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Abstract: 110O

Behaviour of citrate-capped gold nanoparticles at biomembranes – atomic insight at supported lipid bilayer and liposome interfaces.

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Introduction: Nanomaterials - materials with nanoscale dimensions - are widely investigated, especially in many biological settings. This is due to their potential use as advanced nano-medicines and diagnostic technologies, antimicrobials, as cellular probes, and in cellular-imaging, among other applications. The commonality between all applications is that they utilise the nanosized features of the material, specifically their departure from traditional bulk-like properties. In general, nanoparticle-based biotechnologies must interact with, and often cross, a cellular membrane to be useful; however, the dynamics of these interaction is still poorly characterised.
Aim: Combine advanced experimental and computation studies to study the interaction of ultra-small gold nanoparticles (AuNP) at a synthetic bio-membrane to see determine the dynamic interaction of model systems at bio-membranes.
Methods: A combination of atomic force microscopy, light and energy scattering, and molecular dynamics simulations were used to study the fundamental behaviour of the AuNPs at the bio-membrane-liquid interface. The systems of interest are models consisting of supported lipid bilayers (SLBs) (see Figure 1.) and free-floating liposomes. These act as archetypal bio-membranes. Liquid-phase, ripple-phase, and gel-phase biomembranes were used to systematically asses interactions.
Results: We investigated the behaviour - dynamics, adsorption, translocation, and physical interactions – of a variety of AuNPs at the biomembrane interface. The techniques listed above are beginning to provide localised, nanoscale information on the dynamics and mechanisms governing the interactions of AuNPs and biomembranes.
Conclusion: The precise mechanism by which AuNPs adsorb to the bio-membrane is beginning to be elucidated, revealing several interesting behaviours: 1) initial adsorption, 2) nanoparticle incorporation and/or translocation, 3) particle-induced phase change, and 4) translocations of the particles. These interactions are of broad scientific and medical interest because nanomaterials have recently become a viable method for manipulating matter at the cellular level, particularly for therapeutic and diagnostic applications.

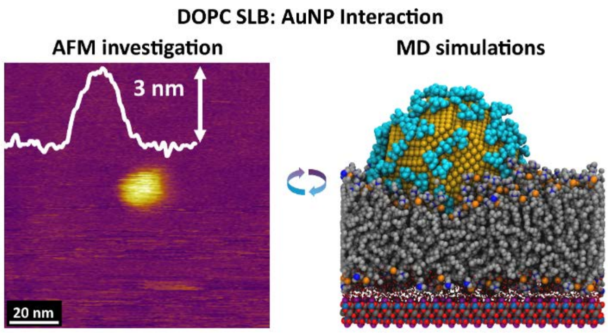

Figure 1. AFM (left) and MD simulations (right) of AuNP-SLB interaction.