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Biocompatible coated magnetosome minerals with various organization and cellular interaction properties induce cytotoxicity towards RG-2 and GL-261 glioma cells in the presence of an alternating magnetic field

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Biologics magnetics nanoparticles, magnetosomes, attract attention because of their magnetic characteristics and potential applications. The aim of present study was to develop and characterize a novel magnetosomes extracted from magnetotactic bacteria, purified to produce apyrogen magnetosome minerals, and then coated with chitosan, neridronate, or polyethyleneimine, to yield stable magnetosomes designated as M-Chi, M-Neri, and M-PEI, respectively. The biocompatibility of nanoparticles was evaluated with mouse fibroblast cells (3T3), Mouse glioblastoma cells (GL-261) and Rat glioblastoma cells (RG-2). Also, we tested these nanoparticles for magnetic hyperthermia treatment of tumor in vitro with GL-261 exposed an alternating magnetic field, heating properties, efficiency and internalization was then evaluated. Nanoparticles coated with chitosan, polyethyleneimine and neridronate are apyrogen, biocompatible and stable in aqueous suspension. The presence of a thin coating in M-Chi and M-PEI favors an arrangement in chains of the magnetosomes, similar to that observed in magnetosomes directly extracted from magnetotactic bacteria, while the thick matrix embedding M-Neri leads to structures with an average of 3.5μm2 per magnetosome mineral. In the presence of GL-261 cells and upon application of an alternating magnetic field, M-PEI and M-Chi lead to the highest specific absorption rates of 120-125W/gFe. Furthermore, while M-Chi lead to rather low rates of cellular internalization, M-PEI strongly associate to cells, a property modulated by application of an alternating magnetic field. Coating of purified magnetosome minerals can therefore be chosen to control the interactions of nanoparticles with cells, organization of the minerals, as well as heating properties and cytotoxicity, which are important parameters to be considered in the design of a magnetic hyperthermia treatment of tumor.

Biography

Edouard Alphandéry has completed his PhD from Oxford University and Postdoctoral studies from Trinity College and the University of Washington. He is an Assistant Professor at the UPMC, France. He has published more than 30 papers in reputed journals and submitted 10 patent families.

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