



# Core Research Facilities Sydney Imaging Case Studies





# SYDNEY 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.



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## Digital Infrastructure - Australian Imaging Service

The ability to generate imaging data is increasing exponentially thanks to improved imaging technology, making the ability to securely store and analyse these data critical, within both research and clinical settings. The need to track imaging data generated from instruments (for example CT scanners and MRI machines) and to analyse these data has never been greater.

In 2017, **Sydney Imaging**, in partnership with ICT and led by Dr Ryan Sullivan (Research Technology, ICT and School of Bioengineering, Faculty of Engineering), developed the Imaging Data Service (IDS). Utilising customised open-source software, **Sydney Imaging** was able to offer its users seamless transfer, reproducible analysis and (legally compliant) secure storage of imaging data, direct from its instruments (and affiliated equipment) within the Charles Perkins Centre and Brain and Mind Centre. These data could be accessed by researchers from any web browser instead of a dedicated computer, enabling new and more efficient research collaborations.

The success of this institutional platform has enabled the University of Sydney to take a leadership position within the national imaging data ecosystem. In 2019, the Australian Imaging Service (AIS) was established with \$700,000 in investment from the Australian Research Data Commons and an accompanying \$1.1 million in co-investment from other Australian institutions.



As a national federation, AIS extends the capabilities developed in IDS, providing secure management, analysis, and collaboration with clinical and academic partners across the country.

In 2020, AIS has subsequently received \$800,000 to build the Melanoma Imaging and Diagnosis National Research Repository and is partnering with other platforms to expand capability in the areas of neurology, electrophysiology, and veterinary pathology. With University of Sydney as the lead node, AIS has expanded to support 15 academic and six clinical partners, supporting vital research in the fields of neurology, dermatology, oncology and radiology, among others.

The University continues to lead the AIS platform with partners such as NSW Health, ensuring that AIS complies with their data requirements. AIS is working to expand secure analysis capability, providing a national set of reproducible tools and implementing AI tools integrated directly into browser-based viewers for streamlined annotation and segmentation used in the training process.

## Quicker interventions for patients in heart failure

Up to 40 percent of COVID-19 deaths are attributed to heart failure. In a world-first preclinical study, researchers have shown it could be possible to implant a potentially life-saving pump into the heart of those with heart failure, without leaving the intensive care unit or breaking isolation restrictions for the sickest of COVID-19 patients.

The study, published in *Nature Scientific Reports*, details a method of implanting the assistive pump into the main heart chamber guided by three-dimensional wide-angle intracardiac ultrasound – used for the first time in Australia as part of the study.

“The 3D ultrasound images are taken from inside the heart and this results in much better-quality images that can assist in complex procedures such as this,” said Professor Paul Bannon (Central Clinical School, Faculty of Medicine and Health).

**Made possible by the state-of-the-art facilities at Sydney Imaging’s Hybrid Theatre, researchers used intracardiac echocardiography probes to guide the implantation of the Impella device (supplied by Abiomed).**



Unlike traditional ultrasound where probes go onto the skin, three-dimensional intracardiac ultrasound goes inside the blood vessels and navigates inside the heart.

The mechanical pump used in the study is a left ventricular assist device currently in use in Australia. It is used for patients undergoing high-risk heart interventions through the skin or in instances where the heart is failing to pump enough blood to support the body.

The translational study was conducted with sheep to replicate heart anatomy similar to humans.

“The Hybrid Theatre represents a hybrid between the massive technological and academic strengths of the University of Sydney, and the drive for innovative and effective treatments from the hospitals we partner with,”

**Professor Paul Bannon**

## Balancing protein consumption for longevity

Amino acids have long been touted by the fitness and bodybuilding communities for their muscle building benefits. From ultra-bulk protein powders to lean mass-promoting snack bars, there's no shortage of products available for those seeking a muscle boost.

However, protein's popularity has also meant that less attention has been paid to researching its potentially negative side-effects.

Published in *Nature Metabolism*, research led by academics from the Charles Perkins Centre and School of Life and Environmental Science, Faculty of Science, Professor Stephen Simpson and Dr Samantha Solon-Biet suggests that while delivering muscle-building benefits, excessive consumption of branched-chain amino acids (BCAAs) may reduce lifespan, negatively impact mood and lead to weight gain. "While diets high in protein and low in carbohydrates were shown to be beneficial for reproductive function, they had detrimental effects for health in mid-late life, and also led to a shortened lifespan," Dr Solon-Biet explained.

Using state of the art imaging techniques at Sydney Imaging, the research examined the body composition of mice to observe the impact of dietary BCAAs and other essential amino acids such as tryptophan had over their lifespan.

### Too much of a good thing

Mice were fed double the normal amount of BCAAs (200%), the standard amount (100%), half (50%) or one fifth (20%) for life, and their body compositions were assessed using EchoMRI (for body fat, lean mass, water) and Faxitron UltraFocus DXA (2D x-ray, body fat, lean mass and bone density).

Mice who were fed 200% BCAAs increased their food intake, resulting in obesity and a shortened lifespan.

"Supplementation of BCAAs resulted in high levels of BCAAs in the blood which competed with tryptophan for transport into the brain," explained Professor Stephen Simpson.



"Tryptophan is the sole precursor for the hormone serotonin, which is often called the 'happiness chemical' for its mood-enhancing effects and its role in promoting sleep. But serotonin does more than this, and therein lay the problem," he said.

"This then lowered serotonin levels in the brain, which in turn was a potent signal to increase appetite. The serotonin decrease caused by excess BCAA intake led to massive overeating in our mice, which became hugely obese and lived shorter lives."

The research was supported by a National Health and Medical Research Project Grant and Dr Solon-Biet was supported by a University of Sydney's Sydney Research Accelerator Fellowship.



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