



## STEM CELL FACTS

1. Stem cells are uncommitted cells that have the potential to turn into any cell in the human body. Scientists are able to isolate stem cells and to keep them indefinitely.
2. We *may* be able to direct stem cells to become any type of human cell (nerves, heart etc.) that can't normally be replaced once damaged.
3. Stem cells can be found in: embryos; umbilical cord blood and adults (bone marrow and brain);
4. Injected into patients, stem cells might slow or even stop degenerative diseases and, possibly, cure burns and certain types of injuries.
5. Diseases that may be treated using stem cells include Parkinson's Disease, Cystic Fibrosis, Multiple Sclerosis, Muscular Dystrophy, Leukaemia, Diabetes, Hepatitis and Osteoporosis.
6. There are ethical issues surrounding the use of stem cells taken from embryos. It is also uncertain whether the therapy will be effective.



## EMBRYONIC STEM CELL FACTS

1. Embryonic Stem Cells are usually taken from embryos about a week old. This process destroys the embryo.
2. The embryos used to obtain stem cells may be created specially or may be 'spare' embryos from IVF treatments.
3. During IVF (in-vitro fertilisation) many embryos are made but not all are implanted into the mother.
4. There are many thousands of spare embryos in the UK. Some feel they may be 'spare' because they are low quality.
5. Embryos created just for research can be created using normal IVF methods (from egg and sperm) or by cloning.
6. There may be problems with rejection when stem cells are used to treat patients. Unless made from a cloned embryo the stem cells will not be genetically matched to the patient and the patient's body may reject them
7. Stem cells can be taken from cloned embryos that are matched to the patient, this avoids problems with rejection. However, there are technical and ethical difficulties.

## THERAPEUTIC CLONING FACTS

1. One of the challenges in stem cell research is to stop the patient's body rejecting the stem cells as foreign tissue.
2. Creating stem cells by using a technique called nucleus transplantation (or therapeutic cloning) can overcome rejection.
3. First the DNA is removed from the egg cell, leaving an egg with no genetic blueprint. Then the patient's DNA is put into that 'blank' egg cell.
4. The egg cell with the patient's DNA in can be made to divide and become an embryo.
5. Stem cells can then be harvested from this embryo after a few days.
6. Some people claim that if therapeutic cloning is banned, embryonic stem cell research may have no effective application. Others strongly reject this.
7. Some people distinguish therapeutic cloning from the cloning of a human - reproductive cloning.
  - a. In therapeutic cloning an embryo is made to match a patient's DNA - cells taken from this embryo are used to treat the patient. There is no intention to create an independent human being.
  - b. Reproductive cloning would aim to implant a cloned embryo into a woman's womb so that it could develop. The result of this would be a person genetically identical to the person who's DNA was used to create the embryo.



## ALTERNATIVES TO EMBRYONIC STEM CELLS

1. Research into *alternatives* to Embryonic Stem Cells (ES cells) is in its very early stages. It is unclear how successful it will be.
2. Stem Cells are found in a few tissues in *adults*, such as bone marrow and the brain. These Stem Cells are difficult to obtain. They may have the potential to develop into fewer different types of cells than ES cells.
3. *Adult Stem Cells* are less controversial than ES cells but they are present only in low numbers and much less research has been done on them than on ES cells.
4. Stem Cells are also found in the *umbilical cord blood* at birth. These are easier to obtain than Adult Stem Cells and may pose fewer rejection risks.
5. It might be possible to re-programme ordinary adult cells, i.e. *non-stem* cells to become other types of cells but this is still unsure.
6. Another alternative is to decide not to use stem cells as a treatment for disease and to give up stem cell research altogether.

## EMBRYONIC DEVELOPMENT

<b>Day 1</b>	Sperm and egg join
<b>Day 14</b>	Primitive streak appears, this will become the nervous system Embryo may split into twins until this point. Legal cut off point for embryo research in UK (and many other countries) Many embryos will spontaneously abort before this without the mother even knowing.
<b>Week 8</b>	Embryo becomes a foetus. All external and internal structures present.
<b>Week 10</b>	Brain structure complete, face has human appearance.
<b>Week 20</b>	Mother feels movement.
<b>Week 22-24</b>	Foetus becomes 'viable', i.e. could survive outside the mother.
<b>Week 24</b>	Foetus responds to light, sound and sensory stimulation. Cut off point for abortions for social reasons in the UK. (Abortion for medical reasons is legal until full term in the UK.)
<b>Week 26</b>	Brain waves similar to full term baby.
<b>Week 30</b>	Eyes open.
<b>Week 38-40</b>	Baby is full term.