Potential for Cell Therapy in Parkinson's Disease Using Genetically-Programmed Human Embryonic Stem Cell-Derived Neural Progenitor Cells.

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Authors: Rajesh Ambasudhan, Nima Dolatabadi, Anthony Nutter, Eliezer Masliah, Scott R McKercher, Stuart A Lipton

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Public Summary:
Human embryonic stem cells (hESCs) are currently the most reliable and self-renewable source of homogeneous and quantifiable populations of dopamine-producing neurons for cell transplantation therapy in Parkinson's disease (PD). In this article, we show recent advancements in harnessing this potential of hESCs for transplantation in PD. In particular, we discuss our new findings that genetically-programming the hESCs with the transcription factor MEF2c can mitigate some of the bottlenecks in prior stem cell therapeutic approaches by limiting tumor formation and enhancing nerve cell survival, both of which are critical for the clinical translation of this stem cell approach.

Scientific Abstract:
Neural transplantation is a promising strategy for restoring dopaminergic dysfunction and modifying disease progression in Parkinson's disease. Human embryonic stem cells (hESC) are a potential resource in this regard because of their ability to provide a virtually limitless supply of homogenous dopaminergic progenitors and neurons of appropriate lineage. The recent advances in developing robust cell culture protocols for directed differentiation of hESCs to near pure populations of ventral mesencephalic (A9-type) dopaminergic neurons has heightened the prospects for PD cell therapy. Here, we focus our review on current state-of-the-art techniques for harnessing hESC-based strategies towards development of a stem cell therapeutic for PD. Importantly, we also briefly describe a novel genetic-programming approach that may address many of the key challenges that remain in the field and that may hasten clinical translation. J. Comp. Neurol., 2014. (c) 2014 Wiley Periodicals, Inc.