Oral PhD

Predicting the kinetics of Protein-Nanoparticle corona formation in a simplified plasma

Oriol Vilanova, Judith Mittag, Philip Kelly, Joachim Rädler and Giancarlo Franzese

Universitat de Barcelona, C/Martí I Franquès 1, 08028 Barcelona, Spain

ovilanova@ffn.ub.edu

When nanoparticles (NP) interact with biological media, such as human plasma or serum, proteins and other biomolecules adsorb on the surface leading to the formation of the so-called "protein-corona". This spontaneous coating gives a biological identity to the NP determining its fate within the living systems. However, as the NP moves from a biological milieu to another, the corona could change its composition due to possible protein exchanges with other competitive proteins in the new fluid. Here we aim to understand the time evolution of the composition of the protein corona in a three-component simplified plasma. We compare results obtained by three different experimental techniques, (i) Fluorescence Correlation Spectroscopy (FCS), (ii) Differential Centrifugal Sedimentation (DCS) and (iii) MicroScale Thermophoresis (MST), to two independent theoretical approaches, (a) Molecular Dynamics (MD) simulations and (b) Differential Rate Equations (DRE) theory. By using the experimental results for single protein solutions as an input and combining the two theoretical approaches we are able to predict the kinetics of the protein corona. We test a posteriori our predictions by direct measurements, finding an excellent agreement.

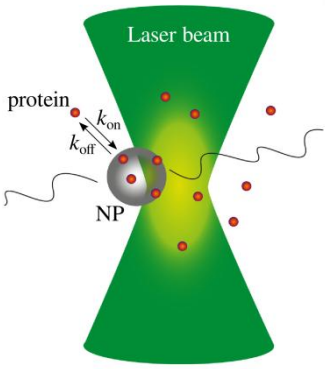

Figure 1. Representation of the FCS experimental technique.

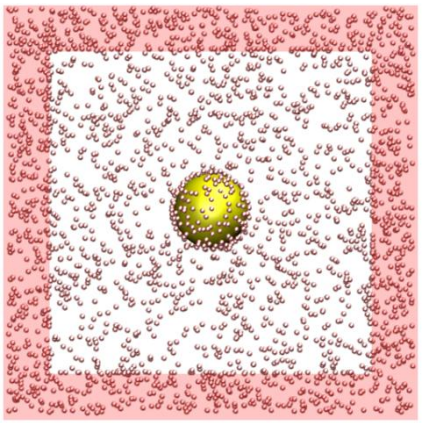

Figure 2 Snapshot of the MD simulation box.