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Fluorescently labeled gold nanoparticles – interactions with biomolecules, cells and intracellular fate

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The great potential of nanoparticles (NPs) for biomedical applications requires a thorough and basic understanding of how these different particles interact with physiological fluids and, in particular, single cells.

Due to their remarkable optical properties, biocompatibility, facile synthesis and surface functionalization, gold nanoparticles (AuNPs) have been identified as a promising candidate for biomedical application. However, the current number of NPs successfully in use in the biomedical field does not match their potential, due to the unrevealed crucial factors which determine NP interactions with biomolecules, cells, and their intracellular fate in lysosomes.

To improve our understanding of the fate of AuNPs in biological systems, we used artificial lysosomal fluid (ALF) as a platform to study the colloidal stability and integrity of these NPs. The data showed that ALF is an appropriate model to study the behaviour of NPs in lysosomes, and revealed that the physicochemical properties of NPs significantly contributed to their fate and stability in the lysosomal environment. Moreover, we observed that the presence of fluorescent dyes attached to the particles could influence NP-cell interactions. Furthermore, the destabilization of nanoparticles can impair the fluorescent properties of dye-labelled NPs, thus affecting the accurate assessment of NP uptake.

The final chapter of the thesis explores the alternatives for fluorescence-based detection, by using the optical properties of AuNPs for detection, via lock in thermography. This method shows great promise for detecting intracellular AuNPs and enables an estimation of AuNP aggregation.

Jury:

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