On-chip cell loading by a micro-robot had a suction mechanism

1. Background

Cell analysis using Micro-fluidic chip and micro-robot.

Advantage: Cell manipulation with high resolution and high speed, Low contamination, Low turbulence

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2. Concept & Fabrication

Cell loading using on-chip micro-robot.

High precision, High speed, Low contamination

3. Aspiration force

Comparison of the aspiration force $F_{\text{as}}$ and fluid resistance $F_{\text{f}}$.

$F_{\text{as}} = 6\pi \eta a V$

$F_{\text{f}}$ - Force of the fluid resistance

$\eta$ - Fluid viscosity

$V$ - Moving velocity of the cell

$a$ - Radius of the cell

When $\eta = 0.01 \text{Ns/m}^2$, $a = 100 \mu\text{m}$, and $V = 1 \text{mm/s}$, $F_{\text{f}} = 3.95 \text{nN}$.

$F_{\text{as}} > F_{\text{f}}$

The aspiration force $F_{\text{as}}$ is enough high for manipulation in liquid.

4. Experiments

Experiment of cell manipulation

Comparison of the aspiration force

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5. Conclusions and future work

1. We developed an on-chip micro-robot with suction pump and evaluated an aspiration force of the robot.

2. We succeeded in cell loading using an on-chip micro-robot and micro-fluidic chip.

3. We design the tip of the micro-robot to improve the success ratio of the loading of cells.

6. References
