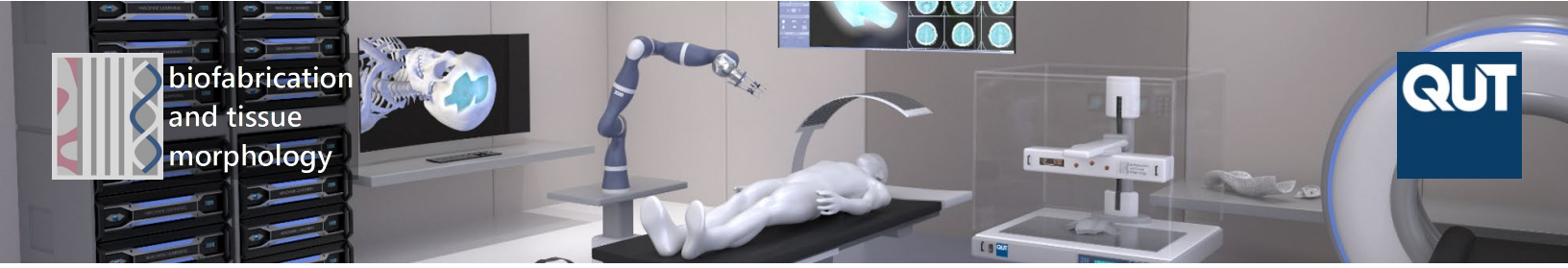

PhD Project Opportunity

Biofabrication & Tissue Morphology Group

27 August 2020

Supervisors: Dr Mark Allenby (mark.allenby@qut.edu.au), Dr Pascal Buenzli, Prof Mia Woodruff, Prof Matthew Simpson

Project Title: **Topological control over cell behaviour for robust additive tissue biomanufacturing**

Required skillset: Mechanical, medical or process engineering, Mathematical and/or data science

Project Scope: Hospital departments are adopting medical imaging, modelling, and 3D printing to automate personalised implant manufacture and avoid malpractice related to surgical handcrafting. Although several 3D printed implants are approved for medical use, their therapeutic value remains limited as acellular devices with coarse resolution. The ability to print scaffold implants with cell microenvironment precision has been achieved using melt electrowriting (MEW), an emerging technique frequently applied to produce cell culture scaffolds.

In contemporary MEW studies, the effect of materials or pore sizes are evaluated to optimise cell growth into tissue. Few papers have probed the effect of microscale geometric features on cell fate using quantitative microscopy techniques. These biophysical relationships will describe scaffold design equations which control tissue formation and morphology within model systems and implants. In collaboration with Royal Brisbane Women's Hospital surgical departments, we will probe the effect of MEW scaffold design on multicellular fate using single-cell imaging and spatiotemporal metrics to parameterise and validate optimisation models for cell therapies.

Research Activities: This project will develop your skills in experimental (e.g. 3D printing or cell culture) and computational (e.g. AutoCAD, MATLAB, R, or Python) technologies. These skills are useful in a wide breadth of healthcare and manufacturing industries. You'll be involved in:

- a literature review of current pathology, surgical treatment and research approaches
- computer aided-design and 3D printing technologies
- cell culture techniques using model cell lines as well as primary patient biopsies
- microscopy techniques and the development of computational algorithms to analyse images
- mathematical modelling of cell dynamics and tissue biophysics to optimize scaffold design for tissue output

This project has received generous QUT funding support. View our first manuscript in *Acta Biomaterialia, 2020*.

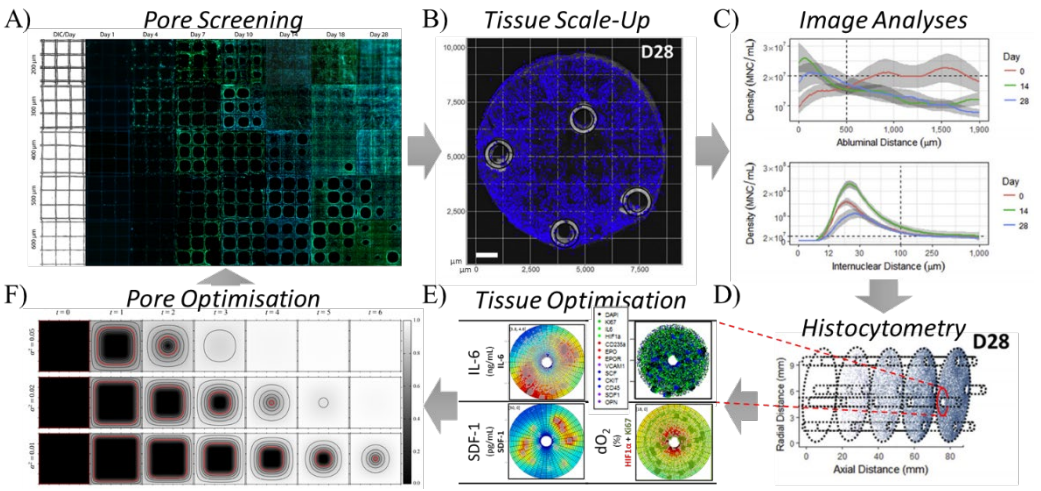

Figure (left): Engineering, culturing, imaging, and image-based optimization of 3D printed scaffolds for human tissue biomanufacture.

Contact the supervisors for more information.