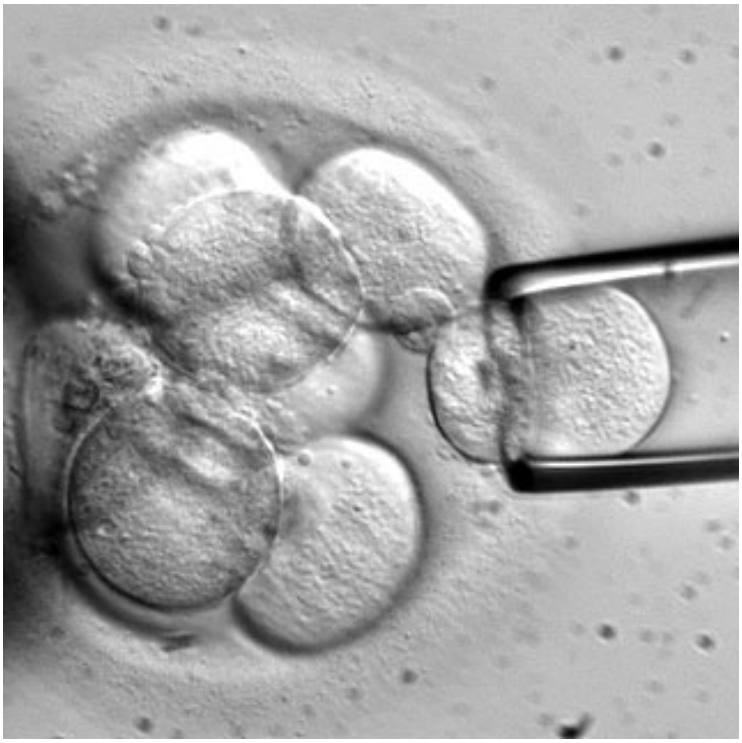
STEM CELL THERAPY × ETHICS AND RELIGION



Source: http://healthcare.zdnet.com/images/stem-cell-harvest.jpg

Group 9

Paula Melo Paulon Hansen

Stine Hesselholt Sloth

Supervisor: Ole Andersen

Basic Studies in Natural Sciences

Roskilde University

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House 13. 2

Abstract

Stem cells are somatic cells that can go through two different kinds of divisions. Symmetric division allows them to divide into undifferentiated cells, whilst asymmetric division produces one undifferentiated cell and a sister cell that will differentiate later on. Human stem cell therapy (HSCT) is a controversial theme in the religious, political, legal, ethical and scientific worlds. Although it is believed by many scientists that stem cell therapy will be able to cure life-threatening diseases and injuries in humans in the future, such as Parkinson's disease, diabetes and some types of cancer, there are still some things that impede a faster and deeper progress of this therapy, such as ethical and religious issues. This report takes into consideration the religious and ethical positions related to human stem cell therapy, from the United States and from the United Kingdom, because they are two leading western countries in the scientific world. This report summarizes the present state of stem cell research and medical use, and discusses this in the light of the religious positions from those countries in the human stem cell research.

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1. Introduction

Stem cells are somatic cells that have the ability to divide either into 2 undifferentiated cells (symmetric division) or into one undifferentiated cell and one sister cell that will differentiate at a later time. The most important types of stem cells are: **embryonic stem cells** that can be found in the cells of the blastocysts, which is a stage after the fecundation up to 6 days old and prior to the embryo stage; **fetal stem cells** that are found in the fetus stage (older than 8 weeks old up to birth); **adult stem cells** which are found in the tissues formed after the fetal stage and **nuclear transplant stem cells.** The most significant difference among those types of stem cells is whether they are committed or not to become a specific kind of tissue after the differentiation process.

Many researchers in the biotechnological and medical areas are willing to study human stem cells more deeply to try to find possible cures for many life-threatening diseases and injuries, like Parkinson's and Alzheimer's disease, some kinds of cancer, multiple sclerosis, spinal cord injury , etc. It has also been mentioned by scientists that stem cells could be used in the future to test new kinds of medicines, which probably would give clearer results to the scientific world than the results that are gotten now, when they use mice and monkeys, for example; and scientists would get to understand a bit better different kinds of human cells.

The main goal of this project is to analyze ethical and religious issues that influence the policies adopted by the United States and the United Kingdom on human stem cell research. Those countries were chosen because they are leading western countries in the scientific world, because enough literature related to human stem cell research in those countries is available to the public (it would be difficult to have access to literature about ethical issues in China, for example) and because those two countries have different points of views related to the therapy mentioned above.

The report starts with a scientific part explaining the science behind human stem cell therapy which is followed by a second part that takes into consideration religious and ethical issues behind this therapy in the United Kingdom and in the United States.

2. Problem Formulation

This report is focusing on the positions of the United Kingdom and of the United States on human stem cell therapy. Along the project those positions will be presented and as far as possible they will be compared in order to obtain an answer to our main question, which is:

- How do ethics and religion influence the policies of the United States and the United Kingdom on human embryonic stem cell research?

3. Semester Theme

The third semester theme for the Basic Studies in Natural Sciences is **"Reflexion on natural science and the dissemination of knowledge in the field of natural science"**. The purpose of this semester project work is the visualization of natural science as a cultural and societal phenomenon.

In our report we will focus on the influence of ethics and religious in the policies of the USA and of the UK on human stem cell research and thereby we will try to fulfill the requirements from the third semester theme.

4. Target Group

Our target group is anyone who is interested in genetics and human stem cell therapy and a basic knowledge of genetics and cell biology will ease the understanding of this project, as along the project there won't be found explanations about basic biology and genetics.

5. Scientific Part

5.1 Definition of stem cells

Cells are the basic unit of any biological system and by that the common basis for all life (Patenting human genes and stem cells, 2004). We have two types of cells: gametes or reproductive cells (egg and sperm cells) and somatic cells.

An essential part of a cell cycle is the process of cell division, which makes the continuity of life possible. A stem cell is a somatic cell with the ability of going through two different kinds of divisions: a symmetric one and an asymmetric one. Symmetric division is related to the potential of

the stem cells to self-renew while producing two undifferentiated stem cells, whilst the asymmetric division is related to their potential of producing an undifferentiated stem cell and a sister cell that will differentiate at some time. This sister cell can become one of a wide variety of specialized cells by differentiating. The undifferentiated cells have the ability to divide unlimited while the differentiated ones, have limited division capability.

We have many kinds of stem cells in our body and they are responsible for renewal, repair and replacing of dead or defective cells. We can say that stem cells are partially committed or uncommitted. When a stem cell is said to be committed it means that they can only become one type of tissue or organ which is where one of the problems with stem cell appears. The problem is that not all tissues in our body have reservoir of stem cells that are able to divide into new stem cells, which can replace old cells if they get defective or die. This is why we need transplants if our heart gets defective, because we don't have a reservoir of heart muscle stem cells with the ability of renewing or repairing old ones. But we know that stem cells from embryos are able to grow into tissues and organs such as heart muscles and neurons which mean that they are not yet committed at this point. So one of the big questions in stem cell research is, if it's possible to isolate one of these uncommitted stem cells and make them differentiate into a specialized stem cell that cannot be produced by the body itself. Another question is, if it's possible to make one such isolated cell to grow in a laboratory until it can be put back into the body replacing defective cells. The most important types of stem cells are:

Embryonic stem cells are found in the inner mass of the blastocysts (Panno, 2004) and they are a collection of stem cells which have a potential of giving rise to many different kinds of organs and tissues (Kiessling and Scott 2003). Until the human embryo is six days old its cells can develop into all types of cell. The cells from this are also embryonic stem cells and can turn into all tissue types in the actual fetus, but not into the tissue around the fetus, such as the fetal membranes. These kinds of cells are called pluripotent because they have plural potentiality.

One of the difficulties that embryonic stem cell researchers face is the tissue rejection that happens because those stem cells still express the proteins encoded by the genes of the embryo when they undergo differentiation. This means that when you take some of these embryonic stem cells and make them differentiate, you will face some rejection problems after inserting them into the body of the patient, because the patient's body will see them as foreign organisms and will try to get rid of

them. Fortunately, a new advance in the manipulation of cells and eggs holds the promise of creating stem cells for each person without creating a unique embryo (Kiessling and Scott 2003). This new advance in manipulating cells and eggs is called nuclear transfer stem cells. Another problem however is that some of these new methods are somewhat the same as those used in cloning, but this will be discussed later under nuclear transfer stem cells.

Fetal stem cells are found in the fetus stage (older than 8 weeks) and because of the fact that the fetus keeps on growing, all tissues and organs, including the brain, contain more or less committed stem cells (Kiessling and Scott 2003). These stem cells are still more or less able to turn into major organs such as heart muscles, brain and germ cells. "It is for this reason, that stem cell researchers are interested in studying fetal tissues" (Kiessling and Scott 2003).

Adult stem cells which are found in the tissues formed after the fetal stage are limited in their developmental potential by the fact that they only give rise to specific cell types which means that they are committed to a specific organ.

For example, "*blood vessel stem cells give rise to blood vessels, but cannot give rise to sperm, and spermatogonia cannot give rise to blood*" (Kiessling and Scott 2003, page 4). As written earlier the organs and tissues which do not keep a population of stem cells throughout life cannot repair themselves (Kiessling and Scott 2003). We do not know at this point why some tissues and organs maintain this population of stem cells and others don't. "Tissues deficient in stem cells include brain, heart, spinal cord, eye and kidney. There have been recent reports that a small population of stem cells also may be present in these tissues, and the challenge to scientists is to isolate them in the laboratory and encourage their multiplication into sufficient numbers to be therapeutically useful"(Kiessling and Anderson 2003).

Nuclear transfer stem cell is a method in human stem cell therapy where you replace the nucleus in an unfertilized egg with the nucleus of a somatic cell like for example a human embryonic stem cell. The general principles used in nuclear transfer stem cells are as it sounds, more or less the same as those used in cloning techniques, this however does not mean that the final outcome is going to be the same.

The intention of nuclear transfer stem cell is to create special embryonic stem cells that are genetically identical to the donor's cells. So the sole purpose of nuclear transfer stem cells is to

create these genetically identical cells and use them in further research. We can therefore not regard it as the same as human cloning, where you try to give rise to an entire human being.
We distinguish between two different kinds of cloning called therapeutic cloning and reproductive cloning. Reproductive cloning has the goal of producing new individuals who is genetically identical to the donor animal whereas the major aim of therapeutic cloning is to produce embryonic stem cells for therapeutic use (Campbell and Reece 2005).

In reproductive cloning you replace the nucleus of an egg cell with the nucleus of a somatic cell and implant it in the uterus of a surrogate mother and thereby create live birth with the result of an organism that in theory are a genetic copy of the somatic cell donor (Campbell and Reece 2005) (www2.massgeneral.org/regenmed/forthepublic_faq.htm).

Therapeutic cloning differs from reproductive cloning by the fact that you don't place the egg cell with the donated nucleus in the uterus of a surrogate mother. The reason why we attempt to use this nuclear transfer stem cell technique is that "*whenever cells, tissue or entire organs are transplanted from one person to another, the recipient's immune system sees the new material as foreign and tries to reject the transplant*" (www2.massgeneral.org/regenmed/forthepublic_faq.htm). But if we use a somatic cell from the recipient then the product of therapeutic cloning would be genetic identical and therefore accepted by the recipient's immune system.

A brief explanation of the differentiation of stem cells before they are inserted in a patient's body is giving below:

A blastocyst can be divided into 2 parts: the outer layer and the inner mass. In the stem cell therapy, human embryonic stem cells are obtained from the inner cell mass, usually from in vitro embryos. They are cultured in plates with special feeders where they grow into undifferentiated colonies. Afterwards they start to differentiate into specific cells, according to the specific environment that they are transferred to. An example of that is given below in figure 1:

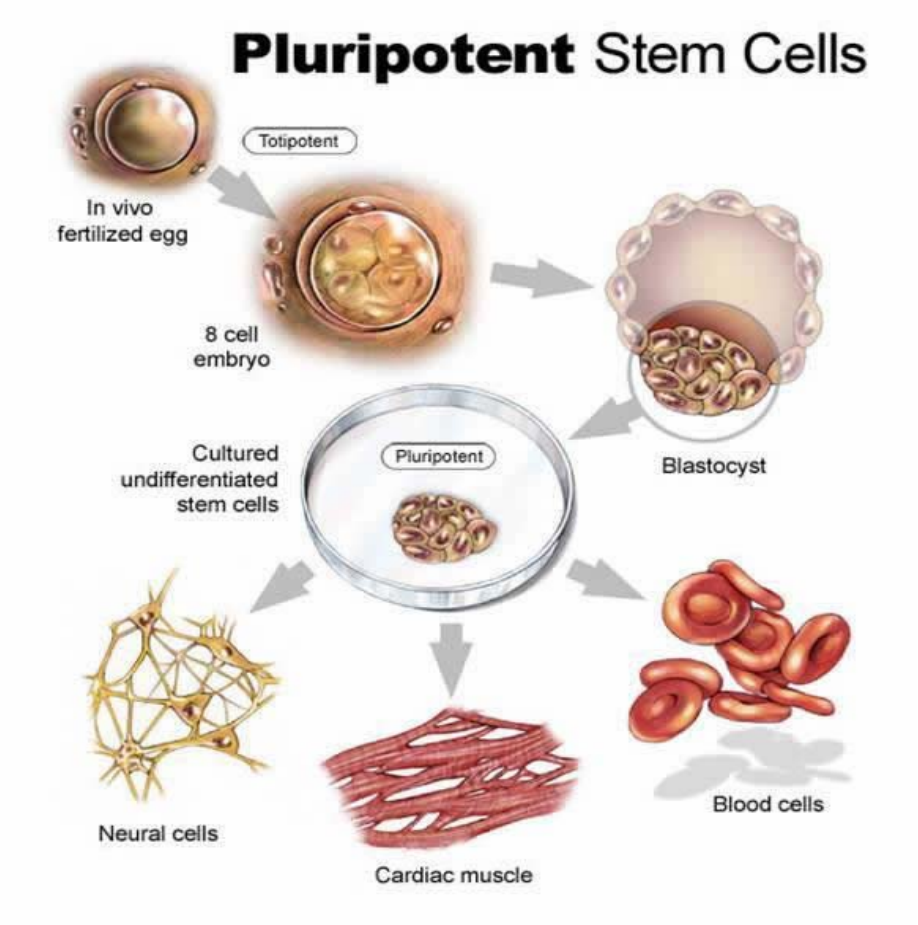

Figure 1. Sketch of the induced differentiation of stem cells

Source: http://www.stem-cell-therapy-now.com/image-files/pluripotent-stem-cells.jpg

5.2 Present and future benefits acquired through stem cell therapy

Stem cell therapy (SCT) has already been used to treat some blood and immune system diseases, like leukemia, and scientists hope to find treatments for other life threatening diseases, by using stem cell therapy. Leukemia and immune system deficiency are two kinds of diseases in which human stem cell therapy has already been used in order to treat them.

Leukemia is a cancer of the white blood cells. The conventional way of treating **leukemia** consists of chemotherapy, destruction of the patient's bone marrow and transplantation of a donated bone marrow. Sometimes it is even possible to remove a healthy part of the bone marrow of the patient that will be transplanted later on, after the sick part of his/her bone marrow has been destroyed. By doing that, high risks of rejection of the bone marrow that otherwise would arise if it came from another person won't exist. Human stem cell therapy would be then a good alternative for treating

this disease because it does not offer risks of rejection by the patient's body. It happens because stem cells from the patient's own bone marrow will be removed and after they have been induced to differentiate into white cells and the sick bone marrow has been destructed, they will be introduced in the body of the patient.

The immune system of human beings defends the organism against intruders. It is made of different kinds of white blood cells and the destruction of this system can lead to dangerous consequences. One kind of **immunodeficiency** that has already undergone stem cell therapy is the inherited disease caused by genetic disorder, called Severe combined immunodeficiency (SCID). There can be different kinds of SCID, but it is mostly characterized by the deficiency of T cells – which are responsible for the control of the other cells in the immune system-, B cells –which fight intruders in the human organism through the production of antibodies and of a gene called gamma-c (Panno 2006). The conventional treatment for this disease is transplantation of a compatible bone marrow, but just like in leukemia, the risks of rejection from the patient's body is really high. Stem cell therapy together with gene therapy has been already used to treat SCDI and it has been mostly successful. The therapy consists of extracting stem cells from the patient's bone marrow, producing healthy cells with healthy genes gamma-c and finally inserting them in the patient's body. A few patients that have undergone such therapy have developed leukemia (Panno, 2006).
Some other diseases are on the waiting list for a possible treatment with stem cell therapy. Two of them are the neurological diseases- Parkinson's and Alzheimer's diseases- that can have their symptoms controlled but are far away to be cured.

Parkinson's disease is caused by the destruction of neurons (dopaminergic neurons) found in the substantia nigra region of the brain that secrete the hormone dopamine and its worst symptom is a great motor disorder. Stem cells could be differentiated into the kind of neurons mentioned above and then introduced in the patient's brain. And those stem cells should rather come from the patient himself, to avoid rejection from the patient's organism. The insertion of induced differentiated neurons were introduced in "Parkinsonian" mice (Panno, 2006) has and better motor control was achieved.

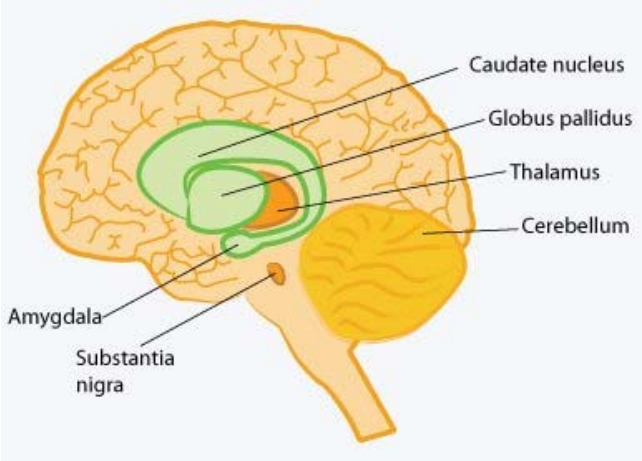

Figure 2: Sketch of the brain showing different regions including the substantia nigra, where the hormone dopamine is produced.
Source: http://www.abc.net.au/health/library/stories/2002/08/22/1830960.htm

Alzheimer's disease is an incurable neurological disease caused by the destruction of the central nervous system and the most common symptom of this disease is loss of memory. Stem cell therapy could be used to treat it, by differentiating stem cell into neurons that later on would be introduced in the patient's brain. It has been tested in mice but it is still not totally certain whether the new neurons connect themselves in the right way or not (Panno, 2006).

Patients suffering from **diabetes**, which according to the World Health Organization (WHO- http://www.who.int/mediacentre/factsheets/fs312/en/index.html) make up a total of around 180 million people and they belong to a group of patients that are waiting for a possible cure through stem cell therapy. The most common kinds of diabetes are type 1 and type 2. Type 1 is caused by the destruction of the β-cells of the pancreas (cells that produce insulin) by the immune system of the patient, and with it there will be an elevated level of glucose in the patient's organism. Nowadays it can be controlled by insulin injections. Type 2 is caused either by the short life of a person's β-cells or by the destruction of such cells because of the high level of sugar in a person's diet. This type of diabetes can be controlled by changing a person's lifestyle. But those kinds of controls do not offer lifelong protection against future symptoms of diabetes, such as kidney disorder, blindness and so on (Monroe et al., 2008). Therefore stem cell therapy could offer a possible cure for diabetes by inducing stem cells to differentiate into β pancreatic cells and then inserting the differentiated cells in the organism of the person suffering from this disease (Monroe et al., 2008).

Stem cell therapy would also be a great alternative treatment for patients with **brain tumors**. One of the good things about this possible treatment is that stem cells could acquire different functions after their differentiation: they could be able to destroy unwelcomed cells in the brain, such as cancer cells; they could be able to produce proteins against tumors, etc (Monroe et al., 2008), and that those differentiated stem cells after inserted in the brain could probably reach the tumors that are localized in positions that make their removal really difficult and sometimes impossible.

Another kind of patients that could probably benefit from SCT, are those suffering from **cardiovascular diseases**. The death of parts of the muscle tissue from the heart, caused by a heart attack diminishes the normal activity of a person's heart. Stem cell therapy could be a way to renew the destroyed parts of a heart, by introducing differentiated bone marrow stem cells in the heart of the patient.

The diseases mentioned above are some of a long list of diseases that probably could or will get cured in the near future by stem cell therapy. But scientists still have to struggle against some negative results that can happen in the human organism, after stem cell therapy has been applied. One of them is a possible rejection by the immune system of the new inserted differentiated stem cells, which happens often if the stem cells do not come from an identical twin sibling or from the patient. Another problem that can be faced later on is the formation of tumors in the patient's organism if undifferentiated embryonic stem cells are accidentally inserted in the patient's body, together with differentiated ones. In all, we can say that this area is still in its early development and some years will pass until scientists can confirm the real benefits that stem cell therapy can offer.

Besides being used to cure diseases stem cells could be used in other different ways. By studying and understanding the way that stem cells differentiate, scientists can improve their knowledge in how a specific disease arises and thereby new ways to control it can be developed. "Human stem cells could also be used to test new drugs. For example, new medications could be tested for safety on differentiated cells generated from human pluripotent cell lines. Other kinds of cell lines are already used in this way. Cancer cell lines, for example, are used to screen potential anti-tumor drugs. But, the availability of pluripotent stem cells would allow drug testing in a wider range of cell types. Scientists will have to be able to precisely control the differentiation of stem cells into the specific cell type on which drugs will be tested in order to screen drugs effectively"

(http://stemcells.nih.gov/info/basics/basics6.asp, 2008). This would then diminish the use of mice and other kinds of animals in the laboratories in pharmaceutical and medical branches.

6. Stem Cell Research vs. Society

6.1 Religion

There have been many ethical and religious discussions about stem cell research and its present and future use to cure life-threatening diseases and injuries. Those discussions are mostly related to the use of embryonic stem cells than to the other kinds of stem cells, and it happens mostly because different religions have different points of views about the start of life and about the moral status of a blastocyst, of an embryo and of a fetus. The report analyses the points of view of the 5 main religious groups in the United Kingdom and in the United States of America. Christianity is the biggest religion group in both countries. It is then followed by Islam, Hinduism, Buddhism and then Judaism, in the United Kingdom; while in the United States, it is followed by Judaism, Islam, Buddhism and then Hinduism (see appendices A and B). We start with the points of view from Buddhists, Hindus, Muslims and Jews about blastocysts, embryos and fetuses and their positions about stem cell research. We will then analyze the position of Christianity related to the same, but in a deeper manner as it is the religious group with the most contradictory position on the theme and that has more influence on the ethical discussions about stem cell therapy. Table 1 on page 14 summarizes the different points of views.

It is not so easy to explain the points of views of Buddhists and Hindus related to stem cell research because there isn't much literature published about it. As showed below in the table, they agree that full moral status is acquired at conception but they won't be against abortion or stem cell research depending on the situation. They will not take into consideration the scientific act in itself, but they will consider the doctrines of karma (reaction caused by our actions) and ahimsa (the matter of nonviolence) related to the scientific act. Embryonic stem cell therapy is seen as a positive action by them as the embryonic cells used come either from leftovers of in vitro fertilized embryos or from natural abortions, and it is used in behalf of helping diseased and injured people.

Islam does not give full status to a blastocyst or to an embryo, and a fetus will just gain full moral status, after it is older than 120 days. The Islamic laws allow fertilization in vitro for infertile couples and those couples can either throw the unused fertilized embryos away or donate them to

research, and Islamic scholars are for the donation of unused fertilized embryos to research. Some Muslims are even for the production of embryos just for the purpose of donating it later on to research centers (Monroe et al, 2008).

Religion	**Blastocyst (up to 6 days)**	**Embryo (6 days to week 8)**	**Fetus (from week 8 to birth)**
Christianity (Different positions about the status of the embryo and fetus) • Roman Catholic • Eastern Orthodox • Fundamentalist Christian	They agree that full moral status is acquired at conception		
• Mainstream protestant	They say that a fetus has just limited moral status and just limited moral status is acquired at conception.		
Buddhism and Hinduism	They give full status at conception, but agree with abortion and stem cell research depending on the situation (karmic considerations)		
Islam	Blastocysts and embryos have no moral status		Fetus has full moral status
Judaism • Orthodox	Blastocysts and embryos don't have moral status		Fetus has limited moral status
• Conservative	Blastocysts and embryos don't have moral status		Fetus has full moral status

Table 1. Overview of the different points of views of the 5 main religious groups

Source: Fundamentals of stem cell debate: the scientific, religious, ethical and political issues by Monroe et. al. page 81.

Conservative and Orthodox Jews have different opinions about the moral status of a fetus. Conservative Jews give full moral status to a fetus at birth, while Orthodox Jews concede limited moral status to a fetus after the 40th day of its conception, but this embryo can be sacrificed if the mother is under any danger. What actually matters to Judaism is that life is protected and therefore, they are for the use of embryonic stem cell therapy to cure injured and diseased people. But they actually limit that those cells should either come from naturally aborted fetuses or from in-vitro-created embryos which are seen by Jews embryos without moral status.

It is hard to explain the position of Christianity about human stem cell therapy because this religious group does not have a unified opinion about it. Christianity has many denominations, such as Catholicism and Protestantism, and their opinions about stem cell therapy are not always in complete agreement. Besides that there are some differences in how this religious group is represented and interpreted in the United Kingdom and in the United States. The first difference that we can consider between Christianity in both countries is its relationship with the State. In the UK, church and State are not separated from each other. But it does not mean, for example, that British politicians will have to follow this religious belief: people with different beliefs are welcomed as politicians in the British Parliament. This relationship between church and State does not mean that the number of Christian Britons is high, but on the contrary. There are more and more Britons expressing their dissatisfaction with the church and declaring themselves as atheists. On the other hand, church and State in the USA are separated from each other and in order to attract more and more "disciples" to their churches, the different Christian denominations in this country go through hard competitions among themselves and are usually politically active (http://www.abarnett.demon.co.uk/atheism/churchstate.html).

Now we consider the points of view of some Christian denominations in general, and afterwards we will examine the strength of such points of views on the policies of the UK and USA on human stem cell research. The table on page 14 shows that Christians do not have a unified meaning related the research mentioned above. Catholics, eastern Orthodox and fundamentalist Christians agree that full moral is gained at conception. While Roman Catholics are against the use of embryonic stem cells for research, even having some theologians that support this case; Eastern Orthodox Christians accept the use of embryonic stem cells, but just when the cells come from natural and not induced abortions. Many Protestants are for the use of embryonic stem cell therapy

as they see it as a good cause to cure sick and injured people. But they still look forward to an alternative kind of stem cell, but embryonic stem cell.

In the United States, where many people are devoutly religious, Christianity has great influence on the policy of this nation against the use of embryonic stem cells for therapy. They argue that a blastocyst is already a living human being that should not be destroyed on behalf of therapeutic meanings, even when most of the blastocysts come from leftovers of in vitro fertilizations, that otherwise would be thrown away, and even when this therapy could represent the cure of many life threatening diseases.

In the United Kingdom, on the other hand, where more and more people are losing their Christian faith, a more liberal and permissive policy related to human embryonic stem cell research has been adopted, and one of the main arguments for this position is the numerous benefits that can be brought by this therapy. But just embryos up to 14 days old are allowed to be used in such researches and the reason for that is that after 14 days an embryo would normally start to develop the nervous system. The House of Lords Committee on Stem Cell Research has recognized that the creation of embryos just with the purpose of using them in stem research should not be considered as an alternative to the use of leftover embryos from in vitro fertilization (http://www.parliament.uk/post/pn174.pdf).

6.2 Ethics

Ethical committees have been created to be sure that the different opinions of people are heard and taken into consideration, so that the best possible solution can be found to the question or problem raised in the area of, for example, human stem cell research. Such a question could be, for example, whether it is ethically okay or not to use human embryonic stem cells or any other type of human stem cells, for the different kinds of research. These solutions and decisions are of course very difficult to make because the ethical judges from the committees have to listen to scientists and to religious and legal authorities before deciding anything related to human stem cell research. "*However, certain of these spiritually, oriented thinkers, although well versed in religious philosophy, have little special education in modern reproductive and medical therapies*" (Kiessling and Anderson 2003). So it is therefore thought of as very unwise to let the religious people have a formal position in the committee's final decision, which naturally makes them feel discriminated.

There are different kinds of ethical committees throughout the world. The private companies have set up Bioethics Committees and most universities have an Institutional Review Board or a Research Ethics Committee and they are a very important part of any research projects and most scientists welcome their recommendations.

The committees use the Helsinki Declaration and the Nuremberg Code as guidelines when they decide whether a problem is ethically right or not. The Helsinki Declaration which is developed by The World Medical Association (WMA) "*is a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.*" (http://www.wma.net/e/policy/b3.htm). The Helsinki Declaration is very long and is therefore put in appendix C.

The Nuremberg Code was created after the end of World War II to try to avoid the horrors that the Nazi doctors created by performing painful experiments on unwilling human beings. This Code is an established list of human rights that must be observed by all moral and ethical researchers for all kinds of research involving human beings. We quoted the principles from the Nuremberg Code from the book: Human embryonic stem cells: an introduction to the science and therapeutic potential, by Kiessling and Anderson (2003), and they are the ones showed below:

1. *"The voluntary consent of the human subject is essential.*
2. *The experiment should yield fruitful results for the good of society, unprocurable by other means.*
3. *The experiment should be based on the results of animal experimentation and the anticipated results should justify the experiment.*
4. *The experiment should avoid all unnecessary physical and mental suffering and injury.*
5. *No experiment should be conducted where there is a reason to believe that death or disabling injury will occur.*
6. *The risk to be taken should not exceed the problem addressed by the experiment.*
7. *Proper preparations should be made to protect the experimental subject.*
8. *The experiment should be conducted only by scientifically qualified persons.*
9. *The human subject should be at liberty to end the experiment.*
10. *The scientist must be prepared to terminate the experiment if he has cause to believe that the experiment is likely to result in injury to the experimental subject."(Kiessling and Anderson 2003).*

"For people who believe that blastocysts are human beings, stem cell research is clearly unethical on these grounds. For people who do not believe that a blastocyst is a human being, the second clause, which requires the consideration of other means of achieving the same goals, such as adult stem cells, remains problematic. Otherwise, stem cell research satisfies these guidelines" (Kiessling and Anderson 2003).

Most ethicists don't believe that a blastocyst is a person and they actually think that it is unethical to let sick people die by denying them a potential treatment. One of the arguments against using blastocysts is the fact that some people would create embryos just for the sake of stem cell therapy. This has been tried to be avoided by forbidding the selling of embryos. Below we quoted what has been written by Kiessling and Anderson (2003) about the additional principles that have been presented to the committees in order to help them in their evaluations related to the theme: human stem cell research. *"Because it is so difficult to work with the ethics about stem cell therapy some extra guidelines have been made to help the committees ruling for the better of good, the laws governing human embryo research:*

- *The scientific goals and techniques of the research.*
- *Potential applications of the research.*
- *The procedures by which human tissues are obtained.*
- *Federal funding restrictions regarding human embryo research.*
- *Alternative methods that might achieve the same goals.*
- *The value of scientific freedom.*
- *Public opinion.*
- *The recommendations of other committees." (Kiessling and Anderson 2003)*

By taking all these things into consideration the different committees try to come up with the best qualified decision. It is very difficult to put the UK and the USA in specific boxes regarding their ethical standings because there are actually different rules inside the same country. In the USA, they have different rules in different states, some are for and some are against. Today it is not illegal to work with human stem cell research in the USA, but it has to be privately funded because the public funds are very restricted and there are of course some restrictions regarding how far they are allowed to go. In the UK it is a little bit different because they have a more liberal policy about the

subject and there is therefore more federal funding along with the private one. Even though there are some differences in how they look upon human embryonic stem cell, they still work together in the way that the USA ship human embryonic stem cell lines to the UK, which use them in their different researches.

7. Discussion

The ethical debate about human embryonic stem cells and stem cell therapy is at its highest point at the moment. This is so because the science behind human stem cell research is relatively new and many rules and guidelines regarding this specific area have yet to be created. A lot of people will of course like to have influence and something to say about this matter and not all of them share the same opinion, which makes the whole process very challenging.

We have seen that the policies adopted by the United Kingdom and the United States are influenced by many different factors that aren't just related to the scientific world. Besides that we can say that emotions also have an important participation in the decisions behind the policies on human stem cell research (Gottweis and Prainsack, 2006). We will base our discussion here on the article "Emotion in political discourse: contrasting approaches to stem cell governance in the USA, UK, Israel and Germany", by Gottweis and Prainsack, which takes into consideration the definitions of Aristotle about pathos, ethos and logos, related to the different policies from the different countries. Pathos is related to the strength of the emotion magnetism that can gather people; ethos is related to the ability of a person to transmit its emotion to the public and logos is nothing more than reason.

In the United States we can say that human embryonic stem cell research (HESC research) is a topic that divides the public's opinions and those opinions are somehow influenced by the public's emotions. The public opinion about HESC research is divided between those that support the research and those that are highly influenced by religious groups that are against the research. The present President of the United States, George Bush, supports the idea that an up to 14 days old embryo is already a human being and this was one of the arguments used to ban the application of federal funds in researches related to human embryonic stem cells, after 2001. But researches in that area which are funded privately are not prohibited.

In the UK, where the government has considered issues related to abortion, stem cell and cloning at an early stage, pathos, ethos and logos work together in a balanced way, differently from the USA,

where just emotion and no reason was used to justify the country's policy on human embryonic stem cell research. The British government defends the use of human embryonic stem cells in researches and they justify their position by emphasizing the benefits that this kind of research will bring with it (Gottweis and Prainsack, 2006).

We can summarize then by saying that the American policy on hESC so far has been driven by too much emotion, and reason has been left outside the discussion related to the theme. On the other hand the British policy on hESC has gotten to balance emotion, reason and the way they communicate their position to the public. "Emotions in public and debates can be a means to generate trust in a regulator's ability to deal with a new technology in a responsible manner. But emotions cannot persuade a public of the positive value of a biomedical research. Trustworthy institutions are a prerequisite for social experiments with new medical technologies. We do not propose the public display of emotions to be a substitute for substantial political debate." (Gottweis and Prainsack, 2006, page 828).

8. Conclusion and perspectives

This report has just taken into consideration religious and ethical issues behind human embryonic stem cells research, as well as some political debates about this theme in the UK and in the USA. Thereby we can conclude that decisions made in the scientific world are profoundly influenced by how religious and ethical issues are interpreted by the authorities from the different countries. In the United States for example, the president agrees with the arguments made by some Christian groups an up to 14 days-old embryo is already a human being, and connected with that, public funds to this kind of research has been banned. The United Kingdom, on the other hand, which is a Christian country, where church and state are not separated from each other, has decided to take more reasonable explanations into consideration in order to establish its policy on hESC therapy. According to the Human Fertilization and Embryology Act that is responsible for the control of clinics that work with "the storage of eggs, sperm and embryos" and the use of young embryos in researches (http://genome.wellcome.ac.uk/doc_WTD021016.html), embryos up to 14 days-old are allowed to be used in researches as they have started to develop their nervous systems yet, and can just be considered as a group of cells.

"Scientific ignorance is the driving engine of the antiembryonic stem cell movement" (Kiessling and Scott 2003).By that it is meant that the more education a person has, the bigger will be the

chances for this person to support research on hESCs. This is so because a better educated person will probably have more knowledge and understanding in this biological area than worse educated people (Kiessling and Scott 2003).

Under the government of the former President Bill Clinton, *"after a thorough discussion of ethical, scientific, legal and social implications of stem cell research"* (Gottweis and Prainsack, 2006, page 824), it was allowed to public fund this kind of research. Then President George Bush came and ruled against the previous law on human embryonic stem cell research by removing all public funding for this research and only allowing the use of stem cell lines created before 2001. The coming American president Barack Obama has promised to change the actual American policy on human embryonic stem cells, by allowing this research to be public funded. In one of his statements he says that he is a "*supporter of the Stem Cell Research*" (http://obama.senate.gov/press/070411-obama_renews_su/) just like he was while working as a Senator under the Bush government. This holds great promises for the future of human stem cell research because the United States of America is one of the leading western countries, with big influences in the scientific world.

The United Kingdom has already a much liberal policy on this issue, so the perspective for this country is hopefully a progression in this area, meaning that they will finally find cures for some life-threatening diseases by using hESC therapy. This could be a possible cause for other countries to share the same kind of policy on human stem cell therapy as the United Kingdom does, in the near future.

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10. Appendices

10 .1 Appendix A

Religious groups in the UK

Population of Great Britain: by religion, April 2001

	Total population		Non-Christian religious population
	(Numbers)	(Percentages)	(Percentages)
Christian	41,014,811	71.8	
Muslim	1,588,890	2.8	51.9
Hindu	558,342	1.0	18.3
Sikh	336,179	0.6	11.0
Jewish	267,373	0.5	8.7
Buddhist	149,157	0.3	4.9
Any other religion	159,167	0.3	5.2
All non-Christian religious population	3,059,108	5.4	100.0
No religion	8,596,488	15.1	
Religion not stated	4,433,520	7.8	
All population	57,103,927	100.0	

Source: www.statistics.gov.uk/cci/nugget.asp?id=954

10.2 Appendix B

Religious groups in the USA

"Top Ten ORGANIZED Religions in the United States, 2001" (*www.adherents.com/rel_USA.html#religions)*

Religion	2001 Est. Adult Pop.		% of U.S. Pop., 2001
Christianity	159,030,000	224,437,959	76.5%
Judaism	2,831,000	3,995,371	1.3%
Islam	1,104,000	1,558,068	0.5%
Buddhism	1,082,000	1,527,019	0.5%
Hinduism	766,000	1,081,051	0.4%
Unitarian Universalist	629,000	887,703	0.3%
Wiccan/Pagan/Druid	307,000	433,267	0.1%
Spiritualist	116,000	163,710	0.05%
Native American Religion	103,000	145,363	0.05%
Baha'i	84,000	118,549	0.04%

Source: /www.adherents.com/rel_USA.html#religions

10.3 Appendix C

Helsinki Declaration

A. "INTRODUCTION

1. The World Medical Association (WMA) has developed the Declaration of Helsinki as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data.

The Declaration is intended to be read as a whole and each of its constituent paragraphs should not be applied without consideration of all other relevant paragraphs.

2. Although the Declaration is addressed primarily to physicians, the WMA encourages other participants in medical research involving human subjects to adopt these principles.

3. It is the duty of the physician to promote and safeguard the health of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfillment of this duty.

4. The Declaration of Geneva of the WMA binds the physician with the words, "The health of my patient will be my first consideration," and the International Code of Medical Ethics declares that, "A physician shall act in the patient's best interest when providing medical care."

5. Medical progress is based on research that ultimately must include studies involving human subjects. Populations that are underrepresented in medical research should be provided appropriate access to participation in research.

6. In medical research involving human subjects, the well-being of the individual research subject must take precedence over all other interests.

7. The primary purpose of medical research involving human subjects is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions (methods, procedures and treatments). Even the best current interventions must be evaluated continually through research for their safety, effectiveness, efficiency, accessibility and quality.

8. In medical practice and in medical research, most interventions involve risks and burdens.

9. Medical research is subject to ethical standards that promote respect for all human subjects and protect their health and rights. Some research populations are particularly vulnerable and need special protection. These include those who cannot give or refuse consent for themselves and those who may be vulnerable to coercion or undue influence.

10. Physicians should consider the ethical, legal and regulatory norms and standards for research involving human subjects in their own countries as well as applicable international norms and standards. No national or international ethical, legal or regulatory requirement should reduce or eliminate any of the protections for research subjects set forth in this Declaration.

B. BASIC PRINCIPLES FOR ALL MEDICAL RESEARCH

11. It is the duty of physicians who participate in medical research to protect the life, health, dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects.

12. Medical research involving human subjects must conform to generally accepted scientific principles, be based on a thorough knowledge of the scientific literature, other relevant sources of information, and adequate laboratory and, as appropriate, animal experimentation. The welfare of animals used for research must be respected.

13. Appropriate caution must be exercised in the conduct of medical research that may harm the environment.

14. The design and performance of each research study involving human subjects must be clearly described in a research protocol. The protocol should contain a statement of the ethical considerations involved and should indicate how the principles in this Declaration have been addressed. The protocol should include information regarding funding, sponsors, institutional affiliations, other potential conflicts of interest, incentives for subjects and provisions for treating and/or compensating subjects who are harmed as a consequence of participation in the research study. The protocol should describe arrangements for post-study access by study subjects to interventions identified as beneficial in the study or access to other appropriate care or benefits.

15. The research protocol must be submitted for consideration, comment, guidance and approval to a research ethics committee before the study begins. This committee must be independent of the researcher, the sponsor and any other undue influence. It must take into consideration the laws and regulations of the country or countries in which the research is to be performed as well as applicable international norms and standards but these must not be allowed to reduce or eliminate any of the protections for research subjects set forth in this Declaration. The committee must have the right to monitor ongoing studies. The researcher must provide monitoring information to the committee, especially information about any serious adverse events. No change to the protocol may be made without consideration and approval by the committee.

16. Medical research involving human subjects must be conducted only by individuals with the appropriate scientific training and qualifications. Research on patients or healthy volunteers requires the supervision of a competent and appropriately qualified physician or other health care professional. The responsibility for the protection of research subjects must always rest with the physician or other health care professional and never the research subjects, even though they have given consent.

17. Medical research involving a disadvantaged or vulnerable population or community is only justified if the research is responsive to the health needs and priorities of this population or community and if there is a reasonable likelihood that this population or community stands to benefit from the results of the research.

18. Every medical research study involving human subjects must be preceded by careful assessment of predictable risks and burdens to the individuals and communities involved in the research in comparison with foreseeable benefits to them and to other individuals or communities affected by the condition under investigation.

19. Every clinical trial must be registered in a publicly accessible database before recruitment of the first subject.

20. Physicians may not participate in a research study involving human subjects unless they are confident that the risks involved have been adequately assessed and can be satisfactorily managed. Physicians must immediately stop a study when the risks are found to outweigh the potential benefits or when there is conclusive proof of positive and beneficial results.

21. Medical research involving human subjects may only be conducted if the importance of the objective outweighs the inherent risks and burdens to the research subjects.

22. Participation by competent individuals as subjects in medical research must be voluntary. Although it may be appropriate to consult family members or community leaders, no competent individual may be enrolled in a research study unless he or she freely agrees.

23. Every precaution must be taken to protect the privacy of research subjects and the confidentiality of their personal information and to minimize the impact of the study on their physical, mental and social integrity.

24. In medical research involving competent human subjects, each potential subject must be adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail, and any other relevant aspects of the study. The potential subject must be informed of the right to refuse to participate in the study or to withdraw consent to participate at any time without reprisal. Special attention should be given to the specific information needs of individual potential subjects as well as to the methods used to deliver the information. After ensuring that the potential subject has understood the information, the physician or another appropriately qualified individual must then seek the potential subject's freely-given informed consent, preferably in writing. If the consent cannot be expressed in writing, the non-written consent must be formally documented and witnessed.

25. For medical research using identifiable human material or data, physicians must normally seek consent for the collection, analysis, storage and/or reuse. There may be situations where consent would be impossible or impractical to obtain for such research or would pose a threat to the validity of the research. In such situations the research may be done only after consideration and approval of a research ethics committee.

26. When seeking informed consent for participation in a research study the physician should be particularly cautious if the potential subject is in a dependent relationship with the physician or may consent under duress. In such situations the informed consent should be sought by an appropriately qualified individual who is completely independent of this relationship.

27. For a potential research subject who is incompetent, the physician must seek informed consent from the legally authorized representative. These individuals must not be included in a research study that has no likelihood of benefit for them unless it is intended to promote the health of the population represented by the potential subject, the research cannot instead be performed with competent persons, and the research entails only minimal risk and minimal burden.

28. When a potential research subject who is deemed incompetent is able to give assent to decisions about participation in research, the physician must seek that assent in addition to the consent of the legally authorized representative. The potential subject's dissent should be respected.

29. Research involving subjects who are physically or mentally incapable of giving consent, for example, unconscious patients, may be done only if the physical or mental condition that prevents giving informed consent is a necessary characteristic of the research population. In such circumstances the physician should seek informed consent from the legally authorized representative. If no such representative is available and if the research cannot be delayed, the study may proceed without informed consent provided that the specific reasons for involving subjects with a condition that renders them unable to give informed consent have been stated in the research protocol and the study has been approved by a research ethics committee. Consent to remain in the research should be obtained as soon as possible from the subject or a legally authorized representative.

30. Authors, editors and publishers all have ethical obligations with regard to the publication of the results of research. Authors have a duty to make publicly available the results of their research on human subjects and are accountable for the completeness and accuracy of their reports. They should adhere to accepted guidelines for ethical reporting. Negative and inconclusive as well as positive results should be published or otherwise made publicly available. Sources of funding, institutional affiliations and conflicts of interest should be declared in the publication. Reports of research not in accordance with the principles of this Declaration should not be accepted for publication.

C. ADDITIONAL PRINCIPLES FOR MEDICAL RESEARCH COMBINED WITH MEDICAL CARE

31. The physician may combine medical research with medical care only to the extent that the research is justified by its potential preventive, diagnostic or therapeutic value and if the physician has good reason to believe that participation in the research study will not adversely affect the health of the patients who serve as research subjects.

32. The benefits, risks, burdens and effectiveness of a new intervention must be tested against those of the best current proven intervention, except in the following circumstances:

- *The use of placebo, or no treatment, is acceptable in studies where no current proven intervention exists; or*
- *Where for compelling and scientifically sound methodological reasons the use of placebo is necessary to determine the efficacy or safety of an intervention and the patients who receive placebo or no treatment will not be subject to any risk of serious or irreversible harm. Extreme care must be taken to avoid abuse of this option.*

33. At the conclusion of the study, patients entered into the study are entitled to be informed about the outcome of the study and to share any benefits that result from it, for example, access to interventions identified as beneficial in the study or to other appropriate care or benefits.

34. The physician must fully inform the patient which aspects of the care are related to the research. The refusal of a patient to participate in a study or the patient's decision to withdraw from the study must never interfere with the patient-physician relationship.

35. In the treatment of a patient, where proven interventions do not exist or have been ineffective, the physician, after seeking expert advice, with informed consent from the patient or a legally authorized representative, may use an unproven intervention if in the physician's judgment it offers hope of saving life, re-establishing health or alleviating suffering. Where possible, this intervention should be made the object of research, designed to evaluate its safety and efficacy. In all cases, new information should be recorded and, where appropriate, made publicly available." (http://www.wma.net/e/policy/b3.htm).