# ASAWARI PARULEKAR

PHD STUDENT | PROGRAM 3
ARC TRAINING CENTRE FOR JOINT BIOMECHANICS

**PhD duration:** January 2021 - July 2024

**My interests**: The future of healthcare faces challenges requiring prompt action: ageing populations with relatively short health spans, unhealthy lifestyles, and improved resistance to infectious diseases increasing mortality from noncommunicable diseases. I aim to operate at the intersection of innovation and technology to address these issues. I am passionate about developing and up-scaling engineering solutions that improve quality of life through the commercialisation of cutting-edge biomedical technologies, with clinical translation of tissue engineering and regenerative medicine research to enhance healthcare.

**BEng (Hons)** (UQ)

**Supervisors:**
Prof. Justin Cooper-White, Prof Lisbeth Grondahl & Dr Eleonore Bolle

## PROJECT OVERVIEW

**Project Title:** Investigating the role of mechanotransduction in fibrotic healing following surgical treatment for aged patients with rotator cuff tears

### THE PROBLEM

**Why are Rotator Cuff Tears (RCTs) a significant problem for older individuals?**

- RCTs affect 40% of those aged 50+ and impose disabling pain upon patients
- RCTs account for >50% of shoulder injuries and contribute $6.25 billion USD in surgical costs annually in the US alone

**Why do RCTs need more research?**

- The current 'gold-standard' treatment for RCTs is Rotator Cuff Tear Repair (RCTR) surgery.
- For older patients, surgical outcomes are quite poor, where restoration of natural, healthy tissue is disrupted by scar tissue formation (fibrosis). This means 1 in 4 patients aged 70+ will experience retears after surgery.

**How can tissue engineering & regenerative medicine help?**

- Regenerative medicine aims to overcome the degenerative changes we see with age by engineering solutions that address the shortfalls in tissue repair and functionality of damaged tissues/organs.
- Tissue degeneration with age is evident in all human tissues. For the human shoulder, the inability of cells to correctly sense and respond to the mechanical cues from their microenvironment (mechanotransduction) with age is one example of degeneration, which we believe has a significant impact on fibrotic healing in elderly RCT patients.

### HYPOTHESIS

An iPSC-derived artificial ageing model exposed to native architectural and fibrotic cues under physiological loading conditions will provide a mechanistic insight into the behaviour of ageing enthesis tissues after RCT repair.

### PROJECT AIMS

1. Replicate the altered mechanotransduction seen in aged tissues in an in vitro cell-based artificial ageing model for rotator cuff tissues.
2. Expose the artificial ageing model to microenvironments which mimic the key mechanical characteristics of healthy and fibrotic tissue.
3. Assess the response of aged cells to the various mechanical cues, to (1) discern which cues are effective in reducing scar tissue formation and (2) understand how altered mechanotransduction contributes to scar tissue formation.

### OUR SOLUTION & EXPECTED OUTCOMES:

An in vitro human artificial ageing model of rotator cuff tissues, exposed to native mechanical cues, will provide an insight into the mechanotransduction of aged tissues and scar tissue formation after RCT repair. This understanding will be used to engineer medical products for RCTR surgery, which mitigate risk of retear for elderly patients.

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