

Lipid-gold clusters (Aurora™): improving gold nanoparticles for lipid membrane studies

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Lipid model membranes in lamellar phases (bilayers) of different phospholipid compositions have been prepared, in the form of vesicles, or of supported lipid bilayers, and doped with Aurora™ at 0.1 mol%. Aurora™ consists of an Au₅₅ gold nanoparticle (about 1.4 nm in diameter) capped with triphenylphosphine ligands and a single diglyceride (distearoyl glycerol, DSG) ligand. Gold nanoparticles have been incorporated in the past inside liposomes, or grafted onto their surfaces, with diagnostic or therapeutic aims [1]. Including the gold nanoparticles in a stable form within the lipid bilayers has serious technical difficulties. We have tested the hypothesis that, because of the diglyceride ligand, Aurora™ would allow the easy incorporation of gold nanoclusters into cell membranes or lipid bilayers without significant effects in their biophysical properties. Our results show that Aurora™ readily incorporates into lipid bilayers, particularly when they are in the fluid phase, i.e. the state in which cell membranes exist. Calorimetric, fluorescence polarization or fluorescence confocal microscopy concur in showing that bilayer-embedded Aurora™ hardly changes the physical properties of the bilayers, nor does it perturb the phase equilibrium in lipid mixtures giving rise to lateral phase separation in the plane of the membrane. Atomic force microscopy shows, in fluid bilayers, well-resolved particles, 1.2 – 2.9 nm in height, that are interpreted as single Aurora™ conjugates (Figure 1). Cryo-transmission electron microscopy allows the clear observation of lipid bilayers with an

enhanced contrast due to the Aurora™ gold nanoparticles; the single particles can be resolved at high magnification. Our studies support the applicability of Aurora™ as a membrane-friendly form of nano-gold particles for biological research or clinical applications [2].

References

- [1] Miao Li, Theobald Lohmüller, Jochen Feldmann. *Nano Lett*, 15 (2015), 770-775.
- [2] Jesús Sot, Sebastião A. Mendanha-Neto, Jon V. Busto, Aritz B. García-Arribas, Shengrong Li, Stephen W. Burgess, Walt A. Shaw, David Gil-Carton, Félix M. Goñi, Alicia Alonso. *Chem Phys Lipids*, 218 (2019), 40-46.

Figures

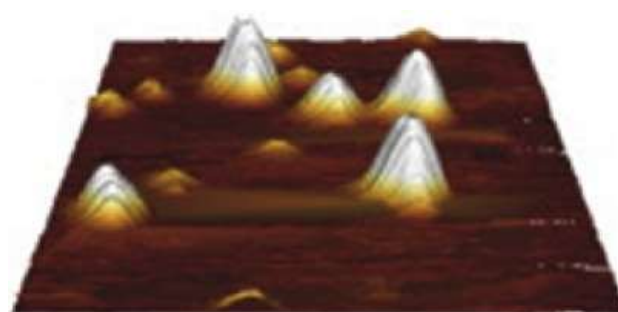


Figure 1: Contact mode AFM image of Aurora™ – DSG gold nanoparticles inserted into a lipid membrane (fluid phase).