

5<sup>th</sup> International Conference on

# Tissue Engineering & Regenerative Medicine

September 12-14, 2016 Berlin, Germany

## Combination of bone tissue engineering and electrical stimulation approaches, *in vitro* and *in vivo* studies

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Electrical stimulation has been successfully used to treat bone defects clinically for many years. Recent *in vitro* studies have demonstrated that ES can change cell behavior such as migration, proliferation and differentiation. The goal of this project was to combine bone tissue engineering (TE) and electrical stimulation (ES) approaches in *in vivo* and *in vitro* experiments to determine its effectiveness and characterize the underlying mechanisms, respectively. *In vitro* experiments were performed in a customized six well ES culture chamber, in which we exposed adipose- (AT-MSC) and bone marrow- (BM-MSC) derived MSC to ES in 2D and 3D culture. Results showed that ES changed osteogenic gene expression patterns in both AT- and BM-MSC, and that these changes differed between the two groups. We found that ES increased BMP2 and TGF- $\beta$ 1 expression in MSC suggesting calcium signaling as a potential mechanism. In *in vivo* experiments, a rat femur critical size defect (CSD) model was used and treated with AT-MSC seeded on calcium phosphate scaffold ( $\beta$ -TCP) material. Femurs from three groups of rats (40 per group; control= $\beta$ -TCP alone; sham= $\beta$ -TCP+AT-MSC; experimental=ES+ $\beta$ -TCP+AT-MSC) were assessed at one and eight weeks post treatment by mean of histology, gene-expression and mechanical testing. The results of this ongoing *in vivo* experiment will be presented at the upcoming meeting. These initial findings may support the use of ES in TE applications which could potentially improve and expand their use in the clinical setting.

### Biography

Liudmila Leppik has completed her PhD in Molecular Biology at the Laboratory of Human Gene Structure and Function at the Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry in Moscow, Russia and Post-doctoral studies at the German Cancer Research Center in Heidelberg, Germany. She is currently a Post-doctoral Research Fellow and Assistant Director at Frankfurt Initiative for Regenerative Medicine at the Goethe-University in Frankfurt/Main.

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