



THE UNIVERSITY OF
SYDNEY

Core research
facilities

Enabling research excellence





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“Excellence in research is increasingly linked to excellence in capability, and that is what our core research facility program is all about.”

Professor Simon Ringer



Director's welcome

At the University of Sydney, our research is driven by the pursuit of excellence. Between 2016 and 2020 the University will triple its investment in research to make Sydney the leading comprehensive, research-intensive university in Australia and one of the best in the world.

The continuing development of our core research facilities is an integral part of this strategy. These facilities are intimately linked to the search for solutions to the most significant challenges of our time in climate, health, food, water, energy, communications, transport, manufacturing, construction and national security.

The facilities bring together world-class instrumentation and outstanding people. They provide staff from Sydney and our partners around the world with an exceptional basis on which to achieve research excellence.

The facilities are designed for use by academics in the physical, medical, life and engineering sciences and throughout the humanities and social sciences. They are intended to serve as a focal point for collaborations and partnerships with researchers from diverse disciplines tackling frontier research questions.

If you or your research team could benefit from the facilities at Sydney, I encourage you to make contact to discuss the possibilities. You will not be disappointed.

Professor Simon Ringer
Director, Core Research Facilities
The University of Sydney

Research & Prototype Foundry

Based at the Sydney Nanoscience Hub, the Research & Prototype Foundry offers precise fabrication of nanostructures in a purpose-built cleanroom with extremely precise regulation of temperature, humidity, light and air composition, vibrations and electromagnetic interference.



The facility is enabling developments in optical chips, electronic devices, microfluidic devices and new quantum science and technology via outstanding lithography, etching, deposition and metrology capabilities.

The facility provides

- Lithography services
- Characterisation tools
- Nanofabrication tools
- Nanoscale metrology
- Ultrapure air
- Ultrapure water
- ISO Class 5 cleanroom
- ISO Class 7 cleanroom.

Techniques offered

- Photolithography
- Electron-beam lithography
- Spin-coating and sputtering
- Wet and dry etching.

More information

sydney.edu.au/nano/hub/foundry-cleanroom

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Research in action

A 3D polymer logo on a silicon wafer, showing features only two microns wide, produced using photolithography at the Sydney Nanoscience Hub. The foundry is capable of printing even smaller details, below 10nm wide, using the most powerful electron-beam lithography instrumentation in the southern hemisphere.



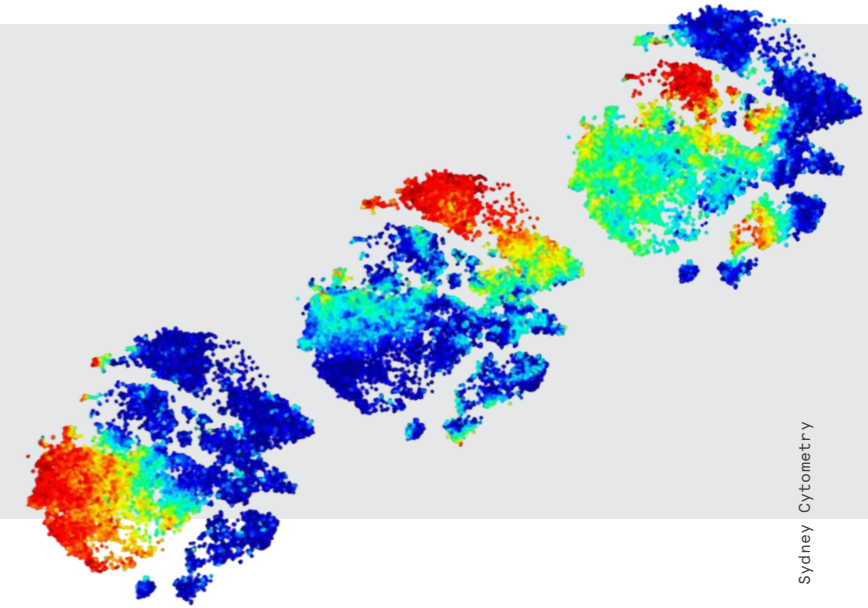
Sydney Cytometry

Jointly operated by the University of Sydney and the Centenary Institute, Sydney Cytometry provides access to and training in cytometry and cell-sorting techniques for researchers both internal and external to the University.



Research in action

The effect of inflammation on the bone marrow haematopoietic system revealed via cytometry by time-of-flight mass spectrometry (CyTOF). The images were produced by the University's CyTOF mass cytometer, the first of its kind in Australia.



We are committed to the development and transfer of cytometry expertise to answer questions in cell biology and biomedical research, applied clinical research and trials, and the diagnosis of cancer and other health disorders.

The facility provides

- Training and access to cytometry instrumentation including analysers and cell sorters
- Consultation services (experimental design, data acquisition and data analysis/interpretation)
- Development of cytometry techniques and instrumentation.

Techniques offered

- Cytometry analysis including flow, imaging and mass cytometry
- Cell sorting.

More information

sydney.edu.au/research/facilities.html

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Sydney Imaging

Offering world-class imaging capabilities and academic expertise, Sydney Imaging is a unique facility for research and education in the field of biomedical science.

The facility offers preclinical and clinical modalities, and a world-class hybrid theatre providing the capability for translational research along with training and development of specialised and complex surgical skills.

The facility's pre-clinical instrumentation includes high-field MRI, combined optical imaging with microCT, body composition analyser in awake animal, high-resolution ultrasound, X-ray, plus image processing and analysis. Our clinical imaging capability includes a 3T MRI suite.

The facility provides

- Expert advice and support for imaging and analysis
- Training and access to imaging facilities
- Access to high-end research infrastructure
- A range of related services to assist researchers with specialist applications.

Imaging modalities

- High-field MRI
- Optical bioluminescence and fluorescence imaging
- High-resolution ultrasound
- Photoacoustic imaging
- X-ray with DXA camera.

More information

sydney.edu.au/research/facilities.html

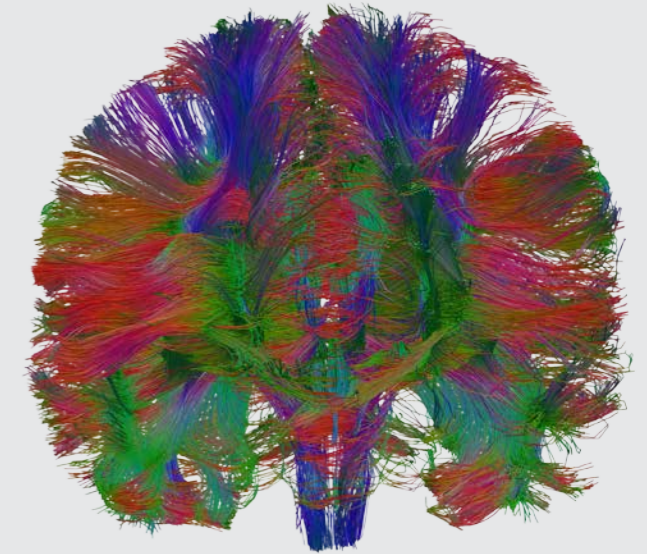
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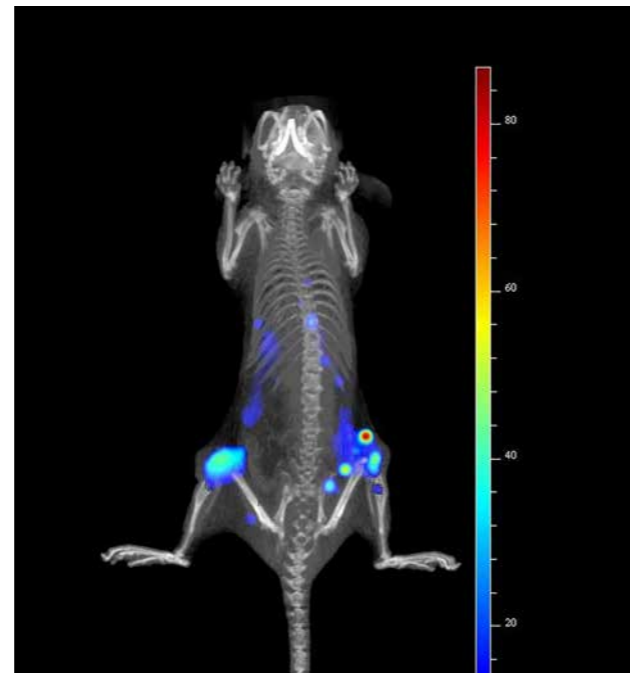
National partnerships

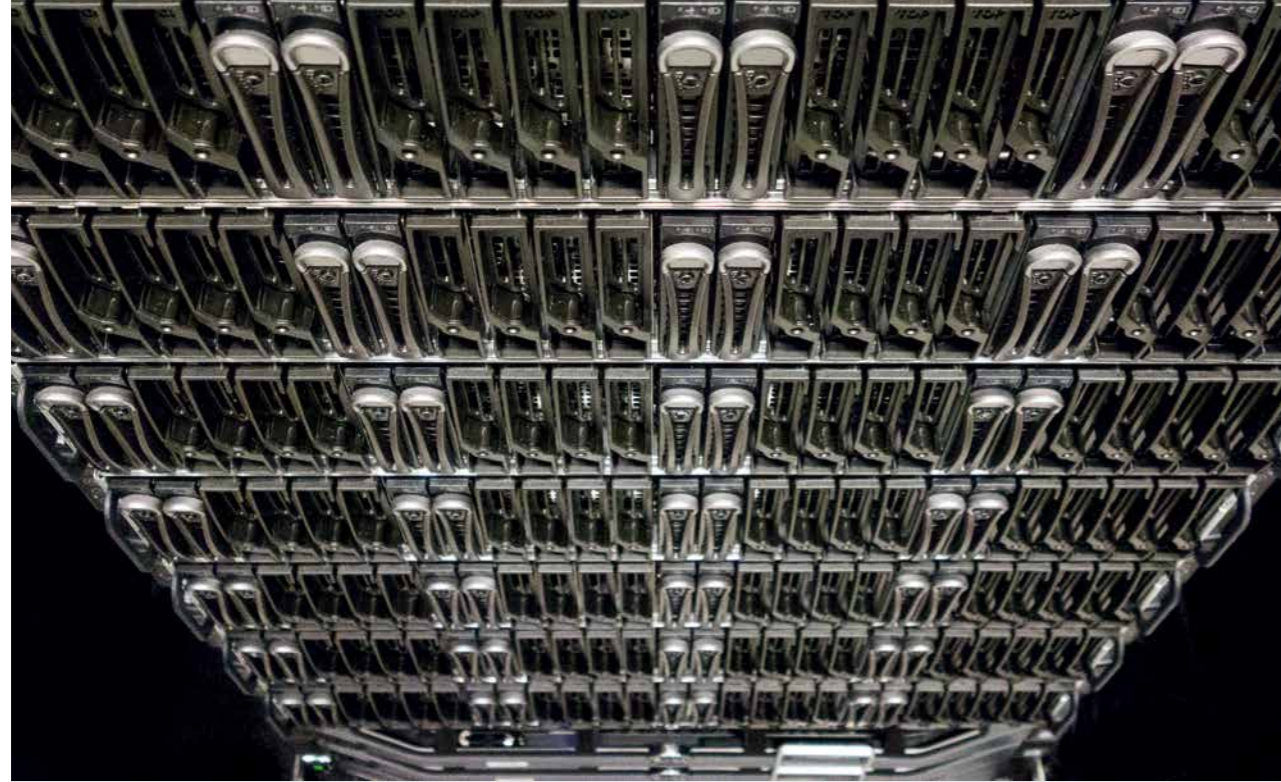


Research in action

White matter fibre tracts in the human brain, produced at Sydney Imaging using a tractography technique applied on diffusion tensor imaging data. We are developing powerful techniques for imaging the brain's structural connectome, information that provides a rare and exciting opportunity to improve mental health outcomes.

In 2017, the facility is installing 3-tesla and 7-tesla MRI machines that will enable non-invasive whole body scans.





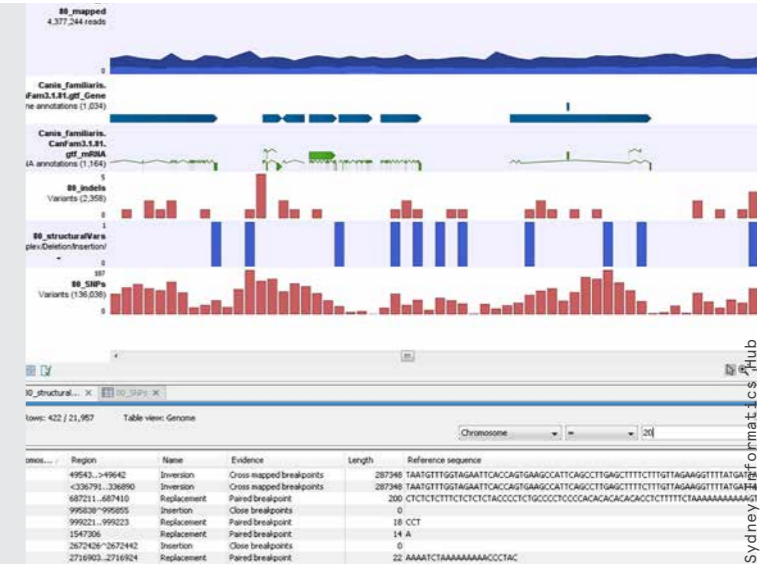
Sydney Informatics Hub

The hub was established to support researchers who rely heavily on the processing, management and retrieval of information, and its transformation into knowledge across disciplines.

The facility leverages staff expertise and capabilities from the University's High Performance Computing cluster, Artemis, the Centre for Translational Data Science, bioinformatics software and consultancy. The hub has recently expanded into other areas including digital humanities, data science and analytics, environmental sensing and modelling, and data visualisation, plus other emerging digital infrastructure.

Research in action

Data produced by CLC Genomics Workbench showing the genetic basis of congenital defects in dogs. Similar techniques of whole genome sequence analysis can be applied to any species. Our scientists are studying fungi, bacteria, viruses and bees as well as infections and diseases of global health significance.



The facility provides

- Expert consultancy
- Research data management support
- Data science support
- Statistical consulting
- Support using HPC and cloud computing
- Hands-on training workshops.

Technologies offered

- Artemis HPC
- Virtual research desktops available from 2018
- Bioinformatics software: CLC Genomics Workbench and Ingenuity Variant Analysis
- Statistical/modelling software: ANSYS and MATLAB
- Bespoke scripts and applications.

More information

sydney.edu.au/research/facilities.html

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National partnerships





Sydney Mass Spectrometry

This core research facility supports research with a global impact in the areas of proteomics, metabolomics and mass spectrometry.

Instrumentation includes a wide portfolio of mass spectrometers and data analysis packages for proteomics, glycomics, metabolomics, lipidomics, and mass spectrometry applications. We can provide advice and assistance for experimental design, sample preparation and data analysis.

The facility provides

- Expert consultation
- Access to more than 10 LC-MS systems for proteomic, lipidomic and metabolomic analysis
- Hands-on training in mass spectrometry for the next generation of mass spectrometrists
- Contract research such as protein identification or quantitative proteomics
- Access to high-performance data-processing and analysis packages.

Techniques offered

- Proteomics, including phosphoproteomics and glycomics
- Metabolomics and lipidomics
- Mass spectrometry imaging
- Bioinformatics.

Applications

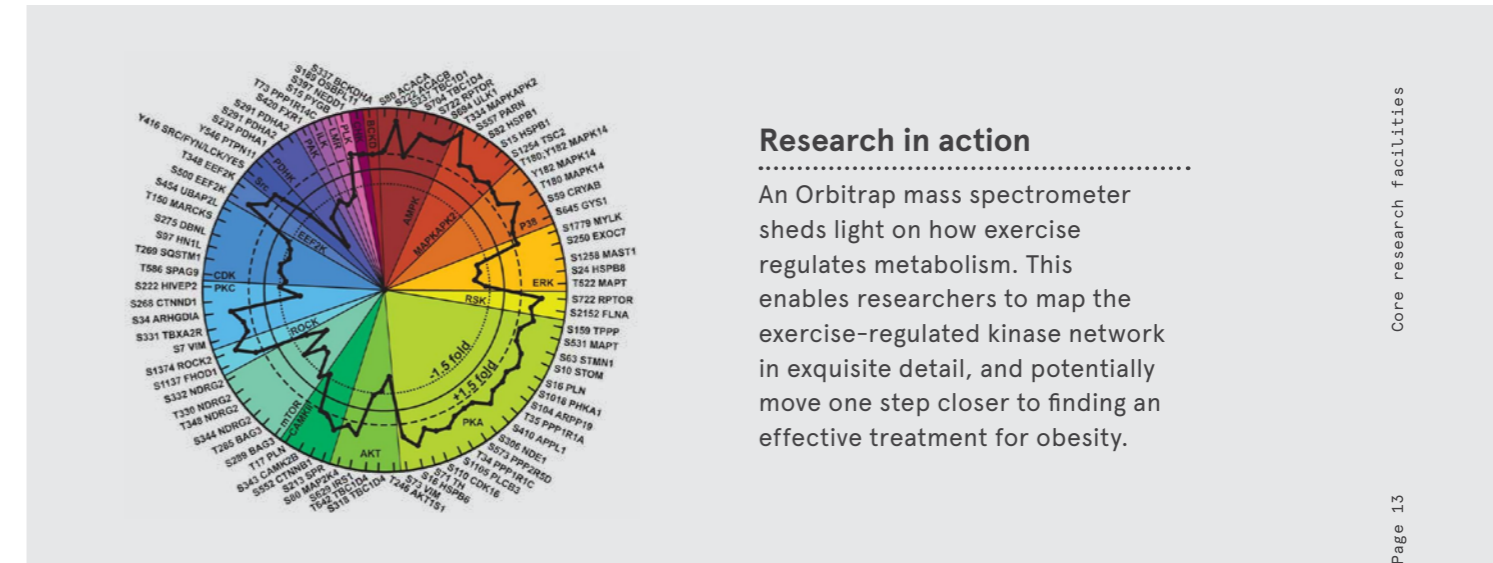
- Obesity and diabetes
- Infectious diseases
- Cancer diagnostics
- Agricultural and veterinary sciences.

More information

sydney.edu.au/proteomics

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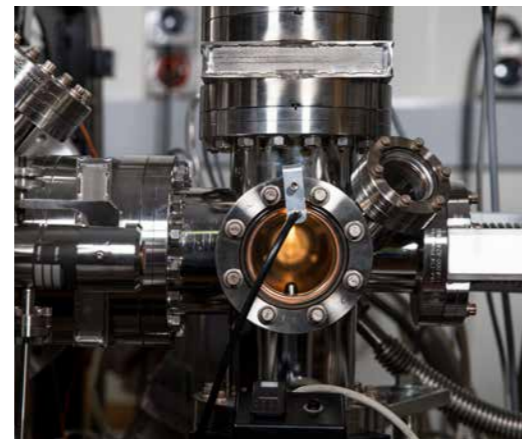
Research in action

An Orbitrap mass spectrometer sheds light on how exercise regulates metabolism. This enables researchers to map the exercise-regulated kinase network in exquisite detail, and potentially move one step closer to finding an effective treatment for obesity.

Sydney Microscopy & Microanalysis

One of the largest and most comprehensive facilities of its kind in the world, Sydney Microscopy & Microanalysis enables insights into how materials work – at the scale of living cells, tissue, molecules, crystals or even individual atoms.

The facility offers access to specialist staff, instruments and training to enable research into physical and biological structures across a wide variety of length scales and time scales. This expertise extends from specimen preparation, data capture and data analysis, and is of use across multiple disciplines, from archaeology and zoology to chemistry, engineering and physics.

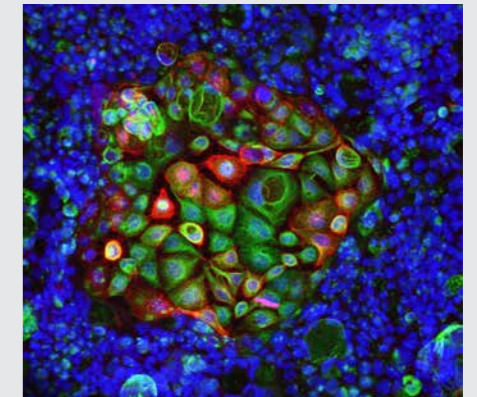
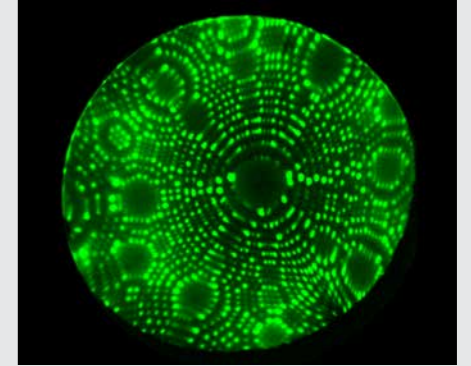


Research in action

Our facilities support research into both inorganic and biological structures.

Top: Atomic resolution field ion image of a tungsten crystal. Metals, alloys, semiconductors and other materials can be viewed at atomic resolution, enabling researchers to design and predict the behaviour of materials and devices.

Right: a confocal micrograph of colorectal cancer cells, as observed at the micrometer scale.



The facility provides

- Access to microscopes
- Expert advice, training, support and consultation on experimental design and the collection, analysis and visualisation of data
- Ability to discover structure, properties and functional relationships in your samples
- Structures revealed at micro- to atomic scales
- Software for image analysis, 3D visualisation and data visualisation.

Techniques offered

- Atom probe tomography
- Transmission electron microscopy
- Scanning probe microscopy
- Scanning electron microscopy
- X-ray microscopy
- Light and laser microscopy
- Super resolution microscopy
- Correlative light and electron microscopy.
- Expert specimen preparation
- Image visualisation

More information

sydney.edu.au/acmm

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National partnerships



Vibrational Spectroscopy

This facility's state-of-the-art instruments and services allow researchers to characterise the molecular structure and composition of solutions and solid materials including the 2D/3D structural distributions in biological and inorganic samples.

We offer spectrometers, rapid mapping, 3D volume mapping, X-ray and ultraviolet photo-emission spectroscopy, experimental design, data collection, data analysis, and consultancy services.



The facility provides

- Consultation services – experimental design, data collection analysis, report writing
- Assistance with both in-house and external equipment, such as the Australian Synchrotron
- Training and workshops.

Techniques offered

- Raman spectroscopy (point spectroscopy and mapping)
- FTIR spectroscopy (point spectroscopy and mapping)
- Synchrotron-based FTIR spectroscopy
- NIR
- XPS
- UPS
- TERS 10nm spatial resolution
- AFM/IR 10nm spatial resolution.

More information

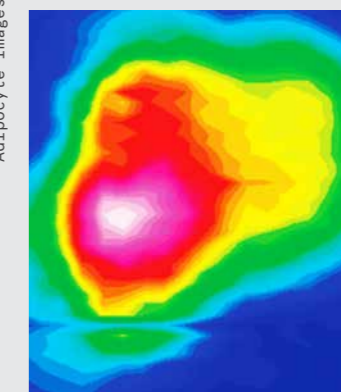
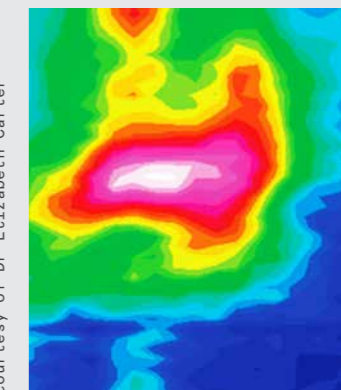
sydney.edu.au/science/chemistry/spectroscopy

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10µm

Adipocyte images courtesy of Dr Elizabeth Carter

Research in action

Infrared images of an adipocyte (fat cell) produced at the Vibrational Spectroscopy facility, showing protein and lipid speciation and distribution (single cell lipodomics). Research into adipocyte biochemistry is helping to increase our understanding of diabetes and cardiovascular diseases.

More information

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