Poulami Mondal

Position: PhD Student

Lab Contribution: Develop and characterize a nanoparticle formulation that is designed to encapsulate a hydrophobic drug and an ultrasound-sensitive contrast agent to achieve targeted drug delivery. Perform focused ultrasound and microbubble mediated BBB opening, and record confirmatory observation and measurements through MRI, flow cytometry and histology.

Beyond the lab: Avid coffee drinker!! I also love being outdoors and enjoy trying new hobbies every few months.

Focused ultrasound mediated drug delivery:   
Focused ultrasound mediated drug delivery is an emerging technique that combines the use of ultrasound waves with nanoparticle-based drug delivery systems. This innovative technique will offer several advantages over traditional drug delivery methods, including increased targeting precision, reduced systemic side effects, and improved therapeutic efficacy. At Sun Lab, our aim is to improve drug delivery by developing a specialized nanoparticle formulation. Our formulation encapsulates a hydrophobic drug alongside an ultrasound-sensitive contrast agent. Our targeting strategy involves polymer conjugation with DBCO-Azide click chemistry molecules, ensuring precise delivery to the target site. When exposed to an ultrasonic field, these polymeric nanoparticles demonstrate stable cavitation, enabling controlled drug release precisely at the intended location.

Focused ultrasound mediated neuro-immunomodulation:

The use of focused ultrasound along with microbubbles is emerging as a popular delivery modality that can efficiently carry immune cells and therapeutic agents across the blood-brain barrier. The blood-brain barrier is a selectively permeable membrane that controls the inflow and outflow of any molecule into the brain, posing significant challenges for the delivery of systemic therapeutics into the brain. At Sun Lab we employ focused ultrasound along with microbubbles to transiently and reversibly open the BBB, thereby enhancing BBB permeability without permanently affecting its morphology. The local and non-invasive administration of this treatment technique will allow the inflow of immune cells and therapeutics and outflow of potential antigenic markers across the BBB leading to better management of neurological diseases.