

Update to BCC stem cell document.

Induced Pluripotent Stem Cells (iPSC)

Since 2006, a new technique for obtaining pluripotent stem cells (PSC), which are remarkably similar to naturally isolated PSC's, was developed to eliminate the need for obtaining these cells from the inner cell mass of the embryo thereby destroying the embryos in the process. This means that a substantial number of PSC's are now available without the necessity to sacrifice embryos to obtain them. iPSC's are obtained by re-engineering the DNA genes of mature non-pluripotent cells such as fibroblasts into genes with the pluripotent capacity. This is achieved through the help of a vector such as a virus which delivers the stem cell associated genes.¹ iPSC's were first produced from humans in 2007.² The danger in this process is the triggering of oncogenes which can trigger cancerous growths if these were to be used in humans. In 2008, a better method was developed where an adenovirus was used instead of a retrovirus as a vector to transfect human cells and this method eliminated the risk of oncogenesis as the adenovirus did not pass any of its genes to the human host.³ In 2009 a procedure that generated human iPSC's was developed where the use of a vector was eliminated by the direct delivery of proteins in the target cells, which proteins were sufficient to induce pluripotency.⁴ The efficiency in this method is still however very poor.

Safety of iPSC's for human use

Since at present the only efficient method to produce iPSC's is through the use of virus vectors, any potential clinical application, runs the risk of forming tumours in the human subject. Adenoviral use is always better than retroviral use. There is also a danger that these iPSC's could theoretically be injected by micropipette into hollow trophoblasts and after blastocyst uterine transfer, this can result in creating chimeric living organisms. This was successfully carried out in mice and can potentially also be carried out in human beings. A new non-sexual form of asexual reproduction just

¹ Baker, Monya (2007-12-06). "[Adult cells reprogrammed to pluripotency, without tumors](http://www.nature.com/stemcells/2007/0712/071206/full/stemcells.2007.124.html)". *Nature Reports Stem Cells*.

<http://www.nature.com/stemcells/2007/0712/071206/full/stemcells.2007.124.html>. Retrieved 2007-12-11.

² Kolata, Gina (2007-11-21). "[Scientists Bypass Need for Embryo to Get Stem Cells](http://www.nytimes.com/2007/11/21/science/21stem.html)". *The New York Times*. ISSN 0362-4331. <http://www.nytimes.com/2007/11/21/science/21stem.html>. Retrieved 2007-12-11.

³ Rob Stein (2008-09-25). "[Scientists Find Way to Regress Adult Cells to Embryonic State](http://www.washingtonpost.com/wp-dyn/content/article/2008/09/25/AR2008092502099.html)". *Washington Post*. <http://www.washingtonpost.com/wp-dyn/content/article/2008/09/25/AR2008092502099.html>.

⁴ "[Cell Stem Cell - Generation of human induced pluripotent stem cells by direct delivery of reprogramming proteins](http://www.ncbi.nlm.nih.gov/pubmed/19481515?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=3)". http://www.ncbi.nlm.nih.gov/pubmed/19481515?itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum&ordinalpos=3. Retrieved January 23rd 2010.

as cloning is! For the moment the use of safe iPSC use in humans is still a serious concern⁵ as regards generation of tumours.⁶

⁵ Takashi Aoi, "et al". generation of Pluripotent Stem Cells from Adult Mouse Liver and Stomach Cells. *Science*[doi:10.1126/science.1154884](https://doi.org/10.1126/science.1154884)

⁶ Ivan Gutierrez-Aranda, "et al". Human Induced Pluripotent Stem Cells Develop Teratoma More Efficiently and Faster than Human Embryonic Stem Cells Regardless of the Site of Injection. *Stem Cells*[doi:10.1002/stem.471](https://doi.org/10.1002/stem.471)