



Title: Bioactive nanofiber-based conduits in a peripheral nerve gap management- an animal model study

Authors: Tomasz Dębski ¹, Ewa Kijeńska-Gawrońska ^{2,3}, Aleksandra Zołocińska ¹, Katarzyna Siennicka ¹, Anna Słysz ¹, Wiktor Paskal ⁴, Paweł K. Włodarski ⁴, Wojciech Świąszkowski ³ and Zygmunt Pojda ¹

¹ Department of Regenerative Medicine, Maria Skłodowska-Curie National Research Institute of Oncology, Wawelska 15B, 02-034 Warsaw,

² Centre for Advanced Materials and Technologies CEZAMAT, Warsaw University of Technology, Poleczki 19, 02-822 Warsaw, Poland

³ Materials Design Division, Faculty of Materials Science and Engineering, Warsaw University of Technology, Woloska 141, 02-507 Warsaw, Poland

⁴ Department of Methodology, Centre for Preclinical Research, Medical University of Warsaw, Banacha 1b, 02-097 Warsaw, Poland

Abstract:

The aim was to examine the efficiency of a scaffold made of poly (L-lactic acid)-copoly(ε-caprolactone), collagen (COL), polyaniline (PANI) and enriched with adipose-derived stem cells (ASCs) as a nerve conduit in a rat model. P(LLA-CL)-COL-PANI scaffold was optimized and electrospun into a tubular-shaped structure. Adipose tissue from 10 Lewis rats was harvested for ASCs culture. 28 inbred male Lewis rats underwent sciatic nerve transection and excision of a 10 mm nerve trunk fragment. In group A, nerve gap remained untouched, in B excised trunk was used as an autograft, in C nerve stumps were secured with P(LLA-CL)-COL-PANI conduit, in the D P(LLA-CL)-COL-PANI conduit was enriched with ASCs. After 6-months of observation rats were sacrificed. Gastrocnemius muscles and sciatic nerves were harvested for weight, histology analysis and nerve fiber count analyses. Group A showed advanced atrophy of the muscle, each intervention (B, C, D) prevented muscle mass decrease ($p < 0.0001$), however, ASCs addition decreased efficiency vs autograft ($p < 0.05$). Nerve fiber count revealed a superior effect in the nerve fiber density observed in the groups with the use of conduit (D vs B $p < 0.0001$, C vs B $p < 0.001$). P(LLA-CL)-COL-PANI conduits with ASCs showed promising results in managing nerve gap by decreasing muscle atrophy.