Forum: Promoting Science

Agenda: On measures to increase accessibility to stem cell research

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Introduction

Stem cells are cells that have yet to differentiate, meaning they possess the potential to develop into different types of cells and can replicate indefinitely; unlike differentiated cells that begin to break down after replicating. A stem cell either remains a stem cell or develops into a differentiated cell once it divides, meaning a single stem cell could theoretically become an infinite, or almost infinite source for more stem cells. This has caused scientists to take a major interest and begin various researches on the origin of stem cells and how they can aid in the advancement of modern medicine and science. Through stem cell research scientists were able to establish that there are two types of stem cells; embryonic stem cells and adult stem cells. Embryonic stem cells used in research are derived from embryos developed in vitro fertilization in a fertilization clinic where the fertilized eggs are donated for research purposes with the consent of donors. This is important to note as when embryonic stem cells are used in research they can no longer develop into infants. The embryonic stem cells then develop into specialized cells as the embryo develops. Adult stem cells on the other hand are found among differentiated cells in organ tissues. Their main functions are to repair and maintain the tissue as they are more limited in differentiation when compared to embryonic stem cells. Additionally, unlike embryonic stem cells that are developed in the embryo, researchers are still trying to fully understand the origin of adult stem cells. Regardless of their source however, all stem cells have three distinct properties; they replicate renewing themselves infinitely, they are unspecialized, and they give rise to differentiated cells. Unlike other cells such as blood and nerve cells, stem cells can proliferate meaning stem cells can yield millions of unspecialized cells with the properties of the parent stem cell.

Due to the cells' ability to differentiate easily scientists globally have begun working collectively to research medical uses for both adult and embryonic stem cells, especially concerning chronic diseases and cancerous tissues. Countries such as Australia, Canada, the United States, and the European Union have made significant progress with stem cell development and research, the United States going as far as to have their first attempt at creating a human embryo in 2017. With progress in science comes ethical arguments that hence require new laws to be passed. countries such as Brazil have refused to fund stem cell researches in the country due to catholic belief this is because once an embryo's stem cells are used the embryo no longer has the ability to develop into an infant. Because of this scientist continue to look for stem cells in other sources discovering that the umbilical cord can provide embryonic stem cells but must be collected immediately making it an unreliable source. With new bacteria and viruses being discovered scientists race to find solutions, an obvious case being the break out of COVID-19 which became a global

pandemic which scientists and medics have yet to find a cure for leading to countries re-evaluating their laws against stem cell research as finding from the United States indicate at stem cells being a possible solution.

Key Terms

Stem cells – Undifferentiated cells in an organism that can replicate indefinitely.

Embryonic stem cells - Stem cells found in embryos and the umbilical cord

Bone marrow transplants – The transfusion of bone marrow from one person to another

Cell differentiation – When a cell develops and differentiates into a specific cell with a specific function

Differentiated cells – Cells that have a set function

General Overview

With injuries such as chemical burns increasing scientists have found a way to use stem cells that are found both in bone marrow an embryo to treat said burns, managing to treat the cornea of a small number of patients and re-store sight to those who have suffered life threatening and blinding chemical burns. It is crucial that MEDCs provide aid to LEDCs through funding and trading of resources and equipment in order for the research to reach global scale, increasing the number of trials done to decrease the number of errors and progress forward, pass the controversy that an embryo is a life form and that the use of it in research and medical treatment would mean the killing of a baby. Furthermore, both LEDCs and MEDCs must work together to create global legislations to prevent the wrong use of stem cells, such as making sure all embryos are donated and the patient donating knows the risks and consequences of doing such, and that it will solely be used to treat illnesses and injuries and not to enhance future generation. Overall, as new bacteria and viruses develop, and science advances countries must pass laws to support stem cell research as well as increase funding and accessibility to equipment and sources needed in order for scientists and medics to discover new solutions for fatal illnesses.

Major parties involved

United Stated National Institute of Health (NIH)

The United Sated National Institute of Health research has progressed on multiple fonts in order to learn more about the different stem cell types ad to begin creating patient-specific cells for in-depth study of various diseases. The ability to create iPS cells was a significant breakthrough as the reprogramming technique used was relatively simple to perform with standard laboratory methods displaying the speed of the progress towards achieving personalized therapies.

World Health Organization (WHO)

The World Health Organization has developed various theories and carried out various clinical trials in the hopes that stem cells could be used to either replace damaged cells or to create an environment for cellular

regeneration to solve as treatment for conditions including osteoarthritis, diabetes, and Parkinson disease. However, currently very few stem cells therapies have proven to be safe and effective in the clinical trials.

National Stem Cell Foundation of Australia (NSCFA)

Despite Australian scientists holding senior position on international scientific committees and conference organizations the government does not provide enough funding the research and hence it has become increasingly difficult to supply scientists with the correct equipment and resources. Australian medics have begun using stem cells to treat illnesses such as asthma and even cerebral palsy.

EuroStemCell

EuroStemCell is a non-profit network of European stem cell researchers dedicated to providing accurate and accessible resources for the public. The network is able to provide research to other medics and scientists across Europe to develop cures for terminal illnesses. Additionally, though EuroStemCell has begun research on using stem cells to treat and or cure COVID-19 currently no treatment has been developed.

Timeline of Events

Date	Description of event
February 1961 -	Drs. James Till, a biophysicist, and Ernest McCulloch, a hematologist, published accidental findings that proved the existence of stem cells in "Radiation Research". At the time both worked for the Ontario Cancer Institute (OCI).
July 1974 -	The 93rd Congress implemented a ban on nearly all federally funded fetal tissue research until United Sates National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research creates guidelines for it.
1980 -	United States President Ronald Reagan decides not to renew the Ethics Advisory Board's chart. Halting federal funding of human embryo research due to the EAB's disbanding.
1988 -	The United States Huan Fetal Tissue Transplantation Research Panel reopens the question and voted to approve the federal funding of embryo research. However, the Department of Health and Human Services (HHS) accepts testimony of three conservative dissenters who argue embryonic research would increase abortions and hence the moratorium on its research is extended.

1993 -	United States HHS secretary Donna Shalala lifts moratorium on federal funding of human embryonic research in accordance with President Bill Clinton's executive orders.
1994 -	In the United States a National Institution of Health human embryonic research panel supports the research but thousands of letter surge President Clinton to reverse his decision causing him to once again halt federal funding of human embryonic stem cell research.
1998 -	University of Wisconsin scientist James Thomson isolates human embryonic stem cells and shows their potential to rejuvenate and specialize into tissues. This discovery initiates the ethical debate on human embryonic stem cell research as his team derives stem cells through process that destroys human embryos.
August 2000 -	United States National Institute of Health Guidelines for research Using Human Pluripotent Stem Cells are published in Federal registration and go into effect. The stipulate: human embryonic stem cells must come from private funds from frozen embryos from fertility clinics; they must have been created for fertility treatment purposes; be in excess of the donor's clinical need; and obtained with consent of the donor.
November 2007 -	Shinya Yamanaka of Kyoto University published a paper on the discovery of induced pluripotent stem cells created from skin cells that had four genes inserted into them with viruses and were eventually coaxed unto becoming beating heart cells and nerve cells.
November 2011 -	Pope Benedict XVI spoke out in favor of adult stem cells research and called for any ensuing treatments to benefit all who need the care regardless of their financial means.
December 2012 -	Chinese scientists from the Guangzhou Institute of Biomedicine and Health converted cells found in urine into pluripotent stem cells that can be used to create neurons and brain cells.
July 2013 -	Scientists in Japan said they had grown human liver tissue from stem cells in a first that hold a promise for alleviating the critical shortage of donor organs.

September 2015 -	Japanese researchers at the Jikei University School of Medicine in Tokyo conducted a series of experiments which culminated in the creation of laboratory grown kidneys that are fully functional.
February 2016 -	Scientists at Riken's Center for Developmental Biology in Kobe, Japan coaxed human embryonic stem cells into developing the cell type and structure necessary to replicate a working pituitary gland.
July 2017 -	The first known attempt at creating genetically modified human embryos in the United States was carried out by a team of researchers in Portland, Oregon.

Possible Solutions

Despite many first world countries understanding the necessity of stem cell research in order to continue progressing modern science the ethical debates still hold governments from providing full funding and support making it hard for scientists to receive the needed stem cells to research. In the United Stated the 2012 court ruling that allowed the federal government to support stem cells research was a huge step forward, one that countries such as Australia, Switzerland, and Canada followed. This however leaves other countries, many of which are LEDCs behind in modern medicine despite being some of the countries that need it most. Furthermore, the UN has yet to provide full support as it has been divided the last few years in whether stem cell research should be a priority and if it is ethical. Hence why MEDCs that have already begun stem cell research and have progressed such as Switzerland, Australia, Canada, Japan, and especially the United Sates must increase government funding of the researches as well as clinical trials, and must also consider working collaboratively with LEDCs to further aid countries that do not have the means to support the research themselves. This can be done by setting up research clinics in LEDCs led by MEDCs working with local scientists to discover how stem cell research can aid in combating local illnesses.

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