

Human Pluripotent Stem Cells and Early Brain Development

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Presentation Description:

I will demonstrate how I create 3-dimensional brain tissue using genetically engineered human stem cells to investigate brain development and disease. Using this approach, I am investigating how a gene mutation involved in autism and epilepsy affects early brain development.

Abstract:

My research focuses on understanding the biological processes that control stem cell identity and how they impact brain development. I will present my project which involves directing the differentiation of genetically engineered human pluripotent stem cells (hPSCs) into 3-dimensional brain tissues called 'organoids'. With the hPSCs, we are able to study the early stages of brain development using human cells. These engineered stem cells carry a mutation that causes epilepsy and autism. The effects of this mutation, we believe, are present during earlier stages of brain development than what has been previously appreciated. The goal of my research is to understand how this mutation affects the earliest stages of human brain development.

In my presentation I will demonstrate how, in our laboratory, we differentiate hPSCs into the mix of cell types that make up the brain. Specifically, I am measuring the amount of brain stem cells and neurons that are generated in order to understand how the disease mutation affects this balance. I will discuss how we culture stem cells in a sterile environment, and how we turn them into brain tissue using defined media formulations and engineered extracellular matrices. To analyze these brain organoids, I stain them with fluorescent antibodies that detect proteins that identify stem cells and neurons, and then image them using cutting-edge microscopy techniques. These ground-breaking technologies have been developed by current leaders in the stem cell field, many of whom work in Canada and the Vancouver region.