Micro-engineering the cerebral cortical cell niche: A new cell culture tool for neuroscience research

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Abstract: A major problem in traditional cell culture methods, such as Petri dishes and culture flasks, is the very simplified artificial environment around the cells. Traditional cell culture methods lack features of the native cell niche, such as gradients and cell organization. This lack probably explains why pharmaceutics against neurological diseases, such as Alzheimer's disease, might successfully stop the propagation of the disease in the Petri dish, but fail so far in clinical trials.

The aim of my thesis was to improve cell culture methods for neuroscience research related to neural developmental questions and neurodegenerative diseases.

The first part of my presentation will introduce the generic neural cell niche and discuss how the brain structure gets influenced in neurological diseases. In addition a simplified model of the generic neural cell niche is introduced that is implemented in a microfluidic base cell culture tool. Finally, I will present two examples were a different environment significantly impacts the neural cell response.

Keywords: Microfluidics, Gradients, Neural cells, 3D micropatterned culture, Multiple cell layer organization, NGF, B27, Neurite guidance, Synapse formation, Tauopathy