J Nanomed Nanotechnol 2014, 5:5
http://dx.doi.org/10.4172/2157-7439.S1.019

OMICS Group Conferences
Accelerating Scientific Discovery

4th International Conference on
Nanotek & Expo

December 01-03, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

Designing nano-based 2D and 3D platforms for neuroengineering

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The ability to manipulate neuronal growth has great implications for both neuronal repair and for the potential design of neuronal-based hybrid devices. Previous studies have identified processes that take place during neuronal growth that influence the geometry of the neuronal dendrites and axons. A key factor is the ability of the sensory-motile growth cones at the tips of growing processes to measure environmental cues. We study neuronal interactions with nano-scale physical and chemical cues as signals for promoting and directing neuronal growth. Neurons on substrates coated with nanoparticles of different materials were grown. Surprisingly, it was found that silver nanoparticle coating which serves as an antibacterial agent promotes growth more than other common used nanoparticles. To direct neuronal growth neurons on patterned substrates were grow. Nanotopographic cues of different shapes and sizes were compared and it was demonstrated that neuronal processes, which are of micron size, have strong interactions with topographical cues even as low as 10 nm and the interaction strength clearly depends on the cues' height. Interestingly, it was demonstrated that the interactions with the nano-cues trigger a neuronal response, similar to interactions with other neuronal cells and affect neuronal activity. Moreover, in order to develop a therapeutic platform for neuronal regeneration *in vivo* 3D neuronal cultures were studied. Neurons in hydrogels embedded with nanometric signals were grown. The growth promoting effects of the 2D and 3D platforms and the effects of the nanometric cues on neuronal morphology and activity will be discussed.

Biography

Orit Shefi has completed her PhD in Physics from Tel-Aviv University and Postdoctoral studies from University of California San Diego Division of Biological Sciences. She joined the Faculty of Engineering at Bar-Ilan University in 2008 and is the Head of the Neuro-Engineering Laboratory. She is also a member of the Bar-Ilan Institute of Nanotechnologies and Advanced Materials. She has organized several international sessions focusing on nanotechnologies for neuroscience and serving as an editorial board member of Frontiers Bioengineering.

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Effect of particle size distribution on spectral characteristics of luminescence

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The quantum confinement effects in semiconductor systems with reduced space dimension have attracted considerable attention; especially interesting are the modified electronic and optical properties of these structures. The best known semiconductor systems with reduced space dimensions are the quantum dots, stimulated by the encouraging results in quantum wells by the researchers a large number of theoretical and experimental studies were carried out to investigate the properties of excited carriers in the completely confined semiconductor quantum dot systems. In this paper we calculated theoretically the particle size distribution of ZnSe quantum dot on the spectral characteristics of luminescence and model the theory using Mathematica. The normalized intensity was calculated for poly disperse ZnSe and found that the intensity of Pl peaks decreases with the increase in size distribution, inhomogeneous broadening is increased for increase in the size distribution but the broadening is reduced when the average size increases from 1 nm to 3 nm.

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