EVALUATION OF PRINTABILITY, FEATURE FIDELITY, AND DEGRADATION BEHAVIOR OF PROPRIETARY BIOINKS USING COMMERCIAL 3D BIOPRINTERS

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Research Area: Bioprinting, 3D printing, material optimization, bioengineering, translation technology

Project Description: Our lab excels in forming biomaterial-based structures using state-of-the-art microfluidic technologies. Our technologies allow for the precise positioning of cells and recapitulation of the structure of the tissue of interest. Specifically, we have developed a solution for the delivery of tissues, such as skin to treat burn wounds for example. Our platform technology consists of three components: (a) a handheld bioprinter instrument, (b) a cellular bioink, and (c) disposable parts for bioink delivery. We have previously demonstrated the only in situ bioprinting approach capable of covering wound areas at a rate >0.2 m^2/h or 10% of the total body surface area/hour (TBSA/h) owing to multi-nozzle microfluidic printheads and a patented handheld bioprinter[1,2]. Recently, we have developed a portfolio of new bioinks that outperform the bioinks investigated in our previous publications[2]. We intend on evaluating these bioinks with both the handheld bioprinter and other commercial 3D bioprinters.

In this project, we focus on identifying the optimal bioprinting window for our new proprietary bioinks and on optimizing the means for its rapid and consistent delivery to form different biologically relevant structures using commercial bioprinters e.g RegenHU and Advanced Solutions 6-axis robot bioprinters. We will investigate the printability of different bioink formulations using a factorial design of experiment (DOE). Later on, with the help of a Ph.D. student, we will assess the ability of our bioink (cellular) to support long-term culture without significant contraction. All the research will be conducted in the brand new, state-of-the-art CRAFT Tissue and Microfluidic foundries[3].

Please contact us for any clarification. Students will be selected via an interview process.

Opportunities for students:

1. Gain research experience working in microfluidic and tissue foundries while learning from the senior graduate students of Guenther Lab.
2. Support research that will lead to publications, patents, and a potential startup company
3. Tackle challenges related to translating technologies from bench to industry

Useful resources:

1 Hakimi, N. *et al.* Handheld Skin Printer: In-Situ Formation of Planar Biomaterials and Tissues. *Lab Chip* **18**, 1440-1451 (2018).

2 Cheng, R. Y. *et al.* Handheld instrument for wound-conformal delivery of skin precursor sheets improves healing in full-thickness burns. *Biofabrication* **12**, 025002 (2020).

3 https://craftmicrofluidics.ca/about-craft