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# Editorial: Cell therapy – When will it deliver its promise?

Stem cell research has attracted enormous public attention and the USA has banned the creation of more human stem cell lines from embryonic material. This raises the question of when and how cell therapies based on human cells will be developed into products.

The use of human foetal-derived neural cells has been successful on a small scale for treating Parkinson's disease, largely limited by supply of cells and the ethical difficulties of using cells from several foetuses for each patient. Skin and cartilage can be grown in culture and autologous cultured skin and cartilage is now routinely used. Promising results have been reported from clinical trials using cell therapy to treat type I diabetes and heart disease. However these two, and most other cell therapies, still have to overcome the problem of rejection of the transplanted cells by the immune system. The one area of the body that tolerates the transplantation of allogeneous (from another person) cells is the central nervous system (CNS), protected by the blood-brain barrier, where immune rejection drugs are only required for a few weeks after transplantation. This opens the door to cell therapies to treat CNS diseases such as Parkinson's disease, stroke and Alzheimer's, and to spinal cord repair.

The term 'stem cells' has acquired a loose meaning, where strictly speaking it applies only to cells with the capacity to grow and divide indefinitely. Many so-called 'stem cells' do not fall into this category but are already committed towards a developmental pathway. These cells need to be immortalised if pure cultures with a precise function are to be produced. This

requires the use of genes such as the well-described, public domain *SV40T* or the telomerase genes used by Geron. Adult 'stem cells' may lack the capacity for multiplication that is necessary for development of commercial products, although there is much activity in this area. Embryonic 'stem cells' need to be directed, *in vitro* or *in vivo*, to produce the cell types required for repair of the part of the body being treated and not to produce other cell types or multiply elsewhere in the body. Direction of this developmental process is not yet routinely possible.

Recent publication of Parkinson's disease cell therapy clinical trial results in the *New England Journal of Medicine*<sup>1</sup> highlighted the need for a safety mechanism to control cells after they are transplanted. These may be the genetic approach, as used by CellFactors or encapsulation as used by NS Gene and Neurotech, but recently discontinued by Modex owing to inadequate expression levels by the encapsulated cells.

There will probably be a rationalisation in the number of cell therapy companies, like the rationalisation of the monoclonal antibody industry into the hands of the companies with dominant intellectual property. Much of the key intellectual property is held by several key players such as Geron (telomerase), Osiris (mesenchymal stem cells), CellFactors (immortalised differentiated cells), NS Gene (neural cell encapsulation), Genzyme (autologous cartilage) and Isotis (skin).

Cell-derived products, where the cell wall and cell organelles have been removed, are unlikely to suffer from immune rejection and are likely to have a faster time to market

than cell transplantation. Applications include bone repair and cartilage repair where products are likely to be only a few years away. These first products will follow the current skin repair products and pave the way for transplantation of neural cells as therapeutic treatments for Parkinson's disease and other neural degenerative diseases. My prediction is that we will see enormous progress in cell therapy within the next five years, leading to very significant clinical benefits.

**Reference**

1. Freed, C. R., Greene, P. E., Breeze, R. E. *et al.* (2001), 'Transplantation of embryonic dopamine neurons for severe Parkinson's disease', *New Engl. J. Med.*, Vol. 344, No. 10.

*Dr Iain Cubitt  
Chief Executive Officer,  
CellFactors plc,  
St John's Innovation Centre,  
Cambridge, UK*

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