EFFECT OF 3D SILICON SURFACE ROUGHNESS INDUCED BY ULTRASHORT PULSED LASER ON NEURAL CELLS

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Introduction

Controlling the outgrowth of neuronal cells is of critical importance in a wide spectrum of neuroscience applications. However, the study of neuron cell outgrowth on more complex topographies remains limited. Phenotype alteration of neuronal cells cultured on traditional flat substrates lacking structural cues, emphasize the necessity to shift from 2D to 3D or multi-scale cell culture models [Hsu S-H, 2009, Klinkhammer K, 2010 Schindler, 2006]. The aim of the present study was to investigate the effect of topographical cues on nerve cell growth**.**

Methods

3D micro/nano structured silicon (MC) surfaces used were fabricated using a femtosecond pulsed laser [Ranella, 2010] and used as substrates for the culture of the pheochromocytoma (PC12) cell line. PC12 were induced to differentiate into nerve cells by nerve growth factor (NGF). Cell growth was visualized using confocal or scanning electron microscopy analysis.

Results

Although in the presence of NGF, low and intermediate rough patterned surfaces (Fig. 1i-ii & 1iv-v) supported PC12 cell differentiation, highly rough surfaces exhibiting longer distances between microcones did not support cell differentiation, independently of the surface chemical coating (Fig. 1iii) & 1vi)).

Discussion

Despite the NGF treatment, PC12 cells failed to differentiate on the high roughness MC surfaces. The results presented here define a useful experimental approach to influence cell differentiation by proper selection of surface microtexture.

The results suggest that the geometrical characteristics of 3D micro/nano structured Si surfaces alone can influence specific cellular functions.

References

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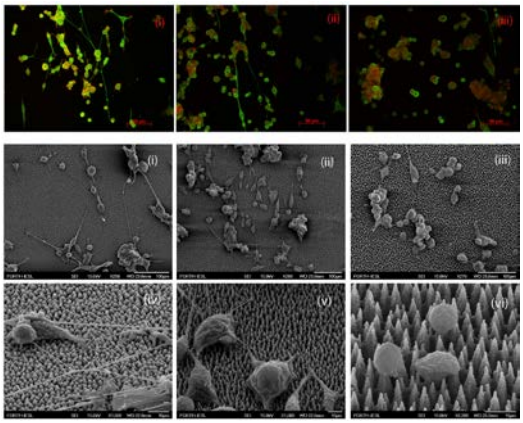

Figure 1: Confocal microscopy & SEM images of NGF-treated PC12 cells on laser patterned Si substrates of different roughness: low substrates (i) & (iv); mid (ii) & (v); high roughness substrates (iii) & (vi).