



MONASH
University

MONASH INSTITUTE OF PHARMACEUTICAL SCIENCES

BETTER
MEDICINES
BY DESIGN

2024
ANNUAL REPORT

COMMITMENT TO INDIGENOUS PEOPLE

We recognise that our four major Australian campuses – Clayton, Caulfield, Parkville and Peninsula – are located on the unceded lands of the people of the Kulin Nations, and pay our respects to their elders, past and present.

We recognise that Australia’s Indigenous people were this country’s first pharmacists and scientists. We are committed to fostering a society that recognises and respects this knowledge, and includes Australia’s First Peoples, cultures and broader knowledge by working with and celebrating Aboriginal and/or Torres Strait Islander peoples, and Indigenous peoples of other places where Monash has a campus or major presence.

Monash University is committed to supporting and contributing to: The Uluru Statement from the Heart process for a First Nations Voice to the Commonwealth Parliament of Australia; and Treaty discussions in the state of Victoria and the Yoo-rrook Justice Commission.

We recognise that indigenous peoples and indigenous knowledge is under-represented in MIPS. We are working to change this.

ACADEMIC FREEDOM AND FREEDOM OF SPEECH

Monash University Council adopted a new Freedom of Speech and Academic Freedom Policy in May 2021. The Policy is based on the Model Code for the Protection of Freedom of Speech and Academic Freedom in Australian Higher Education Providers (Model Code), and is applied across the Monash Group and all its related policies and procedures. The adoption of the Freedom of Speech and Academic Freedom Policy demonstrates our continuing commitment to freedom of speech and academic freedom as defining values of the University, in policy, practice and culture. In June 2021, the Federal Department of Education, Skills and Employment notified the University that it considers the University’s policies to be fully aligned to the Model Code. Those policies, including the Freedom of Speech and Academic Freedom Policy, are available to our staff and students online, via the University’s policy bank website.

Cover image: Cryo-electron microscopy (cryo-EM) is a powerful technique that helps us understand the molecular mechanisms of receptor function. Here we see the cryo-EM structure of the PAC1 receptor (PDB ID: 8E3X), an important receptor involved in neurological processes. The structure is displayed using atom spheres, with light rays that illuminate the PACAP agonist (green), which activates the receptor (blue). The image was created using the 3D graphics software Blender. Green was used for the agonist, symbolising 'hope', and Monash blue was used for the receptor, symbolising the vital research done at Monash University.

Credit: Dr Sarah Piper, postdoctoral research fellow, Drug Discovery Biology Theme. In 2024 Sarah was awarded an ARC DECRA Fellowship for research captured in this image.

This image was the winner of the MIPS image competition, selected by a sub-committee of the MIPS Executive.

Any enquiries or comments regarding this publication, including requests regarding use or reproduction, should be directed to MIPS.

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CONTENTS

MIPS 2024 – by the numbers	2
About MIPS	3
Director’s message	6
MIPS Review & Planning	8
2024 Highlights & Staff Achievements	12
2024 MIPS Research Symposium	20
Faculty Research Awards	22
Research Themes	28
Therapeutic Program Areas	56
Drug Discovery Research Platforms	62
National collaborations	72
Internal Initiatives to grow and support our staff and student community	84
Partnerships & Collaborations	88
Commercialisation & Translation	89
MIPS Organisational Structure and Expertise	96
Our Graduate Research Students	98
Financial Snapshot	102

MIPS 2024 – BY THE NUMBERS

RANKING

#2 
Worldwide, in Pharmacy & Pharmacology
(QS Ranking by Subject, 2024)

PEOPLE

277  **247** 
Staff Research students

RESEARCH OUTPUTS

275  **56%** 
Research articles International co-authorship

RESEARCH GRANTS AND CONTRACTS

51  **\$77.3M** 
Research grants awarded Research income awarded

\$48M 
In Australian Competitive Grant funding

66  **\$22.2M** 
Research contracts in research contracts and international grants

COMMERCIALISATION

21  **1** 
Invention disclosures Spin-out and start-up company

5  **3** 
Patents Licences including options and assignments

ABOUT MIPS

The Monash Institute of Pharmaceutical Sciences (MIPS) can trace its roots to 1881 when the Victorian College of Pharmacy opened. Monash University was established in 1958 and in 1992 the College of Pharmacy was merged with the University. In 2008 the College became the Faculty of Pharmacy and Pharmaceutical Sciences and the Monash Institute of Pharmaceutical Sciences was established.

Today, MIPS is a dynamic, innovative and ambitious centre of research and learning, with a growing emphasis on cutting edge projects to deliver societal impact.

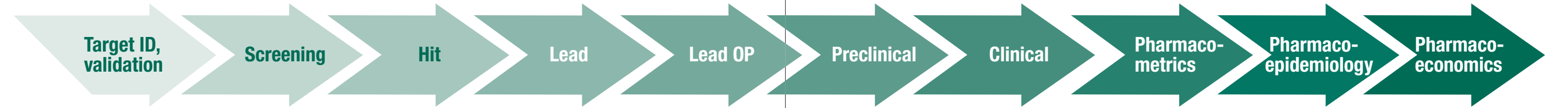
As the home of the majority of research activity within the Monash Faculty of Pharmacy and Pharmaceutical Sciences, MIPS brings together more than 500 of the world's best scientists to research drug discovery, design, delivery and use. Our therapeutic strengths lie in neuroscience and mental health, cardiovascular and metabolic health, and global health.

We are committed to research translation and have made major contributions to collaborative drug discovery programs that have progressed more than 40 novel drug candidates into clinical development.

OUR VALUES

- Innovation and impact**
We take excellence as a given. Instead we strive for excellence that is innovative and leads to internationally recognised impact making a difference to the lives of people all over the world.
- Collaboration**
We achieve so much more by working with others. We actively seek collaborations within MIPS and Monash more broadly but, vitally, with national and international partners. Our research is better for it.
- Diversity and inclusion**
We know that diversity in our people brings better scientific and health outcomes. By fostering an inclusive environment we are developing a culture where all of our staff and students know that they are valued.
- Integrity**
Public trust in health research is vital. We earn the trust of our collaborators, as well as health consumers, by upholding the highest standards of integrity and honesty.

MIPS AT A GLANCE



RESEARCH THEMES

Drug Discovery Biology Medicinal Chemistry Centre for Drug Candidate Optimisation Drug Delivery, Disposition & Dynamics Centre for Medicine Use and Safety

THERAPEUTIC PROGRAM AREAS

Cardiovascular and Metabolic Health Neuroscience and Mental Health Global Health

RESEARCH PLATFORMS

LOCATION

MIPS is housed at the Monash University Parkville campus, the university's most research intensive campus. Close to Melbourne's CBD and part of Australia's top health and biomedical precinct, our neighbours include major hospitals, the University of Melbourne, WEHI, the Florey, the Doherty Institute and CSL Limited. We have a secondary research presence in Clayton at the Melbourne Centre for Nanofabrication and the Medicines Manufacturing Innovation Centre has a node at the nearby Australian Synchrotron.

2024 has seen extensive planning for the expansion of the campus to the new site at 343 Royal Parade, which was acquired in 2023. Work to refit the building will commence in 2025 with completion expected in 2027.



MIPS WITHIN THE MELBOURNE BIOMEDICAL PRECINCT PARKVILLE



DIRECTOR'S MESSAGE

It is a great pleasure to provide this introduction to the MIPS annual report for 2024. Time moves on amazingly quickly, especially in the scientific world, and it is good to be able to take stock and look back at the highlights of the year.

Perhaps the most significant event for the year was the final budgetary approval to revitalise our new building at 343 Royal Parade. This new site will become a focal point for research translation and provide a single point of access to many of our platforms and capabilities that support small molecule drug discovery. We are all thrilled to see this exciting project get started, with occupation expected in early 2027. In a similar vein, in July, we were delighted to welcome Victorian Deputy Premier and Minister for Medical Research the Hon Ben Carroll to officially open the newly built Medicines Manufacturing Innovation Centre extension within the heart of the Monash Technology Precinct at Clayton. This expansion will provide further opportunities for innovation across medicine formulation, resolving manufacturing process challenges and building the supply of highly-skilled, industry ready candidates for the workforce.

2024 also saw the culmination of our 5-year planning and review cycle with the meeting of our international review & advisory Board in August. The Board had a busy two days engaging with all aspects of MIPS' research programs, platforms and researchers and we thank all Board members (detailed on page 8) for their time, insight and engagement. Their invaluable feedback was combined with our internal planning and led to the launch of the MIPS Strategic plan. More detail on the plan is provided on page 10, and notably, we identified four areas of new focus that will be central to our activities over the coming years: 1) Artificial intelligence and data science; 2) Enhanced translation and commercialisation; 3) Addressing the challenges of climate health; and 4) Enhanced support for non-traditional academic and research roles.

In our major research collaborations, 2024 saw the initiation of the first research projects for MedChem Australia. This is a national program, headquartered at MIPS, run in collaboration with WEHI and the University of Sydney, and funded by the Commonwealth Government's Medical Research Future Fund (MRFF), Therapeutic Innovation Australia and the partner organisations.

It provides medicinal chemistry and drug metabolism and pharmacokinetics support to drug discovery programs across the country and aims to help fill the funding and knowledge gap between early programs evaluating, for example, advances in fundamental receptor biology and downstream commercial investment in better developed and de-risked drug discovery programs. Access to the program is competitive and projects are selected by an independent Selection and Review Committee Chaired by Dr Susan Pond AM.

In the rapidly evolving mRNA space we were delighted to see the development of the Monash Moderna Quantitative Pharmacology Accelerator which really hit its straps in 2024 with new projects and people coming on board and additional new hires expected in 2025. We were also delighted to receive \$4 million from MRFF to establish Australia's first National Centre for Biopharmaceutical Optimisation of mRNA Therapeutics (CORTx), an initiative led from MIPS but including leading biotech companies, Moderna and iCamuno, along with investigators from WEHI, the Australian National University, University of Melbourne, and University of Queensland. CORTx will focus on a critical step in the development process for mRNA medicines – evaluation of the patterns of delivery and biodistribution in the body, data that informs the plausibility of an mRNA candidate progressing toward human studies.

In wider grant news MIPS had good success in NHMRC Ideas and Development Grants and the best results in ARC Discovery Project that we have ever had with ten successful programs. We were also successful in receiving AUD\$4 million for a program funded by the Advanced Research Projects Agency for Health (ARPA-H), an agency within the US Department of Health and Human Services, to drive forward a new treatment for ischemic stroke. This collaboration with Yale School of Medicine was especially pleasing as US-based funding agencies are tough to break into for grants led from Australia.

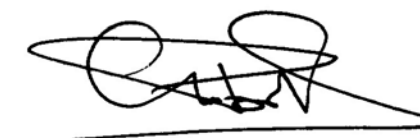
In the following sections describing the activities of the MIPS research Themes, more detail is provided of the specific research programs, but highlights include:

- the first description of a cholesterol sensor protein that is a unique hybrid of a cell transporter commonly found in plants and a G protein-coupled receptor (published in Nature)
- ongoing programs using cryo-electron microscopy to drive structure-based drug design (published in Nature Chemical Biology and Nature Communications)
- description of a new AI tool that predicts binding affinity using only target sequence data (published in Nature Machine Intelligence)
- the development of a novel fluorescence sensor to detect amyloids associated with neurodegenerative diseases such as Alzheimer's
- the development of a new assay to quantitatively assess the extent of transport of nucleic acid cargoes (such as mRNA) from the endosome to the cytosol – currently a key bottleneck in the understanding of mRNA medicines
- advancement of new clinical practice guidelines for dementia and MDMA-assisted psychotherapy for post-traumatic stress disorder
- initiation of the APRICOT trial that is designed to address the estimated 250,000 hospital admissions each year associated with medication-related problems

In research commercialisation news we were excited to see the NASDAQ listing of Septerna, a US based start-up where Professors Arthur Christopoulos and Patrick Sexton are two of the founding scientists. We also welcomed the continued progression of Phrenix Therapeutics—the first spinout from Monash University's Neuromedicines Discovery Centre—with significant seed investment secured from specialist biotech venture capital firms Curie.Bio (US) and Brandon Capital (Australia). We were also very pleased to see continued progression of the lymph targeted prodrug technology that was discovered at MIPS and licenced to PureTech Health. In 2024 the technology was spun out of PureTech to form Seaport Therapeutics in transactions that raised US\$335 million across Series A and B funding rounds. The lead Seaport asset (SPT-300) has completed a Phase 2a clinical trial and is progressing towards entry into Phase 2b. MIPS teams also received BioCurate proof-of-concept funding to help progress a further two commercialisation programs with promising signs for the future.

2024 also saw changes to leadership within the MIPS Themes. Firstly, Professor Susan Charman signalled her intent to retire as Director of the Centre for Drug Candidate Optimisation and she will step down in early 2025. As one of the co-founders of CDCO and sole Director for the last 17 years Sue's contribution to CDCO, MIPS and the drug discovery community more broadly have been profound. She will be sorely missed – but very well substituted by her successor as CDCO Director, Professor Joseph Nicolazzo. We have also appointed Deputy Directors across all Themes to provide leadership experience opportunities and to enhance contingency provisions.

Finally, the heart of all University based research endeavours is the graduate research program and we congratulate each of the 46 PhD students from MIPS that graduated in 2024. We were also pleased to see Monash again recognised by the QS World University Rankings by Subject as a leading institution in Pharmacy and Pharmacology (#2 worldwide in 2024) and to see four MIPS scientists named in the 2024 Clarivate Highly Cited Researcher list. There are also many individual award winners listed in the report. My sincere congratulations to all and great thanks to everyone for their efforts through 2024.



Professor Christopher J.H. Porter
Director



MIPS REVIEW & PLANNING

The University undertakes a thorough review of all research institutes every 5 years. MIPS was reviewed in August 2024 by an International Review Board, comprising nationally and internationally eminent researchers.

The Board members:

- Chair: Professor Mike Ryan, Interim Deputy Vice-Chancellor (Research), Monash University
- Professor Kim Brouwer, Associate Dean for Research and Graduate Education, University of North Carolina Eshelman School of Pharmacy
- Professor Fabienne Mackay, Director and CEO, QIMR Berghofer Medical Research Institute
- Dr Mark Noe, Vice President Discovery Sciences, Pfizer Worldwide
- Professor Terence O’Brien, Chair of Medicine and Head, The School of Translational Medicine, Monash University
- Dr Joshua Rennick, Research Scientist, Recombinant Proteins, CSL.

The Board was tasked with reviewing and advising MIPS on research performance and strategic initiatives. They received and considered a significant amount of documentation including a self-review that covered the period 2019-2023. Over a two-day meeting they also heard from a range of MIPS staff and students. On the first day they heard summaries of research and achievements in the Themes and Therapeutic Program Areas and met with our ECRs and graduate Research students. The second day was a look to the future as we outlined the future areas of focus: AI and data science; our sustainability efforts and our response to emerging global health challenges in a changing climate; our ambitions for greater research translation and commercialisation activities; and development and support of the work-force needed to deliver in these areas.

At the conclusion of the Review the Board delivered a series of commendations and recommendations to the MIPS Director and the Dean of the Faculty. The Board commended the Institute’s research performance, making particular note of the focus on quality over quantity. They endorsed the MIPS Strategic Plan (see pages 10-11) and the areas of future focus that have been identified. Additional recommendations made by the Board were designed to future-proof the organisation and to ensure that MIPS continues to do work that is of the highest integrity. These were:

- To place an increased focus on succession planning and developing our future leaders.
- To work to increase the diversity—cultural, gender, and age—of our staff.
- To increase clinical and consumer engagement.
- To ensure that in our expansion to the new site at 343 Royal Parade we ensure the coherence and connection of these activities to our foundations at the main site.

The collective insight and wisdom of the Board members was of great benefit to defining our future and ensuring that MIPS is on the right path—we thank them for their time and considered contributions.



STRATEGIC PLAN

Over 2023 and into 2024 the Institute undertook an in-depth and comprehensive strategic planning process. This was immensely valuable—both for the opportunity to take stock of what we’re doing well, and to consider what lies ahead in the future. MIPS staff at all levels were asked to reflect on what is happening in the environment around us, who we are, what we should be doing and not doing, and what we want the future of MIPS to look like. The contributions to this point, along with input from our collaborators and graduate research students, shaped a two-day retreat of the mid-career and senior staff in the Institute late in 2023.

The retreat, which was facilitated by Andrew Hollo of Workwell Consulting, helped us to refine the things that we truly value:

- Innovation and impact: like all research institutes we expect to be doing excellent research. That is not enough for us—we want our excellent research to make a difference to people’s lives.
- Collaboration: our research is better for the collaborations we have locally, nationally and internationally.
- Diversity & inclusion: just as we collaborate externally, we know that diversity in our people brings better outcomes.
- Integrity: none of the work that we do will be of value unless it is done with integrity and honesty.

We spent time capturing the things that are working well and the areas that we want to particularly focus on. We have built this into the MIPS strategy, which was endorsed by the MIPS International Board in August.

The strategy recognises our foundations and our imperatives—that we have the best people, doing world-leading science that ultimately has an impact on society.

To achieve our strategy we rely on our existing success factors:

- We are a preferred home for discipline thought leaders
- We invest in state-of-the-art drug discovery and use infrastructure and capabilities
- We seek to enhance human health outcomes
- We support and enhance the science of our partners and the broader ecosystem
- We are a collection, in fact a collaboration, of excellent and engaged employees, and
- We offer flexible and rewarding career paths.

These are strategies that have got us to where we are today and will continue into our next phase.

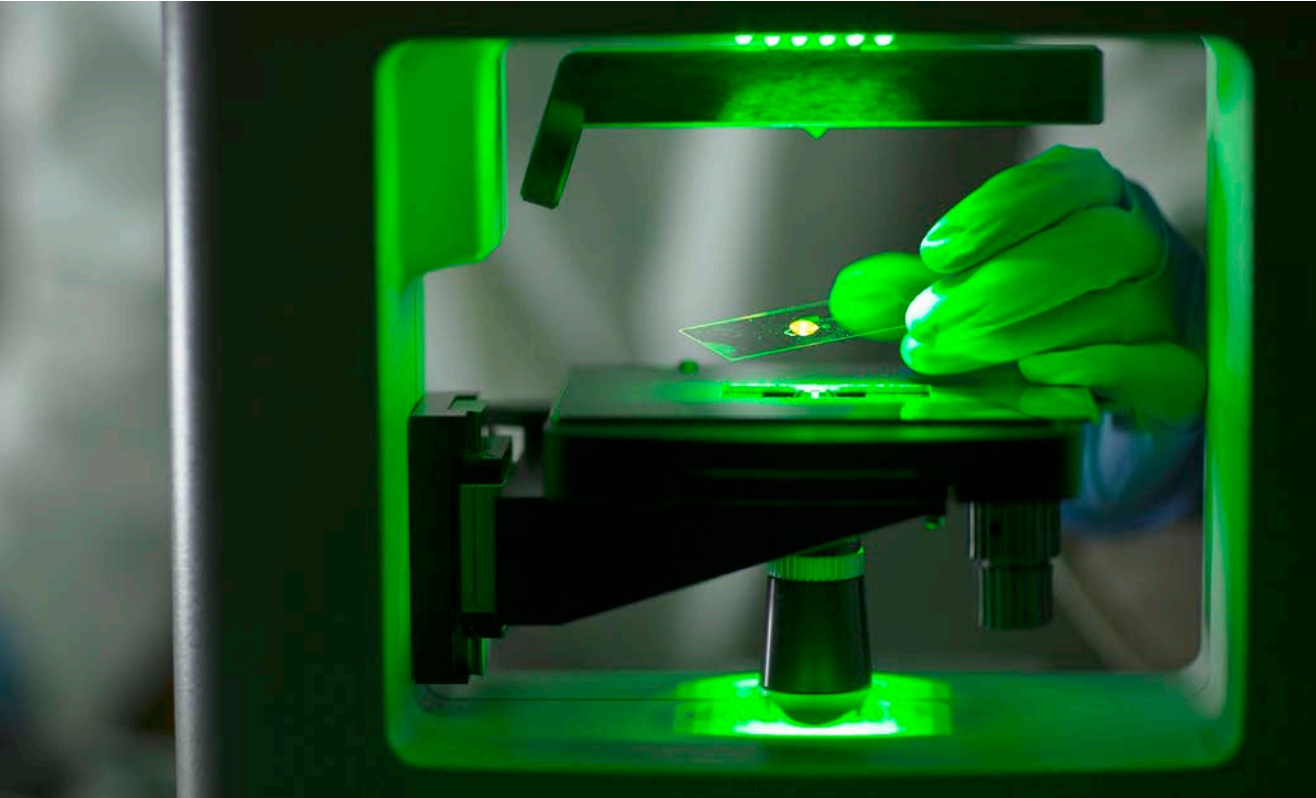
We will build on these core research activities, and bring new focus to the following areas:

- artificial intelligence and data science
- enhanced translation and commercialisation
- meeting the challenges associated with climate health, and
- enhancing support for staff in non-traditional roles.

MIPS STRATEGIC PLAN SUMMARY

BREAKTHROUGH PHARMACEUTICAL SCIENCE | DRUG DISCOVERY AND DEVELOPMENT | SAFER AND MORE EFFICIENT USE

Imperatives	World-Leading Science		Societal Impact		The World's Best People	
Success Factors	A preferred home for discipline thought leaders	State-of-the-art integrative drug discovery & use capabilities	Enhanced human health outcomes	Impactful benefits on ecosystems & partners	Excellent & engaged employees	Flexible & rewarding career paths
New Areas of Focus	Artificial intelligence & data science		Enhanced translation and commercialisation	Addressing the challenges of climate health	Support for non-traditional roles	



2024 HIGHLIGHTS & STAFF ACHIEVEMENTS

MONASH UNIVERSITY RETAINS ITS #2 GLOBAL RANKING FOR PHARMACY AND PHARMACOLOGY

Monash University has been ranked No. 2 globally for Pharmacy and Pharmacology in the 2024 QS World University Rankings by Subject. The University remains the top-ranked institution in Australia and the Asia-Pacific for this field and has consistently placed in the top three worldwide over the past eight years.

Professor Arthur Christopoulos, Dean of the Faculty of Pharmacy and Pharmaceutical Sciences, attributes this success to the dedication of its researchers, educators, and practitioners. “Our Faculty continues to expand its education and research programs, establish new initiatives, and lead the way with programs to foster equity, diversity, and inclusion,” he said.

We extend our gratitude to QS and our international colleagues for their recognition, and most importantly, to our dedicated researchers, educators, and students whose relentless pursuit of excellence continues to drive our success. Their innovation, collaboration, and commitment to advancing pharmaceutical sciences and education have once again positioned Monash among the world’s best. This achievement reflects not only our Faculty’s leadership in research and education but also our broader mission to shape the future of healthcare.



MIPS RESEARCHER AWARDED A PRESTIGIOUS ARC INDUSTRY LAUREATE FELLOWSHIP



Professor Benjamin Boyd from MIPS and the University of Copenhagen has been awarded an ARC Industry Laureate Fellowship, one of only eight granted nationally. This prestigious fellowship fosters collaboration between research and industry to address key challenges. Professor Boyd has partnered with Fonterra Australia and The Australian Synchrotron (ANSTO) to advance food and nutrition science. His \$3M awarded project will link Australia’s large-scale research facilities with industry to improve food design and nutrient delivery, particularly for specific populations like the elderly.

SIR JOHN MONASH DISTINGUISHED PROFESSOR



Professor Chris Porter, Director of MIPS, has been named a Sir John Monash Distinguished Professor, the University’s highest academic honour, recognising his exceptional contributions to pharmaceutical sciences, research translation, and industry engagement. Under Professor Porter’s leadership, MIPS has become a powerhouse for drug discovery and commercialisation, driving major biotech ventures such as Cincera, Septerna, Phrenix, Celesta, and the Glyph® drug delivery platform, which recently spun out into Seaport Therapeutics. His work also underpins Starpharma’s DEP® drug delivery technology. His vision has expanded MIPS’ research footprint, including new industry partnerships, mRNA innovation hubs, and a dedicated drug discovery site on Royal Parade.

Congratulations to Professor Porter on this well-deserved recognition.

EMERITUS SIR JOHN MONASH DISTINGUISHED PROFESSOR



Sir John Monash Distinguished Professor Bill Charman AO retired from Monash University in September 2024, concluding a distinguished academic and research career spanning over three decades. In recognition of his exceptional contributions, he was conferred as an Emeritus Sir John Monash Distinguished Professor.

As Dean of the Faculty of Pharmacy and Pharmaceutical Sciences (2007–2019) and inaugural Director of the Monash Institute of Pharmaceutical Sciences (2007-2017), Professor Charman led transformative initiatives, including the establishment of MIPS, strategic faculty redevelopment, and new curricula innovations. He also played a key role in forming PharmAlliance, a global partnership with University of North Carolina at Chapel Hill and University College London. His visionary leadership has left an enduring legacy, shaping MIPS into a global leader in pharmacy and pharmaceutical sciences. The Faculty thanks him for his extraordinary service and wishes him well in retirement.

MIPS PHD CANDIDATE NAMED AMONG
TOP100 FUTURE LEADERS



MIPS PhD candidate Alice Terrill was named a Top100 Future Leader by the Australian Financial Review, an initiative recognising outstanding Australian university students. Selected from 1,700 applicants, Alice was a finalist for the Quantum Data Science and Transition Hub First in Family Awards. As part of the program, she attended the Sydney event, networking with fellow leaders and top graduate employers.

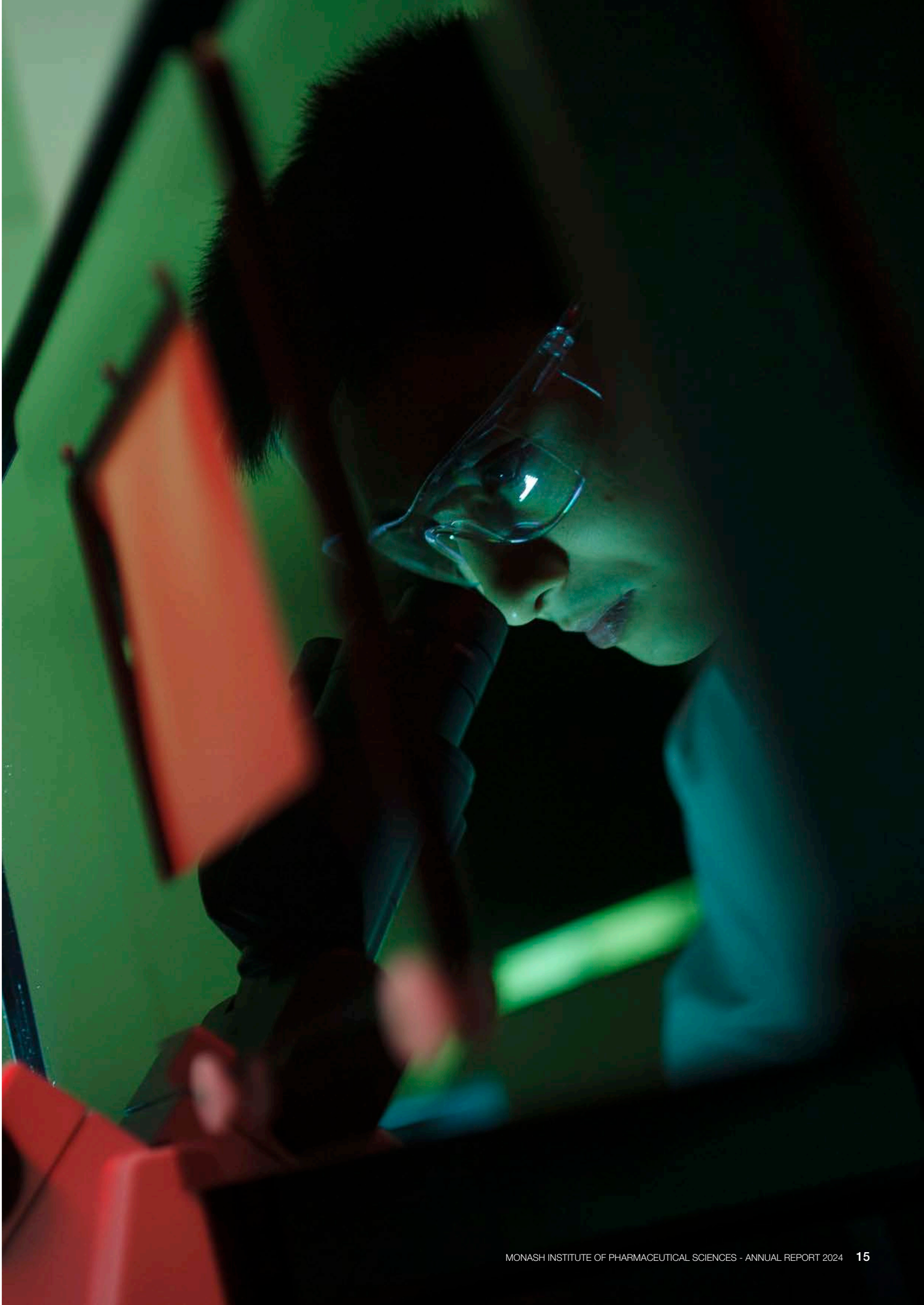
Alice's PhD research focuses on optimising antibiotic treatment regimes for personalised medicine against superbugs. She previously completed a Bachelor of Pharmaceutical Sciences Advanced (Honours) at Monash and is also an Assistant Lecturer. Passionate about science communication, Alice's recognition highlights the impact of MIPS researchers in shaping the future of pharmaceutical sciences.

ASPET GOODMAN AND
GILMAN AWARD



Professor Arthur Christopoulos, Dean of the Faculty of Pharmacy and Pharmaceutical Sciences, has been awarded the 2024 Louis S. Goodman and Alfred Gilman Award in Receptor Pharmacology by the American Society for Pharmacology and Experimental Therapeutics (ASPET). He is the first Australian recipient of this prestigious award, which recognises outstanding research in receptor pharmacology.

A world-renowned pharmacist and molecular pharmacologist, Professor Christopoulos has made pioneering discoveries in G protein-coupled receptors, the largest class of medicinal protein targets. His research has transformed drug discovery, identifying novel allosteric modulators and biased agonists for major health burdens. Named a Highly Cited Researcher in Pharmacology and Toxicology for nine consecutive years, he co-founded Septerna Inc. and established the Neuromedicines Discovery Centre. Professor Christopoulos was also instrumental in Monash's No. 1 global ranking in Pharmacy and Pharmacology (QS 2022). This is his second ASPET award, following the 2013 John J. Abel Award in Pharmacology.



CLARIVATE™ HIGHLY CITED RESEARCHERS



The annual Clarivate™ Highly Cited Researchers list is a compilation of the most influential scientists in their field, worldwide. In 2024 four MIPS staff were ranked in the top 1% in the field of pharmacology and toxicology – Professor Arthur Christopoulos, Dean of the Faculty of Pharmacy and Pharmaceutical Sciences, Professor Chris Porter, Director of Monash Institute of Pharmaceutical Sciences, Professor Patrick Sexton, and Associate Professor Natalie Trevaskis. For Professors Christopoulos and Sexton this is the fourth year in a row that they have been named a highly cited researcher, and for Associate Professor Trevaskis her third year in a row.

The annual list uses quantitative and qualitative analysis to identify individuals from across the globe who have demonstrated significant and broad influence in their field of research. Specifically, the Highly Cited Researchers' names are drawn from the publications that rank in the top 1% by citations for field and publication year in the Web of Science citation index over the last decade. Once the author list of highly cited papers is compiled, it is further refined using qualitative analysis and expert judgement. In 2024, 6,636 researchers were recognised from 1,200 institutions worldwide, including 25 from Monash University.

EXPANSION OF THE MEDICINES MANUFACTURING INNOVATION CENTRE TO CLAYTON



Pictured here (L-R): Prof Michelle McIntosh, Prof Sharon Lewin, Hon Ben Carroll, Prof Sharon Pickering, Prof Chris Porter, Prof Michael James.

The Medicines Manufacturing Innovation Centre (MMIC) was officially opened at Monash Technology Precinct, Clayton, by Victorian Deputy Premier and Minister for Medical Research, the Hon Ben Carroll. Led by Professor Michelle McIntosh, MMIC advances research commercialisation, supporting end-to-end medicine development from lab-scale projects to clinical trial manufacturing using state-of-the-art technology. The \$12.58 million expansion funded by the Victorian Higher Education State Investment Fund (\$8.58M) and Monash University (\$4M), enhances MMIC's capabilities in medicine formulation, manufacturing innovation, and workforce development.

SEAPORT THERAPEUTICS ADVANCES NEUROPSYCHIATRIC TREATMENTS WITH MONASH UNIVERSITY'S PIONEERING GLYPH PLATFORM



Seaport Therapeutics, a clinical-stage biopharmaceutical company, has raised US\$325 million in funding to advance its pipeline of neuropsychiatric medicines. This includes a US\$225 million Series B financing round, led by T. Rowe Price Associates, Inc., Foresite Capital, Invus, Goldman Sachs Alternatives, CPP Investments, and other new investors. Founding investors ARCH Venture Partners, Sofinnova Investments, Third Rock Ventures, and co-founder PureTech Health also participated. This followed a US\$100 million Series A round. Seaport employs the Glyph™ drug delivery platform, originally developed by Monash University's Professor Chris Porter and his team, to enhance the oral bioavailability of therapeutics that face limitations such as high 'first pass' liver metabolism or hepatotoxicity.

The Glyph platform, which re-routes drug absorption to the lymphatic system in the gut, thereby avoiding the liver, is integral to Seaport's clinical pipeline, including SPT-300, an oral form of allopregnanolone for treating major depressive disorder, and SPT-320, for anxiety disorders. Monash's research team, including Associate Professor Natalie Trevaskis, played a crucial role in advancing this innovative technology. Seaport aims to revolutionise the treatment of neuropsychiatric conditions, ensuring more accessible and effective therapies for patients. This ongoing collaboration highlights MIPS' significant contribution to global medical advancements.

PARKVILLE CAMPUS EXPANSION



In 2023 Monash acquired a new site at 343 Royal Parade in Parkville, including the existing building which will be refurbished. The building is less than 100m down the road from the main Parkville campus and in 2024 the budget to revitalise the building was confirmed by the University. This allowed us to proceed with setting out the floorplans and designs for the building’s internal and external fit-out. We will co-locate our major externally facing drug discovery platforms in the building, along with incubator space, providing a public interface with MIPS’ translation activities.

2025 will see some necessary building structural enhancements, along with the removal of the internals of the building ready for the much-needed new laboratories, offices and meeting spaces.

Captured above is the intended façade, facing Royal Parade.

ARC DISCOVERY PROJECT SUCCESS

MIPS researchers had extraordinary success in the 2024 round of the ARC’s Discovery Project scheme—the largest program for fundamental research in Australia. Ten proposals led by MIPS researchers were funded to a total of \$8.5 million. The funded research covers a broad range of topics from receptor function and signalling, and parasite and microbial biology, to surfactant chemistry and nanoparticle technologies. These projects reflect a 77% success rate for MIPS in the second round of assessment—significantly more than the national success rate of 47%.

2024 was also notable for the introduction of a two-stage process for Discovery Projects, where preliminary shorter expressions of interest were assessed with shortlisted Eols invited to submit a full proposal. MIPS researchers did better than the national average at Eol stage too, with a 41% success rate compared with the national average of 28%.



Australian Government
Australian Research Council



2024 MIPS RESEARCH SYMPOSIUM

In December 2024, we hosted the inaugural MIPS Research Symposium at the Monash City Campus, bringing together over 120 researchers from the Monash Institute of Pharmaceutical Sciences for a day dedicated to discovery, collaboration, and celebration. This landmark event provided a unique platform for researchers to showcase their work, exchange ideas, and strengthen connections across disciplines.

The symposium featured 30 engaging presentations aligned with the Therapeutic Program Areas of Global Health, Cardiovascular & Metabolic Health, and Neuroscience & Mental Health, as well as MIPS' key focus areas of Sustainability and Artificial Intelligence. These presentations represented significant contributions from all MIPS research themes, highlighting the breadth and impact of ongoing projects within the Institute.

A particular highlight of the day was the inspiring keynote address by Professor Bob Wong from the Monash School of Biological Sciences. His thought-provoking presentation, titled 'Drugs in the Environment: Nature's High?', explored the environmental impact of pharmaceuticals and their unintended effects on ecosystems. Professor Wong's address set the stage for meaningful discussions about the intersection of pharmaceutical sciences and environmental sustainability, reinforcing MIPS' commitment to responsible and forward-thinking research.

Throughout the day, researchers had the opportunity to engage in discussions, gain new insights, and explore potential collaborations. The event culminated in a closing address by Professor Chris Porter, who reflected on the successes of the Symposium and acknowledged the outstanding achievements of MIPS researchers in 2024. He emphasised the institute's collective progress in advancing pharmaceutical sciences and encouraged continued innovation and interdisciplinary engagement.

The symposium concluded with a vibrant networking and celebration session, providing attendees with the chance to further connect in an informal setting. This segment was particularly well received, offering a valuable space for researchers to discuss ideas, establish new collaborations, and celebrate their contributions to the field.

Feedback from participants has been overwhelmingly positive, with attendees praising the event's organisation, the quality of presentations, and the opportunities for meaningful engagement. The success of this inaugural symposium underscores MIPS' dedication to fostering a dynamic and supportive research community. As we look ahead, we are excited to see how the MIPS Research Symposium will evolve, continuing to inspire and unite researchers in pursuit of excellence.



FACULTY RESEARCH AWARDS

The annual Faculty Research Awards recognise the sustained excellence in research and graduate research of MIPS staff. Staff are nominated by their peers and winners are determined by a sub-committee of Faculty Executive, Chaired by the Associate Dean Research. The members of the sub-committee for the 2024 awards were Professor Peter Scammells (Associate Dean Research, Chair), Associate Professor Natalie Trevaskis (D4), Associate Professor Cornelia Landersdorfer (D4), Dr Aeson Chang (DDB), Dr Manuela Jorg (Med Chem), Dr David Shackleford (CDCO), Cameron Nowell (professional staff member).

The Awards were presented by the Associate Dean Research at the Faculty's annual awards ceremony in November.



FACULTY RESEARCH AWARD



Awarded in recognition of a sustained and outstanding contribution to the Faculty's research.

2024 winner - **Professor Denise Wootten**, Drug Discovery Biology Theme

Denise is an exceptional scientist, generous collaborator and mentor, and is internationally recognised for her work deciphering incretin receptor activity and drug response mechanisms. She employs a multidisciplinary approach (structural biology, molecular pharmacology, analytical pharmacology, computational biology and in vivo studies of disease) to investigate the molecular mechanisms of G protein-coupled receptor (GPCR) signalling and biased agonism for exploitation in GPCR drug discovery programs. She has also pioneered a very significant breakthrough in structural studies using cryo-electron microscopy (cryo-EM). She has received major awards, sustained competitive research funding (\$6.5M as CIA in the last two years, and >\$33M since 2014) and has published in leading scientific journals including Nature, Science and Cell.

Not only was Denise the winner of the Faculty Research Award, but she was also the joint winner of the newly introduced **Vice-Chancellor's Researcher of the Year Award**. This award recognises an individual who has achieved exceptional research outcomes in the previous one to two years and who also embodies the Monash University values and exhibits exceptional leadership both internally and across the wider research community. Denise received the University Researcher of the Year award in recognition of her exceptional science, that she is a generous collaborator and mentor, and is internationally recognised for her work deciphering incretin receptor activity and drug response mechanisms.

Congratulations Denise!

FACULTY AWARD FOR RESEARCH ENTERPRISE



Awarded in recognition of excellence in innovation and collaboration, and successful partnership with industry, government or other external organisation.

2024 winners - **Dr Gregory Stewart and Professor Christopher Langmead**, both from Neuromedicines Discovery Centre, DDB.

Greg and Chris received the award for their work in the translation and commercialisation of neuromedicines.

The development of new medicines for mental health and neurological conditions is a major area of unmet need and poorly addressed compared to other therapeutic areas. Through the recently established Neuromedicines Discovery Centre, Chris and Greg have established a series of translational and commercial partnerships and ventures to combine the University's expertise in neuroscience and medicines development, resulting in a new pharmaceutical company partnership with Servier (France) and two new biotechnology startups, Pacalis Therapeutics and Phrenix Therapeutics.

The outstanding work of the Neuromedicines Discovery Centre was also recognised in the University research awards where the team won the 2024 **Vice-Chancellor's Award for Excellence in Research Enterprise and/or Commercialisation**. Congratulations to the whole team!

EARLY CAREER RESEARCH AWARD



Awarded in recognition of excellence by an early career researcher (less than 10 years post-PhD) who has achieved outstanding research excellence and impact.

2024 winner - **Dr Amandeep Kaur**, Medicinal Chemistry

Amandeep's research focusses on the development of advanced imaging tools to explore health and disease at the nanoscale.

To date, Amandeep has developed ten highly impactful sensors, utilised by more than 45 research groups globally, and two have been commercialised. Her impressive publication record boasts 35 papers, in notable high-impact journals. She has secured \$3.3 million in research funding including prestigious nationally competitive grants and fellowships.

EMERGING EARLY CAREER RESEARCH AWARD



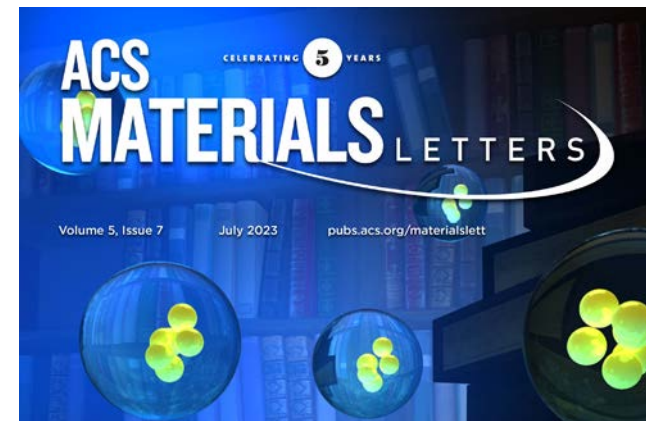
Awarded in recognition of excellence by an early career researcher (less than 5 years post-PhD) who has achieved research excellence.

2024 winner - **Dr Arisbel Batista Gondin**, DDB

Arisbel, a research fellow in the Drug Discovery Biology Theme at the Monash Institute of Pharmaceutical Sciences, is an emerging leader in G protein-coupled receptor pharmacology. Her research program integrates molecular pharmacology, structural biology, antibody discovery, and nanotechnology to advance understanding of proteins that are critical for human health and to drive the discovery of new therapies. Her excellence and innovation have been recognised through prestigious fellowships, including the Bridge Researcher Exchange and Development within Industry (REDI) fellowship, ARC Discovery Early Career Researcher Award (DECRA), and NHMRC Emerging Leadership Investigator grant, highlighting her impact as an ECR.

Arisbel's research excellence was also recognised in the Vice Chancellor's research awards where she won the **2024 Vice-Chancellor's Early Career Researcher of the Year Award – STEM Award**. Congratulations!

EARLY CAREER RESEARCHER PUBLICATION AWARD



Awarded for in recognition of publication excellence by researchers up to 5 years post-PhD.

2024 winner - **Dr Muamer Dervisevic**, D4

Publication details: Dervisevic, M., and Voelcker, N.H., Microneedles with Recessed Microcavities for Electrochemical Sensing in Dermal Interstitial Fluid. **ACS Materials Letters** 5 (2023) 1851-1858. <https://doi.org/10.1021/acsmaterialslett.3c00441>

As the first author, Muamer Dervisevic co-led and conceptualised this project and was in charge of methodology, validation, investigation, data curation, formal analysis, and visualisation of the work, as well as drafting and editing the manuscript. Dr Dervisevic was unable to attend the awards ceremony.

FACULTY AWARD FOR EXCELLENCE IN POSTGRADUATE SUPERVISION



Awarded to staff who have demonstrated exceptional supervision, mentoring and training practices to benefit and enrich the experiences of their graduate research students. The nominator for this award was a graduate research student.

2024 winner - **Associate Professor Daniel Poole**, DDB

Dan has successfully supervised 8 PhD and 2 masters completions in the last 5 years. He currently supervises 7 PhD students. Dan's PhD graduates are now employed as tenured faculty, bioimage analysts, clinical research associates, and postdoctoral researchers.

Dan has a demonstrated passion for enhancing his HDR supervision and mentoring, reflected by the success of his students, the learning, engagement and employment opportunities that they have pursued, and by the supportive environment that his team has established. His students have received national and international awards in recognition of their achievements.

FACULTY PROFESSIONAL RESEARCH AWARD



Awarded to professional staff members who have made outstanding contributions to the success of Monash research.

2024 winner - **Dr Michael Campbell**, CDCO

Mike received a PhD in Chemistry from the Victorian College of Pharmacy (awarded through the University of Melbourne) followed by an industrially-focussed post-doctoral fellowship with Prof Bill Charman. He joined the CDCO at its inception in 2003 as the Chemistry Section Leader, becoming Section Leader for the combined Chemistry/Bioanalytical team in 2019.

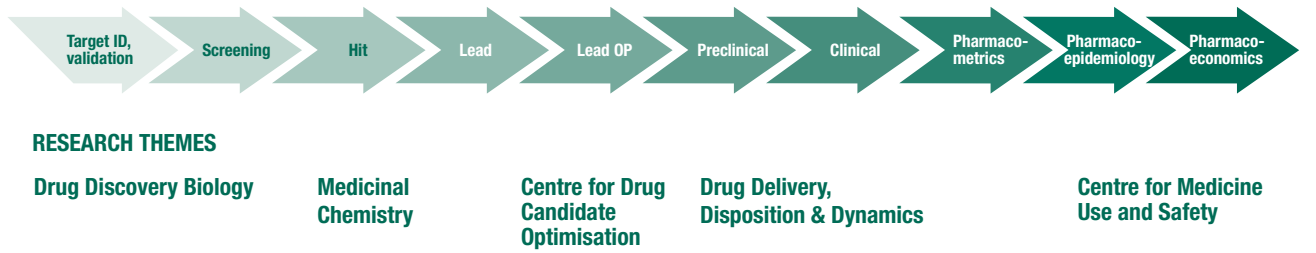
Over the past 20+ years, Mike has made numerous contributions to many significant drug discovery programs through his role within the CDCO. He provides expertise and guidance in pharmaceutical chemistry, physicochemical profiling, and bioanalysis to support internal and external research programs, and provides training and mentorship to CDCO scientists in these areas to ensure high quality data outputs.

Mike has been responsible for the implementation and maintenance of all CDCO data management and archiving processes over the years, and he was pivotal to the establishment of the CDCO electronic lab notebook and inventory database in 2008.



RESEARCH THEMES

The MIPS Themes are the home of our research expertise. Each Theme contributes to the drug discovery, development, and use activities of the Institute.



DRUG DISCOVERY BIOLOGY



Grants awarded

28

Staff

89

Awarded research income

\$27,822,862

Publications

66

Graduate research students

72

PhD completions

15

Theme Leader: **Professor Rebecca Ritchie**
Deputy Theme Leader: **Associate Professor Michelle Halls**

The Drug Discovery Biology Theme (DDB) works in pharmacology and drug discovery and has a sustained impact on the understanding and treatment of major global health burdens.

DDB research is based on four major multidisciplinary and complementary areas of expertise:

- Pharmacology
- Structural biology
- Target identification and
- Translational science.

DDB's principal therapeutic focus areas are neurological disease, cardiovascular disease and metabolic disease. The researchers also have interests in pain, inflammatory disease and cancer.

DDB serves as the headquarters of the ARC Industrial Transformation Training Centre for Cryo-Electron Microscopy of Membrane Proteins for Drug Discovery, a national training centre with collaborators from the University of Melbourne, WEHI and the University of Wollongong and research partners including AstraZeneca, Servier and Thermo Fisher Scientific.

DDB has a specific interest in the structure and function of G protein-coupled receptors and the role of allostery and bias in receptor signalling. Their expertise is applied particularly to neuroscience, the genes, proteins and pathways that are important in metabolic disease and the development of new treatments for heart failure resulting from interruptions in coronary blood supply (such as in heart attack) or as a result of diabetes.

DDB incorporates the headquarters of the Neuromedicine Discovery Centre (NDC). The NDC is a national collaboration to discover and translate a new generation of trusted, evidence-based medicines and therapies for those experiencing mental health conditions. Further information about the NDC is provided in this report on page 76.



MAJOR RESEARCH & ACHIEVEMENTS OF 2024

AWARDS

Researchers from DDB were recognised for their outstanding contributions to science and community with a number of awards in 2024, including (in alphabetical order):

- Dr Arisbel Batista Gondin - Faculty of Pharmacy and Pharmaceutical Sciences Emerging Early Career Research Award, Vice-Chancellor's Early Career Researcher of the Year Award (STEM)
- Prof Arthur Christopoulos - Clarivate Analytics Highly Cited Researcher in Pharmacology & Toxicology, 2024 ASPET Fellow, ASCEPT Lecturer
- Prof Mark Febbraio - AuPS Invited Lecture Medal
- A/Prof Michelle Halls - ASCEPT Achievement Award
- A/Prof Daniel Poole - Faculty of Pharmacy and Pharmaceutical Sciences Award for Excellence in Postgraduate Supervision
- Prof Rebecca Ritchie - 2024 ASCEPT Fellow
- Prof Patrick Sexton - Clarivate Analytics Highly Cited Researcher in Pharmacology & Toxicology
- Dr Gregory Stewart and Prof Christopher Langmead - Faculty of Pharmacy and Pharmaceutical Sciences Award for Research Enterprise, Vice-Chancellor's Award for Excellence in Research Enterprise and/or Commercialisation
- Prof Denise Wootten - Faculty of Pharmacy and Pharmaceutical Sciences Research Award, Vice Chancellor's Researcher of the Year Award

- Dr Lauren May, A/Prof Karen Gregory, A/Prof Michelle Halls, Prof Denise Wootten, Dr Simona Carbone, Dr Huong Nguyen, Dr Chengxue Helena Qin, Dr Arisbel Batista Gondin, Dr Gregory Stewart - Faculty of Pharmacy and Pharmaceutical Sciences Equity Diversity and Inclusion Award for Her Research Matters (HRM)

Our students were also recognised for their research and communication skills. Key highlights include:

- ASCEPT Neville Percy Prize, and Neuropharmacology Special Interest Group Prize - Ms Michaela Kaoullas
- Faculty Three Minute Thesis (3MT) Winner, and People's Choice Award - Ms Chloe Landy
- Multiple Sclerosis (MS) Australia Postgraduate Student Scholarship - Mr Jack McDonald
- Faculty of Pharmacy and Pharmaceutical Sciences Citation for Outstanding Contributions to Student Learning (Sessional Academic) - Ms Narges Mahdavian
- Best Late Breaking ECR Abstract at the Cancer Neuroscience Symposium (USA) - Ms Annabel Manoleras
- CSANZ Ralph Reader Prize - Mr Jaideep Singh
- Fred Mitchelson Award (top DDB Honours student) - Ms Shaqayeq Ramazani

FELLOWSHIPS AND GRANTS

Three early career researchers in DDB were awarded nearly \$1.5 million in funding from the Australian Research Council (ARC) through the Discovery Early Career Researcher Award fellowship scheme. Their research fellowships will further our understanding of the activation and function of G protein-coupled receptors, targets of ~30% of all medicines. The projects will use cutting-edge approaches, including artificial intelligence, cryo-electron microscopy, and environmental biology.

- Dr Anh Nguyen - Understanding G protein-coupled receptor response mechanisms to environmental pollutants
- Dr Sarah Piper - Understanding structure, dynamics, and function of receptor splice variants
- Dr Brian Cary - Leveraging electron microscopy to study receptor structure and function
- Dr Felix Bennetts also won a 2-year fellowship from the Male Contraceptive Initiative.

Over the entire DDB Theme, researchers were awarded 28 grants and contracts including:

- ARC Discovery Projects: Prof Patrick Sexton, Dr Matthew Belousoff, Dr Tracy Josephs, Dr Sarah Turpin-Nolan, Prof Arthur Christopoulos
- NHMRC Ideas Grants: Dr Dana Hutchinson, Dr Brian Cary, Prof Erica Sloan, A/Prof Karen Gregory, Dr Shane Hellyer, Dr Anh Nguyen
- Medical Research Future Fund: Prof Mark Febbraio, Dr Sarah Turpin-Nolan, A/Prof Daniel Poole, Dr Simona Carbone

RESEARCH SNAPSHOTS

DDB researchers contributed to >65 publications in 2024, spanning our research strengths in G protein-coupled receptors, and the molecular mechanisms that underlie pathologies such as metabolic disease, cardiovascular disease, neurological disease, cancer, pain and inflammation.

Key research publications from our teams included:

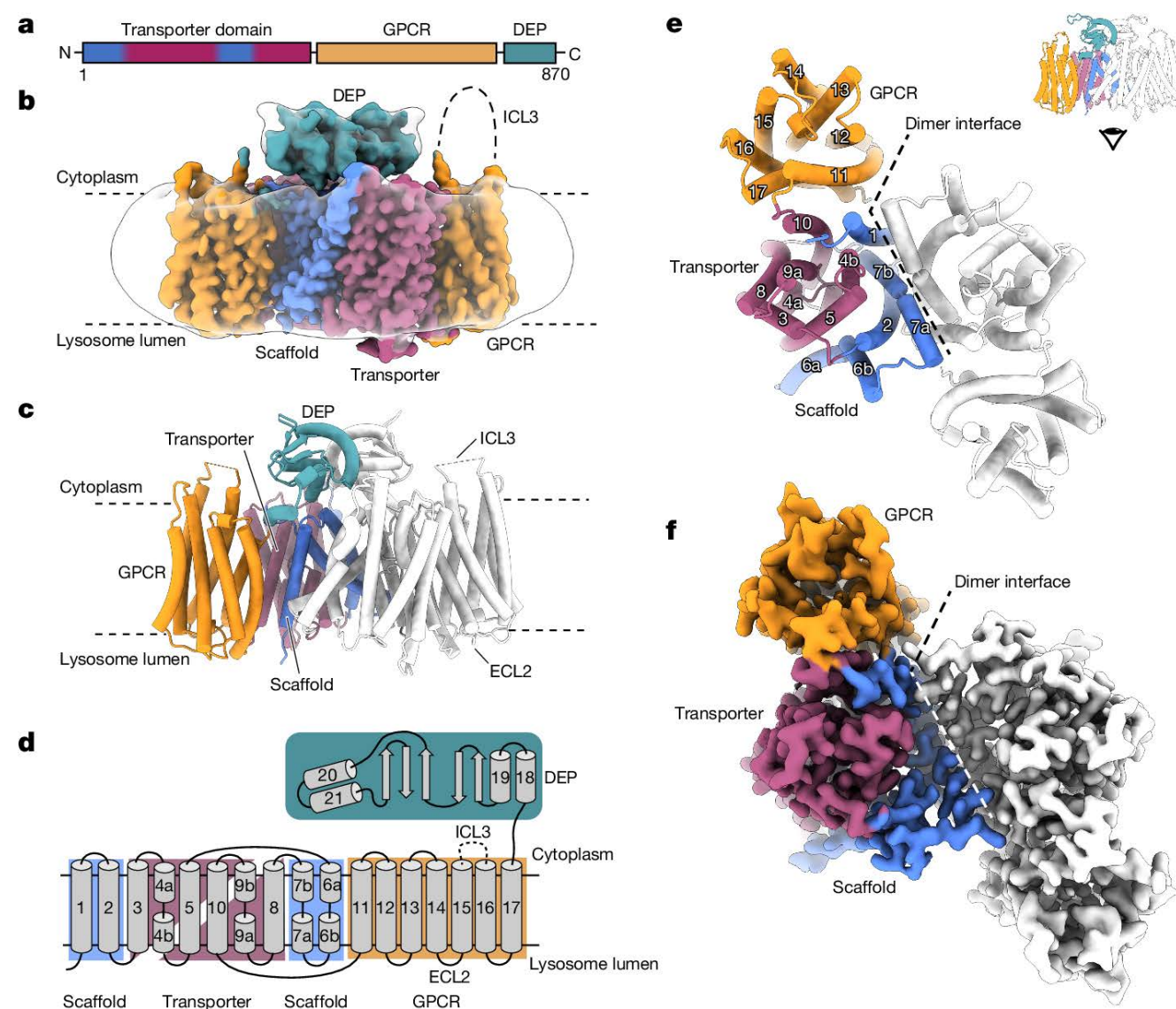
- Identification of mutations in the metabotropic glutamate receptor 1 (mGlu1) that are associated with rare subtypes of the neurodegenerative disorder, spinocerebellar ataxia, suggesting that allosteric modulators of the mGlu1 could be of benefit in this patient population (Wang, Muraleetharan, Langiu, Gregory, Hellyer in The British Journal of Pharmacology; doi: 10.1111/bph.16510).
- Determination of the 3D structure of the human P2X1 purinergic receptor using cryo-electron microscopy, opening the path for targeted drug development of a hormone-free, reversible male contraceptive pill (Bennetts, Mobbs, Ventura, Thal in Nature Communications; doi: 10.1038/s41467-024-52776-7).
- Development of the open-source, Gut Analysis Toolbox (GAT), which integrates AI to automatically identify and analyse enteric neurons and their neurochemical coding in tissue from the gastrointestinal tract (Sorensen, Mahdavian, Rowe, Saito, Mutunduwe, Glennan, Veldhuis, Carbone, Poole in The Journal of Cell Science; doi: 10.1242/jcs.261950).
- Determination of the 3D structures and conformational dynamics of agonist-bound amylin receptors, suggesting strategies for the design of long-acting, nonselective dual amylin and calcitonin receptor agonists (or DACRAs) with potential anti-obesity effects (Cao, Belousoff, Gerrard, Fletcher, Dal Maso, Johnson, Wootten, Sexton in Nature Chemical Biology; doi: 10.1038/s41589-023-01393-4).
- Discovery that a diet high in saturated fats results in the increased production of a toxic lipid, C16 ceramide, which is exported out of the gut via the lymphatic system, opening the way for new research into drugs that could target C16 ceramide to prevent progression of metabolic diseases (Mah, Tegegne, Febbraio, Turpin-Nolan in Science Advances; doi: 10.1126/sciadv.adp2254).
- Demonstration of the effectiveness of compound 17b (Cmpd17b), a small molecule agonist of formyl peptide receptors, at limiting hypertension-induced end-organ damage in models of hypertension (Singh, Jackson, Gumanti, Tang, Parker, Nowell, Woodman, Ritchie, Qin in Cardiovascular Research; doi: 10.1093/cvr/cvae103).

HIGHLIGHT PAPERS FROM DDB RESEARCHERS

LYCHOS IS A HUMAN HYBRID OF A PLANT-LIKE PIN TRANSPORTER AND A GPCR

Bayly-Jones C, Lupton CJ, Keen AC, Dong S, Mastos C, Luo W, Qian C, Jones GD, Venugopal H, Chang Y-G, Clarke RJ, Halls ML*, Ellisdon AM*. *co-corresponding authors
 Nature, 634, 1238-1244 (2024). <https://doi.org/10.1038/s41586-024-08012-9>

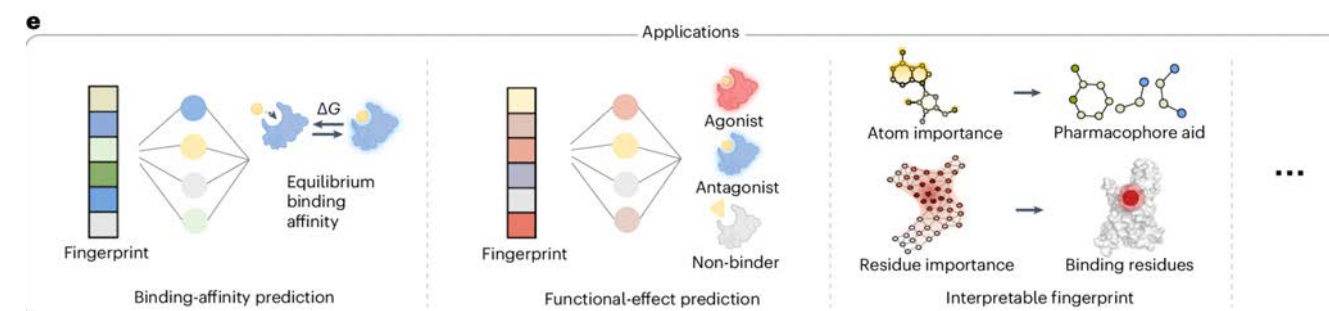
Human cells need cholesterol for healthy growth, but the way cells and cholesterol interact is a delicate balance. LYCHOS (GPR155) is a lysosomal transmembrane protein that functions as a cholesterol sensor, facilitating the cholesterol-dependent activation of the master protein kinase mechanistic target of rapamycin complex 1 (mTORC1). This study determined the 3D structure of LYCHOS using cryo-electron microscopy and discovered that it is a unique hybrid of a cell transporter commonly found in plants (and not humans), and a G protein-coupled receptor (GPCR). The GPCR and plant-like transporter work together to sense cholesterol at the lysosome and regulate cell growth, making LYCHOS an exciting new drug target for diseases perpetuated by abnormal cell growth which can lead to the formation of cancerous tumours and neurological dysfunction.



PHYSICOCHEMICAL GRAPH NEURAL NETWORK FOR LEARNING PROTEIN-LIGAND INTERACTION FINGERPRINTS FROM SEQUENCE DATA

Koh HY, Nguyen ATN*, Pan S*, May LT*, Webb GI*. *co-corresponding authors
 Nature Machine Intelligence, 6, 673-687 (2024). <https://doi.org/10.1038/s42256-024-00847-1>

Although computational methods within drug discovery are well-established, there is a lack of novel AI tools capable of rapidly, robustly and cost-effectively predicting the strength of interactions between molecules and proteins – a critical step in the drug discovery process. This study describes a new AI tool, 'PSICHIC' (PhySicoChemIcal), which decodes protein-molecule interactions with state-of-the-art accuracy. Despite using only sequence data, PSICHIC matched and even surpassed leading structure-based methods in binding-affinity prediction. The team used PSICHIC to effectively screen new drug candidates and perform selectivity profiling at the adenosine A1 receptor. The data, code, and optimised PSICHIC model is available to the broader scientific community. Visit www.psichicserver.com for more information.



MEDICINAL CHEMISTRY



Theme Leader: **Professor Martin Scanlon**
Deputy Theme Leader: **Dr Dan Priebbenow**

Research in the Medicinal Chemistry Theme is focused on the design and synthesis of small molecules as new therapeutic candidates or tool compounds for better understanding biological mechanisms. Research encompasses computational chemistry, synthetic medicinal chemistry, peptide science, chemical biology and structure-based drug design. Our research is highly collaborative in nature and extends across many target classes and therapeutic areas.

Grants & research
contracts awarded

13

Staff

45

Awarded research income

\$3,712,164

Publications

42

Graduate
research
students

73

PhD & MPhil
completions

13

As well as the significant number of academic groups conducting cutting edge basic and translational research, the Medicinal Chemistry Theme is home to two of Monash University's state-of-the-art Research Platforms. The Monash Fragment Platform conducts early stage hit identification and a uses a range of different biophysical methods to characterise binding interactions. The Australian Translational Medicinal Chemistry Facility supports hit optimisation and hit-to-lead programs. The Medicinal Chemistry Theme also headquarters the MRFF-funded initiative MedChem Australia, which, in partnership with both WEHI and the University of Sydney, provides medicinal chemistry capability to support drug discovery at a national level.

MAJOR RESEARCH & ACHIEVEMENTS OF 2024

NEW APPOINTMENTS IN MEDICINAL CHEMISTRY

Medicinal Chemistry saw a change of leadership in 2024 with Professor Martin Scanlon appointed as the new Theme Leader, and Dr Dan Priebbenow appointed as the inaugural Deputy Theme Leader. In addition, the theme welcomed two new Teaching and Research Academics. Firstly, Dr Emma Watson (pictured below left), a current ARC DECRA fellow whose research focuses on using biomolecules as building blocks to develop smart, responsive systems for therapeutic applications. Secondly, Dr Manuela Jörg (pictured below right), a former Monash-Newcastle Research Fellow, whose research focuses on the development of novel chemical probes to better understand the structure, activation, degradation, oligomerisation, allostery and selectivity of specific drug targets. In 2024, Dr Chris Smedley also began his ARC DECRA Fellowship in the Medicinal Chemistry Theme exploring Diversity Oriented Click-Chemistry to streamline the synthesis of important molecules.



MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

New artificial intelligence models for predicting chemical properties with very high accuracy, approaching the quality of high-end quantum mechanics calculations, but with much lower computational cost are being developed. This work was published by PhD student Teng See in the *Journal of Chemical Theory and Computation* (J. Chem. Theory Comput. 2024, 20, 8886 doi:10.1021/acs.jctc.4c00798), which describes improved graph neural networks for calculating properties such as molecular energies. These methods aim to improve our computational models for use in drug design applications.

NEW THERAPIES FOR AUTOIMMUNE AND NEUROINFLAMMATORY DISEASES.

The voltage-gated potassium channel Kv1.3 is highly expressed by terminally differentiated effector memory T cells, which play a major role in the pathogenesis of a range of autoimmune diseases, including multiple sclerosis, rheumatoid arthritis, psoriasis and lupus. Extensive in vitro and in vivo studies have validated Kv1.3 as a target for immunotherapy and shown that venom-derived peptides are potent blockers of this channel and effective immunomodulators. Recent evidence shows that Kv1.3 is also upregulated on microglia in the brain in neuroinflammatory diseases such as Alzheimer's and Parkinson's diseases. Researchers in the Medicinal Chemistry Theme (led by Prof Ray Norton) have designed several highly selective and potent inhibitors of Kv1.3 based on peptides from sea anemones and scorpions and are currently determining their efficacy in a range of models of both peripheral and central inflammatory diseases and investigating the effects of lipidation on their pharmacokinetics and biodistribution.

SUSTAINABILITY IN DRUG DESIGN

MIPS researchers contributed to describing the 'benign-by-design' approach, which aims to create environmentally friendly pharmaceuticals. A publication in Nature Sustainability doi:10.1038/s41893-024-01374-y co-authored by Dr Manuela Jörg highlights the growing concern of pharmaceutical contamination in our ecosystems. The authors emphasise the necessity of developing drugs that are not only effective and stable for their intended medical applications, but also environmentally friendly. This requires a paradigm shift in medicinal chemistry practices, as the intentional design of drugs to biodegrade into harmless products, such as inorganic salts, is not yet a widespread practice in drug discovery.



PHOTOCHEMISTRY

The use of photochemical irradiation to activate small molecules is a powerful tool for accessing high-energy reactive intermediates. Within the Medicinal Chemistry Theme, the development and application of photoactivatable chemical probes for photoaffinity or photoproximity labelling in cellular settings is being explored by several research groups (including Dr Manuela Jörg, Dr Amandeep Kaur and Dr Dan Priebbenow). Synthetic photochemistry (the use of light irradiation to drive chemical reactions) also offers the significant potential to enhance the safety and sustainability of synthetic methods and can deliver access to novel drug architectures or tool compounds for deciphering biological mechanisms. Research within the Medicinal Chemistry Theme (led by Dr Dan Priebbenow) led to the discovery of a novel photochemical approach for accessing benzocyclobutenone, molecular scaffolds that can be further transformed to both therapeutic agents and complex natural products (see Chem. Sci. 2024, 15, 19328-19335 doi:10.1039/D4SC05715E).

LICENSED COMPOUNDS ENTER CLINICAL TRIALS

MIPS medicinal chemists Prof Paul Stuppel and Dr Ylva Bozikis spearheaded the chemistry effort discovering first-in-class KAT6 inhibitors as part of the Cancer Therapeutics CRC, culminating in a landmark licensing deal with Pfizer and a 2023 joint publication (Sharma et al., Cell Chemical Biology 30: 1191-1210 doi:10.1016/j.chembiol.2023.07.005). PF-07248144 has shown great promise in early clinical trials for estrogen receptor-positive (ER+), HER2-negative metastatic breast cancer. In a Phase 1 study involving heavily pretreated patients, PF-07248144 combined with fulvestrant achieved positive outcomes with an objective response rate of 30.2% and a clinical benefit rate of 51.2%. Encouraged by these results, Pfizer announced in 2024 its plans to initiate a Phase 3 trial for PF-07248144 by mid-2025.

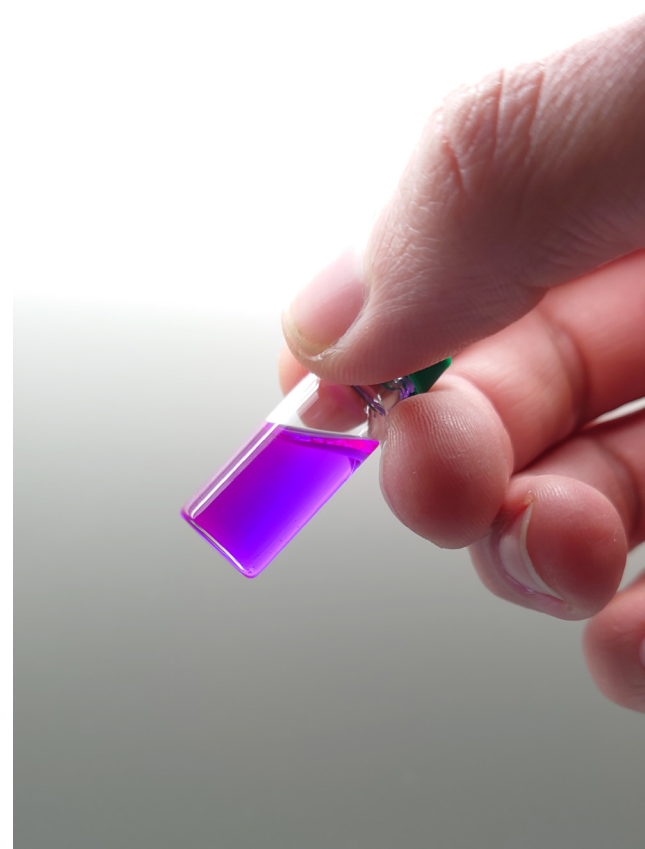


TARGETED PROTEIN DEGRADATION

The Medicinal Chemistry Theme has an active set of programmes aimed at generating Proteasome Targeting Chimeras (PROTACs). Over the past decade, targeted protein degradation has been established as an entirely new modality for modulating cellular function. PROTACs can eliminate target proteins from the cell and thereby prevent all function(s) of that protein, providing a 'pharmacological knock-out'. There are both basic research programs looking at strategic approaches to PROTAC synthesis, assay development, computer based-design, tagged protein degradation and translational development of PROTACs as therapeutics in cancer.

POLYNUCLEOTIDE-TARGETING APPROACHES

A group led by Professor Bernard Flynn secured research funding from CUREator (Australia's national biotech incubator) to establish a drug-design platform to address polynucleotides as therapeutic targets. The platform involves the design, synthesis and testing of a library of novel molecules that contain privileged scaffolds designed to bind to polynucleotides. A suite of biophysical assays are being validated to test the binding of these molecules to different RNA targets.

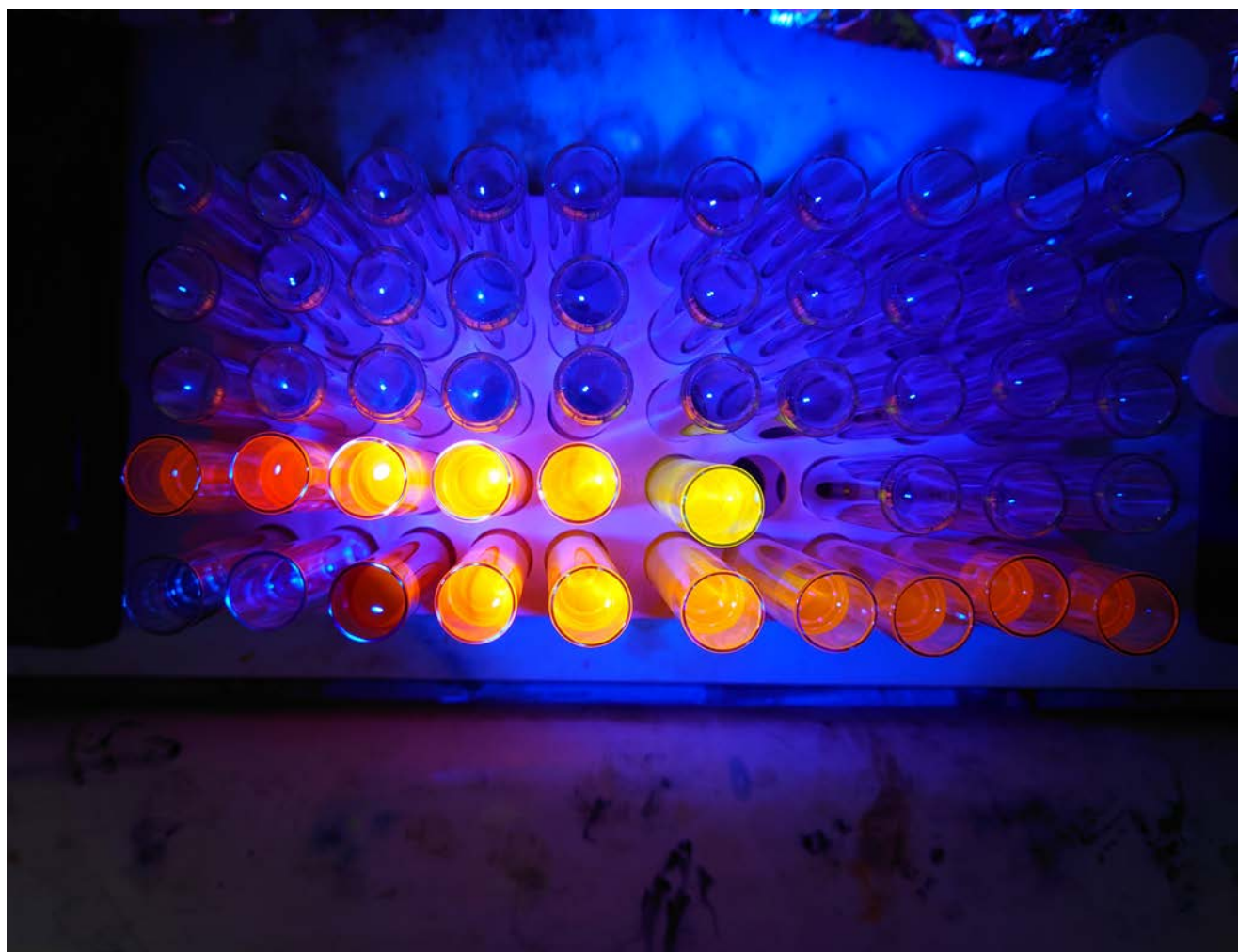


HIGHLIGHT PAPERS

A COUMARIN-BASED ARRAY FOR THE DISCRIMINATION OF AMYLOIDS

Trinh N, Bhuskute KR, Varghese NR, Buchanan JA, Xu Y, McCutcheon FM, Medcalf RL, Jolliffe KA, Sunde M*, New EJ*, Kaur A*. *co-corresponding authors
ACS Sensors, 9, 615-621 (2024). <https://doi.org/10.1021/acssensors.3c01334>

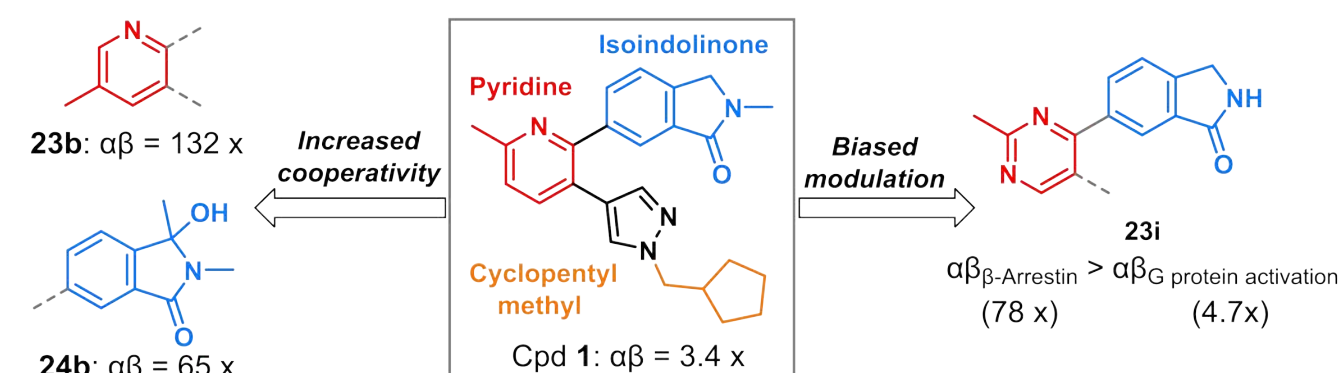
A team, led by Dr Amandeep Kaur, has developed a novel fluorescent sensor array to detect and differentiate amyloids associated with neurodegenerative diseases such as Alzheimer's and Parkinson's. The self-assembly of misfolded proteins into amyloids plays a key role in these diseases, making their early and precise detection critical for diagnosis and intervention. The sensing technology developed by this team can discriminate between four different disease-associated amyloids with high accuracy, enabling disease monitoring. By testing these sensors on brain samples from Alzheimer's mouse models, the team observed distinct fluorescence patterns between early (6 months) and late (12 months) disease stages. This breakthrough integrates expertise in chemistry, fluorescence, and amyloid biology, offering a promising tool for researchers to study amyloid-related diseases and refine diagnostic strategies. Dr Kaur and her team anticipate that this technology will improve the early and accurate detection of neurodegenerative disorders.



DISCOVERY OF 2-METHYL-5-(1H-PYRAZOL-4-YL)PYRIDINES AND RELATED HETEROCYCLES AS PROMISING M4 mAChR POSITIVE ALLOSTERIC MODULATORS FOR THE TREATMENT OF NEUROCOGNITIVE DISORDERS

Liu B, Thompson G, Jörg M, Barnes N, Tha, DM, Christopoulos A, Capuano B*, Valant C*, Scammells PJ*. *co-corresponding authors
J. Med. Chem., 67, 15, 13286–13304 (2024). <https://doi.org/10.1021/acs.jmedchem.4c01207>

The M4 muscarinic acetylcholine receptor (mAChR) is a biological target for neurocognitive disorders. The reference compound (1) is an ago-PAM for the M4 mAChR. Led by researchers within the Medicinal Chemistry Theme, this study involved the design, synthesis, and evaluation of novel putative M4 mAChR PAMs based on 1. These analogues were screened and then fully characterised in two functional assays (GoB protein activation and CAMYEL activation) to quantify their allosteric and ago-PAM properties against acetylcholine (ACh). A selection of seven M4 positive allosteric modulators (PAMs) were assessed for their ability to modulate ACh-mediated β -arrestin recruitment and revealed four distinct clusters of M4 PAM activity: (1) analogues similar to 1, (2) analogues demonstrating only allosteric agonism, (3) analogues with increased allosteric properties, and (4) analogs with a biased modulatory effect toward β -arrestin recruitment. These novel M4 chemical tools disclose discrete molecular determinants, allowing further interrogation of the therapeutic roles of cAMP and β -arrestin pathways in neurocognitive disorders.



CENTRE FOR DRUG CANDIDATE OPTIMISATION



Theme Leader: **Professor Sue Charman**
Deputy Theme Leader: **Associate Professor David Shackelford**

The Centre for Drug Candidate Optimisation (CDCO) fosters drug discovery innovation through multidisciplinary collaboration with commercial partners, not-for-profit organisations and academic research institutes. The CDCO specialises in characterising physicochemical, metabolic, biopharmaceutical and pharmacokinetic properties of candidate molecules to guide and inform medicinal chemistry and biology and translate promising molecules into drug candidates suitable for clinical development.

Grants & research contracts awarded

20

Provisional patent applications

2

Total research income

\$3,550,114

Publications

6

Staff

20

The CDCO utilises industry-standard approaches and protocols for in vitro ADME and in vivo pharmacokinetic platforms to fulfil candidate selection and progression criteria. These include in vitro chemical screens to assess solubility, partitioning, ionisation, and stability; in vitro assays to assess drug metabolism, enzyme inhibition, permeability, and protein binding, and in vivo assessment of drug absorption, disposition, clearance and bioavailability.

The CDCO contributes to the discovery and optimisation of drug candidates to treat infectious diseases, cancer, CNS disorders, cardiovascular and metabolic disease. Since its establishment in 2003, the CDCO has contributed to the advancement of 42 compounds into clinical development and the registration of two new drugs.

MAJOR RESEARCH & ACHIEVEMENTS OF 2024

2024 FACULTY PROFESSIONAL RESEARCH AWARD

Long standing CDCO staff member, Dr Michael Campbell, was awarded the 2024 Faculty Professional Research Award. Mike has made numerous contributions to drug discovery programs by providing expertise and guidance in pharmaceutical chemistry, physicochemical profiling, and bioanalysis. He was responsible for the implementation and maintenance of CDCO data management and archiving processes and was pivotal to the establishment of the CDCO electronic lab notebook and inventory database. Mike is highly regarded by the CDCO team and actively promotes a culture of collaboration and scientific engagement to achieve Centre goals and objectives.



NEW TREATMENTS FOR SOLID TUMOURS

The CDCO team will join forces with MIPS medicinal chemists at the Australian Translational Medicinal Chemistry Facility and cancer biologists at the Children's Cancer Institute and UNSW, through a new NHMRC Development grant to develop METTL5 inhibitors for the treatment of solid tumours in children and adults. METTL5 (methyltransferase-like protein 5) is an RNA methyltransferase that plays an important role in regulating translation and has been linked to progression of several cancers including breast, pancreatic, and paediatric neuroblastoma. Led by Associate Professor Ian Street at the Children's Cancer Institute, the program will aim to develop novel chemistry and proof of concept efficacy data in preclinical models to support future translation and commercialisation. The team has a well-established history of collaboration, having worked together through the CRC for Cancer Therapeutics (CTx), a highly successful Australia-wide small molecule focused drug discovery collaboration (2007-2020), which delivered 8 commercial licensing deals, two with multinational pharmaceutical companies. The METTL5 program also received funding through Therapeutic Innovation Australia's Pipeline Accelerator scheme in 2024.

TERNARX

The CDCO will support the drug discovery activities of a new WEHI spinout company, Ternarx, dedicated to finding new treatments for hard-to-treat cancers. The company will utilise protein degrader medicines and technology to provide a powerful new tool for destroying disease-causing proteins that cannot be targeted by conventional drugs. A \$15 million grant awarded in 2023 by the Medical Research Future Fund Frontier Health and Medical Research initiative to establish the Australian Centre for Targeted Therapeutics – a collaboration between experts from WEHI, the Children's Cancer Institute and Monash University – along with support from WEHI laid the foundation for the formation of Ternarx. The company was officially launched in June 2024 by the Australian Minister for Health and Aged Care, Mark Butler. CDCO Director Professor Susan Charman will be a member of the Ternarx Scientific Advisory Board and said "Understanding the absorption, distribution, metabolism and excretion properties of novel target protein degrader molecules will be critical to realising the full potential of this exciting new class of drugs. The CDCO team looks forward to working alongside our research partners to help optimise the delivery of these drugs and, ultimately, positively impact the lives of many people around the world."



NEW LEADERSHIP FOR THE CDCO



In December 2024, Professor Joseph Nicolazzo was appointed as the new CDCO Director and Associate Professor David Shackleford was elevated to the role of Deputy Theme Leader. Both Joe and Dave will assume their new roles in early 2025. Joe has been a member of the Drug Delivery, Disposition and Dynamics Theme since 2007, and brings to the CDCO Director position significant experience in drug disposition and pharmacokinetics, particularly in relation to drug transporters and understanding drug access to the brain. He also has long-standing leadership experience within the Faculty and deep links to the national and international pharmaceutical sciences community. Dave has led the Biopharmaceutics section of the CDCO since its inception in 2003, and brings a wealth of knowledge and expertise in drug metabolism and pharmacokinetics to the new leadership team, along with significant organisational experience. Supported by a talented and dedicated CDCO team, Dave's elevation to this role will provide continuity to internal and external project teams in delivering quality outcomes in support of drug discovery and research translation.

After 22 years as founding and continuing Director and Theme Leader of the CDCO, Professor Susan Charman announced that she would be stepping down from her role in 2025. She has built the CDCO into an organisation that has expertise, capability and a reputation that is unparalleled in Australia, and is truly one of a handful of elite groups in drug metabolism and pharmacokinetic lead optimisation worldwide. Under Professor Charman's leadership, the CDCO team has contributed to the success of numerous drug discovery programs within Australia and internationally, with more than 40 programs progressing candidates into clinical development.

"I'm extremely proud of the successes of the CDCO team and it has been an honour and a privilege to serve as Director and Theme Leader over the years. I'm very confident that the new leadership team will continue to deliver high quality data to enable the translation of novel molecules into viable drug candidates to treat human disease", said Professor Charman.

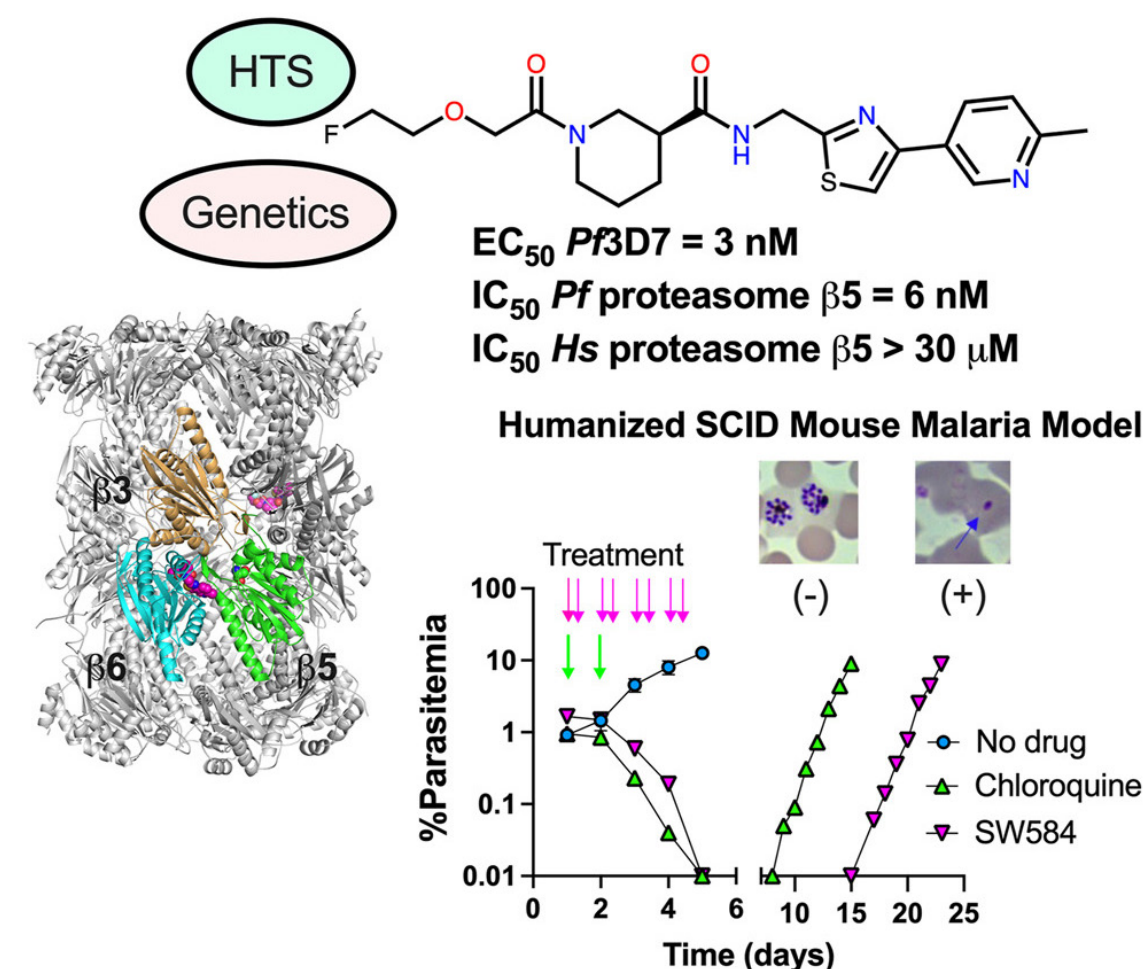
KEY PUBLICATIONS OF 2024

IDENTIFICATION OF POTENT AND REVERSIBLE PIPERIDINE CARBOXAMIDES THAT ARE SPECIES-SELECTIVE ORALLY ACTIVE PROTEASOME INHIBITORS TO TREAT MALARIA

Lawong A, Gahalawat S, Ray S, Ho N, Han Y, Ward KE, Deng X, Chen Z, Kumar A, Xing C, Hosangadi V, Fairhurst KJ, Tashiro K, Liszczak G, Shackleford DM, Katneni K, Chen G, Saunders J, Crighton E, Casas A, Robinson JJ, Imlay LS, Zhang X, Lemoff A, Zhao Z, Angulo-Barturen I, Jiménez-Díaz MB, Wittlin S, Campbell SF, Fidock DA, Laleu B, Charman SA, Ready JM, Phillips MA.

Cell Chemical Biology, 31, 8, 1503-1517 (2024). <https://doi.org/10.1016/j.chembiol.2024.07.001>

Malaria is a tropical infectious disease caused by protozoan parasites that are transmitted through the bite of an Anopheles mosquito. Worldwide, malaria causes more than 249 million cases and over 600,000 deaths each year. An international collaboration between scientists at the University of Texas Southwestern Medical Centre, the CDCO and the Medicines for Malaria Venture have identified a series of potent, species selective, reversible and orally bioavailable inhibitors of the Plasmodium falciparum proteasome, a target essential for parasite survival. Published in August 2024 in *Cell Chemical Biology*, the piperidine carboxamide series was discovered using a phenotypic screen for activity against P. falciparum parasites and cryoelectron microscopy structures identified that inhibition occurred through reversible interaction with the $\beta 5$ Pf_proteasome active site. Importantly, the series has low propensity to develop parasite resistance. Lead optimisation activities are continuing to optimise potency, safety and pharmacokinetic properties and identify a candidate suitable for further preclinical and clinical development.

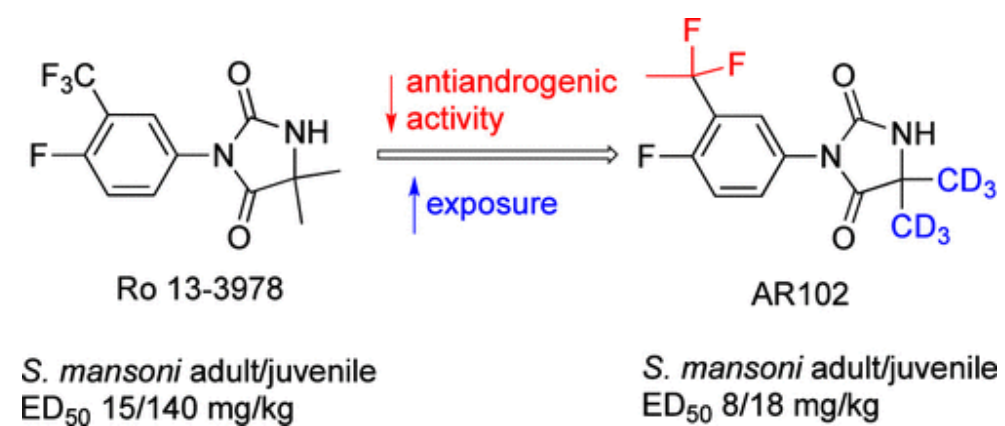


SINGLE-DOSE DRUG DEVELOPMENT CANDIDATE FOR SCHISTOSOMIASIS

Leas DA, Keiser J, Charman SA, Shackleford DM, Jones JO, Campbell M, Chen G, Katneni K, Patil R, Hu M, Pham T, Häberli C, Schulze TT, Neville, AJ, Wang X, Dong Y, Davis PH, Vennerstrom JL.

ACS Infectious Diseases, 10, 11, 3963-3972 (2024). <http://doi.org/10.1021/acsinfecdis.4c00677>

Schistosomiasis is an infectious parasitic disease caused by blood flukes of the genus *Schistosoma*. There are more than 200 million people worldwide affected by the disease, and the current frontline drug used for treatment and chemoprophylaxis (praziquantel) has suboptimal efficacy and is rapidly metabolised. Building off initial efforts by F. Hoffmann-La Roche in the early 1980s, an international team of medicinal chemists (University of Nebraska Medical Centre), parasite biologists (Swiss Tropical and Public Health Institute), and pharmaceutical scientists (CDCO) modified the existing aryl hydantoin substructure to identify compounds without the unwanted side effects present in the Roche compounds, and with significantly improved metabolic stability and pharmacokinetic half-life. As reported in *ACS Infectious Diseases* in October 2024, the lead compound, AR102, was found to be potent, selective, safe and have broad spectrum activity against both adult and juvenile schistosomes in preclinical models of disease. A very long pharmacokinetic half-life, predicted to be greater than 30 days in humans, could provide for a single dose administration and much needed convenient treatment for this persistent parasite.



DRUG DELIVERY, DISPOSITION AND DYNAMICS



Theme Leader: **Professor Michelle McIntosh**
Deputy Theme Leader: **Dr Kristian Kempe**

The Drug Delivery, Disposition and Dynamics (D4) Theme is focused on designing and developing drug delivery systems that efficiently target drugs to the right place at the right time, be that via oral administration, inhalation or injection.

D4 are leaders in drug delivery and nanomedicine and have particular strengths in lipid based drug delivery and lymphatic transport.



- D4 major programs address the challenges of:
- precise delivery of mRNA medicines using lipid nanoparticles (LNPs)
 - targeting drugs to the lymphatic system to better treat immune and metabolic disease
 - switching the need to administer drugs by injection to using other routes such as inhalation
 - better understanding the subcellular trafficking of drug molecules
 - targeting anticancer medicines to tumours
 - understanding drug transport into the brain
 - identifying novel mechanisms of action, and overcoming resistance mechanisms for pathogens
 - delivering drugs that have very low solubility

MAJOR RESEARCH & ACHIEVEMENTS OF 2024

FELLOWSHIPS

Professor Benjamin Boyd is one of eight outstanding Australian researchers to receive an Australian Research Council Industry Laureate Fellowship to help address industry-identified challenges and opportunities. The Fellowships aim to promote national and international collaboration partnerships between key stakeholders in research and innovation. Professor Boyd formed industry partnerships with Fonterra Australia and The Australian Synchrotron to establish a project of key national and international interest - better food and nutrition.

Dr Liam Koehn received an ECR FightMND Fellowship which will support his research program for four years. His research focuses on reducing inflammation in the brain. Dr Koehn will trial different modifications of a new drug targeting inflammation and investigate the best way to deliver it to the brain in order to reduce MND symptoms.

AWARDS

Professor Ben Boyd 2024 recipient of the American Association of Pharmaceutical Scientists prestigious Dale E. Wurster Research Award. The award is only presented every second year and recognises individuals who have made significant research contributions in the field of pharmaceuticals. For Professor Boyd this includes the wide-ranging impact of his research pertaining to advancing our understanding of lipid (fat) behaviour during gastrointestinal processing and how this could translate into better oral drug delivery and enhanced nutrition.

PhD candidate, **Alice Terrill**, has been named a 2024 Top100 Future Leaders through the Australian Financial Review initiative established a decade ago to recognise top Australian university students.

Alice was selected among 1,700 applicants nationwide and was a finalist for both the Quantum Data Science and Transition Hub First in Family Awards. Those who made the Top100 Future Leader list were flown to Sydney for the opportunity to network with fellow students and gain exposure to Australia’s top graduate employers.

Alice’s PhD project is focused on the optimisation of antibiotic treatment regimes towards personalised medicine against ‘superbugs’. Prior to undertaking her PhD she completed a Bachelor of Pharmaceutical Science Advanced (Honours) through Monash’s Faculty of Pharmacy and Pharmaceutical Sciences.

ARC DISCOVERY SUCCESS

Researchers in D4 were successful in the ARC Discovery Program with grants awarded to Darren Creek (CIA), John Quinn (CIA) and Ben Boyd, Natalie Trevaskis (CIA), Angus Johnston (CIA) and Enyuan Cao, Jie Tang (CIA), Michelle McIntosh and Ben Boyd, Angus Johnston (CIA), and Stanley Xie (CIA).

CORTx

The National Centre for Biopharmaceutical Optimisation of mRNA Therapeutics (CORTx) was established with a \$4 million grant from the Australian Government’s Medical Research Future Fund. Collaborating with Moderna, iCamuno, and prominent academic institutions, co-directors **Associate Professors Angus Johnston and Natalie Trevaskis** from D4, are leading efforts to advance mRNA delivery systems. They are working to overcome the challenges of therapeutic mRNA instability and cellular uptake efficiency to treat diseases such as cancer, diabetes, and inflammatory bowel disease, positioning MIPS and CORTx as a versatile technology development platform for next-generation mRNA therapeutics.

PANDEMIC THERAPEUTICS

Dr Jie Tang, Prof Colin Pouton, Prof Michelle McIntosh and **Dr Shadab Haque** were funded with a Cumming Global Centre for Pandemic Therapeutics Foundation grant. This project aims to develop inhalable therapies for viral infections, merging cutting-edge research in gene editing and nanomaterials with a formulation designed to achieve maximal airway coverage. This will enable swift reactions to future pandemics, effective and direct virus eradication in the lungs, and convenient inhaler use to avoid the need for injections. The team were one of ten successful applications selected from across Australia and the UK.

ARPA-H SPRINT

Assoc Prof Natalie Trevaskis and colleagues from Monash University and Professor Anne Eichmann from the Yale School of Medicine, USA, have together received funding from the Advanced Research Projects Agency for Health (ARPA-H), an agency within the US Department of Health and Human Services (HHS), to drive forward a new treatment for ischemic stroke. The award was within the ARPA-H Sprint for Women’s Health spark track for early-stage research efforts. The Sprint addresses critical unmet challenges in women’s health, champions transformative innovations, and tackles health conditions that uniquely or disproportionately affect women.

The research team in D4 includes **Dr Michael Whittaker** and post-doctoral researchers **Dr Mohammad Abdallah** and **Dr Roisin McCague** along with Associate Professor Connie Wong from the School of Clinical Sciences and Associate Professor Jean-Léon Thomas and Assistant Professor Lindsay McAlpine from the Yale School of Medicine.

SEAPORT THERAPEUTICS

Seaport Therapeutics, a clinical-stage biopharmaceutical company based around a unique drug delivery platform originally developed by researchers in D4, announced the closing of a US\$100 million oversubscribed Series A financing round and a subsequent US\$235 million Series B. The Series A round was co-led by ARCH Venture Partners and Sofinnova Investments along with Third Rock Ventures and Seaport founder PureTech Health. The Series B financing round was led by T. Rowe Price Associates, Inc., Foresite Capital, Invus, Goldman Sachs Alternatives, CPP Investments, and other new investors. The founding investors also participated

Using the proprietary Glyph™ platform – which was initially developed by Professor Chris Porter and his team – Seaport Therapeutics is advancing a clinical stage pipeline of neuropsychiatric medicines in areas of high unmet patient needs including depression and anxiety disorders – currently being held back by key limitations such as negligible oral bioavailability or hepatotoxicity. The Glyph platform solves these limitations by rerouting the mechanism of absorption to the lymph to enable oral administration and reduce liver exposure.

Pictured facing page: D4 Theme staff and students (top), D4 researchers at work.



TWO HIGHLIGHT PAPERS

BEYOND THE ENDOSOMAL BOTTLENECK: UNDERSTANDING THE EFFICIENCY OF MRNA/LNP DELIVERY

Liu H, Chen MZ, Payne T, Porter CJH, Pouton CW, Johnston APR.

Advanced Functional Materials, Jul 6, 34, 2404510 (2024).

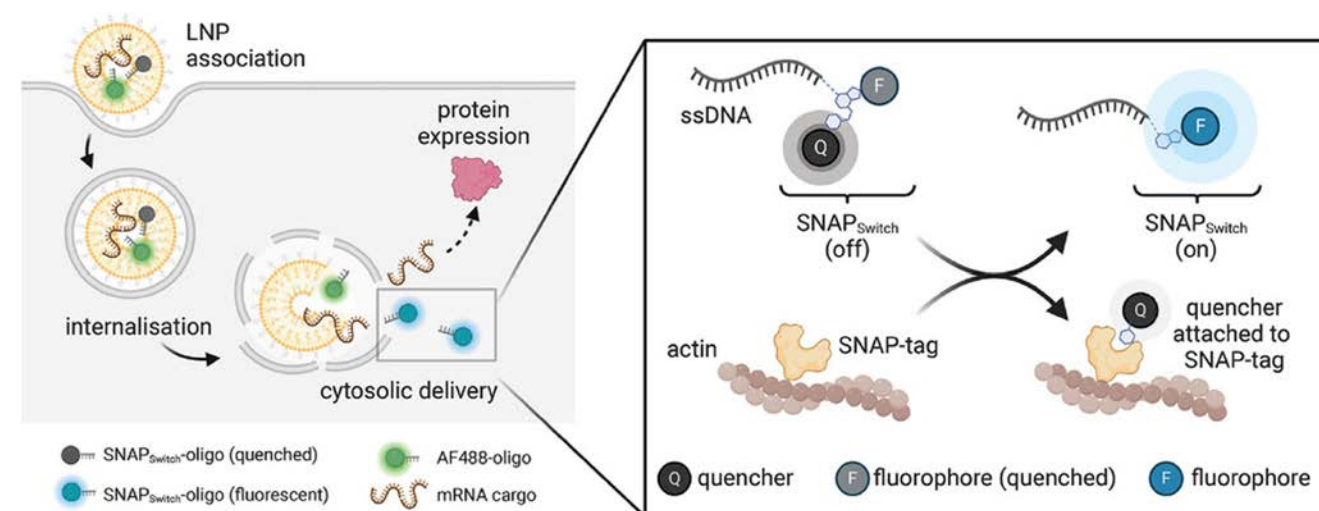
<http://doi.org/10.1002/adfm.202404510>

Lipid nanoparticles can protect and deliver therapeutic RNA to target cells, though the mechanisms governing intracellular delivery remain poorly understood. A key barrier is endosomal escape, the pathway in which therapeutic RNA must exit intracellular compartments to reach the cytosol and elicit therapeutic effects.

The publication team developed SNAPSwitch, a next-generation assay that enables direct, quantitative measurement of mRNA delivery into the cytosol, setting a new benchmark for evaluating intracellular delivery.

Applying SNAPSwitch, the team systematically profiled clinically relevant lipid nanoparticle formulations. These results revealed consistently low endosomal escape efficiencies, challenging the prevailing assumption that higher protein expression equates to more efficient delivery. The team also demonstrated that enhanced cellular uptake does not necessarily translate into improved cytosolic delivery, highlighting the nuanced interplay between particle composition, intracellular processing, and functional outcome.

By advancing tools to probe RNA delivery at a mechanistic level, this work is not only redefining how delivery systems are evaluated but also positioning us at the forefront of innovation in RNA therapeutic development.



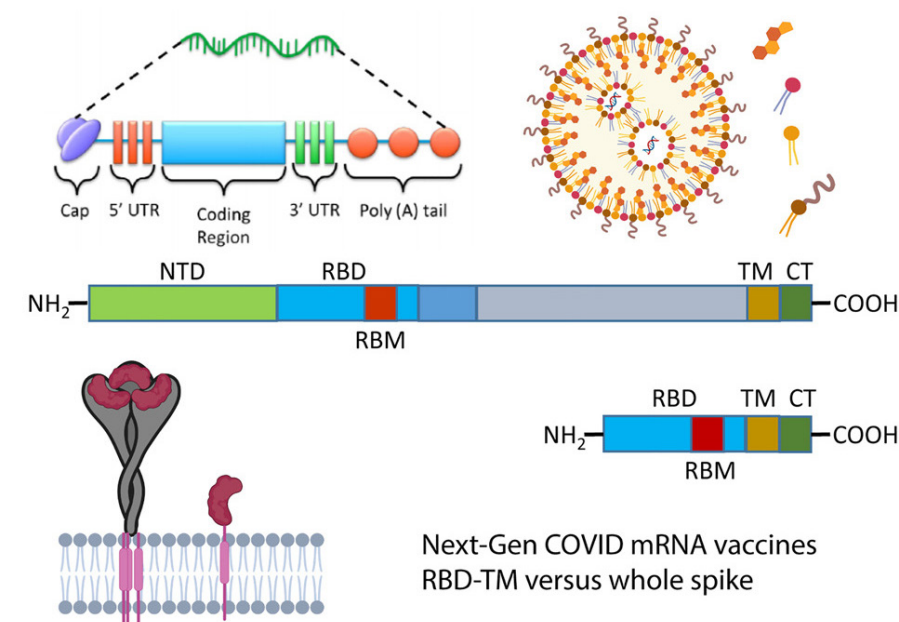
MRNA VACCINES ENCODING MEMBRANE-ANCHORED RBDS OF SARS-COV-2 MUTANTS INDUCE STRONG HUMORAL RESPONSES AND CAN OVERCOME IMMUNE IMPRINTING

Al-Wassiti HA, Fabb SA, Grimley SL, Kochappan R, Ho JK, Wong CY, Tan CW, Payne TJ, Takanashi A, Lee CL, Mugan RS, Sicilia H, Teo SLY, McAuley J, Ellenberg P, Cooney JP, Davidson KC, Bowen R, Pellegrini M, Rockman S, Godfrey DI, Nolan TM, Wang LF, Deliyannis G, Purcell DFJ, Pouton CW.

Molecular Therapy Methods & Clinical Development Nov 15;32(4):101380 (2024). <http://doi.org/10.1016/j.omtm.2024.101380>

The publication describes preclinical studies to investigate whether the MIPS receptor binding domain (RBD) mRNA vaccine platform could potentially overcome immune imprinting and produce effective second-generation COVID vaccines.

Mice received two doses of ancestral 'whole spike' SARS-CoV-2 mRNA vaccine and then were vaccinated with either a third dose of the same vaccine, a dose of an Omicron XBB.1.5 whole spike vaccine, or a dose of a MIPS Omicron XBB.1.5 RBD vaccine. After 56 days, serum was sampled from mice and evaluated for its ability to prevent infection by Omicron XBB.1.5 virus. Fold-improvement over ancestral vaccine was just 1.3 for the whole-spike XBB.1.5 vaccine, similar to data published using convalescent human serum samples. In contrast, the fold-improvement achieved by the MIPS RBD XBB.1.5 vaccine was 16.3. The study indicates that the MIPS vaccine could protect vulnerable individuals from infection and could be used to produce broad-spectrum vaccines by mixing mRNAs encoding multiple variant RBD sequences.



CENTRE FOR MEDICINE USE AND SAFETY



Theme Leader: **Professor Simon Bell**
Deputy Theme Leader: **Dr Emily Reeve**

The Centre for Medicine Use and Safety (CMUS) conducts innovative research to promote safe and effective medicine use. CMUS runs major national and international collaborative and multidisciplinary projects. These projects address Australia's National Health Priority Area of Quality Use of Medicines and Medicine Safety.

CMUS has research strengths in clinical practice guidelines, health economics, health services research, pharmacoepidemiology and pharmacometrics. Key therapeutic areas include ageing and aged care, deprescribing, cardiovascular disease, diabetes and respiratory disease.



Grants & research contracts awarded

6

Staff

23

Total research income

\$4,525,339

Publications

94

Graduate research students

33

PhD & MPhil completions

5

CMUS co-leads the Neurological and Mental Health Global Epidemiology Network (NeuroGEN) and Optimising Geriatric Pharmacotherapy through Pharmacoepidemiology Network (OPPEN). CMUS staff are recognised national and international leaders in deprescribing research, including through the Australian Deprescribing Network. CMUS staff address the evidence-practice gap through investigating novel strategies to translate evidence into practice.

CMUS is committed to building research capacity. CMUS is home to 30 Australian and international PhD candidates and an expanding team of post-doctoral researchers focused on ensuring that patients achieve optimal health and medication outcomes.

MAJOR RESEARCH & ACHIEVEMENTS OF 2024

AUSTRALIAN PRIMARY CARE INITIATIVE FOR MEDICINE USE OPTIMISATION AND SAFETY (APRICOT)

APRICOT is a cluster-randomised controlled trial of interventions designed to address the estimated 250,000 hospital admissions each year associated with medication-related problems. Funded through the Medical Research Future Fund, the trial will investigate the impact of medication audit and feedback alone and in combination with different intervention strategies. The intervention strategies include evidence-based medication knowledge brokers, a consumer mHealth app, support to access and update My Health Record, Home Medicines Review and a health professional community of practice. Project partners include Australian Primary Health Care Nurses Association, Western Victoria Primary Health Network, CSIRO Australian E-Health Research Centre, North Western Melbourne Primary Health Network, Pharmaceutical Society of Australia and the Royal Australian College of General Practitioners.

DEVELOPING CLINICAL PRACTICE GUIDELINES

Australian Clinical Practice Guidelines and Principles of Care for People with Dementia

CMUS and other Monash University researchers were commissioned by the Australian Government Department of Health and Aged Care to update Australia's 2016 Clinical Practice Guidelines and Principles of Care for People with Dementia. To date the development of the new Australian Dementia Guidelines has involved consulting with over 50 different organisations across Australia. The new Dementia Guidelines will include clinical questions related to risk reduction, diagnosis and therapies and post-diagnostic care.

Australian Clinical Practice Guideline on MDMA-Assisted Psychotherapy for Post-traumatic Stress Disorder

Supported by philanthropic funding, CMUS is working with the Neuromedicines Discovery Centre to develop the world's first clinical practice guideline for MDMA-assisted psychotherapy for post-traumatic stress disorder (PTSD). This follows the landmark decision of the Australian Therapeutic Goods Administration to reschedule MDMA for the treatment of PTSD from a prohibited to a controlled drug, thus permitting authorised prescribing outside of clinical trials.

Deprescribing recommendations in clinical practice guidelines

CMUS identified that less than one-third of clinical practice guidelines include recommendations about deprescribing. Guidelines that contained deprescribing recommendations rarely outlined specific steps on how to do it. CMUS is leading an international initiative exploring barriers and enablers to integrating deprescribing recommendations into clinical practice guidelines. This has involved engaging with end-users about their preferred content, language and format of deprescribing recommendations.

INTERNATIONAL ENGAGEMENT

Assoc Prof Johnson George, Mr John Jackson, Assoc Prof Jenni Ilomaki and Prof Simon Bell were invited guests and plenary speakers at the 10th International Conference on Clinical Pharmacy in Manipal, India. This year's conference attracted delegates from 49 colleges of pharmacy across India. Assoc Prof George has helped organise and present at this event each year for the past 10 years. Over this 10-year period, the conference has involved more than 2000 scientific presentations from over 4700 delegates.

Professor Kirkpatrick was also awarded a Fellowship of the British Pharmacological Society. Professor Carl Kirkpatrick is Chairing the upcoming World Congress of Basic and Clinical Pharmacology to be held in Melbourne in 2026. This conference will host a diverse community of researchers, clinicians and other interest parties at all stages of their career from students and early career researchers to global leaders in basic and clinical pharmacology.

Dr Justin Turner facilitated a workshop on establishing a Belgian Deprescribing Network as part of a symposium on the mental health of older adults convened by Her Majesty, Queen Mathilde of Belgium. Dr Turner was also the invited keynote speaker at the Icelandic Deprescribing Conference. While in Iceland, Dr Turner was interviewed for 20-minutes on national TV and met with the Minister of Health to discuss deprescribing.

Prof Zanfina Ademi led the first-ever multi-country cost-effectiveness analysis of lipoprotein(a) [Lp(a)] testing in high-income countries, commissioned by Familial Hypercholesterolaemia Europe Foundation through the Lp(a) International Task Force. This landmark study provides critical evidence to support the integration of Lp(a) testing into cardiovascular prevention strategies.

OUTSTANDING EARLY CAREER RESEARCHERS

In 2024, 5 PhD candidates successfully submitted and were awarded their PhD degree. In addition to these successful completions many of our early career researchers were recognised for the impact of their work on practice and policy:

- Dr George Tan was the Spotlight Poster Winner in the Real-World Evidence Collaborative Category at the 40th International Conference of Pharmacoepidemiology in Berlin, Germany.
- Dr Justin Turner received the ASCEPT New Investigator Award at the 2024 ASCEPT, APFP and APSA Joint Congress for his work ‘Translating evidence to practice: pharmacist-led deprescribing and the SaferMedsNL initiative’.
- Dr Amanda Cross was awarded a Fellowship of the Pharmaceutical Society of Australia (PSA). Dr Cross also presented the PSA Lecture at the 2024 ASCEPT, APFP and APSA Joint Congress on the topic ‘To improve is to change – shifts in aged care pharmacist accountability and responsibility’.
- Dr Shin Liau was awarded the ASCEPT Pharmacoepidemiology Special Interest Group prize for her research ‘STOPPFrail medication use in aged care: comparison across Asia, Oceania and Europe’ at the 2024 ASCEPT, APFP and APSA Joint Congress.
- PhD candidate Adam Livori was awarded the 2024 Advanced Pharmacy Australia Medal of Merit for his contributions to the organisation and his broad portfolio of work centred on medication use and equity in cardiology.
- PhD candidate Ash McEvoy was awarded best poster presentation at the Australian Deprescribing Network Annual Meeting for her research ‘Deprescribing Benzodiazepine Receptor Agonists in People Living with Dementia: A Systematic Review’.
- PhD candidate Maria Alfonso Arvez represented the Pan American Health Organization (PAHO) at the World Health Organization Global Advisory Committee on Vaccine Safety and Advisory Committee on Safety of Medicinal Products Joint Meeting in Geneva, Switzerland. Through PAHO, Ms Arvez supports national pharmacovigilance efforts across the Americas, working closely with countries to strengthen their regulatory systems.

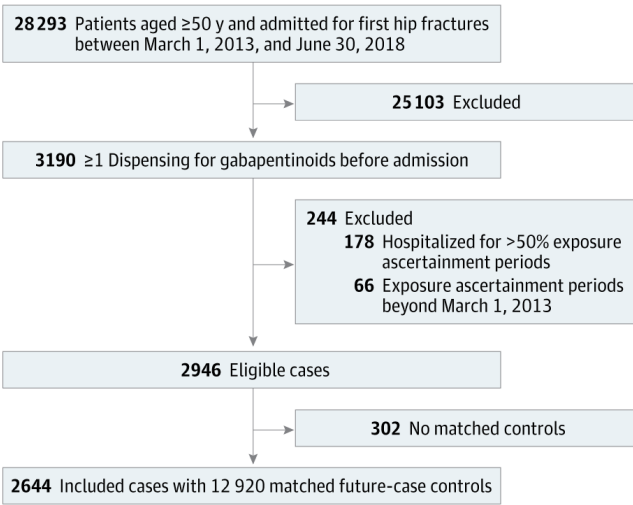


TWO HIGHLIGHT PAPERS

GABAPENTINOIDS AND RISK OF HIP FRACTURE

Leung MT, Turner JP, Marquina C, Ilomäki J, Tran T, Bykov K, Bell JS.
JAMA Network Open. 2024 Nov 4;7(11):e2444488. <https://doi.org/10.1001/jamanetworkopen.2024.44488>

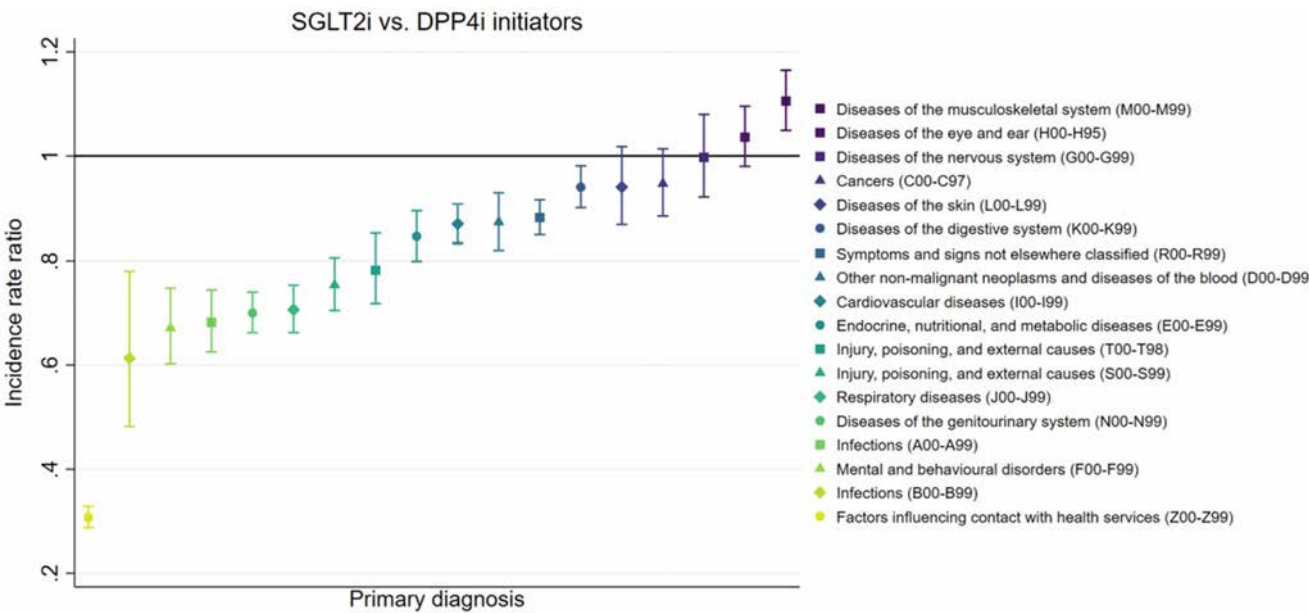
This innovative case-case-time-control study reported that using gabapentinoids (pregabalin or gabapentin) is linked to a 30% higher risk of hip fractures, especially in people who are frail or have chronic kidney disease. CMUS analysed data for over 28,000 patients hospitalised for hip fractures in Victoria, Australia. The findings highlight the need for caution when prescribing gabapentinoids, particularly for patients at high baseline risk of falls and fractures.



SGLT-2 INHIBITOR USE AND CAUSE-SPECIFIC HOSPITALIZATION RATES: AN OUTCOME-WIDE STUDY TO IDENTIFY NOVEL ASSOCIATIONS OF SGLT-2 INHIBITORS

Tan GSQ, Morton JI, Wood S, Shaw JE, Magliano DJ, Ilomäki J.
Clinical Pharmacology & Therapeutics. 2024 Jun;115(6):1304-1315. <https://doi.org/10.1002/cpt.3194>

Recent interest has focused on use of real-world data to identify potential opportunities for drug repurposing. This study analysed data from an Australia-wide diabetes registry. The study compared patterns of hospitalisation among people who initiated SGLT-2 inhibitors and other newer diabetes medications. SGLT-2 inhibitors were associated with lower rates of hospitalisation for specific infections, anaemias and obstructive airway diseases. CMUS is now conducting further research into these novel associations.



THERAPEUTIC PROGRAM AREAS

Much of our collaborative work in drug discovery and development, and medicine use is disease agnostic, however, we have a particular focus in three main therapeutic areas:

- Cardiovascular and Metabolic Health,
- Global Health, and
- Neuroscience and Mental Health

In 2020 MIPS established the Therapeutic Program Areas (TPAs) to focus on these topics. By bringing together our collective expertise in these areas we are better able to develop medicines to address priority health needs, and to respond to targeted grant opportunities.

Within the TPAs we have major programs in neuropsychiatric disorders, chronic pain, addiction, metabolic disease, heart failure, fibrosis, antibiotic resistance and malaria.

The TPAs are led by established researchers in the Faculty and run a range of programs to build a community with shared research interests and are a forum to discuss relevant scientific developments and opportunities. They have both internal and external facing roles, generating a critical mass to address a particular therapeutic need and to connect MIPS with the broader ecosystem. These broader networks include the Australian Global Health Alliance, the Monash Neuroscience Committee, and the Victorian Cardiovascular Research Network.

Since their establishment in 2020 the TPAs have grown their communities through ‘Tea and Talk’ sessions where topics of common interest are presented by MIPS researchers, by holding seminars and symposia and by providing support to researchers through grant review and development and co-funding. Over the next few years we aim to broaden collaboration and engagement with end-users including clinicians, patients and industry partners.

CARDIOVASCULAR AND METABOLIC HEALTH

Co-leads: **Associate Professor Natalie Trevaskis** & **Dr Chengxue Helena Qin**

The expertise from MIPS in the Cardiovascular and Metabolic Health TPA encompasses medicinal chemistry, structural biology, analytical pharmacology, drug disposition, drug delivery, translational models of disease, and medicine use and safety.

We focus on understanding how excess nutrient consumption and non-functioning metabolic organs contribute to obesity, diabetes, metabolic associated steatotic liver disease and metabolic-associated cancers, thus enabling the development of improved treatments for metabolic-associated diseases.

We have broad expertise in delineating the underpinning mechanisms of cardiovascular disease and in developing new treatments for heart failure resulting from interruptions in coronary blood supply (such as in heart attack), diabetic cardiomyopathy, and cardiopulmonary disease, lymphatic disease, and ischemic stroke.



MAJOR ACTIVITIES OF 2024

EVENTS

- Hosted the MIPS Cardiovascular and Metabolic Health Symposium, Oct 2024. Approximately 50 attendees from MIPS, University of Melbourne, Victorian Heart Institute, Baker Institute, St Vincent’s Institute, La Trobe University, Monash Centre for Inflammatory disease and Alfred Medical Research Institute.
- Hosted the 3rd A.I.M. cardiovascular EMCR symposium, Oct 2024. This national event was co-hosted by ASCEPT Cardiovascular Special Interest Group, International Society for Heart Research, and MIPS Cardiovascular Health TPA

COMMUNITY BUILDING ACTIVITIES

- Tea & Talks (Angus Johnston, and Sam McNeil and Brian Cary from Denise Wooten and Patrick Sexton’s lab)
- Sarah Turpin-Nolan has continued to strengthen the relationship between MIPS and CSL.
- Ongoing networking opportunities at ASHRA (Australian Stroke and Heart Research Accelerator) and Victorian Heart Institute events, including seminars series and education and training workshops.



MAJOR AWARDS AND OTHER ACHIEVEMENTS IN 2024

- Thank you to Dr Lauren May for chairing the cardiovascular and metabolic health TPA from 2021-2024. Welcome Dr Chengxue Helena Qin as the new co-chair of the TPA from 2024.
- Congratulations to cardiovascular researcher Prof Rebecca Ritchie on being named 2024 ASCEPT Fellow
- Congratulations TPA members Dr Amandeep Kaur, Dr Jason Cao, A/Prof David Thal, Prof Arthur Christopoulos and Prof Mark Febbraio on receiving prestigious NHMRC Investigator Grants.
- Congratulations Dr Dana Hutchinson and team on receiving a NHMRC Ideas Grants for ‘Impact of biased agonism at the GLP-1R in the treatment of obesity and type 2 diabetes’
- Congratulations to Dr Chengxue Helena Qin and team receiving an NHMRC Development grant for the ‘Development of innovative small molecule for therapeutic interventions for pulmonary arterial hypertension’
- Congratulations to the ten MIPS led teams who were awarded ARC Discovery grants
- Congratulations A/Prof Natalie Trevaskis, Dr Michael Whittaker, Dr Amandeep Kaur, Prof Darren Creek and teams on receiving ARPA-H funding for projects focussed on ischemic stroke and lymphatic disease.



GLOBAL HEALTH

Co-leads: **Professor Darren Creek & Associate Professor Pete Lambert**

The Global Health TPA works to address inequities in health for people worldwide.

Our major activities focus on infectious diseases and maternal, child and reproductive health, along with capacity-building programs for pharmacy globally.

Our research ranges from the discovery of new drugs, vaccines and diagnostics, to improving medicines and treatment regimens to suit specific populations.

Existing collaborations operate in the Pacific, South and Southeast Asia and sub-Saharan Africa and we look to expand our reach further, aligning our activities with local, national and international frameworks to make a positive impact on global health.



MAJOR ACTIVITIES OF 2024

EVENTS

- Hosted the Victorian Infection and Immunity Network Young Investigator Symposium
- Hosted the Melbourne Malaria Seminar Series 2024
- Hosted the Global Health TPA Infectious Disease Symposium
- Supported the World Health Summit regional meeting (hosted by Monash in Melbourne)
- Supported the Molecular Approaches to Malaria Conference (Lorne)
- Invited participant at DFAT Indo-Pacific Regulatory Strengthening Programme partner meeting (Cambodia)

COMMUNITY BUILDING ACTIVITIES

- Dissemination of global health events and funding opportunities to TPA members
- Continued interaction with other global health leaders and initiatives across Monash (including Monash School of Public Health and Preventative Medicine, Monash Sustainable Development Institute, World Mosquito Program, and RISE). Discussions are ongoing to establish formal global health network within Monash
- Attendance at Burnet Institute/Doherty Institute/ Melbourne Children’s Global Health and the Nossal Institute Global Health Seminar series.

LOBBYING/NETWORK REPRESENTATION

- Continued membership of the Australian Global Health Alliance (and attendance at multiple events). Includes supporting development of AGHA statement in relation to discontinuation of USAID
- Membership of Victorian Infection and Immunity Network (and representation at events)
- Virtual attendance of World Health Summit meeting in Berlin
- Monash Quality of Medicines Initiative formalised as partner to DFAT Indo-Pacific Regulatory Strengthening Programme
- Representation on the Maternal Health Supplies Caucus (sub-group of Reproductive Health Supplies Coalition)

MAJOR AWARDS AND OTHER ACHIEVEMENTS IN 2024

- Research published by Monash Quality of Medicines Initiative informs new WHO guideline ‘WHO recommendations on the assessment of postpartum blood loss and use of a treatment bundle for postpartum haemorrhage’
- An international study, co-led by the Centre for Drug Candidate Optimisation has reported the discovery and preclinical development of a potential drug candidate to target leishmaniasis
- Medicines Manufacturing Innovation Centre receives grant from Cumming Global Centre for Pandemic Therapeutics Foundation for development of inhaled antivirals against respiratory viruses
- A study co-led by MIPS researcher, Associate Professor Cornelia Landersdorfer, used advanced data science to describe and predict for the first time when resistance to antibiotics will emerge during treatment for a bacterial infection, based purely on the knowledge of pre-existing bacterial resistance mutations
- Professor Michelle McIntosh receives Inspiring Leader award at the BioMelbourne Network Women in Leadership Awards
- MIPS scientists solve the molecular structure behind the primary receptor target associated with the development of a hormone-free, reversible male contraceptive pill
- Australia’s first mRNA COVID Vaccine, developed at MIPS, demonstrates ability to overcome immune imprinting
- A study co-led by MIPS researchers shows the efficacy of a novel LNP-mRNA vaccine in boosting immunity against tuberculosis.
- Our PhD students have completed field studies in Ethiopia (Teha Gebi), Nepal (Pooja Maharjan) and at the London School of Hygiene and Tropical Medicine (Annie Roys) to enhance our programs in malaria and medicines quality.
- Our Antimalarial Synergy Team involving Professors Creek, Charman and Scammells published two studies describing the mechanism of action of some promising new antimalarial candidates.

MOLECULAR APPROACHES TO MALARIA CONFERENCE (LORNE)



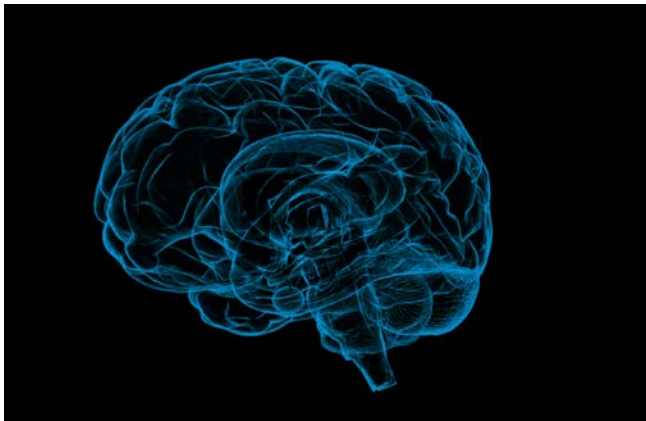
DFAT INDO-PACIFIC REGULATORY STRENGTHENING PROGRAMME PARTNERSHIP MEETING (SIEM REAP, CAMBODIA)



NEUROSCIENCE AND MENTAL HEALTH

Co-leads: **Dr Manuela Jörg & Dr Amanda Cross**

The Neuroscience and Mental Health TPA (Neuro TPA) aims to break down existing discipline-based research ‘silos’ to facilitate synergistic multidisciplinary teams to tackle unmet medical needs in psychiatry, neurodegeneration, pain, and other mental health conditions. To improve patients’ outcomes, we bring together experts in medicinal chemistry, structural biology, analytical pharmacology, drug disposition, translational models of disease and medicines use and safety. Additionally, we aim to increase the visibility of the excellent research of our members to a range of diverse, external stakeholders such as researchers, clinicians and consumers.



MAJOR ACTIVITIES OF 2024

Multiple events were organised by the Neuro TPA to increase the visibility of the research performed by our members, provide networking opportunities and support new collaborations.

This included:

- TPA Seminar Series
 - > Seminar 1 - Overview of the breadth of exciting Neuroscience and Mental Health research happening at MIPS, (Speakers: Ben Capuano, Joe Nicolazzo, Rebecca Ritchie and Simon Bell)
 - > Seminar 2 - Highlighting research within wider Monash Neuroscience Network, (Farshad Mansouri and Samuel Crossman)
- Dementia Australia Memory Walk/Jog 2024 – a team of researchers representing the Neuro TPA and Centre for Medicine Use and Safety participated in the Memory Walk/Jog in May 2024 and raised money for Dementia Australia.
- Students of Brain Research (SOBR) Networking Dinner – Neuro TPA sponsored this event and sponsored three PhD students to attend the networking dinner in September 2024.
- Consortium for Research in Eating Disorders (CoRe-ED) – Neuro TPA sponsored the inaugural event, hosted by a Neuro TPA member (Dr Monica Langiu) and held at Monash University Parkville in September 2024.
- End-of-the-Year Networking Event – MIPS Neuro TPA members gathered for a networking event in December 2024. The event included short talks from several TPA members and the announcement of the winners of the Publication Awards.
- Neuro TPA members also engaged in the wider Monash Neuroscience Network, including positions on the Monash Neuroscience Executive Committee and the Monash Neuroscience EMCR sub-committee.



TPA AWARD AND GRANT RECIPIENTS

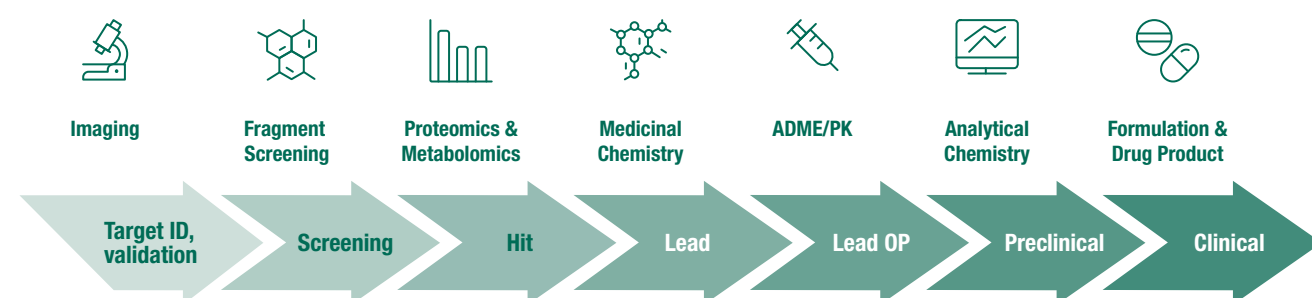
The Neuro TPA awards and funding opportunities recognise the excellent research of our members and support new collaborative and multidisciplinary research projects.

The 2024 recipients included:

- Neuroscience Team Publication Award recognising excellent neuroscience research led by a team at MIPS
 - > Boqun Liu, Geoff Thompson, Celine Valant and Peter J. Scammells
- Neuroscience Individual Publication Awards recognising excellent neuroscience research led by an individual at MIPS
 - > Amandeep Kaur
- MIPS TPA Discovery Accelerator Co-funding Program supports proof-of-concept, de-risking or capacity development studies. This program provides a mechanism to leverage co-funding opportunities and underpin the establishment of larger research programs.
 - > The 2024 recipients were Chris Langmead, Greg Stewart, Natalie Diepenhorst, Michelle Camerino (all MIPS), Jess Nithianantharajah (The Florey) who requested funding to use the Monash Fragment Platform’s capability in DNA-encoded library screening to identify novel GPR88 agonists for the orphan GPCR, GPR88.

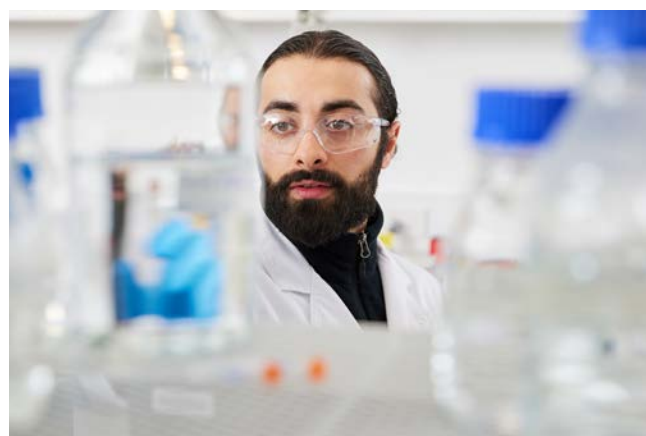
DRUG DISCOVERY RESEARCH PLATFORMS

Our Research Platforms provide the technology, equipment and expertise that underpins our research. They support internal and external drug discovery programs across all stages of drug discovery from hit identification to candidate selection.



The Platforms vary in how they engage with users - through arrangements that include collaboration, partnerships and fee-for-service.

The **Centre for Drug Candidate Optimisation (CDCO)** is a unique group within MIPS being both a Research Theme and a Research Platform. The CDCO supports academic and commercial drug discovery teams to provide expertise and infrastructure in physicochemical property evaluation, drug metabolism and pharmacokinetics for improved compound design, selection and progression. For information about the activities of the CDCO in 2024 see their Theme entry on page 40.



MONASH FRAGMENT PLATFORM

DIRECTOR: PROFESSOR MARTIN SCANLON

The Monash Fragment Platform (MFP) is a biophysical screening and characterisation facility that supports small molecule drug discovery as well as basic science research. MFP employs NMR, SPR, ITC, X-ray crystallography and other techniques to characterise molecular interactions across a wide affinity range and between diverse molecules such as small-molecules, peptides, proteins, RNA/DNAs, and antibodies. Screening for novel small molecule binders to therapeutic targets of interest is undertaken using DNA-encoded libraries (DEL) or fragment-based screening (FBS). FBS uses MFP's high-quality, in-house fragment library designed to maximise chemical space coverage and enable rapid hit optimisation. Additional support services in assay development, routine screening and characterisation of samples further supports translation and basic research in the academic and commercial scientific community.

MAJOR ACHIEVEMENTS OF 2024

In addition to FBS, we incorporated DEL screening as a complementary service developing our computational and AI tools as well as collaborations in the technology. Over the past 12 months, we successfully executed DEL screens for six targets for internal and external clients identifying novel chemical matter with appropriate binding profiles. These include membrane bound targets, soluble enzymes, protein-protein interactions of existing as well as novel drug targets.

To support DEL services, MFP acquired and implemented protocols for complex liquid handling and sample processing using a highly flexible OpenTrons robot. Automation of DEL bead binding tests and DEL selections has enabled higher throughput, more consistent and replicable experiments to be conducted. This acquisition further streamlines current services, allowing more automated sample handling and management.

We also celebrated the successful completion of Race Oncology's FTO (fat mass and obesity-associated) program. In 2022, Race Oncology engaged MFP for NMR-based fragment screens to identify unique structures that bind to the FTO or ALKBH5 proteins. After two years of collaboration, the program successfully completed in November.

In 2024, MFP supported five successful Therapeutic Innovation Australia voucher applications. These vouchers provided services including screening, medicinal chemistry, and biophysical interaction analysis, demonstrating our commitment to advancing drug discovery through comprehensive support and collaboration.

A highlight of the past year was co-hosting the prestigious Fragment-Based Lead Discovery Conference (FBLD) in Boston, USA, in September. After a six-year hiatus, this multidisciplinary conference returned to the US as an in-person event, attracting over 150 international delegates. The conference, co-organised by collaborators from the US and MFP members, provided a unique opportunity for experts in chemistry, biochemistry, and related disciplines to discuss the latest developments in the field. The FBLD conference facilitated the exchange of cutting-edge scientific knowledge and broadened our international network, fostering new collaborations and partnerships that will drive future innovations in drug discovery.

MFP along with the Australian Synchrotron are developing and implementing a high-throughput crystallographic fragment screening platform. The platform will accelerate development of fragment hits to leads by rapidly generating structural data to guide medicinal chemistry and lead molecule design. A high throughput crystal handling system has been installed at the Australian Synchrotron that supports preparation of 100's of crystals for data collection. X-ray diffraction data on these crystals are acquired using an AI augmented automatic and unattended data collection protocol. The Auto-Rickshaw crystal structure determination platform processes the data to generate models of the ligand bound structures. This pipeline increases throughput by almost 10-fold making fragment screening by crystallography at the Australian Synchrotron practical and efficient.

DRUG TARGET IDENTIFICATION PLATFORM

ACADEMIC LEADER: PROFESSOR DARREN CREEK

The Drug Target Identification Platform uses a range of cutting-edge metabolomics, lipidomics and proteomics capabilities to identify and deconvolute new drug targets, to elucidate mechanisms of drug action and to discover novel biomarkers of drug action. Our analytical methods are suitable for samples arising from cell culture, animal studies or clinical trials, and our workflows are ideally suited to targeted or untargeted comparative analyses.

MAJOR ACHIEVEMENTS OF 2024

Following significant renewal of capabilities in 2023 after successfully obtaining a competitive \$3M MRFF grant through the National Critical Infrastructure Initiative, Australia's first dedicated Drug Target Identification Platform (DTI) was established.

Our new, state of the art, Orbitrap Astral mass spectrometer has provided a 5-fold increase in sample throughput and unprecedented sensitivity and coverage for global proteomics analyses. In 2024, DTI started offering new specialised proteomics workflows that are suitable for deconvoluting drug-protein interactions for researchers at Monash and Australia-wide. Newly established workflows include solvent proteome profiling and the proteolytic stability assay which are sensitive techniques that allow the identification of protein targets in highly complex biological samples (cell lysates). The latter also allows elucidation of structural ligand-binding information to explore which regions of a protein may bind to a drug or other ligand, which is an excellent new tool for structural biology questions within the drug target ID space. We also expanded our range of immunoprecipitation workflows with new proximity assays based on biotinylation. As our research load increased, we also welcomed a new staff member, Dr Joshua Morrow, to support expanded proteomics capacity.

Metabolomics and small molecule bioanalysis were in demand for clinical studies, contributing to improving outcomes in human studies in the future. Key publications from our collaborators in 2024 used chemo proteomics to validate protein targets of novel anti-malarial drugs synthesised by MIPS researchers (eLife), lipidomics was used to investigate ceramide accumulation in chylomicrons and lymphatic transport upon high fat diet in mice (Science Advances), short chain fatty acids in the gut were shown to influence predisposition to cardiovascular disease in offspring (Circulation Research), and we demonstrated the application of multiplexed native mass spectrometry to determine ligand selectivity for fatty-acid binding proteins.



AUSTRALIAN TRANSLATIONAL MEDICINAL CHEMISTRY FACILITY

DIRECTOR: PROFESSOR PAUL STUPPLE

The ATMCF is a purpose-designed, outward-facing, collaborative facility that provides high-level medicinal chemistry know-how, both practical and theoretical, for translation of small molecules into therapeutic candidates. Supported by Therapeutic Innovation Australia via the National Collaborative Research Infrastructure Strategy, ATMCF provides medicinal chemistry insight, expertise and a translational bridge between early-stage biology and translational lead optimisation and pre-clinical development.

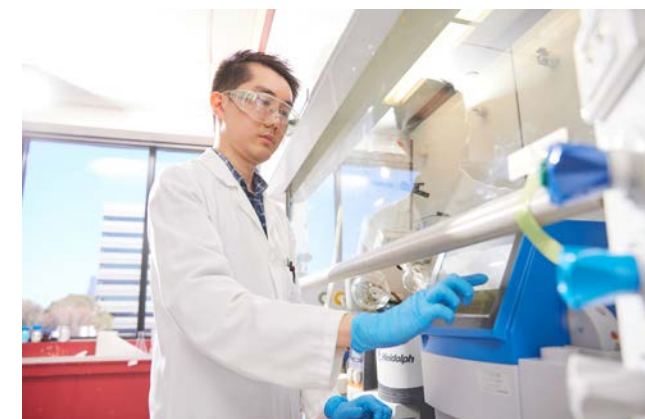
MAJOR ACHIEVEMENTS OF 2024

ATMCF and collaborating external partners were successful in a number of grants and funding opportunities towards the end of 2024, including an NHMRC Development Grant, and NHMRC Ideas Grant. There was also significant funding from MedChem Australia and BioCurate which commenced in late 2024/early 2025. These opportunities are great examples of the collaborative nature of the ATMCF and acknowledges the translational experience of the team in leading these proposals. All of these projects build on previous programs of work, and talk to the strength of the relationships the facility staff form with our collaborators.

The ATMCF provided the chemistry for three spin-out companies funded by CUREator, two of which are owned or part-owned by Monash. All three programs began their chemistry within the ATMCF on the back of the Therapeutic Innovation Australia Pipeline accelerator program. A number of industry-funded medicinal chemistry programs also began within the ATMCF in the second half of 2024. These opportunities are great examples of the facility driving translational outcomes, supporting medical research with commercial potential.

The ATMCF is further developing relationships across its client base to establish strategic partnerships on future projects, with the intent that further industry funded medicinal chemistry will be undertaken within the facility across 2025.

The ATMCF is conscious of the growing impact of AI-driven models in drug discovery and is in the process of assessing the capabilities of various tools that could support this. An essential part of the preparation for the development of such models is the use of databases to accurately store project data. The ATMCF continues to provide this amenity to collaborators through access to the CDD Vault software, for which the facility was awarded funding to assist in securing a 2-year license



HELEN MACPHERSON SMITH TRUST ANALYTICAL LABORATORY

DIRECTOR: PROFESSOR MICHELLE MCINTOSH

The Helen Macpherson Smith Trust (HMST) Analytical Laboratory is an open-access analytical facility that uses sophisticated physical and chemical characterisation techniques to overcome challenges faced in modern drug development. Academic and industry researchers can access a comprehensive suite of advanced chemical characterisation instruments.

MAJOR ACHIEVEMENTS OF 2024

The HMST Analytical Laboratory has supported numerous major research projects throughout 2024 through access to advanced instrumentation and method development, including supporting >\$35M in research grant income (44 research grants, 1-5 years) and >\$800K in contracted research services (direct translational research). The HMST Analytical Laboratory has provided advanced bioanalytical services for highly challenging drug development projects including developing validated, quantitative bioassays for novel metallic tumour imaging agents; assessing the stability of complex biotherapeutics to prevent drug waste; providing parallel validation of new, continuous drug monitoring medical devices; developing advanced, quantitative immune-precipitation assays for cardiovascular disease markers; and supporting the development of a 'mobile', on-site drug testing laboratory – all in collaboration with national and international pharmaceutical companies and start-ups. The laboratory has supported one invention disclosure in 2024 and two spin-outs that are taking the next step to translating their research discoveries.

The open-access laboratory has supported 107 researchers from across Victoria, with over 9,500 instrument hours, in a laboratory that offers extended access and a highly supportive technical team – a valuable combination that supports research success. The HMST Analytical Laboratory is providing new capabilities for complex analysis like HPLC-CAD, a benchtop MALDI-MS, nanoLC/HPLC-timsTOF MS and imaging (in collaboration with the Melbourne Centre for Nanofabrication).

MEDICINES MANUFACTURING INNOVATION CENTRE

DIRECTOR: PROFESSOR MICHELLE MCINTOSH

The Medicines Manufacturing Innovation Centre (MMIC) is a cutting-edge, industry-focused facility that supports the pharmaceutical and allied sectors in addressing diverse and often complex development challenges for both industry and institutional clients. Our expertise spans formulation development, physicochemical characterisation, scale-up manufacturing, and preclinical consultancy ensuring tailored support for diverse pharmaceutical needs.

MAJOR ACHIEVEMENTS OF 2024

OFFICIAL OPENING OF MMIC CLAYTON FACILITY

The MMIC's new \$9M facility was officially opened by the Honourable Ben Carroll MP, Deputy Premier of Victoria and Minister for Education and Medical Research and Vice Chancellor Professor Sharon Pickering. With increasing interest in respiratory delivery, especially around biological therapeutics and pandemic preparedness, the new facility includes specialty laboratories to enhance the MMIC's drug development and analytical capabilities.

Updated new equipment to assess the deposition of nasal sprays and scale up development of capsule-filled formulations, lyophilisation and rheological assessment of nebulised solutions have also been purchased to complement our new facilities whilst leveraging opportunities to provide capabilities in respiratory formulation and delivery

The opening of the new facility also coincided with the start of an exciting research partnership with the Cumming Global Centre for Pandemic Therapeutics based at the Peter Doherty Institute for Infection and Immunity. Together with MIPS colleagues, the MMIC was awarded a grant to support developing inhalable therapies with formulations designed to achieve maximal airway coverage.



ENGAGEMENT WITH INDUSTRY AND TRAINING

As an innovation centre, the MMIC continues to engage with the pharmaceutical, medtech and biotech sectors through advanced preclinical services. The MMIC completed more industry projects in 2024, up 41% compared to the previous year, focusing on solubility screening, targeted drug delivery, and inhaled delivery technologies, including our ongoing support of the WHO Biowaiver program. Our innovative contributions to industry were recently recognised with our director, Professor Michelle McIntosh, being awarded the prestigious BioMelbourne Network Women in Leadership Award - Inspiring Leadership.

As part of the MMIC's workforce development and industry engagement, we hosted 13 students throughout 2024 as part of our internship program including, for the first time, industry placements for the MPharmSci degree. The MMIC internship program continues to be recognised for its contribution to providing participants with industry relevant experience. The success of the program was reflected in a nomination for the Vice-Chancellor's Excellence Awards for Industry Education. This recognition highlights our commitment to collaborating with industry, with plans to further expand and enhance the program over the next 12 months.



IMAGING, FACS & ANALYSIS CORE

LEADER: CAMERON NOWELL

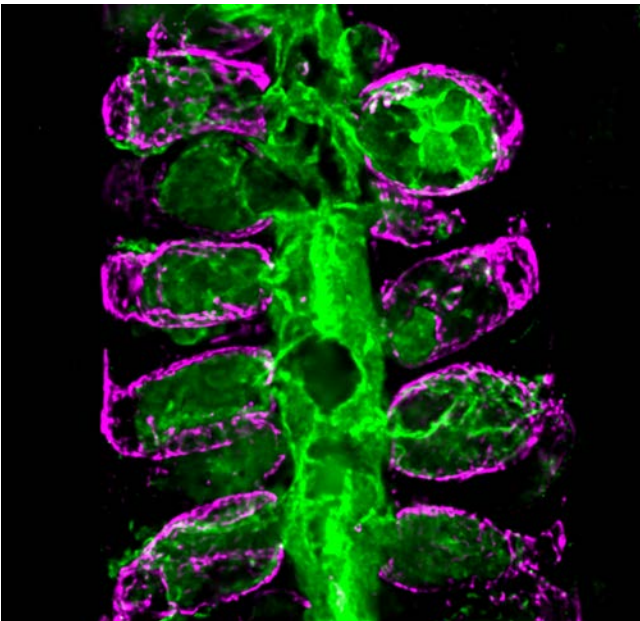
Imaging, FACS & Analysis Core (IFAC) uses the latest imaging, flow cytometry and analysis platforms for samples ranging from single molecules to whole animals. Our extensive range of ultra-precision microscopes include widefield, high throughput, holographic, hyperspectral, electron, super-resolution, confocal, multiphoton, lifetime imaging and label free. We also provide analytical and sorting flow cytometry capabilities. Advanced image and data analysis is also available, providing users with bespoke analysis pipeline development that leverage traditional and new generation (AI/ML) approaches.

MAJOR ACHIEVEMENTS/SCIENCE OF 2024

At the start of 2024 IFAC hired Matthew Rowe on a part time basis to help cover support, training and image analysis. Matt is currently a PhD student within the Integrated Neurogenic Mechanisms lab.

IFAC has continued to support imaging, FACS and analysis for both MIPS and external (national and international) users through support for project design, instrument training, technique development and custom analysis pipelines. The facility is now recognised within the imaging community as the go to place for trying something a little different or to develop unique pipelines for imaging and analysis. IFAC staff have also run numerous workshops on image analysis across Australia (Sydney Uni, Adelaide Uni) and internationally (A*STAR Singapore) to a range of students, ECR and senior researchers.

2024 saw IFAC support 176 users across 32 technology platforms for a total of 12,500 hours over 6,700 individual sessions. Facility staff were authors on 16 publications with MIPS researchers and national and international collaborators.

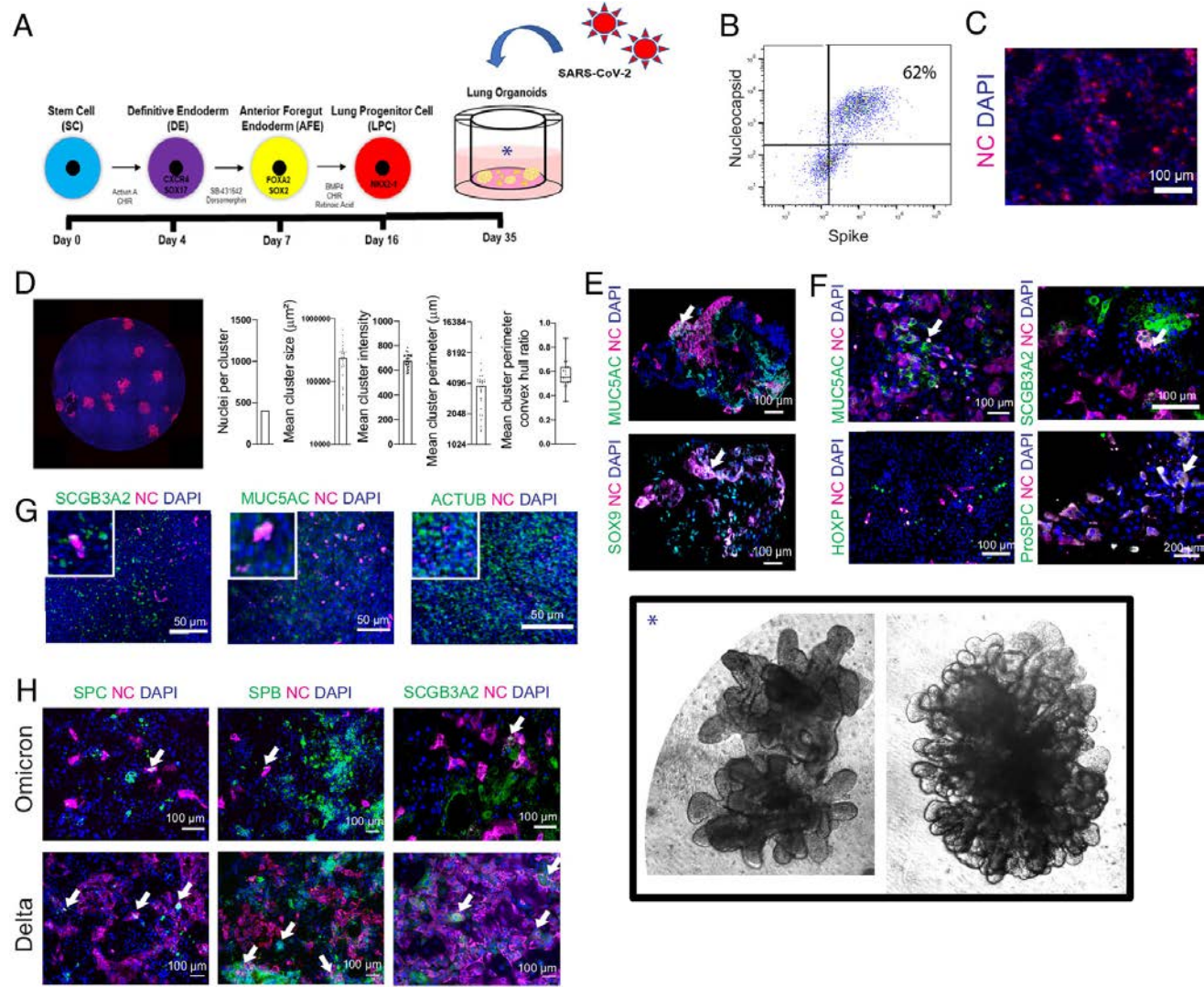
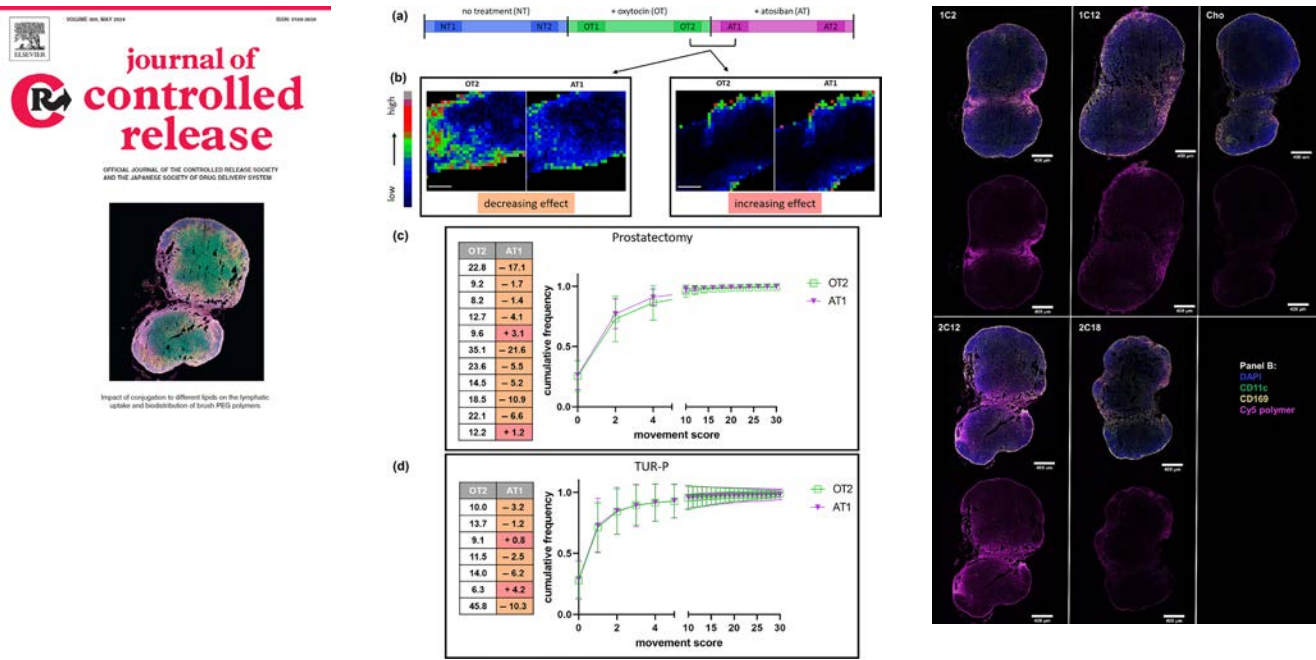


Images and analyses from the Platform have contributed to significant publications (clockwise from top left):

Abdallah M, Lin L, Styles IK, Mörsdorf A, Grace JL, Gracia, Landersdorfer CB, Nowell CJ, Quinn JF, Whittaker MR, Trevaskis NL, Impact of conjugation to different lipids on the lymphatic uptake and biodistribution of brush PEG polymers, *Journal of Controlled Release*, Volume 369, 2024, Pages 146-162, <https://doi.org/10.1016/j.jconrel.2024.03.032>
Images from this publication were also featured on the issue cover.

Bester B, Koslowa K, Gronau A-C, Mieten, A, Nowell CJ, Whittaker MR, Pilatz A, Wagenlehner F, Exintaris B, & Middendorff R (2024). The oxytocin antagonist cligosiban reduces human prostate contractility: Implications for the treatment of benign prostatic hyperplasia. *British Journal of Pharmacology*, 181(16), 2869–2885. <https://doi.org/10.1111/bph.16369>

Leibel SL, McVicar RN, Murad R, Kwong EM, Clark AE, Alvarado A, Grimmig BA, Nuryyev R, Young RE, Lee JC, Peng W, Zhu YP, Griffis E, Nowell CJ, James B, Alarcon S, Malhotra A, Gearing LJ, Hertzog PJ, ... & Snyder EY, A therapy for suppressing canonical and noncanonical SARS-CoV-2 viral entry and an intrinsic intrapulmonary inflammatory response, *Proceeding of the National Academy of Sciences*. 121 (30) e2408109121, <https://doi.org/10.1073/pnas.2408109121>



NATIONAL COLLABORATIONS

MIPS is a national leader in research and translation. We partner with other experts to bring together teams to deliver training and commercialisation outcomes to benefit human health.

The Australian Research Council Industrial Transformation Research Program supports university researchers to partner with industry in priority areas for Australia. Through the program's Industrial Transformation Training Centres (ITTCs) they support higher degree by research students and postdoctoral researchers to gain practical skills and experience through placements with industry. MIPS is proud to host the headquarters of two ITTCs - the Centre for Fragment Based Design, and the Centre for Cryo-electron Microscopy of Membrane Proteins - and is a participant in three other ITTCs - the Centre for Personalised Therapeutics Technologies, the Centre for Next-Generation Technologies in Biomedical Analysis, and the Centre for Cell and Tissue Engineering Technologies. In the middle of 2024, it was announced that the Research Hub for Molecular Biosensors at Point-Of-Use (MOBIUS) had been awarded \$4.7M to accelerate the growth of Australia's biosensing industry. This Research Hub is also part of the ARC's Industrial Transformation Program, and MIPS is pleased to be part of this collaborative program, led by La Trobe University.

State and Federal Governments are investing in research and development programs led by MIPS. mRNA Victoria has funded the Victorian mRNA Innovation Hub hosted by MIPS, to develop next-generation mRNA vaccines and therapeutics. MIPS is also contributing to a number of other mRNA vaccine and antiviral therapeutic programs funded by mRNA Victoria. Through the Medical Research Future Fund National Critical Research Infrastructure program we are leading MedChem Australia, a partnership with WEHI, the University of Sydney, and Therapeutic Innovation Australia to accelerate early stage drug discovery projects towards clinical trials and new medicines. The National Critical Research Infrastructure program has also funded the Drug Target Identification Platform at MIPS - see page 64 for more information on that platform.

MAJOR ACHIEVEMENTS OF CFBD MEMBERS IN 2024

CENTRE FOR FRAGMENT BASED DESIGN

DIRECTOR: PROFESSOR MARTIN SCANLON

The Centre for Fragment-Based Design (CFBD) is an Australian Research Council Industrial Transformation Training Centre. CFBD is a national multi-disciplinary training centre for identifying novel ligands for a range of protein targets, with collaborators from Griffith University and the University of Sydney and research partners including ANSTO, CSIRO, Cytiva, and Vernalis.



MAJOR ACTIVITIES IN 2024

2024 marked the final fully operating year for CBFD, concluding five years of interdisciplinary research across three nodes and industry partners. To prepare our members for their next career steps, we organised various training sessions, including an ITTC Career Day with Monash Parkville's Training Centre for Cryo-electron Microscopy of Membrane Proteins (CCeMMP), SEAM, ARC CMIT, ARC CTET, and ARC CPTT. This workshop provided students and postdocs with new ideas and guidance for their future careers, offering opportunities to connect with individuals who have pursued non-traditional career paths.

In June, we hosted the FBDD_DU conference in Brisbane from 25 to 27 June, bringing together biologists, biochemists, biophysicists, and chemists from academia and industry to discuss the latest techniques and progress in fragment-based drug design. This event coincided with the Centre's final research forum, reflecting on five years of collaboration and research.

In March 2024, Centre Director Professor Martin Scanlon was appointed Theme Leader for the Medicinal Chemistry Theme. His group has made fundamental contributions to the design of screening libraries and the evaluation and ranking of 'hit' fragments. Prof Scanlon is a dedicated educator contributing to both undergraduate and postgraduate teaching in the Faculty.

We are also proud to share that CFBD Chief Investigator Professor Sally-Ann Poulsen (Griffith University) received the RACI 2024 Margaret Sheil Leadership Award recognising outstanding female leaders in chemistry-related fields. This includes academia, teaching, and the public or private sector. This award honors those who inspire and mentor junior female chemists and promote workplace equity. It includes a medal and support for a lecture tour within Australia to inspire the next generation.



A special research achievement this year was Karol Sanches' project on the Kv1.3 potassium channel inhibitor. Ion channels, found in all living organisms, play crucial roles in cell functions. Voltage-gated potassium channels (KV) help control potassium ion flow and cell electrical activity. Human T cells, part of the immune system, express varying levels of Kv1.3 and KCa3.1 channels. Kv1.3 is higher in certain active T cells, making it a target for treating autoimmune diseases by blocking these channels.

In the brain, immune cells called microglia increase Kv1.3 levels during inflammation. Blocking Kv1.3 can reduce brain inflammation and improve conditions like Alzheimer's. Animal venoms contain peptides that can block Kv channels, with some being very selective for Kv1.3.

The main goal of this project was to develop an efficient way to study how peptide toxins interact with the Kv1.3 channel. The group used a single-celled organism, *Tetrahymena thermophila*, to produce labelled Kv1.3 for detailed analysis. This method is a significant step forward and can be used for other challenging targets. Karol (under the supervision of Prof Ray Norton) also labelled a Kv1.3 blocker to study its binding to the channel. Overall, they produced Kv1.3 in *Tetrahymena thermophila*, tested its suitability for detailed studies, and explored labelling techniques for further analysis. This approach could help develop new drugs targeting ion channels.

CENTRE FOR CRYO-ELECTRON MICROSCOPY OF MEMBRANE PROTEINS

DIRECTOR: PROFESSOR PATRICK SEXTON

The Australian Research Council Centre for Cryo-electron Microscopy of Membrane Proteins, CCeMMP, focuses on training industry-ready, world class graduates in cryo-electron microscopy of membrane proteins. It is a collaboration between MIPS, WEHI, The University of Melbourne, and The University of Wollongong alongside 15 educational and industry partners.



MAJOR ACTIVITIES IN 2024

In 2024, the Centre ran a 2-day CCeMMP Research Symposium with 137 attendees that hosted an international and national keynote speaker, with 13 presentations selected from members, students, industry partner and the local scientific community and 33 poster presentations.

The Centre also held its annual EduWeek, delivering 7 professional development workshops and an additional 11 professional and scientific workshops throughout the year to members and the scientific community to promote networking, collaboration and skill-building.

The Centre saw four students complete their 3-month industry placements with three of our industry partners, Astex (Cambridge, UK), AstraZeneca (Cambridge, UK) and Boehringer Ingelheim (Biberach, Germany), while one student continued to do 1 day per week with local partner, Dimerix (Fitzroy).

The Centre continues outreach activities to the scientific community through quarterly newsletters highlighting achievements and activities and by delivering regular monthly seminars with expert domestic and international speakers and additional special seminars to host European experts. In 2024, we ran the inaugural Bench to Art competition where members and the scientific community entered their scientific images (of a membrane protein or other protein visualised by cryo-electron microscopy) as art. There were 28 entries from around the world that were judged by three experts, as well as a People's Choice award.



Image caption: From Isabella Russell, CCeMMP PhD student, with industry partner AstraZeneca. Class A Orphan receptor, GPR3, with a potential lipid ligand, represented by the fatty acid chain shown as white spheres, bound within a hydrophobic groove. Image rendered by Dr Sarah Piper.

MAJOR ACHIEVEMENTS OF CCEMMP MEMBERS IN 2024

- Professor Renae Ryan - the International Award from the Biochemical Society
- Professor Arthur Christopoulos - Louis S. Goodman & Alfred Gilman Award in Receptor Pharmacology (ASPET)
- Professor Arthur Christopoulos - ASCEPT Lecturer Award
- Professor Patrick Sexton - NHMRC Peter Doherty Award (Leadership)
- Professor Denise Wootten - NHMRC Elizabeth Blackburn Award (Basic Science)
- Professor Denise Wootten - Researcher of the Year: Vice-Chancellor's Excellence Awards (Monash University)
- Professor Denise Wootten - Faculty Research Award (Faculty of Pharmacy and Pharmaceutical Sciences)
- Professor Chris Langmead and Dr Greg Stewart - Award for Excellence in Research Enterprise and/or Commercialisation: Vice-Chancellor's Excellence Awards (Monash University)
- Professor Chris Langmead and Dr Greg Stewart - the Faculty Award for Research Enterprise (Faculty of Pharmacy and Pharmaceutical Sciences)
- Early career researchers, Dr Cindy Zhang and Dr Jason Cao, were both recognised with the Anders Award (Lorne Proteins), with Dr Cindy Zhang also receiving the ASCEPT Bellberry New Investigator Award and Dr Jason Cao the Mollie Hollman Medal
- Professors Patrick Sexton and Arthur Christopoulos – Clarivate Highly Cited Researchers 2024
- CCeMMP members were awarded over \$10.2 million in competitive funding from grants, over \$10 million in industry funding
- 45 publications; 3 preprints; 11 updated publications
- 20 international and 10 domestic conference talks, 6 presentations to industry, 61 academic presentations and 79 poster presentations (42 at international and national conferences and 37 at local meetings)
- 40 solved structures deposited, including a structure from one of our PhD students

NEUROMEDICINES DISCOVERY CENTRE

LEADER: PROFESSOR CHRIS LANGMEAD

The Neuromedicines Discovery Centre (NDC) is focussed on the discovery, development, and use of medicines to address significant unmet medical needs across neuropsychiatric conditions, including schizophrenia, depression, substance-use disorders, eating disorders and PTSD.

The NDC's primary focus is on new drug discovery and development, but also encompasses research as broad as guideline development for clinical practice and community and decision-maker stakeholder engagement. Working closely with the University of Melbourne and the Florey Institute of Neuroscience and Mental Health, our achievements in 2024 cemented the NDC's and MIPS' role as a leader in new medicines development in this sector.

MAJOR RESEARCH & ACHIEVEMENTS OF 2024

- Accelerating drug discovery for schizophrenia and impaired cognition: In December 2024 the NDC's first spinout company, Phrenix Therapeutics, secured syndicated seed investment from Curie.Bio (USA) and Brandon Capital (Australia) to accelerate the development of its pipeline of therapeutics targeting complex psychiatric, neurological, and cognitive disorders. Led by co-founders Prof Chris Langmead, Dr Greg Stewart, and A/Prof Jess Nithianantharajah (Florey), the company is using state-of-the-art technologies to optimise small molecule therapeutics that specifically target cognition and co-morbid symptoms for patients with schizophrenia and other neuropsychiatric conditions.
- Supporting the science for new drug approval: In September 2024 the US FDA approved a new drug, Cobenfy, for the treatment of schizophrenia. Over the last decade, NDC and MIPS researchers have collaborated with Cobenfy's developers on the basic science and contributed to the understanding of its mechanisms of action and therapeutic potential.
- Development of clinical practice guidelines: In collaboration with the Centre for Medicines Use and Safety, the Florey, the University of Melbourne, and with thanks to a generous philanthropic donation to the NDC and Faculty, the NDC is developing clinical practice guidelines for the use of MDMA-assisted psychotherapy to treat post-traumatic stress disorder. The collaborative group recently published an overview of systematic reviews and meta-analyses in the Australian & New Zealand Journal of Psychiatry.
- The potential of psychedelic medicines in eating disorders. The NDC's Dr Claire Foldi, based at the Biomedicine Discovery Institute at Clayton, published an impactful study showing that the psychedelic medicine, psilocybin, is effective in reducing development of an anorexia-like phenotype in female rats by increasing cognitive flexibility.

OTHER ACHIEVEMENTS OF 2024

The NDC's Director, Prof Chris Langmead, contributed to several scientific, regulatory, community, and student events including:

- Panellist at the Consortium for Research in Eating Disorders (CoRe-ED) launch, addressing the question 'How do we best translate research along every step of the research pipeline so it reaches those who will benefit?'
- Keynote speaker at the Students of Brain Research Dinner, speaking to the challenge of 'Translating the Brain: Bridging Minds and Medicine' and the role of lived and living experience in research.
- Webinar presentation to the Therapeutic Goods Administration, providing a field-leading update on 'Next generation neuromedicines: from psychedelics to antipsychotics.'
- Chairing an expert panel discussion on 'Psychedelics in psychiatric disorders: Where are we now and where to next?' at AusBiotech

In February 2024, Prof Chris Langmead and Dr Greg Stewart visited New York and Boston (USA) to promote the NDC and its spinout ventures to both investors and industry.

MAJOR AWARDS AND OTHER ACHIEVEMENTS OF 2024

- The NDC's second spinout company, Pacalis Therapeutics, co-founded by Prof Chris Langmead and Prof Arthur Christopoulos, was the joint winner of AusBiotech 2024's Early-Stage Innovation Forum for its work on developing new mental health therapeutics targeting serotonin receptors.
- In October 2024, Professor Chris Langmead and Dr Greg Stewart were awarded both the Faculty of Pharmacy and Pharmaceutical Sciences and Vice-Chancellor's Award for Excellence in Research Enterprise and/or Commercialisation for their program of work 'Translation and commercialisation of neuromedicines'.



MEDCHEM AUSTRALIA

DIRECTOR: PROFESSOR BRENDON MONAHAN

Led by the Monash Institute of Pharmaceutical Sciences, MedChem Australia is the nation's first dedicated initiative aimed at breaking down capability barriers by providing subsidised medicinal chemistry expertise to promising drug discovery programs.

MAJOR ACTIVITIES IN 2024

The focus for 2024 was operationalisation, with project selection at its core. After conducting an independent and competitive application process, MedChem Australia announced its inaugural Round 1 projects in July 2024. These projects address a range of diseases, highlighting the initiative's role in advancing drug discovery in Australia.

Applications were received from universities and research institutes across four states, spanning eight therapeutic areas with significant unmet needs. Following rigorous assessment by the independent Selection and Review Committee, six projects were selected—three as 'Portfolio Projects' and three as 'Pilot Projects.'

Portfolio Projects receive substantial medicinal chemistry and DMPK support, with an 80% subsidy. Pilot Projects receive mentorship, advice and other support, with the aim to progress toward being 'Portfolio Project' ready. Each selected project exemplifies MedChem Australia's mission to translate cutting-edge research into tangible drug discovery advancements, tackling diseases such as cancer, heart disease, a paediatric genetic disorder, hearing loss, and obesity.



Established in 2023, MedChem Australia is committed to translating innovative biomedical research into new medicines and commercial opportunities. By connecting outstanding Australian science with world-class medicinal chemistry and DMPK expertise, MedChem Australia provides a critical bridge between research and real-world impact. Headquartered at MIPS in Parkville, the initiative is a partnership between Monash University, WEHI, the University of Sydney, with support from the Australian Government's Medical Research Future Fund and Therapeutic Innovation Australia.

ROUND 1 PORTFOLIO PROJECTS:

- **Development of HCK-inhibitors** to enhance anti-cancer immune checkpoint response and treat chronic lung inflammation (Olivia Newton-John Cancer Research Institute, La Trobe School of Cancer Medicine) – Prof Matthias Ernst
- **A novel GPCR-biased agonist for heart failure with preserved ejection fraction** (Monash University) – Prof Rebecca Ritchie, Dr Chengxue Helena Qin
- **Epigenetic approach to treating Prader-Willi Syndrome** (WEHI) – Prof Marnie Blewitt, Prof James Murphy, Dr Nicholas Liau

ROUND 1 PILOT PROJECTS:

- **Selective targeting of oncogenic JNK** signalling (Garvan Institute of Medical Research) – A/Prof David Croucher, Prof Jonathan Morris, Dr Sharissa Latham.
- **Development of a new protein kinase inhibitor for metabolic disease** (St Vincent's Institute of Medical Research) – Dr Kim Loh
- **Novel small molecules for treating sensorineural hearing loss** (Ear Science Institute Australia) – A/Prof Elaine Wong

The second round of MedChem Australia applications opened in November 2024 and closed in February 2025, with assessments currently underway. Public announcements of Round 2 projects are expected in June 2025.

Beyond project selection, MedChem Australia remains deeply engaged with the research community. Prof Brendon Monahan has met with numerous researchers to discuss potential projects, reinforcing the initiative's commitment to supporting innovative drug discovery. The strong interest in MedChem Australia underscores the critical need for this initiative.



mRNA INITIATIVES

The Monash Institute of Pharmaceutical Sciences is committed to building a strong future for mRNA therapeutics. In 2024 we expanded our innovation initiatives and capacity to build a diverse range of interconnecting platforms, that support and expedite the development and success of mRNA medicines.



MAJOR ACTIVITIES OF 2024

NATIONAL CENTRE FOR BIOPHARMACEUTICAL OPTIMISATION OF mRNA THERAPEUTICS

2024 saw the growth of mRNA initiatives at MIPS with the establishment of the National Centre for Biopharmaceutical Optimisation of mRNA Therapeutics (CORTx). Supported by a \$4 million grant from the Medical Research Future Fund (MRFF), CORTx collaborates with Moderna, iCamuno, and prominent academic institutions to advance mRNA delivery systems. CORTx is leading technology and innovation of mRNA therapeutics, enhancing delivery specificity and cellular uptake by engineering lipid nanoparticles with versatile proprietary targeting agents developed at MIPS, focusing on diseases including cancer, diabetes, and inflammatory bowel disease. CORTx has strong collaborative ties with mRNA Core, the Victorian mRNA Innovation Hub (VMIH) and the Monash-Moderna Quantitative Pharmacology Accelerator (MMQPA). CORTx is uniquely placed as a dynamic and versatile platform for the development of next-generation mRNA therapeutics.

VICTORIAN mRNA INNOVATION HUB

Also headquartered at MIPS, the Victorian mRNA Innovation Hub (VMIH) has evolved into a foundation for innovative technology development for mRNA therapeutics. As of 2024, VMIH-associated research activities have seeded new grant-funded projects totalling more than \$17 million, has engaged three industrial collaborations, secured three invention disclosures, and published eight peer-reviewed publications. Established in 2023 with funding from the Victorian State Government via mRNA Victoria, the VMIH spans MIPS, the Monash Biomedicine Discovery Institute, the University of Melbourne and the Doherty Institute. The VMIH continues to drive collaborative research to addresses critical health priorities including respiratory and immunosuppressive viruses, neurological diseases, in addition to building mRNA technologies of the future. The VMIH works closely with mRNA Core and CORTx, cross-feeding knowledge to synergistically improve the development of mRNA medicines.

mRNA CORE

MIPS is also home to mRNA Core. Supported by a \$5 million MRFF mRNA Clinical Trials Enabling Grant in 2023 and Therapeutics Innovation Australia, mRNA Core serves as a catalyst for advancing next-generation mRNA therapeutics by providing comprehensive support to over >20 Australian research groups. It offers a pipeline for critical resources, including RNA materials, expert guidance on experimental design, and optimisation of mRNA delivery systems leading to clinical applications. mRNA Core explores a vast array of therapeutic possibilities, including vaccines, cardiovascular treatments, and interventions for rare genetic diseases. mRNA Core collaborates with national research entities to enhance mRNA technology, focusing on refining delivery mechanisms and therapeutic efficacy.



MONASH-MODERNA QUANTITATIVE PHARMACOLOGY ACCELERATOR

The Monash-Moderna Quantitative Pharmacology Accelerator (MMQPA) supported by Moderna funding (\$3 million over 5 years) aims to revolutionise mRNA medicines using quantitative pharmacology methodologies. The team at Monash University, in collaboration with Moderna, leverages advanced quantitative pharmacology techniques to accelerate the development of mRNA-based vaccines and therapeutics. In 2024, the MMQPA was highlighted at the ASCEPT-APFP-APSA conference in a presentation on MMQPA capabilities, collaboration models and translational mRNA therapeutics. Additionally, an abstract led by MMQPA, in collaboration with CORTx, was awarded the Top Poster Ribbon at the American Society for Clinical Pharmacology and Therapeutics (ASCP) at the ASCPT Annual Meeting in May 2025. Mathematical modelling conducted by the MMQPA team has substantially informed decision-making for key Moderna mRNA development programs.

MAJOR AWARDS COMMENCING IN 2025

Also in 2024, Assoc. Prof Natalie Trevaskis and Prof Colin Pouton in collaboration with WEHI, UNSW and the University of Melbourne were awarded a \$5 million NHMRC Synergy grant to reimagine mRNA vaccine design to promote long-term, durable immune protection against emerging and evolving respiratory viruses, such as Influenza and COVID. The multidisciplinary team will be working with mRNA Core in the future to establish mechanistic 'rules' to produce the first unified model of long-lived vaccine response and to expedite the translation of next-generation vaccines with universal efficacy.

MAJOR FUNDING AWARDS IN 2024

- MRFF \$4 million: National Centre for Biopharmaceutical Optimisation of mRNA Therapeutics (CORTx)
- NHMRC Synergy \$5 million: A mechanistic approach to next-generation vaccine design. Assoc. Prof Joanna Groom (WEHI), Assoc. Prof Natalie Trevaskis (MIPS), Assoc. Prof Adam Wheatley (Doherty Institute), Assoc. Prof Deborah Cromer (UNSW), Prof Colin Pouton (MIPS).



INTERNAL INITIATIVES TO GROW AND SUPPORT OUR STAFF AND STUDENT COMMUNITY

Both the Faculty and MIPS benefit from an extraordinarily active and engaged and diverse staff and student community. This is exemplified by the *Early- and Mid-Career Researchers Committee* (EMCR Committee), *Her Research Matters* (HRM), and *Multicultural Outreach and Support for Advancement, Inclusion and Community* (MOSAIC). Each group has been established to represent and build a community in their areas, respectively EMCRs, research staff and students who are women, and staff and students of colour.

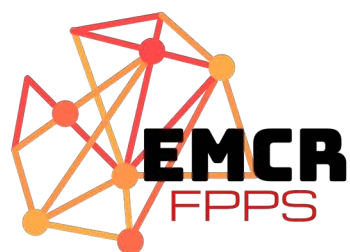
MIPS applauds the dedicated members of each group and recognises the challenges that they are working to help us address. Through their considerable efforts we have a growing community of young researchers, a pleasing number of whom are women. MOSAIC has recently been established to help improve cultural and linguistic diversity across the Institute.

EARLY AND MID-CAREER RESEARCHER COMMITTEE

The early and mid-career researchers' (EMCR) committee represents the community of developing researchers in the Faculty. The Committee promotes and runs specialised training programs and organises events to enable the exchange of scientific ideas and generate new collaborations.

MAJOR ACTIVITIES OF 2024

We are pleased to report that 2024 was a successful year for the FPPS EMCR committee in supporting and facilitating connections within the MIPS EMCR community, achieved through a series of professional and social events. These included 2 FASTtrack workshops and 3 social events. The first FASTtrack workshop was held in July on establishing collaborations for grant applications, featuring 3 invited speakers from within MIPS, and the second in September focusing on crafting an ARC application (delivered by Empirical Careers). Our mid-year Trivia Night was held in conjunction with the Parkville Postgraduate Association and was very well-received. As always, our welcome lunch (March) and EOY celebration (December) provided a friendly and informal space for EMCR networking.



The committee has continued our engagement with the broader EMCR community in the Parkville precinct through our involvement in 3 inter-institute social events (April, July, October) and the Melbourne Emerging Leaders in Biomedical Research (MELBR) Symposium, which saw >120 participants (including 18 from MIPS) across 12 leading research institutes in Melbourne gather at the Florey in September for a day of stimulating keynotes, EMCR presentations and panel discussions. In November, we held a joint mentoring and collaboration workshop (delivered by Mind Your Way and attended by 30 MIPS researchers and HDR students) with Her Research Matters, Parkville Postgraduate Association, MOSAIC and the Faculty Research Office, and the success of this event has encouraged us to explore additional opportunities for co-hosted events in 2025.



HER RESEARCH MATTERS

Her Research Matters (HRM) is a grassroots driven, outcome focused collective within the Faculty that promotes, sponsors and fosters an inclusive and equitable leadership environment empowering all women to reach their full potential.

MAJOR ACTIVITIES OF 2024

HRM had a productive and exciting 2024, organising ten events and coordinating reviews of grant and promotion applications to support our members. We were pleased to collaborate with Multicultural Outreach and Support for Advancement, Inclusion and Community (MOSAIC), the Early-Mid Career Researchers (EMCR) committee, Dose of Pharma, Parkville Postgraduate Association (PPA) and Dr Betty Exintaris (Associate Dean Equity, Diversity and Inclusion) in hosting events and contributing as allies to their mission.

EQUITY, DIVERSITY AND INCLUSION

In April, we held a Re-launch Event to reintroduce HRM's mission, clusters and themes through a networking lunch, featuring a keynote address on improving research culture by Prof Francine Marques. Then during Pride Week, in collaboration with the PPA and Dose of Pharma, we hosted the IDAHOBIT Panel: No One Left Behind. The event spotlighted equality and justice in research for the LGBTQIA+ community, with panel discussions later released as a podcast. We also hosted with Dose of Pharma, MOSAIC, and PPA another panel for Diversity and Inclusion Week, focusing on overcoming adversity in STEM, with insights released as a podcast. In August, our 'Embracing Diversity: Transforming Drug Development and Usage' Panel addressed sex, gender, genetic and ethnic considerations in medical research and education.



PROFESSIONAL DEVELOPMENT

HRM contributed to a four-hour mentoring workshop in partnership with the Faculty Research Office, the EMCR Committee, MOSAIC, and PPA, titled 'How to Build Your Circle of Mentors and Collaborators to Drive Your Professional Growth', designed to help participants strengthen their professional networks. We also organised a coffee catch-up to facilitate networking among members. In September, our ARC grant-writing workshop provided targeted advice on preparing competitive grant applications. We also continued to offer grant and academic promotion application reviews throughout the year to assist HRM members with this process.

SPONSORSHIP

HRM proudly sponsored Dr Anh TN Nguyen and Dr Monica Langiu to attend Science Meets Parliament in Canberra, where participants explored the intersection of science and government and the role of research in policy making. We concluded the year with our Annual General Meeting, celebrating key achievements, electing a new board and setting goals for 2025. We were also delighted to announce the winners of our inaugural HRM Impact Award for 2024, Associate Professor Natalie Trevaskis and Dr Simona Carbone. This award was created to recognise and celebrate the achievements of those contributing to an environment supporting women in research.

HRM extends its gratitude to our board members, general members and allies for your continued support and engagement throughout 2024. We look forward to another year of growth, collaboration and advocacy.



MULTICULTURAL OUTREACH AND SUPPORT FOR ADVANCEMENT, INCLUSION AND COMMUNITY

Multicultural Outreach and Support for Advancement, Inclusion and Community (MOSAIC) is a support network in the Faculty for people of colour, including those of culturally and linguistically diverse backgrounds, with the goal to increase representation of traditionally marginalised communities in decision-making groups and leadership positions.

MAJOR ACTIVITIES OF 2024

MOSAIC had a transformative 2024, growing its membership from 28 to 40 and strengthening its presence as a vital network within MIPS.

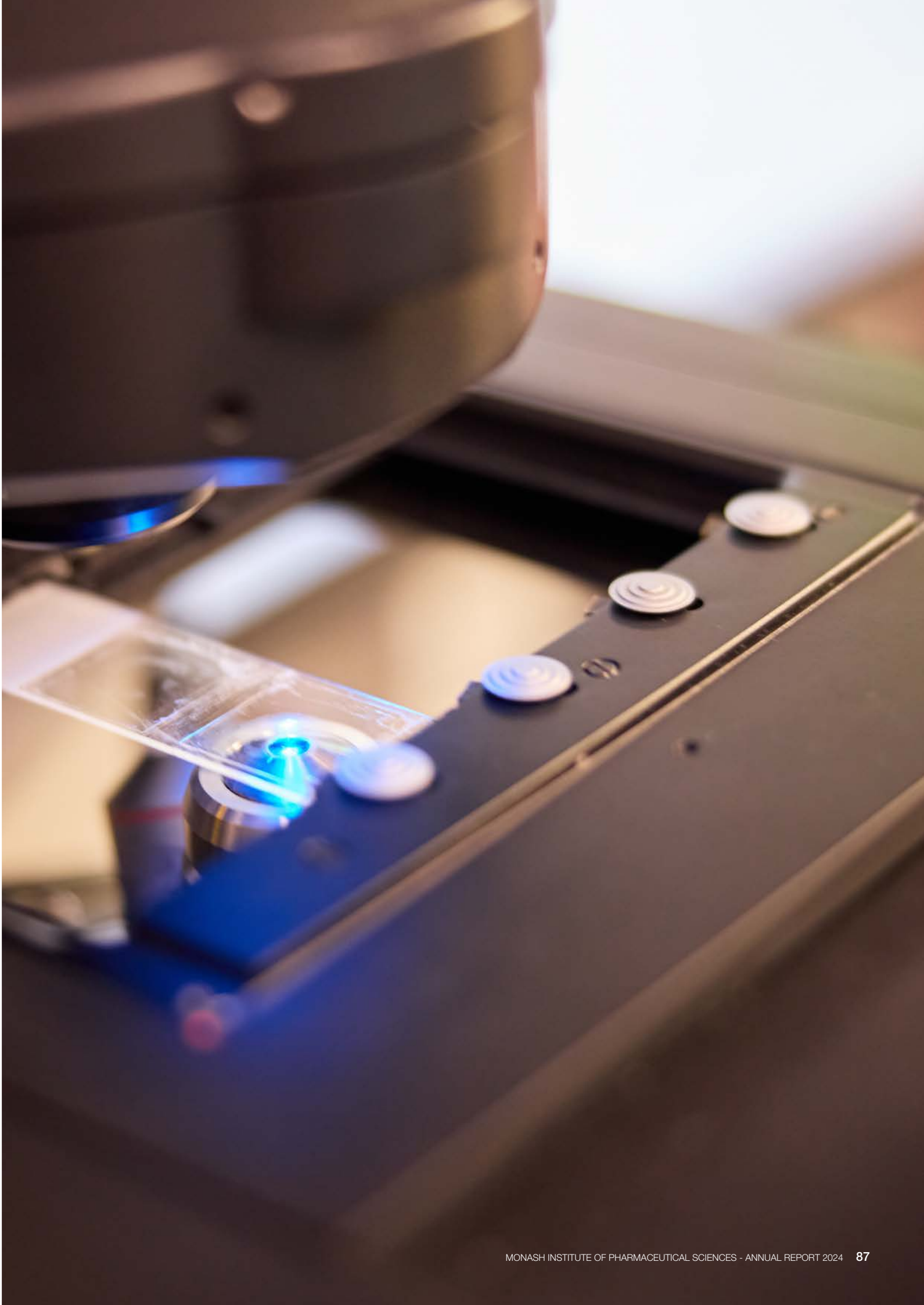
A key milestone was our official launch in 2024, attended by 46 participants, including Fiona Marshall, Director of Monash Equity, Diversity & Inclusion (EDI), Prof Paul White, Deputy Dean, Faculty of Pharmacy & Pharmaceutical Sciences, and Marian Costelloe, Faculty General Manager. The event highlighted our mission to support people of culturally and linguistically diverse (CALD) backgrounds and increase representation. Fiona Marshall, Director Monash EDI, said, ‘This mission to support people of colour and drive increased representation is central to our broader goals in helping to quash unconscious bias and significantly improve equal opportunity for those from CALD backgrounds.’

MOSAIC’s impact was further recognised when we were shortlisted as a finalist for the Monash University’s Vice-Chancellor’s Excellence Award for EDI. Additionally, we received a special mention from the Vice-Chancellor during her 2024 International Women’s Day speech, acknowledging our contributions to advancing EDI across the University.

A major initiative in 2024 was the launch of a six-month sponsorship program in partnership with Monash EDI, Associate Professor Betty Exintaris, Associate Dean EDI, and Winitha Bonney OAM, a global expert in EDI. This program paired 15 sponsees from CALD backgrounds—including academics, EMCRs, professional and technical staff—with 15 senior sponsors within MIPS. MOSAIC Co-Chair Dr Amandeep Kaur stated, ‘We are driving both bottom-up and top-down approaches to identify and eliminate barriers that contribute to the attrition of people from CALD backgrounds in academia, and it’s been truly rewarding to see the impact we’re making.’ One sponsee reflected, ‘Every session has been incredibly empowering and eye-opening.’

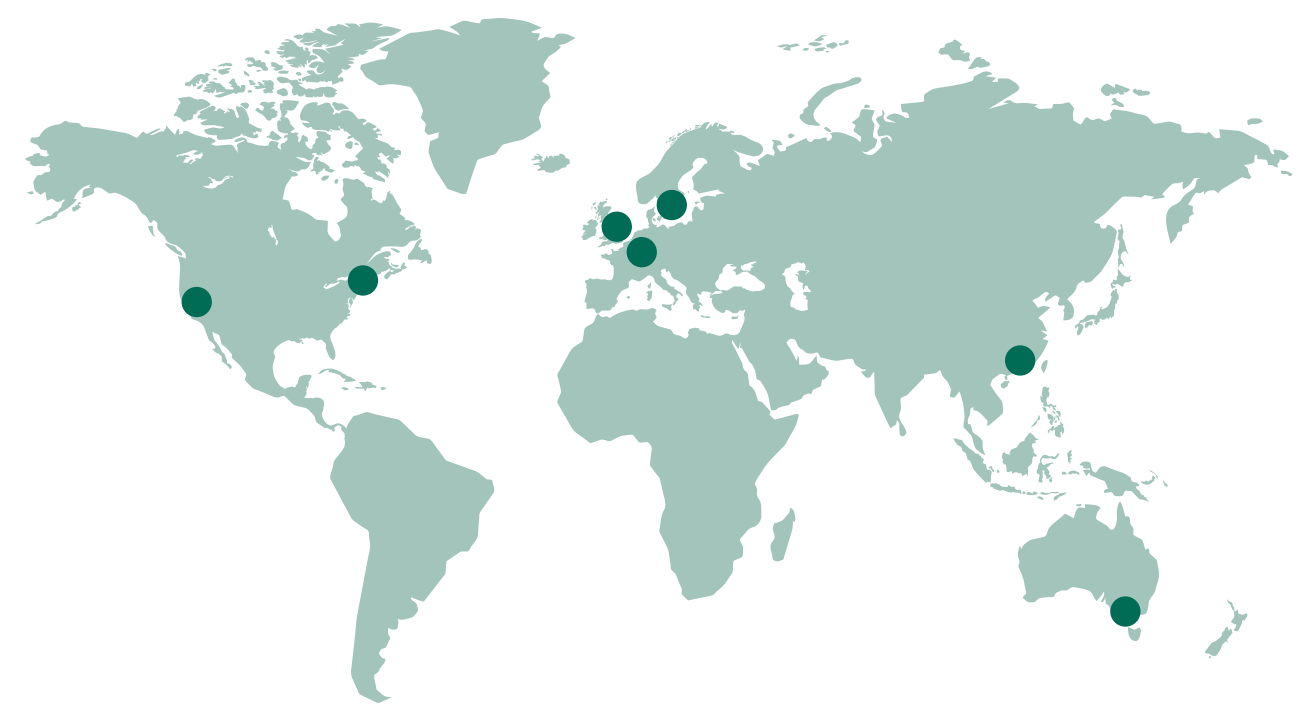
We were also pleased to welcome our new Co-Chair, Dr Nilushi Karunaratne, who said ‘I’m honoured to step into this leadership role. MOSAIC is about visibility, belonging, and driving real change—together.’

MOSAIC looks forward to 2025 with a continued commitment to advocacy, visibility, and systemic change.



PARTNERSHIPS & COLLABORATIONS

We are a deeply international research institute. Our research staff and students have come from all over the world, and we partner with international experts and collaborators to achieve better health outcomes for all.



We are part of PharmAlliance, a strategic partnership between three global leaders: Eshelman School of Pharmacy at the **University of North Carolina at Chapel Hill, United States**; School of Pharmacy at **University College London, United Kingdom**; and the Faculty of Pharmacy and Pharmaceutical Sciences, **Monash University**.

Other major international collaborations:

- Moderna, Boston, USA
- Servier, Paris, France
- Vernalis, Cambridge, UK
- Takeda, Tokyo, Japan
- Pfizer, New York, USA
- Seaport Therapeutics, Boston, USA
- Genentech, San Francisco, USA
- ThermoFisher Scientific, Massachusetts, USA
- Starpharma, Melbourne, Australia
- Halozyme, San Diego, USA
- Medicines for Malaria Venture & Drugs for Neglected Diseases Initiative, Geneva, Switzerland
- University of Nottingham, United Kingdom
- University of Copenhagen, Denmark
- University of Hong Kong, China

A quarter of our awarded grants and research contracts are with an international partner and over 50% of our publications have an international co-author.

Our Australian research collaborations are equally important to us. They include Australian universities including all of the Group of Eight and medical research institutes such as the Baker, WEHI, the Florey and the Peter Doherty Institute. We work with the major health networks in Melbourne (Melbourne Health, Austin Health, Monash Health, Alfred Health/Hospital), as well as national scientific organisations including the CSIRO, Australian National Fabrication Facility and Therapeutic Innovation Australia.

COMMERCIALISATION & TRANSLATION

MIPS is leading the way in transforming its research discoveries into real-world impact, improving health outcomes, and driving economic growth. With the largest concentration of pharmaceutical researchers in the country and a strong legacy of excellence in pharmaceutical science, MIPS has established itself as a leader in translational drug discovery and development. Our focus on therapeutic innovation positions us at the forefront of research translation, addressing critical human health challenges.

COMMERCIALISATION

Invention Disclosures

21

Patents

5

Spinout and Startup

1

Licences including options and assignments

3

MIPS fosters a collaborative, multi-disciplinary culture that embraces entrepreneurship, as demonstrated by its successful spinout companies, licensing deals, and long-standing industry partnerships. The combination of world-class pharmaceutical research expertise, drug development capabilities, and commercialisation experience enables MIPS to drive the development and translation of innovative therapies. The highlights of these activities in 2024 are outlined below.

SEAPORT THERAPEUTICS LAUNCHED TO DEVELOP MIPS TECHNOLOGY

In 2024, Seaport Therapeutics was launched with US\$325 million through two oversubscribed financing rounds. Seaport Therapeutics is developing medicines that utilise technology invented by Professor Chris Porter and his team at MIPS. The technology was originally licenced to Seaport's co-founder, PureTech Health, in 2017, and now is exclusively licenced to Seaport. Seaport's lead therapeutic candidate is an oral prodrug of allopregnanolone intended for the treatment of major depressive disorder, but Seaport is advancing a pipeline of clinical-stage neuropsychiatric medicines that exploit the MIPS technology to enhance oral bioavailability and reduce side effects, thereby improving the efficacy of clinically active drugs that were previously limited by these challenges. MIPS and Seaport scientists continue to work together on further platform development, including through an ARC-funded Linkage project exploring formulations to enhance lymphatic targeting for immune system modulation and imaging applications.



Complementing MIPS' expertise in pharmaceutical science is a strong foundation in commercialisation and business development, enabling the advancement of research towards meaningful commercial opportunities. A key aspect of research translation at MIPS is the identification, development, and commercialisation of novel intellectual property and research outcomes. A dedicated team of business development and commercialisation professionals provides researchers with support in contract management, strategic planning, partnership development, and commercial strategy, ensuring a clear pathway from discovery to impact. Researchers also benefit from mentorship, coaching, and expert guidance throughout their commercialisation journey. In 2024, MIPS welcomed its inaugural Director of Enterprise and Engagement, Dr Russel Tait, to further support its commercialisation endeavours. Russell has held senior executive roles in biotech, higher education, and government, specialising in intellectual property management, business development, and commercialisation. His new role highlights MIPS' growth in research translation, commercialisation, and enterprise.

PHRENIX THERAPEUTICS SECURES INVESTMENT FROM US AND AUSTRALIAN VENTURE CAPITAL FIRMS

Phrenix Therapeutics, a MIPS spinout developing next-generation medicines for psychiatric and neurological disorders, has secured significant seed investment from CurieBio (US) and Brandon Biocatalyst (Australia) venture firms. Founded in 2022, Phrenix Therapeutics was the first spinout from MIPS’ Neuromedicines Discovery Centre, in partnership with The Florey Institute. Led by co-founders Professor Chris Langmead (CEO), Dr Greg Stewart (CSO), and Associate Professor Jess Nithianantharajah (VP, Translational Biology), Phrenix focuses on treatments for psychosis and cognitive impairments in schizophrenia. Phrenix has previously received support from the Medical Research Future Fund’s CUREator scheme, Therapeutic Innovation Australia, the Monash Research Impact Fund, and Monash Investment Holdings. The new investment will accelerate Phrenix’s pipeline towards clinical application and is a testament to MIPS’ strengths in translational research and commercialisation.



MIPS RESEARCH TEAM SECURES MORE THAN \$1.6 MILLION IN FUNDING FROM BIOCURATE, THE NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL AND THERAPEUTIC INNOVATION AUSTRALIA TO PROGRESS DEVELOPMENT OF LIFE-SAVING MEDICINES

Dr Chengxue Helena Qin and her team at MIPS received crucial support from BioCurate’s Proof of Concept fund to advance development of a ground-breaking treatment for pulmonary arterial hypertension (PAH), a progressive and life-threatening condition that primarily affects women. In addition to BioCurate’s support, the project has secured a NHMRC Development Grant and two TIA Pipeline Accelerator vouchers. These funds will enable the team to advance their drug candidates through hit-to-lead and lead optimisation and into preclinical validation, moving closer to delivering a transformative treatment for PAH patients. BioCurate not only provides financial assistance towards this effort, but also offers industry expertise to enhance the project’s commercial viability by helping to bridge the gap between early-stage discovery and drug candidate development. The collaborative endeavour between MIPS and BioCurate underscores their alignment in supporting scientific innovation, commercial strategy, and patient-centred impact to facilitate the potential development of a breakthrough therapy in an area of significant unmet medical need.



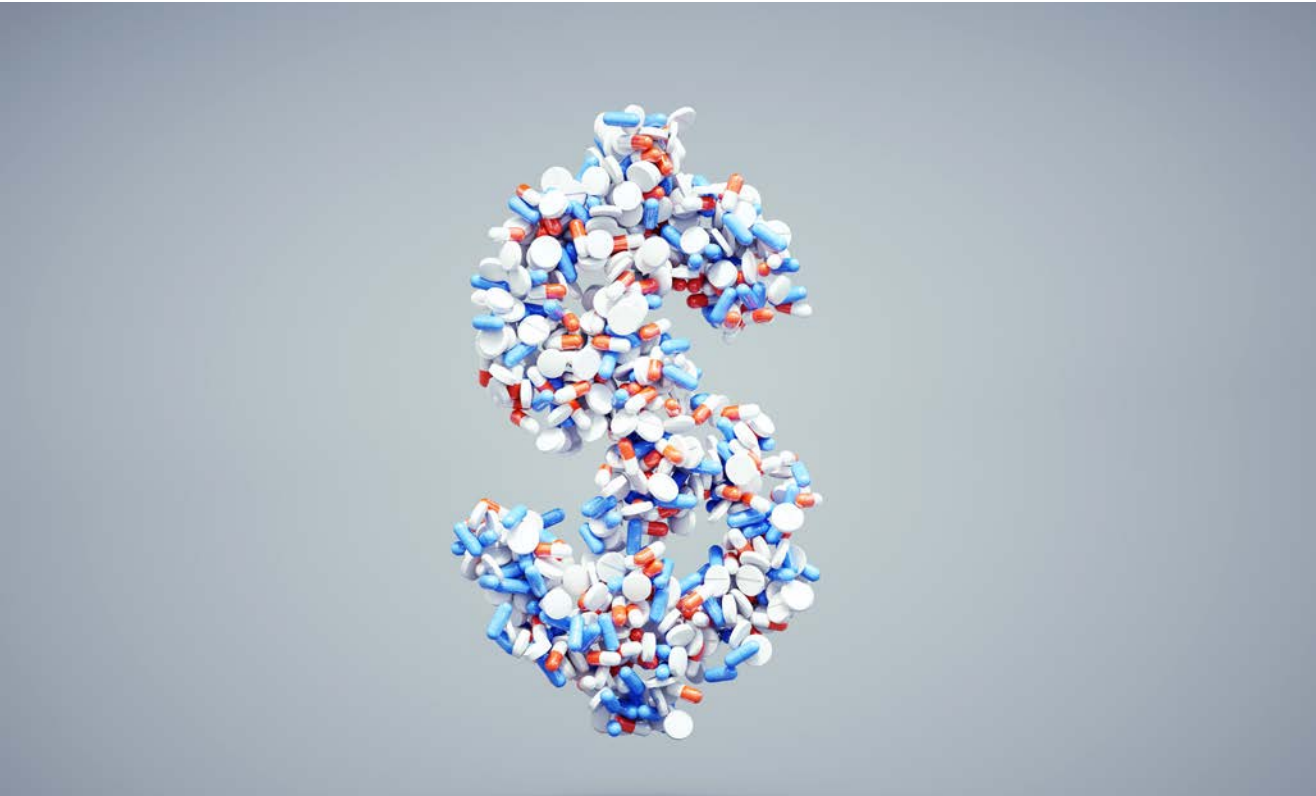
IMPROVING HEALTH OUTCOMES WITH A SMART WEARABLE DRUG DELIVERY SYSTEM

In 2024, MIPS joined an exciting collaboration between Remagine Labs, the University of Melbourne, and AK Clinical Research seeking to advance the world’s first smart wearable drug delivery system for epilepsy treatment. The system, which is being developed by Remagine Labs, delivers epilepsy medication through the skin via a patch, ensuring precise, week-long drug delivery and improving treatment adherence. Remagine Labs, the University of Melbourne, Monash University and AK Clinical Research received a \$3 million Commonwealth Government CRC-P grant to advance the technology towards epilepsy clinical trials. The MIPS’ research team, led by Professor Nicolas Voelcker, is working to extend the platform for larger molecule drugs to treat other chronic diseases. The work highlights the impact of industry-academic collaboration and the importance of government support in advancing ground-breaking technologies.



ADVANCING DRUG DELIVERY USING NANOTECHNOLOGY

A longstanding partnership between researchers at MIPS and Melbourne-based biotech company Starpharma has secured ARC Linkage grant support for development of a new drug delivery technology under a licencing arrangement. The team of MIPS researchers, led by Associate Professor Angus Johnston, is combining MIPS’ targeted delivery technology with Starpharma’s proprietary dendrimer system to create an affordable and targeted drug delivery system that quickly enters specific cells to release drug cargo where it is needed. This research strengthens the collaboration between Starpharma and MIPS, who have been working together for a number of years to create next-generation drug delivery technologies.



TRANSLATION

We have a strong focus on bridging the gap between our research strengths and its practical application in healthcare, ensuring that research findings are used effectively to improve patient care and outcomes. This involves communicating research evidence to stakeholders, such as healthcare providers, policymakers, and consumers, to influence their decision-making and promote the adoption of evidence-based practices through clinical practice guidelines.

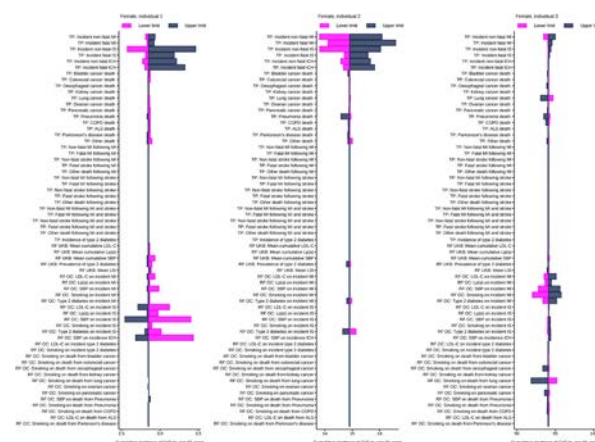
2024 has seen MIPS researchers build on our solid track record of research translation through all of the mechanisms described above, and more.

COPD-X GUIDELINES

Associate Professor Johnson George has been an active member of the Lung Foundation Australia's (LFA) Chronic Obstructive Pulmonary Disease (COPD) Guidelines Committee since 2013. He is the sole pharmacy representative on the 8-member multidisciplinary guidelines committee that meets quarterly to review and update the COPD guidelines for Australia. The Committee has three resources: the co-branded LFA and Thoracic Society of Australia and New Zealand's (TSANZ) *The COPD-X Plan: Australian and New Zealand guidelines for the management of chronic obstructive pulmonary disease; COPD-X Handbook*, a summary clinical practice guideline; and the *Stepwise Management of Stable COPD*, a one-page summary. These guidelines have been published as a summary in the Medical Journal of Australia twice; most recently in September 2022. The guidelines are endorsed by various professional bodies including the Royal Australian College of General Practitioners, Royal College of Nursing Australia, Australian Association of Consultant Pharmacy, Australian Physiotherapy Association, and Asthma Respiratory Foundation New Zealand. COPD-X Handbook is also available as a practical, mobile-friendly guide designed specifically for healthcare professionals, with over 100,000 online accesses in 2024. Associate Professor Johnson has also co-authored the updated LFA position statement 'Cough in Children and Adults: Diagnosis, Assessment and Management (CICADA)', and the first TSANZ position statement on environmental impact of inhaled medicines.

HEALTH ECONOMIC MODEL FOR THE PRIMARY PREVENTION OF CARDIOVASCULAR DISEASE

The Health Economic Model for the Primary Prevention of Cardiovascular Disease (HEM-PPCVD), developed by Professor Zanfina Ademi and Dr Jedidiah Morton, is a comprehensive causal model designed to assess the economic and clinical impact of interventions for cardiovascular disease (CVD) prevention. It integrates multiple modifiable risk factors to simulate long-term health and cost outcomes, supporting evidence-based health policy and resource allocation. The HEM-PPCVD allows users to input demographic, risk factor, and intervention-specific data, enabling tailored cost-effectiveness analyses for diverse populations. A key advantage of the model is its ability to quantify the lifetime cumulative impact of risk factors on clinical and economic outcomes, unlike traditional models that focus on short-term or isolated effects. For policymakers, researchers, and healthcare professionals, HEM-PPCVD serves as a valuable tool to optimise CVD prevention strategies and enhance the efficient use of healthcare resources.



The model is currently free for research purposes, but not for commercial use. The team is currently developing a user-friendly version of the model, allowing users to interact with it more easily as it is only as a code version at present. We anticipate that this version will be available early in 2026.

<https://shop.monash.edu/primary-prevention-cardiovascular-disease-health-economic-model.html>

MONASH QUALITY OF MEDICINES INITIATIVE

The Monash Quality of Medicines Initiative (QoMI) applies the pharmaceutical science expertise at MIPS to address the issue of poor-quality medicines in low- and middle-income countries. In 2024 studies, led by QoMI Director Associate Professor Pete Lambert alongside a number of collaborative partners, have resulted in impactful changes in countries of highest need. For example, quality assessment of maternal health products in Francophone African countries on behalf of WHO led to the identification of substandard medicines that were subsequently removed from the market. In addition, Monash investigations identified previously unknown quality issues with critical medicines used at childbirth that result in a dangerous reaction between products when mixed. This information now informs warnings within newly issued WHO guidelines.



INHALED OXYTOCIN PROJECT CLINICAL TRIALS

The inhaled oxytocin project aims to address the leading global cause of maternal mortality, postpartum haemorrhage (PPH), in resource poor countries. PPH leads to 70,000 deaths per year and improved tools for prevention and treatment are urgently needed. Professor Michelle McIntosh and Associate Professor Pete Lambert have led the work that recently completed clinical trials. The trials showed that an optimised, simple-to-use and affordable inhaled product is equally effective at delivering oxytocin when compared to the current injection product, but eliminates the need for cold-chain storage and sterile needles and syringes. The project has been independently assessed as the only product in development for PPH with the potential for high impact and Monash seeks philanthropic and private sector industry partners to bring this product to fruition and save the lives of mothers in need.



NATIONAL GUIDELINES REVIEW FOR THE TREATMENT OF EPILEPSY

The Centre for Medicine Use and Safety (CMUS) was commissioned by the Australian Government Department of Health and Aged Care to review Australian and international guidelines and protocols for the treatment of epilepsy. CMUS then modelled the utilisation and cost of different antiseizure medications using Australian Pharmaceutical Benefits Scheme dispensing data and Population Level Analysis & Reporting prescribing data. The results will directly inform clinical and regulatory decision making. The project was undertaken by Associate Professor Jenni Ilomaki, Professor Zanfina Ademi, Professor Simon Bell and Ms Choon Ean Ooi in partnership with Professor Patrick Kwan and Dr Emma Foster from the Department of Neuroscience and Alfred Health.

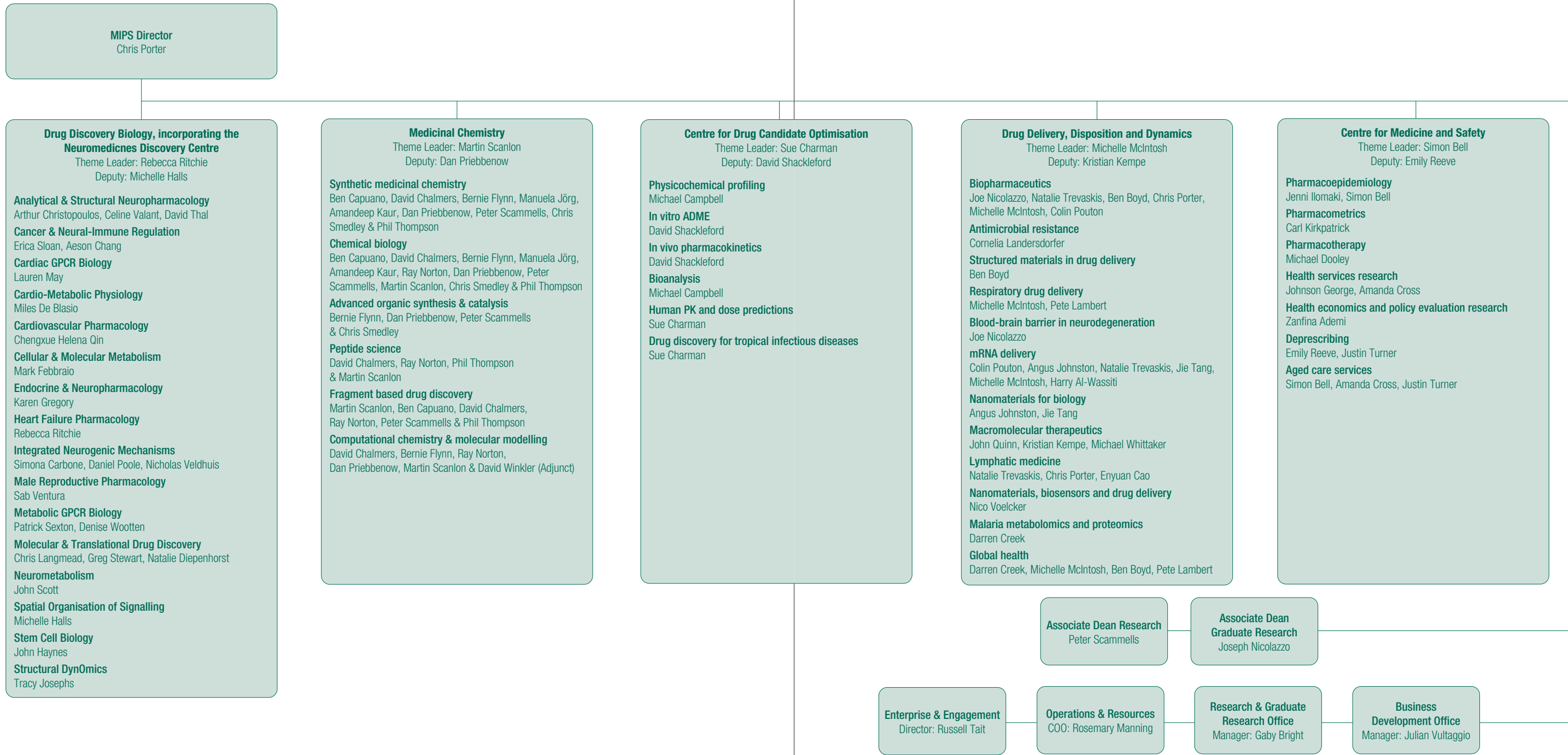
INTERNATIONAL CONFERENCE ON CLINICAL PHARMACY

Associate Professor Johnson George, Mr John Jackson, Associate Professor Jenni Ilomaki and Professor Simon Bell from the Centre for Medicine Use and Safety were invited guests and plenary speakers at the 10th International Conference on Clinical Pharmacy in Manipal, India. This year's conference was themed 'Transforming Pharmacy Practice for Value-Based-Care Models' and attracted delegates from 49 pharmacy colleges of pharmacy across India. Assoc Prof George has helped organise and present at this event each year for the past 10 years. Over this 10-year period, the conference has involved more than 2000 scientific presentations from over 4700 delegates.



MIPS ORGANISATIONAL STRUCTURE AND EXPERTISE

All MIPS research staff and students are affiliated with one of the Research Themes. The MIPS Leadership group consists of the Theme Leaders, the Faculty Associate Deans of Research and Graduate Research, the Director of Engagement & Enterprise, the Chief Operating Officer, and the Managers of Research and Graduate Research, and Business Development.



OUR GRADUATE RESEARCH STUDENTS

Graduate research students – those studying for a PhD or Masters by research – make up almost 50% of MIPS researchers. They contribute enormously to our research efforts whilst undertaking training with our world-leading researchers. Our students in the graduating cohort have embarked on varied careers across the globe – undertaking postdoctoral research fellowships at universities including Nottingham, University Teknologi Mara (Malaysia) and Dundee, working in scientific and clinical roles in industry, and some haven’t gone quite so far afield and are working here in Australia at various sites including the University of Sydney, Deakin University as well as MIPS.

Congratulations to all 46 of the graduates of 2024

DOCTOR OF PHILOSOPHY

JANUARY

Dr Oliver Fuller

The Role of Extracellular Vesicles and Tissue Cross-Talk in Health and Disease

Professor Mark Febbraio, Professor Suresh Mathivanan (La Trobe Institute for Molecular Sciences), Dr Sarah Turpin-Nolan, Associate Professor Martin Whitham (University of Birmingham)
[Drug Discovery Biology](#)

Dr Julia Park

Characterisation and evaluation of pro-resolving G protein-coupled receptors (GPCRs) in resolution of inflammation
Associate Professor Christopher Langmead, Dr Darren Riddy
[Drug Discovery Biology](#)

Dr Tianxia Zhang

The development a peptide-based agent for imaging application
Professor Colin Pouton, Professor Philip Thompson
[Drug Delivery, Disposition and Dynamics](#)

FEBRUARY

Dr Jamie Currie

Fragment-Based Drug Design for Novel Inhibitors of Dengue Polymerase
Professor Martin Scanlon, Dr Bradley Doak
[Medicinal Chemistry](#)

Dr Kieran Alder-Deane

Refining G protein-coupled receptor biochemistry to obtain challenging cryogenic electron microscopy structures
Dr Matthew Belousoff, Dr Emma Dal Maso, Professor Patrick Sexton, Professor Denise Wootten
[Drug Discovery Biology](#)

Dr Yuen Lam

A Metabolic Glycan Labelling Based Approach for Highly Selective Gastrointestinal Delivery
Professor Ben Boyd, Dr Kristian Kempe, Dr Angel Tan
[Drug Delivery, Disposition and Dynamics](#)

Dr Kate Petrie

The diagnosis and management of chronic obstructive pulmonary disease in at-risk populations
Associate Professor Johnson George, Professor Michael Abramson
[Centre for Medicine Use and Safety](#)

MARCH

Dr Sadia Alvi

Allosteric Modulation at the Delta Opioid Receptor for the Treatment of Gastrointestinal Motility Disorders
Associate Professor Celine Valant, Dr Simona Carbone, Professor Arthur Christopoulos, Dr Vi Pham, Associate Professor Daniel Poole, Associate Professor David Thal
[Drug Discovery Biology](#)

Dr Jae Pyun

Impact of copper complexes on P-glycoprotein expression and function at the blood-brain barrier
Professor Joseph Nicolazzo, Associate Professor Jennifer Short
[Drug Delivery, Disposition and Dynamics](#)

Dr Alexander Rajakanthan

Water-dispersible Arsonic Acid Functional Polymer Coated Iron Oxide Nanoparticles as Efficient Imaging Agents
Dr Kristian Kempe, Dr Paul Wilson (University of Warwick)
[Drug Delivery, Disposition and Dynamics](#)

Dr Wenxiao Yue

Design of Novel Cyclic Peptidomimetics - Melanocortin Peptides as An Example
Professor Philip Thompson, Professor Colin Pouton
[Medicinal Chemistry](#)

MAY

Dr Amit Hetsron

Development of Foldamers for Peptide Receptor Radionuclide Therapy of NPY1 Tumours
Professor Philip Thompson, Dr Mohammad Haskali (Peter MacCallum Cancer Centre)
[Medicinal Chemistry](#)

Dr Jack Phelps

The rational design of Zika protease inhibitors
Professor Martin Scanlon, Dr Luke Adams, Dr Bradley Doak
[Medicinal Chemistry](#)

Dr Kimberly Vo

Metacognitive scaffolding in chemistry education: Investigating student problem-solving approaches and instructor perspectives and practices
Associate Professor Elizabeth Yuriev, Dr Mahbub Sarkar (Faculty of Medicine, Nursing and Health Sciences), Professor Paul White
[Medicinal Chemistry](#)

Dr Jingjing Zhao

Therapeutic Properties of the Designer Cytokine IC7Fc to Treat Metabolic Diseases
Professor Mark Febbraio, Dr Sarah Turpin-Nolan
[Drug Discovery Biology](#)

JUNE

Dr Le Tuong Vi Dinh

Development of Calcium-sensing receptor (CaSR) positive allosteric modulators for the treatment of CaSR-related disorders
Associate Professor Ben Capuano, Dr Aaron Debono, Dr Tracy Josephs, Dr Katherine Leach
[Medicinal Chemistry](#)

Dr Laura Dowd

Exploring the safe and effective use of analgesic medications in residential aged care facilities
Professor Simon Bell, Dr Amanda Cross
[Centre for Medicine Use and Safety](#)

Dr Gopisankar Mohanannair Geethadevi

Prediction model-guided midlife dementia risk reduction
Associate Professor Johnson George, Professor Simon Bell, Dr Amanda Cross, Dr Ajay Mahal (University of Melbourne)
[Centre for Medicine Use and Safety](#)

Dr Yildiz Tasdan

Development of EcDsbA Inhibitors Using Fragment-Based Design Strategies
Professor Martin Scanlon, Associate Professor Ben Capuano, Dr Bradley Doak
[Medicinal Chemistry](#)

Dr Muhammad Shaffiq Bin Zainal Osman

Expanding the Toolbox of Poly(2-Oxazoline)s-Based Hydrogels for Biomedical Applications
Dr Kristian Kempe, Associate Professor John Quinn
[Drug Delivery, Disposition and Dynamics](#)

AUGUST

Dr Celine Hung

Modifying Pasireotide Analogues For Improved Oral Peptide Delivery
Professor Colin Pouton, Associate Professor David Chalmers, Dr Orlagh Feeney, Dr Dallas Warren
[Drug Delivery, Disposition and Dynamics](#)

Dr Peiyuan Luo

Investigating the mode of action of novel bis-1,2,4-triazine antimalarials using proteomics and LC-MS-based analytical techniques
Professor Darren Creek, Dr Ghizal Siddiqui
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Dr Theodore Nettleton

Structure and dynamics of the PAC1R in different conformational states
Professor Denise Wootten, Dr Sarah Piper, Professor Patrick Sexton,
[Drug Discovery Biology](#)

Dr Jaideep Singh

Targeting the Formyl Peptide Receptors Axis Regulates Physiological and Pathological Cardiovascular Damage Dr Chengxue Qin, Dr Geoffrey Head (Baker IDI Heart and Diabetes Institute), Dr Kristy Jackson (Baker IDI Heart and Diabetes Institute)
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SEPTEMBER

Dr Felix Bennetts

Structural and Pharmacological Investigation of the P2X1 Receptor as a Drug Target
Associate Professor David Thal, Dr Jesse Mobbs, Dr Sabatino Ventura
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Dr Liam Hales

Profiling Glucagon-Like Peptide -1 Receptor Transducer Coupling, Signalling and Biased Agonism
Professor Philip Thompson, Associate Professor David Chalmers
[Medicinal Chemistry](#)

Dr Yao Lu

Profiling Glucagon-Like Peptide -1 Receptor Transducer Coupling, Signalling and Biased Agonism
Dr Gregory Stewart, Associate Professor Christopher Langmead, Professor Denise Wootten
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Dr Grace Mennen

Profiling Glucagon-Like Peptide -1 Receptor Transducer Coupling, Signalling and Biased Agonism
Dr Elva Zhao, Dr Tracy Josephs, Professor Patrick Sexton, Professor Denise Wootten
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Dr Abhipree Sharma

Profiling Glucagon-Like Peptide -1 Receptor Transducer Coupling, Signalling and Biased Agonism
Professor Rebecca Ritchie, Dr Miles De Blasio
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OCTOBER

Dr Joel Coffie

*Decoding G Protein-Coupled Receptor Signalling Fingerprints to Identify Novel Therapeutic Targets for Cardiac Fibrosis Treatment*Dr Lauren May, Dr Simon Foster, Professor Paul White
[Drug Discovery Biology](#)

Dr Ashleigh Gould

Structural and functional characterisation of peptide toxins from Australian sea anemones
Associate Professor Daniel Poole, Dr Emily Eriksson (WEHI), Professor Sebastian King (Royal Children's Hospital)
[Drug Discovery Biology](#)

Dr Jessica Huang

Engineering Cells to Understand Cellular Transport
Associate Professor Angus Johnston, Dr Daniel Yuen
[Drug Delivery, Disposition and Dynamics](#)

Dr Mun Ko

Design and Exploration of Sphingolipid Mimetics in Lipid Metabolism
Professor Bernard Flynn, Dr Sarah Turpin-Nolan
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Dr Nimna Perera

Exploring the role of extracellular vesicles in obesity and diabetes-associated cardiovascular disease
Professor Mark Febbraio, Dr Miles De Blasio, Professor Rebecca Ritchie
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Dr Zoe Porter

Investigations into VprBP Functions, Engagement and Inhibition
Professor Philip Thompson, Dr Ian Jennings
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Dr Karoline Sanches

Molecular Basis for Inhibition of the Voltage-Gated Potassium Channel Kv1.3 by Peptide Toxins
Professor Raymond Norton, Professor Martin Scanlon
[Medicinal Chemistry](#)

Dr Yikai Song

Discovery of Novel Calcium-Sensing Receptor Allosteric Modulators Using Fragment-based Drug Design Approaches
Associate Professor Ben Capuano, Professor Martin Scanlon
[Medicinal Chemistry](#)

Dr Lian Xue

Design and Synthesis of Novel CNS-Penetrant 18F Radioligands of MERTK for the Imaging of Multiple Sclerosis
Professor Peter Scammells, Dr Michelle Binder (Florey Institute of Neuroscience and Mental Health), Dr Ylva Bozikis, Dr Trevor Kilpatrick (University of Melbourne)
[Medicinal Chemistry](#)

NOVEMBER

Dr Dayangku Binti Pengiran Hassanel

Exploring Polymer-Lipids in Lipid Nanoparticle Formulations
Professor Colin Pouton, Professor Stephen Kent (University of Melbourne), Dr Nghia Truong Phuoc, Dr Emily Pilkington
[Drug Delivery, Disposition and Dynamics](#)

Dr Muhammad Rehan Sarwar

Optimising the Management of Chronic Obstructive Pulmonary Disease by using a Treatable Traits Approach
Associate Professor Johnson George, Professor Michael Abramson, Professor Vanessa McDonald (University of Newcastle)
[Centre for Medicine Use and Safety](#)

Dr Showmika Supti

The role of Alzheimer's disease related factors on blood-brain barrier transport of fatty acids and astrocyte release of apolipoprotein E isoforms
Professor Joseph Nicolazzo, Dr Liam Koehn
[Drug Delivery, Disposition and Dynamics](#)

Dr Serena Teo

*Understanding intracellular trafficking and endosomal escape of macromolecules*Professor Colin Pouton, Associate Professor Angus Johnston
[Drug Delivery, Disposition and Dynamics](#)

DECEMBER

Dr Vanessa Chew

Polynes to Polycycles: The Construction of Pi-Rich Polycyclic Aromatic Compounds via Alkyne Activation
Professor Bernard Flynn, Professor Peter Scammells
[Medicinal Chemistry](#)

Dr Shin Liao

Optimising Medication Use in Older People Living with Frailty and Dementia
Professor Simon Bell, Dr Samanta Lalic
[Centre for Medicine Use and Safety](#)

Dr Michael Mah

The contribution of intestinal derived ceramides to whole-body metabolic dysfunction
Dr Sarah Turpin-Nolan, Professor Mark Febbraio
[Drug Discovery Biology](#)

MASTER OF PHILOSOPHY

Mr Artin Assardi

Establishing bulk electroporation as a benchmark method for intracellular delivery of reprogramming factors into human fibroblasts
Professor Nicolas Voelcker, Dr Yaping Chen
[Drug Delivery, Disposition and Dynamics](#)

FINANCIAL SNAPSHOT

	2023	2024
External Revenue	\$'000s	\$'000s
Australian Government (includes MRFF and infrastructure)	#49,426	37,003
Victorian Government	1,350	212
Other Australian Competitive grants	4,920	3,133
Australian contracted research	6,403	10,190
Donations - research, scholarships and other	1,402	668
HDR Student fees	3,770	4,305
International grants and contracted research	6,231	8,159
Total	73,502	63,670
Expenditure	\$'000s	\$'000s
Direct research costs - salary, consumables and collaborations	* 48,406	50,462
Directorate mgmt. and business development	* 3,413	3,919
University overheads (legal, mgmt. IT, Finance, etc)	10,938	12,061
Space and infrastructure	10,174	11,718
Student scholarship costs	7,648	8,358
Total	^80,579	^86,519

Notably, in 2023 we received income for two large multi-year grants that will be expended over future years.

* These figures are different to the data in last year's report due to a change in categorisation rather than different expenditure.

^ MIPS research expenditure exceeds our external revenue, as is common in the Australian research funding environment. Our research is supported by other Faculty revenue, specifically education.

Revenue



- International grants and contracted research
- HDR Student fees
- Donations - research, scholarships and other
- Australian contracted research
- Other Australian Competitive grants
- Victorian Government
- Australian Government (includes MRFF and infrastructure)

Expenditure



- Direct research costs - salary, consumables and collaborations
- Directorate mgmt. and business development
- University overheads (legal, mgmt. IT, Finance, etc)
- Space and infrastructure
- Student scholarship costs

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This information was correct at the time of publication
(June 2024).

*Monash University reserves the right to alter this
information should the need arise.*