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Advanced characterization of gold nanoparticles: probing the bio-nano interface

Zeljka Krpetic
University of Salford Manchester, UK

Probing the bio-nano interface is a challenging task that requires skills between different fields, i.e. involving analytical chemistry, biochemistry, microscopy and nanoscience. Many techniques routinely used for nanoparticle characterization promise reliable results, however many also fail in that task, as the assessment of the interactions of nanoparticles with biological media, biomolecules and biologically relevant features require complex sample processing that may interfere with the findings and yield bias or incomplete results. Differential centrifugal sedimentation (DCS) is a powerful emerging particle sizing tool capable of high resolution sizing of functionalized nanoparticles and *in situ* characterization of the bio-nano interface. Nanoparticles in contact with biological fluids, dispersed in biological media may adsorb on their surface biomolecules that confer a biological identity to the particles. The way these biomolecule-nanoparticle complexes then interacts furthermore with cells and living organisms may be different from the interaction of the separate units themselves, triggering different biological responses and entry mechanisms. The research is focused on the preparation of high quality nanomaterials for biomedical applications and understanding of the surface properties of nanoparticles and functional molecules, their orientation and impact to the cellular membranes, finding novel ways of characterizing the bio-nano interface and applying the findings in the refinement of synthetic protocols for the preparation of engineered gold nanoparticles and nanoparticle libraries for biomedical applications. Different examples of nanoparticle-biomolecule interaction and advanced characterization approaches involving DCS will be discussed, i.e. from the high resolution sizing of the monolayer protected gold clusters to the clarification of functional biomolecular motifs at the nanoparticle interface. In particular, the DCS's role in the identification of the spatial location of proteins, their functional motifs and binding sites will be highlighted, and new promising approaches to characterizing the stability of ligand-nanoparticle complexes.

z.krpetic@salford.ac.uk