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Scientists develop 3-D stem cell culture technique to better understand Alzheimer's disease

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A team of researchers at The New York Stem Cell Foundation Research Institute led by Scott Noggle, PhD, Director of the NYSCF Laboratory and the NYSCF – Charles Evans Senior Research Fellow for Alzheimer's Disease, and Michael W. Nestor, PhD, a NYSCF Postdoctoral Research Fellow, has developed a technique to produce three-dimensional cultures of induced pluripotent stem (iPS) cells called embryoid bodies, amenable to live cell imaging and to electrical activity measurement. As reported in their *Stem Cell Research* study, these cell aggregates enable scientists to both model and to study diseases such as Alzheimer's and Parkinson's disease.

The NYSCF Alzheimer's disease research team aims to better understand and to find treatments to this disease through stem cell research. For such disorders in which neurons misfire or degenerate, the NYSCF team creates "disease in a dish" models by reprogramming patients' skin and or blood samples into induced pluripotent stem (iPS) cells that can become neurons and the other brain cells affected in the diseases.

The cells in our body form three-dimensional networks, essential to tissue function and overall health; however, previous techniques to form complex brain tissue resulted in structures that, while similar in form to naturally occurring neurons, undermined imaging or electrical recording attempts.

In the current study, the Noggle and Nestor with NYSCF scientists specially adapted two-dimensional culture methods to grow three-dimensional neuron structures from iPS cells. The resultant neurons were "thinned-out," enabling calcium-imaging studies, which measure the electrical activity of cells like neurons.

"Combining the advantages of iPS cells grown in a 3D environment with those of a 2D system, our technique produces cells that can be used to observe electrical activity of putative networks of biologically active neurons, while simultaneously imaging them," said Nestor. "This is key to modeling and studying neurodegenerative diseases."

Neural networks, thought to underlie learning and memory, become disrupted in Alzheimer's disease. By generating aggregates from iPS cells and comparing these to an actual patient's brain tissue, scientists may uncover how disease interferes with these cell-to-cell interactions and understand how to intervene to slow or stop Alzheimer's disease.

"This critical new tool developed by our Alzheimer's team will accelerate Alzheimer's research, enabling more accurate manipulation of cells to find a cure to this disease," said Susan L. Solomon, CEO of NYSCF.

Provided by New York Stem Cell Foundation