Clarkson University
Department of Chemical and Biomolecular Engineering
SEMINAR

"Fabricating an Advanced 3D Hydrogel to Improve Human Mesenchymal Stem Cell (hMSC) Chondrogenesis Towards Treatment of Osteoarthritis"

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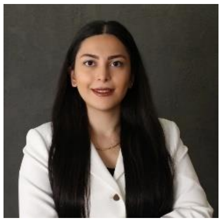
Osteoarthritis is a degenerative disease of the joint affecting more than 32 million US adults, resulting in pain and long-term disability. One potential therapy that has recently garnered significant interest is the injection of human mesenchymal stem cells (hMSCs) into the patient's joints to initiate cartilage regeneration. However, the use of hMSCs as a cellular therapy for osteoarthritis has several limitations, such as heterogeneous differentiation, low survival after injection, and reduced capacity of chondrogenic differentiation in 2D due to inherent differences with the native 3D microenvironment, to name a few.

To overcome these limitations, researchers have explored the incorporation of hMSCs within polymeric hydrogels. Hydrogels are widely used in cartilage tissue engineering due to their inherent biocompatibility, facile fabrication methods, use as a drug delivery vehicle, and retention of a high volume of water, mimicking the native articular cartilage environment. Further, their physicochemical properties can be tuned to modulate hMSC chondrogenesis. One way to influence the physicochemical properties of hydrogels is through using physical and chemical crosslinking methods. Hydrogels made by chemical crosslinking have higher stability and mechanical properties compared to physically crosslinked hydrogels. However, chemical crosslinking methods such as photopolymerization and the use of some chemical crosslinkers are typically cytotoxic. In this talk, I will discuss the design and fabrication of an injectable, self-healing, hMSC-laden hyaluronic acid/collagen type I hydrogel crosslinked using bioorthogonal Diels-Alder click chemistry towards the development of an hMSC-biomaterial treatment for osteoarthritis. I have selected Diels-Alder click chemistry because it occurs under mild, cell culture-relevant conditions, produces limited, benign byproducts, and results in high-yield hydrogels, allowing cells to be encapsulated within the hydrogel during gelation. In this talk, we show the successful fabrication and characterization of hydrogels using this chemistry.

Monday, March 6th, 2023 at 2:30 pm
CAMP 175



Romina Keshavarz is a Ph.D. student in Materials Science and Engineering at Clarkson University under the supervision of Dr. Almeida. Prior to joining Clarkson University, she received her Bachelor of Science in Materials Science and Engineering from K. N. Toosi University of Technology. Her research focuses on designing hydrogel platforms to enhance human mesenchymal stem cell (hMSCs) chondrogenesis for the treatment of osteoarthritis.