Spatially controlled proliferation, migration and differentiation of neural stem cells on novel 3D conductive scaffolds

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Several studies on the regeneration of the central nervous system have demonstrated the importance of combining neural stem cells (NSCs) and polymer scaffolds. In fact, expandable sources of neurons and properly engineered scaffolds, which can provide neural differentiation to specific lineage, can be instrumental for the effective repair of the neural tissue. [1] Specific functionalization of substrates with proteins from the extracellular matrix, such as laminin, are generally required for adhesion and proliferation of NSCs. [2] In this study, we developed electrically conductive polymer scaffolds, constituted by randomly distributed or aligned nanofibers, which are able to promote the proliferation and differentiation of NSCs without laminin functionalization. The scaffolds were fabricated by electrospinning technique which provides nanofibers that mimic the extracellular matrix. [3,4] The NSCs, seeded on the 3D scaffolds, not only attached and proliferated, but also were able to migrate and infiltrate inside the porosity of the fibrous mats. In this way, 3D cellular networks were created. Furthermore, the alignment of the fibers induced the growth of NSCs along one specific direction. In fact, the cells were able to highly elongate following the direction of fibers, creating aligned parallel patterns. The obtained results demonstrate that the developed scaffolds are characterized by exceptional biocompatibility and that the topographical cues can be advantageously used in neural tissue engineering.

References

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