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Study of the interaction of plasmonic nanoparticles with plasma proteins: a comparison between static and dynamic regime

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In recent years, noble metal nanoparticles (NP) have received significant attention in cancer medical research due to their unique efficacy and specificity in imaging, diagnosis, and therapy. Gold nanoparticles (GNPs) are widely used, particularly in cancer research, because of their ease of synthesis, adjustable size and shape, remarkable biocompatibility, unique optical properties, and surface plasmon resonance (SPR) properties [1]. When exposed to physiological fluids in these kinds of treatments, it is important to understand the interaction with biomolecules such as proteins, lipids, or nucleic acids. Particular attention is given to the immediate adsorption of proteins on the NP surface, since it forms a protein corona (PC) [2] that may modify structures of adsorbed proteins and also eliminate their physiological functions.

Plasma protein such as: albumin (BSA), myoglobin (MYO) and fibrinogen (FIB) were used to study long and short-term interactions in both static and dynamic regime, since it simulates the highly dynamic nature of blood and its heterogeneous flow velocity [3].

In this work, GNPs of different geometries were synthesized which were then interacted with three plasma proteins under a static and dynamic regime, by using microfluidics devices in order to assess the complexation, structural changes, stability and activity of proteins, to further understand the ensuing phisiological responses.

Results indicated a strong interaction between GNPs and plasma protein (due to increase in the hydrodynamic diameter, corroborated with SEM and DLS, and differences in the SPR of each geometry) specially under dynamic conditions, where the time of interaction is major. Static regime outcomes are completely different from the former ones, mainly due to protein-protein interactions and the formation of PC.

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