

# Exemplar

Extended Project

Unit: P301

Topic: Stem Cell Controversy



**Proposed project title:** Are stem cells worth the cost and controversy that surrounds them?

Section One: Title, objective, responsibilities

**Title or working title of project (in the form of a question)**

"Is the impact that stem cells will have on the future of medicine worth the cost and controversy that surrounds them every day?"

**Project objectives (eg, what is the question you want to answer? What do you want to learn how to do? What do you want to find out?):**

I want to find out more about stem cells and the role that they will play in the future of medicine. Also I want to learn more about the funding of the advances of medicines such as stem cells and see how they determine how much funding one type of medicine gets in comparison to others. The questions I want to answer are how much has been invested in stem cells and is this a suitable amount considering the impact that stem cells could have on the world of medicine and whether the controversy that surrounds their extraction from embryos affects the funding that research receives around the world.

Section Two: Reasons for choosing this project

**Reasons for choosing the project (eg, links to other subjects you are studying, personal interest, future plans, knowledge/skills you want to improve, why the topic is important):**

I hope to study medicine at university and I believe that stem cells are the future of medicine and may be a key type of medicine for me in my career as a doctor. With this in mind, despite having basic knowledge on stem cells and their potential impact on society I want to know more about the whole process of treating and building organs using stem cells, what else they can be used for and most importantly the effects that this could have and has had on present and future patients for illnesses such as stroke and organ failures.

Section Three: Activities and timescales	
Activities to be carried out during the project (eg, research, analysis, writing, preparing for the presentation, etc):	How long this will take:
Choosing title	22 <sup>nd</sup> October
Research, Bibliography and Analysis of data	25 <sup>th</sup> December
Prepare for presentation	6 <sup>th</sup> March
Finish writing and proof reading	28 <sup>th</sup> March
Milestone one: Finish Research by Christmas	
Target date (set by tutor-assessor): 17 <sup>th</sup> January (First Draft)	
Milestone two: begin Preparation for presentation 6 <sup>th</sup> March	
Target date (set by tutor-assessor): 7 <sup>th</sup> March (Final Draft)	
Section Four: Resources	
<b>What resources will you need for your research, write up and presentation (eg, libraries, books, journals, equipment):</b>	
Christopher Thomas Scott, <i>Stem Cell Now: A Brief Introduction to the Coming Medical Revolution</i> , Plume (2nd October 2006)- this book will be useful for outlining the impact that stem cells will have on modern medicine.	
Ted peters, <i>The Stem Cell Debate</i> , Fortress Press U.S (21 st September 2007)- this book gives the views of both sides	
Kristen Renwick Monroe, Ronald B Miller 8: Jerome Tobis, <i>Fundamentals of the Stem Cell Debate: The Scientific, Religious, Ethical, and Political Issues</i> , University of California (23rd November 2007)- this book will again give a very well rounded case for both sides of the argument	
<b>What your areas of research will cover?</b>	
I hope my research on the subject will cover any animal and human testing of stem cells in the UK and the results of these tests in terms of improvement of quality of life and also the long term effects that this treatment will have on the patients. I will also try to find results of tests from countries outside of the UK and see how they compare. I will also cover the ethics surrounding the extraction of embryonic stem cells and whether I believe that despite the controversial extraction, whether stem cells impact is worth the cost and controversy that surrounds it.	
Comments and agreement from tutor-assessor	
Is the learner taking this project as part of the Diploma? If yes, which Diploma are they taking? Comments (optional):	Yes/ <b>No</b>
Is project derived from work which has been/wilt be submitted for another	

<p>qualification?                  Which qualification (title and unit)?                  Comments (optional):</p> <p>I confirm that the project is not work which has been or will be submitted for another qualification and is appropriate.                  Agreed: X</p>	<p>Yes/<b>No</b></p>
<p>Comments and agreement from project proposal checker</p>	
<p>Comments (optional):                  I confirm that the project is appropriate.                  Agreed: X</p>	



This form should be used to record the process of your project and be submitted as evidence with the final piece of work.

You may want to discuss:

- what you have done (e.g., from one week to the next)
- if you are working in a group, what discussions you have had
- any changes that you have or will need to make to your plans
- what resources you have found or hope to find
- what are encountering and how you are solving them
- what you are going to do next

Date	Comments
24 <sup>th</sup> September To 8 <sup>th</sup> October	These days are when I began with the taught course of the subject I had 6 lessons in this two week period, these lessons were very helpful in teaching me the skills that were essential to succeed when doing an Extended Project. The group of people in my class and I discussed these skills using situations in real life such as newspaper articles for the 5Ws, and also ethical issue for the thinking skills lesson. At this stage I knew that I wanted to do a project on medicine and wanted to use the question "What is the biggest breakthrough in medicine for the last 100 years?" for the next few weeks I will continue the taught course and I will try to finalise my question for the project.
9 <sup>th</sup> October To 23 <sup>rd</sup> October	This fortnight I had 4 taught course lessons and finished the taught course. These lessons were focused on narrowing down the question that we were going to answer and also teaching us the skills of writing a Bibliography and referencing and also about writing a proposal form. Over these two weeks the topic that I wanted to do had been changed and narrowed down considerably. I decided that I wanted the main focus of my project to be focussed around stem cells and so I decided that my question would be "Are stem cells worth the cost and controversy that surrounds them?" Over the coming weeks I want to begin my research into the topic and finish my research before Christmas.
24 <sup>th</sup> October To 7 <sup>th</sup> November	After the taught course was finished and I had my title I started with the research of the project, over this two weeks I started looking at internet sites mostly looking for stories of cures that have been caused by stem cell treatment. Most of these sources were British newspapers that can be trusted however they did sometimes exaggerate the extent of the cure the patient had during their treatment however this was a good place to start. I began sessions with my tutor for the project and he advised me to write notes about the sources that I have so that I did not have to keep rereading the whole of my sources to get the quotes that I was looking for. I will try to

	find book and journal sources over the next two weeks
8 <sup>th</sup> November To 22 <sup>nd</sup> November	I continued my research however I began to focus on finding books for the project, however although it was easy to find books and internet sources talking about the controversies surrounding the use of embryonic stem cells it was difficult to find anything about the cost of stem cell research each year and whether the results that were being produced were worth the price tag that they had. Therefore regrettably I decided to drop the cost aspect of the project and focus on the controversies that surround stem cell research and change my title to "Is the impact that stem cells will have on modern medicine worth the controversy that surrounds them?" Over the next weeks I am aiming to finish my research and then begin my write up.
23 <sup>rd</sup> November To 7 <sup>th</sup> December	Over these two weeks i finished the research stage of my project finding 22 sources, 5 books, 2 journals and 15 websites. These sources I felt gave me a well-rounded view of stem cell research and I had sources from all the different arguments for and against the use of stem cells. I planned to start my write up however I did not as I had some AS and A2 exams in January and these became my main priority for two of the three week holiday. I hoped to start my write up in two weeks' time and start by writing my introduction contents and bibliography.
8 <sup>th</sup> December To 22 <sup>nd</sup> December	I did nothing these weeks due to January exam revision.
27 <sup>th</sup> December To 10 <sup>th</sup> January	I started in these weeks writing an introduction bibliography and a contents page which outline what subtitles I would use in my project and how I would lay it out. Later on in the fortnight I began to write the main body of my dissertation with my introduction to stem cells and how they work and adult stem cells and the impact that I felt that they could have on modern medicine. Over the next two weeks I will try to write about the differences between embryonic stem cells, the impact that embryonic stem cells could have on modern medicine and the controversy that surrounds them.
11 <sup>th</sup> January To 25 <sup>th</sup> January	Over these two weeks I was able to write quite a lot of my dissertation covering the differences between embryonic and adult stem cells, the potential impacts of embryonic stem cells and I was able to also write about the religions and ethical controversy surrounding the use of stem cells. My tutor was happy with my progress and told me to continue the way I was. At this point my aim was to finish the dissertation in late February or early March. Over the next two weeks this meant that I had to finish the political issues surrounding stem cell research, write about skin stem cells and the issues surrounding them and also try to write my conclusion.
26 <sup>th</sup> January To 9 <sup>th</sup> February	These two weeks were not as productive as I hoped that they would be because at the time I had two sets of coursework running in tandem as well as the extended project. This meant

	that it was difficult to find times to write my dissertation. However I was able to write about the political issues surround stem cell research and also i was to write an introduction to skin stem cells as an alternative to embryonic stem cells. over the next two weeks I had to work hard to catch up with what I had missed over the last two weeks.
10 <sup>th</sup> February To 24 <sup>th</sup> February	These two weeks were one of the most productive fortnights that I had over the whole project. I was able to complete the issues surrounding skin stem cells, my conclusion and evaluation and completed half of my research review. Over the next two weeks I would be starting to have lessons again about how to write an abstract and how to prepare for your presentation. Apart from this though I hope that I would be able to finish my research review and write my abstract over the coming weeks
25 <sup>th</sup> February To 11 <sup>th</sup> March	I was able to achieve what I wanted over these two weeks finishing both my research review and my abstract. I also was able to finish the slides that I was going to use in my presentation however I had not practice actually saying the presentation yet to anybody so I tried to organise times where I could say it to friends, family and my tutor. Over the next two weeks I hope that I will do well in my presentation which is on the 22nd March and then tie up any loose ends of the project.
12 <sup>th</sup> March To 21 <sup>st</sup> March	I spent just over a week tying up the loose ends of my project for example moving all the different parts of my project onto one document and writing some key terms that I felt needed to be understood before reading my project. I also practiced giving my presentation to a variety of people and eventually on the 21st gave my presentation to the rest of my class. The presentation went alright, however I was a bit frustrated as I had performed better when I was giving the presentation to other people.

## Extended Project Oral Presentation Record Form


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Learner Name M.

Learner number

Centre Name

College

Centre Number

Project Title

 Is the impact that stem cells will have on  
 modern medicine worth the  
 controversy that surrounds them?

Date 21/03/2011

		Band placement					
<b>Content</b> How clear are the main ideas? Definitions given &	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: Some lack of clarity due to density of information, clear content.						
<b>Organisation</b> How clear and logical is the structure? Do the different parts of the presentation link together?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: Definitions separated from findings made it harder to follow. Overall structure logical						
. ce Is the presentation well paced?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: Tried to say too much. Overran.						
<b>Voice</b> Is the presentation clearly audible? Does the presenter avoid simply reading the presentation aloud?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: No script or cards. Occasional hesitation.						
<b>Visual aids</b> If visual aids are used, are they relevant and consistently effective in supporting the presentation? Are they clearly visible and not over-crowded with too much information?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <del>over</del> Good starting slide. Simple bullet points needed graphics.						
<b>Contact with audience</b> r. s the presenter engage well with the audience and hold their attention?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: Personal rationale engaged at start. Relaxed style.						
<b>Handling questions</b> Does the presenter handle questions calmly and confidently? Are they answered clearly and insightfully, in a way which shows good subject knowledge?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: Clear, knowledgeable answers to questions						
<b>Strengths of the presentation</b>	AO4 Mark Awarded: 7						
Interest & depth of knowledge. Honest self evaluation. Strong personal engagement.							
<b>Signed (Teacher/assessor):</b>				<b>Position:</b>			



# Extended Project Oral Presentation Record Form



Learner Name M.

Learner number \_\_\_\_\_

Centre Name College

Centre Number \_\_\_\_\_

Project Title STEM CELL CONTROVERSY

Date 21/03/2011

		Band placement					
<b>Content</b> How clear are the main ideas?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>clear content</i>						
<b>Organisation</b> How clear and logical is the structure? Do the different parts of the presentation link together?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Structured but slightly lost his way</i>						
<b>Pace</b> Is the presentation well paced?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Good at first but lost pace in middle. Overran</i>						
<b>Voice</b> Is the presentation clearly audible? Does the presenter avoid simply reading the presentation aloud?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Needed more variety. No Notes</i>						
<b>Visual aids</b> If visual aids are used, are they relevant and consistently effective in supporting the presentation? Are they clearly visible and not over-crowded with too much information?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Lacking in illustration. Clear slides</i>						
<b>Contact with audience</b> Does the presenter engage well with the audience and hold their attention?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Good contact but rather long winded in parts</i>						
<b>Handling questions</b> Does the presenter handle questions calmly and confidently? Are they answered clearly and insightfully, in a way which shows good subject knowledge?	Low 1	High 1	Low 2	High 2	Low 3	High 3	
	Comments: <i>Good knowledge shown.</i>						
<b>Strengths of the presentation</b>		AO4 Mark Awarded: <u>7</u>					
<i>showed interest.</i>							
Signed (Teacher/assessor): <u>C.</u>				Position: <u>EP DIRECTOR</u>			

## Observation Record/Witness Statement

Learner Name M Learner number \_\_\_\_\_  
 Centre Name CONCRE Centre Number \_\_\_\_\_  
 Unit Name \_\_\_\_\_ Unit number \_\_\_\_\_  
 Project Title \_\_\_\_\_

This form should be included in the candidates work which is submitted for moderation


What task/activity are you assessing?

EPR Presentation on Stem Cell Research.

How has the task/activity met the requirements of the Specification?

Confident Presentation - No notes meant one or two garbled moments.  
 Timing a bit rushed towards the end.  
 Covered all main points in brief, and demonstrated good basic knowledge. ~~and~~  
 Interesting/informative for non-medical audience.

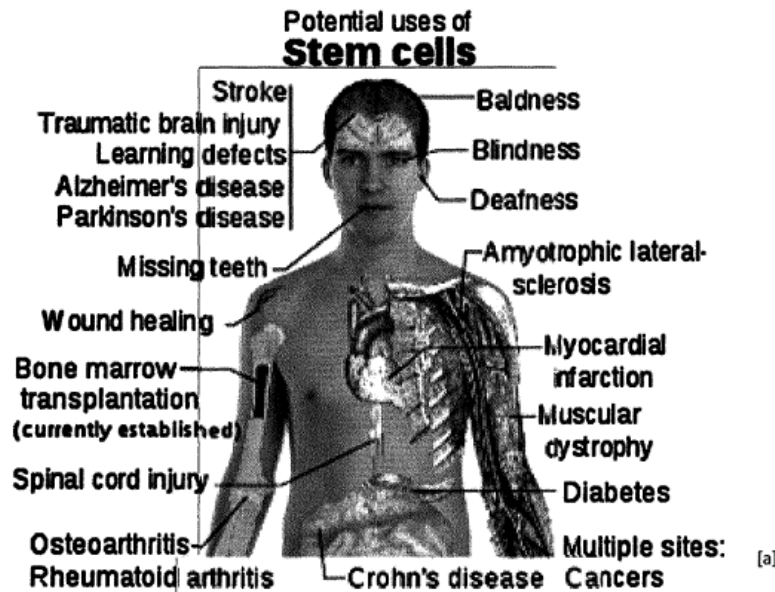
Assessors Details

Name	<u>SJ</u>	Position/role	<u>Teacher</u>
Signature		Date	<u>21/3/11.</u>

Confirmed by

Name		Position/role	
Signature		Date	

**Is the impact that stem cells will have on modern medicine worth the controversy that surrounds them?**



**Abstract**

In this project, I give an explanation of what stem cells are, mentioning all three types of stem cells: adult, embryonic and skin stem cells, including where they are found, how they work and why they are so special. I then talk about the impact adult and embryonic stem cells are and could have on modern medicine in the near future in treatments of conditions like diabetes, strokes and types of cancer. I outline, the differences between embryonic and adult stem cells in terms of how differentiated they are and the number of different cell types that they can differentiate into in the body, the religious and ethical controversy that surrounds them and the political issues that affect the research process. I look at skin stem cells as an alternative to embryonic stem cells and the problems that occur when trying to produce them. Concluding that skin stem cells have the most potential however a lot of research needs to be done into how to produce them in a more efficient way. I also added that adult stem cells should be used as well as they have great potential and very little controversy surrounding them in comparison to embryonic stem cells.

**Key terms**

Differentiation- This is the process in biology where unspecialised cells specialise into a specific type of tissue or cell in the body. For example bone marrow differentiates into red blood cells, white blood cells and platelets.

Pluripotent - This is when a stem cell is only slightly differentiated and therefore can differentiate into most of the cell types of the body.

Multipotent -This is when a stem cell is more differentiated and can only differentiate into a few cell types in the body.

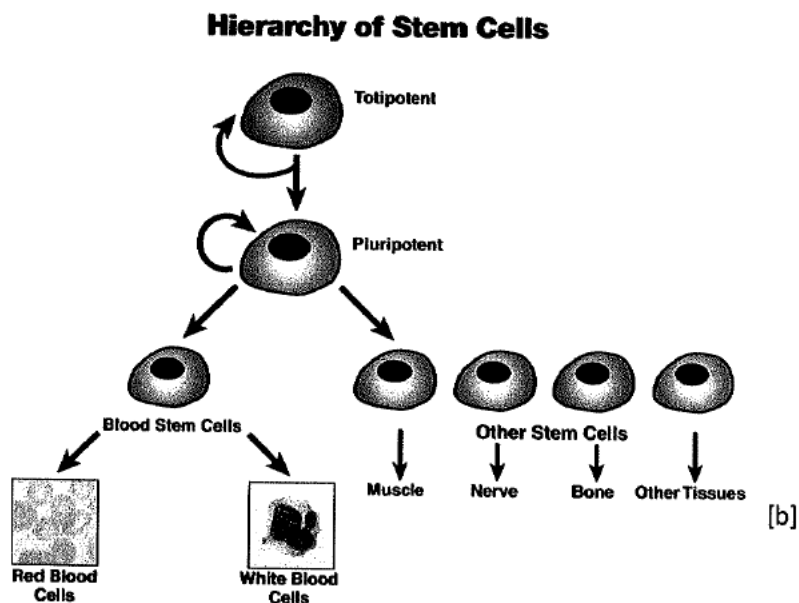
Blastocyst - This is the structure formed 6 days after fertilisation, and in the inner cell mass of this structure is where embryonic stem cells are situated.

## **Introduction**

Type 1 and 2 diabetes, transplant rejection, organ failure and spinal cord injuries are all conditions that, at the present time, are either untreatable, require major surgery and risks or are treated using daily pills which do not cure the patient but allow them to stay alive. Stem cells could be the answer to these treatments. Stem cells are cells found all around the body in the form of adult stem cells and embryos that are unspecialised and can be specialised into most types of cells. However adult stem cells are not able to differentiate into different types of cells as freely as embryonic stem cells are as they are found for example in different organs or in bone marrow where they are limited to different cells that function in that organ or in the blood, this means that the use of embryonic stem cells is more favourable to scientist as they have the potential to differentiate into any of the 200 or so different cell types in the body, the issue with this is that although the range of illnesses that can be cured is increased when embryos are used, there is a large amount of controversy surrounding the research that is currently in progress "Controversy exists...because the current technique to harvest these cells involves the destruction of the human blastocyst, a pre-embryo"[S] . This controversy that surrounds this research comes in many different forms; it mainly comes from three areas: ethics, religion and politics. My aim is to understand whether the controversy that surrounds the research of stem cells is worth all the controversy that surrounds it and whether or not when stem cell treatment becomes widely available in the future people who disagree with the research would reject lifesaving treatment due to the fact that they don't believe that the use of stem cells is morally or religiously right. Also new research is being done into making stem cells very similar to embryonic stem cells using skin cells from humans, whether or not this treatment is as effective must be questioned and whether or not this will stop the controversy in all the three areas mentioned or not is also questionable, skin stem cells do seem to be a step forward for stem cell research if they are as effective as a standard embryonic stem cell, this will surely silence the critics who are against the destruction of the embryo. Although stem cells are not used commercially as a treatment for illnesses in Britain there are stem cell clinics around the world, for example in Germany and China, these regularly use stem cells as a cure for conditions such as cerebral palsy and more, these clinics although they have changed the lives of many people have also had disastrous results including cases which have resulted in the death of the patient being treated. This has led people to believe that we don't know enough about stem cells and the risks that they may present to be using them commercially as treatments for multiple conditions. Stem cells are often seen as the scientific breakthrough that could make humans treatable for any possible cure they see stem cells as a "miracle cure" [22] scientists however have warned people that these cells may not be the miracle cure that they are looking for, however some of the impacts that they have had on different cases from cerebral palsy to HIV is staggering. Whether this is a miracle cure or not this research promises to produce one of the largest breakthroughs in modern medicine. There is little doubt in my mind that stem cell research will continue despite all the controversy that surrounds it however the fact that it is continuing does not mean that the impact that the research will have on

medicine is worth the controversy. Although this is tough to measure and is a very opinionated subject I will try to see whether the benefits outweigh the harms when it comes to stem cell research and whether it really is worth all the controversy and issues that many people in the world are voicing.

I wanted to do this project as I am applying to study medicine at university this year. My top university choice "Bart's and the london" are large researchers into stem cells and are currently carrying out a test using stem cells on damaged heart muscles which could be used to cure coronary heart disease in the future. Also I wanted to find out more about the potential of stem cells and how long it will be before they are used commercially as a treatment and whether this would be in my lifetime if I were to become a doctor in the future.



There are three different types of stem cells: adult, embryonic stem cells. Adult stem cells are "multipotent"[3] meaning that they are only able to differentiate into a select number of cells, For example stem cells which are found in bone marrow may only be able to differentiate into red blood cells platelet cells and white blood cells. They are more regularly accepted around the world as they do not involve the killing of embryos; however there remains controversy over natural law and playing god. There are about 65 conditions that are believed to be able to be treated by adult stem cells, including 23 different forms of cancer [13]. Despite this the research that is being done on adult stem cells is exciting for the future of medicine as it may be able to find a cure beyond a mastectomy for the millions of women in the world who are suffering from breast cancer. However adult stem cells will only become of major importance if the use of embryonic and skin, stem cells fails.

Embryonic and skin stem cells have the same function and this is to be a cell that unlike adult stem cells are able to differentiate into most of the different cells that are found in the body. This would mean that diseased that are caused by cells in the body could be cured by replacing them with the uninfected equivalent of the cell. Another important aspect of stem cell research is to do with the central nervous system. This is the brain and the spinal cord, if these are damaged it often causes paralysis. There have been cases in trials of people being cured of this paralysis by stem cells. Also this is very important for stroke

victims, this is because a stroke is caused by a lack of blood flowing to the brain often caused by a blood clot or atherosclerosis which is a build-up of a fatty plaque in arteries, strokes often leave the sufferers with severe brain damage however it is believed that if stem cells are injected in the part of the brain which is not functioning this will allow that part of the brain to function, and also following animal trials by Sir Christopher Evans it is believed that that section of the brain will be better condition than before the accident as connections in the brain that were not broken by the stroke are also fixed and so the animal, in this case a monkey, was able to function better than before he was brain damaged and given the stem cell injection. An example of an embryonic stem cell cure occurred 3 years ago to a woman in Australia, "Her own doctors told her to prepare for life in a wheelchair"[22], she however heard about the trials being run in India by Dr. Shroff [22], and she began controversial treatment by having stem cell injections into her spinal cord. "Now, after having about eight weeks of injections, Mrs Smith has regained bladder and bowel control; her leg muscles are growing and she says she can feel deep sensation in her thighs and feet." [22] These cures of conditions that otherwise would cause paralysis and a large change of lifestyle are what is causing people to believe that embryonic stem cells will be the miracle cure.

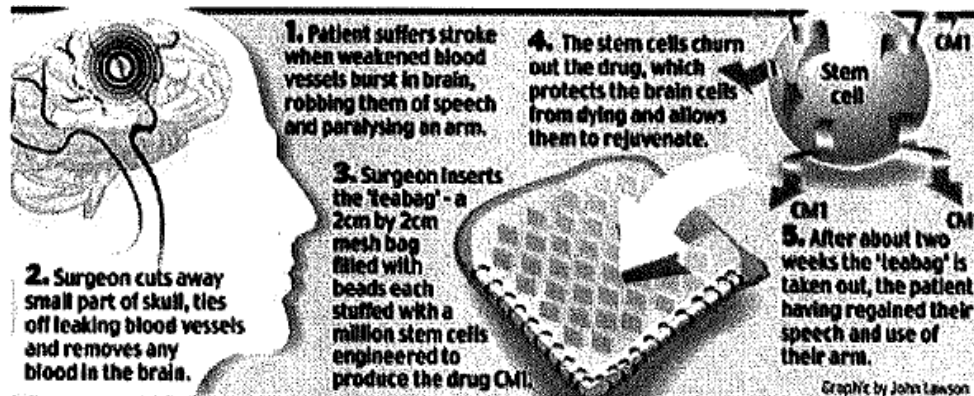
Skin stem cells have been claimed by scientists to carry out all of the functions of a normal embryonic stem cell however they don't result in the death of the pre-embryo, this claim if true eliminates a lot of the ethical controversy that is surrounding stem cells and some of the religious controversy. Skin stem cells have been used in trials and it has been discovered that skin stem cells can be used to make adult blood, this could be a large breakthrough for people who struggle to find someone with the same rare blood type as they do, when they require a blood transfusion, also this will be excellent for sufferers of conditions that affect the cells in the blood for example sickle cell anaemia, this illness causes the red blood cells to be sickle shape in the blood of the sufferer rather than the normal concave shape which is the optimum shape for the function of carrying oxygen around the body. However there is still some controversy over the facts that although you are no longer using human embryos to carry out the treatment of these diseases many religious believers consider this as playing god and believe that this is wrong.

### **Adult stem cells and their uses in modern medicine**

Adult stem cells are widely more accepted than embryonic stem cells, mostly because they don't result in the death of an embryo. Although these cells don't have the freedom to divide into any cell in the body that they want known as "pluripotent" [3] the impact that they can have on treating diseases and also disabilities caused by illness and disease such as strokes is still a large step forward for modern medicine although not as exciting as embryonic stem cells.

An example of a use of adult stem cells that is used commercially around the world is bone marrow transplants which are having a huge impact on modern medicine as they are used to cure a variety of illnesses such as leukaemia and aplastic anaemia which were two illnesses which before the use of transplants were incurable and the effects of the illnesses can only be prevented. However these treatments are not perfect as not anybody's bone marrow could be used to treat the illness, the donor must be a match to the patient, also these matches

are not always perfect, and if the bone marrow transplant is rejected it can cause a large amount of pain. So therefore work can still be done on the use of adult stem cells in medicine.



Adult stem cells have been also known to cause what is appeared to be a miracle cure and they are far ahead in comparison to embryonic stem cells in terms of the research into their use in modern medicine. As shown in the picture adult stem cells have helped a stroke victim to "restore power of speech" and "regain use of his right arm" [14] this is just one of the many uses of adult stem cells that may become a regular part of medicine in the future in the near future and despite the cells having less potential than embryonic stem cells they are still have been used to cure blindness and "Long Segment Tracheal Stenosis, which leaves sufferers with a very narrow windpipe" [21] as mentioned earlier there are thought to be 65 disease that have been treated using adult stem cells and some of these include "brain cancer " a "brain cancer" and "aplastic anemia" which is a serious illness where the immune system begins to attack its own bone marrow and this results in problems with clotting of blood and production of blood cells, as the bone marrow is the stem cell source for the blood and differentiates into red and white blood cells platelets and all the cells needed in the blood, the treatment for this used to be regular ongoing blood transfusions which occur for the whole of the sufferers life however these transfusions although they can be lifesaving also carry risks for example viruses such as HIV can survive in the blood and can be transferred when the blood transfusion occurs.

### **Differences between adult and embryonic stem cells**

From the examples above we can see that adult stem cells can have a massive impact on curing or reversing the effects of potentially life changing events and illnesses. However the impact of adult stem cells is overshadowed by the potential of embryonic stem cells and the impact that they can have on medicine due to their pluripotent ability compared to the multipotent ability of adult stem cells. But what difference does this make and how will it differ from the use of adult stem cells in the future.

The main difference between the use of adult and embryonic stem cells in medicine is that with embryonic stem cells there is the potential of growing organs meaning that organ transplants will become easier and their will be no need for transplant lists in hospitals and arguments which patient deserves the

organ more or whether they deserve one at all. Also the post transplant process will become a lot easier as the risk of rejection will be very small and therefore the use of immunosuppressant medicine will become void, which means that the risks of infection after the transplant is also reduced.

Another difference between adult and embryonic stem cells is how accepted they are around the world. Adult stem cells are widely accepted around the world as a groundbreaking advance in modern medicine that could make illnesses that would have otherwise been life-changing a thing of the past, whereas embryonic stem cells, despite the fact that they are more likely to cure and treat illnesses that before them would have been terminal, are surrounded by large amounts of controversy due to the termination of a "hatched blastocyst" [5] which occurs about 6 days after fertilisation has occurred" as it is argued that this is life and therefore it is effectively murder, however much like arguments similar it comes down to the question, when does life begin?

### **The impact of embryonic stem cells on present and future medicine**

Embryonic stem cells are found in the inner cell mass of a blastocyst; they are extracted from there and can be used in any area of the body that is needed to differentiate into tissues and cells and can replace tissue that is damaged or not functioning, the potential impact that this has could transform medicine forever making illnesses such as diabetes become a thing of the past; diabetes is caused by the beta cells in the pancreas being unable to produce insulin leading to a build up of glucose in the blood and the urine. Stem cells could be injected to the pancreas and they would begin to generate working beta cells which would then be able to produce insulin and cure the disease. Not only illnesses will be affected but also trauma treatment may also be transformed and treatment will be completely reformed by the discovery of stem cells and their potential uses in medicine for example if stem cells are injected into a injured or snapped spinal chord they can be used to reform the spinal chord nerve connections and hopefully restore movement and feeling throughout the body like the Australian woman mentioned earlier. Stem cells will also mean that transplant rejection as stem cells have the potential to be used to grow whole livers in order to transplant into patients, this also eradicates the problems that surround transplant lists, including who gets on the list and who has the highest priority.

### **Political surrounding the use of embryonic stem cells**

Funding from stem cell "research is supported by both private money and public money" [5] this causes controversy in terms of the public money as it raises the questions, whether or not governments of countries should fund research into things that is not accepted by all of the population. However if this public funding is cut off then stem cell research in the country refusing to fund it will grind to a halt as although there is funding coming from private sources this does not "compare to what the government puts into research" [5]. Due to companies such as the "National Institute of Health (NIH)" [2] which funds all of the USA's biomedical research and is the reason that America "lead the world of biomedical research" having large budgets such as "28.8 billion" [2] as medicine pushes into controversial boundaries such as stem cell research and not everyone agrees with the research that is going on means that stem cell research is relying of the "shifting winds of politics" [2] a perfect example of this



shifting wind is that under the republican government George Bush limited the countries stem cell funding, however Obama after winning the election lifted this allow stem cell research to secure the large amounts of funding that comes with the government backing.

### **Religious controversy surrounding the use of stem cells**

The religious controversy surrounding the use of stem cells as a whole comes from two main arguments; these are natural law and playing god. Catholicism follows natural law which says that if something is not being used for its natural process then that action is wrong and should not be allowed. Stem cells are being taken from the bodies of humans to carry out processes that they would not carry out if they were left alone for example embryonic and adult stem cells are used in other peoples bodies to treat illness like in bone marrow transplants for example and this is not the natural process that they would have followed if left alone in the bones of the original donor.

The playing god argument is that the use of stem cells would cure people from illnesses that would otherwise have killed them, therefore altering gods plan and effectively playing god. However if this argument is used it can easily be countered that if this treatment is not allowed to be used at it is playing god, then medicine as a whole should be banned and all illnesses should be allowed to run their course, this is a direct contradiction to the sanctity of life as if life is sacred then it must be a priority to preserve it and therefore these arguments cannot be presented together.

The main religious controversy surrounding the use of embryonic stem cells is the sanctity of life argument which suggests that all life is sacred, this argument only exists however if life begins at fertilisation. The sanctity of life argument is that life is sacred and therefore an innocent life should not be taken in anyway and therefore if it is believed that life begins at fertilisation then the termination of the hatched blastocyst is thought of as taking a life and therefore should not be allowed.

### **Ethical controversy surrounding the use of embryonic stem cells**

The ethical controversy surrounding the use of stem cells surrounds embryonic stem cells and follows on from the sanctity of life argument as it is to do with the death of the blastocyst and how it is wrong as it has the potential to become life. However this argument can be countered by saying that abortion is legal in most countries and this results in the termination of a foetus which is more differentiated than a blastocyst and is therefore more human, however this procedure is carried out' legally multiple times a day with no gain to anybody else, however extracting stem cells from the inner cell mass of a blastocyst although resulting in the termination of that blastocyst could save another person's life and therefore it could be argued is more beneficial to the community than abortions.

The other argument is that embryonic stem cells have rather overshadowed adult stem cells and therefore not enough research has gone into the use of adult stem cells to treat illnesses that people are so keen to use embryonic stem cells to cure, and therefore the blastocyst that are being destroyed, are for no

reason. This argument can be backed up as adult stem cells have been very successful in testing and have made more cures than embryonic stem cells however I believe that this is more due to the fact that they are further in the testing process than embryonic stem cells not because they are a better treatment in anyway.

There have also been problems with stem cell treatment as things can go wrong. In the X-cell clinic in Dusseldorf, the biggest in Europe, an 18 month old boy "was injected in the brain with stem cells and subsequently died." [15] This shows that stem cell research is not perfect and therefore it should not be used as a commercial treatment till all of the problems have been ironed out and things like this are not repeated again.

### **Alternatives to embryonic stem cells**

Scientists in Kyoto and California have discovered a way in which they believe they are able to turn back the clock in terms of how a cell is differentiated and are able to turn a skin cell into a pluripotent stem cell that then can be used in the body just as an embryonic stem cell would be used. Without complication this could be the answer that everyone is looking for as this would mean that a lot of the ethical and religious problems concerning the use of embryonic stem cells would be avoided and therefore skin stem cells would be more accepted around the world as an ethical alternative to embryonic stem cells. The skin cells are transformed by "viruses injecting genes into the cell's DNA." [6] Which allow the cells to become pluripotent and useable in the body to treat illnesses.

### **Issues surrounding the use of skin stem cells**

There are issues surrounding skin stem cells however, firstly the virus is not taken up by all the cells in a culture and therefore not all of the cells in that culture are embryonic stem cells. This means that there is a low yield in terms of the number of embryonic stem cells that are produced from each culture of skin cells. therefore a new method needs to be thought out where the virus is taken up by all of the cells in the culture and therefore there is a higher yield and also there is no need for separation of stem and skin cells after the process has been carried out.

Another issue with using embryonic stem cells is that the virus does not work one hundred per cent of the time, the virus has been known to cause some mutations to the cells that if injected in the human body could cause more problems that they solve, such as cancer. Therefore a new method needs to be drawn up for inserting the gene into the skin stem cells in order for this method of stem cell production is to be used.

### **Conclusion**

To conclude, I believe that the use of Adult stem cells is worth the little controversy that surrounds their use as they are more widely accepted and can still have a large impact on modern medicine if they are able to cure those 65 illnesses that were previously incurable. In terms of embryonic stem cells I believe that the future lies in the hands of the skin stem cells, however a lot of

research needs to be done to make sure that they are genetically identical to pluripotent embryonic stem cells and also the method of which they are produced needs to be looked at and improved drastically. I believe that if skin stem cells did not exist then embryonic stem cells are still worth the controversy that surrounds them as they would have a massive impact on modern medicine and with procedures such as abortions being carried out daily then the controversy that surrounds them is not significant enough to stop the testing of these cells. If however, these problems are overcome then I believe that the impact that these stem cells could have on modern medicine will be huge and could be the biggest medical breakthrough in terms of treatment of illness in history however I believe that there is a long way to go before this scenario is reached however most people will be waiting with bated breath to see the outcome of testing and will monitor the progress of these tiny cells very closely.

## **Evaluation**

I wanted to do this project as it was an opportunity for me to do a subject that I chose to do, not bound by a syllabus and do all my own research without being told which sources to use and which websites are useful. Overall I think that I rose to the challenge well with this project, however if there are things that if I had the opportunity to do the project again I would do differently.

Initially in this project I wanted to write the project using the title "Are the Impacts that Stem Cells will have on Modern Medicine worth the Cost and Controversy that Surrounds them?" However when initially researching I found it difficult to find sources talking about the sort of money that is spent on the use of stem cells every year and therefore I dropped the cost aspect on the project.

However if I could do the project again I would have probably spent more time on the cost aspect, because it would be interesting to see whether the results that we are getting are worth the cost of the research per year, and this would have added another aspect to the stem cell debate in this project.

Another thing I would have done would have been to start my write up earlier as earlier in the year I had more time which I could have used for my dissertation, however as the year went on and the exams drew nearer I found that I had a lot more work and I found it difficult to find time to write my dissertation.

I have learnt that I can be a lot more organised with my time as juggling this project with my four other A-levels was a tough ask however I managed to achieve this. Also this project broadened my knowledge on a very important subject in medicine and the information that I acquired from doing this project was very useful in my medicine interviews and could have been the difference between receiving a rejection and a condition offer in one case.

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IS THE IMPACT STEM CELLS WILL HAVE ON MODERN MEDICINE WORTH THE CONTROVERSY THAT SURROUNDS THEM?

Potential uses of Stem cells

Stroke, Traumatic brain injury, Learning defects, Alzheimer's disease, Parkinson's disease, Missing teeth, Wound healing, Bone marrow transplantation (currently established), Spinal cord injury, Osteoarthritis, Rheumatoid arthritis, Stroke, Baldness, Blindness, Deafness, Amyotrophic lateral sclerosis, Myocardial infarction, Muscular dystrophy, Diabetes, Multiple sites: Crohn's disease, Cancers

Mansur Batchelor, 2550, Level 3 Extended Project Unit 1: Dissertation

### Contents

- Rationale
- Key terms
- My Journey
- Research
- What I found
- Conclusion
- Self-Evaluation

### Rationale


- Aspiring medical student
- University choice, "Bart's and The London" are leading researchers of stem cells
- Potentially the biggest medical breakthrough in history
- Wanted to learn more about the potential of stem cells and how close we are to using them as treatment

### Key terms

- Differentiation
- Pluripotent
- Multipotent
- Blastocyst

### My Journey

- Decided I wanted to do an Extended project
- Wanted to do a topic about medicine
- Remembered talk by Chris Evans
- Decided to write about stem cells
- Began finding books and internet sources



### My Journey- continued

- Began write up with title "Are stem cells worth the cost and controversy surrounding them?"
- Dropped the cost aspect of the project
- Prepared for presentation and wrote abstract

## Research

- 22 sources in total
- 5 books
- 2 journals
- 15 websites
- Main source  
"Fundamentals of  
the stem cell  
debate"



## What I found?

- Embryonic stem cells pluripotent
- Adult stem cells multipotent
- A lot more controversy surrounding embryonic stem cells
- Religious controversy
- Ethical controversy
- Political issues
- Skin stem cells

## Conclusion

- Adult stem cells should be regularly used
- Skin stem cells have most potential
- However research does need to be done
- We could have a miracle cure on our hands

## Self evaluation

- Difficult to find time
- Time organisation improved
- Knowledge from this helped at interview
- If I had more time, would have researched the cost aspect of the project

**Any Questions?**

## Picture References

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