

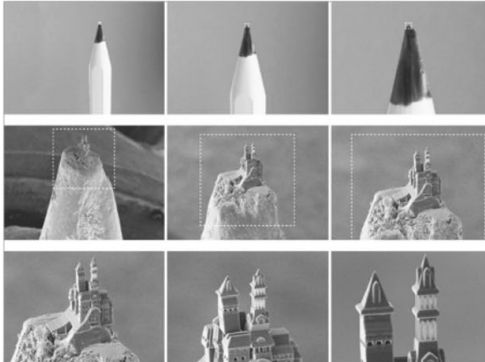
CONTROLLED VASCULARIZATION FOR ORGAN-ON-CHIPS

Our Group: 3D printing and Biofabrication

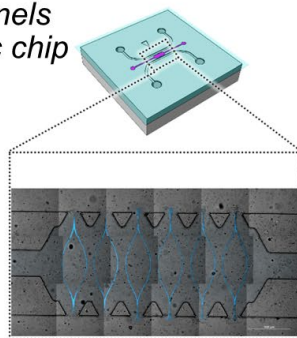
EXPERTISE



Castel on a pencil tip



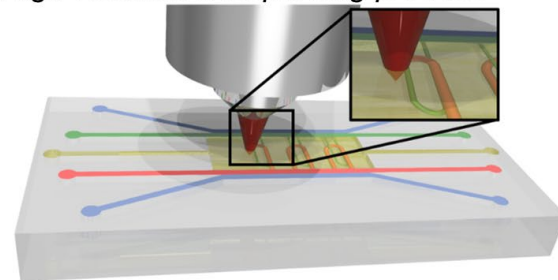
Grafted channels in microfluidic chip



Laser Scanning Microscope



High resolution bioprinting process



Supervisory Team¹

Primary Supervisor: *Aleksandr Ovsianikov (Institute for Material Science and Technology)*

TU Wien project partners: *Peter Ertl (Institute of Applied Synthetic Chemistry), Stefan Baudis (Institute of Applied Synthetic Chemistry)*

External academic partners: *Ryo Sudo (Keio University, Tokyo, Japan)*

External industry partners: *Uwe Marx (TissUse GmbH, Berlin, Germany)*

Project Description

Organ-on-Chips rely on multicellular tissues organized in 3D, and need to receive nutrients and oxygen, exchange chemical signals, and transport drugs or cellular products to and from an external fluidic network. This PhD project focuses on the development of tools to stimulate and guide the formation of a controlled microvascular network in a hydrogel, that can serve as a support for the growth of a vascularized tissue in a microfluidic platform. Hydrogels are soft materials with a very high water content, that can mimic the physical and chemical properties of the natural extra-cellular matrix, thus promoting cell growth and

¹ The Early Stage Researchers (ESRs) will be accompanied during their thesis by an individual "Thesis Advisory Committee" (TAC), which will guide the ESR through the graduate studies. The TAC will consist of the thesis primary supervisor, and two additional members of the Supervisory Team selected by the ESR.

differentiation. The use of femtosecond laser-based high-definition bioprinting techniques will allow to produce modifications within the hydrogel volume, following any arbitrary geometry, to obtain preferential migration of the vascular sprouts along the bioprinted structures.

Key Goals and Tasks

The primary aim of this PhD thesis is to develop a versatile toolset to create controlled microvascular networks in different tissues. The work will be structured along the following tasks:

- identification of the most suitable cell combination and cell culture conditions that can lead to efficient vascular sprouting
- selection and eventual modification of a portfolio of adequate hydrogel materials, that can support cells growth in a three-dimensional environment, favor sprouts formation, and their evolution into microvessels
- development of femtosecond laser-based techniques to modify the hydrogel structure and properties in a controlled fashion, in terms of cell migration speed and direction. This could include cleaving the matrix, grafting molecules to the backbone, or induce further crosslinking into the network.

Project-specific Requirements

- Completed master studies in Biomedical Engineering, Materials Science, Biophysics, Biotechnology
- Knowledge on one or more of the following disciplines: biology, material science, tissue engineering
- Experience and skills in cell culture and confocal microscopy are positively evaluated
- Interest in working with cell culture equipment, hydrogels, laser-based bioprinters
- Enthusiasm for new technologies, Organ-on-Chip, regenerative medicine
- Affinity for interdisciplinary topics, working with experts from different fields
- Willingness to travel to project meetings and scientific conferences
- Excellent English language skills in scientific field
- Personal skills: ability to understand complex problems, work within a team, communicate own results, look for novel solutions