PURDUE UNIVERSITY | Weldon School of Biomedical Engineering

BME 3rd Year Seminar Series
Friday, November 15th, 2024
1:30 – 2:30 PM EST
MJIS 1001

Evaluation links:
Adam Wright: https://purdue.ca1.qualtrics.com/jfe/form/SV_5oHr7tCH1pYgxNA
Tuba Marjan: https://purdue.ca1.qualtrics.com/jfe/form/SV_6wZA650L4jCMzIO

Evaluation surveys should only be completed after the seminar has taken place, and only by those who attended the seminar.

Magnetic resonance imaging tools to navigate the path from healthy brain aging to brain dysfunction
Adam Wright (Qiuting Wen/Yunjie Tong, advisors)

Abstract: The brain is a remarkable organ, constantly engaged in maintenance and remodeling to support our everyday thoughts, actions, and experiences. However, the brain doesn't always function perfectly. A delicate balance exists between age-related declines in brain function and dysfunction that lead to disease. To navigate this complexity, it's essential to understand what constitutes healthy aging, enabling us to better identify and interpret the disruptions associated with neurological diseases. In our research, we leverage magnetic resonance imaging's (MRI) sensitivity to diverse physiological processes–such as cardiac pulsations, respiration, and slow vessel motion–to non-invasively study various aspects of human brain health. We have developed tools to study waste clearance, cerebrovascular health, and cerebral circulation. With advanced aging, we have observed changes across these processes, including waste clearance dysfunction, reduced vascular compliance, and increased cerebral blood circulation times. Our improved understanding of healthy, age-related changes in brain function will ultimately guide future research on brain dysfunction in neurological and neurodegenerative conditions.

Constructing a decellularized extracellular matrix containing interpenetrating network hydrogel to probe cell-material interactions

Tuba Marjan (Taimoor Qazi, advisor)

Abstract: Synthetic biomaterial scaffolds are commonly used in vitro to study cell behavior, but they often lack the native biochemical cues essential for guiding cellular responses. Decellularized extracellular matrices (dECMs) offer bioactivity but generally lack the mechanical stability needed for long-term cell culture. To address this, we developed an interpenetrating network (IPN) by integrating dECM into a synthetic, photo-crosslinkable hydrogel based on Norbornene-modified hyaluronic acid (Nor-HA). Porcine skeletal muscle tissue was first decellularized, and varying concentrations of dECM were incorporated into the Nor-HA hydrogels. Rheological tests showed that adding dECM at 2.5 mg/mL increased the storage modulus of the IPN hydrogel from ~500 Pa to ~1200 Pa. However, higher dECM concentrations (5 & 10 mg/mL) led to a significant decrease in mechanical strength, likely due to inhibited crosslinking. Hydrogel cryosections stained with Picrosirius red showed uneven dECM distribution potentially caused by dECM particle aggregation. Cell adhesion studies using NIH 3T3 fibroblasts showed that cells had the greatest spreading area on IPNs containing 2.5 mg/mL dECM corresponding to the highest observed mechanical modulus. In contrast, IPNs with higher dECM concentrations and lower mechanical moduli showed reduced cell spreading. Future studies will look into controlling mechanical properties across all groups to isolate the biochemical effects of dECM on cell behavior. Overall, this IPN platform provides a photo-crosslinkable, bioactive scaffold to explore cell-matrix interactions which may help us understand wound healing better in various tissue and disease contexts.