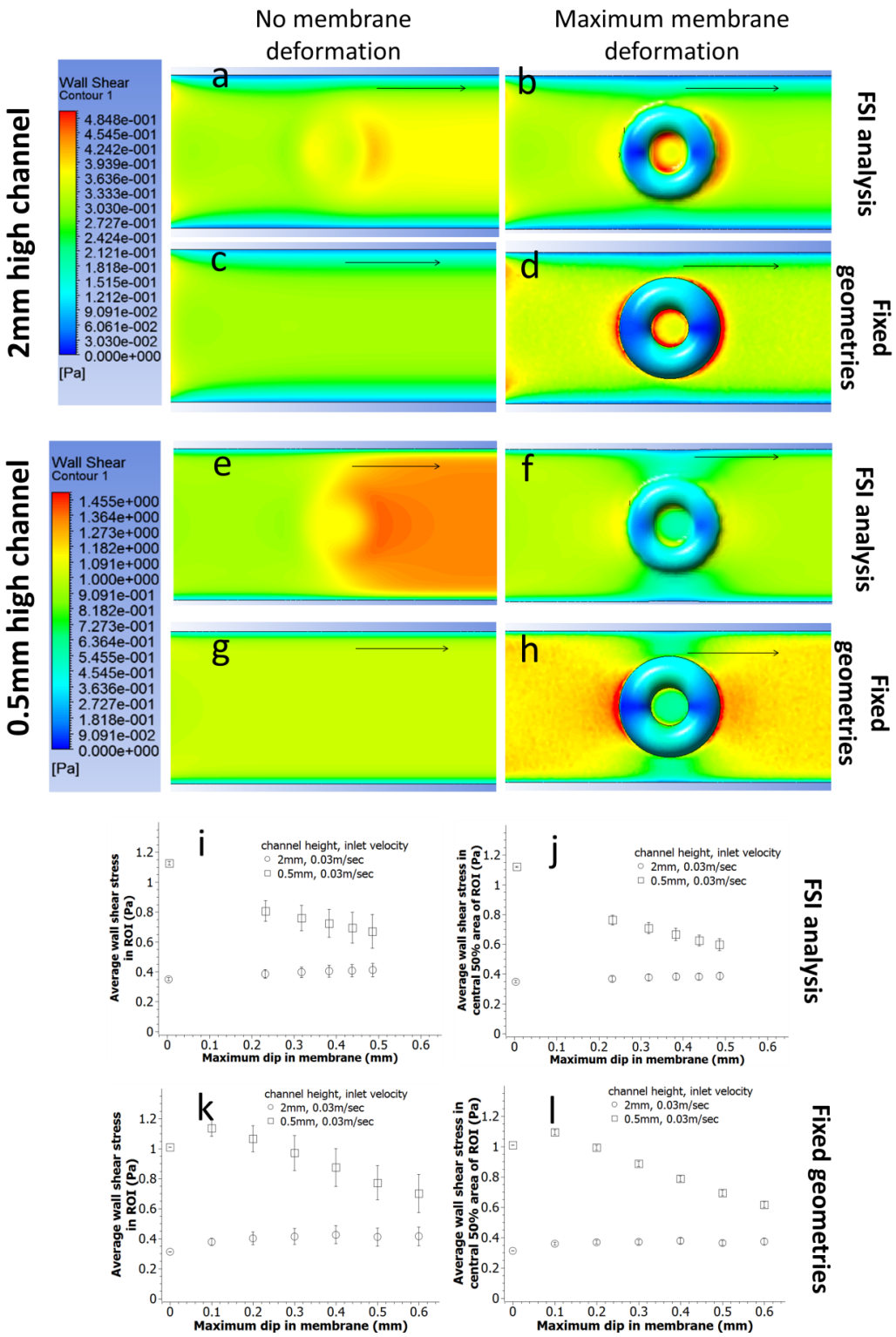
Electronic Supplementary Material (ESI) for Lab on a Chip.



Supplementary Fig. 1 Fluid structure interaction (FSI) analysis was used to study the variation of the fluid flow in response to the strain actuating membrane deformation. Fluid flow was also modeled for fixed deformed geometries and compared with the FSI results. The wall shear stress contours are shown here for the un-deformed and maximally deformed states of the membrane for a 2mm high channel (a-d) and a 0.5mm high channel (e-h). An inlet velocity of 0.03 m/sec and a zero pressure outlet was used in all cases. The flow direction is marked by arrows in all figures. The variations in the average shear stress in the ROI corresponding to membrane deformation are shown for both methods (i-l). The variations in the average shear stress in the ROI are similar for the FSI and the fixed geometry analyses, suggesting that the variations are primarily a result of the geometry variations.

Supplementary Table. 1 Two-way ANOVA was used on cell data from ROIs grouped by the strain-flow combination condition (25 conditions with 4 replicates each) and one-way ANOVA was used on the cell data from ROIs grouped by either strain or flow condition (5 conditions with 20 replicates each). Both analyses returned p-values, which if less than 0.01 (shown in red in the table), were taken to negate the null hypothesis that there was no significant difference between the various conditions. The analyses were carried out for 4 devices – flow only (FO), flow and strain (FS), strain only (SO) and static control (St). The two ANOVA analyses were carried out even for cases where the number of conditions present and number of conditions compared did not match (for example two way ANOVA for the strain only device) in order to check whether any observed differences were effects of the position on the device. Significant differences ($p<0.01$) were found mainly between the various strain conditions. Some factors showed differences between other conditions, but the differences were smaller, as also seen by the relatively higher p values. T-tests were done to compare data from ROIs with data from regions between ROIs. The t-test returned a 1 when the two conditions were significantly different ($p<0.05$), a 0 otherwise. On devices where no strain was applied (FO and St), differences between ROIs and non-ROI regions were expected to be insignificant, but found to be significant for factors other than cell number. This suggested that using the non-ROI regions as unstrained controls needs careful consideration.

2-way ANOVA

		Cell # (normalized)	Area	Form Factor	Major axis/Minor axis
FO	flow	0.263213325	0.091201	0.052799793	0.352788184
	strain	0.013252454	0.171383	6.57E-08	0.004467472
	interaction	0.041103131	0.482364	0.43319145	0.547948814
FS	flow	0.356026947	0.32859	0.202778108	0.597204157
	strain	1.39E-14	2.00E-10	4.78E-14	4.50E-06
	interaction	0.627780101	0.933926	0.355938506	0.164774518
SO	flow	0.058291705	0.161963	0.598837836	0.462308631
	strain	6.43E-23	4.50E-13	3.51E-16	0.002702897
	interaction	0.008131175	0.129575	0.788479979	0.078569795
St	flow	0.140654525	0.450029	0.007681472	0.101620398
	strain	0.087907369	0.456048	0.152737632	0.169856376
	interaction	0.185109819	0.127023	0.368383033	0.328498573

1-way ANOVA

	Cell # (normalized)	Area	Form Factor	Major axis/Minor axis
FO - flow	0.371555918	0.09571	0.169892616	0.410157909
FO-strain	0.033530264	0.130339	8.15E-08	0.00469338
FS - flow	0.723187556	0.581433	0.582993143	0.740649714
FS-strain	6.07E-16	2.14E-11	3.93E-14	5.73E-06
SO - flow	0.638943789	0.521241	0.879676821	0.576318542
SO-strain	2.86E-21	4.39E-13	3.34E-19	0.005119711
St - flow	0.177585145	0.488578	0.009073113	0.115100237
St-strain	0.099771061	0.567622	0.294709284	0.226614697

T-test

	Cell number	Area	Form Factor	Major axis/Minor axis
FO	0	1	1	1
FS	1	1	1	1
SO	1	1	1	1
St	0	1	1	1