Minicolloque n° 15 Confined media **x Oral** **☐Poster**

Selective protein binding using a solid-state nanopore into a microfluidic device

Izadora Fujinami Tanimoto[a*,b*], Benjamin Cressiot[c], Nathalie Jarroux[a], Gilles Patriarche[d], Bruno Le Piouffle[b], Juan Pelta[a,c] and Laurent Bacri[a]

a Université Paris-Saclay, Univ Evry, CNRS, LAMBE, 91025, Evry-Courcouronnes, France
b Université Paris-Saclay, ENS Paris-Saclay, CNRS, LuMIn, 91190, Gif-sur-Yvette, France
c CY Cergy Paris Université, CNRS, LAMBE, 95000, Cergy, France
d Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, 91120, Palaiseau, France.
* email : izadora.fujinamitanimoto@univ-evry.fr, izadora_mayumi.fujinami_tanimoto@ens-paris-saclay.fr

Solid-state nanopores are powerful tools to detect DNA configurations [1,2], protein size [3,4] and conformation [5,6,7], nanoparticles [8] and virus [9]. The nanometric diameter of solid-state nanopores can be tuned to fit the analyte size. Moreover, they present better chemical and mechanical stability than the biological ones [10]. However, the interactions between nanoparticles to be detected and the nanopore remain poorly controlled, while the membrane supporting the nanopore has a short lifetime attributed to a high surface energy [5]. To overcome these drawbacks, we have proposed a polymer functionalization to better control the pore size, to passivate the membrane. Hence avoiding nonspecific interactions of nanoparticles, by manipulating the chemical and physical surface properties [10]. Furthermore, to increase the specificity, a receptor can be immobilized on the nanopore surface to specifically capture the target molecules [9], leading to an active sensor. The nanopore chip was inserted into a microfluidic device to facilitate its handling and ease the possible change of buffers. The proof of concept was done using the streptavidin-biotin complex, where the streptavidin was captured by the grafted biotin inside the nanopore [11]. We plan to use this approach for virus detection.

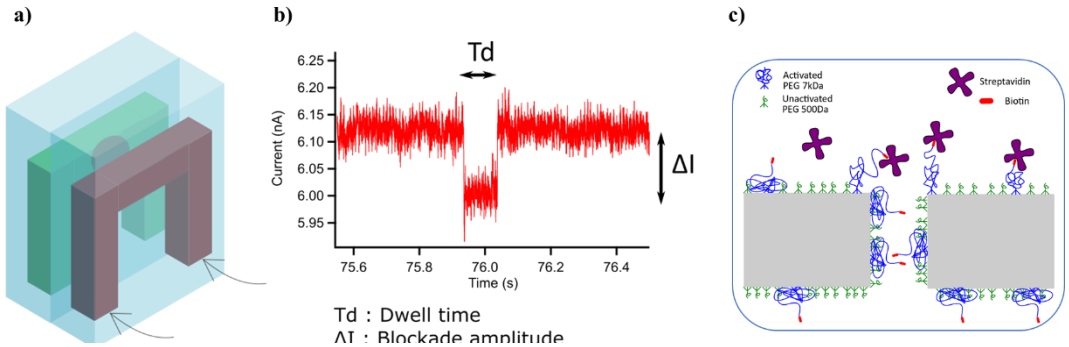

Fig. 1 a) Microfluidic device with a nanopore chip placed on it. b) Current blockade when a streptavidin molecule transiently resides inside a functionalized nanopore. c) Streptavidin interactions with a nanopore grafted with short and biotinylated long polymer (PEG) chains.

[1] GM. Nano Lett., **9**, 2953-2960 (2009)
[2] J. Li, Nat Mater., **2**, 611-615 (2003)
[3] R. Wei, Nature Nanotech, **7**, 257-263 (2012)
[4] E. Yusko, Nature Nanotech, **12**, 360-367 (2017)
[5] A. Oukhaled, ACS Nano, **5**, 3628-3638 (2011)
[6] KJ. Freedman, Sci Rep, **3**, 1638 (2013)
[7] P. Waduge, ACS Nano, **11**, 5706-5716 (2017)
[8] L. Bacri, J. Phys. Chem. B, **115**, 2890-2898 (2011)
[9] A. Arima, J. Am. Chem. Soc., **140**, 16834–16841 (2018)
[10] J. Roman, ACS Sensors, **3**, 2129–2137 (2018)
[11] IMF. Tanimoto, Biosensors and Bioelectronics, **183**, 113195 (2021)