Master thesis:

Title: Development of biopolymer-based 3D structures from natural materials and enzymatic crosslinking

Short description: In view of the demand for environmentally friendly and safe 3D biomaterials for cardiovascular diseases, bioscaffolds made of natural polymers have become a desirable candidate for the construction of vascular grafts compared to synthetic scaffolds. However, the production of stable and multifunctional bioscaffolds from natural polymers with the required physicochemical properties is challenging with the available convention techniques. Recently, it has been shown that 3D bioprinters and enzymatic crosslinking can be used to produce complex polysaccharide scaffolds with multifunctionality and stability via an environmentally friendly approach.

In this thesis, you will focus on the chemical modification of biopolymers, the development of inks and the fabrication of dimensionally stable 3D scaffolds from chemically modified natural polysaccharides such as nanocellulose and alginate. These two polymers will be integrated into the development of the inks, which will ultimately be transformed into 3D printed structures followed by enzymatic crosslinking (see **Figure 1**). The optimised and selected inks and scaffolds will be characterised regarding their rheology, physicochemical and mechanical properties as well as their biological properties.

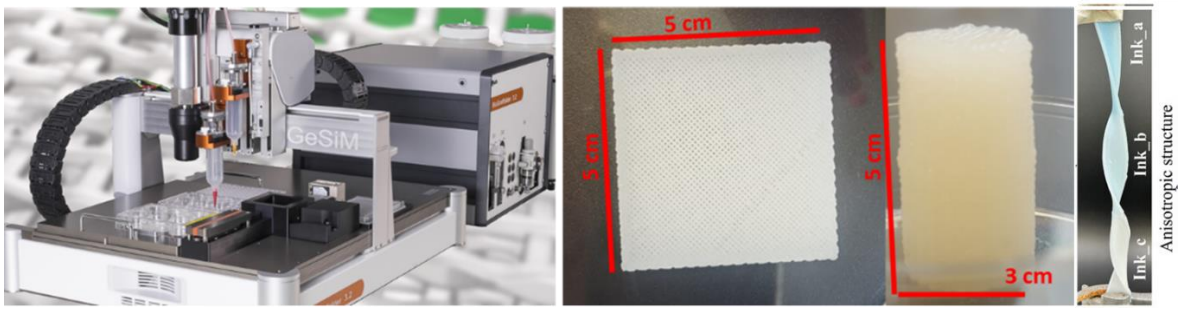

Figure 1. Illustration of the 3D bioprinter (left) producing complex 3D scaffolds or anisotropic structures (right).

Key tasks:

- Chemical modification of polysaccharides in aqueous environment
- Involvement in the development of printable inks and 3D scaffolds
- Development of enzyme-crosslinking chemistry for scaffolds
- Evaluate the measurements, analyze the various features of scaffolds.
- Handling of the start-of-the art 3D bioprinter

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