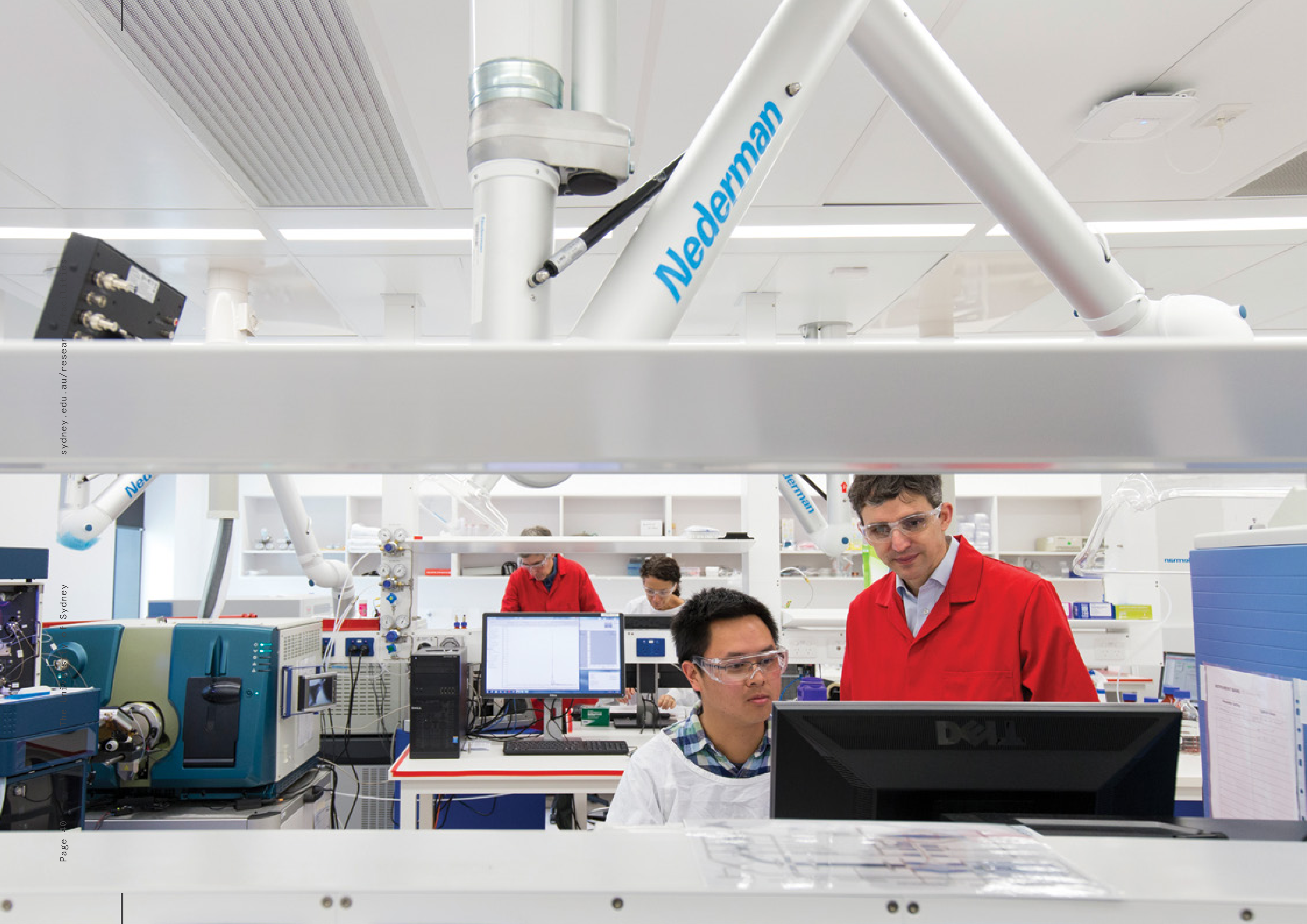
Core Research Facilities
Sydney Mass Spectrometry
Case Studies

THE UNIVERSITY OF SYDNEY


Nederman
DELL

SYDNEY MASS SPECTROMETRY

Sydney Mass Spectrometry provides state-of-the-art tools and expertise for proteomics, metabolomics and mass spectrometry imaging for the life and biomedical science communities.

Establishing new capabilities to fight bowel cancer

The philanthropic organisation Bowel Cancer Australia donated $6.4 million to the University of Sydney to create the Lawrence Penn Chair of Bowel Cancer research, as well as provide a start-up fund for the recipient.

In 2018 Professor Mark Molloy (Northern Clinical School, Faculty of Medicine and Health) became the inaugural Penn Chair.

Professor Molloy's research centres on molecular analysis of tumour biology, which apart from requiring the use of advanced mass spectrometers, benefits from co-location within a clinical setting.

Research capability next to a clinical setting

Recognising the research enabling potential for Professor Molloy and other researchers, **Sydney Mass Spectrometry** embarked on the creation of a new node of the facility operating out of the Kolling Institute at Royal North Shore Hospital. This new node has allowed the Molloy group and other University research teams to work across the research and clinical spaces.

The establishment of this new facility leveraged philanthropic donations from both Bowel Cancer Australia, and the Cancer Research Fund at the University. This purchased and installed the new mass spectrometers and funded building work to upgrade the lab space.

The **Sydney Mass Spectrometry** node at the Kolling Institute was officially launched in 2019 and has been highly utilised by Professor Molloy and his research team. Apart from leveraging significant funds to realise the new capability at the Kolling Institute, the Core Research Facility program continues to grow the new facility, attracting a number of other clinical researchers.

"Utilising the Kolling node of the Sydney Mass Spectrometry core has enabled us to propose new biomarker proteins associated with bowel polyps and bowel cancer progression. Our use of the equipment continues to grow and we are seeing interest from other research groups in the Kolling Institute."

Professor Mark Molloy

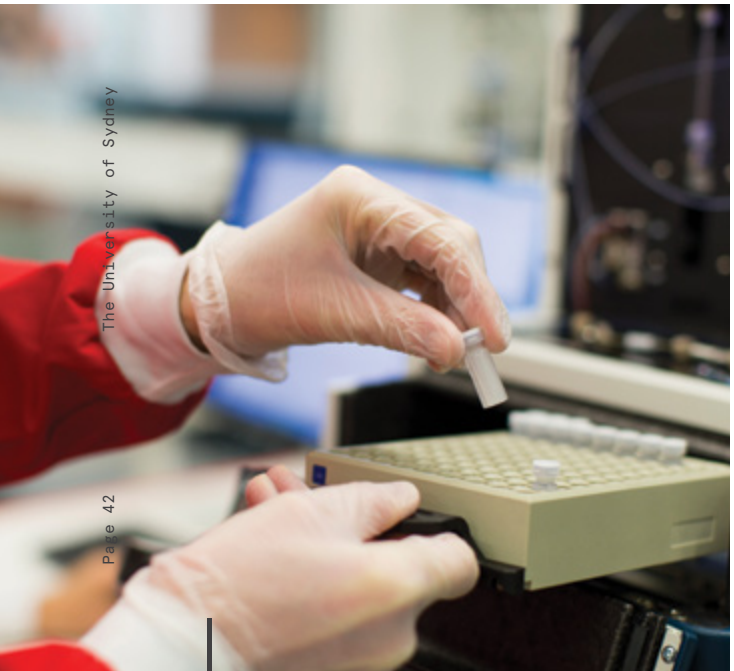
Find out more

- sydney.edu.au/research/facilities/sydney-mass-spectrometry

Supporting high impact research – Professor David James

Professor David James (School of Life and Environmental Sciences, Faculty of Science), the Leonard P Ullmann Chair in Molecular Systems Biology, is a world-leading researcher in metabolic sciences, and was awarded a prestigious Australian Research Council, Laureate Fellowship for his work in systems biology.

Throughout his tenure at the University, Professor James and his research group have been supported by **Sydney Mass Spectrometry** and **Sydney Microscopy and Microanalysis**.



The James Research Group were early adopters and capability drivers for 'omics research at **Sydney Mass Spectrometry**, developing pioneering multi-'omic research that demonstrates how changes in the kinome can impact the proteome, metabolome and lipidome and contributes to a 'systems biology' understanding of complex diseases.

This cutting-edge research has pushed capability and driven demand for newer mass spectrometers with greater capability. In one research project, which was published in Nature in 2019, the research team embarked on what was then the largest proteomics study **Sydney Mass Spectrometry** had undertaken. The study redefined a 'large' quantitative proteomics project, and mapped hundreds of mouse liver and plasma proteomes.

The need to process more samples led Professor James to work with the Ian Potter Foundation and **Sydney Mass Spectrometry** to purchase a robot which will provide **Sydney Mass Spectrometry** with high throughput sample preparation and support the next phase of his and other users' research. Utilising **Sydney Microscopy and Microanalysis**, Dr James Burchfield (School of Environmental and Life Sciences, Faculty of Science and part of James Research team) has been a key user of the light microscopy capabilities at Charles Perkins Centre, where they have utilised various microscopes to visualise signal transduction mechanisms and protein trafficking in live cells.

Professor James and Dr Burchfield worked with Core Research Facilities after securing a major equipment grant from the National Health and Medical Research Council to upgrade the Live Cell Microscope at **Sydney Microscopy and Microanalysis**, and in 2020 and was awarded another equipment grant from the Australian Research Council for an integrated, multimodal system platform for the multiplexed imaging of signal transduction.

> "Mass spectrometry represents the next big transformation in biological research enabling us to dig deeper than ever before into the world of proteins and metabolites thus bridging the gap between genetics, epigenetics and phenotype. The goal over the next decade is take this technology into every single lab so that researchers can discard their gel tanks and power supplies and rely on a much more comprehensive and quantitative technology for protein research."
>
> **Professor David James**

Redesigning respiratory virus testing

Effective testing is a key public health initiative to slow and stop the spread of the highly contagious COVID-19 virus. The current gold standard for screening active infections is the PCR assay which directly detects the RNA genome of the virus. While very sensitive, there are some drawbacks to this test – namely that - some people repeatedly test positive but are asymptomatic and it is unclear if they remain infectious. There was also concern in the early phase of the pandemic regarding supply of key reagents for the PCR assay.

An ongoing collaboration between Professors Rita Horvath and Bill Rawlinson (NSW Health Pathology), Professor Stuart Cordwell (School of Life and Environmental Sciences, Faculty of Science) and Dr Ben Crossett (**Sydney Mass Spectrometry**), has delivered a breakthrough that addresses both of these issues.

The team's proof of concept study successfully demonstrated that mass spectrometers could detect SARS-CoV-2 proteins in clinical nasopharyngeal samples.

The project aims to deliver an assay that detects the protein component of the virus and provide a more quantitative result than the PCR assay. The ultimate goal is to create a new assay that is a better predictor of the level of infectivity of a patient and overcome the false-positive drawbacks of the PCR assay.

The new assay under development uses standard equipment and readily available reagents so could be relatively produced at low cost and at scale.

The project initially received six months' funding from NSW Health to further develop assays utilising the equipment and expertise at **Sydney Mass Spectrometry**. The team are currently seeking additional funding to enable the translation of the assay to NSW Health laboratories in 2021, as well as to investigate if it can identify individual strains of the SARS-CoV-2 virus, screen for new mutations and detect other common respiratory viruses such as influenza.

It is hoped that this COVID-19 research collaboration will lead to a long-term partnership between the University of Sydney and NSW Health, with University researchers gaining access to clinical labs, and NSW Health Pathology staff continuing to develop new assays using the state-of-the-art instrumentation and expertise available at **Sydney Mass Spectrometry**.

sydney.edu.au/research/facilities
@Sydney_CRF

Produced by Marketing and Communications, the University of Sydney, June 2021. The University reserves the right to make alterations to any information contained within this publication without notice.