Electronic Supplementary Material (ESI) for Lab on a Chip

Electronic Supplementary Information

Targeted Delivery to Single Cells in Precisely Controlled Microenvironments

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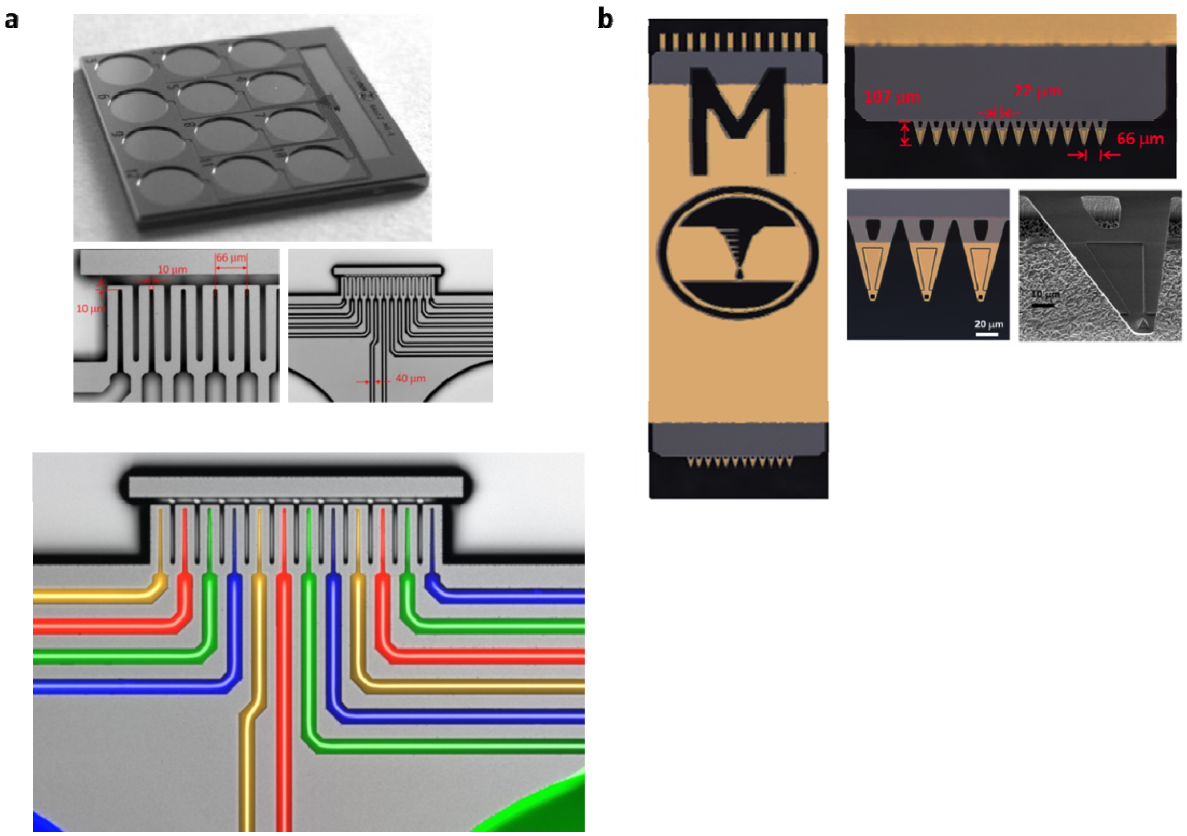
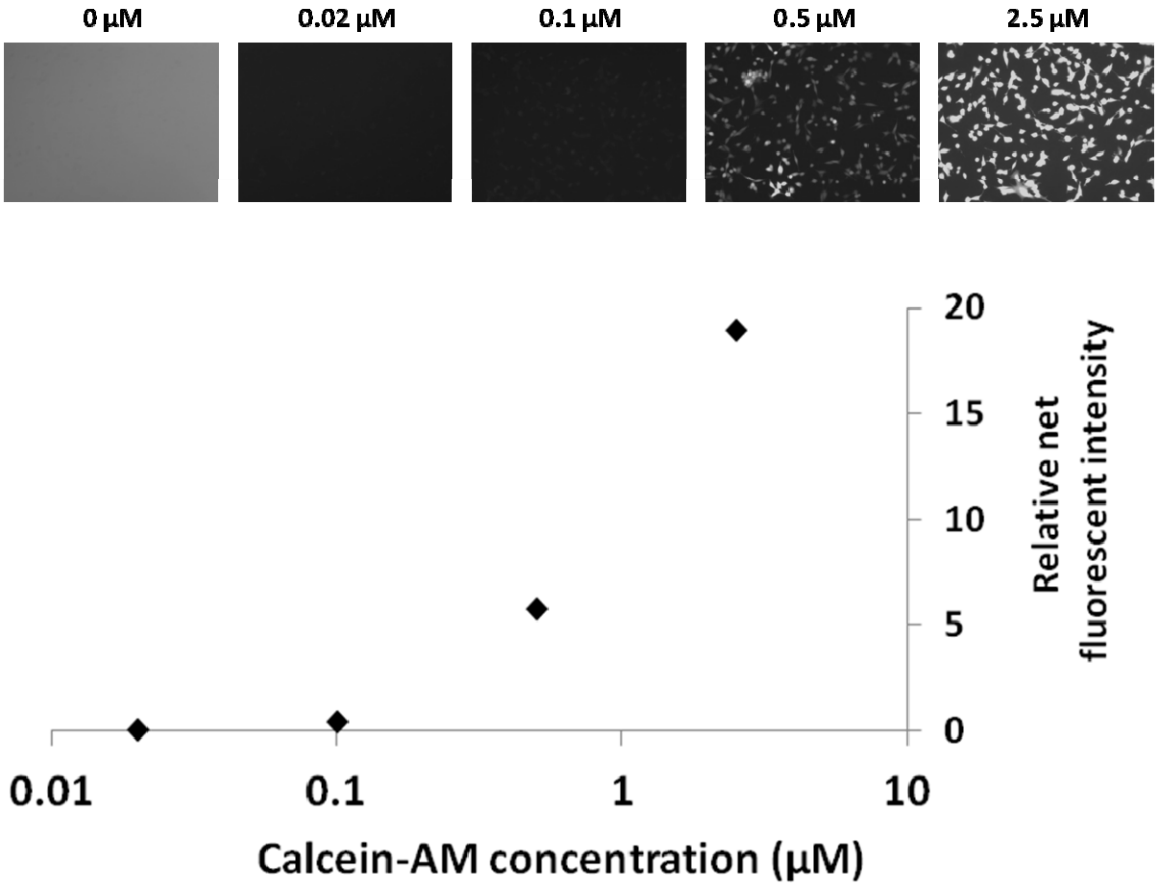
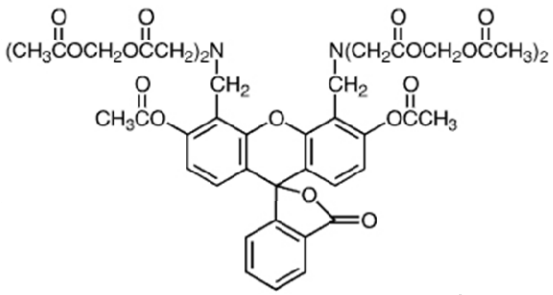


Supplementary Figure 1. Consumables used with NLP2000 for patterning. **A.** M-type inkwell array corresponding to M-type tips, used to coat cantilever pen tips with material. The pen array is dipped into the micron-sized channels, containing different inks for coating the tips of the pen array**.** The spacing between the microchannels is 66 µm, corresponding exactly to the spacing between each pen of the Type-M pen array. **B.** Type M, A-frame cantilevers were used for all patterning. Multiple cantilever arrays allow the tips to be loaded with different materials for multiplexing.



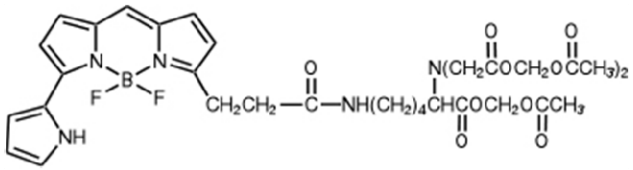
Supplementary Figure 2. Bulk experiments with cells in a standard 96 well plate. Relative fluorescence intensity increases with more Calcein AM in the media. Fluorescence of cells after targeted delivery of Calcein AM was similar to fluorescence of cells resulting from bulk delivery of 0.5 µM Calcein AM.

Calcein AM



Molecular Weight: 994.9 g/mol

Calcein Red AM



Molecular Weight: 789.55 g/mol

Comparison of targeted delivery to bulk delivery

- Assume hemisphere polymer spot radius = 5 µm, volume = 2.62 x 10^{-10} ml
- Assume for bulk, 10,000 cell per well, 200 µL volume
- Assume for targeted delivery, single cell exposed to one polymer spot

For Targeted Delivery: 2.62x 10^{-10} ml of 2000 µM Calcein AM consists of 5.23x 10^{-16} mol and each cell is exposed to 3.15x 10^{8} molecules.

For Bulk Delivery: 0.2 ml of 0.5 µM consists of 1x10^{-10} mol and each cell (10,000/well) is exposed to 6.02x 10^{9} molecules.

Therefore, via targeted delivery, cells are exposed to **19.1x** less Calcein AM than via bulk solution.

Supplementary Figure 3. Chemical structure and corresponding molecular weights of Calcein AM and Calcein Red AM, illustrating differences between the two molecules delivered to cells. Calculations comparing amount of Calcein AM delivered to cells via targeted polymer features or bulk solution.