Project Title	Experimentally modelling the interactions between red blood cells and endothelial cells in disease
Supervisor	Dr Joseph van-Batenburg Sherwood
Theme(s)	Biomechanics and Medical Devices
Project Type	Lab based
Project Description	“Microvessels, smaller than a hair, are embedded in all living tissues to deliver nutrients and exchange gases. The regulation of microvascular blood flow must be tightly controlled and dysregulation is associated numerous diseases, such as diabetes. A major mechanism of regulation involves endothelial cells (ECs) that line all blood vessels and sense shear stresses from the flowing blood. ECs then release bioactive compounds that dilate or constrict the vessel to control blood flow. While much research is focused on how ECs are affected by disease, less attention has been paid to how the blood itself changes. Clinical studies have reported the red blood cells (RBCs) of patients with diseases are different, for example they can be less deformable or aggregate (stick-together) more readily. We are interested in understanding how these changes to the blood can affect endothelial cell responses and thus disease progression. To investigate the flow of blood in microvessels, we have developed a specialised micro-particle image velocimetry system for measuring the flow of blood in microchannels that mimic the microvasculature. We have also developed microvessel-on-a-chip models that incorporate both human ECs and RBCs. By using controlled modifications to one or both of the cell types, we can evaluate the interactions between the two. The project may involve aspects of experimental design, cell culture, immunofluorescence microscopy, fluids dynamics measurements and data analysis. Depending on preference of the student, it could focus more on the RBC or EC side of the research."