

## CAPABILITY STATEMENT

# Developing new drugs and treatments



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**The University of Wollongong (UOW) has a long history of using cutting-edge research to develop better drugs and treatments for some of the biggest medical challenges of our times.**

These conditions range from Alzheimer's disease, schizophrenia and various cancers, to the "superbugs" that are constantly challenging medical science by developing resistance to established drugs.

The University of Wollongong's reputation for inter-disciplinary research comes to the fore in its drugs research, with collaborations between academic and clinician researchers with skills and experience in clinical practice, medicinal chemistry, microbiology, molecular biology, ICT, radiography, materials science, physics, engineering and nanotechnology.

In October 2016, it was announced that UOW will build an \$80 million centre for molecular life sciences. The Molecular Horizons facility is an investment in the future health of all Australians and an example of how innovation can play a critical role in transforming regional communities. Molecular Horizons will be UOW's biggest ever self-funded research infrastructure investment.

The purpose-built collaborative research centre will be equipped with world-leading technologies, centred around the revolutionary \$7m Titan Krios cryo-electron microscope.

The Titan Krios microscope – one of only a handful in the world and only the second, but most advanced, in Australia – is the world's most powerful and flexible high-resolution electron microscope for biological research. It will allow researchers to see with unprecedented clarity the inner workings of human cells and enable new health-related breakthroughs.

The Centre will allow researchers to understand how proteins move and interact over time. This is critical to developing new ways to detect and fight diseases ranging from cancer to Alzheimer's or developing new classes of antibiotics to fight superbugs.

Purpose designed to foster interdisciplinary collaboration, Molecular Horizons will be located alongside existing intellectual strongholds in the areas of physical sciences, biology and laser chemistry in the Illawarra Health and Medical Research Institute (IHMRI) and existing teaching and research facilities in the Faculty of Science, Medicine and Health to provide a seamless transition for students from learning to research.

It will house around 150 researchers, including prominent research teams led by internationally renowned Professors Nick Dixon, Antoine van Oijen and Mark Wilson, and be equipped with facilities from single-molecule to molecular and cellular imaging including X-ray crystallography, electron microscopy and flow cytometry as well as single-molecule and high-resolution fluorescence microscopy, structural mass spectrometry and nuclear magnetic resonance spectroscopy.

The establishment of Molecular Horizons is expected to foster increased collaboration with organisations such as Monash University in Melbourne, the Victor Chang Cardiac Research Institute in Sydney and leading international institutions including Harvard Medical School and Johns Hopkins University in the US.

Construction of Molecular Horizons will commence in mid-2017 and the centre is expected to open in 2019.

### **Illawarra Health and Medical Research Institute**

The Illawarra Health and Medical Research Institute (IHMRI), which opened in 2010, has given the University an even sharper focus on health-related research.

Key research centres in this field include the Centre for Medicinal Chemistry, which is leading a drug development cluster, the Centre for Medical and Molecular Bioscience and the Cancer Drug Discovery Group at IHMRI.

Established as a joint initiative of the University of Wollongong and the Illawarra Shoalhaven Local Health District, IHMRI is dedicated to excellence and innovation in health and medical research.

IHMRI's researchers span many disciplines and work collaboratively to understand, diagnose, treat and prevent disease and illness in the region.

Based at a \$30 million research facility with purpose-built clinical trials facilities and sophisticated laboratories on the University of Wollongong campus, IHMRI connects the University's best health and medical researchers with the region's best clinicians. More than 100 scientists are now based at IHMRI with a further 180 using the facilities on a regular basis.

IHMRI's research program is organised around three broad-based themes. The Diagnostics and Therapeutics theme aims to explore the fundamental mechanisms of disease and use this knowledge to design, test and evaluate new drugs and develop innovative drug delivery and release strategies.

Drug development within this theme includes the development and testing of new cancer treatment formulations to achieve greater efficacy, the design of new antibacterial compounds to challenge drug resistance and the conduct of drug and therapy trials in both in-patient and out-patient settings.

Other themes in IHMRI's research program are Mental health and the ageing brain; and Chronic conditions and lifestyle.

### Centre for Medical and Molecular Bioscience

CMMB brings together a multidisciplinary team of chemists, biologists and medical researchers with a common interest in the molecular basis of disease. Members are drawn from the Schools of Chemistry, Biological Sciences and Medicine at the University of Wollongong.

CMMB's translational programs are aimed at developing new drug leads to more effectively tackle diseases associated with ageing and to address problems of cancer and drug resistance in infectious disease. Researchers with CMMB also work to expand understanding of molecular origins and mechanisms of disease to develop novel, potent pharmaceutical agents.

### Centre for Translational Neuroscience

CTN's researchers are working to find the means to prevent and treat schizophrenia, obesity and obesity-related colon cancer. Their approach is to study the pathological mechanisms of the diseases using human brain tissue, animal models and cell culture. New findings are then translated into novel pharmacological and dietary interventions for human diseases.

### Cancer drug discovery group

Researchers from the Centre for Medicinal and Molecular Bioscience and oncologists from the Illawarra Cancer Care Centre within the Illawarra Shoalhaven Local Health District and private cancer clinics are involved in multi-disciplinary work to understand the biological processes underlying the disease, increase efficacy and reduce side effects of current drugs, find new targets for drugs, design new formulations and explore new drug delivery methods.

Research includes drug design, synthetic organic and medicinal chemistry, radio-imaging, tumour cell biology and pre-clinical assessment to identify and validate new and/or improved classes of chemotherapeutics and diagnostics for cancer.

### Case study: Developing intelligent drugs

A University of Wollongong research program is developing a safer, more effective way to treat some of the most stubborn types of cancer.

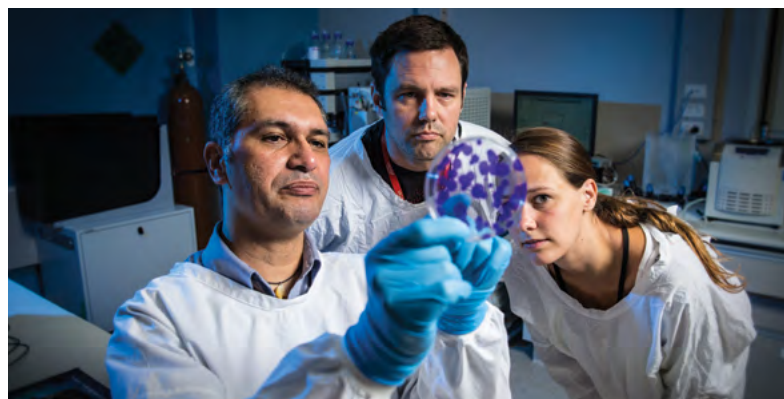
The National Health and Medical Research Centre-funded project, which is being led by biophysicist Dr Moeava Tehei at IHMRI and the University's School of Physics, aims to develop intelligent drugs that attach to malignant tumours like magnets.

These powerful, next-generation chemotherapy drugs will seek out cancerous cells, allowing physicians to see exactly where tumours lie. Nano-particles inside the drugs then switch on upon contact with X-ray radiation beams.

Dr Tehei, who leads the Targeted Nano-Therapies Research Group at the University of Wollongong, said this new method, which can diagnose, deliver targeted therapy and monitor the response to therapy all at the same time, would reduce the amount of radiation needed to kill cancer cells.

The researchers are initially focusing on cancers that do not respond to traditional radiotherapy techniques, such as certain brain tumours, but hope the therapy can be adapted for several different cancers, including breast and prostate cancers.

This collaborative project brings together researchers from the Australian Institute of Innovative Materials, Centre for Medical Radiation Physics, Centre for Medical and Molecular Bioscience and the Prince of Wales Hospital.



Dr Moeava Tehei (left) with Master of Science student Lee Taylor and PhD student Kathrin Bogusz.

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