

Dr. Josef Jaros's Experiences List

Some examples of devices and technologies I developed and experienced with my team and cooperating labs in biology, chemistry and engineering.

My research was focused on development of (i) 3D tissue models; (ii) tools and cell culture platforms to study stem cell differentiation, how cells communicate; and (iii) angiogenesis.

As excellent developmental model we utilized human embryonic stem cells and their derivatives as well as pluripotent stem cells induced from primary cells of patients in combination with state-of-the-art instrumentation, such as microfluidics and 3D bioprinting of cells and synthetic hydrogels.

With my biomedical engineering background, I and my team members developed strong interest in building platforms for stem cell-based biotechnologies and morphological organization of stem cells toward 3D structures. We were targeting unresolved aspects of tissue morphogenesis, cell-cell and cell-ECM interactions for applications in tissue engineering.

1. Development of 3D tissue models

1.1. 3D microfluidics - organoids on chip

Led a years-long collaboration with research groups in the Czech Republic, Israel, and Austria to design and produce numerous prototypes and functional devices for generating cerebral, retinal, and lung organoids. Developed these tissue representatives for protocol optimizations and drug testing.

1.2. 3D cell culture and bioprinting of stem cells

Designed multiple original systems for cell growth and communication, organoid fusion, and printing vascularized constructs.

1.3. Vascularization of tissue models

Collaborated on the development and characterization of synthetic and natural hydrogels, scaffolds, and nanofibers to optimize protocols for vascularization and growth of stem cell organoids.

2. Nanopatterning

Developed nanopatterned surfaces for immobilizing various molecules and influencing stem cell behavior, such as proliferation and differentiation.

3. Methods

I mastered various techniques and technologies: e.g. advanced light, superresolution, electron microscopy, as well as high-throughput microscopy, AFM.

I conducted image and data processing using Knime, Cellprofiler, ImageJ, and Matlab. I conducted 3D simulations with computational fluid dynamics in Ansys, 3D modelling in several Autodesk programs.

I utilized histology and molecular biology methods.