

Supplementary Information for

Optical Tweezer-Assisted Cell Pairing and Fusion for Somatic Cell Nuclear Transfer within an Open Microchannel

Yidi Zhang^{ab#}, Han Zhao^{b#}, Zhenlin Chen^b, Zhen Liu^b, Hanjin Huang^b, Yun Qu^b, Yaowei Liu^{ac}, Mingzhu Sun^{ac}, Dong Sun^{b*}, Xin Zhao^{ac*}

^a *Institute of Robotics and Automatic Information System (IRAIS) and the Tianjin Key Laboratory of Intelligent Robotic (tjKLIR), Nankai University, Tianjin 300350, China*

^b *Department of Biomedical Engineering, City University of Hong Kong, Hong Kong, SAR, China*

^c *Institute of Intelligence Technology and Robotic Systems, Shenzhen Research Institute of Nankai University, Shenzhen 518083, China*

These authors contributed equally to this work.

* To whom correspondence should be addressed: medsun@cityu.edu.hk (*Dong Sun); zhaoxin@nankai.edu.cn (* Xin Zhao)

1. Fabrication of microchannel (Fig. S1)

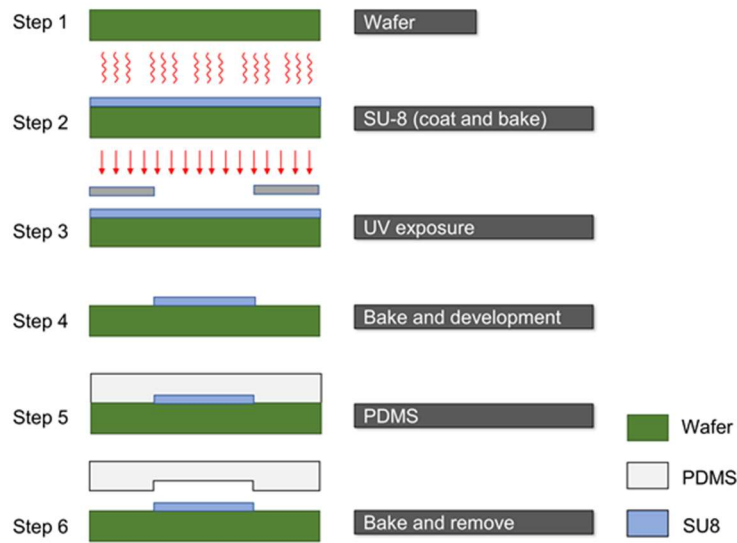


Fig. S1 Fabrication process of PDMS structure. Step 1: prepare a silicon wafer. Step 2: SU-8 photoresist is spin coated on a silicon wafer and prebaked on a hotplate. Step 3: expose the SU8 to UV light with the mask of the upper microchannel on top to make it harden. Step 4: rinse off excess photoresist. Step 5: a mixture of PDMS and curing agent with a ratio of 10:1 is dropped onto the master mold and baked in an oven for 1.5 h. Step 6: peel off the master mold.

2. Oocyte reaches the wrong position (Fig. S2)

The height of PDMS pillars determines whether cells can accurately halt at the target position under the influence of DEP forces. When the height of the microchannel is lower than the radius of the oocyte, the contact point between the oocyte and the PDMS pillars is below the height of the oocyte center. The oocytes easily roll over the PDMS pillars due to the torque generated by the DEP force exerted on the oocytes, as shown in Fig. S2.

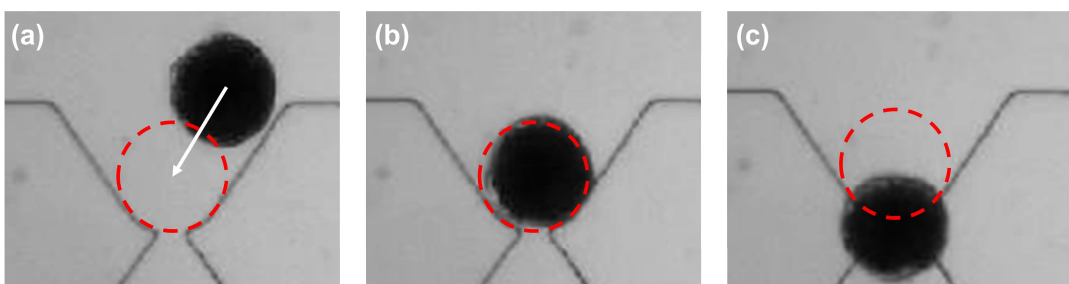


Fig. S2 The oocyte rolls over the PDMS pillars to the wrong position during the transfer process. (a) The initial location of the oocyte before capture. (b) Under the action of DEP force, the oocyte moves towards the narrowest part of the hourglass groove, with the red dashed line indicating the target position of the oocyte. However, due to the height of the PDMS pillars ($60\ \mu\text{m}$), it is difficult to stop the larger oocytes with a diameter of $130\text{--}150\ \mu\text{m}$ stopping at the target position. (c) The oocyte passes the target position, rolls over the PDMS pillars, and finally stops in the wrong position.