Project Title: Analysing miRNA-mRNA interactions in human insulin-producing cells for Diabetes	**Code: SMS13**
Host School / Institute: Sydney Medical School/ NHMRC Clinical Trials Centre	**Address:** 92-94 Parramatta Road, Medical Foundation Building (K25) level 1, University of Sydney, Camperdown, NSW
Certificates & Clearances required: No	
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Co-Supervisor/team: A/Prof. Anand Hardikar and Dr. Mugdha Joglekar	
Project Type: Data Analysis	
Project Category: Genetics; Endocrinology/Metabolism	
Skills / Attributes of a successful student: We are looking for a student who is enthusiastic and willing to learn multiple data analytical methods, also interested in exploring in both fields of data analytics and islet biology and also who has interest in taking up a future honours or masters project.	
Project Keywords: Type 1 Diabetes; Insulin-producing cells; Non-coding RNAs; MicroRNAs; Transcriptome	

Project Description: Pancreatic islet transplantation is the only cell-based clinical therapy for treatment of Type 1 Diabetes (T1D) in Australia and a few other countries in EU and Canada. However it is limited by the available cadaveric donors and islet isolation yield. Therefore it is important to find an alternate source of potent insulin-producing cells. Our laboratory is the first to demonstrate the presence of insulin-producing cells in the human gallbladder (GB) epithelium. This source has shown significantly higher pro-insulin transcript levels than those reported through most stem cell differentiation studies. Interestingly, insulin-producing cells have also been identified in brains of flies, mice and in an insulinoma patient with congenital brain malformation.

For the past decade non-coding (nc-)RNAs such as micro (mi-)RNAs, which are short ncRNAs that are 18-22 nucleotide long, have been shown to post-transcriptionally regulate gene expression. MiRNAs are now well-recognised to be involved in different cellular process and are essential for cell development, differentiation and homeostasis. The aim of this research is to analyse the transcriptome profiles of the insulin-producing cells in the pancreas, GB epithelium and the brain.

Different advanced molecular techniques such as Next Generation Sequencing (NGS) and TaqMan-based real-time PCR were used to construct the transcriptome profiles of insulin-producing cells (in human islets, GB epithelium and the brain). Analysis will be carried out using different data analytical workflows and machine learning algorithms to identify relevant interactions between non-coding RNAs and targeting mRNAs within the insulin-producing cells across all different tissues.

The selected candidate will be trained using the RNA-sequencing software (Strand LS) and various other data analytical tools (involving R-scripts for visualizing data using tSNE, volcano, cluster plots, heatmaps and analyse key candidates using multiple regression analyses and machine learning algorithms. This summer project will provide the opportunity to gain significant training and expertise in data analytics and miRNA biology.
In all, this research will improve our understanding of ncRNAs-mRNA interactions across insulin-producing cells and will also develop our understanding of islet biology towards generating a sustainable source for cell replacement therapy in diabetes.