Prediction of the penetration of Au nanoparticles through lipid membranes at liquid/air surface

Nóra Ábrahám[1], Edit Csapó[1], Gabriella Bohus[2], Imre Dékány[1,3]

[1]MTA-SZTE Supramolecular and Nanostructured Materials Research Group of the Hungarian Academy of Sciences, H-6720 Aradi vt. 1., Szeged, Hungary
[2]Department of Physical Chemistry and Materials Science, Faculty of Science and Informatics, University of Szeged H-6720 Aradi vt. 1., Szeged, Hungary
[3]Department of Medical Chemistry, Faculty of Medicine, University of Szeged, H-6725 Dóm sqr. 8., Szeged, Hungary

E-mail address: n.abraham@chem.u-szeged.hu

Novel physical properties and application of gold nanoparticles (AuNP) has attracted much attention in the past decades. The novel optical properties of AuNPs provide wide range of applications (catalysts, sensors, modern optics, bio-medics, etc.). Biomedical applications require the biocompatibility of these materials; therefore the nanostructured gold is a good candidate. It is essential to understand the behavior of the nanoparticles in living systems for successful targeting: the penetration through cell membranes or the blood brain barrier is a key factor. Due to the complexity of the living cell, it is obvious to work with model systems. The advantage of model membranes is to build up the membranes step by step from a simple system to a quite complex one so it is possible to characterize the effect of each added component. Langmuir monolayers formed at the air water interface are excellent models of a biological membrane: there are several parameters which can be varied easily such as the lipid composition, additional constituents (e. g. peptides), the subphase (composition, ionic strength, pH, etc.) and temperature to mimic the biological membranes.

We have synthesized spherical and rod-like Au nanoparticles and biofunctionalisation with cysteine and glutathion were carried out. The AuNPs were characterized with TEM and DLS methods. Model monolayer membranes of phospholipids were formed in Langmuir through at the air/water interface. The penetration of the biofunctionalized gold nanoparticles into the model membrane was studied by measuring the surface pressure of a preformed model membrane. The effect of membrane composition and the initial surface pressure were investigated. Monolayer films were transferred with Langmuir-Blodgett technique onto solid substrates and supported films were characterized with AFM technique.

Acknowledgements
The authors are very thankfully for the financial support of TÁMOP-4.2.2.A-11/1/KONV-2012-0047, TÁMOP-4.2.2/B-10/1-2010-0012 and DEVTEGEN PROJECT HUSRB/1002/214/078.