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Microbioreactor System for Cell Behavior Analysis Focused on Nerve Tissue Engineering

Authors : Yusser Olguín, Diego Benavente, Fernando Dorta, Nicole Orellana, Cristian Acevedo

Abstract : One of the greatest challenges of tissue engineering is the generation of materials in which the highest possible number of conditions can be incorporated to stimulate the proliferation and differentiation of cells, which will be transformed together with the material into new functional tissue. In this sense, considering the properties of microfluidics and its relationship with cellular micro-environments, the possibility of controlling flow patterns and the ability to design diverse patterns in the chips, a microfluidic cell culture system can be established as a means for the evaluation of the effect of different parameters in a controlled and precise manner. Specifically in relation to the study and development of alternatives in peripheral nervous tissue engineering, it is necessary to consider different physical and chemical neurotrophic stimuli that promote cell growth and differentiation. Chemical stimuli include certain vitamins, glucocorticoids, gangliosides, and growth factors, while physical stimuli include topological stimuli, mechanical forces of the cellular environment and electrical stimulation. In this context, the present investigation shows the results of cell stimulation in a microbioreactor using electrical and chemical stimuli, where the differentiation of PC12 cells as a neuronal model is evidenced by neurite expression, dependent on the stimuli and their combination. The results were analysed with a multi-factor statistical approach, showing several relationships and dependencies between different parameters. Chip design, operating parameters and concentrations of neurotrophic chemical factors were found to be preponderant, based on the characteristics of the electrical stimuli.

Keywords : microfluidics, nerve tissue engineering, microbioreactor, electrical stimuli
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