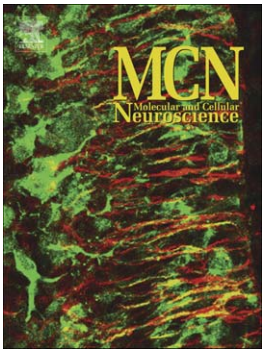

Modeling Alzheimer's disease with human induced pluripotent stem (iPS) cells

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Modeling Alzheimer's disease with human induced pluripotent stem (iPS) cells.

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Abstract

In the last decade, induced pluripotent stem (iPS) cells have revolutionized the utility of human *in vitro* models of neurological disease. The iPS-derived and differentiated cells allow researchers to study the impact of a distinct cell type in health and disease as well as performing therapeutic drug screens on a human genetic background. In particular, clinical trials for Alzheimer's disease (AD) have been often failing. Two of the potential reasons are first, the species gap involved in proceeding from initial discoveries in rodent models to human studies, and second, an unsatisfying patient stratification, meaning subgrouping patients based on the disease severity due to the lack of phenotypic and genetic markers. iPS cells overcome this obstacles and will improve our understanding of disease subtypes in AD. They allow researchers conducting in depth characterization of neural cells from both familial and sporadic AD patients as well as preclinical screens on human cells.

In this review, we briefly outline the *status quo* of iPS cell research in neurological diseases along with the general advantages and pitfalls of these models. We summarize how genome-editing techniques such as CRISPR/Cas will allow researchers to reduce the problem of genomic variability inherent to human studies, followed by recent iPS cell studies relevant to AD. We then focus on current techniques for the differentiation of iPS cells into neural cell types that are relevant to AD research. Finally, we discuss how the generation of three-dimensional cell culture systems will be important for understanding AD phenotypes in a complex cellular milieu, and how both two- and three-dimensional iPS cell models can provide platforms for drug discovery and translational studies into the treatment of AD.