Immunocytochemical Identification of Layer-Specific Markers in iPSC-Derived Cortical Neurons

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Stem cells have the unique ability to replicate indefinitely and transform into different cell types, making them crucial for applications like tissue repair and drug development. Traditional methods, such as embryonic stem cells or bone marrow, raise ethical, political, and scientific problems. In 2006, Japanese scientist Shinya Yamanaka introduced induced pluripotent stem cells (iPSCs), which enables somatic cells into a pluripotent state (the ability of an immature cell to grow into several different cell types), allowing them to become nearly any cell type except reproductive cells. Unlike conventional stem cells, iPSCs bypass ethical controversies and hold promise for treating a wide range of diseases affecting various organs. Induced pluripotent stem cells (iPSCs) provide a versatile platform for generating patient-specific cells for regenerative medicine. In this study, iPSCs were differentiated into cortical neurons and characterized to identify their cortical layer identity, which means the stem cells were turned into brain cells and then checked to see which type of brain cell and which layer of brain they became. Immunocytochemical staining (a way to tag parts of a cell so they can be seen under a microscope) was performed using antibodies against neuronal and progenitor markers, including Ctip2, MAP2, PSD95, Pax6 and Tuj1. Secondary antibodies conjugated to fluorescent dyes enabled visualization with a Keyence BZ-X810 fluorescence microscope. The results showed that layer V neuronal markers were most commonly expressed in the test samples, combined with positive staining for immature neuronal markers, indicating the presence of a heterogeneous population that included immature cells as well as already differentiated level V cortical neurons. This study demonstrates the ability of iPSC-derived neurons to partially

mimic cortical layer specification, indicating their potential relevance in simulating cortical development and illness.