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► **To cite this version:**

Mohammad Hussein Baz, Lucas Charpin, Coralie Sengenès, Emmanuelle Trévisiol, Anne Marie Gué. Lab-on-a-chip for Isolating Circulating Adipose Stromal Cells: Pre-processing Module. International Symposium on Microscale Separations and Bioanalysis (MSB), May 2023, Tallahassee, Florida, United States. , 2023. hal-04117613

HAL Id: hal-04117613

<https://laas.hal.science/hal-04117613>

Submitted on 5 Jun 2023

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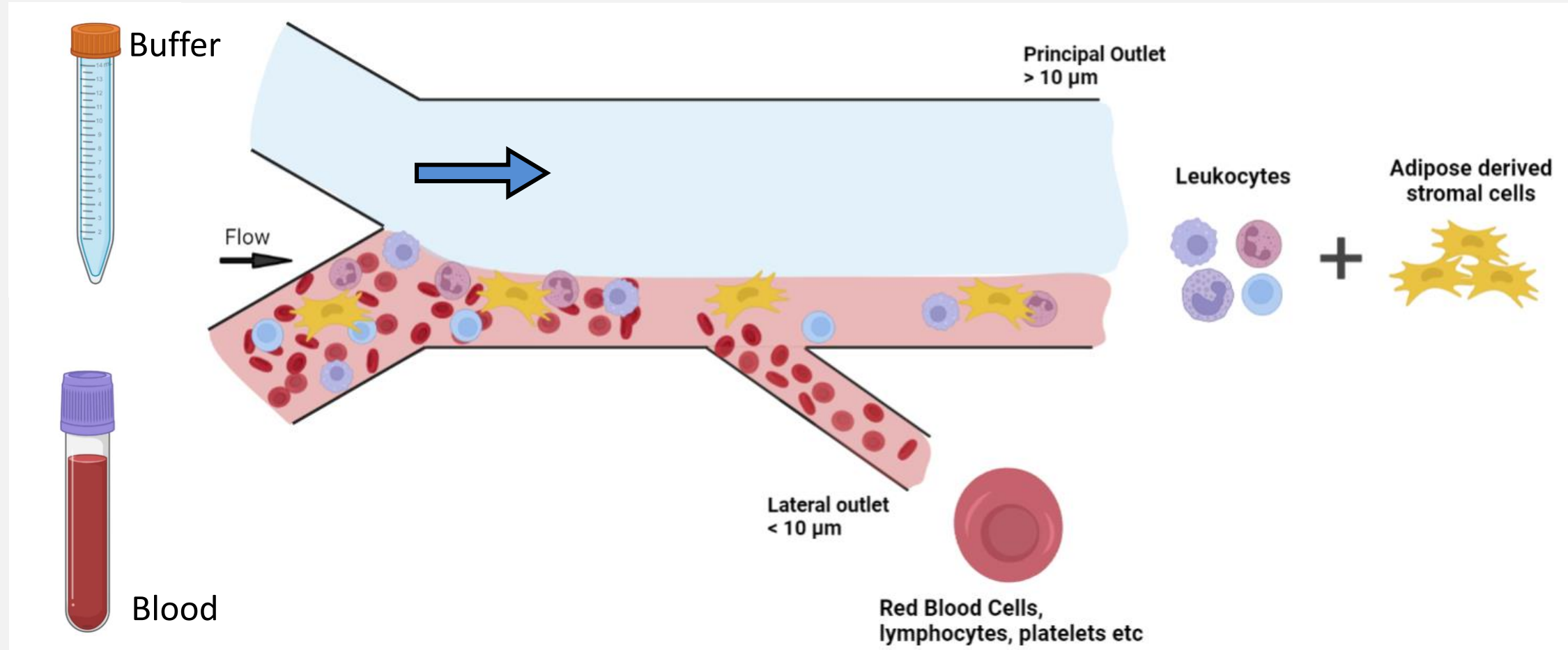
Lab-on-a-chip for Isolating Circulating Adipose Stromal Cells: Pre-processing Module

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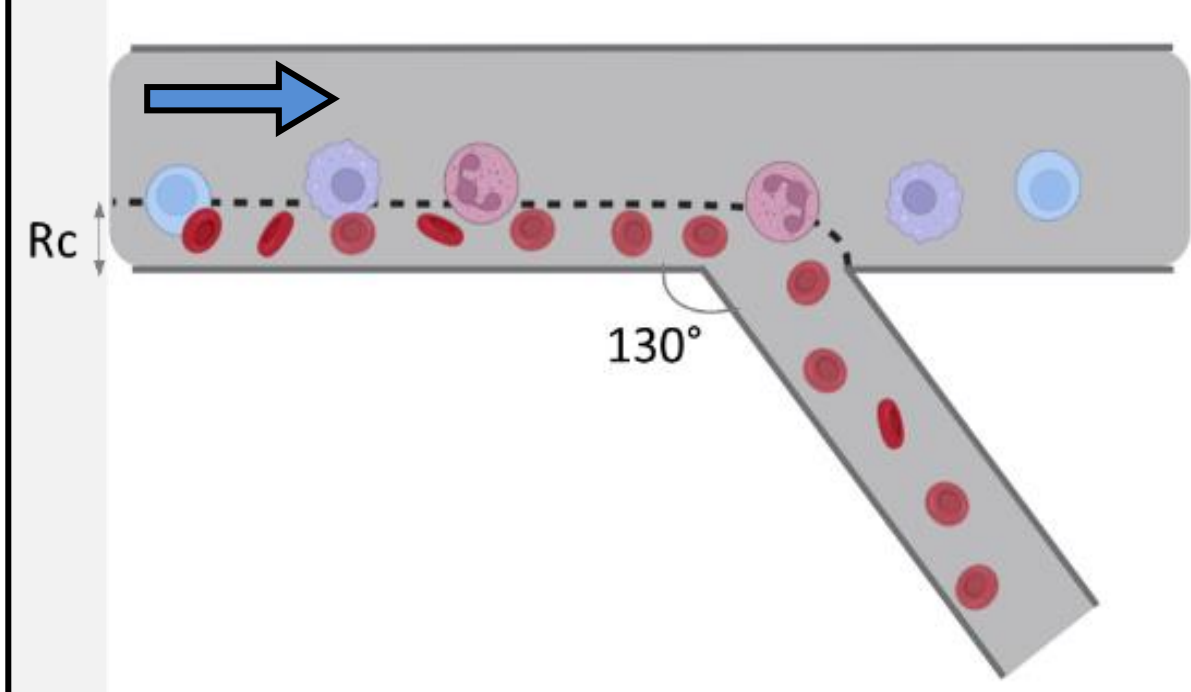
Context :

Circulating Adipose-derived Stromal Cells (ASC) can be considered as biomarkers of type II diabetes as recent research shows. However isolating ASC from whole blood is a difficult task, since no unique specific marker is assigned to these cells. They also have a wide size-distribution, hence a preconcentration step has to be done in order to completely isolate them. In this work, we demonstrate an ASC preconcentration module based on hydrodynamic filtration.



Filtration of whole blood:
In the side-outlet: the smaller cells (Red Blood Cells, RBC)
In the main-outlet: the bigger cells (White Blood Cells, WBC)

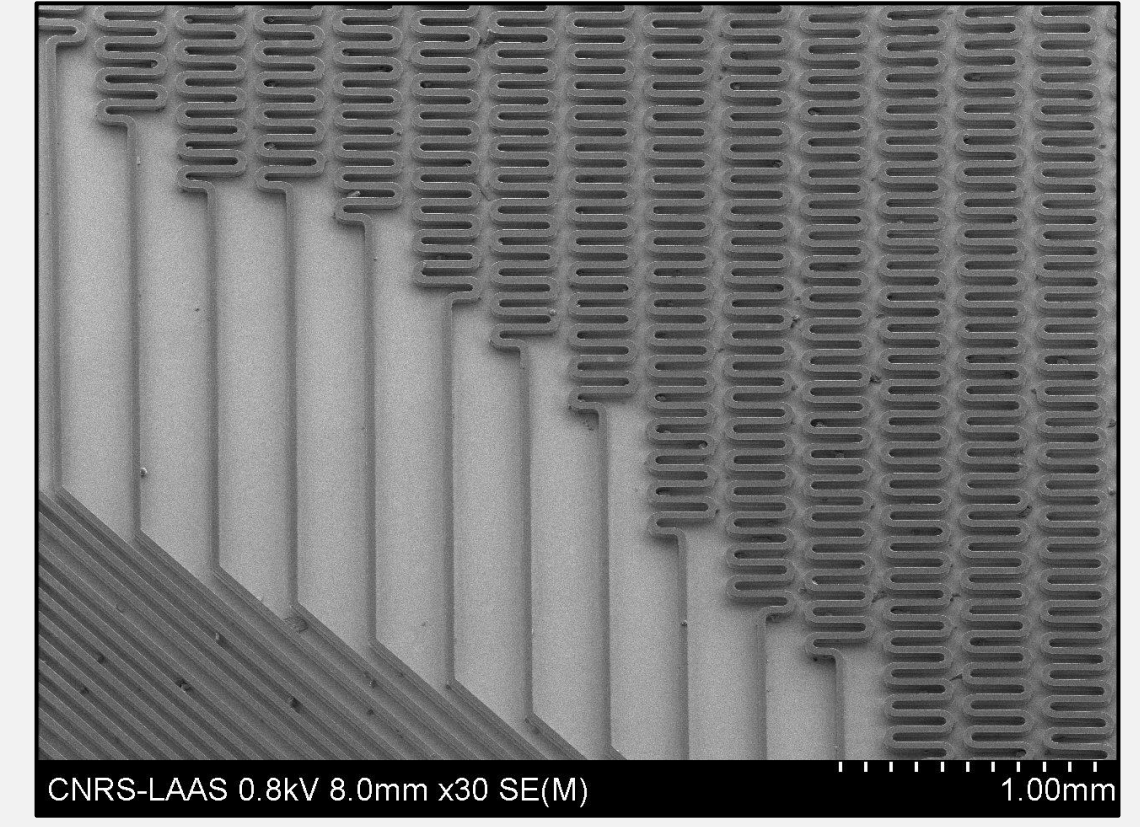
Materials and Methods :



Hydrodynamic filtration chip design

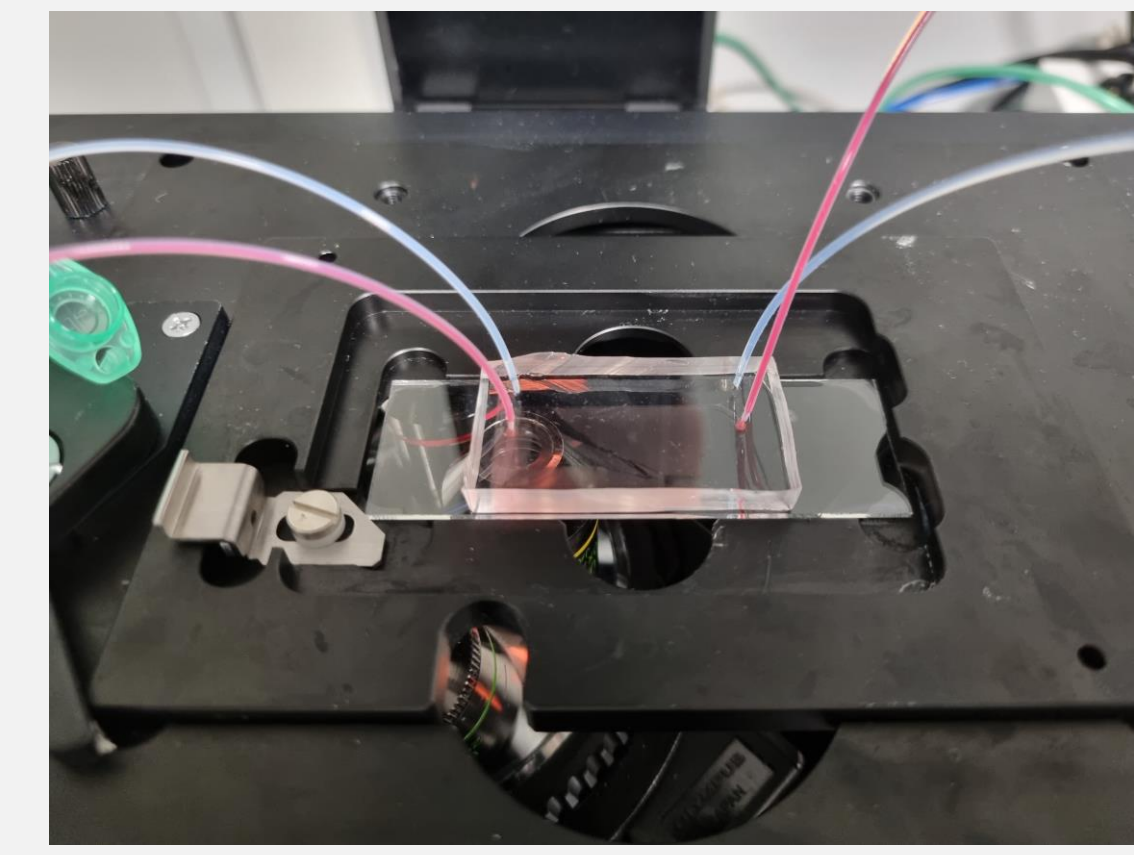
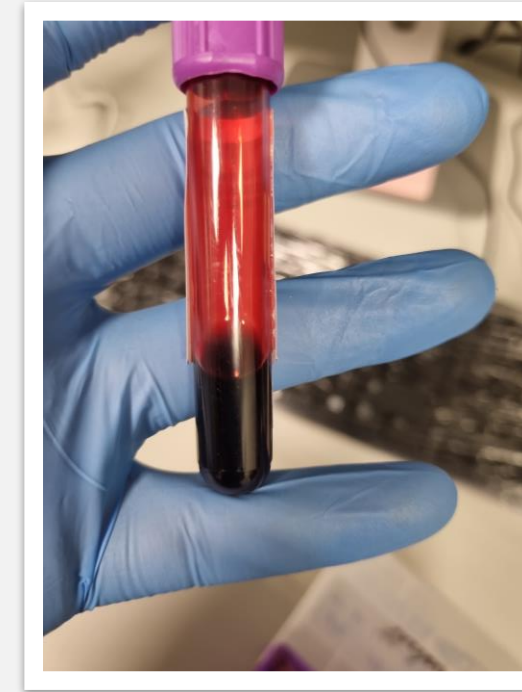
$$Q^* = \frac{Q_1}{Q_{in}} = \frac{Q_2}{Q_{12}} = \dots = \frac{Q_{100}}{Q_{99,100}}$$

$$Q^* = \left(\frac{R_c}{w}\right)^2 \left(3 - \left(\frac{2R_c}{w}\right)\right)$$



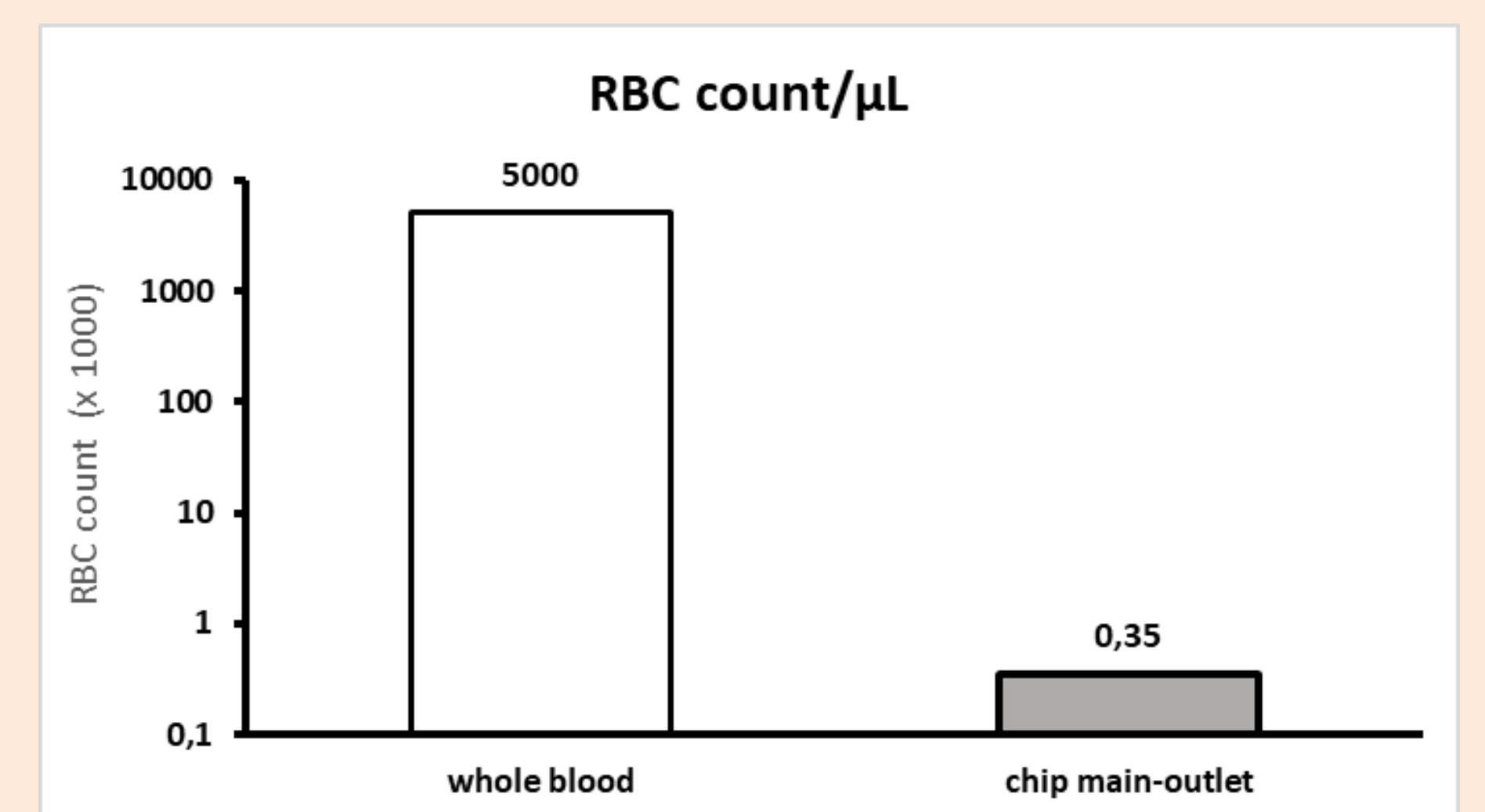
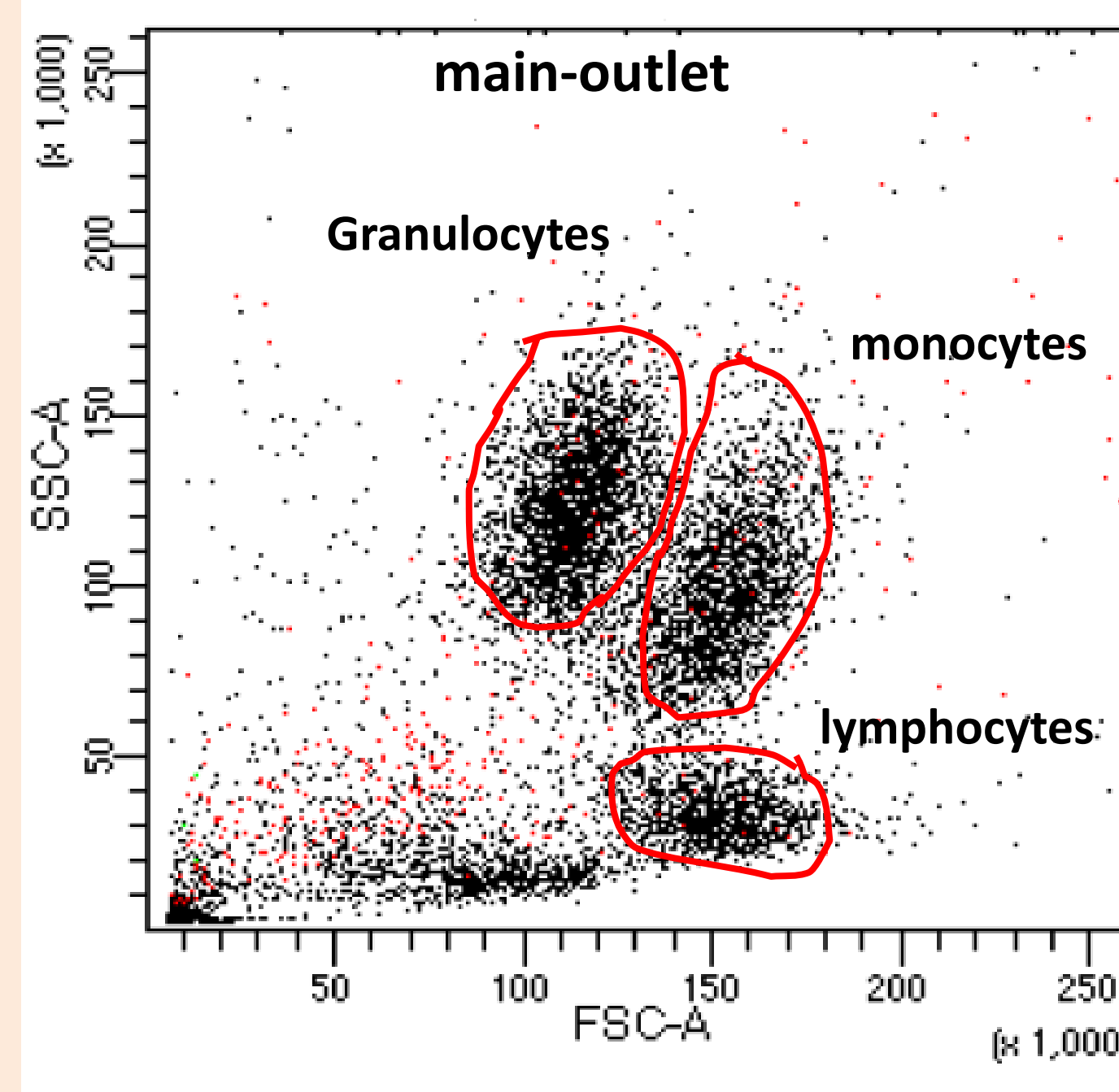
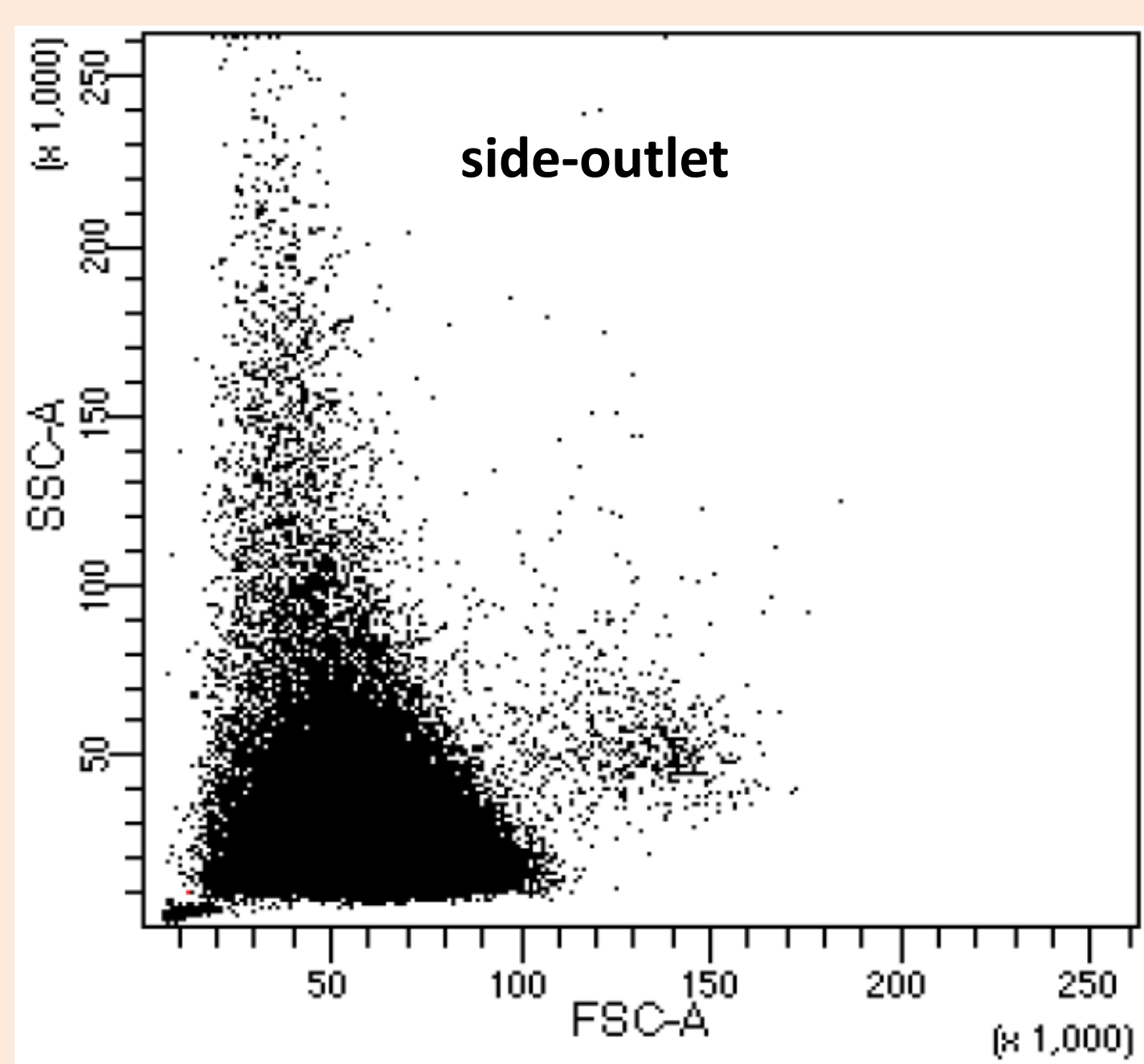
Dry-film photolithography

PDMS microfluidic chips for whole blood filtration



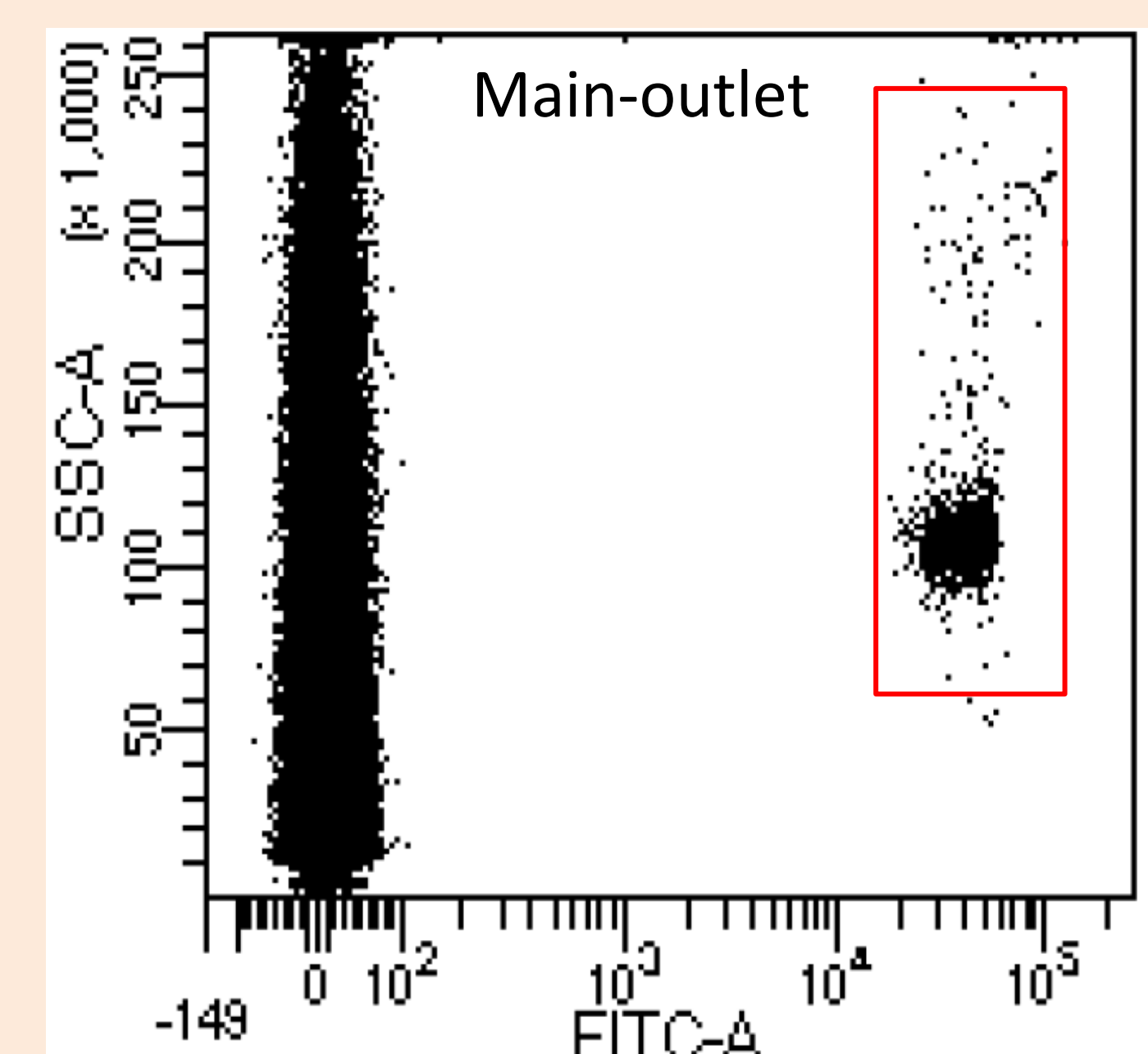
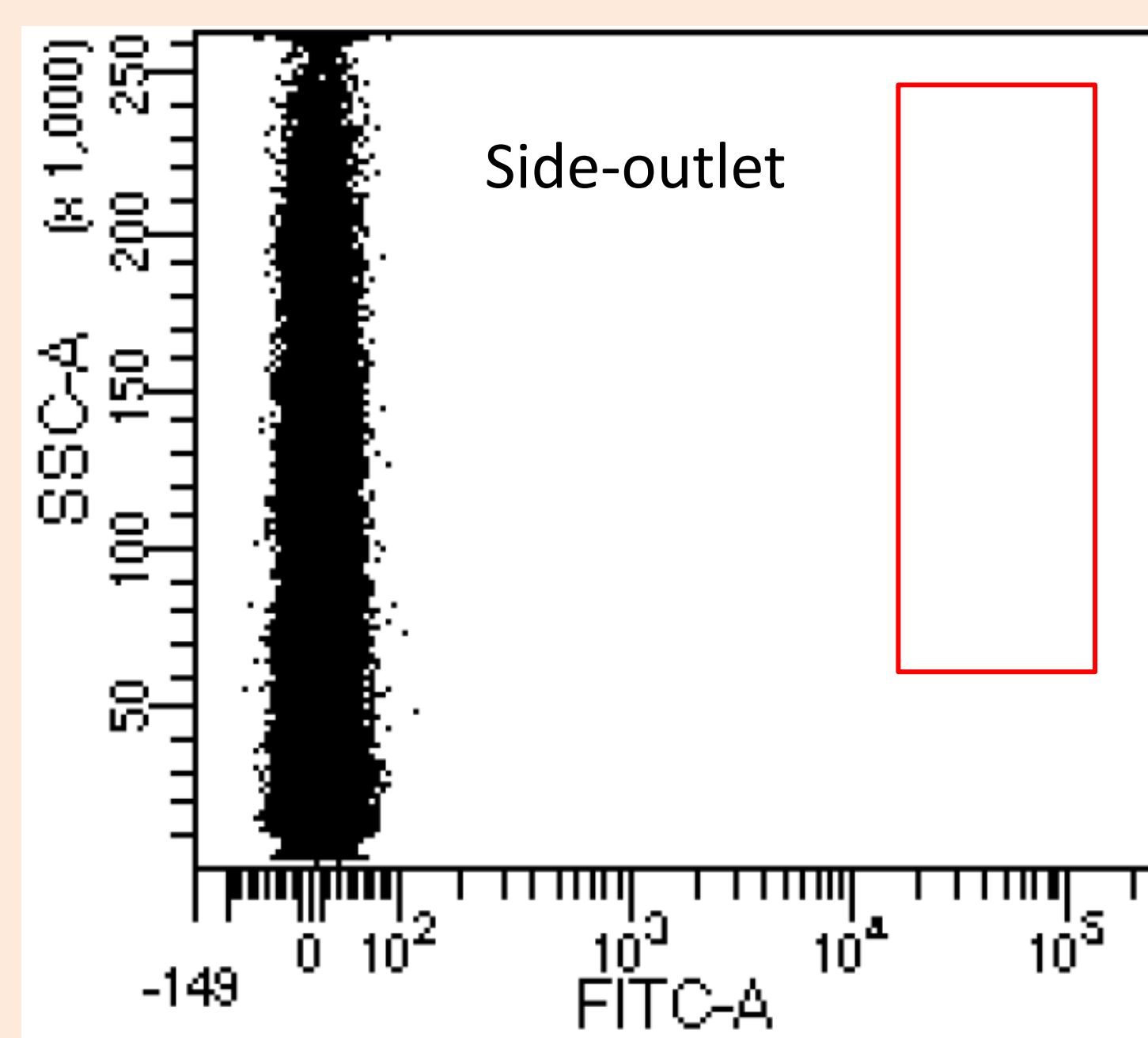
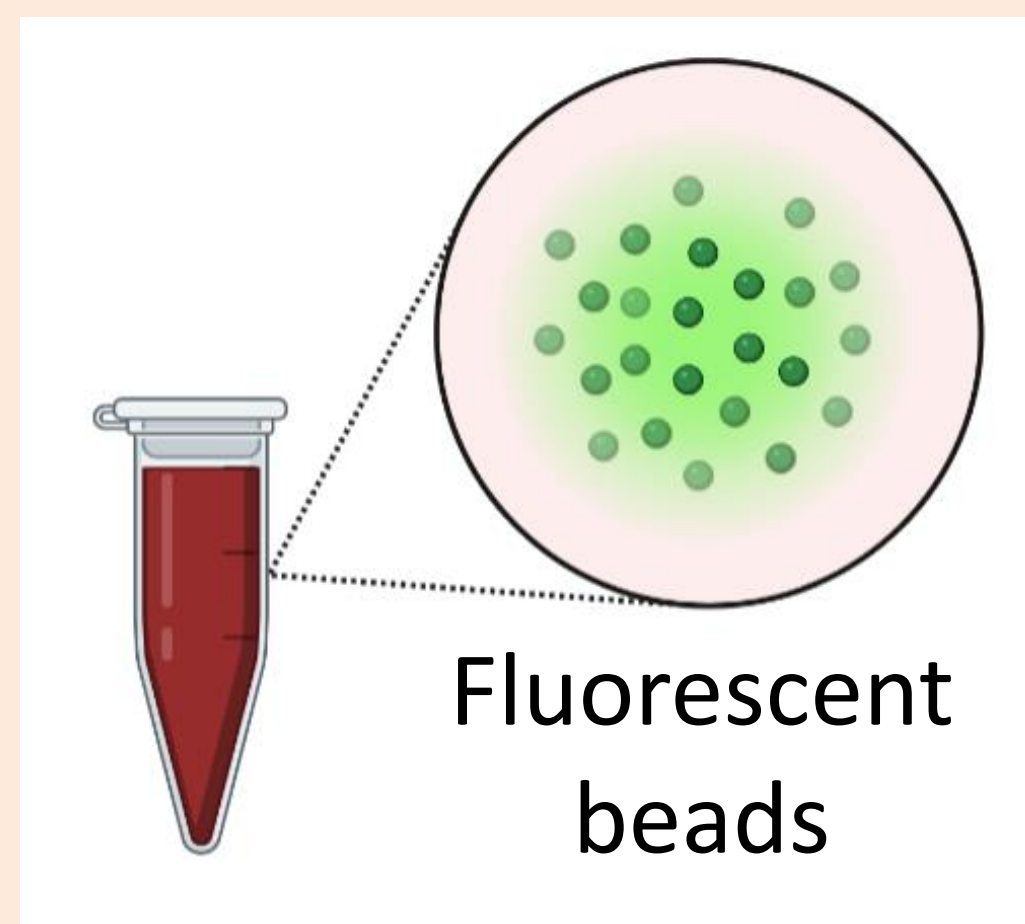
Hydro filtration chip

A. Whole blood filtration



Purification of 99,9 % of RBCs from whole blood samples

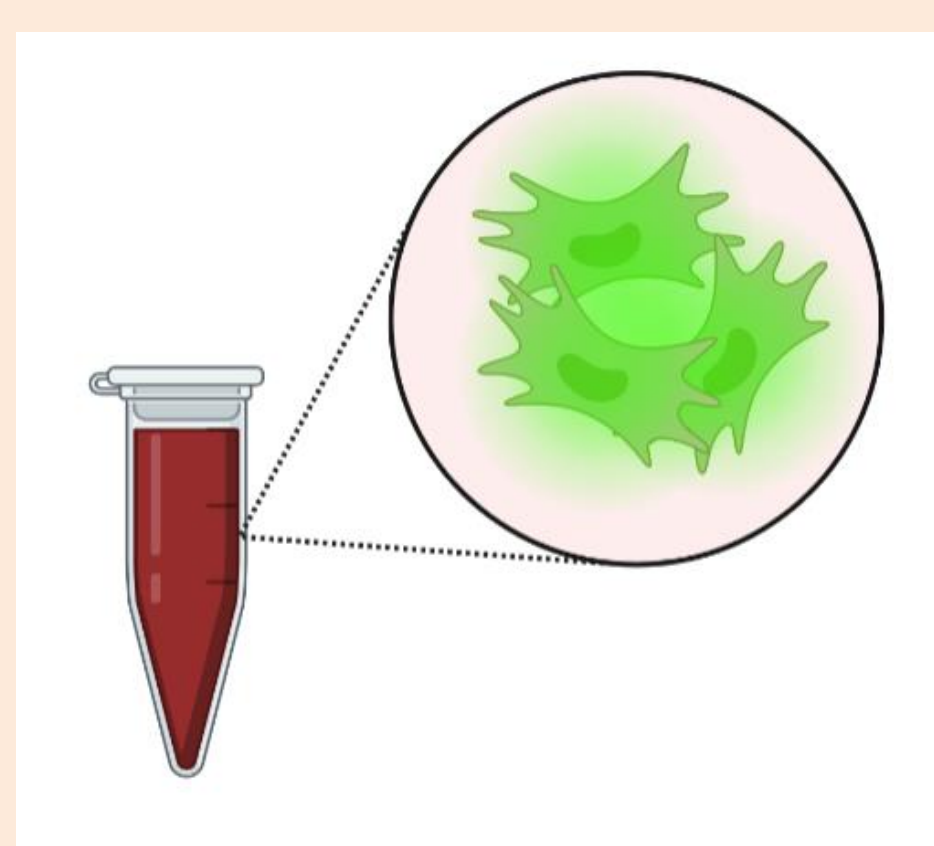
B. Whole blood sample spiked with fluorescent beads



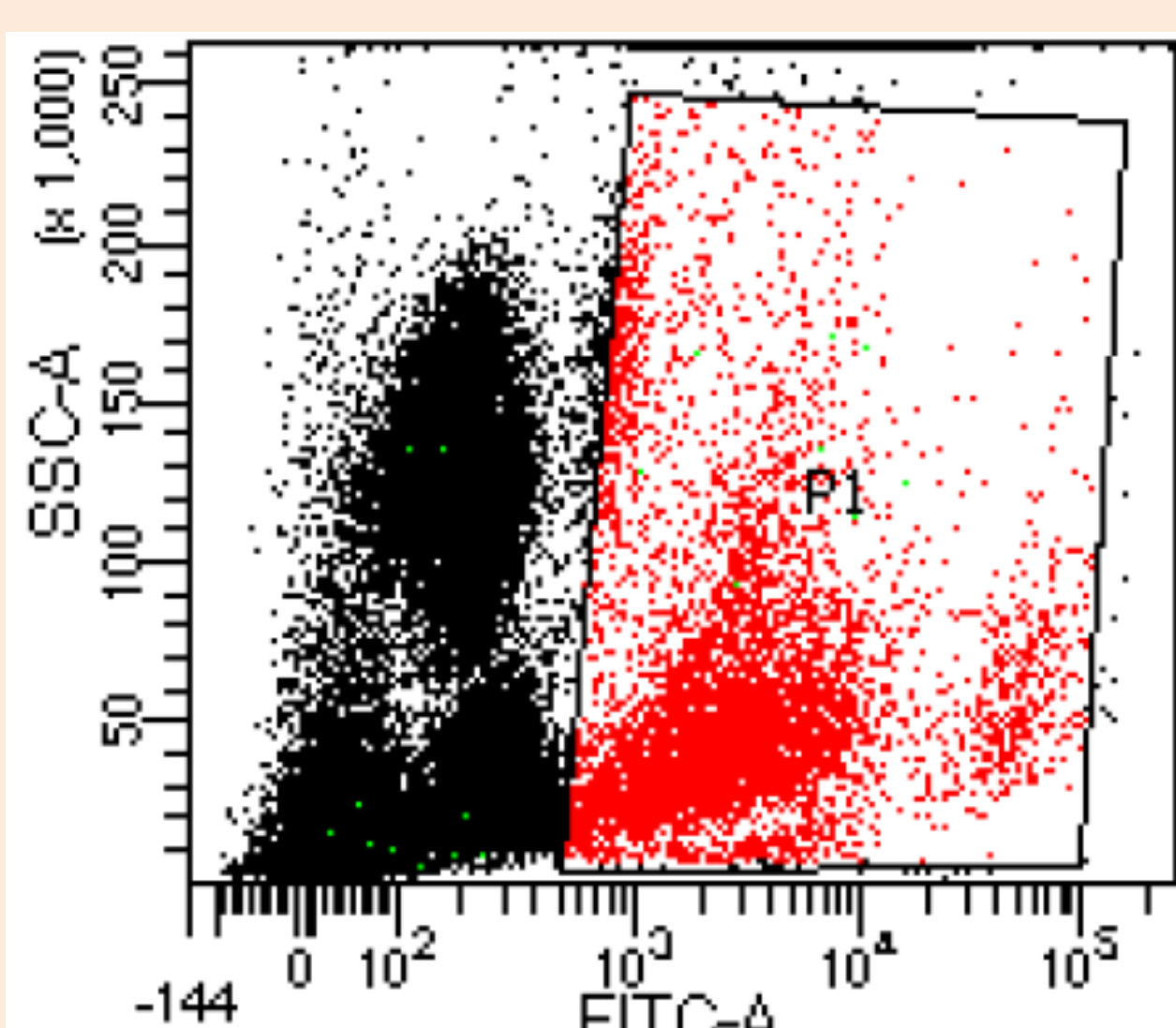
100 % recovery of 15 μm fluorescent beads

C. Whole blood sample spiked with ASCs

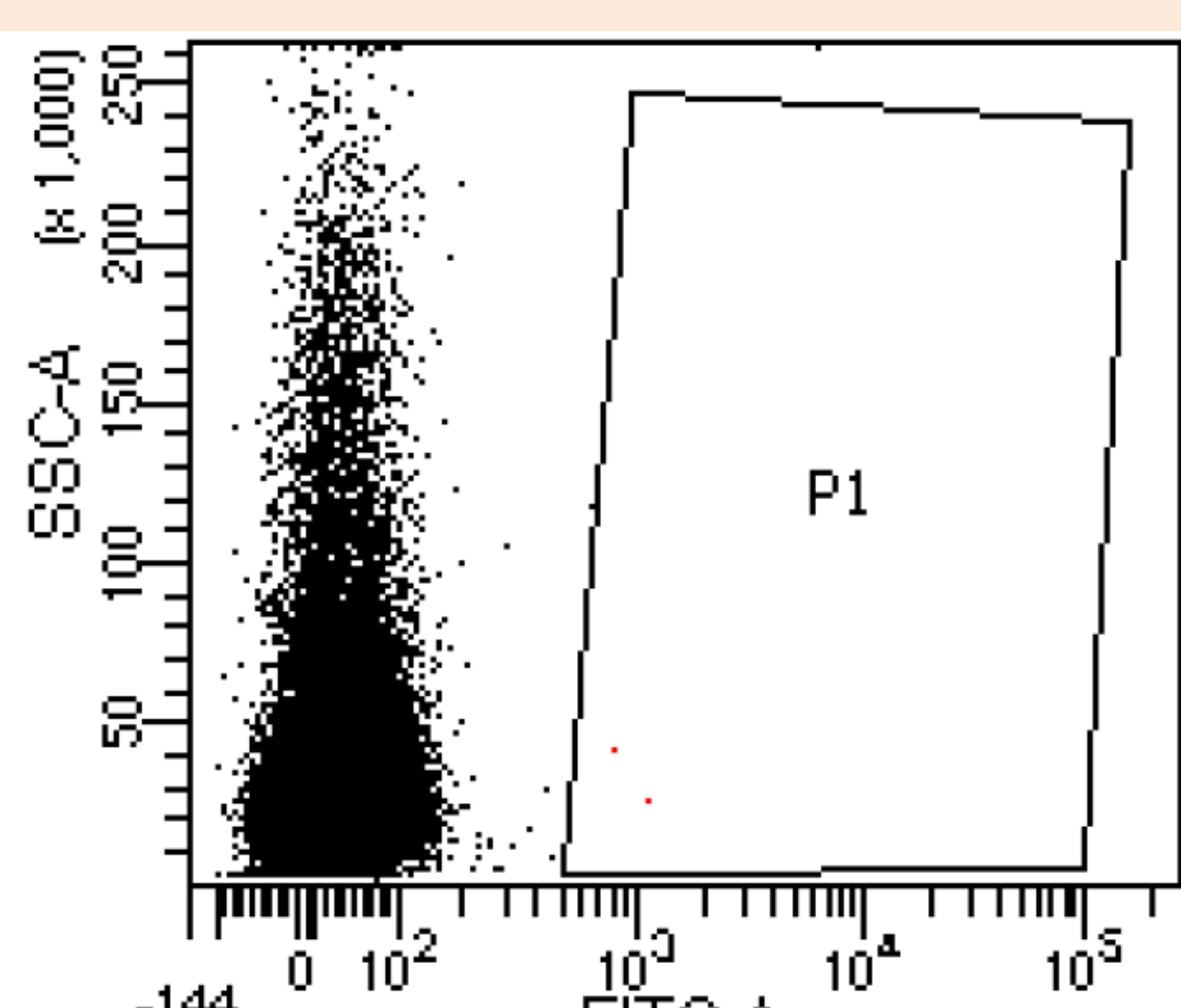
Quasi-total ASC recovery !



Fluorescent ASCs



Main-outlet



Side-outlet

Conclusions and perspectives :

We demonstrate a highly promising blood pre-processing chip which outperforms standard leukocyte separation protocols that adopt stringent conditions. The chip demonstrated 100 % filtering of beads from extremely low concentrations in bead/blood mixtures. Experiments with ASC/blood mixtures showcase high recovery and detection of ASC which is indeed very promising. Work is undergoing on another magnetophoresis chip that depletes remaining leukocytes in order to finally purify ASC.