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Scalable expansion of neural stem cells supported in electrospun nanofiber scaffolds: Modelling and experimental approaches

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Therapeutic strategies based on stem cell (SC) therapies require large cell numbers, howeverthese are found in low numbers in the human body. Therefore, there is a call for *ex-vivo* scaled-up processes in order to overcome the limited availability of SCs. When envisaging regeneration of neural tissue; cultivation of neural SC in aligned nanofiber scaffolds is particularly attractive. Such substrates actually providephysical guidance with high surface-to-volume ratio, contributing to cell attachment andorientation, in structures mimicking the natural extracellular matrix (ECM) environment. Culture of SC within nanofiber scaffolds is usually performed in static systems, often neglecting the scalability required for the systematic production of tissue transplants, or tissue engineered platforms. Effective supply of adequate factors (nutrients cytokines, growth factors, oxygen), cell interactions and shear forces are also critical. Therefore anovel scalable system for culture of stem cells combining cues from controlled hydrodynamic conditions with electrospun scaffolds for guidance of human neural stem cells (hNSC) culture is presented. In this work, the flow structure and wall shear stress was investigated by computational fluid dynamics. The system was also evaluated through the expansion of a hNSC population over 18 days, reaching a 3.5 fold increase in cell number, with a population that expanded uniformly along the nanofibers. These results are promising for scale up production of tissue constructs for regenerative medicine, drug testing or other biomedical applications.This work was co-financed by BIOREG (SOE3/P1/E750)-INTERREG IV-B SUDOE Program with ERDF funds; information on this project is included.

Biography

Miriam C. Amores de Sousa is currently a PhD student at Department of Bioengineering of Instituto Superior Técnico (IST), in University of Lisbon (UL). Miriam thesis is focused on study the interaction between electrospun functional nanofiber matrices and neural stem cells, to evaluate cell fate envisaging applications in tissue engineering. Miriam graduated in Applied Chemistry (minor in Biotechnology) in 2007 and concluded the Master in Biotechnology in 2009, in Universidade Nova de Lisboa (UNL). Previously, as Research Assistant, Miriam worked on the characterization ofbiocompatible cellulose acetate membranes as potential drug delivery systems, focusing on the solid-state mobility properties.

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