
stryker
Artis WP
Home Patient Acquisition Options Help
413821
* 28/03/2022
STUDY 1
28/07/2022
11:31:02 AM
19 - 1/1
DSA Abdo CARE
cm 50
A
kV 73

Sydney Imaging
Biomedical imaging

Sydney Imaging provides a comprehensive suite of preclinical and clinical imaging modalities, a state-of-the-art hybrid theatre and world-class imaging techniques.

National Imaging Facility

NCRIS National Research Infrastructure for Australia
An Australian Government Initiative

Find out more

sydney.edu.au/sydney-imaging

3D-printed implants for bone reconstructive surgery

Challenge

People who require surgery for treatment of oral cancer often are left with large bone deficits in the jaw, which are reconstructed using bone from other areas of the person's body. While autologous bone is effective in restoring jaw function, there are negative aspects for the patient which could be improved by using 3D-reconstructed biocompatible implants.

Research

Professor Jonathan Clark AM (Central Clinical School, Faculty of Medicine and Health; Chris O'Brien LifeHouse) and his research group, Integrated Prosthetics and Reconstruction, are designing and manufacturing 3D implant/scaffolds for reconstructive surgery. The implants use bone tissue engineering techniques to promote bone ossification with the implant, with the aim of improving patient outcomes.

Undertaken using a sheep model, this multi-faceted project centres on the use of a porous 3D-printed hybrid polymer-ceramic scaffold. This scaffold is integrated with different biomaterials, left in-situ over a clinically relevant period and then imaged in vivo at different time points using the Siemens Artis Pheno robotic C-arm in Sydney Imaging's Hybrid Theatre to track implant and bone integration rates. At the completion of the in vivo part, the implants are removed and studied using microCT at Sydney Imaging's Preclinical Imaging facility to evaluate bone ingrowth and the material's suitability as an implant. The work is being aided by the invaluable technical expertise of Lisa Partel, Senior Technical Officer and Veterinary Technician Specialist, and Pranish Kolakshyapati, Senior Technical Officer in the Hybrid Theatre facility.

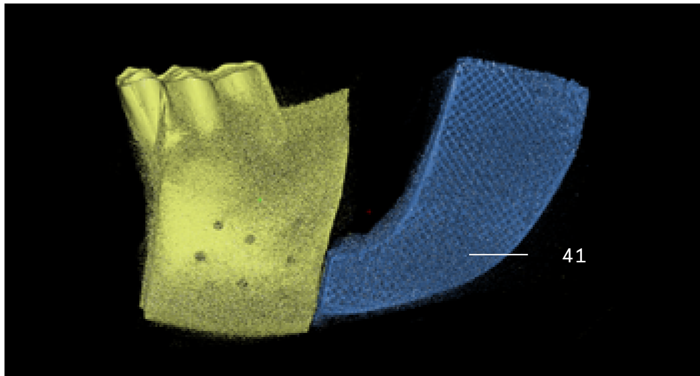
Results

The project has identified the superiority of 3D-printed plasma-treated polymer scaffolds for bone reconstruction. The findings were published in *Plasma Processes and Polymers*, and further publications are in the pipeline. The researchers can now build on this discovery to identify the most suitable bioactive materials to combine with the 3D hybrid scaffold, bringing this emerging biotechnology one step closer to improving the lives of oral cancer patients.

Funding sources include:

- Ato-Hardy Family Foundation
- Cancer Institute NSW
- Lang Walker Family Foundation
- Sydney Local Health District

Right: The team utilised micro-CT for in-depth analysis of tissue integration between the native healthy tissue (bone integration represented in yellow) and the implanted 3D-printed device (in blue).



Mending broken hearts

Challenge

Heart disease was the leading cause of death for men and the second-leading cause for women in Australia in 2022, with one Australian experiencing a heart attack every ten minutes. After a heart attack, the body replaces damaged heart muscle with stiffer scar tissue. This leads to a mechanical mismatch between the scar and healthy tissue, resulting in abnormal levels of stress and impacting heart function. Solutions for healing heart scarring promise to improve heart function and quality of life in heart attack survivors.

Research

Associate Professor Robert Hume and Dr James Chong (Westmead Institute for Medical Research and Sydney Medical School, Faculty of Medicine and Health) ran a preclinical trial of a novel treatment to reduce heart scarring using the protein tropoelastin. Tropoelastin haspreviously shown efficacy in wound healing applications but has not been significantly investigated in cardiac repair. The researchers sought to test whether tropoelastin injected into a damaged heart could boost healing in rats.

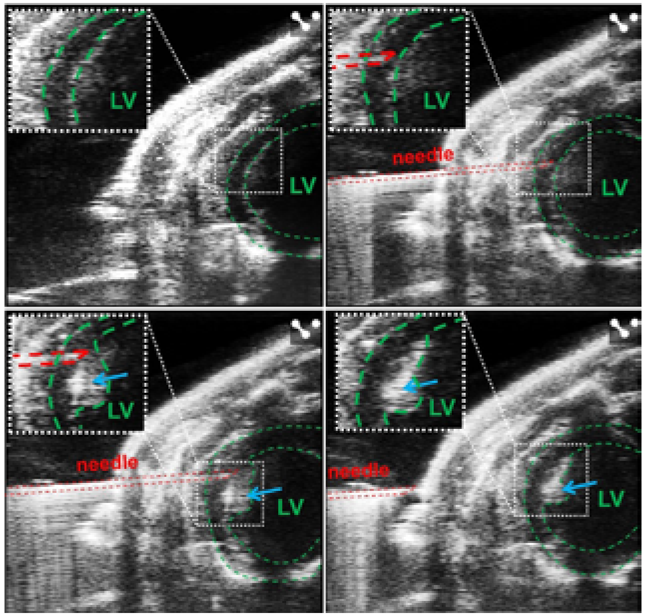
Working in Sydney Imaging's world-class preclinical imaging facility, the researchers applied the VisualSonics ultra-high-frequency ultrasound system in two ways. First, they administered treatment to animal hearts using a novel ultrasound-guided intramyocardial injection protocol, which is less invasive than conventional techniques. Second, they assessed post-treatment heart recovery using echocardiogram. The group that received injections survived the entire study, with echocardiography assessments showing that the tropoelastin had significantly improved heart function.

Results

For the first time, the researchers demonstrated that purified human tropoelastin can significantly repair infarcted hearts in rodents by reducing scar expansion and increasing scar elastogenesis. The findings received major media coverage and provide evidence for potential clinical translation of tropoelastin to treat and improve the lives of millions of heart failure patients, literally mending broken hearts. This work was published in *Circulation Research*.

Funding sources include:

- National Health and Medical Research Council
- National Heart Foundation of Australia
- NSW Health



Right: Short axis echocardiograms showing intramyocardial delivery of tropoelastin in the myocardium of the Left Ventricle (LV). Ultrasound imaging permits a less invasive intramyocardial therapeutic delivery of tropoelastin. Source: Hume et al., Circulation Research. 2023; 132: 72-8642

Australian National Total Body PET Facility: Accelerating Biomedical Research

Strategic partnership
Sydney Imaging has established a new flagship platform, the Australian National Total Body PET Facility, in partnership with Northern Sydney Local Health District (NSLHD) and the National Imaging Facility (NIF), under the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS).

Australian-first research capability
The Australian National Total Body PET Facility is pioneering a hybrid model of open-access research-oriented capability alongside rigorous clinical applications service at the Royal North Shore Hospital (RSNH). This $15 million facility aims to accelerate biomedical research by providing unique insights into the complex molecular mechanisms of human physiology.

Advantages and applications
Total Body PET (Positron Emission Tomography) technology represents a remarkable advancement in molecular imaging, unlocking novel experimental paradigms and creating new research opportunities. The extended axial field of view enables acquisition of comprehensive whole-body dynamics and pharmacokinetics. This facilitates systemic disease pathway investigations, identification of novel therapeutic targets, and exploration of multi-organ signalling, including vital connections such as the brain-gut axis. The exceptional sensitivity of the facility's scanner, a Siemens Biograph Vision Quadra, produces diagnostically superior images in substantially less time and with reduced radiation exposure than conventional PET scanners, enabling research on vulnerable populations such as children and the elderly. In addition, the improved statistical power of imaging studies may accelerate clinical trials, helping researchers to reach surrogate endpoints earlier.

Funding sources include:

- National Imaging Facility, under the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS)
- Northern Sydney Local Health District
- University of Sydney

sydney.edu.au/research/total-body-pet

Above: The Australian National Total Body PET Facility is located at Royal North Shore Hospital and opened in August 2023.