CENTENNIAL HIGH SCHOOL MODEL CONGRESS CONFERENCE 2018

SENATE – COMMERCE, SCIENCE, AND TRANSPORTATION

REGULATION OF STEM CELL RESEARCH

By Kaitlyn Won and Heer Patel

Dear delegates,

My name is Kaitlyn Won, and I am a senior at Centennial. I will be serving as your chair for the Senate Commerce, Science, and Transportation committee for the third annual Centennial High School Model Congress conference. I am currently serving as the PENNMC coordinator for Model Congress, and I joined this club in freshman year to develop my public speaking skills and became passionate about the simulations revolving around domestic policies. I look forward to meeting all of you at the conference and the discussions that will unravel.

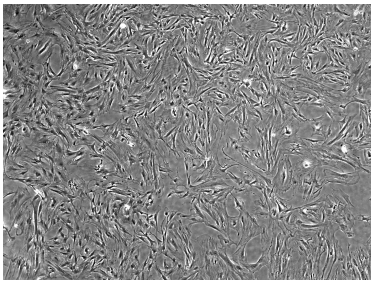
Welcome to CHSMC! My name is Heer Patel, and I will be co-chairing this committee with Kaitlyn. I joined Model Congress in sophomore year to improve my public speaking skills and to learn about the day-to-day functions of Congress. This club has given me an opportunity to engage in a simulation of congress. I can't wait to see the exciting arguments that you will bring to the conference.

In this committee, we will be debating on the topic of stem cell regulation. During the past couple decades, stem cells have been a rising field of scientific research and development. Discussions of this topic are mostly about ethics,surrounding controversies, and stem cells' various, increasing uses. Legislation promoting stem cell research is a recent advancement, and there has been a great number of breakthroughs following the lift of restriction. Such proliferation, evincing stem cells' rising significance, primarily in the medical and biological fields, has lead to a greater necessity to increase regulation.

At CHSMC 2018, we will be working to identify the controversies surrounding stem cell research and to debate on the issues regarding the regulation and funding for the research.

INTRODUCTION

At the turn of the 20th century, scientists made a remarkable discovery. They found that manipulating adult mouse tissues yielded different cell types, meaning that cells, regardless of origin, could produce different types of cells. These tissues were made of **stem cells**, which, as defined by the National Institutes of Health (NIH), are "cells with the ability to divide for indefinite periods in culture and to give rise to specialized cells." Essentially, stem cells have the ability to develop into a great variety of cells in early phases of growth and development in a process called differentiation.



Rat mesenchymal stem cells (bone marrow)
Source: PrimCells

Two distinct characteristics of stem cells are that they are unlimited in their capacity of renewing themselves and that they can be induced to have a certain function. Such inducement is a significant attribute of stem cells, as some organs have stem cells that divide only under specific conditions. There are several types of stem cells that can be used for research, medical, and other educational purposes. However, there are certain guidelines and ethical issues regarding stem cells. In this committee, you will be researching about the rules and regulations enforced by the congress regarding the stem cell, and debating about whether they are appropriate; you will also be creating new bills about them.

TYPES OF STEM CELLS

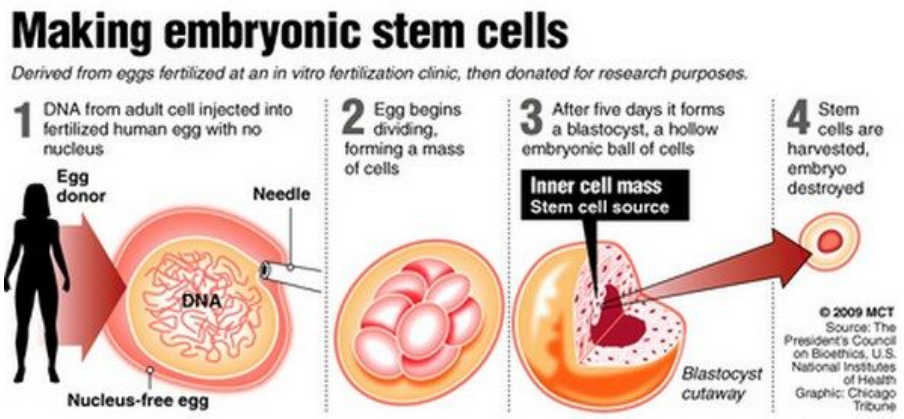
Stem cells are the foundation for every organ and tissue in your body. There are many different types of stem cells that come from different places in the body or are formed at different times in our lives.

Embryonic Stem Cells

Embryonic stem cells are obtained from the inner cell mass of the *blastocyst*, a mainly hollow ball of cells that, in the human, forms three to five days after an egg cell is fertilized by a sperm. A human blastocyst is about the size of the dot above this "i."

In normal development, the cells inside the inner cell mass will give rise to the more specialized cells that give rise to the entire body—all of our tissues and organs. However, when scientists extract the inner cell mass and grow these cells in special laboratory conditions, they retain the properties of embryonic stem cells.

Embryonic stem cells are *pluripotent*, meaning they can give rise to every cell type in the fully formed body, but not the placenta and umbilical cord. These cells are incredibly valuable because they provide a renewable resource for studying normal development and disease, and for testing drugs and other therapies. Human embryonic stem cells have been derived primarily from blastocysts created by in vitro fertilization (IVF) for assisted reproduction that were no longer needed.



Source: Penn State

Somatic/Adult Stem Cells

Somatic stem cells (also called adult stem cells) exist naturally in the body. They are important for growth, healing, and replacing cells that are lost through daily wear and tear.

Most types of somatic stem cells are present in low abundance and are difficult to isolate and grow in culture. Isolation of some types could cause considerable tissue or organ damage, as in the heart or brain. Somatic stem cells can be transplanted from donor to patient, but without drugs that suppress the immune system, a patient's immune system will recognize transplanted cells as foreign and attack them.

Induced Pluripotent Stem Cells

Induced pluripotent stem (iPS) cells are cells that have been engineered in the lab by converting tissue-specific cells, such as skin cells, into cells that behave like embryonic stem cells. iPS cells are critical tools to help scientists learn more about normal development and disease onset and progression, and they are also useful for developing and testing new drugs and therapies.

While iPS cells share many of the same characteristics of embryonic stem cells, including the ability to give rise to all the cell types in the body, they aren't exactly the same. Scientists are exploring what these differences are and what they mean. For one thing, the first iPS cells were produced by using viruses to insert extra copies of genes into tissue-specific cells. Researchers are experimenting with many alternative ways to create iPS cells so that they can ultimately be used as a source of cells or tissues for medical treatments.

EXISTING AND POTENTIAL USES

Somatic Stem Cell Therapy

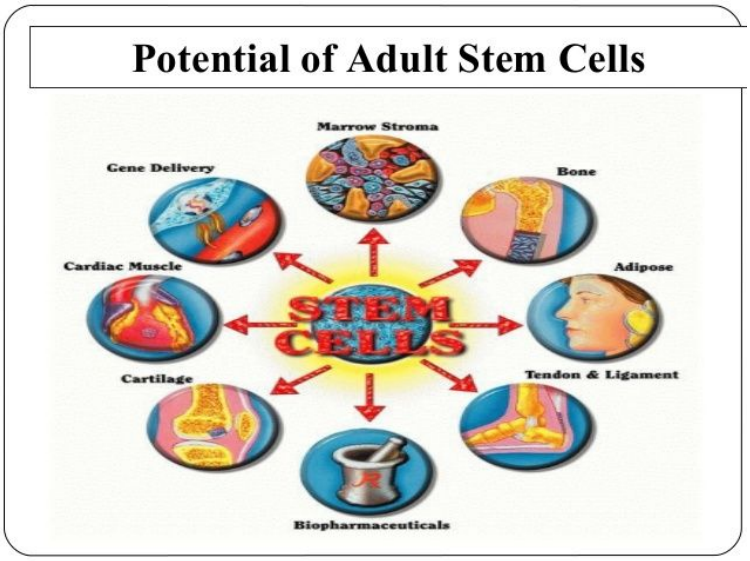
In 1968, doctors performed the first successful bone marrow transplant. Bone marrow contains somatic stem cells that can produce all of the different cell types that make up our blood. It is transplanted routinely to treat a variety of blood and bone marrow diseases, blood cancers, and immune disorders. More recently, stem

cells from the bloodstream (called peripheral blood stem cells) and umbilical cord stem cells have been used to treat some of the same blood-based diseases.

In a bone marrow transplant, the patient's bone marrow stem cells are replaced with those from a healthy, matching donor. To do this, all of the patient's existing bone marrow and abnormal leukocytes are first killed using a combination of chemotherapy and radiation. Next, a sample of donor bone marrow containing healthy stem cells is introduced into the patient's bloodstream.

If the transplant is successful, the stem cells will migrate into the patient's bone marrow and begin producing new, healthy leukocytes to replace the abnormal cells.

New evidence suggests that bone marrow stem cells may be able to differentiate into cell types that make up tissues outside of the blood, such as liver and muscle. Scientists are exploring new uses for these stem cells that go beyond diseases of the blood.



Potential of Adult Stem Cells
Source: S. Ramyabharathi 11BBC031 Adult Stem Cell Therapy

Regenerative Medicine

Stem cells can be guided into becoming specific cells that can be used to regenerate and repair diseased or damaged tissues in people.

People who might benefit from stem cell therapies include those with spinal cord injuries, type 1 diabetes, Parkinson's disease, Alzheimer's disease, heart disease, stroke, burns, cancer and osteoarthritis.

Stem cells may have the potential to be grown to become new tissue for use in transplant and regenerative medicine. Researchers continue to advance the knowledge on stem cells and their applications in transplant and regenerative medicine.

Stem Cell Lines

A stem cell line is a group of cells that all descend from a single original stem cell and is grown in a lab. Cells in a stem cell line keep growing but don't differentiate into specialized cells. Ideally, they remain free of

genetic defects and continue to create more stem cells. Clusters of cells can be taken from a stem cell line and frozen for storage or shared with other researchers.

Therapeutic Cloning

Therapeutic cloning, also called somatic cell nuclear transfer, is a technique to create versatile stem cells independent of fertilized eggs. In this technique, the nucleus, which contains the genetic material, is removed from an unfertilized egg. The nucleus is also removed from a somatic cell of a donor.

This donor nucleus is then injected into the egg, replacing the nucleus that was removed, a process called nuclear transfer. The egg is allowed to divide and soon forms a blastocyst. This process creates a line of stem cells that is genetically identical to the donor's — in essence, a clone.

Some researchers believe that stem cells derived from therapeutic cloning may offer benefits over those from fertilized eggs because cloned cells are less likely to be rejected once transplanted back into the donor and may allow researchers to see exactly how a disease develops.

OBSTACLES, CONTROVERSIES, AND ETHICS

When scientists discovered a method for removing stem cells from embryos, both anticipation for the major developments and concerns of ethics emerged. Although stem cells have a great potential, the weight of destroying a human embryo does not diminish. Questions raised ask whether the human embryo should be regarded as equal to a human child, whether the human embryo has rights, and whether the destruction of a single human embryo is justified by its medical usages.

In the National Academies' guidelines, there are practices related to stem cells that are banned. One such practice is reproductive cloning. Although they are different methodologies, they share a laboratory technique known as **nuclear transfer**, through which scientists create blastocysts containing "clone" stem cells. This technique enables safer alternatives to traditional tissue transplants as the genetic material of the donor and clone are identical.

The debate on stem cells, particularly embryonic stem cells, is both political and scientific. Politically, it is divided between pro-life and high-profile; the debate is one between those who believe embryos have moral rights and those who prioritize the medical benefits of stem cells. The scientific dispute focuses on the origins of the stem cells, or in other words, where the stem cells were obtained. In essence, the debate focuses on benefits and costs that result from application and experiment.

NIH GUIDELINES

The National Institute of Health has implemented various laws and guidelines for the regulation and research using stem cells. To access the complete set of guidelines regarding stem cells, refer to the link provided below:

https://stemcells.nih.gov/policy/2009-guidelines.htm

GOVERNMENTAL ACTION

Below are a few of the legislation and bills addressing stem cell research. There are many more acts and bills regarding this topic; the ones included below are critical in shaping the course of stem cell research.

The Dickey-Wicker Amendment rose as a republican response of the Bush administration to proposals from the NIH Human Embryo Research Panel to address moral and ethical aspects of stem cell research. The amendment initially banned federal funding of federal funding of experimenting on human embryos, but was later revised, in accordance to the interpretation by Harriet Rabb from the Department of Health and Human Service, to permit the usage of federal funds for stem cell research. Leftover restrictions were lifted by the Obama administration in 2009, and hence, the Dickey-Wicker amendment remains as the only barrier to federal funding of experimentation utilizing stem cells.

The **Stem Cell Research Enhancement Act** is a two time attempt by both the house and senate to expand funding for stem cell research. Both attempts gained bipartisan support. However, both were vetoed by President Bush, and the vetoes were unable to be overridden.

The **21st Century Cures Act** is a very recent legislation concerning stem cell research. It was signed into law by President Obama in December 2016, and it contains specifications regarding review by the FDA and modernization of regenerative therapies.

BLOC POSITIONS

Conservative

The government should restrict embryonic stem cell research. Life begins at conception, hence extracting embryonic stem cells is destruction of a human life. Adult and umbilical stem cells are tolerated as they have already proven their use as treatment for cancer and injuries, including leukemia and spinal cord injuries. On the other hand, embryonic stem cells have not been successfully used to treat an illness or injury.

Liberal

Government should fund stem cell research, including embryonic stem cell research. Life does not begin at conception; a blastocyst has no human characteristics. Thus, the extraction of an embryonic stem cell is not a destruction of human life. It is especially significant that the government funds embryonic stem cell research because it has a high potential in treating diseases.

Presidential

President Trump has not revealed his position on stem cell research. What is known is that he has stated that he will "cancel every unconstitutional executive action, memorandum and order issued by President Obama" in a plan he proposed for his first 100 days in office.

QUESTIONS TO CONSIDER

1. Should the human embryo should be regarded as equal to a human child?
2. Does the human embryo have rights?
3. Is the destruction of a single human embryo is justified by its medical usages?
4. When does life begin? (upon conception or after birth)
5. What are alternatives to human embryos?
6. To what extent should stem cell research be limited?

CONCLUSION

Stem cell research is a rising area of the biomedical field. Due to their unique properties, stem cells are seen as both a great potential for treatment of certain illnesses and injuries and a violation of human rights. During the past two decades, there has been legislation created to fund and restrict stem cell research. Overall, breakthroughs related to stem cells have increased greatly, furthering the need for regulation. Therefore, this committee must strive to develop regulations that will address both the ethical issues and increasing potential of stem cell research in regards to the future of the nation.

SOURCES

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