

### Single Cell Interaction Monitoring of Trapped Cardiomyocytes in a Centrifugal Microfluidic Chip

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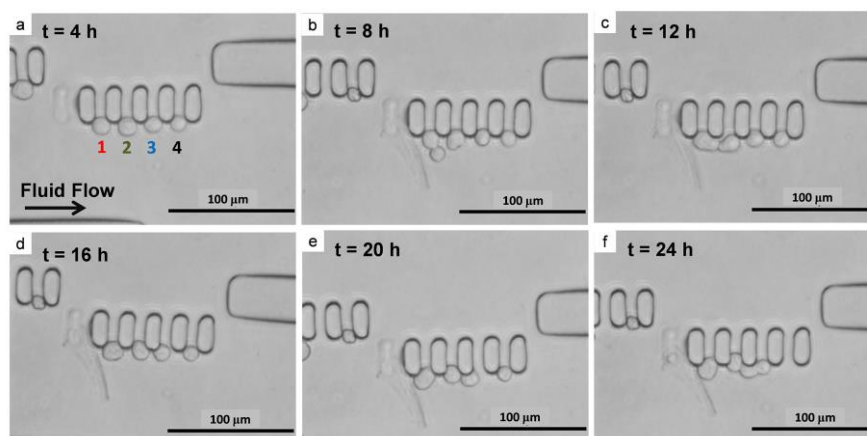
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Microfluidics technology has been exploited in single cell study because of its ability to manipulate particles and control over culture conditions. This can be utilized in a range of cell related applications such as cell manipulation, cell separation, cell culture, and cell lysis. Two downsides of the existing studies in this field are that (1) they require large supporting equipment like an incubator and a syringe pump; which involves more culture media volume, and that (2) the trapped cells are isolated from one another that cell interaction is obstructed or not considered. These limit the applications and advantages of microfluidics compared to conventional petri dish method. In this study, centrifugal microfluidics (at 125Xg) is utilized to trap single cells of primary cultures of neonatal rat cardiomyocyte with controlled separation distance (10 – 50  $\mu\text{m}$ ). Cell growth, coupling, and beating are successfully observed and monitored in the fabricated microfluidic device without large supporting equipment. This is done right after trapping which cannot be done in a typical petri dish approach which requires at least a day for the cells to adhere at the bottom of the dish and be observable. Fig 1 shows the bright field images of a group of cardiomyocytes observed every 4 h after plating: (a) 4 h (b) 8 h (c) 12 h (d) 16 h (e) 20 h (f) 24 h. Beating (ranging from 2 bpm to 24 bpm) and coupling were successfully observed after 8 h of plating. Cell coupling and beating pattern varied in the duration of the observation span for four observed cells.



**Fig 1.** Monitoring of beating cardiomyocytes.

Coupling and decoupling dynamics, that is a first to be observed in cardiomyocyte cell microfluidics, can be proven useful in the headway of controlled cell growth and orientation research. Furthermore, these findings can be applied to future chip design and operation for cardiomyocyte studies and high-throughput lab on-a-chip devices.