

**Supporting information for**  
**Pumping-induced perturbation of flow in microfluidic channels and its**  
**implications for cell culture on-chip**

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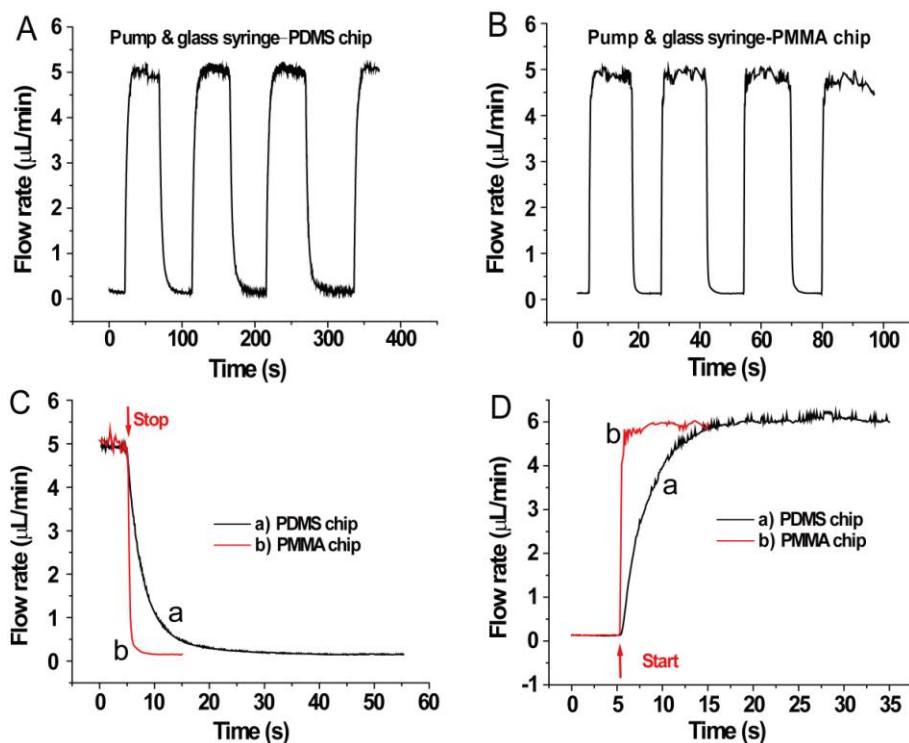
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**1. The rates of response in flow on PDMS and PMMA chips upon starting/stopping a syringe pump equipped with a glass syringe**

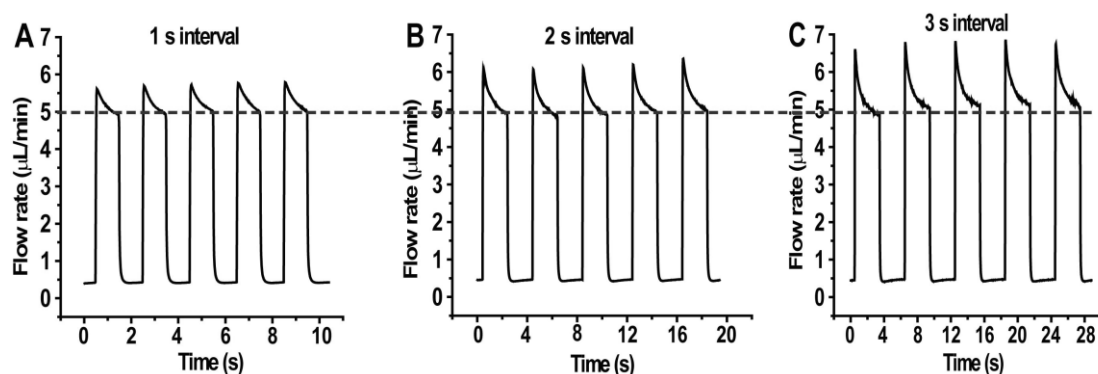
We fabricated a poly(methyl methacrylate) (PMMA) chip using hot embossing using replica molding techniques and PDMS embossing masters.<sup>1</sup> First, we made a PDMS stamp with positive relief channel structure, then placed a clean PMMA piece (Shenzhen Golden Sun Plexi-glass Products Company, China) onto it; two microscope slides were placed on its both sides and a binder clips was used to pack them together. We put the device into an oven at 150 °C to soften the PMMA piece. After 1 h, the embossing assembly was allowed to cool down for 5 min and then the embossed PMMA piece was manually separated from the PDMS stamp. Access holes were drilled, and the piece was cleaned with 2-propanol and blew dry by nitrogen. The PMMA piece and glass slide with Pt electrodes on it were sealed together by heating to approximately 130 °C for 4 h to form enclosed chip.

Figure S1A and B show the rate of response in flows on PDMS and PMMA chips upon stopping/starting the pump alternatively. The rate of flow is set at 5.0  $\mu\text{L}/\text{min}$ . By comparing the rate of response to changes in the rate of flow on PDMS chip and PMMA chip (Figure S1C and D), we find that the rates of flow on PDMS chip and PMMA chip decrease to their 50% of maximum at 2.8 s and 0.30 s, respectively; and the rates of flow increase to their 50% of maximum at 2.1 s and 0.26 s. It indicates that the rate of response in flow on PMMA chip is much faster than that on PDMS chip.



**Figure S1.** The rate of response to changes in the rate of flow on PDMS and PMMA chip controlled by a syringe pump equipped with a glass syringe. (A) The rate of response to changes in the rate of flow on PDMS chip when the pump stops/starts; (B) The rate of response to changes in the rate of flow on PMMA chip when the pump stops/starts. Comparison of the response time of the rates of flow on PDMS and PMMA chips when the pump stops (C) and starts (D); curve a: on PDMS chip; curve b: on PMMA chip.

## 2. Dependence of fluctuation on the opening/closing time interval of a pneumatic valve



**Figure S2.** The fluctuations in rate of flow induced by a pneumatic valve with different time intervals. (A) 1 s; (B) 2 s; (C) 3 s. The ratio of valve width to channel width is 8:1. The syringe pump equipped with a glass syringe is running when valve opens and closes, and the rate of flow is set at 5 μL/min.

## References

1. G. S. Fiorini, G. D. M. Jeffries, D. S. W. Lim, C. L. Kuyper, D.T. Chiu, *Lab Chip*, 2003, **3**, 158-163.