

Exosomes: naturally secreted nanoparticles characterized by biophotonic techniques

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Exosomes have been proposed as potential biomarkers of multiple diseases. The quantity of exosomes released from cells and their composition changes according to the physio-pathological condition of the tissue of origin, mirroring their direct involvement in specific pathogenic mechanisms, including neurodegenerative diseases. Nowadays, an effective method for the detection and characterization of exosomes is still needed. In order to better understand exosomes' biological function for a future exosomes-based clinical personalized application, we propose herein two biophotonic approaches: Surface Plasmon Resonance imaging (SPRi) that allows the study of exosomes interactions with biomolecules, and Raman spectroscopy (RS), suitable for exosomes characterization. Taking advantage of the multiplexing capability of SPRi technology, both generic and tissue specific (i.e. neuronal marker) biomarkers have been simultaneously analyzed on exosomes from plasma. The SPRi approach allowed to perform the concomitant characterization of multiple exosomes subpopulations. The collected Raman spectra (from different human mesenchymal stem cells) showed the ability of the method to provide an overview of the chemical composition of exosomes and to distinguish the vesicles released by different cell-types. The proposed approaches couple nanomedicine and biophotonic techniques to a biomedical issue that is currently limited in its clinical application by the lack of robust and innovative characterization methods.