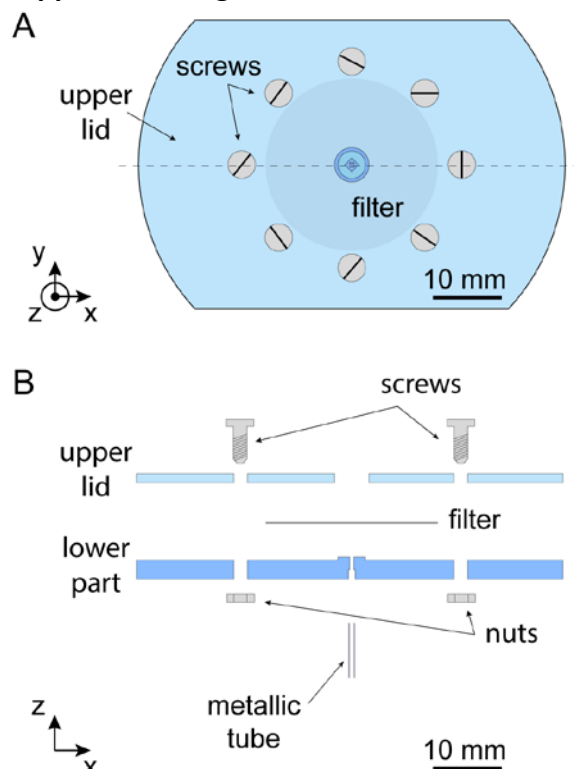
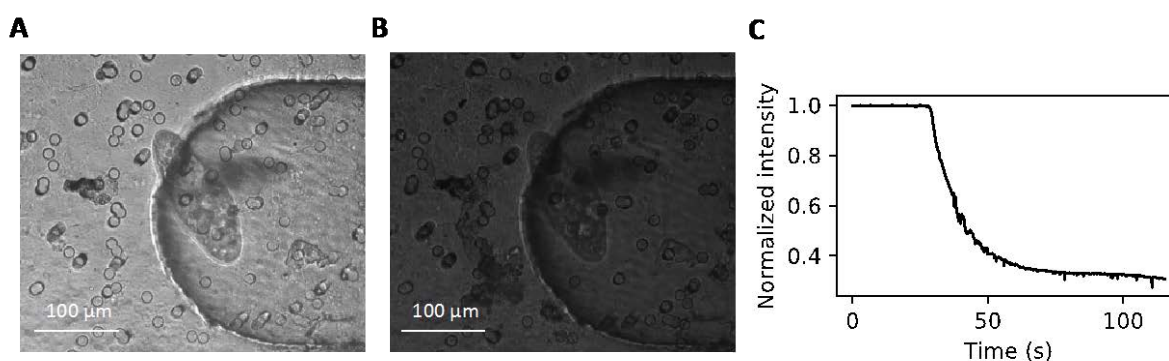


## Supplemental figures and movies

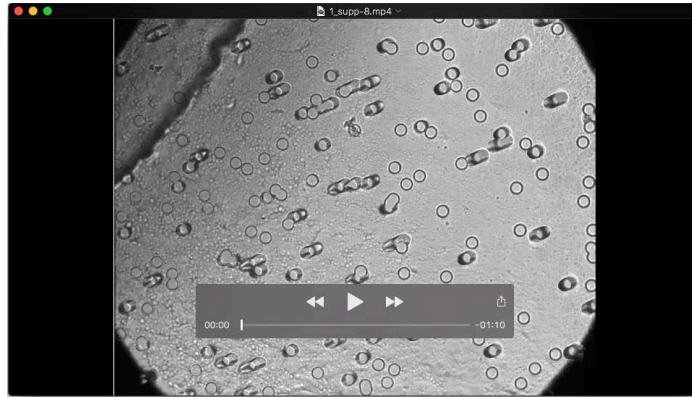
### Supplemental figures



**Figure S1. Assembly diagram.** (A) Top view of the device. (B) Side view of the device along the dashed line in (A). The filter is sandwiched between the upper lid and the lower part, tightened with 8 screws and nuts. A metallic tube is inserted into the lower part, to which a flexible tubing can be connected.



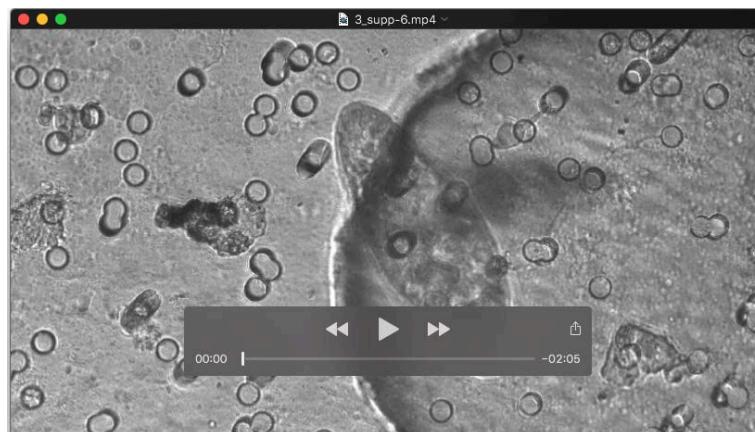
**Figure S2. Solution exchange while a Paramecium is immobilized.** (A) Paramecium immobilized against the filter by depression. The round object is a microfluidic channel below the filter. (B) Immobilized Paramecium at the end of the solution exchange. (C) Change in normalized image intensity after the bath is replaced by a solution stained with Copper chlorophyllin, using a gravity perfusion system. Normalized intensity decreases at an initial rate of 0.04 / s, which is the expected value for an exchange flow rate of 5 mL/min and a 2 mL bath volume.



**Movie 1.** Reversible immobilization of *Paramecia* with a peristaltic pump. The pump is switched on at  $t = 10$  s and switched off at  $t = 40$  s.



**Movie 2.** Reversible immobilization of *Paramecia* with depression. Depression is on between  $t = 10$  s and  $t = 40$  s.



**Movie 3.** Solution exchange while a *Paramecium* is immobilized. A stained solution (Copper chlorophyllin) replaces the clear extracellular solution.



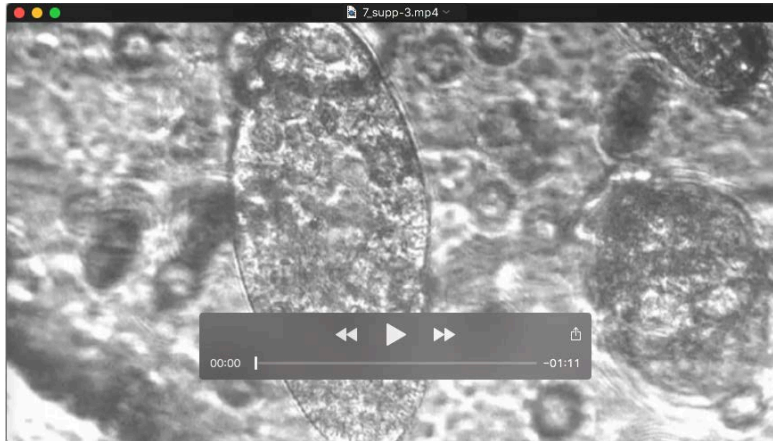
**Movie 4.** Immobilization of *Paramecium caudatum* with a peristaltic pump and a filter with 12  $\mu\text{m}$  holes. Rotating speed about 3 times that used for *P. Tetraurelia*. The pump is switched off at  $t = 10$  s.



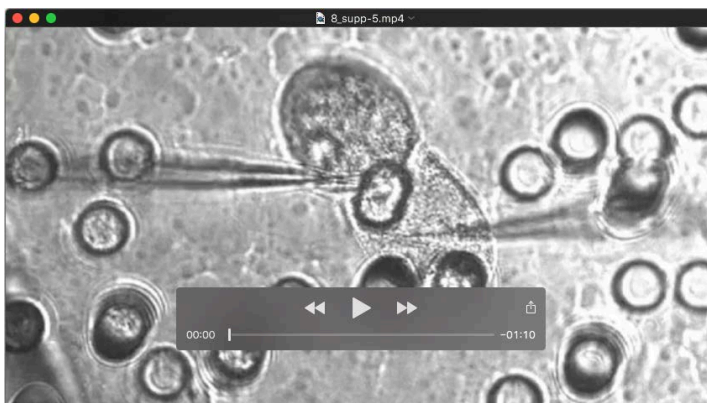
**Movie 5.** Immobilization of *Tetrahymena* by depression (-85 mbar), using a filter with 5  $\mu\text{m}$  holes.



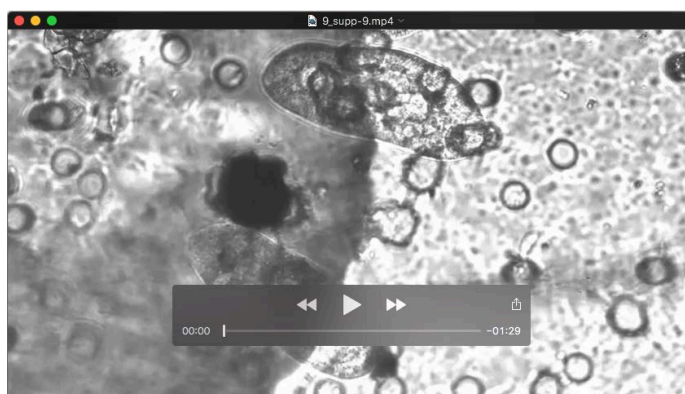
**Movie 6.** Accelerated (x5) recording of *Paramecium tetraurelia* immobilized by depression, showing two contractile vacuoles (tagged with red ellipses). Cytoplasmic streaming is also apparent.



**Movie 7.** Impalement of immobilized *Paramecium* with two microelectrodes. The electrodes are filled with 1 M KCl and connected to an electrophysiological amplifier. A voltage drop appears when the electrode is inserted into the cell.



**Movie 8.** Intracellular voltage recording while the pump is switched on and off. The pump is switched on at  $t = 20$  s, then is switched on and off every 10 s. The pump pulsation is visible as movements of *Paramecium*, with no apparent change in membrane potential.



**Movie 9.** Microinjection of fluorescent Alexa in immobilized *Paramecium*.