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Near field electrospun fibers for neural stem cell differentiation

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Topography and mechanical stiffness of the substrate has been shown to influence neural stem cell differentiation. Herein, near-field electrospinning (NFES) was employed to provide a topographically aligned polymeric fibrous scaffold for neural stem cell differentiation, which mimics the similar process found in the brain cortex and the peripheral neurons. Unlike conventional 3D aligned fibers, 2D NFES fibers allow progressive imaging of the cells grown on top of the fibers to study various differentiation parameters such as neurite length and the number of neurites per cell continuously. The expression profile of neuronal marker, Map2, could be used to evaluate how much the stem cells have differentiated into neurons in different scenarios. Neuronal differentiation was found to be affected by the NFES fibers' sizes, spacing and stiffness, where there is an interesting correlation between the neurite length, the number of neurite and Map2 expression. NFES polymeric fibers were co-electrospun with carbon nanotube to build an electrode which stimulates neuronal stem cells differentiation under the application of 80 Hz sinusoid current waveform at 1.5 mA. NFES fibers could also be composited with thermo-responsive polymer which showed the cell detachment below the LCST of 22˚C. Finally, coaxial polymeric fibers were patterned inside a microfluidics with incrementally increased spacing, to allow sustained release of the protein inside the core in a gradient fashion. With the system, neuronal migration and differentiation along the aligned nanofibers towards the gradient release of neuronal migration factor could be progressively studied.

Biography

Atipat Patharagulpong is currently pursuing PhD from the University of Cambridge, UK.

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