Project Title	Catheter Intervention in the Fetal Heart to Prevent Congenital Malformations
Supervisor	Dr Choon Hwai Yap
Theme(s)	Biomechanics and Mechanobiology Computational and Theoretical Modelling
Project Type	Desk based
Project Description	Congenital heart malformations, or heart birth defects, occur to about 1% of pregnancies, and are devastating. There is evidence that these malformations are caused by abnormal blood flow forces in the fetal heart. In recent years, cardiologists investigated using fetal heart intervention, or catheter based manipulation of the fetal heart, to restore normative hemodynamic conditions, and found that many fetal babies could subsequently avoid having malformed hearts at birth. Here, we propose to study one such procedure, the aortic balloon valvuloplasty, on a specific malformation, the evolving hypoplastic left heart syndrome, and try to understand the biomechanics impact of the procedure, so as to help doctors understand how to improve the procedure. We also hope to build a tool that can help predict outcomes of the intervention, so that doctors can more accurately select patients to minimize unnecessary risks and maximize benefits. Working with paediatric cardiologists in Austria, and other members of our lab, we will analyse 4D ultrasound images of diseased fetal hearts before and after the intervention. Using existing software tools under interactions with our lab members, we will then perform image motion tracking to extract heart motion, and then use this information to build a finite element modelling (FEM) of the fetal left ventricle, to understand what changes in biomechanical and heart function can be brought about by the intervention, and to explore using this FEM tool to predict the outcome of the intervention, using only pre-intervention data.