

Project 3.15 Vascular tissue engineering on granular scaffolds: experiments and modelling

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Background:

Tissue engineering aims at fabrication of ‘artificial’ tissues, that is constructs involving living cells and performing the native tissue functions, yet outside the body. Such engineered tissues offer multitude of applications in regenerative medicine, basic tissue biology research, and testing of drugs—as an alternative to animal models or in personalized cancer treatments. A fundamental problem in tissue engineering is fabrication of tissues with an embedded vasculature, a network of capillary vessels allowing delivery of nutrients to individual cells. Current approaches to vascular tissue engineering typically rely on spontaneous self-assembly of the endothelial cells into branched tubular networks. However, such self-assembled networks are far from optimal since they (i) develop slowly in time, (ii) are heterogeneous and weakly percolated, and (iii) do not allow any external control over the global morphology.

Aim:

The goal of the project is the development of a new experimental tool for generation of vascular networks with a pre-designed global architecture and characterization of the networks using cutting-edge image analysis tools based on machine learning. Additional goal is integration of the networks with a cancer tissue and the use of the platform in testing of drugs on several different cancer cell lines as a proof-of-concept of the future personalized cancer treatments.

Requirements:

- excellent track record from undergraduate studies,
- laboratory experience,
- experimental/engineering skills and creativity,
- background in chemistry and biology would be advantageous