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# AuNP-based drug delivery: Cellular uptake and immune response

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Gold nanoparticles (AuNPs) typically possess sizes between 1 and 100 nm, a size range that underlies the phenomenon of surface plasmon resonance (SPR). This effect results from the collective excitation of surface electrons upon interaction with electromagnetic radiation at specific wavelengths, leading to characteristic absorption bands[1,2,3,4]. In addition, the nanoscale size of AuNPs facilitates their translocation across biological membranes and confers a high surface-to-volume ratio, which enhances their ability to conjugate therapeutic molecules on the surface. Such nanocarrier systems enable targeted and controlled drug release at the intended site of action [5,6].

AuNPs showing LSPR at 560 nm, functionalized with the fluorescent dye fluorescein isothiocyanate (FITC), were used in the present study. Incorporation of the fluorochrome allows identification and tracking of cells that internalize the nanoparticles. FITC-labeled AuNPs (FITC-AuNPs) were thoroughly characterized by different spectroscopic techniques, confirming their nanometer size distribution (70-100 nm), colloidal stability, and successful fluorescent functionalization, verified by flow cytometry.

Flow cytometric analyses were also conducted to investigate the major immune cell populations interacting with the nanoparticles and to assess cell viability after the interaction. Next, the AuNPs were functionalized with a pharmaceutical agent currently used in the treatment of multiple sclerosis, with the aim of assessing whether the drug conjugated to the nanoparticle surface exhibits enhanced anti-inflammatory and immunomodulatory effects. For this purpose, a customized flow cytometry panel was developed to analyze various immune cell subpopulations and different activation markers.

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References

[1] I. Venditti, et al. Particle & Particle Systems Characterization 2021, 39, 2100282
[2] I. Venditti, et al. Nanomaterials 2020, 10, 1898
[3] I. Venditti, A. Stringaro, M. Colone, A. Calcabrini, V. Dini, G. Iucci, L. Tortora, M. Marsotto, C. Battocchio; AIP Conference Proceedings; 2021, 24165, 020019
[4] Z. Zhang, J. Wang, C. Chen, Theranostics. 2013; 3(3): 223–238
[5] K. Bouchemal, Drug Discovery Today. 2008, 13, 21.
[6] A.T. Haine, T. Niidome, Chem Pharm Bull. 2017, 65, 625.

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