"Nanomedicine and Nanotoxicology: The Manipulation of Cell Membranes and Nanomaterials for Diagnosis and Therapy"

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Manipulation of nanocomposites in conjunction with biomolecules is crucial for the development of novel bio-conjugates for applications in medical areas, for both, diagnosis and therapy. These so-called theranostic materials represent the state-of-the-art in the development of nanoscale-based materials for fighting cancer. Gold nanorods (AuNRs) and graphene have found promising applications in medicine, mainly because of the absorption band in the infrared region exhibited by these materials. The absorption in the near infrared region makes them appropriate for *in vivo* photothermal applications due to the maximum radiation penetration through tissue. Besides, investigations on novel nanomaterials for photo-hyperthermia applications are of great importance to understand the toxicity of nanomaterials at the molecular scale and the influence of lipids in the uptake process, bringing important benefits to the field of personalized nanomedicine. We report on the development of a nanosystem comprising cell membrane-coated AuNRS, which have been synthesized by colloidal seed-mediated, surfactant-assisted approach, followed by coating with human lung adenocarcinoma epithelial cell (A549) membrane. Glutamine-graphene oxide nanocomplexes were also synthesized and applied in the hyperthermia studies The nanoconjugates presented higher toxicity to cancer cells compared to healthy fibroblasts. The incorporation of gold nanorods into real membrane monolayers was also studied using Langmuir techniques via kinetics absorption and surface pressure measurements and revealed significant differences on how the AuNRs interact with the cell membranes depending on the size of the gold nanorods, indicating that the lipids present in the covering membrane exerted high influence on the uptake process. These results revealed the potential of cell membrane-coated nanomaterials and open opportunities for the development of more efficient nanosystems for cancer applications