Stem Cells: Problems Solved?

Emily Brown

It is almost undisputed that stem cells are of huge importance in terms of furthering our scientific understanding and advancing our medical abilities. Despite this, embryonic stem (ES) cell research has been surrounded by controversy, and the freedom of research has been greatly restricted by ethical disputes and consequent legislation. In the US, only limited use of ES cells is allowed by scientists receiving public funding *(1)*. But, at last, in the light of a new technique for creating stem cells, will the ethical conflict cease, and stem cell research be able to flourish fully?

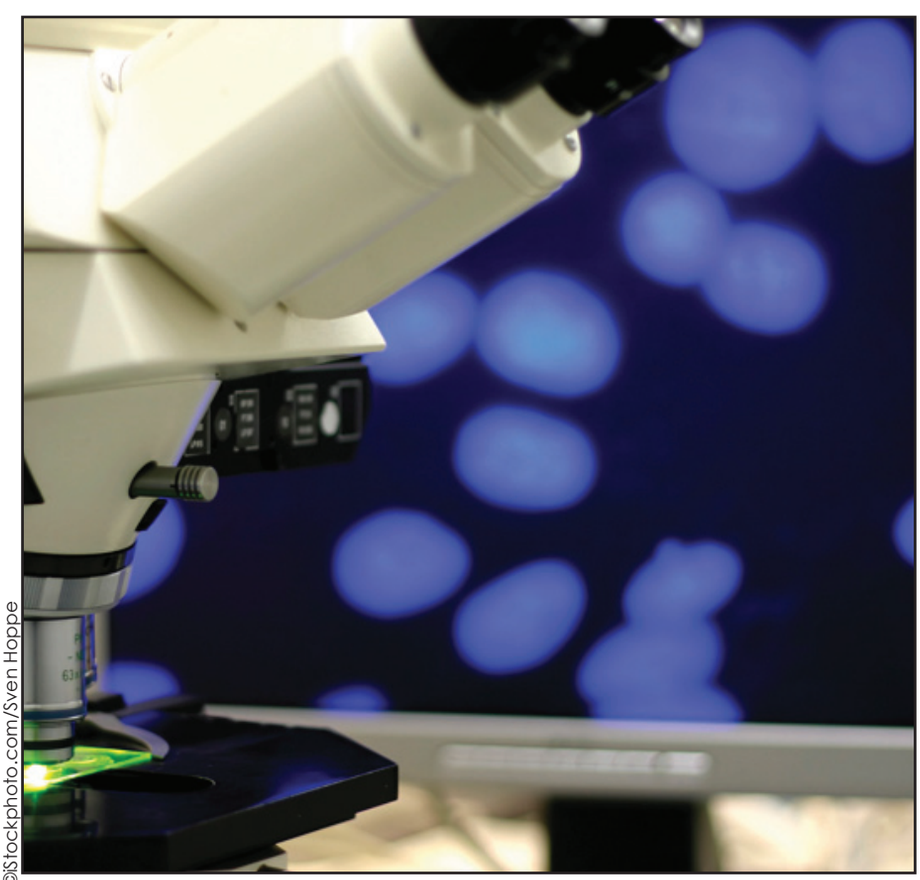
Stem cells are unspecialised cells with two important characteristics: they can replenish their numbers for a long time by cell division, and, given specific signals, they can differentiate into specialised cells with specific functions. The ES cells used for research have the potential to become any of the approximately 220 cell types in the body. There is enormous medical potential for using ES cells to replace cells lost in various diseases. Further to this, studying human ES cells may give information about the complex events that occur during human development *(2)*, and could aid in testing the safety of new drugs *(2)*.

The ethics of using ES cells have been hotly debated for some time now, since, to obtain them, human embryos are used and destroyed. The embryos are generally those that have been created in IVF, but never implanted. Many see this use of surplus embryos as unacceptable, considering them to be potential life. The pro-life movement "recognises fertilisation as the start of new life," and believes that "it can never be right to deliberately end an innocent human life" *(3)*. Research published in November 2007 has given hope that there may be light at the end of the long tunnel of controversy. Teams from Japan and the US have made the equivalent of ES cells starting from a normal adult cell *(4,5)*. Differentiated human somatic cells were reprogrammed to generate 'induced pluripotent' stem (iPS) cells. In essence, they have turned back the developmental clock, and created cells which have the potential to turn into any tissue in the body. The Japanese team used a retrovirus to insert four transcription factors into the adult cells. The iPS cells that were created show the essential characteristics of ES cells, and the researchers induced them to differentiate into both neural cells and beating heart cells. The US team carried out a similar process using a slightly different combination of transcription factors.

Crucially, in terms of the ethical debate, this new technique allows the creation of stem cells without the need to use an embryo, allowing stem cell research to be carried out in a much less controversial manner.

The former ethical hurdles, claims Thomson, a member of the US team, have "set the field back four or five years." Pro-life campaigners are delighted with the new discoveries: "It is a very ethical way forward. For once we have got better science coinciding with better ethics," says Josephine Quintavalle, of Comment on Reproductive Ethics. Despite the proclaimed success of this technique, there are still major caveats to be tackled. The specific processes leading to the reprogramming need to be understood, and, although the iPS cells appear very similar to ES cells, further research is required to ensure there are no significant, but as yet unnoticed, differences.

Finally, the greatest concern is the safety of this technique. The technique relies on viruses, which may increase the chances of tumours forming. In the future, methods which do not rely on viruses must be developed to ensure the safety of the process. Nonetheless, we can still benefit from these cells in the short term, by using them for testing drugs and studying disease mechanisms, and it is certainly clear that this discovery is a fundamental landmark in overcoming the ethical barriers to stem cell research.



©Stockphoto.com/Sven Hoppe

Emily Brown is a 2nd Year, reading Biological Natural Sciences, at Christ's College.She is currently an Associate Editor for The Triple Helix, Cambridge.

References:

1. BBC News, *Skin transformed into stem cells*, **2007** news.bbc.co.uk/1/hi/health/7101834.stm
2. National Institute of Health, *Stem cell information, Stem cell basics* stemcells.nih.gov/info/basics/
3. Prolife Alliance, *Embryo Abuse* www.prolife.org.uk/pdfs/Embryo_abuse.pdf
4. Takahashi, K. et al. *Cell* **2007**, *131*, 861-872.
5. Yu, J. et al. *Science* **2007**, *318*, 1917-1920.