A generic Microfluidic Approach for Deciphering Nanoscale biovesiclES propertieS

Pillemont Lyne^{1*}, Guneysu Daniel², Elie-Caille Céline², Boireau Wilfrid², Gué Anne-Marie¹

1 CNRS, LAAS, 7 avenue du colonel Roche, F-31400 Toulouse, France

2 FEMTO-ST institute, UBFC, CNRS, 25030 Besançon, France

* lyne.pillemont@laas.fr

Abstract

Extracellular vesicles (EVs) are vesicles shed by almost all cells with nanometric size and heterogeneous characteristics (biogenesis, shape...). EVs allow cell-to-cell communication and have a key role in lot of (patho)physiological reactions¹. Since EVs cover a large size range (from 30 to 1000 nm) and originate from every cells, their characterization in their entirety represents a real challenge. Indeed, there is a lack of method enabling their isolation and analysis, in complex media, that impairs EVs to be qualified and used as biomarkers. Succeeding in EVs detection from their physiological environment and analyzing them in different subsets represent ambitious objective of many research groups. To reach this goal, one solution is to combine several technics and/or improve technical and preanalytical steps. We propose here to develop a microfluidic device, based on hydrodynamic filtration, also called deterministic lateral displacement^{2,3}: the aim of this system is to separate EVs to desired size if EVs are between sidewall and the cutoff radius (Rc), which are the maximum radius value allowing particle to pass in the lateral channel. A fluid flow, containing particles, is introduced into the main channel. In the cross section, only small portion of fluid pass in lateral channel: particles with radius smaller than Rc. This system will be coupled to a home-made gold biochip presenting microarrays enabling specific EVs subsets capture. Then, this lab-on-chip would make possible the recovery and analysis of EVs subsets at once.



Figure 1. a) Hydrodynamic filtration principle with big (pink colour) and small (blue) particles calibrant, b) design of a 10-channels chip, c) 10-channels chip realized by lamination and photolithography of photosensitive dry films



Figure 2. Hydrodynamic filtration of nanobeads at channels intersection (x: no filtration, o: filtration)

References

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