

# Improving personalised cancer treatments across Australia and globally

<b>Project Title</b>	ACRF Single Cell Cancer Proteomics Laboratory
<b>Lead Institute</b>	The University of Sydney, NSW
<b>Focus Area</b>	Unlocking unprecedented insights into how individual cells behave and respond to treatment
<b>Cancer Types</b>	Melanoma, prostate, blood and breast cancers, treatment of lymphoma by CAR T-cells

## Challenge and Opportunity

Cancer remains one of the most pressing challenges in healthcare, with its complexity and heterogeneity posing significant obstacles to effective diagnosis and treatment. While advancements in genomics (the study of DNA including genes and their interactions with the environment, structure, function, and evolution) and transcriptomics (the study of the complete set of RNA transcripts) have revolutionised our understanding of cancer biology, the proteins they encode remain the major driver of cancer biology.

Single cell proteomics has emerged as a powerful tool to dissect the molecular landscape of cancers at unparalleled resolution, offering insights into cellular diversity and therapeutic vulnerabilities.

The ability to analyse proteins from individual cancer cells, and cancer-associated cells, is incredibly unique and only through significant recent technological development has this capability become available.

This project will build Australia's first dedicated laboratory for studying cancer at the single-cell protein level using this cutting-edge approach (single cell proteomics). **Proteomics is the study of proteins**, which are the actual workhorses of cells and play a key role in how cancer behaves and responds to treatment.



*Associate Professor Mark Larance, Chief Investigator*

**Heterogeneity** means the cells within a single tumour - or tumours from different patients - aren't identical; they have diverse traits.

## Project in Brief

By establishing Australia's first dedicated single cell cancer proteomics laboratory, the research team will unlock unprecedented insights into how individual cancer and immune cells behave and respond to treatment.

The project brings together a team of top scientists, clinicians, and data experts from The University of Sydney, Royal Prince Alfred and Royal North Shore Hospitals, Garvan Institute, Melanoma Institute Australia, Chris O'Brien Lifehouse and international partners in the US, UK, Africa, and Europe.

The lab will use state-of-the-art equipment to isolate single cells from tumours, measure thousands of proteins in each cell and use advanced computer tools to analyse and share the data.

In the first 3 years the lab will:

- Analyse individual cancer cells from prostate, breast, and melanoma tumours.
- Study immune cells used in therapies, to understand why some treatments work and others fail.
- Combine data from multiple sources (genes, proteins, imaging) to build a complete picture of cancer at the single-cell level.

After the first year the program will start to expand the research to other forms of cancer.

This equipment will empower researchers nationwide to make transformative discoveries in cancer biology and precision medicine.

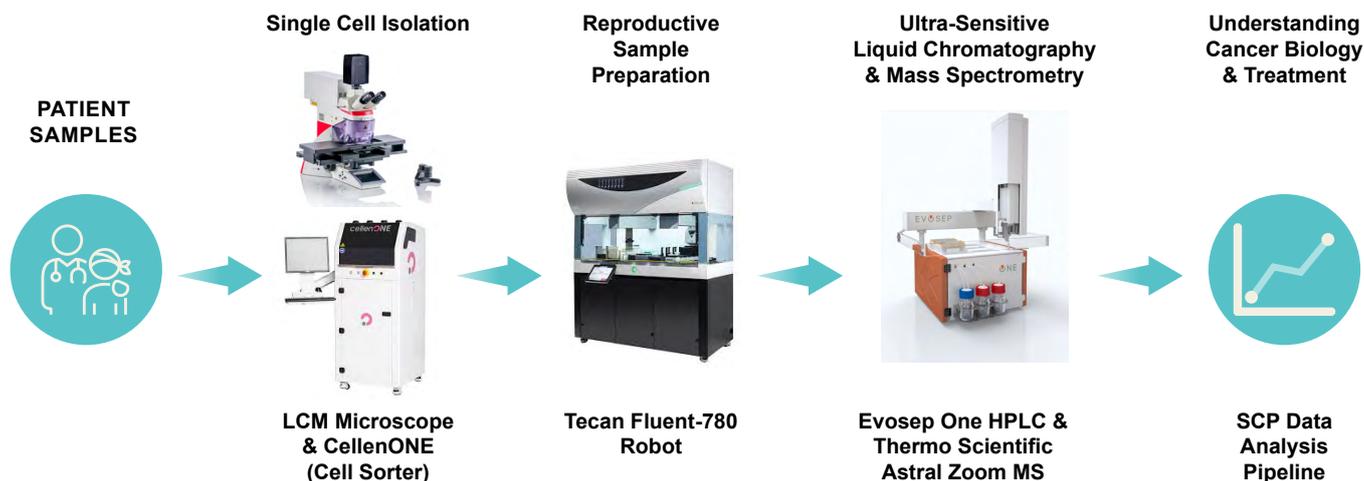
"Access to new technology in research is like installing a brighter lamp-post on a dark street, it doesn't just help you see more clearly, it reveals entire paths you didn't know existed. Without it, scientists are stuck examining what's already illuminated; with it, they can explore the unknown, uncover hidden mechanisms, and make breakthroughs that were previously out of reach."

*Associate Professor Mark Larance, Chief Investigator*



## The Benefit

This equipment will establish **Australia's first complete platform** for single-cell cancer proteomics, empowering researchers nationwide to make transformative discoveries in cancer biology and precision medicine.



## Workflow from patient sample to data outcomes

The project will aim to achieve:

- New insights into cancer diversity and why some patients respond differently to treatment.
- Better understanding of immunotherapy, especially CAR-T cell therapy for blood cancers.
- Tools for other researchers to use this data to improve cancer care.

In time, the outcomes of this research could be:

- Improving precision medicine for cancer patients using proteomics data, by providing a cellular atlas for each type of cancer. This will be used by oncologists to make the best choice for individual patient treatment. Trials of this approach are currently running, and we hope to provide data to boost these trials in 1-2 years' time.
- Basic discoveries about cancer cell biology, which can be exploited for new treatment options and to address resistance to cancer treatment. We are also trying to understand why some of the newer cell-based cancer treatments (e.g. CAR T-cells) aren't effective in some patients.

**It's anticipated that the impact of this research could revolutionise a cancer diagnosis, personalise therapies, and improve outcomes for patients across Australia and globally.**

## Use of Funds

The ACRF investment to establish the ACRF Single Cell Cancer Proteomics Laboratory will be \$1.8 million. The University of Sydney are providing a co-investment to further support the establishment of this pioneering facility. The laboratory will be based at the Charles Perkins Centre at Camperdown.

Equipment includes:

- A laser microscope to cut out individual cells from tissue.
- A robotic system to sort and prepare cells for analysis.
- A mass spectrometer that can analyse proteins in single cells.

Technology	Cost
Leica Laser Capture Microdissection Microscope (LMD7)	\$518,000
CellenONE Neo - Single cell isolation and sample processing system	\$549,000
Evosep One Chromatography System & Thermo Scientific Astral Zoom Mass Spectrometer	\$2,346,000
<b>Total</b>	<b>\$3,413,000</b>
<b>ACRF contribution</b>	<b>\$1,800,000</b>

## Meet the Team of Chief Investigators

The ACRF Single Cell Cancer Proteomics Laboratory will support the work of eight Chief Investigators (below) and a further 14 research personnel.



**Lead: Associate Professor Mark Larence, BSc (Hons), PhD**

Charles Perkins Centre

Theme Lead - Molecular Biomedicine

School of Medical Sciences, Faculty of Medicine and Health, The University of Sydney

**Professor Vanessa M. Hayes, BSc (Hons), MSc, PhD**

Petre Chair of Prostate Cancer Research, Charles Perkins Centre

School of Medical Sciences, Faculty of Medicine and Health, The University of Sydney

Affiliate Investigator, University of Manchester, UK

Affiliate Investigator, University of Pretoria, South Africa

Affiliate Investigator, University of Nairobi, Kenya

Affiliate Investigator, University of Illinois at Chicago, USA

**Professor Cameron J. Turtle, MBBS, PhD, FRACP, FRCPA**

CLEARbridge Chair in Cancer Immunotherapy

Faculty of Medicine and Health, The University of Sydney

Medical Director and Head of Research, Immune Effector Cell Service, Royal North Shore

Hospital, Northern Sydney Local Health District

Affiliate Investigator, Fred Hutchinson Cancer Center, Seattle, WA, USA

**Associate Professor Inês Pires da Silva, MD, PhD, FRACP**

Medical Oncologist, Melanoma Institute Australia

Faculty of Medicine and Health, The University of Sydney

**Associate Professor James S. Wilmott, BSc (Hons), PhD**

Melanoma Institute Australia

Faculty of Medicine and Health, The University of Sydney

**Dr Mun Hui, MBChB, PhD, FRACP**

Staff Specialist Medical Oncologist and Phase I Clinical Trial Lead, Chris O'Brien Lifehouse

Faculty of Medicine and Health, The University of Sydney. Garvan Institute of Medical Research

**Professor Sandra O'Toole, MBBS, PhD, FRCPA,**

Senior Staff Specialist, Royal Prince Alfred Hospital, Faculty of Medicine and Health, The University

of Sydney, Garvan Institute of Medical Research

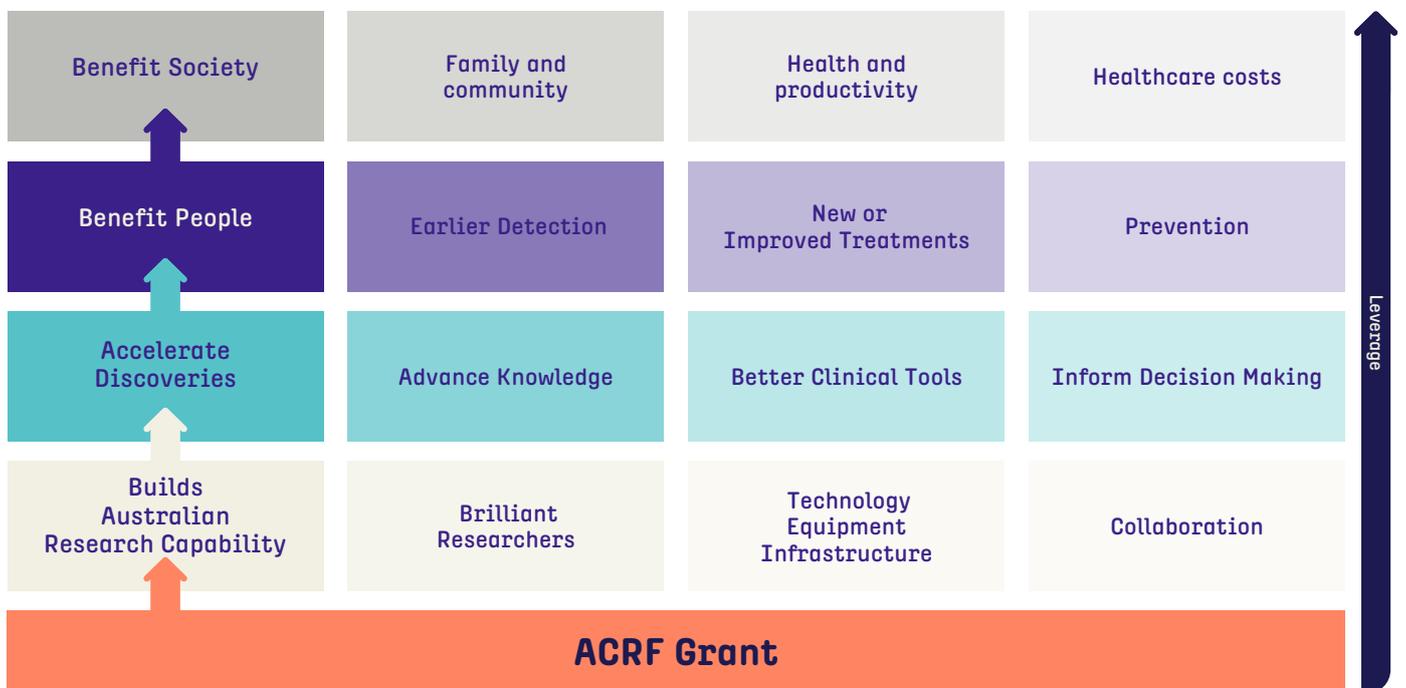
**Dr Shila Ghazanfar, BSc (Hons), PhD**

Sydney Precision Data Science Centre, ARC DECRA Fellow

School of Mathematics and Statistics, Faculty of Science, The University of Sydney

## ACRF's approach accelerates impact

- ACRF is uniquely positioned to access brilliant researchers and facilitate collaboration across Australia. Our focus on equipping researchers with technology and infrastructure is vital to progress and innovation.
- An outstanding independent panel of Australian and international cancer experts recommended funding this project. The research is cutting edge, distinctive, and has the potential for impactful outcomes.
- Projects outcomes will be reported to ACRF for seven years. These typically include scientific breakthroughs, advanced knowledge, publications, new approaches both in the clinic and use of information.
- The impact for people affected by cancer – through earlier detection, new and improved treatments – is better quality of life through the diagnosis, and lives saved. In some cases, research even results in preventing cancer.
- Furthermore, research benefits society – including keeping families and communities intact, reducing healthcare costs and keeping people healthy and productive.



ACRF seed funds remarkable projects and recipients typically leverage the ACRF grant to secure funding from other funding agencies. Reports from 33 grants (2013 – 2023) with an award total of \$80 million evidence self-reported leverage to \$778 million, a factor of 9.6 times.

Beyond the primary research objectives ACRF funded equipment has been used in the training of numerous new doctors and scientists, and it has played a part in attracting and retaining leading talent in Australia and global acknowledgement of the high quality of Australian cancer research.

**B A C K I N G  
B R I L L I A N T**

To find out more about Australian Cancer Research Foundation, the ACRF Accelerate program and this exciting project please contact [philanthropy@acrf.com.au](mailto:philanthropy@acrf.com.au) 1300 884 988