

Building Photolabile and On-Demand Bioprinted Hydrogel 3D Cell Culture Platforms

Co-Graduate Student Mentors:

- Bree Huntington, 4th year PhD Candidate – Chemical & Biomolecular Engineering
- Sam Swedzinski, 4th year PhD Candidate – Materials Science & Engineering

Advising Professors:

- Primary: Dr. April Kloxin, Chemical & Biomolecular Engineering and Materials Science & Engineering
- Supporting: Dr. Eric Furst, Chemical & Biomolecular Engineering

Abstract:

Hydrogels, which are hydrophilic polymer networks swollen in water, are attractive material platforms for three-dimensional (3D) cell culture owing to the tunability of their mechanical properties, biochemical compositions, and viscoelastic properties, such as shear-thinning and stress-relaxation. Additionally, these systems are often engineered to be reductionist in nature, removing the complexity of animal models and human subjects while imparting dimensionality, well-defined biophysical and biochemical cues, and greater spatio-temporal property control than conventional two-dimensional (2D) cultures on tissue culture plastic. This project primarily aims to design two hydrogel systems: A strain-promoted azide-alkyne cycloaddition (SPAAC) click chemistry hydrogel with tunable photochemistry for degradation and stiffening of the gel, and an on-demand bioprinted hydrogel that can be printed in a high-throughput fashion for rapid assessment of cellular response to applied stimuli. We seek an undergraduate student to assist in characterization of the mechanical properties of these hydrogel systems. The selected student will learn hydrogel chemistry and formulations relevant to 3D cell culture and associated material characterization techniques, shear rheometry including in-situ photopolymerization and temperature sensitive rheometry, atomic force microscopy (AFM) including sample preparation and experimental workflow, inkjet bioprinting processes using the RASTRUM™ bioprinter, and more depending on the recruited student's interests. While we currently do not anticipate any involvement of the recruited student in any mammalian cell culture aspects of the projects owing to time commitment required, there may be opportunities during winter and/or summer sessions to learn basic mammalian cell culture should the recruited student be interested. Furthermore, the recruited student will be actively involved in investigating background literature currently in the field, conducting and designing experiments alongside the graduate mentors, preparing figures and manuscripts for publication, and providing updates to graduate mentors and advising professors.

Qualifications & Expectations:

- 2nd – 3rd year undergraduate student in Chemical & Biomolecular Engineering, Materials Science & Engineering, Biomedical Engineering, or related field.
- Must be a U.S. Citizen owing to regulations around related collaboration agreement
- 10 hour per week time commitment to research during the semester (excluding examination time frames)

Interested students should contact Bree Huntington breehunt@udel.edu and Sam Swedzinski sswedz@udel.edu by email expressing interest and sharing a copy of their CV/resume that includes current GPA