Combined effect of shear stress and topography on Schwann cells behavior

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Whereas the axons of the peripheral nervous system spontaneously regenerate after an injury, the occurring regeneration is rarely successful because axons are usually directed in inappropriate targets. Thus, finding successful methods to guide neurite outgrowth, *in vitro*, is essential for neurogenesis [1]. The present work aims to present a first study of the combined effect of shear stress and topography on Schwann (SW10) cells behavior under dynamic culture conditions attained via continuous flow. For this purpose, a precise flow controlled microfluidic system with custom-designed chambers incorporating laser-microstructured polyethylene terephthalate (PET) culture substrates comprising microgrooves (MG) [2] was developed. The MG were positioned either parallel or perpendicular to the direction of the flow inside the chambers and the response of SW10 cells was evaluated in terms of adhesion, orientation, and cell length. Additionally, the cell culture results were combined with computational flow simulations to calculate accurately the shear stress values. Our results demonstrated that wall shear stress gradients may be acting either synergistic or antagonistic to substrate groove orientation in promoting guided morphologic cell response when microgrooves are placed parallel or perpendicular to the mean flow direction respectively. The ability to guide the outgrowth of SW10 cells, *in vitro,* via flow-induced shear stress and surface topography, could be potentially useful in the fields of neural tissue engineering with the creation of autologous graft substitutes for nerve tissue regeneration.

REFERENCES

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