3D Human Stem Cell Model for Neural Development

Kopparapu, Ishita (School: Hathaway Brown School)

Organoids are a 3D stem cell model which recapitulate the physiology of human organs and are derived from induced pluripotent stem cells (iPSCs). The purpose of this project was to optimize a cortical organoid differentiation protocol to be implemented in neurodevelopment and disease progression studies. Animal models such as mice have limitations due to the inaccurate representation of the human brain. 2D models such as iPSCs only capture one or two cell types whereas organoids present a unique model as they are closer to that of a human organ's physiology in composition and cell-cell interactions. Thus organoids allow human diseases to be tested in the most human-like model. This project builds off a protocol for cortical organoids that has cost effective advantages. The protocol will be an ideal model for neurodevelopmental and neurodegenerative disease studies with the necessary improvements to increase reproducibility. iPSCs were cultured until completely confluent and later differentiated into cortical organoids to study neurodevelopment. When observing the organoids, growth and cell type antibodies were studied to identify neurodevelopment and progression of differentiation. Results showed that at specific time points, the progenitor cells within the organoid began to migrate. During the differentiation process, neural rosettes formed in the organoids which indicated neural development as they are known to be representative of the neural tube. Signs of neurodevelopment were observed through the neural rosette and further testing of the organoids will confirm observed trends.

Awards Won:
Fourth Award of $500