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Graphene oxide-calcium phosphate: The revolutionary nanomaterial for bone regeneration

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Nanotechnology strategies for tissue engineering in creating implantable tissues have been viewed as the most promising technology for regenerating damaged tissues such us bone. Indeed nanomaterial scan increase the cell growth, differentiation and tissue regeneration. In this context graphene and its derivatives possess intrinsic characteristics for tissue engineering applications enhancing i.e. the osteogenic differentiation (Dubey et al., Stem Cells Int, 2015). However, is well known how also the immune system, especially monocytes, play an important role guiding the differentiation of human mesenchymal stem cells (hMSCs) in osteoblast (Nicolaidou et al., PloS one, 2012). As previously demonstrated graphene oxide (GO), with small lateral dimension was able to induce specific activation stimuli on monocytes (Orecchioni et al., Advanced Healthcare Materials, 2016). Herein, we combined the immune modulatory proprieties of GO and the well-recognized osteoinductivity capacity of calcium phosphates (CaP) in a novel unique biocompatible nanomaterial called GO-CaP improving the bone-regeneration. The GO-CaP osteoinductive proprieties were investigated analyzing several aspects from the bone matrix formation to the expression of several markers such as ALP, OCN and BMPs *in vitro* and *in vivo*. Surprisingly, this new material was able to facilitate osteoblast-differentiation of hMSC in a co-culture with monocytes. This action of GO-CaP was confirmed also *in vivo* without any adverse inflammatory reactions. Microcomputed-tomography revealed an increase of trabecular number (Tb.N), trabecular thickness (Tb.Th) and trabecular relative volume (BV/TV) in GO-CaP treated mice. From a public health perspective, GO-CaP could become a promising therapeutic material able to support and improve the bone regeneration therapy.

Biography:

Dr. Lucia Gemma Delogu has been an Assistant Professor at the University of Sassari (UNISS), Sardinia, Italy since 2012. She received her Ph.D. title in Biochemistry and Molecular Biology from the UNISS in Italy. She has worked as a postdoctoral fellow at the University of Southern California, Los Angeles USA (2007-2009) and was a visiting researcher at the Sanford-Burnham Institute of San Diego, CA USA in 2008 and at the Department of Health and Human Services at the NIH in Bethesda, MD USA in 2013. Today, Dr. Delogu leads the Laboratory of Bionanotechnology in the Department of Chemistry and Pharmacy, UNISS Italy.