

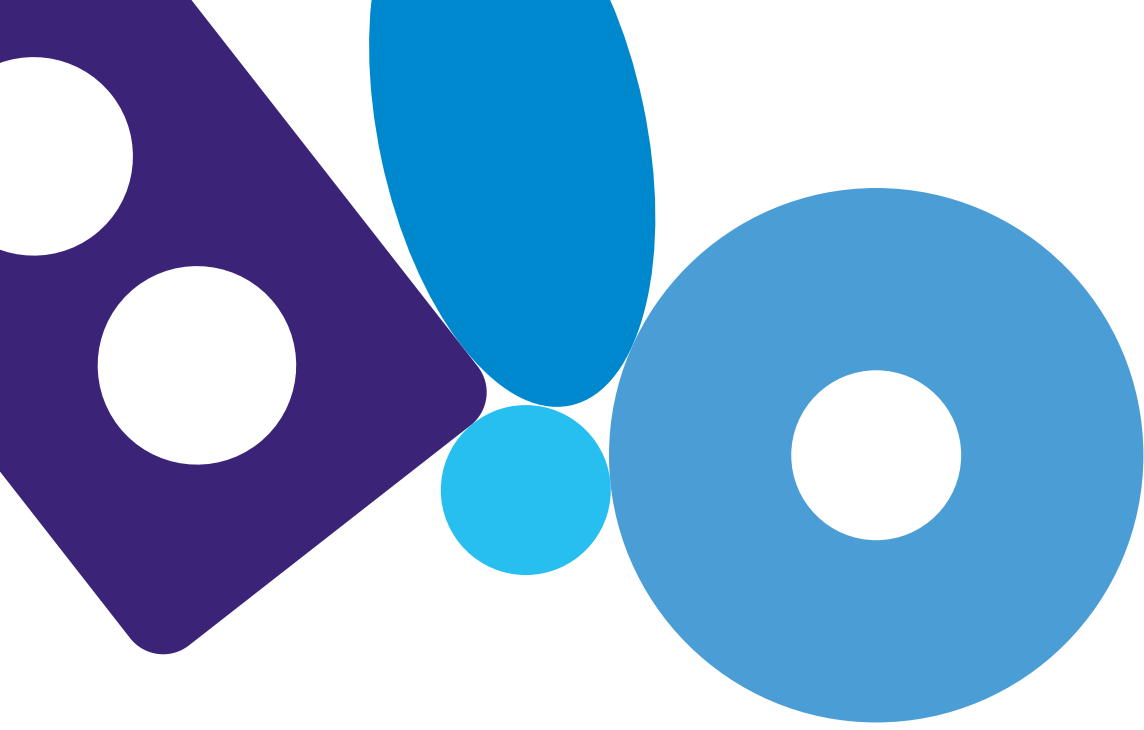
# Transforming medical possibilities into clinical realities



University of  
South Australia

Centre for  
Pharmaceutical  
Innovation

[unisa.edu.au/centre-pharma-innovation](http://unisa.edu.au/centre-pharma-innovation)



# Our purpose and vision: Delivering better medicines for a healthier world.

**UniSA's Centre for Pharmaceutical Innovation (CPI) partners with local and international organisations, research groups, government agencies and professional associations to deliver cutting-edge pharmaceutical solutions.**

Our team develops advanced medicines while actively developing the skills of future pharmaceutical leaders through our world-class educational practices.

CPI effectively and efficiently transforms medical possibilities into clinical realities. Our expertise, experience, infrastructure and innovation allow our multidisciplinary team to deliver better medicines that will revolutionise healthcare. We are on the path to becoming an internationally-recognised enterprise that provides disruptive pharmaceutical solutions and highly skilled future leaders.

## **Acknowledgment of Country**

CPI is situated on Kaurna Land. We pay our respects to the land's Traditional Owners, the Kaurna Peoples, and to Elders past and present. We respect Aboriginal ways of Knowing, Being and Doing and the value traditional medicines bring to health and holistic wellbeing.



# Discover our research specialisations

We lead the university's strategic research in pharmaceutical science. Our diverse expertise includes drug discovery, pharmaceuticals, biotechnology, nutraceuticals and education. Our key focus is developing patient-centric formulations, novel therapies and theranostics with industry partners.



We have six distinct research groups within CPI:



## Pharmaceutical innovation & development

The Pharmaceutical and Innovation Group within CPI is led by Professor Sanjay Garg. It specialises in the pharmaceutical development pipeline, from initial mechanistic studies to preclinical and clinical product development. Our interdisciplinary group focuses on engagement, innovation, translation and real-world impact. We collaborate with private and public entities to forge new solutions to complex product development challenges, including poor solubility, undesirable stability and targeted delivery.

### This group produces:

- 3D-printed personalised medication
- Cancer drug targeting
- Patient-centric projects
- Pharmaceutical education
- Veterinary delivery systems
- Novel antimicrobial compounds & formulations.



## Nanostructure and drug delivery

Led by Professor Clive Prestidge and co-led by Dr Paul Joyce, this group conducts research on drug delivery systems and provides innovative solutions to therapeutic challenges. Our researchers use pharmaceutical science, drug delivery, and nanomedicine approaches to develop new medicines for the treatment of cancer, infectious disease, cardiovascular disease, mental health, viruses and gut and metabolic health. We translate our findings into clinical applications through diverse cross-disciplinary collaborations.

### This group focuses on:

- Modulating the gut microbiome
- Next-generation nanomedicines
- The gut as a biological barrier
- Combating antimicrobial resistance & recalcitrant infections
- Drug delivery solutions to address clinical needs.



## Molecular biology of gut-brain axis and ageing therapeutics

The group, led by Dr Ibrahim Javed, is examining how gut bacteria can influence the physiological ageing of the brain and the role gut bacteria has in triggering an early onset, or acceleration, of brain disease. The group is specifically focusing on dementia in relation to gut bacteria and have designed strategies to target gut bacteria with nanomedicine or probiotics. It is thought that these two interventions will prevent gut bacteria from contributing to the development of brain disease.

### This group examines:

- Gut bacteria's influence on ageing of the brain
- Gut bacteria's role in the development of brain diseases
- How nanomedicines & probiotics can combat ageing and brain disease.



## Applied chemistry and translational biomaterials

This group, led by Associate Professor Anton Blencowe, is a diverse team of researchers with expertise in organic, supramolecular, polymer and materials chemistry. The team specialises in the development of controlled delivery systems – ranging from nanomedicine platforms through to injectable solid, liquid and hydrogel implants to smart coatings and polymer scaffolds – for the entrapment and/or delivery of therapeutics, biologics, antibiotics, cell therapies, odours and toxins for applications in the pharmaceutical, agricultural and livestock, food, ecological, mining and defence sectors.

### This group focuses on:

- Engineered nanoparticle platforms for targeted & responsive delivery
- Injectable implants for sustained, long-term delivery of payloads
- Novel antibiotics & antimicrobial coatings
- Biosustainable surfactants for emulsions & formulations
- Ligation strategies for the manufacture of bioconjugates
- Technologies for the control of invasive pest species.



## Bioinorganic synthesis and imaging

The development of theranostic agents for cancer and metabolic disease treatment is the key focus of this group. The group also specialises in the synthesis of new antimicrobials. This interdisciplinary research involves the use of synthetic, organic and inorganic chemistry to create new molecules. These new molecules are then used to characterise the molecules' interactions within the cell using advanced imaging techniques.

### This group focuses on:

- Developing long-lived stable luminescent molecules & those capable of theranostic activity
- Creating stable luminescent molecules for live cell targeting and tracking
- Investigating new antimicrobial classes to combat resistance.



## Pharmacotherapeutics

The pharmacotherapeutics research group specialises in developing novel assays to quantify small-molecule and protein-based medicines. The group aims to personalise drug dosage by determining the relationship between drug concentration, efficacy and toxicity. Additionally, we analyse the effect of patient factors such as genetics and medication adherence on the efficacy of medicines.

### This group develops:

- Novel assays
- Personalised drug dosage
- In-vitro models of drug metabolism
- Suites of statistical analysis plans for enhanced client decision making.



# Collaborate with our world-class team to achieve success

We have reached unparalleled success in solving research challenges with the utmost efficiency and speed.

Our close collaboration with life science organisations across the globe has led to remarkable breakthroughs and advancements.

**300** peer-reviewed papers authored by our scientists over the past five years

**100** patents cite our scientists as inventors

**70** of our graduated PhD students and postdoctoral researchers currently work in industry and academia

**50** current PhD, Masters and Honours students study at our centre

**25** industry partners currently work with CPI, with more than 100 partners engaging with our centre over recent years

**TOP 10** Top 10 in Australia for pharmacy & pharmacology  
*Ranked #10, 2024 QS Subject Rankings*

## Forming dynamic stakeholder relationships

We have worked with more than **100 clients and stakeholders** from across Australia and overseas from 2022 to 2024. Our collaborative projects have an impressive continuation rate, with **more than 90%** progressing to the next project phase. Don't just take our word for it; read what our satisfied clients have to say about their experience working with CPI.



**George Kokkinis, Technical Director,**  
**Pharmako Biotechnology Pty Ltd.**

*"We have partnered with Professor Clive Prestidge and his team at CPI for more than eight years on many different projects concerning novel encapsulation and delivery systems. We have also partnered with CPI for preclinical development, human application and commercial development. We have hired highly skilled PhD students from CPI, who have since advanced to senior scientist positions at Pharmako Biotechnology. These staff are highly valued by our company. Our collaborations with Professor Prestidge and CPI has amounted to co-invented patents, published papers and successful national grant bids."*



**Dr. Stephen Page,**  
**Director, Luoda Pharma**

*"Together with the amazing CPI team, led by Professor Sanjay Garg, we have designed an incredibly stable and long-acting omeprazole injection that suppresses the acid production in horses with severe ulcers for weeks. The product has been successfully licensed to Virbac – one of the world's top veterinary companies."*



# Case Study:

## Fighting leukaemia with nanomedicine

### The problem:

Acute myeloid leukaemia (AML) is a formidable blood cancer, claiming the lives of roughly 70% of adults under 60 and an alarming 90% of elderly patients. This dire prognosis is attributed, in part, to the high rates of cancer relapse and drug resistance that continue to thwart existing treatment modalities. The pro-survival signalling enzyme called 'sphingosine kinase 1' (SPHK1) is targeted using a SPHK1 inhibitor known as 'MP8'. MP8 has demonstrated an ability to mitigate cancer relapse by sensitising certain cells to chemotherapy. However, despite these encouraging results, the efficacy and clinical translation potential of MP8 are hindered by its low solubility, limited bioavailability and sub-optimal biodistribution.

### The solution:

To address this obstacle, Professor Clive Prestidge and his team at the CPI have utilised sophisticated nanomedicine techniques to create a refined nanomedicine. This innovation has shown increased effectiveness against AML cells, thanks to enhanced delivery of MP8 to bone marrow, where cancer relapse-driving cells live. Preliminary studies of a combination therapy involving MP8-nanomedicine with chemotherapy or targeted medication reveal a synergistic effect against human AML cells. These findings suggest that MP8-nanomedicine holds promise as a potential new effective therapy for managing AML.

### Outcomes for industry and society:

This pioneering work has the potential to fast-track the translation of SPHK1 inhibition through newly developed MP8-nanomedicine into clinical trials for AML therapy and holds promise for enhancing patient survival.

### CPI expertise in action:

- New drug development
- Cancer nanomedicine
- Liposomal drug encapsulation
- In-vivo leukaemia xenograft model
- Pre-clinical studies.

# Case Study:

## Treating stomach ulcers in race horses

### The problem:

Equine gastric disease affects millions of horses globally and is the most prevalent disease amongst the species, including racehorses. Oral paste is the current standard treatment for gastric disease and associated stomach ulcers. In some cases, this oral treatment is ineffective, as horses typically try to reject the paste. In cases where the paste is ingested, stomach ulcers can still persist after two or three months after daily paste treatment. The persistence of the ulcers can be due to the instability of the drug in acidic pH, insufficient dose at the site of action, and inconsistent dosing due to horses refusing to consume the paste.

### The solution:

A long-acting injection of omeprazole was developed by Professor Sanjay Garg and his team at CPI in collaboration with Luoda Pharma. The injectable formulation was able to heal the ulcers faster than the conventional approach of oral paste. The long-acting injection was able to suppress stomach acid within hours after administration and maintain the therapeutic level continuously for up to seven days, allowing time for ulcers to heal. Clinical reports indicate that the treatment has resulted in the healing of ulcers in less than 14 days. The formulation was also designed to bypass the undesirable instability issues of native omeprazole.

### Outcomes for industry and society:

The formulation is licensed to one of the world's top 10 veterinary pharmaceutical companies and has become the treatment of choice for many veterinarians.

### CPI expertise in action:

- New drug development of long-acting formulations
- Nanotechnology
- Improving physicochemical reverse engineering.

# Case Study:

## Deciphering the highway between gut-microbes and the brain

### The problem:

Ageing is the inevitable clock of life that we all carry in our pockets. Alzheimer's disease is the most common form of dementia. The disease severely effects the quality of ageing and puts enormous social and economic burden on families and Australia's healthcare system. In 2020, more than 28,000 people were diagnosed with younger onset dementia (this being, people under the age of 65). Our research at CPI has indicated that this alarming situation has a strong link to gut bacteria. Gut bacteria is recently emerging as a silent driver of different diseases and, thus, holds therapeutic answers to different diseases.

### The solution:

A team led by Dr Javed at CPI are working on resolving the molecular pathways and linkages that open the gates of communication between gut bacteria and the brain. These gates of communication leave the brain vulnerable to gut bacteria. CPI has discovered that molecules responsible for making biofilms for bacterial colonies in the gut can permeate from the gut and then access brain tissues. Once in the brain, they can trigger and accelerate the pathological cascade that leads to dementia. This process can be held responsible for early-onset dementia. It is also a potential adjunct target for dementia therapeutics. This discovery by CPI will allow the centre to design the next generation of pharmaceuticals and drug delivery strategies that will target the molecular pathways along the gut-brain axis.

This will mitigate the infectious involvement of gut bacteria in dementia and improve the quality of ageing.

### Outcomes for industry and society:

The insights gained from this research will help guide the development of new drugs that treat or prevent brain disease. Additionally, this work has the potential to influence the development of nutritional supplements that promote a healthier balance of gut bacteria.

### CPI expertise in action:

- Nanomedicine
- Preclinical studies
- Advanced cellular models
- New drug delivery strategies
- Next generation pharmaceuticals.



# About Us

Our goal is to transform medical possibilities into clinical realities. Armed with unparalleled expertise, extensive experience, and robust infrastructure, we deliver pharmaceutical solutions to address unmet medical needs and revolutionise the healthcare industry.



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