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Induced pluripotent stem cells as models of human disease: A promising approach for studying Parkinson's disease

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Induced pluripotent stem cells (iPSCs) have great potential to model, and possibly treat human ailments that have long been difficult to study in the laboratory. One example is Parkinson's disease (PD), a progressive neurodegenerative disorder marked by a loss of dopaminergic neurons in the brain. Because of the lack of access to disease tissue and the paucity/scarcity of good animal models, iPSC-generated neurons hold promise in the development of model systems to study PD. Beyond the core principles of generating iPSCs, a series of technologies are needed to develop these cells as disease models and therapeutics. These include the non-integrating introduction of stem cell factors, precise editing of iPSC genomes and effective differentiation methods. Using PD as an example, the author will describe a non-integrating virus delivery system that was used to generate iPSCs from Parkinson's patients and a Transcription Activator-Like (TAL) effector nuclease technology for targeted DNA editing of those cells. The author will also cover methods for studying these PD patient cells, including methods for direct differentiation of iPSCs to neural stem cells (NSCs) without the usual intermediary embryoid body and rosette formation, and downstream methods for monitoring phenotypes that are associated with PD cells. A long-term goal is to use these cells and assay technologies as a platform for interrogating small molecule compounds in order to identify drug candidates that "relieve" the phenotypes associated with PD. The author will end with thoughts on challenges, but hope, of using stem cells to model and treat human diseases.

Biography

Stephen Lin received his Ph.D. from the Washington University in St. Louis and did his Postdoctoral research at Harvard University. In 2006 he joined StemCells, Inc. of California as a Scientist for liver cellular therapeutics, where he discovered pathways that contribute to the rapid decline of function and expansion of primary human hepatocytes. Since 2012 he has been Staff Scientist for early-stage product concepts at Life Technologies (now part of Thermo Fisher Scientific), a global life sciences company that develops and offers tools for every aspect of stem cell and gene therapy including genetic manipulation, genetic analysis, and cell culture.

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