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

A simple multi-array stretching device to induce inflammatory responses of vascular endothelial cells

Jiasheng Wang [a], Beiyuan Fan [a], Yuanchen Wei [a], Xingmei Suo [b]*, Yongsheng Ding [a]*
Affiliation:
a College of Life Sciences, University of Chinese Academy of Sciences, Beijing 100049, China
b School of information engineering, Minzu University of China, Beijing, 100081, China

Section S-1

The calculation of deformation of spherical cap (the diameter of each culture well is 6 mm)

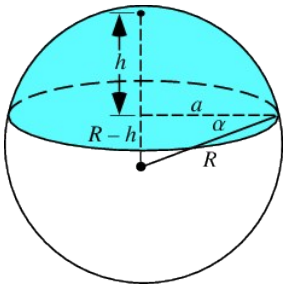


Figure S-1. A spherical cap diagram

A spherical cap is the region of a sphere which lies above (or below) a given plane. Let the sphere have radius R, then the volume V of a spherical cap of height h and base radius a is given by the equation of a spherical segment,

$$V = \pi h^2 (R - \frac{h}{3}) \qquad \text{(S-1.1)}$$

The surface area of the base circle gives

$$S_0 = \pi a^2 \qquad \text{(S-1.2)}$$

The curved surface area of the spherical cap gives

$$S_i = 2\pi Rh \qquad \text{(S-1.3)}$$

Let ε denote the change in surface area on the middle layer between the stretched and unstretched status. The relationship can be described as by

$$S_i = (1+\varepsilon) S_0 \qquad \text{(S-1.4)}$$

Combining the formula 2.2, 2.3 and 2.4, the equation gives

$$2Rh = (1+\varepsilon) a^2 \qquad \text{(S-1.5)}$$

Using the Pythagorean Theorem gives

$$(R-h)^2 + a^2 = R^2 \qquad \text{(S-1.6)}$$

Combining the equations 2.5 and 2.6, R and h can be solved as

$$R = \frac{a(1+\varepsilon)}{2\sqrt{\varepsilon}} \qquad \text{(S-1.7)}$$

$$h = a\sqrt{\varepsilon} \qquad \text{(S-1.8)}$$

Substituting R and h, the equation (2.1) can be rewritten

$$V = \frac{1}{6}\pi a^3(3+\varepsilon)\sqrt{\varepsilon} \qquad \text{(S-1.9)}$$

Section 2

Table S-1. The Theoretical and Calibrated volume of the formed spherical cap

Degree of deformation (%)	Corresponding height of spherical cap (mm)	Theoretical volume (μL)	Calibrated volume (μL)
5	0.67	9.6	18.0
10	0.94	13.8	22.0
15	1.16	17.2	26.0
20	1.34	20.2	30.0

Table S-2. The sequence of primers

Gene	Sequences of primers	Products
MCP-1	Forward: 5′cca gca gca agt gtc cca aag 3′ Reverse: 5′tgc ttg tcc agg tgg tcc atg 3′	115 bp
IL-6	Forward: 5′gcc act cac ctc ttc aga acg 3′ Reverse: 5′ttt cac cag gca agt ctc ctc 3′	208 bp
IL-8	Forward: 5′ttc agg aat tga atg ggt ttg c 3′ Reverse: 5′cac tgt gag gta aga tgg tgg c 3′	234 bp
ICAM-1	Forward: 5′ttg gaa gcc tca tcc g 3′ Reverse: 5′caa tgt tgc gag acc c 3′	231 bp
eNOS	Forward: 5′gca acc aca tca agt atg cca cc 3′ Reverse: 5′tgt tcc aga ttc gga agt ctc ctc 3′	102 bp
Rel-A	Forward: 5′gac gac tgt tcc ccc tc 3′ Reverse: 5′cct cgc act tgt agc gg 3′	110 bp
GAPDH	Forward: 5′tca acg acc act ttg tca agc tca 3′ Reverse: 5′gct ggt ggt cca ggg gtc tta ct 3′	118 bp

Section 3

The round surface of the well bottom was formed after injection of water into chamber.

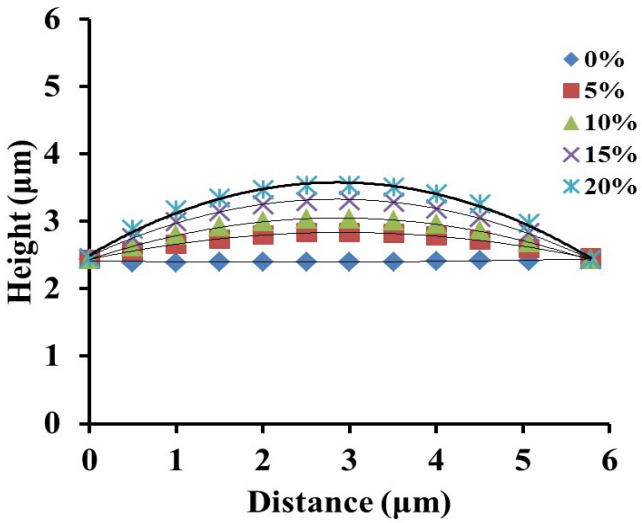
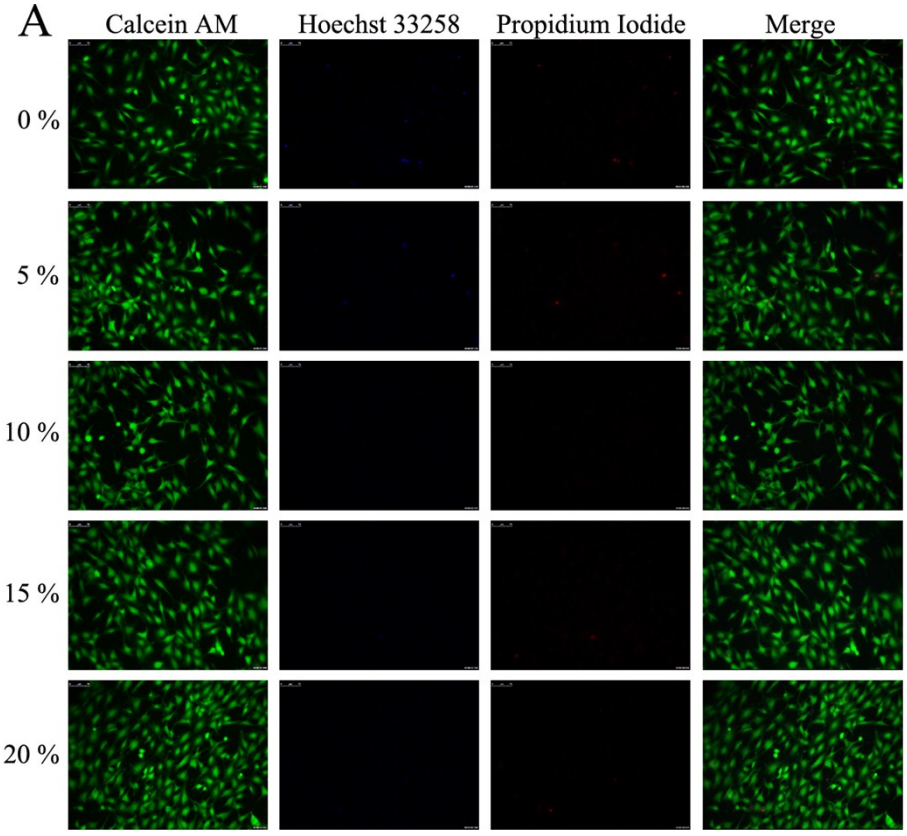
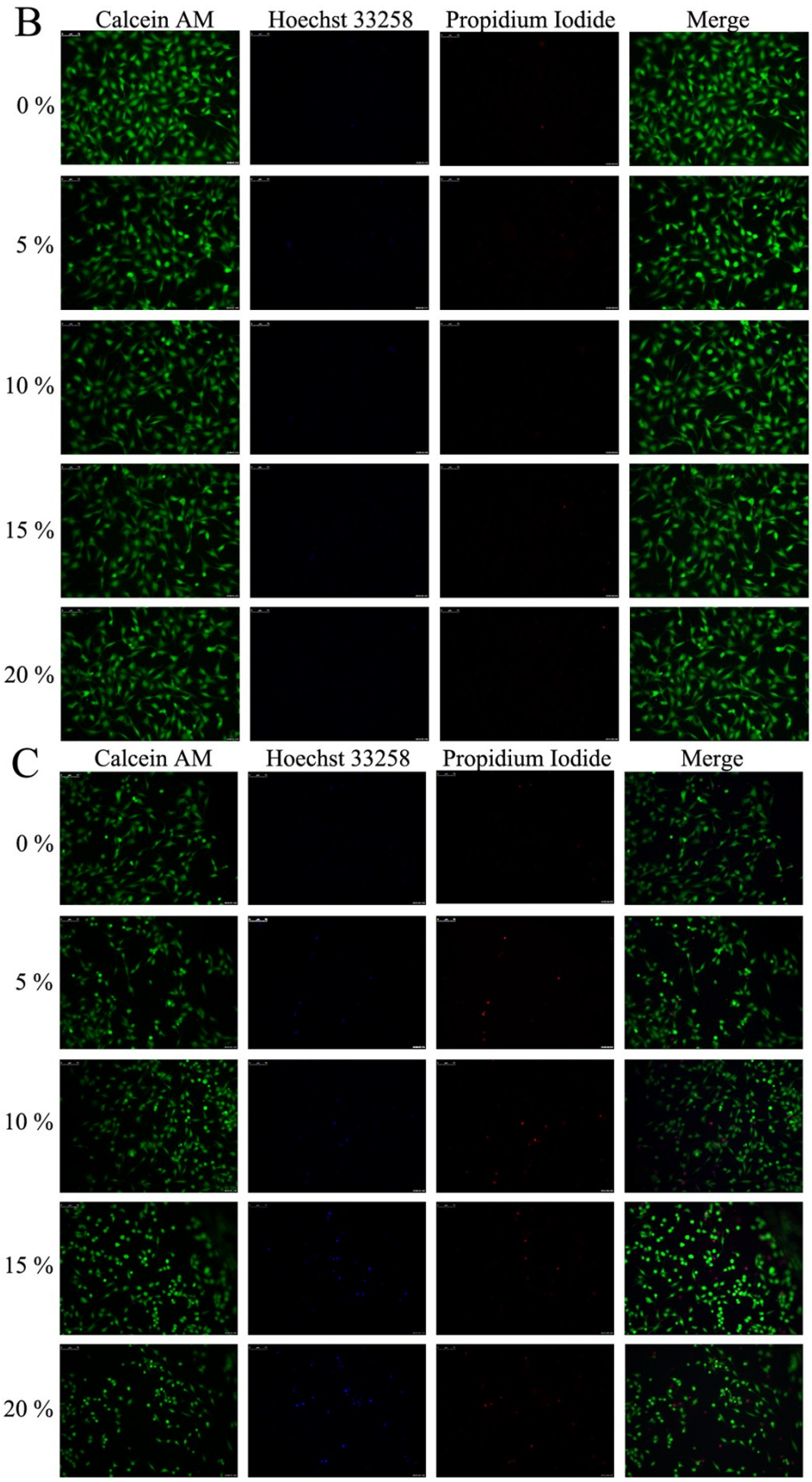


Figure S-2. The round shape of well bottom was verified by plotting the height of the focus plate of the points distributed on a longitude line under the different degrees of the deformation.

Cell viability of peripheral region and intermediate region after 6 h and 12 h stretch




B
Calcein AM
Hoechst 33258
Propidium Iodide
Merge
0 %
5 %
10 %
15 %
20 %
C
Calcein AM
Hoechst 33258
Propidium Iodide
Merge
0 %
5 %
10 %
15 %
20 %

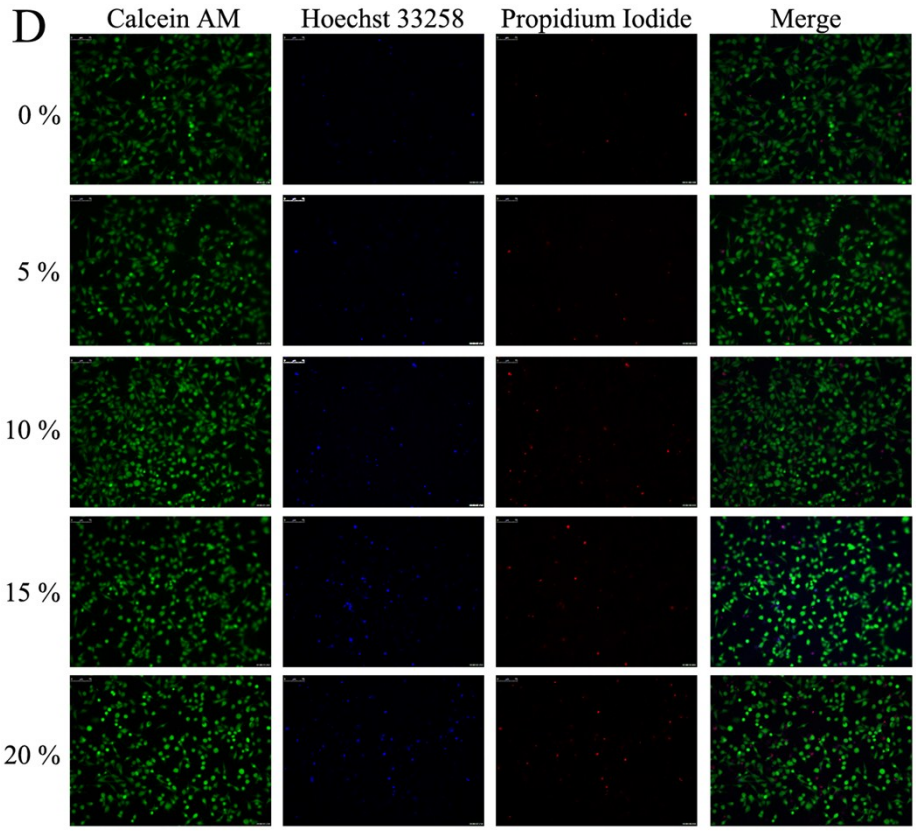


Figure S-3. Fluorescent images (20× objective) of the cells in the peripheral regions and intermediate regions in the membranes under the different degrees stretch for 6 h and 12 h. The scale bar is 75 μm. A) The peripheral regions after 6 h stretch; B) the intermediate regions after 6 h stretch; C) the peripheral regions after 12 h stretch; D) the intermediate regions after 12 h stretch.