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The use of microRNA assisted and gene-manipulated mesenchymal stem cell (hMSC) derived osteoblasts optimally propagated and differentiated in TiO2 scaffolds

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MicroRNAs are small RNAs, 21–25 nt in length, encoded in the genome, and exert important regulatory roles. However, only a few articles have dealt with microRNA expression and function in osteoblasts. MiR-125b has been shown to down-regulate osteoblastic cell differentiation, by arresting cell proliferation, possibly targeting ErbB2 and osterix. BMP2-induced osteoblast differentiation involves miR-135 and miR-133, which target Smad5, a mediator of the BMP-2 signaling, as well as Runx2. Several other microRNAs (16, 24, 125b, 149, 328, and 339) have been shown to constitute an osteochondral "signature". These microRNA species may thus either introduce a collapse of the system maintaining all the important cellular functions constituting the osteochondral phenotypes, or serve as a switch towards osteoblastic cell development. When it comes to the application of engineered bone tissue into critical size lesions, the selection of scaffold material seems at be of vital importance. Recently, TiO_2 was shown to be a promising material due to its microstructure allowing for cell migration, vascularization, and mimicking the pore size of trabecular bone.

The scaffold material TiO_2 appeared superior to PLA and HA no matter which parameters were measured in osteoblasts derived from MSCs or ASCs: 1) osteoblast phenotypic markers, 2) osteochondral microRNA profiles, 3) osteoblast resilience towards phenotypic changes, 4) osteoblast resilience towards over-activation of osteoclasts and/or differentiation of osteoclasts from PBMCs. 5) The use of TiO_2 also seemed to enhance the ability of engineered osteoblasts to start the process of vascularization (as assessed by marker genes important for this process)

Biography

Jan O. Gordeladze, PhD (borne 24th of April, 1950), holds a triple professor competence (medical biochemistry, physiology, and pharmacology), and is presently working as a professor at the Department of Biochemistry, Institute of Basic Medical Science, University of Oslo, Norway. He has previously been employed as the medical director of MSD, Norway, serving two years as a Fulbright scholar at the NIH, Bethesda, Maryland, USA, and from 2006-2009 being employed as associate professor at the University of Montpellier, France. He has published more than 100 scientific articles, reviews/book chapters and presented more than 250 abstracts/posters/talks at conferences world wide

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