

Plasmonic nanoparticles to probe the mechanical properties of synthetic lipid bilayers

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Over the past several years, the combination of inorganic nanoparticles (NPs) with biomimetic lipid interfaces has gained particular interest with recent advancements in Nanomedicine, suggesting that this synergy holds the potential to explore crucial phenomena occurring at the nano-bio interface and build up innovative lipid-NPs hybrid materials [1].

In this context, recent studies have focused on the interaction between gold nanoparticles (AuNPs) and synthetic lipid bilayers. Notably, it has been demonstrated that the spectral shift of AuNPs localized surface plasmon resonance (LSPR) relies on some ensemble-averaged properties of lipid assemblies, which can be elucidated through the spontaneous clustering of citrate-capped AuNPs on the lipid membrane [2,3].

This contribution aims to investigate the plasmon-mediated relationship between AuNPs aggregation and the mechanical response of lipid membranes, addressing new plasmonic descriptors to characterize AuNPs-lipid bilayers interactions.

Through UV-Vis measurements, we monitored the evolution of the LSPR profile of AuNPs when exposed to synthetic unilamellar liposomes with varying rigidities at different vesicles/AuNPs molar ratios. Our analysis of UV-Vis spectra revealed a specific concentration range where an isosbestic point emerges, which is unique to each lipid composition and dependent on liposomes' stiffness. By combining UV-Vis data with structural and morphological insights resulting from Cryo-EM and SAXS experiments, we introduce the isosbestic wavelength as a novel analytical tool for precisely evaluating the stiffness of membrane-enveloped nano-objects.

Overall, these findings will enrich our comprehension of the AuNPs self-assembly process onto lipid vesicles, unravelling the distinct effects of membrane rigidity and concentration on AuNPs plasmonics and thus paving the way for smart nanosized analytical probes to sample ensemble-averaged properties of membrane-enveloped particles.

Keywords: gold nanoparticles; LSPR; lipid bilayers; nano-bio interface.

References:

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