

# STEM CELL AND REGENERATIVE MEDICINE & 4<sup>th</sup> Annual Conference on BIOMATERIALS

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## Adult stem cells in bone and vascular tissue engineering – A review

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Adult stem cells, i.e. stem cells derived from various tissues of the adult organism, are promising for cell therapy and tissue engineering. These cells overcome the ethical and legal issues associated with the use of human embryonic and fetal stem cells, and also enable the use of autologous stem cells for the implantation into patients. Human bone marrow mesenchyme stem cells (bmMSCs) have been widely used and even applied in numerous clinical trials, e.g. for treatment of critical limb ischemia during diabetes, lower limb long bone nonunion or neurological diseases. Recently, another promising source of mesenchyme stem cells emerged, namely adipose tissue. In comparison with the bmMSCs, the adipose tissue-derived stem cells (ASCs) are available in larger quantities and by less invasive approaches, such as liposuction. Although ASCs were discovered relatively recently, in 2002, they have been relatively widely clinically applied in human patients, particularly for reconstructive, corrective, aesthetic and cosmetic purposes. In our studies, we attempted to differentiate human ASCs, isolated from lipoaspirates obtained by liposuction, towards osteoblasts (Ob) and vascular smooth muscle cells (VSMCs). For differentiation towards Ob, the ASCs were seeded on chitosan/glucan/hydroxyapatite and cultivated in an osteogenic medium supplemented with ascorbic acid,  $\beta$ -glycerophosphate and dexamethasone. In comparison with commercially available human bmMSCs, the ASCs produced similar amounts of type I collagen and Runx2, i.e. early markers of osteogenic differentiation, but lower levels of osteocalcin, a late marker of osteogenic differentiation. For differentiation towards VSMCs, the ASCs were cultivated in a medium supplemented with transforming growth factor- $\beta$ 1 and bone morphogenic protein-4. This medium induced the appearance of alpha-actin, calponin and myosin heavy chain, i.e. an early, intermediate and late marker of VSMC differentiation, respectively, in ASCs, and the amount and intensity of fluorescence of these markers were further enhanced by cultivation in a lab-made pressure-generating dynamic cell culture system. Thus, ASCs appears to be more suitable for vascular tissue engineering than for bone tissue engineering.

### Biography

Lucie Bacakova, MD, PhD, Assoc. Prof. has graduated from the Faculty of General Medicine, Charles University, Prague, Czechoslovakia in 1984. She has completed her Ph.D at the age of 32 years from the Czechoslovak Academy of Sciences, and became Associated Professor at the 2nd Medical Faculty, Charles University. Since 2005, she is the Head of the Department of Biomaterials and Tissue Engineering, Institute of Physiology of the Czech Academy of Sciences. She is a specialist for studies on the interaction of differentiated and stem cells with various biomaterials, and for vascular, bone and skin tissue engineering. She has published more than 160 papers in reputed journals

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