PhD Project Proposal

Title: **Deciphering tissue-specific gene regulatory networks in metabolically distinct phenotypes.**

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Guide's Name: **Dr. Susan Thomas**

Dept: **Biomedical Informatics Centre**

Date and time: **19th May 2026 at 3 pm**

Venue: **Dr. Shanta Rao Auditorium**

ABSTRACT:

The proposed study aims to address the limited understanding of tissue-specific molecular regulation and inter-organ crosstalk in metabolic obesity. The global prevalence of obesity is rapidly increasing and has become a major public health concern due to its strong association with metabolic disorders and chronic diseases. Obesity may contribute to the development of CKD both directly through obesity-related renal injury and indirectly through associated metabolic complications such as hypertension, atherosclerosis, and type 2 diabetes, in which metabolic dysregulation, inflammation, and lipotoxicity contribute to progressive renal injury and dysfunction. Although metabolic obesity is associated with systemic metabolic dysfunction and organ-specific complications, the underlying regulatory networks driving these alterations remain poorly characterized, particularly in kidney tissue.

Emerging evidence suggests that exosomes serve as important mediators of intercellular communication by transporting proteins, lipids, mRNAs, and non-coding RNAs between tissues. In this study, exosomes derived from metabolically unhealthy obese (MUO) liver and kidney tissues will be isolated and exposed to healthy kidney spheroids to investigate their pathological effects on renal tissue. The study aims to evaluate how tissue-specific exosomal signaling perturbs renal metabolic, inflammatory, and fibrotic pathways and contributes to kidney dysfunction.

By integrating tissue-specific exosome biology with spheroid-based functional models, this study seeks to decipher gene regulatory networks and organ crosstalk mechanisms underlying metabolically distinct phenotypes. The findings may provide novel insights into obesity-associated renal dysfunction and identify potential biomarkers and therapeutic targets for metabolic disorders.