the future, the continuation of human genome research is up and rising especially now with an increase of technology at this rate there will be more research done on human genetics. The following statements should be considered supportive of genetic modification of humans allowed in the United States.

1. Gene therapy has evolved over the past generations and have significantly helped people with genetic disorders such as Severe combined immune deficiency (SCID), cancer and neurodegenerative diseases. According to the American Society of Gene and Cell Therapy,

"Multiple gene therapy strategies have been developed to treat a wide variety of cancers, including suicide gene therapy, oncolytic virotherapy, anti-angiogenesis and therapeutic gene vaccines. Two-thirds of all gene therapy trials are for cancer and many of these are entering the advanced stage",

"a landmark study representing a first case of gene therapy "cure," or at least a long-term correction, for patients with deadly genetic disorder was conducted by investigators in Italy...The therapeutic gene called ADA was introduced into the bone marrow cells of such patients in the laboratory, followed by transplantation of the genetically corrected cells back to the same patients."

"Genome-editing technologies may offer a powerful approach to treat many human diseases, including HIV/AIDS, haemophilia, sickle-cell anaemia and several forms of cancer. All techniques currently in various stages of clinical development focus on modifying the genetic material of somatic cells, such as T cells (a type of white blood cell). These are not designed to affect sperm or eggs." (Nature 2015)

2. The process of in vitro and genetic modifications to embryos has led to new research for future reproductive advances. This relies on genetic modifications so that the next generations have a higher fitness. In vitro techniques have been used in genetic diagnostics to show possibilities in modifications of mutations, articles used from Nature and IFLScience say,

"Established methods, such as standard prenatal genetic diagnostics or in vitro fertilization (IVF) with the genetic profiling of embryos before implantation, are much better options for parents who both carry the same mutation for a disease"

" a Chinese group from Sun Yat-sen University, reported that they had, in fact, done it: they had created the first genetically-modified human embryo. First, the experiments were performed on human embryos. The researchers collected non-viable embryos from IVF clinics. Then they used this non-viability argument as the ethical justification for performing the work. Scientists know that the embryos were not capable of resulting in a human life, because they were tripronuclear. That means one egg had been fertilized by two sperm, a biological situation we know cannot result a live baby."

Debate Brief February 17, 2017

Dr.Ray
BIOL 4301

3. Genetically modified human genomes will allow us to understand age longevity. By testing and determining specific genomes we can modify to increase age mortality parallel to a generations health. In a research by the Proceedings of the National Academy of Science (PNAS) performed by Bradley Willcox et all,

"to more precisely assess potential genetic contributions to human longevity from genes linked to IIS signaling, we chose a large, homogeneous, long-lived population of men well-characterized for aging phenotypes, and we performed a nested-case control study of 5 candidate longevity genes. Genetic variation within the FOXO3A gene was strongly associated with human longevity, Further exploration of the FOXO3A gene, human longevity and other aging phenotypes is warranted in other populations."(PNAS 2008)

4. Genetic engineering used in human pharmaceuticals is beneficial for genetically modifying human diseases. These treatments improve genomic diseases and allows for more potential experiments in scientific research. In an online article from popular science, Clay Dillow informs us about the FDA experiment used for pharmaceutical improvements,

"For the first time the U.S. Federal Drug Administration has approved a drug for humans that was produced in a genetically engineered plant cell. The approval could open the door to a range of biologic drugs that are generated in plant cells and then transferred to human patients.. The drug, called Elelyso, is a treatment for a disorder known as Gaucher disease that results from the lack of a specific enzyme. Engineers at Israeli biotech firm Protalix Biotherapeutics figured out how to grow this enzyme in carrot cells by inserting a specific gene into them that encodes for this human enzyme. In trials, subjects who received the "bio-pharmed" version of the enzyme showed improvement comparable to that of subjects given another treatment for Gaucher disease derived from hamster cells.(popsci 2012)

Dr.Ray

BIOL. 4301. 077

February 17, 2017

Annotated Bibliography

Andrew, Elise. "World's First Genetically Modified Human Embryo Raises Ethical Concerns." *IFLScience*. IFLScience, 15 Aug. 2016. Web. 16 Feb. 2017. <http://www.iflscience.com/health-and-medicine/world-s-first-genetically-modified-human-embryo-raises-ethical-concerns/>.

This article presents the World's First Genetically Modified Human Embryo Raises Ethical Concerns. The author exposes how researchers in Chinese used non-viable embryos to arrive to a tripronuclear embryo. This technique can have a big impact if applied on life embryo on reducing diseases.

Dillow, Clay. "The First Drug Made by Genetically Modified Plants Is Approved for Human Use by the FDA." *Popular Science*. Bonnier Corporation Company, 2 May 2012. Web. 16 Feb. 2017. <http://www.popsci.com/science/article/2012-05/first-plant-derived-biologic-drug-approved-human-use-fda>.

Clay Dillow presents how The First Drug Made by Genetically Modified Plants is Approved for Human Use by the FDA. This article states that "*the approval could open the door to a range of biologic drugs that are generated in plant cells and then transferred to human patients.*" This is a big step in the Pharmaceutical world.

D, Platis, and Labrou NE. "Chemical and Genetic Engineering Strategies to Improve the Potency of Pharmaceutical Proteins and Enzymes. - PubMed - NCBI." *National Center for Biotechnology Information*. U.S. National Library of Medicine, 2008. Web. 16 Feb. 2017. <https://www.ncbi.nlm.nih.gov/m/pubmed/18691050/>.

In the article named *Chemical and genetic engineering strategies to improve the potency of pharmaceutical proteins and enzymes*, Platis and Labrou explain how the

modification of proteins sequence can improve their therapeutic abilities by using a method called genetic engineering and site-specific chemical synthesis/modification techniques.

Gene Therapy for Diseases | ASGCT." *Gene Therapy for Diseases | ASGCT - American Society of Gene & Cell Therapy*. American Society of Gene & Cell Therapy, n.d. Web. 16 Feb. 2017. <http://www.asgct.org/about_gene_therapy/diseases.php>
This article lists the methods that have been used in human genome editing for some diseases such as acquired diseases (cancer) and genetic disorders (bubble boy disease).

Lanphier, Edward, Fyodor Urnov, Sarah Ehlen Haecker, Michael Werner, and Joanna Smolenski. "Don't Edit the Human Germ Line." *Nature News*. Nature Publishing Group, 12 Mar. 2015. Web. 16 Feb. 2017. <http://www.nature.com/news/don-t-edit-the-human-germ-line-1.17111>.
Edward Lanphier et all argue that "genome editing in human embryos using current technologies could have unpredictable effects on future generations." In fact, they based their research on the fact that genome editing can be beneficial. They also stated that "established methods, such as standard prenatal genetic diagnostics or in vitro fertilization (IVF) with the genetic profiling of embryos before implantation, are much better options for parents who both carry the same mutation for a disease."

Liang, P., Xu, Y., Zhang, X. et al. Protein Cell (2015) 6: 363. doi:10.1007/s13238-015-0153-5
This article presents a case of gene editing in humans in a triprouclear zygotes. They stated that "Genome editing tools such as the clustered regularly interspaced short palindromic repeat (CRISPR)-associated system (Cas) have been widely used to modify genes in model systems including animal zygotes and human cells, and hold tremendous promise for both basic research and clinical applications." This experiment can be seen as an important advancement for future generation.

Willcox, Bradley J., Timothy A. Donlon, Qimei He, Randi Chen, John S. Grove, Katsuhiko Yano, Kamal H. Masaki, Craig D. Willcox, Beatriz Rodriguez, and David J. Curb. "FOXO3A Genotype Is Strongly Associated with Human Longevity." *PNAS | Mobile*. The National Academy of Sciences, 9 July 2008. Web. 17 Feb. 2017. <http://m.pnas.org/content/105/37/13987.short>.

"Human longevity is a complex phenotype with a significant familial component, yet little is known about its genetic antecedents." This article explains how researchers used animal and human testing to try to understand how gene affect aging in human.