**Stem Cell Controversy**

Mention the word 'foetus' and heated controversy is likely to soon follow. This is particularly the case in the field of embryonic stem cell research.

Embryonic stem cells are derived from the foetus-research into the therapeutic properties of these stem cells and have triggered massive debate amongst politicians, religious groups, the general public and lastly, a minority of scientists.

**Good and Bad of the Stem Cell Debate**

Opponents of embryonic stem cell research compare the destruction of an embryo to an abortion. They believe that the embryo constitutes life because it has the potential to fully develop into a human being. Those against embryonic stem cell use believe that is it immoral and unethical to destroy one life to save another.

By using stem cells and discarding the embryo, it is thought that human life is ultimately de-valued by this act and is paving a slippery slope for further scientific procedures that similarly de-value life. In particular, many religious groups who are adamantly pro-life have condemned embryonic stem cell research and all of its applications. Other arguments against embryonic stem cells cite the fact that adult stem cells are the ones currently being used in therapies and thus, there is no need to even venture into embryonic stem cell territory.

Those who support embryonic stem cell research believe that an embryo is not equivalent to human life because it is inside the womb. Supporters also contend that the societal costs of many diseases and conditions, both in monetary and suffering aspects, means that the ethical concerns regarding embryonic stem cell usage are not sufficient to warrant discontinuation of this promising therapy.

Another argument for embryonic stem cell research is that the embryos are leftover from in-vitro fertilisation and would otherwise be destroyed, so they should instead be put to greater use. Even further down the line in development is the belief that those embryos from legal abortions, which have already been destroyed, would be better used to advance human health rather than simply discarded.

**Any Solutions to this Conundrum?**

Fortunately, there are alternatives but they are far from perfect and they do still require further research before they can be used with an acceptable level of success. Two new embryonic stem cell treatments avoid the foetal destruction by either:

* Deriving embryonic stem cells without destructing the foetus
* Obtaining embryonic stem cells without actually creating a foetus

In altered nuclear transfer (ANT), an embryo is not created. A derivative of somatic cell nuclear transfer (SCNT), the nucleus of the somatic cell (any body cell other than an egg) is altered, or genetically reprogrammed, prior to being transferred into the egg. The alteration consequence is that the somatic cell DNA still produces stem cells but does not generate an embryo.

In blastomere extraction, an embryo is created but not destroyed. This procedure is performed on a two-day old embryo, following the division of the fertilised egg into eight blastomeres or cells. Previously, the techniques used for harvesting involving the derivation of embryonic stem cells at a later developmental stage, when the embryo is made up of approximately 150 cells. When these cells were harvested, the embryo was destroyed. Embryonic stem cells can instead be extracted from blastomeres, therefore preventing embryo destruction and allowing use of stem cells for research and therapeutic treatment of disease.

The other alternative is to strictly use adult stem cells because these are derived from adult tissues. The therapeutic potential is lower, however, because adult stem cells can't differentiate into as many different types of cells as can embryonic stem cells. They are also more likely to have developed genetic abnormalities over time and they don't tend to replicate as efficiently.

It is unlikely that a comprehensive solution will be found for the embryonic stem cell debate anytime soon. In the meantime, both national and international policies along with collective public views will likely guide the research and therapy efforts for [Embryonic Stem Cells](http://www.explorestemcells.co.uk/creating-embryonic-stem-cells-embryo-destruction.html). There is no doubt that stem cells have great potential for treating disease but there unfortunately still remain doubts as to the ethical and moral ramifications of pursuing this potential.

**Stem Cell Safety**

It is an unfortunate reality that the therapies often holding the most potential also carry numerous queries regarding their safety. Stem cells are one such topic of concern - their potential to treat disease is exciting but their safety concerns have kept them from being approved for many treatments, despite their initial indications of promising success.

#### Do the Stem Cells Act as Intended?

A crucial element in assessing stem cell safety is the question: do the cells act as they are intended once transplanted? The unpredictable reality can be that once implanted, stem cells may begin to uncontrollably divide and differentiate into cancer cells, leading to tumour growth. Scientists test the therapies by inducing conditions in laboratory animals, such as a diabetic condition in mice. Laboratory animal models are still, however, far from being perfect predictors of how stem cells will behave once transplanted in humans. The fear of unregulated growth leading to cancerous tumour development is a frightening concept that must be solved before stem cells can reach mainstream status for use to treat the full range of diseases they show potential to help.

#### Stem Cell Contamination

Stem cell lines used for research are not always 'pure' because their exposure to other animal cells to maintain viability results in contamination. Many animal cells contain microscopic microbes and diseases that are undetectable and contaminate human embryonic stem cells used for research. Older stem cell lines that are approved for use are also not as 'fresh' and may therefore develop genetic dysfunctions due to their age. As they proliferate, these genetic abnormalities then put the cells at risk for developing into a tumour. Used in a stem cell transplant, the ramifications could potentially be very dangerous.

#### Donor Screening

Regardless of the stem cell source - whether embryonic, adult or cord blood - screening is important to ensure compatibility to the recipient and the specific medical condition being treated. If stem cells were derived from someone with a strong familial history of cardiovascular disease, for example, they would perhaps not be well suited to a recipient who required cardiac heart cells for a damaged heart. In addition, gene analysis and testing for infectious diseases is mandatory to prevent transmission to the recipient.

#### Biological Activity of Stem Cells

Before stem cells are transplanted, they must possess sufficient biological activity to ensure that they will be successful once implanted. This basically means that scientists need to be certain that the stem cells are healthy and functioning before going through the arduous process of transplantation, often for a person who is extremely ill and can't afford the time-consuming procedure of a stem cell transplant that simply won't work.

Clearly, stem cell safety must be scrutinised and assessed throughout the entire treatment or research process. Guidelines and strategies must also be developed to ensure that every aspect of stem cell use - from identification and isolation of stem cells to stem cell transplant - is stringently coordinated. Stem cell lines must be adequately screened for disease and the sources must be examined in depth. If doctors and scientists can establish safe protocols for stem cell use, everyone can benefit from the full potential of the remarkable and possibly life-saving stem cell therapies.

**Immunological Challenges for Stem Cell Research**

Stem cells carry a vast potential for treating disease but they also come with hurdles that must be overcome to ensure their success and viability for treating disease. One challenging area is that involving a patient's immune system. The challenges are also unusual because they mostly pertain to embryonic stem cells whereas adult stem cells can actually alleviate immunological challenges that tend to accompany embryonic stem cells. It's important to understand what exactly happens during immune rejection before looking at the different immunological consequences from use of embryonic stem cells.

**What Is Immune Rejection?**

Immune rejection is a complication that may occur with stem cell transplantation. When it occurs the immune system of a person sees the transplanted cells as 'foreign' and thus begins a fast and possibly aggressive response to attack those cells that are not recognized as 'self.' During a chronic rejection response, the attack is:

* Milder
* Occurring over a longer time period

In the case of acute rejection, the attack is:

* Aggressive/strong
* Immediate

Whether a rejection is acute or chronic, the ultimate consequence is that the patient's body rejects the stem cells.

**How Do Embryonic Stem Cells Trigger An Immune Reaction?**

Embryonic stem cells hold enormous potential and benefit for treating disease because they have the ability to differentiate into virtually any tissue in the human body. This means that if scientists can learn to successfully and safely control and regulate their growth, the unspecialised embryonic stem cells can be coaxed to differentiate into specialised cells for almost any tissue in a patient's body. The problem is that the transplanted cells will likely be recognised as foreign and a person's immune system will reject the potentially life saving treatment.

**Immunosuppressive Drugs**

By utilising treatment with immunosuppressive drugs, the reaction can be reduced but if the response is already mounted, the drugs will not eliminate the body's attack. A problem with immunosuppressive drugs, however, is that they essentially wipe out a patient's immune system and thus, leave the patient highly vulnerable to infection. Any microscopic diseases in the stem cells or surrounding environment can more easily harm the patient.

**Nuclear Transfer**

Nuclear transfer is a newer, potentially promising approach to combating an immune reaction sparked by embryonic stem cells. It replaces the DNA of embryonic stem cells with a patient's DNA, rendering the new and healthy stem cells, 'self.' Additional research is still required to make this a regularly used viable procedure, but it does appear to hold great potential for overcoming the immunological challenges of embryonic stem cell therapy.

**Using Adult Stem Cells**

Adult stem cells offer a way to overcome the immunological challenges associated with embryonic stem cells. The approach to avoid an immune rejection is to provide a perfect match between a donor and recipient. If the match is similar, a person may still need to remain on immunosuppressive drugs for a lifetime to prevent rejection. Adult stem cells utilise a person's own cells, which are isolated from tissues, triggered to multiply in culture, and then transplanted back into the patient. This type of therapy thus avoids the immunological challenges of embryonic stem cell therapy although adult stem cells do not multiply as readily in comparison with embryonic stem cells.

The immunological challenges of stem cell therapy are important to address because they are capable of rendering stem cell treatment useless. Research into new therapies to prevent rejection will hopefully allow patients with serious diseases to benefit from stem cell therapies.

**Concerns About Stem Cells**

Despite the enormous therapeutic potential for stem cells to treat a vast array of serious diseases there are still concerns about potentially dangerous results. Scientists are excited about the possibilities of saving lives and reducing morbidity from disease but at the same time, there are fears regarding unexpected results and effects from stem cell usage. With recent technologies having triggered a major increase in stem cell treatments, the concept of stem cell therapies is no longer such a foreign one.

Both scientists and the public shouldn't, however, simply accept these technologies without first contemplating their impact on society. Although the benefits of stem cell therapies are enormous, risks must also be considered.

#### Passing on Viruses

A possible concern is that stem cell therapy could pass on viruses or other microscopic agents that cause disease. Patients who are receiving transplants often take strong drugs that essentially 'wipe out' their immune system. This is to reduce the chances of their body rejecting a transplant. The flip side is that if any viruses are present in the transplanted stem cells, a patient's immune system is completely vulnerable to disease.

#### Diseases From Other Animals

Animal sources may be used to provide nutrients to stem cells that are being cultivated in the laboratory. These sources could contain various diseases that may then be passed on to humans receiving cell-based therapies. A concern is that screening is currently insufficient to detect known diseases that may be present. Also, there may be diseases we are still yet unaware of that could be passed on to humans.

#### Uncontrolled Growth

One concern with embryonic stem cells is related to the very quality that makes them so useful and versatile. Embryonic stem cells are 'young' cells and tend to grow quickly; the fast growth must, however, be carefully guided by scientists. These stem cells need to be cultivated and directed into specialised cells with great care because the potential for remaining stem cells to grow uncontrolled could be disastrous. These uncontrolled cells could eventually form tumours.

#### Misdirected Growth

The possibility of transplanted stem cells differentiating into the wrong type of tissue is yet another concern regarding therapeutic stem cell use. Once stem cells are cultivated in a laboratory, researchers need to control and direct their growth into desired tissue cells. Scientists are attempting to overcome this problem by inducing partial stem cell differentiation prior to transplanting it into a patient. This would hopefully limit the capacity of the cells to differentiate into undesired tissue types once implanted.

At present, scientists still know very little about how stem cell differentiation is controlled. One such example occurred in 2001, when researchers claimed to have created cells that produced insulin. This claim was later found to be incorrect because cells had merely absorbed insulin from the environment, rather than producing it. Further research will ideally explain how cell signals operate to trigger cell differentiation.

Current stem cell treatments may eventually become routine and regular therapies for serious disease. It's important, however, that the safety of these therapies is evaluated and that caution is displayed before a therapy becomes accepted for use. This will allow everyone to reap the full benefits of stem cell therapies.