Introduction: Non-healing wounds and skin loss are major healthcare problems around the world costing the healthcare systems billions of dollars a year.

Background: Recent technologies such as stem cell biology, tissue engineering, biomaterial science, and in situ 3D printing have significantly advanced the development of skin tissue mimetics with clinical potential. The novel therapeutic strategies enabled the development of split (Fig. 1A) or full-thickness skin substitutes (Fig. 1B) to recapitulate the native functional skin. The tissue-engineered skin models have also been used as tools to develop new therapeutics and reveal the mechanisms of skin regeneration.

Our approach: The Skin/Burn Biofabrication Program is a collaborative program between scientists and clinicians from The Professor Stuart Pegg Adult Burns Centre, Herston Biofabrication Institute, The University of Queensland and Queensland Skin Culture Centre (QSCC) Biobank. We aim to develop and validate novel biofabrication treatment strategies across all stages of severe burn injury treatment from patient assessment through to surgery and scar management (Fig. 2).

Our goals: The program is focused on the following collaborative research projects (Fig. 2):
- 3D patient assessment of burn depth and size to guide surgical planning and treatment using advanced 3D imaging technologies.
- Post-operative burn scar management using 3D scanning, 3D modelling, and 3D printing for custom pressure devices and prosthetics.
- Virtual reality for procedural and peri-procedural pain and anxiety management.
- Optimizing the skin culture techniques, and development of tissue-engineered skin (Fig. 3) as an alternative to the use of donor skin for burns patients.

Current Clinical Studies by the team at RBWH:

Figure 1: A) Cultured Skin Epidermal Progenitors for Wound Treatment.

B) Assessment of safety and effectiveness of biodegradable temporizing matrix (BTM) in the treatment of deep burn skin injuries.

Figure 2: Biofabrication techniques in skin regeneration and wound care.

Figure 3: In situ bioprinting strategies for wound patients. Heinrich MA, Small. 2019.