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Proliferation and Differentiation of Rat Pheochromocytoma Cells (PC12) on Copper-Implanted Quartz Glasses

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The role of patterned copper-implanted quartz glasses on PC12 cells, which constitute an extremely valuable neural model cell and undergo neural differentiation in response to neuron growth factor (NGF) stimulation, is investigated. The quartz glass samples are prepared by plasma immersion ion implantation (PIII) and the patterns are fabricated on the quartz glasses by soft lithography and chemical etching. The influence of implanted copper ions in the quartz glasses on the PC12 cells is determined. No living single PC12 cells can be found on the implanted substrate, but the cells can be found on other substrates such as poly-D-lysine coated slices and culture to proliferate and differentiate normally in the same medium. Such results indicate that the toxicity of implanted copper ions to neurons. However, the implanted copper ions should not diffuse into cell culture medium and at least the ion concentration in the medium should not be high enough to influence cell proliferation and differentiation. Hence, the influence of the patterned copper-implanted quartz glasses on PC12 cells is studied. Single living cells are observed to survive in the patterned channels on the implanted substrate and synapse with NGF added after one week of cultivation. All the synapses grow along the channels and can bifurcate according to the channel patterns to form networks. The proliferation and differentiation behavior is only observed on the patterned copper-implanted surface based on repeated experiments. Our results suggest that quartz glasses modified by PIII can render stable performance. Applications of the materials to lab-on-a-chip devices particularly neuron synapse mechanism research are thus possible.

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