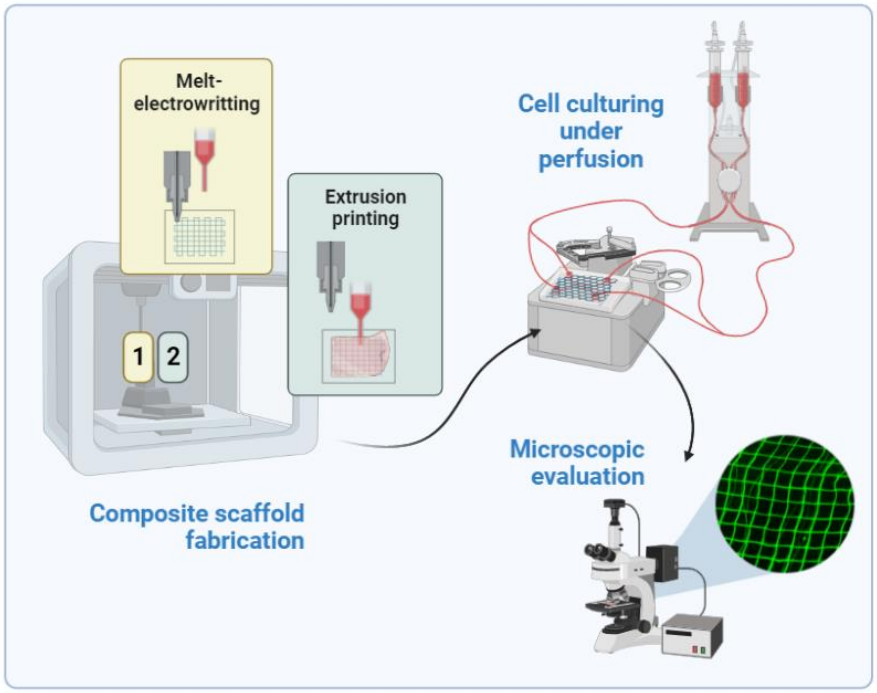
1. Hydrogel vascular grafts reinforced with melt-electrowritten (MEW) polycaprolactone (PCL) lattices

By providing oxygen and nutrients to the cells, as well as eliminating metabolic waste, vascularization is a vital factor in the success of tissue engineering and yet one of its main challenges. Despite multiple advantages, natural polymers used for hydrogels creation have poor mechanical properties limiting their applications. Melt-electrowriting (MEW) offers the possibility to modify physical characteristics of multi-material constructs comprising fibers and providing a scaffolding to enhance cell survival and ingrowth properties. Such multi-material MEW processes can be adapted to a wide range of mechanical properties, and thus enable target tissue specific adjustments to obtain ideal scaffold properties. Reinforcing MEW frames embedded in hydrogel can affect toughness and elastic modulus of the construct, helping to maintain the designed dimensions and architecture.

Keeping that in mind this project combines MEW approach and extrusion printing of a soft hydrogel material to overcome current limitations associated with the creation of artificial vasculature. Additionally, it will investigate whether microstructure fibers can facilitate the specific alignment of cells. The projects' tasks will cover, the design and fabrication of PCL (polycaprolactone) grids and fibers utilizing melt-electrowritting technique, followed by a process of extrusion printing of soft hydrogel material (gelatin and hyaluronic acid) to provide a cell-friendly interaction site. Composite scaffolds of preferable properties in terms of cells adhesion and durability will be further tested with in-house prepared PDMS chips, by subjecting the scaffolds to a continuous flow condition. Hopefully, the resulting scaffolds can become promising matrices to support vascularization processes addressing the challenge of angiogenesis within hydrogel-based tissue scaffolds.



Abstract of the Master thesis project' created in Biorender.com

Related literature:

- https://doi.org/10.1038/s41598-022-24275-6
- https://doi.org/10.3389/fbioe.2020.00793
- https://doi.org/10.1002/adhm.201800418

Contact: julia.siminskastanny@ulb.be and amin.shavandi@ulb.be