JANUARY 2025, ISSUE 15

ARC Industrial Transformation Training Centre for Cryo-electron Microscopy of Membrane Proteins

Quarterly newsletter

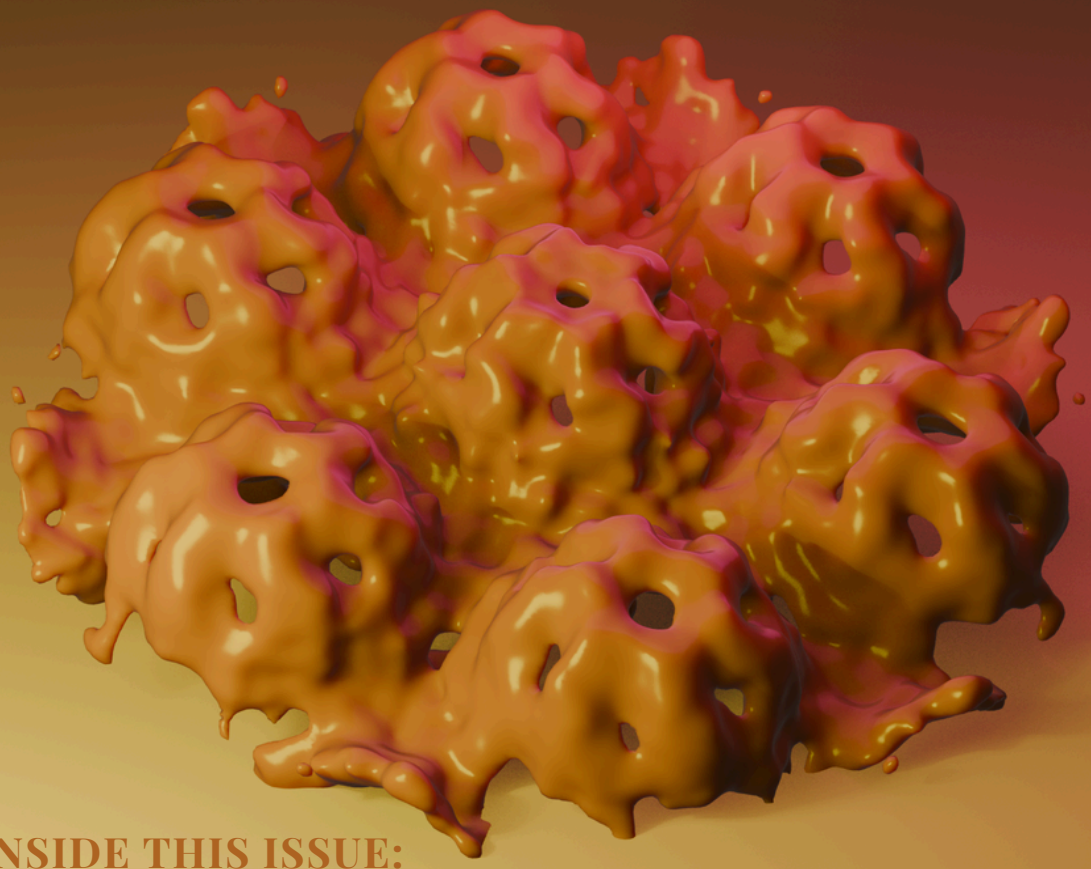


Image credit - Dr. Sepideh Valimehr

INSIDE THIS ISSUE:

Australian Government
Australian Research Council
MONASH University
THE UNIVERSITY OF MELBOURNE
bio21 institute
MOLECULAR HORIZONS
UNIVERSITY OF WOLLONGONG AUSTRALIA
WEHI brighter together

CCeMMP acknowledges the peoples of the Kulin, Dharawal, Yuin and Wadi Wadi Nations on whose land the Centre and its Nodes operate. We pay our respects to their Elders, past, present and emerging.

From the Director

Prof. Patrick Sexton

Welcome to the 15th instalment of the ARC CCeMMP quarterly newsletter, and also to 2025! In this quarter the Centre was very active with our Research Symposium, the CCeMMP strategic retreat and the review of the Centre's operation and performance by our Scientific and Industry Advisory Committee. We are also excited to report on the many grant successes that our members enjoyed in the latest ARC Discovery Projects and NHMRC Ideas rounds. Congratulations to all grant awardees, and also to the many individuals who have received various prestigious awards and honours during this quarter. Details in the Node reports!

Thanks to everyone involved in organisation of the CCeMMP activities, it is only through the commitment and dedication of those individuals that we are able support to the Centre's mission and the broader membrane protein community.

I look forward to another exciting year.

Prof. Patrick Sexton
Director

Did you know?....

Smell….like any sensory information it is processed by receptors, glorious little membrane proteins.

For sight there are two receptors that respond to a colour palette derived from three primary colours, red, blue and green; for sound, frequency and volume are transduced by receptors but what are the parameters of smell?…fruity, minty, musty, woody,sweet, smelly, eww yuck? Smell is extremely complex, the system itself and the fact that (i) two different chemicals can have a similar smell or two chemically similar compounds can have two very different smells, thus knowing the chemical structure gives no hint to the smell;(ii) most smells are made up of a mixture of many, many different aroma molecules; and (iii) there are approximately 400 human odorant receptors (around half of the Class A GPCRs) that have proved to be very difficult to work with. Well "smell is having a moment" - scientists are trying to crack the olfactory code in order to understand how animals use it to find food, a mate and the links it has to memory, emotion, appetite. While others are trying to digitize smell to build new technologies (e.g., diagnosing disease, safer insect repellents). One step is to discover the structure of the receptor and how molecules bind to it.

The study of these receptors has not been easy, in fact researchers have had to really think outside the box, "outside the nose" actually, looking for instances where these receptors are expressed beyond the nose. Odorant receptors are difficult to express in heterologous systems, but there is an odorant receptor that is abundantly expressed outside the nose (gut and prostate) thus opening up the possibility for the researchers to express it in a cell line. This receptor (OR51E2) responds to a pungent cheesy odour, propionate, and acetate. Using cryoEM, researchers were able to visualise where propionate binds and how it changes the shape of the receptor and convey information. But remember, this is one odorant and one of 400 receptors…. With over a trillion odours, there is a long way to go. Further work continues with computational modelling and machine learning; through AI machine learning, odour molecules have been identified that bind to 20% of human odorant receptors.
Nature 633, 26-29 (2024), doi: https://doi.org/10.1038/d41586-024-02833-4

***On the cover**: From the **Ghosal lab** at our UoM/Bio21 Node. Subtomogram average of the Metallosphaera javensis AS-7 surface layer, EMD-42578. Johnson MD, Shepherd DC, Sakai HD, Mudaliyar M, Pandurangan AP, Short FL, Veith PD, Scott NE, Kurosawa N, Ghosal D. Cell-to-cell interactions revealed by cryo-tomography of a DPANN co-culture system. Nature Communications, 15(1):706, 2024. doi: 10.1038/s41467-024-51159-2.*
Image credit: Dr. Sepideh Valimehr

ICHDR Update

Industry Placements

Current placements include: Alok Pradhan (Dimerix, Fitzroy, 12 months, one day per week). Alok continues to spend a day a week with local industry partner, Dimerix, in Fitzroy. Alok will soon be finishing up his placement, we will be able to hear about his experience in the next newsletter.

This month saw Minakshi Baruah leave for placement with her industry partner, Pfizer (Groton, Connecticut, USA).

Preparations continue for students planning to do their placement this year; Sanofi, ThermoFisher, Servier and Aculeus.

PhD Progress

Some students from our first cohort of PhD students are starting to write up. Isabella Russell and Jack Tovey have locked in their exit seminar date. Members and affiliates should have received an invitation, March 26, 9:00 AM (AEDT). With structures solved, manuscripts in preparation and thesis writing in full swing, the future is at their feet! Continue to watch your inboxes for these seminar invitations, they are separate to our regular seminar series.

Centre Updates

National Competitive Grants Success

Many members and affiliates were successful in the latest funding round for the ARC Discovery Projects (November 2024) and NHMRC Ideas Projects (December 2024). Congratulations to all, and in some cases double congratulations!

ARC Discovery Project

Dr. Matthew Belousoff (CIB), Monash Node
Prof. Arthur Christopoulos (CIB), Monash Node
Prof. Arthur Christopoulos (CIB), Monash Node
Dr. Tracy Josephs (CIA), Monash Node
Dr. Jacob Lewis (CIA), UoW Node
Prof. Megan Maher (CIA), UoM/Bio21 Node
Prof. Megan O'Mara (CIB), Univ. of Queensland
Prof. Megan O'Mara (CID), Univ. of Queensland
Prof. Michael Parker (CIA), UoM/Bio21 Node
Prof. Patrick Sexton (CIA), Monash Node
Prof. Patrick Sexton (CIB), Monash Node
A/Prof. Shabih Shakeel (CIA), UoM/Bio21 Node
Dr. Lisanne Spenkelink (CIB), UoW Node
Dr. Alastair Stewart (CIA), Victor Chang Cardiac Research Institute

Respective projects can be found in the Node updates.

NHMRC Ideas Grant

Dr. Matthew Belouoff (AI), Monash Node
Dr. Brian Cary (CIB), Monash Node
Dr. Evelyne Deplazes (CID), Univ. of Queensland
Dr. Karen Gregory (CIA), Monash Node
Dr. Yan Jiang (CIC), University of Sydney
Prof. Megan Maher (CIB), UoM/Bio21 Node
Prof. Renae Ryan (CIA), University of Sydney

Science & Industry Advisory Committee (SIAC) Review

The Centre is fortunate to have an expert team of academic and industry advisors (Lisa Dube, MTPConnect; Radostin Danev, University of Tokyo; Nellie Georgiou-Karistianis, Pro Vice Chancellor Research & Training, Monash University; Leigh Farrell, Adned; Anne-Laurre Puaux, Head Business Development WEHI; Alastair Stewart, University of Melbourne and Director of the ARC ITTC for Personalised Therapeutics Technologies; Cathy Drinkwater Biocurate (formerly)). The committee assists in ensuring that the Centre fulfils its key objectives. In-line with our goals of continued improvement, we asked members of the SIAC to review the operation, performance and strategic planning of the Centre on November 18th, 2024. This marked approximately 2 years since our last review. The committee was particularly impressed by the number and quality of the manuscripts, as well as the extent of leveraging of new partnerships and income supporting translational impact. They also found that CCeMMP represented an outstanding return on investment. We are very grateful to all members of our SIAC for making time in their busy schedules to support the Centre.

In the Spotlight.....

This quarter we feature Dr. Bronte Johnstone and Dr. Jacob Lewis from The University of Melbourne/Bio21 and University of Wollongong Nodes, respectively.

If you would like to be featured "In the Spotlight" please contact the chair of the Outreach and Public Engagement Committee, Dr. Sarah Piper (sarah.piper@monash.edu). Otherwise someone may tap you on the shoulder....

IN THE *spotlight*

Bronte Johnstone

@bronteaj
@bjohnstone.bsky.social
http://linkedin.com/in/bronte-johnstone-80953b129

Background

I completed my undergrad studies at Monash and then Honours and my PhD at the University of Melbourne with Prof. Michael Parker, which focused on bacterial pore-forming toxins.

Current research

I am using cryo-ET to study virus-host interactions using a pseudovirus and proteoliposome system. I have experience using membrane vesicles for both single-particle cryo-EM and cryo-ET, so happy to chat with others doing similar!

Looking forward

Advice for students: Try to embrace hurdles and troubleshooting as much as possible and use it as an opportunity to grow. It is frustrating when things don't work, but those situations are when you will probably learn much more than you would otherwise.

About me

I enjoy cooking and baking, although seem to gravitate towards more intense baking challenges – basically anything with numerous components or layers!

If you're a CCeMMP member and would like to be featured, please reach out to the CCeMMP Outreach and Public Engagement Committee (sarah.piper@monash.edu).

IN THE *spotlight*

Jacob Lewis

@Jacob_Lewis90
@helixhero.bsky.social

Background

Watching DNA helicases assemble under the microscope felt like catching nature in the act – revealing the choreography of initiation of DNA replication.

Current research

I'm currently using cryo-EM and single-molecule imaging to build a detailed framework mapping human DNA replication, exploring heterogeneity in the process, and uncovering how errors trigger cancer. Feel free to reach out for processing advice.

Looking forward

I'm most excited about hybrid approaches combining single-molecule fluorescence imaging to track dynamic processes in solution with cryo-EM to visualize their structures in stunning detail.

About me

Outside of research, I enjoy landscape photography, a pursuit of fleeting moments in nature that helps me recharge and find inspiration.

If you're a CCeMMP member and would like to be featured, please reach out to the CCeMMP Outreach and Public Engagement Committee (sarah.piper@monash.edu).

Node Updates

Monash Node

Prof. Denise Wootten

Node Leader, Monash University

Monash University Vice-Chancellor's Excellence Awards

Prof. Denise Wootten

Prof. Chris Langmead

Dr. Greg Stewart

19 November, 2024, Monash University celebrated the annual Vice-Chancellor's Excellence Awards. Three CCeMMP members were recognized for their outstanding achievements with the Researcher of the Year awarded to Prof Denise Wootten and the Award for Excellence in Research Enterprise and/or Commercialisation awarded to Prof Chris Langmead and Dr Greg Stewart. Excerpts from the awards are included below-

Prof. Denise Wootten (Researcher of The Year): 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 and has published in leading scientific journals including *Nature*, *Science* and *Cell*.

Prof. Chris Langmead and Dr. Greg Stewart (Award for Excellence in Research Enterprise and/or Commercialisation):): '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.

Faculty of Pharmacy and Pharmaceutical Sciences, Faculty Awards

November 27, 2024, all three recipients of the VC awards were also recognised by their own Faculty awards; **Prof. Denise Wootten was awarded the "Faculty Research Award"** for significant contribution to a discipline related to the faculty's research priorities plus international peer recognition; **Prof. Chris Langmead and Dr. Greg Stewart were awarded the "Faculty Award for Research Enterprise"** for researchers who have achieved, or are achieving, excellence in innovation, enterprise and collaboration.

Prof. Denise Wootten

Faculty of Pharmacy and Pharmaceutical Sciences, Faculty Awards

Prof. Chris Langmead & Dr. Greg Stewart

Clarivate Highly Cited Researchers for 2024

Prof. Patrick Sexton

Profs Patrick Sexton and Arthur Christopoulos have again been recognised as Highly Cited Researchers, Pharmacology and Toxicology. As such, they both rank in the top 1% by citations in the field of Pharmacology and Toxicology, in the Web of Science over the last decade. For the complete list in each category– https://clarivate.com/highly-cited-researchers/

Prof. Arthur Christopoulos

Michaela Kaoullas Awarded Neuropharmacology SIG Prize, ASCEPT & the Percy Prize, ASCEPT

Michaela Kaoullas, ASCEPT, APFF, APSA Joint Congress, December 2024,

At the ASCEPT, APFF, APSA Joint Congress, December 2024, Michaela Kaoullas was awarded the Neuropharmacology SIG Prize, for the second year in a row! The prize was awarded for her poster "Structural Insights into Positive Allosteric Modulation at the M4 Muscarinic Acetylcholine Receptor". Michaela then went on to be awarded the ASCEPT Neville Percy Prize . The Percy Prize is awarded annually to a Higher Degree student for the best poster communication at the Annual Scientific Meeting. Finalists for the Percy prize are nominated by SIG Chairs following the judging of the SIG prizes.

Of the world's population of scientists and social scientists,

HIGHLY CITED RESEARCHERS ARE 1 IN 1,000

https://clarivate.com/highly-cited-researchers/

New members/affiliates

Dr. Christopher Stubenrauch (Clayton) Group Leader, Isa Nuryana (student affiliate), Sneha Desa (student affiliate).

Prof. Arthur Christopoulos Named 2024 Fellow of ASPET

Prof. Arthur Christopoulos

Prof. Arthur Christopoulos has been named a 2024 Fellow of the American Society for Pharmacology and Experimental Therapeutics (ASPET).

Selection as a Fellow of ASPET (FASPET) is an honor bestowed to the Society's most distinguished members and represents acknowledgement of their sustained commitment to advancing the field of pharmacology through scientific achievements, mentorship, and service.

Grants Awarded

Dr. Brian Cary (CIB) was awarded an NHMRC Ideas Grant of $2,488,624.00 for the project "Impact of biased agonism at the GLP-1R in the treatment of obesity and type 2 diabetes."

A/Prof. Karen Gregory (CIA) was awarded an NHMRC Ideas Grant of $1,446,409 for the project "Dissecting the genetic diversity and therapeutic potential in targeting trace amine receptor 1 for psychiatric disorders."

Dr. Tracy Josephs and Prof. Patrick Sexton were awarded $636,811 for an ARC Discovery project to elucidate how biological signals essential to life are transmitted through receptors on the surface of our cells. This project seeks to directly enhance the understanding of how receptors respond to essential life molecules to control fundamental physiological responses, with anticipated future benefits for the pharmaceutical industry.

Prof. Arthur Christopoulos (CIB) was awarded $1,053,670 for an ARC Discovery project to develop new chemical-biology probes for selectively targeting signalling pathways mediated by G-coupled protein receptors using the M4 muscarinic acetylcholine receptor as an exemplar. Novel ligands that possess different binding modes to the natural ligand (i.e. allosteric and bitopic ligands) will be developed and their potential to act as pathway selective agents that can preferentially activate the desired signalling pathways and reduce unwanted side effects will be explored.

Prof. Arthur Christopoulos (CIB), was awarded $623,274 for an ARC Discovery Project. This project aims to understand how adenosine regulates neural circuit activity in spinal networks. Adenosine is a building block of life and essential for energy metabolism, but also functions as a signalling molecule. In this role, it has been studied extensively in the heart, but there has been less focus on neuronal signalling in sensory pathways. This project will focus on adenosine A1-receptor signalling to address this gap in the field by revealing the source of adenosine in this region, the effects of A1 receptor activation from the level of a single neuron, up to the network of sensory neurons regulated by adenosine. They also plan to develop new tools that can be used to understand adenosine signalling in multiple systems.

Prof. Patrick Sexton and **Dr. Matthew Belousoff,** were awarded $1,396,173 for an ARC Discovery Project. Patrick and Matt aim to develop cryo-EM methods that move from static snapshots of structures at different stages of GPCR activation to continuous assessment of protein dynamics using time-resolved sampling and sophisticated analytical methods. The expected outcomes will address key knowledge gaps in understanding of how the GPCR family of receptors works. They will also evolve techniques broadly applicable to other membrane proteins.

University of Melbourne (Bio21) Node

Prof. Isabelle Rouiller

Node Leader and Deputy Director, University of Melbourne

Graduate Research Career Forum, 8 November 2024

ICHDR Marialena Georgopoulou co-chaired the Careers Forum

November 8, 2024, a Graduate Research Career Forum was held at Melbourne University in collaboration with CCeMMP. ICHDRs Riya Joseph and Marialena Georgopoulou were members of the organising committee. Eight CCeMMP ICHDRs registered to attend. This event provided an opportunity for PhD students to enhance their career readiness and also explore diverse career paths beyond academia. The forum was presented in two sessions. The first by HR professionals on crafting impactful CVs and cover letters, mastering interviews, optimizing LinkedIn profiles and developing resilience in the job search. The second gave the students the opportunity to engage with industry experts and network with professionals in fields such as large corporations, small enterprises, start-ups, government, clinical trials, patenting and communications. The latter career forum panel was co-chaired by ICHDR Marialena Georgopoulou. In this session, students were given the opportunity to ask questions to the invited speakers regarding their career paths.

Prof. Isabelle Rouiller

Isabelle Rouiller promoted to Professor

Deputy Director and UoM Node Leader Isabelle Rouiller was promoted to Professor December 2024. Congratulations Isabelle. You can hear about Prof. Rouiller's work in the first seminar of the year - February 11, 2025, 10:00 AM AEDT

The 10th International Congress on Electron Tomography, 28-30 January, 2025

The 10th International Congress on Electron Tomography was a great success, bringing together experts from around the world. Co-hosted by WEHI and the University of Wisconsin-Madison, the conference kicked off at WEHI on Day 1 before moving to the Bio21 Molecular Science and Biotechnology Institute at the University of Melbourne for Days 2 and 3.

The event was expertly organised by A/Prof. Andrew Leis (WEHI) and Prof. Elizabeth Wright (University of Wisconsin), with invaluable support from the local organising committee: Prof. Eric Hanssen, A/Prof. Debnath Ghosal, Dr. Sepideh Valimehr (Bio21), A/Prof. Shabih Shakeel, Prof. Isabelle Lucet (WEHI), A/Prof. Melanie Rug (ANU), A/Prof. Jason Roberts (Peter Doherty Institute), and A/Prof. Georg Ramm (Monash University).

Featuring an impressive lineup of international speakers, the congress provided a platform for cutting-edge discussions and exchange of knowledge. Several Centre members also had the opportunity to present their research, contributing to the dynamic and engaging program.

Poster Prize Tomo10. Shubha Udupa & Dr. Sepideh Valimehr

The CCeMMP sponsored a $250 poster prize, which was awarded to Shubha Udupa, a PhD student in Debnath Ghosal's group, for her outstanding poster presentation. The Event also received support from Centre industry partner, ThermoFisher Scientific.

The 11th Congress in the series will be held in Madison-Wisconsin in approximately 2 years time, exact date still to be announced.
The level of local participation in the recent meeting will hopefully provide a stimulus for greater Australian involvement in this prestigious event. Only one Australian attended the previous event in The Netherlands. CCeMMP was well represented with five oral presentations and four poster presentations.


Herald Sun

Piece of brain's puzzle unlocked

Alzheimer's enzyme find

EXCLUSIVE
Robyn Riley

Crystal structure of Alzheimer's disease phospholipase D3 provides a molecular basis for understanding its normal and pathological functions

Herald Sun Feature Article

On 19 November 2024, The Herald Sun featured Professor Michael Parker, highlighting his team's groundbreaking work on Alzheimer's disease. Co-authors in this research work are PhD student affiliate Kenta Ishii and IHCDR Marialena Georgopoulou. Published in the FEBS Journal, the research unveiled the 3D structure of the enzyme PLD3, which plays a key role in amyloid beta regulation. Prof. Parker described the discovery as a critical step toward developing effective drugs for Alzheimer's and other dementias like Lewy body dementia.

"Piece of brain's puzzle unlocked" by Robyn Riley, 19/11/2024, page 9, The Herald Sun (and syndicated to news.com.au - Townsville Bulletin, Daily Telegraph, Adelaide Now; 4BC and 5AA radio).

The FEBS publication was also an Editor's Choice article from the 18 December 2024 issue, (https://doi.org/10.1111/febs.17277) .

Mayada Mazher, CCeMMP ICHDR, training visit in Canada

"Last July, I had the opportunity to visit Prof. Rikard Blunck's lab at the University of Montreal, Canada, where I spent nearly three months learning the whole-cell patch clamp electrophysiology technique as part of my PhD studies. This training allowed me to perform whole-cell electrophysiology experiments, which became a turning point in my PhD project. Through this training visit, I gained valuable insights into the functional characterization of my membrane protein of interest, TMEM120A, significantly advancing my research and deepening my understanding of its role."

Grants Awarded

Prof. Eric Hanssen (AI) Marsden Project Grant ($941,000 NZD). How does Streptococcus pneumoniae, the main cause of community acquired pneumonia and meningitis in children and the elderly, acquire a critical antioxidant from its host to survive at infection sites?

Prof. Megan Maher (CIA) ARC Discovery Project ($819,000). Megan's project will investigate the mechanisms of action of a newly discovered class of insecticidal proteins from ferns. These proteins show broad activities against the larvae of common crop pests (i.e. butterflies and moths), including those resistant to existing insecticidal approaches. The project will employ an integrated biological, biochemical and structural approach to determine how these proteins impart their insecticidal activities and to optimise their efficacy for future agricultural applications.

Prof. Megan Maher (CIB) NHMRC Ideas Grant ($1,297,682). Harnessing structural insights into bacterial zinc efflux for new therapeutics. With external affiliate, **Dr Evelyne Deplazes** (CID) and **Dr. Matthew Belousoff** (AI).

Prof. Michael Parker (CIA) ARC Discovery Project ($755,000). Deciding cell fate: the beta common receptor family. This project aims to unravel missing molecular details of how the beta common family of receptors, is able to signal across cell walls and generate new knowledge about how membrane bound receptors transmit biological signals in living organisms.

University of Wollongong Node

A/Prof. Gökhan Tolun

Node Leader, University of Wollongong

Lucy Fitschen awarded SPG Thompson Prize prize

The 33rd annual Sydney Protein Group Thompson Prize was held at the University of Technology Sydney, November 2024. Talks were presented by five early career researchers with the judges awarding PhD student Lucy Fitschen with the prize for her talk "Cryo-EM Structures of the Herpes Simplex Virus 1 Annealase Protein ICP8"

Lucy Fitschen presenting the winning talk, Sydney Protein Group Thompson Prize

Dr. Aidan Grosas, Lecturer and Group Leader

Dr. Aidan Grosas

Dr. Aidan Grosas has started as Lecturer and Group Leader in the School of Science at UoW in November 2024. Aidan joined the CCeMMP as an ICPD at the UoW node in 2022, where he developed and ran the local Biochemistry Rotation and undertook logistics for the Microscopy Rotation. Aidan co-supervised all CCeMMP PhD students helping to design and develop the protein structure aspects of their projects in both ion channels and GPCRs. He also contributed to several committees, including the graduate research, seminar, and outreach committees. In 2022, he also chaired the inaugural CCeMMP Symposium. Aidan will remain a member of the CCeMMP at the UoW node and continue as a co-supervisor for MK, David, and Thomas.

Grants Awarded

Dr. Jacob Lewis and Dr. Lisanne Spenkelink, ARC Discovery project ($699,000). Jacob and Lisanne's project aims to study the molecular mechanisms of the mitochondrial replisome, the machinery that copies mitochondrial DNA. While DNA replication in the cell nucleus has been extensively studied for decades, processes that define mitochondrial DNA replication are poorly understood. This interdisciplinary effort will merge cutting-edge cryo-EM with novel single-molecule biophysical tools to establish the architecture of human mitochondrial replication and define how it coordinates synthesis of the two DNA strands.

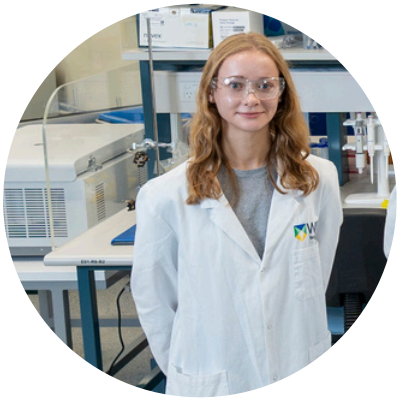
WEHI Node

Prof. Isabelle Lucet

Node Leader, WEHI

ICHDR Emily Park wins poster prize.

ICHDR Emily Park won a poster prize at the WEHI Student & Postdoc Symposium, November 25-26 2024, for her poster "Understanding the molecular structure and signalling functions of Eph receptor pseudokinase EphA10".



Emily Park

Shakeel lab wins at WEHI Art of Science 2024

WEHI's Art of Science exhibition has been running since 1977, founded by the former director Prof. Suzanne Cory AC. Art of Science is open to all WEHI scientists, providing them an artistic means to share their discoveries with the public; "where captivating imagery meets transformative medical research". Now an online exhibition featuring both still and moving categories, the winner in the 2024 exhibition, in the still image category, was A/Prof Shabih Shakeel with A/Prof Andrew Leis and PhD student, Mihin Perera, for their image "Down the Rabbit Hole".

> *"Down the Rabbit hole: To look deeply into the structures of life, scientists use a range of inventive methods. Here, we see one of the many small holes in a mist generator – an ultrasonic humidifier that has been adapted by WEHI researchers for use in 3D cryo-electron microscopy.*

Down the Rabbit Hole

The black hole at the centre of this image is about one-tenth the diameter of a human hair.

Researchers spray fine mists of protein molecules onto a surface, which is then frozen and transferred into an electron microscope. The frozen protein molecules are photographed at a magnification of about 100,000 times to visualise their structure.

Knowing the structure of a disease-causing protein helps scientists develop precision treatments that can target exactly the right molecule, so patients will experience fewer side effects. "

For the exhibition: https://www.wehi.edu.au/art-of-science/2024/
For the write up:https://www.wehi.edu.au/news/masterpieces-in-groundbreaking-medical-research-unveiled/

Dr. Winnie Tan awarded WEHI Postdoctoral Association Professional Award

November, 2024, Dr. Winnie Tan was awarded a WEHI Postdoctoral Association Professional Award, $1500. This award helped Winnie attend the EMBL Transcription and Chromatin Conference (poster presented August 2024), and visit the EMBL Imaging Centre, Heidelberg, Germany to learn CLEM and FIB-milling from the lab of Dr. Julia Mahamid. Winnie was already awarded the CASS travel award to attend this international meeting, the WEHI award supplemented the extra travel costs associated with the lab visit.

Dr. Winnie Tan

Grants Awarded

A/Prof. Shabih Shakeel (CIA) ARC Discovery Project ($691,000). This project aims to understand how a molecular machine, the dissolvasome, fixes tangled DNA to ensure error-free repair of damaged DNA by homologous recombination, a critical process in all life forms. This will generate new knowledge about this pathway by recreating the function of dissolvasome in a test tube and providing atomic snapshots of its individual steps using cryo-EM, thus creating a 'molecular movie' of the fundamental process of DNA repair.

External Affiliates Update

Grants Awarded

Dr. Evelyne Deplazes (CID), NHMRC Ideas Grant ($1,297,682). Harnessing structural insights into bacterial zinc efflux for new therapeutics. With **Prof. Megan Maher**, University of Melbourne

Prof. Renwick Dobson (AI) Marsden Project Grant ($941,000 NZD). Understanding how lytic enzymes could allow drugs to breach membranes in bacteria causing illnesses such as salmonella, and pneumonia.

Prof. Renwick Dobson (AI) Marsden Project Grant ($941,000 NZD). How does Streptococcus pneumoniae, the main cause of community acquired pneumonia and meningitis in children and the elderly, acquire a critical antioxidant from its host to survive at infection sites?

Prof. Megan O'Mara (CIB), ARC Discovery Project ($591,594). This project aims to engineer an environmentally friendly antiviral nanocoating designed with new and universal mode of viral inactivation for broad-spectrum and long-lasting viral protection. Using a combination of synthesis, computational modelling, and cutting-edge visualisation and quantitative analysis techniques, this project expects to provide new antiviral design principles to guide surface coatings development.

Prof. Megan O'Mara (CID), ARC Discovery Project ($844,766). This project aims to investigate neurotransmitter receptors in Varroa destructor mites, a significant threat to bees responsible for honey production and pollination of economically vital agricultural crops. The project expects to generate new interdisciplinary knowledge by characterising varroa receptors (the key targets of miticides) and exploiting differences in varroa and bee receptor structure and pharmacology to develop novel varroa-specific miticides (varroacides).

Prof. Megan O'Mara Quantum-Enabled Low-Field Magnetic Resonance Imaging for High-Performance Sport (2024-2027) through the Queensland Government Department of Environment, Science and Innovation Quantum 2032 Challenge Program ($999,855). This project aims to integrate innovative quantum technologies for low-field MRI to enhance musculoskeletal imaging in Olympic and Paralympic athletes. This will build on earlier advancements in portable and low-cost magnetic resonance imaging.

Prof. Renae Ryan (CIA) and **Dr Yan Jiang** (CIC), NHMRC Ideas Grant ($987,264). The twisted link between a dual function transporter and Episodic Ataxia.

Dr. Alastair Stewart (CIA) ARC Discovery Project ($421,502). Biological energy production is a fundamental process occurring in all forms of life. This process relies on molecular interactions that drive an essential cellular protein generator. Despite energy production being critical to life, the molecular mechanisms of this process are not understood. This project aims to decipher the molecular mechanisms underlying biological energy production.

New Affiliates

The Centre continues to reach out to scientists, both within our existing Nodes and outside of the founding academic institutions, who are involved in cryo-EM and membrane protein research to provide opportunities for them to become members or affiliates of the Centre. If you are interested in becoming a member or affiliate, please reach out to us at ccemmp@monash.edu.

New Affiliate Members

Dr. Hongyi Xu, Group leader, ANU

Upcoming Events

Our seminar series continues on the second Tuesday of the month, 10:00 AM - 11:00 AM (AEST/AEDT). To celebrate both International Day of Women and Girls in Science (11 February), and International Women's Day (March 8th) our first two speakers are the Centre's own Women in Science, leaders (and Node Leaders), mentors and role models, Prof. Isabelle Rouiller (11 February) and Prof. Isabelle Lucet (11 March).

Miss a seminar? Most are recorded so you can access them from our website (https://ccemmp.org/events/ccemmp-seminar-series/) or our youtube channel.

Our seminar calendar is fully booked for 2025. Next quarter we will hear from Dr. Brian Cary (Monash Node), April 8; Prof. Juan Du (Northwestern University), May 13; and the first of our special seminars Mazdak Radjainia (Cryoduck), May 20 (4:00PM AEST) and Prof. Yifan Cheng (UCSF), June 10 4:00 PM AEST).

Outreach

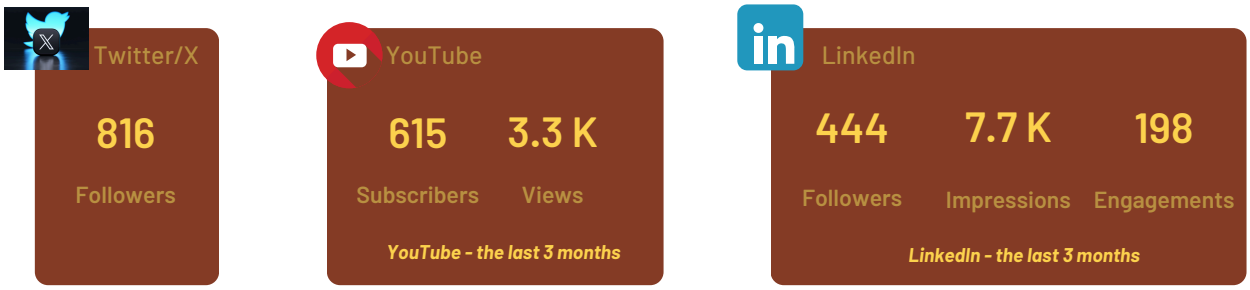
In the Media

- https://www.mitegen.com/news/events/– CCeMMP Research Symposium featured on the Events page of our sponsor's website (their Events page on the website)
- **Herald Sun, Nov 19, 2024**: "Piece of brain's puzzle unlocked" by Robyn Riley, page 9, (and syndicated to news.com.au - Townsville Bulletin, Daily Telegraph, Adelaide Now; 4BC and 5AA radio)."Melbourne researchers crack code on key Alzheimer's enzyme". Highlighting the research paper for members Marialena Georgopoulou, Kenta Ishii and Michael Parker. Ishii K, Hermans SJ, Georgopoulou ME, Nero TL, Hancock NC, Crespi GAN, Gorman MA, Gooi JH, Parker MW. Crystal structure of Alzheimer's disease phospholipase D3 provides a molecular basis for understanding its normal and pathological functions. The FEBS Journal, 26 September 2024 https://doi.org/10.1111/febs.17277
- **The FEBS Journal Commentary** (Bijelic and Macheroux) Comment on: https://doi.org/10.1111/febs.17277. Structure of human phospholipase D3, a single-strand exonuclease associated with Alzheimer's disease, Ishii et al., 2024

Social Media

- **@FEBSjournal** Dec 24, 2024 - **editors choice** Ishii K, Hermans SJ, Georgopoulou ME, Nero TL, Hancock NC, Crespi GAN, Gorman MA, Gooi JH, Parker MW. Crystal structure of Alzheimer's disease phospholipase D3 provides a molecular basis for understanding its normal and pathological functions. The FEBS Journal, 26 September 2024 https://doi.org/10.1111/febs.17277

- https://www.linkedin.com/feed/update/urn:li:activity:7264879567209656320/ Dr. Winnie Tan on CCeMMP Research Symposium and WEHI TEMPO cryoEM data processing workshops



Outreach - Training

Centre members continue to present training within CCeMMP and externally, on more than just Cryo EM.

- **Dr. Matthew Belousoff:** 26-28 November, 2024 Res Baz 2024, Monash University, Clayton; Presented two sessions on Single Particle CryoEM (30 Participants).

- **Dr. Winnie Tan:** Organised and hosted 2 x 4 hour workshops at WEHI TEMPO on Relion and Cryosparc cryoEM data processing, 10 participants each day (total = 20)

Training

Attendees

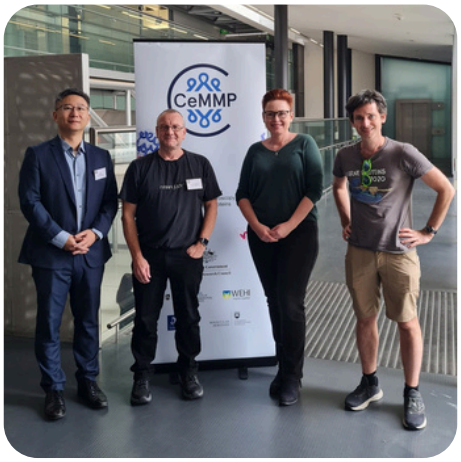
- Isabella Russell: Python Projects for Beginners Bootcamp (delivered by Dr. Matthew Belousoff)
- A/Prof. Karen Gregory: Professional development workshop - Beyond Cheating Concerns: Desgning (Valid) Assessments that Truly Matter, FPPS, Monash

Industry Engagement

Members and student members continue to have their regular meetings with their respective industry partners (Boerhinger Ingelheim, Astex, Servier, AstraZeneca, Dimerix and Pfizer). ICHDRs and their supervisors are also talking with industry partners regarding their 3 month placements. ICHDRs are beginning to meet with their industry mentors.

- Prof. Patrick Sexton: Astex, Cambridge, UK. talk and round table. Molecular insights into glucagon-like peptide-1 (GLP-1) receptor function, 21 January, 2025.
- Alok Pradhan: continues 12 months placement (1 day/week) Dimerix, Fiztroy.
- Minakshi Baruah commenced industry placement, Pfizer, Groton CT.

Recent Centre Activities and Achievements



CCeMMP Director with industry & keynote speakers: L to R, Dr. Xie Nin, Prof. Patrick Sexton, Prof. Renae Ryan, Assistant Prof. Oliver Clarke

CCeMMP Research Symposium 11-12 November 2024

The Centre held a two day research symposium in November 2024. There were 137 attendees who enjoyed a broad range of interesting and engaging scientific talks and posters. Our opening and closing keynotes were Assistant Prof. Oliver Clarke (Columbia University) and Prof. Renae Ryan (University of Sydney), respectively. Talks were presented by members, affiliates, partner organisations and the local scientific community: Dr. Nicholas Kirk (WEHI), Isabella Russell (ICHDR, Monash), Dr. Matthew Johnson (UoM), Fabian Munder (Monash), Dr. Felix Bennetts (Monash), Yiling Yu (The Florey), Dr. Winnie Tan (WEHI), Dr. Hongyi Xu (Australian National University), Mihin Perera (WEHI), Dr.Sarah Piper (Monash), Dr. Nie Xin (ThermoFisher Scientific, Singapore), Dr. Rhys Grinter, (UoM), Mahmuda Yeasmin (Monash). Thank you to the Chairs of each of the sessions for the smooth running and keeping to time: Dr. Sepideh Valimehr, Dr. Joshua Hardy, Dr. Wessel Burger, Dr. Sarah Piper, Dr. Winnie Tan and Dr. Aidan Grosas.

Prize winners with our Director; L to R: Prof. Patrick Sexton, Dr. Luca Troman, Daniel Fox & Mihin Perera

Thermofisher Scientific sponsored our Poster Prizes. In all there were 33 posters for viewing at morning tea, lunch and afternoon tea. We were fortunate to have 14 eager judges to assess the posters; a big thank you to Dr. Matthew Belousoff (Monash), A/Prof. Gökhan Tolun (UoW), Dr. Matthew Johnson (UoM/Bio21), Dr. Richard Birkinshaw (WEHI), Dr. Jesse Mobbs (Monash), Dr. Rhys Ginter (UoM), Dr. Fabian Bumbak (Monash), Dr. Nicholas Kirk (WEHI), Prof. Eric Hanssen (UoM/Bio21), Dr. Manasi Kumar (UoM/Bio21), Dr. Shadi Maghool (UoM/Bio21), Dr. Mohammad Tanipour (Monash), Dr. Bronte Johstone (UoM/Bio21), Dr. Debnath Ghosal (UoM/Bio21), we really appreciate the time taken to assess the posters. Prizes were awarded for the best poster and runner up; the judges awarded the prize for best poster to Daniel Fox (UoM/Monash) and runner up to Dr. Luca Troman (UoM). Daniel received $300 and a 3D printed model; Luca received $100.

People's Choice: Mihin Perera

We also had a People's Choice award for the most popular oral presentation; this was awarded to Mihin Perera (WEHI). Mihin received a 3D printed protein model and a 2D structure print. Congratulations to all.

To inspire engagement at question time, we ran a raffle for the most questions asked; every question asked, a raffle ticket was added to the 'bowl'. These were awarded to Dr. Richard Birkinshaw from WEHI and Yi Zeng from Victor Chang Cardiac Research Institute.

Mihin Perera, People's Choice Oral Presenter, 2024

The Organising Committee 2024; L to R Dr. Winnie Tan, Dr. Wessel Burger, Xiaomin Wang, Dr. Sepideh Valimehr, Emily Park & Riya Joseph

A big thank you must go to the organising committee, without them, the meeting would not have been the success that it was: Dr. Sepideh Valimehr, Dr. Wessel Burger, Dr. Winnie Tan, ICHDR Emily Park and ICHDR Xiaomin Wang. A lot of unseen work goes on behind the scenes for these meetings to come together, your time and effort was very appreciated.

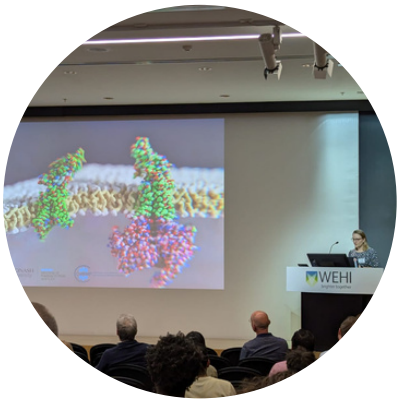
CCeMMP Mentoring Session and Strategic Meeting, November 12, 2024.

Centre students presented prior to the Strategic Meeting, Nov 12, 2024. L to R: Inamur, Mayada, Bhavika, MK & David

As part of the CCeMMP Research Symposium, the Centre invited members and affiliates attending the meeting to join a strategic meeting to discuss our current position and plan for the future. As part of this, five ICHDRs presented on their projects to date; there were 52 attendees to this session. Following their talks, the students took part in a mentoring session with our keynote speakers, Oliver Clarke and Renae Ryan; 17 ICHDRs took part in the mentoring session.The strategic meeting took place after the student talks, 23 people joined in the discussion of where we are now and planning for the future.

Conference Presentations

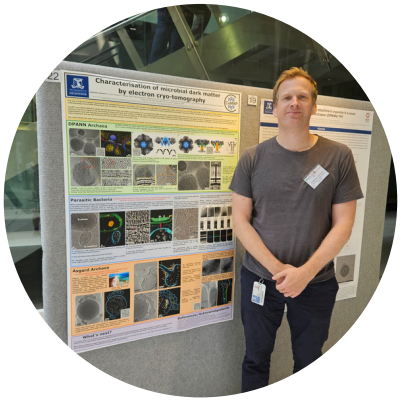
International Meetings



Dr. Sarah Piper, Tomo10, Jan 2025

A/Prof. Debnath Ghosal: Invited presentation. Electron cryotomography of EnvB phage infection reveals signatures of eukaryotic viral replication. The 10th International Congress on Electron Tomography, Tomo10, 28-30 Jan 2025, Parkville, Australia.

Dr. Sarah Piper: Invited Presentation. Seeing is believing: visualising structures and dynamics of membrane receptors in 3D animations. The 10th International Congress on Electron Tomography, Tomo10, 28-30 Jan 2025, Parkville, Australia.

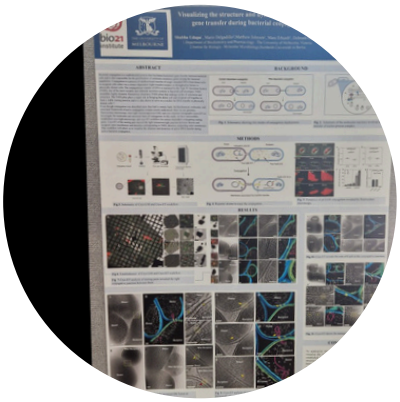


Dr. Matthew Johnson, Tomo10, Jan 2025

Dr. Hamish Brown: Selected talk. Montage cryo-tomography with square and rectangular beams. The 10th International Congress on Electron Tomography, Tomo10, 28-30 Jan 2025, Parkville, Australia.

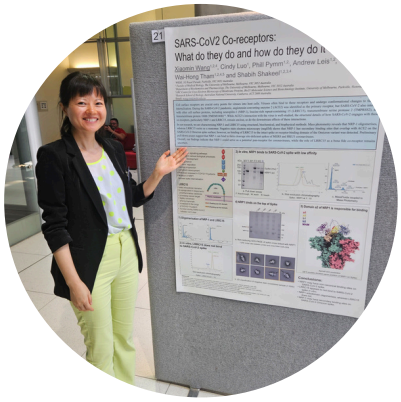
Bindusmita Paul: Selected talk. Structural basis of biofilm formation by the oral pathogen Treponema denticola. The 10th International Congress on Electron Tomography, 28-30 Jan 2025, Parkville, Australia.

Doulin Shepherd: Selected talk. Investigating the molecular basis of effector delivery through the bacterial Type IV secretion system. The 10th International Congress on Electron Tomography, Tomo10, 28-30 Jan 2025, Parkville, Australia.



Shubha Udupa - winning poster Tomo10, Jan 2025

Somavally Dalvi: Poster presentation. Crossing the barrier: Understanding the life cycle of membrane containing phages at molecular resolution. The 10th International Tomography Congress, Tomo10, 28-30 Jan 2025, Parkville, Australia.



Xiaomin Wang, Tomo10, Jan 2025

Lucy Fitschen: Poster presentation. Towards the cryo-EM structures of viral EATR proteins. BioMolecular Horizons, 22-24 Sept 2024, Melbourne, Australia.

Dr. Matthew Johnson: Poster presentation. Characterisation of microbial dark matter by electron cryo-tomography. The 10th International Tomography Congress, Tomo10, 28-30 Jan 2025, Parkville, Australia.

Shubha Udupa*: Poster presentation. Visualizing the assembly and disassembly dynamics of the bacterial conjugation machinery. The 10th International Tomography Congress, Tomo10, 28-30 Jan 2025, Parkville, Australia. **Best student poster*

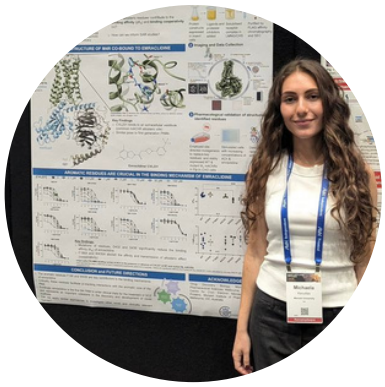
Xiaomin Wang: Poster presentation. SARS-CoV-2 co-receptors: What they do and how they do it? The 10th International Tomography Congress, Tomo10, 28-30 Jan 2025, Parkville, Australia.

National Meetings

Prof. Arthur Christopoulos: Keynote presentation ***(ASCEPT Lecturer).*** Message in a model: GPCR allostery from theory to practice ASCEPT, APFF, APSA Joint Congress, 1-4 Dec 2024, Melbourne, Victoria.

Prof. Renwick Dobson: Invited talk. TRAPped in an elevator. Crystal35 Conference, 27-29 Oct 2024, Perth, Western Australia.

Dr. Wessel Burger: Selected talk: An intracellular lipid pocket at Frizzled receptors regulates transducer activity. ASCEPT, APFF, APSA Joint Congress, 1-4 Dec 2024, Melbourne, Victoria.



Michaela Kaoullas, ASCEPT, APFF, APSA Joint Congress, Dec 2024,

Hellyer et al.: Poster presentation. Dissecting the role of differential phosphorylation in mGlu5 signalling and regulation. ASCEPT, APFF, APSA Joint Congress, 1-4 Dec 2024, Melbourne, Victoria.

Michaela Kaoullas*^: Poster Presentation. Structural insights into positive allosteric modulation at the M4 muscarinic acetylcholine receptor. ASCEPT, APFF, APSA Joint Congress, 1-4 Dec 2024, Melbourne, Victoria. ***Neuropharmacology SIG Prize; ^The ASCEPT Neville Percy Prize.***

Kos et al.: Poster presentation. Exploring sex differences of metabotropic glutamate receptor 5 (mGlu 5) negative allosteric modulators (NAMs). ASCEPT, APFF, APSA Joint Congress, 1-4 Dec 2024, Melbourne, Victoria.

Local Meetings

Prof. Renae Ryan: Keynote speaker. The twisted link between a dual function glutamate transporter and Episodic Ataxia. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Prof. Megan O'Mara: Invited talk. Simulation Toolkits to resolve biological noise. QUBIC ARC CoE symposium, 8-11 Dec 2024, Noosa, QLD

MariaKatarina Lambourne: Invited student talk. Structural studies of potassium ion channels implicated in epilepsy. CCeMMP Strategic Meeting, 12 Nov 2024, Parkville.

Bhavika Rana: Invited student talk. Structural and pharmacological validation of allosteric sites at the M5 mAChR. CCeMMP Strategic Meeting, 12 Nov 2024, Parkville.

Dr. Felix Bennetts: Selected talk. Decoding the P2X1 receptor structural insights and drug development. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

CCeMMP Research Symposium. L to R: Prof. Peter Czabotar, Prof. Eric Hanssen & A/Prof. Gökhan Tolun

Lucy Fitschen*: Selected talk. Cryo-EM Structures of the Herpes Simplex Virus 1 Annealase Protein ICP8" . Sydney Protein Group Thompson Prize, 22 Nov 2024, University of Technology Sydney, Sydney **** Winner of the Thompson Prize by the Sydney Protein Group.***

CCeMMP Research Symposium, Prof. Isabelle Lucet & A/Prof. Michael Griffin

Dr. Rhys Grinter: Selected talk. Inhibiting bacteria heme-piracy using de novo designed proteins. CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

Dr. Matthew Johnson: Selected talk. Characterisation of microbial dark matter by electron cryo-tomography. CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

Fabian Munder: Selected talk. High affinity PQQ import is widespread in gram-negative bacteria. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Dr. Sarah Piper: Selected talk. Visualising structural biology data of Class B1 GPCRs in 3D animations. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Dr. Sarah Piper: 3 min presentation. "Visualising structural biology data of Class B1 GPCRs in 3D animations." MIPS Research Symposium, 10 Dec 2024, Melbourne.

Isabella Russell: Selected talk. Stabilisation Methods for structural determination of ligand free parathyroid receptor 1 in complex with Gs protein. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

CCeMMP Research Symposium. L to R: David Safadi, Dr. Aidan Grosas, Minakshi Baruah & MK Lambourne

Dr. Winnie Tan: Selected talk. MORC2 is a phosphorylation-dependent DNA compaction machine. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Dr. Hongyi Xu: Selected talk. Electron crystallography methods for protein structure determination. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Mahmuda Yeasmin: Selected talk. Structural basis of the clinical candidates at muscarinic acetylcholine receptors. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

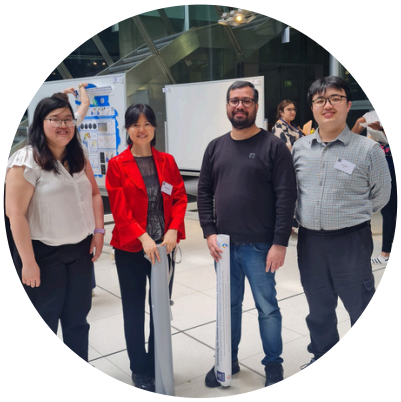
Yiling Yu: Selected talk. Identification of a high affinity antagonistic nanobody against a challenging GPCR target. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Minakshi Baruah: Oral presentation. Revealing the hidden face of GPCRs- mapping inactive states. 19th Annual HDR Symposium, 6 Nov 2024, Monash University, Parkville.

Riya Joseph: Oral presentation. A structural perspective on pore formation and regulation of Bacteroides fragilis toxins. ANSTO Australian Synchrotron User Meeting (UM2024), 27-29 Nov 2024.

Bahvika Rana: Oral presentation. Structural and pharmacological validation of allosteric sites at the M5 mAChR. CCeMMP Research Symposium Strategic Meeting, 12 Nov 2024, Parkville.

Minakshi Baruah: Poster presentation. Determination of antagonist-bound vasopressin receptor structures by cryo-electron microscopy. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.



CCeMMP Research Symposium. Dr. Winnie Tan, Xiaomin Wang, Inamur Rahman & Qiji Geng

Anna Beyger: Poster presentation. The structural & pharmacological characterization of CXCR3 isoforms. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Somavally Dalvi: Poster presentation. Crossing the barrier: Understanding the life cycle of membrane containing phages at molecular resolution. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Susovan Das: Poster presentation. Structural insight into G protein coupling and activation of human frizzled receptors. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

James Davies: Poster presentation. Structure of the human carnitine transporter. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Daniel Fox*: Poster presentation. AI-designed protein inhibitors can block heme uptake and inhibit growth of pathogenic E. coli. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville. ***Winner ThermoFisher Poster Prize***

Marialena Georgopoulou: Poster presentation. Structural studies of cell signalling adaptor protein STimulator of INterferon Genes (STING) in complex with small molecule inhibitors. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

A/Prof. Debnath Ghosal: Poster presentation. Understanding the infection cycles of membrane-containing phages at molecular resolution. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Brooke Hayes: Poster presentation. Aiming to kill: Rhs effector delivery by the type VI secretion system. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Daniel Fox & Dr. Ryan Shaw, ThermoFisher Best Poster Prize, 2024

Kenta Ishii: Poster presentation. Harnessing cryo-EM to understand how retatrutide interacts with GLP-1R. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

CCeMMP Research Symposium. A/Profs. Shabih Shakeel & Debnath Ghosal

Riya Joseph: Poster presentation. Pore formation and regulation of recently identified Bacteroides fragilis cholesterol-dependent cytolysin Like (CDCL) proteins. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

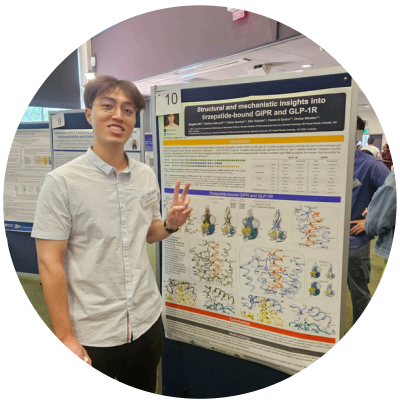
Micheala Kaoullas: Poster presentation. Structural insights into positive allosteric modulation at the M4 muscarinic acetylcholine receptor. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

MariaKatarina Lambourne: Poster presentation. A twist in the tail: investigating the impact of a novel epilepsy mutation on Kv7.3 protein structure and tetramerisation. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Dongju Lee: Poster presentation. Structural and pharmacological insights into orphan GPCR, GPR151 with G protein couplings. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Mayada Mazher: Poster presentation. Studying the potential of TMEM120A membrane protein as a voltage gated ion channel . CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Theodore Nettleton: Poster presentation. Cryo-EM structures and HDX-MS data of PAC1R splice isoforms in different states of activation. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.



Qinghao Ou, 19th Annual HDR Symposium

Qinghao Ou: Poster Presentation. Structural understanding of tirzepatide on GIPR and GLP-1R. 19th Annual HDR Symposium, 6 Nov 2024, Monash University, Parkville.

Qinghao Ou: Poster Presentation. Structrual and mechanistic insight into tirzepatide-bound GIPR and GLP-1R. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Emily Park*: Poster presentation. "Understanding the molecular structure and signalling functions of Eph receptor pseudokinase EphA10" WEHI Student & Postdoc Symposium, 25-26 Nov 2024, Parkville. ***Poster Prize***

Alok Pradhan: Poster presentation. Structure Determination of GPCR heteromers. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Inamur Rahman: Poster presentation. Destroying the human immunodeficiency virus before infection. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Bhavika Rana: Poster presentation. Structural and pharmacological validation of allosteric sites at the M5 Muscarinic acetylcholine receptor – a target for CNS disorders. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Milad Reyhani: Poster presentation. Characterization of a large protein complex in Nanobdellota archaeon YN1. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Solace Roche: Poster presentation. Evidence for the mechanism of pore-formation of an ABC toxin. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Minakshi Baruah, 19th Annual HDR Symposium

David Safadi: Poster presentation. Structure and function of the GABAB receptor upon the binding and activation by analgesic peptides. CCeMMP Research Symposium, 11-12 Nov 2024, Parkville.

Monica Suehiro: Poster presentation. Investigating the role of TDP-43 in mitochondrial dysfunction and neurotoxicity. 19th Annual HDR Symposium, 6 Nov 2024, Monash University, Parkville.

Jack Tovey: Poster presentation. Binding mode of a thiazole based small molecule agonist to the cholecystokinin type 1 receptor". CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

Dr. Luca Troman*: Poster presentation. Single particle cryo-EM analysis of spirochete periplasmic flagella. CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville. ***Runner Up ThermoFisher Poster Prize, CCeMMP Research Symposium***

Shubha Udupa: Poster presentation. Visualizing the structure and dynamics of the horizontal gene transfer during bacterial conjugation. CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

Dr. Luca Troman & Dr. Ryan Shaw, ThermoFisher Runner Up Best Poster Prize, 2024

Xiaomin Wang: Poster presentation. SARS-CoV-2 co-receptors: What they do and how they do it? CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

Yi Zeng: Poster presentation. The ins and outs of transport and inhibition of Organic Cation Transporter 1. CCeMMP Research Symposium, 11-12 Nov, 2024, Parkville.

2024

5796

PDB ENTRIES USING EM

2025

876

PDB ENTRIES USING EM (MORE THAN DOUBLE THE TOTAL FOR 2016)

Academic Presentations

International

A/Prof. Karen Gregory: Fine-tuning glutamate receptor activity to enable drug discovery for psychiatric and neurodegenerative disorders , UCL - School of Pharmacy departmental seminar, London UK, 13 December, 2024.

Academic Seminars

Dr. Rhys Grinter: Twist Bioscience webinar. “Using AI to design proteins that inhibit bacterial heme-piracy”. 22 January 2025 (Online).

Dr. Rhys Grinter: oNKo Innate seminar series. “Using AI to design proteins that inhibit bacterial heme-piracy”. 13 December 2024, Melbourne.

Dr. Sarah Piper: GPCR forum (ECI talk), "Using Blender to visualise Class B1 GPCR structural data in 3D animations.". Online, zoominar, 7th November 2024.

Publications

New Publications

Burgess AE, Loughran TA, Turk LS, Dunlop JL, Jamieson SA, Curry JR, Filipcik P, **Brown SHJ,** Mace PD. DET1 dynamics underlie co-operative ubiquitination by CRL4DET1-COP1 complexes. Science Advances *accepted 15 Jan 2025*.

Fox DR, Samuels I, Binks S, **Grinter R**. The structure of a haemoglobin–nanobody complex reveals human β-subunit-specific interactions. FEBS Letters, 598(18): 2240-2248, 2024. 10.1002/1873-3468.14958

Ivanova EP, Nguyen THP, Linklater DP, Le PH, Vilagosh Z, Perera PGT, Appadoo DRT, Vongsvivut J, Sharma T, Leeming, MG, Williamson NA, **Hanssen E**, Dekiwadia C, Tobin MJ, Juodkazis S, Croft RJ. Adaptations of Escherichia coli K 12 to synchrotron sourced THz radiation. ACS Omega, 9 (50): 49878–49886, 2024. 10.1021/acsomega.4c08710

Kos JA, Langiu M, Hellyer SD, **Gregory KJ**. Pharmacology, signaling and therapeutic potential of metabotropic glutamate receptor 5 negative allosteric modulators. ACS Pharmacology & Translational Science, 7(12): 3671–3690, 2024. https://doi.org/10.1021/acsptsci.4c00213

Kropp A, Gillett DL, Venugopal H, Gonzálvez MA, **Lingford JP**, Jain S, Barlow CK, Zhang J, Greening C, **Grinter R**. Quinone extraction drives atmospheric carbon monoxide oxidation in bacteria. Nature Chemical Biology, Jan 29, 2025, *online ahead of print*. https://doi.org/10.1038/s41589-025-01836-0

Mazigi O, Langley DB, Henry JY, Burnett DL, Sobti M, Walker GJ, Rouet R, Balachandran H, Lenthall H, Jackson J, Ubiparipovic S, Schofield P, **Brown SHJ**, Schulz SR, Hoffmann M, Pöhlmann S, Post J, Martinello M, Ahlenstiel G, Kelleher A, Rawlinson WD, Turville SG, Bull RA, **Stewart AG**, Jäck H-M, Goodnow CC, Christ D. Affinity maturation endows potent activity onto class 6 SARS-CoV-2 broadly neutralizing antibodies. Proceedings of the National Academy of Sciences of the United States of America, 122(1):e2417544121, 2025. https://doi.org/10.1073/pnas.2417544121

Newton-Vesty MC, Currie MJ, Davies JS, Panjikar S, Sethi A, Whitten AE, Tillett ZD, Wood DM, Wright JD, Love MJ, Allison TM, Jamieson SA, Mace PD, **North RA, Dobson RCJ.** On the function of TRAP substrate-binding proteins: the isethionate-specific binding protein IseP. Biochemical Journal, 481 (24):1901-1920, 2024. https://doi.org/10.1042/BCJ20240540

Woodgate J, Sumang FA, Salliss ME, **Belousoff M**, Ward AC, Challis GL, Zenkin N, Errington J, Dashti Y. (2025) Mode of action and mechanisms of resistance to the unusual polyglycosylated thiopeptide antibiotic persiathiacin A. ACS Infectious Diseases, 11 (1): 155–163, 2025. https://doi.org/10.1021/acsinfecdis.4c00503

Zangabad PS, Vasani RB, Tong Z, Anderson D, Rudd D, Hick CA, **Wootten D, Sexton PM,** Yan L, Esser L, Voelcker NH. Porous silicon microparticles enable sustained release of GLP-1R agonist peptides for the treatment of type 2 diabetes. Advanced Therapeutics, 7 (12):2400136, 2024. https://doi.org/10.1002/adtp.202400136

Preprints

El Eid L, **Deane-Alder K**, Rujan RM, Mariam Z, Oqua AI, Manchanda Y, **Belousoff MJ**, Bernardino de la Serna J, Sloop KW, Rutter GA, Montoya A, Withers DJ, Millership SJ, Bouzakri K, Jones B, Reynolds CA, **Sexton PM, Wootten D**, Deganutti G, Tomas A. *In vivo* functional profiling and structural characterisation of the human Glp1r A316T variant. bioRxiv, Nov 10, 2024:2024.10.19.619191. doi:10.1101/2024.10.19.619191

Updated Publications

Furlong EJ, Reininger-Chatzigiannakis IP, Zeng YC, **Brown SHJ**, Sobti M, **Stewart AG**. The molecular structure of an axle-less F1-ATPase. Biochimica et Biophysica Acta - Bioenergetics, 1866(1): 149521, 2024. https://doi.org/10.1016/j.bbabio.2024.149521. [PDB:8U1H; EMDB-41811; EMPIAR-12183] [PDB: 9AVJ, EMD-43903]

*__Ishii K__, Hermans SJ, **Georgopoulou ME**, **Nero TL**, Hancock NC, Crespi GAN, Gorman MA, Gooi JH, **Parker MW**. Crystal structure of alzheimer's disease phospholipase D3 provides a molecular basis for understanding its normal and pathological functions. FEBS J. 291(24): 5398-5419, 2024. [PDB:8VFT] ***This is an Editor's Choice article from the 18 December 2024 issue***

King-Hudson T-RJ, Davies JS, Quan S, Currie MJ, Tillett ZD, Copping J, Panjikar S, Friemann R, Allison JR, **North RA, Dobson RCJ.** On the function of TRAP substrate-binding proteins: Conformational variation of the sialic acid binding protein SiaP. Journal of Biological Chemistry, 300(11): 107851, 2024. https://doi.org/10.1016/j.jbc.2024.107851

McSweeney A, Eruera A-R, McKenzie-Goldsmith G, **Bouwer JC, Brown SHJ**, Stubbing L, Hubert J, Shrestha R, Sparrow K, Brimble M, Harris L, Evans G, Bostina M, Krause K, Ward V. Activity and cryo-EM structure of the polymerase domain of the human norovirus ProPol precursor. Journal of Virology, 98(11): e01193-24, 2024. https://doi.org/10.1128/jvi.01193-24

Wang Y, Muraleetharan A, Langiu M, **Gregory KJ,** Hellyer SD. SCA44- and SCAR13-associated GRM1 mutations affect metabotropic glutamate receptor 1 function through distinct mechanisms. British Journal of Pharmacology, 181 (22): 4514-4530, 2024. https://doi.org/10.1111/bph.16510

Yuliantie E, **Trinh PN,** Hick C, Ebenhoch R, Nar H, Weichert D, **Christopoulos A, Sexton PM, Wootten D**. Isoquinoline small molecule ligands are agonists and probe-dependent allosteric modulators of the glucagon subfamily of GPCRs. Biochem Pharmacol., 229:116483, 2024. doi: 10.1016/j.bcp.2024.116483. ***With Industry partner Boehringer Ingelheim***

Released Structures

EMD-46788 - VFLIP Spike trimer with 4C12-B12 FAB

- Alastair Stewart
- Mazigi et al., Proceedings of the National Academy of Sciences of the United States of America, 02 Jan 2025, 122(1):e2417544121 https://doi.org/10.1073/pnas.2417544121

CCeMMP Cryo-EM Structure Image Gallery

Image credit: Dr. Sarah Piper