

Plasmonic properties of gold nanoparticles interacting with synthetic lipid bilayers

Ilaria De Santis¹, Jacopo Cardellini¹, Lucrezia Caselli², Costanza Montis¹, Debora Berti¹

¹ Department of Chemistry “Ugo Schiff” and CSGI, University of Florence, 50019 Sesto Fiorentino, Florence, Italy

² Department of Physical Chemistry 1, University of Lund, SE-22100 Lund, Sweden

Presenting author e-mail: ilaria.desantis@unifi.it

Gold nanoparticles (AuNPs) exhibit unique optical properties originated from the localized surface plasmon resonance (LSPR). These properties are highly sensitive to specific parameters such as size and shape, as well as to the surrounding environment, including the medium refractive index and interparticle distance. As a result, even slight LSPR shifts can be easily monitored by UV-Vis spectroscopy. These plasmonic properties have been recently investigated to gain insights into the nano-bio interactions involving AuNPs and biomimetic lipid interfaces under simplified and controlled conditions, which can provide useful hints to model the interactions with cell membranes for cytotoxicity studies [1,2].

In this contribution, we present a systematic approach to address the interaction of citrate-capped AuNPs and synthetic lipid bilayers with varying compositions. To achieve this goal, we prepared a library of unilamellar liposomes with low polydispersity and similar size from a set of synthetic phosphatidylcholines (PC), differing for length and degree of unsaturation of their acyl chains.

Our analysis of the UV-Vis spectra reveals a significant variation in the LSPR profile of AuNPs when challenged with nanosized lipid vesicles of varying rigidities. We also discovered a remarkable dependence on the vesicles/AuNPs molar ratios. By developing a new model for spectral analysis, we were able to separate the rigidity and concentration effects, providing a more accurate understanding of the interactions. Our findings suggest that plasmonic nanoparticles hold the potential to become a unique tool for probing both the concentration and rigidity of nano-objects enveloped by lipid bilayers, such as viruses or extracellular vesicles.

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

References

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