

Application of Stem Cell Therapy in Parkinson Disease

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Embryonic stem (ES) cells have been suggested as candidate therapeutic tools for cell replacement therapy in neurodegenerative disorders. However, limitations for the use of these cells lie in our restricted knowledge on the molecular mechanisms involved in their specialized differentiation and in the risk of tumor formation.

Although most cells of the body, such as muscle cells, are committed to fulfilling a particular function, a stem cell is uncommitted until it receives a signal to develop into a specialised cell. Stem cells can be obtained from embryonic, foetal and adult tissues. Based on their differentiation potential, stem cells can be:

- (i) Pluripotent, meaning that they can individually give rise to all types of cells that develop from the germ layers (endoderm, mesoderm and ectoderm) and germ cells,
- (ii) Totipotent, cells that have the capability of pluripotent cells plus the ability to give rise to placental tissue,
- (iii) Unipotent, can give rise to only one type of differentiated cell, and
- (iv) Multipotent, a state between unipotent and pluripotent.

Parkinson's Disease exemplifies a type of disorder that could prove miraculously tractable to stem cell therapies. Even early studies that injected crude human fetal tissue extracts (presumably containing stem cells) appear to have had some long-term benefits, although those results are continually re-evaluated. Unfortunately, this approach has daunting drawbacks, including how much tissue is needed for each treatment and a lack of uniformity in tissue extracts used for each individual treatment.

There are parallels between Parkinson's and diabetes, that appears to respond to stem cell therapies in a mouse model. Although molecular mechanisms are not completely understood, in the initial progression of diabetes only islet cells die, and therefore only one kind of cell needs regeneration. In research in mice, scientists took cells from the pancreas and grew them in culture. Unable to characterize stem cells visually, they simply took all the cultured cells and transplanted them. The mice seemed to grow normal islet cells and their diabetic condition seemed to reverse (long-term results are pending). An islet cell transplant protocol is being developed for diabetes, but—as in Parkinson's—this approach is limited by the availability and consistency of the cells.