Electronic Supplementary Material (ESI) for RSC Advances.

ELECTRONIC SUPPLEMENTARY INFORMATION

Use of dielectrophoresis for directing T cells to microwells before nanostraw transfection: modelling and experiments.

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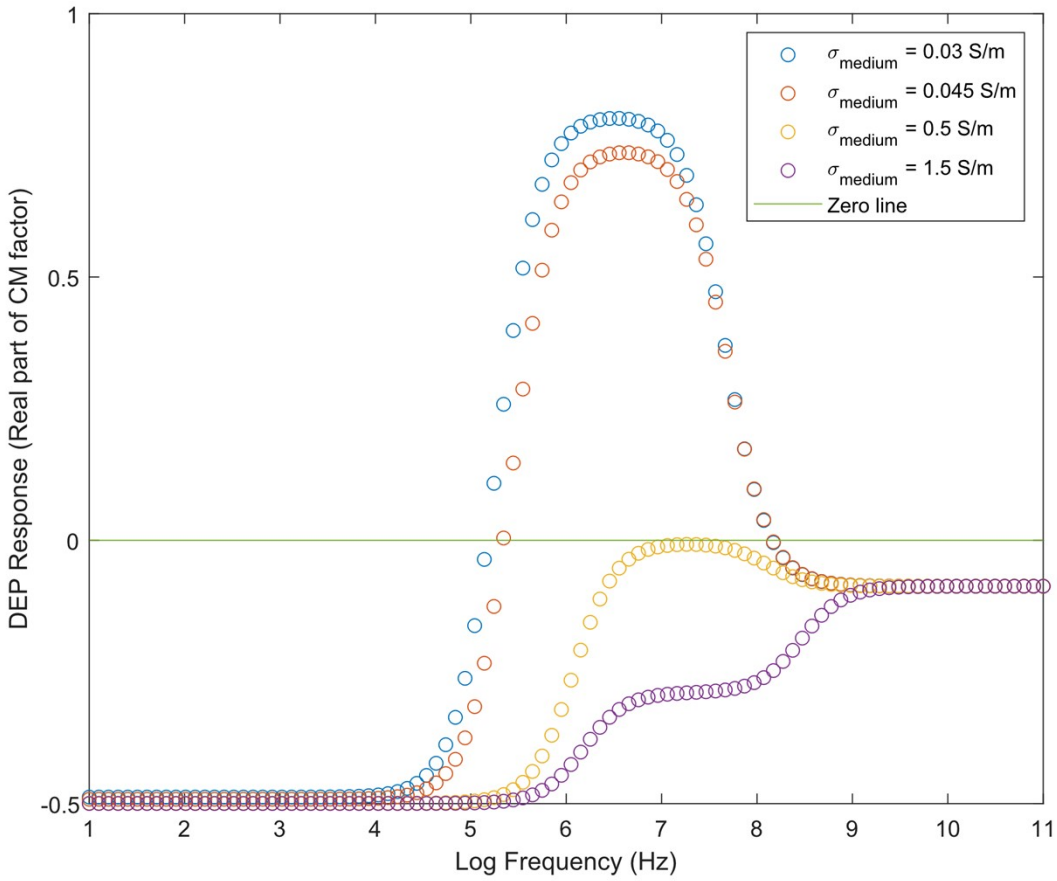

Figure S1: COMSOL simulations of the Real part of the Clausius Mossotti factor. (parameters)

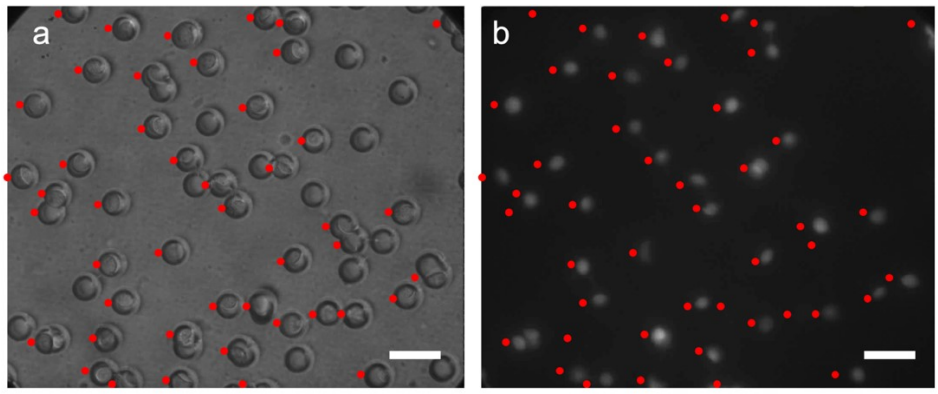

Figure S2: Representative images of cells trapped in the microwells using DEP and subsequently stained with CalceinAM for cell viability. (a) Bright field image. (b) Calcein fluorescence. A red dot was added to the left of each visible cell in the bright field image and the red dots were added to the fluorescence image in order to facilitate comparison. Scale bars 30 µm.

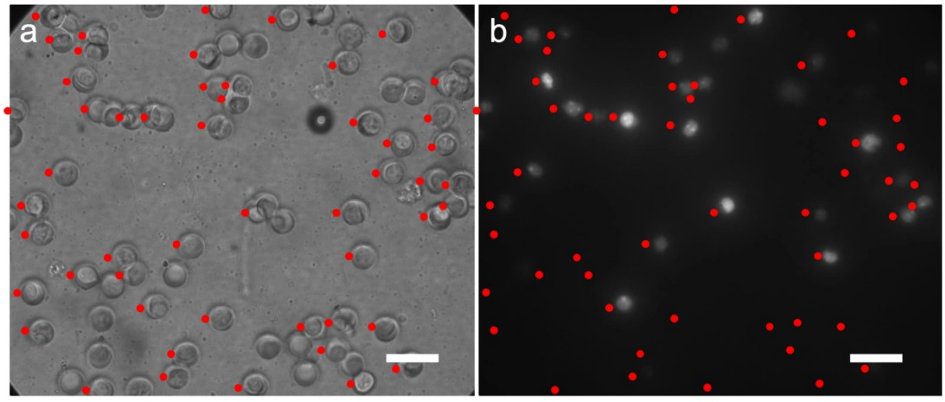

Figure S3: Representative images of cells trapped in the microwells using DEP and subsequently injected with PI. (a) Bright field image. (b) PI fluorescence after PI injection. A red dot was added to the left of each visible cell in the bright field image and the red dots were added to the fluorescence image in order to facilitate comparison. Scale bars 30 µm.

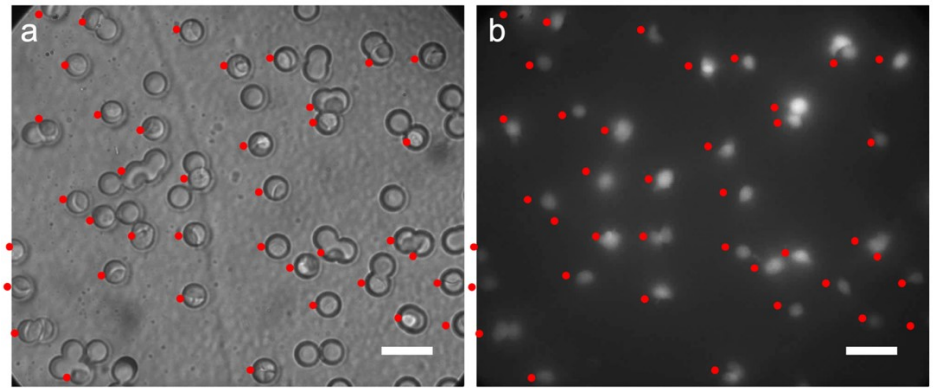

Figure S4: Representative images of cells trapped in the microwells using DEP and subsequently undergoing mock EP followed by staining with CalceinAM for cell viability. (a) Bright field image. (b) Calcein fluorescence. A red dot was added to the left of each visible cell in the bright field image and the red dots were added to the fluorescence image in order to facilitate comparison.Scale bars 30 µm.

Notation	Value	Description
D_{well}	$15\ \mu m$	Diameter of the well
D_{straw}	$160\ nm$	Outer diameter of the straws
t_{Al2O3}	$10\ nm$	Thickness of the straws
$L_{straw\_to\_straw}$	$2.2\ \mu m$	Distance between two straws in the same row or column
W_{domain}	$32\ \mu m$	Width of the simulated domain, i.e. the geometrical unit cell that contains one microwell, mentioned in the text
t_{top}	$34\ \mu m$	Thickness of the top membrane after the etching step
t_{bottom}	$24\ \mu m$	Thickness of the bottom membrane after the etching step
H_{tip}	$1\ \mu m$	Height of the tips of the straws, extruding at the bottom of the well.
t_{medium_above}	$500\ \mu m$	Thickness of the liquid medium above the membranes
t_{medium_below}	$50\ \mu m$	Thickness of the liquid medium below the membranes
D_{cell}	$10\ \mu m$	Diameter of the cell
$t_{cell\_membrane}$	$5\ nm$	Thickness of the cell membrane
z_{cell}	$varied$	z-coordinate of the cell, relative to the bottom of the well. This parameter is varied together with the x_{cell} below so that a map of electrical force on the cell can be obtained.
x_{cell}	$varied$	x-coordinate of the cell, relative to the center of the well. This parameter is varied together with the z_{cell} above so that a map of electrical force on the cell can be obtained.
V_0	$25\ V$	The magnitude of the applied voltage. This corresponds to a 50 $V_{peak\text{-}to\text{-}peak}$.
f_0	$2.5\ MHz$	The frequency of the applied voltage.

Table S1: List of parameters used in the simulations

Movie S1: Available at https://youtu.be/tBqDs4s9Azo
Time lapse images of Jurkat T cells being pulled to wells with nanostraws at the bottom. The DEP force is applied on frame 106 (15,1 sec) in the movie.

Movie S2: Available at https://youtu.be/Zo9ok9eQ-Q0
Time lapse images of Jurkat T cells being pulled to wells with nanostraws at the bottom. The DEP force is applied on frame 30 (4,3 sec) in the movie.

Movie S3 and S4: Trajectories of a cell in a simulated experiment where the cell settles from 500 µm above the top membrane in medium. Overview (Movie S3) and Zoom (Movie S4). a) Whole trajectory. The field is turned off at 180 s. b) The cell floats at a balanced position before the field is turned off. c) After the field is off, the cell continues to settle down and finally rests on the nano straws.