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Silvia Panseri

National Research Council of Italy, Italy

Attractive advanced cell therapy by using bioresorbable magnetic nanoparticles

Cell therapy is one of the most exciting and promising areas for disease treatment and regenerative medicine. However the success rate of cell-based therapies, despite their great potential, is limited mainly due the ineffective delivery and retention of therapeutic cells in the specific organ. Magnetic targeting has emerged as a method to overcome these limitations. So far these attempts have used superparamagnetic iron oxide nanoparticles (SPIONs), only clinically approved metal oxide nanoparticles. Nevertheless the exposure to SPIONs has always been associated with significant toxic effects such as inflammation, apoptosis and generation of ROS. Our group, by doping hydroxyapatite (HA), the mineral component of bone, with Fe²⁺/Fe³⁺ ions, had obtained novel biocompatible and fully bioresorbable superparamagnetic nanoparticles (FeHA). This work demonstrates the opportunity of FeHA in mesenchymal stem cells (MSCs) labeling. MSCs easily internalized the FeHA, and they became magnetic enough to be guided and retained to specific site by a magnet. Magnetic MSCs maintained their morphology and cell viability was not negatively affected. Due the well-known osteoinductive feature of HA, magnetic MSCs overexpress osteogenic genes. We are also investigating the possibility to combine these above-mentioned results with the contrast ability of FeHA for a real time imaging of the magnetic MSCs *in vivo* by magnetic resonance imaging. In conclusion, due to the intrinsic magnetic properties of FeHA, its fast degradation and very low iron content compared to SPIONs, this approach could be simply transferred to different cell types obtaining an attractive advanced approach for several regenerative medicine applications.

Biography

Silvia Panseri is a Biologist and has completed her PhD in 2009 at the University of Milan, Italy. Her research activity is mainly focus on nano and regenerative medicine. She has great expertise in cell-biomaterial interactions at the nanoscale, in magnetic cell guiding and 3D cell culture in bioreactor with several scaffolds. She is an author of more than 50 papers published in international peer-reviewed journals, 12 book chapters, co-inventor of two patents and H-index=19. She has been serving as a Guest Editor in *International Journal of Molecular Sciences* and *Frontiers in Bioengineering and Biotechnology*.

silvia.panseri@istec.cnr.it

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