Bioactive fibrin coatings for cardiovascular tissue engineering

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Abstract

Fibrin is a versatile biopolymer that can be used for its biocompatibility and biodegradability in various tissue engineering applications (*e.g.* bone, cartilage, skin, vascular, nervous, muscle tissue engineering, etc.). Here, we present a method of cardiovascular scaffold surface modification with fibrin nanostructures prepared using a technique based on the catalytic effect of fibrin-bound thrombin. This technique enables surface-attached thin fibrin networks to form with precisely regulated morphology without the development of fibrin gel in bulk solution. This technique can be applied on virtually any substrate. In addition, these fibrin networks were post-functionalized with various bioactive molecules (such as fibronectin, laminin, collagen, VEGF, and bFGF). Biofunctionalization of fibrin with extracellular matrix proteins and growth factors increased attachment, proliferation and differentiation of endothelial cells seeded on the fibrin surface and lead to formation of homogenous endothelial monolayer. Furthermore, covalent attachment of heparin to the fibrin nanostructures reduced thrombogenicity of the fibrin coating. It is envisioned that these nanostructures can be used for surface modification of various artificial biomaterials designed for different biomedical applications (e.g. artificial vessels, stents, hear valves, bone and cartilage constructs, skin grafts, etc.) in order to promote the therapeutic outcome.

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Professional Biography (100-150 words)

Dr. Tomáš Riedel has completed his PhD in biochemistry at the Institute of Hematology and Blood Transfusion in Prague in 2011. Currently, he works as a research fellow at the Institute of Macromolecular Chemistry. His research focuses on the interactions at the interface between synthetic materials and blood. The results of his work are being applied in biomaterial coating (*e.g.* for cardiovascular surgery) and label-free sensing of biomarkers of clinical interest in blood plasma and serum. He has published more than 52 papers in impacted international journals.



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