Stem cell research narrative essay

Science, Anatomy

All organisms are made up of cells. A cell is the most basic functioning unit of a living organism. Cells make up the body. Not all cells are the same, though. There are different kinds ot cells such as brain cells, nerve cells, skin cells, etc. Most cells In the human body are specialized, meaning they are only designed to do certain jobs within particular parts of the body. If too many cells die, the body part that they form is damaged forever. (Alberts) However, certain cell organs in the human body are capable of regenerating themselves.

Cell regeneration is basically the " process of enewal, restoration, and growth that makes genomes, cells, organs, organisms, and ecosystems resilient to natural fluctuations or events that cause disturbance or damage. " Regeneration is a " process that allows multicellular organisms to repair and malntaln the Integrity of their physiological and morphological states. " (Carlson, 400) When we get a wound. stem cells in our skin replaced the damaged cells. When we donate blood, red blood cells that are lost are replaced by the stem cells in our bone marrow.

The cells In the human body are constantly regenerating; replacing ost or damaged organs and parts in the organisnys body by formation of new tissue. The shedding of skin, menstruation (by replacing the cells that line the uterusb production ot new blood cells from the blood marrow, and replacement ot cells In the gastronomical tract are all examples of cellular regeneration Cells that can divide (through mitosis) and differentiate Into diverse specialized cell types and can self renew to produce more cells are called stem cells.

Basically, stem cells are unspecialized or undifferentiated cells, meaning they are immature cells that have ot been directed to become a specialized cell with a specific function. Most multicellular organisms have stem cells. What characterize stem cells from other cells in the body are three distinctive properties: (1) The capability of dividing and renewing themselves for long periods (2) Being unspecialized/undlfferentlated (3) The ability to give rise to special cell types Unique Properties of Stem Cells Stem cells are capable of dlvldlng and renewing themselves for long periods. Other cells such as muscle cells, blood cells. nd nerve cells do not normally replicate themselves. Stem cells have the ability to replicate themselves many times, a process called proliferation (" expansion of the number of cells by the continuous dlvlslon of single cells into two Identical daughter cells'). Stem cells continue on proliferating, producing cells that continue to be unspecialized like the parent cells. They are capable of long-term self-renewal (abllity of stem cells to replicate themselves by dividing into the same non-speciali7ed cell type over long periods that may range from months to years depending on the specific type of stem cell). This is why a of cells. Bethesda. MD) What greatly Interests scientists about the proliferation of stem cells are the specific factors and conditions that allow stem cells to remain unspecialized. Understanding the signals and conditions in a mature organism that can cause a stem cell population to proliferate and remain unspecialized Is crucial for scientists to De aDle to grow a large population 0T stem cells In tne laooratory Tor Turtner experimentation. As stated above, stem cells are unspecialized. This fundamental property of a stem cell is

defined as it not having any tissue-specific structures that allow it to perform specialized functions.

Stem cells cannot pump blood through the body (like cardiac cells), nor can it carry oxygen molecules through the blood stream (like red blood cells) but it has the potential to be a specialized cell, including cardiac cells, red blood cells, nerve cells, etc. The last unique property stem cells have is the ability to give rise to specialized cells. The process whereby an unspecialized cell acquires the features of a specialized cell such as a heart, liver, or muscle cell is called cell differentiation.

Differentiation is controlled by the interaction of a cell's genes with the physical and hemical conditions outside the cell, usually through signaling pathways involving proteins embedded in the cell surface. In the process of differentiation, the cell usually goes through several stages. At each step, the cell is becoming more and more differentiated or specialized. The internal signals are controlled by a cell's genes, found in the DNA, and carry coded instructions for all cellular structures and functions.

Some external signals for cell differentiation include chemicals secreted by other cells, physical contact with neighboring cells, and certain molecules in the icroenvironment (fluid surrounding a cell filled with molecules and compounds such as nutrients and growth factors). These signals during the process of differentiation cause the cell's DNA to acquire epigenetic (relating to the process by which regulatory proteins can turn genes on or off in a way that can be passed on during cell division) marks that restrict DNA expression in the cell and can be passed on through cell division.

Potential and Breakthroughs of Stem Cells in the Medical Field Stem cells possess unique qualities that enable them to become a potential cure for many diseases and conditions. They have even been termed as the " Holy Grail of Medicine" because of their promise to become a cure to many currently incurable diseases and conditions. Success stories on stem cells (particularly adult stem cells) have been circulating all over the web.

Laura Dominguez, a 16-year -old American who suffered a spinal chord injury in a car accident that left her as a paraplegic, is now starting to walk again with the help of adult stem cells taken from her own body. In a videointerview, Laura describes her experience saying, " l thought it all was a bad dream. When I was first injured, I didn't want to do anything. I Just wanted to lie in bed. I guess in a sense I felt sorry for myself. " Laura was told that she would never be able to walk again. But her parents insisted on finding alternative procedures to cure her spinal injury.

This led them to discover Dr. Carlos Lima, a surgeon in Portugal. Laura underwent stem cell treatment facilitated by Dr. Carlos Lima. What he did was take cells from her nose and from her injury site and cultured them. They treated her spinal injury by replacing the sedentary tissues in her legs. Laura then had to go through therapy such as exercising or practicing how to walk. The treatment helped in reviving the tissues in her legs. Laura states, " Before I couldn't feel anything from neck down. It Just kinda seemed patchy.

Some areas I could feel stuff but other areas I was more or less numb. Now, when I move a foot or a toe or something like that, it's very inspiring. It's very inspiring. It drives you to go Torwara. Now I'm aDle to stand ana wal . K

I ao so many tnlngs tnat I Just never thought before. " Laura even ends her interview saying, " I'm gonna walk again. " (" LifeLeakA) Besides Dr. Carlos Lima, otherhealthorganizations such as the DaVlnci Biosciences, help patients with spinal chord injuries to recover from this through dult stem cell treatment.

Francisco Silva, President of DaVinci Biosciences even states that " While this was only a safety and feasibility study, the outcome for our patients was amazing and we plan to build upon our results," (" DaVinci Biosciences") Adult stem cell treatment has also cured many other diseases and conditions through restoring bones using cells derived from bone marrow, developing insulin- producing cells for Type 1Diabetes, and repairing damaged heart muscle following a heart attack with cardiac muscle cells, among others.

Ethical Issues Regarding Embryonic Stem Cell Treatment Although there are already many diseases cured by adult stem cells, scientists still continue to pursue embryonic stem cell research because of other incurable diseases that it can potentially cure. However, pro-life activists and some religious groups are against embryonic stem cell research because derivation of stem cells from the embryo involves the destruction of the embryo. Opponents of stem cell research argue that using embryos forsciencedevalue human life.

This is because the derivation of stem cells involves the destruction of an embryo, which (for many people) already carries moral status. A quote from Bill Frist, former U. S. senator and Republican majority leader from Tennessee on July 29, 2005, in a speech on the Senate floor states: " l am pro-life. I believehuman life begins at conception. I also believe that

embryonic stem cell research should be encouraged and supported. An embryo is nascent human life. This position is consistent with my faith.

But, to me, it isn't Just a matter of faith. It's a fact of science. " (PewForum) Nevertheless, scientists and doctors who are for stem cell research insist that embryonic stem cell research should be pursued because of the countless benefits hat it entails that they argue " outweighs" the moral implications that come with sacrificing the life of an unborn child. Stem cell supporters find it necessary to pursue embryonic stem cell research because it results in technologies that have significant medical potential.

Louise Slaughter, a pro-embryonic stem cell supporter is quoted saying, " We have aresponsibilityto promote stem cell research which could lead to treatments and cures affecting millions of Americans. " (PewForum) The controversy around stem cell research revolves around the issue of which source the stem cells come from are used, instead of whether stem cells should be sed for improving and prolonging people's lives. Adult stem cell treatment is widely accepted, but human embryonic stem cell treatment creates a big argument.

The debate on stem cells really poses an immense moral and ethical issue. A good understanding of stem cells and their different types is crucial in the debate process. This is why the next few parts of this paper will discuss adult stem cells, embryonic stem cells, and their similarities and differences. Adult Stem Cells Adult stem cells are undifferentiated cells found among differentiated cells in a tlssue or organ tnat can renew ItselT ana can OITTerentlate to yle10 tne major pecialized cell type of the tissue or organ.

The primary role of adult stem cells in a living organism is to aid in repairing damaged tissue in the body. Adult stem cells are sometimes referred to as somatic stem cells, meaning they are cells of the body. (Bethsoda, MD) In humans, these cells can be found in many tissues and organs, primarily in the bone marrow. Conversely, it is also in peripheral and cord blood, the brain, spinal cord, gum tissue, epithelia of the skin and digestive system, cornea, retina, liver, teeth, and many more. They reside in a specific area of each tissue called a " stem cell iche". Bethsoda, MD) Adult stem cells may remain quiescent (non-dividing) for a period of time until they are needed to maintain and repair tissues. There is a very small number of stem cells in each tissue, and once these cells are initiated to be used and are therefore removed from the body, their capacity to proliferate becomes limited. This is why scientistscultureadult stem cells in large quantities and manipulate them to generate specific cell types. The cultured stem cells are used to treat injury and disease. (" The National Institute of Health Resource for Stem Cell Research")

Embryonic Stem Cells As its name suggests, an embryonic stem cell is a stem cell derived from an embryo, particularly in the epiblast tissue of inner cell mass of a blastocyst (an early stage embryo) or earlier morula stage. To date, nearly all research has taken place using mouse embryonic stem cells and human embryonic stem cells. Both have the essential stem cell characteristics, yet require different environments in order to maintain undifferentiated. (Bethsoda, MD.) Usually, these embryonic stem cells are derived from eggs that have developed into embryos through in vitro fertilization.

In vitro fertilization is a technique used to fertilize eggs by uniting the egg and sperm in a laboratory or on a petri dish instead of inside the female body. These in vitro embryos are donated for stem cell research with informed consent of the donors. Embryonic stem cells can also be harvested from excess embryos used in infertility treatment clinics or from aborted fetuses. (Bethsoda, MD.) Embryonic stem cells are pluripotent, meaning they can give rise to the three primary germ layers: ectoderm, endoderm, and mesoderm.

It is this quality that enables them to develop into more han two hundred cell types of the adult body, provided that are given sufficient and necessary stimulation for a specific cell type. (" The National Institute of Health Resource for Stem Cell Research") Differences Between Adult and Embryonic Stem Cells Besides origin, adult stem cells and embryonic stem cells differ in a few ways. They mainly differ in the number and type of differentiated cell types they can become. Embryonic stem cells have the potential to differentiate into most of the cells of the body because they are pluripotent.

On the other hand, the cell types an adult stem ell can differentiate into is limited. They can only become the cell type of their tissue origin. (Devolder) Embryonic stem cells are relatively easier to culture than adult stem cells. This is because adult stem cells are rarely found in mature tissues, thus becoming difficult to isolate from itsenvironment. This factor significantly affects stem cell research, as large populatlons 0T stem cells are neeaea Tor stem cell replacement tneraples. (Bethsoda, MD. Another difference between adult stem cells and embryonic stem cells are in the way they are rejected

after transplantation. Adult stem cells are less likely to be rejected after transplantation. This is because the stem cells transplanted are of the patient's own cells that have been grown in culture, manipulated into a specific cell type, and reinstated into the patient's body. Because the stem cells come from the patient, the body recognizes the cells and therefore accepts the stem cells. Thesis Statement This research paper will argue that stem cell research should be pursued, given that no life will be destroyed.

Consequently, this means that this paper supports stem cell treatment that does not involve the destruction of embryos. This research paper will also suggest that adult stem cell treatment and induced pluripotent stem cells can be viable alternatives to embryonic stem cell research, thus proving that not only is embryonic stem cell research unethical, but also unnecessary. The paper will also argue that even though adult stem cells and induced pluripotent stem cells cannot fully replace the properties embryonic stem cells offer, it is still unethical to use embryos to lengthen the life of other living persons.

Arguments The paper will argue that embryonic stem cell treatment should not be pursued or the following reasons: (1) Embryos already possess a moral status and therefore, must be protected by moral rights. (2) Adult stem cell treatment already cures a variety of diseases, and since adult stem cell treatment does not involve damaging the life of an individual, scientists should focus more on developing and studying on this field of stem cell research. 3) Induced pluripotent stem cells can be used as a potential feasible alternative to embryonic stem cells because they also possess

qualities similar to embryonic stem cells and their derivation does not include any destruction of human life. The first argument illustrates the value of the embryo as a living person, and therefore poses an argument regarding the moral status of the embryo. Subsequently, the first argument aims to point out that embryonic stem cell research is unethical because destruction of an embryo is also the destruction of a life.

Moreover, the last two arguments suggest that embryonic stem cell research is not only unethical but also unnecessary because adult stem cell treatment and induced pluripotent stem cell treatment can be potential viable alternatives to embryonic stem cell treatment. First Argument: Embryos possess a moral status The main controversy surrounding embryonic stem cell research involves the derivation of stem cells from embryos that result in the destruction of the embryo. Some important ethical questions that this issues poses are a.

When do humans become humans? b. Do embryos, although unborn, possess the same moral status as a livinghuman being? An embryos moral status has always been a heated subject of debate. From the issue ofabortionto the embryonic stem cell treatment, society has shown conflicting views on the ethical condition of the human embryo. According to an article onHarvardMagazine, bass professor of the government Michael Sandel finds that an embryo is " one that has to be taken seriously," but sees no attachment of moral status to an embryo.

He finds a fault in the argument regarding tne moral status 0T an emoryo to go wrong " In Its assumptlon t at n tnere are only two ways of conceiving the

moral status of an embryo ” either as an object open to un- fettered use or as a full human being worthy ofrespect. " (" Harvard Magazine") Micahel Sandel looks at the human life from a developmental perspective and debates that there is no biologically determined moment when such a life acquires the moral status ofa person. He maintains, " To regard an embryo as a mere thing open to any use we may desire or devise does, it seems to me, miss its significance as potential human life.

You don't have to regard an embryo as a fullhuman personto believe that it is due a certain respect. " (Harvard Magazine") Robert George, J. D. , McCormick professor of Jurispidence however, contradicts his arguments. Robert George believes in the equal moral status of the human embryo. In the same article from Harvard Magazine, he reasons, " The principle to which I subscribe is one that says that all human beings are equal, and ought not to be armed or considered to be less than human on the basis of age or size or stage of development or condition of dependency. (" Harvard Magazine") Robert George states that fertilization " produces a new and complete, though immature, organism" that possesses " the epigenetic primordia for self-directed growth into adulthood with its determinateness and identity fully intact. " (" Harvard Accordingly, humans deserve to be treated with respect no matter what kind of entity they are, nor by virtue of acquired characteristics or abilities, which each one holds in varying degrees even once fully grown.

Robert George maintains that development is a continuous process - there is no special moment when human life suddenly becomes worthy of respect

andhuman rights. Therefore, embryos should not be used as a means to an end, regardless whether they are good ends such as cures for diseases or to save another human life. (" Harvard Magazine") Robert George emphasizes that an embryo is not a potential life, but a life with potential. " An embryo is not something distinct from a human being," he writes; " it is a human being at the earliest stage of its development. (" Harvard Magazine") Second Argument: Adult Stem Cell Treatment should be the main focus of scientists for stem cell research Because of the budding controversy arising from embryonic stem cell treatment, scientists have begun exploring different ways to obtain embryonic stem cells or stem cells that are similar to it that do not involve the destruction of living human embryos and therefore may be less troubling to some individuals. A paper released in 2005 by The President's Council on Bioethics identified potential alternative methods and sources in deriving embryonic stem cells.

One of these potential sources is stem cell derived from adult tissue or umbilical ord blood. There have been a number of recent publications on the abilities and characteristics of adult stem cells that are derived from different sources, such as bone marrow and umbilical cord following birth. One such study, " Olfactory Mucosal Autografts and Rehabilitation for Chronic Traumatic Spinal Cord Injury," by Associate Professor Jean Peduzzi-Nelson of the Department of Anatomy and Cell Biology which was published online in the Journal NeurorenaDllltatlon ana Neural Repalr Involves tne use 0T adult stem cells In tne patient's own nasal tissue.

Jean Peduzzi-Nelson explains that " the use of a person's wn stem cells lessens the problems of rejection, tumor formation and disease transmission. " (Grovsky) 20 patients with severe chronic spinal cord injuries participated in the study and received a treatment combination of partial scar removal, transplantation of nasal tissue containing stem cells to the site of the spinal cord injury and rehabilitation. The treatment showed marvelous success.

Jean Peduzzi-Nelson even states, " This may be the first clinical study of patients with severe, chronic spinal cord injury to report considerable functional improvement in some patients with a combination reatment," (Grovsky) According to the study, " One paraplegic treated almost three years after the injury now ambulates with two crutches and knee braces. Ten other patients ambulate with physical assistance and walkers (with and without braces).

One 31 -year-old male tetriplegic patient uses a walker without the help of knee braces or physical assistance. When the stem cell transplant and scar removal process was combined with an advanced form of rehabilitative training that employs brain-initiated weight- bearing movement, 13 patients improved in the standard measures used to assess unctional independence and walking capabilities. (Grovsky) Because of the success of the treatment, Jean Peduzzi-Nelson concludes, " olfactory mucosal autograft is feasible, relatively safe and possibly beneficial in people with chronic spinal cord injury when combined with post-operative rehabilitation," He also adds, " There are clear indications of efficacy based on neurological, functional and electrophysiological testing that Justify moving forward to a larger, controlled

clinical trial. In patients who are willing to commit to lots of intense rehabilitation, this ombination treatment holds promise to improve their condition. (Grovsky) Besides success in curing spinal cord injuries, adult stem cells have been used as therapy for bone marrow transplantation for 30 years to successfully treat patients for a variety of blood-related conditions. Several private companies such as such as MorphoGen, NeuralStem, Osiris Therapeutics, Stemsource, and ViaCell, among others, are working on additional therapeutic uses of adult stem cells. Oohnson, Williams) Many advocate that adult stem cells should be used as an alternative to mbryonic stem cells because it does not include the destruction of life.

However, scientists argue that adult stem cell treatment is limited because adult stem cells may not live as long and may not be as versatile in developing into various types of tissue as embryonic stem cells. Oohnson, Williams) Still, this paper argues that even though adult stem cell treatment is limited, research on its capabilities should still be supported because its methods do not involve unethical practices. Although there is great potential for embryonic stem cell treatment, it is a sin to be conducting it because a life is still at stake.

Scientists should focus more on developing and researching on the potential cures that adult stem cells can offer instead of embryonic stem cells. Third Argument: Induced Pluripotent Stem Cells may be the alternative for embryonic stem cells What interests scientists most about embryonic stem cells is their capacity to OITTerentlate Into any speclallzea cell, a property tnat Is aosent In adult stem cells. Be that as it may, recent technologies have

helped scientists develop cells that have similar properties as embryonic stem cells but do not include the destruction of human life in its derivation.

These cells are called induced pluripotent stem cells. Induced pluripotent stem cells are cells that possess the same pluripotent characteristics of embryonic stem cells; however, they are not obtained from embryos, nor using eggs or cloning. They are obtained by taking an ordinary somatic (body) cell, such as a skin cell, and reprogramming it to an embryonic-like pluripotent state; the somatic cell is induced to become a pluripotent cell, much like a computer is reprogrammed to run a different program. (" stemcellresearch. rg") According to TheCoalitionof Americans on Research Ethics, induced pluripotent tem cells play a significant role in hushing down the embryonic stem cell debate because, " From the outset, the ability to reprogram ordinary body cells back to an embryonic-like undifferentiated, pluripotent state had been considered the " holy grail" of stem cell research. That is because the ability to reprogram ordinary body cells provides researchers an almost limitless supply of readily obtainable pluripotent stem cells in an ethically acceptable and non-contentious way. (" The Coalition of Americans on Research Ethics") The ability of induced pluripotent stem ells to be reprogrammed to a pluripotent state is considered one of the most striking scientific advances of recent times. Because of thistechnology, scientists hope that the current debate over the use of embryonic stem cells become obsolete now that induced pluripotent stem cells provide a likely alternative.

James Thompson, author of one of the 2 papers describing the human iPS cell technique is quoted saying, " The human 'PS cells described here meet the defining criteria that we originally proposed for human ES cells, with the notable exception that the 'PS cells are not derived from embryos. Similar to human ES cells, human iPS cells should prove useful for studying the development and function of human tissues, for discovering and testing new drugs, and for transplantation medicine.

For transplantation therapies based on these cells, with the exception of autoimmune diseases, patientspecific IPS cell lines should largely eliminate the concern of immune rejection. " (Thompson) With induced pluripotent stem cells, embryonic stem cells become unnecessary. Conclusion In conclusion, embryonic stem cell treatment should not be pursued not only because the process of its derivation is unethical but also because with new scientific dvancements and viable alternatives (such as adult stem cells and induced pluripotent stem cells), the use of embryonic stem cells is unnecessary.