School of Nano Science

IPM

Nano Science Colloquium

Microfluidic Devices for 2D and 3D Cell Migration in Controllable Microenvironments

Invited Speaker:

Dr. Amir Shamloo

Associate Professor in the Mechanical Engineering at Sharif University of Technology

Abstract:

Microfluidic devices have received wide attention and shown great potential in the field of tissue engineering and regenerative medicine. Investigating cell response to various stimulations is much more accurate and comprehensive with the aid of microfluidic devices. In this study, we introduce a microfluidic device by which the matrix density as a mechanical property and the concentration profile of a biochemical factor as a chemical property could be altered. Our microfluidic device has a cell tank and a cell culture chamber to mimic both 2D to 3D and 3D to 3D migration of three types of cells. Fluid shear stress is negligible on the cells and a stable concentration gradient can be obtained by diffusion. The device was designed by a numerical simulation so that the uniformity of the concentration gradients throughout the cell culture chamber was obtained. Adult neural cells were cultured within this device and they showed different branching and axonal navigation phenotypes within varying nerve growth factor (NGF) concentration profiles. Neural stem cells (NSCs) were also cultured within varying collagen matrix densities while exposed to NGF concentrations and they experienced 3D to 3D collective migration. By generating vascular endothelial growth factor (VEGF) concentration gradients, adult human dermal microvascular endothelial cells (HDMVECs) were also migrated in a 2D to 3D manner and formed a stable lumen within a specific collagen matrix density. It was observed that a minimum absolute concentration and concentration gradient was required to stimulate migration of all types of the cells. This device has the advantage of changing multiple parameters simultaneously and is expected to have wide applicability in cell studies.

Wednesday, 22 Aban 98 (13 November , 2019), 4 - 5 pm

Farmaniyeh Building, Conference Hall.