細胞通過センサを有した集積化マイクロピペットによる
単一細胞回収
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新発想：MEMS技術とペーパーを組み合わせてピペット機能に革新を起こす！

### Background

#### Single-cell analysis

- High-precision cancer diagnosis
- Clarification of Generation, differentiation
- Evaluation of rare cell

Resent researches found that cell mass is hetero. So, single-cell analysis is the more resent and highly regarded.

⇒Single-cell isolation/dispersing system is necessary.

#### Conventional technique

- Cell dispensing success rate is not perfect.
- It is serious problem in the case of rare-cell.

### High-Functionalization of micropipette.

Glass capillary + Sensor = Integrated micropipette

### Fabrication

We fabricated integrated micropipette from two glass substrate.

### Design

- Capacitance sensor
  - High precision, high responsibility
  - Can be designed in µm order
  - Discriminate cell from bubble

- Capacitance between two electrodes
  \[ C = \frac{\pi K \varepsilon_0 \varepsilon_\rho}{2d} \left( \frac{\varepsilon}{a} \right)^2 \left( \frac{2a}{w} + 1 \right) \]
  \[ w : \text{effective width of electrodes} \]
  \[ d : \text{depth of channel} \]

- Effective width of electrode
  \[ w_{\text{eff}} = \frac{a}{d} \left( \frac{\varepsilon}{\varepsilon_\rho} \right)^{1/2} \]

### Experiment

- We succeeded in fabricating glass capillary that have sensor for passage detection of cell.
- In experiment, we succeeded in sucking and detecting cell.

### Conclusion

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### Reference