Video Article

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Abstract

Protocol

Two rapidly growing areas in biomedical engineering are cell patterning and microfluidics. Noo Li Jeon and his group at the University of California, Irvine show the fabrication of their "Neuron Device" – a microfluidic cell culture platform that allows researchers to compartmentalize and fluidically isolate neuron soma and axon, subject them to different treatments, and to obtain pure axonal fractions. In addition, this device may be employed as an vitro model system for axonal regeneration studies.

The Revzin lab at the University of California, Davis demonstrates a method to pattern fibroblasts onto optically-transparent indium tin oxide electrodes. Sunny Shah of the Revzin lab takes you through the fabrication process and usage of this device from the initial photolithography to the eventual patterning of cells. "The flexibility of this cell patterning technique", Sunny explains, "will allow for the assembly of multiple cell types on the surface of this device that are spatially isolated, allowing in vivo microenvironments to be mimicked in culture."

The Khademhosseini lab at Harvard-MIT Division of Health Sciences and Technology shows two experimental approaches to monitor cell behavior using microfludic devices. In their first experiment, patterned groove microstructures are used to enable cell capture and culture under specific conditions. In the second experiment, this group applies a gradient-generating microfluidic device to study cell migration. Dr. Elliot Hui from the Bhatia lab at MIT has developed a micromechanical system for the dynamic regulation of cell-cell interactions. He demonstrates an application of this system for manipulating cell-cell interactions in the co-culture of hepatocytes and fibroblasts.

A second series of articles focuses on immunology, with special emphasis on transplant immunology. Jeffrey A. Bluestone, director of the diabetes center at UCSF, explains concepts of tolerance and functions of regulatory T cells or "Tregs". The Bluestone group demonstrates a method of pancreatic islet isolation – a complex, multi-step cell culture technique, involving the distension, digestion and mechanical disruption of the pancreas followed by the isolation of islets using a five layer density gradient. These experiments are an integral component of the concerted effort towards the clinical application of islet cell transplantation. Dr. Sang Mo Kang of the Department of Surgery at UCSF, discusses two important animal models (1, 2) for the study of transplant rejections and Fengchun Liu, demonstrates a small bowel transplantation procedure in mice, a very challenging surgical task, involving tissue with a high degree of immunogenicity.

Finally, Melanie Matheu from the Cahalan laboratory demonstrates the dissection and preparation of peripheral lymph nodes from mice for 2-photon imaging. This imaging preparation was pioneered by the Cahalan lab in 2002 (Science 2002; 296:1869-73), and has since then become an established method in immunology, specifically for the study of lymphocyte motility in a variety of tissue types.

New additions to our Basic Protocol Section include fundamental cell culture techniques such as passaging and quantification of human embryonic stem cells.