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Engineering patterned human brain cells on silicon chip

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Abstract

The human brain consists of over 100 billion neurons and one order of magnitude more in supportive glia. Thus, large network studies of the brain at the single cell level become difficult due to the entwined growth of neurons and glial cells in the neocortex. In Neuroengineering, the field of cell patterning promises precise placement of individual cells and their arrangement into organised networks. The majority of studies in cell patterning are limited to small model organisms and rodent studies due to ethics, cost and quick reproduction. However, better models of the pathological human brain, require brain cells derived from human tissue, as their properties provide a better match than those of the commonly used embryonic rat. One alternative to primary tissue is that of stem cell lines which can provide an accessible way to provide large quantities of well characterised neurons. In particular, the human hNT neuron (derived from the human teratocarcinoma cell line (hNT)) and its supportive cell, the hNT astrocyte, express ubiquitous neuronal/astrocytic markers, are widely available and provide the closest model to healthy, adult, functional, human neural tissue. Furthermore, they raise no ethical concerns as neurons are differentiated from an immortalised cell line rather than embryonic tissue.

In this seminar, I will discuss the protocol we developed to pattern the first human hNT neurons on parylene-C/SiO_2 substrates and how, in our more recent work, we have patterned the first hNT astrocyte, on such substrates to single cell resolution.

Biography

Deanna Mulvihill has her expertise in evaluation and passion in improving the health and wellbeing. Her open and contextual evaluation model based on responsive constructivists creates new pathways for improving healthcare. She has built this model after years of experience in research, evaluation, teaching and administration both in hospital and education institutions. The foundation is based on fourth generation evaluation (Guba & Lincoln, 1989) which is a methodology that utilizes the previous generations of evaluation: measurement, description and judgment. It allows for value-pluralism. This approach is responsive to all stakeholders and has a different way of focusing



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