Laser-induced periodic surface structures as substrates for Schwann cells alignment and oriented nanofiber collection

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People with injuries to the peripheral nervous system, due to its poor functional regeneration, suffer often from paralysis. Therefore, there is an urgent need for conduits that effectively support the healing of large defects in nerve pathways through specific guidance of nerve cells. This paper describes two specific methods for achieving directed growth of Schwann cells, a type of glial cells that can support the regeneration of the nerve pathway by guiding the neuronal axons in the direction of their alignment [1]. One method implies the exposure of a poly(ethylene terephthalate) (PET) foil to a KrF* laser beam, that induces the generation of laser-induced periodic surface structures (LIPSS). The other method uses aligned polyamide-6 (PA-6) nanofibers produced via electrospinning on a very fast rotating structured collector. These collectors can be covered by antiadhesive laser-induced or mechanically inscribed periodic surface structures, which enable easy nanofiber detachment, without additional effort [2,3]. Schwann cells growth on LIPSS or oriented nanofibers was inspected after one week of cultivation by means of scanning electron microscope (SEM). For both methods, we show that Schwann cells grow in a certain direction, predetermined by nanoripples and nanofibers orientation. In contrast, cells cultivated onto unstructured surfaces or randomly oriented nanofibers, show an omnidirectional growth behavior.

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