STEM CELLS

Introduction

I chose to research the topic stem cells because I have always been interested in the benefits and moral conflict of stem cell research. I don't know much about different types of stem cells or their uses, but I'm hoping that this project will help me gain a better understanding of how stem cells can be used.

Section 1: Background and Problem Statement

- **Web site #1 Name:** **Stem Cell Information**
- **Web address:** **http://stemcells.nih.gov/**
- **Background Information:**

Healthy people 2010 had no information on stem cells so I located other Web sites that would have accurate information on stem cells and the ongoing debate about their use. This Web site gave me a lot of good information on what a stem cell actually is along with important information on what is being done about the issue of stem cells. Stem cells are unspecialized cells that are capable of specializing into whatever type of cell is needed in the body. For example, blood cells, muscle cells or bone cells. Treating diseases such as diabetes with stem cells is referred to as "regenerative or reparative medicine." But, there is one problem with stem cell treatments. There is a great deal of controversy about the harvesting human embryonic stem cells because they come from the embryo of a terminated pregnancy.

- **Web site #2 Name:** **Explore Stem Cells**
- **Web address:** **http://www.explorestemcells.co.uk/**
- **Background Information:**

While most people are blinded by the morality issues of stem cell research, there are actually huge benefits to working with stem cells. Currently, scientists are using stem cells to gain insight into the cell differentiation process. It is believed that many diseases and defects such as cancer occur during this critical period in cell development. If we can harness an understanding of what goes wrong in the cell to cause these problems, we may be able to stop it in the future. Stem cells can also be grown and used as transplants for people who need certain dysfunction cells replaced. This would help diseases such as Parkinson's and arthritis. In Parkinson's disease, cells could be manipulated into healthy brain cells to replace the ones that are damaged due to disease. This could possibly make the possibility of curing this disease a reality. Stem cells also offer a valid test subject for new drugs. If we can

test the effects of new pharmaceuticals on stem cells, we can gauge how they will affect the cells in a human body after taking the drug.

- **Web site #3 Name:** **Mayo Clinic**
- **Web address:** **http://www.mayoclinic.com/health/stem-cells/CA00081/METHOD=print**
- **Background Information:**

There are actually four different types of stem cells. Adult, embryonic, adult cells altered to have the properties of stem cells, and amniotic fluid stem cells. All of these stem cells to have to potential to differentiate and form new cells, but embryonic stem cells are thought to have the widest possibilities for differentiation. They are also the ones surrounded by the most controversy. What most people don't realize is that the embryonic stem cells that scientists are using come from in vitro fertilization clinics (here, the egg and sperm are fertilized outside of the body) when the donors either do not want the embryo anymore, or have no use for it because they have conceived another way.

Section 2: Research

- **Web site #1 Name:** Stem Cell Therapy in a Caprine Model of Osteoarthritis
- **Web address:** **http://www.2f-stemcells.de/de/veroeffentlichungen/Murphy_goat_AO.pdf**
- **Summary of the research:**

In this study, scientists used goat knee joints to test how effective stem cells were for treatment of osteoarthritis. To do so, osteoarthritis was created in the knee joints of the goats by removing the medial meniscus and altering the anterior cruciate ligament. Stem cells were taken from bone marrow and grown for six weeks. After six weeks scientists injected the stem cells into the knee with a mixture of sodium hyaluronan. As a control, there were other goats that had the same implantation of osteoarthritis but received only sodium hyaluronan injections as treatment. The goal of this study was to see if the stem cells would help reverse the effects of osteoarthritis. Evidence was found that the stem cell injections helped regenerate the medial meniscus although the ligament showed no signs of repair.

- **Web site #2 Name:** **WorldHealth.net**
- **Web address:** **http://www.worldhealth.net/news/stem_cell_experiment_offers_hope_to_park/**
- **Summary of the research:**

As I discussed in the background section, it is believed that stem cells can have a positive effect on brain cells destroyed by Parkinson's disease. This was made evident by an experiment done on rats with "Parkinson's like" symptoms. When embryonic stem cells were injected directly into the rats' brains there was significant evidence that the stem cells were developing into neuron cells that are destroyed

during Parkinson's disease. These neurons produce dopamine in the brain and the experiment showed that they were also able to produce dopamine and perform normal neural function. Although this experiment offered overwhelming insight into how stem cells can treat Parkinson's disease, there were complications. Some of the rats grew tumors where the stem cells had been injected into the brain. This doesn't mean that research should halt, it merely means that more testing is needed before we can safely treat Parkinson's in humans with stem cell injections.

- **Web site #3 Name:** **PubMed.gov**
- **Web address:** **http://www.ncbi.nlm.nih.gov/pubmed/20169166?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=1**
- **Summary of the research:**

In this experiment, researchers again used rats to explore the benefits of stem cells. This time, they were testing to see if stem cells could help the night blindness and other vision problems caused by Retinitis pigmentosa. In this experiment they used stem cells that developed from bone marrow called mesenchymal stem cells or MSC's. To test if stem cell treatment was effective, researchers injected stem cells into the rats tail vein before any vision damage had a chance to occur. What they found was that the control rats who received no stem cells had only one layer of photoreceptors, the treated rats had between 5-6 cell thick photoreceptors. When they tested the vision of the rats, the treated rats performed significantly better than the control rats. This may mean a perfect treatment for human retinal degeneration. The procedure isn't invasive and as far as research shows actually works to help stop the degeneration of vision before it happens.

Section 3: Statistics

- **Web site #1 Name:** **.docstoc**
- **Web address:** **http://www.docstoc.com/docs/897602/statistics-on-stem-cell-research**
- **Summary of the statistics:**

60 to 70 percent of people who need a tissue transplant, to do not have a family member that matches their HLA tissue type. This means that in order for these people to become healthy, other people need to donate. That's why Bone Marrow Donors Worldwide has established their database and has collected over 10,000,000 samples from 42 countries. In 2004 35% of the 7,266 donations were given to people from different countries. This shows how far the search can go for someone who is a match. The website goes on to say that more than 50,000 patients world wide have been given a transplant by an unrelated donor and 5,000 patients have gotten an unrelated blood cord transplant.

- **Web site #2 Name:** **xcell-center**

- **Web address: http://www.xcell-center.com/treatments/results/lumbar-puncture-safety-statistics-.aspx**
- **Summary of the statistics:**

This website was reporting on the results of a trial done involving a treatment of diseased such as Parkinson's using a lumbar puncture with stem cells. They studied 870 people who had the procedure done and found that the cells had no harmful effects on the body. 98% of the people said their side effects went away in the first 10 days. The most severe of the symptoms were back pain and headaches. Since those are related to the actual lumbar puncture not the treatment, it is safe to say that the stem cells did not have any negative side effects when administered in a lumbar puncture.

- **Web site #3: Gallup**
- **Web address: http://www.gallup.com/poll/116485/Majority-Americans-Likely-Support-Stem-Cell-Decision.aspx**
- **Summary of the statistics:**

After president Barak Obama gave a speech on stem cells in March 2009, a poll was taken to see how the public felt about stem cell research. 14% of people polled said they believe there should be no restriction on stem cell research. 34% of people polled said that current laws should be revised to allow more research. 22% felt that current restrictions should be kept in place and finally 19% said that the government should not fund stem cell research at all. They also provided statistics on whether the public viewed stem cell research as morally wrong. In 2003 about 53% of people though stem cell testing was morally acceptable while 39% said it was morally wrong. In 2009, 62% of people believed it was morally acceptable while only 30% believed it was morally wrong.

Section 4: Consumer Information

- **Web site #1 Name: Stem Cell Information**
- **Web address: http://stemcells.nih.gov/**
- **Summary of the information:**

This Web site if full of consumer-friendly information on anything and everything stem cell related. From this Web site I learned that while adult stem cells are considered "multipotent" human embryonic stem cells are thought to be "pluripotent." This means that an adult stem cell can only specialize into certain types of cells found in the body. But, human embryonic stem cells have to ability to transform into any cell in the body other than the male and female gamete. If scientists could harness this potential, a whole new world of cell-based treatments could be opened up.

- **Web site #2 Name: Medline Plus**
- **Web address: http://www.nlm.nih.gov/medlineplus/stemcells.html**
- **Summary of the information:**

Here I found a directory of all information concerning stem cells. From stem cell basics, to policy information, everything can be found here. Here I also found an

interesting fact that could be used for my twitter entry. Scientists were able to create a pluripotent stem cell from an ordinary skin cell. These cells are called induced pluitpotent stem cells or iPS. Using this lab engineered stem cell scientists were able to help stop the early ageing that is associated with dyskeratosis congenita. This is a disease that causes early graying of hair, warped fingernails and high risk of cancer. While creating the iPS, scientists discovered that one of the key symptoms of the disease could be stopped. The disease causes a cell to lose the enzyme that controls the cap on the end of a chromosome (known as a telomere). With out this cap, the DNA unravels and the cell ages prematurely and dies. They found that in the iPS cells the created from the skin cells of a person with this disease the telomeres were healthy and functioning. This could mean an end to the premature aging caused by dyskeratosis congenita.

- **Web site #3 Name:** **Stemcellresources.org**
- **Web address:** **http://www.stemcellresources.org/index.html**
- **Summary of the information:**

This Web site had a lot of links to interesting articles that provide good information on stem cells and the future of stem cell research. For example I found out that there has been a proposal to change the definition of an embryonic stem cell. The change in definition would allow scientists doing federally funded research to experiment with stem cells even sooner in their development. Currently, the law only allows scientists to work with stem cells when they reach the "blastocyst" stage. This is a stage in embryonic development that happens approximately five days after fertilization. The new guidelines would allow scientists to work with the "blastomeres." These are the cells that develop with in the first few divisions of a zygote.

Section 5: Solutions to the Problem (or Issue)

- **Web site #1 Name:** **Bone Marrow Donors Worldwide**
- **Web address:** **http://www.bmdw.org/**
- **Summary of the information:**

This is an international volunteer organization that is helping to address the shortage of donor-patient matches around the globe. The goals of this organization include: increasing the chances for patients to find matches by creating a world wide database, to give reasonable estimates as to what chance a certain patient has for finding a match, to provide information that's easy for patients to understand, and to make it easier to search for a match through the internet. The site has an easy to use navigation menu to help patients register with the organization and provide information about what struggle lies ahead in their search for a bone marrow donor.

- **Web site #2 Name:** **World Marrow Donor Association**
- **Web address:** **http://www.worldmarrow.org/**
- **Summary of the information:**

This organization is based in the Netherlands, but also is trying to create an international source of bone marrow donations for patients in need. Their mission is

to provide patients with high quality stem cell specimens for transplants all over the world. This website provides a place for people who are interested in being a part of the solution. The site does accept individual members, but is mostly a place where donor registries and blood banks can join together to form a larger database of what kind of bone marrow is available.

- **Web site #3 Name:** **National Marrow Donor Program**
- **Web address:** **http://www.marrow.org/**
- **Summary of the information:**

This organization is a non-profit organization whose goal is also to place potential donors with patients in need. Here, new donors can begin the process of registering to give their marrow. This site is also use a source of information for patients to get pertinent information to their conditions and what they can expect during the transplant process. There is also a section for doctors to get information about new registrants and a spot where donations can be made to further fund the expansion of the bone marrow registry.

Conclusions:

Through out this fact sheet I learned so much information on the benefits of stem cell research and donation. I had no idea how hard it was for someone in need of a transplant to find a suitable donor. All of the information I collected makes me consider becoming a donor so that I know someone somewhere was helped by me. Also I was glad to learn about all of the research being done with embryonic stem cells and am in support of the research to come. Although at first I believed that I was wrong to use embryos for research, after I learned that they were mostly donations from invitro fertilization clinics I felt much better about their use. I would hope that anyone else who read this paper would also have been made aware of the vast possibilities that stem cells have to offer.

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