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A Fluid-Walled Microfluidic Device for Cell Migration Studies

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Abstract : Various microfluidic platforms have been developed in the past couple of decades offering experimental methods for the study of cell migration; however, their implementation in the laboratory has remained limited. Some reasons cited for the lack of uptake include the technical complexity of the devices, high failure rate associated with gas-bubbles, biocompatibility concerns with the use of polydimethylsiloxane (PDMS) and equipment/time/expertise requirements for operation and manufacture. As sample handling remains challenging due to the closed format of microfluidic devices, open microfluidic systems have been developed offering versatility and simplicity of use. Rather than confining fluids by solid walls, samples can be accessed directly over the open platform, by removing at least one of the solid boundaries, such as the cover. In this paper, a method for the fabrication of open fluid-walled microfluidic circuits for cell migration studies is introduced, where only materials commonly used by the life-science community are required; tissue culture dishes and cell media. The simplicity of the method, and ability to retrieve cells of interest are two key features of the method. Both passive and active flow-devices can be created in this way. To demonstrate the versatility of the method a cell migration assay is performed, which requires fabricating circuits for establishing chemical gradients, loading cells and incubating, creating chemical gradients, real time imaging of cell migration and finally retrieval of cells. The open architecture has high fidelity as it eliminates air bubble related failures and enables the precise control of gradients. The ability to fabricate custom microfluidic designs in minutes should make this method suitable for use in a wide range of cell migration studies.

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