課題番号　:F-17-HK-0075
利用形態　:機器利用
利用課題名（日本語）　:内皮細胞層の細胞間接着力の推定
Program Title (English)　:Determination of mechanical forces at cell-cell contacts in endothelial cells
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1. 概要（Summary）

The cell-cell contact forces, which are the forces generated at the intercellular junctions when multiple cells adhere to each other, is attracting many interests recently. It is important to study how the contact forces affect biological processes such as morphogenesis, cell migration. Here we propose a new microfluidic single cell arraying device with high efficiency based on the least fluidic resistance principle. A micropillar substrate will be used to determine the cell-cell contact force.

2. 実験（Experimental）

【利用した主な装置】

Mask Aligner (Suss MicroTec MA-6), Electron Beam Lithography (Elionix ELS-3700)

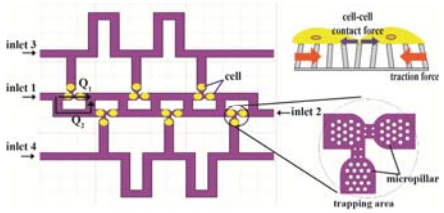
【実験方法】

Fabrication of microchannels was fabricated by photolithography process after producing the mask from EB lithography process. The CFD module of ANSYS (Fluent) was used to build up 3D model of microfluidic device in rectangular shape as Fig. 1(b). The laminar flow state was simulated with the density, viscosity properties of water and the assumption of no-slip boundary condition at the wall. For fluid flow simulation, the inlet velocity was set as 100 μm^{-1} and an atmosphere pressure was assigned 100kPa to the outlet of device.

3. 結果と考察（Results and Discussion）

Using the simulation data, flow ratio Q_1/Q_2 (Fig 1(a)) was calculated when one, two, and three cells are trapped respectively at the trap sites (cells are indicated by circles inside microchannel in Fig.1(b)). When first site is taken by one cell, the flow ratio at that site drop to lower than 1 (from 1.3 to 0.4), thus that site loses the fluid flow and could not capture more cells. Meanwhile the flow ratio of next site is higher than 1 (1.2) and the next site become a substitute as the first one to capture cells. The figure 1b shows how the fluid flow is redirected when cells stuck at the sites. The equivalent processes are conducted from the flow direction of inlet 2, 3 and 4 to form the cell-cell contacts (Fig1.(b)). The size of cell is the most concerned factor. If the cell's size is large, it can block the main microchannel, but if it has the significant small diameter, it fail to be captured at the trap sites.

a)



b)

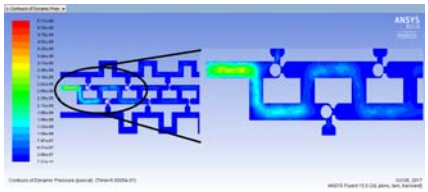


Fig. 1: (a) The fluidic device　(b) The numerical results for fluid flow in microfluidic channel

4. その他・特記事項（Others）

I would like to thank Dr. Agus Subagyo for his support.

5. 論文・学会発表（Publication/Presentation）.

N/A

6. 関連特許(Patent)

N/A