Stem Cells – A Medical Breakthrough?

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Introduction

Stem cells are cells that have a great potential in the medical world. This is because they are pluripotent cells. Pluripotent means that a cell has the ability to become many different types of cells. For example, stem cells can become nerve, muscle or even heart cells. Stem cells can be classified into two major groups: embryonic stem cells, and adult stem cells. Both types of stem cells have different characteristics and have their own advantages and disadvantages. There have, however, been many debates over the moral issues of using embryonic stem cells. The reason there is so much controversy is because in order to obtain embryonic stem cells, scientists need to kill live human embryos, which renders this type of scientific research highly controversial.

Although scientists have the ability to harvest and culture these valuable cells, the supply is very limited. Cell culture is a method used to multiply these priceless cells in different conditions. Also, recent research has proven that a solution to the moral issues of stem cell research is in the near future. Scientists from Japan and Wisconsin have separately developed a new method to turn skin cells into pluripotent cells, which are very similar to stem cells. This new type of pluripotent cells is called “induced pluripotent stem cells.” With the possibility of differentiating stem cells and a possibility of resolving the ethical questions, stem cells could be the next, if not the greatest, medical breakthrough in the near future.

What are Stem Cells?

What are stem cells? According to the Longevity Meme (2007), stem cells are cells with no set function, which means that they have ability to differentiate and become any part within body, for example cartilage, muscle or bone cells and many more. The future for stem cells is bright and they have the potential to become a great medical breakthrough. There are two different types of stem cells, adult, and embryonic, and they each have different properties with different pros and cons. (Wikipedia, 2008; The Longevity Meme, 2007)

According to Wikipedia (2008), stem cells have many possible uses within medical therapies, including regenerative medicine, which means that stem cells have the potential to prolong life (The Longevity Meme, 2007). Stem cells can also speed up the natural healing process. Stem cells and regenerative medicine can be used to treat damaged nerves, broken bones, broken tissues, damaged hearts and many other medical conditions (The Longevity Meme, 2007). Aging causes internal damage, but while this is very minor and can not be harmful by itself, it still adds up. Regenerative medicine used with stem cells can heal some of this internal damage.

According to the National Institute of Health (2008) research on stem cells is providing more knowledge about how an organism develops from one cell. This research also studies how healthy cells can replace damaged cells in humans and animals. Because stem cells are unspecialized cells, which mean that they have not taken a particular form yet, with special physiologic conditions, they can become cells with specialized functions, such as heart tissue.
The history of stem cells started 20 years ago, according to the National Institute of Health (2008), when some of the first stem cells were taken from mouse embryos. Wikipedia (2008) states that all stem cells have two properties, which are potency and self-renewal. Potency means being able to turn into various types of cells, and self-renewal is being able to go through unlimited cell divisions without changing.

In a 3-5 day old embryo, called a blastocyst, stem cells in developing tissue differentiate into the many specialized cell types that form the human body, making up the heart, lungs, skin, and all other tissue. These are embryonic stem cells. In grown tissue, such as bone marrow, muscle, and brain, tiny groups of adult stem cells generate replacements for cells that are lost normally; these are adult stem cells (National Institute of Health, 2008). Some scientists predict that in the future, stem cells could treat diseases such as Parkinson's disease, diabetes, and heart disease.

All stem cells have the same unique properties. According to the National Institute of Health (2008) all stem cells have three general characteristics. First is that they can divide and renew themselves, second is that they are unspecialized, and the third property is that they can change into specialized cell types.

Also, stem cells cannot work with their neighbor and pump blood, they cannot carry oxygen through the blood stream, or give signals to other parts of the body, like nerve cells, but they can do all of these things if they transform and are specialized to do them. The National Institute of Health (2008) also states that stem cells may replicate many times, and this is called proliferation. If stem cells proliferate for a few months in a lab, the result could be millions of unspecialized stem cells. When stem cells change into a specialized cell this is called differentiation, and then this cell is no longer unspecialized. (National Institute of Health, 2008)

Embryonic Stem Cells

According to the Longevity Meme (2007), the type of stem cells which is more controversial is the embryonic stem cells which are found in embryos. These stem cells have the potential to replace tissue, and to be used as regenerative medicine, but a problem with all stem cells is preventing transplant rejection. Embryonic stem cells are very controversial because in order to create an embryonic stem cell line, the destruction of a human embryo is required.
Adult Stem Cells

Adult stem cells are the stem cells that come from an adult body and are used to repair minor damage to the organs in which they are located. For example, if a bone is broken, adult stem cells replace some of the damaged bone. They can also treat leukemia and other diseases (Wikipedia, 2008). Also, unlike embryonic stem cells, adult cells are not controversial because unlike embryonic stem cells, adult stem cells do not need to have an embryo destroyed to use them in a lab. (Wikipedia, 2008).

The Longevity Meme (2007) and Wikipedia (2008), say that adult stem cells are found inside a fully-developed organ. The National Institute of Health (2008) clarifies this by stating that an adult stem cell is an undifferentiated cell found among differentiated cells in a tissue or organ; it can also renew itself, and can differentiate to yield the major specialized cell types of the tissue or organ. The NIH also says that adult stem cells have to maintain and repair the organs or tissue where they are found. Some scientists give adult stem cells a different name, and they call them somatic stem cells (National Institute of Health, 2008).

According to Cell Medicine (2008), adult stem cells may also be able to repair damaged tissue. There are some stem cells which come from non-controversial sources, like bone marrow, skin, fat, or blood. These are the general characteristics and properties of adult stem cells. The main controversy about stem cells centers on the other type, embryonic stem cells. Many scientists say that embryonic stem cells have much more potential than adult stem cells.

What is the difference?

Adult and embryonic stem cells each have advantages and disadvantages in regard to how they can be used in regenerative therapies (National Institute of Health, 2008). Embryonic stem cells can become any type of cell in the body since they are pluripotent. But according to the National Institute of Health (2008), adult stem cells can only differentiate into the organ in which they came from, which is a huge disadvantage, and a reason why scientists say the embryonic stem cells are much more useful, and have a lot more potential.
How can Stem Cells Help Us?

Stem cells have the potential to help mankind in a way that no other medical breakthroughs can. According to some (National Institute of Health, 2008; Cell Medicine, 2008), embryonic stem cells have the potential to cure diabetes, cell degeneration, vision and hearing loss, spinal cord injury, and even Parkinson’s disease, as well as many others. Stem cell research can really benefit the future generations of mankind and will serve a purpose that will mark history.

How to Harvest & Culture Stem Cells

Since there isn’t an endless supply of embryonic stem cells, scientists of today have designed a way to harvest these priceless cells. This process is also known as cell culture. According to the National Institute of Health (2008), stem cell culturing is done inside scientific laboratories. This scientific process is quite simple. Stem cells are first put into dishes where they start to multiply (National Institute of Health, 2008). According to the National Institute of Health, (2008), a culture is a multiplying group of cells within each separate dish. When a dish has many, many cells, scientists will put separate stem cells into separate dishes (National Institute of Health, 2008), this is called sub-culturing.

To prevent the stem cell cultures from differentiating by themselves, scientists turn the stem cells into specific cells such as muscle, nerve, or heart cells (National Institute of Health, 2008). To do this, according to the National Institute of Health (2008), scientists simply alter the dish surface of the culture or change the chemicals within the dish. Another way is by inserting various types of genes into the blank stem cells to change them (National Institute of Health, 2008). According to some (National Institute of Health, 2008), if it is possible for scientists direct the cell differentiation, then it is very possible that stem cells could be the next, and possibly the greatest breakthrough in the medical world.

What is the controversy?

When it comes to stem cells and how they are obtained, there is a huge controversy on using embryonic stem cell, not adult stem cells. The stem cell controversy is the ethical debate centered on research involving the creation, usage and destruction of these human embryonic stem cells (Wikipedia, 2008). Each side of the debate, the side for, and the side against using embryonic stem cells, has plenty of valid reasons as to why their side should prevail. According to Wikipedia (2008), the people against stem cells say that it is a slippery slope which will eventually lead to human cloning. On the other hand, people in favour of stem cell research argue that they have enormous medical potential and could be a scientific breakthrough.

From an objective point of view, one of the reasons why stem cells could be vital in medical research is because stem cells can help trauma to the brain, spinal cord, skeletal muscles, and the heart, as well as degenerative diseases such as Parkinson’s disease (Wikipedia, 2008).
Wikipedia (2008), states that this issue is highly controversial because with the present state of technology, to start an embryonic stem cell line it requires the destruction of a human embryo, an early form of human life. Certain people, who are opposed to stem cell research, say that because an embryo is an early form of human life, it should not be killed. If they are in fact killed, then they believe that it should be considered murder (Wikipedia, 2008).

Wikipedia (2008), states that in the US alone, at least 400,000 embryos have been either destroyed or kept for long periods of time in labs, long past their viable storage life. Wikipedia also says that medical researchers widely believe that stem cell research has the potential to dramatically change approaches to understanding and treating some diseases, and to stop suffering. Researchers have been able to obtain mouse embryonic stem cells without actually killing the embryos, which could prove vital in the debate if this can be done to human cells. The key issue is whether potential life should be valued as much as life that already exists.

**Arguments for Stem Cell Research**

The people who favour embryonic stem cell research are mostly scientists, and they have many arguments. The first of these arguments is called utilitarianism, which is about how the benefits of stem cell research outweigh the ethical problem of destroying embryonic life (Wikipedia, 2008). An example of utilitarianism is that embryonic stem cells have the capacity to grow a lot in a lab and can differentiate into almost all types of bodily tissue. This makes embryonic stem cells a good source for cellular therapies to treat many diseases. Also the social, economic and personal costs of the diseases that embryonic stem cells can cure are far greater than the costs associated with the destruction of embryos.

Another argument for research of stem cells retrieved from embryos is human potential and humanity, which is a similar argument to utilitarianism (Wikipedia, 2008). According to Wikipedia (2008), the argument of humanity is about how embryos are not technically life when they are inside the womb, but instead are merely potential for life. Also, the argument says that a blastocyst, which changes into an embryo, is a group of human cells that have not differentiated into anything yet; making cells of the inner cell mass no more "human" than a skin cell. Another thing that the scientists who favour stem cell research say is that the ends (saving people who are already living) justify the means (killing things that are not alive yet).

The scientists also say that stem cell research is efficient as well, which means that if an embryo is going to be destroyed anyway, it is better to use it for good than to waste it (Wikipedia, 2008). In vitro fertilization (IVF), which is when an egg is fertilized in a lab, generates large numbers of unused embryos. Many of these thousands of IVF embryos are slated for destruction but instead scientists say that they could use them for scientific research which utilizes a resource that would otherwise be wasted. Wikipedia (2008), also suggests that abortions are legal in many countries and a logical argument is that if these embryos are being destroyed anyway, why not use them for stem cell research?
The final argument used by those who would like to advance the research of embryonic stem cells is superiority, that embryonic stem cells can be considered a lot better therapeutically than adult stem cells (Wikipedia, 2008). Embryonic stem cells are easier to grow into cultures; they divide quicker, and they are much more abundant than adult stem cells, not to mention that embryonic stem cells can treat a wider range of diseases than adult stem cells (Wikipedia, 2008). There are just as many arguments against embryonic stem cells as there are for, but the biggest question is the grey area between where human life begins, whether it is in a fertilized egg, in the womb, or when the fetus can survive independently from the mother.

Arguments against Stem Cell Research

There just as many people against stem cells research as there are for it. These people range from politicians, especially right wing politicians, to scientists, to religious people. Wikipedia (2008) says that one of these people’s biggest arguments against stem cells is the value of life. This argument in the highly controversial stem cell debate is based on the belief that an embryo is actually human, and that it should be treated just like human life, and this happens as soon as an egg is fertilized.

Another argument is that there are better alternatives to embryonic stem cells (Wikipedia, 2008). Embryonic stem cells should be abandoned in favor of alternatives like adult stem cells, and pro-life supporters say that the use of adult stem cells from sources such as umbilical cord blood has consistently produced more promising results than the use of embryonic stem cells. (Wikipedia, 2008) This argument directly contradicts the pro-embryonic stem cell argument about how embryonic stem cells are superior to adult stem cells. Adult stem cell research will prosper if they get the money currently going to embryonic stem cells, the pro-life supporters point out.

The final argument for the people against embryonic stem cells research is the scientific flaws that could be involved with the use of embryonic stem cells in therapies. According to Wikipedia (2008), one concern with embryonic stem cell treatments is that sometimes stem cells from embryos can create tumors. The bottom line of this argument is that stem cells may not be as good as some scientists say they are. The main issue of this raging debate is whether potential embryonic life should be treated the same way as you or me.

Are there any Alternatives for Embryonic Stem Cells?

After many researches done by separate scientific teams from both Wisconsin and Japan, scientist finally found a way to turn skin cells into an alternative for embryonic stem cells (Kolata, 2007). The newly developed way, according to Kolata (2007), no longer requires the need to kill live embryos in order to get stem cells. The new way simply requires scientists to add four different types of genes into the skin cells in order to “erase” its original “program” (Kolata, 2007). However, according to some (Kolata, 2007), there are disadvantages to this new method. First of all, even though the blank skin cells have the same effect as stem cells, they are
still somewhat dangerous. Also, one of the four genes that serve as an eraser for the skin cells’ chromosomes is a cancer gene, and thus renders it very risky. On the other hand, according to Kolata (2007), this newly developed way removes the question of morality, since scientists no longer need to kill embryos to obtain stem cells. Also, the body will not reject the new blank skin cell (Kolata, 2007). According to Kolata (2007), the new name for the blank skin cells is “induced pluripotent stem cells”. The word “pluripotent” means being able to become other cells (Kolata, 2007). However, according to some (Kolata, 2007), there are still no guarantees that the new method will work better than actually using stem cells, so using human embryos to get stem cells is still better for now.

Conclusion

Stem cell research is a scientific topic that revolves around ethical issues as well as medical ones. This is because scientists need to kill live embryos in order to obtain embryonic stem cells. However, with the hard work done by separate research teams from Japan and Wisconsin, it is now possible to have alternatives for embryonic stem cells, and thus removes all moral issues. With the progressing scientific technology and knowledge, stem cells will be one of the greatest medical breakthroughs in history. Many diseases and injuries that were never thought to be able to be cured are now within reach. Stem cells will without a doubt mark history in the medical world and will benefit mankind of the future generations yet to come.
**Sources/Bibliography**


