



## Capability Statement

# Developing new drugs and treatments

The University of Wollongong (UOW) has a long history of working to develop better drugs and treatments to tackle some of the biggest medical challenges of our times.

These conditions range from Alzheimer's disease, motor neuron disease, COVID-19, and cancers, to the "superbugs" that are constantly challenging medical science by developing resistance to established drugs.

UOW's strong reputation for interdisciplinary research comes to the fore in our work on new drugs and treatments, with collaborations between academic and clinician researchers who have skills and experience in clinical trials and practice, medicinal chemistry, microbiology, molecular biology, ICT, radiography, materials science, physics, bioengineering and nanotechnology.

### MOLECULAR HORIZONS

UOW's Molecular Horizons research facility is dedicated to illuminating how life works at a molecular level, helping researchers solve some of the biggest health challenges facing the world.

The Molecular Horizons initiative brings together a multidisciplinary team of chemists, biologists, clinical and biomedical researchers with a common interest in the molecular basis of disease. Members are drawn from the disciplines of Chemistry, Biology, Nursing and Medical Science at UOW.

Molecular Horizons delivers research outcomes that recognise the future intertwining of molecular biology and chemistry to deliver personalised medicine and enable us to move from developing treatments to finding cures. It also serves as a centre for the training of new cryogenic electron microscopy (Cryo-EM) scientists throughout Australia.

Molecular Horizons' translational programs are aimed at developing new drugs to more effectively tackle diseases and to address problems of cancer and drug resistance in infectious diseases.

To facilitate this world-leading research, UOW has invested in a suite of revolutionary technology including Australia's most powerful biological electron microscope, the FEI Thermo Fisher Titan Krios Cryo-EM. The Titan Krios enables 3D visualisations of molecules and specifically protein molecules (the most structurally complex molecules known). Both the Titan Krios and the FEI Thermo Fisher Talos Arctica are part of the cutting-edge technology within Molecular Horizons.

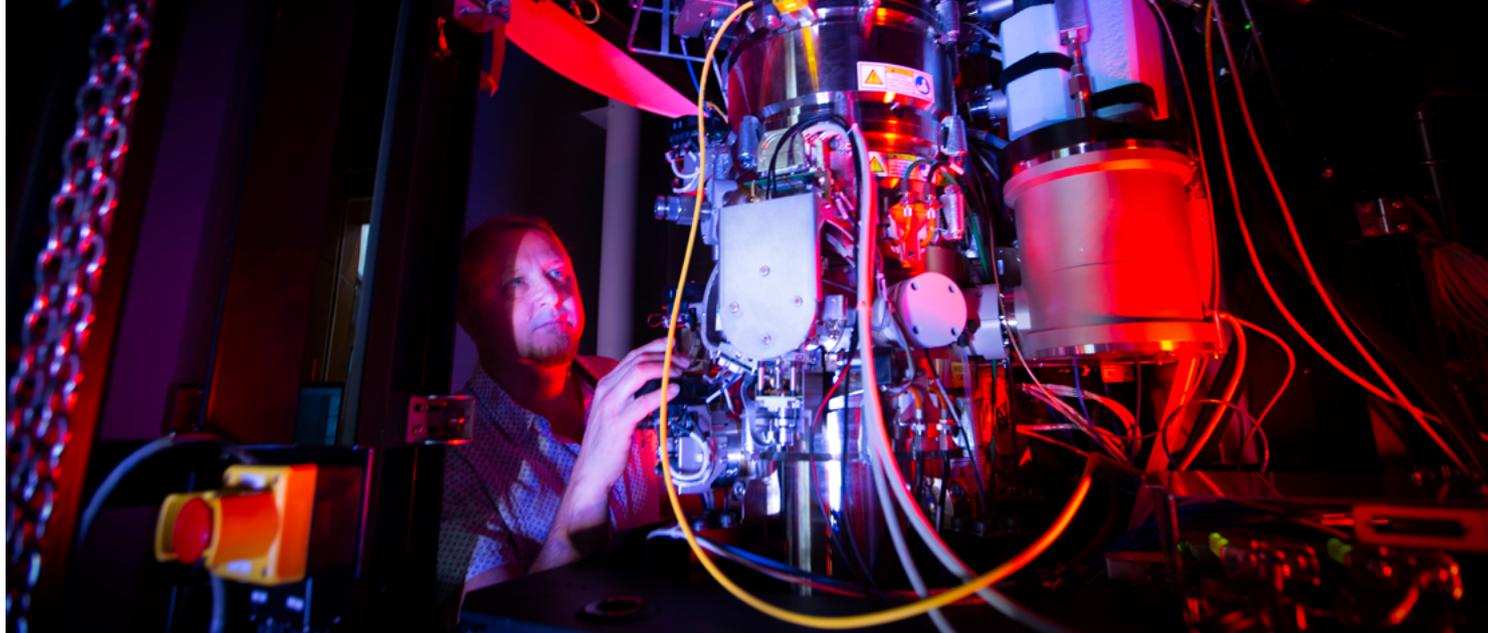
The infrastructure and research expertise to visualise proteins at the atomic level has rapidly become a key weapon in our battle against disease and UOW is also well-placed to contribute to production of the compound/s through our synthetic/medicinal chemistry capability and capacity.

The cryoelectron microscopes at Molecular Horizons are available to external partners to help researchers understand molecular interactions and develop vaccines and drugs. The institute's globally unique capacity led to it being awarded \$US1 million by the US National Institutes of Health to study how superbugs become resistant to antibiotics. This work is in collaboration with the University of Southern California and the University of Wisconsin, Madison.

UOW researchers actively pursue novel diagnostic strategies to detect viruses, both in patients and in the environment. As part of this, Molecular Horizons has partnered with US start-up company Protein Evolution Inc to develop blood tests that detect a wide range of diseases.

Molecular Horizons has extensive collaborations 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 United States. Overseas research and education links include Frederic Alexander University in Germany and the University of Groningen in the Netherlands.

UOW has established a partnership with Panasas, a world-leader in high performance computing data storage, to support medical and scientific research initiatives that deploy Cryo-EM.



### **ILLAWARRA HEALTH AND MEDICAL RESEARCH INSTITUTE**

The Illawarra Health and Medical Research Institute's (IHMRI) purpose-built research facility has a dedicated clinical research and trials unit (CRTU) designed to run a range of drug-related studies. The CRTU works with commercial partners to test drugs in an outpatient setting. This includes vaccines and novel therapies to treat chronic disease.

The well-equipped facilities include patient examination rooms, a blood collection and patient observation clinics, secure pharmacy and investigational product storage (including secure pharmacy fridge), pre-analytical laboratory for specimen preparation, -80 degree freezer storage and basic life and automated external defibrillation equipment.

### **ANTIMICROBIAL RESISTANCE**

UOW is taking an interdisciplinary approach to addressing the global issue of antimicrobial resistance.

UOW has been researching microbial systems for more than 20 years and instigated an Australia-wide initiative on antimicrobial resistance in 2017.

New antibiotics are just part of UOW's strategy to combat antibiotic resistance. We have programs designed to engage chemists and microbiologists with researchers and practitioners in education, medicine, public health, psychology, engineering, economics, ecology and the environment, to tackle problems in public education, sanitation and hygiene, antibiotic over-prescription and environmental management, as well as commercial viability of developing drugs of last resort that may rarely be used.

UOW is a research partner in the Collaborative Research Centre for Solving Antimicrobial Resistance in Agribusiness, Food and Environments (CRC SAAFE). The collaboration harnesses the capacity of more than 70 partners including major universities in each state and a consortium of partner organisations from multiple industries including aquaculture, horticulture, livestock, feed and technology, water utilities, water recyclers, regulatory authorities, and government agencies.

Molecular Horizons researcher Distinguished Professor Antoine van Oijen is one of the founders of the Wollongong Antimicrobial Resistance Alliance (WARRA). The WARRA initiative aims to tackle the challenge of antimicrobial resistance, by developing and testing interventions to stop, or at the very least slow down, rates of resistance.

**Molecular Horizons' translational programs are aimed at developing new drugs to tackle chronic and acute diseases more effectively.**

### **TESTING NEW CANCER DRUGS**

Researchers from Molecular Horizons and oncologists from the Illawarra Cancer Care Centre within the Illawarra Shoalhaven Local Health District and private cancer clinics are involved in multidisciplinary work to understand the biological processes underlying cancers, 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.

The work of researchers from UOW and the Illawarra Health and Medical Research Institute (IHMRI) has led to undertaking a pre-clinical evaluation to improve delivery methods of anti-cancer drug Zantrene®, designed by Race Oncology. The program is being led by Professor Marie Ranson from UOW's Molecular Horizons in partnership with Race Oncology's Principal Scientist and former UOW and IHMRI affiliate researcher, Professor Michael Kelso. Professor

Ranson is an esteemed cancer biologist based at IHMRI, with extensive experience in drug development and formulation.

The collaboration also aims to advance development of formulation approaches that could allow Zantrene® to be delivered orally.

Researchers from the IHMRI and the ARC Centre for Excellence for Electromaterials Science (ACES) are looking to develop drug delivery system (DDS) biomaterials. These are materials that interact with living cell systems. Researchers have been working for a number of years on developing innovative controlled drug delivery strategies, creating the next generation of biopolymers for localising drug delivery systems.

Advances in implantable DSS means targeted treatments to a tumour site are showing promise as a more effective alternative to chemotherapy. These systems contain one or more drugs and are placed around or inside the tumour to directly target the cancerous cells. They also aim to reduce the limitations of traditional chemotherapy treatments such as toxicity to healthy tissue and the failure to prevent recurring cancer.

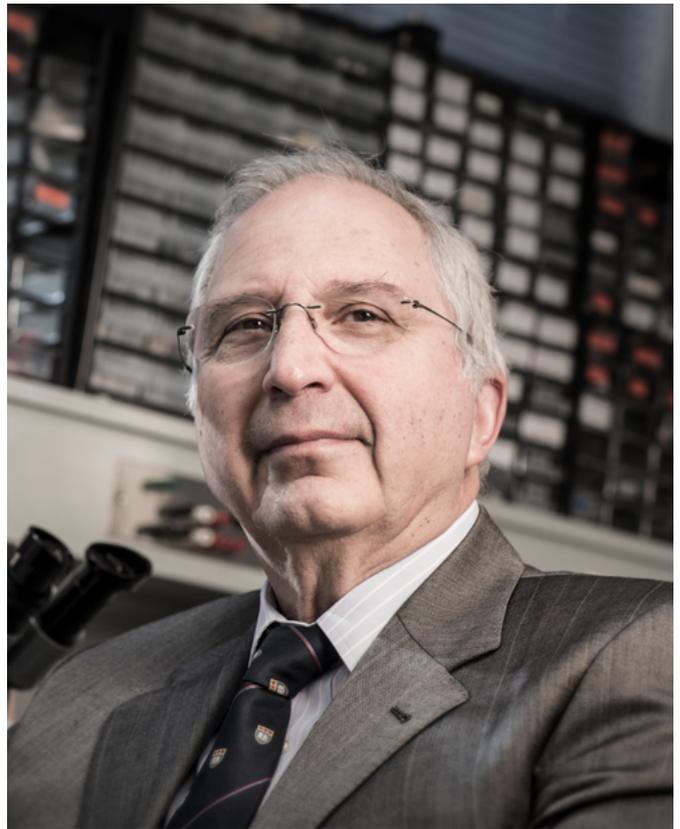
#### **BRAIN HEALTH RESEARCH**

Researchers from Molecular Horizons and IHMRI are investigating potential treatments for a range of brain health diseases, including mental health and psychiatric disorders, Alzheimer's disease, Parkinson's disease and motor neuron disease (MND). Their approach is to study the pathological mechanisms of these diseases using human brain tissue, animal models and cell culture. This work is aimed at finding novel therapies for these debilitating diseases.

One project, in collaboration with ProMIS Neurosciences, is testing a gene therapy that targets misfolded proteins associated with familial MND. If successful, this potential therapeutic strategy could increase the average length of patient survival after diagnosis, which for many is currently only between one to five years. There is also work being undertaken on developing targeted drug delivery technology to treat MND.

A Professorial Fellow in neurodegenerative disease and molecular biologist, UOW's Professor Justin Yerbury AM, is recognised internationally as a true pioneer in his field. Despite the challenges of living with MND, he has been unstinting in his efforts to find a cure for the disease.

Professor Yerbury was awarded the 2022 UNSW Eureka Prize for Scientific Research, recognising his dedication to MND research and the significant advancements his research has uncovered. Investigations led by Professor Yerbury have demonstrated that protein deposits found in motor neurons, the hallmark of MND, result from dysfunction in a process known as protein homeostasis. This is a breakthrough discovery that is informing the search for new therapies.



#### **SAFER RADIATION THERAPY**

The Centre for Medical Radiation Physics (CMRP) is a research team within UOW's School of Physics which is dedicated to the development of real-time semiconductor detectors and dosimeters for clinical applications, specialising in fields including innovative cancer treatments.

Cancer Council NSW has funded the Centre to develop a world-first system to ensure the safe delivery of radiation doses to cancer patients. The centre has developed the technology for MOSkin - the world's most advanced and cost-effective medical radiation sensor technology which precisely measures radiation dose and dose rate. Electrogenics Laboratories Ltd has been granted the exclusive global licence for MOSkin and it will be manufactured in Australia and commercialised globally.

The director and founder of the CMRP, Distinguished Professor Anatoly Rozenfeld, was named Outstanding Cancer Researcher of the Year at the 2022 NSW Premier's Research Awards.

#### **UOW WELCOMES THE OPPORTUNITY TO WORK WITH GOVERNMENT AND INDUSTRY PARTNERS TO DELIVER EXCEPTIONAL OUTCOMES**

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