Multichannel Microfluidic Device for Tracking Cell Lineages

CNF Project # 1977-10
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Abstract:

We report on the fabrication of a multichannel microfluidic device that geometrically confines cancer stem cells to divide in a row, permitting tracking of phenotype variations over generations of the cell lineage.

Summary of Research:

A device to facilitate the tracking of generational variations in a cell lineage of colon cancer inducing (CCI) cells was created, using a design inspired by work done to track lineages of yeast cells [1]. Cells are introduced at the inlet and aggregates are broken up or caught by an array of posts that acts as a filter. Individual cells encounter the trapping channel array, travel down one of the channels in the array before getting lodged in a constriction at the end of the channel. Upon becoming lodged in the constriction, the hydraulic resistance of the channel increases significantly, preventing additional cells from entering the channel. In this manner, only one cell is captured in each channel.

Due to the tight confines of the channel, the cells are constrained and division occurs longitudinally, like beads on a necklace. Typical trapping channel dimensions are 16 µm deep (with a square profile) and 960 µm long. Silicon master is created using the DRIE Bosch etcher and final devices cast in PDMS.

References:


Figure 1, top: Multichannel microfluidic device with cell inlet filter and array of trapping- and bypass- channel pairs shown. Fluorescein solution added to help visually define device structure.

Figure 2, bottom: Cells confined in trapping channels.