Supporting Information

Micromotor-Based Lab-on-Chip Immunoassays

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Supporting videos description.

SI Video S1A. Guided movement of the unmodified polymer/Ni/Pt microengine within different sections of a LOC microchannel network containing a PBS solution along with the H_2O_2 fuel and NaCh surfactant.

SI Video S2. Anti-IgG-modified microtransporter capturing multiple S-PP-tagged-IgG.

SI Video S3. Pick-up and transport of a single antigen-coated microsphere by the anti-IgG-modified microtransporter.

SI Video S4. Negative controls.

SI Video S5. 'On-the-fly' DASA assay of protein mixture.

SI Video S6. 'On the fly' protein capture upon contacting the tagged-antigen present at the 20 µg/ml level, in the presence of a 10-fold excess of BSA and lysozyme proteins.

‡ These authors have contributed equally to this work.

SI Video S7. Anti-proteinA antibody-modified microengine recognizing Protein-A from the cell wall of *Staphylococcus aureus (S. aureus)* while moving within the microchip.

SI Video S8. Selective binding and transport of the small rod-shaped (~2 μm length) *S. aureus* bacteria.

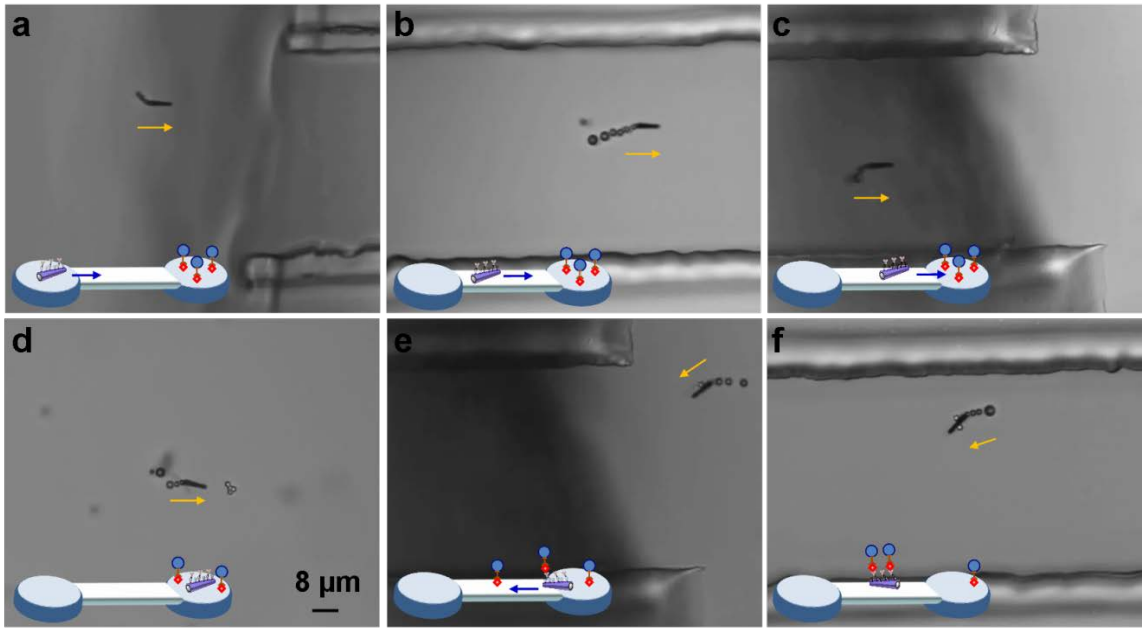
SI Video S9. Binding and transport of a *S. aureus* target cell in a urine sample.

Table 1. Optimal conditions for the fabrication of COOH-PEDOT:PEDOT/Pt/Ni/Pt microtransporters.

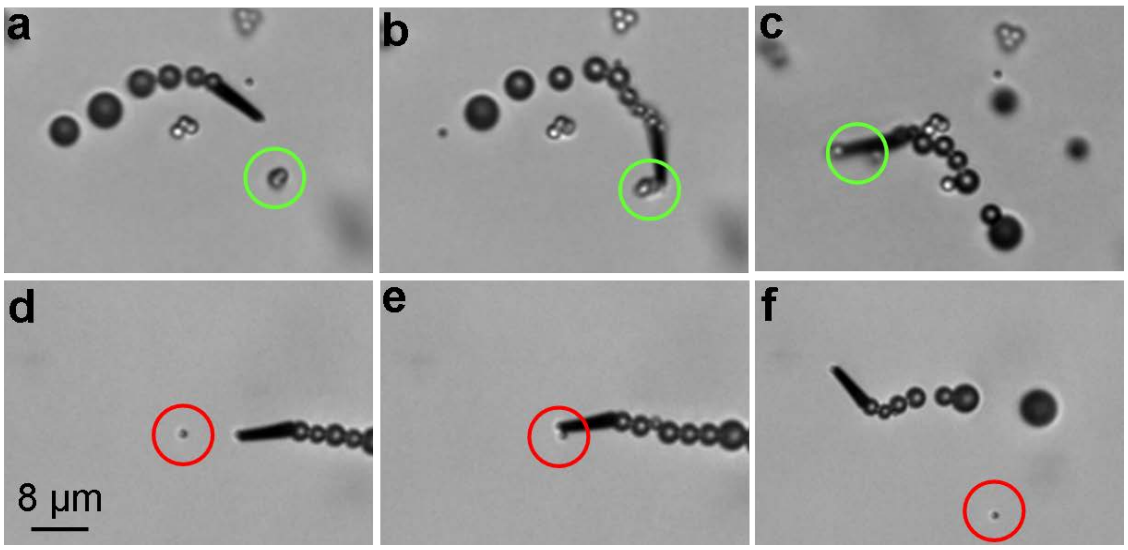
Layer	**Electroplating solution**	**Electrochemical conditions**
COOH-PEDOT:PEDOT	7.5 mM:7.5 mM, in 7.5 mM KNO_3 containing 100 mM SDS	+0.85 V, 0.5 C
Pt	commercial plating solution, see experimental section for details	-2 mA, 500 s
Ni		-1.3 V, -4.0 C
Pt		-2 mA, 450 s

Table 2. Optimal conditions for the functionalization of the COOH-PEDOT:PEDOT/Pt/Ni/Pt microtransporters.

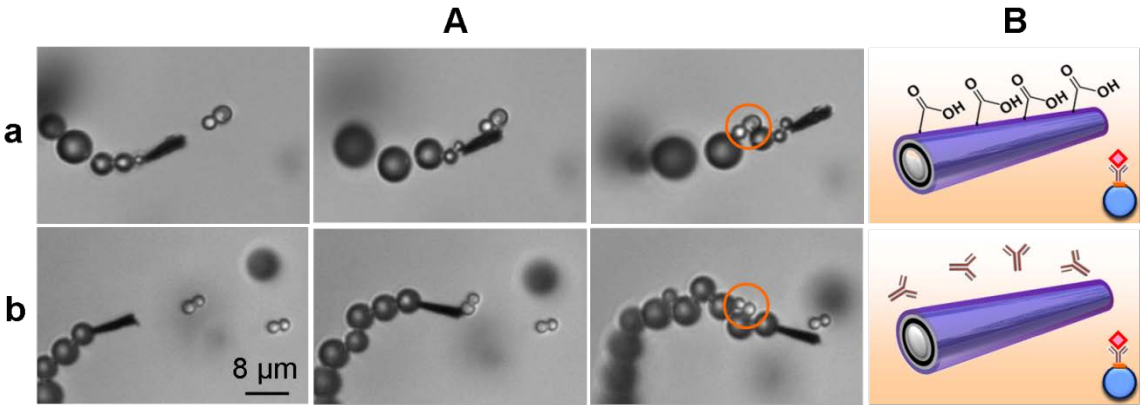
Parameter	**Optimal value**
Concentration of capture antibody / µg/ml	750
Amount of microtransporters / mg	~ 0.60 ± 0.15
Vortex speed / r.p.m	1000
Concentration of tagging antibody / µg/ml	400



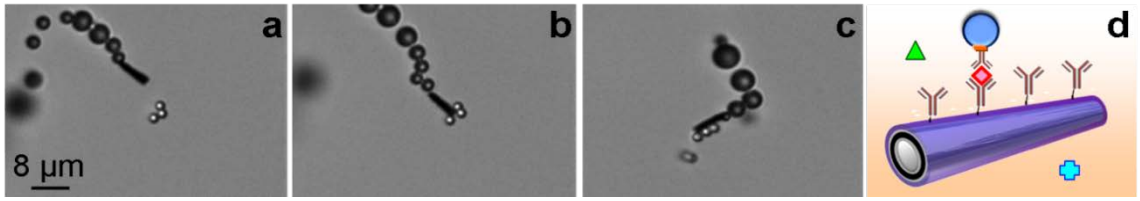
SI Figure S-1. Anti-IgG-modified microtransporter leaving the microengines reservoir (A), passing through the interconnecting section of a linear-shaped chip (B) and arriving to a second reservoir (C), where IgG/anti-IgG-modified biotinylated S-PPs are present. Modified microtransporter navigated on this second reservoir, captured the S-PP-tagged-IgG (D) and left the reservoir (E). When the microengine, coming back to the channel and loading the tagged analyte, found a cluster of three more S-PP-tagged-proteins was able to interact and pluck one of them from the cluster (F).



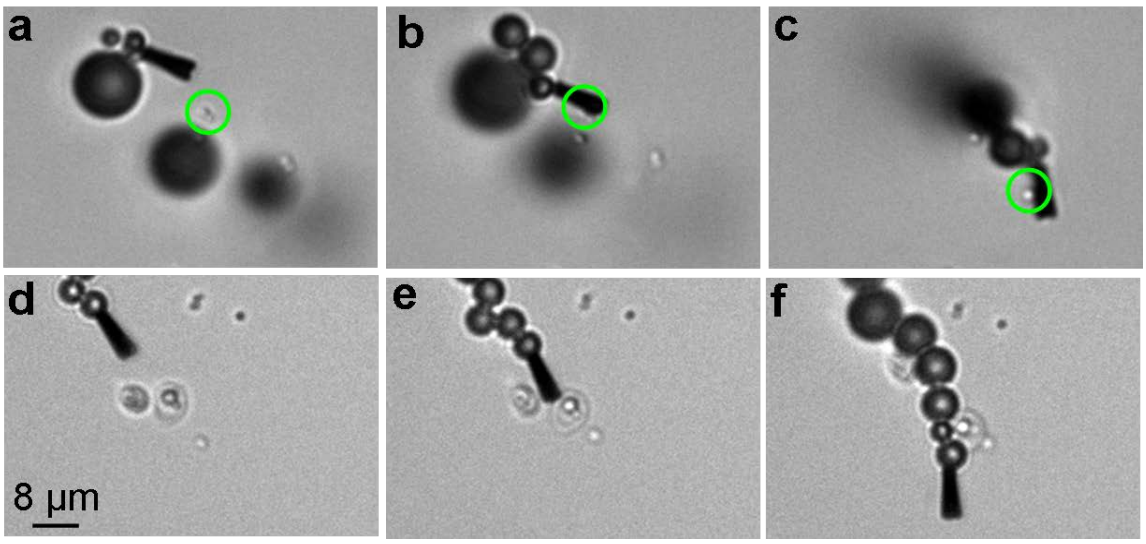
SI Figure S-2. Modified microengine capturing and transporting a IgG-anti-IgG-modified-PP complex (delineated by green circles), and interacting (but not loading) with PP of smaller size (delineated by red circles).



SI Figure S-3. Interaction between nanomotors and AntiIgG-IgG-modified S-PP, navigating in a glass slide (A). Negative controls: PEDOT/PEDOT-COOH (a) and PEDOT-anti-IgG-incubated nanomotors (b), respectively. Corresponding sketches for a) and b) and modified S-PP (B), respectively. Contacted but unloaded particles, highlighted by an orange circle.



SI Figure S-4. Anti-IgG-functionalized-microtransporters displaying an immediate 'on the fly' protein capture upon contacting the tagged-IgG target being present in a concentration of 20 µg/ml in the presence of a 10-fold excess of BSA and lysozyme proteins (Experiments performed on a glass slide). IgG, BSA and lysozyme, red rhombus, green triangle and blue cross, respectively.



SI Figure S-5. Selective binding and transport of the small rod-shaped (~2 µm length) *S. aureus* bacteria (delineated by green dotted circles) *vs* the bigger round-shaped *S. cerevisiae* cells (unlabeled, ~5 µm in diameter), unloaded even when after multiple contacts with the antiproteinA-modifed microtransporter.