

A microfluidic device for monitoring cancer cell migration

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Directed cancer cell migration and invasion is a phenomenon that is closely related with tumor malignancy. Actively migrating cells that detach from the primary tumor can penetrate into the blood stream and subsequently form metastasis in distant parts of the body which significantly reduces patient's chance of survival. It is therefore important to correctly evaluate tumor malignancy during diagnosis and then apply appropriate treatment. To address these needs, we have developed a microfluidic device for testing the epithelial-mesenchymal transition in large population of cancer cells. The device was fabricated by standard soft-lithography technique and direct molding of polydimethylsiloxane (PDMS) on a SU-8 negative master mold. After oxygen plasma treatment, the PDMS chip was bonded to glass surface.

The device contains a main channel barred by arrays of micropillars with decreasing spacing that simulate narrow pores within organs and tissues. Two ports are punched at the channel, inlet and outlet, and filled with medium without fetal bovine serum (FBS) and medium with 10% FBS generating a nutrient gradient that induces the active migration of cells towards the barriers. The cells are loaded at the inlet and after adhesion to the surface their migratory potential and penetration through the pillar arrays is monitored on an inverted microscope IX71 (Olympus) at 37°C, 5% CO₂ and 90% humidity. Such a device can potentially find its use in personalized cancer therapy but it can be used for studying other cell migration related processes like wound healing and tissue growth as well.

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