Passage of Nasopharyngeal Carcinoma Cells through Narrow Channels

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Metastasis remains a major challenge in the treatment of nasopharyngeal carcinoma (NPC). During metastasis, cancer cells navigate various confined spaces within the physiological tissues. The ability of cancer cells to traverse through these confined microenvironments is closely tied to their dissemination potential, influenced by both the confinement levels and the nanotopography of the basement membrane.

To mimic the complex *in vivo* microenvironment with different confinement levels and nanotopography, an array of microwells and connecting channels featuring a patterned nanohole bottom was designed and fabricated in this work. These biomimetic platforms serve as valuable *in vitro* tools for investigating the metastatic potential of NPC cells, specifically by assessing the traversing probability of cells through narrow channels.

Figure 1 shows the micrograph of the microwells and a 20 μm wide connecting channel with uniformly patterned nanohole topography at the bottom. The platform was replicated from a silicon stamp and constructed using polydimethylsiloxane. A similar platform with a flat bottom was also fabricated for comparison. NPC43 cells were seeded on these platforms, and time-lapse imaging was conducted to capture cell behaviors over 16 h.

The results demonstrated a significant decrease in the traversing probability of NPC43 cells through channels with nanohole patterned at the bottom, as depicted in Fig. 2 (a). This reduction is likely due to the impaired NPC43 cell migration ability in response to the nanohole topography, as evidenced by the shorter migration trajectories observed in 100x100 μm^2 microwells with nanoholes compared to the microwells with a flat bottom, as shown in Fig. 2 (b). Additionally, Fig. 3 (a) illustrates the F-Actin distribution in NPC43 cell on the nanohole surface, revealing some dotted and unconnected structures. Figure 3 (b) shows that the F-Actin fraction of NPC43 cells decreased on the nanohole surface compared to the flat surface. These findings suggest that nanotopography could regulate cancer cell migration behavior and potentially impact their metastasis, thus enhancing our fundamental understanding of NPC. These biomimetic platforms can be applied to various types of cancer cells as an *in vitro* tool for assessing metastatic potential.

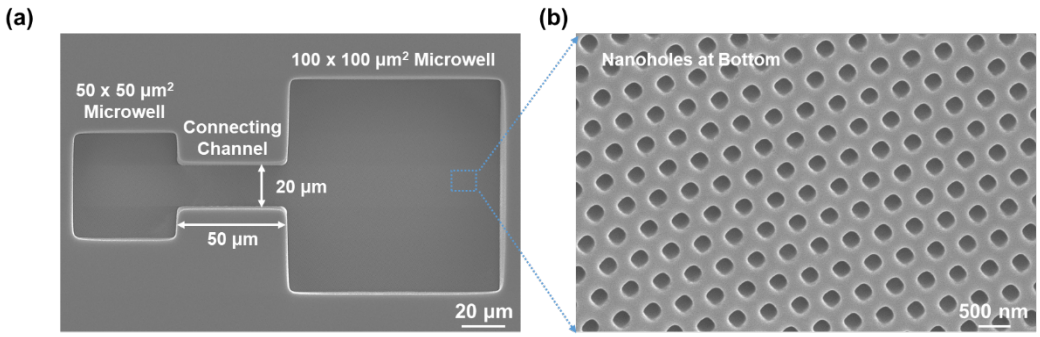

Figure 1: (a) Micrograph of microwells and 20 μm wide connecting channel with patterned nanoholes at bottom. Microwells had sizes of 50x50 and 100x100 μm^2. (b) Nanoholes on bottom of microwells and connecting channel with period of 535 nm and width of 280 nm.

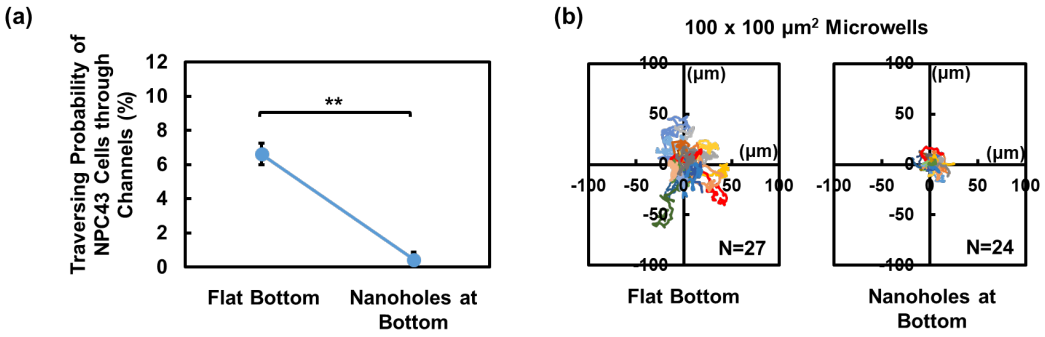

Figure 2: (a) Traversing probability of NPC43 cells through 20 μm wide channels decreased with nanoholes at bottom. (b) NPC43 cells had shorter migration trajectories in 100x100 μm^2 microwells with nanohole topography at bottom. One-way ANOVA and Tukey's *post hoc* test with **p <0.01.

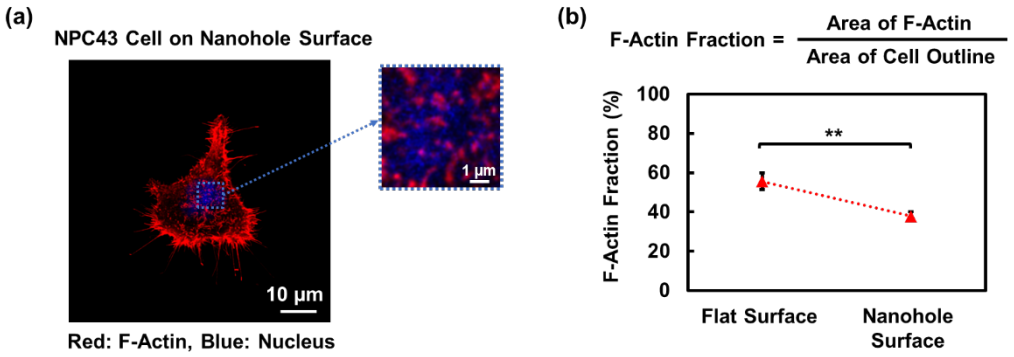

Figure 3: (a) Distribution of F-Actin in NPC43 cell on nanohole surface. F-Actin shows dotted and unconnected structures. (b) F-Actin fraction of NPC43 cells decreased on nanohole surface compared to flat surface. F-Actin fraction was defined as ratio between F-Actin and cell outline area. One-way ANOVA and Tukey's *post hoc* test with **p <0.01.