ADDITIVE MANUFACTURING OF COMPOSITE BIOMATERIALS

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Research Area: Bioengineering, biomaterials, additive manufacturing

Project Description: This project aims to develop a biomanufacturing approach for producing composite biomaterials that mimic the hierarchical architectures of native tissues, using an extrusion method to produce ultra-thin biopolymeric sheets with molecular alignment along the extrusion direction and subsequent rolling into tubular structures. The key challenges include consistent and uninterrupted feeding of ultra-thin biomaterials and maintaining uniform contact between each layer of rolled tubular structure.

The MEng student will design, assemble, and validate the biomanufacturing setup, taking into account sterility. They will also conduct biomechanical tests of the composite biomaterials, measure the burst pressure and suture retention strength, and iterate, refine, test, and optimize the design. Prior experience in engineering design, mechatronics, 3D printing, and mechanical characterization of materials is an asset, while prior knowledge in biomaterials is not required.

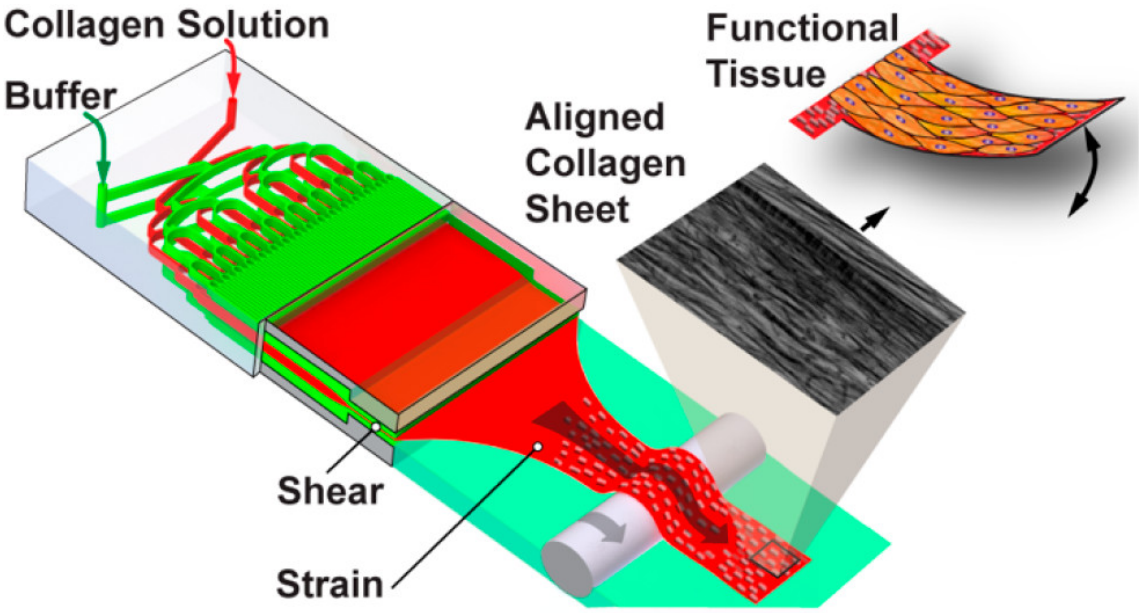
This project will be conducted in the state-of-the-art CRAFT Tissue and Microfluidic foundries, providing the student with access to cutting-edge equipment and resources. The successful completion of this project has the potential to result in a platform technology with broad applications, including the development of human-sized tissues.

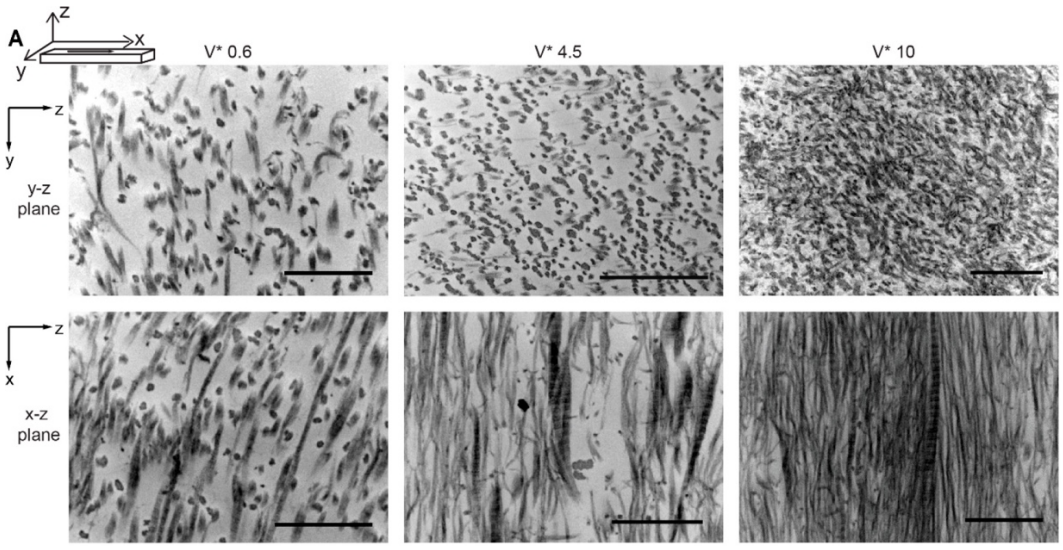
Opportunities provided by the MEng project:

a) Gain research experience working in microfluidic and tissue foundries while learning from the senior graduate students of the Guenther Lab, as well as researchers and technical staff from the National Research Council of Canada.
b) Support research that will lead to publications and patents
c) Tackle challenges related to creating platform technologies

Useful resources:

1. "Continuous Formation of Ultrathin, Strong Collagen Sheets with Tunable Anisotropy and Compaction" S. Malladi et al. *ACS Biomaterials Science & Engineering* ***2020*** 6 *(7), 4236-4246 DOI: 10.1021/acsbiomaterials.0c00321*
2. https://craftmicrofluidics.ca/about-craft/


Collagen Solution
Buffer
Functional
Tissue
Aligned
Collagen
Sheet
Shear
Strain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V* 0.6
V* 4.5
V* 10
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