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Single nanopore applications : from biomimetism to protein detection

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Single nanopore technology is considered as one of the major breakthroughs in the field of nanotechnology over the last decades[1]. The main challenges followed in this scale are to develop biomimetic channel (i.e. to reproduce at best the amazing biologic properties using protein confinement)[2] or single protein sensor able to sequence DNA strand[3] or to detect the protein size[4]. Among all the technologies aimed at confirming such applications, numerical simulations such as molecular dynamics are usual tools able to predict or to understand at the molecular level, the biophysical behavior of the simulated systems. We will present during this talk our results issued from diverse simulations. These results will show that the precise control of the nanopore geometry allows confining proteins in their biological conformation to give specific properties of ionic selectivity or DNA sequencing to the nanopore. We will also demonstrate that the internal functionalization of the nanopore wall can discriminate the size of the amyloid fibril that translocate through it in order to develop a precise nanoscale sensor.

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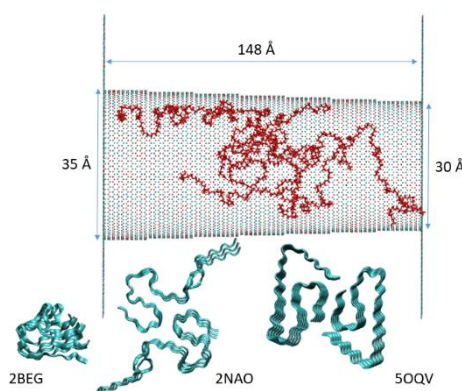[4] N. Arroyo, S Balme, F Picaud, The Journal of Chemical Physics 154 (10), 104901

Figure 1 : Top :PEG functionalization of a conical nanopore. Bottom: Three kinds of amyloid fibrils