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DESIGNING SCAFFOLDS FOR TISSUE ENGINEERING: 3D GEOMETRY-FUNCTION RELATIONSHIP

Sasha Berdichevski

University of Cambridge, UK

One of the main goals in producing engineered tissues at clinically relevant dimensions is creating perusable vascular networks, since cell viability and function cannot be sustained through diffusion alone. Therefore a great deal of research in the field of regenerative medicine has been devoted to establish *in vitro* pre-vascularization approaches. In this context, we propose to create capillary-like networks using human umbilical cord endothelial cells, cultured with human osteoblasts, as these cells were demonstrated to have both direct and indirect pro-vasculogenic effects, within freeze-dried collagen scaffolds with tailored pore architecture. We guided scaffold pore architecture by manipulation of the freeze-drying conditions; producing porous scaffolds with randomly oriented (isotropic) or uniaxially aligned (anisotropic) pore architectures. We characterized the scaffolds' structural, permeability and mechanical properties and showed that pore architecture affected the invasion, morphology and self-organization of the endothelial cells, in both mono- and co-cultures. Results showed that cell proliferation and metabolic activity were affected by pore architecture as well. Pore anisotropy promoted more uniform cell infiltration deeper within the scaffold, and improved cell organization into multi-cellular vessel-like networks. Co-culture conditions further improved the network quality. We suggest that deeper cell infiltration, along with more efficient medium perfusion within the anisotropic scaffolds account for these findings. However, the exact mechanism and conditions for optimal 3D vascular network formation as function of pore architecture have yet to be established.

Biography

Sasha Berdichevski is a Post-doctoral Research Associate in Engineering Department at University of Cambridge, UK. She has obtained a Blavatnik Fellowship by the Blavatnik Family Foundation, British Council and University of Cambridge, and currently she holds a Marie Curie Fellowship. She has been awarded as outstanding Researcher in Engineering and Science Award and Prize for Excellence in Nano-science and Nanotechnology during her PhD in the Technion, Israel. She has published her research in leading journal papers, and co-authored publications in three books. Her research interests include "Biomaterials, tissue engineering, scaffold-tissue/cell interactions, and scaffolds' 3D geometry function relationship".

sashenka125@gmail.com