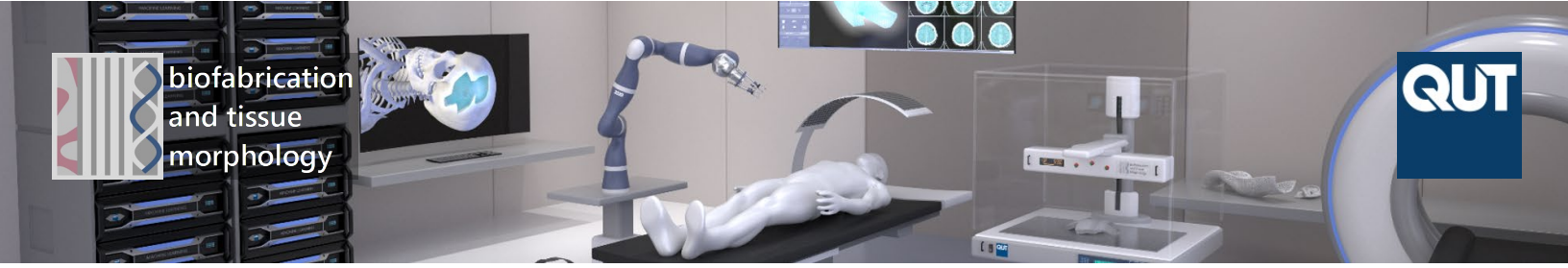


PhD Project Opportunity

Biofabrication & Tissue Morphology Group

27 August 2020

Supervisors: Dr Mark Allenby (mark.allenby@qut.edu.au), Dr David Alonso-Caneiro, Prof Zhiyong Li, Prof Mia Woodruff

Project Title: **A biofabrication surgical referral suite to predict intracranial aneurysm rupture**

Required skillset: Mechanical, medical or process engineering; Mathematical or data sciences.

Project Scope: Intracranial aneurysms are bulging, weak areas of an artery that supply blood to the brain which are relatively common. While most aneurysms do not show symptoms, 1% spontaneously rupture which can be fatal or leave the survivor with permanent disabilities. This catastrophic outcome has motivated surgeons to operate on approximately 30% of aneurysms despite their rate of complications arising and cost of operation.The impact of aneurysm morphology on blood flow shear stress and rupture could educate surgical decision-making and better identify at-risk aneurysms for either endovascular or neurosurgical procedures.

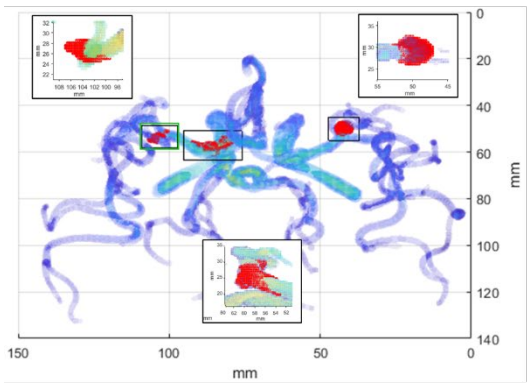
In this project, medical image datasets of patients admitted with intracranial aneurysms will be leveraged to produce digital and physical aneurysm models using medical image analysis and artificial intelligence, computational and experimental fluid dynamics, and 3D printing. These models will identify at-risk aneurysmal features leading to an automated referral software to guide clinical decision making. This project has been granted ethical approval, has access to hundreds of patient medical records, and is in close collaboration with RBWH neurosurgeons and radiologists.

Research Activities: This project will develop the your skills in computational and experimental technologies. These skills are useful in a wide breadth of healthcare and manufacturing industries. The aim of the current project is to:

- develop a medical image 3D reconstruction procedure
- 3D print vascular models which are visually transparent at high resolution and deformable with a realistic feel
- develop a computational and/or experimental fluid dynamics pipeline to simulate blood flow through aneurysms
- correlate fluid dynamics outcomes with at-risk imaged aneurysm features
- validate at-risk aneurysm features with new medical image cases.

There is flexibility to incorporate tangential fields, eg soft robotics and cell culture, to create biological models in the lab.

This project is supported by Advance Queensland and RBWH Foundation. **View our first computational detection study.**



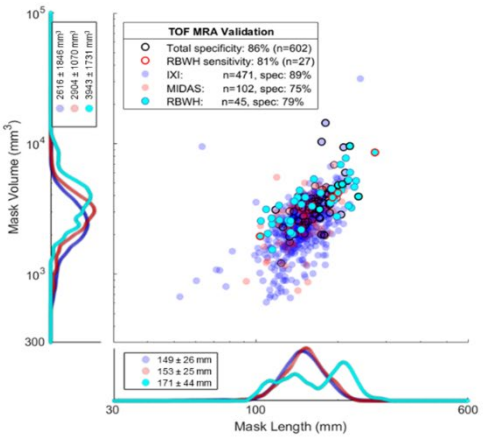


Figure (left): Imaging blood flow (shades of blue) and detection of aneurysms (red) in neurovasculature. (right) Computational detection performance across 600 patients.

Contact the supervisors for more information.