Supplementary Material for

Bubble gate for in-plane flow control

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Table S1. Summary of representative strategies for active flow control reported in the literature in terms of mechanism of actuation, fabrication and working liquids.

	Authors	Type of flow control	Mechanism of Action	Substrate Material	Number of Masking Layers	Working Liquid
1	Jacobson *et al.*[1a]	valving, sampling	electrokinetic	glass	1	biological buffer
	Schasfoort *et al.*[1b]	sampling, pumping	electro-osmosis	silicon, glass	1	biological buffer
2	Unger *et al.*[2a], Thorsen *et al.*[2b], Weaver *et al.*[2c]	valving, pumping	pneumatically actuated membrane	glass, PDMS	2, 4	water
	Grover *et al.*[2d], Zhang *et al.*[2e]	valving, pumping	pneumatically actuated membrane	glass, PDMS or PMMA, PDMS	3-4	water, whole blood
	Irimia *et al.*[2f]	valving, sampling	pneumatically actuated membrane	glass, PDMS	3	whole blood
3	Gu *et al.*[3a], Weibel *et al.*[3b,3c], Sundararajan *et al.*[3d]	valving, pumping, mixing	deflection of microchannel induced pneumatically or by actuator	glass, PDMS	1	biological buffer, water
4	Kaigala *et al.*[4a]	valving	phase-change actuated membrane	glass, PDMS	3	biological buffer
	Kim *et al.*[4b]	valving, pumping	pneumatically actuated membrane	PDMS, glass, hydrogel	3	biological buffer
	Pemble *et al.*[4c]	valving	membrane deformation induced by shape memory alloy	silicone microbore tube	N/A	water

5	Beebe *et al.*[5a]	valving	Stimulus responsive hydrogel	PDMS, hydrogel	1	water
	Sánchez-Ferrer *et al.*[5b]	valving	liquid-crystalline elastomer	silicon	2	water or buffer
6	Jian *et al.*[6a]	pumping, flow direction control	laser-induced thermal bubble	glass, PDMS	1	water/ ethanol
	Wijngaart *et al.*[6b]	valving	thermally controlled bubble	glass, PDMS	3	water
	Lee *et al.*[6c]	valving	membrane, electro-chemically actuated bubbles	PDMS, PMMA, SU-8, silicon	4	NaCl solution

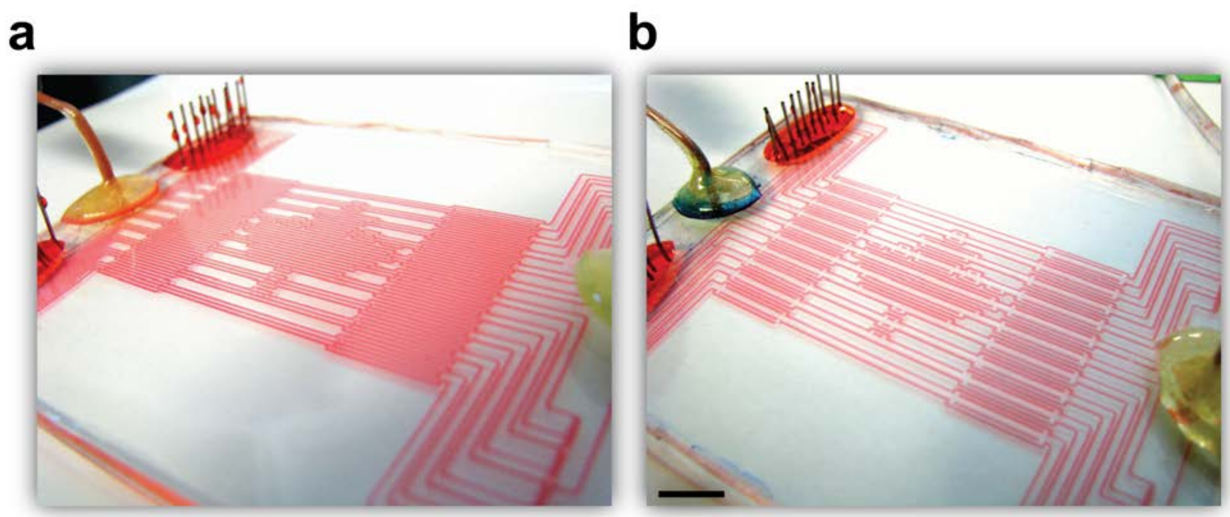

Figure S2. Photographs obtained during testing of microfluidic device with 124 bubble gates to trap red-coloured liquid displaying the National Flag of Canada. (a) First step: the entire device was purged with red dye (b) Second step: Bubble gates were closed and as a result the dye trapped at the designated locations. The liquid in the remaining (bypass) sections was substituted by clear liquid to display the Maple Leaf as shown in Fig. 7 of the paper. Scale bar is 8mm.

Supplementary Movie S3

The bubble gate in oscillation between open and closed positions. The bubble gate was subjected to a square wave pressure signal with the conditions: P_{Closed} = 0.26 psi, P_{Open} = 0.11 psi, P_L = 0.00 psi and f = 1.00 Hz.

Liquid sampling in a Y-channel sampling device incorporating the bubble gates for sampling between two liquid reservoirs one labeled with fluorescent dye and one without the dye. The bubble gates were alternated every five seconds and the concentration of the liquid flowing downstream the Y-channel was measured by image processing. The flow conditions in the video are: P_{Closed} = 0.3 psi, P_{Open}= 0.19 psi and P_L = 0.23 psi.

Three-layer sampling device incorporating the bubble gates for selective distribution of a fluorescently labeled liquid sample. The bubble gate on the middle layer was closed to block the flow of the fluorescent solution in the layer. As a result the florescent solution passed through the bottom and top layers but not the middle layer. The flow conditions in the video are: P_{Closed} = 0.30 psi, P_{Open} = 0.19 psi and P_L = 0.23 psi.

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