Culturing of PC12 Cells, Neuronal Cells, Astrocytes Cultures and Brain Slices in an Open Microfluidic System

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The brain is the center of the nervous system, where serious neurodegenerative diseases such as Parkinson's, Alzheimer's and Huntington's are products of functional loss in the neural cells (1). Typical techniques used to investigate these diseases lack precise control of the cellular surroundings, in addition to isolating the neural tissue from nutrient delivery and to creating unwanted gradients (2). This means that typical techniques used to investigate neurodegenerative diseases cannot mimic in vivo conditions, as closely as desired. We have developed a novel microfluidic system for culturing PC12 cells, neuronal cells, astrocytes cultures and brain slices. The microfluidic system provides efficient nutrient delivery, waste removal, access to oxygen, fine control over the neurochemical environment and access to modern microscopy. Additionally, the setup consists of an in vitro culturing and electrochemical sensor system that enables real time detection of metabolites, e.g. dopamine from cell cultures and brain slices.
In summary we present results on culturing of brain slices and cells in the microfluidic system as well as on the incorporation of an electrochemical sensor system for characterization of exocytotic dopamine release from neural and brain cultures.

References:
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(2) Y. Huang, J. Williams, S. Johnson, Brain slice on a chip: opportunities and challenges of applying microfluidic technology to intact tissues, The Royal Society of Chemistry (2012)